PUBLIC VERSION

BEFORE THE
SURFACE TRANSPORTATION BOARD

E.I. DUPONT DE NEMOURS & COMPANY Complainant, v. NORFOLK SOUTHERN RAILWAY COMPANY Defendant.	)	Docket No. NOR 42125

REPLY EVIDENCE OF NORFOLK SOUTHERN RAILWAY COMPANY

NARRATIVE SECTIONS III-E THROUGH IV

(Volume 3 of 5)

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SHORT FORMS FOR FREQUENTLY CITED CASES

The following short form case citations are used herein:

AEPCO 2001	*Arizona Electric Power Cooperative, Inc. v. Burlington Northern & Santa Fe Railroad Co. & Union Pacific Railroad Co.*, STB Docket No. 42058 (served Dec. 31, 2001)
AEPCO 2002	*Arizona Electric Power Cooperative, Inc. v. Burlington Northern & Santa Fe Railroad Co. & Union Pacific Railroad Co.*, 6 S.T.B. 322 (2002).
AEPCO 2005	*Arizona Electric Power Cooperative, Inc. v. Burlington Northern & Santa Fe Railroad Co. & Union Pacific Railroad Co.*, STB Docket No. 42058, (served Mar. 15, 2005)
AEPCO 2011	*Arizona Electric Power Cooperative, Inc. v. Burlington Northern & Santa Fe Railroad Co. & Union Pacific Railroad Co.*, STB Docket No. 42113, (served Nov. 16, 2011)
AEP Texas	*AEP Texas North Co. v. BNSF Railway Co.*, STB Docket No. 41191, (Sub-No. 1) (served Sept. 10, 2007)
CP&L	*Carolina Power & Light Co. v. Norfolk Southern Railway Co.*, 7 S.T.B. 235 (2003)
Duke/CSXT	*Duke Energy Corp. v. CSX Transportation, Inc.*, 7 S.T.B. 402 (2004)
Duke/NS	*Duke Energy Corp. v. Norfolk Southern Railway Co.*, 7 S.T.B. 89 (2003)
Duke/NS Reconsideration	*Duke Energy Corp. v. Norfolk Southern Railway Co.*, 7 S.T.B. 862 (2004)
FMC	*FMC Wyoming Corp. v. Union Pacific Railroad Co.*, 4 S.T.B. 699 (2000)
IPA	*Intermountain Power Agency v. Union Pac. R.R. Co.*, STB Docket No. 42127 (served April 2, 2012).
M&G	*M&G Polymers USA, LLC v. CSX Transportation, Inc.*, STB Docket No. 42123 (served Sept. 27, 2012)
Major Issues	*Major Issues in Rail Rate Cases*, STB Ex Parte No. 657 (Sub-No. 1) (served Oct. 30, 2006), *aff'd sub nom. BNSF v. STB*, 526 F.3d 770 (D.C. Cir. 2008)

McCarty Farms	*McCarty Farms, Inc. v. Burlington Northern, Inc.*, 2 S.T.B. 460 (1997)
Otter Tail	*Otter Tail Power Co. v. BNSF Railway Co.*, STB Docket No. 42071 (served Jan. 27, 2006)
SAC Procedures	*Procedures for Presenting Evidence in Stand-Alone Cost Rate Cases*, 5 S.T.B. 441 (2001)
TMPA I	*Texas Municipal Power Agency v. Burlington Northern & Santa Fe Railway Co.*, 6 S.T.B. 573 (2003)
TMPA II	*Texas Municipal Power Agency v. Burlington Northern & Santa Fe Railway Co.*, 7 S.T.B. 803 (2004)
West Texas	*West Texas Util. Co. v. Burlington Northern Railroad Co.*, 1 S.T.B. 638 (1996).
WFA I	*Western Fuels Ass'n & Basin Elec. Power Cooperative v. BNSF Railway Co.*, STB Docket No. 42088 (served Sept. 10, 2007)
WFA II	*Western Fuels Ass'n, Inc. v. BNSF Railway*, STB Docket No. 42088 (served Feb. 17, 2009)
WP&L	*Wisconsin Power & Light v. Union Pac. R.R. Co.*, 5 S.T.B. 955 (2001)
Xcel	*Public Service Co. of Colorado d/b/a Xcel Energy v. Burlington Northern & Santa Fe Railway Co.*, 7 S.T.B. 589 (2004)

ACRONYMS

AAR	Association of American Railroads
ABC	Algorithmic Blocking and Classification
AEI	Automatic Equipment Identification
AEO	Annual Energy Outlook
AFE	Authorizations for Expenditure
APA	Administrative Procedure Act
AREMA	American Railway Engineering and Maintenance-of-Way Association
ARIL	Arrival at Intransit Location
ATC	Average Total Cost
B&B	Bridge & Building
BCFD	Billion Cubic Feet per Day
BCY	Bank Cubic Yard
BMP	Best Management Practices
BNSF	Burlington Northern Santa Fe Railway Company
BRC	Belt Railway of Chicago
C&S	Communications and Signals
CAGR	Compound Annual Growth Rate
CAPP	Central Appalachian
CBG	Coal Business Group
CDL	Commercial Driver's License
CFS	Commodity Flow Survey
CMA	Chemical Manufacturers Association
CMP	Aluminized Corrugated Metal Pipe

CRE	Counselors of Real Estate
CSAPR	Cross-State Air Pollution Rule
CSXT	CSX Transportation, Inc.
CTC	Centralized Traffic Control
CWA	Clean Water Act
CWR	Continuous Welded Rail
DCF	Discounted Cash Flow
DFLC	Departed From Location
DME	Dimethyl Ether
DMF	Dimethyl Formamide
DMI	Digital Mapping Index
DOT	Department of Transportation
DP	Distributed Power
DRR	DuPont Railroad
EAP	Employee Assistance Program
ECY	Embankment Cubic Yard
EIA	Energy Information Administration
EMT	Elizabeth Marine Terminal
ENS	Emergency Notification Signs
EOS	End of Siding
EPA	Environmental Protection Agency
ERP	Enterprise Resource Planning
EVA	Energy Ventures Analysis, Inc.
FAS	Financial Accounting Standards
FASB	Federal Accounting Standards Board

FED	Failed Equipment Detector
FELA	Federal Employers Liability Act
FMLA	Family and Medical Leave Act
FRA	Federal Railroad Administration
FRICS	Fellow of the Royal Institute of Chartered Surveyors
FSC	Fuel Surcharges
G&A	General & Administrative
GAO	Government Accountability Office
GDP	Gross Domestic Product
GVW	Gross Vehicle Weight
HM-1	United States Hazardous Materials Instructions for Rail
HTUA	High Threat Urban Area
ICC	Interstate Commerce Commission
ICHD	Interchange Delivery
IHB	Indiana Harbor Belt Railway
ISA	Intercarrier Service Agreement
ITMS	Integrated Transportation Management System
KCS	Kansas City Southern Railway
LARS	Locomotive Assignment and Routing System
LCY	Loose Cubic Yard
LNW	Louisiana and North West Railroad
LUM	Locomotive Unit Mile
MAI	Member of the Appraiser Institute
MATS	Mercury and Air Toxics Standards
MGT	Million Gross Ton

MMBtu	million British Thermal Units
MOW	Maintenance-of-Way
MRE	Market Research and Economics Group
MSE	Mississippi Export Railroad
MSP	Modified Straight-Mileage Prorate
N&W	Norfolk and Western
NAPP	Northern Appalachian
NARS	Non-accident Releases
NERC	North American Electric Reliability Corporation
NMC	Natural Moisture Content
NPRM	Notice of Proposed Rule Making
NRCS	Natural Resource Conservation Service
NROI	Net Railway Operating Income
NS	Norfolk Southern Railway Company
NYMEX	New York Mercantile Exchange
O/D	Origin/Destination
OMC	Optimum Moisture Content
PACT	Placed at Customer Facility
PFPS	Pulled from Patron Siding
PHMSA	Pipeline and Hazardous Safety Administration
PIH	Poisonous-by-Inhalation
PRB	Powder River Basin
PTC	Positive Train Control
R/VC	Revenue to Variable Cost
RCAF	Rail Coal Adjustment Factor

RCP	Reinforced Concrete Pipe
RCRA	Resource Conservation and Recovery Act
ROW	Right-of-Way
RPMS	Real Property Management System
RSAM	Revenue Shortfall Allocation Method
RSC	Rail Security Coordinator
RTA	Railroad Tie Association
RTC	Rail Traffic Controller
SAC	Stand-Alone Cost
SARR	Stand-Alone Railroad
SCAN	Soil Climate Analyst Network
SCTG	Standard Classification of Transportation Goods
SFAS	Statement of Financial Accounting Standards
SIP	State Implementation Plans
SPLC	Standard Point Location Code
SSA	Shared Asset Area
SSI	Sensitive Security Information
STB	Surface Transportation Board
STCC	Standard Transportation Commodity Code
SWPPP	Stormwater Pollution Prevention Plan
T&E	Train & Engine
TBT	Thoroughbred Bulk Terminal
TCS	Triple Crown Services
TDIS	Thoroughbred Direct Intermodal Services
TIH	Toxic-by-Inhalation

TKMV	Track Move/Inventory Move
TMS	Transportation Management Services
TRANSCAER	Transportation Community Awareness and Emergency Response
TRRA	Terminal Railroad Association of St. Louis
TSA	Transportation Security Administration
TYES	Thoroughbred Yard Enterprise System
USDOT	U.S. Department of Transportation
USPAP	Uniform Standards of Professional Appraisal Practice
WQMP	Water Quality Management Plan
WSS	Web Soil Survey
WTI	West Texas Intermediate

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E. NON-ROAD PROPERTY INVESTMENT

Non-road property investment costs, including costs for locomotives, railcars, and other equipment, are addressed in other sections of NS's reply evidence.

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III. STAND-ALONE COST

F. ROAD PROPERTY INVESTMENT

NS's Reply Evidence demonstrates that DuPont underestimated the road property investment costs of the DRR by more than $17 billion, as summarized by Table III-F-1 below. In this Section III-F, NS details the explanations for the significant differences in NS's and DuPont's calculations.

Table III-F-1
Comparison of DRR Construction Costs ($ millions)

	DuPont Opening	NS Reply	Difference
Land	$3,374.0	$4,732	$1,358
Roadbed prep	$3,969.0	$8,641	$4,672
Track construction - 1/	$8,242.0	$10,492	$2,250
Tunnels	$444.0	$1,097	$653
Bridges	$1,928.0	$4,282	$2,354
Signals & Comm - 2/	$1,247.0	$1,833	$586
Buildings & Facilities	$229.0	$2,437	$2,208
Public Improvements	$122.0	$243	$121
Mobilization	$437.0	$784	$347
Engineering	$1,618.0	$2,904	$1,286
Contingencies	$1,824.0	$3,272	$1,448
Total	**$23,434.0**	**$40,722**	**$17,288**
1/ - Reply land values reported at July 2007 levels			
2/ - A total of $484.2 Million in 2009 2Q PTC costs are invested after start up			

1. Land[1]

DuPont's Opening Evidence on real estate costs for the DRR is predicated on fundamentally flawed methodologies and incorrect assumptions regarding when the DRR would

[1] This Land Valuation Section is sponsored by Michael P. Hedden, who is a real estate expert. Mr. Hedden has reviewed the DuPont land valuation evidence and prepared an alternative retroactive mass-appraisal valuation report. Mr. Hedden's credentials and expertise are described in more detail in Section IV.

need to acquire land for its Right-of-Way ("ROW") if it is to begin operations in June 2009. The DuPont appraiser[2] posits that the DRR could acquire all of the necessary land—including land for the ROW for 7,300 DRR-owned route miles, and land for yards and microwave towers totaling 4,329 acres—for around $3.37 billion. <u>DuPont achieves that low estimate in part by choosing to value the real property as of June 1, 2009, which is the date that the DRR is supposed to commence operations, and which is, according to DuPont's own construction schedule, over *two years* after the DRR would need to acquire its property in order to begin construction</u>. *See* DuPont Opening WP "Complete Construction Schedule.xls;" DuPont Opening III-F-50 to III-F-51. The DuPont appraiser offers no justification for this valuation date, which appears to be a blatant attempt to game the SAC result by valuing property as though it were acquired in the depths of the 2009 recession and real estate crash.[3] The DuPont appraiser's reliance upon the June 1, 2009, valuation date is unsupportable, and its land valuation evidence should be rejected for that reason alone.

This manipulation of the real estate valuation date, however, is not the only flaw in DuPont's real estate evidence. As detailed below, the DuPont appraiser significantly

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[2] DuPont's real estate evidence was sponsored by Richard R. Harps and several other witnesses who appear to have been working under Mr. Harps' direction. *See* DuPont Opening III-F-2. Because in some cases it is not clear whether work was performed by Mr. Harps or by one of DuPont's other witnesses, the terms "DuPont appraiser" and "DuPont appraisal team" are used herein to refer collectively to DuPont's real estate witnesses.

[3] The only semblance of an attempt by the DuPont appraiser to justify June 1, 2009, as a valuation date is a bizarre claim that a June 1, 2009, valuation date was "the date specified by the Surface Transportation Board." *See* DuPont Opening WP "DuPont SAR Land Valuation-April 24 2012.pdf" at 18. The Board plainly did not "specify" 2009 as the valuation date, and indeed Board precedent plainly requires use of a valuation date that corresponds to the date land would be acquired. *See McCarty Farms*, 2 S.T.B. at 525, n.132 (adjusting the land valuation date back to the beginning of the construction period); *Arizona Pub. Serv. Co. v. The Atchison, Topeka & Santa Fe Railroad Co.*, 2 S.T.B. 367, 387, n.55 (1997) (valuing land at 1993 values so as to provide for a 1-year construction period prior to the initiation of service in 1994).

undervalued the land that DuPont physically inspected; selected inappropriate comparable sales; used a flawed "global mean" approach to aggregate sales data in a way that artificially depressed per-acre prices; and valued easements in a way that is directly contrary to Board precedent. NS's expert witness Michael Hedden details the oversights, distortions, and improper methodologies used by the DuPont appraiser in his Rebuttal Report, which is attached as NS Reply Exhibit III-F-2. Mr. Hedden is a member of the Appraiser Institute ("MAI") and the Counselors of Real Estate (CRE) and is a distinguished Fellow of the Royal Institute of Chartered Surveyors (FRICS).

Because DuPont's real estate appraisal is biased and methodologically flawed, Mr. Hedden prepared an alternative retroactive mass-appraisal valuation report that is consistent with Uniform Standards of Professional Appraisal Practice ("USPAP") and Board precedent. Mr. Hedden's valuation report is NS Reply Exhibit III-F-3. Mr. Hedden performed an independent valuation analysis of the cost of land needed to acquire the ROW for the DRR. As demonstrated below and in the Report itself, Mr. Hedden's appraisal applied methodologies that are consistent with industry standards, and it features more specific and detailed analysis than the DuPont appraiser's report. Mr. Hedden concludes that the land acquisition costs for the DRR would total $5,323,836,000. In comparison, DuPont posited that the DRR could acquire its needed land for an understated $3,370,800,000—$1,953,036,000, or 37%, less than NS's properly developed appraisal value.

The following sections detail the process Mr. Hedden undertook in his appraisal and summarize the serious flaws in DuPont's appraisal. These flaws render DuPont's real estate evidence unreliable and unsupportable. Mr. Hedden's more thorough technique produced a more reliable and accurate valuation. As such, Mr. Hedden's analysis should be accepted by the Board in its entirety.

a. The DRR's Land Must Be Valued As of the Date the DRR Would Need to Acquire It.

The most pervasive and blatant distortion in the DuPont appraiser's approach is the decision to value the DRR's real estate as of June 1, 2009—over two years after the DRR would need to begin acquiring property. DRR's own construction schedule proposes that the DRR would acquire land between April 2007 and October 2007 and that it would begin construction in August 2007. *See* DuPont Opening WP "Complete Construction Schedule.xls;" DuPont Opening III-F-50 to III-F-51. The DuPont appraiser's choice of a June 1, 2009, valuation date for a SARR that is to commence operations on that very same day is irreconcilable with its proposed construction schedule, and plainly fails to take into consideration the substantial time that would be required to acquire all of the land needed for the DRR ROW and facilities and to construct the DRR. The DuPont appraiser's decision to assume that the DRR would be paying 2009 prices for the land it would be acquiring in 2007 directly conflicts with both Board precedent and common sense, and it should be rejected.

In contrast, Mr. Hedden selected a valuation date of July 1, 2007—a date in the middle of the land acquisition period specified by DuPont—which accords with the DRR construction schedule and accounts for the time necessary to acquire the land and construct the infrastructure for the DRR in order to provide rail service beginning June 1, 2009. *See* NS Reply Ex. III-F-3 at 4.

Land for the DRR's ROW must be purchased before construction of the DRR can begin. The Board has recognized the common-sense truth that a SARR must purchase the land at values consistent with the timing of its construction schedule; that is, land valuation dates must correspond to the date of acquisition. *See McCarty Farms,* 2 S.T.B. at 525, n.132 (adjusting the land valuation date back to the beginning of the construction period); *Arizona Pub. Serv. Co. v. The Atchison, Topeka & Santa Fe Railroad Co.*, 2 S.T.B. 367, 387, n.55 (1997) (valuing land at 1993 values so as to provide for a 1-year construction period prior to the initiation of service in 1994).[4] DuPont provides no justification for its attempt to depart from Board precedent and SAC theory, and its failure to do so requires rejection of its arguments. *See SAC Procedures*, 5 S.T.B. at 446 ("[T]he parties to SAC cases are cautioned not to attempt to relitigate issues that have been resolved in prior cases. Unless new evidence or different arguments are presented, we will adhere to precedent established in prior cases."). There is no justification for DuPont's June 1, 2009, valuation date, particularly given the significant changes in the real estate market between 2007 and 2009.

DuPont's use of a June 1, 2009, valuation date is not a mere technicality. On the contrary, it significantly distorts the analysis in two ways. First, the DuPont appraiser included comparable sales data from 2008 and 2009—including third and fourth quarter 2009 sales, which occurred <u>following</u> the commencement of DRR operations[5]—to value land that the DRR would have had to purchase in 2007. Those post-2007 sales (which occurred in a depressed recession-era real estate market) are not reasonable evidence of the prices that the DRR would have had to pay to acquire land in 2007. Second, the DuPont appraiser made improper market adjustments that equated the value of all comparable sales to the 2009 marketplace. Again, this "adjustment"

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[4] Real estate valuation has not been a contested issue in many prior SAC cases, primarily because most previous cases involved low-value, rural land and did not involve the unique real estate market shifts that occurred during the recent recession. For these reasons, it may be that in some past cases a defendant railroad may have accepted a valuation date as of the SARR start date. But both SAC principles and the Board's *McCarty Farms* and *Arizona Public Service* precedents demand that in this case, the valuation date must correspond to the acquisition date.

[5] *See* NS Reply Ex. III-F-2, at 7-8.

to 2009 recession-era values is not a reasonable measure of what the DRR would have been required to pay to acquire land in 2007.

<u>First</u>, the DuPont appraiser used "forward-looking" comparable sales data in its appraisal calculations that were based on future events that were unknown as of July 1, 2007, resulting in erroneous valuations. *See* DuPont Opening WP "DuPont SAR Land Valuation – April 24 2012.pdf" at 29. This technique does not comply with USPAP Rules, which hold that "[t]he appraiser should determine a logical cutoff [date] because at some point distant from the effective date, the subsequent data will not reflect the relevant market." The Appraisal Foundation, *2012-2013 Uniform Standards of Professional Appraisal Practice*, Standard No. 3 (2012). This is particularly true in the 2007-2009 time frame. The economic downturn that crippled real estate prices in the third-quarter of 2008 and into 2009 was a dramatic departure from market conditions in mid-2007. Thus, sales from the third-quarter of 2008 and 2009 do not reflect market conditions and real estate values in 2007 and should not have been considered. Indeed, several of the 2008 and 2009 sales used by DuPont were foreclosure or other distress sales.[6] Using these sales to influence the value of property that would have been bought before the recession is transparently biased and utterly unsupportable.

<u>Second</u>, the DuPont appraiser improperly deflated the value of comparable sales from other years to reflect its June 1, 2009, valuation date. So sales from 2006 or early 2007 (which would have been highly persuasive indicators of value to real estate sellers in 2007) were not

[6] For example, comparable sales used by DuPont include: (i) a September 2008 foreclosure sale of residential property in Portage County, OH (DuPont Opening WP "Ohio-DuPont-COSTAR-Sorted and Valued.xlsx" line 2007); (ii) 2008 auction and distress sales for commercial property in Kanawha County, WV (DuPont Opening WP "WV COSTAR Sorted and Valued.xlsx" lines 107 & 111); and (iii) multiple 2009 bank sales of residential properties in Gwinett County, GA and Macomb County, MI (DuPont Opening WP "GEORGIA-COSTAR Sorted and Values.xlsx," Lines 2508, 2515; DuPont Opening WP "MICHIGAN – COSTAR and LoopNet Sorted.xlsx," Lines 784 through 799).

taken at face value, but rather were indexed down to recession-era values. This methodology had a considerable impact on DuPont's value conclusions. The indices the DuPont appraiser used to calculate these market adjustments reduced comparable values by five to twenty-five percent, depending on the year of the comparable sale. *See* NS Reply Ex. III-F-2 at 4. Thus, as demonstrated in the following Table III-F-2, the total impact of the DuPont appraiser's erroneous "market adjustments" was substantial.

Table III-F-2
Percentage Decrease of Comparable Sale Values Due To Market Adjustment Factors
2007 vs. 2009 Valuation Dates

	Residential	**Industrial**	**Commercial**
2004 Sales	31.0%	15.6%	36.7%
2005 Sales	26.2%	13.1%	31.3%
2006 Sales	24.9%	11.5%	27.9%

Mr. Hedden determined that the DuPont appraiser's methodology reduced residential property values from 24.9 to 31%.[7] *See id.* at 5. For industrial property, the DuPont appraiser's reduced values from 11.5 to 15.6%. *Id.* at 6. And for commercial property, values were reduced from 27.9 to 36.7%. *Id.* DuPont's assumption of a valuation date of June 1, 2009—and adjustment of comparable prices thereto—significantly reduced the real estate market value and investment required for the DRR. Because the DRR would have to acquire the land in 2007, it may not claim the cost benefit from land values two years later.

Together, both of these errors—using "forward-looking" sales and applying inappropriate market adjustments to deflate comparable sales to 2009 values—produced inaccurate and significantly reduced appraisal values. For example, the combination of the DuPont appraiser's use of sales from 2008 and 2009 and its market adjustments to 2009 prices to sales in Cuyahoga

[7] Mr. Hedden relied upon prior comparable sales dating from January 1, 2004, to December 31, 2007.

County, OH, artificially reduced the value of comparable sales by 22.84% for commercial property, by 40.26% for residential property, and by 53.97% for industrial property. *Id.* The Table III-F-3 below demonstrates the distorting effects of the DuPont appraiser's use of the June 1, 2009, valuation date on the value of comparable industrial sales in Cuyahoga County, OH.

Table III-F-3

Sales Comparables and Market Adjustments 2009 vs. 2007						
Cuyahoga County, OH - Industrial			June 1, 2009 Valuation Date		July 1, 2007 Valuation Date	
Sale Year	Acres	Sale Price	Time Adjustment	Time Adjusted $ Sales Price	Time Adjustment	Time Adjusted $ Sales Price
2006	n/a	n/a	0.945	n/a	1.060	n/a
2007	42.00	$ 4,400,000	0.891	$ 3,920,400	1.000	$ 4,400,000
2008	15.96	$ 891,322	0.967	$ 861,908		
2009	82.70	$ 2,000,000	1.000	$ 2,000,000		
Total	140.66	7,291,322		6,782,308		4,400,000
			Weighted Average Value	$48,218		$104,762
			DuPont Conclusion Value	$75,000	Wt. Avg. Variance 2009/2007	-53.97%

Table III-F-3 illustrates how the DuPont appraiser applied its market adjustments. For example, in 2007, 42.00 acres of industrial property in Cuyahoga County, OH, sold for $4,400,000. Using a July 1, 2007, valuation date, Mr. Hedden calculated a per-acre cost for Cuyahoga County industrial property of $104,762. But the DuPont appraiser slashed this figure by more than half through its use of an improper valuation date. First, the time adjustment employed by DuPont (0.891) to reflect its assumed June 1, 2009, valuation date reduced the total 2007 sale prices by $479,600 to an "adjusted sales price" of $3,920,400. And then DuPont's use of recession-era prices from 2008 and 2009 pushed the weighted average value all the way down to $48,218 for industrial property in Cuyahoga County, OH—less than half the valuation suggested by 2007 sales. DuPont's use of an improper valuation date thus boils down to a claim that a willing seller in 2007 would have sold its property to DRR at half the per-acre price for contemporaneous similar property. That is utter nonsense, and it should be rejected.

Because the June 1, 2009, valuation date selected by DuPont is clearly inappropriate for a SARR that commences service on June 1, 2009, and because of the significant impact the valuation date had on the analysis of comparable sales, the DuPont appraiser's conclusion of value is neither reasonable nor accurate for the relevant 2007 time period and cannot be relied upon. Instead, Mr. Hedden's appraisal report uses a valuation date of July 1, 2007, which accounts for the time needed to construct the DRR facilities in time to begin operations on June 1, 2009. *See* NS Reply Ex. III-F-3 at 4. Mr. Hedden based his conclusions of value on comparable sales from 2004 through 2007, that would have influenced market prices in July 2007.[8] As such, Mr. Hedden's valuation date and methods produced more reliable results and should be accepted as the best evidence.

While the inappropriate valuation date and market adjustments were the most egregious of the DuPont appraiser's errors, other factors discount the reliability of the appraisal report as well. The following sections contrast DuPont's erroneous analysis with NS's more thorough and supported appraisal.

b. NS's Approach to its Appraisal of the ROW Produced More Accurate Results.

Mr. Hedden conducted a retrospective appraisal using the widely accepted sales comparison approach, in which fair market value is determined by comparing a subject property to similar recent sales. *See* NS Reply Ex. III-F-3 at 10.[9] This approach has been sanctioned by

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[8] Appraisers use comparable sales that may occur within a reasonable timeframe after a valuation date under the assumption that the financial terms of a transaction are understood prior to the actual sale date. *See* NS Reply Ex. III-F-2 at 3-4 (noting the USPAP standard the requires that an "appraiser should determine a logical cutoff [date]").

[9] Mr. Hedden's appraisal is subject to certain assumptions and limiting conditions. For example, Mr. Hedden assumes that the ROW to be acquired is 100 feet wide, except in certain towns and cities where it is 75 feet wide. Mr. Hedden's appraisal does not include an assemblage premium or certain acquisition costs, such as brokerage fees. In addition, Mr. Hedden assumes the

the Board. *See FMC*, 4 S.T.B. at 797 (expressing preference for comparable sales approach to valuation); *WP&L*, 5 S.T.B. at 1018 (same). The following Table III-F-4 presents Mr. Hedden's conclusions regarding the total appraised value for the DRR land.

Table III-F-4
DRR Appraised Market Value

Component of Valuation	Acres	Market Value	Avg. Value Per Acre [1]
ROW - Fee Simple Value	86,571	$4,154,519,000	$47,990
Land Value for Yards	6,223	$1,302,172,000	$209,265
Land Value for Communications Facilities	586	$29,818,000	$50,852
Partially Owned Lines	789	$140,635,000	$178,266
Less: Land Value for Easement Areas	9,170	($332,106,000)	($36,217)
Plus: Cost for DRR Easement Areas	9,170	$28,798,000	$3,140
Total Valuation	94,169	$5,323,836,000	$56,535

Notes:
1. Total average value per acre does not include easement acres.

Mr. Hedden's appraisal of the DRR ROW land valued 94,168 acres of property—7,330 miles of land divided into 9,448 Valuation Units. In comparison, the DuPont appraiser valued 81,624 acres of land, and a total of 7,276.9 miles. Mr. Hedden's total acreage includes land acquired by easement (which the DuPont appraiser removed from its final acreage totals), as well as land that the DRR will have to acquire in Chicago, IL, to account for track built between the DRR's Ashland Avenue Yard and Ogden Junction to facilitate a necessary connection between the DRR and UP and BNSF. *See* NS Reply III-B-1. In addition, Mr. Hedden's appraisal report values 789 acres—65 miles—of Partially Owned Lines that the DRR will have to acquire in order to obtain the same ownership interest in the land that NS holds. *See infra* III-F-13. The

property is vacant land and that title to the property is good and marketable; that there are no hidden conditions that would affect the value; and that no property is encumbered by leasehold interests. For a complete list of the assumptions and limiting conditions underlying the appraisal report, see NS Reply Exhibit III-F-3 at 117-120.

following Table III-F-5 reflects the amount of DRR ROW appraised by Mr. Hedden in each state traversed by the DRR.

Table III-F-5:
Valuation Units and Acreage of DRR Land

States	Valuation Units	Miles	Acres
Alabama	917	761	9,025
Delaware	35	16	166
Georgia	935	711	8,424
Illinois (1)	668	623	7,420
Indiana	527	586	7,057
Kentucky	351	285	3,399
Louisiana	525	66	694
Maryland	54	42	489
Michigan	27	29	356
Mississippi	113	206	2,497
Missouri	101	196	2,335
North Carolina	499	288	3,485
New Jersey (1)	172	71	859
New York	213	231	2,785
Ohio	1,209	881	10,351
Pennsylvania	1,291	627	7,526
South Carolina	365	313	3,787
Tennessee	666	532	6,258
Virginia	551	641	7,727
West Virginia	229	225	2,720
Total	9,448	7,330	87,360

(1) Note: Illinois and New Jersey figures include Partially Owned Lines.

In addition to the land necessary to acquire the ROW, Mr. Hedden included in his appraisal the retrospective market value of the land necessary to support the DRR's yards and support facilities including fiber optic sites. *See infra* III-F-7.

Mr. Hedden applied well-accepted appraisal methodologies as part of the sales comparison approach to determine the aggregate retrospective market value for the DRR. Mr. Hedden classified the land along the DRR ROW and identified appropriate Valuation Units. He derived classifications either using (i) physical inspection, during which typical parcels along both sides of the DRR's ROW were inspected to determine the across-the-fence Highest and Best Use and classification, or (ii) for ROW he did not physically inspect, Mr. Hedden accepted the DuPont appraiser's classification of land and identification of Valuation Units. NS Reply Ex. III-F-3 at 20. Mr. Hedden compiled comparable sales data from CoStar, LoopNet, and CoreLogic[10] data services, and used that data to develop an average comparable value per acre of vacant land without improvements for each land use classification in each county through which the DRR travels. *See id.* at 13-14. Finally, Mr. Hedden valued the land using the comparable sales approach. *Id.* at 20. For properties that he physically inspected, Mr. Hedden compared those properties to sales data for comparable properties to determine appropriate market values. For land not physically inspected, Mr. Hedden reviewed aerial and ground photography and comparable sale values to develop an average unit value (per acre) for each Valuation Unit. *Id.* at 20. Finally, Mr. Hedden aggregated the market values of all Valuation Units along a particular DRR route to conclude the overall market value of that route. He subsequently aggregated the values of all routes in a state. *Id.* at 23. By aggregating the market value for all Valuation Units by state, Mr. Hedden calculated the market value of the entire DRR ROW. *Id.*.

In contrast, the DuPont appraiser failed to apply well-accepted methodologies; made determinations of appraised value based upon a desktop review of property, only using minimal physical inspection to "confirm" the conclusions of its desktop review;[11] and failed to aggregate appropriately market values to derive an accurate conclusion of overall market value.

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[10] CoStar, LoopNet, and CoreLogic are recognized sources of real estate sales data routinely used by market participants including appraisers.

[11] *See* DuPont Opening WP "DuPont SAR Land Valuation 4-24-12.pdf" at 23 ("These on-the-ground inspections confirmed the reliability of determining the adjacent uses for the line segments using aerial imagery from Google Earth and other internet sites.").

The analysis below compares the flawed DuPont approach and Mr. Hedden's approach on the following issues: (i) identification of Valuation Units, including physical inspection of the DRR ROW; (ii) the development of appropriate comparable sales data; and (iii) ultimate valuation of the ROW based upon the classification of the parcels of land and application of the comparable sales data. As demonstrated below, the significant errors in the DuPont appraiser's analysis render the entire analysis unreliable.

i. Identification of Land Valuation Units along the ROW.

In order to identify the various land uses along the ROW, Mr. Hedden applied one of two methods. First, Mr. Hedden physically inspected approximately 712 miles of the DRR ROW in high-value areas, during which typical parcels along both sides of the DRR's ROW were inspected to determine the Highest and Best Use and classification. While this detailed physical inspection is the preferred valuation method, the size of the DRR made inspections of the full ROW impractical. Therefore, for ROW he did not physically inspect, Mr. Hedden accepted the DuPont appraiser's classification of land and identification of Valuation Units. NS Reply Ex. III-F-3 at 20. This technique has been repeatedly approved by the Board. *See TMPA I*, 6 S.T.B. at 698 (accepting such a technique and noting that "BNSF's more detailed procedure produces a better estimate of land values").

(a) Land Physically Inspected.

One of the most significant differences between the approach taken by Mr. Hedden and that of the DuPont appraiser was the extent of the physical inspection undertaken. Both parties engaged in appraisal analysis that involved some physical inspection of land abutting the DRR's ROW, as well as appraisal of land absent physical inspection. However, Mr. Hedden and his team spent considerably more time and effort physically inspecting high-value metropolitan areas along the DRR than did DuPont's witnesses. NS's experts[12] spent a total of 43 days in the field between April 2011 and August 2012, physically inspecting property along both sides of the ROW in urban areas across 11 states. In comparison, the DuPont appraiser conducted a desktop review, and only ventured into the field to "confirm" the results of that analysis. *See* DuPont Opening WP "DuPont SAR Land Valuation 4-24-12.pdf" at 23 ("These on-the-ground inspections confirmed the reliability of determining the adjacent uses for the line segments using aerial imagery from Google Earth and other internet sites.").

In keeping with the DuPont appraiser's decision to use physical inspections only to "confirm" results of a desktop review, DuPont inspectors spent a total of 14 days in the field, often spending only a few hours at a location and sometimes "inspecting" multiple cities in the same day. *See* Figure III-F-6 "City Inspections" below. For example, on October 21, 2011, the DuPont appraisal team visited three cities—Knoxville, TN, Chattanooga, TN, and Atlanta, GA. According to Google Maps, the driving time alone between these locations is approximately four hours. *See* NS Reply WP "Knoxville, TN to Atlanta, GA – Google Maps.pdf." It is difficult to understand how the DuPont appraisal team could perform a thorough inspection of <u>three</u> cities in a <u>single</u> day, while still accounting for at least <u>four</u> hours of travel time, not even accounting for traffic.

Similarly, between September 10th and September 12th, the DuPont appraisal team "inspected"—and traveled between—five cities: Columbus, OH, Cincinnati, OH, Toledo, OH, Cleveland, OH, and Detroit, MI. On September 10, 2011, DuPont visited Columbus, OH. On September 11, 2011, the DuPont appraisal team visited both Cincinnati, OH, and Toledo, OH.

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[12] Initial inspections were performed by Mr. Arnold Tesh (now deceased). Mr. Hedden completed the physical inspections following Mr. Tesh's untimely death and reviewed Mr. Tesh's inspection reports as part of the process of appraising the value of the land.

The very next day, on September 12, 2011, the DuPont appraisal team visited both Cleveland, OH, and Detroit, MI. In other words, DuPont visited five cities over of the course of three days, with at least 10 hours of travel time involved between cities, without accounting for traffic. *See* NS Reply WP "Columbus, OH to Detroit, MI – Google Maps.pdf." Such drive-by inspections are insufficient to develop accurate, detailed determinations of the land uses in these cities. Indeed, the brief periods of time spent in these cities illustrate that the DuPont appraisal team viewed city visits as simply a mechanism to "confirm" its desktop appraisal. *See* DuPont Opening WP "DuPont SAR Land Valuation 4-24-12.pdf" at 23.

In comparison, Mr. Hedden and his team spent three days in Atlanta, GA, and two days in each of the following cities: Chattanooga, TN, Knoxville, TN, Columbus, OH, Cincinnati, OH, and Cleveland, OH. Moreover, the DuPont appraisal team did not even visit New Orleans, LA, where Mr. Hedden and his team spent three days, or Philadelphia, PA, where Mr. Hedden and his team spent two days. In Chicago, IL, an area with considerable high-value, urban real estate and complicated railroad routing, DuPont spent a single day on the ground, whereas Mr. Hedden and his team visited Chicago, IL, on two separate multi-day inspection tours, for a total of eight days on the ground.

The following Table III-F-6 depicts the dates that each party's appraisers spent in the inspected cities.

Table III-F-6
Days Spent On Physical Inspections

City	DuPont Date	Total DuPont Days	NS Date	Total NS Days
Allentown/Bethlehem, PA	10/11/2011	0.5	N/A	N/A
Atlanta, GA	10/21 - 23/2011	2.5	12/14 - 12/16/2011	3
Birmingham, AL	N/A	N/A	4/7 - 4/8/2011	2
Buffalo, NY	N/A	N/A	N/A	N/A
Charlotte, NC	10/19/2011	0.5	N/A	N/A
Chattanooga, TN	10/21/2011	0.5	5/30 - 5/31/2012	2
Chicago, IL	9/25/2011	1	7/16 - 7/18/2012; 9/6 - 9/10/2011	8
Cincinnati, OH	9/11/2011	0.5	6/27 - 6/28/2012	2
Cleveland, OH	9/12/2011	0.5	6/21 - 6/22/2012	2
Columbus, OH	9/10/2011	1	6/19 - 6/20/2012	2
Detroit, MI[13]	9/12/2011	0.5	N/A	N/A
Greensboro, NC	10/20/2011	1	7/10 - 7/11/2012	2
Greenville, SC	10/19/2011	0.5	5/21 - 5/22/2012	2
Harrisburg, PA	10/10/2011	0.5	N/A	N/A
Knoxville, TN	10/21/2011	0.5	6/6 - 6/7/2012	2
Mobile, AL	N/A	N/A	4/13 - 4/14/2011	2
New Jersey	10/11/2011	0.5	N/A	N/A
New Orleans, LA	N/A	N/A	1/10 - 1/12/2012	3
Philadelphia, PA	N/A	N/A	4/27 - 4/28/2011, 5/16/2011	3
Pittsburgh, PA	9/19 - 20/2011	2	9/11/2011, 10/24 - 10/26/2011	4
Reading, PA	10/10/2011	0.5	7/23 - 7/24/2012	2
St. Louis, MO	9/26/2011	1	N/A	N/A
Toledo, OH	9/11/2011	0.5	N/A	N/A

Not only did the DuPont appraisal team spend less time in the field, it not surprisingly ended up inspecting a significantly smaller portion of the ROW—in terms of mileage, acreage, and market value. The DuPont appraisal team inspected less than 5% of the ROW acreage, and just over 5% of the DRR mileage during its 14 days of physical inspection. The land appraised during those inspections accounted for less than 20% of the appraised value for the entire DRR.

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[13] DuPont did not use any values from its Detroit inspection in its analysis, instead choosing to incorrectly claim that the DRR could operate over Conrail Shared Asset Areas using "trackage rights." *See* discussion of Partially Owned Lines below at Section III-F-13.

In comparison, Mr. Hedden inspected 9.7% of the total ROW mileage and 9.0% of the ROW acreage—nearly twice the amounts inspected by DuPont. The land appraised during Mr. Hedden's inspections accounted for 36.7% of the market value of the total land value to be acquired by the DRR. The following Table III-F-7 compares the parties' respective inspection approaches.

Table III-F-7: Amount of Land Inspected[14]

States	DuPont Miles	NS Miles	DuPont Acres	NS Acres	DuPont Market Value	NS Market Value
Alabama		9.50%		8.80%		18.70%
Delaware						
Georgia	7.40%	3.90%	7.40%	3.00%	31.05%	22.80%
Illinois	6.90%	9.60%	6.90%	8.60%	58.12%	46.50%
Indiana		3.10%		3.00%		18.20%
Kentucky		6.70%		6.80%		22.70%
Louisiana		83.40%		80.80%		86.90%
Maryland						
Michigan	88.10%		88.10%		88.14%	
Mississippi						
Missouri						
North Carolina	8.70%	23.30%	8.70%	23.30%	16.91%	45.90%
New Jersey	39.70%	63.90%	39.70%	63.90%	53.62%	80.60%
New York						
Ohio	10.50%	12.00%	10.50%	10.00%	30.99%	41.90%
Pennsylvania	12.90%	20.60%	12.90%	20.30%	24.14%	62.20%
South Carolina	3.20%	13.20%	3.20%	13.30%	4.59%	36.70%
Tennessee	4.10%	13.60%	4.10%	12.60%	7.87%	34.10%
Virginia						
West Virginia						
Total	**5.11%**	**9.70%**	**4.78%**	**9.00%**	**19.02%**	**36.70%**

In areas where Mr. Hedden physically inspected the ROW, he independently identified Valuation Units based upon land use classifications as determined by the land's Highest and Best

[14] The percentage of miles and acres inspected by Mr. Hedden is calculated based upon his calculation of the total number of miles of track and total acreage for the DRR. Comparatively, the calucation of DuPont percentages is based upon DuPont's calculation of miles and acres by state.

Use or a change in unit value across the fence on either side of the ROW. *See* NS Reply Ex. III-F-3 at 15, 18-19. Mr. Hedden's physical property inspections identified the variation in land use and changes in value along the DRR as the basis for identifying Valuation Units. The physical property inspections provided the opportunity to identify the ATF Highest and Best Use of the properties, as well as observe market conditions and comparable sales in the immediate vicinity of the DRR ROW. *Id.* at 18.

Actual, thorough, on-the-ground physical inspections are the Board's preferred method for classifying Highest and Best Use. *See, e.g., FMC*, 4 S.T.B. at 797 (approving of UP's physical inspection approach to valuation). Such direct actual inspections are particularly important for accurate classification of land in metropolitan areas where land use changes rapidly and value is typically highest. Mr. Hedden's more extensive, thorough, and detailed physical inspections produced more accurate land classifications than those of DuPont, which directly impacted valuation.

Mr. Hedden's detailed physical inspection resulted in the identification of a significantly higher number of Valuation Units along the ROW than the DuPont appraiser identified. For example, in the Cleveland, OH, metropolitan area, the DuPont appraiser aggregated 4.9 miles of land spanning from U.S. Interstate 90 to Union Avenue in downtown Cleveland into a <u>single</u> Valuation Unit. In comparison, NS's appraiser identified 16 distinct Valuation Units within this same segment. *See* Ex. III-F-4 at A-CLE-06. DuPont valued the entire 4.9 miles as low-value industrial land. However, NS's appraiser's more refined and precise analysis identified many more Valuation Units consisting of different classes of land, including high-value commercial land, residential property, and higher value industrial land. As a second example, over a 4.3 mile segment of ROW between Florida Avenue and Lebeau Street in downtown New Orleans, LA, Mr. Hedden identified ten times more valuation segments than the DuPont appraiser (62 as opposed to 6). *See id.* at A-NEWOR-09. NS's Exhibit III-F-4 provides a detailed comparison of the number of Valuation Units identified by Mr. Hedden as compared to those identified by the DuPont appraiser along segments of the ROW. This comparison demonstrates that Mr. Hedden's more detailed analysis consistently identified a higher number of Valuation Units in segments along the ROW, which led to a more thorough and accurate appraisal.

Indeed, the DuPont appraiser's failure to identify a sufficient number of Valuation Units resulted in its failure to account for variations of land use in urban areas where property values can vary significantly. For instance, DuPont failed to identify any commercial land on certain segments in the Chicago metropolitan area, some of which Mr. Hedden valued at over $1.6 million per acre, in comparison to the residential and industrial values along that segment, which Mr. Hedden valued below $400,000. *See id.* at A-CHI1-01; *see also id.* at A-CHI1-07; A CHI2-01; A CHI2-02; A CHI2-03. The DuPont appraiser similarly failed to classify any land as Commercial on certain segments in New Orleans, LA, and Knoxville, TN. *See* NS Reply Ex. III-F-4 at A-NEWOR-04; A-NEWOR-05; A-NEWOR-09; *see also id.* at A-KNOX-03; A-KNOX-04; A-KNOX-06; A-KNOX-07; A-KNOX-08. The DuPont appraiser's failure to identify any commercial land uses within these segments is illustrative of its general failure to classify land with a sufficient level of detail.

In his Rebuttal Report, Mr. Hedden has provided several on-the-ground pictures showing locations where the DuPont appraiser misclassified land uses in Reading, PA. *See* NS Reply Ex. III-F-2, Appendix B. For two Valuation Units that the DuPont appraiser classified as Industrial, Mr. Hedden has provided pictures of a shopping center and an outlet center, in support of his commercial classification. Similarly, for a Valuation Unit that DuPont identified as Rural Town, Mr. Hedden has provided a picture of a subdivision, in support of his residential classification. These images provide first-hand evidence of the DuPont appraiser's failure to classify appropriately the land use of urban segments.

In sum, the significant amount of time Mr. Hedden spent in the field provided a more accurate understanding of the nature of the varying land uses along the DRR ROW, and thus more accurate classifications. Mr. Hedden's overall approach to the ROW inspection and Valuation Unit classification is reasoned and supported. Mr. Hedden's superior appraisal should be accepted as the best evidence of the valuation of land that the DRR will have to acquire.

(b) Land Not Physically Inspected

For land in areas not physically inspected by Mr. Hedden, he accepted the DuPont appraiser's classification of land use and its quantification of Valuation Units. Thereafter, Mr. Hedden relied upon his own calculations and comparable sales data to derive a market value of this land based upon the value of typical parcels abutting each side of the Valuation Unit. Mr. Hedden's practice of valuing inspected land based upon his field inspection and analysis of land sales along the ROW, while accepting DuPont's categorization of land use along the areas of the ROW he did not inspect and adjusting the values of the land accordingly, has been accepted by the Board as an appropriate valuation technique.[15]

The following discussion explains Mr. Hedden's collection and analysis of comparable sales data, which was used to value both inspected and uninspected land.

ii. Collection and Analysis of Comparable Sales Data.

In addition to performing physical and non-physical inspections of the DRR Row, Mr. Hedden collected and analyzed comparable sales data to develop accurate land valuations. In

[15] *See TMPA I*, 6 S.T.B. at 698 (accepting such a technique and noting that "BNSF's more detailed procedure produces a better estimate of land values.").

reviewing sales data reported by CoStar, LoopNet, and CoreLogic data services, Mr. Hedden took the following approach to valuation. First, Mr. Hedden sorted the data from all three sources by county and land use classification (agricultural, industrial, residential, and commercial). To determine whether a sale is comparable, various factors are considered, including the real property rights conveyed, the physical characteristics of the land, and the use of the land. *See* NS Reply Ex. III-F-3 at 10. Second, Mr. Hedden reviewed the data for transactions that were clear outliers,[16] duplicates, or had incomplete data, and removed them from the analysis. Third, he sorted the data to correspond to the DRR routes. Finally, Mr. Hedden calculated the average comparable value per acre of vacant land without improvements for each land use classification and county. *Id.* at 14. Mr. Hedden's approach is consistent with USPAP Standard No. 6 regarding mass-appraisal development and reporting. *See* The Appraisal Foundation, *2012-2013 Uniform Standards of Professional Appraisal Practice*, Standard No. 6 (2012).

In comparison, while the DuPont appraiser also relied upon a sales comparison approach, it made numerous errors both in selecting appropriate sales and aggregating the value of those comparable sales.

(a) Comparable Sales Must Have a Known Land Use And Be Unimproved Land.

Land classification requires the comparison of land sales based on standard criteria, such as zoning, proposed use, and prevalent secondary uses in the market. *See* APPRAISAL INSTITUTE, THE APPRAISAL OF REAL ESTATE at 297-98 (13th ed. 2008). The DuPont appraiser made two significant errors in selecting comparable sales, which negatively affected its valuation of land to

[16] Mr. Hedden employed a conservative approach and excluded transactions that were clearly inconsistent with the volume of market activity (*i.e.*, transactions with pricing above the range of the predominant volume of transactions).

be acquired by the DRR. First, the DuPont appraiser included sales of land with an "unknown land use" in its comparable sales. Second, the DuPont appraiser compared sales of land with improvements to the vacant land acquired by the DRR. In contrast, Mr. Hedden strictly included only sales of vacant land and excluded sales with an "unknown" land use.

The DuPont appraiser included sales of land with an "unknown land use" in its comparable sales analyses. *See* NS Reply Ex. III-F-2 at 9. Such sales are an inappropriate basis of valuation of land to be acquired by the DRR, as the land may or may not be comparable to the land adjacent to the DRR ROW. Because the land has no known usage, it is impossible to verify the valuation. The DuPont appraiser relied upon the sale of land of "unknown land use" 780 times throughout its appraisal. This approach distorted the DuPont appraiser's market value estimates. *Id.*

For example, in Hunterdon County, NJ, the DuPont appraiser calculated a market value for agricultural land of $18,000 per acre based upon 17 comparable sales. Of those 17 sales, 14 were classified as "unknown land use." When those "unknown land use" sales are excluded from the comparison, the concluded value of the agricultural land rises to $65,521 per acre—a difference of $47,521 per acre. *Id.* The inability to determine the land use for those 14 "unknown land use" properties renders them an inappropriate basis of comparison for the valuation of the ROW. Mr. Hedden excluded all sales of land having unknown use from his comparable sales.

In addition, the DuPont appraiser inappropriately used sales of improved land as a basis of comparison for land acquired along the DRR's ROW. The valuation of a SARR ROW is based upon the sales of unimproved land. *See, e.g., WP&L*, 5 S.T.B. at 1018 (approving of the method used by both parties, who "assume[d] that the EWRR would acquire vacant, unimproved land in fee simple"). The DuPont appraiser, however, relied upon approximately 70,666 acres of comparable sales with improvements, even though DuPont had sufficient data for vacant land sales upon which DuPont could have based its comparison. *See* NS Reply Ex. III-F-2 at 9.

Using sales of land with improvements as a basis of comparison for valuation of vacant land requires the use of a "market extraction" technique that attempts to remove the value of the improvement and estimate the value of the land absent the improvement. *See* NS Reply Ex. III-F-2 at 10. While typically the value of the improvement is determined by that improvement's depreciated value, the DuPont appraiser used tax assessment ratios to approximate the value of the improvements. *Id.* When the extraction technique is applied to assessment ratios, however, the technique "is generally not persuasive because the assessment ratios may be unreliable and the extraction method does not reflect market considerations." APPRAISAL INSTITUTE, THE APPRAISAL OF REAL ESTATE at 295 (10th ed. 1993), *in* NS Reply Wp "Appraisal of Real Estate 10th.pdf." Thus, the use of the market extraction technique was inappropriate, especially since the DuPont appraiser had readily available comparable data for the sales of actual vacant land.

Even assuming that the extraction technique would have been appropriate, however, DuPont's workpapers provided insufficient detail to determine the nature of the improvements or the accuracy of assessment values. Instead, the value of improvements was incorporated into the DuPont appraiser's calculation of its global mean of comparable sales value for vacant land. *See* NS Reply Ex. III-F-2 at 11. The DuPont appraiser incorrectly applied this valuation technique, and simply incorporated the value of improvements into its calculations, resulting in a distorted and unreliable analysis of the average value of comparable vacant land.

The impact of the DuPont appraiser's treatment of Ohio comparable sales data is illustrative of its misapplication of the extraction technique. In Ohio, the DuPont appraiser included 219 sales of improved land in the comparable sales dataset. *Id.* at 11. The improvements to this land contributed anywhere from 1% to 95% of the total assessed value of each sale. *Id.* Without explanation, the appraiser did not perform an improvement extraction calculation at all and instead included the entire value of the land and its improvements in its calculation of comparable value for vacant land. The inclusion of 219 inappropriate comparable sales distorted the analysis of average value of comparable vacant land and distorted the DuPont appraiser's ultimate conclusion of value.

In sum, the DuPont appraiser's inclusion of sales of land with an "unknown" land use, as well as sales of improved land, further contributed to the unreliability of its conclusions.

(b) Comparable Sales Should Be Aggregated Using a Stratified Mean Methodology to Preserve the Accuracy of the Valuation.

In order to assess market conditions for purposes of valuation, it is necessary to aggregate comparable sales. Mr. Hedden used a stratified data analysis, calculating the average value per acre of comparable sales based on the sales price paid per acre for each individual transaction. This precise method accounts for the unique attributes of each transaction and allows for the extraction of patterns in the data that are otherwise hidden by the use of a global mean. Comparatively, when data is aggregated on a macro level, as with the DuPont analysis, the unique aspects of the transactions—and thus more detailed patterns in the data—are lost.

The DuPont appraiser's attempted analysis is inappropriate—its technique was flawed, its results were inaccurate, and it did not produce reliable assessments of relevant market conditions. Rather than accounting for the appropriate unit of comparison (dollars per acre)[17] of prevailing and specific individual transactions in the marketplace, the DuPont appraiser

[17] That is, unique dollars per acre produced by each individual transaction (as opposed to a global mean or weighted average of overall dollars per acre).

aggregated sales into a global mean to "effectively act as a single transaction" in order to analyze sales data. NS Reply Ex. III-F-2 at 12. To calculate the global mean, the DuPont appraiser "divided the total of all individual comparable sale prices for that area by the total acreage to calculate the comparable price paid per acre based on all the sales in that particular market area." *Id* at 11. This approach leads to unreliable results because it is not representative of the volume of transactions in the actual marketplace, prevents the appraiser from analyzing the specific attributes of individual transactions, and fails to account for the more accurate dollars per acre unit of comparison. The Appraisal Institute rejects this kind of mass agglomeration, noting that "[l]ike units must be compared, so each sales price should be stated in terms of appropriate units of comparison." APPRAISAL INSTITUTE, THE APPRAISAL OF REAL ESTATE at 305 (13th ed. 2008). By amalgamating sales into a global mean, the specific attributes of each transaction and associated values are diluted and direct market comparisons become impossible, leading to unreliable results.

In contrast, the stratified data analysis employed by Mr. Hedden identifies specific market conditions most frequently encountered by market participants, and thus presents a more accurate view of overall market conditions. The following Table III-F-8 illustrates the effect of applying a global mean analysis as opposed to a stratified mean.

Table III-F-8
Illustration of Difference Between Global Mean and Stratified Mean

	Sale Price	Acres	$ per Acre
Parcel 1	$100	1	$100
Parcel 2	$100	1	$100
Parcel 3	$100	1	$100
Parcel 4	$100	1	$100
Parcel 5	$100	1	$100
Parcel 6	$100	1	$100
Parcel 7	$100	1	$100
Parcel 8	$100	1	$100
Parcel 9	$100	1	$100
Parcel 10	$100	1	$100
Parcel 11	$500	10	$50
Global Mean: $1,500 / 20 =			**$75**
Stratified Mean: $1,050 / 11 =			**$95**
Percentage Variance			**-21.43%**

As illustrated by Table III-F-8, suppose there were ten one-acre parcels in a particular county that had each sold for $100 each, or a price of $100 per acre. Suppose that an eleventh parcel of 10 acres sold for $500, or a price of $50 per acre. DuPont's approach simply would add together these transactions to reach a "global mean" of $75 per acre ($1,500 for 20 acres), which would have prevented the DuPont appraiser from analyzing the attributes of the individual transactions separately and from noticing the prevailing price for smaller parcels was only $100 per acre, with the larger transaction being a significant outlier. Using a stratified mean analysis, the average value per acre is $95 ($1,050 for 11 parcels), which takes into account the significant discount being paid for the larger parcel of land. The variance produced between the two methods is a considerable 21.43%.

As Table III-F-8 illustrates, a global mean tends to overweigh the influence of large land purchases on the per-acre calculation and to give less influence to the per-acre averages from smaller transactions. As a result, a stratified mean is a significantly superior approach to a global mean here, for assembling the DRR's right of way would require thousands of individual purchases of relatively small parcels of land. *See* NS Reply Ex. III-F-2 at 11-14; *cf.* APPRAISAL INSTITUTE, THE APPRAISAL OF REAL ESTATE at 305 (13th ed. 2008). DuPont's reliance upon the global mean thus resulted in conclusions of value that "significantly undervalued comparable market sales and as a consequence significantly understated the actual value of the DRR." NS Reply Ex. III-F-2 at 14. DuPont's analysis of the comparable sales data cannot be relied upon to provide an accurate analysis of the value of the land to be acquired by the DRR.

In sum, these significant errors in the DuPont appraiser's collection and analysis of comparable sales render its appraisal unreasonable and unreliable. The DuPont appraiser relied upon inappropriate comparable sales such as land with "unknown" uses and improved land and developed an overly-broad global mean purchase price. To the contrary, Mr. Hedden analyzed only unimproved comparable sales with known land uses and evaluated comparable sales using a stratified rather than a global mean. Because Mr. Hedden employed a more reliable methodology for evaluating comparable sales, his appraisal should be accepted by the Board.

iii. Calculation of Total Value of Land to be Acquired by the DRR.

In determining the conclusion of value for each route, Mr. Hedden reviewed the land classifications along each segment of the ROW, based on across-the-fence Highest and Best Use and changes in market conditions. Mr. Hedden relied upon physical site inspections and comparable sale indices, including average values, to conclude the market value for Valuation Units. Where Mr. Hedden did not physically inspect the DRR ROW segments (Valuation

Units), he relied upon the DuPont appraiser's identified segments and used the average unit value of comparable sales to conclude the market value for these Valuation Units. *See* NS Reply Ex. III-F-3 at 23.

Mr. Hedden aggregated the market values of Valuation Units to conclude the overall market value for each route and, subsequently, the market value of the ROW located in each state traversed by DRR routes. Finally, Mr. Hedden determined the market values for all Valuation Units by state, including yards, easements, and partially owned lines, and aggregated them to conclude the market value for the entire proposed DRR land acquisition. *Id.*

Nevertheless, while both Mr. Hedden and the DuPont appraiser followed the ATF comparable sales valuation technique (which has been widely accepted in SAC cases),[18] the DuPont appraiser's implementation of that technique was careless and error-filled. In particular, the DuPont appraiser failed to reconcile or explain the considerable differences from the comparable sales data and its ultimate conclusions of value, provided no analysis of its conclusion of value for Rural Towns, valued easements in a manner that is inconsistent with Board precedent, and failed to value DRR ROW in which the DRR has a partial ownership interest.

(a) Concluded Values Must Be Logically Connected to the Comparable Sales Relied Upon.

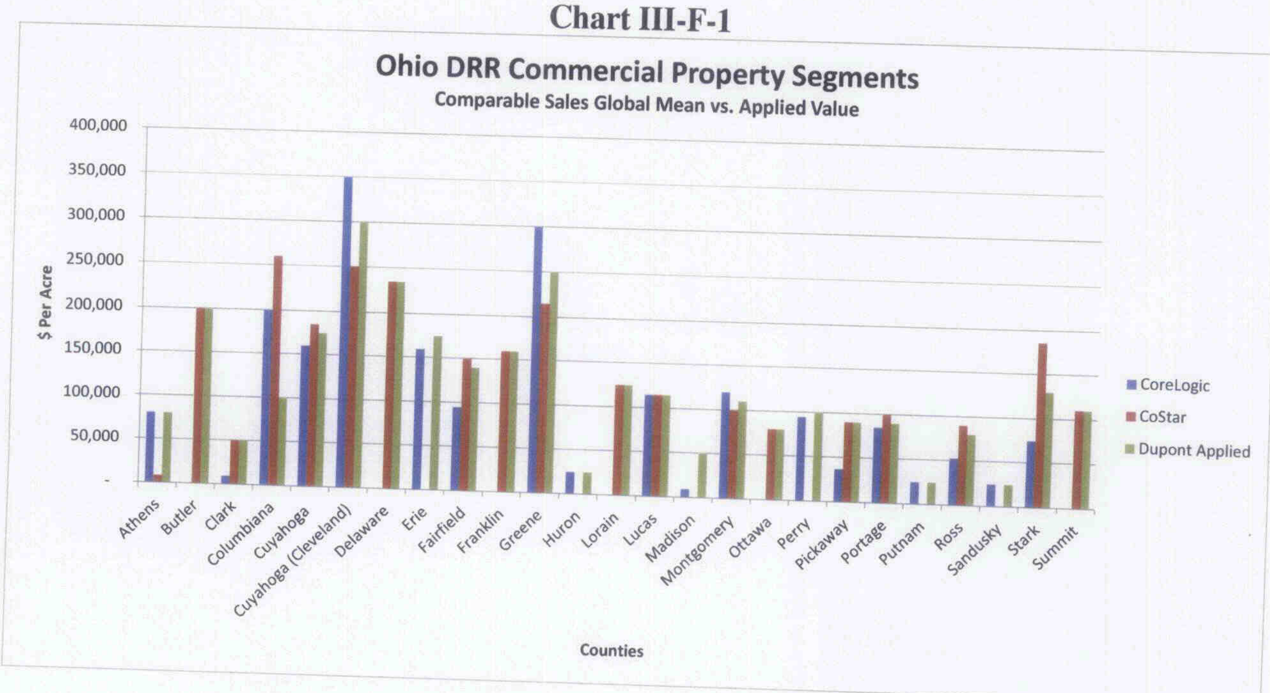
For a significant number of DRR segments, the DuPont appraiser's concluded values appear to be entirely arbitrary—*i.e.,* there is no apparent nexus between the concluded values and the global mean values the DuPont appraiser derived from CoStar and CoreLogic comparable

[18] *See, e.g., West Texas*, 1 S.T.B. at 702, n.143 ("ATF value is the highest price that a piece of property will bring on the open market when the buyer and seller have full knowledge of all potential uses of the property."); *McCarty Farms*, 2 S.T.B. at 505; *Duke/CSXT*, 7 S.T.B. at 473-74; *TMPA I*, 6 S.T.B. at 698.

sales data, nor is there any other support or explanation provided by the DuPont appraiser for its ultimate conclusions of value. *See* NS Reply Ex. III-F-2 at 14. The analyses of the two datasets (CoStar and CoreLogic) often offered conflicting valuations in a given county. In such instances, the DuPont appraiser provided no explanation for its method (if indeed there was any systematic method) of reconciling the differences and concluding value. And the DuPont appraiser offered no workpaper to explain or support its conclusions. The lack of support or explanation of the DuPont appraiser's determination of values from disparate data suggests that the DuPont appraiser relied upon random selection and undocumented or anecdotal information to derive its final conclusions of value.

By way of example, the following Chart III-F-1 compares the DuPont appraiser's assigned values for commercial property segments in Ohio to the global mean values it derived from the CoreLogic and CoStar comparable sales data.

Chart III-F-1



As illustrated, there is no consistent correlation between DuPont's applied values and the CoreLogic and CoStar data. At times it appears that the appraiser selected a rough average between the two datasets. For example, in some counties, such as Cuyahoga (Cleveland) and Stark, DuPont's applied value falls between the two datasets. In other counties DuPont's applied value is significantly higher than one of the datasets. For example, in Athens County, the selected value is slightly lower than the CoreLogic dataset, but is significantly higher than the CoStar data. Conversely, in Columbiana County, DuPont's applied value is drastically lower than that reported in either of the datasets. The variance between the comparable sales data and the selected applied values is unexplained, unjustified, and undocumented.

Indeed, the DuPont appraiser's failure to explain and justify its conclusions of value led to some surprising and questionable applied values. For example, in Pittsburgh, PA, the DuPont appraiser assigned virtually no value to commercial land in the downtown core area near the Pittsburgh convention center and the Pittsburgh Pirates Major League Baseball stadium. In comparison, comparable sales in that area reflect commercial land sales at well above $10 million per acre, reflecting the high demand for access to this important commercial district. *See* NS Reply Ex. III-F-4 at A-PIT-05. Similarly, in Atlanta, GA, the DuPont appraiser ignored the fact that the DRR passes by the Georgia Dome, home of the NFL's Atlanta Falcons, and valued commercial property at less than $1,000,000 per acre. However, comparable sales indicate that commercial land in this area demands prices in excess of $4 million per acre. *Id.* at A-ATL-04. The DuPont appraiser's repeated failure to recognize the market demand for this high-value, commercial urban land undercuts the accuracy of its value conclusions.

Because DuPont's methodology cannot be discerned or evaluated from the evidence submitted in its case-in-chief, it has failed to meet its burden of proof and its unsupported value conclusions must be rejected. *See, e.g., AEPCO 2011*, STB Docket No. 42113 at 115 ("AEPCO has failed to satisfy its burden of proof by not supporting or explaining its input choices"); *id.* at 117 (noting that complainant, "AEPCO[,] has the burden of proof and did not support its [evidence].").

(b) The DuPont Appraiser Provided No Justification for Its Valuation of Rural Towns.

Neither the DuPont appraisal nor the appraisal workpapers provide a clear explanation of its conclusion of value for DRR ROW in rural towns, which amounted to $119,400,000. *See* NS Reply Ex. III-F-2 at 16-17; *see also* DuPont Opening WP "Illinois Summary Review," Tab "Rural Town Applied Values." In Illinois, DuPont selected some statewide comparable sales and averaged them to derive a rural town valuation. *Id.* However, those comparisons had no clear or stated connection to actual land comprising the ROW. The Board has criticized parties in the past for using sales with little connection to the ROW. *See e.g., TMPA I,* 6 S.T.B. at 698 ("BNSF's procedure of examining land directly along the ROW is superior to TMPA's procedure of valuing land in the general area."). This is just another example of the DuPont appraiser's flawed appraisal methodology.

(c) The DuPont Appraiser's Valuation of Easements is Contrary to Board Precedent.

The DuPont appraiser inappropriately valued easements. The DuPont appraiser failed to properly index the value of easements to current market value. While the DuPont appraiser estimated the fee simple value for the portions of the ROW for which the DRR would acquire easements, it then removed those costs from the overall land valuation in its entirety and substituted a crude, general "average cost per easement acre for each state . . . applied to the acreage for each easement in the individual state." DuPont Opening III-F-5-6. DuPont does not make any attempt to explain this methodology or how it used the easement data produced by NS, which DuPont states that it reviewed. *See id.* Rather than taking the actual cost of each easement paid by NS and indexing it to the current market value, the DuPont appraiser valued the easements based upon the unindexed historic value paid by NS or its predecessors at the time that the easement was acquired. The DuPont appraiser refused to index values even though many of these easements dated from before 1952—and some from before 1871. The DuPont appraiser then took an average of those historic costs and applied that average to all of the easements in each SARR state. *Id.* at III-F-6.

This method of valuation is flatly contrary to settled Board precedent. The Board has made it abundantly clear that, like all other investments, easements must be valued at their current market value. *Xcel,* 7 S.T.B. at 669 ("Because all of a SARR's investments should be valued at current costs, BNSF's estimate is used here [for valuing easements]. Xcel's evidence does not reflect the current value of obtaining the necessary easements."). DuPont made no attempt to index the costs of the easement values paid by NS to current market prices. DuPont's easement valuation plainly does not "reflect the current value of obtaining the necessary easements." *Id.*

Mr. Hedden, in contrast, properly indexed easement values to current market levels. Using this proper easement valuation methodology, Mr. Hedden indexed the actual historical cost of the easements to determine the 2007 value per acre. Mr. Hedden then calculated each state's average cost per easement acre and applied that value to the total DRR easement acreage in the state. Mr. Hedden totaled the value of all easements and added that to the total valuation of DRR land to account for the cost of acquiring easements. Mr. Hedden has determined that the 2007 market value of the easements along the ROW is $28,798,000.

(d) The DuPont Appraiser Failed to Value Land in which the DRR Has a Partial Ownership Interest.

The DuPont appraiser failed to value land along the DRR ROW on lines in which NS maintains a partial ownership interest. The DRR must step into NS's shoes and acquire the same ownership interest in the land that NS holds. *See AEPCO 2002*, 6 S.T.B. at 328. As such, the DRR is responsible for the pro rata share of ownership that the NS currently owns along the segments traversed by the DRR. *See infra* III-F-12. For example, because NS owns a 58% interest in Conrail, the DRR must account for 58% of the land acquisition costs pertaining to the segments of Conrail over which the DRR operates. *Id.* Mr. Hedden valued the land using the same methodology used for segments of land for which the DRR must acquire full fee simple ownership. That is, Mr. Hedden determined ATF Highest and Best Use and applied the average price for comparable sales to conclude a fee simple value. That cost was then apportioned based upon the pro rata share owned by NS—and thus the DRR. *See* NS Reply Ex. III-F-3 at 21. Mr. Hedden has concluded that the DRR's proportionate value of the Partially Owned Lines—a value completely excluded by DuPont—is $140,635,000. *Id.* at 108-109.

In sum, the DuPont appraiser's valuation methodology in both unsupported and unreliable. The DuPont appraiser provided no justification or explanation as to how it reached its ultimate conclusions of value in light of the comparable sales data. Moreover, it provided no justification for its valuation of rural towns, valued easements in a manner that was inconsistent with Board precedent, and failed to value partially owned lines. All of these errors significantly undermine the reliability of DuPont's appraisal and warrant its rejection by the Board.

c. Appraisal of Land for Yards and Communications Facilities

In addition to valuing the DRR ROW, Mr. Hedden's appraisal accounts for the land required for yards, support facilities, and communications facilities. As explained in Sections

III-B and III-C, the yards facilities posited by DuPont are wholly inadequate to meet the needs of the DRR's customers. *See* NS Reply III-B-14 to III-B-15; III-C-36. DuPont posits 123 yards that require a total of 604 acres of land. DuPont's valuation of acreage required for yard facilities is inaccurate in two ways. First, because DuPont did not properly configure or size its yards, the number of acres valued is grossly insufficient. Second, the DuPont appraiser's methodology for appraising the land is inaccurate and unreliable for the same reasons explained above pertaining to valuation of the ROW. In comparison, NS's DRR configuration posits 71 yards, eight automotive facilities, and 31 intermodal facilities, that are specifically sized and configured to handle the necessary classification and blocking of the 3 million carloads of merchandise traffic that DuPont selected. *See* NS Reply III-C-60. Those yards and support facilities require 6,307 acres of land. Mr. Hedden valued the land required for the yards and support facilities as industrial land using the same methodologies applied to sections of the DRR ROW that were not physically inspected by FTI. *See* NS Reply Ex. III-F-3 at 20. Mr. Hedden valued the 6,307 acres required for yard facilities at $1,311,939,000. *Id.* at 105-07.

NS does not dispute DuPont's microwave tower communications site acreage or placement. *See* NS Reply Sec. III-F-6. However, as with the DuPont appraiser's ROW valuation, the valuation of the land needed for communications facilities is significantly understated. NS has valued that land according to Mr. Hedden's methodologies and the average value per acre of a particular route's ROW is applied to communications site acreage. Mr. Hedden concluded that the value of the land required for the communications facilities is $29,818,000. *See* NS Reply Ex. III-F-3 at 110-14.

d. Conclusion

As demonstrated, Mr. Hedden's retroactive appraisal report relies on sound appraisal methodology that is far superior to the DuPont appraiser's unreasonable and unsupported methodology. While the DuPont appraiser improperly valued land as of June 1, 2009, Mr. Hedden properly relied upon a July 1, 2007, appraisal date, which took into consideration the land acquisition period that DuPont admits is required for a SARR of this size. Therefore, unlike the DuPont appraiser, Mr. Hedden appropriately excluded any comparable sales after the year 2007 and refrained from the improper market adjustments the DuPont appraiser used to deflate comparable sale values to recession-levels. Furthermore, Mr. Hedden and Mr. Tesh spent well over a month in the field visually inspecting and valuing the DRR ROW, as compared with the 14 days spent by the DuPont appraiser "confirming" the results of its desktop review. This detailed inspection allowed Mr. Hedden to classify the ROW more accurately than the DuPont appraiser, who used significantly fewer Valuation Units than Mr. Hedden. Moreover, Mr. Hedden's analysis uses appropriate comparable sales of vacant land in areas along the DRR ROW, unlike the DuPont appraiser who relied upon sales with "unknown" land uses and improved land. While the DuPont appraiser relied upon an overly-broad global mean to evaluate comparable sales data, Mr. Hedden's valuation is based upon a stratified mean analysis that takes into consideration the price per acre paid for each transaction and thus accounts for prevailing market conditions. Whereas Mr. Hedden has provided a detailed explanation as to his ultimate conclusions of value, the DuPont appraiser provided no evidence or justification as to how it reconciled the comparable sales data with its ultimate applied values. Mr. Hedden's analysis properly took into consideration the value of easements and partially owned lines, both of which must be acquired by the DRR, but which the DuPont appraiser erroneously excluded from its valuation. And finally, Mr. Hedden accurately valued the acreage required for DRR yards, support facilities, and communications facilities.

In sum, Mr. Hedden's retrospective appraisal report presents a far more accurate, reliable, and supported analysis of the land acquisition costs required of the DRR. Mr. Hedden's analysis is supported not only by real estate industry practices, but also by Board precedent. Mr. Hedden's analysis should be accepted in its entirety.

2. Roadbed Preparation

The roadbed preparation section of the NS Reply is sponsored by NS witnesses Michael Baranowski, Robert Phillips, Paul Bobby, and Patrick Bryant. Mr. Baranowski is a Senior Managing Director at FTI Consulting and has over thirty years of experience in transportation analysis. Mr. Baranowski has testified in numerous Board proceedings and stand-alone cost cases, and sponsored evidence in virtually every SAC case since 1997, including sponsoring earthwork and other road property investment evidence in numerous cases. Mr. Bobby is a Project Manager with STV, a firm offering engineering, architectural, planning, environmental and construction management services. He has worked on several railroad construction projects and has participated in their design of roadway and track alignment, cost estimation, and the development of construction staging plans. Mr. Bryant is a Civil Engineer with STV and has more than 15 years of experience in rail, roadway, highway, and bridge design and construction. He has worked as a Rail Engineer on several rail projects for KCS and NS. Mr. Phillips is Vice President of the Rail Division of STV and has over 35 years of experience in track design and maintenance, grade crossings, and construction management of rail projects. Mr. Phillips has also developed road property investment evidence in several prior SAC cases. These experts' qualifications are further detailed in Section IV.

DuPont made several fundamental errors and omissions in calculating roadbed preparation costs, which are described in this section. A summary comparison of NS's roadbed preparation costs with those submitted in DuPont's opening evidence is presented in Table III-F-9.

Table III-F-9[19]
Roadbed Preparation Costs
($ thousands)

	Item	DuPont	Reply	Difference
1	Clearing and Grubbing	$81,191	$127,954	$46,763
2	Earthwork			
	a. Common	$666,288	$2,382,946	$1,716,658
	b. Loose Rock	$507,986	$690,839	$182,853
	c. Solid Rock	$1,265,234	$1,977,648	$712,414
	d. Borrow	$674,182	$742,922	$68,740
	e. Land for Waste Excavation	$206,860	$611,365	$404,505
3	Drainage			
	a. Lateral Drainage	$49,919	$50,086	$167
	b. Yard Drainage	$-	$135,385	$135,385
4	Culverts	$131,919	$746,813	$614,894
5	Retaining Walls	$346,129	$938,032	$591,903
6	Rip Rap	$36,908	$36,989	$81
7	Relocation of Utilities	$147	$147	$0
8	Topsoil Placement/Seeding	$1,439	$867	$(572)
9	Surfacing for Detour Roads	$524	$524	$0
10	Environmental Compliance	$177	$177	$0
11	Water for Compaction		$76,476	$76,476
12	Finish Grading		$68,592	$68,592
13	Other		$274,396	$274,396
14	**Total**	**$3,968,903**	**$8,862,160**	**$4,893,257**

[19] *See* NS Reply WP "DRR Open Grading errata NS Reply," Tab "Summary."

Much of the difference in the parties' earthwork costs is driven by the fact that, contrary to well-established Board precedent favoring the use of R.S. Means costs for common earthwork excavation, clearing and grubbing, and seeding, DuPont instead proposes to extrapolate all of these costs from a single, 1.3 mile railroad line relocation project in rural Tennessee, and apply them to the entire 7300 route-mile DRR.[20] The small line relocation project on which DuPont relies, the "Trestle Hollow Project" conducted for the South Central Tennessee Railroad near Centerville, Tennessee, is not even located on any portion of the NS lines replicated by the DRR.

The Board has long accepted R.S. Means as the appropriate, authoritative source for earthwork costs. Indeed, in nearly every SAC case, the Board has applied R.S. Means as the best source of earthwork construction costs, as well as other road property investment unit costs. In *FMC*, for example, the Board applied R.S. Means in calculating the appropriate unit costs for earthwork. *FMC*, 4 S.T.B. at 800. In *WP&L* the parties agreed to use R.S. Means, which the Board accepted. *WP&L*, 5 S.T.B. at 1020, n.147. In *Duke/NS*, the Board relied on R.S. Means costs. *Duke/NS*, 7 S.T.B. at 171; *see also CP&L*, 7 S.T.B. at 310. In *Otter Tail*, the Board accepted R.S. Means unit costs. *Otter Tail*, STB. Docket No. 42071 at D-11.[21]

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[20] As discussed in section III-F-3, DuPont also relies inappropriately on this project for subballast costs.

[21] *See also West Texas*, 1 S.T.B. at 704 (Accepting Complainant's "unit costs for earthwork as reasonable, because they are based upon actual quotations obtained from the construction industry and recognized compilation services" where the Complainant used R.S. Means); *PPL v. BNSF*, 6 S.T.B. 286, 305, n.26 (2002) (Applying Complainant's unit cost for excavation, based on R.S. Means); *TMPA I*, 6 S.T.B. at 705 (Using Complainant's culvert costs estimate based on R.S. Means); *Duke/CSXT*, 7 S.T.B. at 479 (Complainant's unit cost for blasting, based on R.S. Means, is used); *Xcel*, 7 S.T.B. at 616 (R.S. Means is "a set of nationwide standardized unit costs that is often relied upon in SAC cases to estimate construction costs."); *Id.* at 677 ("Xcel's common excavation costs are supported by *Means* ... Xcel's cost figures for common excavation are used here ... Xcel's equipment specifications are used here because they are supported by *Means*"); *APS v. ATSF*, STB Docket No. 41185, at 27 (July 27, 1997) (Accepting Complainant's R.S. Means-based index); *WFA I*, STB Docket No. 42088, at 86 (Applying Complainant's R.S.

DuPont erroneously cites the Board's 2007 decision in *WFA I* and the 2011 decision in *AEPCO* as supporting its unprecedented approach of using a small, short-line project that is untethered to any track owned by NS as the basis for earthwork unit costs for construction of a far larger SARR.[22] In *WFA I*, defendant BNSF produced actual construction unit costs for common excavation and embankment from its then-recently-completed Shawnee-to-Walker Third Main line construction project on the Orin line. At approximately 126 miles,[23] the BNSF's Orin line comprised a substantial portion of the actual route replicated and traversed by the relatively short 218 mile SARR proffered by complainants in *WFA I.*[24] And the Shawnee-to-Walker construction project comprised 14 miles[25] of the 126 mile Orin line. Defendant BNSF accepted the use of *its own actual costs* of the very *lines replicated by the SARR* for common excavation costs in that proceeding. *See WFA I*, STB Docket No. 42088, at 86. Unlike in *WFA I*, (1) the Trestle Hollow Project was not conducted by NS and is not on the NS system; (2) the Trestle Hollow project was tiny in size and scope in comparison to the DRR; and (3) NS does not accept it.

Means-based excavation costs); *Id.* at 86-87 (Accepting Complainant's "Means average for drilling and blasting and bulk drilling and blasting"); *AEP Texas*, STB Docket No. 41191, at 79 ("For segments that would require both clearing and grubbing, AEP Texas uses the R.S. Means Manual (Means) cost"); *AEPCO 2011,* STB Docket No. 42113, at 83-84 ("AEPCO submits separate unit costs for clearing and grubbing, using Means to determine its unit costs ... Therefore, we accept AEPCO's unit costs for clearing as the best evidence of record. We use the agreed-upon grubbing unit costs.").

[22] *See WFA I*, STB Docket No. 42088, at 86; *AEPCO 2011*, STB Docket No. 42113, at 83-84.

[23] The BNSF Orlin Line extends generally from MP 0 near Donkey Creek, WY to MP 126.2 at Orin Junction, WY. *See* NS Reply WP "BNSF Orin Line.pdf."

[24] *See WFA I*, STB Docket No. 42088, at 25-26.

[25] NS Reply WP "BNSF Shawnee to Walker miles.pdf."

Similarly, in *AEPCO 2011*, the complainant based its common excavation unit costs on the average costs of five actual BNSF capacity expansion projects covering nearly seventy-seven miles on the Orin and Hereford Subdivisions, from materials produced by BNSF in discovery.[26] Unlike *AEPCO*, the Trestle Hollow Project is not an expansion project on the lines of the defendant carrier. Indeed, Trestle Hollow is not even a project on a Class I railroad like the DRR.

In both *WFA I* and *AEPCO 2011*, due primarily to the projects' proximity to the route being replicated by the SARR and the fact that they were projects conducted by the defendant itself on a Class I railroad system, the defendant railroads accepted the use of their own experience and costs for common excavation for estimating SARR common excavation costs.[27]

Neither *WFA I* nor *AEPCO 2011* provides precedent for using the costs of a small project on a foreign short-line as the basis for the costs of constructing a SARR that purports to replicate the core of a Class I carrier. Rather, the projects used to derive construction costs for both *WFA I* and *AEPCO 2011* were much larger in size and far closer in geographic proximity and topography to the lines being replicated by the SARRs involved in those cases. The unit costs proffered by DuPont in its opening evidence are not those of the incumbent on the SARR route as in *WFA I* and *AEPCO 2011*, but rather based upon a small, isolated, and atypical short-line construction project on the South Central Tennessee Railroad in middle Tennessee. The size, scope, and geographic and topographic diversity of the DRR make it much more amenable to use of R.S. Means average costs than to extrapolation from any single project—particularly a small,

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[26] *See* NS Workpaper "UP and BNSF AEPCO Public Reply Excerpt – Project Miles.pdf."

[27] *See WFA I*, STB Docket No. 42088, at 86 (explaining that the parties agree on the cost for common excavation); BNSF and UP Reply, *AEPCO 2011*, STB Docket No. 42113 at III-F-22 (May 7, 2010).

atypical project like Trestle Hollow, which was not even conducted on lines replicated by the DRR.

Even if it were otherwise appropriate to extrapolate unit costs for a *7,000* foot short-line relocation project to a *7,000-plus* mile SARR, there are many reasons that the South Central Tennessee Railroad's purported costs on a construction project that was not even located on lines replicated by the DRR are not applicable, reliable, or appropriate estimates for this case:[28]

- The Trestle Hollow Project introduces a new earthwork category not previously used by the Board: "Mass Excavation." DuPont has not explained what it means by the term mass excavation or how it is distinguished from common excavation. Critically, DuPont has not demonstrated that any of the common excavation required for the DRR is properly characterized as "Mass Excavation." DuPont's application of a mass excavation unit price to common excavation should be summarily rejected as unprecedented, unexplained, and unsupported.

- Even if DuPont's very low unit price for mass excavation in the Trestle Hollow Project were accurate, NS's Engineering Experts have determined the project's unit price is a function of the high concentration of excavation volumes within a small geographic area. According to workpapers provided by DuPont, the Trestle Hollow Project involved 787,223 units of common excavation over 7,000 feet, or an average of nearly 600,000 units per mile.[29] The DRR total earthwork including common, loose and solid rock excavation and borrow would average less than 73,000 cubic yards per mile,[30] less than 13 percent of the volume per mile in the Trestle Hollow Project (using DuPont's cubic yards assumption). Common excavation alone averages just under 45,000 cubic yards per mile or 7.5 percent of the Trestle Hollow Project volumes. The economies realized by the Trestle Hollow Project contractor from conducting all of its work in a small concentrated area would not be available to the DRR contractors. NS's engineering experts have determined that those economies likely were realized through shorter

[28] The discussion of the Trestle Hollow Project is sponsored by NS witness Don Bagley, who personally visited the Trestle Hollow Project as well as many segments replicated by the DRR. *See* NS Reply WP "South Central Tennessee Railroad-Trestle Hollow Project.pdf."

[29] 787,223 / 7,000 x 5,280 = 593,791. Without explanation or support, DuPont assumes that "units" means cubic yards.

[30] *See* NS Reply WP "DRR Open Grading errata NS Reply.xls," Tab "EW Costs," Cell N390.

equipment cycles for excavating and transporting materials along the right of way, which tremendously increases the productivity of the manpower and equipment.

- The Trestle Hollow Project is a lump sum bid contract. There is no discernible link between the contract bid documents included by DuPont in its work papers showing the K.W. Lankford lump sum bid price of $2,698,324 and the separate single page entitled "Trestle Hollow Line Change Cost Tracker" ("Cost Tracker") totaling $2,698,334 upon which DuPont relies for its unit costs. The Cost Tracker document was not included in the Lankford bid documents, and there is no evidence it was created contemporaneously with the Lankford bid, or was even intended to support or be used with that bid. Because the totals in the bid and the Cost Tracker sheet are not the same, there is no way to determine if the unit price details in the Cost Tracker sheet were used to develop a project price and then the contractor reduced its actual final bid by a small amount, or if the cost tracker price details were created after the fact, possibly for litigation purposes.

- Inconsistencies between the contract bid documents and the contractor notes further undermine the credibility of DuPont's proffered unit costs. Specifically, the Cost Tracker sheet relied upon by DuPont for the DRR's common excavation unit cost identifies 787,223 units of mass excavation.[31] There is no indication anywhere in DuPont's supporting documentation of how that figure was derived or what the term "units" represents. DuPont treats the unit cost as a cost per cubic yard applicable to common excavation. The 6/08/06 contractor meeting notes, however, indicate the yardage for the project as 630,000 cubic yards[32] or only 80 percent of the mass excavation quantities used in DuPont's work papers. This represents a considerable difference. Although NS requested from DuPont the Trestle Hollow Project plan set to verify quantities and resolve the discrepancy, DuPont refused to provide any such additional documentation or explanation.[33]

- DuPont asserts that the Trestle Hollow project was challenging due to hilly terrain and that some of the unit prices are conservative.[34] In fact,

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[31] DuPont Opening WP "Trestle Hollow Project Cost Sheet.pdf."

[32] DuPont Opening WP "Trestle Hollow Specifications.pdf" at 279.

[33] *See* NS Reply WP "Email to DuPont Re: Trestle Hollow Project.pdf."

[34] DuPont Opening III-F-14 to III-F-15.

based on a site visit and review, a review of the aerial photos of the area,[35] and the limited concept documents provided in DuPont's workpapers, NS's Engineering Experts have determined there was nothing complicated about the Trestle Hollow project, particularly compared with the adverse topography encountered on significant portions of the 7,277 mile DRR.[36]

- Grading contractors working on the Trestle Hollow Project had the significant cost-saving advantage of a wide right-of-way that provided ample width for vehicle turning; inadvertent over-excavation; and haul roads adjacent to the roadbed under construction. Based on DuPont's report that 30 acres were cleared and grubbed for the project and an overall project length of 7,000 feet, the average right of way width is at least 187 feet. Some contractor notes suggest Trestle Hollow rights of way areas with as much a 600 feet of clearance before encroaching on adjacent property lines.[37] DuPont's submission limited DRR rights-of-way to 75 and 100 feet, which would constrain grading operations significantly, because equipment operators would have to exercise special care not to encroach on adjacent properties, and equipment would have less mobility, thereby reducing productivity.[38] Moreover, the lack of hauling roads along the DRR right-of-way would force its construction haulers to use the railroad roadbed during construction, further reducing equipment productivity.

- The Trestle Hollow Project enjoyed additional unusual economies including that the contractor was able to distribute excavated spoil materials along the right of way.[39] In contrast, because of the narrow DRR 75 and 100 foot right of way, DRR earthwork contractors would be required to haul spoil materials longer distances to special disposal areas acquired at points adjacent to the right of way.

- According to the soil boring reports prepared by Qore Property Sciences and provided by DuPont as part of the overall bid package on the Trestle Hollow Project, the in-situ moisture contents of the soils tested for the Trestle Hollow Project had near optimal moisture content, meaning little if

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[35] DuPont Opening WPs "Aerial_Photos #1.pdf" and "Industrial_Map.pdf" in Trestle Hollow Pictures subfolder. These pictures show easy access to a major highway and that the area appears to have been partly clear cut by previous logging.

[36] NS Reply WP "South Central Tennessee Railroad-Trestle Hollow Project.pdf."

[37] DuPont Opening WP "Trestle Hollow Specifications.pdf" at 279.

[38] DuPont Opening III-F-3.

[39] DuPont Opening WP "Trestle Hollow Specifications.pdf" at 279.

any additional water was needed for compaction.[40] Encountering soils with such optimal moisture content is atypical and, as explained below, quite unlikely for the vast majority of the terrain traversed by the DRR. Using the Soil Climate Analysis Network (SCAN) and the Web Soil Survey (WSS), NS's Engineering Experts have found 38 monitoring stations located close to the DRR route. Of the 38, five areas are below the optimum and would require water for compaction, 15 are within 4% of optimum, and 18 are above the optimum moisture content requiring drying of material before compaction.[41] See *supra* III-F-2-c-ii-(f).

- Separate confirmation that the soils encountered as part of the Trestle Hollow Project are atypical for the DRR is provided by a detailed soil analysis conducted by NS's Engineering Experts. The Trestle Hollow Project is located within the Interior Low Plateau region.[42] In addition to the Interior Low Plateau region the DRR will traverse the regions described in NS Reply Exhibit III-F-5 "DRR Physiographic Provinces," all of which have materially different earth characteristics and, as such, different earthwork cost characteristics: The Trestle Hollow Project near Centerville, Tennessee is situated in the Highland Rim Section of the Interior Low Plateaus Province. As confirmed by the NS site visit, there are no rock outcroppings or slope stability concerns, which are associated with more geologically complex or steep terrain such as in the Appalachian Highlands, and no soft soil conditions or river crossings such as in the Coastal Plain. The Trestle Hollow Project is situated in a small portion of one of the 24 physiographic sections found in the 9 Physiographic Provinces that DRR route would traverse. The Trestle Hollow Project is not representative of other more difficult terrain over the route, and roadway design and construction costs are higher in other locations with more difficult terrain.

a. DuPont's Fabricated Rationale

In an effort to avoid the use of actual costs that NS has recently incurred for earthwork activities, DuPont complains that NS produced in discovery only a limited volume of documents containing earthwork cost information. DuPont further claims that because the documents relate

[40] DuPont Opening WP "Trestle Hollow Specifications.pdf" at 226 – "Report of Geotechnical Exploration Services."

[41] NS Reply WP "DRR Soil Moisture Content R1.xls."

[42] NS Reply WP "DRR Physiographic Provinces.docx."

to construction of short track extensions or yard tracks, the Board should reject the NS costs as not representative of the costs of constructing the DRR. DuPont Opening III-F-13.

DuPont's complaints ring hollow. In response to DuPont's discovery requests related to earthwork cost, NS produced a list of Authorizations for Expenditure ("AFE") for all NS construction projects completed during the time period from January 1, 2007 through December of 2010. The NS AFE list included information for 775 separate AFEs covering all aspects of NS capital expenditures over the relevant time frame.[43] Sixty-eight of the AFEs on the list included costs for "Grading" activities at a total cost of $84 million.[44] Of the sixty eight grading projects, DuPont selected only ten for detailed review.[45] After this limited review, DuPont dismissed the costs from all of the AFEs for which it requested detailed supporting information because DuPont deemed the projects it had chosen to be too small.[46] DuPont has not described the criteria it used in concluding that the specific NS projects it selected for review were too small. Nor did DuPont seek to review any additional projects once it deemed those it had selected to be unfit for its purposes.

It is difficult to understand how DuPont deemed the actual NS projects to be too small while it found the Trestle Hollow Project to be an appropriate size to extrapolate to a 7,300 route-mile rail network. The Trestle Hollow Project upon which DuPont relies for DRR common excavation costs is a scant 1.3 miles. NS reviewed the details of its AFEs that report costs under the NS grading function (code 5103). Of the ten projects reporting costs under the

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[43] *See* NS Reply WP "AFE List.xlxs."

[44] *See* NS Reply WP "DuPont Earthwork AFEs.xlsx."

[45] *See* NS Reply WP "DuPont Letter Requesting Detailed AFEs.pdf."

[46] DuPont Opening III-F-13.

grading function code, eight projects included costs directly related to excavation and borrow. Table III-F-10 summarizes the relevant details of the earthmoving costs.

Table III-F-10
Summary of Earthwork Costs From NS AFEs Produced to DuPont

AFE	Year	Length (miles)	Earthwork Description	Earthwork Quantity (cubic yards)	2009 Unit Cost
40856	2004	1.46	Unclassified Excavation	25,000	$12.89
50096	2005	2.14	Unclassified Excavation	10,500	$11.98
50739	2005	0.31	Unclassified Excavation	1,270	$11.98
51323	2005	1.63	Grading - Cut	18,000	$9.59
60561	2005	2.18	Grading - Cut/Borrow	20,300	$17.30
70553	2006	2.59	Grading - Borrow	21,600	$12.85
70565	2007	2.27	Unclassified Excavation	30,000	$10.06
81228	2008	0.19	Rock Excavation	17,000	$61.69
Total (incl. rock excv.)		12.77		143,670	$18.20
Total (excl. rock excv.)		12.58		126,670	$12.36

Source: NS Reply Workpaper "DuPont Earthwork AFEs.xlsx."

As Table III-F-10 shows, NS AFEs produced to DuPont in discovery include costs for nearly 13 miles of earthmoving work, totaling over 143,000 cubic yards. The seven projects not involving rock excavation averaged 1.82 miles[47] in length, or approximately 37% <u>longer</u>[48] than the Trestle Hollow Project. The NS actual cost per cubic yard, indexed to 2009 using the AAR indexes of chargeout prices and wage rates, range from a low of $9.59 for excavating a cut, to a high of $61.69 for excavating rock.[49] The NS actual cost average $18.20 per cubic yard including the rock excavation project and $12.36 per cubic yard is the high cost of the rock

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[47] 12.77 / 7 = 1.82.

[48] 1.82 / 1.33 = 1.37.

[49] NS Reply WP "NS Actual Earthwork Costs.xls."

excavation project is removed.[50] The AFE estimates are developed and used in NS's regular course of business by experienced railroad project engineers and are accurate and reliable. DuPont fails to acknowledge the real reason it seeks to dismiss NS's real-world AFE unit costs—that those costs are well above those of the unrepresentative Trestle Hollow Project and well above earthwork costs developed from R.S. Means construction cost data, upon which most Board decisions have relied.[51]

In addition to the AFEs, NS produced in discovery to DuPont details of NS's Keystone Build-Out Project near Shelocta, Pennsylvania. The project was completed by NS in 2006 and involved the construction of a new 5.3 mile rail line between Saltburg and Clarksville, Pennsylvania, along with the rehabilitation of 10.8 miles of existing abandoned track between Clarksville and Shelocta.[52] The 5.3 miles of new construction is one of the largest greenfield rail construction projects in the U.S. in recent years. The new construction portion of the project involved the excavation of over 1.4 million cubic yards of soil, most of which involved making large cuts in the existing hillside to carve out a flat path for the rail corridor. NS's cost for just the earthwork on the Keystone Build-Out Project averaged $10.91 per cubic yard at 2009 levels.[53] Details of the Keystone Project were produced to DuPont in discovery and are included in the NS reply workpapers.[54]

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[50] *Id.*

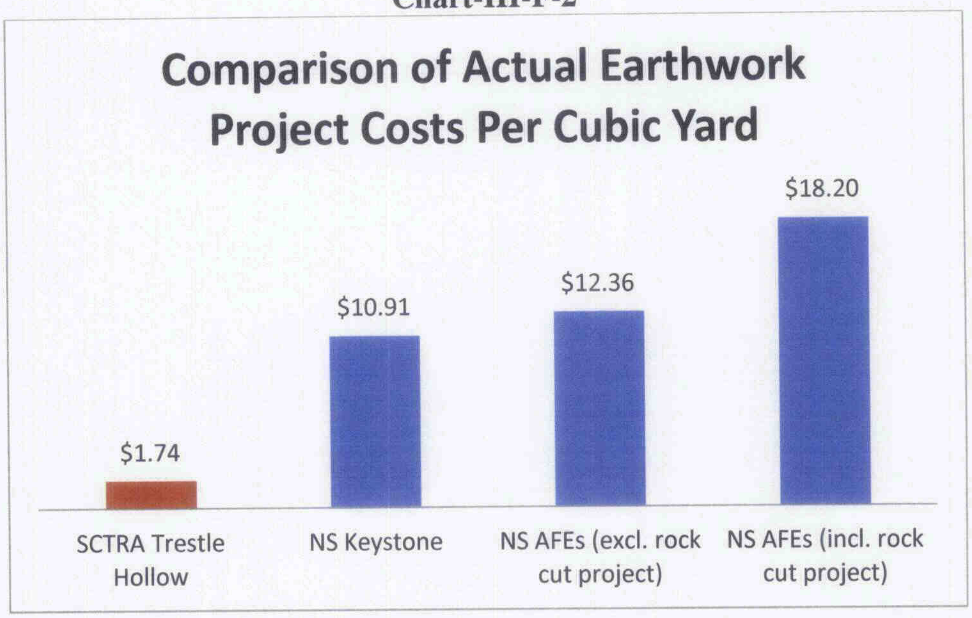
[51] *FMC*, 4 S.T.B. at 800; *WP&L,* 5 S.T.B. at 1020, n.147; *Duke/NS*, 7 S.T.B. at 171; *CP&L*, 7 S.T.B. at 310; *Xcel*, 7 S.T.B. at 616; *Otter Tail*, STB Docket No. 42071, at D-11.

[52] *See* NS Reply Exhibit III-F-7 ("Building the Shelocta Line") (DVD); NS Reply WP Folder "Keystone Data," NS Reply WP "Keystone Videos," "Keystone Narrative.pdf" (materials also produced to DuPont in discovery: Keystone Videos, NS-DP-HC-DVD-025 to 029; and Keystone narrative, NS-DP-HC-25663-25701).

[53] *See* NS Reply WPs "SPENDING FORECAST 2002-03-22 (NS-DP-HC-37990.pdf" and "NS Actual Earthwork Costs.xlsx." Although it represents NS actual experience in building a new

DuPont suggests that the NS AFE information is somehow deficient because it involves extensions to existing track. *See* DuPont Opening III-F-13. DuPont says nothing regarding the recent NS experience on the Keystone Build-Out Project. The Chart below compares the earthwork costs actually incurred by NS in the AFEs produced to DuPont and on the Keystone Project (indexed to 2009 levels) with the Trestle Hollow Project costs proffered by DuPont.

Chart-III-F-2



Source: NS Reply Workpaper "NS Actual Earthwork Costs.xls."

Chart III-F-2 shows that the Trestle Hollow Project costs are far out of line with NS's actual earthwork project experience.

Neither the NS AFEs nor the Keystone documents provide separate unit cost for common, loose rock or solid rock excavation so the cost per cubic yard reflected in Chart III-F-2 are the average cost for all categories of earthwork in each of the representative projects. In SAC

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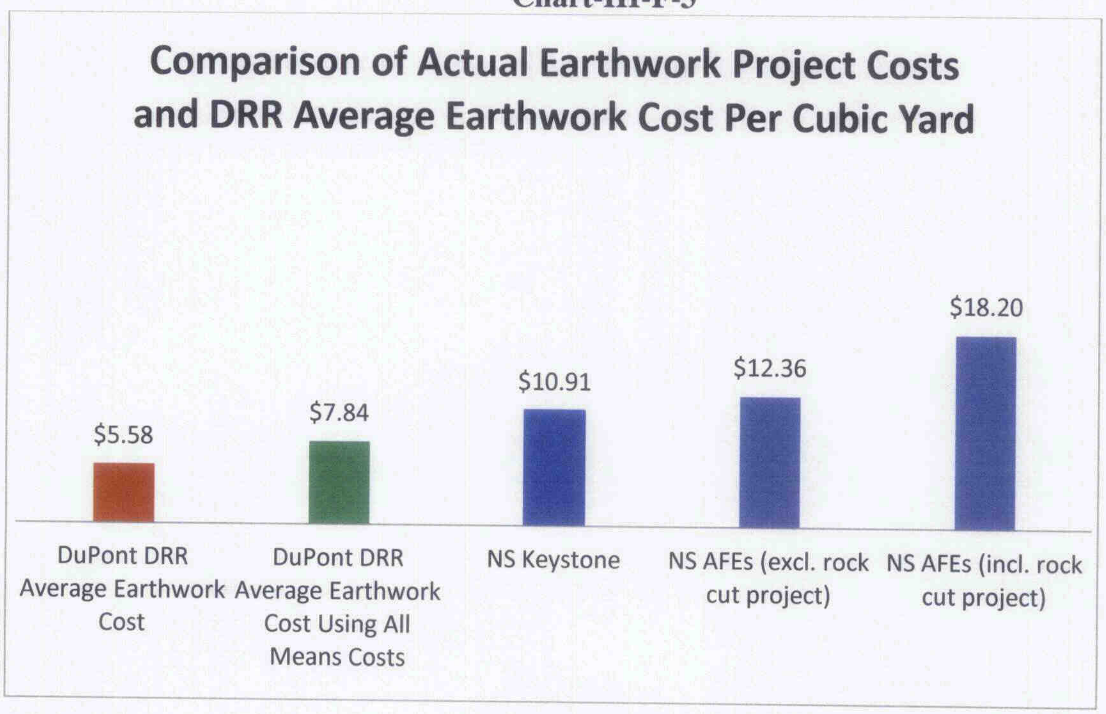
line of railroad, unlike R.S. Means the Keystone Project costs reflect the construction characteristics of a single project and therefore should not be assumed to be representative of the costs of building a railroad the scope of the DRR.

[54] NS Reply WP Folder "Keystone Data."

cases, earthwork quantities normally are separated into individual classifications of common excavation, loose rock excavation, solid rock excavation, and borrow.[55] In order to compare the reasonableness of the DRR earthwork unit costs, it is useful to compare the overall project cost per cubic yard from the NS AFEs and Keystone project to the overall average DRR earthwork costs. Chart III-F-3 below compares (i) the average DRR cost per cubic yard for common, loose rock and solid rock excavation from DuPont's opening evidence, which includes use of the Trestle Hollow Project unit cost for common excavation to (ii) what DuPont's own average DRR cost per cubic yard would be if, as in past cases, DuPont's costs were calculated using R.S. Means for all earthwork costs.

Chart-III-F-3



Source: NS Reply Workpaper "NS Actual Earthwork Costs.xlxs."

Chart III-F-3 shows that even when R.S. Means is used to develop the DRR cost for common excavation, the overall earthwork average project cost for the DRR is still well below

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[55] *See, e.g.*, *Xcel*, 7 S.T.B. at 676.

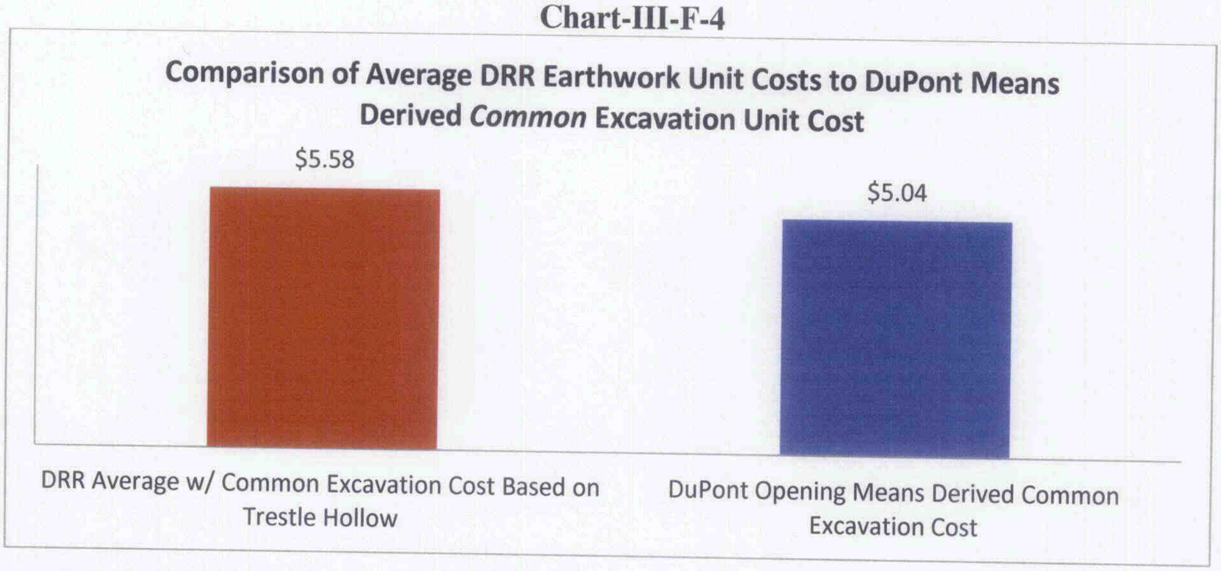
NS's actual costs experienced on the Keystone Project and in the AFEs provided to DuPont in discovery. This is because the Trestle Hollow Project costs assumed by DuPont for DRR common excavation are unrealistically low and produce average DRR earthwork costs that are roughly half of the average cost NS incurred in building the 5.3 mile Keystone Project and are less than one-third of the costs actually incurred by NS for earthwork on for the AFE projects produced to DuPont in discovery.[56] Chart III-F-3 shows that composite DRR costs that include the use of R.S. Means for common excavation, while still conservatively lower than the NS actual experience, are more in line with typical railroad construction project costs.

Further demonstrating that the Trestle Hollow Project costs are out of line and unreasonably skew the average DRR earthwork costs, is DuPont's own calculation of common excavation cost consistent with prior Board precedent and included those calculations in its workpapers. DuPont WP "DRR Open Grading errata.xls," Tab "Unit Costs." Seeing the results of calculating costs in accordance with R.S. Means as the Board has done in most prior cases, DuPont jettisoned that work in an attempt to depress DRR's excavation costs. Chart III-F-4 below compares DuPont's proposed overall unit cost for *all earthwork* (which includes common excavation, loose and solid rock excavation, adverse loose and adverse solid rock excavation, and borrow) to the R.S. Means-derived unit cost for *common excavation alone*. DuPont developed the latter Means-based common excavation unit cost in its electronic grading work but then decided not to use it. This shows that the standard Means-based cost approach (which the Board has adopted in prior cases) for the single earthwork cost component of common

[56] As Chart III-F-4 shows, DuPont average earthwork cost for all aspects of DRR earthwork activities is only slightly higher than the Board-accepted, Means-derived unit price for common excavation.

excavation alone– as calculated by DuPont itself – is nearly the same as the cost DuPont ultimately proposed in its opening evidence for *all* earthwork.

Chart-III-F-4



Source: NS Reply Workpaper "NS Actual Earthwork Costs.xlxs."

b. Clearing and Grubbing

Clearing is the process of removing brush and trees (leaving roots and stumps), and is the initial step in roadbed preparation. Clearing quantities from the ICC Engineering Reports can be divided into two general types, based on the type of plant cover and degree of difficulty of clearing. The first type is clearing of areas having primarily smaller brush and few trees. This entails using a rake to cut the brush, and stockpiling the cut material. The stockpiled brush is loaded into trucks and hauled to a waste site. The second type is clearing of areas with trees, a more arduous undertaking that involves cutting and chipping the trees.

Grubbing is the process of removing tree roots and stumps left by clearing of the areas with trees. Grubbing is required for areas with trees, but generally is not required for areas primarily covered with brush and smaller vegetation. *See* NS Reply WP "DRR Open Grading errata_NS Reply.xls" showing what is cleared, and what is grubbed.

i. Clearing and Grubbing Quantities

NS accepts DuPont's method of determining clearing quantities and grubbing quantities and its resulting clearing and grubbing quantities. *See* NS Reply WP "DRR Open Grading errata_NS Reply.xls," Tab "Clearing and Grubbing Costs." NS rejects DuPont's proffered clearing and grubbing costs. In past cases, clearing and grubbing costs have been split into two separate categories – those acres containing trees that require both the clearing of trees and the grubbing of stumps and those acres without trees that require only light clearing to remove and dispose of brush.[57] Here, DuPont applied a combined clearing and grubbing unit cost of $2,110.98/Acre based upon the Trestle Hollow Project. As NS explained in detail in Section III-F-2, the Trestle Hollow Project is not comparable in scale, scope, topography, rock and soil conditions, and other diverse conditions to the areas traversed by the expansive DRR system.

DuPont attempts to justify the use of a one-size-fits-all "combined" cost by claiming that applying this combined unit cost to the total acres requiring clearing is conservative and may "overstate[] the total costs as not all acres have trees or require grubbing." DuPont Opening III-F-9. While it is true that not all SARR land would require grubbing, DuPont's workpapers show its approach is not conservative. DuPont's opening workpapers show it did develop *separate* "alternative" costs for clearing and grubbing, using the R.S. Means Handbook.[58] The R.S. Means Handbook provides a "set of nationwide standardized unit costs, adjusted for localities, used to estimate the cost of construction" that has long been accepted by the Board. *See, e.g., CP&L*, 7 S.T.B. at 310; *Duke/NS*, 7 S.T.B. at 171, n.99. Although DuPont ultimately chose not

[57] *AEPCO 2011*, STB Docket No. 42113, at 83.

[58] *See* DuPont Opening WP "DRR Open Grading errata.xls," Tab "Unit Costs," Rows 97 – 108 and Tab "Other Items," Rows 368 – 379. Specifically DuPont calculates separate unit costs applicable to acreage with trees that require both clearing of trees and grubbing of stumps and acreage without trees that require only the clearing of brush.

to use these costs to determine the DRR clearing and grubbing costs, its workpapers nonetheless show most of the relevant R.S. Means unit costs required for clearing and grubbing activities.[59] Instead of using the separate unit costs it identified for clearing and grubbing in its workpapers, DuPont substituted a lower amalgamated cost based upon the Trestle Hollow Project.[60] DuPont's alternative clearing and grubbing costs are 10% higher using the Means-derived individual unit cost categories than those derived using the combined Trestle Hollow Project clearing and grubbing cost.[61] DuPont provides no justification for why the Trestle Hollow Project costs are either more accurate or more representative than its Means costs.

Further, DuPont has failed to demonstrate that the clearing and grubbing cost per acre from the Trestle Hollow Project is representative of the clearing and grubbing costs that would be incurred in the construction of the DRR. Specifically, the limited supporting documents provided by DuPont for the Trestle Hollow Project unit costs indicate only an amount of 30 acres and a unit cost of $2,000 per acre.[62] There is no indication of whether the 30 acres represent all of the Trestle Hollow Project acreage that required both clearing and grubbing or something else. The ICC Engineering Reports used to determine the DRR clearing and grubbing quantities contain detailed splits of the relative amount of acres requiring clearing only versus those requiring both clearing and grubbing.[63] Without information on the relative mix of clearing only

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[59] *Id.*

[60] *See* DuPont Opening WP "DRR Open Grading errata.xls," Tab "Unit Costs," Rows 110 – 113.

[61] *See* NS Reply WP "DRR Open Grading errata NS Reply.xlsx," Tab "Unit Costs," Rows 130 to 147.

[62] *See* DuPont Opening WP "Trestle Hollow Project Cost Sheet.pdf."

[63] *See* DuPont Opening WP "DRR Open Grading errata.xls," Tab "Eng Rpt Input," Columns AU and AX.

versus clearing and grubbing from the Trestle Hollow Project—which DuPont has not provided —it is impossible to determine the relevance of the Trestle Hollow Project clearing and grubbing costs to the DRR.

ii. Acres Requiring Both Clearing and Grubbing

For acreages with trees that require both clearing and grubbing, NS rejects DuPont's proposed use of the Trestle Hollow Project as the source for DRR clearing and grubbing unit costs and adopts DuPont's alternative R.S. Means-based approaches included only in DuPont's workpapers[64] that develops separate unit costs for clearing of $5,135 per acre based on the R.S. Meanscost for cutting and chipping trees up to twelve inches in diameter[65] and for grubbing of $3,130 per acre based on the R.S. Means cost for grubbing and removing stumps.

NS's approach is consistent with Board preceden. *See, e.g., AEPCO 2011*, STB Docket No. 42113, at 83 (providing separate R.S. Means unit costs for clearing and grubbing); *CP&L*, 7 S.T.B. at 310 (same). NS applied these unit costs to the DRR acres requiring both clearing and grubbing identified in its reply.

c. Acres Requiring Only Clearing

DuPont's alternative R.S. Means based clearing and grubbing costs include a unit cost of $239.32/acre for areas that require clearing but do not need to be grubbed. NS accepts the application of a separate unit cost to acreages requiring only clearing but rejects DuPont's proposed cost for clearing because DuPont made two significant errors in deriving its clearing costs estimate: (a) applying the R.S. Means costs for equipment that could not clear land at the

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[64] See DuPont Opening WP "DRR Open Grading errata.xlsx" Tab "Unit Costs," Rows 101 through 108.

[65] DuPont Opening WP "DRR Open Grading errata.xlsx," Tab "Unit Costs," Rows 101 through 105.

rate of speed assumed by DuPont; and (b) neglecting to include the R.S. Means cost of the equipment and labor necessary to load and haul away loose material created during clearing. Below NS explains those errors in detail.

First, the equipment corresponding to the unit cost DuPont selected would be incapable of clearing land at the production rate DuPont assumes. The R.S. Means unit cost that DuPont developed is based on a B-11A crew with a single 200-horsepower dozer capable of clearing eight acres per day using a twelve-foot wide brush rake.[66] However, DuPont necessarily assumes the same dozer would both pull the clearing rake and stockpile resulting materials. The R.S. Means cost does not include any additional equipment (dozer) to stockpile cleared material.[67]

Under DuPont's approach, therefore, a single bulldozer would have to split its time between the two tasks, which would substantially increase the time and unit costs for clearing. NS's Engineering Experts have adjusted the clearing rate by cutting it in half (to four acres per day) to reflect this division of time and work.[68]

Once the materials are cleared and stockpiled they cannot remain on the narrow DRR roadbed (because they would impede other construction work) and must be hauled away for disposal. This task cannot be accomplished with a bulldozer selected from R.S. Means to perform the clear and stockpiling operations because the bulldozer blade is incapable of lifting the stockpiled materials and placing them in a truck to be hauled away. DuPont failed to account separately for the time, labor, and equipment necessary to load and haul away the stockpiled

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[66] *See* NS Reply WP "Clearing Crews.pdf" and NS Reply WP "DRR Open Grading errata NS Reply.xlsx," Tab "Unit Costs," Rows 132 to 133.

[67] *Id.*

[68] *See* NS Reply WP "Clearing Equipment_Selection_NS_Reply.xlsx."

material. To correct this error and account for the necessary costs of removal, NS's Engineering Experts added the R.S. Means cost of a B-30 crew—an equipment operator, an excavator, two dump trucks and drivers—to remove such material. This is an economical choice of equipment, allowing the small excavator to load one truck while the second truck is hauling the waste to the dump sites.

After reducing the clearing rate to an achievable four acres per day and adding the cost of a crew to load and haul away materials after clearing, the total daily cost of clearing and loading a 30-foot wide section of land is $1,281.90 per acre.[69]

d. Earthwork

NS accepts DuPont's general method of determining earthwork quantities from the ICC Engineering Reports, but corrects errors in DuPont's implementation of that method. As detailed below, NS accepts DuPont's general methodology for determining yard earthwork quantities but rejects DuPont's overall yard track construction earthwork quantities because DuPont understates both the number and size of DRR yards. NS also rejects DuPont's unit costs for earthwork excavation and land for waste sites, but accepts DuPont's borrow unit cost. In addition, NS's Reply Evidence corrects DuPont's failure to include stripping, undercutting, swelling of excavation for haulage, solid rock over-excavation, and finish grading quantities and costs.

i. Earthwork Quantities from ICC Engineering Reports

NS accepts DuPont's assignment of valuation sections to the DRR route and its adjustment of the ICC Engineering Reports' quantities to reflect modern construction standards. NS also accepts DuPont's proposed roadbed widths. However, NS rejects DuPont's earthwork

[69] NS Reply WP "DRR Open Grading errata NS Reply.xlsx," Tab "Unit Costs," Rows 132 to 133.

quantities. The general methodology DuPont used for calculating earthwork quantities is acceptable in theory, but DuPont made several implementation errors. Specifically, DuPont input erroneous common earth excavation quantities for five valuation sections and incorrect solid rock excavation quantities for two valuation sections.[70] In addition, DuPont did not include earthwork quantities for DRR segments in which NS has a partial ownership share. *See infra* III-F-12. NS's Reply Evidence corrects these errors.[71]

ii. Other DRR Earthwork Quantities and Earthwork Costs

(a) DRR Yards

DuPont proposed that the DRR would include six large yards and 117 minor yards. DuPont developed the earthwork quantity estimates for all of these facilities by assuming an average one foot fill height per yard track foot. The one-foot fill assumption for yard tracks is a function of the assumptions made to remove earthwork quantities attributable to yard and other tracks from the quantities reported in the ICC Engineering Reports.

NS's Operations Experts rejected 45 of DuPont's proposed yards and consolidated eight separate DuPont yards to four yards. *See supra* III-B-Final Yards. [72] In addition, NS experts also added 120 yard facilities to the DRR for sufficient support of proposed revenue service.[73] The types of yards added are:

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[70] *See* NS Reply WP "DRR Open Grading errata NS Reply.xls," Tab "DRR-ICC Quantity Errors."

[71] *See* NS Reply WP "ICC Engineer Reports for New Reply DRR Trackage Segments.pdf" and NS Reply WP "DRR Open Grading errata NS Reply.xls," Tab "Eng Rep Input," Lines 220 to 243.

[72] *See* NS Reply WP "Final Yards DRR Yard Matrix Reply.xlsx."

[73] *Id.*

- 16 New Small Yards
- 51 New Industrial Supply Yards
- 8 New Auto Facilities
- 31 Intermodal (IM) Facilities
- 14 Bulk Transfer (TBT) Facilities

See supra III-B-Final Yards. Because the NS Reply DRR yards are within reasonable proximity of where NS has yards today, NS's Engineering Experts accepted the one-foot fill height per yard track mile and added the resulting quantities to the Common Earth Excavation quantities. Except in special circumstances, NS accepts the one-foot fill assumption for the DRR yards.

(b) Segments with Partial NS Ownership

In several instances, DuPont assumed that the DRR would step into NS's shoes by exercising trackage rights held by NS for certain rail lines. Apparently assuming the lines in question were wholly owned by another rail carrier, DuPont did not include any of the costs of constructing these lines in its DRR road property investment calculation. As discussed in detail below, *see infra* III-F-13, NS has a significant ownership interest in several of the foreign railroads traversed by the DRR, including the Conrail Shared Asset Areas, the Terminal Railroad Association of St. Louis (TRRA), Indiana Harbor Bet (IHB), and the Belt Railway of Chicago (BRC). Because NS's rights to operate over these lines are an inextricable part of its ownership interests, the DRR could exercise such operating rights only if it acquired NS's ownership rights in those lines. Accordingly, the DRR must pay the cost of construction of NS's share of those lines, including roadbed preparation costs. *See infra* III-F-13. NS's Engineering Experts calculated NS's share of the earthwork quantities from the ICC reports and have included them in the DRR earthwork quantities.[74]

(c) Total Earthwork Quantities

For the reasons set forth above, NS rejects the total earthwork quantities DuPont submitted in its Opening Evidence. NS has adjusted DuPont's earthwork quantities to correct the errors and omissions described above. Those corrections, and resulting earthwork quantities, are detailed in NS's workpapers.[75] The following table compares earthwork quantities proposed by DuPont and the corrected quantities developed by NS in this Reply.

Table III-F-11
DRR Earthwork Quantities and Costs[76]

	Item	DuPont(CY)	NSReply(CY)	Difference(CY)
1	Common Excavation	368,661,915	388,388,274	19,726,359
2	Loose Rock Excavation	49,273,283	51,204,002	1,930,719
3	Solid Rock Excavation	92,106,569	95,586,007	3,479,438
4	Borrow	43,035,802	45,884,256	2,848,454
5	Total	553,077,568	581,062,540	27,984,972

(d) Earthwork Unit Costs

NS has evaluated DuPont's proffered earthwork unit costs and made appropriate corrections and adjustments. Revisions to DuPont unit costs are described in the following sections.

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[74] *See* NS Reply WP "DRR Open Grading errata_NS Reply.xls," Tab "EW Cost" and NS Reply WP "ICC Engineer Reports for New Reply DRR Trackage Segments.pdf."

[75] NS Reply WP "DRR Open Grading errata_NS Reply.xls," Tab "EW Cost."

[76] *Id.*

(i) **Haul Distance Assumptions**

Implicit in the development of earthwork unit prices is an assumption regarding the average length of haul for materials excavated and loaded into vehicles for placement in embankment or dumping to waste pits. To develop common excavation costs from R.S. Means, DuPont selected a unit price for a scraper with an average haul distance of 3,000 feet.[77] Haul distance represents the distance the loaded materials are actually moved,[78] so the round trip distance (loaded plus empty) for the scraper is 6,000 feet. In its development of R.S. Means derived earthwork unit costs for common – adverse, loose and loose – adverse rock and solid and solid – adverse rock DuPont assumes that haulage would be accomplished by large dump trucks or haulers, but without any support assumed that the round trip distance would be less than half that assumed for the scraper. Specifically DuPont selects from R.S. Means hauler unit prices for round trips of one-half mile or only 2,640 feet.[79] This lower, unsupported round trip produces unachievable efficiencies that artificially lower earthwork construction costs. Under DuPont's assertion, all material would have to be excavated within 1,320 feet of embankments and excavation waste dump sites. A more realistic and efficient choice is to develop haulage costs consistent with the haul assumptions for common excavation and select costs for a 1-mile cycle. NS has adopted this approach in restating DuPont's R.S. Means based excavation costs that rely on haulers to transport excavated materials.

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[77] DuPont Opening Workpaper "DRR Open Grading errata.xlsx," Tab "Unit Costs," Row 12.

[78] See NS Reply Workpaper "Haul_Definition.pdf."

[79] DuPont Opening Workpaper "DRR Open Grading errata.xlsx," Tab "Unit Costs," Rows 22, 46, 60 and 75.

(ii) Common Excavation

As discussed previously, DuPont based its unit costs for common excavation on the Trestle Hollow Project. NS rejects the notion that common excavation unit cost for the DRR will be the same as the single, isolated 7,000 *foot* Trestle Hollow project. *See* NS Reply WP "South Central Tennessee Railroad-Trestle Hollow Project.pdf." Instead, NS's experts have developed common excavation cost from R.S. Means. NS Reply WP "DRR Open Grading errata_NS Reply.xls," Tab "Unit Costs."

Unlike the unrepresentative, suspect unit price estimates derived from the small and isolated Trestle Hollow Project, R.S. Means costs are developed from real-world costs of a large variety of actual construction projects, which serve as a far better basis for calculating the costs of constructing the sprawling DRR. To develop its annual average costs, R.S. Means contacts manufacturers, dealers, distributors, and contractors all across the U.S. and Canada for input. R.S. Means' labor costs are based upon the average of wage rates from 30 major U.S. cities. Its wage rates are determined from both union labor agreements and open-shop rates. R.S. Means bases its equipment costs on national rental rates and include operating costs such as servicing, fuel, and lubricants. It obtains equipment rental rates from contractors, suppliers, dealers, manufacturers, and distributors throughout North America.[80] And R.S. Means has long been accepted by the Board as an authoritative source. *See, e.g., CP&L*, 7 S.T.B. at 310.

In DuPont Opening workpaper "DRR Open Grading_errata.xls" DuPont presented a unit cost across the diverse terrain and conditions traversed by the entire 7,277 route mile DRR network that it developed from R.S. Means.[81] NS accepts that R.S. Means-based unit cost for

[80] NS Reply WP "Equipment_Selection_Graphics.pdf."

[81] DuPont Opening WP "DRR Open Grading errata.xls," Tab "Unit Costs."

common excavation in non-adverse conditions that DuPont included its unit cost workpaper (but did not use in its final cost calculations). NS applied that unit cost to common excavation quantities to derive common excavation costs for the DRR.

(iii) Adjustment for Adverse Terrain

Without any meaningful explanation or identification of its criteria, DuPont assumed that only 19% of the DRR excavation quantities qualify for the additional cost associated with excavation in adverse terrain. *See* DuPont Opening III-F-13. Adverse terrain is rugged or mountainous topography that must be traversed in order to construct the DRR routes identified by DuPont. These routes require steep grades with many sharp curves to get through the mountainous terrain, and construction of a roadbed along twisting rivers where the roadbed must be carved out of the sides of mountains that slope steeply into river bottoms. The DRR crosses the Appalachian Mountains several times. The parts of the Appalachian chain traversed by the DRR include the Allegheny, Blue Ridge, Pocono, Catskill, Taconic, and Cumberland Mountains. Rail routes along riverbeds, where the roadbed is built adjacent to the river and above the river flood stage, are characterized by many sharp curves, and sometimes have steep grades, but generally follow the river grade. Roadbed construction through adverse terrain requires more work, effort, time, and resources for earthwork because earthmoving equipment must traverse steep slopes and deep ravines, which significantly reduces production rates and limits the type of equipment that can be used. DuPont considered as adverse portions of only the following line segments:

(1) the line between Pittsburgh, PA and Harrisburg, PA

(2) the line between Alloy, WV and Walton, VA

(3) portions of the line between Harrisburg, PA and Perryville, MD

(4) portions of the line between Roanoke, VA and Bristol, TN

(5) portions of the line between Somerset, KY and Chattanooga, TN

(6) the Celco Branch

(7) the Waynesville Branch

(8) portions of the Asheville Branch.

See DuPont Opening III-F-12 to III-F-13.

NS's Engineering Experts examined the routes identified above using topographical maps, track charts, and other relevant data (included in NS workpapers) to assess DuPont's proposed adverse condition determinations. *See* NS Reply WP "Adverse Territory Identification Narrative.pdf." Based on their experience and working knowledge of these routes, hi-rail inspections, examination of the topographical maps,[82] and evaluation of track charts curvature and grade data, NS's Engineering Experts agree that the routes DuPont identified above traverse adverse terrain.[83]

In addition, NS's Engineering Experts also determined that DuPont understated the extent of the adverse terrain for a number of routes. Using the criteria described above, NS's Engineering Experts determined that the following additional DRR routes include adverse terrain:

(9) Austell, GA to Iron Junction, AL

(10) Binghamton to Buffalo, NY

(11) Danville, VA to Eden, NC

(12) Gainesville, GA to Greenville, SC

(13) Harrisburg to Sunbury, PA

[82] DuPont claims to have consulted topographical maps, but offers no explanation of how it used those maps or what method or criteria it used to identify adverse terrain.

[83] *See* NS Reply WP "Adverse Territory Identification Narrative.pdf."

(14) Roanoke, VA to Hagerstown, MD

(15) Roanoke to Altavista, VA

NS's Engineering Experts have reclassified as adverse DRR segments that were incorrectly categorized as non-adverse by DuPont in its Opening Evidence. Detailed explanations of NS's Engineering Experts' adverse terrain determinations are set forth in the NS reply work papers.[84]

(iv) Adverse Terrain Unit Costs

NS rejects DuPont's unit cost for common excavation in adverse terrain. Here again, DuPont developed a separate unit cost based on R.S. Means but then did not use it. *See* DuPont Opening WP "DRR Open Grading errata.xls," Tab "Unit Costs," Rows 19 – 25. Instead, DuPont calculated a ratio of adverse conditions unit costs to common earth unit costs from R.S. Means, and then applied this ratio to the Trestle Hollow Project unit cost to generate an artificially depressed adverse conditions unit cost estimate.

As NS demonstrated, the Trestle Hollow Project unit cost estimates (even assuming, *arguendo*, they were adequately explained and supported) are inapplicable because they were generated in special circumstances of an unusual, unrepresentative project that produced exceptional economies not attainable elsewhere under different, less-optimal conditions. Particularly important here, the Trestle Hollow Project did not involve <u>any</u> adverse conditions, making it impossible to derive common excavation costs in adverse terrain from that project. Accordingly, DuPont's attempt to create adverse conditions unit costs based upon Trestle Hollow Project costs is illogical and unsupportable.

[84] *See* NS Reply WP "Adverse Territory Identification Narrative.pdf."

NS's Engineering Experts instead accept the R.S. Means unit cost for common excavation in adverse terrain, as identified in DuPont's workpapers, with one modification. NS's Engineering Experts reject the use of a 42 CY off-road hauler as infeasible in adverse conditions. NS's Engineering Experts evaluated this hauler based on the physical dimensions of the hauler, its loaded weight, overall practicality, cycle distance, and daily production as presented by DuPont's workpapers and in R.S. Means.[85] These extremely large haulers are mainly used in mining, quarries, and other large, broadly sprawling earthwork projects in areas that are as wide as they are long. Such huge haulers are rarely used in very long narrow linear roadbed projects. Particularly because of the narrow right-of-way widths DuPont has specified for the DRR, the 42 CY haulers would be infeasible for DRR excavation in adverse terrain. The massive 42 CY haulers are 17 feet 8 inches wide, which would prevent two haulers from meeting or passing one another on a 24-foot wide roadbed.[86] Moreover, even a single 42 CY hauler could not fit on bridges designed to DuPont's standard. Due to their tremendous weight, the haulers would not be allowed to traverse public roads and could only traverse the previously constructed DRR roadbed. Public roads and bridges usually are designed for AASHTO H20 or HS20, which allow a maximum of 32,000 pound axial loading. Rear axle loading of the 42 CY hauler is 149,437 pounds,[87] 4.7 times the allowable load. Horizontal clearance dimensions for single track bridge

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[85] DuPont assumes the use of a 42 CY off-road hauler in its development of earthwork unit costs for common excavation in adverse terrain, loose rock excavation in normal and adverse terrain and solid rock excavation in normal and adverse terrain. As discussed in detail in these sections, NS rejects as completely infeasible the use of 42 CY haulers for all common, loose rock and solid rock adverse terrain but accepts limited use of 42 CY where potentially feasible (but not practical) for loose and solid rock excavation in normal terrain.

[86] *See* NS Reply WP "42_CY_Hauler_on_34.5 ft_Roadbed.pdf" and "42_CY_Hauler_on_24 ft_Roadbed.pdf," "22_CY_Hauler_on_Roadbed.pdf."

[87] DuPont Opening WP "42 CY Truck.pdf."

widths are less than 14 feet with guard timbers in place.[88] This would prohibit the 14-foot wide (outside wheel to outside wheel) 42 CY haulers from safely passing over completed bridge decks.

Further, for transit over DRR culverts, the 42 CY hauler's loaded weight would require 3.0 to 4.5 feet of compacted cover over all DRR corrugated metal pipe culverts to absorb the load without damaging to the pipe.[89] Loaded weight for the hauler is 219,760 pounds.[90] When loaded the rear axle carries 68% of the weight or 149,437 pounds (75 tons). From DuPont's workpaper "Contech Pipe Weights.pdf" Contech[91] requires 3-feet of cover for small diameter Corrugated Metal Pipes ("CMPs") and 4.5-feet of cover for medium and large diameter CMPs for axle loads greater than 110,000 pounds (110 kips). The 42 CY hauler's large load also limits its use on steep grades, sharp curves, and mountainside construction that characterize adverse terrain construction. NS's Engineering Experts disagree with DuPont's selection of a 42 CY hauler because it is infeasible under any circumstances for adverse terrain construction where terrain and other physical impediments limit available working area.

As demonstrated above, the 42 CY haulers that DuPont has proffered are not capable of working in adverse terrain and would not be feasible for much of the earthwork necessary to prepare the DRR roadbed. Moreover, for DRR earthwork tasks, the 42-CY hauler would be grossly inefficient. For example, the 42 CY haulers could not achieve their rated efficiency when

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[88] *See* NS Reply WP "Typical_Sub-Ballast Page 1.pdf."

[89] Because of the practical limitations like the loaded weight of a 42 CY hauler exceeding the capacity of the culverts, prior Board precedent accepting the use of 42 CY haulers in rate cases is inapposite.

[90] DuPont Opening WP "42 CY Truck.pdf."

[91] Contech is a pipe manufacturer and is assumed by DuPont to be the supplier of DRR culvert pipe material.

paired with a 3 CY excavator that DuPont posited. These large haulers, which are used mostly for large scale mining operations, are normally paired with larger excavators meant for mining sites, which have buckets in the 6-12 CY size to achieve maximum productivity.[92] As explained below, comparing the production rates presented in R.S. Means, the 42 CY haulers (882 CY/day) paired with a 3 CY excavator (2,000 CY/day) could only achieve an efficiency rating of 76%. To maximize production, DuPont would require three 42 CY haulers (totaling 2,646 CY/day) to fully utilize the 3 CY excavator (2,000 CY/day). This would necessarily require each truck to wait to be loaded while other trucks were being loaded, thereby reducing the efficiency of the hauler and causing the price per cubic yard of the haul to increase. Efficiency = 2000/2646 = 76%. A common rule of thumb in the earthmoving industry is the excavator should only take 4-7 passes to fill a hauler.[93] The 3 CY excavator would require fourteen passes to fill a 42 CY hauler. This combination would be extremely inefficient and would more than offset the efficiency gains of the greater capacity hauler.

To correct the problems with the 42 CY haulers in adverse conditions,[94] NS's Engineering Experts have replaced the 42 CY hauler with a 22 CY hauler and, consistent with the discussion regarding DuPont's unrealistically low haul distances, having a roundtrip or cycle distance of one mile. NS's solution is consistent with past Board precedent requiring additional equipment to maintain production rates. *See Otter Tail*, S.T.B. Docket No. 42071, at D-12. The

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[92] WP III-F.2-b._Hitachi_Mining_Excavators.pdf.

[93] *See* NS Reply WP "NS Number of Excavator Bucket Loads per Hauler.pdf."

[94] The discussion of practical limitatations to the use of large haulers in the preceding several paragraphs applies equally to all non-adverse terrain in which a hauler would be used, *i.e.,* all but common excavation in non-adverse conditions. Accordingly, NS Engineering Experts have replaced the 42 CY haulers posited by DuPont for various stages of the roadbed construction process in non-adverse conditions. *See* NS Reply WP "DRR Open Grading errata NS reply," Tab "Unit Costs Modified."

physical size and loaded weight of the 22 CY hauler would allow trucks to pass on a 24-foot wide roadbed, and pass over culverts with as little as one-foot of cover and its smaller size and better maneuverability is better suited to adverse grades.[95] In addition, the 22 CY hauler would have an efficiency of 99% based on R.S. Means production rates.[96]

NS's Engineering Experts have adjusted equipment combinations to maximize efficiency, and developed a more realistic price for common excavation in adverse terrain of $9.50 per cubic yard.[97] *See* NS Reply WP "DRR Open Grading errata_NS Reply.xlsx," Tab "Unit Costs," Ln 25.

(v) Loose Rock Excavation

NS accepts DuPont's use of R.S. Means data as the source for loose rock excavation costs. NS's Engineering Experts selected a more reasonable hauler combination than that proposed by DuPont, and adjusted unit costs accordingly.

For the reasons articulated above, NS rejects the uniform use of the 42 CY Hauler proposed by DuPont for loose rock excavation costs.[98] In general, a 42 CY hauler is too large and rigid for the construction of a roadbed. Its weight alone requires prior construction of a

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[95] NS Reply WPs "22_CY_Hauler_on_Roadbed.pdf" and "42_CY_Hauler_on_24 ft_Roadbed.pdf."

[96] Efficiency = 2000/(4 x 506) = 99%. Note that haulers generally are not required in non-adverse terrain. In such terrain, scraper equipment generally performs the function of movement of soil and excavated material.

[97] As with common excavation in non-adverse terrain, NS added water for compaction charge to the top 20% of the adverse conditions excavation quantity. *See infra*, Subgrade Preparation at III-F-2-c-ii-(f).

[98] The steep grades, hillside construction and sharp curves associated with adverse terrain render use of the 42 CY hauler infeasible for any adverse terrain construction. Other aspects of the 42 CY hauler, primarily its massivesize and tremendous weight, render it demonstrably infeasible for various stages of roadbed construction in non-adverse terrain.

separate well-graded-and-maintained haul road for economical and efficient use. See Section III-F-2-c-ii-(d)-(i) for a detailed explanation of why the 42 CY hauler cannot be used in many circumstance and conditions that would be encountered in construction of the DRR roadbed.

Solely because the Board has accepted the use of 42 CY haulers in prior SAC cases, NS's Engineering Experts reluctantly accept its use where potentially practical for loose rock excavation. Specifically, using the criteria outlined in the previous section concerning roadbed width and the ability to pass, culvert cover, bridge design, and loading efficiency, NS's Engineering Experts determined a 48/52% split for the 42 CY haulers and the 22 CY haulers is more realistic and feasible for non-adverse loose rock excavation.[99] *See* NS Reply WP "DRR Open Grading errata_NS Reply.xlsx," Tab "Unit Costs Modified," Lines 29 to 31. NS's Engineering Experts looked at specific roadbed dimensions and their capacity to accommodate large haulers at various stages of construction. They determined that the 42 CY hauler could be used on the roadbed up to the level called for in the DRR culvert plan (one foot above the top of culverts).[100] From that level up to 4½ feet above the top of the culvert, only the 22 CY hauler could be used without crushing or otherwise damaging the culvert as stated in III-F-2-c-ii-(d)-(i). From that level to 3.5 feet below the top of the 24' wide roadbed the 42 CY hauler could be used. For the top 3.5 feet, only the 22 CY hauler can be used due to width of the roadbed—larger haulers would not have room to pass each other at this width. As NS's workpapers show, applying these criteria to the loose rock excavation in non-adverse terrtain yields the conclusion that 48% of the roadbed could be built using the 42 CY hauler, while construction of 52% of the

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[99] NS Reply WP "48-52_Hauler_Roadbed Stage of Construction.pdf."

[100] *Id.*

roadbed would require the use of a 22 CY hauler. NS has applied this split, corrected DuPont's unreaslistically low cycle assumption, and calculated an overall unit cost of $13.01/CY.[101]

As explained in detail below, DuPont failed to include necessary costs due to swell and shrinkage of hauled excavated and embanked materials in its calculation of unit costs for loose rock excavation, solid rock excavation, and adverse loose rock excavation. *See infra* III-F-2-c-ii-(e)-vi. NS's Engineering Experts included these inevitable costs in their calculation of unit costs for these earthwork categories. *See* NS Reply WP "DRR Open Grading errata_NS Reply.xlsx," Tab "Unit Costs."

(vi) Adverse Loose Rock

NS rejects DuPont's loose rock excavation quantities in adverse terrain and has substituted its more detailed adverse condition designations as set forth above. *See* NS Reply WP "Adverse Territory Identification Narrative.pdf.pdf;" *supra* III-F-2-c-i-Adjustments for Adverse Terrain. NS has moved the quantities for these segments out of the general loose rock excavation and into the adverse loose rock excavation quantities.

NS also rejects DuPont's adverse loose rock excavation unit cost, because DuPont again assumes the use of an infeasible 42 CY hauler. As discussed in the adverse common earth excavation section, in the experience and judgment of NS's Engineering Experts, a 42 CY hauler is not feasible for any aspect of earthwork construction under adverse conditions. NS has replaced DuPont's unworkable oversized hauler with a 22 CY hauler with a one-mile round trip haul as a feasible alternative for adverse loose rock excavation, and calculated a corresponding R.S. Means-based unit cost of $11.32. *See* NS Reply WP "DRR Open Grading errata_NS Reply.xlsx," Tab "Unit Costs Modified," Line 51.

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[101] NS Reply WP "DRR Open Grading errata_NS Reply.xlsx" Tab "Unit Costs."

(vii) Solid Rock Excavation

NS rejects DuPont's solid rock excavation unit costs. In general NS's Engineering Experts agree with DuPont's assessment of the type of effort required for solid rock excavation. However, DuPont's evidence improperly manipulated R.S. Means cost data for "Drilling and Blasting" solid rock. Solid rock removal for roadbed construction would necessarily require a mobile blasting crew that would move as roadbed construction progressed. Based upon their experience, site inspections, and examination of the physiological characteristics along the DRR route, NS's Engineering Experts have further determined that solid rock removal would in some cases require pre-splitting of rock slopes in order to prevent over-excavation and arbitrary weathering of exposed slopes that could eventually result in rock slides on the roadbed. In other areas, NS's Engineering Experts have determined that solid rock removal would require benching[102] in order for weathered rock to have a safe place to fall. In fact, many completed railroad slopes in adverse terrain are equipped with slide fencing that is connected to the signal system in case of rock falls. *See* NS Reply WP "WP III-F.2-b._Atlanta to Lynchburg and Roanoke to Burkeville Photos_Slide_Fencing.pdf." Instead of considering the actual specific conditions that would likely be encountered in construction of a railroad bed in the areas traversed by the DRR and then developing solid rock excavation cost estimates tailored to those conditions, DuPont arbitrarily averaged open face rock blasting costs with the costs of bulk drilling and blasting generally used in mining and quarry operations. *See* DuPont Opening WP "DRR Open Grading," Tab "Unit Costs," Lines 70 to 72. NS agrees with DuPont's use of unit costs for open face blasting of rock over 1,500 cubic yards, but does not agree with DuPont's facile averaging of this cost with that of bulk blasting. In reality some areas would require pre-

[102] Benching is a form of slope stabilization consisting of horizontal berms cut into the sideslope to mitigate water runoff and control erosion.

splitting of rock faces and areas close to highways and densely populated areas would require blasting mats.[103] DuPont has erroneously excluded those costs.

NS accepts DuPont's 50% reduction in solid rock quantities and reclassification of the remaining 50% classified as loose rock. The ICC Engineering Reports classified loose rock as being up to less than one cubic yard in size (approximately 2 tons based on a density of 150 lbs/cu.ft.). DuPont contends that modern earthmoving machinery could excavate and load this material. But DuPont has failed to include in its revised cost estimate the additional cost of loading, hauling, and burying the resulting boulders[104] in the embankments or waste pits. Boulders are much heavier and more difficult to handle than regular loose rock.[105] Production rates for excavating and hauling rock are much lower than for common excavation. And the costs of excavating rock is higher. *See* NS Reply WP "RSMeans_2009_Earthwork_Production_Rate.pdf." R.S. Means correctly accounts for these extra costs in its "Drilling and Blasting Rock" cost data. *See* NS Reply WP "WP III-F.2-b._RSMeans_Blasting_Items.pdf." NS's Engineering Experts estimate, based on the expected characteristics of the rock the DRR would encounter, that 20% of the entire quantity of the solid rock classification (both blasted and ripped) found in the ICC Engineering Reports would be boulders of at least one-half cubic-yard in size. The DRR would be required to excavate and haul such large boulders to embankments or waste pits during the construction process. NS's Engineering Experts' 20% assumption is very conservative and likely substantially

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[103] A heavy, flexible, tear-resistant covering that is spread over the surface during blasting to contain earth fragments.

[104] A detached and rounded or much-worn mass of rock. http://www.merriam-webster.com/dictionary/boulder.

[105] NS Reply WPs "US 70 Hondo Valley Project 021203.pdf" and "Hondo Valley Equipment 030603 RCP.pdf."

underestimates the volume of boulders the DRR would encounter, particularly given that loose rock classification could also contain many large boulders. NS has revised the unit cost developed from R.S. Means by using the correct open face blasting item, excavating and hauling boulders, and using a 58/52 split of the 42 CY hauler and the 22 CY hauler (*see* Section III-F.2-d.(i)). The resulting corrected unit price for solid rock excavation is $14.76 per cubic yard. See NS Reply WP "DRR Open Grading errata_NS Reply.xlsx," Tab "Unit Costs," Lines 98 to 116.

NS rejects DuPont's solid rock excavation quantities in adverse terrain. As discussed above, NS's Engineering Experts reclassified segments that are adverse but were incorrectly categorized as non-adverse by DuPont. *See* NS Reply WP "Adverse Territory Identification Narrative.pdf." Consistent with this corrected classification, NS has moved the quantities for these segments from the solid rock excavation category used by DuPont into the adverse solid rock excavation category. *See* NS Reply WP "DRR Open Grading errata NS Reply," Tab "EW Cost," Columns K and V .

(viii) Adverse Solid Rock Excavation

NS rejects DuPont's adverse solid rock excavation unit cost. DuPont used a 50/50 combination of its understated solid rock excavation unit cost and its loose rock excavation unit cost. DuPont Opening III-F-16. As discussed, NS's Engineering Experts have determined that a 42 CY hauler cannot be used in adverse conditions. *See supra* III-F-c-ii-(d)-(i). NS therefore has substituted a 22 CY hauler for the infeasible 42 CY hauler for adverse solid rock excavation. The resulting unit cost for such adverse solid rock excavation is $15.28 per cubic yard. *See* NS Reply WP "DRR Open Grading errata_NS Reply.xlsx," Tab "Unit Costs," Line 97.

(ix) Embankment/Borrow

NS accepts DuPont's unit cost for borrow. NS rejects DuPont's exclusion of water for compaction for the entire extensive DRR network roadbed. NS added a separate conservative water for compaction charge. *See* Section III-F-2-c-ii-(f) Subgrade Preparation.

(e) Other Earthwork Quantities & Unit Costs

NS rejects DuPont's proposed quantities and unit cost for land for waste excavation, for the reasons described below. *See infra* III-F-2-c-ii-(e)-(i). As further described below, NS also corrects DuPont's failure to include stripping, undercutting, swelling of excavation for haulage, solid rock over-excavation, and fine grading quantities and costs. *See infra* III-F-2-c-ii-(e)-(ii) thru (v).

(i) Land for Waste Excavation

DuPont assumes that the DRR would acquire additional land adjacent to its right-of-way to store materials excavated from the DRR right-of-way that would not be re-used for fill or embankment. *See* DuPont Opening III-F-17. Overall, DuPont assumes that 30% of the materials excavated in building the DRR roadbed will not be used as embankment and will instead be "wasted" along the DRR right-of-way. *Id.* III-F-2-b-iii-(3). This assumption is consistent with prior Board SAC precedent and NS accepts this assumption.[106] However, NS rejects both DuPont's estimate of the land area that the DRR would need to acquire to accommodate this wasted material, and its hypothesized cost per acre of such land. As discussed below, there are three major flaws in DuPont's calculation of land for waste excavatin.

First, DuPont assumes a very short cycle distance for waste excavation haulers, which would result in an inordinate number of waste dump sites. The cycle (round trip) distance for

[106] *See AEP Texas*, STB Docket No. 41191 (Sub-No. 1), at 86.

common excavation associated with the unit cost selected by DuPont is only one-half mile. *See* DuPont Opening WP "DRR Open Grading.xls," Tab "Unit costs," Line 22. This means that all material would have to be excavated within 1,320 feet of embankments and excavation waste dump sites (requiring an excavation waste dump site to be established every half mile of the 7,277 mile DRR which would result in 14,553 sites across the DRR network). DuPont's evidence only provided an area needed to contain the waste, but did not specify how many dump sites are needed. *See* DuPont Opening WP "DRR Open Grading.xls," Tab "Other Costs," Lines 76 to 87. A more appropriate and efficient choice would be to select costs for a 1-mile cycle, putting the material placement within an average of one-half mile (2,640-ft.) from the point of excavation. This approach, adopted by NS in this Reply, allows for a more reasonable one waste dump at each mile (rather than every half mile, as would be required by DuPont's proffered unit cost) of DRR route miles, for a total of 7,277 dumps.[107]

Second, DuPont's area calculations assume that waste can be placed 15 feet high with a perfectly vertical sideslope (0:1 sideslope). According to NS's Engineering Experts, without an angled sideslope or a retaining wall of some sort, a pile of waste would collapse under its own weight into a wider, lower heap.[108] NS has corrected the footprint to include a conservative 1:1 sideslope for the waste pile materials.[109] The second fundamental flaw is that the land area DuPont has proposed for excavation waste is exactly the same size as the area DuPont estimated

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[107] *See infra* III-F-2-c-ii-(e)-(i).

[108] NS Reply WP "WP III-F.2-b.-ii.-(e)-(i)_Waste_Ex._Pile_Field_Pictures.pdf" and "WP III-F.2-b.-ii.-(e)-(i)_Waste_Ex._And_Borrow_Methodology.pdf."

[109] *See* NS Reply WP "DRR Open Grading errata_NS Reply.xlsx" Tab "Other Costs," Line 94; NS Reply WP "Waste_Ex._And_Borrow_Methodology"; NS Reply WP "Waste_Ex._And_Borrow_Cross_section.pdf"; NS Reply WP "Waste_Ex._Pile_Field_Picture.pdf."

would be needed for the waste material and not an acre more, and with no setback. This unrealistic assumption would leave no space or way for equipment to work the site to deposit and pile the excavation waste or to prevent drainage problems and embankment collapse onto property owned by neighboring site. NS's Engineering Experts corrected this oversight by including land for a standard 20-foot setback from the toe of the slope to the property line.[110] NS conservatively assumed that each waste site would be perfectly square in shape, thereby minimizing land area needed for sideslope and setback. *See* NS Reply WP "DRR Open Grading errata_NS Reply.xlsx," Tab "Other Costs," Lines 87 to 96.

Third, for the costs of the excavation waste dump sites, DuPont used the average of its estimated cost of all rural land acquired by the DRR of $27,000 per acre. DuPont provides no explanation or support for the counter-intuitive notion that land for disposal of excavation waste would be necessary only in rural areas. DuPont posits in its Opening Section III-F-1 that almost 30% of the DRR right-of-way would be in more expensive residential, industrial, or commercial areas.[111] If DuPont were to limit its disposal land acquisition to rural locations, it would be required to adjust the DRR earthwork excavation costs to account for the substantially longer haul distances required to transport excavated materials from residential, industrial, and commercial areas (such as Atlanta, Chicago, and Pittsburgh) to the rural excavation waste areas. DuPont made no such adjustment and therefore cannot assume that land for excavation would be located exclusively in rural areas.

[110] *See* NS Reply WP "DRR Open Grading errata_NS Reply.xlsx" Tab "Other Costs," Line 95.

[111] DuPont Opening Table III-F-3 shows the DRR distribution of land use as 13 percent residential, 11 percent industrial and 5 percent commercial, or a total of 29 percent.

DuPont's excavation unit cost buildup from R.S. Means assumes haul distances of between one-quarter mile[112] and 3,000 feet,[113] which means that the DRR would need one excavation waste dump site for every mile of the DRR,[114] regardless of land classification. Further, because DuPont's excavation unit costs do not provide for any transportation over the road, logic dictates that all of the DRR waste sites would necessarily be adjacent to the right-of-way. NS has corrected DuPont's assumed average unit cost of land for excavation waste to reflect the average price of all land acquired by the DRR, not just the average cost of rural land.[115] As discussed below, NS also added land for waste excavation material generated by necessary stripping, undercutting, and solid rock excavation activities. With this additional land, the land needed for sideslope and setback, and the unit cost adjustments described above, the total corrected cost for land for excavation waste derived by NS's Engineering Experts is $611 Million, instead of DuPont's opening estimate of $207 Million. *See* NS Reply WP "DRR Open Grading errata_NS Reply.xlsx," Tab "Other Costs."

(ii) Stripping

DuPont failed to include stripping costs, claiming that costs for stripping and undercutting were included in the unit costs of the Trestle Hollow project. See Section III-F-2-d-(i) for NS's demonstration that the Trestle Hollow Project does not provide a reasonable or

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[112] One-half mile average round trip translates into an average of one-quarter mile for the loaded portion of the haul.

[113] *See* DuPont Opening WP "DRR Open Grading errata.xls," Tab "Unit Costs."

[114] Spacing every mile will result in an average haul length equal to one-half the distance between each site or 2,640 feet (5,280 / 2).

[115] *See* NS Reply WP "DRR Open Grading errata_NS Reply.xlsx" Tab "Other Costs," Lines 98 to 103.

reliable basis for extrapolating costs for a large, diverse, geographically dispersed, and complex project such as the construction of the 7,277-route-mile DRR network.

Contrary to DuPont's simplistic claim, separate stripping is required for roadbeds built on embankments, because this work requires far more than simply removing a layer of soil. Based on NS's Engineering Experts' experience, before building an embankment, all vegetation at the base of the embankment must be removed down to the root mat, a task a brush rake cannot perform. This requires removing all roots exceeding three inches in diameter. Otherwise, the roots will decompose, leaving soft spots that will cause the embankment to shift under the loading of live tracks. Where roots and stumps are removed, the ground must be filled and compacted. This differs from grubbing in that grubbing is only removing stumps and roots of trees, not other vegetation. Then, the entire area that will support the embankment must be proof-rolled to locate any soft areas. Where soft areas are found, the entire area must be plowed or scarified,[116] then compacted with water. Only after all those preparation steps is it possible to place the embankment material. The foregoing stripping costs are not subsumed in the initial excavation costs because areas to be stripped are in embankment areas that are not subject to excavation. Further, stripped organic material removed must be disposed of in waste pits. DuPont has not included these necessary costs of stripping in its excavation waste cost estimate, or anywhere else.[117]

To determine the amount of the DRR roadbed that would require stripping, NS's Engineering Experts developed the square footage of the roadbed under embankment based on

[116]The term "scarified" refers to the process of breaking up the surface using specialized machinery.

[117]NS Reply WP "NS Clearing & Grubbing Spec.pdf" and "WP III-F.2-a._Construction Planning, Equipment, and Methods - Robert Peurifoy - Clearing.PDF" and "WP III-F.2-a.__Railroad Engineering - William Hay - Clearing and Grubbing.pdf."

the relative proportion of embankment to excavation calculated based on the ICC Engineering Report quantities. Although roots that exceed three inches in diameter that must be removed by the stripping process often extend deep into the ground. NS's Engineering Experts conservatively assumed an average of six inches of stripping would be needed to stabilize the roadbed properly to support embankment. NS's Engineering Experts used this depth to convert the square footage to cubic yards. This quantity was then added to the total Common Excavation quantity. *See* NS Reply WP "DRR Open Grading errata NS Reply.xls," Tab "Stripping."

(iii) Undercutting

DuPont similarly failed to include separate undercutting costs, asserting that any additional costs for stripping or undercutting were included in the unit costs of the discredited Trestle Hollow Project. *Compare* DuPont Errata III-F-q. *with* NS Reply Evidence at Section III-F.2-d.(i) (explaining the unsuitability of that project as a source of DRR costs or quantities). Undercutting involves the removal of pockets of organic and other materials unsuitable for use in railroad embankments including sand, certain clays, and wet soils. The volume of undercutting needed to stabilize a roadbed varies based on the amount of organic material in a given location.

In *CP&L*, the Board rejected undercutting cost estimates because NS had not demonstrated how much right of way would be constructed in solid rock areas. *See CP&L*, 7 S.T.B. at 304. Here, to determine how much of the DRR roadbed embankment would require undercutting, NS's Engineering Experts began with embankment quantities in the ICC Engineering Reports. The ICC Engineering Reports do not specify the amount of undercutting because they are based on post-construction cross-sections taken every 100 feet and on observations of physical characteristics of topography or structures that were readily observable parts of the roadbed construction effort. Such information and observation could not and does not provide estimates of subsurface roadbed or slope stabilization devices—including undercutting of unsuitable material—subsurface under-drainage, subsurface excavation, or subsurface fill preparation. A cross-section viewed long after completion of construction simply cannot be used to determine what was removed or added to create a stable roadbed.

Therefore, to estimate the amount of the DRR roadbed that would require undercutting, NS's Engineering Experts superimposed wetland maps from the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory along the entire route of the DRR.[118] NS determined that 155.9 miles of DRR is within wetlands that are chronic sources of heavy organic and unsuitable soil. NS's Engineering Experts converted embankment roadbed square footage to estimated cubic yardages of undercut material. NS developed quantities using the following assumptions: undercutting of an average of two-feet of material to reach material suitable for compaction; and ground compaction for placement of the embankment, as required by modern railroad construction standards.[119] *See* NS Reply WP "DRR Open Grading errata NS Reply.xls," Tab "Undercutting – Wetlands."

To account for the undercutting quantities, NS's Engineering Experts added the volume of undercut material to the total common excavation quantity. They then calculated the resulting costs by applying NS's common excavation unit costs to these quantities. They also adjusted the volume of borrow material by including the volume required to fill the average two feet undercut in the total borrow quantities.[120]

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[118] *See* NS Reply WP "Undercutting Unsuitable Soil -Wetland Exhibit.pdf"; "NS Reply - Undercutting Unsuitable Soil -Wetland Exhibit - Narrative.docx"; "NS Reply – Undercutting of Wetlands typical pictures.pdf."

[119] NS Reply WP "Undercutting write-up.pdf."

[120] NS Reply WPs "DRR Open Grading errata NS Reply.xlsx" Tabs "EW Costs" and "Undercutting – Wetlands."

(iv) Over-Excavation

DuPont failed to include costs for over-excavation. When solid rock is encountered at subgrade levels in cuts, modern roadbed construction requires at least twelve inches of over-excavation and replacement of that over-excavated rock with at least of twelve inches of select material, compacted to the same specifications as embankments.[121] On many projects, sub-ballast is used for the twelve inches of material to bring the level back to subgrade elevation. However, a lower-cost alternative is to use compacted fill to replace the over-excavation of solid rock.[122]

NS's Engineering Experts used the roadbed dimensions provided by DuPont to estimate cubic yard quantities of solid rock over-excavation required in rock cuts. NS's Engineering Experts corrected DuPont's omission of over excavation quantities by adjusting the quantity of rock excavation accordingly, using the unit cost developed in Section III-F-2-b-iii-(d).[123]

(v) Fine Grading

Fine grading is the final shaping of the constructed roadbed in order to establish the cross sections and profile of the engineering design. NS's Engineering Experts explain that fine grading is not included in normal grading because fine grading requires different equipment. The excavation and borrow unit costs use scrapers and bulldozers to achieve a rough grade while fine grading uses Motor-graders to achieve a more precise final grade.[124] The Board has held that

[121] NS Reply WP "DRR Open Grading errata_ NS Reply.xlsx" Tab "EW Costs"; see also "NS Grading Spec.pdf" page GR-5 section D.

[122] NS Reply WP "Over_Excavation of Solid Rock_Cross_Section.pdf."

[123] NS Reply WP "NS Reply III-F.2 DRR Open Grading errata_ NS _Response.xlsx" Tab "EW Costs" and Tab "Over Ex."

[124] NS Reply WP "NS Reply III-F.2 DRR Open Grading errata_ NS _Response.xlsx" Tab "Unit Costs." and "WP III-F.2-b._RSMeans_Scraper&Bulldozer_Crews.pdf" and "WP III-F.2-b.-ii.-

fine grading uses specialized equipment and is not included in normal grading. *Otter Tail*, STB Docket No. 42071, at D-14. Indeed, the Board recognized R.S. Means lists fine grading separately. *Id.* at D-14; R.S. Means at 31-22-16.10-0200 Finish Grading-Grade subgrade for base course, roadways.[125] Moreover, the Board found in *Xcel* that fine grading was "an actual and necessary construction element for rail lines" in part because R.S. Means lists fine grading separately. *Xcel*, 7 S.T.B. at 678.

Bull dozers roughly shape the roadbed section but are not capable of the finer tasks of creating the crown of the roadbed or the shape of the ditches. Bull dozers can compact the slopes of roadbeds prior to seeding but they are only capable of creating grades within several inches. Because of this limitation on the use of bull dozers to achieve the final shape and form of the roadbed, railroad roadbed contractors use motorgraders to provide the final shape and smoothness desired on the crown of the roadbed during the final compaction process. Motorgraders operated by experienced personnel are capable of obtaining final subgrade elevations within one inch.[126] The R.S. Means crew selection for bulldozers compared to motorgraders also demonstrates the different accuracies achieved, with the bulldozer crews having only a 0.5 laborer charge while the finish grading's motorgrader has a 1.0 laborer charge.[127] This labor charge is composed of the effort of the laborers and surveyors assisting the

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(e)-(v) Motor grader pictures.pdf" and "WP III-F.2-b._RSMeans_Fine_Grading_B-11L_Crew.pdf."

[125] NS Reply WP "WP III-F.2-b._RSMeans_Fine_Grading_Item.pdf."

[126] *See* NS Reply WP "NS Reply Fine Grading_2."

[127] NS Reply WP "NS Reply III-F.2 DRR Open Grading errata_ NS _Response.xlsx" Tab "Unit Costs." and "WP III-F.2-b._RSMeans_Scraper&Bulldozer_Crews.pdf" and "WP III-F.2-b.-ii.-(e)-(v) Motor grader pictures.pdf" and "WP III-F.2-b._RSMeans_Fine_Grading_B-11L_Crew.pdf."

equipment operators to achieve desired grade. The laborer assists the operator by comparing the grades staked out in the ground by surveyor to the grades being achieved by the operator. Obviously, the accuracy of the grade of the roadbed is directly proportional to the labor effort with the labor charge of the finish grading being twice the charge of the excavation and borrow grading. Not only is it desirable to obtain the designed subgrade elevation, a smoothly shaped, well-compacted subgrade minimizes the waste when placing the sub-ballast.[128] Failure to achieve a smooth compacted subgrade at the designed elevation would cause major overruns of sub-ballast quantities (and attendant costs) to achieve a uniform aggregate base thickness. NS has provided as workpapers the identical materials that the Board found to be sufficient proof of the need for fine grading in *Otter Tail. See* NS Reply WP "DRR Open Grading errata NS Reply.xls," Tab "Finish Grading."

DuPont failed to account for the necessary function of fine grading, apparently assuming fine grading would not be done on the DRR roadbed. Despite excluding fine grading from its roadbed preparation costs, DuPont further failed to include the additional sub-ballast quantities and costs that would be necessary to compensate for the lack of fine grading. *See* DuPont Opening WP "Track Construction Costs errata.xls," Tab "Track Quantity Calculator," Cells C99 to D102.

DuPont contends that the Trestle Hollow Project finish grading cost is included in its earthwork unit cost. However, the Trestle Hollow Project documents are for a lump sum bid, and do not clearly show whether fine grading was included in the earthwork costs for the project. Moreover, as NS previously demonstrated, the small, isolated Trestle Hollow Project is not representative and cannot be used as a reliable basis for extrapolating the costs that would be

[128] *See* NS Reply WPs "NS Reply Fine Grading_1.PDF" and "NS Reply Fine Grading_2.PDF."

incurred to construct a 7000-plus route mile rail network such as the DRR. *See supra* III-F-2 to III-F-2-a. While NS agrees that some construction projects to include this cost with earthwork, R.S. Means uses a separate cost line item to develop the earthwork unit cost. DuPont did not use this specific R.S. Means line item to develop its unit cost. NS's Engineering Experts calculated a unit cost for fine grading using R.S. Means. NS's Engineering Experts determined the quantity of fine grading needed using DuPont's specifications for the dimensions and parameters of single- and double-track roadbed. NS calculated a total cost for fine grading using the R.S. Means unit cost for finish grading of $0.42/CY and the area to be fine graded. They then used the total amount of earthwork on the DRR to determine a unit cost of $0.11 per cubic yard of earthwork. NS then added this to the unit cost for each earthwork type.[129]

(vi) Swell

DuPont also failed to include any adjustment in earthwork unit costs or quantities for swell or shrinkage of material during excavation, hauling, and compaction. In order for embankments to properly support loads sustained from train traffic, soil particles in each lift must be packed tightly using mechanical compaction. The process of excavating, hauling, and backfilling material involves three soil states: bank, loose, and compacted (or embanked), each having a different density. Bank material has a medium density and is generally defined as undisturbed earth. Loose material is defined as soil or earth within a hauling vehicle or unconsolidated pile on an embankment (not compacted) and is the least dense soil state. Compacted or embanked material is the most dense, even more tightly compacted than original banked soil. To accurately estimate the cost of excavating, hauling, and constructing a roadway

[129] NS Reply WP "DRR Open Grading errata NS Reply.xlsx" Tab "Finish Grading."

embankment, these different soil densities for each phase of the process must be taken into consideration using swell and shrinkage factors.

To quantify equivalent volumes for the three different soil states with varying soil densities, NS's Engineering Experts applied swell and shrinkage factors to the base unit cost of Common Earth-Adverse, Loose Rock, Loose Rock Adverse, Solid Rock, and Solid Rock-Adverse. When discussing earthwork, Bank Cubic Yard ("BCY") is the base unit (referring to the soil state and density of undisturbed material), which matches the ICC Engineering Reports. The following method was used to apply shrinkage and swell factors: BCY Material is excavated, and in the process unconsolidated (decrease in density); then hauled as Loose Cubic Yard ("LCY"); and then compacted to Embankment Cubic Yard ("ECY") (increase in density). NS's Engineering Experts used typical soil volume conversion factors used to construct the earthwork unit costs, taken from Ringwald's "Means Heavy Construction Handbook" [130]:

Table III-F-12

Common Ex. - Adverse Swell & Shrinkage Factor:			
BCY	to	BCY	1.00
LCY	to	BCY	1.25
ECY	to	BCY	0.90
Loose Rock Swell & Shrinkage Factor:			
BCY	to	BCY	1.00
LCY	to	BCY	1.35
ECY	to	BCY	0.90
Solid Rock Swell Factor:			
BCY	to	BCY	1.00
LCY	to	BCY	1.50
ECY	to	BCY	1.30

[130] NS Reply WP "Swell and Shrinkage – Ringwald, Means heavy Construction Handbook.pdf."

It is important to note that blasted solid rock material is never able to consolidate as tightly or densely after excavation. This lesser compaction is reflected in the lower shrinkage factor for solid rock material from ECY to BCY.

An example calculation utilizing swell and shrinkage factors is as follows:

10 CY of Loose Rock earthwork =10 BCY Excavated

10 BCY X (1.35 LCY / 1 BCY) = 13.5 LCY Hauled

10 BCY X (.90 ECY / 1 BCY) = 9 ECY Compacted

The three units utilized in the above methodology correspond with applicable equipment unit costs used by R.S. Means, but applied incorrectly by DuPont to calculate earthwork estimates. For example, R.S. Means lists the cost per unit for a 22 CY hauler as dollars per loose cubic yard ("LCY") and not bank cubic yards ("BCY"). The density difference for these two types of materials is 25% for Adverse Common Earth Quantities (using the Ringwald 1.25 swell factor). Swell and shrinkage factors are also explained within the R.S. Means text Building Sitework - Site Preparation section, which illustrates how to construct a cost per Cubic Yard of material from equipment and labor per pay item.[131] By neglecting to factor swell and shrinkage into unit costs applied to earthwork quantities, DuPont significantly underestimated the cost of embankment construction for the DRR.[132] NS has corrected this error by modifying all of the excavation unit cost to account for swell and shrinkage. *See* NS Reply WP "DRR Open Grading errata NS Reply," Tab "Unit Costs Modified," Columns E to P.

[131] NS Reply WP "RS Means Site Prep Worksheet – swell and shrinkage factor.pdf."

[132] As noted above, the effects of swell and shrinkage are accounted for in NS's calculation of unit costs for the affected activities (including loose rock excavation, adverse loose rock, and solid rock excavation). *See supra* III-F-2-c-ii.

(f) Subgrade Preparation

NS rejects DuPont failure to include cost for subgrade preparation, which includes water for compaction and drying of wet material.

In some prior coal rate cases, the Board excluded water for compaction costs because the railroad failed to provide evidence demonstrating the need for water for compaction. *See, e.g. CP&L*, 7 S.T.B. at 84; *Duke/NS*, 7 S.T.B. at 179-180. However, the Board accepted water for compaction in *TMPA*, where defendant provided YSDA Ecosystem Domain maps. *TMPA I*, 6 S.T.B. at 707. There is little doubt that water for compaction is widely used in transportation construction projects.[133] Construction techniques that are actually used are not a barrier to entry—even if they were not used in the original construction. *CP&L*, 7 S.T.B. at 318 (silt fences "modern construction technique" and not a barrier to entry). The Board's prior emphasis has been on the addition of water for compaction, primarily to arid soils typically encountered in the west.[134] There has been an assumption in prior proceedings involving eastern carriers that the east has sufficient water content and that no soil preparation is required.[135] This is a simplistic over-generalization that is inconsistent with real-world construction experience, and it is particularly inappropriate with respect to a SARR of the DRR's geographical size and scope. Soil moisture content varies widely, both with the geographic area and type of soil, and with the season. DuPont has offered no evidence to support its gross assumption that subgrade preparation using water for compaction or additional drying would not be needed in any area or any season during the two-year construction of the topographically diverse and far-flung DRR

[133] *See, e.g.*, NS Reply WP "Wisconsin Transportation Bulletin – Compaction.pdf."

[134] *TMPA I*, 6 S.T.B. at 707; *WFA I*, STB ocket No. 42088, at 91; *AEPCO 2011*, STB Docket No. 42113, at 97-98.

[135] *Duke/NS*, 7 S.T.B. at 179-180.

network. In the experience and opinion of NS's Engineering Experts, any large-scale construction project conducted year-round across the wide variety of soils and conditions the builders of the DRR would encounter would require subgrade preparation, at a minimum for properly placing and shaping the crown of the roadbed.

Soil compaction increases the strength of the soil, which increases the load-bearing capacity of the soil and the stability of embankment slopes. It also reduces the potential for volume change that could occur from soil settlement, swelling due to moisture content changes, and frost heave.

Factors that affect compaction include soil type, particle size, compactive effort, and moisture content. Moisture content plays a very important role in obtaining a desired compaction. Water lubricates soil particles helping them slide into a denser position. Every soil has an optimum moisture content ("OMC") at which it is possible to obtain the maximum compaction. Compaction is measured in terms of a soil's dry unit weight, as measured in pounds per cubic foot, and its moisture content. Moisture content is defined as the weight of water in the soil divided by the weight of the solids in a given volume of soil. A typical compaction curve will show the dry unit weight increases as the moisture content increases up to the OMC. The dry density corresponding to the OMC is called the maximum dry density. Any increase in moisture content beyond the optimum value tends to reduce the dry unit weight.

Project specifications for railroad embankment construction typically require soil to be compacted to at least 95% of the maximum dry density.[136] To achieve this level of compaction, the soil should have a moisture content in a range of +/- 4% of the optimum level.[137] If the soil

[136] *See* NS Reply WP "NS Grading Spec.pdf."

[137] *See* NS Reply WP "NS Reply WP Compaction Standard Compaction Curve.pdf."

that is placed as fill does not have a natural moisture content within this range, a minimum of 95% compaction cannot be achieved without moisture conditioning. In this situation, reuse of the soil as fill requires moisture conditioning.

Moisture conditioning involves adding water to the soil if it is too dry for compaction, or drying the soil if it is too wet. Chemical additives can also be used to modify the properties of the soil, but these methods would not be used in the DRR construction. Adding water involves using a water truck to spray the soil lift, then compacting that soil. For fine-grained clays and silts that don't readily absorb water, the water usually must be mixed into the soil before compacting. In addition to the need to add water when soils are dry, the ability to achieve optimal moisture content to ensure proper compaction requires drying of soils through either the addition of dry soil or aeration.[138]

NS's Engineering Experts have studied the soil conditions along the DRR. The DRR is located in 20 states and at least four physiographic provinces including the Appalachian Highlands, Piedmont, Coastal Plain, Interior Low Plateaus, and Central Lowlands. *See* NS Reply Exhibit III-F-5 "DRR Physiographic Provinces" (discussing physiographic provinces). Each of these physiographic provinces can be subdivided into multiple regions with differing geology, climate, topography, vegetation, and other characteristics that shape the landforms and influence the soil types and moisture conditions. *See* NS Reply WP "DRR_Geo_Loc.pdf" for map of soil conditions throughout the DRR system.

Attempting to characterize the soil moisture conditions on such a large-scale, regional basis is difficult. The compaction characteristics of a particular soil are typically evaluated at a very local basis as soil conditions can vary dramatically over short distances and with depth.

[138] *See* NS Reply WP "Wisconsin Transportation Bulletin – Compaction.pdf."

Information sources that characterize soils on a state or physiographic province scale do not exist.

The Natural Resource Conservation Service ("NRCS"), part of the United States Department of Agriculture, has compiled detailed soil information for local areas in much of the United States. Although developed primarily for agricultural purposes, the data includes engineering properties, construction suitability features, and other data.

NS's Engineering Experts used two NRCS resources to estimate general soil conditions along the DRR; the Soil Climate Analysis Network ("SCAN") and the Web Soil Survey ("WSS").

The SCAN system collects soil moisture, precipitation, and other climatic information at specific stations across the U.S. and makes it available in real-time over a website.[139] Within most states traversed by the DRR, NS has identified at least one SCAN station near the alignment. The SCAN station identification number is presented in table format, along with moisture content values at 20 and 40 inches depth. *See* NS Reply WP "DRR Soil Moisture Content R1.xls." The moisture contents represent the average natural moisture content ("NMC") of the soil for the 2011 calendar year, or the 2010 calendar year if data were incomplete for 2011. These NMC values are applicable to soil at the specific SCAN station.

NS's Engineering Experts used NMCs from the SCAN data to compare moisture contents obtained from the WSS. The WSS generates soil maps for areas less than 10,000 acres. Individual soil units may cover a few acres or less. Each WSS webpage shows a soil map,

[139] http://www.wcc.nrcs.usda.gov/scan/.

individual soil units, and the available physical properties of the soil.[140] These soil maps were overlayed on the DRR route to determine the soil and moisture content for the DRR segments.

Two water content values are given in the WSS. These values represent a dry condition (15-bar) and a wet condition (1/3-bar).[141] The water content data from the NRCS are determined using different test methods than the water content used for soil compaction evaluation. However, in the opinion of NS's Engineering Experts, the NRCS data provides a reasonable representation of the natural moisture content for preliminary analysis.

NS has developed a Table showing the NMC estimated from NS's comparison of the SCAN and WSS data. *See* NS Reply WP "DRR Soil Moisture Content R1.xls." Estimated maximum dry densities and OMC values for the predominant soil types are also shown in the workpaper. These values were taken from correlations in Table 9.7 of the Civil Engineering Reference Manual by M.R. Lindeburg, 6th ed., 1992. The difference between the OMC and the NMC indicates whether the soil may be dryer or wetter than optimal. If the soil is shown to be dryer than optimum, the quantity of water that needs to be added to achieve 95 percent compaction is calculated and shown in the right-most column.

The results of NS's analysis indicate that the majority of the soils along the DRR alignment are wetter than optimum, and consequently would require drying before suitable compaction can be achieved. As discussed below, NS's Engineering Experts applied a drying

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[140] http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm.

[141] Free water or gravitational water will drain from a soil until the soil water potential reaches -1/3 bar. This is called field capacity. Gravitational water is not considered available to plants because it is in the soil only a short time and reduces oxygen levels to the point where the plant will not be absorbing water anyway. As the soil continues to dry--or water is used by plants--more and more energy is needed by the plants to remove the water. Eventually a point is reached where the plant can no longer remove water. This is called the wilt point and occurs at -15 bars water potential for most plants. From -1/3 to -15 bars is the zone of available water. http://www.swac.umn.edu/classes/soil2125/doc/s7chp3.htm

cost only to those soil areas where it would be most needed. Of the 38 major soil types listed in the Table, only five are drier than optimum and thus require water to be added. The other 33 soil types traversed by the DRR would not require water for compaction.

For the 33 soil types that have NMC values above optimum, 15 have NMCs within 4 percent of optimum. Adequate compaction of these soils is possible with little to no moisture conditioning. For the remaining 18 soil types, significant drying is required. To dry the soil after it is excavated; it must be spread and scarified by discing or blading. Repeated discing or blading cycles are required until enough water evaporates for the soil to approach optimum moisture conditions. Drying soil often is costly due to the large areas needed to spread the soil, the need for suitable weather, and potential construction delays while waiting for the soil to dry.

NS Engineering experts evaluated the locations of the soil monitoring stations and sorted DRR segments based on proximity to stations. ICC Val report maps, NS maps and DRR route maps were all used to assign each route segment a moisture content level based on the closest monitoring station within each state.[142] Based on the detailed soil analysis, NS has determined that approximately 124 million cubic yards of earthwork material will require some drying and the approximately 12 million cubic yards will require water for compaction. These represent approximately 21 and 2 percent of the DRR total earthwork volumes.[143]

DuPont did not allow for either drying soil that has a higher moisture content than needed for compaction or applying water to soil that has a lower moisture content than that needed for compaction. DuPont bases its position on the atypical experience of the Trestle Hollow Project where the soil boring reports indicate the existing soil had an optimum moisture content needed

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[142] NS Reply Workpaper "WP III-F-2 DRR Open Grading errata NS Response.xlsx," Tab "Subgrade Preparation."

[143] *Id.*

for compaction. See *supra* III-F-2 for NS's discussion of the reasons the Trestle Hollow costs are inapplicable to this case.

The R.S. Means cost, before any distorting manipulation by DuPont, correctly includes the cost of loading, transporting, and distributing the water in the roadbed material. The primary portion of the roadbed that requires water for compaction is the top 18 to 24 inches of the embankment. This is considered the crown of the roadbed, which must be placed correctly and shaped to the typical section proposed by DuPont for the application of sub-ballast. NS's Engineering Experts have conservatively applied water for compaction based on the R.S. Means cost data only to the top portion of the roadbed consisting of only 20% of the total common excavation and borrow material quantities.[144]

DuPont did not apply a cost for drying wet material. For the soil material with a moisture content too high for proper compaction, NS's Engineering Experts have developed a soil drying unit cost from R.S. Means items. NS used from the B-84 Crew an operator and tractor (same as the crew used for clearing) and added a Disc Harrow Attachment for a total cost of $840.44/day. NS assumed a production rate of 4,000 CY/ day, which is the production rate of 8 scrapers (530 CY/day each). This is a unit cost $0.21/CY and NS has applied this cost to each CY of Common Excavation and borrow used in the areas with soil that is too wet.[145]

(g) Total Earthwork Cost

The adjustments described above increase the costs associated with total earthwork, (including additional land purchases), for the DRR to a total of $8,862 million, an increase of $4,893 million.

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[144] NS Reply WP "Railroad_Engineering_William_Hay-Water and Compaction.PDF" at 306, section 11.

[145] NS Reply WP "DRR Open Grading errata_NS Reply.xlsx" Tab "Subgrade_Preparation."

e. Drainage

i. Lateral Drainage

NS accepts DuPont's use of the ICC Engineering Reports to quantify lateral drainage needed for the DRR route and its proposed unit costs.

ii. Yard Drainage

NS's Engineering Experts determined that DuPont did not include sufficient cost estimates for yard drainage structures and only included a cost of $28.7 million for catch basins and drainage pipes for their proposed six large hump yards[146] Proper drainage is required at all yards to ensure continuous revenue service through weather events and to prevent facility damage from, for example, flooding and or washouts.

Based on recent NS yard construction, *see* NS Reply WP "NS Yard Drainage Calc.xls," NS's Engineering Experts formulated a unit cost of $16.66 per linear foot of yard track for drainage structures.[147] This unit cost was derived using bid cost data from new construction of drainage infrastructure at the recently expanded NS Bellevue yard in Ohio. The Bellevue Yard is a fairly typical large yard on the NS system, and yard drainage units costs for a recent project should be representative of costs the DRR would incur to install proper drainage infrastructure at its yards. NS's Engineering Experts divided total drainage costs at the Bellevue Yard by the approximate length of new track constructed to produce a cost per linear track foot. Typical items included in the yard drainage system estimate consist of multi-diameter drainage pipe, catch basins, and excavation and construction costs.

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[146] *See* DuPont Opening III-F-18.

[147] *See* NS Reply WP "NS Bellevue Class Yard Drainage.pdf"; "NS Bellevue Drainage Unit Costs.pdf."

To estimate the cost of yard drainage for the DRR system NS's Engineering Experts applied the $16.66 per linear foot of yard track to the total combined yard track length. The total estimated cost of drainage infrastructure along the DRR yards calculated using the above method totaled $132,459,803 along 1,505.83 miles of new yard track.[148]

f. Culverts

NS rejects DuPont's proffered culvert costs and quantities.

i. Culvert Unit Costs

NS rejects DuPont's culvert unit cost estimates because those estimates either omitted or incorrectly applied costs associated with the installation of culverts. DuPont also made many calculation errors in their worksheets.

DuPont posited in its narrative that the DRR will have Aluminized Corrugated Metal Pipe ("CMP") culverts in all locations on the lines of the DRR having culverts, as identified in the NS culvert list.[149] That culvert list, however, includes a variety of circular and box shapes of culverts that use a variety of materials, as appropriate for each site.[150] The different shapes and variety of culvert materials have different hydraulic characteristics. In specifying only a single pipe material for the DRR, DuPont failed to account for the varying flow characteristics of the existing culverts and understated the culvert requirements for the DRR. Although accepting DuPont's CMP culvert specification, NS's Engineering Experts corrected DuPont's hydraulic flow oversight by sizing each new DRR culvert to match the hydraulic capabilities of the existing NS culverts. For culvert costs, DuPont confused its own specification for the type of

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[148] *See* NS Reply WP "NS Bellevue Class Yard Drainage.pdf"; "NS Bellevue Drainage Unit Costs.pdf."

[149] *See* DuPont Opening III-F-20.

[150] NS Reply WP "Culvert Construction Costs errata_NS Reply.xlsx," Tab "Active."

CMP deployed for the DRR. Its price quote from ConTech for CMP unit prices are for *Aluminized Steel* CMPs, *not* the Aluminum CMP called for in its narrative. *Aluminized Steel* CMP is less costly than *Aluminum* CMP.[151] The website metalprices.com (last visited November 26, 2012) listed a monthly average spot price of $1,930/ton for aluminum in November, 2012, while the website worldsteelprices.com (last visited November 26, 2012) listed a spot price of $717/ton for steel in the month of October, 2012. This shows aluminum CMP's raw material cost is about 2.7 more costly than steel CMP. Either is adequate for use on the DRR and NS's Engineering Experts accept the use of lower cost Aluminized Steel CMP. However, DuPont used the lighter weights of Aluminum CMP for material transportation cost instead of the heavier Aluminized Steel CMP weights that are the basis of the ConTech haulage quote,[152] thus understating transportation costs. *See* DuPont Opening WP "Culvert Construction Costs errata.xls," Tab "Unit Costs," Cells B50 to J59. An example of this error is that 24" Aluminum CMP has a weight of 10.8 lbs/Foot while 24" Aluminized Steel has a weight of 33 lbs/Foot for same pipe gauge. DuPont also uses the wrong 48" and 120" aluminized CMP weight per lineal foot. Based on the 48" and 120" aluminized CMP price chart from DuPont opening workpaper "Contech Pricing.pdf. the gauge number should be 12 and 10 respectively. However, DuPont uses gauge number 10 and gauge 8 for the 48" and 120" aluminum CMP on the pipe weight. NS has corrected this error.[153]

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[151] *See* NS Reply WP "Contech_Pricing.odf" and "Contech_CMP_Stnd._Specification.pdf."

[152] DuPont Opening WP "Contech Pricing.pdf."

[153] *See* NS Reply WP "Culvert Construction Costs errata_NS_Reply.xlsx," Tab "Unit Costs," Cells I51 to I59.

Transportation costs are a constant $0.035/ton-mile, without regard for the type of culvert material, so transportation cost is purely a function of weight.[154] The weight ratio between the two CMP types is 0.33. Because transportation costs are determined by weight, the Aluminum CMP haulage would cost one third the price of Aluminized Steel CMP. To summarize, NS accepts DuPont's unit cost for Aluminized Steel CMP. NS rejects DuPont's calculation of haulage charges and increases them by nearly a factor of three to reflect the correct weight of Aluminized Steel CMP.[155]

NS rejects DuPont's unit cost for bedding material. DuPont used a bedding material unit cost from the inapposite Trestle Hollow Project. As demonstrated, unit costs from the Trestle Hollow Project are not representative of the costs the DRR would incur. *See supra* III-F-2-d-(i). Therefore, NS's Engineering Experts applied the R.S. Means unit cost of $35.13/CY for bedding material.[156]

NS accepts the R.S. Means unit costs for excavation and trench backfill that DuPont used in its Opening Evidence.

ii. Culvert Installation Plans

DuPont incorrectly calculated culvert installation quantities. Specifically, the culvert installation plan in DuPont's Opening Evidence and DuPont's workpapers for trench dimensions are conflicting and confused. In its Opening Evidence, DuPont states that "the trench for the CMP is excavated one foot wider on each side than the culvert width. The bottom of the excavation is covered with an average depth of 12" of crushed stone bedding material to act as a

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[154] DuPont Opening Errata III-F-27.

[155] *See* NS Reply WP "Culvert Construction Costs errata_NS_Reply.xlsx," Tab "Unit Costs," Cells M51 to M59.

[156] NS Reply WP "RSMEANS Bedding Unit Price.pdf."

foundation and cushion for the culvert."[157] DuPont's culvert spreadsheet, in contrast, used trench widths that varied from culvert-width-plus-one-foot to culvert-width-plus-two-feet.[158] NS accepts DuPont's stated specification of a trench width of two feet wider than the culvert width, one foot wider on each side than the culvert width, as described in DuPont's narrative evidence. NS rejects the unsupported, unexplained, and inconsistent use of narrower widths for some culverts used in DuPont's workpapers. DuPont did not consider the space between multiple barrels necessary to allow efficient operation and selection of compaction equipment. NS applied the recommended minimum spacing between pipes on multiple barrels with different sizes of culvert pipe from National Corrugated Steel Pipe Association Installation Manual.[159]

DuPont's plan does not specify a trench depth. Without any explanation, or support, DuPont's culvert spreadsheet applied trench depths that varied from culvert height plus one foot to culvert height plus two feet. NS accepts DuPont's specified trench height of two feet higher than the culvert height. In summary, the culvert trench will be excavated with dimensions one foot wider on each side than the culvert width, a foot below the flow line of the culvert, and a foot above the top of the pipe for cover. The culvert trench on multiple barrels will be excavated with dimensions one foot offset from the side of culverts plus the minimum spacing between the culverts plus culvert widths, a foot below the flow line of the culvert, and a foot above the top of the pipe for cover. NS's Reply Evidence corrects the trench excavation quantities to reflect the correct trench dimensions.[160]

[157] DuPont Opening Errata III-F-19.

[158] NS Reply WP "Culvert Pipe Trench by DuPont.pdf."

[159] NS Reply WP "NCSPA Installation Manual.pdf."

[160] *See* NS Reply WPs "Culvert Pipe Trench by NS.pdf" and "Multi Barrels Min Spacing By NS.pdf."

For culvert bedding, DuPont's Narrative states "[t]he bottom of the excavation is covered with an average depth of 12" of crushed stone bedding material to act as a foundation and cushion for the culvert, providing a means for transferring the load into the ground below the culvert as well as a level surface." DuPont Opening III-F-19. DuPont's spreadsheet, however, failed to provide enough bedding material to cover the bottom of the specified culvert width.[161] As described above, DuPont's Opening Evidence specifies a trench width of two feet (one foot on each side of the culvert pipe) plus the culvert width. The bedding has to cover the bottom of the trench, so it must be sized consistent with the trench specification of two feet plus the width of the pipe for a single culvert and providing minimum spacings between pipes for multiple culverts. DuPont erroneously calculated the bedding area based only on the culvert width-plus-one-foot, thereby understating the required amount of bedding material.

DuPont also understated the height of required bedding material by erroneously stopping the bedding material at the flow line at the bottom of the culvert. Bedding material must go to the pipe springline (middle of pipe height).[162] This is standard industry practice, for two reasons. One reason is that this level of bedding is necessary for complete load transfer to the bedding material. The second reason is that earthen backfill material is hard to compact under the pipe between the springline and the flow line while crushed stone, because of its added weight, naturally fills any voids. The material DuPont proposed to use for the trench backfill is from the excavation obtained on site and will be highly heterogeneous, not the select material typically used for backfill. With only a one-foot gap between the trench wall and the pipe, only very small compaction equipment can be used. This equipment is far less powerful than the rollers and

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[161] *See* DuPont Opening WP "Culvert Construction Costs errata.xls," Tab "Unit Costs," Cells E21 to E31.

[162] NS Reply WP "Culvert Pipe Trench by NS.pdf."

sheepfoots used for the roadbed and cannot achieve the needed compaction on DuPont's backfill material. Therefore, bedding material (easily compacted) should be used in the more difficult parts of the trench. NS has calculated the correct quantity of bedding needed.[163]

DuPont incorrectly calculated trench backfill quantity with the same trench dimension errors as on the previous items. As a check, the bedding quantity should be the exact same as the backfill quantity. This is because the pipe will be in the exact center of trench and the bedding goes from the bottom of the trench to the springline (middle) of the pipe while the backfill goes from the springline to the top of the trench.[164] NS calculated the correct quantity of trench backfill accordingly.[165]

iii. Culvert Quantities

NS's Engineering Experts reject a number of DuPont's culvert quantities. NS's Engineering Experts also reject DuPont's substitution of culverts for bridges as infeasible in many instances.

There are a number of critical shortcomings with DuPont's proposed DRR culvert inventories. For culverts smaller than 10 feet wide, DuPont proposes replacing all culverts, no matter the existing material or shape, with CMP culverts. DuPont's Opening Evidence also seeks to convert approximately 1,500 bridges that are 20' or shorter to CMP culverts. Approximately 300 of these 1,500 bridges (22% of the total) are bridges over automobile roads that could not be converted to CMP culverts. This error is addressed separately, in the Bridges

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[163] NS Reply WP "Culvert Construction Costs errata_NS_Reply.xlsx," Tab "Unit Costs," Cells E21 to E31.

[164] NS Reply WP "Culvert Pipe Trench by NS.pdf."

[165] NS Reply WP "Culvert Construction Costs errata_NS_Reply.xlsx," Tab "Unit Costs," Cells L21 to L31.

section of this evidence. *See infra* III-F-5. Approximately 1,170 of the shorter bridges (78% of total) that DuPont proposes to convert to CMP culverts are concrete box culverts and circular storm sewers, with the balance being arches and various types of conventional bridges (beam, deck, and trestle). DuPont's attempted conversion of these bridges and culverts to CMP culverts is riddled with errors.[166] A critical component of hydraulic design is that the flow capacity of a replacement CMP culvert must equal the flow capacity of the existing culvert or bridge. If not, the DRR would be exposed to a substantial risk of flooding and a wash out of the entire roadbed due to the water backing up behind the entrance to the culvert.

One example of DuPont's errors is its proposed replacement of the large box culverts on the Pittsburgh Division. At NS mile post 235.32, DuPont proposes replacing a 12' x 6' high box culvert over the Juniata River with a 108" (9 foot) CMP culvert. To accommodate the track structure above, a replacement culvert must be the same height as the existing culvert. In this example, a nine-foot CMP culvert would be far too high, likely extending into the ballast or possibly even higher than the top of the rail.[167] The replacement culvert cannot be lower than the existing culvert without extensive stream modifications. Likewise, the track profile cannot be raised without extensive earthwork modifications. Neither of these physical limitations has been addressed by DuPont.

DuPont's mistaken assignment of culvert sizes results in real world absurdities. The below picture shows an eight foot tall culvert at MP 788.77 in the Alabama Division. Defying

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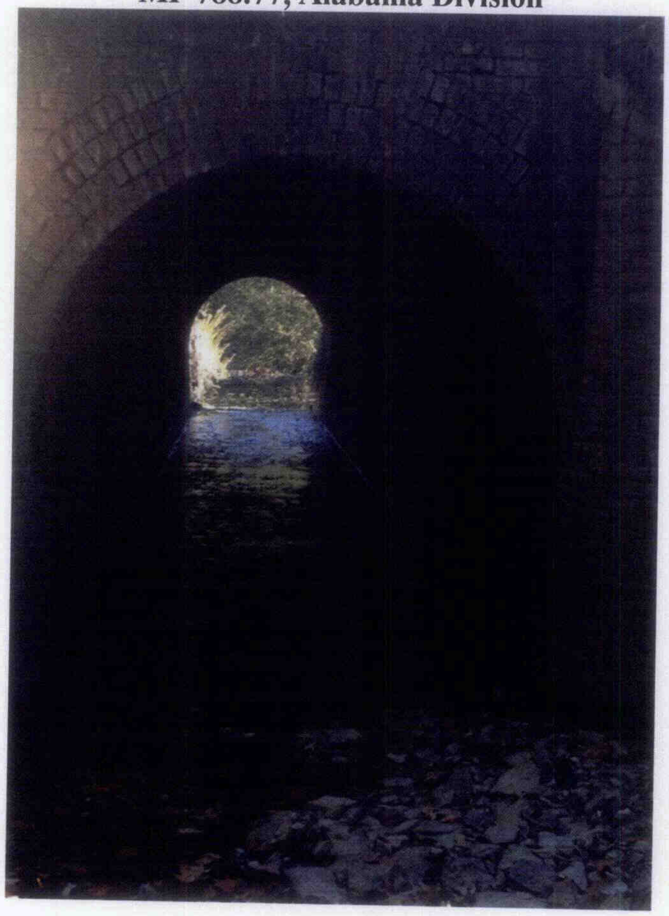
[166] *See* NS Reply WP "Culvert_Field_Pictures.pdf."

[167] NS Reply WP "Culvert XSection Drawing 1.pdf."

engineering common sense, DuPont proposed to install a 24 inch diameter culvert at this same location[168]

Figure III-F-1
MP 788.77, Alabama Division



NS calculated the number of CMP culverts needed to replace the bridges and large box culverts using the standard flow velocity equations that consider the existing and proposed pipe's material composition and the slope necessary to generate the minimum velocity. For the small percentage of bridges and culverts that are very deep, NS assumed flow area as width times the height (width and height are equal in a circular pipe). Most of NS's existing large culverts and bridges carry large flows of 200 CFS – 1,000 CFS, with many carrying flow of 1,000 to 2,000

[168] See NS Reply WP "8 Foot Culvert at MP 788.77" and NS Reply WP "Culvert Construction Cost NS Reply.xls," Tab "Active," Line 41 (specifically, cells AA41 and AB41).

CFS. In comparison, one 120" CMP culvert (10 feet in diameter) at a slope of 0.1% can carry about 284 CFS.[169] Most of the culverts and bridges that DuPont proposed to replace will need to be replaced with multiple barrels (3-7 pipes) CMPs in order to provide at least the equivalent flow capacity of the existing structures..

Bridges spanning high over waterways cannot be replaced by culverts, particularly on the narrow DRR rights of way. At a 1.5 to 1 side slope, the DRR roadbed would extend beyond its 100 foot right of way boundaries if the bridge to be replaced is more than 27 feet above the flow line of the culvert to base of rail in single track, and more than 23 feet above the flow line of the culvert in double track. Also, the DRR roadbed would extend beyond its 75 foot right of way boundaries if the bridge to be replaced is more than 19 feet above the flow line of the culvert to base of rail in single track.[170]

As shown in NS's workpapers, replacing the bridges and box culverts with CMP carrying the equivalent flow is a more expensive option than using a simple span bridge.[171] NS's Engineering Experts calculated both the cost of replacing bridges and box culverts with CMP culverts and replacing them in kind. When the cost of replacing with CMP exceeded the cost of replacement in kind, NS rejected the replacement with CMP and included costs for replacement in kind. DuPont also committed a significant calculation error in addressing culverts less than 10-feet wide that converted each and every NS box culvert into a single 24" CMP culvert, no

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[169] Q = (1.49/0.24) x {((10/2)^2)xPI} x {((10/2)^2)xPI)/(2xPIx(10/2))}^0.67 x (0.001^0.5) = 284 CFS. [Manning's Eq.: Flow(Q) = (1.49/n) x Area x (Hyd.Rad. ^0.67) x (Slope^0.5)]; NS Reply WP "Culvert Construction Costs errata_NS_Reply.xlsx," Tab "IHB."

[170] NS Reply WPs "100 ft ROW Single ML.pdf" "100 ft ROW Double ML.pdf"and "75 ft ROW Single ML.pdf."

[171] NS Reply WP "Culvert Construction Costs errata_NS_Reply.xlsx," Tab "20ft<Bridges Rev.," Columns CS and CT.

matter the size of the box culvert. For example, DuPont converted the 96" x 96" concrete box culvert at mile post 788.77 on NS's "Alabama" Division to a single 24" CMP culvert. The cross-sectional area of the 96" box culvert is 20 times larger than that of the proposed 24" CMP culvert. The price comparison is $174.39/LF for the 96" CMP culvert to $30.61/LF for the 24" CMP culvert. NS's Engineering Experts corrected this spreadsheet error by using the CMP culvert size that is equivalent to the box culvert it would replace, which is necessary to prevent flooding/washouts.[172]

DuPont further erred in assuming that a CMP culvert of the same diameter as a reinforced concrete pipe ("RCP"), ductile iron, or other material pipe, would carry the same flow. This is incorrect: a CMP's corrugations cause turbulence in the flow that reduces the flow volume capacity of a CMP culvert. The same size and shape RCP carries approximately two times the volume as a CMP can carry. So two CMP culverts of the same size and shape would be needed to replace a single RCP. This is demonstrated by the Manning's flow equation,[173] which is used throughout the design industry to calculate flow in a pipe. This equation has been in use since the 1890s and is based on the area of the pipe, the wetted perimeter of the pipe, slope of pipe, and the friction coefficient used in Manning's equation. The rougher the material, the higher the friction coefficient. And, the higher the friction coefficient value, the lower the flow capacity of the pipe. Therefore, a CMP with a substantially higher friction coefficient will have a much lower flow capacity than RCP or other alternatives.[174]

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[172] *See* NS Reply WP "Culvert XSection Drawing 2.pdf."

[173] Manning's Eq.: Flow(Q) = (1.49/n) x Area x (Hyd.Rad. ^0.67) x (Slope^0.5).

[174] NS Reply WP "WP III-F.2-d.-iii. Roughness coefficient.pdf."

Sound engineering practices require that if the hydraulic conditions of an existing culvert are unknown, the replacement culvert should have capacity to carry at least the same flow as the existing culvert. Anything less could restrict the flow and put the railroad and adjacent landowners at risk of flooding or washing out the railroad roadbed.

NS's Engineering Experts have determined that a reasonable simplification to determine flow of the existing pipe is to assume the pipe is flowing full and the slopes for the existing and proposed culverts are based on the minimum velocity needed to keep the pipe clean. This minimum velocity is 3 feet per second pipe flow velocity and is a function of pipe size, shape and material.[175] The Manning's velocity equation is used to determine the minimum slope of each culvert necessary to maintain a minimum flow velocity of 3 feet/second. CMP's friction coefficient values range from 0.024 to 0.028.[176] NS assumed a conservative friction coefficient of 0.024 for CMPs in its calculations. Concrete, steel, cast iron, ductile iron, and smooth plastic pipe's friction coefficient values range from 0.011 to 0.013. NS has used an average friction coefficient of 0.012 for all non-CMP. NS's Engineering Experts used these assumptions, the Manning's flow equation and the existing pipes' physical properties (size, shape, and the coefficient of friction) to determine existing culverts flow capacities.[177] For each culvert, NS then determined the equivalent number of CMPs needed to achieve the same flow. Because the top of a culvert pipe is typically placed at the calculated flood level, the proposed replacement

[175] NS Reply WP "WP III-F.2-d._Lindeburg_Minimum_Pipe_Velocity.pdf."

[176] NS Reply WP "Roughness coefficient.pdf."

[177] NS Reply WP "Culvert Construction Costs errata_NS Reply.xlsx," "Active," Cells M1 to N3, Columns T and U.

pipes must be the same height as the existing pipe to ensure pipes are flowing full. NS has revised the culvert spreadsheet to calculate the additional pipe quantity.[178]

In addition, DuPont erroneously excluded culverts less than 20' in length, reasoning that such culverts could not span the full width of the roadbed. This rationale is based on a mistaken understanding of the function and use of 20-foot culverts. The shorter pipes are used to extend existing pipes. Extensions are needed when NS widens its roadbed to modern dimensions. For example on the Alabama division, at mile post 730.10, there are three entries, named sections 1, 2, and 3. They are all 36" with the middle pipe having a length of 60' and the sections having lengths of 20' and 10'. At this location there are not three separate culverts, but one culvert totaling 90' made up of three pipe segments, one 60' and two extensions of 10' and 20'. NS has corrected DuPont's erroneous exclusion of culvert segments shorter than 20 feet, and included those extensions in the total quantities.[179]

Finally, DuPont further erred by confusing the spreadsheet column with the number of sections of a pipe (this is a pipe and its extensions) with the number of barrels in a culvert system. Culvert systems with multiple barrels list each barrel separately. For example, on the Alabama division, at mile post 4.9, there are six culverts, each 60 feet in diameter and 60 feet in length. Here, DuPont's spreadsheet correctly accounted for the total length of 360 feet for the six-barrel culvert. Elsewhere on the Alabama division, at mile post 753.23, there is a 24" culvert with two extensions, each 24" in diameter. DuPont mistakenly dropped the quantities for the extensions as discussed above, but then multiplied the original culvert (which is section 2) length

[178] NS Reply WP "Culvert Construction Costs errata_NS Reply.xlsx," Tab "Active," Column AF.

[179] NS Reply WP "Culvert Construction Costs errata_NS Reply.xlsx," Tab "Active," Column AK.

by two, presumably assuming a two barrel culvert at this location. Though correcting DuPont's error decreases the quantity of pipe and therefore reduces its cost, NS has fixed these errors throughout the spreadsheet.[180]

DuPont failed to provide culvert inlet protection during construction. Silt fences are cost-effective culvert protection devices. Silt fence should be located at the inlet to storm sewer culverts to prevent sediment entering, accumulating in and being transferred by a culvert and the associated drainage system prior to permanent stabilization of a disturbed project area. NS's Engineering Experts have used an average of 100 LF silt fence around each culvert inlet on either single or multi barrels condition.[181] The total cost of providing silt fences at culvert outlets is $3,360,973.[182]

iv. Total Culvert Costs

NS has determined the cost of culverts to be approximately $800 million, rather than the $415 million calculated by DuPont.

g. Other

i. Sideslopes

NS accepts DuPont's average sideslope ratio of 1.5:1.

ii. Ditches

NS accepts DuPont's specifications of side ditches in trapezoidal sections with cuts two feet wide and two feet deep for all locations.

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[180] NS Reply WPs "Culvert XSection Drawing 4.pdf"; *see also* "Culvert XSection Drawing 5.pdf" to Culvert XSection Drawing 13.pdf."

[181] *See* NS Reply WP "Silt Fence at Culvert.pdf"; "Silt Fence at Multi Barrels.pdf."

[182] *See* NS Reply WP "Silt Fence unit cost.pdf"; "Culvert Construction Costs errata_NS _Reply.xlsx" Tab "Silt Fence."

iii. Retaining Walls

NS rejects DuPont's retaining wall quantities. Retaining wall quantities for the DRR were extracted from the ICC Engineering Reports. The ICC Engineering Reports include cubic yards of masonry, timber walls, and walls made from timber ties and pilings under the category "Protection of Roadway" included in Account 3, Grading. Rather than construct masonry or timber retaining walls, DuPont proposed to use gabions (galvanized steel mesh boxes filled with rock) for all of its retaining walls.

DuPont replaced the cubic yards of Masonry wall with equal cubic yards of gabion wall. It also replaced the computed square yards of face of timber and tie retaining walls with the equivalent exposed face of gabions. DuPont replaced timber piling walls with untreated timber piles.

NS accepts the use of gabions for retaining walls, but rejects the quantities determined by DuPont. The Complainant's evidence also failed to include any costs for preparation of the foundation area of the walls, and failed to account for the increased wall heights that would result from increased roadbed width. NS also rejects DuPont's use of untreated timber piles for timber piling walls.

Both masonry walls and gabion walls are gravity structures. However, masonry walls have a greater weight by volume than do gabions, which are filled with loose rock and have a significant volume of void space. Therefore, it is incorrect to assume that a given volume of masonry wall can be replaced by an equivalent volume of gabion wall. NS Reply workpaper "Gabion_Wall_Conversion.pdf" indicates the required cross section of gabion wall necessary.

Gabions were originally developed in Italy by the Maccaferri Company, which is now a major supplier of gabions throughout the world. Their design guidelines indicate that the first layer of gabions in a wall must be sunk into the foundation area by a depth of either one half gabion or one full gabion, based on wall height.[183] The average gabion wall is nine feet high.[184]

In its Opening Evidence, DuPont posited that the roadbed width will increase by 5 feet for single track and 7 feet for double track (based on proposed 15' track centers) on fills. DuPont also indicated that the roadbed in cuts will increase by 17' for single track and 19' for double track. Measuring from the center line of track this will move the break point of the slope out an additional 2.5 feet for single track and an additional 3.5 feet for double track on fills and will move the break point out 8.5 feet for single track and 9.5 feet for double track in cuts. The effect this would have on retaining walls is very significant. Retaining walls are utilized where there is not enough room to construct the typical roadbed section. An adjacent roadway, building, stream or other obstacle encountered during construction may dictate the need for a retaining wall. Widening the roadbed does not relieve or move the constraint of the obstacle encountered. Therefore the retaining walls would need to be enlarged to accommodate the wider roadbed.

For track on fill, using a 1.5 horizontal to 1 vertical sideslope, the widening of the roadbed described above would have the effect of increasing the height of a retaining wall by 1.67 feet for single track and 2.33 feet for double track. For track in cut, the increase is significantly greater; the height of a single track retaining wall increases by 5.67 feet and for double track by 6.33 feet. Analysis of the proposed DRR construction indicates that of the proposed 7,277 route miles, 3,185 (44%) are double or multiple track.[185] Further, the increased

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[183] *See* NS Reply WP "Maccaferri Gabion Description.pdf."

[184] NS Reply WP "Retaining_Wall_Description.pdf."

[185] NS Reply WP "DRR Open Grading errata_NS _Reply.xlsx," Tab "Gabion Retaining Walls."

roadbed width not only increases the height of the retaining wall, but also lengthens the retaining wall. In some cases that would bring new obstacles in the path of a roadway and require additional roadbed support or additional retaining walls. The result is a greater force pushing on the wall, an increased moment trying to overturn the wall and increased live loads due to modern axle loadings (retaining walls for embankment support the railroad bed). It is standard route design practice to balance cuts and fills, so it is reasonable to assume that half of the retaining walls are in fill sections and half are in cut sections. Further, the DRR indicates that 44% of the proposed route is double track. Based on these factors, the height of an average wall would increase by 4.0 ft.

NS's workpapers[186] clearly show the increased loading as they relate to height for a 1.5 horizontal to 1 vertical sideslope on retaining wall. This effect requires a much larger foundation and a more substantial wall.

DuPont did not include the use of treated timber piles for timber piling walls. The International Code Council, which is the source for most of the state building codes through which the DRR is routed, requires either treated wood or wood of a species naturally resistant to rot and insect attack to be used in ground contact.[187] Using untreated wood in retaining walls which support track or protect track from slides is a safety hazard that could cause a derailment. NS's Reply uses treated piles, which increases the cost of the piling to $48,311,609.[188]

Gabion Quantities

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[186] *See* NS Reply WP "Active Components for Retaining Walls with Broken Slope Backfill (from Civil Engineering Reference Manual, Sixth Edition, Michael R. Lindeburg, NS Reply WP "Active Components for Retaining Walls with Broken Slope Backfill.pdf."

[187] *See* NS Reply WP "Treated Wood and the 2003 International Building Code.pdf."

[188] *See* NS Reply WP "DRR Open Grading errata_NS Reply.xlsx," Tab "Other Items."

DuPont understated the quantity of gabion needed to build the retaining walls. DuPont opts to replace the masonry and timber of the retaining walls in the ICC Engineering Reports with gabion walls.[189] While this is feasible, DuPont does not properly calculate how much gabion is needed to make the substitution. Specifically, where the ICC Engineering Reports list masonry walls, DuPont substitutes only one cubic yard of gabion to replace one cubic yard of masonry.[190] However, the retaining power of a masonry gravity-type wall is based on weight, not volume.

A cubic yard of gabion (a rectangular wire basket filled with small pieces of stone) weighs significantly less than a cubic yard of masonry (larger chunks of stone kept together with or without mortar). As a result, gabion has a significantly lower load-carrying capacity than masonry. To substitute gabion for masonry, the weight of gabion used must equal the weight of the masonry replaced. DuPont improperly substituted gabions based only on volume. NS's Engineering Experts developed the proper volume conversion ratio below.

To determine the correct gabion-to-masonry substitution ratio, it is necessary to determine both the average weight of a cubic yard of masonry and the average weight of a cubic yard of gabion. Masonry walls are composed of units of solid material like that found around the right-of-way. The ICC Engineering Report lists examples of this material, including: blocks of cut stone, cobbles, rubble, and (in some cases) concrete or brick. In the regions that DRR traverses, the most common stone that could be used for masonry would be sandstone and soft-to medium-density limestone.

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[189] *See* DuPont Opening WP "ICC_Engineering_Reports.pdf."

[190] DuPont Opening WP "DRR Open Grading errata.xlsx," Tab "Other Items."

The sandstone and limestone have solid unit weights of 140 pounds per cubic foot and 138 pounds per cubic foot, respectively (averaging 139 pounds per cubic foot).[191] The broken-stone unit weight of both types of stone is 90 pounds per cubic foot. Incorporating all of these factors produces an average of 3,753 pounds per cubic yard of sandstone/limestone masonry. A gabion basket containing one cubic yard of broken sandstone or limestone will weigh only 2,430 pounds.[192]

The quantity of gabion needed to replace all the masonry walls in the ICC Engineering Reports is equal to the ratio between the weight of masonry that is being replaced and the weight of gabion that will be used to replace the masonry (slightly over 1.54:1),[193] multiplied by the total quantity of masonry being replaced. Design charts created by Maccaferri show that the same type of calculation is used when substituting solid stone gabion basket unit weights for broken stone gabion basket unit weights for gravity retaining walls.[194] Applying these calculations, NS's Engineering Experts adjusted the required volume of gabion.[195]

Similar to the masonry stone wall, DRR miscalculated the conversion for timber walls to walls made of gabion baskets. NS agrees with DRR's conversion of MBM (a unit of volume equal to 1000 board feet) to square yards and agrees with the conversion of timber ties to square

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[191] *See* NS Reply WP "Retaining_Wall_Diagram.pdf" drawing "RET_WALL-1."

[192] *See* NS Reply WP "Maccaferri.pdf," Section "Effective weight of a structure made up with gabions."

[193] This calculation is as follows: $3{,}753 \div 2{,}430 = 1.5\overline{4}$. *See* NS Reply WP "DRR Open Grading errata_NS Reply.xlsx," Tab "Gabion Retaining Walls."

[194] NS Reply WP "Retaining_Wall_Description.pdf," Section: Effective weight of a structure made up with gabions, Table 2.

[195] NS Reply WP "Retaining_Wall_Diagram.pdf."

yards of wall, but disagrees with the conversion of square yards of timber or tie walls to cubic yards of gabion wall.

DRR converted one square yard of timber wall to one cubic yard of gabion wall. This conversion assumes that a square yard of exposed timber wall is interchangeable with the exposed gabion surface. However, this assumption is only valid for very low height walls that have only a single course of gabion baskets. The retaining walls actually in service along the alignment clearly retain far more than one 3-foot high course of gabion.[196] The Maccaferri design guidelines indicate that even a 4.5-foot high wall includes a foundation course wider than 3.0 feet.

It is standard design practice to attempt to balance cuts and fills, so it is reasonable to assume that half of the retaining walls on the DRR are in fill sections and half are in cut sections. Further, the DRR indicates that 44% of the proposed route is double track. Based on these factors, the height of an average wall would increase by 4.0 ft. For an average existing wall height of 10 feet, measured from the ground line, a gabion wall requires 1.5 feet of foundation depth, and, at a height to base ratio of 2.0, a base width of 5.75 feet. However, when this height is increased by 4 feet to accommodate the proposed roadbed widths, a 14 ft gabion wall requires 3.0 feet of foundation depth, and a base width of 8.5 feet. These proportions are indicated in the Maccaferri design guidelines. Thus, the increase in height caused by the proposed roadbed width causes an increase in volume of gabion. Photos at various locations along the route indicate that an average wall height of 10 feet is reasonable. For a wall height of 12 feet,[197] the cross section

[196] *See* NS Reply WP "DRR Open Grading errata_NS _Reply.xlsx," Tab "Gabion Retaining Walls."

[197] *Id.*

area is 55.5 ft^2, for a wall height of 18 feet,[198] the cross section area is 93 ft^2, a 68% increase. Based on the increases in volume caused by the conversion of masonry to gabions and the increased height of wall required by the increased roadbed width, NS's Engineering Experts determined the cost of the gabions to be $822,385,741.[199]

If the average existing wall height of 10 feet is used, an equivalent length of all the retaining wall can be determined. Using this length, a foundation excavation volume of 1,058,555 CY was determined. This quantity was added to the Common Excavation totals.[200]

These quantity adjustments, along with the use of treated piles described above, increase the cost for retaining walls from $346,128,689 to $870,697,350.[201]

iv. Rip Rap

NS rejects DuPont's quantity of rip rap, but accepts the unit cost. DuPont missed 64 CY of Riprap on one of the ICC valuation sections, NYC-231-MI, and NS adjusts rip rap quantities to reflect that additional quantity. *Compare* DuPont Opening. WP "DRR Opening Grading errata.xls," Tab "Eng Rep Input" *with* NS Reply WP "DRR Opening Grading errata Reply.xls," Tab "Eng Rep Input." *See* NS Reply WP "DRR Open Grading errata NS Reply," Tab "DRR-ICC Quantity Errors."

v. Relocating and Protecting Utilities

NS accepts DuPont's costs for relocating and protecting utilities.

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[198] *Id.*

[199] *Id.*

[200] *See* NS Reply WP "DRR Open Grading errata_NS Reply.xlsx," Tab "EW Costs."

[201] *See* NS Reply WP "DRR Open Grading errata_NS _Reply.xlsx," Tab "Other Items."

vi. Seeding/Topsoil Placement

NS accepts DuPont's embankment protection quantities, but rejects DuPont's use of the Trestle Hollow Project unit cost for seeding due to all the flaws in DuPont's attempt to extrapolate from that unrepresentative project, discussed above. *See supra* III-F-2. NS used the more representative seeding unit cost from R.S. Means to calculate total seeding cost.[202]

vii. Water for Compaction

Water for compaction for dry soils along the DRR route and drying of wet soils along the route are addressed in Section III-F-2-c-ii-(f), (Subgrade Preparation), *supra.* NS rejects DuPont's unit cost and quantity of the water needed for compaction, although it agrees that water for compaction is necessary as represented in DuPont's workpapers, which is consistent with precedent. *See TMPA I*, 6 S.T.B. at 707.[203]

viii. Surfacing for Detour Roads

NS accepts DuPont's costs for surfacing detour roads.

ix. Environmental Compliance

NS accepts DuPont's costs of environmental compliance.

x. Lighting for Night Work

DuPont did not include lighting crew cost for night time work during the seven-month roadbed construction period. Working at night would require lighting for the entire grading and construction period if the aggressive schedule is to be met. This becomes even more critical

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[202] *See* NS Reply WP "DRR Open Grading errata_NS _Reply.xlsx," Tab "Unit Costs," Lines 172 to 176.

[203] As demonstrated in Section III-F-2-c-ii-(f), although DuPont did not apply a cost for water for compaction to its DRR earthwork quantities, DuPont's work papers included a unit cost for water for compaction. While this represents a step in the right direction, DuPont misinterpreted the R.S. Means water for compaction cost selected and failed to provide for the necessary equipment and cost for the distribution of water for compaction.

during the winter months when available daylight is significantly diminished. This will require a lighting crew at night to move, setup and maintain lights for construction equipment and crews. NS calculates the total lighting crew cost per day, which includes lights with generators, pickup truck, labor foreman and laborer costs with location factor. Then NS applies the total lighting crew cost per day in 25 days a month for the seven-month construction period to determine $367,110 per crew. One lighting crew should be needed in every 10 miles over the total of 7,277 route miles for the project. Accordingly, the project would need 728 lighting crews. As a result, the total cost of lighting crew for seven months of grading construction is approximately $267,146,016.[204]

xi. Dust Control Work

During construction, the contractor should provide adequate dust control. Dust control is part of erosion control practices which include mulch, vegetation, minimization of soil disturbance, binding agents, and water spraying. Dust control can prevent air pollution and prevent pollutants from infiltrating storm water. According to United States Environmental Protection Agency (EPA)'s Storm Water Management Fact Sheet Dust Control document EPA 832-F-99-003 and Natural Resources Conservation Service (NRCS)'s Code 373 on Dust control on unpaved roads and surfaces, dust control should always be practiced during construction.[205]

Especially in urban areas, public complaint about dust pollution is always an issue if there are communities located near the railroad and road construction site and traffic volumes are

[204] NS Reply WPs "Lighting for Nighttime work.xls" and "Lighting for Nighttime Work Crew.pdf."

[205] NS Reply WPs "Dust Control Work NRCS CODE 373.pdf" and "Dust Control Work EPA.pdf."

high. Therefore, dust control should always be applied in urban areas to protect public and environmental health.

Water spraying is commonly used for dust control and affords protection for haul roads and other heavy traffic roads. NS applied a B-59 (2009 R.S. Means) with water spraying as a dust control measure in urban area only. NS calculates the total adjusted cost of dust control Crew B-59 per day which includes 1 truck driver, 1 truck tractor and 1 water tanker costs. Then NS applied the total dust control Crew B-59 cost per day in 25 days a month for the seven-month construction period to derive a cost of $142,159 per crew. One Crew B-59 should be needed every 10 miles over a total of 503 urban area miles.[206] The project thus needs 51 crews. The total cost of dust control Crew B-59 work in 25 working days a month for 7 months construction period is $7,250,116.

3. Track Construction[207]

Track construction is the work required to lay track once the subgrade has been completed. This includes both acquiring and placing subballast, ballast, ties, rail, and other track components. DuPont's opening submission on track construction included a number of conceptual and implementation flaws that understated the DRR's track construction costs. The NS Track Engineering Experts have corrected these errors on reply. In addition, as described in Section III-B-1, the DRR as configured by DuPont did not have sufficient running, siding and

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[206] NS Reply WP "Dust Control Work.xlsx."

[207] Section III-F-3 of NS's Reply Evidence is sponsored by NS witnesses Michael Baranowski of FTI Consulting, Robert Phillips of STV, and George Zimmerman. Mr. Zimmerman is a Project Manager and Senior Engineer with STV. He has over 30 years of experience in roadway and bridge projects, with a particular expertise in freight planning, design, and construction management. Among his many duties, Mr. Zimmerman provides structural design and plan reviews for NS railway and bridge projects. All of these experts' qualifications are further detailed in Section IV. These experts are collectively referred to herein as the "NS Track Engineering Experts."

yard tracks to serve the DRR customers. NS therefore increases track construction quantities to account for all the necessary additional track mileage set forth above in Section III-B-2. Table III-F-13 below compares DuPont's opening DRR track construction costs with the corrected figures included in the NS Reply.

Table III-F-13
DRR Track Construction Cost Comparison
($ millions)

Item	DRR Opening	NS Reply	Difference
1.Geotextile Fabric	$2,328	$4,809	$2,481
2. Ballast	$1,152,318	$2,354,887	$1,202,569
3. Ties	$1,635,780	$1,820,758	$184,978
4. Track (Rail)			
a. Main Line	$1,711,271	$2,755,694	$1,044,423
b. Yard and Other Track	$789,809	$498,220	$(291,589)
c. Field Welds	$33,356	$33,964	$608
d. Switches (Turnouts)	$503,563	$575,227	$71,664
5. Rail Lubricators	$2,167	$12,068	$9,901
6. Plates, Spikes and Anchors	$852,751	$882,650	$29,899
7. Derails and Wheel Stops	$1,289	$85,446	$84,157
8. Track Labor and Equipment	$1,557,178	$1,585,570	$28,392
9. Total	$8,241,810	$10,609,293	$2,367,483

a. Geotextile Fabric

DuPont understates the cost of geotextile fabric by failing to provide enough material to cover entire turnouts. DuPont places geotextile fabric under turnouts and at at-grade crossings. *See* DuPont Opening III-F-25. For at-grade crossings, DuPont assumes that the cost for geotextile fabric is included in the cost of the at-grade crossing materials; NS's Engineering Experts accept this assumption. But for turnouts, DuPont systematically understated the volume of geotextile materials needed. Specifically, DuPont's calculations assume that geotextile fabric is needed only from the frog area to the end of the turnout long ties—or under approximately half of the required length.[208] DuPont provides no explanation or evidence of why only a portion of the turnout would need geotextile material support—instead it merely announces the geotextile quantities in the turnout tabs of DuPont Opening WP "Track Construction Costs.xls."[209] In fact the full length of the turnout is subject to lateral forces when trains switch tracks and requires additional support, as specified in NS track construction standards produced to DuPont in discovery.[210] NS corrected DuPont's geotextile material calculations to provide enough material to extend under the full length of each turnout. NS accepts DuPont's geotextile material price of $1.20 per square yard. Including all of the additional turnouts required under the NS reply operating plan, the DRR requires a total of 4.0 million square yard of geotextile fabric under turnouts at a cost of $24.8 million. The total DRR geotextile quantity calculations are included in the costs of turnouts and grade crossings.[211]

b. Ballast

DuPont's ballast evidence errs both in its calculation of ballast quantities and in its determination of ballast costs. DuPont miscalculates ballast quantities primarily because of a clear mathematical error that led it to use an incorrect weight-to-volume conversion factor. It

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[208] That is, DuPont's evidence placed geotextile under only the frogs and the widening end of turnouts, but failed to include geotextile under the switch portion going back to the frog. In NS's Engineering Experts experience and opinion, it is this latter portion of turnouts for which geotextile is most important.

[209] Having failed to provide such evidence on Opening, DuPont is precluded from doing so on rebuttal. *See SAC Procedures*, 5 S.T.B. at 445-46; *Xcel*, STB Docket No. 42057, at 2 (served Apr. 4, 2003).

[210] *See* NS Reply WP "NS Turnout Geotech Sketch.pdf."

[211] *See* NS Reply WP "Track Construction Errata Reply.xls," Tab "REPLY GEOTEXTILE CALCULATION."

misstates ballast costs primarily because it fails to appropriately account for the costs of transporting ballast.

i. Ballast Quantities

DuPont's basic ballast depth specifications are acceptable. Specifically, for all main tracks, DuPont's engineers used 18" of ballast and subballast, consisting of a 6-inch subballast layer and a 12-inch layer of clean rock ballast. For yard tracks and set-out tracks, DuPont's engineers used 10" of ballast and subballast, consisting of a 4-inch subballast layer and a 6-inch ballast layer. The NS Track Engineering Experts accept these specifications.

DuPont's calculation of ballast quantities is marked by serious errors, however. First, DuPont miscalculates the weight-to-volume conversion for ballast. While DuPont claims to use the standard conversion of 1.5 tons of ballast per cubic yard to convert from cubic yard quantities to tons, it did not do so. *See* DuPont Opening III-F-26. A review of DuPont's work papers reveals that DuPont actually used a *lower* conversion factor of 1.35 tons per cubic yard for its ballast, thereby understating the required tonnage. Specifically, DuPont's track construction spreadsheet assumes ballast weighs 100 pounds per cubic foot.[212] But 100 pounds of ballast per cubic foot equates to only *1.35* tons per cubic yard, as demonstrated below:

$$100 \text{ LBS/CF} = \frac{1.35 \text{ Tons}}{1 \text{ CY}} \times \frac{1 \text{ CY}}{27 \text{ CF}} \times \frac{2{,}000 \text{ LBS}}{1 \text{ Ton}}$$

1.5 tons of ballast per cubic yard equates to 111.11 pounds per cubic foot, as shown here:

$$\frac{1.5 \text{ Tons}}{1 \text{ CY}} \times \frac{1 \text{ CY}}{27 \text{ CF}} \times \frac{2{,}000 \text{ LBS}}{1 \text{ Ton}} = 111.11 \text{ LBS/CF}$$

[212] *See*, for example, DuPont Opening WP "Track Construction Costs.xls," Tab "Track Quantity Calculator," Cell D61 applying 100 pounds per cubic yard in calculating ballast tons per 100 foot of track.

NS has corrected DuPont's error by using the proper conversion formula in NS Reply Workpaper "Track Construction.xls," Tab "Track Quantity Calculator" for all ballast section calculations to properly implement the standard conversion factor of 1.5 tons of ballast per cubic yard as DuPont intended.

Moreover, DuPont's calculations of the ballast cross section areas are flawed. Although it includes as part of its workpapers pdfs of proposed ballast cross sections,[213] DuPont does not provide any computer programs, spreadsheets, or other workpapers indicating how those cross sections were calculated.[214] The NS Track Engineering Experts were unable to replicate DuPont's calculations, which appear to understate necessary quantities. Because they were unable to verify DuPont's calculated cross sections with the limited documentation provided, the NS Track Engineering Experts developed scale drawings of DuPont's proposed ballast cross sections based on AREMA Chapter 1, Section 2.1 standard dimensions,[215] using Microstation engineering software.[216] The detailed calculations supporting NS's ballast cross sections are included in NS's workpapers. Table III-F-14 below compares DuPont's ballast cross section areas with those calculated by NS's Engineering Experts using AREMA Guidelines and Microstation.

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[213] *See* DuPont Opening WP "Ballast Sections.pdf."

[214] Having failed to provide these calculations on Opening, DuPont is foreclosed from providing them on Rebuttal. *See SAC Procedures,* 5 S.T.B. at 445-46; *Xcel,* STB Docket No. 42057, at 2 (served Apr. 4, 2003).

[215] NS Reply WP "AREMA Section 2.1.pdf."

[216] NS Reply WP "STV Typical Sections.pdf."

Table III-F-14
Comparison of DuPont and NS Ballast Cross Section Area Calculations
(Square Feet)

TRACK SECTION	DuPont Opening	NS Reply	Difference
Single Track, Tangent	21.65	21.70	+0.05
Single Track, 0 to 3 degree	22.76	24.43	+1.67
Single Track, 3 deg. and above	25.89	28.18	+2.29
Industrial/Yard Tracks *(All single)	15.11	13.90	-1.21
Double Track, Tangent	43.55	42.25	-1.30
Double Track, 0 to 3 degree	45.61	45.21	-0.40
Double Track, 3 deg. and above	51.51	51.85	+0.34
Triple Track, Tangent	64.91	63.73	-1.18
Triple Track, 0 to 3 degree	67.83	68.90	+1.07
Triple Track, 3 deg. and above	76.42	78.38	+1.96
Single Track and Siding, Tangent	43.31	42.72	-0.59
Single Track and Siding, 0 to 3 degree	43.40	45.36	+1.96
Single Track and Siding, 3 deg. and above	49.10	51.55	+2.45
*Includes all tracks with 6" ballast sections.			

Moreover, most of DuPont's Opening Workpaper "Ballast Sections.pdf" is pure window dressing, for DuPont fails to use nine of the thirteen proposed cross-sections in its evidence. DuPont's ballast quantity calculations use only the single track cross sections set forth in "Ballast Sections.pdf"; the double track, triple track and single plus siding cross sections are never used.[217]

Because DuPont's cross sections are unsupported and incorrect, the NS Engineering Track Experts use their calculated cross sections and provide the appropriate supporting documentation.[218] NS's Engineering Experts have also corrected DuPont's flawed approach of

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[217] DuPont Opening WP "Ballast Sections.pdf."

[218] NS Reply WP "Track Construction Errata Reply.xls," Tab 'Track Quantity Calculation," Lines 59 to 93.

using only single track cross sections and used the cross sections appropriate for each specific DRR track configuration.

ii. Ballast Pricing

DuPont's ballast cost evidence is also skewed, primarily because it underestimates ballast transportation costs. DuPont derives its ballast unit price per ton from an average of NS supplier prices. The NS Track Engineering Experts accept this approach, but include two additional suppliers to fill a gap in the DRR ballast supply network. DuPont Opening Workpaper "Ballast Purchases.xls" (which derives from a document NS produced in discovery) shows that NS purchased approximately 2.3 million tons of ballast from eleven different quarries at an average material cost of $9.06, excluding NS on-line transportation costs. The quarries routinely used by NS to supply ballast are strategically located to meet the NS system-wide ballast requirements and ballast materials are routinely transported over the NS owned track by NS trains to locations where ballast is needed in the track. However, the DRR, unlike the existing NS, does not yet exist and must be constructed. *See, e.g., Otter Tail,* slip op at D-26 (rejecting assumption that SARR could transport material over SARR lines that had yet to be built). As such, the ballast quarries that may work strategically for NS are not optimally placed for the DRR, which will have to employ the services of third party rail carriers, including the residual NS, to transport ballast materials from the quarry origins to the DRR construction railheads.

The NS Track Engineering Experts created a composite map of the DRR depicting the current NS ballast supplier locations and identifying the transportation routes for ballast from the current NS ballast suppliers over the residual NS and other railroads to the DRR railheads. That map shows that the quarries used by NS today to fulfill its ballast needs would leave a large supply gap in the central portion of the DRR network.[219] Specifically, due to the numerous construction obstructions to the ability to deploy unit rail trains of ballast such as large, significant bridges, long duration low level bridges such as the Lake Pontchartrain Bridge near New Orleans, tunnels, and the 102 separate track construction packages as stated by DuPont, DuPont Opening III-F-51, there will be a need for additional ballast suppliers. As the map shows, the area lacking adequate coverage for ballast supplies is generally the Ohio River Valley. NS added two ballast suppliers to fill this void, the first from Coolsprings Quarry near Uniontown, PA and the second the Hinkle Construction Quarry near Tateville, KY.

Price quotes (which exclude transportation costs) were obtained from the two additional quarries in June 2012 as follows:

Tateville, KY	Hinkle Contracting Quarry	$8.05 per ton
Uniontown, PA	Coolsprings Quarry	$13.50 per ton

These quotes were indexed back to 2009 levels using the AAR Material Chargeout Price Index consistent with the escalation assumptions in the DCF model. Prices at 2009 levels are $7.43 and $12.54, respectively for Tateville and Uniontown. These two unit prices were added to the prices provided by NS and used by DuPont.[220] Because the average price is a weighted average price and because the two new quarries would be used to supply a substantial portion of the ballast for the DRR, each quarry unit price was given a weighting equal to the average tons provided by the top six quarries from which NS purchased ballast. The revised ballast price used by the NS Track Engineering Experts is $8.82 before transportation costs.

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[219] NS Reply WP "Ballast Distribution Map.pdf."

[220] *See* NS Reply WP "Ballast Purchases NS Reply.xls."

iii. Ballast Material Transportation to the DRR Railheads

To obtain the ballast it purchases from various suppliers, the DRR would be required to use other railroads to transport the ballast to the DRR's railheads. From the railheads, the DRR would transport the ballast to the locations where the ballast is needed. The DRR would therefore incur two separate kinds of costs: (1) the cost to have third-party railroads transport ballast to the DRR railheads; and (2) the cost to move ballast from the DRR railheads to the locations where it would be placed. However, DuPont's ballast material transportation costs are predicated on an assumption that all ballast will be transported an average of 100 miles at a single flat rate of 0.035 cents per-ton mile. These assumptions are unsupported and unrealistic. This section addresses the proper calculation of transportation distances; section III-F-3-b-v. addresses transportation costs.

The DRR network itself cannot be used for transporting ballast during construction. Under the SAC construction plans, the DRR would be built rapidly and simultaneously over a wide geographic range. But there will be gaps in the DRR network until near the end of construction, both because of the fact that the DRR is being built in 102 separate track construction packages and because construction will involve many time-consuming projects such as tunnels, major bridge structures, and long low level bridges such as the Lake Pontchartrain Bridge near New Orleans. These lengthy construction projects will render the DRR route unavailable for on line shipment of materials from suppliers to the construction railheads. Therefore, the lines of the DRR cannot be used to transport ballast from the source quarries to the construction railheads. The residual NS lines and the lines of other railroads must be used for the delivery of ballast to the DRR. Construction issues aside, railroads in the real world must pay to transport ballast.[221]

DuPont recognizes the need for ballast transportation to the railheads, *see* DuPont Opening III-F-27, but it fails to perform any analysis of the cost of such transportation. Instead, DuPont arbitrarily assumes an average transportation distance of 100 miles for ballast delivery from the suppliers to the DRR railheads. Nowhere in the ballast narrative nor the supporting workpapers does DuPont explain how it derived the 100 mile transportation distance. This unsupported guess is not reliable evidence, and as demonstrated below, it underestimates the average mileage over which the DRR would need to transport ballast.[222]

The NS Track Engineering Experts conducted a detailed analysis to identify the ballast sources and transportation alternatives to each of the DRR railheads. The NS Track Engineering Experts then calculated an average transportation distance from these sources to the railheads. This analysis is detailed in NS's Reply workpapers and is described briefly below.[223]

The NS ballast suppliers are located primarily along the eastern edge of the Appalachian Mountains from Georgia to the eastern Pennsylvania area. These suppliers can readily use the lines of the residual NS to supply the areas of the DRR in eastern Pennsylvania, Virginia, North

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[221] *See, e.g.*. NS Reply WP "Progressive Railroading Ballast Article," *available at* http://www.progressiverailroading.com/csx_transportation/article/Class-I-MOW-Executives-In-Their-Own-Words--13196 (comments of FEC MOW executive that railroad that cannot use its own trains to transport ballast "must pay the going freight rates to and from our ballast source").

[222] Having failed to provide any support for its mileage estimate, DuPont is precluded from doing so on Rebuttal. *See SAC Procedures*, 5 S.T.B. at 445-46; *Xcel*, STB Docket No. 42057, at 2 (served Apr. 4, 2003).

[223] *See* NS Reply WP "Ballast Supplier Map"; NS Reply WP "Track Construction Errata Reply," Tab "BALLAST REPLY COST" (On DRR portions of mileage are listed on lines 6 to 14); NS Reply WP "Offline Ballast Shipping.pdf"(Off DRR portions of mileage are broken down in this file).

Carolina, South Carolina, Georgia, and northern Alabama. Other carriers (primarily CSXT) would be used to reach the DRR lines from Kingville, SC, east; the line from Walton, VA, to the Charleston, WV, area; the portions of the H-Line between Riverton, WV, and Roanoke, VA; and all the lines in Northern Alabama.

The DRR lines in New York between Binghamton and Buffalo will need to be supplied from both suppliers in eastern Pennsylvania via CSXT and local shortline railroads such as the Rochester Southern RR via Silver Springs, NY, since the DRR's configuration would leave no residual NS lines in the area.

The Ohio River Valley area will be supplied using the proposed additional suppliers located at Uniontown, PA, and Tateville, KY, that would use residual NS and CSXT trackage to the DRR. The southwestern portion of the Ohio River Valley would obtain ballast by the Ironton, MO suppliers,[224] which would ship by way of CSXT and the residual NS to the DRR at Columbus, OH, Cincinnati, OH, and Louisville, KY.

The Ironton suppliers would also ship to the western end of the DRR at Kansas City, MO and to the western railheads at Memphis, TN, and New Orleans, LA.

For the northern or upper Midwest portion of the DRR, the NS suppliers of Canadian traprock ship ballast from St. Marie Ontario via Great Lakes Ships to Toledo, OH, and Chicago, IL, for use in this area.

Based on the above ballast sourcing assumptions, the NS Track Engineering Experts calculated the average quarry to railhead transportation distance as 132.4 miles, not counting

[224] The ballast unit prices from Ironton include third party transportation costs over UP from Ironton to UP connections with the NS at Kansas City, MO. Transportation costs are added by NS only for movement from the interchange points to the DRR construction railheads.

distribution along the DRR. *See* NS Reply WP "Offline Ballast Shipping.pdf." NS uses this 132.4 mile distance in its calculation of costs for ballast transportation by third parties.

iv. Ballast Material Distribution Along the DRR Right-of-Way

In addition to the off-DRR transportation from the source quarries to the construction railheads, ballast needs to be moved along the DRR lines from the construction railheads to the location in the track where the ballast will be placed. DuPont provides no separate costs for transportation along the DRR right-of-way, however, and instead suggests that it obtained a quote for ballast distribution that included on-line transportation. But a review of the quote on which DuPont relies reveals that it did not include on-line transportation costs.[225] Specifically, in the Track Labor and Equipment section of its Opening Evidence, DuPont states that it received a quote for track construction labor and equipment costs from Queen City Railroad Construction. DuPont provided limited workpapers showing some of the details of its quote request. In its request to Queen City for the quote,[226] DuPont specifies that "[a]ll material will be provided by the owner" *i.e.*, by the DRR, and that Queen City has responsibility only to "[d]istribute ballast from hoppers or ballast cars." Based on DuPont's instructions, the quote provided by Queen City assumes that Queen City would have the ballast delivered to it in railroad hoppers or ballast cars *at the point of placement* and that Queen City would be required only to empty the ballast from the car and place it in the track.[227] The quote, by definition, does not include the cost of

[225] NS Reply WP "Queet Labor Quote Page 4 of 6 Ballast Analysis.pdf."

[226] DuPont Opening WP "Queen Labor Quote.pdf."

[227] Contractors performing work for large Class I railroads typically are supplied ballast in rail cars to be deposited in the track structure once it arrives at the site. At that point the contractor spots the cars at locations it determines need additional ballast. The contractor then unloads the ballast, directing the train crew to move ahead at speeds that will deposit the ballast in a way that

transporting the ballast from the construction railhead to the point of placement. The NS Track Engineering Experts correct DuPont's omission and add the cost to transport ballast materials from the construction railheads to where it will be placed in the track.

To estimate the ballast transportation cost from the construction railhead to placement in track, the NS Track Engineering Experts looked at the 102 rail construction contracts assumed by DuPont for the DRR and calculated the average number of route miles assumed to be covered by each contract. Over the 7,293.1 route mile DRR, the 102 rail construction contractors will average 71.3 route miles each. *See* NS Reply WP "Track Construction Errata Reply," Tab "BALLAST REPLY COST." NS experts then assumed that ballast would have to be transported an average of 35.67 miles—one-half the distance covered by each contract. *See* NS Reply WP "Track Construction Errata Reply," Tab "BALLAST REPLY COST." Ballast would need to be distributed over this full 71.3 miles—with some transported a very short distance and some transported the full distance -- but the average distance that ballast materials will have to be transported from the railhead to placement in track is half the 71.3 miles, *i.e.*, 35.7 miles. *See* NS Reply WP "Track Construction Errata Reply," Tab "BALLAST REPLY COST."

At the current size of the DRR, the total ballast delivery includes the 132.4 miles of off-line delivery plus the on-line delivery of 35.7 miles for a total of 168.1 miles.

v. Material Transportation Cost for Ballast

DuPont also understates ballast transportation costs by using an estimate of on-line transportation costs to approximate off-line transpiration costs. DuPont uses a unit price of $0.035 per ton-mile to calculate off-line rail transportation costs, on the grounds that that price was "a transportation charge from *AEPCO*." DuPont Opening III-F-27. This claim is seriously

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allows the contractor to place it as efficiently as possible. *See* files in NS Reply WP Folder "Ballast Car Pictures" for pictures of ballast trains and cars.

misleading, because while the $0.035 per ton mile price is "from" *AEPCO* in the sense that the number appeared in the decision, it was not accepted by the Board as a price for off-line rail transportation. In *AEPCO*, the complainant proposed "an on-line (ANR system) shipping cost of $0.035 per ton mile, and a hardcoded unit price for the off-line transportation costs." *AEPCO 2011*, STB Docket No. 42113, at 99 (emphasis added). While the actual unit price proposed by the complainant for off-line transportation was highly confidential, it is clear that the Board did not accept use of the $0.035 cost for off-line transportation. Indeed, in responding to the defendant's evidence, the decision noted that a $0.035 estimate would be "a conservative cost," because it represents "the cost a railroad would charge itself for shipping on its own lines, when the [SARR] would need to ship ballast over other carriers' lines." *Id.* at 100. It is also worth noting that the $0.035 per ton mile transportation cost is outdated—it is based upon a 1994 price first used by the Board in *Arizona Public Service Co. v. Atchison, Topeka & Santa Fe Railway Co.* Because it reflects cost to move railroad materials over its own lines and because it is from 15 years ago, the $0.035 per ton mile transportation cost is certainly not a reliable estimate of the DRR's off-line ballast transportation costs. DuPont provided no evidence of current costs for transporting ballast on NS or on third party railroads, and accordingly may not do so on Rebuttal. *See General Procedures*, 5 S.T.B. at 445-46.

Because its rail lines have not been built, materials assumed to move by rail have to be transported from the source to the construction railheads using third party (i.e., not DRR) rail service over either the residual NS or another carrier. *See Otter Tail*, STB Docket No. 42071, at D-26 ("We have found that it would not be proper to assume that a SARR could transport materials over the very lines that the SARR would need to build."). To determine the actual cost that DRR would incur shipping its ballast on the lines of the residual NS not replicated by the

DRR and over the lines of other carriers, the NS Track Engineering Experts contacted aggregates supplier Vulcan Materials Company to obtain the rate for transporting ballast materials. *See* NS Reply WP "Scanned Vulcan Transportation Information.pdf." Based on the price per ton and length of haul provided by Vulcan for shipping a carload of ballast, NS engineers determined that the per-car cost for transporting ballast in a 100-ton open-top hopper car is $.072 per ton mile indexed to 2009 levels. *See* NS Reply WP "Track Construction Errata Reply," Tab "BALLAST REPLY COST."

For the portion of the ballast transportation from the railhead to the placement in track, which would be accomplished by moving carloads of ballast over the unfinished DRR track structure, the NS Track Engineering Experts adopt DuPont's $0.035 per ton-mile. This results in a weighted average price per-ton mile of $0.064 applied to the total ballast transportation distance of 168.1 miles.[228]

vi. Subballast

(a) Subballast Quantities

DuPont specifies a subballast section of 6" on all mainlines, single and multiple tracks, 4" on yard tracks and 4" on set out tracks. The NS Track Engineering Experts accept these assumptions. DuPont assumes further that subballast consists of similar parent materials crushed to provide a well-graded, dense layer of crushed rock similar to road base material and that it would be supplied from the same locations as the ballast. As explained in more detail below, the NS Track Engineering Experts accept DuPont's general specifications for subballast but reject DuPont's assertion that subballast will only be sourced from the same locations as those

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[228] *See* NS Reply WP "Track Construction Errata Reply," Tab "BALLAST REPLY COST,"Lines 32 to 36

supplying ballast, because that assumption is inconsistent with the need to deliver subballast by truck.

As with ballast, DuPont developed subballast area cross sections. It provided a pdf of proposed cross-sections but did not provide any of the inputs or the calculation programs themselves. *See* DuPont Opening WP "Typical Sub-ballast.pdf." The NS Track Engineering Experts again ran DuPont's proposed subballast specifications through Microstation and determined that for mainline single, double, and triple track its results matched closely to those provided by DuPont. The NS Track Engineering Experts therefore accept DuPont's calculated subballast cross sections for mainline track. For yard and other siding track, even though DuPont's narrative specifies a four inch subballast section, its work papers compute the cross section area based on a six inch depth. Because it accepts the subballast cross section specified by DuPont for yard and siding tracks of four inches, NS corrects DuPont's error and computes the DRR subballast cross section area as 7.83 square feet based on that standard and uses the results in its reply.

Also similar to its approach on ballast, DuPont explains that it uses the standard conversion factor of 1.5 tons per cubic yard to convert subballast area cross sections into tons, yet its work papers use an adjustment factor of 100 pounds per cubic foot, which converts to only 1.35 tons per cubic yard.[229] The NS Track Engineering Experts correct DuPont's work papers to match is stated assumption of 1.5 tons per cubic yard. *See* NS Reply WP "Track Construction Errata Reply," Tab "Track Quantity Calculator," Lines 98 to 109.

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[229] *See* explanation of this calculation error above at Section III-F-3-b-i.

(b) Subballast Material Costs

DuPont relies solely on the Trestle Hollow Project for its unit price of subballast of $13.00 per ton. DuPont asserts that this unit price includes both the cost of transportation and placement in the roadbed. *See* DuPont Opening III-F-27. As discussed previously, DuPont's Trestle Hollow Project unit prices are unsupported and generally untethered to the lump sum contract bid quote. The NS Track Engineering Experts reject DuPont's proposed unit costs. As detailed below, the NS Track Engineering Experts have developed subballast material and transportation costs from third party quotes.

The proposed DRR is a far reaching system that encompasses many geologic and geographic regions; therefore the cost for supplying the subballast to such a widespread rail system will vary with regional production and transportation costs of subballast to the DRR. To determine subballast unit prices that reflect the prices the DRR would actually be required to pay, the NS Track Engineering Experts identified suppliers from various geographic regions and at various locations along the proposed DRR route and obtained both material and transportation price quotations from each supplier. *See* NS Reply WP "Sampling of Subballast Pricing.pdf." The NS Track Engineering Experts used an assumed 40 mile average delivery distance, which would allow for there to be a potential approved supplier every 160 miles along the DRR.[230] An average unit cost for material and transportation was calculated. The average DRR price for subballast is $12.28. *See* NS Reply WP "Track Construction Errata Reply," Tab "SUBBALLAST REPLY COST," Cell B21.

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[230] NS's Engineering Experts used a 40 mile average distance to allow for the practical use of trucks making 4 round trips in an average 8 hour day. If trucks average 40 mph and take little time to actually dump at the spreader box they can make around 4 trips per day. This assumption is based on NS's Engineers' experience with maximum haul distances in the road and railroad construction industry.

DuPont assumes that the DRR's subballast would be supplied by the same quarries supplying ballast to the DRR, but this is not a reasonable assumption. While the DRR could obtain some subballast from the same quarries supplying ballast, those quarries cannot supply the entire network because it is not economical to transport subballast by rail. Moving subballast by rail means that the contractor would have to offload the subballast at the DRR railhead site and then reload it into trucks to deliver for placement on the subgrade. This transload process is neither efficient nor cost-effective, in part because subballast is a prepared material that can be degraded by excessive handling. Moreover, rail transportation itself can degrade subballast quality. For example, long transit distances in rail hopper cars exposed to rain can cause the subballast to compact inside the car due to vibrations in transit. When this occurs, the materials have to be "re-excavated" out of the cars. When subballast materials become excessively degraded and out of specification because of excessive handling, the supplier or contractor must reblend the material before use on the roadbed.

In a typical placement of subballast, the prepared subballast aggregate is delivered to the project by trucks that dump the material directly into a spreader box that delivers a uniform layer of uncompacted subballast to the roadbed. Immediately after placement the material is compacted, and water added if necessary to obtain the specified compaction. Final shaping is completed and the top of the subballast finish rolled to seal out water. To obtain final acceptance the materials must be placed with limited handling.

In short, subballast materials need to be delivered to the installation location by truck in order to ensure product quality and to reduce costs. The scope of the DRR means that there needs to be a wide range of subballast suppliers within reasonably close proximity to the DRR roadbed. Because subballast is similar to the crushed stone used for highway road base material, NS's Engineering Experts assumed that suitable subballast suppliers will be available along the DRR route.

(c) Subballast Material Placement Costs

Once the subballast materials are received at the construction railheads they must be transported by truck over the finished roadbed and then dumped, shaped and compacted. The DRR track labor quote from Queen City does not provide for such transportation and other services,[231] so the NS Track Engineering Experts developed the required costs from Means.

For the subballast depth of 6," the R.S. Means costing for the typical stone base placement is found in Section 32 11 23.23 2021. Included is a crew B-36 for placement of the materials at 900 tons per day.[232] Since the material is being priced separately the bare costs for labor and equipment plus overhead and profit to transport, dump, shape, and compact the subballast based on a square yard measure is computed as follows:

2009 R.S. Means labor and equipment for 32 11 23.23 2021 per Ton would be:

Labor	$1.76
Equipment	$1.66
O & P	$0.38 (using same % as if material included (33.50-29.92)/30= 0.1069)
Total	$3.80 per Ton (2009 R.S. Means)

c. Ties

Crossties for the DRR are described on III-F-27 of DuPont's Opening Evidence as Grade 5 wood ties spaced at 20.5 inches apart for all main track, passing sidings, and branch lines consistent with the railroad industry for mainline tracks. For yard and set-out tracks, the DRR

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[231] *See supra* at III-F-3-b-iv.

[232] See NS Reply WP "2009 RS Means Base placement.pdf."

engineers used a spacing of 24 inches. The NS Track Engineering Experts accept DuPont's proposed tie type and spacing. Using the AREMA Guidelines, the subgrade pressures were verified for the various rail and tie combinations and found acceptable in the use of 136# and 115# rail for the maximum mainline and yard and siding speeds specified by DuPont for the DRR.

DuPont's calculated weights for crossties are unsupported and incorrect. DuPont's Opening Workpaper "Track Construction Costs.xls" uses 223.125 pounds for the weight of a single crosstie. DuPont provided no workpaper support or reference for this estimated weight. The NS Track Engineering Experts contacted the Railroad Tie Association ("RTA") to develop information on tie weights. The RTA "Tie Guide" indicates that the untreated weight of a hardwood crosstie is 218 pounds—before accounting for creosote treatment and moisture content. *See* NS Reply Workpaper "RTA Tie Material Properties.pdf." The head of the RTA indicated that creosote treatment and average moisture content respectively would add approximately 25 and 12.5 pounds to the tie weight, which means that the average weight per crosstie would be 255.5 pounds. *See* NS Reply Workpaper "RTA Tie Information.pdf." The NS Track Engineering Experts used this weight when calculating transportation costs.

DuPont's unit costs for crossties were based on a quote from Tangent Rail as the supplier with transportation costs added using an average assumed distance of 450.6 miles to the railheads at $0.035 per ton-mile. While DuPont's methodology is acceptable at the conceptual level, it made three critical errors, one relating to unit price, one to estimating the transportation miles, and one to shipment costs.

First, within the "Ties" tab of DuPont's Opening Workpaper "Track Construction Costs.xls," the item for Tangent Rail's tie cost shows a price that does not correspond with the quote provided in DuPont's workpapers. DuPont's summary spreadsheet claims a "Tangent Rail June 2009 Quote" of $40.00 per tie,[233] but the Tangent Rail price quote in DuPont's workpapers is a Tangent Rail June 8, 2010 quotation of $44.50 per tie.[234] DuPont's workpapers do contain a "Missouri_Tie_Quote(1)" file indicating a $40.00 price per tie, but it provides no information as to the source of this number. It derives from a spreadsheet with no company logo, no information as to who prepared it, and no identification save for the ambiguous "Missouri_Tie_Quote(1)" file name.[235] Accordingly, DuPont's proffered cost is inadequately supported, and must be rejected. DuPont may not provide additional evidence in its rebuttal to attempt to shore up its deficient case-in-chief. *See General Procedures,* 5 S.T.B. at 445-46. Correcting the Tangent Rail price quote to $44.50 and indexing it back to second quarter of 2009 results in a higher unit price than the next lowest tie price quote in DuPont's workpapers, a price of $41.89 each from a June 1, 2009 quote from McCord Tie and Timber.[236] Following DuPont's approach to selecting the lower available bid price for the DRR, NS's Engineering Experts based the DRR reply tie unit price on the McCord Tie and Timber quote.

Second, DuPont computes average transportation distances from four (although at some points it states three) potential tie suppliers to various DRR locations, but then picks the tie price from a single supplier. DuPont includes in its workpapers an average 450.6 transportation mileages from the various crosstie producers to the DRR under "Average Distance from 3

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[233] *See* DuPont Opening WP "Track Construction Costs.xls."

[234] *See* DuPont Opening WP "Tangent Tie Quote.pdf."

[235] *See* DuPont Opening WP "Missouri Tie Quote.xls."

[236] *See* NS Reply WP "Track Construction Errata Reply.xls," Tab "Ties Running," Line 15.

Plants" in its track costing workpaper.[237] The average distance was apparently computed by McCord Tie and Timber and the calculations contain several of the originating cities from the "Mileage Matrix for Supplier" tab of the "Track Construction Costs.xls" workpaper. It is noted that the McCord representative does give those cities as origination points, but also names a different supplier for each. McCord Tie and Timber has only one production location in Falkville, AL. DuPont cannot have its cake and eat it too by assuming that the DRR would enjoy the lowest tie price quote from a single supplier and also enjoy shorter average transportation hauls from a number of alternate (and higher priced) suppliers. Rather, if DuPont wishes to use this lowest-cost tie provider, it must account for transportation from this location using the CSXT rail line that services this plant to each of the DRR railheads. The NS Track Engineering Experts include the appropriate calculations in NS Reply WP "Track Construction Errata Reply.xls," Tab "Mileage Matrix for Supplier," Cell U9.

Lastly, DuPont's use of a $0.035/ton-mile proxy for crosstie transportation costs is unreasonable for the reasons detailed in the discussion of ballast material transportation cost. Crosstie transportation requires the use of specialized railcars. The NS Track Engineering Experts calculated the cost of crosstie transportation by obtaining a quote from McCord Tie and Timber of $6,000 per car for a 590-mile delivery of crossties in 61' Center Beam gondola cars with a maximum load of 840 crossties per car. *See* NS Reply Workpaper "McCord Timber and Tie Transportation Information.pdf." After indexing this cost to the second quarter of 2009, the NS Track Engineering Experts calculated the cost of crosstie shipping to be $0.0874 per ton/mile. *See* NS Reply WP "Track Construction Errata Reply.xls," Tab "Ties Running," Cell H19.

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[237] *See* DuPont Opening WP "Track Construction Costs errata.xls," Tab "Mileage Matrix for Supplier," Cell O14.

d. Rail

i. Main Line and Yards and Siding

DuPont proposed rail sections for the DRR are 136-pound Continuous Welded Rail ("CWR") for most of the main tracks and passing sidings (20 Million Gross Ton ("MGT")/year or greater), with premium rail used on curves 3 degrees or greater. On light density portions of the DRR (less than 20 MGT/year) new 115-pound CWR will be used. In yards and for helper and set out tracks 115-pound CWR will be used. NS accepts these specifications in its reply.

ii. Rail Pricing

DuPont obtained rail price quotes from various rail suppliers and from the NS 2009 R-1 Report. To develop its rail price, DuPont chose a cost of $872 per ton derived from NS's 2009 R-1 as the lowest-priced option. But in doing so, DuPont overlooks the key distinction between the rail cost reflected in NS's R-1 and the rail costs that the DRR would receive: namely, the R-1 cost does not include any transportation costs for haulage over NS's own lines. Schedule 724 of the R-1 plainly instructs that "[t]he cost of unloading, hauling over carrier's own lines, and placing the rails in tracks and of train service in connection with the distribution of the rail should not be included in this schedule." NS 2009 R-1 at 89. NS obtains substantial amounts of rail from suppliers located on and near its lines, and the average rail costs reported on Schedule 724 of its R-1 do not include any of the costs of transporting that rail over the NS system, despite the fact that the Board has repeatedly recognized that a SARR must pay to transport rail. *See, e.g., AEPCO 2011*, STB Docket No. 42113, at 104-05. Therefore NS accepts DuPont's use of an $872 per ton unit price for rail, but adds a cost for transporting rail from the manufacturer to the railheads.

The DRR will not have tracks over which rail could be transported during the construction phase, and it would have to pay an additional cost to transport rail from the supplier to the construction railheads. *See Otter Tail*, STB Docket No. 42071, at D-26 ("We have found that it would not be proper to assume that a SARR could transport materials over the very lines that the SARR would need to build."). In *AEPCO 2011*, the Board rejected the complainant's transportation plan for rail for failing to provide a plan on Opening that accounts for this limitation, and the Board should similarly reject DuPont's transportation plan for rail here. *See AEPCO 2011*, STB Docket No. 42113, at 104-05 (rejecting complainant's transportation plan for rail and rejecting complainant's new evidence presented on rebuttal).

DuPont includes a small cost for rail transportation, but it is hopelessly understated. Specifically, DuPont proposes that the DRR would source all its rail from the Steelton, PA rail manufacture, just south of Harrisburg, PA. The plant location is serviced by the Steelton and Highspire Railroad. The Steelton and Highspire Railroad connects with the NS system in Harrisburg, PA, 3.9 miles north of the Steelton plant. This 3.9 mileage is the <u>only</u> distance that DuPont used in calculating rail transportation costs—DuPont entirely ignored the cost of transporting rail to the many distant DRR railheads using the residual NS. The NS Track Engineering Experts calculated revised mileage to ship the rail using the residual NS and foreign carriers. *See* NS Reply WP "Rail Transportation Mileage.pdf." (As explained, the DRR itself would not be available for shipping the rail during construction).

DuPont's proposed transportation cost per mile is unsupported and unreliable. DuPont uses a cost of $0.035 per ton-mile, but provides no backup or support for that figure. Instead, DuPont's only justification for using it is a claim that it was "based on a transportation charge from *AEPCO*." DuPont Opening III-F-27. As explained in Section III-F-3-b-v, this claim is completely unfounded.

The NS Track Engineering Experts obtained a quote for rail delivery from L.B. Foster, a major rail supplier, for full trains of CWR. L.B. Foster quoted a price of $5,067 per car (plus a fuel surcharge of $0.41/mile) for fully loaded 30-car rail trains carrying 80,000 linear feet of 136-pound rail. *See* NS Reply WP "Rail Transportation Memo to File.pdf." After adjusting this quote to the second quarter of 2009, the additional transportation cost for rail amounts to $7.90 per track foot. *See* NS Reply WP "Track Construction Errata Reply.xls," Tab "RAIL REPLY COSTS," Cell B34.

iii. Rail Unloading Costs

DuPont's rail unloading costs are flawed because they omit the cost of locomotives and crews to operate rail trains. The DRR would need specially outfitted road trains to deliver the rail from the supplier to the railhead. An example of one of these trains is depicted below.

Figure III-F-2
Specially Outfitted Road Trains

Continous Welded Rail Train

The DRR's road train crews would operate the train from the railhead to the contractors work area as in any general freight movement. Once the train arrives at the contractor's site for unloading, the DRR contractor will provide the labor and equipment to attach a cable to the end of the strand of continuous welded rail ("CWR") and pull the rail onto the prepared roadbed ahead of the rail delivery train. The train must stop at each quarter mile point for the contractor to skeletonize the track sufficiently to slowly advance the rail train to the next quarter mile point. The process will be repeated until all rail strands are removed from the rail train.

Although DuPont's rail construction labor contractor included a line item for unloading in its quote,[238] it does not include the cost of the rail train locomotives and the crew. Using DuPont's proposed schedule of building one-half mile of track per day, the rail train will advance at the same pace. Should any other materials need to be delivered to the construction area, the rail train would have to move to a siding and allow other equipment to pass. Therefore the train must be fully crewed at all times in anticipation of such a movement.

The NS Track Engineering Experts estimated the cost of a rail train and crew as follows. A rail train carrying fifty-five 1,440 foot strings of CWR contains approximately 40,000 track feet, or 7.58 track miles, of rail. Accepting DuPont's assumed track construction rate of 0.5 miles per day, it will take 15 days to unload a rail train at the rail head, or 2.5 weeks working six days a week. Assuming that a rail train can complete a cycle from the railhead to the welding plant for reloading and return to the rail head in two weeks, it will take one rail train approximately one month to complete a cycle. The NS Track Engineering Experts obtained a third-party quote to rent a 30 car rail train for $27,000 per month plus a daily cost of $1,700 after delivery to the unloading location, with five free days for unloading. *See* NS Reply WP "Holland Rail Welding Proposal." This gives a cost per track foot for use of a rail train of $0.68 per track foot for monthly train rental and a cost per track foot of $0.43 for unloading days. The combined cost for rental of a rail train for transport and unloading is $1.10 per track foot. *See* NS Reply WP "Track Construction Errata Reply.xls," Tab "RAIL REPLY COSTS," Cells B46 and B66.

Once the rail is delivered to the railhead by a road crew, a work train crew will assume operation of the train for the duration of the unloading. The NS Track Engineering Experts used

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[238] *See* NS Reply WP "Queen_Labor_Quote[1] page 4 of 6.pdf."

documents made available to DuPont in discovery to determine a cost for work train service including crew costs, fuel, and equipment rental that amounts to $0.82 per track-foot.[239] *See* NS Reply WP "Track Construction Errata Reply.xls," Tab "RAIL REPLY COSTS," Cell B55.

In total, therefore, the additional cost per track-foot for handling of the rail from the welding plant through unloading at the rail head is $1.10 + $0.82, or $1.92.

iv. Field Welds

DuPont understates the number of field welds required for the DRR by only counting the welds needed to weld together 1,440 foot rail sections, 18 welds per panel turnout, and 4 welds per grade crossing. Field welds are also required for other track construction related activities including cutting in road crossings, insulated joints, diamond crossings, and turnouts, and the final assembly of the individual panels that make up the completed panelized turnouts. The NS Track Engineering Experts have computed the number of field welds by counting a field weld at the end of each rail strand, plus a set amount for each track item that must be assembled or cut into the track. NS's inventory count is set forth in NS Reply WP "Track Construction Errata Reply.xls," Tab "Summary," Cells D24 to D28.

The NS Track Engineering Experts accept DuPont's field weld unit price.

v. Insulated Joints

Consistent with the approach used by DuPont, the NS reply discussion of insulated joints is included in the signals and communications portions of the reply narrative.

e. Switches

The NS Track Engineering Experts generally accept DuPont's approach to switches (*i.e.*, turnouts). DuPont based its estimated costs for turnout installation along the DRR on quotes

[239] *See* NS Reply WP "CSXT AFE Work Train Labor Line.pdf."

from various suppliers and contractors, as shown in DuPont's opening workpaper "Track Construction Costs.xls." DuPont includes all the required cost elements for turnouts, namely materials cost, delivery charges, and installation labor,[240] but makes several mistakes in its calculation of these elements for individual turnouts, primarily in connection with DuPont's calculations of shipment costs. NS describes these errors and its corrections below.

At the outset, it should be noted that all the turnout deliveries must be by rail, because DuPont posits that the DRR will be purchasing panelized turnouts. DuPont's labor installation cost is based on a quote by Queen City Railroad Construction for labor to install "[p]aneled" turnouts. *See* DuPont Opening WP "Queen Turnout Quote.pdf" (including "Paneled and no switch machines" notation with quote for installing turnouts). Panelized turnouts cannot be shipped by truck, but must be loaded onto special rail cars and shipped to the DRR by rail. *See* http://www.akrailroad.com/panelized-track (noting that panelized turnouts are shipped in custom panel cars). Indeed, a panelized turnout is too large to be transported any other way, as is shown in the picture below.

[240] For each turnout the geotextile underlayment is included. Geotextile costs are discussed above in Section III-F-3-a.

Figure III-F-3
Panelized Turnout

First, NS corrects transportation costs to incorporate the proper shipping weights of the panelized turnouts. DuPont lists shipment weights in its "Track Construction Costs.xls" workpaper, but neither there nor anywhere else in its workpapers does it provide any support for these shipment weights. Nor do DuPont's DRR turnout standard drawings contain any reference to the weight of the turnouts. NS's Engineering Experts developed shipment weights for each of the DRR's turnouts by consulting publicly available UP/BNSF turnout standards, which contain panel weights for various turnouts. *See* NS Reply WP "UP_BNSF Turnout Common Standards.pdf."[241] Because the UP/BNSF Common Standards only include panel weights for No. 9, No. 11, and No. 15 turnouts, NS's Engineering Experts made the following adjustments to calculate panel weights for each of the DRR turnouts:

[241] *Available at* http://www.uprr.com/aboutup/operations/specs/attachments/amended/turnouts_std.pdf.

- **DRR No. 10 Turnout.** The average weights of a No. 9 and No. 11 turnout were used to replicate the DRR No. 10 turnout for shipping purposes only.

- **DRR No. 14 Turnout.** The 51.84 ton turnout weight for No. 15 turnouts was used, with a proportional reduction in shipping weight to account for the shorter No. 14 turnout. This reduction lowered the shipping weight for No. 14 turnouts to 49.75 tons.

- **DRR No. 20 Turnout.** The 51.84 ton turnout weight for No. 15 turnouts was used, with a proportional increase in shipping weight for the fact that No. 20 turnouts are approximately 61 feet longer than No. 15 turnouts. This increase resulted in a shipping weight for No. 20 turnouts of 71.44 tons.

In addition, since switch stands are not included in the panelized turnout weights on the BNSF/UP combined standards,[242] an additional 500 lbs. per stand has been added to account for shipping the stands with the panel turnouts. A summary of shipping weights follows:

Table III-F-15
Turnout Shipping Weight by Turnout Size

Turnout type	Shipping Weight	Shipping Weight With Stand
#10 Turnout	39.13	39.38
#14 Turnout	49.75	50.00
#20 Turnout	71.44	71.69

NS corrects the transportation costs for turnouts, which DuPont once again based on an outdated $0.035/ton-mile proxy for which it provided no documentary support. The NS Track Engineering Experts obtained a quote from A&K Railroad Materials for delivery of panelized turnouts in gondola cars for $4,000 per car for a 500 mile delivery. *See* NS Reply WP "AK Turnout Transportation.pdf." Indexing these costs to the second quarter of 2009 produced a cost per ton-mile of $0.082.[243]

[242] *See* http://www.uprr.com/aboutup/operations/specs/attachments/amended/turnouts_std.pdf.

[243] *See* NS Reply WP "Track Construction Errata Reply.xls," Tab "No. 20 Turnouts," Cells F24 to G33.

NS accepts DuPont's other turnout construction costs, including its costs for switch heaters.

f. Other

i. Rail Lubricators

DuPont's evidence of the number and cost of rail lubricators is flawed in several respects. First, DuPont's experts underestimate the quantities of rail lubricators needed by the DRR. DuPont's experts claim to have placed rail lubricators "as warranted by track conditions," DuPont Opening III-F-30, but their workpapers are devoid of any evidence that DuPont considered specific track conditions and operating needs when placing rail lubricators. On the contrary, DuPont's workpapers reveal that its rail lubricator quantities are predicated entirely on an arbitrary metric of one lubricator for every 20 route miles. This metric is unsupported by any evidence and is untethered to the real-world needs of the DRR, and it should be rejected. NS's Engineering Experts developed rail lubricator quantities for the DRR by considering specific track conditions and the placement of lubricators on the NS lines replicated by the DRR. NS's rail lubricator count is set forth in NS Reply WP "Track Construction Errata Reply.xls," Tab "Lubricators – Reply."

Second, DuPont's proposed unit price for rail lubricators and drum pumps omits the cost of transportation. NS accepts DuPont's proposed lubricator cost (which is based on a June 17, 2009 quote from L.B. Foster), but that quote is for the rail lubricators and drums to be shipped FOB from the L.B. Foster facility in Niles, OH. The quote therefore does not include the cost of shipping lubricators and drum pumps to the various railheads of the DRR. The NS Track Engineering Experts determined that the rail lubricators and drum pumps would be shipped by truck to the various railheads, and calculated an average highway mileage to the DRR railheads of 571.1 miles. Shipping costs were determined through UPS pricing, considering the combined shipping weight of 285 Lbs. *See* NS WP "Delivery cost for Lubricator.pdf" and "LB Foster Weight.pdf." The total delivery cost adjusted to 2Q09 is $219.89 for each lubricator.

Third, a protective mat must be added to the cost of the rail lubricator in order to protect the ballast in the area of the rail lubricator. This protective mat allows any rail lubricant that is thrown off the train wheel to be captured before it can contaminate the ballast section.[244] Protective mats include three sections: one for the area between the rails, and two field side pieces. Because many of the lubricators will be located at remote sites, the NS Track Engineering Experts selected a large absorbent capacity mat to minimize maintenance costs. The total cost per lubricator location for the necessary mats plus shipping is $617.95. *See* NS Reply WP "Mat material and delivery cost.pdf." Supporting calculations are set forth in NS's workpapers.

Finally, DuPont neglected to include labor costs for installation of the rail lubricator and the initial track mat protection required during the construction of the DRR. The NS Track Engineering Experts estimated that each lubricator and accompanying mats could be installed in four hours. Using 2009 R.S. Means Crew B-14 costs for installation of a car bumper as a reasonable proxy for lubricator installation costs, the total installation costs for a rail lubricator, drum pump, and track mat is $942.00.

[244] According to NS's Track Engineering Experts, if grease isn't caught it falls into the ballast section and fills the voids in the ballast with both the grease and whatever sticks to the grease. This blocks the ballast from drainage water, allowing it to be trapped in the ballast section which requires cleaning or extra maintenance to hold proper surface and alignment. This would create a future maintenance problem and hazardous working conditions as this grease would get everywhere, causing slip and trip hazard. It also would require environmental cleanup and accompanying costs.

The total costs for rail lubricators, including transportation, protective mats, and installation costs is therefore $7,304.84, compared to the DRR's assumption of $5,525.

ii. Plates Spikes and Anchors

NS accepts DuPont's basic specifications and unit costs for other track materials including plates, spikes, and anchors. But once again DuPont has miscalculated transportation costs for these track materials, both by misstating the transportation distances and using an unsupported transportation cost.

<u>First</u>, DuPont ignores the need for materials transportation from the railhead to the actual construction locations. The NS Track Engineering Experts calculated the average on-DRR shipping distance for other track materials and added this distance to the off-DRR distances to obtain a total transportation distance.[245]

<u>Second</u>, DuPont once again uses an unsupported $0.035/ton-mile shipping cost for other track materials. For the reasons described above at III-F-3-b-v, this unsupported number is not a reasonable proxy for transportation costs. The NS Track Engineering Experts have obtained a real-world estimate of other track material delivery costs that amounts to $0.0906 per ton-mile, and assumes that the DRR would use highly efficient bulk loading in 100-ton gondola cars. *See* NS Reply WP "Scanned OTM Transportation computations.pdf." The NS Track Engineering Experts used this price to calculate transportation costs for other track materials.

iii. Derails and Wheel Stops

(a) Derails

DuPont's evidence of derails for the DRR contains several errors. First, DuPont has not proposed an adequate derail for main line tracks. DuPont proposes to use Aldon One-Way

[245] *See* NS Reply WP "Track Construction Errata Reply," Tab "Mileage Matrix for Supplier," Lines 7 and 26.

Retractable Derails with a tall switch stand with a target for all main line and yard derails. But this retractable derail is not designed to operate on main line tracks. Indeed, the Aldon Company website warns that this derail is only to be used in areas where "cars and locomotives [are] operating at SLOW SWITCHING SPEEDS." NS Reply WP "Aldon Derail Caution" ("CAUTION: Install derails on exposed rail track only. Derails are designed for cars and locomotives operating at SLOW SWITCHING SPEEDS."). The speed of an errant car or locomotive can easily dislodge or jump over the type of derail proposed by the DRR, and it therefore cannot be used on DRR main lines.

Double switch point derails are required in order to properly protect the mainline track from cars rolling onto the mainline. These double switch point derails are used along the NS track being replicated by DRR. *See* NS Reply WP "Double Switchpoint Derail Lynchburg, VA.pdf"(photograph of double switch point derail in Lynchburg, VA). As can be seen in NS Reply workpaper "NS Double Switchpoint Derail detail.pdf" the switch points actually direct the wayward car or locomotive away from the mainline.

The NS Track Engineering Experts accept DuPont's proposed retractable derail for DRR yard locations, and its proposed unit price. For mainline locations, however, the NS Track Engineering Experts have substituted the double switch point derail.[246] The NS Track Engineering Experts developed a cost for double switch point derails from DuPont's own evidence—specifically a June 4, 2010, quote from Progress Rail Services for Double Switch Point Derails that DuPont included in its evidence.[247] The Progress quote was for Double Switch Point Derails at $15,000 each, fully panelized. This quote is a reasonable starting point, but it

[246] NS's Engineering Experts also have increased the number of derails to reflect the track configuration set forth in section III-B.

[247] DuPont Opening WP "Progress Rail Quote.xlsx" located in subfolder III-F-3-f.

does not include (1) the switch stand or switch box for the derails; (2) installation costs; or (3) transportation costs.

First, the Progress quote does not include the switch stand necessary for this type of derail, a 51A Switch Stand with rod and bow handle. *See* NS Reply WP "NS-DP-HC-038401 Switch Stand 51A Cost.pdf." NS plan showing details for the double switch point derail]. NS produced information to DuPont in discovery about its own costs for switch stands, and those costs were used by NS's Engineering Experts. *See* NS Reply WP "090876 (NS-DP-HC-38401 to 38402).pdf" also produced in discovery. Adding the switch stand cost to the Progress rail price and indexing to 2Q09 produces a total materials cost of $15,165.67.

Second, for installation the NS Track Engineering Experts developed a prorated price from the $23,599.04 Queen City Railroad Construction labor quote used by DuPont for turnout installation. Double point switch derails are 34% as long as turnouts (40 feet vs. 117 feet), and the relative panel length is a reasonable proxy for installation costs. Multiplying the turnout installation cost by 34% produces a labor quote for double switch point derails of $8,023.67.

Finally, transportation for the panelized double switch point derail would need to be added from the Progress Rail yard at Decoursey, KY to each of the railheads along the DRR. The transportation weight for double point switch derails reasonably approximates to the shipping weight found for Panel Number 1 on the BNSF/UPRR Common Standards for a No. 11 Turnout, for similar lengths and materials produce similar shipping weights. The shipping weight for this panel is 20,000 pounds, and the cost is $ 0.082 per ton-mile.[248]

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[248] *See* NS Reply WP "Track Construction Errata Reply.xls."

(b) **Wheel Stops**

The NS Track Engineering Experts accept DuPont's unit costs for wheel stops. NS makes changes to the quantities of wheel stops consistent with the additional track set forth in Section III-B, and adds wheel stops at the end of set-out tracks where DuPont neglected to include them.

iv. Crossing Diamonds

DuPont appears to have entirely ignored the need for hard rail crossings, or diamonds, in the construction of the DRR. By failing to include necessary at grade cross-over structures along their proposed alignment, DuPont's proposed network would prevent existing opposing non-DRR railroad traffic from crossing DRR's lines. This is plainly unreasonable, particularly for a network that intersects with other carriers as frequently as the DRR's network does.[249] To correct DuPont's error, NS's Engineering Experts developed an inventory of required crossing diamonds and reasonable least-cost prices for those diamonds.

NS's Engineering Experts compiled a list of all at grade cross-over structures (diamond crossings and slip switches) along the NS lines replicated by the proposed DRR alignment that are necessary for DRR system operation. *See* NS Reply WP "NS Reply Crossing Diamonds1.xls." NS's Engineering Experts categorized these diamond crossings into nine types based on American Railway Engineering and Maintenance-of-Way Association (AREMA) 2004 Portfolio of Trackwork Plans geometric crossing plan numbers 700F through 700J. The nine diamond crossing types categorized were determined by interior angles of the structures. The DRR proposed alignment will require:

[249] Having failed to provide any evidence of crossing diamond costs on Opening, DuPont is precluded from doing so on Rebuttal. *See SAC Procedures*, 5 S.T.B. at 445-46; *Xcel*, STB Docket No. 42057, at 2 (served Apr. 4, 2003).

- 89 diamond crossings with interior angles between 90 to 60 degrees;
- 29 diamond crossings with interior angles between 60 to 50 degrees;
- 22 diamond crossings with interior angles between 50 to 40 degrees;
- 6 diamond crossings with interior angles between 40 to 35 degrees;
- 26 diamond crossings with interior angles between 35 to 25 degrees;
- 33 diamond crossings with interior angles between 25 to 14 degrees;
- 8 diamond crossings with interior angles between 14 to 11 degrees;
- 13 diamond crossings with interior angles between 11 to 9 degrees; and
- 12 crossings with interior angles less than 9 degrees.[250]

Crossings required with angles of nine degrees or less will require a double switch slip per AREMA 2004 Portfolio of Trackwork Plan Number: 814-02.

Material costs per diamond crossing were determined from original NS order cost data and industry vendor estimates. In order to investigate cost estimates for the wide variety of crossings required in the DRR system, an analysis was performed to determine the average angle of crossing for all nine AREMA diamond types listed above. The simple analysis resulted in nine different diamond crossing angle samples, 78 degree, 56 degree, 45 degree, 38 degree, 30 degree, 19 degree, 13 degree, 10 degree, and 8 degree, which were then submitted to vendors for price quotes. An independent vendor at Progress Rail[251] estimated a cost of $100,000 to $125,000 for the total range of diamonds and an estimate of $215,000 for a #8 double slip switch (used for crossing angles with less than 9 degrees). To determine conservative estimates per

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[250] *See* NS Reply WP "NS Reply Crossing Diamonds1.xls," Tab "Construction Output."

[251] *See* NS Reply WP "Diamond Crossing Quote – Progress Rail.pdf."

diamond angle type, the NS Track Engineering Experts used a prorated cost method derived from the vendor's quote adjusted to 2Q2009 dollars.

Table III-F-16

Diamond Costs Derived from Prgress Rail Quote					
AREMA Type (degree of angle)	Average Angle (degrees)	Cost Range: $100K to $125K Quote (2012)	Cost in 2009 2Q Dollars (Price Index = .935)	Number of Diamonds	Cost of diamonds
90 to 60	78	$100,000	$93,514	89	$8,322,746.00
60 to 50	56	$103,571	$96,854	29	$2,808,759.82
50 to 40	45	$107,143	$100,194	22	$2,204,258.63
40 to 35	38	$110,714	$103,533	6	$621,200.17
35 to 25	30	$114,286	$106,873	26	$2,778,701.85
25 to 14	19	$117,857	$110,213	33	$3,637,026.86
14 to 11	13	$121,429	$113,553	8	$908,421.78
11 to 9	10	$125,000	$116,893	13	$1,519,602.62
9 or less (Slip Switch)	8	$215,000	$201,055	12	$2,412,661.20
			TOTAL	238	$25,213,378.94

*NOTE: Price Index from RSMeans (178/190 = .935)

The NS Track Engineering Experts recognize that installation of diamond crossings throughout the proposed DRR system will eliminate sections of planned track. The total length of each diamond crossing type was measured from AREMA specifications (2004 Portfolio of Trackwork Plan Number: 814-02) to determine total track feet replaced. Lengths of each crossing type ranged from approximately 14 track feet for 90 to 80 degree crossings to 63 track feet for 14 to 9 degree crossings. Track removed by the new diamond crossings totals to 8384 feet or 1.59 miles. NS has deducted 1.59 miles from the total track mileage and associated OTM costs to reflect the addition of crossings along the DRR system.

The NS Track Engineering Experts determined that the labor and equipment for the installation of the diamond crossings is similar to the efforts to install a track turnout, and therefore the NS experts have used the same labor quote used by DuPont for turnout installation as the cost of labor to install all diamond crossings.

(a) **Materials Transportation**

Like DuPont, NS has addressed the specific transportation costs of each item with the total cost for that item, so no additional transportation costs have been added under this heading.

(b) **Track Construction Labor**

The DRR Engineers requested and received a quote for Track Construction from Queen City Railroad Construction for the construction of the track and placement of the track turnouts (switches) for the DRR. In its request for quotation DuPont instructs Queen City to assume the size of the rail construction project to be 50 miles. The NS Track Engineering Experts accept this assumption. The key assumption for the quote is that the owner of the project would provide the required track materials at the point at which they are assumed to be placed in the track. *See* NS Reply WP "Queen_Labor_Quote Page 4 of 6 Ballast Analysis.pdf." As discussed in the sections above, the NS Track Engineering Experts have added the necessary costs to transport track materials from the construction railheads to the locations for placement in track and to unload rail.

4. **Tunnels**

NS accepts the tunnel inventory and tunnel lengths that it provided to DuPont during discovery and uses that data for the 62 active NS tunnels specified by DuPont for the DRR. NS rejects DuPont's assumption that all except one of the DRR tunnels would be single track, and converts five of these tunnels from single track to double track. In addition to the 62 active tunnels, NS open cut[252] the 268 foot tunnel at milepost N 279.80 on the Virginia Division at

[252] Open cutting, also referred to as daylighting involves elimination of a tunnel by excavating the earth above the tunnel and creating a large cut.

Shawsville, VA, in 1990.[253] Because a tunnel existed prior to the cut in place today at that location and because the ICC Engineering Reports used to develop DRR earthwork quantities do not report the excavation quantities associated with the new open cut,[254] NS adds the cost of constructing the original tunnel to the DRR tunnel costs.

NS rejects DuPont's undifferentiated cost per linear foot for all tunnels, which is unsupported, unreliable, and contrary to Board precedent. Instead, NS's tunnel engineers develop detailed costs tailored specifically to the size of the tunnels on the DRR system.

Defendants' expert tunnel design and engineering witnesses Roberto Guardia and Donald Hilton worked in conjunction to develop costs for the tunnels and sponsor this Section. Mr. Guardia is Vice President of Shannon & Wilson, a geotechnical and environmental engineering services consulting firm. Mr. Guardia has almost 20 years of experience in tunneling, microtunneling and horizontal drilling projects, including experience on the enlargement of approximately 25 railroad tunnels. Mr. Hilton is a professional estimator and has decades of experience in estimating the cost of tunnel construction projects. These experts' qualifications are further detailed in Section IV.

Rather than develop a cost per linear foot tailored to the varying characteristics of the DRR tunnels, DuPont used a tunnel construction cost per foot from 1980 taken from an Interstate Commerce Commission decision in *Coal Trading*.[255] DuPont indexed that cost to 2009 using the R.S. Means Construction Cost Index. DuPont has not even attempted to show that the tunnels

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[253] *See* NS Reply WP "Shawsville Tunnel Details from NS.pdf" and supporting documentation in NS Reply WP Folder "Shawsville Tunnel."

[254] The Engineering Reports were prepared in the early part of the 1900's while the Shawsville Tunnel cut was opened in 1990.

[255] *See* DuPont Opening III-F-33, n.89.

upon which the 1980 cost was based remotely resemble those of the DRR.[256] In *AEPCO,* the Board found that complainant and its witness Harvey Crouch failed to meet its burden of demonstrating that the 1980 costs included costs for steel and concrete lining. Such lining would be required for most DRR tunnels. The Board concluded instead that the costs used in *Coal Trading* were for timber-lined tunnels.[257] The Board reached a similar conclusion in its 2007 *Western Fuels* decision.[258] The Board has correctly concluded that timber-lined tunnels are different. Because timber lined tunnels require additional maintenance that is not required for tunnels constructed with concrete and steel (*id.*), and therefore are more costly and less efficient over time.[259] They also increase the risk of tunnel fires which can cause serious traffic delays and require total tunnel reconstruction.[260] As in *AEPCO*, DuPont has failed to provide any evidence to justify its expansive use of *Coal Trading*, and its approach must also be rejected here.

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[256] DuPont's entire Tunnels narrative evidence consists of less than 4 ½ lines. DuPont's superficial case-in-chief for tunnels fails to explain its assumptions and approach adequately. It further erroneously claims it has followed governing Board precedent by using *Coal Trading* tunnel costs, without accounting for either the costs of maintenance of timber-lined tunnels or for the higher costs of modern concrete- and steel-lined tunnels. *Compare* DuPont Opening III-F-32 to III-F-33 *with* AEPCO Opening, *AEPCO*, STB Docket No. 42113, at F-59-62 (Jan. 25, 2010).

[257] *AEPCO v. BNSF*, STB Docket No. 42113, at 110-111.

[258] *WFA I*, STB Docket No. 42088, at 107.

[259] Railroad engineers have recognized for more than a century that timber lined tunnels are a "temporary expedient" that are not cost-effective over time. *See* CHARLES PRELINI, TUNNELING: A PRACTICAL TREATISE 68 (1902) ("Timber is seldom employed in lining tunnels except as a temporary expedient, and is replaced by masonry as soon as circumstances will permit").

[260] As explained in the previously-cited treatise, "timber linings possess few advantages. It is only the matter of a few years when the decay of the timber makes it necessary to rebuild them, and there is always the serious danger of fire... causing serious delays in traffic, and necessitating complete reconstruction." *Id.*

DuPont's cursory narrative evidence did not state whether it intended to use old-fashioned timber lined tunnels like those at issue in *Western Fuels*, but the *Coal Trading* unit costs it proposed are wholly inadequate to construct modern concrete and steel tunnels. Moreover, DuPont failed to account for the increased maintenance costs associated with timber-lined tunnels as required by Board precedent. *See WFA I*, STB Docket No. 42088, at 75, 107; *AEPCO 2011*, STB Docket No. 42113, at 110. Thus, DuPont's tunnel costs are both incomplete and unreliable in violation of the Board's prior admonitions. NS's Tunnel Engineering Experts reject the use of an outdated and unsupported tunnel construction cost that the Board has determined applies only to timber-lined tunnels and has rejected in recent decisions. Instead, NS's Engineering Experts have developed detailed estimates of the construction costs for the specific types of tunnels the DRR would be required to build.

a. Tunnel Cost Components

Tunnel construction costs generally have a fixed and a variable component and are not simply proportional to the length of the tunnel. Fixed costs consist of constructing the portal or entrance to each end of the tunnel. These costs include clearing and excavating the approach cuts, providing support to the slopes and the portal structure. Variable costs consist of the excavation and support of the tunnel. There are three primary parameters to determine tunnel variable costs, the length of the tunnel, the number of tracks (which affects the width of the tunnel), and whether or not the tunnel is lined. According to NS's Tunnel Engineering Experts, as the overall length of a tunnel increases, the excavation cost increases both because more cubic yards of material needs to be excavated and because the excavated materials must be transported longer distances for disposal outside the tunnel.

The number of tracks in a tunnel affects the size of the tunnel bore and drives both excavation costs and portal costs. Tunnels accommodating double tracks require a larger size tunnel bore than single track tunnels.

Tunnel lining stabilizes the tunnel walls and ceiling inside the tunnel by constructing a steel reinforced concrete surface or lining along the walls and ceiling of the tunnel bore after the excavation is complete.

b. DRR Tunnels

The DRR has replicated at total of 62 active tunnels located in 10 different states plus the daylighted Shawsville Tunnel. These tunnels vary in length from 106 feet to 4,893 feet long, and the cumulative length of those DRR tunnels is 61,231 feet. As discussed previously, tunnel costs are driven by a number of factors. Therefore, rather than develop a single cost estimate applicable to all DRR tunnels, the NS Tunnel Engineering Experts divided the DRR tunnels into five separate groups based primarily on overall length to more accurately capture the dynamic relationship between the variable excavation cost and relatively fixed portal cost on the composite construction cost per linear foot.[261] NS then separated the tunnels within each group based on whether the tunnels are single or double track and whether the tunnels are lined or unlined. NS Tunnel Engineering Experts then used the individual characteristics of the tunnels within each group and subgroup to create a hypothetical composite tunnel representative of each subgroup, which were used as the basis for the development of bottom-up detailed cost estimates. Table III-F-17 below summarizes the DRR tunnel groups and sub-groups used by the NS Tunnel Engineering Experts to develop detailed cost estimates.

[261] This approach is similar to the one employed by the parties to calculate DRR bridge investment costs, which have relatively fixed abutment cost and pier and superstructure costs that vary with both bridge height and length.

Table III-F-17
Summary of DRR Reply Tunnels by Category and Sub-Category

Length Classification Category	Number of Tunnels	Number of Tracks		Lining	
		Single	Double	Unlined	Lined
5000	6	5	1	0	6
2500	4	4	0	0	4
1500	5	5	0	0	5
1000	16	12	4	1	15
650	32	31	1	12	20
Total	63	57	6	13	50

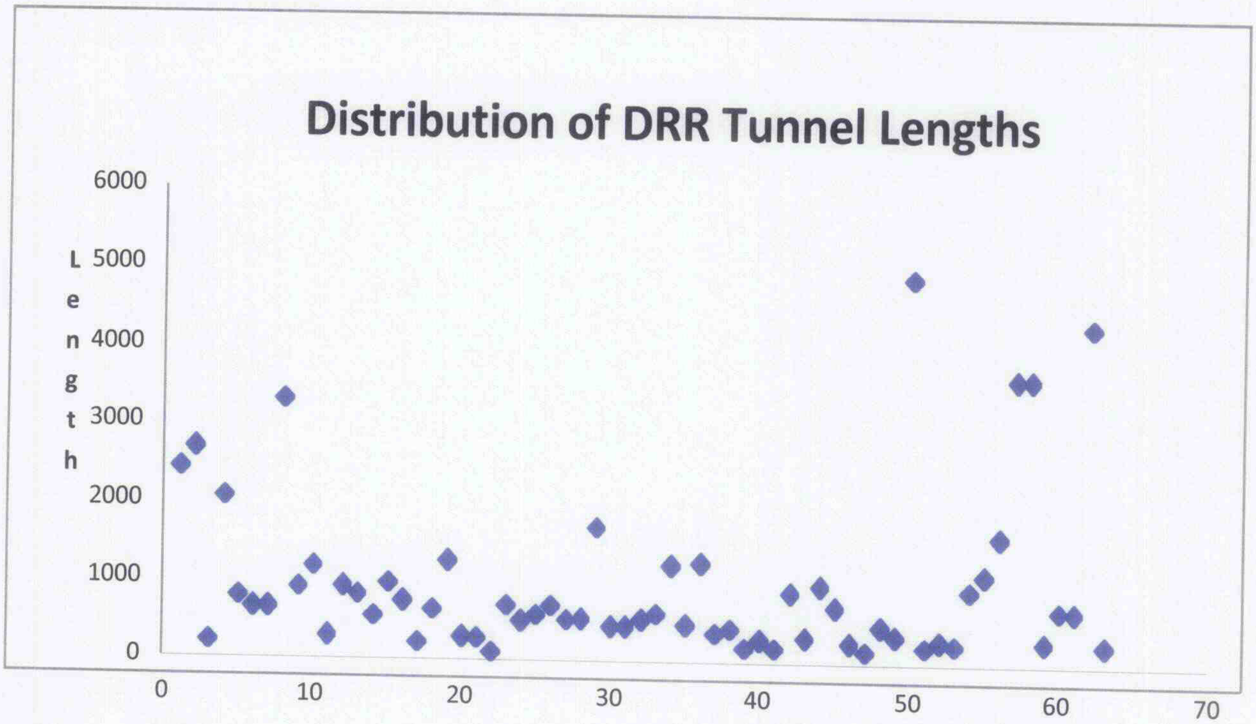
This approach is far more specific, detailed, and reliable than DuPont's undifferentiated approach, which assumes that every tunnel on the DRR system would have exactly the same cost per linear foot, regardless of specific design, requirements, and parameters of different tunnel types and lengths.

c. Tunnel Classification Description

i. Length Classification Category

As discussed previously, the DRR tunnels range in length from just over 100 feet to almost 5,000 feet. Chart III-F-5 below shows the distribution of tunnel lengths for the DRR.

Chart III-F-5



Source: NS Reply WP "DRR Tunnels Length Chart.xls."

As Chart III-F-5 shows, the vast majority of the DRR tunnels are less than 1,000 feet. Based on their cost estimating experience and understanding of the effects of increased tunnel lengths on excavation costs per linear foot, NS Tunnel Engineering Experts identified five separate length categories for the DRR. As summarized in the Table III-F-18 below, the average length of tunnels in each category are near the midpoint of the classification tunnel length range.

Table III-F-18
Summary of NS Reply DRR Tunnels by Category and Sub-Category

Length Classification Category	Number of Tunnels	Length Classification range Midpoint	Average Tunnel Length
5,000	6	3,750	3,732.3
2,500	4	2,000	1,954.4
1,500	5	1,250	1,226.3
1,000	16	825	809.7
650	32	325	372.9

ii. Number of Tracks Sub-Category

DuPont's proposed track configuration for the DRR includes areas of single track where NS has double track today. However, these segments are located in the Virginia Division. In contrast, DuPont's Active Tunnel List only presents the Allegheny Tunnel as double track. Five tunnels that are single track on the DRR are double track on the NS today: the Mansion, Leesville, Huddleston, Goodview, and Hardy tunnels. The Operating Plan presented in Section III-C demonstrates that the DRR would need double track for these tunnels. Accordingly, NS Tunnel Engineering Experts have developed costs for these tunnels assuming double track. Dimensions for double track tunnel openings were developed based on AREMA standards.[262]

iii. Lining Sub-Category

NS's Engineering Experts investigated the current type of liner of the tunnels replicated by the DRR and found that some of the tunnels (12 tunnels) are unlined (meaning that the rock is sufficiently strong to not require liner support).[263] For costing purposes, NS's Engineering Experts also conservatively assumed that the Shawsville Tunnel that was daylighted in 1990 was unlined. For all other tunnels, NS assumed an initial liner support and a final liner support consisting of steel bar or steel set reinforced cast-in-place concrete lining.

The specific tunnel lining materials within each tunnel category varied based on the results of a study conducted by NS's Engineering Experts. Specifically, NS's tunnel experts determined the type of lining support needed for the lined tunnels based on a sample of 22 tunnels from the recent NS Heartland Corridor Project that are similar to the lined tunnels required for the DRR. Ground categories are typically established to determine the quality of the

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[262] AREMA Chapter 1, Part 8, Section 1.4 and 1.5, Figures 28-1-3 and 28-1-4.

[263] *See* NS Reply WP "DRR Tunnels Reply.xlsx;" NS Reply WP "DRR Lining Indentification Using RIMS.pdf."

ground and the corresponding support method. For the sampled tunnels, the tunnel experts classified ground types into three standard categories A, B, and C. Ground classification is an assessment and measure of the type, strength and degree of fracturing of the rock excavated for the tunnel bore and the presence or absence of water inflow. Category A ground has higher strength and less fracturing than Category C ground and the required support is progressively stronger. Category A is good ground, C is poor ground, and B is the ground quality between A and C. In some tunnels 100% of the tunnel was in Category A and in others 100% of the tunnel was in Category C. The analysis and engineering judgment revealed that typical tunnels will generally have 50% of Ground type A, 32% of Ground Type B and 18% of Ground Type C. For lined tunnels in Ground Types A and B, NS tunnel experts assumed the initial support lining materials would consist of less costly shotcrete and rock dowels. For lined tunnels in the more difficult Ground Type C, NS assumed initial support liners consisting of steel sets. The details of each liner type are described in NS's tunnel cost workpapers.[264]

iv. Development of Tunnel Costs

Once the DRR tunnels were appropriately categorized, NS tunnel experts developed detailed unit costs for each tunnel subcategory. Because DuPont did not develop its own tunnel construction costs beyond an undifferentiated cost per linear foot, it did not present detailed specifications for the tunnels or any assumptions regarding construction methods, practices, or techniques. Based on their considerable experience, NS's Engineering Experts developed a set of tunnel specifications and construction methods for the DRR tunnels.[265] Based on the real

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[264] *See* NS Reply WP "Overall GST-GCT Classification.pdf" and NS Reply WP Folder III-F-4-"Ground Classifications.pdf."

[265] *See also* NS Reply WP Folder "III-F-4-Cost Detail Report."

tunnels that the DRR tunnels would replicate, NS's tunnel experts made the following assumptions regarding tunnel design and construction:

- Because of the relatively short length and the horseshoe shape of the tunnel openings, the tunnels would be excavated using drill and blast methods. Large and expensive rock tunnel boring machines that excavate tunnels in a circular shape are typically used for much longer tunnels. Such an approach would not be efficient for the DRR tunnels. The real-world versions of those tunnels were excavated using drill and blast methods. *See* CHARLES PRELINI, TUNNELING: A PRACTICAL TREATISE 68 (1902) (Tunnels of the turn of the century were excavated by drill and blast methods).

- Concrete lining thickness for each tunnel is assumed to be twelve inches of reinforced cast-in-place concrete. This is a common wall width for concrete tunnel liners. *See* NS Reply WP Folder "III-F-4-Cost Detail Report."

- The tunnels would be excavated in a non-gassy environment, meaning that NS conservatively assumes that methane or other explosive gasses usually found in coal deposits would not be encountered during construction. The presence of methane can cause costly delays and the risk of explosion and fires endangering construction personnel.

- Tunnel excavated rock and other materials are assumed to be stockpiled within one mile of the portals. NS did not include the costs of disposal at a final disposal location.

- Typical portal excavation includes 2,315 bank cubic yards of soil, 4,740 bank cubic yards of ripping rock and 4,740 bank cubic yards of drill and blast rock. *See* NS Reply WP Folder "III-F-4-Cost Detail Report." This same proportion of ripped rock and blasted rock was used in the solid rock excavation quantities. NS assumes portals are supported with rock dowels, spiles and shotcrete as detailed in the cost estimate. *See* NS Reply WP Folder "III-F-4-Cost Detail Report."

- The DRR would generate electricity on site with diesel generators, instead of using power grid electricity, which generally would not be available at remote tunnel sites when the DRR is under construction.

Using these assumptions and advance distance per blast round and initial support requirements to excavate blasted materials, NS tunnel experts developed a Tunnel Cycle Time for each tunnel as described in their workpapers.[266] The individual cost estimates for the different types of tunnels are summarized in Table III-F-19 below and are set forth in NS Reply WP Folder III-F-4-Cost Detail Report.

Table III-F-19
Summary of NS Reply DRR Tunnels Cost Per Foot by Category and Sub-Category

	Single Track		Double Track	
Length Classification Category	Lined	Unlined	Lined	Unlined
5000	$13,460	N/A	$18,689	N/A
2500	$14,875	N/A	-	N/A
1500	$17,589	N/A	-	N/A
1000	$15,753	$11,108	$28,652	N/A
650	$28,332	$17,918	$37,656	N/A

NS's Tunnel Engineering Experts multiplied the applicable unit costs by the length of the corresponding tunnel to obtain the construction cost of each tunnel, and those costs were summed to calculate a total tunnel construction cost as set forth in the following Table.

[266] Tunnel Cycle Time is the time it takes to drill blast holes, load blast holes with explosives, detonate, excavate the blasted rock and install temporary support. Here, based on their real-world experience and authoritative references, NS tunnel experts developed Tunnel Cycle Time based on the following assumptions: a drilling speed of six feet per minute with three drills; a loading time of four minutes per hole; a muck excavation rate of 40 loose cubic yards per hour; a rockbolt installation rate of six minutes per bolt with three drills; and a shotcrete installation rate of four cubic yards per hour. *See also* NS Reply WP Folder III-F-4-Cost Detail Report.

Table III-F-20
Summary of NS Reply Tunnels Cost by Category and Sub-Category ($ thousands)

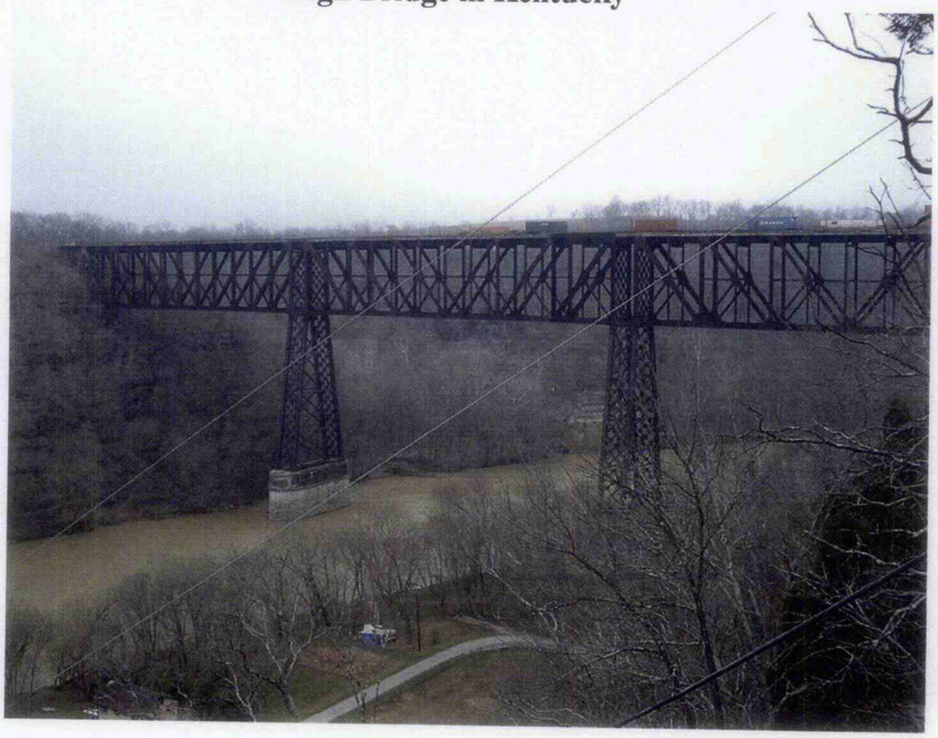
	Single Track		Double Track	
Length Classification Category	Lined	Unlined	Lined	Unlined
5000	$251,180	N/A	$69,755	N/A
2500	$116,284	N/A	N/A	N/A
1500	$107,850	N/A	N/A	N/A
1000	$140,305	$8,994	$92,796	N/A
650	$211,300	$73,491	$14,042	N/A
Total	$826,919	$82,485	$176,593	-
Grand Total				$1,085,997

The resulting total cost of constructing DRR tunnels is $1,086 million (*See id.*), compared to $444 million submitted by DuPont using an undifferentiated gross cost per linear foot approach.

5. Bridges

The bridges on the DRR proposed by DuPont bear little resemblance to the real NS bridges that they purport to replicate. Some of this is to be expected, because DuPont is proposing to construct the DRR bridges using its own "standard" bridge types, which differ from the bridges' original design and construction. This alone is not a point of contention. However, there are many corrections to be made other than typical span type in order for DuPont's evidence to represent feasibly and accurately the relevant attributes of the bridges in the real world that currently carry NS traffic. To be clear, the corrections to be made are not matters of "least cost" to build the structures, but whether or not the proposed DRR bridges would geometrically fit into the real world topography, have the same functionality as the existing real world bridges, and have adequate substructure capacity. To take one illustrative example, DuPont assumes a bridge height of 11 feet for NS's High Bridge in Kentucky. *See* DuPont Opening workpaper Bridge Construction Costs Errata.xls, Tab "Only Active Bridges," Lines 957-960, Column U. That bridge actually is 308 feet high.[267] The myriad shortcomings and inadequacies in DuPont's bridges evidence are discussed in more detail in the sections that follow, along with appropriate measures taken to correct the inadequacies.

Figure III-F-4
High Bridge in Kentucky[268]



NS's evidence regarding bridge costs for the DRR is sponsored by NS witnesses Willie Benton III and Dave Magistro. Mr. Benton is a consultant for Scott Bridge Company and president of B-3 Engineering. Mr. Benton joined NS's predecessor in 1972 and stayed with the railroad until 2009, rising to Engineer, Structures, Western Region. Prior to that, Mr. Benton

[267] NS Reply WP "Norfolk Southern Bridge List.xls," Tab "Active Bridge List, Lines 2422-2425," Column L, produced in discovery at NS-DP-DVD-008.

[268] The shipping containers visible on the top of the bridge are at least eight feet high.

served as a Bridge Engineer for NS. Mr. Magistro is a Senior Engineer and Project Manager for STV. He has almost 15 years of experienced with structural design, focused on movable bridges and railroad structures. These experts' qualifications are further detailed in Section IV.

Messrs. Magistro and Benton are sometimes referred to collectively hereinafter as "NS's Bridge Engineering Experts." Those Bridge Engineering Experts have corrected the errors in DuPont's development of DRR bridge costs and conclude properly developed DRR bridge investment to be approximately $4,283 Billion as summarized in the following table.

Table III-F-21

NS Reply DRR Bridge Cost - 100% Owned			
Bridges Less Than 20-Feet *	$15,656,263		
Bridges with Only Type I Spans	$135,393,282		
Bridges with Only Type II Spans	$67,168,398		
Bridges with only Type III Spans	$1,559,645,844		
Bridges with only Type IV Spans	$4,380,263		
Bridges with Mixed Span Types	$185,909,381		
Movable Bridges	$1,042,319,961		
Major Non-Movable Structures over Navigable Waterways	$228,736,234		
Major "Tall" Structures	$843,366,065		
Highway Overpasses	$12,689,920		
Total Cost - 100% Ownership	$4,095,265,611		
NS Reply DRR Bridge Cost - Partially Owned			
Railroad	Full Cost	Ownership %	DRR Cost
Beltway Railway Company of Chicago	$118,110,843	25%	$29,527,711
TRRA Bridges	$54,644,314	14%	$7,808,672
IHB Bridges	$141,857,769	25%	$35,464,442
Conrail Shared Asset Bridges	$197,648,600	58%	$114,636,188
Total Cost - Fractional Ownership	$512,261,526		$187,437,013
Total NS Reply DRR Bridge Cost			$ 4,282,702,624

Source: NS Reply WP "Bridge Construction Costs errata Reply.xls," Tab "NS Cost Summary."

a. Bridge Inventory

The bridge inventory proposed by DuPont is fairly accurate with respect to the location of required bridges on the DRR compared to where they are located in the real world. However, simply having bridges in the same location as they exist today does not mean that other material parameters and attributes of the DRR bridge inventory are correct. In fact, there are numerous significant corrections that must be made.

The most notable error in DuPont's opening bridge evidence is that it simply assumed values for bridge heights that bear no relation to their actual, required heights. This error is important for several reasons, first and foremost being the sheer number of bridges that are affected, which is the vast majority of structures in the DRR inventory. Secondly, this error has a significant impact on the construction cost of every type of structure on the DRR, so there is no part of the bridge inventory that is not affected. Third, this error stands out because it was completely avoidable: DuPont made the error because it ignored readily available data that NS furnished in discovery. This surprising error demonstrates an inept and indolent approach to replicating NS's real world structures on the DRR. That approach also drastically underestimates DRR bridge costs.

NS furnished maximum bridge height data in discovery,[269] but DuPont chose to ignore that data. According to DuPont's opening narrative, it disregarded the available bridge height data because it deemed that data not "complete and detailed"[270] because it contained "only maximum height." Based on this cryptic and unexplained criticism, DuPont ignored NS's *actual* bridge heights and instead fabricated self-serving criteria for "estimating" DRR's bridge heights.

[269] NS Reply WP "Norfolk Southern Bridge List.xls," Tab "Active Bridge List," Column L.

[270] DuPont Opening Errata III-F-34.

See DuPont Opening III-F-34. The bridge height "estimates" generated by DuPont's criteria fall far short of the actual NS bridge heights. Because DuPont failed to account for actual bridge height requirements for the bridges replicated by the DRR, DuPont's proposed DRR bridges would not function in the manner necessary to create a workable railroad.

For at least two reasons, the Board should reject DuPont's fabrication of hypothetical bridge heights. *First*, in its discovery requests to NS, DuPont's Request for Production number 129 asked for NS bridge lists providing specified information for each NS bridge. Subpart h. of that request asked for "Height." In response, NS provided its available bridge height information from its records, reflecting the maximum height of each of the bridges for which data is available.[271] Despite more than ample opportunity during a lengthy discovery period, DuPont did not advise NS during discovery that it believed the bridge height data NS provided to be incomplete, nor did it ask for any additional bridge height data. DuPont makes no attempt whatsoever to explain what additional height information it sought. DuPont cannot run from its own discovery request, and is estopped from asserting for the first time in its case-in-chief that NS's production of maximum bridge heights in response to DuPont's request for bridge "height" is somehow insufficient. Thus, despite its assertion that "bridge height is an essential aspect of the cost of a bridge," DuPont declined to use actual bridge heights and instead fabricated

[271] There are some bridges for which height was not included in the NS bridge data. Approximately 12.5 percent of the bridges in the list produced by NS contain a value of 0 in the "Max Height" column (*See* NS Reply WP "Norfolk Southern Bridge List_NS Reply.xls," Tab Active Bridge List, Cell L14529). For the minority of bridges in NS's Bridge List that were missing height data, NS's Reply uses the height assumed by DuPont in its evidence. DuPont did not, however, complain about missing bridge heights, but rather that the bridge heights provided stated "only the maximum height." In any event, missing height data for a small minority of bridges cannot justify ignoring actual bridge height data produced for the vast majority of NS bridges.

different bridge height assumptions that are wholly untethered to the actual bridge height data NS produced in discovery, and that substantially understate bridge costs.

Second, DuPont's rationale for establishing new bridge height criteria is nearly identical to the position Complainant took in *Seminole,* STB Docket No. 42110, a case involving different parties and completely different bridge data. In *Seminole,* Complainant Seminole Electric retained the same expert, Harvey Crouch, to sponsor its stand-alone railroad bridge plan and develop bridge costs. In that proceeding, Mr. Crouch developed a methodology for estimating bridge heights. The bridge height approach used by Mr. Crouch in the *Seminole* proceeding is exactly the same as the approach he used for the DRR.[272] In the *Seminole* case, however, CSXT did not produce bridge height information in discovery, which necessitated an alternative approach for calculating SARR bridge heights. Here, in contrast, NS provided responsive bridge height information in the form maintained by NS in its ordinary course of business. While it was undoubtedly convenient and easier for Mr. Crouch to recycle his *Seminole* template and woodenly apply it to this case, the fact that NS supplied actual bridge height data eliminated any justification for use of the approach Mr. Crouch used in *Seminole.*

It is not surprising that DuPont prefers Mr. Crouch's manufactured hypothetical bridge height categories to the actual maximum heights reported in the NS bridge list. Consider the bridge height criteria proposed by DuPont:

Highway / Interstate	16.5' (AASHTO – Interstate Requirements)
Other Roads	14.5' (AASHTO – Other Highways)
Navigable Waterways	USCG Clearance Requirements
Other Waterways	11'

[272] SECI Opening, *Seminole*, STB Docket No. 42110, at III-F-59 to III-F-60 (Jan. 25, 2010).

When these criteria and heights are compared to the actual bridge height data furnished by NS in discovery, the real reason for DuPont's unexplained substitution of the foregoing hypothetical heights for actual bridge heights is exposed. Take for example, DRR Bridge V233.00 on the Virginia Division. NS data indicates that bridge has a maximum height of 106 feet[273] Ignoring this actual height, DuPont assigned the bridge a height of just *11 feet,* because it falls under DuPont criterion number four—a bridge crossing a non-navigable "other" waterway.[274]

Thus, DuPont's unjustified use of a fabricated height reduced the height of the bridge by 95 feet, or 90 percent of its actual height. DRR Bridge V344.40 on the Pocahontas Division is another example. The NS bridge inventory shows the bridge has a maximum height of 192 feet.[275] Based on its criterion number two—crossing a non-interstate highway—DuPont assigned this bridge a height of just *14.5 feet,* a 177.5 foot understatement of the actual bridge height.[276] A picture of the bridge as it exists on NS's system is set forth below, clearly demonstrating the absurdity of DuPont's height assumption.

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273 NS Reply WP "Norfolk Southern Bridge List.xls," Tab, "Active Bridge List," Cell L5633.

274 DuPont Opening WP "Bridge Construction Costs Errata.xls," Tab "Only Active Bridges," Cell U2560.

275 NS Reply WP "Norfolk Southern Bridge List.xls," Tab "Active Bridge List," Cell L63413.

276 DuPont Opening WP "Bridge Construction Costs Errata.xls," Tab "Only Active Bridges," Cell U2590.

Figure III-F-5
V344.40, Pocahontas Division

There are thousands of bridge locations where DuPont's artificial and ill-fitting bridge criteria produced bridge heights that are lower than the actual bridge heights furnished by NS. Several dozen of the height understatements are of similar magnitude to those described above, where actual bridge heights ranging from 100 feet to up to 308 feet are purportedly "replicated" by DuPont's assumed DRR bridge heights between 11 feet and 16.5 feet. Clearly, these hypothetical bridges are not tall enough to connect the track they purport to connect. In this

Reply Evidence, NS's bridge experts have accounted for actual bridge heights by using the data furnished by NS in response to DuPont's discovery requests.

The maximum bridge heights furnished by NS are entirely appropriate for developing bridge abutment and pier costs for most bridges at issue in this proceeding, which NS has categorized into Types I, II, and III DRR bridge types. For these "standard" bridges in the Types I, II, and III DRR bridge categories, the average number of spans is low enough that there are zero or one piers on the vast majority of these bridges as set forth below. Therefore, the maximum bridge height data furnished by NS in discovery is actually a very accurate representation of the bridge heights that should be considered for these bridges. Pier heights are typically at maximum somewhere near the center of the length of the bridge, and gradually decrease in height as the bridge approaches the abutments at the ends of the bridge. But if there is only one single pier, its height is the same as the "maximum height."

Type I Bridges – Average Number of Spans = 1.40[277]

Type II Bridges – Average Number of Spans = 1.00[278]

Type III Bridges – Average Number of Spans = 2.46[279]

In exceptional circumstances where longer bridges with multiple spans may not maintain maximum height over the entire length of the bridge, as described above, NS's bridge experts graduated the substructure costs to reflect the decreasing pier heights, and did not use standard

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[277] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Bridges – Type I Spans Only," Cell P1400.

[278] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab, "Bridges – Type II Spans Only," Cell P654.

[279] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Bridges – Type III Spans Only," Cell P2878.

Type I, II, and III bridges. In such cases, the pier heights and material quantities are calculated in NS's Reply workpapers.[280]

DuPont's bridge evidence also frequently uses incorrect bridge lengths. DuPont's use of erroneous total bridge lengths for bridges with multiple span types produced a substantial overstatement of the DRR bridge lengths. For example, Bridge Number W156.80 on the Piedmont Division[281] has a real world total bridge length of 650 feet. This is what the NS bridge list and track charts furnished in discovery show.[282] However, DuPont's bridge costs spreadsheet for the DRR shows a length of 1,120 feet for this bridge.[283] This and similar length overstatements are the result of errors in the costing spreadsheet formulas DuPont used to calculate total bridge lengths. Specifically, the NS bridge list includes two separate fields reflecting bridge length information, labeled "Length" and "Total Length." For bridges with a single uniform span type, only the "Total Length" field is populated, and the "Length" field is blank. For bridges consisting of more than one type of span, the NS bridge list contains an entry in the "Length" field for each type to span. For example, NS bridge W156.80 crosses Crane Creek with two ballast deck steel beam spans of 20 feet, three open deck plate girder spans of 60 feet, and twenty ballast deck steel beam spans of 21.5 feet. The total length of the bridge is 650 feet.[284] The bridge list "Length" field for the Crane Creek bridge has entries of 40, 180, and 430

[280] NS Reply WPs "NS Special Bridges_Movable.pdf," NS Special Bridges_Non Movable Over Navigable Waterways.pdf," and "NS Special Bridges_Tall.pdf."

[281] NS Reply WP "Norfolk Southern Bridge List.xls," Tab "Active Bridge List," Cell K1463, Crane Creek Bridge.

[282] NS Reply WP "2010_PIEDMONT_03 (NS-CP-C-7446 to 7958).pdf" at 327.

[283] DuPont Opening Errata WP "Bridge Construction Cost Errata.xls," Tab "Only Active Bridges," Cell O497.

[284] (2 x 20) + (3 x 60) + (20 x 21.5) = (40 + 180 + 430) = 650.

feet respectively for the two steel beam spans, three deck plate girder spans and twenty beam spans. The "Total Length" field in the bridge list identifies the combined total length of the bridge in the first line entry for each bridge, and reports the same value as in the "Length" field for the remaining bridge span types. Thus in the bridge inventory for the Crane Creek Bridge (W156.80) the "Total Length" field first lists 650 feet (the total length of all spans on the bridge)[285] and then 40 feet and 430 feet respectively for the 20 and 21.5 foot steel beam spans. Instead of adding the entries in the "Length" field to determine total bridge length, DuPont incorrectly summed all entries in the "Total Length" field, which adds the total bridge length reported in the first line entry with the lengths of the subsequently reported span types, overstating the bridge length by 470 feet.

DuPont made this error to its own detriment in hundreds of bridge locations, so the list of errors is far too lengthy to enumerate in this narrative. This gross error further illustrates the careless and unreliable nature of the bridge evidence proffered by DuPont. Although DuPont's repeated error would favor NS, in the interest of accuracy NS has corrected DuPont's overstatements of bridge lengths. The corrected cells are highlighted in NS reply work papers and NS's bridge experts have attached a comment to each highlighted cell indicating the correction they made

A third common error in DuPont's bridge evidence is its frequent assignment of incorrect and inconsistent numbers of tracks to various bridge locations. For example, consider MP H16.50 to H20.20 on the Georgia Division. DuPont's Stick Diagram of this segment shows just

[285] Individual line entries for bridges are reported in alphabetical order by span type regardless of actual placement in bridge.

a single track. However, DuPont's bridge cost spreadsheet uses two tracks in this area..[286] This error occurs numerous times in DuPont's favor, but it also occurs numerous time to its detriment. There is no consistency in this error as to which side it favors, which again exemplifies the sloppy nature of the evidence. DuPont made this in too many locations to list here, but NS has corrected those errors in its Reply Evidence bridge cost spreadsheet.[287] NS has highlighted the corrected cells and attached a comment to each highlighted cell indicating which page of the Stick Diagrams contains the conflicting data. Like DuPont's bridge length errors, its myriad errors in the straightforward task of assigning number of tracks underscore DuPont's haphazard approach to developing its bridge evidence and results in an unreliable evidentiary presentation.

A fourth category of errors in DuPont's bridge evidence is its broad-brush assumption that all bridges less than 20 feet in length could be replaced with culverts. Replacement of bridges less than 20 feet long with culverts would work only if the replacement culvert maintains the functionality of the bridge. But bridges cannot be replaced indiscriminately based solely on whether they are less than 20 feet in length. Most obviously, a great number of short bridges span a feature other than a waterway or drainage area (e.g., a road), where a culvert could not perform the same function as the existing bridge. For example, consider Bridge HP88.07 in Lebanon, PA on the Harrisburg Division, pictured below.[288]

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[286] DuPont Opening Errata WP "Bridge Construction Costs Errata.xls," Tab "Only Active Bridges, Cells AO704-AO711."

[287] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "All Bridges Complete Inventory," Column AP.

[288] NS Reply WP "Norfolk Southern Bridge List.xls," Tab "Active Bridge List," Lines 7801-7803.

Figure III-F-6
Bridge HP88.07, Harrisburg Division

This existing bridge is shown in NS's bridge inventory as being 12 feet in length and spanning 25th Street, an automobile roadway. The data furnished by NS also indicates a bridge height of 17 feet. DuPont would replace this structure on the DRR with a pair of 108-inch (9 feet) diameter pipes.[289] In order for 25th Street to remain in service, the bridge's horizontal and vertical clearances must be preserved to allow sufficient space for cars to pass under the bridge. Replacing the 25th Street bridge with a pair of culverts will not preserve those clearances. Also consider Bridge CJ237.24 on the Lake Division over a private crossing. NS data shows the

[289] DuPont Opening WP "Culvert Construction Costs.xlsx," Tab "20ft<Bridges Rev," Cells P253-P254.

existing bridge is 20 feet in length and has a maximum height of 30 feet.[290] DuPont's evidence purports to replace this bridge with a pair of pipes that are each 108-inches in diameter.[291] Again, the culvert pipes proposed by DuPont clearly would provide neither the horizontal clearance nor the vertical height of the bridge they purport to replace. These are just two examples of hundreds of instances in which DuPont's proffered replacement of a bridge with a culvert would not provide the same capacity or functionality as the existing real world bridge. Accordingly, NS has rejected any attempt by DuPont to replace a bridge with culverts where the bridge at issue spans a feature other than a waterway. A detailed list of the structures at issue and a costing of those structures are set forth in NS's workpapers.[292]

DuPont's bridge inventory also included another error that resulted in substantial understatement of DRR bridge costs, the omission of three movable bridges. Bridges 229.00[293] and NO172.20[294] on the Alabama Division and Bridge W151.40[295] on the Illinois Division were listed by DuPont in its standard bridge inventory rather than the "Special" or movable inventory. The NS bridge inventory clearly identifies those bridges as moveable spans. DuPont offered no justification for omitting those structures from the movable bridge list, or for its failure to assign

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[290] NS Reply WP "Norfolk Southern Bridge List.xls," Tab "Active Bridge List," Lines 13423-13424.

[291] DuPont Opening WP "Culvert Construction Costs.xlsx," Tab "20ft<Bridges Rev," Cells P118-P119.

[292] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "<20' Bridges."

[293] NS Reply WP "Norfolk Southern Bridge List.xls," Tab "Active Bridge List," Cell G3606.

[294] NS Reply WP "Norfolk Southern Bridge List.xls," Tab "Active Bridge List," Cell G3810.

[295] NS Reply WP "Norfolk Southern Bridge List.xls," Tab "Active Bridge List," Cell G14350.

to those bridges costs commensurate with a movable span.[296] NS's Reply Evidence restores those bridges to their proper status as movable bridges.

A further bridge inventory error is DuPont's assignment of costs to the DRR for two bridges that are not actually owned by NS. Bridges NO190.60 and NT9.20 on the Alabama Division are actually owned by the N.O. Dock Board, not NS. To correct for the resulting overstatement of bridge costs, NS has removed the construction costs for these two structures from the DRR inventory, despite the fact that this correction works to DuPont's advantage

Finally, DuPont's evidence failed to accurately account for exceptionally tall structures and the major river crossings, which require larger horizontal or vertical clearances than can be provided by the DRR standard spans and piers.[297] NS's Reply Evidence has categorized such extraordinary bridges as "Special Bridges," which are discussed in detail below.

DuPont made a variety of other errors throughout its DRR bridge inventory. All errors that NS identified and corrected are noted in the NS reply bridge cost spreadsheet.[298] Those specifically discussed above were particularly significant errors.

b. Bridge Design and Cost Overview

DuPont's bridge design and cost narrative is short and simple. *See* DuPont Opening III-F-33 to III-F-38. Scrutiny reveals DuPont's approach to be simplistic and infeasible. DuPont's superficial and unexamined approach is fundamentally unsound and unworkable: it omits and

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[296] In previous rate cases, DuPont's engineering witness has attempted to justify removing movable bridges based on a simplistic and erroneous rationale that if a movable span is not operated very frequently, it must not be necessary. This rationalization is gravely mistaken, as discussed below in the movable bridges section.

[297] The High Bridge, discussed *supra*, is an example of a structure requiring larger clearances than DRR's standard spans and piers.

[298] NS Reply WP "Bridge Construction Cost_NS Reply.xlsx," Tab "All Bridges Complete Inventory."

glosses over fundamental physical requirements, fails to account for numerous essential elements of bridge engineering and design, and does not present a complete, integrated, workable bridge design plan. Below, NS discusses the fundamental flaws in the design and implementation of DuPont's bridge plan. NS also describes the changes and adjustments it has made in this Reply Evidence to correct the flaws, errors, and omissions in DuPont's case-in-chief regarding bridge design and corresponding costs.

i. Cost Overview

NS accepts the base unit prices used for bridge components on the DRR system, with the exception of movable bridges. "Base" unit cost refers to region-specific unit cost values that DuPont obtained from specified sources. It is important to note, however, that all of the unit costs proffered by DuPont were gathered from small and limited geographical locations. All of the railroad bridge costs were based on bids in the State of Tennessee. Similarly, all of the overhead bridge costs were based upon a few highway projects in the State of Florida. DuPont presents no argument or evidence that the localized costs it used are representative of the costs the DRR would have to pay to construct a SARR spanning 20 different States and numerous regions and conditions within those States. On reply, NS adjusted the base unit costs by applying a Location Factor per R.S. Means based on the location of each bridge in question.[299]

DuPont's bridge component unit costs are substantially lower than specific costs that would be obtained from any one contractor's integrated bid. This is because DuPont cherry-picks the lowest cost available for each bridge component from a number of bids and other sources. DuPont assumes that each of these component "least costs" will be available in aggregate to the DRR. This is an unrealistic assumption that produces an understatement of unit

[299] NS Reply WP "Location Factors.pdf."

costs of constructing the DRR bridges. Bridge contractors frequently offer lower prices on some components of a job while making up for such "loss leaders" by charging higher prices for other components. Construction bids are offered as an integrated package, not as an ala carte menu from which the buyer may select individual components. It is one thing to allow a Complainant to select the lowest overall project bid it can find and use all of the component unit costs from that bid. It is an entirely different—and wholly unrealistic—matter for a Complainant to assume it could cherry-pick the lowest individual line items from different contractors' integrated bids for every individual component of SARR bridge construction projects. No real world contractor would agree to such an approach.

Solely because the Board has accepted Complainants' cherry picking approach in past SAC proceedings, NS very reluctantly accepts DuPont's cherry picked bridge component unit prices here, adjusted for location. However, NS urges the Board to reconsider the fundamentally unrealistic and unfair nature of permitting SAC Complainants to use such an approach.

NS generally rejects the quantities used by DuPont to estimate DRR bridge costs, largely because of DuPont's abject failure to accurately take into account and address bridge heights. However, NS will discuss specific items in more detail in the sections below that address the individual bridge types. For movable bridges, NS rejects not only the unit costs, but also the cost share that DuPont assigned to each structure. NS has developed an appropriate unit cost from real cost data for movable bridges that were actually constructed. NS's development of unit cost and its reasons for correcting the cost share are explained below in the section on Movable Bridges.

DuPont's workpapers show that it substantially understated the cost of constructing the bridges on the DRR.[300] This is because, while DuPont came up with acceptable unit costs for material, it failed to develop feasible substructure designs. The lack of feasible designs, in turn, led to inaccurate estimates of quantities for DuPont's DRR bridge inventory. Additionally, DuPont failed to accurately reflect a reasonable cost to replicate special bridges, including movable bridges, bridges over major rivers and navigable waterways and exceptionally tall bridges. NS's Engineering Experts have corrected the errors in DuPont's development of DRR bridge costs and conclude properly developed DRR bridge investment to be approximately $4.1 billion as summarized in the following table.

Table III-F-22
Comparison of NS' Estimate of Bridge Costs With DuPont's Estimate of Bridge Costs

	DuPont's Opening Cost	NS Reply Cost
Bridges	$1,836,445,670	
Bridges <20 Feet		$15,656,263
Bridges w/ Only Type I Spans		$135,393,282
Bridges w/ Only Type II Spans		$67,168,398
Bridges w/ Only Type III Spans		$1,559,645,844
Bridges w/ Only Type IV Spans		$4,380,263
Special Bridgess – Movable	$91,583,599	$1,042,319,961
Special Bridges – Major Non-Movable over Navigable Waterways		$228,736,234
Special Bridges - Tall		$843,366,065
Highway Overpasses *		$12,689,920
		$4,095,265,611

*DuPont's total bridge cost shown in Table III-F-1 at DuPont Opening III-F-1 apparently does not include the cost of Highly Overpass Structures. The total in Table III-F-29 above adds the cost of these structures into DuPont's total bridge costs.

300 DuPont Opening III-F-1.

ii. Bridge Design

In order to address all of the shortcomings with DuPont's proposed bridge designs for the DRR inventory, it is useful to break the discussion into two categories: superstructure and substructure. "Superstructure" refers to the horizontal members, or spans, that actually carry the rail traffic. Superstructure includes prestressed box beams, steel deck girders, and through plate girders. The superstructure spans are supported by substructure units, which are vertical members that transmit the superstructure loads down to the ground. The substructure units primarily consist of piers and abutments.

(a) Superstructure Design (Spans)

DuPont claims that it developed standard bridge types for the DRR. Implicit in the term "bridge type" is the development of superstructure and corresponding abutments and piers designed for each of the standard bridge types. In reality, however, DuPont designed and developed costs for standard superstructure span types, uniform standard substructure piers, and a single uniform standard abutment. DuPont developed costs for each bridge by combining its uniform costs for each standard component. In other words, based on the way DuPont developed its bridge costs, bridges with spans of all lengths crossing over non-navigable waterways always have the same 11 foot high pier design and same abutments, regardless of the length of the bridge span. Because span length drives the load capacity requirements of the abutments and piers, DuPont's approach results in mismatches between bridge superstructures and substructures that would render the DRR bridges infeasible and in many instances unsafe.

To correct DuPont's use of unrealistic "one-size-fits-all" bridge designs, NS separated the DRR bridge inventory into multiple categories, assigning each bridge to one of the following categories: Type I Bridge, Type II Bridge, Type III Bridge, Type IV Bridge, Bridges with

Multiple Span Types, or one of the various types of Special Bridges. This allows for substructure parameters to be matched with the type of superstructure they must support.

While NS rejects the methodology that DuPont used to assemble the bridges in the DRR inventory and how the superstructure spans are combined with the substructure units, it accepts the superstructure span designs proposed by DuPont for all of the Type I, Type II, Type III, and Type IV spans. Specifically, the precast double void box beam shown in DuPont's opening workpaper "Type 1_Photos and Plans.pdf" could carry the standard 286,000 pound car loads for the span lengths covered by the Type I span. Similarly, the steel deck girder span shown in DuPont's opening workpaper "Type II_Photos and Plans.pdf" adequately could carry the standard 286,000 pound car loads for the span lengths covered by the Type II span, the prestressed concrete I-beam span shown in DuPont's opening workpaper "Type III_Photos and Plans.pdf" could carry the standard 286,000 pound car loads for the span lengths covered by the Type III span and the steel through plate girder shown in DuPont's opening workpaper "Type IV_Plans and Photos.pdf" could carry the standard 286,000 pound car loads for the span lengths covered by the Type IV span.

NS does not take exception to an approach that matches individual span types with different standard substructure units within individual bridges. This sort of cafeteria approach is reasonable if it is executed properly. Proper execution of such an approach, however, is complicated and requires that each of the standard substructure units (piers and abutments) have the load capacity necessary to support the various superstructure span types that might be paired with them. Further, each of the superstructure span types must fit geometrically onto each substructure that might possibly be utilized to support them. DuPont fails to satisfy these essential requirements. Consider, for example, Bridge 219.40 on the Piedmont Division.[301] DuPont proposed to use its standard Type III span superstructure[302] in conjunction with its standard 11-Foot tall pier substructure.[303] The pier cap dimensions for the standard 11-Foot tall pier proposed by DuPont for the DRR are 12' wide x 3' deep. However, the Typical Section for a Type III span shown in DuPont's workpapers[304] clearly shows that a Type III girder would not fit on a pier cap that is only 12 feet wide. The footprint of the beams takes up a width of exactly 16 feet.

All structural design codes require maintenance of a minimum edge distance, such that the top surface of the pier cap or abutment is larger than the actual footprint of the beams they are supporting. For example, to meet AREMA guidelines, the edge of the concrete must be at least 6 inches away from the edge of the bearing supporting a superstructure beam.[305] Following AREMA's guidelines, the pier cap would have to be a minimum of 17 feet wide. Additionally, the anchor bolts that are positioned on the outside of the two exterior beams will be outside the limits of the standard 11-foot pier cap.

In addition to its failure to match superstructure and substructure components, DuPont's bridge designs omit spans used over major waterways and navigable waterways that would meet USCG horizontal and vertical clearance requirements. Consider, for example, Bridge 249.00

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[301] DuPont Opening Errata WP "Bridge Construction Costs Errata.xls," Tab "Only Active Bridges," Lines 20-30.

[302] DuPont Opening Errata WP "Bridge Construction Costs Errata.xls," Tab "Only Active Bridges," Cells Z20-Z23.

[303] DuPont Opening Errata WP "Bridge Construction Costs Errata.xls," Tab "Only Active Bridges," Cells U20-U-23.

[304] DuPont Opening WP "Type III_Photos and Plans.pdf" at 15.

[305] NS Reply WP "AREMA Bearing Edge Distance.pdf."

over the Tenn-Tom Waterway on the Alabama Division. The United States Coast Guard requires a horizontal clearance of 300 feet in this location.[306] NS's bridge data shows that this bridge contains a 480-foot long through truss over the waterway, which meets the USCG horizontal clearance requirement. However, DuPont proposes to replace this superstructure with Type III spans where the maximum horizontal clearance would then be only approximately 90 feet, which obviously fails to satisfy the United States Coast Guard's horizontal clearance requirement.[307]

Generally, DuPont's engineers assumed that some combination of its standard spans could be assembled into a bridge that could be used to cross regulated waterways. As the foregoing example demonstrates, however, that assumption is invalid. To correct these deficiencies, NS's Reply estimates quantities for long span trusses that could be used over these navigable waterways, designs rest piers sufficient to support the long span trusses, and then assigns costs for these quantities based on the unit prices proposed by DuPont. Specific details of NS's approach are discussed in the section covering special bridges. *See infra* III-F-5-b-viii.

(b) Substructure Design (Piers and Abutments)

DuPont's substructure designs and details are infeasible in the manner that DuPont has attempted to apply them to the entire DRR bridge inventory. DuPont's approach has two fatal flaws: one is that the standard pier details do not properly account for bridge height; and the second is that the standard pier details proposed by DuPont do not account for differing span lengths. The root cause of these fundamental errors is DuPont's failure to perform any engineering calculations.

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[306] NS Reply WP "USCG_Clearance_Guide_Excerpt_Tenn-Tom Waterway.pdf."

[307] *See id.*

The two core problems with DuPont's standard pier designs mentioned above each have a profound impact on the costing of the bridges in the DRR inventory. As DuPont itself asserts, bridge height is an essential feature of bridge design, and it has a large effect on the cost of bridges. *See* DuPont Opening III-F-34. Essentially, the taller a pier structure is, the less weight it can support. Consider an example. Suppose a 2X4 piece of lumber that is two feet long standing on-end as a column can support a weight of 400 pounds before it fails or buckles. A 2X4 piece of lumber that is 10 feet long standing on end cannot support that same 400-pound weight unless it is heavily braced. If the same 400 pounds needs to be supported at a height of 10 feet, it makes more sense to use larger dimension lumber. Even large dimension lumber may still require bracing. The load capacity of a given post or pier at a particular height cannot be known until the engineering analysis is performed. The foregoing principles of physics and engineering mean that NS cannot correct DuPont's pier design errors by merely using the standard pier details posited by DuPont and "stretching" them to account for the correct bridge height. Rather, the pier dimensions and capacity needed for taller bridge heights must be analyzed and re-calculated. NS's bridge engineering experts undertook this analysis and recalculation, as discussed in more detail below.

The second fundamental problem with DuPont's standard pier designs -- their failure to account for differing span lengths -- also boils down to load capacity. For example, a Type I span that is 32 feet long will require much less substructure support than a Type IV span that is 150 feet long. The shorter span has less dead load, or self weight: there are only 32 feet of beam, track, ties, and ballast, as opposed to 150 feet of beam, track, ties, and ballast for the Type IV span. Additionally, the shorter span is required to support only 32 feet of a train's length, rather than 150 feet, so there is much less live load that needs to be supported for the shorter span. But DuPont did not account for span length in defining the standard piers, so the 32-foot Type I span and the 150-foot Type IV span both utilize the same standard pier in DuPont's bridge cost spreadsheet. The standard pier and abutment that DuPont used for the both types of spans is far more suitable to support a Type I span than it is a Type IV span.

NS has evaluated DuPont's standard pier details as DuPont proposed to apply them in the DRR inventory. Based on that evaluation, NS will accept the 11-foot, 14.5-foot and 16.5 foot standard piers to the extent that they can be used on structures with only Type I or Type II spans. The standard pier designs can support the loads imposed by Type I and Type II superstructure spans up to the heights specified.

However, NS had to design additional piers to be used with Type I and Type II spans for the heights exceeding 16.5 feet to address column buckling and slenderness effects discussed above, as well as pile loads. As DuPont pointed out, and NS's analysis confirmed, the taller piers require more stability and more material than a shorter pier to support the same weight. *See* NS Reply WP "NS Type II Bridge.pdf." Also, NS had to design entirely new piers to be used with Type III and Type IV spans for the entire range of pier heights: NS's bridge experts' analysis concluded that DuPont's standard pier details are not adequate to support the larger dead loads and live loads imposed by the longer Type III and Type IV superstructure spans for any bridge height. *See* NS Reply WP "NS Type III Bridge.pdf."

For this Reply, NS has designed piers in a range of heights between 11 feet and 65 feet to be used with each of the Types I through IV superstructure spans. This means that in NS's Reply Evidence, a 20-foot tall pier that supports a Type I span will be unique to the loads imposed by a Type I span, and necessarily different from a 20-foot tall pier that supports a Type III span. The bottom line is that DuPont did not develop pier details that were specific to the length of the superstructure span they would be required to support, and also failed to account accurately for the true heights of the bridges. To remedy this deficiency, NS produced a matrix of pier designs that can be assigned to each bridge in the inventory based both on the actual length of the superstructure span they are supporting and the true height of the bridge.[308]

For DRR bridge abutments, DuPont developed a cost for a single standard abutment and assumed the design would be applicable to all DRR bridges including special bridges with movable spans. But DuPont is also clearly proposing to replicate bridges with a variety of types of spans. And as discussed above regarding span lengths, an abutment that is suitable to support the load of a Type I span is not necessarily suitable to support the load of a Type III span due to the differences in length. Therefore, NS rejects this one-size-fits-all approach and instead designed and developed costs for abutments tailored to the specific superstructure characteristics of each DRR bridge category.

iii. Type I Bridges

Type I bridges proposed by DuPont for the DRR are described in its Opening Evidence as being made up of Type I spans ranging from 20 feet to 32 feet in length. NS accepts this designation.

DuPont's Opening Evidence proposes the use of *six* HP14x73 piles as the foundation for the Type I bridge abutment.[309] DuPont's bridge cost spreadsheet, however, clearly uses a standard *CSXT* stub abutment, which utilizes only *four* piles rather than six, as a basis for its abutment cost.[310]. Because the standard CSXT stub abutment with its four piles would be

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[308] *See* NS Reply WPs "NS Type I Bridge.pdf," NS Type II Bridge,pdf," "NS Type III Bridge.pdf," and "NS Type IV Bridge.pdf."

[309] DuPont Opening III-F-36.

[310] DuPont Opening WP "CSXT Standard Stub Abutment.pdf" at 6.

adequate to support Type I spans on the DRR, NS corrected this quantity for abutment piles to be used with Type I bridges on the DRR.[311]

For Type I piers, NS determined that the 11-foot, 14.5-foot and 16.5-foot standard pier details furnished by DuPont in its opening workpapers are adequate for supporting superstructure for the DRR Type I spans up to the specified heights. However, approximately a third of the Type I bridges on the DRR have pier heights exceeding 16.5 feet, as demonstrated by the average pier height and mean pier height calculations in NS's workpapers.[312] To remedy DuPont's failure to properly account for these structures taller than 16.5 feet, NS had to design piers in a range of heights greater than 16.5 feet to address the various pier heights exhibited by Type I bridges. Although DuPont designed piers at heights of 54 feet, 64 feet and 94 feet, it would not be reasonable to assign the quantities and cost of these much larger piers for bridges that in some cases exceed the 16.5-foot pier height ceiling by only a few feet.

Based on bridge height data for the bridges NS classified as Type I, it developed and designed new piers for bridge heights of 20 feet, 25 feet, 35 feet, 45 feet, 55 feet and 65 feet.[313] Each Type I bridge was assigned pier costs for the standard Type I pier height (in the range developed by NS's bridge engineering experts) that was closest to the actual height of the bridge. For example, a Type I bridge with pier height of 37 feet would be assigned pier costs for a 35-foot standard Type I pier, because 37 feet is less than the point halfway between the two NS proposed standard pier heights on either side of the pier height in question, 35 feet and 45 feet.

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[311] *See* NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Abutment Piles," Cell F6.

[312] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Bridges – Type I Spans Only," Cells R1403-S1406.

[313] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Bridges – Type I Spans Only," Cells P1408-S1427.

Similarly, a Type I bridge with pier height of 42 feet would be assigned pier costs for a 45-foot standard Type I pier, because 42 feet is greater than the halfway point between the NS proposed 35-foot and 45-foot standard pier heights.

To develop the new NS Type I standard pier design, NS's bridge engineering experts began with details substantially similar to those proposed by DuPont for its standard piers, with the only difference being the height of the pier. NS retained the cap dimensions, footing dimensions, pile size, and pile quantities proposed by DuPont for the new pier designs unless physical requirements or other analysis dictated a change. NS's more detailed approach ensures that the various pier heights are designed based on real design loads that are consistent with the proportions and parameters of the bridges in question. The breakdown of heights ranging from 20 feet to 65 feet creates a reasonable spread in pier heights to ensure that the pier quantities are not overstated for any given pier height. NS's pier designs and quantities can be found in its workpapers.[314]

Even though DuPont's pier details for the 11-foot, 14.5-foot, and 16.5-foot standard piers are acceptable for use with Type I spans from a design strength standpoint, the concrete quantities for these standard piers required correction. DuPont proposed pier dimensions for which the pier height exactly matches the required vertical clearance. This assumption would require the bottom of the pier footing to be resting directly on top of the ground. In practice, these footings must be buried, such that the top of the footing is at least two feet below the ground line. The assumption by NS of two feet of cover over the top of the pier footing is quite conservative. Standard design codes and design guideline resources require pier footings to be covered, with the cover ranging between 5-10 feet, depending on soil properties in the specific

[314] *See* NS Reply WP "NS Type I Bridge.pdf."

geographic location *See* NS Reply WP "AREMA Frost Penetration.pdf." NS chose to use a very conservative value so that it could be applied to every Type 1 bridge, and to avoid the need to assign a specific pier footing depth and corresponding concrete quantities for every bridge in the inventory based on regions. NS also assumed footings two feet below the ground line for its pier designed for supplemental heights. The result of this conservative approach is that NS's Reply concrete quantities understate the actual concrete quantities that would be needed to construct piers for Type I bridges on the DRR.

iv. Type II Bridges

NS largely accepts DuPont's Type II bridge design and designations. DuPont describes the Type II bridges it proposes as consisting of Type II spans ranging from 32 feet to 45 feet in length. NS accepts this designation. NS's abutment design for Type II bridges will be the same as the abutments for Type I bridges so the modifications to the abutment design discussed for the Type I bridge above also apply to Type II bridge abutments.

All of the DRR bridges designated as Type II bridges by DuPont are single span bridges. In accepting DuPont's Type II bridge designations, NS did not change the DRR bridges assigned to the Type II category, so the NS reply Type II bridges are also single span. Because single span bridges require only abutments and no piers, NS has not designed bridge piers of varying heights for Type II bridges.

v. Type III Bridges

Type III bridges proposed by DuPont for the DRR are described in its Opening Evidence as consisting of Type III spans ranging from 60 feet to 92.5 feet in length. NS accepts this designation.

NS developed Type III standard piers for the same range of heights as exhibited for Type I spans: 11 feet, 14.5 feet, 16.5 feet, 20 feet, 25 feet, 35 feet, 45 feet, 55 feet, and 65 feet. But each of these standard Type III piers, while exhibiting the same height as the standard Type I piers, have different details and quantities. These details and quantities are specifically tied to the design loads for a Type III span that ranges from 60 feet to 92.5 feet in length, rather than the 32-foot maximum span length of a Type I span. In other words, the standard Type III pier that is 35 feet tall must have substantially more load capacity than the standard Type I pier of the same height, due to the length of superstructure span and resulting design loads that each is required to support.

DuPont furnished conflicting information regarding abutments for Type III bridges on the DRR. DuPont's Opening Evidence suggests the use of six HP14x73 piles as the foundation for the Type III bridge abutment. *See* DuPont Opening III-F-37. DuPont's bridge cost spreadsheet, however, clearly uses the standard CSXT stub abutment as a basis for its cost.[315] As previously noted, there is a discrepancy between the cost calculations in the spreadsheet using the standard CSXT abutment, which uses only four piles as compared to the description of a six pile abutment DuPont claims to have used. *See* DuPont Opening III-F-37. But in the case of Type III bridges, there is a larger and even more significant error: the standard CSXT stub abutment is not adequate to withstand the loading imposed by a DRR Type III span, regardless of whether it is used with four piles or six piles.[316] Spans with lengths up to 92.5 feet require more support than can be provided by the standard CSXT stub abutment. The typical Type III bridge details that DuPont furnished actually support NS's Bridge Engineering Experts' determination that the standard CSXT stub abutment is inadequate for the Type III span loads. The bridge that DuPont

[315] DuPont Opening WP "Bridge Construction Costs Errata.xls," Tab "Abut Concrete – Piling," Cell C5. DuPont's narrative evidence does not disclose its use of CSXT bridge data and specifications, let alone why it used that data or how it is appropriate for DRR bridges.

[316] NS Reply WP "NS Type III Bridge.pdf."

used to exemplify its Type III bridge category for the DRR, a bridge that was actually designed and constructed, uses a significantly more substantial abutment.[317]

Because the standard CSXT stub abutment is inadequate to carry DRR Type III spans, and DuPont's narrative did not fully describe Type III abutment attributes, NS evaluated the adequacy of the abutment details for a bridge that DuPont used as to exemplify Type III bridge abutments. *See* DuPont Opening III-F-37, nn.99-100; NS Reply workpaper "NS Type III Bridge.pdf." NS's bridge experts' analysis in this workpaper showed that the HP12x53 piles represented in DuPont's example plans were overstressed when supporting a Type III span.. NS retained the pile layout and number of piles represented in DuPont's illustrative Type III abutment details, but determined that larger HP14x73 piles would be required to carry the loads resulting from a Type III span.

The difference between the HP12x53 and the larger HP12x73 piles is in the depth of the pile cross section, and the weight per foot of the pile. The HP12x53 section is nominally 12 inches deep and weighs 53 pounds per foot with a cross sectional area of 15.5 in^2. The HP14x73 section is nominally 14 inches deep and weighs 73 pounds per foot with a cross sectional area of 21.4 in^2. The HP14x73 pile has 38% more steel area to carry the loads imposed upon it than does the HP12x53 pile. In design and analysis, pile sizes are determined by limitations on pile stress imposed by design codes. For instance, AREMA guidelines prescribe a maximum basic allowable stress of 27,500 pounds per square inch (psi) for compression members. That allowable stress translates to a maximum load for the piles discussed above as follows:

HP12x53: 15.5 square inches x 27,500 psi = 426,250 pounds

HP14x73: 21.4 square inches x 27,500 psi = 588,500 pounds

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[317] *See* DuPont Opening WP "Type III_Photos and Plans.pdf" at 16-17.

NS adjusted the quantities of concrete,[318] steel piling,[319] and pile tips[320] for Type III abutments on the DRR based on NS's own Type III abutment calculations.[321] NS revised the costs for Type III bridges on the DRR using these new abutment quantities and the same unit costs proposed by DuPont. Updated quantities and abutment costs are shown in NS's workpapers.[322]

Abutment design is not the only shortcoming with the Type III bridge details proposed by DuPont for the DRR. Type III piers proposed by DuPont are also insufficient, for the same reasons discussed in the previous sections: pier parameters were not tailored to Type III spans, and DuPont did not account for the bridge heights properly. In order to correct these problems, NS designed an array of Type III piers. These Type III piers were designed for the same range of pier heights discussed in the section on Type I bridges: 11 feet, 14.5 feet, 16.5 feet, 20 feet, 25 feet, 35 feet, 45-feet, 55 feet, and 65 feet. However, NS specifically designed these Type III piers for the design loads imposed on the piers by the Type III spans. The bridges in the DRR inventory that NS delineated as Type III bridges on reply were evaluated in the same manner as described for the Type I bridges in order to design these standard Type III piers. The number of spans used in the analysis of the standard Type III pier design of each of the respective heights was determined by averaging the number of spans found on Type III bridges in the height range

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[318] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Abut. Concrete – Piling."

[319] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Abutment Piles," Column G.

[320] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Abut. Pile Tips," Column G.

[321] NS Reply WP "NS Type III Bridge.pdf."

[322] *See* NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Combined Bridge Component Costs," Cells B72-E78.

in question.[323] NS then assigned to each Type III bridge costs for standard piers of the appropriate height based on the bridge height data NS produced in discovery. NS used the same method that it used with Type I bridges to determine the standard Type III bridge height it assigned to each Type III bridge.

The foregoing adjustments made by NS's bridge experts ensure that the revised standard Type III piers it uses in this Reply are designed to handle real design loads imposed by Type III superstructure spans. Additionally, use of a range of heights for standard Type III piers ensures that quantities, and therefore costs, are not overstated for any of the standard Type III piers. NS adjusted the quantities of concrete,[324] steel piling,[325] and pile tips[326] for Type III Bridge piers on the DRR, based on its adjusted designs of standard Type III piers.[327] The costs for Type III bridges on the DRR were updated using these new pier quantities, and the same unit costs proposed by DuPont. Updated quantities and pier costs are shown in NS's workpapers.[328]

vi. Type IV Bridges

After sorting through the DRR inventory proposed by DuPont and pulling out the bridges that NS classified as Type I, Type II, or Type III, as discussed above, there is a relatively small

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[323] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Bridges – Type III Spans Only," Cells R2888-R2906.

[324] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Pier Concrete Quantifies," Cells N7-R134.

[325] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Combined Bridge Component Costs," Cells N95, N103, N111, N119, N127, N135, N143, N151 and N159.

[326] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Combined Bridge Component Costs," Cells N96-N104, N112, N120, N128, N136, N144, N152 and N160.

[327] NS Reply WP "NS Type III Bridge.pdf."

[328] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Combined Bridge Component Costs," Cells L90-O162.

collection of bridges remaining. All but one of those remaining bridges is either a multiple span-type bridge or a special bridge, which are discussed in the later sections. There remains only one bridge that DuPont proposed to replicate solely with Type IV spans in the DRR inventory, bridge CJ208.52 on the Lake Division. Below, NS analyzes this single structure based on the details proposed by DuPont for Type IV bridges.[329]

The abutment issues for this Type IV bridge are similar to the issues discussed for Type III bridges. Similar to the approach taken for Type III abutments, NS adjusted the quantities of concrete,[330] steel piling,[331] and pile tips[332] for Type IV abutments based on NS's Type IV abutment calculations.[333] The costs for the Type IV bridge on the DRR were updated per these new abutment quantities, and the unit costs proposed by DuPont. Updated quantities and abutment costs are shown in NS's workpapers.[334]

Here too, DuPont's standard pier details were found to be insufficient to withstand the design loads of the Type IV bridge on the DRR. The single bridge remaining on the DRR that's

[329] DuPont Opening WP "Type IV_Plans and Photos.pdf."

[330] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Pier Concrete Quantities," Cells T122-X1341.

[331] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Combined Bridge Component Cost," Cell S159.

[332] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Combined Bridge Component Cost," Cell N160.

[333] NS Reply WP "NS Type IV Bridge.pdf."

[334] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Combined Bridge Component Cost," Cell Q156-T162.

categorized as a Type IV bridge is a 665-foot long structure[335] The required pier properties based on this analysis are shown in NS's work papers.[336]

vii. Bridges with Multiple Span Types

As discussed above, NS segregated the bridges in the DRR inventory such that all bridges DuPont proposed to replicate with a single superstructure span type were grouped together. This was done so that the substructure elements (abutments and piers) could be accurately evaluated with respect to the type of superstructure span that would be placed upon them and the resulting load that they would be supporting. Additionally, there are extraordinary bridge structures that NS has addressed separately as "special bridges." In addition to the single-superstructure span type and special bridges, there still remained a collection of bridges that DuPont proposed to replicate with more than one superstructure span type. These multiple-span-type bridges are shown in the NS Reply bridge costs spreadsheet in a separate tab.[337]

In order to address the complexities attributable to multiple span type bridges, NS evaluated each bridge individually. NS determined the appropriate number and type of abutments and piers by looking at the specific span composition proposed by DuPont for each bridge in question. For example, consider Bridge 233.00 on the Piedmont Division. DuPont proposed to replicate this bridge with one Type I span and one Type III span, supported by their standard abutment at each end of the bridge with a standard 11-foot tall pier between the two

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[335] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Bridges – Type IV Spans Only."

[336] NS Reply WP "NS Type IV Bridge.pdf."

[337] *See* NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Multiple Span Type Bridges."

spans.[338] On reply, NS assigned a Type I abutment to support the end of the Type I span and a Type III abutment to support the end of the Type III span.[339] The single pier between the two spans was designated as a Type I pier, which is the smaller of the two adjoining spans that rest upon it. Alternatively, a Type III pier could have been designated, but this would have resulted in an overstatement of the cost required for a pier to support the Type I span. So the smaller of the two possible pier selections was designated to be conservative with the construction cost. The Type I pier height was designated based on the "Max Bridge Height" data, which came from NS's discovery material.[340] For this bridge, NS used the 35-foot Type I pier because the 38-foot actual bridge height falls between the standard 35-foot and 45-foot pier heights, but is closer to the 35-foot value.

Evaluating each of these multiple span type bridges individually ensured that the superstructure design and costs are in line with their substructure design and costs.[341]

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[338] DuPont Opening Errata WP "Bridge Construction Costs Errata.xlsx," Tab "Only Active Bridges," Line 29.

[339] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Multiple Span Type Bridges," Line 21.

[340] NS Reply WP "Norfolk Southern Bridge List.xls," Tab "Active Bridge List," Cell L213.

[341] Note that in the NS spreadsheet tab dedicated to multiple span type bridges there are numerous locations where there are two lines of data representing two separate bridges for a given mile post location, presumably side-by-side in double track territory. *See* NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Multiple Span Type Bridge." DuPont sometimes elected to replicate one of these bridges all with the same type of superstructure span, but then used a different type of superstructure span for the other bridge at the same location. Consider Bridge 0.33 on the Pittsburgh Division. There are two bridges noted at this location. DuPont proposed to replicate one of them entirely with Type IV spans and replicate the other entirely with Type III spans. These bridges could have been separate such that one of them was included in the Type III bridge tab and the other in the Type IV bridge tab. However, NS elected to keep multiple bridges at a specific mile post location together on the same tab. As such, they are shown on the multiple span type tab, even though all of the spans within each of the bridges are the same type.

viii. Special Bridges

There are a number of bridges that must be replicated for the DRR that do not fit into the criteria that define any of the four standard bridge types. These bridges have been classified by NS as "Special Bridges," and include three primary subgroups: Movable Bridges, Exceptionally Tall Bridges, and Non-Movable Bridges over Navigable Waterways. DuPont's attempt to replicate these complex structures on the DRR with standard bridges was wholly inadequate. Below, NS addresses why DuPont's proposed standard bridge components are inadequate for these special bridges, detailing how the costs were corrected for each subgroup.

(a) Movable Bridges

DuPont's attempt to replicate the movable structures on the DRR is riddled with flaws and errors. Correcting DuPont's failed attempt requires a great deal of explanation and clarification, in part because its narrative evidence was conspicuously silent regarding movable bridges. Given the import of moveable bridges, their impact on total bridge costs, and DuPont's failure of proof with respect to those structures, NS will detail DuPont's apparent costing approach.

<u>First</u>, the list of movable structures proposed by DuPont for the DRR was inaccurate. There were movable bridges that DuPont included as part of the general bridge inventory rather than in its calculation of movable bridge costs. Also NS does not own two of the movable bridges included in the DRR movable bridge inventory. NS has corrected these errors in its Reply Evidence.

<u>Second</u>, the unit costs for movable bridges proposed by DuPont are unsupported and understated. DuPont did not provide any data or documentation to back up the unit costs it proposed for the movable bridges on the DRR. Instead, its workpapers obliquely referenced a rebuttal narrative, sponsored by its engineering witness Harvey Crouch *in a different rate*

case.[342] DuPont's approach does not come close to meeting the Board's standard for providing supporting work papers and documentation, and DuPont is precluded from attempting to cure this inadequacy in its case-in-chief in its rebuttal submission. *See SAC Procedures*, 5 S.T.B. at 445-46; *Xcel*, STB Docket No. 42057, at 2 (served Apr. 4, 2003). DuPont's wholly inadequate movable bridges presentation required NS to develop its own movable bridge cost evidence.

NS's approach renders moot DuPont's machinations from its referenced rebuttal narrative attempting to reduce movable bridge costs to reflect costs it contends the DRR would not incur. First, modern movable bridges are typically built off-site and floated into position on barges.[343] The primary reason for doing this is that the United States Coast Guard requires that the navigation channel remain clear and unobstructed throughout construction of the bridge. This would be true whether the bridge was being built as new or being replaced. Because the off-site movable span erection is so common, the preponderance of modern movable bridge spans construction is performed both in the absence of rail traffic and in an area that is much easier to work in than the physical bridge location itself. The reason for this is that the construction staging areas and "lay-down areas" are specially selected for convenience, ready access, and ease of construction. Importantly, they are on land, rather than over water. This modern construction approach eliminates the need to reduce the actual real-world observed construction costs by some unsubstantiated factor to address the notion of cost savings associated with building bridges in the absence of rail traffic, because the portion of the cost attributed to the movable span already accounts for the bridge being built in the absence of rail traffic.

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[342] DuPont Opening WP "Moveable Span Cost.pdf."

[343] NS Reply WP "AMTRAK Niantic River Bridge.pdf," "BNSF Burlington Bridge Cost.pdf," and "Vertical Lift Bridge Value Engineering Report.pdf."

The other reduction factor DuPont employed in the prior case it referenced is intended to ensure that its construction costs account for only the portion of cost attributable to the movable span, and not to the replacement of existing spans and structures. NS negates that concern through careful analysis of the data and careful calculation of reply unit costs. In the development of the movable bridge unit costs, NS excluded all of the line items devoted to demolition, removal of old structure, modification of existing structure, and similar tasks from the real world movable bridge construction project used for unit costs, so such costs are not used to calculate NS's Reply movable bridge unit costs. Therefore, the unit cost for movable spans proposed by NS on reply is derived only from costs that are associated with the movable span. The costs that NS proposes for the fixed approach spans on Reply are based on calculations that were specifically developed for the fixed approach spans, irrespective of the movable spans.

NS's Reply movable bridge unit costs are based on construction of a real movable bridge. For the vertical lift bridges, data was taken from vertical lift movable bridge costs detailed in a Value Engineering report,[344] published by a reputable movable bridge engineering firm, and publicly available on the consultant's website.[345] The data used to generate the unit cost for vertical lift bridges is unassailable, because it breaks down the bids into categories where the movable bridge line items can be delineated from the non-movable bridge line items. Further, because the data is furnished as part of Value Engineering study, the VE firm revised several unit costs and quantities to a lower value than what the contractors bid on in an effort to reduce the overall project cost. For these line items, NS used the Value Engineering data, so it is truly the

[344] NS Reply WP "Vertical Lift Bridge Value Engineering Report.pdf."

[345] www.hntb.com (visited June 13, 2012).

lowest conceivable cost for a vertical lift movable bridge span. All of this data can be found in NS's workpapers in the form of both the original VE report and as used by NS.[346]

For bascule span unit costs, NS accepts the unit cost proffered by DuPont before it applied the reduction for an assumed 10% cost share.[347] The reason that the 10% cost share is erroneous is discussed below.

However, before proceeding to the topic of cost share, it is important to debunk an erroneous claim that has been raised by complainants in prior rate cases. Some complainants have sought to dismiss movable bridge cost data in prior rate cases based on the irrelevant claim that the bridge in question was funded in whole or in part by some source other than the bridge owner. This is a non-sequitur and a red herring: the unit *costs* of building a movable bridge are in no way related to *who pays* for the project. Concrete and steel cost the same regardless of who is paying for them. The issues of (i) movable bridge unit costs; and (ii) the percentage of the total cost of that movable bridge paid by the owner are two entirely different and analytically distinct issues that should be addressed separately. NS has identified and developed unit costs that do not depend on who funded the projects. A 10% cost share assumption is indefensible, regardless of who funds the bridges in question.

NS takes exception to DuPont's 10% railroad cost share that DuPont implicitly assumed for all movable bridges on the DRR. Conspicuously, DuPont's evidence made no attempt whatsoever to justify or support its approach of attributing only 10% of the movable bridge cost to the DRR. Instead, without any explanation whatsoever, DuPont's movable bridge cost

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[346] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Vert. Lift Movable Unit Cost."

[347] DuPont Opening Errata WP "Bridge Construction Costs Errata.xlsx," Tab "Special Bridges," Cells C9-F9.

calculations apply a 10% factor to estimate the proportion of the total movable bridge cost that it posits the DRR would pay. *See* DuPont Opening WP "Bridge Construction Costs Errata.xls," Tab "Special Bridges," Cell E9.

A possible rationale for DuPont's assumption that the DRR would pay only 10% of the cost of movable bridges over navigable waterways might be gleaned indirectly from its "documentation" of movable bridge costs, evidence submitted in a prior rate cases that stated *"However, to be conservative, and consistent with the approach used for overhead bridges, SECI has included 10 percent of the cost of building the movable structure . . ."* SECI Rebuttal, *Seminole*, STB Docket No. 42110, at III-F-105 (April 15, 2010). The notion, proffered in a prior rate case, that was settled before a Board decision, that a *highway* overpass structure is even remotely analogous to a movable bridge over a navigable waterway is fantastic and utterly unsupportable.

Moreover, mere citation of the rationale of a prior complainant's rebuttal argument, without more, falls far short of meeting DuPont's burden of proving the DRR would pay only 10% of the cost of movable bridges. DuPont fails to offer any argument or support to show its 10% figure is reasonable or justified; how a factor developed for overhead *highway* bridges built over an existing rail line (even if it were valid for such structures) would somehow apply to movable spans over navigable waterways; or why an estimate developed for a prior case should apply in this case, which involves a different railroad, different structures, and a much different SARR network. Because DuPont failed to even *attempt* to justify, explain, or support its 10% cost share approach for movable bridges on the DRR in its Opening Evidence, its proposal should be rejected for failure to meet—or even attempt to meet—complainant's burden of proof. This is the sort of failure of proof in the complainant's case-in-chief that may not be "remedied" by a new argument or rationale offered for the first time on rebuttal. Although DuPont may not attempt to "remedy" this failure of proof in its rebuttal presentation,[348] below NS nevertheless discusses rationalizations complainants have offered to attempt to support a similar gambit in prior rate cases.

In previous cases, plaintiffs have argued that movable bridge owners may not be required to pay for the entire cost of some movable bridges because the Federal Government sometimes subsidizes the construction of movable bridges. *See, e.g.* SECI Rebuttal, *Seminole*, STB Docket No. 42110, at III-F-105 (April 15, 2010) (Complainant stated *"However, . . . movable spans are generally not paid for by the railroad when they are installed over navigable waterways . . . Indeed, the projects that CSXT used for its unit costs were all government funded."* The "government funded" bridges that Seminole's engineer referred to were bridges funded by the Truman Hobbs Act. *See* 33 U.S.C. §§ 512-516. 523. This is the only government funding mechanism currently in place for the sole purpose of aiding bridge owners with the replacement of movable structures. The notion that movable bridge spans are generally funded by the federal government, however, is belied by Coast Guard data reporting that, from the inception of the Truman Hobbs Act in 1940 until July 2012, Truman Hobbs Act funding has been used for only 27 bridges. *See* Department of Homeland Security Bridge Alteration program description at 3 (Coast Guard has completed 27 bridge alteration projects under TH Act), available at *http://www.fedprogramsearch.com/cfds/bridge_alteration.htm* (visited July 11, 2012). Moreover, there is no fixed percentage cost sharing specified by the Truman Hobbs Act. Instead, the Act specifies that costs should be apportioned in accordance with the benefits that accrue to the bridge owner relative to the benefits that accrue to navigation and the public. *See* 33 U.S.C.

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[348] *See SAC Procedures*, 5 S.T.B. at 445-46.

§ 516; *see also* 33 C.F.R. § 116.50 (specifying formula for determining appropriate share of costs for each Truman Hobbs Act bridge alteration). However, even if in some instances cost apportionment for a Truman Hobbs Act project resulted in assignment of a 10% cost share for *alteration* of a particular movable bridge, that cost share would be inapplicable to the initial *construction* of a SARR. A SAC analysis assumes the construction of a stand-alone railroad from scratch in an area where there is no existing railroad infrastructure in place. Truman Hobbs Act funds are authorized only for use in the *replacement* of *existing structures. See* 33 U.S.C. §§ 512-516, 523; 33 C.F.R. Part 116. This clearly eliminates the Truman Hobbs Act as a possible funding source for *new* bridges constructed on the DRR. The movable bridges constructed on the DRR would not be replacing lawfully constructed bridges that at one time satisfied the needs of navigation, but no longer satisfy those needs.[349] Nor is there any evidence that any of those bridges obtained any Truman Hobbs Act funding or any other government payment to subsidize the cost of their construction.

Absent any contrary evidence, a SAC analysis must assume that the railroad owner bore the full cost of constructing the movable bridge when the structure originally was built. That bridge is what the SARR must replicate. Because the incumbent railroad presumptively bore the full cost of constructing its movable bridges, requiring the SARR to bear 100% of the cost of a movable bridge is not a barrier to entry for the SARR, it is exactly what the original bridge owner had to pay to construct the movable span. If DuPont wished to persuade the Board to reach a different conclusion, they would have to produce evidence showing the railroad did not

[349] The Coast Guard web site summarizes the Truman Hobbs Act and program "The act provides for federal funding to alter lawfully constructed railroad or publicly owned bridges that allowed for the reasonable needs of navigation at the time of construction, but not longer do so because the character of navigation has changed. Under the T-H Act, USCG issues an Order to Alter to owners of bridges that are unreasonable obstructions to navigation" NS Reply WP "Purpose of Truman Hobbs Act.pdf."

pay 100% of the cost for its movable bridges. DuPont produced no such evidence, and therefore it is precluded from contending that the DRR would pay anything less than 100 percent of the cost of those bridges.

Although it is DuPont's burden to show that NS paid less than the full cost of movable bridges it owns, and NS is not obliged to "disprove" a wholly unexplained and unsupported assumption that the federal government (or some other unidentified source) paid for 90 percent of the cost of those bridges, NS has nonetheless conducted further inquiry to determine if any of the movable bridges at issue received federal funding. NS's bridge experts reviewed data and information for all movable bridges on the DRR system that might theoretically have been eligible for Truman Hobbs Act funding. In the first instance, because Truman Hobbs was enacted in June 1940, any movable bridge built or modified before that time could not possibly have received funding under that Act. Second, as previously explained, Truman Hobbs funds are available only for replacement or renovation of existing bridges over navigable waterways. Thus, bridges on the DRR that have not been replaced or renovated also would not have been eligible for Truman Hobbs Act funding. Based upon NS bridge experts' review of NS records, these two limitations eliminate the vast majority of the movable bridges on the DRR from eligibility for federal government funding under the Truman Hobbs Act.

NS's exhaustive search of its records found only two bridges on the DRR route that appear to have received federal funding. The first is the alteration/relocation of an existing bridge near Epes, Alabama that NS's predecessor railroad (the Alabama Great Southern Railroad Company), performed at the request of the federal government as part of the Tennessee-Tombigbee Waterway Project. NS has located a contract indicating that the federal government would pay the full cost of that alteration and relocation, estimated to be approximately

$19,700,000. *See* NS Reply WP "Epes Bridge Agreement.pdf." NS does not have record of the actual cost of the project, or how much the federal government reimbursed NS for the project. Moreover, because NS constructed the bridge in the first instance and the federal government appears simply to have paid for alteration and relocation of the bridge, the DRR would be required to pay the full cost of constructing the original bridge. The second instance of a bridge on the DRR system that received federal funding for alteration of an existing bridge crosses the Mississippi River at Hannibal, Missouri. NS records indicate that the federal government paid approximately 78% of the cost of replacement of the bridge under the Truman Hobbs Act, and NS paid the remaining 22%.[350] Again, however, this project involved the alteration of an existing bridge, not its original construction. Because NS's predecessor railroad paid to construct the bridge in the first instance, the DRR also would be required to pay the full cost of constructing the bridge over the Mississippi River at Hannibal at the time of construction of the DRR.

The preceding discussion specifically addresses the cost of the actual movable spans. However, in every case where there is a movable span on the DRR, there is also some length of fixed approach spans leading up to that movable span. The approach spans were evaluated using whichever superstructure span type that DuPont had proposed in its original bridge cost spreadsheet. In some cases it was DuPont's Type IV span, but in some cases it was DuPont's

[350] The total cost of the bridge alteration was $14,967,039. The federal government paid $11, 748,710 and NS predecessor the Norfolk & Western Railway Company paid $3,218,329, accounting for 78% and 22% respectively. Thus, even if the Board were to disagree with NS and determine that a SARR should only be required to pay the proportionate share the incumbent carrier paid for alteration of an existing bridge and not the full original construction cost, the DRR would be required to pay at least 22 percent of the replacement cost of the Hannibal bridge.

Type III span.[351] However, while DuPont's specific proposal for the superstructure types on the approach spans to movable bridges may be feasible, the piers had to be designed from scratch. The previous sections on bridge design demonstrate that DuPont's standard piers were insufficient for anything other than Type I or Type II spans and bridge heights less than 16.5 feet tall.

NS evaluated the needs for the substructure units specific to the approach spans for these movable bridges. Since there were typically a number of fixed approach spans, NS could not use the maximum bridge height data furnished in discovery to design the approach span piers. Instead, NS used that data to determine the tallest piers, which were located immediately adjacent to the movable span and navigation channel. Then, NS developed a layout where the structure height tapered back to the abutments. NS's bridge experts then evaluated the approach span piers as a range of pier heights.[352]

In the case of the movable bridges, the max bridge height in the NS bridge inventory is not the same as the maximum pier height. The maximum bridge height represents the height of the structure above land or water. This value does not include the water depth, which necessarily adds to the required pier height. When the water depth could be verified by reliable sources, NS added water depth to the maximum bridge height to arrive at the actual pier height. When the actual water depth could not be confirmed, a reasonable and conservative assumption was made. Those assumptions are shown in NS's workpapers.[353] NS's pier designs also can be found in the

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[351] DuPont Opening WP "Bridge Construction Costs Errata.xls," Tab "Special Bridges," Columns AA and AB."

[352] NS Reply WP "NS Special Bridges_Movable.pdf."

[353] NS Reply WP "NS Special Bridges_Movable.pdf."

same workpaper file. Using the quantities from these pier designs, NS adjusted the cost of the approach span piers at movable bridge locations[354] using DuPont's unit costs.

(b) Exceptionally Tall Bridges

There is another a group of structures on the DRR that cannot be replicated using DuPont's prescribed standard piers because of the height of the bridges. These structures all have exceptionally tall piers[355] which for the purposes of this discussion are heights exceeding 65 feet. The tallest standard piers that NS's Engineering Experts designed for this evidence are 65 feet tall. NS's bridge experts selected that height based on the many years of experience by NS's Engineering Experts, who have found that when pier heights approach 60 to 70 feet tall, the applicability and utility of standard design assumptions and construction methods diminishes. As bridges reach this height and beyond, they behave differently from bridges with shorter piers, which are much stiffer relative to the superstructure. The fact that they behave differently means that the engineering analysis to evaluate these structures is different from analysis of bridges with shorter, stiffer substructure units.

The exceptionally tall bridges were analyzed by assigning each bridge in this subgroup to one of seven additional pier design groups, developed by NS's bridge experts based on both span length and pier height. The pier height assigned to each structure was determined in a manner similar to that described above for the Type I and Type III bridges. NS maintained the superstructure span types proposed by DuPont for these structures, but revised the cost for the

[354] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Combined Bridge Component Costs," Cells V90 – Y162.

[355] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "All Bridges Complete Inventory," Lines 5594-5736, Column X.

substructure units based on the new substructure designs.[356] NS added another element to its costing of the piers for this subgroup of structures that is peculiar to this group of structures. Because some of these extremely tall bridges have piers that taper in height as the pier locations approach the ends of the bridge, NS applied a reduction factor to the pier cost for any bridge with three or more piers. Generically, these pier cost reduction factors can be summarized as follows:

25% of the Piers are costed at 100% of the unit cost

25% of the Piers are costed at 75% of the unit cost

25% of the Piers are costed at 50% of the unit cost

25% of the Piers are costed at 25% of the unit cost

For any of these bridges that contain only one or two piers, the full 100% of the pier unit costs were applied to the piers, for the same reason that NS's maximum bridge height data was used for the typical bridges with only 2 spans. The resulting costs for these bridges can be found in NS's workpapers.[357]

(c) Non-Movable Bridges over Navigable Waters

There is another group of structures on the DRR that reasonably could not be replicated using DuPont's prescribed standard piers and spans. Those structures are all non-movable structures over navigable waterways that currently provide horizontal clearance far in excess of what could be achieved with DuPont's standard spans. Consider, for example, Bridge A159.00 on the Central Division. This bridge provides horizontal clearance over the Tennessee River by using a 384-foot long truss.[358] DuPont has proposed to replicate this structure on the DRR with

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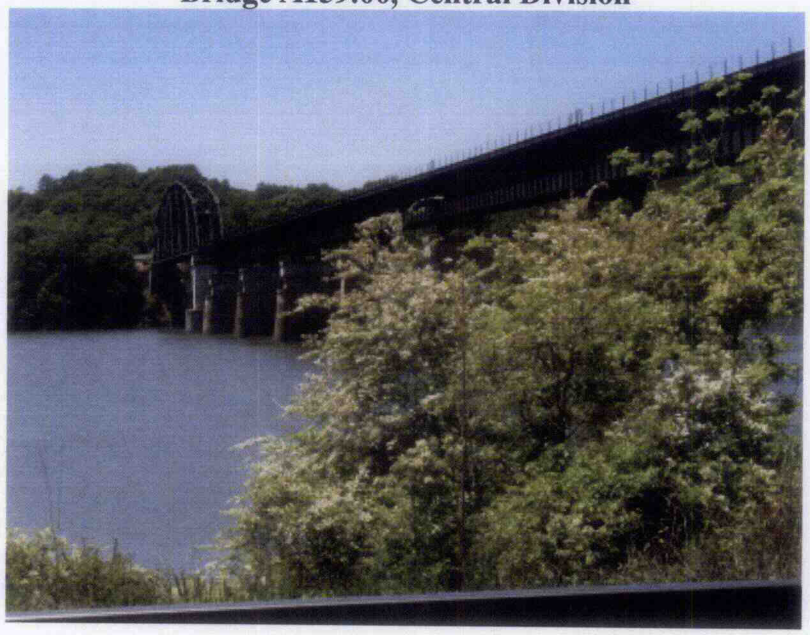
[356] NS Reply WP "NS Special Bridges_Tall.pdf."

[357] NS Reply WP "Bridge Construction Costs.xlsx," Tab "Special Bridges – Tall."

[358] NS Reply WP "Norfolk Southern Bridge List.xls," Tab "Active Bridge List," Line 2861.

Type III spans that have a maximum span length of just 92.5 feet.[359] This proposal comes up well short of allowing for the same navigational activity on the Tennessee River as the existing bridge.

Figure III-F-7
Bridge A159.00, Central Division



Also consider Bridge W269.00 on the Central Division, pictured below. This bridge provides horizontal clearance over the Ohio River by utilizing a series of six 428-foot long trusses.[360] DuPont has proposed to replicate this structure on the DRR with both Type III spans and Type IV spans, providing a maximum span length of 150 feet.[361] This proposal comes up well short of allowing for the same navigational activity on the Ohio River as the existing bridge. The DRR must construct its bridges to provide the same functionality for serving rail and water traffic as the existing bridges.

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[359] DuPont Opening WP "Bridge Construction Costs.xls," Tab "Only Active Bridges," Line 1184.

[360] NS Reply WP "Norfolk Southern Bridge List.xls," Tab "Active Bridge List," Line 3217.

[361] DuPont Opening WP "Bridge Construction Costs.xls," Tab "Only Active Bridges," Lines 1234 and 1237.

Figure III-F-8
Bridge W269.00, Central Division

To remedy the failure to provide adequate horizontal clearance to accommodate existing water traffic, NS proposes to replicate one of the long truss spans for each of these bridges. NS assumes the remainder of the bridge length would be constructed with standard superstructure spans all the way back to the ends of the bridge. With this approach, the DRR structures will have at least one span over the navigational channel that provides the same clearance as exists today, which would preserve the existing bridges' functionality. However, the DRR would not have to replicate the existing structure exactly as it exists today, which in some cases contains multiple long span trusses over these navigable waterways.

NS's Engineering Experts developed steel quantities for the long span trusses from a straight-forward procedure of calculations that estimates the required steel weight based on span length.[362] To validate this approach as both reasonable and accurate, NS used this calculation approach to estimate the weight of steel for an existing long span truss where the steel weight was known. The results given by the estimating procedure are within 9.6% of the actual steel weight on the design plans for the example bridge.[363] This exercise demonstrates that the method NS used to estimate steel weight on these long truss spans yields accurate results.

The truss weight estimating procedure discussed above only addresses the main river span in each of these locations. The approach spans leading up to the main long truss span for each bridge were assembled and costed in the same manner described for the movable bridges above. The comprehensive list of these special bridges, their specific make-up, and all of the associated costs can be found in NS's workpapers.[364] The quantities were updated based on NS's design analysis, and the bridge costs were tabulated using DuPont's proposed unit costs, with one notable exception. Nowhere in DuPont's work papers was there a unit price for the structural steel that would be required to build these long span trusses. That being the case, NS's Engineering Experts used the lowest unit cost for "Truss Steel" found in the value engineering report referenced in the section above on movable bridges.[365] Note that the unit cost used by NS

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[362] NS Reply WP "NS Special Bridges_Non-Movable Over Navigable Waterways.pdf."

[363] NS Reply WP "NS Special Bridges_Non-Movable Over Navigable Waterways.pdf."

[364] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Special Bridges – Non Movable."

[365] NS Reply WP "Bridge Construction Costs_NS Reply.xlsx," Tab "Vert. Lift Movable Unit Cost," Cell K23.

is actually lower than the value engineering unit cost proposed by the firm that performed the study, to ensure that it is the lowest possible cost approach for constructing a truss for the DRR.

c. Highway Overpasses

NS accepts the unit costs proposed by DuPont for highway overpasses on the DRR, which are expressed as a cost per square foot of bridge deck area.[366] However, the manner in which those unit costs are applied to the highway overpasses in the inventory is not acceptable. DuPont attempted to generically assign a bridge deck area for each bridge based on a formula.[367] Applying a formula might be a reasonable approach to estimate the bridge deck areas if the actual bridge deck area data were not available. However, this generalization and formulaic approach is not necessary in this case, because the actual bridge deck areas are publicly available from Department of Transportation for the state in which the bridge is located. Not only is the artificial formula unnecessary, the formulas used by DuPont generally underestimate actual bridge deck areas reported in real-world data, so the generation of estimates using a formula is inaccurate in addition to being unnecessary. Consider that the "Average Square Footage" for 1-Span and 2-Span bridges[368] are mere fractions of the actual deck areas of the bridges DuPont used to arrive at their "Average Cost/Sq Foot" value.[369] To correct this error, NS simply applied DuPont's unit cost to the actual real-world deck area for each bridge to come up with a cost for

[366] DuPont Opening WP "Over Head Bridge Construction Costs.xls," Tab "OH Bridge Double Track Cost," Cell F17.

[367] DuPont Opening WP "Over Head Bridge Construction Costs.xls," Tab "OH Bridge Double Track Costs," Cells A2-E6.

[368] DuPont Opening WP "Over Head Bridge Construction Costs.xls," Tab "OH Bridge Double Track Costs," Cells E5-E6.

[369] DuPont Opening WP "Over Head Bridge Construction Costs.xls," Tab "OH Bridge Double Track Costs," Cells C11-C151.

each bridge. NS accepts the 10% cost share for each bridge, and thus applied a 10% factor to the cost per bridge in the final calculation.[370]

6. Signals and Communications[371]

DuPont's evidence of the cost of DRR signals and communications systems is fraught with both conceptual problems and implementation errors. DuPont's most fundamental error is its assumption that the DRR could begin operations with a Positive Train Control ("PTC") system in June 2009—even though the components to operate a PTC system have not yet been developed today, over three years after the DRR would begin operations. This plainly impossible assumption is just the beginning of DuPont's errors.

DuPont's inventory of signals equipment for the DRR is irreconcilable with its proposed DRR track configuration and undercounts the total amount of signals that the DRR would need to operate. Its calculations of signal unit costs flatly misstate the unit cost quotes included in its own workpapers and omit many necessary signal components, such as foundations, battery/charger sets, and grounding equipment. And its estimates of PTC and crossing signal costs substantially understate the total costs that the DRR would incur. Below, NS's Engineering Experts explain the errors in DuPont's signals and communications evidence and detail their estimate of the DRR's signals and communications costs. Table III-F-23 compares DuPont's

[370] NS Reply WP "Overhead Bridge Construction Costs_NS Reply.xlsx," Tab "OH Bridges."

[371] NS's evidence regarding the costs to the DRR for signals and communications is sponsored by NS witnesses Richard Ray and Dick Smith. Mr. Ray is the founder of RR Rail Hwy Crossing Consultants, which provides consulting services to railroads and governments concerning rail/highway crossings. Mr. Ray has over 40 years of experience, including 39 years at NS where he worked as the Administrator of Highway Grade Crossing. Mr. Smith is a consultant with XORail and has over 35 years of experience in railroad operations. Prior to his retirement, Mr. Smith was Chief Engineer, Communications and Signals for the Northern Region at NS. These experts' qualifications are further detailed in Section IV.

Opening Evidence to NS's Engineering Experts' estimate of the costs of DRR signals and communications.

Table III-F-23
Comparison of DRR Signals and Communication Costs

Item	DuPont Opening	NS Reply	Difference
Non PTC Components			
CTC-Based Signal System (Not Incl. Xing Share)	$809.3	$1,133.5	$324.3
Crossing Protection Share of Sig Costs	$60.2	$68.7	$8.5
Microwave Communications	$250.9	$254.8	$3.9
PCS for Hump Yards	$-	$213.6	
Non PTC Subtotal	**$1,120.3**	**$1,670.7**	**$550.3**
PTC Components			
-			
PTC - 2009 Deployment	$19.5	$-	$(74.5)
PTC – 2009 Signal Investment	$74.5	$-	$(33.1)
PTC - 2009 Loco Radios Investment	$33.1		
PTC - 2010-2015 Development	$-	$153.8	$153.8
PTC - 2015 Deployment	$-	$26.28	
PTC – 2015 Signal Investment	$-	$210.6	$210.6
PTC - 2015 Loco Radios Investment	$-	$93.5	$93.5
PTC Subtotal	**$127.1**	**$484.2**	**$357.1**
Total	**$1,247.5**	**$2,154.9**	**$907.5**

a. Centralized Traffic Control

i. The DRR Could Not Install PTC In 2009.

DuPont posited in its case-in-chief that "the DRR will install PTC at the beginning of DRR operations."[372] That proposal is impossible, because critical PTC components still do not exist and certainly did not exist in 2009 when the DRR would begin operations. DuPont's claim that it could reduce "investment expenditures" by "installing a PTC system from the outset" is

[372] DuPont Opening III-B-8; III-F-39.

irrelevant, for it is plainly not feasible for the DRR to install a PTC system years before any functional system existed.[373] Instead, the DRR will be required to construct a Centralized Traffic Control ("CTC") system for the beginning of operations in 2009 and then overlay a PTC system by December 31, 2015. This two-step process is consistent with both the real world—in which NS and all other Class I railroads are required to convert their CTC systems to PTC—and with the Board's holding in *AEPCO 2011* that the *AEPCO 2011* SARR would be required to install PTC as an overlay to CTC in 2015.[374]

DuPont's assumption that the DRR would use PTC from the outset of its operations in 2009 is not feasible, because essential PTC technology and systems did not exist in 2009.[375] Indeed, today PTC is still in the development stage, and a number of unresolved implementation obstacles persist. A recent FRA report to Congress noted that "significant technical and programmatic issues" made it unlikely that most railroads could complete full implementation of PTC by December 2015.[376] These issues include communications spectrum availability, final radio design and availability, design specification interoperability, back office server and dispatch system availability, track database verification, and installation engineering.[377] The idea that the DRR could have installed PTC in June 2009—over three years <u>before</u> the FRA's Report on the significant issues that may delay the implementation of PTC by 2015—is sheer fantasy.

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[373] *Id.*

[374] *AEPCO 2011*, STB Docket No. 42113, at 33.

[375] This discussion of the current challenges for PTC implementation is sponsored by NS witness Gerhard Thelen.

[376] Federal Railroad Administration, Report to Congress on Positive Train Control Implementation Status, Issues, and Impacts at 1 (August 2012) (included as NS Reply WP "2012 FRA PTC Report").

[377] *See id.*

To focus on one element that the DRR could not possibly resolve by 2009, the railroad industry has been required to obtain radio spectrum and create a private radio frequency network to transmit and receive the data necessary to support an interoperable PTC network.[378] After purchasing the spectrum, rail carriers have had to design and develop a completely novel type of radio to use this frequency for PTC purposes.[379] Indeed, a report issued at the end of 2010 by the Government Accountability Office ("GAO") found that essential PTC technology had not yet been developed, tested, and implemented. As GAO summarized at the end of 2010,

> Railroads currently expect that key PTC components will be available by 2012, but there is uncertainty regarding whether this can be achieved, given the delays in developing the interoperability standards and current lack of software for PTC components . . . If the railroad industry is unable to develop fully functional components within the expected time frame, it is possible that testing and installation of these components could not be completed by the 2015 deadline.

GAO Report: Rail Safety: Federal Railroad Administration Should Report on Risks to the Successful Implementation of Mandated Safety Technology, at 21 (December 2010). GAO listed the following essential elements of a PTC system that had yet to be developed as of the end of 2010, 18 months *after* the DRR would commence operations in June 2009:

- Data and communication radios for locomotives and wayside units, essential for PTC communication on new radio spectrum purchased by rail carriers for PTC;
- Tested wayside unit hardware;
- PTC software "to perform all train control functions, including determining a train's location and calculating a train's braking distance." Development and implementation of such software is essential to a

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[378] *See* AAR, *PTC Implementation: The Railroad Industry Cannot Install PTC on the Entire Nationwide Network by the 2015 Deadline* at 8 (January 18, 2012).

[379] *Id.*

working PTC system, because "PTC systems cannot be tested and implemented until software is finalized";

- Implementation of interoperability standards to allow rail carriers' equipment to have PTC functionality on foreign carriers' systems.

Id. at 17-21. Plainly, technology and systems that are essential to a functioning interoperable PTC system did not exist in mid-2009, 18 months before the GAO report. Therefore, a working PTC system that would meet applicable requirements was not available when the DRR commenced operations in June 2009.

More recently, rail carriers submitted a report to the FRA demonstrating that significant development, technology, and integration challenges remain even in 2012. In January 2012, the Association of American Railroads submitted a report to the FRA demonstrating that it was unlikely that rail carriers would be able to meet the RSIA mandate for a full nationwide interoperable PTC network by December 2015.[380]

The Report described numerous development, technology, integration, testing, and implementation work, challenges, and delays, affecting every major component of PTC systems that then remained to be addressed before carriers could implement an operating PTC system that meets federal regulations.[381] One example of an essential and time-consuming PTC development task is the ongoing development and implementation of numerous interoperability standards. A number of interoperability standards are still in development. In August 2012, FRA estimated that interoperability standards would not be finalized until late 2012.[382]

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[380] *See* AAR, *PTC Implementation: The Railroad Industry Cannot Install PTC on the Entire Nationwide Network by the 2015 Deadline* (January 18, 2012) (NS Reply WP "PTC Implementation Report").

[381] *See* PTC Implementation Report at 1-14.

[382] *See* NS Reply WP "2012 FRA PTC Report" at 23.

Once these interoperability standards have been promulgated, they must be implemented and tested on the numerous PTC system components on each rail network that will install PTC.[383] Thus, according to FRA's current estimate, interoperability standards would not be available for testing and implementation until at least three full years after the June 2009 commencement of DRR operations. The difficulties and complexities of interoperability standards and implementation are discussed in more detail in a 2012 study by the Transportation Technology Center.[384] These interoperability issues are a major issue for the DRR because it connects with every other Class I railroad. DuPont cannot reasonably assume a PTC system that DRR would attempt to implement in 2009 would be interoperable with those connecting railroads once those other railroads develop and implement their own PTC systems, six years later.

The DRR's inability to use technology that did not yet exist in 2009 is not an impermissible barrier to entry. Rather, it is a real-world limitation that is faced by existing railroads, including NS. Just as a SARR must incur the same costs that the incumbent would incur in building new rail lines through territory in which no rail line presently exists, so it must face the same technical challenges, limitations, and costs that real-world carriers faced in 2009 and through the 2015 implementation deadline. *See, e.g., BNSF v. S.T.B.*, 114 F.3d 206, 214 (D.C. Cir. 1997) ("[T]he Board defined barriers to entry as those 'costs that a new entrant must incur that were not incurred by the incumbent.'") (citing *West Texas*, 1 S.T.B. at 670). These are actual costs and technological limits faced by NS and the other Class I railroads in developing and implementing PTC. Basic economic and SAC principles do not allow the DRR to assume

[383] *See id.* at 14-15.

[384] *See* NS Reply WP "TTCI Report.pdf" (advocating phased implementation of PTC to account for the complexity of interoperability).

the existence of PTC technology before it exists. For example, the DRR cannot assume that it would purchase locomotives that are more efficient or otherwise superior to the locomotives that exist in the real world. SARR operations, configuration, and road property investment must be *feasible*. It is not feasible to assume that the SARR would implement PTC technology before that technology exists.

The Board has acknowledged that requiring a SARR to install PTC at the time it is available does not constitute a barrier to entry.[385] In *AEPCO 2011*, carrier defendants included the cost of implementation of PTC in 2015. The complainant argued that PTC costs should be excluded from the calculation of SARR road property investment.[386] The Board rejected AEPCO's argument, finding that the SARR—like real world rail carriers—would incur PTC costs in accordance with the law requiring installation of PTC by the end of 2015.[387] Significantly, although AEPCO assumed its SARR would commence operations in 2008-09, neither the parties nor the Board assumed that the SARR would be able to implement the technology in 2009. Instead, they assumed the SARR would implement PTC in 2015.[388] Nothing in the Board's decision suggests that the inability of the SARR to implement (non-existent) PTC technology prior to 2015 constituted an impermissible barrier to entry.

Because installation of PTC at the commencement of DRR operations in 2009 would not be feasible,[389] NS's Engineering Experts substitute the realistic assumption, consistent with the

[385] *See AEPCO 2011*, STB Docket No. 42113, at 33.

[386] *See id.* at 33-34.

[387] *Id.* at 34.

[388] *See id.*

[389] As noted above, the DRR's PTC system would need to be interoperable with systems implemented in 2015 by other carriers with which the DRR would interchange traffic. Thus,

existing legal requirement, that the DRR would install a CTC system that would be operational at the 2009 commencement of its operations. The DRR would then be required to convert the system to PTC by the December 31, 2015 statutory deadline.[390] These costs are described below in section III-F-6-b.

ii. DuPont's Inventory of Signals Components Is Unreliable

A second fundamental problem with DuPont's signals evidence is that the signals it proposes to build have no relation to the actual DRR track configuration. DuPont claims to have developed signals inventory by considering "the layout of the DRR as manifested in the DRR stick diagrams and the track charts provided by NS in discovery." DuPont Opening III-F-39. While this would have been a reasonable approach, it does not correspond to what DuPont actually did. The DuPont workpaper listing its inventory of DuPont's signals components is a spreadsheet entitled "DuPont C&S Estimate errata.xls." The "Page Counts" tab of that workpaper references pages from individual NS track charts and purports to include counts for such signal items as interlocking huts, signals, switches, and track circuit ends. But DuPont's signal item counts and associated interlocking component inventories are irreconcilable with either the NS track charts or the DRR stick diagrams.

NS Reply workpaper "Signal Inventory Equipment Evaluation.xls" sets forth a few examples of the inconsistencies between DuPont's signal inventory, its stick diagrams, and the

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even if the DRR were to conduct all of the research and development necessary to develop a stand-alone PTC system prior to June 2009, it still would not be able to make such a system interoperable with other carriers' systems, which are not required to be operational until the end of 2015.

[390] The DRR would thus be required to incur the initial expenses of installing a CTC signaling system to be operational in June 2009. Over the course of the next six years, the DRR would be required to make capital expenditures and investments necessary to convert that system into a PTC system, in order to meet the December 2015 statutory deadline.

actual signals equipment on the NS tracks being replicated by the DRR. For example, on the Lake Division segment from milepost B-460 to B-465, DuPont's signal inventory workpaper shows three automatic signals, and its DRR stick diagram shows no signal equipment whatsoever. But the NS track charts clearly show that the E. Thomason Interlocking is on this segment and that the DRR would need multiple signals, switches, and track circuit ends for this segment. See NS Reply WP "Lake Div Trk Chart" at 54. Indeed, DuPont's inventory count omitted most crossing at-grade interlockings with other railroads, except for the few located within existing NS control points that were replicated on the DRR. For example, DuPont fails to include an at grade railroad crossing at Charlestown, WV with CSXT on DRR route segment #421 between Shenandoah Jct. and the WV/VA Line. This crossing is shown on the NS Track Chart for "Virginia / Hagerstown / Hagerstown-Shenandoah / 008790 – 8793" at milepost H27.94. Line 390 of the "Page Counts" tab of DuPont opening work paper "DuPont C&S Estimate errata.xls" shows no signal equipment between mileposts H25 and H30. NS on reply added a control point with no switch on line 1,444 of the "Reply Signal Layout" tab of the NS Reply workpaper "DuPont C&S Estimate errata Reply.xls" to account for this rail crossing interlocking. Based on similar review, NS Signal Engineers added 47 control points with no switches to account for missing railroad at grade crossing interlockings on the DRR.[391]

The inconsistencies in DuPont's signals inventory are exacerbated by its failure to provide any documentation of the milepost locations of either (1) any of the automatic signals (AS1- AS4) locations on the DRR; or (2) 674 crossover tracks.[392] It is impossible to assess the

[391] See NS Reply WP "NS Reply DRR Interlocking and Bridge Inventory," Tab "Inventory," Column E."

[392] Through detailed review of the DRR stick diagrams, NS's Engineering Experts were able to associate 155 of these 674 crossover tracks with likely defined locations. The locations of the remaining crossover tracks are not ascertainable from any of the workpapers DuPont provided.

adequacy of DuPont's proposed signals network without knowing precisely where it proposes to place these network elements. For example, DuPont's failure to identify the locations of crossover tracks for rail/highway grade crossings could cause the omission of necessary additional unidirectional detection equipment, as described under III-F-6-d needed to provide adequate warning times to the public of an approaching train. More generally, site-specific information is essential to locate a control point, which governs placement of other equipment such as automatic signals and additional detection equipment for rail/highway crossing signals.

In short, DuPont utterly failed to provide documentation of its signals inventory or any reliable evidence that DuPont's proposed signals configuration would be adequate for the DRR. NS's Engineering Experts therefore developed their own count of required signals based on the proposed DRR network, using site-specific criteria and industry-accepted signal practices. NS's Engineering Experts developed their analysis in light of the SAC principles that the SARR would be a least-cost, most-efficient operator, but must nonetheless have a feasible infrastructure that is consistent with the requirements of real-world railroading. In many cases NS's Engineering Experts' approach resulted in less signals equipment on a segment than DuPont posited—in other cases DuPont clearly omitted necessary equipment.

The first step employed by NS's Engineering Experts was to determine the least-cost, most-efficient signal design for the DRR. NS's Engineering Experts developed test buildouts of four different signal system designs for a hypothetical 20 mile segment sample. The alternatives evaluated were: (1) cab signaling supplemented with wayside signals; (2) cab signaling with no wayside signals; (3) the signal configuration currently in use over the former Norfolk & Western ("N&W") territory; (4) and the signal configuration currently in use over the former Southern

Railway ("Southern") territory.[393] This analysis showed that the most efficient signal configuration was the configuration currently in use over the former Southern territory, which is slightly less costly than the one in place over the former N&W territory and approximately one-third less costly than either of the cab-based systems.[394] Under the selected design, controlled signals have either two or three signal heads. Wayside intermediate signals throughout the block[395] will have either one or two signal heads. The signal spacing throughout the block is roughly 2.0 to 2.5 miles depending on terrain, sight lines, and estimated train stopping distances, with no block being longer than 3.0 miles. These block distances were chosen to maximize the efficiency of train operations by expediting following train moves and signal equipment utilization.[396] Cut sections were used when track circuit length between wayside signals exceeded three miles and it was not feasible to add a wayside signal in those limits.

NS's Engineering Experts next used DuPont's DRR stick diagrams to identify the specific signal requirements for each turnout, interlocking, rail crossing and junction for the DRR. Specifically, NS's Engineering Experts identified for each individual signal site the count of associated interlocking components for that site. (For example, an end of siding ("EOS") on the DRR stick diagram would require components including one EOS hut, two 2-headed signals, one 3-headed signal, one grounding kit, one 12-volt battery, one 24-volt battery, and various cables). NS provides a list of typical interlocking components for each type of site identified on

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[393] *See* NS Reply WP "Typical Signal System Costs to Install CTC.pdf."

[394] *See id.*

[395] A CTC signal block is the track distance between two signal control points.

[396] Track circuit lengths are generally kept at less than three miles maximum to allow for varying track conditions.

the DRR in NS Reply WP "DuPont C&S Estimate Errata Reply.xlxs," Tab "Reply Signal Typicals."

Since the DRR signal foundation is a CTC system for wayside signal control, all movements over power operated switches must be governed by controlled signals. NS's Engineering Experts assumed that all switch turnouts on the DRR stick drawings marked as #20 and #14 were power operated and that turnouts marked as #10 are hand thrown and equipped with electric locks. For other turnouts not identified by size in the DRR stick diagrams, NS's Engineering Experts used existing NS track charts to determine milepost and the type of turnout.

NS's Engineering Experts reject DuPont's unprecedented proposal to use a "scaling factor" to account for the cost of larger interlockings.[397] DuPont provides no explanation for how it derived its "scaling factor," and its calculations of that factor have transparent flaws.[398] Moreover, while it is true that the amount and type of interlocking components vary based on site needs, there is no reason why larger interlocking models cannot be costed directly. Indeed, quotes from DuPont's own workpapers provide much of the necessary support for costing larger interlockings. NS's Engineering Experts' site-specific approach and rejection of DuPont's "scaling" methodology caused them to identify more component types than were used by DuPont for interlocking huts (NS Reply WP "DuPont C&S Estimate Errata Reply," Tab "Reply Signal Typicals," Rows 5 – 11 & 16 – 17"), signal configurations, (NS Reply WP "DuPont C&S Estimate Errata Reply," Tab "Reply Signal Typicals," Rows 29 – 34 and NS Reply WP "Different Signal Configurations") and electric lock cases, (NS Reply WP "DuPont C&S

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[397] *See* DuPont Opening III-F-39 to III-F-40.

[398] For example, DuPont fails to include all equipment at a standard EOS. DuPont's scaling workpaper claims that there are three track circuits per EOS; however, there are actually five track circuits: one for each of the three approach tracks and two within the control point.

Estimate Errata Reply," Tab "Reply Signal Typicals," Rows 19 – 20, showing components) as detailed below.

- Interlocking Huts. DuPont proposed one interlocking hut type for all the different configurations for control points on the DRR, and proposed to use its scaling methodology to account for more complex configurations. In contrast, NS's Engineering Experts developed five additional huts and one item for "switch equipment to operate more than 12 switches." These new items and their unit costs are set forth in NS Reply WP "DuPont C&S Estimate Errate Reply," 'Reply Components & Tabulation' Tab, Rows 9 through 18. Labor installation costs were obtained from Interrail. *See* NS Reply WP "Interrail Labor 081012.pdf"

- Signal Configurations. DuPont used one signal with mast and two heads to cover all the different configurations for signals at control points and automatic signal locations on the DRR. NS experts added six different signal configurations, which accurately reflect signals needed at control points and automatic signal locations. These new items and their unit costs are set forth in NS Reply WP "DuPont C&S Estimate Errata Reply," Tab "Reply Components & Tabulation," Rows 32 through 37. Labor installation costs were obtained from Interrail. *See* NS Reply WP "Interrail Labor 081012.pdf"

- Electric Lock Cases. DuPont used only one type of electric lock case. However, over 100 locations on the DRR have more than one electric lock that must be operated out of the lock case. Therefore, NS's Engineering Experts added an electric lock hut - 2 track. This new item and its unit costs are set forth in NS Reply WP "DuPont C&S Estimate Errata Reply," Tab 'Reply Components & Tabulation,' Rows 22 & 23. Labor installation costs were obtained from Interrail. *See* NS Reply WP "Interrail Labor 081012.pdf"

The specifics of the NS reply signal inventory by milepost and component are set forth on the "Reply Stick Count" tab of NS Reply WP "DuPont C&S Estimate errata Reply.xls." Table III-F-24 compares the signal component inventory developed by NS's Engineering Experts with that presented in DuPont's opening. It is worth noting that NS's site-specific methodology resulted in a lower overall number of Control Huts and a significantly lower number of signal mast and heads.

Table III-F-24
Comparison of NS Reply Signal Component Inventory to DuPont Opening

	DuPont Opening	NS Reply	Difference
Interlockings 1/	1,688	1,582	(106)
Double track automatic signal hut	1,063	477	(586)
Single track automatic signal hut	2,891	1,664	(1,227)
Electric lock case 2/	429	1,233	804
Single track failed equipment detector 2/	273	526	253
Dragged Equipment Detector	273	1,420	1,147
Signal, two head (three aspects each) 3/	14,792	10,876	(3,916)
Power mainline switch machine: 24VDC	2,576	3,160	584
Manual mainline switch mechanism	558	1,420	862
Battery/charger set 12V 400AH.	6,451	16,533	10,082
Commercial power drop	6,451	12,227	5,776
Foundation - Signal Mast	*n/a*	*20,337*	*20,337*
Battery/charger set24V 400AH	*n/a*	*2,147*	*2,147*
Grounding Kit for Signal Equipment Shelter	*n/a*	*12,374*	*12,374*
Track Connections - Near and Far Rail	*n/a*	*39,959*	*39,959*

1/ - NS adds five new types of huts tailored to control point needs

2/ - Double track versions added when applicable

3/ - NS replaces generic signal with six specific signal types that vary in heads and aspects

iii. DuPont's Unit Costs For Signals Components Are Incorrect.

DuPont's approach to estimating the costs for signals components is as flawed as its approach for determining signals inventory. DuPont's primary error is a failure to account for all of the parts necessary to construct complete and functional signals components. As demonstrated below, DuPont omits fundamental items like foundations, battery power, and grounding kits for its signals components. DuPont also misstates the costs for two signals components.

DuPont's omissions of necessary signal component equipment are detailed below:

Foundations. DuPont's opening evidence did not include the cost of signal foundations needed to erect signals at control points, approach signals, intermediate signals, and crossing signals. DuPont used quotes from Safetran to obtain unit costs for these components, but Safetran has confirmed that foundations are not normally included in its quotes for either signals or crossing signals. *See* NS Reply WP "Safetran Foundations.pdf." NS's Engineering Experts developed the cost of signal foundations from an NS AFE made available to DuPont during discovery[399] and developed labor costs for installation from Interrail.[400]

Electronic Locks. DuPont's materials package for its electronic lock locations did not include insulated joints, pipeline material, or labor to connect to the hand throw switch at the electric lock or track connections. Therefore, NS's Engineering Experts added insulated joints for electric locks to the overall DRR insulated joint count.

Track Connections. DuPont also omitted Track Connections (Near& Far) for all track circuits. Track Connections are necessary to make the physical connection between the rail and underground (track) cable as part of the track circuit. NS's Engineering Experts included track connections for all track circuits (*i.e.*, signals, crossing signals and electric locks). NS's Engineering Experts developed the cost of track connections from an NS AFE made available to DuPont during discovery,[401] and developed labor costs for installation from Interrail.[402]

Battery/Chargers. DuPont also omitted a number of 12 volt battery/charger sets, which are required to provide DC power to wayside equipment such as control points, intermediate

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[399] *See* NS Reply WP "NS AFE – F11158.pdf."

[400] *See* NS Reply WP "Interrail Labor 072612.pdf."

[401] *See* NS Reply WP "NS AFE – F10635.pdf."

[402] *See* NS Reply WP "Interrail Labor 072612.pdf."

signals, electric locks, detectors, crossing signals, and AEI locations. NS's Engineering Experts added these sets where a 12 volt power supply is required to operate signal circuity using a 12 volt source. This change is shown in NS Reply WP "DuPont C&S Estmate Errata Reply," Tab "Components & Tabulation," Row 41, Columns D & E.

DuPont also did not include material and labor cost for 24-volt batteries and chargers for 24-volt battery systems, which are necessary to provide 24-volt power to switch machines and hot box detectors. NS's Engineering Experts added these costs using a materials cost from DuPont's own workpapers and used the same labor costs as DuPont used for installing the 12-volt batteries and chargers in DuPont WP "DuPont C&S Estimate Errata, Tab – 'Components & Tabulation ', Row 19, Columns D & E.".[403]

Cables. DuPont did not include the correct cable for connecting AC Power between the service drop and the equipment shelter. AC Service drops are wired for 240 volts, which requires a three conductor cable to hook up the two phases and the ground tap. NS's Engineering Experts therefore used 3C#6 cable. NS's Engineering Experts developed the cost of cables from an NS AFE made available to DuPont during discovery[404] and used the same labor cost that DuPont used for cabling.

Grounding Kits. DuPont also did not include grounding kits for signal equipment shelters. Grounding kits are necessary to ground the signal shelter and protect railroad personnel from electrical shock and to protect electronic equipment from damage due to lightning strikes or power surges. It is critical that the signal equipment shelters have excellent grounding, because the electronic equipment that will be required for the DRR's signals is susceptible to damage by

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[403] *See* DuPont Opening WP "DuPont C&S Estimate Errata."

[404] *See* NS Reply WP "NS AFE – F10635.pdf."

foreign current causing failure of the signal or crossing signal system. NS's Engineering Experts developed the cost of grounding kits from an NS AFE made available to DuPont during discovery[405] and developed labor costs for installation from Interrail.[406]

Derails. DuPont asserts that the derails of the DRR are pipe connected[407] to the main line switch, but does not include material and labor for those pipeline connections. Pipeline connections represent old and unsafe technology that is not feasible for safety reasons and maintenance cost, therefore NS began elimination of pipeline connections back to the main switch many years ago and started replacing them with a separate switch stand and signal circuitry. This decision was driven by the many injuries to railroad personnel when throwing a switch on the mainline that was connected to the derail by a pipeline located approximately 350 feet from the switch. The obsolescence of pipeline connections to derails is confirmed in DuPont's derail workpapers which do not include either material or labor costs for the derail pipeline connection (DuPont opening WP "DuPont C&S Estimate Errata"). DuPont also misstated the material unit costs for two items. Specifically, material unit costs for Power Mainline Switch Machine 24VDC were shown as $15,126, and Manual Mainline Switch Machine were shown as $16,890.[408] However, DuPont's workpapers show that it was quoted prices of $26,000 for the Power Mainline Switch Machine 24VDC and $21,000 for the Manual

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[405] *See* NS Reply WP "NS AFE – F11056.pdf."

[406] *See* NS Reply WP "Interrail Labor 072612.pdf."

[407] Pipe connected or pipeline is a system of pipe and pivot points connecting two or more pieces of movable equipment to act as one, whereas, when the primary piece of equipment is moved the other pieces move in unison.

[408] *See* DuPont Opening WP "S-C Workpapers.pdf " at 19.

Mainline Switch Machine. NS uses the corrected costs from DuPont's opening workpaper "S-C Workpaper 19" in its Reply. *See* NS Reply WP "DuPont C&S Estimate Errata Reply."

b. PTC

i. PTC Wayside System

As addressed above, DuPont's assumption that the DRR would begin operations with PTC is impossible and plainly infeasible. Instead, the DRR would be required to begin operations with a CTC system and to overlay PTC by December 31, 2015 as required by the Rail Safety Improvement Act. NS's Engineering Experts developed PTC installation costs as follows.

NS's Engineering Experts developed costs for a PTC integrated system to be installed at all wayside control points, wayside signals, and tunnels. Moveable span bridges would be outfitted in the same way as control points, because from a signals perspective, those bridges are the same as control points. Details of NS's Engineering Experts' proposed signal configuration for the DRR are set forth in NS's Reply workpapers.[409] NS's workpapers also include unit costs for new components and correct outdated unit costs used by DuPont. DuPont made a number of unexplained and unsupported adjustments to the NS cost estimates that reduced the costs of both materials and installation. For example, although the NS PTC cost detail provided to DuPont in discovery contained cost estimates for both standard control points and more complex and expensive control points at double crossovers, DuPont used only the lower cost for standard control points. DuPont also excluded necessary antenna tower costs for PTC radio equipment at wayside interfaces and arbitrarily reduced installation labor by 75 percent.

Table III-F-25

[409] *See* NS Reply WP "DRR Sticks Signal System Design Mark Up.pdf", "DuPont C&S Estimate errata Reply.xls," Tabs "Reply Signal Layout" and "Reply Signal Typicals."

PTC Costs

Table -- Comparison of NS and DRR Wayside PTC Unit Costs					
Equipment Item	**NS Quoted Cost for PTC Per Typical Single Interlocking**	**DuPont Open Cost Share**	**DuPont Open Cost**	**NS Reply Cost Share**	**NS Reply Cost**
WIU	$8,000	100%	$8,000	100%	$8,000
WIU KIT	$1,500	100%	$1,500	100%	$1,500
GPS	$400	100%	$400	100%	$400
RADIO	$3,800	100%	$3,800	100%	$3,800
TOWER 60'	$4,400	0%	$0	100%	$4,400
ANTENNA / KIT	$7,500	100%	$7,500	100%	$7,500
ENGINEERED PLANS	$8,000	100%	$8,000	100%	$8,000
LABOR	$25,000	25%	$6,250	100%	$25,000
TOTAL	**$58,600**		**$35,450**		**$58,600**

Where appropriate, NS corrected DuPont's unsupported unit cost adjustments for components that would be deployed in the DRR PTC system. For those components that have been more recently developed, NS Engineering Experts obtained from vendors more current quotes for newer PTC components. All PTC component prices are indexed to the third quarter of 2015, using vendor-provided price adjustments when possible and otherwise using a forecast of the AAR's Material and Supplies Rail Cost Recovery Index.

ii. PTC IT Costs

NS provided to DuPont in discovery its estimates of the cost for the information technology components of the PTC system, which are shown in Table III-F-26 below.

Table III-F-26

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}} NS Engineering Experts reject both adjustments. First, DuPont's "UTCS adjustment per Phil" is arbitrary, unsupported, and unwarranted. Second, unlike wayside costs which vary by the number of miles of PTC installed and the number of wayside components outfitted with PTC capabilities, the IT back office costs are lump sum estimates that are largely unaffected by the route miles deployed. The lone exception is the cost for the 802.11 buildout, which involves outfitting points along the right of way with PTC communication capabilities. NS Engineering Experts assume the DRR would

[410] DuPont assumes the DRR will install PTC over 7,273 route miles while NS estimates its actual deployment as 10,904 route miles.

incur the same costs as NS for all PTC IT deployment elements except the 802.11 buildout, which has been scaled by the relative DRR route miles of PTC versus NS's planned deployment. The DRR PTC IT Deployment costs are summarized in Table III-F-27.

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iii. PTC Locomotive Costs

DuPont assumes that the DRR will incur a cost of approximately {{ }} to outfit each locomotive with PTC capability. NS Engineering Experts accept this figure and apply it to the number of DRR locomotives calculated using its reply operating plan.

iv. PTC Development Costs

Because it is a nationwide mandate, a critical aspect of PTC deployment is interoperability across railroads, which involves the communications links between wayside equipment, locomotive, and the network office. Effective PTC deployment requires that various types of equipment owned by many different railroads must be able to communicate on any track equipped with PTC. Class I railroads have spent considerable time and other resources coordinating on various aspects of PTC deployment to ensure interoperability. Radio frequency, for example, must be settled in advance so that radio receivers and network equipment can be standardized for use by all railroads. To that end, PTC-220 LLC, a consortium of the UP, NS, CSXT, and BNSF railroads, has purchased licenses to some frequencies in the 220 MHz range and is actively pursuing acquisition of additional spectrum for operation in congested areas. In addition, in 2008 BNSF, CSXT, NS, and UP signed an agreement to establish PTC interoperability standards for a number of critical aspects that include:

- Development of PTC Standards
    - Uniform interface standards
    - Messaging format
    - Wireless protocol
    - Braking algorithm
    - Track database format
- Interoperable Hardware Platforms
    - Waysides
    - Base stations
    - Locomotives
- Infrastructure Sharing
- Utilization of 220MHz frequency spectrum

NS also has initiated its own pilot test project on different sections of existing track segments on its Piedmont Division. The project began in 2005 and currently is in the development and design phase, although some components are being tested. Since 2005, NS has been able to test and validate various communications components, wayside interface units and switch monitors, initial locomotive computer design, the track database formatting, and communications coverage. In the office, NS has tested design versions of software for the Back Office Server and for UTCS enhancements as well as some of the UTCS enhancements for train tracking.

The NS PTC development effort is substantial and ongoing. Table III-F-33 summarizes NS's estimated PTC development cost, both incurred to date and forecast over the remainder of the projected deployment period.

Table III-F-28

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Table III-F-28 shows that NS has spent and plans to spend over one-half billion dollars on PTC development and related costs in addition to the actual field, back office, and locomotive cost deployment. As a new entrant without a variety of legacy signal and communications technologies to upgrade or retrofit the DRR will not need to incur all of the development costs of the residual NS, but it would still encounter substantial development costs.

Table III-F-29
DRR PTC Deployment Cost Estimate

PTC Element	NS Amount	DRR %	DRR Amount
C&S PTC Related Projects			
TC Green	$232,000,000	0.0%	$0
Poleline	15,845,869	0.0%	0
ECII / Trakode	115,000,000	0.0%	0
Subtotal	**$362,845,869**		**$0**
Other PTC Related Projects			
OBN	$62,999,983	161.2%	$101,583,086
LEADER (500 TMC's)	16,500,909	0.0%	0
Subtotal	**$79,500,892**		**$101,583,086**
Other PTC Related Projects			
GIS (Expense item, not capitalized)	$18,000,000	66.7%	$12,006,053
Subtotal	**$18,000,000**		**$12,006,053**
PTC Related Subsidiaries			
PTC-220 LLC (Purchase/Contributions)	$7,629,000	66.7%	$5,088,565
MCC LLC (Purchase/Contributions)	17,900,000	66.7%	11,939,353
Subtotal	**$25,529,000**		**$17,027,918**
PTC Pilot/Development AFE's			
05-1251 Total AFE authority	$37,694,007	50.0%	$18,847,004
10-0087 Total original AFE authority	8,673,209	50.0%	4,336,605
Subtotal	**$46,367,216**		**$23,183,608**
Total	**$532,242,977**		**$153,800,665**

As Table III-F-29 shows, of the $532 million in PTC development cost estimated to be incurred by NS in addition to its actual PTC deployment cost, the DRR would be required to incur nearly $154 million or approximately 29 percent.

1. C&S PTC Project Costs: The TC Green, Poleline and ECII/Trakcode projects represent expenditures required to upgrade and/or modifiy the NS legacy signal systems to accommodate PTC. Because the DRR is assumed to build a new CTC system with which to begin operatons in 2009, it will not be required to upgrade or modify any legacy systems and will not incur any of these costs.
2. Other PTC Related Projects: OBN stands for On Board Network and is the communication system package required for the locomotive on board communication hardware to interface with the PTC based communication network. These cost will vary directly with the number of locomotives that are PTC equipped and is in addition to the approximately {{ }} to outfit each locomotive with PTC capability discussed above under Section 6.b.iii. The NS actual OBN costs of $63 million were divided by the 3,411 locomotives NS anticipates outfitting for PTC[411] to derive an OBN cost per unit of approximately $18,500. This cost is multiplied by the number of locomotives required for the DRR.

   Leader costs represent the costs NS incurred to equip 500 locomotives with a prototype version of PTC train manangement computers. The earlier vintage train management computers represent the same type of equipment that will be installed for each locomotive that is covered by the approximately {{ }} to outfit each locomotive with PTC capability discussed above under Section 6.b.iii so the DRR will not be required to incur any additional development cost for this item.
3. Other PTC Related Projects: GIS is the Geographic Information System component of PTC that keeps track of the track curve and grade information along the train route

[411] See NS Reply Workpaper "2011-02-10 PTC Cost Estimate NS Reply.xlxs," Tab "C&S Deployment Cost."

of movement as input to the PTC braking algorithms. NS has and projects to incur $18 million in operating expenses to gather and upload the GIS data into the PTC related systems for its planned PTC deployment miles. The DRR would be required to incur the same expenses for its relative share of PTC related mileage.

4. PTC Related Subsidiaries: PTC 220 LLC and MCC LLC are companies formed by a consortium of railoads, of which NS is a part, to obtain the required comuunications radio spectrum for PTC operations. The DRR as a replacement to NS is stepping into NS's shoes regarding participation in these organizations. The DRR contribution is calculated based on the relative miles of DRR proposed PTC deployment versus NS's planned deployment.
5. PTC Pilot/Development AFE's: PTC is still in the development stages. In order to test and refine the PTC technology, NS developed two PTC pilot programs on portions of its network. The NS pilot programs began in 2005 and covered a 114 mile non-signaled line from Charleston, SC to Columbia, SC and a 108 mile signaled line from Columbia, SC to Charlotte, NC.[412] Because PTC is not yet available off the shelf, the DRR would also be required to incur costs for a PTC pilot program, but would likely not comment the program until after railroad operations begin in June 2009. Because of the later start date, NS in its reply assumes that the DRR would incur one-half the cost NS has incurred and is expected to incur on its own pilot program.

[412] NS Reply Workpaper "2011-01-16 PTC overview (NS-DP-HC-38350 to 38371).pdf" Slide 8.

v. PTC Expenditure Schedule

FRA mandates that PTC deployment be completed by December 31, 2015. In its reply NS assumes that the DRR will meet the FRA mandate and assumes that all PTC related expenditures except development costs will be incurred in the year 2015. NS assumes DRR PTC development costs will be spread equally over January 1, 2010 through December 31, 2014 time period. In addition, even though NS treats certain of the PTC development costs as operating expense, NS assumes all PTC related costs will be capitialized by the DRR.

c. Detectors

DuPont's evidence of the DRR's signals investments is further flawed by its complete omission of the need for slide fences and its substantial understatement of the need for failed equipment detectors ("FEDs").

First, DuPont did not account for the cost of slide fences. Slide fences are essential equipment in mountainous areas where rock slides may occur without warning.[413] NS's Engineering Experts developed a list of necessary DRR slide fences by considering the DRR's territory and NS's existing slide fences, and they determined that the DRR would require a total length of 112,084 feet of slide fences. The cost of slide fences is included in NS Reply WP "DuPont C&S Estimate errata Reply.xls," Tab "Reply Components & Tabulation," Line 87.

Second, DuPont proposes to place FEDs 35 miles apart. This spacing is too great and is inconsistent with modern railroading. DuPont's claim that its spacing is "consistent with the current industry standard" is incorrect. DuPont Opening III-F-40. DuPont's only support for that claim is a citation to a superseded AREMA Manual from 2001. *Id.* at n.107. The 2007 AREMA Manual removed the spacing guidance on which DuPont relies.

[413] A slide fence alerts the signal system when it is dislodged by rock slides, allowing nearby trains to be stopped before a potential derailment. Slide fences are essential safety equipment.

Current AREMA standards suggest that FED placement and spacing requires consideration of a number of relevant factors, including the type of defect to be detected, the characteristics of the train traffic, and the available locations that are suitable for the installation of detectors.[414] Other factors specific to each line segment would impact the line segment's exposure factor and could be used to focus the detector type and placement best suited to a given line segment. Some typical elements are:

- Passenger Density
- Freight Traffic Density – Gross Ton Miles
- Line Speed
- Hazardous Material Mix
- Environmental Impact Exposure
- Adjacent Property Use
- Past Rolling Stock Problems
- Physical Characteristics, Curves, Grades, etc.

NS's current spacing standard for FEDs is 15 miles, a standard that NS developed based on its experience with FED equipment performance and previous history of derailments.[415] NS's Engineering Experts believe this spacing provides for the maximum use of equipment while still maintaining the safest operation. While no specific spacing of FEDs can guarantee that a journal bearing will not fail, closer spacing increases the likelihood of detection before a failure becomes

[414] *See* NS Reply WP "AREMA Section 5.3.1 – FED."

[415] DuPont is well aware of this standard, which NS disclosed to DuPont in discovery. *See* NS Reply WP "Criteria and cost (NS-DP-HC-18430).pdf." ("Historically NS and predecessor roads used 20 mile nominal spacing for hotbox detectors employing inboard scan. However, in recent years, 15 mile nominal spacing was adopted, with this spacing believed to provide the best balance between the risk of bearing failure and installation/maintenance cost.").

a derailment. NS's Engineering Experts selected to use the actual FEDs located on NS as shown by the NS Track Charts This adoption was driven heavily by the supreme importance of ensuring the safety of the public and of train crews, particularly for trains on a SARR that would carry significant volumes of hazardous materials and other chemicals.

NS corrects the inventory of FED equipment in NS Reply WP "DuPont C&S errata Reply.xls," Tab "FED Locations."

d. Crossing Signal Equipment

DuPont's evidence of the DRR's crossing signal investment is characterized by the same flaws as its other signals evidence. DuPont both inaccurately calculates the quantities of crossing signals required for the DRR and omits essential equipment. NS's Engineering Experts have corrected these errors as explained below.

First, DuPont's inventory of DRR crossings is inaccurate.[416] DuPont omitted many existing NS crossings from the lines DRR is replicating, without any explanation or justification for doing so. For example, DuPont failed to include seventeen crossings on the Industry Track serving the Tri-City Area in Charlotte, NC. . See NS Reply WP "Master Count Crossings – Seg 112 which notes the crossings added." DuPont also incorrectly included crossings from lines that the DRR is not building. For example DuPont included crossings from a different NS division not replicated by the DRR but that used similar milepost prefixes or suffixes. Examples can be found in DuPont's WP "Dupont C&S Estimate," Tab "Crossings," Rows 4,7 & 182.

NS's Engineering Experts corrected the errors in DuPont's crossing inventory. The additions and deletions made by NS's Engineering Experts are set forth in NS Reply WP "Master Count Crossings, Individual Line Segment Tab noting crossings added in Column A"

[416] This inventory can be found in DuPont Opening WP "C&S Estimate.xls," Tab "Crossings" Tab.

and "Crossings Dropped From DRR Crossing List.xlsx." NS's Engineering Experts based their corrections on review of information produced to DuPont in discovery (including a crossing inventory and track charts) and publicly available data (such as the FRA Inventory Database and Google Maps satellite imagery). In some limited instances the crossing inventory maintained internally by NS and produced to DuPont in discovery did not contain sufficient detail to determine the precise makeup of the crossing protection components; in those limited instances, review of track charts and public information enabled NS's Engineering Experts to identify specific crossing components more accurately.

Second, DuPont omits essential equipment from its crossing design. Most significantly, DuPont ignored the costs for unidirectional equipment, understated the necessary flashing light pairs, and omitted cantilever signals.

Unidirectional Equipment: DuPont's first major equipment design error is its omission of unidirectional equipment at locations where train signal insulated joints are present within the approach to the crossing. Because detection equipment track circuitry from the crossing terminates at the insulated joints, using ordinary crossing equipment at locations near train signal insulated joints would unacceptably reduce the approach distance to the crossing and shorten the warning time. For this reason, another piece of detection equipment usually referred to as a 'unidirectional' must be installed on the opposite side of the insulated joints from the crossing. The unidirectional completes the approach circuitry to the termination shunt and allows the crossing signal approach circuitry to be extended to the necessary length to provide sufficient warning. Unidirectional equipment is mandated by FRA Regulations. *See* NS Reply WP "FRA Unidirectional Requirements.pdf" (Unidirectional equipment provides the necessary functionality to facilitate mandated FRA regulations requiring a minimum warning time of 20 seconds for Rail/Highway Grade Crossing Warning Systems and that gates shall assume the horizontal position at least five seconds before arrival of a normal train movement through the crossing). Construction of a unidirectional typically involves installation of another shelter with electronic detection equipment, circuitry, and batteries. A track connection is made between the unidirectional detection equipment and track to complete the approach for the crossing, and track detection information is sent back to the detection equipment located at the crossing via underground cable.

NS's Engineering Experts developed material costs for single-track and multi-track unidirectional locations from AFEs made available to DuPont in discovery[417] and developed labor costs from DuPont's own estimate for predictor hut installation.[418] In an effort to minimize the number of unidirectional shelters, when a group of crossings were in close proximity to each other with overlapping approaches, NS's Engineering Experts would select a unidirectional for the affected crossing farthest from the insulated joints and use one shelter to provide unidirectional circuitry for all crossings between it and the insulated joints. Also, where possible, an effort was made to assume the wiring of the unidirectional into the shelter at the crossing to eliminate the use of another shelter.

<u>Flashing Light Pairs</u>: As detailed in NS Reply WP "Master Count Crossings.xlsx," a significant portion of the crossing signal locations are required to have several flashing light pairs to provide warning to vehicles approaching the crossing from differing approach directions. *See* 49 C.F.R. § 234.5 (discussing flashing lights on active highway-rail grade crossing warning systems). DuPont's C&S Estimate Errata provided for only a single Front and Back Flashing

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[417] *See* NS Reply WPs "NS AFE – F10635.pdf" and "NS AFE – F10460.pdf."

[418] *See* DuPont Opening WP "DRR C&S Estimate," Rows 12 & 13, Columns H & I.

Light unit in those locations, and this reduction in grade crossing protection equipment is not supportable. NS's Engineering Experts developed material costs for this item from an NS AFE made available to DuPont during discovery[419] and developed labor costs for installation from Interrail.[420]

Cantilever Signals: Many of the crossing signals on the NS routes replicated by the DRR are cantilever signals. DuPont failed to account for this fact, even though the crossing inventory produced by NS in discovery plainly identified cantilever locations.[421] The existing NS cantilever signal arms on the DRR routes range in length from approximately 14 feet up to 40 feet. Rather than using numerous extensive site visits to ascertain the specific length of each cantilever arm, NS's Engineering Experts derived a 26 foot cantilever arm as an conservative average. *See* NS Reply WP "DuPont C&S Estimate Errata Reply." NS's Engineering Experts developed material costs for the cantilever signal from an NS AFE made available to DuPont during discovery,[422] material costs for the cantilever foundation from another AFE made available during discovery,[423] and labor costs for installation of the foundation and signal from Interrail.[424]

Underground conduit: DuPont also did not include conduit for running underground cable under roads or track to protect the cable and allow for easier installation or replacement.

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[419] *See* NS Reply WP "NS AFE – F11158.pdf."

[420] *See* NS Reply WP "Interrail Labor 072612.pdf."

[421] *See* NS Reply WP "Crossing Inventory" at 'FLASHOVR' Column 'AD.'

[422] *See* NS Reply WP "NS AFE – F10051.pdf."

[423] *See* NS Reply WP "NS AFE – F11056."

[424] *See* NS Reply WP "Interrail Labor 072612.pdf."

Conduit is necessary to protect underground cable when installing cable under tracks or roads because cable in these areas is subject to significant vibrations and additional weight. Over time, cable that is exposed to these additional forces can be damaged, causing a failure or a misrepresented signal indication. Moreover, most road authorities will not allow the road or highway to be cut to install cable; therefore, it is standard practice for conduit to be pushed under a road when cable is installed under that road.[425] Conduit also is used when cable crosses trestles or bridges. In the experience of NS's Engineering Experts, if conduit is not used in these areas, then additional clean fill or sand has to be acquired to be placed below and over the cable before back filling. NS's Engineering Experts developed material costs for conduit from an NS AFE made available to DuPont during discovery[426] and used DuPont's labor costs for installing cabling as a reasonable proxy for installing conduit.

<u>Termination Shunts</u>: DuPont also ignored the need for termination shunts for crossing predictor equipment. Terminal shunts are necessary to terminate electronic train detection circuitry for crossing signals and to establish the approach distance, as required by FRA regulations. Termination Shunts usually are ordered separately due to variance of frequencies. DuPont similarly ignored the need for (1) track connection kits for termination shunts, which are necessary to make the physical connection between the termination shunt and the rail; and (2) termination shunt cover assemblies, which are necessary to protect the termination shunt located between the tracks at the end of the approach. NS's Engineering Experts developed material costs for termination shunts, track connection kits, and termination shunt assemblies from NS

[425] *See* NS Reply WP "Conduit Declaration.pdf"

[426] *See* NS Reply WP "NS AFE – F10635.pdf."

AFEs made available to DuPont during discovery,[427] and developed labor costs for installation of these components from Interrail.[428]

Cabling: Cable for crossing signal equipment was estimated on a typical cable run between the Equipment Shelter and outside equipment. A breakdown for the typical cable run is listed in the NS Reply WP "DuPont C&S Estimate errata Reply.xls," Tab "Reply Signal Typicals," Lines 46 to 53.

e. Communication System

NS accepts DuPont's costs for material and installation for the DRR Communications and Microwave Systems.

f. Hump Yard Equipment

The eight hump yards located on the DRR will require integrated switching and control to perform their required functions. NS Signal Engineer's relied on actual NS costs for a fully operational hump yard switch system at Bellevue, OH and scaled the costs to represent the various sizes of the DRR's hump yards. Details are set forth in NS Reply WP "DRR Reply Hump Yard Equipment.xlsx." *See* NS Reply WP "Belluevue OH Proposed PCS for Additional 38 Class Tks Signal Costs (AFE-11-5992).pdf" and ""Belluevue New Yard Material Pricing.xls." The total cost to equip hump yards with intergrated switching is $213 million.

7. Buildings and Facilities

Based upon their review of DuPont's Opening Evidence Section III-F and related workpapers, (including DuPont Opening WP "DRR Facilities Cost Errata.xlsx"), NS's Engineering Experts have found that the cost and size of the buildings and facilities that DuPont

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[427] *See* NS Reply WPs "NS AFE – F10051.pdf" & "NS AFE – F10460.pdf."

[428] *See* NS Reply WP "Interrail Labor 072612.pdf."

proposes often are difficult or impossible to determine or verify because of numerous ambiguities, discrepancies, obvious errors, incorrect spreadsheet formulas, or missing pertinent information. Additionally, the cost estimates included in DuPont's opening workpaper "DRR Facilities Cost Errata.xlsx" are unorthodox in organization and logic (*i.e.,* they do not follow industry standards), making them difficult to comprehend. Nevertheless, NS's Engineering Experts reviewed DuPont's Opening Evidence and determined that the buildings' and facilities' designs and costs are inadequate and erroneous for a number of reasons explained below. NS's Engineering Experts developed costs for those same buildings and facilities to correct DuPont's errors.

The size and dimensions of many of the DRR's buildings and facilities were determined by the operating plan developed by NS for the DRR (the "Operating Plan"), and provided to NS's Engineering Experts by the NS Operating Witnesses. NS's Engineering Experts then built out the relevant buildings and facilities to include all of the necessary cost and design features, based on historic sample projects, price quotes from suppliers, R.S. Means cost data and other standard and reliable sources. For buildings and facilities that were not directly derived from the Operating Plan, NS's Engineering Experts independently designed the respective buildings and facilities to meet the DRR's needs, and built out the buildings and facilities with the necessary cost and design features, again based on historic sample projects, price quotes from suppliers, R.S. Means cost data and other reliable data sources. Whether the design of a particular building or facility was dictated by the Operating Plan or independently designed by NS's Engineering Experts, and whether the cost data was derived from historic sample projects, price quotes from suppliers, or R.S. Means cost data, is indicated in each respective section below. All cost data were indexed to appropriate 2009 costs and are supported by work papers as referenced in each section.

NS's evidence regarding the cost of the DRR's buildings and facilities is sponsored by NS witness Mark Peterson. Mr. Peterson is a Vice President and Architect at STV with more than 25 years of experience in the design and oversight of new and renovated transportation facilities. His transportation work has included master planning, programming, and design for all types of facilities for Class I railroads and transit agencies. Mr. Peterson's qualifications are further detailed in Section IV.

a. Headquarters Building

NS rejects DuPont's design and costs for its headquarters building as fatally flawed and unsupported. In its narrative, DuPont explains that the DRR headquarters building, assumed to be in Roanoke, VA, is a two story structure with a total of 20,000 square feet. DuPont states that the square foot cost for the building is derived from the R.S. Means on line square foot calculator "for building structures of this kind" and references its opening workpaper "DRR Facilities Cost errata.xlsx," tab "HQ Bldg." DuPont Opening at III-F-44. A review of DuPont's Opening Workpaper "DRR Facilities Cost Errata.xlsx" reveals that DuPont calculated the required square footage for a headquarters building to accommodate 142 DRR employees in a total of 103 offices, requiring a total of 31,803 square feet.[429] DuPont provides no explanation for why it developed costs for a 20,000 square foot building when its own calculations conclude a 31,803 square foot building is required.

In addition to calculating costs for a headquarters building that is inconsistent with its own calculations, as described in Section III-D-3 and 4, DuPont grossly underestimated the

[429] DuPont Opening workpaper "DRR Facilities Cost errata.xlsx" tab "HQ Building."

number of DRR employees that would occupy the headquarters building. The DRR headquarters in Roanoke would need to accommodate 1,233 DRR employees. These include 434 operating management and supervisory personnel, 680 general and administrative personnel, and 119 engineering headquarters personnel.[430] To develop the headquarters building size needed to accommodate all of the DRR headquarters personnel, NS calculated DuPont's average square footage per headquarter employee based on DuPont's assumed opening headquarter staff of 142 and its calculated headquarter size of 31,803 square feet, which is 224 square feet per employee. NS multiplied that figure by the DRR headquarters personnel count determined in Reply sections III-C-3 and 4 of 1,233 DRR employees to arrive at a headquarters building size of 276,192 square feet.

As with all buildings designed for the DRR based on square footage needs, NS's Engineering Experts started with R.S. Means Square Foot Costs 2012 edition and selected the building type most closely resembling the building type in question. Using the RS Means "Costs per square foot of floor area" table associated with each building type, NS's Engineering Experts selected a square foot cost based on the requisite size of the building, footprint and perimeter linear feet, number of stories, and story height. NS's Engineering Experts then adjusted the base square foot costs by adding or deducting cost factors, as is recommended by R.S. Means. Once a base square foot cost was established, NS's Engineering Experts deducted certain cost items from the costs set forth in R. S. Means to the extent that such costs were duplicative of other costs assumed by NS's evidence. For example, NS's engineering experts deducted the architect's design fee from the square footage costs dictated by R.S. Means because NS's evidence applies a separate architect's design fee. NS's Engineering Experts also added specific

[430] NS Reply Workpaper "HQ Staff.xlsx."

cost items to the estimates that the R.S. Means Square Foot Costs table did not include. For example, RS Means Square Foot Costs tables do not include lockers or fixed furnishings such as corkboards and white boards. NS's Engineering Experts did not add costs to the R.S. Means square footage costs to the extent such costs were separately accounted for elsewhere in NS's evidence, such as mobilization costs and other costs for contractor's general conditions.

For the headquarters building, NS's Engineering Experts used RS Means M.470 "Commercial/Industrial/ Institutional – Office, 5-10 story" square foot cost data to determine the cost of a 276,192 square foot building and used the following design parameters: a five-story building with equal square feet per floor, a square footprint, and a steel structure with pre-cast concrete panel cladding. Specific and critical cost items were then added to the estimate, such as closed circuit television ("CCTV") systems, computer access flooring, a back-up generator, and lockers.

In general, NS accepts DuPont's site construction unit costs for the headquarters building. However, DuPont understated or omitted the cost of certain site construction items. NS's Engineering Experts started with DuPont's site construction unit costs and added the understated or omitted items. For example, DuPont assumed that the headquarters building would require a single fire hydrant. However, based on the headquarters building's 235 feet by 235 feet footprint and typical hose-pull limits of 150 feet in any direction, three fire hydrants would be required to fully cover the headquarters building and comply with the applicable fire code. DuPont also excludes costs for other site items such as gates, electrical transformer and pad, and parking lot striping for the 110 stalls that they provide. Using R.S. Means cost data, NS's Engineering Experts developed costs for these additional items.

Through the process outlined above, NS's Engineering Experts developed a total cost of the headquarters building of $33.1 million. See NS Reply WP "11 STV Facilities Cost_MAG.xlsx", tab "Headquarters" and NS Reply WP "12 STV Facilities Cost Exhibits_MAG.pdf" at 7 for details.

b. Fueling Facilities

i. Fueling Platforms

DuPont assumed that each DRR yard with fixed fueling facilities would have eight fueling stations, with fueling platforms at its six major yards. At smaller facilities, DuPont assumed locomotive fueling by truck directly to locomotives. Based on the Operating Plan, however, the DRR would require twelve fueling stations at each DRR hump yard and each large flat switching yard, and six fueling stations per yard at all other yards. *See* NS Reply WP "DRR Facilities List Reply.xls," Tab "Facilities Cost," Columns V and W.

Although DuPont provides little support for its assumed components and list prices, NS accepts DuPont's base cost for each locomotive fueling station of just over $350,000 as a starting point,[431] with the addition of specified costs for missing components using bid costs from locomotive fueling projects in Stockton, California; San Bernardino, California; and Tacoma, Washington (see NS Reply workpapers "00 41 16 Schedule of Quantities and Prices - Flintco Revised 09.29.11.pdf," "EMF Bid Comparison.xls, and "Basis of Design Report_100729_draft_10_ROM Cost Estimate.pdf" respectively). For example, DuPont did not include hose reels for fuel delivery at the DRR fueling stations. Hose reels would be required to allow for the manipulation of the size and weight of required hoses and to prevent tripping hazards. DuPont also excluded overhead service platforms required to distribute fuel, lube oils

[431] A fueling "station" is a spot along the fueling platform that can accommodate one locomotive.

and other utilities to the fueling platform. Overhead service platforms are a cheaper and, therefore, preferable alternative to double-walled pipe that otherwise would be required to run hydrocarbon liquids underground, which DuPont also failed to provide for. DuPont also failed to include platform mounted fuel cranes and fuel management systems required to track fuel consumption at the fueling stations. All of these required elements were costed and added to the cost per locomotive fueling station developed by DuPont. *See* NS Reply WP "DRR Cost Per Fuel and Shop Facility Reply.xls," Tab "Fueling Platform, Lube Oil & Sanding."

DuPont assumed that locomotive servicing tracks designed for fueling locomotives by truck, and including sanding and lube facilities, are located in DRR yards in order to provide such services as needed. DuPont Opening at III-F-45. DuPont included costs in each yard site based on the unit costs for the necessary facilities (including any necessary storage tanks) derived from bid tabulations of projects with similar scope and size. NS accepts DuPont's approach and includes added costs for yards where DTL fueling is performed. *See* NS Reply WP "DRR Cost Per Fuel and Shop Facility Reply.xls," Tab "Fueling Track;" NS Reply WP "DRR Facilities List Reply.xls," Tab "Facilities Cost," Column X.

c. Locomotive Repair Facilities

DuPont assumes the DRR will have locomotive repair facilities at its Elkhart, Conway, Roanoke, and Chattanooga yards,[432] and presented a cost of $3,095,098 per facility including facility tools.[433] NS rejects both the number of locomotive repair facilities and the designs and costs per locomotive repair facility proffered by DuPont. Based on its Operating Plan, NS determined that the DRR will require a total of ten major locomotive repair facilities—four at the

[432] DuPont Opening at III-F-45

[433] DuPont Opening Workpaper "DRR Facilities Cost errata.xlxs" tab "Major" cell D59.

locations specified by DuPont (Elkhart, Conway, Roanoke, and Chattanooga), and one each at six other locations (Bellevue, OH, Decatur, IL, Enola, PA, Birmingham, AL, Linwood, NC and Macon, GA). NS rejects DuPont's designs and costs for its locomotive shops because the facilities and equipment specified by DuPont would be inadequate to service the DRR's locomotives.

Locomotive repair facilities generally cost in the range of $350 to $400 per square foot, not the $12.03 per square foot assumed by DuPont.[434] In general, DuPont's costs for the DRR's locomotive repair facilities were derived from values and sources that are incomplete and not representative of the structures required to accommodate heavy locomotives and shop equipment. NS's Engineering Experts, on the other hand, derived the size and design of each locomotive repair facility based on the requirements of the Operating Plan and based on industry standards for length and configuration of repair tracks and activities performed on each such track. *See* NS Reply WP "DRR Facilities List Reply.xls," Tab "Facilities Cost," Column Y. The locomotive repair facilities were then outfitted with necessary utility systems, equipment and architectural, structural, and industrial systems to create a fully functional shop. NS's Engineering Experts developed the cost components for each locomotive repair facility based on actual costs from a number of similar facilities. [435]

DuPont's proposed locomotive shop design is derived from a proposal by a pre-engineered building manufacturer that clearly states it provides the building superstructure only (frame and siding) with framed openings for doors and windows, but no doors or windows

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[434] *See, e.g.,* NS workpapers "00 41 16 Schedule of Quantities and Prices - Flintco Revised 09.29.11.pdf," "EMF Bid Comparison.xls, and "Basis of Design Report_100729_draft_10_ROM Cost Estimate.pdf" respectively.

[435] *See id.*

themselves.[436] The eave height of 25 feet also is inadequate to accommodate overhead cranes required to lift and move heavy locomotive components and instead would have to be at least 44 feet to accommodate these cranes. The shop footprint dimensions also are too small to efficiently work on locomotives. Engineering standards for locomotive shop design dictate that track lengths for locomotive shops should be based on locomotive length plus 15 feet at either end. This added clearance on both ends anticipates that locomotives often will be equipped with snowplows and other front and rear end assemblies, as well as allowing room for mechanical crews to access the front and rear of the locomotive for work on coupler and air brake components and to allow forklifts and other equipment to pass on either side of stationed locomotives. Assuming a conservative 75 feet for the locomotive (approximate length of a GE ES44AC series locomotive), the locomotive track length would be 90 feet per locomotive plus an additional 15 feet behind the last locomotive. Based on the requirements of the Operating Plan, each locomotive repair facility would require two heavy maintenance tracks built to accommodate three locomotives requiring 285 feet in length around these two tracks, and a third heavy maintenance track built to accommodate four locomotives requiring 375 feet in length.

The foundation for a major locomotive shop typically constitutes the single largest expense for construction of the facility due to the need to accommodate extreme locomotive weights, the complexity of constructing the various service and equipment pits, and the number of embedments required to support tracks and other equipment in the building. The cost for track in each facility as assumed by DuPont does not take into account these requirements, nor does it take into account that 50% to 60% of the track necessarily would be very expensive elevated pedestal track or direct fix or embedded rail.

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[436] DuPont Opening Workpaper "Locomotive Shop.pdf"

Supporting ten spots for heavy locomotive maintenance would require at least two drop tables, one wheel truing machine, and several pits associated with the pedestal track. NS's Engineering Experts developed costs for drop tables of approximately $1.6 million each, installed, not including pit costs.[437] NS's Engineering Experts developed costs for each wheel truing machine (which would be required on site rather than sending wheelsets off-site given the volume of repair activity) of approximately $1.9 million installed,[438] compared to the unsupported ,undocumented, and wholly unrealistic cost of $65,000 assumed by DuPont.

DuPont also failed to provide lighting, power, compressed air, and fluid storage and distribution (water, engine oil, compressor oil, journal oil, various heavy weight greases) for the locomotive repair shops. In addition, DuPont omitted costs for toilet dumps, as well as costs for mechanical systems for heating, cooling, ventilation (HVAC) and exhaust equipment required by code for locomotive exhaust. (*See* NS Reply workpaper DRR Facilities Unit Cost Development.xls and the International Mechanical Code which requires six changes of air per hour). The PEMB quote relied upon by DuPont contains no interior finishes or improvements for offices, parts storage and warehousing, restrooms, locker rooms, training/safety briefing rooms, lunch areas, nor any of the complex outfitting required for back shops for trucks, electronics, machining, etc. *See* DuPont Open WP DRR Facilities Cost errata.xlsx. Further, there is not enough detail in the materials provided by DuPont to understand how it assumes locomotive trucks, combos, and wheelsets would be moved around the locomotive shops. This typically is accomplished using several jib cranes and in-floor turntables and track to move the

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[437] NS Reply WP "DRR Cost Per Fuel and Shop Facility Reply.xls," Tab "Locomotive Shop," Lines 28 to 30.

[438] NS Reply WP "DRR Cost Per Fuel and Shop Facility Reply.xls," Tab "Locomotive Shop," Lines 31 to 33.

trucks from the locomotive to the back shops. DuPont provides for none of this in its evidence. DuPont also failed to provide for any facilities or equipment for pressure washing various components prior to repair, or for a trainwasher, which typically includes separate equipment, track and utility distribution costs. NS's Engineering Experts developed costs for the addition of all of these required elements. *See* NS Reply WP "DRR Cost Per Fuel and Shop Facility Reply.xls," Tab "Locomotive Shop."

d. Car Repair

i. Major Car Repair Facility

DuPont assumes that all freight cars would be acquired through full service leases and that the DRR would not need car repair facilities. This assumption fails to consider the DRR's responsibility to repair cars owned by foreign carriers that are bad ordered while on the DRR system. In some early SAC cases, the Board declined to include costs for car repair facilities on SARRs, instead assuming that the SARRs exclusively would use cars serviced by others. In most of those early cases, the SARRs at issue were coal-only carriers, and many of the coal cars were privately owned. However, the DRR is much larger than those prior SARRs and provides extensive carload service in interchange with NS and all other Class I carriers, meaning that an unprecedented number of foreign cars will move over the DRR network. In fact, the DRR's interchange agreements (*i.e.*, NS's interchange agreements that the DRR would assume), as well as AAR standards, would require the DRR to repair foreign carriers' cars to the extent necessary while on the DRR network. Car repair shops would be essential for the DRR to discharge this responsibility.

Based on the Operating Plan's requirements, the DRR will require major freight car repair facilities at Chattanooga and Elkhart. To determine the cost of these two major car repair facilities, NS's Engineering Experts reviewed NS's car repair facilities to determine appropriate size parameters for the DRR and determined that NS's Schaffer's Crossing car repair facility would be appropriate (see NS Reply WP CarSCX.jpg). The Shaffer's Crossing car repair facility is roughly 25,000 square feet with three through tracks and is supported by 6,000 square feet of office, welfare and warehouse space. Using these dimensions, NS's Engineering Experts selected a pre-engineered building as the basis for both DRR car repair facilities, with insulated metal panel siding, concrete block protection and a height of nine feet. Car repairs within the two car repair facilities would be performed on three tracks facilitated by a system of portable jacks on thickened concrete slabs, overhead and jib cranes, and associated tools. One of the three tracks will be fitted with fall protection to permit repairs when a worker is elevated more than six feet above the floor surface, as dictated by industry standards for safe car repair operations. *Cf.* 29 CFR 1926.501(b)(2) (requiring fall protection for employee walking on a surface six feet or more above a lower level)

Both the car repair facility itself and the associated warehouse area employ high-bay structures to provide clearance for crane lighting ventilation equipment and high-bay storage common in car repair facilities. *See* NS Reply WP "DRR Cost Per Fuel and Shop Facility Reply.xls," Tab "Car Repair."

ii. Freight Car Repair Tracks

DuPont made a blanket assumption that the DRR would include a total of 84,000 track feet at 45 separate DRR yard locations for repair-in-place ("RIP") tracks. DuPont Opening Workpaper "DRR Yard Matrix errata.xlxs." In contrast, NS developed individually the number, location, and length of each RIP track as dictated by the needs of the Operating Plan. NS Reply Workpaper "DRR Yard Matrix errata NS Reply.xlxs."

Although DuPont included cost for the track itself, it did not include other necessary costs for tools and parts storage, pole mounted work lighting, welding outlets, or compressed air stations. To allow efficient movement of parts, tools and personnel, RIP tracks need paved roadways on each side of the track. Due to the potential for inclement weather, some portion of the tracks requires covering to permit work under all weather conditions. A steel framed canopy structure of approximately 250 feet by 85 feet, or 21,000 square feet, would be necessary to provide this weather protection at specified RIP tracks as dictated by the needs of the Operating Plan. NS Reply Workpaper "DRR Yard Matrix errata NS Reply.xlxs." Details of these RIP track elements are set forth in NS Reply WP "DRR Cost Per Building Facility Reply.xls," Tab "RIP Canopy;" NS Reply WP "12 STV Facilities Cost Exhibits_MAG.pdf" at 11, 12, 15, & 16.

e. Crew Change Facilities

NS rejects the number of crew change facilities proposed by DuPont and replaces it with a number of facilities derived from the Operating Plan. Accordingly, crew change facilities were developed at all hump and large flat switching yards, and at all other yards where DRR crew changes occur. *See* NS Reply WP "DRR Facilities List Reply.xls," Tab "Facilities Cost," Columns J and K.

DuPont developed two separate costs for DRR crew change facilities, one for a minor facility comprising 1,400 square feet and one for a major facility comprising 2,240 square feet. NS accepts the proposed sizes of DuPont's crew change facilities, but rejects DuPont's costing assumptions and calculations. DuPont's building costs are based on only a prefabricated metal building shell with no interior walls. See DuPont's Opening Workpaper "Yard-Crew Building.pdf." Critical and costly omissions from DuPont's crew change facilities include toilet facilities, showers, storage and file rooms, interior lighting, electrical outlets and switches, data and phone outlets and cabling, HVAC systems, office partitions and drywall, interior and exterior doors, ceilings, and interior finishes, such as carpet, rubber base, sheet vinyl, tile, paint, windows, and simple cabinetry. DuPont also omitted furnishings, fixtures, and equipment (FF&E) items such as mini-blinds, cork boards, dry-erase boards, refrigerators, and microwaves, that are typical for such facilities. Beyond the building shell itself, DuPont's proposed foundation costs are unrealistically low and do not provide costs for an electrical transformer serving the building or for concrete equipments pads for the transformer and AC condensers. DuPont's crew facilities calculation spreadsheet also contains a formula reference error that further understates costs.[439]

To determine the cost of DRR minor and major crew change facilities, NS's Engineering Experts used R.S. Means M.455 "Commercial/Industrial/ Institutional – Office, 1 story" square foot cost data assuming the buildings to be constructed of wood stud, wood truss, and wood siding. This type of construction is not only economical, but also provides lasting durability required by railroad operations. Similar to the headquarters building, the cost for both the minor and major crew buildings was derived using the R.S. Means "Costs per square foot of floor area" table for calculating a base cost square foot cost, adjusted as described in the discussion of the headquarters building. Specific and critical cost items added to the NS cost estimate include lockers, breakroom appliances, and others itemized on NS Reply WP "DRR Cost Per Building Facility Reply.xls," Tab "Crew Change," in conjunction with NS Reply WP "12 STV Facilities Cost Exhibits_MAG.pdf" at 8.

f. Yard Offices

DuPont used the same design and cost assumptions for DRR yard offices it used for DRR crew change facilities. Accordingly, the criticisms of DuPont's crew change facility costs apply

[439] DuPont Opening workpaper "DRR Yard Matrix Errata.xlxs" tab "Crew Facilities" cell J23 incorrectly references cost for a copper water line instead of concrete pad construction costs.

equally to DuPont's yard office costs. Unlike crew change facilities however, NS's Engineering Experts also reject DuPont's proposed sizes for yard offices as inadequate to support DRR operations under the Operating Plan. Instead, NS's Engineering Experts base yard office sizing on facilities existing on the NS system today, which NS's Operating Witnesses determined to be appropriately sized for efficient DRR operations. *See* NS Reply WP "DRR Facilities List Reply.xls," Tab "Facilities Cost," Columns G and H.

NS's Engineering Experts developed major yard offices for all hump and large flat switch yards. NS's Engineering Experts determined the NS yard office building at Croxton Yard, Jersey City, NJ, at 6,800 square feet, is representative of the typical major yard office that would be required by the DRR. For minor yard office buildings, NS's Operating Witnesses determined that the NS yard office building at Gang Mills, NY, at 3,300 square feet, is representative of the typical minor yard office required by the DRR.

As with crew change facilities, NS's Engineering Experts used R. S. Means M.455 "Commercial/Industrial/ Institutional – Office, 1 story" and the associated "Costs per square foot of floor area" table, to determine the cost data The same approach was used to add and deduct costs based on size, perimeter, etc. Refer to NS Reply WP "12 STV Facilities Cost Exhibits_MAG.pdf" at 8, in conjunction with NS Reply WP "DRR Cost Per Building Facility Reply.xls," Tab "Yard Office," for documentation of these costs.

g. MOW Buildings

DuPont used the same design and cost assumption for DRR maintenance of way facilities that is used for DRR minor crew change facilities and for yard office buildings. Accordingly, NS's criticisms of DuPont's minor crew change facility unit costs and calculations apply equally to DuPont's proposed maintenance of way office costs. In addition, DuPont's proposed maintenance of way facility costs are undersized, and fail to provide adequate parking for oversized maintenance of way vehicles or storage for materials, tools, and other equipment.

DuPont assumed a 1,400 square foot structure would be sufficient to: (i) house maintenance of way crews; (ii) garage MOW vehicles; and (iii) store materials, equipment, and parts. But there simply is not enough space in a 1,400 square foot structure to accommodate all of that equipment, materials, crews and activity. Therefore, DuPont's sizing is infeasible. By way of comparison, NS's maintenance of way building in Mount Vernon, IL, that is designed and used solely to house MOW crews, is 1,530 square feet. Garaging of vehicles and material and equipment storage is provided in a separate building. In order to accommodate all of the necessary MOW crews, equipment, parts and materials each DRR maintenance of way facility would have to be in the range of 3,000 to 3,500 square feet Moreover, in the experience of NS Engineering Experts, it is standard practice for rail carriers to provide storage areas for maintenance of way track gangs separate and apart from storage areas for communications and signals maintainers, in order to protect the sensitive electronics equipment of the communications and signals department from heavy-duty track materials used by maintenance of way track gangs. This separation requires additional space. *See* Two-Person Signal Maintainers Building, *infra* at 7.i.g.

Because of the deficiencies and omissions discussed above, NS's Engineering Experts developed costs for MOW facilities that would be adequate to meet the needs of the DRR. As discussed below, in addition to a standard MOW building, NS's Engineering Experts developed additional costs for two other types of necessary buildings: mechanic facilities to service MOW high rail vehicles; and warehouses for storing large track supplies, tools, and equipment.

Although an adequately sized MOW building for the DRR should be at least 3000 square feet, NS Engineering Experts conservatively assume a 2240 foot MOW building.[440] This size is the same as the size used by DuPont for major crew change facilities and, therefore, NS's Engineering Experts used the same R. S. Means base square foot costs used for the major crew change facilities. Refer to NS Reply WP "12 STV Facilities Cost Exhibits_MAG.pdf" at 8, in conjunction with NS Reply WP "DRR Cost Per Building Facility Reply.xls," Tabs "MOW Yard" and "MOW field," for documentation of these costs.

Site Costs. Some of the MOW buildings are located in yards, and therefore the corresponding site costs are covered in their accompanying corresponding yard estimates. However, as indicated in the Operating Plan, some MOW buildings will be located on the railroad system as standalone facilities not associated with a yard. *See* NS Reply WP "DRR Facilities List Reply.xls," Tab "Facilities Cost," Columns L and M. Such stand alone MOW locations would require site development, and thereby site cost estimates. NS Engineering Experts have developed costs for such additional site development. *See* NS Reply WP "DRR Cost Per Building Facility Reply.xls," Tab "MOW field." Because DuPont has neglected to include a cost for this item, the NS site estimate is derived from DuPont's headquarters site cost estimate.[441]

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[440] Similar to major crew change facilities, NS Engineer's have used RS Means M.455 "Commercial/Industrial/ Institutional – Office, 1 story" square foot cost data to determine the cost of maintenance of way facilities based on the following design scenario: Wood construction of a 2,240 SF building with a 35'x64' footprint

[441] DuPont's headquarters building assumes a site construction cost to accommodate 110 parking stalls. Its MOW building is based on 10 parking stalls - spaces for the personal autos of 4-6 staff, plus 4 MOW vehicle parking. Therefore the MOW site base cost is 9% (10/110) of the headquarters site cost.

Another significant item missing from DuPont's cost analysis are separate mechanic facilities to service high-rail MOW vehicles. This is required for a fully functional MOW department, but DuPont failed to account for such necessary facilities. *See, e.g.*, 49 CFR §§ 214.531 & 214.533. The Operating Plan determined the number of MOW vehicle mechanic shops that the DRR would require. *See* NS Reply WP "DRR Facilities List Reply.xlsx," Tab "Facilities Costs," Column O. NS's Engineering Experts have provided a cost for these necessary shops based on RS Means M.290 "Garage, Repair" and the associated "Costs per square foot of floor area" table. For this building type, specific R.S. Means additive items have been included to account for the service hoist, air compressor, lube dispenser, and other items needed for a fully functional mechanic shop. *See* NS Reply WP "12 STV Facilities Cost Exhibits_MAG.pdf" at 9, for details. For site costs related to these buildings, the same basis as is used for the MOW building described above is provided. *See* NS Reply WP "DRR Cost Per Building Facility Reply.xls," Tab "MOW Mech," for details.

Finally, DuPont did not include costs for the secure storage of large track supplies, tools, and equipment, including trailered generators, air compressors, trailered light stands, switches, herbicides, and welding kits. These items are large and bulky, and require significant space to store. Typically, they are stored in a fenced enclosure adjacent to the MOW building. In climates where it snows or locations with security issues, it is typical that these items be stored within a warehouse storage building to protect them. The Operating Plan determined the number of such MOW storage warehouses the DRR would require, and NS's Engineering Experts developed appropriate costs for those warehouses. *See* 7.i.e, *infra*, (discussion of warehouses and their costs).

h. Wastewater Treatment

DuPont includes a cost of $5.7 million for oil/water separators to handle runoff from various work by-products (*e.g.*, oil) before reaching the public sewer system. According to DuPont, under this arrangement the DRR would send effluent to an oil/water vaporizer which would produce a dry powder for easy disposal. DuPont's description and estimate of costs of handling these by-products is insufficient. As noted in DuPont's opening evidence (DuPont WP Oil-Water Evaporator.pdf), the oil/water separators proposed by DuPont can only handle ten gallons per *hour* of effluent. In comparison, the volume of runoff from shop industrial processes often is substantially more than ten gallons per *minute*. This is particularly true when locomotive or car components are being washed prior to repair. Adequate water quality must be achieved before effluent water may be discharged to any public or private sewer system. This includes effluent from shop processes and those from trainwashers and stormwater runoff from unprotected areas such as locomotive fueling and service platforms. To determine the cost of DRR wastewater treatment facilities, NS's Engineering Experts considered the number of locomotives in a shop, the wastewater output from trainwashers, and the uncovered areas at locomotive fueling and service areas, and matched them to oil/water separator systems that could manage the volume of effluent water that DRR facilities would generate. Because of the pollutants found within these industrial areas, these units employ filtration media and other technologies specifically designed to assure water quality at the point of discharge. *See* NS Reply WP "DRR Cost Per Fuel and Shop Facility Reply.xls," Tab "Locomotive Shop," Lines 49 to 54.

i. Other Facilities/Site Costs

The "other facility" and "site" costs category includes a variety of site preparation, drainage and other infrastructure and accessories costs for yards and other facilities. The

Operating Plan determined the DRR would need various yard and facility types, consisting of intermodal facilities (small, medium, large), classification yards (small, medium, large), hump yards (small, medium, large) and automotive facilities (small, medium, large). Each of these yard and facility types was based on an existing NS yard or facility that met the size dimensions required by the Operating Plan.[442] *See* NS Reply WP "DRR Facilities List Reply.xls," Tab "Facilities Cost," Columns AA to AK for lighting and Columns AL to AV for paving.

DuPont understated the amount of paving that would be required for the DRR facilities. DuPont assumed the DRR would pave only the access to the yard leads and the public way. DuPont's case-in-chief failed to provide for paving for parking lots necessary for yard, shop, and transportation employees. NS's Engineering Experts have developed quantities and associated costs for perimeter roadways at typical flat and hump yards of varying sizes by referencing the proxy, template yard types as shown in NS Reply workpaper "09 Yard Lighting and Roadway Quantities.pdf." and NS Reply WP "10 Costs and Quantities - Yard Road and Lighting Summary.pdf."

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[442] Templates developed by Operating Witnesses for all buildings and facilities are in NS Reply WP III-B-Folder "Building and Facility Templates" and NS Reply III-F-7 WP Folder. Including among those templates are the typical **yard configuration for small, medium and large flat switch yards, industrial sidings and hump yards** – "Yard_Template_1_Small_Flat.pdf", "Yard_Template_2_Medium_Flat.pdf", "Yard_Template_3_Large_Flat.pdf", "Yard_Template_4_Hump.pdf", "Industrial Support Typical.pdf"; **Intermodal facilities, small, medium and large** – "Small Intermodal Facility.pdf", "Medium Intermodal Facility.pdf", and "Large Intermodal Facility.pdf"; **Autoramp facilities, small, medium and large** – "Small Auto Center.pdf", "Medium Auto Center.pdf", and "Large Auto Center.pdf"; **TBT terminal** – "TBT Typical.pdf";**Locomotive shop** – "DRR Locomotive Shop Floor Plan.pdf";**Car repair shop** – "Car Facility Template.jpg"**Pavement/Light for all above facilities:** "09 Yard Lighting and Roadway Quantities.pdf";**Yard size/TF/acres** - "DRR Yard Matrix Reply.xlsx" ;"Calc Template- Sm and Med", "Calc Template- Large", "Calc Template- Hump". **Building/Pavement/Lighting Requirements -** "DRR Facilities List Reply.xls" – The "Main Yards and Facilities" and "Facilities Costs" tabs list building/lighting/paving costs for each yard and facility.

Using aerial photos of the template yards and facilities, NS's Engineering Experts developed perimeter roadways, parking lots at facility buildings, inspection cart paths, and thickened concrete for intermodal cranes, as would be appropriate and typical for a given yard type. Paving material volumes were then derived using average soil types and average volume and type of traffic anticipated for a particular roadway based on the experience and expertise of NS's Engineering Experts. Those Experts determined that an adequate depth of aggregate base (AB) would be six inches thick under cart paths, eight inches thick under roadways in automotive, classification, and hump yards, and 11 inches thick under intermodal roadways and crane paths. An adequate depth of asphalt concrete (AC) was determined to be three inches thick for cart paths, five inches thick for roadways in hump, classification, and automotive yards, and seven inches thick for roadways in intermodal yards. An adequate depth of Portland Cement Concrete (PCC) was determined to be 24 inches thick under crane paths along the strip tracks in intermodal yards. In order to convert AC volume to tonnage, the industry standard density of 1.89 ton/cubic yard was used. *See* NS Reply WP "NS Reply Yard Lighting and Paving Costs For Facilities List.xls." *See also* Concrete Asphalt Density, Acqua-Calc, http://www.aqua-calc.com/page/density-table/substance/Concrete-coma-and-blank-Asphalt.

The same aerial yard and facility photos were used to quantify approximate yard lighting needs. NS Engineering Experts based the yard lighting systems on 100 foot steel poles with "stadium" lighting that is widely used in the railroad industry. Common practice employs light stanchions every 500 feet, which provides enough overlap to maintain safe lighting levels at ground level. The photometric footprints of these lighted areas were superimposed on maps in order to determine the minimum number of light poles needed to light each yard. Each light pole would require two pull boxes, one for power and one for CCTV/communications. Duct banks containing four conduit pipes each were drawn to connect light poles to a power source located outside the yard. *See* NS Reply WP "NS Reply Yard Lighting and Paving Costs For Facilities List.xls."

DuPont provided no detail supporting its proffered cost of site lighting (foundations/height of pole/type of fixture) or for the infrastructure required to power the lights (ductbank/cabling/vaults). DuPont provided for only 2,000 feet of electrical conduit per yard, ranging in size from three-quarters of an inch to two inches in diameter. It is standard for railroad yards to utilize three-phase power, and each phase must be in its own conduit as required by the National Electrical Code. *See* National Electrical Code §§ 300, 310 (2005). Conduits typically are four inches in diameter to allow for cable size and heat dissipation. Conduits form a ductbank and the ductbank is sealed in concrete for protection. Additional conduits and ductbanks would be included for CCTV, communications, and other low voltage needs. NS's Engineering Experts designed the lighting system based on 480 volt, three-phase power to optimize the balance between conductor size and voltage drop. Three four-inch conduits are dedicated to the lighting power while a forth is for communication distribution. Costing also included concrete foundations, which are required to support 100-foot light poles and require additional collision protection at their base.

DuPont also failed to include a cost for the main electrical switchgear for each large yard and locomotive shop. Such a switchgear would be necessary to provide site power, and would cost roughly $800,000 for a large yard or for a locomotive shop. *See* NS Reply WP "DRR Cost Per Fuel and Shop Facility Reply.xls," Tab "Locomotive Shop," Line 42. DuPont failed to include any cabling whatsoever for distribution of power. NS's Engineering Experts have developed quantities and costs for power and communication duct banks containing the above mentioned conduits and cables as well as associated pull boxes for each yard type and size. *See* NS Reply WP "Costs and Quantities - Yard Road and Lighting Summary.pdf".

DuPont provided for 25 bollards in major yards and six bollards in minor yards. Bollards are short vertical posts used in numerous locations around yards and shops and within shop buildings, principally to provide protection against moving equipment. For example, each yard air connection is typically protected by at least two bollards set in a roadway allowing workers to connect air hoses to the compressor and to the train. This alone requires at least four bollards per yard track. Bollards also provide a place to coil and hang the air hose used to provide air to the train. Additionally, bollards are provided for protection of lighting stanchions, intra-yard crossing gates, fire hydrants, and building corners and at vehicular entrances to buildings (often four per door opening). NS's Engineering Experts determined a conservative estimate of 200 bollards per yard based on the average number of features per yard requiring bollards, as discussed above.

i.a – Guard Booths

DuPont did not provide for guard booths at the entrance of any yards to prevent theft.[443] Consistent with industry standards, NS's Engineering Experts provided for guard booths at the entrance of every intermodal facility to prevent theft of expensive commodities, and at every automotive facility to prevent theft and vandalism of vehicles. Two guard booths were provided

[443] *See* Norman West et al., College of Urban Planning and Public Affairs, University of Illinois Chicago, Planning Considerations for Projected Intermodal Rail Yards in Chicago Region Studied by Key-Informant Interviews (2005) available at http://www.trforum.org/forum/downloads/2005_PlanningConsiderations_paper.pdf (detailing security and terrorists concerns for intermodal facilities and the necessity of applying enhanced security measures "to the gate areas of entry and dispatch"); State Police Unit Cracks Down on Cargo Theft, Herald News, Sept. 24, 2012, http://heraldnews.suntimes.com/news/4932331-418/state-police-unit-cracks-down-on-cargo-theft.html ("Every year, between $15 billion and $30 billion worth of merchandise is stolen out of cargo trailers, intermodal facilities, railroad yards and warehouses across the United States.").

at certain larger intermodal and automotive facilities that would need both an in-gate and an out-gate.[444] Smaller intermodal and automotive facilities were provisioned with a single guard booth based on a single point of entry and exit. An example of two guard booths is NS's Titusville, FL auto yard, which NS used as a template for an auto yard. Costs of each guard booth includes the guard booth itself, plus the additional costs for a concrete pad, and power, data, phone and utilities. NS's Engineering Experts developed costs for the necessary guard booths using an eight foot-by-eight foot prefabricated shelter. A cost estimate was obtained from a supplier, FS industries. That cost includes a 24 inch overhang for sun protection, an HVAC wall unit, delivery, sales tax of 8%, and general contractor markup of 10%. *See* NS Reply WP "12 STV Facilities Cost Exhibits_MAG.pdf" at18 & 19, in conjunction with NS Reply WP "DRR Cost Per Building Facility.xls," Tab "Guard Booths," for documentation of these costs.

i.b – Mechanic Repair Shops

DuPont's evidence did not provide for mechanic repair shops at any of the DRR yards. These shops would be necessary for the railroad to maintain and repair yard hostlers and forklifts. Examples of this are the mechanic shops located at NS's Shelbyville, KY and Austell, GA yards. A mechanic's shop building is taller than a standard one-story crew building or yard office to allow for hostlers to be hoisted. At a minimum, a mechanic repair shop includes repair bays with mechanical lifts, oversized roll-up doors, a small mechanic's office, concrete foundations, pressure washer, an eyewash station, storage for parts, shelving, an air compressor system, sufficient lighting, HVAC equipment, and an adequate ventilation system for vehicle exhaust. Such facilities also require standard electrical outlets and switches, interior lighting,

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[444] Indeed, DuPont failed to provide for intermodal and auto yards altogether. It is thus not surprising that it failed to provide for guard houses and other necessary facilities and equipment for such yards.

data and phone outlets and cabling, office partitions and drywall, interior doors, ceilings, and interior finishes, such as carpet, rubber base, sheet vinyl, tile, paint, as well as furnishing items such as mini-blinds, cork boards, and dry-erase boards. NS's Engineering Experts provided for the construction of these mechanic repair shops in accordance with the requirements of the Operating Plan. *See* NS Reply "DRR Facilities List Reply.xls," Tab "Facilities Costs," Column O

In developing costs for these buildings, NS's Engineering Experts used R. S. Means M.290 "Garage, Repair" and the associated "Costs per square foot of floor area" table, to determine the square foot cost data based on a one-story, 2,400 square foot building with a 40 foot-by-60 foot footprint. This would allow two adjacent service bays at 20 feet-by-40 feet each, plus one additional bay at 20 feet-by-40 feet for a small office, parts storage, and large tool areas. Similar to the MOW vehicle mechanic shop, the NS Engineering Experts included cost items to account for the service hoist, air compressor, lube dispenser, and other items needed for a fully functional repair shop. *See* NS Reply WP "12 STV Facilities Cost Exhibits_MAG.pdf" at 9 in conjunction with NS Reply WP "DRR Cost Per Building Facility.xls," Tab "Mech Shop," for calculations of these costs.

i.c –Observation/Yard Master Tower

DuPont's evidence did not include any observation building or yard master towers. Such towers are required for monitoring certain rail yards, including every auto yard.[445] Like the guard booths at yard entrances, the yard towers provide security to prevent theft, and allow visual monitoring of the entire yard. NS's Engineering Experts provided for the construction of these observation towers in accordance with the requirements of the Operating Plan. For

[445] For example, NS has such observation buildings in their yard template for Titusville, FL auto yard, and their Petersburg, VA auto yard.

locations, refer to NS Reply WP "DRR Facilities List Reply.xls," Tab "Facilities Costs," Column I.

To determine the costs of these towers, NS's Engineering Experts integrated required observation towers into the crew change facilities at the applicable yards. Yard crews would report to the same building housing the tower. This is practical and economical so that only one structure is built on the site, rather than two separate structures. The observation towers were developed at 30 feet high with an internal staircase, full wrap-around glass windows, and 36 inch roof overhangs to protect from the sun and glare. See NS Reply WP "DRR Cost Per Building Facility.xls," Tab "Auto Observation," for additional information.

i.e –Storage & Warehouse Buildings

DuPont's evidence did not provide for any storage or warehouse buildings on the DRR. These buildings are required throughout the railroad for several purposes. For example, they are required by railroad departments for storage of parts, equipment, and materials. Storage buildings are also required for the maintenance of way facilities to protect large parts, tools, and equipment, as mentioned previously in section 7.g *supra*. An adequately sized maintenance of way storage building is 1900-2000 square feet, as exemplified by the NS's Lancaster, PA MOW storage building. Larger warehouse buildings are required at larger yards, not only for maintenance of way activities, but for other railroad departments and functions. An example of this is the 24,000 square foot warehouse at the Columbus, OH TBT yard. NS's Engineering Experts developed the number of such buildings and their locations based on the requirements of the Operating Plan. *See* NS Reply WP "DRR Facilities List Reply.xls," Tab "Facilities Costs," Columns P and Q.

NS's Engineering Experts developed the cost of these warehouses and storage based on RS Means M.700 "Warehouse, Mini " for the minor and major warehouses. *See* NS Reply WP

"DRR Cost Per Building Facility.xls," Tab "Storage Buildings." The RS Means "Costs per square foot of floor area" table for each warehouse is included in NS Reply WP "12 STV Facilities Cost Exhibits_MAG.pdf" at 10.

i.f – Foundation Designs

DuPont did not account for the piles and caissons that are necessary to support some buildings. Because of varying soil conditions in different locations, some DRR buildings would require piles or caissons under the foundation. Piles increase construction costs significantly. An example of this is the NS Croxton Yard Office Building in Jersey City, NJ. This facility has 99 timber piles with concrete pile caps and grade beams. NS's Engineering Experts conservatively determined that piles would be required only at the headquarters buildings and the major warehouse buildings, based on the fact that these buildings are the largest and heaviest buildings on the DRR. The cost for the piles are itemized at NS Reply WP "DRR Cost Per Building Facility.xls," Tab "Headquarters," Line 31 and Tab "Storage Buildings," Line 25. NS derived the pile cost using R. S. Means *see* NS Reply WP "12 STV Facilities Cost Exhibits_MAG.pdf" at 15a & 15b, calculating costs (based on piles proposed at approximately 12'-4" O.C., for a total of 400 piles for the headquarters building).

i. Two-Person Signal Maintainers Building

DuPont did not provide for the housing of signal maintainers. The Operating Plan requires that signal maintainers be stationed throughout the DRR system in 150 separate, two-man crews, with each provided a small building. Based on NS's Bluffton, Indiana facility, an appropriate size for this building is approximately 32- feet-by-18 feet, with a single, unisex restroom, a small office area, and a separate storage area. *See* the Maintenance of Way Buildings section, *supra* at 7.g (discussing the need for a separate storage area). NS engineers have used the actual NS AFE costs of $61,000 for these facilities, *See* NS Reply WP "12 STV

Facilities Cost Exhibits_MAG.pdf" at 22 & 23. The AFE has been adjusted for location factor and 2nd quarter 2009 historic cost index. *See* NS Reply WP "DRR Cost Per Building Facility.xls," Tab "2-Person Sig Maint" (showing adjusted price calculation).

8. Public Improvements[446]

a. Fences

NS accepts DuPont's general assumption that the vast majority of DRR right-of-way would not be fenced. However, fencing is included at key Maintenance-of-Way and signal facilities and is discussed in the appropriate sections. *See supra* III-D-4.

b. Signs and Road Crossing Devices

DuPont's Opening Evidence included cost estimates for what it calls a "standard package" of railroad signs, including milepost, whistle post, yard limit, and cross buck signs and posts for a total cost of $8 million. *See* DuPont Opening III-F-48. NS's Engineering Experts have determined that DuPont's "standard package" is insufficient due to the omission of Emergency Notification Signs ("ENS") that are required by FRA's Rail Safety Improvement Act 2008 – Section 205[447] and due to insufficient installation costs for RR crossbucks. The costs referenced in the DRR's opening evidence do not take into consideration additional tasks and measures required to install signage on RR right-of-way and around at-grade crossing locations .

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446 NS's evidence on the cost of public improvements to the DRR is sponsored by NS witness Randall Frederick. Mr. Frederick is a Project Manager and Senior Engineer with STV and has over 30 years of experience managing construction engineering and inspection services for highway and railway bridges and tunnels. Prior to joining STV, Mr. Frederick was a Principal Engineer with CSXT. Mr. Frederick's qualifications are further detailed in Section IV.

447 NS Reply WP "FRA Rail Safety Improvement Act 2008 – Section 205.pdf."

i. Advance Warning Signs and Crossbucks

DuPont's support for sign costs[448] reflect material and labor costs based upon the Tennessee Department of Transportation's railroad advance warning highway signage (e.g. MUTCD W10-1, *see* FHWA's Manual on Uniform Traffic Control Devices – 2009 Edition), but not railroad crossbuck signage (i.e. MUTCD R15-1). Moreover, DuPont's proposed costs[449] also did not take into consideration additional measures required to install signage on DRR right-of-way and around at-grade crossing locations (e.g. additional labor to locate underground RR utilities which are not included in a standard utility locate request).

Therefore, NS's Engineering Experts have quantified railroad crossbuck sign installation using cost data from actual NSj projects, which NS produced in discovery. This cost information is referenced in DuPont's opening Track Construction Cost spreadsheet (Tab CROSSBUCK – "NSR Price"), but DuPont apparently decided not to use it. Therefore NS's Reply evidence increases the cost to install Crossbucks at all crossings by $2.655 million to reflect actual documented labor and material costs. *See* NS Reply WP "Track Construction Errata Reply," Tab "Crossbuck;" "Crossing Surface Cost - NS Discovery NS-DP-HC-025627.pdf"

ii. ENS

Emergency Notification Signs are now a requirement for railroads, based upon FRA's Rail Safety Improvement Act 2008 – Section 205.[450] In 1994, based upon a demonstrated need for an Emergency Notification System for Class 1 railroads, Congress directed the Secretary of

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[448] DuPont Opening WP "Advance Warning Sign Price.pdf."

[449] DuPont Opening WP "Track Construction Costs errata.xls."

[450] NS Reply WP "FRA Rail Safety Improvement Act 2008 – Section 205.pdf."

Transportation to pursue a pilot program for a toll-free notification system at all at-grade rail/highway crossings (both public and private). The National Transportation Safety Board, in conjunction with the FRA, recommended implementation of an ENS system on all Class 1 railroads. A key component of this system is two emergency notification signs ("ENS") at each at-grade rail/highway crossing communicating the following information: "1-800 Telephone Number and Grade Crossing Identifier." ENS was made mandatory by the Rail Safety Improvement of Act 2008 - Section 205. NS's Engineering Experts added costs of compliance with the ENS signs requirement for all crossings (both public & private). *See* NS Reply WP "Track Construction Errata Reply," Tab "ENS Cost – Reply."

The DRR would include a total of 9,000 at-grade crossings. Therefore, NS's Engineering Experts have determined that 18,000 ENS signs are needed to comply with the FRA requirement, thereby increasing DRR crossing costs by $1.78 million.[451] *See* NS Reply WP "Track Construction Errata Reply," Tab "Summary."

c. Grade-Separated and At-Grade Crossings

i. Grade Separations

Because all of the DRR's referenced grade-separated crossings are highway overpasses, these costs are addressed in a separate section. *See supra* III-F-5-c (Highway Overpasses).

ii. At-grade Crossings

The DRR would build all at-grade crossing surfaces and pay 100% of material costs. *See* DuPont Opening III-F-49. NS's Engineering Experts have confirmed the number of crossings identified along the hypothetical DRR route and accept that number. NS's Engineering Experts

[451] NS Reply WP, "ENS Sign Costs.pdf."

also accept DuPont's rubber and asphalt/rail-seal crossing surface configuration as a general surface type.

However, NS's Engineering Experts take exception to DuPont's proposed Grade Crossing construction cost of $532 per track foot. Review of DuPont's supporting Grade Crossing surface estimates shows that its bid costs range widely from $305 to $1,100 per track foot.[452] Further, several of the estimates lack sufficient supporting information to show compliance with Class I railroad crossing standards. Documents NS provided to DuPont in discovery clearly document its at-grade crossing surface materials and labor costs which also reflect a Year 2009 per track foot cost of $753.[453] NS's Engineering Experts therefore, have revised the grade crossing construction costs to reflect these actual documented material and labor costs, thereby increasing the total stated Grade Crossing cost by $43.6 million for a new total of $149,169,300.[454]

iii. At-grade Crossing Detours

DuPont's Opening Evidence does not include any costs associated with roadway detours and signage required while the roadway is closed for construction of DRR track and at-grade crossings. These costs include, but are not limited to, identification of the detour route, signs denoting the detour route, barricades at the crossing, and advance notices of the road closure(s) in local publications. A typical detour, based upon the federal Manual on Uniform Traffic Control Devices (MUTCD)[455] requires a full complement of signs and barricades. The signage

[452] DuPont Opening WP "Bayline Turnout Bid.pdf."

[453] NS Reply WP "Crossing Surface Cost – NS Discovery NS-DP-HC-025627.pdf."

[454] NS Reply WP "Track Construction Costs errata NS Reply.xlsx."

[455] NS Reply WP "MUTCD Detour Signage.pdf."

configuration and associated costs are quantified in the NS Reply workpapers.[456] Based upon the construction of 9,000 at-grade crossings identified on the DRR, the total cost for detour signage increases DRR construction costs by $58.1 million. *See* NS Reply WP "Track Construction Errata Reply," Tab "Crossing Detour Cost – Reply."

iv. At-grade Crossing Vegetation Removal

The Sight Triangle at highway rail crossings, which provides vehicles traveling at the legal speed limit with an adequate view of approaching trains[457] at highway-rail at-grade crossings, is paramount for the safety of the motoring public. Both the Federal Highway Administration and the Federal Railroad Administration have guidelines and requirements for establishing and maintaining the Sight Triangle at highway-rail crossings. Additionally, the Federal Railroad Administration's, Compilation of State Laws and Regulations Affecting Highway – Rail Grade Crossings[458] reflects the railroad's state law responsibility for vegetation control at highway-rail crossings.

In compliance with safety guidelines of the Federal Highway Administration's Railroad-Highway Grade Crossing Handbook,[459] the NS Railway regularly conducts a Grade Crossing Quadrant Clearing Program on each of its operating Divisions. This program consists of a comprehensive vegetation removal program for each at-grade crossing. The standard NS

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[456] NS Reply WP "Detour Signage Costs.pdf."

[457] *See* NS Reply WP "FHWA Sight Distance Diagram.pdf."

[458] FRA Compilation of State Laws and Regulations Affecting Highway-Rail Grade Crossing – 5th Edition, NS Reply WP "FRA Compilation of State Laws and Regulations - Ch12.pdf."

[459] FHWA Railroad-Highway Grade Crossing Handbook – Revised Second Edition August 2007 (excerpt), NS Reply WP "FHWA Site and Operational Improvements.pdf."

clearing areas are illustrated in the NS Reply workpapers.[460] NS provided documentation of its vegetation removal costs to DuPont in discovery.[461] The NS Railroad Engineering experts have included additional costs for vegetation clearing at each at-grade crossing on the DRR, based upon a total of 9,000 at-grade crossings.[462]

In sum, NS's Engineering Experts estimate total public improvement costs for the DRR of $256 milllion, or $134 million more than DuPont's opening evidence estimate.

9. Mobilization

NS accepts DuPont's mobilization cost factor of 2.7 percent applied to all DRR road property investment accounts except land. It is well-established in SAC cases that the standard mobilization factor is not applied to land costs. As demonstrated below, however, there also would be significant additional initial costs associated with acquisition of nearly 100,000 acres of land, spread over most of the eastern United States, in a relatively short period of time. Dupont's evidence did not account for this substantial cost, and thereby understated DRR road property investment costs. NS's experts have developed a reasonable estimate of the additional costs associated with the acquisition of land for the DRR, and this Reply evidence adjusts DRR road property investment costs to account for the acquisition costs omitted by DuPont's evidence.

9.1 Real Estate Acquisition Costs[463]

[460] NS Reply WP "NS Vegetation Cut Pattern. Pdf."

[461] NS Reply WP "GCOC Crossing Clearing and Maintenance Summary 2004-2011.xlx."

[462] NS Reply WP "NS Reply WP III-F-249.pdf."

[463] This section is sponsored by Mark D. Mathewson, Owner of Mathewson Right of Way, who is an expert in right of way acquisition. Mr. Mathewson is a licensed attorney in the State of Illinois. His company provides land acquisition services for governmental and private sector clients. Over the last 25 years, Mr. Mathewson has overseen the acquisition of more than 10,000 parcels of property throughout the State of Illinois. Mr. Mathewson's qualifications are further detailed in Section IV.

Although the DRR would need to purchase 94,254 acres of land for its ROW, communication facilities, and yards, *see supra* Section III-F-1, DuPont did not provide for <u>any</u> additional costs to the DRR for acquiring this massive amount of real estate. Such an omission understated DRR land acquisition costs because, in the real world, a railroad purchasing real estate must pay not only the purchase price of the land, but also the associated transaction costs of acquiring that land, including title work, surveys, appraisals, negotiations, and closing costs.[464] Indeed, the costs that accompany any land acquisition are particularly significant for right-of-way acquisitions, because such acquisitions typically involve purchasing land that is not presently on the market and require labor-intensive efforts to identify and negotiate with landowners. These costs are separate and apart from the Across-the-Fence valuation of the land to be acquired by the DRR, and NS's appraiser specifically excluded these costs from his appraisal report.[465]

According to the DRR construction schedule, the DRR would acquire the 94,254 acres of land necessary for its operations during the <u>six month</u> period between April and October 2007. *See* DuPont Opening WP "Complete Construction Schedule.xls." In order for the DRR to be able to purchase that quantity of land in the incredibly short period of six months, the DRR must engage contractors to perform the necessary title work, surveys, appraisals, and landowner

[464] When condemnation proceedings become necessary, railroads also must pay the associated litigation costs. These costs are ignored for purposes of this analysis, as it is assumed that the DRR would be able to purchase the land without the need for eminent domain.

[465] *See* NS Reply Exhibit III-F-3 at 121 ("The following acquisition costs are disregarded: brokerage fees; legal and accounting fees; insurance; surveys; appraisals; title search; transfer taxes; landowner association fees; special assessments; permits for non-conforming use; subdivision fees; condition assessments and surveys; demolition, relocation or rehabilitation of improvements on abutting parcels; severance damages; and damages for creating any landlocked parcels not included in the acquisition.").

negotiations. This work cannot be performed by the DRR Real Estate department, who will not yet be employed by the DRR at the time of real estate acquisition in April 2007. However, even assuming that the DRR Real Estate Department could oversee this effort, the scope of the acquisition still would require the use of outside resources because neither the four-person Real Estate staff proposed by DuPont on Opening or the eight-person staff that NS has proposed on Reply possibly could acquire 94,254 acres in six months. *See supra* III-D-136 to III-D-137.

Indeed, despite NS's Real Estate Department of over forty people, *see supra* III-D-137, NS itself uses real estate consultant services, including those provided by Mr. Mathewson, as well as brokerage services, for real estate transactions that pale in comparison to the scope of the DRR acquisition and that are completed over a much longer period of time.[466] Because right-of-way acquisition involves purchasing land that is not presently on the market, there is considerable work involved in identifying, contacting, and negotiating with landowners, in addition to the other tasks, such as title work, surveys, and appraisals, which cannot be performed in-house as they require specific skill sets and certifications.

Mr. Mathewson has developed a conservative estimate as to what the DRR would have to pay for real estate acquisition costs on a per parcel basis.[467] First, Mr. Mathewson conservatively assumes that the DRR consists of 9,000 parcels, which is over ten acres per parcel. By comparison, the average acreage of the valuation units Mr. Hedden used in valuing the DRR ROW was 9.25 acres, so Mr. Mathewson's assumption conservatively attributes only one parcel

[466] *See, e.g.*, NS Reply WP "Exclusive Representation Agreement.pdf" (contract for brokerage services for the acquisition of a small number of parcels in Jefferson County, Alabama).

[467] Pricing for right-of-way services are often calculated on a fixed fee basis, including on a per parcel basis. *See, e.g.*, NS Reply WP "Right of Way Consultant Contracts.pdf."

per valuation unit. Second, Mr. Mathewson calculates costs for essential tasks that the DRR or a contractor would need to perform in order to acquire each parcel. These costs and tasks are set forth in Table III-F-30.

Table III-F-30
DRR Real Estate Acquisition Costs[468]

Cost Category	Category Description	Per parcel cost
Title Work	Title research resulting in a commitment for title insurance; this fee includes updates required during the acquisition process	$500
Survey	A boundary survey indicating the precise property to be acquired, including an area calculation	$4,000
Appraisal[469]	A expert opinion of the value of the property or real estate interests to be acquired	$2,000
Negotiations	Negotiations with landowners over the cost of the property	$2,500
Closing Costs[470]	Closing costs include recording fees, title insurance, escrow fees, document preparation fees, mortgage payoff fees and attorneys' fees; amount will vary largely based on cost of property	$3,440
	Total Per Parcel Cost	**$12,440**
	Total Estimated Cost for DRR	**$111,960,000**

This estimate is founded on conservative assumptions regarding the costs the DRR would incur to acquire the necessary land based upon Mr. Mathewson's extensive experience in the field of

[468] *See* NS Reply WP "Real Estate Acquisition Costs.xls." This estimate does not include costs for environmental studies or permitting.

[469] This estimate does not include an appraisal review, which is sometimes required in ROW acquisition projects.

[470] To be conservative, Mr. Mathewson has only included in his estimate the costs of title insurance, closing fees, recording fees, and transfer taxes. All other closing costs, including attorneys' fees, have been omitted.

right-of-way acquisition. Accordingly, the DRR would incur $111,960,000 in expenses for real estate acquisition separate and apart from the cost of the land itself.

10. Engineering

NS accepts DuPont's engineering additive.

11. Contingencies

NS accepts DuPont's contingency factor.

12. Construction Schedule[471]

Under the Board's theory of unconstrained resources, NS accepts DuPont's proposed 30 month construction schedule for the DRR but makes adjustments where appropriate to the DRR construction costs to account for the real world effect of lost production due to winter cold and rainfall.

The DRR covers a majority of the eastern seaboard. From east to west the route stretches from New York City on the east coast to Kansas City in the heart of the country on the Missouri River. From north to south the route stretches from the big cities of Chicago, Detroit, and Buffalo on the Great Lakes to Mobile and New Orleans on the Gulf Coast. Between these points the route crosses the Appalachian Mountains several times. The route not only traverses a vast land mass but also encounters different degrees of seasonal weather year round. The summer season in the southeast can be extremely hot and humid while the winters in the northern regions of the Appalachian Mountains and the Great Lakes can be extremely cold. In addition, seasonal climatic events such as hurricanes, droughts, and heavy rains that cause flooding and mountains

[471] NS's evidence regarding the DRR's construction schedule is sponsored by NS witness George Zimmerman, a Project Manager and Senior Engineer with STV. Mr. Zimmerman's qualifications are further detailed in Section IV.

slides can and have occurred.[472] In the recent past record snowfalls caused by lake effect snow and other climatic conditions have hit Chicago and Buffalo. Category 4 hurricanes have hit the Gulf Coast not only causing extensive damage along the shoreline but also causing inland flooding. Major flooding along the Missouri and Mississippi Rivers has occurred. A railroad bridge over the Mississippi River at Hannibal, MO was almost wiped out by flooding. Floods in West Virginia wreaked havoc on many towns along the same rivers that the railroad experienced washouts. Weather is a real factor in costing any construction that relies on good weather to accomplish the work.

The original builders of the many lines that make up the DRR also had the challenge of coping with weather related events. DuPont ignores these challenges and adverse events when costing the property investment to build the DRR. RS Means Construction Cost Data and the associated production rates are based on good weather and site conditions.[473] NS's Engineering Experts observed many roadbed repairs and installation of preventative measures along sections of the DRR route constructed over the years due to slides and washouts caused by extreme weather events. It is expected that many such events will occur during a three year construction schedule involving DRR rail lines. In addition typical seasonal weather events that occur annually such as snow, rain, extreme cold or extreme hot temperatures will slow production. During extreme weather events some roadbed, culverts and even bridges will have to be repaired or completely rebuilt due to damages incurred.

NS's Engineering Experts looked at two factors that will have an annual impact on construction. The snowfall and cold weather of winter and the days lost to rain were examined

[472] NS Reply WP "DRR Climatic Data Winter Months.xls," Tab "Weather Events."

[473] NS Reply WP "RS Means Pages_IX&X.pdf."

to determine lost production that results in higher construction costs. As pointed out by DuPont in Opening Evidence a majority of the DRR has a classified "Climatic Zone" of either "Humid," "Sub-Humid," or "Moist Sub-Humid."[474] Annual rainfall in these areas range from 33 to 62 inches. Although the rain is spread out over the year, there are many days that work cannot be performed or rain slows production. Some areas of roadbed could even be permanently impacted causing complete rework or repair. NS's Engineering Experts also obtained weather information for the months of December through March for major cities along the DRR route.

DuPont Opening Workpaper "Complete Construction Schedule.xls" reveals eleven construction segments. The construction segments are divided by NS Operating Divisions. Each schedule indicates that construction will begin August of 2007 and end March of 2009. The schedule also indicates that earthwork and drainage will take seven months (August 2007-February 2008); bridge construction will take 12 months (March 2008-February 2009); track construction 12 months (also March 2008-February 2009); and tunnels 12 months (February 2008-January 2009). Overall, the construction that is most subject to winter weather and outside activities that depend on good weather occur over a 19 month period that include seven months of winter.

NS's Engineering Experts have identified three sources that document the productivity losses due to cold weather as well as other environmental factors. They are:

- Productivity Improvement in Production (NS Reply WP "Human Time Study-Env Aspect.pdf");
- Determination of INDOT Highway Construction Production Rates and Estimation of Contract Times (NS Reply WP "INDOT Hwy Production Study-selected pages.pdf"); and

[474] DuPont Opening WP "DRR Route avg rainfall.pdf."

- Construction Law Library's "Calculating Lost Labor Productivity in Construction Claims" (NS Reply WP "Productivity Losses-Weather.pdf").

Each of the above cited workpapers reference studies that have documented and measured lost productivity caused by cold weather.

As stated in the material, "The greatest impacts of adverse weather are upon outside operations and, most particularly, on those operations involving either earthmoving or material sensitive to temperature and weather, such as concrete and mortar."[475] RS Means labor, equipment and production rates do not take into account adverse weather conditions.[476] NS's Engineering Experts have identified the following areas of outside construction activities that are impacted by cold weather effects on labor, equipment and material:

- Earthwork and Drainage – In addition to the human factor, at temperatures below freezing equipment loses efficiency. Equipment becomes harder to start and it takes hydraulics longer to warm up to efficient operating levels. Material from the previous day's operation freezes overnight and must be either thawed and dried or replaced.[477] During heavy or steady rain, soil turns to mud and obviously cannot be easily excavated or transported on wet and muddy roads. Wet periods put too much moisture in the material to achieve proper compaction. Wet haul roads become muddy and if the roads are steep become almost impassable. At the end of a rain event material must be given time to dry out or discs and scarifiers need to be used to assist in the drying process. Obviously culverts and low lying areas fill with water to prevent installation of culverts unless diversion channels have been constructed.

- Bridge Construction – New bridge construction is largely dependent on outside labor driving pile, constructing formwork, installing reinforcement rods, and placing concrete. Cold weather has a greater impact on these activities than most others and labor is always exposed to the elements. Pouring concrete when the ambient air temperature is less than thirty-five (35) degrees F will require the concrete temperature to be 70-degrees or higher. Then the concrete must be kept at a temperature of at least 50-

[475] NS Reply WP "Productivity Losses Weather.pdf" Chapter 5, page 103.

[476] NS Reply WP "RS Means Pages_IX&X.pdf."

[477] NS Reply WP "NS Grading Spec.pdf."

degrees for 72 hours[478] requiring the concrete to be heated and cured under insulated blankets or controlled heated air. Rain also has an impact when crews have to build in low lying areas that may flood during heavy rain events. Flooding has also occasionally wipes out concrete forms and other previously constructed bridge components, causing additional losses to labor and material already spent on the project.

- Track Construction – Largely dependent on labor exposed to the elements and equipment; the only equipment with enclosed cabs would be surfacing and lining equipment and cranes. All other track equipment requires operators and/or laborers to be outside the machine. In addition, welded rail that is laid during winter operations needs adjusting in the spring or summer due to heat expansion.[479] Although rail heaters are used during extreme cold the effects are minimal. NS engineering policy requires that rail be laid within 10-degrees of the mean temperature for the region. If rail is laid at a lower temperature the contractor will have to come back to the site and "adjust" the rail at the higher temperature.[480] Obviously it would be difficult to achieve the mean temperature in the dead of winter. Also subject to the effect of cold weather is the manufacturing, shipping and placement of sub-ballast and ballast. While shipping ballast in rail cars in the winter the moisture in the ballast becomes frozen turning the mass of ballast into a huge ice cube. Unloading ballast from rail cars is virtually impossible without first heating the car (very impractical for track construction). Placement of sub-ballast is also hindered because of the need for water to achieve compaction requirements and the freezing of the moisture that is already in the material. In addition to the cold weather rain will hinder track construction operations. Specifically starting with the sub-ballast rain will allow too much moisture in the material to be properly compacted prior to placement of the track on top of the sub-ballast. Rain also will hinder outside labor. Although track can be constructed during wet weather it slows down operations due to labor and machine operators affected by not being sheltered from the rain. Rail, ties and OTM also become slick and more difficult to handle.

- Tunnel Construction – Although tunnels are "out of the weather," cold weather does impact icing of tunnels and the same effect on labor and equipment as described earlier. In addition, ground water inside of tunnels creates large icicles that become very large and heavy creating a hazard to workers and equipment. Equipment that depends on compressed air can become inoperative due to ice buildup in the airlines causing delays until

[478] NS Reply WP "NS Structural Concrete Spec.pdf."

[479] NS Reply WP "Track Stability Procedures.pdf."

[480] NS Reply WP NS Trackwork Spec.pdf."

they are thawed. Concrete and shotcrete for tunnel linings and portals must be applied properly and cannot be subject to freezing. Water must be kept a warm temperature when mixing concrete and shotcrete.

a. Additive to Compensate for Lost Productivity During Winter Construction

To quantify the production lost due to cold weather and snow, the reference material listed above was reviewed to determine a reasonable methodology. First monthly temperatures and snowfall were documented.[481] Wind speeds were also included in this data because of the effect they have on temperature. Second, NS's Engineering Experts identified the cost of labor and equipment for each operation. From the studies included in the reference material, it is clear that labor is affected the most during cold weather. Equipment is not affected until temperatures remain below freezing, however if operators are exposed to the elements it will decrease the efficiency of the operation.[482] Third, NS's Engineering Experts determined the average rates of production for each operation carried out during winter weather. Last, an efficiency factor or labor multiplier was developed to apply to labor and equipment costs.

Average temperatures, snowfall and wind speeds for 42 cities along the DRR were obtained from the websites *www.weatherbase.com, www.city-data.com, and www.currentresults.com.* This data was compiled and averaged in NS Reply Workpaper "DRR Climatic Data Winter Months.xls." The average temperatures, snowfall, wind speeds, and rainfall were documented for each NS Operating Division shown on the DRR construction schedule. Where R.S. Means costs were used, the labor, equipment and production rates for each line item was identified. In situations where costs are based on quotes or prices that did not provide the costs breakdown the labor and equipment costs were estimated based on similar

[481] NS Reply WP "DRR Climatic Data Winter Months.xls."

[482] *See* NS Reply WP "Productivity Losses Weather.pdf" Figure 5-1.

items found in R.S. Means Costs Data and the production rates determined by total quantities and the total months duration shown in the DuPont schedule.[483]

Using guidance from the construction productivity materials, NS's Engineering Experts developed efficiency multipliers for major construction cost categories. *See* NS Reply Workpaper "Productivity Losses-Weather.pdf." The nomographs[484] found in Figures 5-3, 5-4, and 5-5 of "Producitivity Losses-Weather.pdf," were used along with the weather data found in NS Reply Workpaper "DRR Climatic Data Winter Months.xls." The climatic data was used to plot and determine a combined labor and equipment multiplier for each winter construction month. Nomographs for each NS Operating Division can be found in NS Reply Workpaper "Nomographs by Division.pdf." Upper and lower efficiency labor multipliers were determined from the nomographs, which NS's Engineering Experts then averaged to obtain one labor multiplier for each month. The average labor multiplier was then averaged with the equipment multiplier based on the observed mix of labor to equipment costs to determine a combined multiplier for each month. These combined multipliers for each region are applied to all costs associated with winter months (Dec-Mar) based on the DuPont work schedule.

NS Reply Workpaper "DRR Winter Costs by Division.xls" was developed from all the data necessary to arrive at a total additive for performing earthwork, bridge and track work during the winter months. Quantities were distributed evenly for each month shown in the DRR construction schedule. Total additional costs due to losses in production during winter months using this methodology amounted to $344.7 million.

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[483] DuPont Opening WP "Complete Construction Schedule.xls."

[484] Nomographs are graphs consisting of three coplanar curves, each graduated for a different variable so that a straight line cutting all three curves intersects the related values of each variable.

b. Additive to Compensate for Days Lost to Rain Events

Continuous rain and especially heavy rain will quickly shut down outside construction activities. During grading and drainage related construction soil turns to mud. Drainage ditches and live streams fill with flowing water. In addition, erosion control measures are quickly strained while bare slopes often erode. Heavy rains can cause newly installed culverts to fill with sedimentation or completely washout. Haul roads become slick if not impassable. Too much water can cause compaction efforts to fail requiring material to be dried or replaced. Use of cranes while building bridges becomes a safety concern. Bridges that require the construction of piers in low lying areas become flooded. In many cases, structural concrete cannot be placed or concrete trucks cannot reach the bridges. Track work is also slowed. Sub-ballast cannot be setup (compacted) properly during heavy rain or wet periods. Although track construction on previously compacted sub-ballast is not an issue, labor and material handling are slowed by rain events.

To quantify lost labor and production due to rain, NS's Engineering Experts determined the number of rainy days and annual rainfall for each NS Operating Division. From this data the number of days lost to rain was determined based on the lower of 50% of rainy days or 80% of the total annual rain fall in inches to reflect the fact that not all rain events result in work stoppages. Contractors (both union and non-union) generally pay crews a "reporting" time even if the crews are not able to work due to weather conditions.[485] That time averaged payment of two hours pay for reporting each day that weather prevented work from being accomplished.[486] To develop the reporting time pay rates NS's Engineering Experts divided the labor amount

[485] NS Reply WP "Contractor Inclement Weather Policies.pdf."

[486] *Id.*

shown in R.S. Means Cost Data for each item by four to calculate the pay for two hours from a standard eight hour day. In situations where R.S. Means cost data were not used NS's Engineering Experts identified similar cost components from R.S. Means to determine percent of labor and then divided that cost by four. Once two hour cost of all labor[487] was derived the quantified cost was then multiplied by the number of days lost to rain events. Total labor cost lost to rain events over the construction period amounted to $60.7 million. Weather and Rail costs amount to a combined total of $405.4 million.

13. DuPont Cannot Avoid Construction Costs On Joint Facilities Partially-Owned By NS

One of the faulty devices DuPont uses to game the SAC analysis is to assume that the DRR could use "trackage rights" to operate over facilities partially-owned by NS, without accounting for NS's ownership interest.[488] For example, DuPont claims that the DRR would be able to use "trackage rights" to operate over 89 miles of Conrail Shared Asset Areas ("SAAs") without paying to construct the tracks and related facilities in those SAAs or otherwise accounting for the NS ownership rights that allow NS to operate within them. DuPont similarly assumes that the DRR could use "trackage rights" to operate on the Indiana Harbor Belt Railway ("IHB") (in which NS holds a 29.58% ownership interest); the Belt Railway of Chicago ("BRC") (in which NS holds a 25% ownership interest); and the Terminal Railroad Association of St. Louis ("TRRA") (in which NS holds a 14.29% ownership interest) —all without spending a dollar on the fixed costs of those facilities.[489] Simply put, DuPont asserts that its SARR should

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[487] Again, crews are typically paid for two hours of labor on days that weather prevents them from working. *See* NS Reply WP "Crontractor Inclement Weather Policies.pdf."

[488] *See supra* Counsel's Argument at I-68.

[489] As detailed above in Section III-D, DuPont's assertion that the DRR would use "trackage rights" over these lines is a serious misstatement, since most of the agreements at issue are

have the benefit of NS's operating rights on partially-owned lines[490] without paying for the ownership rights that are part and parcel of those operating rights. This is transparent gaming that violates Board precedent and fundamental SAC principles, and it must be rejected.

DuPont's opening submission does not offer a shred of evidence or legal reasoning to support its decision to completely ignore NS's ownership interest in the Partially Owned Lines. Instead, DuPont asserts that it has done nothing out of the ordinary and that it simply assumed that "[t]he DRR 'steps into the shoes' of NS" by "utiliz[ing] existing joint use, trackage rights, haulage rights, and switching agreements." DuPont Opening Ex. III-C-2 at 1. That seriously misrepresents what DuPont actually has done on the Partially Owned Lines, which is to assume that the DRR could exercise all of the rights and privileges that accrue to NS as a co-owner of the Partially Owned Lines without paying anything for NS's ownership interests or shouldering NS's responsibilities as an owner. DuPont's disregard of the ownership costs that NS incurred to obtain its rights on the Partially Owned Lines is not "stepping into NS's shoes"—it is claiming vastly more favorable terms for the DRR than NS actually enjoys and creating a false SAC analysis that does not incorporate the full stand-alone costs of NS operations over the Partially Owned Lines.

The "trackage rights" payments that DuPont hypothesizes for DRR operating rights on the Partially Owned Lines do not come close to covering the costs of NS's ownership interests in

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plainly operating agreements giving operating rights to NS as a co-owner, not "trackage rights" agreements. *See, e.g.*, NS Reply WP "Detroit SAA Operating Agreement.pdf"; NS Reply WP "North Jersey SAA Operating Agreement.pdf"; NS Reply WP "South Jersey SAA Operating Agreement.pdf"; NS Reply WP "BRC Operating Agreement.pdf."

[490] The term "Partially Owned Lines" collectively refers to the Conrail SAA, IHB, BRC, and TRRA lines over which DuPont asserts that the DRR would operate. NS is a partial owner of each of the railroads that owns these lines.

those lines.[491] Indeed, DuPont does not claim that they do—rather its approach is to completely ignore NS's ownership interest in the Partially Owned Lines. DuPont's approach fails to recognize that NS is a co-owner of these lines and that the fees NS pays to operate over the Partially Owned Lines reflect those partial ownership interests.

DuPont's erroneous assumption must be corrected by requiring the DRR to account for the full cost of NS's ownership interest on any lines over which the DRR operates. If the DRR is to step into NS's shoes on a line where NS has both an ownership interest and a shared operating rights arrangement, the DRR cannot step into the operating shoe and ignore the ownership shoe. To extend the "stepping into the shoes" metaphor, the DRR has to wear either both of NS's shoes or neither of them.

To be clear, NS is not proposing that the DRR must account for the full construction costs of joint facilities that NS partially owns. Rather, NS assumes that the DRR could step into NS's shoes as a joint owner of the Partially Owned Lines and thus would be responsible only for the replacement cost for the NS-owned interest. NS's Engineering Experts have estimated this cost by calculating the full construction costs of the Partially Owned Lines and then assigning the DRR a pro rata share of those costs equivalent to the NS ownership share. NS's approach is consistent with Board precedent and SAC theory and was explicitly endorsed by the Board's 2002 decision in *AEPCO 2002*, 6 S.T.B. 322 at 328-29.

Subsection a below details the SAC principles and Board precedent that require the DRR to pay a pro rata share of the construction costs of the Partially Owned Lines if it is to operate

[491] Moreover, DuPont's evidence of the costs of the DRR's trackage and operating rights is riddled with unwarranted assumptions and obvious misreadings of the applicable agreements – once again in an apparent effort to understate the operating costs that the DRR would incur were it actually to step into NS's shoes on the relevant agreements. The errors in DuPont's trackage rights calculations are explained and corrected below in Section III-D-6.

over those lines. Subsection b describes NS's ownership interest in each Partially Owned Line, and shows that NS's partial ownership interest of the lines was an essential precondition to NS's obtaining the operating rights that the DRR seeks to use.

a. SAC Principles Require the DRR to Account for NS's Ownership Interests in the Partially Owned Lines

If the DRR is to operate over joint facilities partially owned by NS, then SAC principles require that the DRR account for the costs of those facilities, including a pro rata share of construction costs commensurate with NS's ownership interest. Two tenets of SAC theory independently mandate rejection of DuPont's "trackage rights" gambit. First, a SARR "stepping into the shoes" of a defendant railroad as to an agreement must accept all the terms, conditions, and prerequisites of that agreement. *See AEPCO 2002*, 6 S.T.B. at 328. While a SARR is permitted to take advantage of an incumbent carrier's existing joint use and trackage rights arrangements, it is not allowed to hypothesize that it could obtain better terms than the incumbent. *See id.* at 328-29. That is precisely what DuPont has done here by positing that the DRR could operate as an owner of the Partially Owned Lines without incurring the costs associated with acquiring an ownership interest.

Second, a complainant must account for the full stand-alone costs of serving the issue traffic. *See Coal Rate Guidelines*, 1 I.C.C. 2d 520, 542-43 (1985). DuPont therefore is precluded from assuming that the DRR could use NS's operating rights over these joint facilities without paying for the full NS ownership interest on these lines. *See AEPCO 2005*, STB Docket No. 42058 at 11. Indeed, DuPont's attempt to use trackage rights over partially-owned NS facilities ignores multiple agency decisions rejecting SAC analyses where the complainant posited that its SARR would operate using trackage rights over the defendant carrier's lines.

i. Because the DRR may step into NS's shoes only on the same terms that NS enjoys, it cannot use NS operating rights on jointly-owned facilities without replicating NS's ownership interests on those facilities

Because a SARR is permitted to assume the same economies of production that the incumbent enjoys, it is allowed to "step into the shoes" of the incumbent. Under the "stepping into the shoes" construct, a SARR may take advantage of the incumbent's existing agreements, including transportation contracts and agreements for trackage rights. In several cases complainants have invoked this rule to argue that a SARR may use a defendant carrier's trackage rights over a third party railroad under the same terms enjoyed by the incumbent.[492] What the SARR cannot assume is that it would obtain a better deal than the incumbent. On the contrary, the Board has made clear that a SARR seeking to "step into the shoes" of the incumbent is required to accept the same terms and conditions that apply to the incumbent. *See AEPCO Guidance 2002*, 6 S.T.B. at 329 ("[T]he SARR may be assumed to have the same cost-sharing arrangements as the defendant carriers have on each segment, so long as the terms of those arrangements (including operational provisions and terms of compensation) are the same as those applicable to the defendant carriers.").

The basic "guiding principles" for a SARR stepping into the defendant's shoes are clear: "a SARR may replicate the existing cost-sharing arrangements but may not hypothesize non-existent revenue or cost-sharing arrangements." *See id.* The reasons for this rule are equally clear. Once a complainant stops "replicat[ing] the existing cost-sharing arrangements" and begins to posit different and more favorable cost-sharing arrangements, the "stepping into the

[492] *See, e.g., Xcel*, 7 S.T.B. at 628; *Duke/ CSXT*, 7 S.T.B. at 416; *Bituminous Coal – Hiawatha, UT to Moapa, NV*, 6 I.C.C. 2d 1, 44 (1989) (SARR permitted to use incumbent's trackage rights over third party railroad because holding otherwise would "[r]equir[e] [the SARR] to incur ownership costs not encountered by the incumbent UP" and create a barrier to entry).

shoes" mechanism stops being a way for the SARR to avoid barriers to entry and turns into a way for it to avoid accounting for the full stand alone costs of serving the issue traffic.

Here, the DRR cannot step into NS's shoes on the Partially Owned Lines without replicating NS's ownership interest. The "existing cost-sharing arrangement" on the Partially Owned Lines is that NS possesses both a partial ownership interest and certain operating rights. DuPont's assertion that the DRR can use "trackage rights" on the Partially Owned Lines without paying for an ownership share of those lines thus would not give the DRR "the benefit of the same opportunities under the same terms" as NS, it would give the DRR the same opportunities with *better* terms than NS enjoys.

DuPont's approach is particularly unwarranted for the operating rights at issue here, which plainly are a function of NS's ownership interests—not trackage rights that could have been offered to any other third party railroad. For example, NS's operating rights over the Conrail SAAs were obtained as part of a transaction in which NS paid $5.9 billion to acquire Conrail lines and a 58% interest in the SAAs. *See infra* III-F-13-b-i. DuPont assumes that the DRR could exercise those same operating rights without spending a penny on capital costs. Similarly, NS has operating rights on the Belt Railway of Chicago because NS is a co-owner of that terminal railroad. *See infra* III-F-13-b-iii. But DuPont claims that the DRR can use NS's ownership rights on the BRC without paying to become a BRC owner. DuPont cannot have it both ways. If it wants the DRR to step into NS's shoes on lines that NS partially owns, then the DRR likewise must incur the costs necessary to replicate NS's ownership interest in those lines.

ii. DuPont Cannot Ignore NS Ownership Interests Because They Are An Essential Element of the Fully Allocated Costs of NS Rail Service

The second fundamental SAC principle requiring rejection of DuPont's position is the basic rule that the SARR must replicate the full stand-alone costs of providing service for the issue traffic. Indeed, the Board has made clear that it will not accept a SAC presentation predicated on SARR trackage rights over the defendant's lines unless "the complainant can demonstrate convincingly that the trackage rights charges paid by the SARR would reflect the full stand-alone costs of providing and maintaining the line." *AEPCO 2005*, STB Docket No. 42058, at 11. Here, DuPont has not even attempted to show that DRR "trackage rights" payments for operations over the Partially Owned Lines would reflect the full stand-alone costs of the NS ownership share in those lines, and it certainly cannot "convincingly" demonstrate that fact. To allow DuPont to posit "trackage rights" over partially-owned NS lines without proving that the trackage rights fees reflect the full cost of both incremental operations and the NS ownership interest would be to allow DuPont to present a SAC analysis that fails to account for the full stand-alone costs of serving the issue traffic. The Board cannot permit DuPont to use this device to artificially depress DRR capital costs.

The SARR is allowed to be optimally sized to serve the selected traffic and to assume efficiencies that are consistent with real-world railroading. *See Coal Rate Guidelines*, 1 I.C.C. 2d at 542. But the SARR must account for all the costs necessary to serve the selected traffic. *See id.* at 542-43. For this reason, the agency has long been skeptical of SARR attempts to use trackage rights over the defendant.[493] Because trackage rights fees ordinarily do not encompass the owning railroad's fully-allocated costs, a usage-based trackage rights or operating rights fee will rarely cover full stand alone costs. *See AEPCO 2005*, STB Docket No. 42058, at 9 (trackage rights compensation "is a usage-based fee that is ordinarily set by agreement between

[493] *Cf. Coal Rate Guidelines*, 1 I.C.C.2d at 543 n.60 ("[A] SAC presentation based on trackage rights over the very facilities to which the rate at issue applies is not useful, since the SAC determination would be no different than the ultimate issue in the case.").

the railroads involved and generally is not intended to reflect the full costs of ownership").[494] Indeed, the agency has twice rejected arguments that a SARR could use trackage rights over the defendant's lines, in both cases because the complainant failed to demonstrate that trackage rights payments would account for full stand alone costs. *See PEPCO v. Conrail,* 367 I.C.C. 532, 551-52 (1983); *AEPCO 2005*, STB Docket No. 42058, at 11.

In *PEPCO v. Conrail*, the first case to be decided under the SAC constraint, the ICC rejected the complainant's assumption that its SARR could "operate using trackage rights over Conrail's existing system." 367 I.C.C. at 551. The ICC concluded that the trackage rental fee proposed by PEPCO was based entirely on the marginal cost of SARR trackage rights trains and did not account for fixed common costs. *See id.* at 552. As a result, the ICC held that PEPCO's proposal was "entirely at odds with the very nature and purpose of stand-alone costing in our constrained market pricing approach." *Id.* Although the ICC did not completely foreclose use of trackage rights in future cases, it made clear that trackage rights would have to be valued in a way that fully accounted for all fixed costs. *See id.*

In *AEPCO 2005*, the Board reaffirmed that a SAC complainant cannot avoid construction costs by assuming that the SARR would use trackage rights to move issue traffic over a defendant carrier's facilities. The Board rejected AEPCO's assumption that its SARR could use the existing facilities of one of the two defendants and account for the costs of those facilities by paying a trackage rights fee. The Board found that there was a sharp distinction between hypothesizing that the SARR could "stand in the shoes" of the incumbent for purposes of using the incumbent's trackage rights over a non-defendant carrier and hypothesizing trackage rights over a defendant's own lines. *See AEPCO 2005*, STB Docket No. 42058, at 10. When assuming

[494] *See also id.* at 11 (observing that "the usual trackage rights fee arrangement" is one "in which the tenant carrier's fee does not reflect the full cost of ownership").

SARR operations over a defendant's own lines, "the usual trackage rights fee arrangement, in which the tenant carrier's fee does not reflect the full cost of ownership, would not be appropriate." *Id.* at 11. Instead, the SARR must fully account for "all necessary costs . . . [of] providing and maintaining the physical plant needed to serve the traffic." *Id.* The Board found that AEPCO failed to satisfy this standard because it could not show that the trackage rights fee it proposed for its SARR would account for "the full costs of ownership":

> AEPCO has failed to show that the level of the fee it assumed the SARR would pay for the use of the facilities would be sufficient, in combination with other traffic sharing in the use of that line, to cover the full costs to supply those facilities. AEPCO thus has not satisfied the objective of the SAC test: to measure whether the defendant railroads are earning sufficient revenues to reproduce the facilities needed to provide the service at issue.

See id. at 3.

In short, the rule established by *PEPCO* and *AEPCO 2005* is that a SARR cannot rely on trackage rights operations unless it demonstrates that the trackage rights encompass the full costs for the defendant to provide rail service over the relevant segment. In the case of trackage rights over third-party non-defendants, a trackage rights fee alone can account for the full costs to the defendant, because in that case the trackage rights fee is the only cost that the defendant incurs for operations over the third party's line. But "trackage rights" over the defendant's own tracks (whether they be fully or partially owned) are unacceptable in the absence of "convincing[]" evidence that the trackage rights fees encompass the full costs of service. *AEPCO 2005*, STB Docket No. 42058, at 11 (complainant seeking to rely on trackage rights over the defendant must "demonstrate <u>convincingly</u> that the trackage rights paid by the SARR would reflect the <u>full stand-alone costs</u> of providing and maintaining the line") (emphases added).

While both *PEPCO* and *AEPCO 2005* addressed trackage rights over lines that were fully-owned by a defendant, the same principles apply to partially-owned facilities. The Board said as much in *AEPCO 2002*, where it explicitly held that a SARR replicating service over "a jointly owned line in which the carriers share costs" was permitted only to "replicate the existing cost-sharing arrangements" and could not hypothesize different and more favorable cost-sharing arrangements. *AEPCO 2002*, 6 S.T.B. at 328-29.[495]

Indeed, there is no principled way to distinguish fully-owned defendant lines from partially-owned defendant lines. In either case, the stand alone analysis requires the Board to consider the full fixed costs of the defendant facilities used to provide service. To be sure, if a railroad partially owns a line, then the SARR may assume that it would have the same partial ownership interest and that it would not have to incur all of the costs of replicating the entire line. But the railroad's *partial* ownership interest cannot be ignored.

Here, DuPont has not even attempted to demonstrate that DRR "trackage rights" payments would account for the stand-alone costs of NS's ownership interest in these lines. And it certainly has not "convincingly" demonstrated that fact, as *AEPCO* requires. Having failed to satisfy its burden of demonstrating in its case-in-chief that the trackage rights payments account for the full stand alone costs of operations over the Partially Owned Lines, DuPont is precluded from attempting to present that evidence on rebuttal.[496]

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[495] *See also AEPCO 2005*, STB Docket No. 42058, at 5 (describing *AEPCO 2002* holding that "if a segment of line owned jointly by UP and BNSF were replicated by [the SARR], [the SARR] could be assumed to enjoy the same benefits of sharing costs with BNSF as UP enjoyed").

[496] *See General Procedures for Presenting Evidence in Stand-Alone Cost Rate Cases*, 5 S.T.B. 441, 445-46 (2001) ("[T]he party with the burden of proof on a particular issue must present its entire case-in-chief in its opening evidence. . . . Rebuttal may not be used as an opportunity to introduce new evidence that could and should have been submitted on opening to support the opening submissions.").

b. DuPont Must Replicate NS's Ownership Interest in Each of the Partially Owned Lines Used By The DRR

This section briefly describes NS's ownership interest in each of the Partially Owned Lines used by the DRR. As detailed below, NS's ownership interest in each of the Partially Owned Lines is well-documented in the public record and was disclosed to DuPont in discovery. DuPont has no excuse for ignoring this clear evidence of NS's ownership interests. The section also demonstrates that NS's operating rights on the Partially Owned Lines are a function of its status as a co-owner. In each case, the evidence shows an inextricable link between NS's partial ownership and its operating rights. The DRR therefore cannot assume that it could step into NS's shoes as to its operating rights without replicating NS's ownership interest.

i. Conrail Shared Assets

DuPont asserts that the DRR would use "trackage rights" to operate over 89.72 miles of Conrail SAAs.[497] But DuPont failed to acknowledge that NS has a 58% ownership interest in all of the SAA tracks by virtue of the Conrail acquisition. In 1998, the Board approved the acquisition of control of Conrail by NS and CSXT and the division of Conrail's assets between NS and CSXT. *See Conrail Approval*, 3 S.T.B. 196, 207, 213 (1998). The result of the Conrail acquisition was to divide Conrail's assets into three categories: (1) Conrail assets that became wholly owned by CSXT; (2) Conrail assets that became wholly owned by NS; and (3) Conrail assets that would be jointly owned and shared by NS and CSXT. *See id.* at 221-28. This third category—the three SAAs in Detroit, North New Jersey, and South New Jersey/Philadelphia—were assets that were to be retained by Conrail to be "owned, operated, and maintained by Conrail for the exclusive benefit of CSX and NS." *See id.* at 228. Because NS and CSXT

[497] *See* DuPont Opening Ex. III-C-2 (segments A.6 (Gibraltar, MI to Detroit, MI); A.8 (CP Port Reading Junction, NJ to Bayway, NJ); B.14 (Edgemoor, DE to Philadelphia Arsenal, PA); and B.17 (CP MA, PA to Morrisville, PA)).

acquired complete control of Conrail (with NS owning a 58% economic interest and CSXT owning the remaining 42%), each of the Conrail-retained SAAs is a jointly-owned NS/CSXT property in which NS owns a 58% interest. *See id.* at 220 (recognizing that NS was acquiring a "58% equity interest" in Conrail).

NS's 58% ownership interest in the Conrail SAAs is plainly documented in its S.T.B. Form R-1[498] and its 10-K.[499] Moreover, NS produced documents in discovery that demonstrated its ownership of the SAAs. *See, e.g.*, NS Reply WP "Detroit SAA Operating Agreement.pdf" at 1 {{(

")}}; NS Reply WP "North Jersey SAA Operating Agreement.pdf" at 1 (same); NS Reply WP "South Jersey SAA Operating Agreement.pdf" at 1 (same).

The operating rights that NS possesses over these lines plainly are not "trackage rights," but rather operating rights that NS possesses as an incident of its ownership. Each of the three SAAs is governed by a specific Operating Agreement. The SAA Operating Agreements implement CSXT/NS's joint ownership by both granting the co-owners operating rights over the SAAs and establishing a plan for the co-owners to share ownership and maintenance costs and

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[498] *See* NS Reply WP "NS 2011 R-1.pdf" at 9 ("Through a limited liability company, NS and CSX Corporation (CSX) jointly own Conrail Inc. (Conrail), whose primary subsidiary is Consolidated Rail Corporation (CRC). NS has a 58% economic and a 50% voting interest in the jointly owned entity, and CSX has the remainder of the economic and voting interests. . . . CRC owns and operates certain properties (the Shared Asset Areas) for the joint and exclusive benefit of NSR and CSX Transportation.").

[499] *See* NS Reply WP "NS 2011 10-K.pdf" at K52-K53 (stating that "NS has a 58% economic and a 50% voting interest in [CRC]" and that "CRC owns and operates certain properties (the Shared Asset Areas) for the joint and exclusive benefit of NSR and CSX Transportation, Inc.").

responsibilities. {{

}} In short, the Operating Rights Agreements are not "trackage rights" agreements allowing a foreign railroad to operate over the lines of another railroad. Rather, they are operating agreements between co-owners to establish their rights and responsibilities on a joint facility. If DuPont seeks to have the DRR step into NS's shoes as to the Conrail SAAs, then the DRR must step into NS's shoes as a co-owner/operator on these lines.

ii. Indiana Harbor Belt Railroad Company

Like with the other Partially Owned Lines, DuPont assumed that the DRR could operate over 15.7 miles of the Indiana Harbor Belt Railroad Company ("IHB") using trackage rights.[503] But NS has a 29.58% ownership interest in the IHB, and the DRR cannot step into NS's shoes on

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[500] *See* NS Reply WP "Detroit SAA Operating Agreement.pdf" at § 3(a); NS Reply WP "North Jersey SAA Operating Agreement.pdf" at § 3(a); NS Reply WP "South Jersey SAA Operating Agreement.pdf" at § 3(a).

[501] *See* NS Reply WP "Detroit SAA Operating Agreement.pdf" at §§ 8(a) & 9; NS Reply WP "North Jersey SAA Operating Agreement.pdf" at §§ 8(a) & 9; NS Reply WP "South Jersey SAA Operating Agreement.pdf" at §§ 8(a) & 9.

[502] *See* NS Reply WP "Detroit SAA Operating Agreement.pdf" at §§ 1(x) & 9(a)(i); NS Reply WP "North Jersey SAA Operating Agreement.pdf" at §§ 1(x) & 9(a)(i); NS Reply WP "South Jersey SAA Operating Agreement.pdf" at §§ 1(x) & 9(a)(i).

[503] *See* DuPont Opening Ex. III-C-2 (segments A.1 (Calumet City, IL to Riverdale, IL); B.4 (Argo, IL to Provo Junction, IL); and B.8 (Riverdale, IL to Blue Island Yard, IL)).

the IHB unless it replicates that ownership interest. NS's ownership stake in the IHB is a matter of public record that DuPont had no basis to ignore.

The IHB is a switch carrier that operates 54 miles of mainline track in the Chicago metropolitan area. Prior to the Conrail transaction, the IHB was owned 51% by Conrail and 49% by Soo Line Railroad Company ("Soo"). *See Conrail Approval*, 3 S.T.B. at 292. When NS and CSXT acquired control of Conrail, they also acquired Conrail's interest in the IHB. The Board recognized that its approval of the Conrail transaction meant that "NS and CSX will hold 29.58% and 21.42% interests in IHB, respectively, with Soo continuing to hold a 49% share."[504] *Id.* Moreover, the data NS produced about the IHB in discovery clearly indicated NS's ownership interest. *See* NS Reply WP "IHB Short Line Profile.pdf" at NS-DP-HC-003757 (produced to DuPont January 14, 2011 on NS-DP-HC-DVD-002) {{

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NS's operating rights on the IHB are a function of its ownership interest. The IHB operating rights that DuPont claims that the DRR would use are rights that NS acquired in the Conrail transaction by succession to Conrail's interests. *See Conrail Approval*, 3 S.T.B. at 229 (ordering that "certain trackage rights of Conrail over IHB will be assigned or made available to . . . be operated by NS"). NS obtained operating rights over the IHB in the very same transaction in which it obtained an ownership interest in the IHB. The link between NS's ownership interest and its operating rights is further confirmed by the agreement implementing NS's and CSXT's succession to Conrail's interest. {{

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[504] These ownership percentages result from applying the 58-42 NS/CSXT economic division of Conrail to Conrail's 51% ownership stake in the IHB.

}} In short, NS's operating rights on the IHB are part and parcel of its ownership interest of the IHB, and the DRR may not claim the operating rights without replicating that ownership interest.

iii. Belt Railway of Chicago

Similarly, DuPont's assertion that the DRR could use "trackage rights" to operate over 16.2 miles of the Belt Railway Company of Chicago ("BRC") without accounting for NS's 25% ownership interest cannot be accepted.[505] The BRC is a major intermediate switching terminal railroad that links every major railroad in Chicago. *See* NS Reply WP "BRC Background.pdf," *available at* www.beltrailway.com. The BRC operates 28 miles of mainline track—DuPont thus proposes that the DRR would use "trackage rights" over 57% of the BRC's lines. *See id.*

The BRC is jointly owned by six Class I railroads: BNSF, CN, CP, CSXT, NS, and UP. NS holds a 25% ownership interest in the BRC. *See* NS Reply WP "NS 2011 R-1.pdf" at Schedule 310 Line 1 (stating that NS has 25% control of the Belt Railway Company of Chicago); *Conrail Acquisition*, 3 S.T.B. at 292 (stating that after the Conrail transaction "NS and CSX will each hold 25% of BRC"). While NS's Form R-1 is more than sufficient to give DuPont notice of NS's ownership interest in the BRC, NS also documented this fact in discovery. NS produced a Short Line Profile of the BRC in discovery informing DuPont that {{

[505] *See* DuPont Opening Ex. III-C-2 (segments B.1 (Pullman Junction (W. South Chicago Yard), IL to Rock Island Junction (E. South Chicago Yard), IL); B.3 (Belt Junction, IL to Argo, IL); and B.6 (East End, IL to Cicero, IL)).

}} DuPont has no excuse for ignoring NS's ownership interest.

Moreover, the BRC Operating Agreement that DuPont cites as a source for DRR "trackage rights" is an agreement among the owners of the BRC to define their operating rights and ownership responsibilities. The BRC Operating Agreement states at the outset that it is an agreement {{

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The inseparability of BRC operating rights and a BRC ownership interest is further demonstrated by {{

[506] *See* NS Reply WP "BRC Short Line Profile.pdf" at NS-DP-HC-003588 (produced to DuPont January 14, 2011 on NS-DP-HC-DVD-002); *see also Conrail Approval*, 3 S.T.B. at 413 & n.302 (detailing BRC ownership percentages).

[507] {{

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In short, NS's operating rights on the BRC are part and parcel of its ownership interest in the BRC, and DuPont's claim that the DRR could operate as a BRC co-owner without paying anything for a BRC ownership interest is ludicrous.

iv. Terminal Railroad Association of St. Louis

The final joint facility over which DuPont wrongly claims that the DRR could use "trackage rights" without paying for NS's ownership interest is the Terminal Railroad Association of St. Louis ("TRRA"). DuPont assumes that the DRR could exercise NS's operating rights over 10.3 miles of TRRA lines,[508] but it does nothing to account for NS's 14.29% ownership interest in TRRA. As with the other Partially Owned Lines over which DuPont assumes that the DRR will operate, the DRR is required to account for NS's ownership interest in the TRRA by paying a pro rata share of construction costs for the TRRA segments used by the DRR.

The TRRA is a switching railroad that operates in the St. Louis area and is jointly owned by UP, NS, CSXT, BNSF, and CN. NS's ownership interest is a matter of public record that is apparent from its R-1. *See* NS Reply WP "NS 2011 R-1.pdf" at Schedule 310 Line 5 (stating that NS has 14.29% control of the Terminal Railroad Association of St. Louis). NS also disclosed its ownership interest to DuPont in discovery.[509] Moreover, TRRA's public website lists NS as a "TRRA Owner Line." *See* NS Reply WP "TRRAOwnerLines.pdf."

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[508] *See* DuPont Opening Ex. III-C-2 (segments A.4 (May Street Interlocking, MO to WR Interlocking, IL) and A.5 (SH Tower, IL to East St. Louis, IL)).

[509] *See* NS Reply WP "TRRA Short Line Profile.pdf" at NS-DP-HC-003975 (produced to DuPont January 14, 2011 on NS-DP-HC-DVD-002) (stating that {{
%)}}).

NS's operating rights on TRRA are a function of its ownership interest in the TRRA. NS acquired its ownership interest in the TRRA by succession to the interests of NS's predecessor railroads the Wabash Railroad Company and the Southern Railway Company, which acquired ownership interests in TRRA in 1889 and 1902, respectively. *See* NS Reply WP "TRRA Operating Agreement.pdf" at 1; NS Reply WP "TRRA Admission Agreement.pdf" at 1. Each of the trackage rights agreements over which the DRR proposes to operate is an agreement that was entered in the 1990s, long after NS had an ownership interest in the TRRA.[510] NS's status as a TRRA co-owner undoubtedly contributed to its ability to secure these trackage rights terms on the line. Indeed, the agency has long recognized that the TRRA has a policy of "grant[ing] trackage rights to owning roads upon request." *See Norfolk So. Ry. Co. – Control – Norfolk & W. Ry. Co.*, 366 I.C.C. 171, 206 n.56 (1982). {{

}}[511] Thus NS's rights to operate over the TRRA are not mere trackage rights secured by a third party rail carrier; rather, they are operating rights granted to a co-owner {{

}} The DRR cannot take advantage of the same agreement unless it accounts for the costs of TRRA ownership.

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510 *See* NS Reply WP "May Street Interlocking TR Agreement.pdf" at 1 (January 1, 1993 agreement between TRRA and Norfolk and Western granting N&W operating rights over the segment between May Street Interlocking and WR Interlocking); NS Reply WP "CP Junction TR Agreement.pdf" at 1 (December 1, 1996 agreement between TRRA and Norfolk and Western granting N&W operating rights over the segment between Madison, IL and East St. Louis, IL).

511 *See also* NS Reply WP "TRRA Admission Agreement.pdf" at ¶ 1 (TRRA admits new owners including Southern Railway Company "to the joint use. . . of all of the terminal facilities of the Terminal Company").

NS's Engineering Experts first calculated the full land acquisition and construction costs for the Partially Owned Lines used by the DRR and then assigned the DRR a portion of those costs equivalent to the NS ownership percentage for that line. In addition to these ownership costs, the DRR (like NS) must also pay user fees for the rights to operate on the Partially Owned Lines. The proper calculation of the fees for DRR operating rights over the Partially Owned Lines is set forth in section III-D-6.

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III. STAND-ALONE COST

G. DISCOUNTED CASH FLOW ANALYSIS

DuPont's discounted cash flow ("DCF") model contains a number of invalid inputs and assumptions ranging from a flawed calculation of the future DRR cost of equity to overly aggressive assumptions regarding future inflation. Each of these issues is discussed below.

1. Cost of Capital

DuPont has followed the Board's approved and preferred approach in developing capital costs for the DRR. For 2006, 2007, 2008, 2009, and 2010 DuPont employs the industry average costs determined by the Board in its annual cost of capital proceedings. DuPont uses the railroad industry cost of capital to calculate the capital recovery charges for all road property investment. NS accepts DuPont's use of the Board determined railroad industry cost of capital as the starting point for the DRR. NS makes one update and two corrections to DuPont's DRR cost of capital calculations. NS updates DuPont's calculations to include the recent 2011 Board cost of capital findings. Specifically, on September 11, 2012, the Board determined that the 2011 railroad industry weighted average cost of capital was 11.57 percent. Consistent with prior Board precedent, NS updated the DRR DCF model to include the 2011 figure.

The first correction involves DuPont's inclusion of the 2006 cost of equity in calculating the average cost of equity for future years of the DCF. For years 2011 through 2019, citing prior precedent, DuPont computes the DRR's cost of common equity as 12.47 percent, which is equal to the simple average of the prior five years' common equity costs. This approach misconstrues prior precedent by failing to underweight the 2006 partial year to reflect the fact that only one month of 2006 was included in the DRR construction period.[1] Specifically, the DRR is assumed

[1] See *Coal Trading Corp. v. Batlimore & Ohio R.R.*, 6 I.C.C.2d 361, 379 (1990) (historic average to estimate future equity costs).

to commence operations as of June 1, 2009, with a 30 month construction period, which means that construction would not start until December of 2006. Accordingly, DuPont has over-weighted 2006 by treating it as a full year rather than a partial year. As Table III-G-1 below shows, the railroad industry cost of equity for 2006 was the lowest annual cost of equity of any year of the DRR's "existence," which amplifies the effect of overweighting it.

Table III-G-1
Recent Board Cost of Equity Determinations and DuPont Treatment for DRR

Year	DRR Cost of Equity	DuPont DRR Cost of Equity Calculation	DRR Status
2006	11.13%	STB	Construction Beginning 12/1
2007	12.68%	STB	Under Construction
2008	13.17%	STB	Under Construction
2009	12.37%	STB	Under Construction/Commence Operations 6/1
2010	12.99%	STB	Operating
2011	12.47%	Average 2006 - 2010	Operating
2012	12.47%	Average 2006 - 2010	Operating
2013	12.47%	Average 2006 - 2010	Operating
2014	12.47%	Average 2006 - 2010	Operating
2015	12.47%	Average 2006 - 2010	Operating
2016	12.47%	Average 2006 - 2010	Operating
2017	12.47%	Average 2006 - 2010	Operating
2018	12.47%	Average 2006 - 2010	Operating
2019	12.47%	Average 2006 - 2010	Operating

As Table III-G-1 shows, although the DRR commenced construction in December 2006, DuPont includes a full year share of the 2006 railroad cost of equity in its average for 2011 through 2019. Because 2006 represents the lowest cost of equity determined by the Board in recent decisions, overweighting 2006 results in an understatement of the future cost of equity.

On reply, NS corrects the overweighting of the 2006 cost of equity by weighting the 2006 cost for only the one month in 2006 that the DRR actually was under construction. Consistent with prior precedent, NS also substitutes the Board's actual 2011 cost of equity determination for future average equity cost assumed by DuPont and includes the actual 2011 determination in the future average. Table III-G-2 summarizes NS reply calculations of the cost of equity for DRR.

Table III-G-2
Recent Board Cost of Equity Determinations and NS Reply Treatment for DRR

Year	DRR Cost of Equity	Cost of Equity Calculation	Future DRR Average Weighting
2006	11.13%	STB	One Month
2007	12.68%	STB	12 Months
2008	13.17%	STB	12 Months
2009	12.37%	STB	12 Months
2010	12.99%	STB	12 Months
2011	13.57%	STB	12 Months
2012	12.93%	Average 12/2006 - 2011	N/A
2013	12.93%	Average 12/2006 - 2011	N/A
2014	12.93%	Average 12/2006 - 2011	N/A
2015	12.93%	Average 12/2006 - 2011	N/A
2016	12.93%	Average 12/2006 - 2011	N/A
2017	12.93%	Average 12/2006 - 2011	N/A
2018	12.93%	Average 12/2006 - 2011	N/A
2019	12.93%	Average 12/2006 - 2011	N/A

Calculation details are set forth in the NS reply workpapers.[2]

The second correction involves adding equity flotation costs for the DRR that were omitted by DuPont. Equity flotation costs are the fees charged by investment bankers when a company raises external equity capital and they can amount to between 2% and 7% of the total amount of equity capital raised, depending on the type of offering.[3] Until 2007, the Board had rejected arguments by railroad defendants in SAC cases that the costs of raising the equity necessary to finance the construction of the SARR must be included in the SAC cost analysis. The Board's rationale was that there was not sufficient evidence of the "existence and size of

[2] NS Reply WP "Exhibit III-H-1 NS Reply.xlsx" tab "Cost of Capital"

[3] *See* NS Reply WP "III-G Cost of Raising Capital.pdf."

equity flotation fees associated with equity issuances of a similar size." *Xcel,* 7 S.T.B. at 659. However, in 2007, the Board changed its approach. In the SAC case involving AEP Texas, AEP Texas objected to the evidence submitted by BNSF as to the size of an appropriate equity flotation fee and argued that the best evidence of the existence and size of an equity financing fee for a major railroad project was set forth in the ICC's railroad industry cost of capital determination for the year 1991, in which the ICC acknowledged that the Burlington Northern Railroad had incurred equity flotation costs of about 3.9 percent in 1991 in connection with the issuance of over 10 million shares of new common stock. *See* AEP Texas Rebuttal , *AEP Texas,* STB Docket No. 41191 (Sub-No. 1), at III-G-4 (July 27, 2004). However, AEP Texas argued that the Board should treat that evidence of equity flotation fees in the SAC analysis the same way those fees were treated in the 1991 cost of capital determination, *i.e.*, by spreading the impact of the equity flotation fees across the entire railroad industry. *Id.* The Board agreed with AEP Texas. *See AEP Texas,* STB Docket No. 41191 (Sub-No. 1), at 108.

More recently, in *AEPCO 2011,* STB Docket No. 42113, at 137-138, the Board rejected Defendants' addition of equity floatation costs that would have to be borne by the SARR for three reasons:

1. Unlike AEP Texas 2007, the parties did not agree that a separate equity flotation cost is warranted.
2. The Board previously has explained that flotation fees already are included in the Board's cost-of-capital computation. *Duke/CSXT*, 7 S.T.B. at 433.
3. The Board has opined that, to include such a fee separately, there would have to be evidence of the existence and size of equity-flotation fees for stock issuances of a similar size as that needed by the SARR. *Xcel* I, 7 S.T.B. at 659.

In *AEPCO*, the Defendant carriers contended that equity flotation costs should be based on a 1991 stock issuance of unspecified size by Burlington Northern (a predecessor of BNSF), as the best available evidence of a railroad's stock-flotation cost. According to the Board, that 1991 figure, 3.9%, rounds to the equity-flotation figure that the Board rejected in *AEP Texas*: 4%. The Board thus concluded that even if it were to allow a separate equity-flotation cost, it had already indicated that a 3.9% figure would be too high.

The DRR's cost to raise equity is a cost that is borne directly by it, just like other direct costs associated with construction of the DRR. The fee that must be paid to underwriters to raise the necessary financing is no different in kind from the fee that must be paid to engineers to design the DRR. It is a cost incurred by a new entrant to construct and operate a major railroad project, and it should be reflected in the SAC analysis. Because railroads have not recently incurred costs to raise new equity, there are no equity floatation costs included in the Board's 2006 through 2011 railroad cost of capital determinations.[4] Although NS believes that the 3.9% cost to raise equity incurred by BNSF in 1991 is in the middle of the range that would be experienced by the DRR for raising its equity,[5] it recognizes that the Board has expressed discomfort with that figure. Therefore NS looked for other recent capital raising efforts for indications of market level equity flotation costs.

Based on DuPont's opening DCF, the DRR would need to raise approximately $17.2 billion in equity.[6] Capital generation demands of that magnitude do not occur frequently. However, in May of 2012, Facebook completed an initial public offering (IPO) and issued and sold 180 million shares of Class A common stock at a public offering price of $38.00 per share. According to Facebook's second quarter 2012 Form 10-Q, Facebook received net proceeds from

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[4] The Board's railroad industry cost of capital determinations do, as explained in the AAR cost of capital submissions to the Board, include debt floatation costs.

[5] *See* NS Reply WPs "III-G Cost of Raising Capital.pdf" and "III-G Stock Market Liquidity and the Cost of Raising Capital.pdf."

[6] This figure is derived from the approximately $22.1 billion in DRR construction costs estimated by DuPont and an average equity weighted capital structure of 77.85 percent.

the IPO of $3.8 billion.[7] According to the 10-Q, Facebook incurred underwriting discounts and commissions of $75 million and other offering expenses of approximately $6 million, for a total cost of $81 million or 2.1 percent of the capital raised. NS has therefore relied upon the Facebook experience to add equity floatation costs for the DRR of 2.1 percent.[8]

2. Inflation Indices

DuPont used actual AAR cost indices and Global Insight's March 2012 forecasts to calculate annual inflation forecasts.[9] NS does not dispute DuPont's road property asset and operating expense DCF inflation indices derived from these sources and, consistent with Board precedent, updates those indices in circumstances where new actual index and forecast values have become available. NS Reply inflation index forecasts for the DRR as based on Global Insight's September 2012 forecast.[10]

NS does, however, take issue with DuPont's inflation index for land. DuPont assumes land values will rise an average of 5.25 percent annually from the second quarter of 2009 through the end of the 10-year DRR DCF period. NS Real Estate expert Michael Hedden explains that DuPont's real estate inflation assumption is overstated and develops an estimate of annual inflation for DRR real estate of 2.39 percent through 2019.[11] NS uses Mr. Hedden's inflation estimate in place of DuPont's overstated forecast.

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[7] See NS Reply WP "Facebook 2Q2012 Form 10-Q.htm" page 8

[8] Given the very large demand for Facebook stock—demand which there is little reason to assume would be equally robust for DRR shares, meaning likely higher equity flotation costs for the DRR—NS' reliance on flotation costs at the same level as those for Facebook is a quite conservative assumption.

[9] DuPont Opening III-G-7.

[10] *See* NS Reply WP "rcaf20123Q.pdf."

[11] NS Reply WP "Inflation Indices.docx."

3. Tax Liability

DuPont's DCF incorporates three errors affecting the calculation of DRR income tax liability. First, as discussed in Section III-H-1-f, DuPont misapplied the guidelines relative to bonus depreciation by assuming this temporary measure would apply to DRR assets at the time of their replacements. Second, as also as discussed in Section III-H-1-f, DuPont used the wrong tax life for certain of the DRR road property assets. Third, as discussed in Section III.H.5, DuPont improperly changed the longstanding and critical assumption in the DCF model that because the DRR cost of debt is locked in at the debt rate in place during the DRR construction period, the DRR debt is amortized over an assumed 20-year financing term. NS corrected these shortcomings as explained in the referenced Sections.

NS accepts DuPont's calculation of the weighted average DRR state income tax rate.

4. Capital Cost Recovery

DuPont calculated the capital recovery cost of DRR's property using a 10-year DCF period in accordance with the Board's decision in *Major Issues*, STB Ex Parte No. 657 (Sub-No. 1).[12] NS accepts DuPont's capital recovery calculations except as set forth in other Sections of NS's III-G and III-H Reply Evidence.

[12] DuPont Opening III-G-8.

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III. STAND-ALONE COST

H. Results of SAC DCF Analysis

In this Section, NS discusses the results of its SAC DCF analysis and the application of the Board's Maximum Markup Methodology ("MMM") and cross-subsidy tests to the evidence in this case.

1. Results of SAC DCF Analysis

NS identified several problems with DuPont's DCF model in Section III-G. There are other problems with DuPont's DCF inputs and assumptions that logically could have been discussed in Section III-G. However, because DuPont discussed these other issues in Section III-H, for the sake of consistency NS addresses them in Section III-H as well. The DCF implementation problems discussed here include DuPont's calculation of the future cost of equity for the DRR, improper change to the Board's standard debt amortization pattern, extension of the benefits of bonus depreciation to the replacement cost of assets as they reach the end of their useful lives, and use of the wrong tax depreciation lives for certain DRR road property assets. NS's corrected DCF analyses are set out in NS Reply Exhibit III-H-1.

a. Cost of Capital

The cost of capital (Table A) for the DRR reflects the Board's annual cost of capital determinations for December 2006 through 2011. The DRR's cost of debt for years 2006 to 2009, the DRR's construction period, is assumed to equal the railroad industry average cost of debt for each specific year in the construction period. For years 2010 through 2019, the DRR's cost of debt equals 6.32 percent and reflects the weighted average of the construction years' debt costs used through the remaining years of the DCF model. The DRR's cost of common equity for the years 2006 through 2011 is assumed to equal the railroad industry cost of common equity for each specific year. As explained in section III-G, DuPont's calculation of the DRR average cost of equity for future years, which is based on the historical average cost of capital, overweights the effects of the 2006 cost of equity in the average and understates the forecasted cost of equity. NS corrected DuPont's calculation to weight the 2006 industry cost of equity consistent with the DRR planned construction schedule. NS also updated the 2011 cost of equity to reflect the Board's most recent cost of equity finding. For years 2012 through 2019, the DRR's cost of common equity equals 12.93 percent.

b. Road Property Investment Values

NS's calculations for road property investment values are detailed in Table C of NS Reply Exhibit III-H-1. NS replaced DuPont's road property investments with those specified in Section III.F. NS accepts DuPont's proposed DRR construction schedule.

For land investments, DuPont's land valuation witness estimated 2009 land values and discounted those values back to the DRR construction period using an index that does not reflect the correct time frame for the DRR's land acquisition. As explained in Section III-G-3, NS corrected the index to reflect properly the change in land values over the relevant time period. In addition, the "Investment" tab of NS Reply Exhibit III-H-1 was modified to treat the land investment as a 2007 value.

c. Interest During Construction

NS calculated interest during construction on construction funds outstanding during the assumed DRR construction period using the same methodology as DuPont.

d. Amortization Schedule of Assets Purchased with Debt Capital

In its opening, DuPont proposes to change the Board's long standing practice of amortizing SARR debt over 20 years. However, DuPont improperly assumes that the DRR could be financed with a single debt instrument that has a 20-year term, while also assuming that the terms of the instrument would reflect the railroad industry cost of debt, which is calculated based in part on instruments with much shorter intervals to maturity and, thus, correspondingly lower yields.

As justification for its proposed change, DuPont asserts that a SARR's debt capital would mirror the type of debt instruments issued by US Class I railroads included in the Board's annual cost of capital determination.[1] DuPont also suggests that nearly 90% of the railroad industry debt consists of corporate bonds, notes, and debentures that incorporate coupon payments of interest, rather than periodic payments with principal and interest components.[2]

DuPont's emphasis on the type of debt instrument creates a disconnect with its assumption that DRR's cost of debt would reflect the railroad industry's cost of debt. When the Association of American Railroads ("AAR") calculates the railroad industry cost of debt for the Board's annual cost of capital determination, it calculates the average yield of the bonds, notes, and debentures that were traded during the year. These bonds, notes, and debentures include instruments with relatively short intervals to maturity and correspondingly lower yields, and those with longer intervals to maturity and correspondingly higher yields. Table III-H-1 below segregates the 2008 traded debt instruments—the last full year of the DRR construction period—that the AAR used in its calculations between those with yields below the 2008 calculated average yield of 6.525% and those with yields above the average.

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[1] DuPont Opening III-H-2.

[2] *Id.* at III-H-3.

Table III-H-1
Breakdown of AAR 2008 Cost of Debt
Between Those With Yields Below and Above the Average Yield
($ millions)

2008 Instruments	Count	Market Value	Weight	Avg. Yield	Avg. Maturity Date	Avg. Years to Maturity
Below Avg.	22	$6,359.5	38.34%	5.72%	2014	4.6
Above Avg.	39	$10,229.6	61.66%	7.03%	2037	28.3
Average	61	$16,589.0	100.00%	6.53%	2028	19.2

Source: NS Reply Workpaper "AAR 2008 Cost of Capital Debt Details Worksheet.xlsx."

Table III-H-1 shows that 22 of the 61 debt instruments used by the AAR to determine the 2008 railroad industry average cost of debt have yields below the average, with an average yield of 5.72%, and that these instruments will mature and be paid in full in an average of 4.6 years. If, as DuPont suggests, the DRR were financed with a single note with a 20-year term with a maturity date of 2029, then the interest rate would have to be recalculated to reflect the longer term nature of the financing. By contrast, the long-standing assumption in the DCF model that debt will be amortized over a 20-year period, rather than that the principal will be paid in full at maturity, incorporates the concept that the cost of debt will reflect a mix that includes some instruments with shorter terms until maturity. In other words, DuPont's decision to use the railroad industry's average cost of debt and the accompanying mix of short and long term maturities is consistent with the long-standing assumption in the DCF model that debt will be amortized throughout the 20 year period, not with an assumption that DRR could be financed with a note under which no principal would not be paid for 20 years.

The current debt amortization schedule in the DCF was first introduced by the Interstate Commerce Commission in its 1990 decision in *Coal Trading Corp.*[3] That amortization assumption is consistent both with the AAR's calculation of the average debt yield and with the

[3] *Coal Trading Corp. v. Baltimore & Ohio R.R.*, 6 I.C.C.2d 361 (1990).

maturity schedules of the underlying instruments. NS corrects DuPont's approach by applying Board precedent for both the amortization of debt on the initial DRR investment and for the debt amortization on the replacement cost of DRR assets as they reach the ends of their useful lives.

e. Present Value of Replacement Cost

NS makes four corrections to DuPont's calculation of the replacement cost of DRR assets. NS corrected the tax depreciation lives for certain DRR assets from 15 to 20 years and corrected DuPont's incorrect assumption that bonus depreciation would be available at the time the DRR assets are scheduled to be replaced as discussed in Section III-H-1. f. below. NS also reestablished the 20-year debt amortization schedule for future asset replacement. Finally NS aligned the replacement cost discounting assumptions with those used for the initial DRR investment by correcting the discount factor used to compute the present value of the asset replacement costs to the average DRR cost of capital instead of the average railroad industry cost of capital used by DuPont.

f. Tax Depreciation Schedules

DuPont's tax depreciation schedules contain three errors. The first is that DuPont assumes that the DRR would take full advantage of the bonus depreciation benefit for all road property assets. DuPont assumes a whopping $6.3 billion of the DRR's road property investment would be written off in the first year of DRR operation as bonus depreciation. In its opening, DuPont acknowledges the skepticism expressed by the Board in *AEPCO 2011* as to whether bonus depreciation allowed under the prior and current tax law should be allowed in SAC presentations. DuPont Opening III-H-6. DuPont argues that not allowing a shipper to avail itself of the bonus depreciation provisions taken and used by the railroad companies, however, would create a clear barrier to entry, and place the shipper at a distinct disadvantage relative to the incumbent railroad. But in fact, it is DuPont's assumption that the DRR would avail itself of the bonus depreciation benefits for virtually all of the DRR's road property investment that would inappropriately place the DRR at a distinct *advantage* relative to the incumbent NS. That is because, unlike the DRR, which benefits from the stand-alone assumption of unconstrained resources that allows for all of the DRR construction to occur during the limited bonus depreciation tax window, NS built its system and periodically replaces components of its system over many years. As such, its ability to take advantage of the limited window of opportunity for bonus depreciation is constrained. To allow the DRR to maximize its benefit from a temporary tax shelter because of a simplifying stand-alone cost assumption would result in a reverse barrier to entry that would bestow cost savings to a new hypothetical entrant that were not available to the incumbent.

NS shares the Board's concerns regarding the potential abuse of the bonus depreciation benefit in SAC cases. In its Reply, NS has assumed that the DRR should be allowed to enjoy the benefits of bonus depreciation only to the extent that NS itself has been able to enjoy such benefits. Specifically, using NS tax returns produced to DuPont in discovery, NS calculated that it enjoyed system-wide {{

}} In addition, the DRR is assumed to replace NS for 7,277 of its 2009 total route miles of 15,676, or 46.4 percent of the full NS network. As such, NS limits the amount of bonus depreciation available to the DRR to 46.4 percent of NS's total 2008 and 2009 benefit of{{ .}}

Second, contrary to its statement on opening that the DCF model limits the bonus depreciation taken by DuPont to only the assets placed into service in 2008 and 2009 (*see* DuPont Opening III-H-6 to III-H-7), DuPont assumes the bonus depreciation benefit, which is not applicable to assets placed in service after January 1, 2013, will be available in perpetuity.[4] Specifically, DuPont modified the "Replacement" tab of the Board's DCF model to apply 50 percent bonus depreciation to assets replaced at the end of their projected useful lives. The shortest lived DRR road property asset—communications systems—has an average service life of 26 years. The DCF assumes that DRR will incur the investment required to replace its communications system in the year 2035, well after the bonus depreciation benefit is scheduled to expire. NS therefore has removed the bonus depreciation benefit from the asset replacement tab of the DCF in its reply.

The third error is that DuPont's tax depreciation schedules use the wrong tax depreciation lives for certain of the DRR's road property assets. Specifically, DuPont assumed certain accounts qualify for 15-year lives when, under IRS rules, they actually qualify as 20-year properties. Internal Revenue Code § 168(e) specifies the rules for the classification of property for purposes of computing the cost recovery allowance provided by the Modified Accelerated Cost Recovery System ("MACRS")—the tax depreciation system used in the United States. Property is classified according to class life as determined in Revenue Procedure 87-56 unless statutorily classified otherwise in § 168.[5] There are no exceptions to this rule. The following assets are specifically listed under asset class 40.2, each carrying a 20-year tax life.

- Account 6 - Bridge & Trestles
- Account 13 - Fences & Roadway Signs
- Account 17 - Roadway Buildings
- Account 19 - Fuel Stations

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[4] *See* DuPont Opening WP "Exhibit III-H-1 errate.xlsx," Tab "Replacement," Cell AN64.

[5] NS Reply WP "Rev. Proc. 87-56 – 5.rtf"

- Account 20 - Shops & Enginehouses
- Account 39 - Public Improvements

Further confirmation that NS treats these accounts as 20-year properties for tax depreciation purposes can be found in NS bonus depreciation documents for 2009 and 2010 produced to DuPont in discovery.[6] These documents show that approximately one-quarter of one percent of property placed in service in 2008 and 2009 was classified as 15-year property, while over 17 percent of the property placed in service in those years was classified as 20-year property.[7]

For each of these asset categories, NS changed the depreciation period from 15 years to 20 years and updated the depreciation percentages to comply with the proper 20-year MACRS table.[8]

g. Average Annual Inflation in Asset Prices

NS accepts DuPont's inflation assumptions for assets other than land and, as discussed in Section III-G-2, updates the indexes to use more recent actual index values where available and updates the forecast indexes based on the more recent Global Insights September 2012 report.

h. Discounted Cash Flow

As explained in detail above in Section III-G-4, NS accepts generally DuPont's proposal to calculate the terminal value after year 10. In its opening, DuPont claims to have identified an additional flaw in the STB's model. DuPont observes that the DCF model explicitly assumes that

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[6] NS Reply WPs "Depreciation and Amortization 2008.pdf" and "Depreciation and Amortization 2009.pdf"

[7] *See* NS Reply WP "15 and 20 year property.xlsx."

[8] NS Reply WP "MACRS tables.pdf."

the SARR's capital structure will remain constant in perpetuity. This means that the amounts of common equity and debt carried on the DRR's financial statements will remain the same forever. However, the STB's DCF model assumes that after year 20, and until the first assets are replaced in the replacement level of the DCF model, the railroad has no debt and no tax shielding interest payments. Stated differently, the model assumes, from a tax payment perspective, that the railroad is 100 percent equity financed after year 20 and before its first replacement cycle. According to DuPont, this creates an irreconcilable mismatch between the DRR's cost of capital and its cash flows. The cost of capital assumes that the DRR is carrying debt, and its associated interest payments, but the cash flows reflect no benefits from the interest tax shields.

DuPont proposes to correct the perceived mismatch by assuming, contrary to long established Board precedent and contrary to its own explicit assumption that the term of the DRR debt is 20 years, that interest payments would continue beyond year 20 and in perpetuity. The mismatch "discovered" by DuPont has been a mainstay of the Board's DCF model since *Coal Trading* and *McCarty Farms* and affirmed by the Board in Major Issues where shippers' proposal there to change to the amortization of debt assumptions in the DCF model was rejected by the Board as beyond the scope of the proceeding.[9] DuPont's improper attempts to again raise the issue in the context of this proceeding should be similarly dismissed.

Further, contrary to its assertion, DuPont's proposed solution to extend the DRR interest payment into perpetuity does not remedy its perceived mismatch. As discussed above in section III-H-1. d., the DRR cost of debt is locked in at the rates in place during the DRR construction period and the rates are based on a collection of short and long term debt instruments. DuPont's

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[9] *Major Issues*, STB Ex Parte No. 657 (Sub-No. 1) at 65.

assumption that these rates will remain in effect in perpetuity creates a new mismatch between the interest rate and the debt term.

If the Board were so inclined, the correct way to eliminate the mismatch issue raised by DuPont is to revert back to *Coal Trading* and recalculate the DRR capital structure as the debt is amortized.[10] In that decision the ICC agreed with defendants' position that the DCF debt to equity ratio would not remain constant and that as the SARR amortized debt, the debt to equity ratio will change, resulting in a greater portion being equity capital.[11] This approach would maintain both the relationship between the locked in debt rate and the terms associated with those rates and make the capital structure consistent with the debt amortization schedule. A version of the DCF model implementing such a change is included as in the NS workpapers. *See* NS Reply WP "Alternative DCF.xlsx."

NS made one other necessary change to the DCF model. The PTC development, IT and wayside deployment costs will not be incurred by the DRR until after commencement of operations. As such, special accommodations need to be made to the DCF to recover PTC related investment only after that investment has been incurred. This was accomplished in a manner generally consistent with the approach taken in the DCF for the replacement of assets as they reach the end of their useful lives. Specifically, a new tab "PTC" was created in the DCF that functions similarly to the "Replacement" tab that calculates future replacement costs. DRR PTC investments for the years 2010 through 2015 were input to the new tab where the tax benefits from accelerated depreciation and tax deductible interest are calculated and deducted

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[10] *Coal Trading Corp. v. Baltimore & Ohio R.R.*, 6 I.C.C.2d 379 (1990).

[11] *Id.*

from the PTC investment. The present value of future PTC investments as the original equipment reaches the end of its useful life is also computed for each investment vintage.

The PTC investments net of tax benefits and the present value of future replacements are carried to the "Investment SAC" cash flow tab. The model is first run with no future PTC investment to establish the base line capital recovery. Then, beginning with 2010, each year's PTC investment is added to the investment total and the model rerun. To prevent recovery of PTC investment before the actual PTC expenditures take place, the model results are locked down for the prior year before the model is rerun with the next year's PTC investment. For example, before the 2010 run is made, the annual capital recovery for the first three quarters of 2009 is saved as values and included as part of the 2010 run outputs. Details of these calculations are set forth in the "PTC" and "Investment SAC" tabs of NS Reply Exhibit III-H-1.

i. Computation of Tax Liability – Taxable Income

NS accepts DuPont's assumed federal tax rate of 35% and calculated composite state income tax rate for the DRR.

j. Operating Expenses

NS updated the base year operating expenses as detailed in Section III.D. For the annual adjustment of operating expenses, DuPont, used ton miles instead of the Board's standard use of tons to take into consideration the shifting nature of the DRR traffic. DuPont Open III-H-11. NS rejects DuPont's use of ton miles and indexes DRR operating expenses based on annual changes in car miles. Use of ton-miles to index changes in DRR operating expenses overweights changes to coal traffic volumes—which NS (and others) forecast to decrease—and underweights intermodal—the lightest traffic—for which the highest volume growth is projected. DRR car-miles provide a more accurate metric than ton-miles for adjusting operating expenses for changes in volume for a SARR with such a diverse traffic base that has very different forecasted volume growth. In using car miles, NS relies upon the flat-car miles for intermodal shipments, which tempers their impact more than if containers were used.

k. Summary of SAC Analysis

NS's stand-alone costs and revenues for DRR are presented in Table L of Exhibit III-H-1 on a quarterly and annual basis and summarized in Table III-H-2 below.

Table III-H-2
NS Reply DRR SAC Results

Year	SARR Revenue Requirement	SARR Revenues	Overpayments (Shortfalls)	Present Value
2009	$4,733.3	$2,851.7	($1,881.6)	($1,835.5)
2010	$8,714.0	5,611.2	(3,102.8)	(2,707.2)
2011	$9,314.1	6,074.8	(3,239.3)	(2,511.1)
2012	$9,620.7	6,561.6	(3,059.1)	(2,148.9)
2013	$9,989.8	7,024.4	(2,965.4)	(1,868.6)
2014	$10,327.4	7,444.6	(2,882.8)	(1,629.5)
2015	$10,772.8	7,825.8	(2,946.9)	(1,494.2)
2016	$11,188.8	8,353.0	(2,835.8)	(1,289.8)
2017	$11,631.8	8,930.9	(2,701.0)	(1,102.0)
2018	$12,090.3	9,547.4	(2,542.9)	(930.7)
2019	$5,207.6	4,254.4	(953.3)	(330.4)
Cumulative Net Present Value				**($17,847.7)**

The results in Table III-H-2 show that the revenues available to the SARR are not sufficient to cover the full SAC costs of the SARR over the 10-year analysis period. In fact, DRR would experience a cumulative revenue shortfall of nearly $18 billion. Thus, DuPont has failed to demonstrate that the challenged rates are unreasonably high.

2. Maximum Rate Calculations

NS's Reply Evidence shows that the Board should have no reason to apply the Maximum Markup Methodology ("MMM"), because the challenged rates do not exceed a maximum reasonable level and no rate prescription is warranted. However, if the Board were to find that DRR's SAC revenues exceed its SAC costs, it should correct three errors in DuPont's proposed application of MMM. First, the Board should account for the unique costs imposed by TIH traffic by applying MMM in a two-step process that distributes costs attributable to handling TIH traffic only to the DRR TIH traffic and allocates the remaining non-TIH costs to the entire DRR traffic group. The MMM analysis proposed by DuPont did not allocate TIH related costs only to TIH shipments and therefore would understate the MMM R/VC ratios. The two-step process NS proposes would correct much of that understatement by allocating TIH-related costs entirely to TIH traffic. Second, the Board should index URCS costs for future years using RCAF-A, in accordance with governing precedent, and reject DuPont's proposal to use a different approach used in different contexts and for different purposes. Third, the Board should correct DuPont's erroneous use of 2010 variable costs with 2009 revenues in the first year of the MMM analysis.

a. Any MMM Analysis Conducted in this Case Should Properly Allocate Unique Costs of TIH Traffic Solely to that Traffic

In the event that the Board determines that DRR revenues exceed DRR costs and application of the MMM becomes necessary, it is important that the Board properly allocate the unique variable costs of TIH transportation solely to the TIH movements. As the Board recently determined, for MMM purposes, variable costs should be calculated in accordance with the operating characteristics of the movements on the SARR , for the selected traffic group. *See AEPCO 2011,* STB Docket No. NOR 42113, at 2 (served June 27, 2011). Similarly, the unique variable costs associated with the DRR TIH traffic should be attributed to that TIH traffic (whose "actual operating characteristics" are the sole cause of those costs), not distributed over the entire DRR traffic group (including non-TIH traffic) as they would be if the Board used NS operating characteristics to allocate those costs.[12]

[12] The MMM variable cost approach discussed in this section concerns the proper attribution and allocation NS system average URCS costs, *not* calculating new average URCS costs for the DRR traffic group. Thus, this method would continue to use NS system average URCS costs, but

The Board developed MMM to "allocate the total SAC costs among all of the movements in the traffic group to determine if the challenged rate is unreasonably high, and if so by how much."[13] The allocation of SAC costs is based on each movement's "relative share of service provided, as measured by URCS variable costs."[14] MMM generates a maximum revenue-to-variable cost ratio that limits the contribution from any single movement to a prescribed ratio based on each movement's "share of service provided."

Logically, each movement's share of service provided should be based on the SARR's costs because MMM is allocating the costs of service provided by the SARR. In *AEPCO*, the Board recognized that a "mismatch" occurs where a complainant posits a SARR that would move traffic in trainload service, but then calculates the variable costs for that traffic using defendant's URCS costs associated with traffic moving in carload and multi-car service.[15] To correct this mismatch, the Board ordered the parties to revise their variable cost calculations for carload and multi-car shipments to account for the efficient, low-cost characteristics of those movements over the portion of the movement replicated by the SARR.[16]

Here, DuPont designed its SARR to carry shipments of TIH commodities. Because URCS does not yet assign TIH related expenditures only to TIH traffic, if the Board were to

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distribute them in a way that more accurately reflects the actual costs of TIH and non-TIH movements. An alternative way to approach the attribution of the unique variable costs of TIH traffic would be to make direct adjustments to NS system average URCS costs for all TIH movements before conducting the MMM process.

[13] *Major Issues in Rail Rate Cases*, STB Ex Parte No. 657 (Sub-No. 1) at 9.

[14] *Id.* at 14.

[15] *AEPCO 2011*, STB Docket No. 42113, at 2.

[16] *Id.*

reach the MMM phase in this case, it should apply MMM in a manner that corrects the mismatch between the URCS costing detail and the unique costs of rail movement of TIH commodities.

To date, the Board has not decided whether or how to take into account the unique variable costs of transporting TIH traffic.[17] NS believes there is even more justification for including unique TIH costs in variable costs calculations for any application of the MMM rate prescription mechanism than for determination of the jurisdictional threshold. The Board has expressly acknowledged, however, that unadjusted URCS costs do not attribute to TIH movements the unique costs of those movements to carriers:

> There may be unique operating costs associated with the transportation of hazardous materials . . . that URCS does not attribute to those movements. For example, transportation of hazardous materials may require the carriers to pay higher insurance premiums.

Class I Railroad Accounting and Financial Reporting – Transportation of Hazardous Materials, STB Ex Parte No. 681 (served Jan. 5, 2009). Because URCS "system average" costs do not take into account significant unique costs of TIH transportation, and fail to accurately allocate others, the Board should recognize that such URCS costs do not provide a reasonable or reliable proxy for the variable costs of moving TIH commodities. Accordingly, at least until it develops an URCS methodology that adequately accounts for unique TIH costs, the Board should include an adjustment to URCS system average costs when calculating the variable costs of TIH movements.[18]

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[17] As a general matter, the Board stated in *Major Issues* that the MMM approach should use unadjusted URCS to calculate variable costs. *See* Ex Parte 657 Decision at 14. The Board has not had occasion to address how the unique costs of TIH transportation—which are not accurately accounted for under the existing USOA and URCS system—should be accounted for in calculating variable costs for purposes of application of MMM.

[18] The Board has not yet taken further official action in Ex Parte 681. NS filed comments in that proceeding, urging the Board to act to ensure that its rate reasonableness determinations fully

Although the Board has decided that it will no longer make movement-specific adjustments to system average URCS variable costs for purposes of determining the jurisdictional threshold in rate reasonableness cases, the rationale for that decision does not apply in the SAC world that includes MMM. *See Major Issues*, STB Ex Parte No. 657, at 50-51. A primary rationale for the Board's general decision to disallow adjustments to system average URCS for jurisdictional threshold calculations was that Congress and the Board intended quantitative market dominance to be a relatively quick and inexpensive threshold determination, but the variable cost adjustment process had become complex and costly. *See, e.g., id.* at 51. In contrast, the MMM process is more consequential and not intended to be simple. MMM analysis and results effectively prescribe rates (maximum R/VC ratios) for a full 10 years. Thus, accuracy and reliability in this process is considerably more important than it is in determining "an administratively quick and easy-to-determine regulatory safe harbor" for rail rates generating R/VC ratios of 180 percent or less. *See id.* And, MMM replaced a substantially more simple methodology the Board had used for decades (the percent reduction method), showing that simplicity is not a determinative value in applying the Board's rate-reduction methodology.

In order to accomplish the appropriate allocation of costs for MMM purposes, NS proposes that the Board conduct a two-step variable cost allocation process. The annual stand-alone requirement for TIH costs (both capital and operating expense, as calculated in the DCF model) should be subtracted from the annual revenue requirement that is used as a primary input to the MMM model. The MMM model would then spread non-TIH SAC across all moves, including TIH moves, based on their variable costs. When standalone revenues exceed SAC, the

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factor in the unique costs of transporting TIH commodities, including the risk of a catastrophic accident. *See Class I Railroad Accounting and Financial Reporting – Transportation of Hazardous Materials*, Ex Parte 681, NS Comments (Feb. 4, 2009).

MMM model would produce a maximum MMM R/VC ratio for non-TIH costs (*see* NS Reply WP "DRR MMM Reply.xlsx.")

The second step would allocate the incremental annual TIH stand-alone requirement to the SARR's TIH traffic only. This allocation would be based on each move's variable costs. To demonstrate this approach, NS used the STCCs available in the waybills for Chemicals traffic to identify the TIH moves in the MMM model. NS calculated the total SARR variable costs for TIH traffic in each year. Then, using TIH stand-alone requirement as the numerator, NS calculated the annual ratio of TIH SAC to TIH variable costs. (*see* NS Reply WP "TIH Allocation.xlsx.") This ratio is then added to the MMM R/VC ratio in each year to determine the maximum R/VC ratio for TIH moves.

Applying a two-step process such as that described above would more properly and accurately allocate the unique costs of moving TIH traffic. This, in turn, would result in MMM R/VC ratios that more accurately represent the relationship between a rail carrier's costs and returns associated with handling TIH traffic. In sum, the Board should ensure that – for any application of MMM at the very least -- its variable cost calculations reflect the unique costs and risks of transporting TIH commodities, and properly attribute those costs to the TIH commodities rather than spreading them to non-TIH traffic that does not generate those costs.[19]

[19] If the Board does not adopt NS's proposed approach, whatever alternative approach it uses should ensure that TIH-specific variable costs are attributed solely to TIH movements and not to non-TIH movements. Moreover, NS continues to advocate the attribution of unique TIH costs to TIH traffic alone for all variable cost uses in SAC cases (including jurisdictional threshold, MMM, and rate prescription floor), including the present case.

b. If it Applied MMM, the Board Would Also Need to Correct DuPont's Two Other Clear Implementation Errors.

As discussed, DuPont's MMM analysis also suffers two other implementation errors, which the Board should correct even if it does not adopt NS's proposed two-step MMM approach for TIH traffic..

First, DuPont used the wrong index to adjust the MMM URCS costs for the years 2009 through 2018. Instead of using the RCAF-A as instructed by the Board in its 2009 decision in *AEP Texas*, STB Docket No. 41191 (Sub-No. 1) at 14, DuPont relied on a strained construction of the Board's decision in *OG&E*[20] to rationalize the use of the Board's standard URCS indexing approach in the MMM analysis.[21] The *OG&E* decision is inapposite here, because it involved short term indexing of URCS costs to inflate them only for specific quarters within one year, and not across years. The DuPont MMM model, on the other hand, is projecting URCS costs nine years into the future. Moreover, the Board has consistently used the RCAF-A approach in applying MMM in other cases, including *Western Fuels* and *AEPCO*. NS followed the Board's *AEP Texas, Western Fuels, and AEPCO* precedents and applied a forecast of the RCAF-A as the basis for forecasts of variable costs in the MMM model.

Second, in addition to using the wrong index, DuPont's SARR traffic group in the MMM analysis includes both 2009 and 2010 shipments and revenues. However, DuPont developed its MMM model results using only 2010 URCS costs and failed to index properly variable costs back to 2009 for the first year of the MMM model. DuPont uses the same 2010 URCS variable

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[20] *Oklahoma Gas & Elec. Co. v. Union Pac. R.R.*, STB Docket No. 42111 (STB served July 24, 2009).

[21] DuPont Opening Nar. at III-H-12.

costs for both its 2009 and 2010 selected traffic.[22] Standard Board procedure is to index URCS costs to match the year of the revenue, yet DuPont failed to index the 2010 URCS costs back one year for its 2009 DRR traffic in the MMM model.[23] This creates an obvious mismatch between 2009 revenues and 2010 URCS variable costs. NS corrected this error on reply by indexing 2010 URCS variable costs back to 2009 using the RCAF-A.[24]

3. The Board Should Recognize the Unique Costs and Risks of Transporting TIH Commodities, and Take Them Into Account Fully in its Rate Reasonableness Analyses

Below, using the example of chlorine, NS explains more fully the reasons the Board's regulatory processes and analyses should fully account for the significant and unique costs and risks of handling TIH traffic. In this particular context, the Board should adjust its MMM process to allocate unique TIH costs solely to TIH traffic.

a. The Board and the DRR Must Account for the Risks that Arise from NS' Required Transportation of the Inherently Dangerous Commodity – Chlorine.

NS does not manufacture, purchase, or sell chlorine. It does not use, consume, or process chlorine in its business activities. And, it does not earn anywhere near the return on chlorine transportation that would be required to compensate it for the costs inherent in transporting chlorine, prominently including the potentially bankrupting liability that could result from a release of chlorine during transportation or storage. Despite this imbalance between costs and return, NS is required by law to transport chlorine and other TIH commodities upon demand by a shipper like DuPont. If rail carriers are compelled to carry TIH commodities, sound economics,

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[22] *See* DuPont Opening WPs "2009.xlsx" and "DRR_2010_TRAFFIC_ATC_OPENING_v1_041412.xlsx."

[23] *See* DuPont Opening WP "DRR MMM Input.xlsx."

[24] *See* NS Reply WP "DRR MMM Input Reply.xlsx."

policy, and fundamental fairness require that the Board's rate reasonableness analysis ensure that the rates established by the analysis fully account for the risks of transporting those commodities that arise from the commodity's inherently dangerous chemical composition.

i. Chlorine Is Inherently Dangerous.

DuPont's traffic group includes four lanes in which the commodity transported is chlorine used or produced by DuPont.[25] Chlorine is a greenish-yellow gas at standard temperature and pressure that is usually transported as a pressurized liquid. DuPont chooses to be in businesses that involve chlorine. NS does not. Nevertheless, NS is forced to assume the risk of a product that is inherently dangerous.

Although chlorine may have legitimate uses in industry, there can be no dispute that chlorine is inherently dangerous. Indeed, during World War I, chlorine was manufactured specifically to be used as a weapon.

- On April 22, 1915, German forces used chlorine gas at Ypres, Belgium against French and Algerian troops.[26]
- On April 24, 1915, German forces used chlorine gas against Canadian forces.[27]
- On September 25, 1915, British forces used chlorine gas at Loos.[28]

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[25] The four lanes are A-10 (Charleston, TN to Edgemoor, DE); B-78 (McIntosh, AL to Deslisle, MS; B-87 (Beauharnois, PQ to Edgemoor); and B-113 (Niagara Falls, NY to Edgemoor). Of course, the DRR handles a number of other chlorine shipments in its "non-issue traffic" as well.

[26] World War I: A Student Encyclopedia, Spencer Tucker, editor, at 474 and 1074 (2006). *See also* Simon Jones, World War I Gas Warfare Tactics and Equipment (2007) (discussing extensively the use of chlorine as weapon in World War I).

[27] *Id.* at 474.

[28] *Id.* at 232 and 475.

As a result, the Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare, usually called the Geneva Protocol, was adopted in 1925.[29] A report prepared for the United States Air Force documents that Bosnian Muslims used chlorine in shells against Bosnian Serb forces on at least three occasions in 1993.[30]

The effects on the body from chlorine are documented and well known. In 1917, Doctor Arthur Hurst published "Medical Diseases of the War," which discussed the observed effects of chlorine gas on soldiers.[31] Today, the Occupational Safety and Health Administration describes the toxicological effects of chlorine as follows:

> Severe acute effects of chlorine exposure in humans have been well documented since World War I when chlorine gas was used as a chemical warfare agent. Other severe exposures have resulted from the accidental rupture of chlorine tanks. These exposures have caused death, lung congestion, and pulmonary edema, pneumonia, pleurisy, and bronchitis [Hathaway et al. 1991]. The lowest lethal concentration reported is 430 ppm for 30 minutes[Clayton and Clayton 1982]. Exposure to 15 ppm causes throat irritation, exposures to 50 ppm are dangerous, and exposures to 1000 ppm can be fatal, even if exposure is brief [Sax and Lewis 1989; Clayton and Clayton 1982]. Earlier literature reported that exposure to a concentration of about 5 ppm caused respiratory complaints, corrosion of the teeth, inflammation of the mucous membranes of the nose and susceptibility to tuberculosis among chronically-exposed workers. However, many of these effects are not confirmed in recent studies and are of very dubious significance [ACGIH 1991]. A study of workers exposed to chlorine for an average of 10.9 years was published in 1970. All but six workers had exposures below 1 ppm; 21 had TWAs above 0.52 ppm. No evidence of permanent lung damage was found, but 9.4 percent had abnormal EKGs compared to 8.2 percent in the

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[29] The Geneva Protocol prohibits the use of chemical weapons and biological weapons, but has nothing to say about production, storage or transfer. Later treaties did cover these aspects—the 1972 Biological Weapons Convention and the 1993 Chemical Weapons Convention.

[30] Theodore Karasik, Toxic Weapons at 21 (attached as Exhibit III-H-2).

[31] Excerpt available at http://www.vlib.us/medical/gaswar/chlorine.htm (attached as Exhibit III-H-3).

> control group. The incidence of fatigue was greater among those exposed above 0.5 ppm [ACGIH 1991]. In 1981, a study was published involving 29 subjects exposed to chlorine concentrations up to 2.0 ppm for 4- and 8-hour periods. Exposures of 1.0 ppm for 8 hours produced statistically significant changes in pulmonary function that were not observed at a 0.5 ppm exposure concentration. Six of 14 subjects exposed to 1.0 ppm for 8 hours showed increased mucous secretions from the nose and in the hypopharynx. Responses for sensations of itching or burning of the nose and eyes, and general discomfort were not severe, but were perceptible, especially at the 1.0 ppm exposure level [ACGIH 1991]. A 1983 study of pulmonary function at low concentrations of chlorine exposure also found transient decreases in pulmonary function at the 1.0 ppm exposure level, but not at the 0.5 ppm level [ACGIH 1991]. Acne (chloracne) is not unusual among persons exposed to low concentrations of chlorine for long periods of time. Tooth enamel damage may also occur [Parmeggiani 1983]. There has been one confirmed case of myasthenia gravis associated with chlorine exposure [NLM 1995].[32]

Chlorine is chemically unstable and is very dangerous to human life and health when released into the air.

> Small doses irritate the eyes, skin, and respiratory tract; large concentrations of chlorine gas can kill people within minutes. If inhaled at very high concentrations, chlorine breaks down in the lungs to hydrochloric acid that burns lung tissue, causing pulmonary edema and essentially causing drowning as liquid fills the lungs. . . . . The lowest lethal exposure is reported as 430 ppm for 30 minutes. Over shorter periods of time, exposure even to 15 ppm of chlorine causes throat irritation, while exposure to 50 ppm is dangerous and exposure to 1000 ppm can be fatal after a few deep breaths.

Branscomb, et al, Rail Transportation of Toxic Inhalation Hazards at 9-10 (2010).[33]

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[32] *See* http://www.osha.gov/SLTC/healthguidelines/chlorine/recognition.html (attached as Exhibit III-H-4). For a further discussion of the toxicology of chlorine *see* Sylvia S. Talmage "Chlorine" in Handbook of Toxicology of Chemical Warfare Agents, Ramesh Chandra Gupta, editor (2009).

[33] L Branscomb, M. Fagan, P. Auerswald, R. Ellis, R. Barcham, "Rail Transportation of Toxic Inhalation Hazards: Policy Responses to the Safety and Security Externality," Discussion Paper #2010-01, Harvard University Kennedy School Belfer Center (February 2010) (hereinafter "*Rail Transportation of Toxic Inhalation Hazards*").

Clearly it is the product itself that poses a risk to railroad employees and the public at large. It is the product itself that makes it attractive to terrorists.[34] The Board must find a way to address the impact of these risks on the chlorine rates at issue in this case.

ii. All Railroads, Including the DRR, Face the Risks Inherent in the Transportation of Chlorine.

A railroad has no choice but to accept chlorine and other TIH commodities upon a reasonable request. Having found that the common carrier obligation encompasses TIH commodities, the Board has prominently exposed the question that must now be resolved in this case -- how will the Board rate regulatory regime acknowledge and incorporate the risks associated with these shipments?

It is beyond dispute that a railroad, including the DRR, has a substantial risk exposure every time a customer tenders a carload of chlorine to it. Even with an impressive safety record, a railroad cannot eliminate entirely the risk of such releases, whether through terrorist attacks, acts of God, third-party activity or other causes. Even for a DRR that might wish to assume a perfect safety record for its own activities, it simply cannot assume away the risks of real world events that NS faces regularly.

The DRR's network, like NS's own, is an open network.[35] The rail network is open because it interfaces with other aspects of society, such as road crossings, transload facilities for multi-modal transportation, and the facilities of customers who ship commodities other than the specified hazardous materials. These interrelationships mean the rail system must remain an open network. Because rail systems must be open, the dangers associated with transporting

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[34] Tucker, *The Future of Chemical Weapons*, at 26-28.

[35] 71 Fed Reg. 76852, 76854 (Dec. 21, 2006) (recognizing that the rail system is an "open network").

chlorine and other TIH commodities cannot be eliminated. The rail system will always be vulnerable to an incident or an attack.

In addition to terrorism,[36] there are a number of other potential causes of calamity that expose the DRR to substantial risks. Consider the following examples of accidents that occurred on NS in recent years:

- In Greensboro, North Carolina, the driver of a gasoline truck stopped his truck across our tracks after allegedly not seeing the warning signals. Our train struck the truck, causing a fiery crash.
- In Augusta, Georgia, a tractor-trailer driver drove through a crossing gate and flashing signal lights and rammed into the side of one of our passing trains, which resulted in the derailment of 24 rail cars.
- In Oakwood, Georgia, a drunk driver ran through a stop sign, continued through a field, and broadsided our train. Twelve cars derailed, including five with hazardous chemicals, which forced the evacuation of 250 people. Fortunately, the only spill was a load of plastic pellets.

In each of these instances an ordinary citizen caused an incident that could have been disastrous if the accident had involved the release of any of the specified hazardous materials. The DRR, and the Board, cannot simply assume these risks do not exist.

Moreover, the magnitude of the risk is extraordinary. Because of the extremely dangerous nature of TIH commodities when released into the air, rail carriers transporting such commodities face catastrophic liability risks every time they move a rail car carrying TIH. For example, a study by an economic consulting firm found that a rush hour rail accident in Chicago involving a chlorine release from a *single rail car* could result in 10,000 fatalities, 32,600 other casualties and inflict more than $7 billion in damages. *See* Risk Management Solutions, *"Catastrophe, Injury, and Insurance: The Impact of Catastrophes on Workers Compensation,*

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[36] *See e.g., id.* at 76873 ("The primary focus of the enhanced inspection would be to recognize an IED.").

Life and Health Insurance" at 54-59 (2004), copy available at www.rms.com/Publications/Catastrophe_Injury_Insurance. An accident involving the release of chlorine from multiple cars obviously would hold the potential for far greater losses and damages.

The potential for catastrophic damage from a release of TIH chemicals from a rail car into the environment is not limited to accidental releases. Terrorism experts have identified an attack on a TIH shipment being transported through urban areas as one of the most severe terrorist threats to civilians. As a former Deputy Homeland Security Adviser explained:

> Of all the various remaining civilian vulnerabilities, one stands alone as uniquely deadly, pervasive, and susceptible to terrorist attack: industrial chemicals that are toxic when inhaled, such as chlorine, ammonia, phosgene, . . . These chemicals, several of which are identical to those used as weapons on the Western Front during World War I, are routinely shipped through and stored near population centers in vast quantities . . . A cleverly designed terrorist attack against such a chemical target would be no more difficult to perpetrate than the September 1 attacks. The loss of life could easily equal that which occurred on September 11 – and might even exceed it. I am aware of no other category of potential terrorist targets that presents as great a danger as toxic industrial chemicals.[37]

At the same time that TIH shipments present potentially ruinous, unavoidable risks to rail carriers, they constitute only a small portion of those carriers' traffic volume and revenues. Thus, absent either compensation commensurate with carriers' risk exposure, or an overriding legal obligation, a rational economic actor in the position of a rail carrier like NS would refuse to transport inherently risky TIH traffic. As discussed below, although rail carriers do not receive

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[37] Richard Falkenrath, former Deputy Homeland Security Adviser and NYC Deputy Commissioner of Police, "We Could Breathe Easier: the Government Must Increase the Security of Toxic Chemicals in Transit," *Washington Post* at A15 (March 29, 2005) (emphasis added).

compensation sufficient to offset the risk of carrying TIH commodities, they are nonetheless required to accept and transport such commodities when tendered by shippers.

b. Sound Public Policy Demands that the Board Account for the Inherent Risk of Transporting Chlorine in This Rate Case.

A recent Harvard report observed that "[t]he [Board's] current regulatory scheme means that the risks of carrying a product that could cause billions of dollars in damage and impose potentially huge liability on a railway in the event of a release are rarely reflected adequately in rail transportation rates."[38] In large part, that regime does not account for the risks of transporting inherently dangerous products, such as chlorine, because the Board has not yet addressed how a SARR should account for that risk. That question is now squarely before the Board. NS agrees with the conclusion of the Harvard report that "[p]olicy solutions should recognize the risk of TIH carriage as an externality, and should aim to incorporate external costs into the cost of TIH products and their transportation."[39]

Railroads have attempted to get protection in other ways from the risks of transporting chlorine and other TIH commodities. Union Pacific sought an order declaring that the common carrier obligation did not encompass those commodities. But the Board rejected that alternative and held that the common carrier obligation requires railroads to transport TIH freight essentially at the demand of a shipper, without regard to the availability of lower risk (and lower cost) transportation alternatives. *See, e.g., Union Pacific R.R. – Petition for Declaratory Order,* STB Docket No. 35219 (served June 11, 2009) (applying common carrier obligation to require rail carrier to accede to shipper demand for particular TIH transportation service, despite availability of lower risk alternatives).

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[38] *See Rail Transportation of Toxic Inhalation Hazards* at 14-15.

[39] *Id.* at 63.

Next, Union Pacific sought an order from the Board that would reduce the risk of long-distance shipments of TIH commodities. The location of TIH production facilities and geographically dispersed receivers and users of TIH commodities (particularly chlorine) results in demand for long distance carriage of those commodities through and near large population centers. Further exacerbating the risks and costs of transportation of chlorine and other TIH commodities is the fact that shippers often demand that rail carriers transport them unnecessarily long distances from a production facility to a destination, despite the availability of closer sources of production or safer alternative products. But again, the Board rejected Union Pacific's plea and held that the common carrier obligation prohibits railroads from declining a shipper's request for transportation of a TIH commodity on the basis that the shipper could obtain the same commodity from an origin that is closer to the destination, or that otherwise presents lower risk of accidental exposure to people and the environment. *See, e.g., UP – Petition for Declaratory Order,* STB Docket No. 35219 (June 11, 2009).

Because, under current law, a carrier must move TIH commodities between any points on its network on demand, and shippers' liability risk does not increase with hauling distance or other risk factors, shippers have little incentive to source TIH commodities from the closest production facility or otherwise take exposure risk into account in their TIH commodity procurement and transportation decisions.[40] As a result, shippers' TIH sourcing and transportation decisions are generally driven by factors (e.g. commodity price) other than

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[40] Both producers and receivers/users of TIH commodities lack incentive to take exposure risk into account when buying, selling, or arranging for transportation of those commodities. Receivers generally bear no more liability risk whether a chlorine shipment travels 10 miles or 1,000 miles, even though release and exposure risks vary directly with transportation distance. Similarly, producers' primary incentive is to sell their product, without regard to the distance it must be transported to they buyer. Like users—but in contrast to carriers—producers' liability risk generally does not increase with the length of the transportation haul of a TIH commodity.

transportation risk factors and those decisions do not adequately take into account the very real and substantial risks of damage and liability inherent in transportation of TIH commodities.

RailAmerica adopted extra safety precautions to transport TIH commodities. Even those additional safety measures were challenged by TIH shippers, including the American Chemistry Council, of which DuPont is a member. So far, the Board has not declared additional safety measures to be a reasonable practice, and so it is unclear whether railroads can even take that modest level of self-help, which in any event would not eliminate the risks inherent in transporting an inherently dangerous commodity like chlorine.

Most recently, Union Pacific sought a declaratory order that it was a reasonable practice for a railroad to include in its tariff a provision that required shippers of TIH commodities to indemnify the railroad against the risks of transporting TIH commodities. Under the Union Pacific proposal, the railroad would remain liable for its own negligence, but the shipper would be responsible for all other causes of a TIH incident. The Board has still not granted railroads any relief from the risks of transporting TIH commodities.

All that is left is to account for the risks of TIH commodities in rate regulation, including in this case. *See, e.g.,* STB Ex Parte No. 681, Comments of Norfolk Southern Railway Company at 3 (Feb. 4. 2009) (urging the Board to ensure that its rate reasonableness determinations fully account for the unique costs and risks of transporting TIH and other highly hazardous materials). As the Harvard study found, the Board's rate regulatory regime must account for these risks and the external costs that arise from these risks when determining the maximum reasonable rate for DuPont's chlorine shipments.

c. NS Bears the Externalities of Regulatory Policy, and Therefore the Maximum Rate Permissible Under that Regulatory Policy Must Also Reflect the Fact that the Railroad Bears the Externalities.

Manufacturers and users of chlorine and other TIH products are well aware of the toxicological risks associated with those products. Unlike railroads that are required by federal law to accept shipments of the chlorine that they do not make, however, there are no federal laws requiring a company to manufacture, sell, purchase, or use chlorine and other TIH commodities. Companies such as DuPont voluntarily choose to engage in the production, use, and sale of TIH commodities because they are profitable -- the revenues they earn from those activities substantially outweigh the costs they bear as a result of undertaking those activities. So long as such firms bear the full cost of the products they produce, use, or sell, their net revenues from such activity are entirely appropriate. But DuPont—like other TIH producers—does not bear the full cost of its decision to manufacture, sell, and distribute TIH commodities. Instead, some of those costs are borne by others, including rail carriers.

The single rate case of which NS is aware in which the Board addressed a carrier's request that rate reasonableness analysis take into account the extraordinary costs and risks of transporting TIH commodities was *E.I. duPont de Nemours and Company v. CSX Transportation, Inc.*, STB Docket No. 42100, (June 30, 2008). In that Three Benchmark case, the Board rejected the defendant carrier's arguments for cost and revenue adjustments to more accurately reflect the actual costs and risk of rail transportation of TIH commodities, and to reflect pricing responses to those costs and risks. *See id. at* 8-9, 15-17, n.48. As an important study concluded in evaluating the *DuPont* decision and the Board's failure to adjust its rate reasonableness analysis to account for the risks and extra costs of transporting TIH commodities:

> the current regulatory scheme means that the risks of carrying a product that could cause billions of dollars in damage and impose

> potentially huge liability on a railway in the event of a release are rarely reflected adequately in rail transportation rates. In other words, they remain externalities.

Rail Transportation of Toxic Inhalation Hazards at 15.

The DRR already must bear the direct costs of TIH transportation, including increased handling, security measures that affect transit times and increase personnel costs and other costs, and positive train control. These costs are accounted for in the DRR's engineering and operating costs.

But the risks of liability for an accidental release on rail carriers and on society are not already included in the DRR costs.[41] This is a classic example of a negative externality—a market failure consisting of a negative effect of a use decision by one party on other parties who do not have a choice in the matter and whose interests are not adequately taken into account. The imposition of the risks of transporting TIH on rail carriers and individuals who do not have a choice whether to undertake and bear those risks and costs is an externality.[42]

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[41] Companies that manufacture, sell, or use chlorine should bear those unique costs in the first instance. They may choose to pass those costs on to customers and consumers who benefit from the use of chlorine by incorporating those costs in their prices. Indeed, including these costs in the price of affected goods and services is an effective market-based solution to distributing concentrated costs to a large and dispersed population of beneficiaries.

[42] These externalities also distort shippers' transportation decisions. Because shippers do not bear the additional costs and risks of shipping TIH commodities over longer distances or through high population areas, they have no incentive to consider those risks and costs in their sourcing and shipping decisions. As experience has shown time and again, economic actors who are not required to bear the costs and risks of their decisions will make riskier and more costly decisions, to the detriment of other market participants and society.

The home mortgage crisis and related financial institution failures and the resulting deep economic recession, as well as federal government expenditure of hundreds of billions of dollars to attempt to address that crisis and stabilize the economy, are only the latest and most prominent examples of the negative effects of businesses discounting or disregarding risks (in that case based partly on a belief that the government was the ultimate actual bearer of those risks). To the extent that the government, and hence society, bore the costs of risky activity of private financial institutions, those costs were negative externalities of that risky activity. As the

The appropriate market-based solution to a negative externality is to shift the externalities back to the entities whose use and activity cause those costs, and thereby to ensure that the market price of the commodity reflects the full costs of the product. Requiring shippers of TIH commodities to "internalize" the costs and risks of transporting TIH commodities would correct this market failure. *See, e.g., Rail Transportation of Toxic Inhalation Hazards* at 28, 29 ("The full societal cost of TIH transportation—including the risks of potential damage from accident or attack—is not reflected in the market prices for TIH products. . . . .If the TIH risk could be quantified and incorporated into the price of TIH products and their transportation, this would allow stakeholders to make economically rational decisions concerning production, use, and shipping of TIH chemicals."). In the context of the present case, the Board should mitigate the effect of these externalities on its rate reasonableness analysis by including in its rate regulatory regime those externalities.[43]

In sum, for all the reasons discussed above, the Board should fully account for and properly allocate the unique costs of handling TIH commodities in the event that it reaches application of MMM in this case. NS has proposed a two-step approach it believes is reasonable and consistent with the Board's precedents and application of MMM in other recent cases. If the Board were to reach the MMM phase but decide not to apply NS's proposed approach, it should ensure that whatever approach it applies properly allocates the unique costs of transporting TIH commodities.

Harvard study concluded, "[p]olicy solutions should recognize the risk of TIH carriage as an externality, and should aim to incorporate external costs into the cost of TIH products and their transportation." *Rail Transportation of Toxic Inhalation Hazards* at 63.

[43] As discussed below, those costs include the costs of special handling and security measures; positive train control system development, installation, and operation; liability insurance costs, and the risk of catastrophic liability in the event of an accidental release.

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IV. WITNESS QUALIFICATIONS AND VERIFICATION

JAMES D. BAGLEY

Mr. Bagley is an independent consultant with over 35 years of experience in the railroad industry, working for Norfolk Southern Railway Company ("NS") (and its predecessor Southern Railway Company) and for CSXT. His office is located at 1781 Harrington Park Drive, Jacksonville, Florida 32225. Between June 2004 and February 2008, Mr. Bagley served as Vice President Engineering and Chief Engineering Officer for CSXT. Mr. Bagley is sponsoring portions of Section III-D of NS's Reply Evidence that relate to Maintenance-of-Way costs and Section III-F that relate to Road Property Investment for the DRR. Mr. Bagley has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

As CSXT's Vice President Engineering and Chief Engineering Officer, Mr. Bagley was responsible for all engineering functions within the CSXT system - track, roadway, bridges and structures, buildings, facilities, and communications and signals. He supervised and managed a workforce of approximately 6,500 employees in over 22 States and two Canadian Provinces covering over 21,000 miles of main track and 9,000 miles of yard and siding tracks.

Before his tenure as CSXT's Chief Engineering Officer, Mr. Bagley had over 30 years of experience working for NS and its predecessor railroads. A sampling of the positions he held over the course of his career include Track Supervisor; Assistant Division Engineer-Piedmont Division; Division Engineer-Asheville Division; Division Engineer-Kentucky Division; Engineer Maintenance of Way-Southwest Region; Engineer Maintenance of Way-Eastern Region; Division Engineer-Virginia Division (following a departmental reorganization); Chief Engineer Line Maintenance-Western Region; Chief Engineer Line Maintenance-Eastern Region; Chief Engineer Line Maintenance-Staff; Chief Engineer Line Maintenance-Northern Region. In these positions Mr. Bagley had increasing responsibility for the maintenance of and daily operations on track and bridges. He represented the Maintenance of Way and Structures Department on the transition team working on the integration of the Conrail territory. In his final position with NS, Mr. Bagley directed over 2,000 employees and had responsibility for over 7,000 miles of main track and 2,000 miles of yard and siding track. Mr. Bagley has also worked as a consultant on a number of projects concerning safety assessment and inspection of track infrastructures.

Mr. Bagley received a Bachelor of Science degree in civil engineering from Southern Polytechnic State University. He is a member of the American Railway Engineering and Maintenance-of-Way Association ("AREMA"), and was a member of its predecessor organizations. Since 2007 he has been a member of AREMA's Board of Governors.

Mr. Bagley's complete curriculum vitae is attached.

VERIFICATION

I, James D. Bagley, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

James D. Bagley

James D. Bagley

Executed on this 14th day of November, 2012.

JAMES D. BAGLEY

♦♦♦

1781 Harrington Park Drive • Jacksonville, Florida 32225
Fax 904 220 0095 • Home 904 220 9287 • Cell 904 200 2859
Email: DonBagley@comcast.net

SUMMARY

35+ years experience with Norfolk Southern Railway Company (and predecessor company, Southern Railway Company), and CSX Transportation, in the Maintenance of Way & Structures and Engineering Departments. Began my career with Southern Railway in November 1968 as a Management Trainee progressing steadily through positions of increasing responsibility from Track Supervisor to Chief Engineer with Norfolk Southern, and then to Vice President and Chief Engineering Officer for CSX Transportation.

WORK HISTORY

INDEPENDENT CONSULTANT - March 1, 2008 to Present

December 2008 and January 2009

Special Consultant for Niemeyer & Associates, PC and Teledyne Brown Engineering, Inc. on track and bridge upgrade work on Russian Railways project near Bolshoi Kamen, Russia.

CSX TRANSPORTATION COMPANY

June 1, 2004 to February 29, 2008
Vice President Engineering and Chief Engineering Officer

Responsible for all engineering functions within the CSX system (track, roadway, bridges & structures, buildings, facilities, communications and signals, design, construction & capacity). Overall responsibility for supervising and managing a workforce of approximately 6500 employees over 22 States and two Canadian Provinces covering 21,000 + miles of main track, 9000+ miles of yard and siding tracks, with an annual expense and capital budget in excess of $1.4B.

2000-2004 **INDEPENDENT CONSULTANT**

August 28-September 1, 2000
September 18-23, 2000

Safety assessment and inspection of track infrastructure on the Alaska Railroad from Anchorage to Fairbanks, Alaska.

November 19-20, 2000

Safety assessment/track inspection of Canadian National Railway's Kitimat Subdivision to assess the feasibility of operating longer/heavier trains between Kitimat and Terrace, B.C., Canada.
January 11-17, 2001

Safety assessment and inspection of track infrastructure of Ferrominera Orinoco Railroad between Porte Ordaz and San Isidro ore mine (146km) in Venezuela, South America.

February 12-16, 2001

Member of a Value Engineering team reviewing Phase I of Metra's rail expansion project on Metra's West Line and Wisconsin Central's North Central Line in the Chicago, IL. area.

April 23-27, 2001

Conducted track maintenance/track inspection training class at Coronach, SK., Canada for Luscar, Ltd.'s track maintenance employees.

May 21-25, 2001

Member of a Value Engineering team reviewing proposed rail expansion project for Metra between Geneva and Elburn,IL.

June 4-8, 2001

Member of Value Engineering team reviewing phase II of proposed rail expansion project for Metra in the Chicago, IL. area on Metra's West Line and Wisconsin Central's North Central Line.

June 11-15, 2001

Member of a Value Engineering team reviewing rail expansion project on the Greenbush Line for the MBTA in Boston, MA.

August 1-3, 2001

Safety assessment and inspection of track infrastructure of the Indiana Railroad between Newton, IL. and Indianapolis, IN.

October 8-12, 2001

Conducted track maintenance/track inspection training classes for INTERCOR track maintenance employees in Columbia, South America.

January 7-10, 2002

Safety assessment and inspection of track infrastructure for Westinghouse Corp. at the Savannah River Nuclear Plant near Aiken, SC.

March 4 – September 30, 2002

Consultant for Norfolk Southern Railway in two coal rate cases before the Surface Transportation Board.

May 20-22, 2002 and July 28 –30, 2003

Safety assessment and inspection of track infrastructure of the Georgia Ports Authority tracks in the Savannah and Brunswick, Georgia areas.

November 18-21, 2002

Conducted training class covering FRA Track Safety Standards, Track Inspection, and Track Maintenance for employees of Westinghouse Corp. at the Savannah River Nuclear Plant near Aiken, SC.

September 9-12, 2003

Performed Inspection, evaluation and risk assessment of Luscar, Ltd.'s Poplar River Mine Rail Line near Coronach, SK., Canada including preparation of a written report.

September 22-25, 2003

Conducted training class covering FRA Track Safety Standards and Track Inspection for employees of Bechtel BWXT Idaho, LLC (BBWI) at the Idaho National Engineering & Environmental laboratory near Idaho Falls, Idaho.

1968-2000 NORFOLK SOUTHERN RAILWAY / SOUTHERN RAILWAY COMPANY

June 1, 1999- February 28, 2000
Chief Engineer Line Maintenance Northern Region (Conrail acquired territories)
Atlanta, Georgia

Overall responsibility for daily track and bridge operations on 7000+ miles of main track and approximately 2000+ miles of yard and siding track. Overall responsibility for directing a maintenance force of approximately 2000 employees with an annual expense and capital budget of approximately $200 million.

May 16, 1997-May 31, 1999
Chief Engineer Line Maintenance-Staff
Atlanta, Georgia

In this position I was the Maintenance of Way & Structures Department representative on a Transition Team involved in Norfolk Southern's acquisition of a very sizable portion of Consolidated Rail Corporation (Conrail). Responsibilities included familiarization of the Conrail territory to be acquired, interviewing Conrail supervisors and maintenance of way employees and extending job offers to existing Conrail employees for non-agreement Maintenance of Way & Structures supervisory positions with Norfolk Southern. Responsibilities also included determining division boundaries for the territories being acquired as well as staffing and manpower requirements for these territories. It was also my responsibility to develop five-year maintenance and capital programs for the physical plant being acquired.

July 1, 1995- May 15, 1997
Chief Engineer Line Maintenance-Eastern Region

Atlanta, Georgia

Overall responsibility for daily track and bridge operations on approximately 7000 miles of main track and 1700 miles of yard and siding track. Overall responsibility for directing a maintenance force of approximately 1700 employees with annual expense and capital budgets of approximately $200 million.

October 1, 1993- June 30, 1995
Chief Engineer Line Maintenance-Western Region
Atlanta, Georgia

Overall responsibility for daily track and bridge operations on approximately 7000 miles of main track and 1800 miles of yard and siding track. Overall responsibility for directing a maintenance force of approximately 1900 employees with annual expense and capital budgets of approximately $200 million.

February 1, 1989- September 30, 1993
Division Engineer- Virginia Division (Departmental Reorganization)
Roanoke, Virginia

Overall responsibility for daily track and bridge operations on heavy tonnage division (110 million gross tons annually on approximately one-third of division) consisting of approximately 1900 miles of main track and 800 miles of yard and siding track. Responsible for directing a maintenance track and bridge force of approximately 450 employees. Responsibilities included preparing annual maintenance and capital programs for both track and bridge projects with an annual budget of approximately $50-60 million.

August 16, 1986- January 31, 1989
Engineer Maintenance of Way- Eastern Region
Roanoke, Virginia

Overall responsibility for daily track operations and maintenance on the Eastern Region of the Norfolk and Western Railway Company (subsidiary of Norfolk Southern Railway Company). The Eastern Region was comprised of approximately 2000 miles of main track and 1000+ miles of yard and siding track. The vast majority of this region was mountainous terrain territory with heavy coal tonnage being the predominate commodity being transported. Directed a work force of approximately 750 employees responsible for the maintenance and safety of the track structure on this region. Responsibilities included preparing annual maintenance and capital programs for track projects with an annual budget of approximately $100 million.

February 1, 1983- August 15, 1986
Engineer Maintenance of Way- Southwest Region
Atlanta, Georgia

Overall responsibility for daily track operations and maintenance on the Southwest Region of the Southern Railway System (subsidiary of Norfolk Southern Railway Company). The Southwest region was comprised of approximately 2500 miles of main track and 1000+ miles of yard and siding track. Approximately 50% of the main track was mountainous terrain with heavy coal tonnage. Directed a work force of approximately 500 employees responsible for the maintenance and safety of the track structure on this region. Responsibilities included preparing annual maintenance and capital programs for track projects with an annual budget of approximately $80-90 million.

July 1, 1976- January 31, 1983
Division Engineer- Kentucky Division
Somerset, Kentucky

Responsible for daily track operations and maintenance on heavy tonnage division between Cincinnati, Ohio and Chattanooga, Tennessee on the Southern Railway System. This division was comprised of 500 miles of heavy tonnage CTC main track (35MGT- 72MGT), 100 miles of secondary main track and approximately 200 miles of yard and siding track. Directed a work force of 130 employees responsible for maintenance and safety of the track structure. Responsible for preparing annual maintenance and capital programs for track projects with an annual budget of approximately $25 million.

March 16, 1974- June 30, 1976
Division Engineer- Asheville Division
Asheville, North Carolina

Responsible for daily track operations and maintenance on mountainous division consisting of approximately 200 miles of heavy tonnage main track, 200 miles of secondary main track, and 100 miles of yard and siding track. Directed a work force of approximately 65 employees responsible for maintenance and safety of the track structure on this division. Responsibilities included preparing annual maintenance and capital programs for track projects with an annual budget of approximately $10 million.

January 16, 1973- March 15, 1974
Assistant Division Engineer- Piedmont Division
Greenville, South Carolina

Assisted the Division Engineer on the Piedmont Division in managing daily track operations and maintenance on approximately 500 miles of CTC main track, 150 miles of secondary main track, and 200 miles of yard and siding track. Assisted the Division Engineer in planning future maintenance and capital programs for the division.

January 1, 1972- January 15, 1973
Track Supervisor-Piedmont Division
Greenville, South Carolina

Responsible for daily track maintenance on 100 miles of Centralized Traffic Control main track, 45 miles of secondary main track, and 15 miles of yard and siding track. Directed a daily work force of approximately 20 employees.

August 12, 1969-December 31, 1971
Track Supervisor- Piedmont Division
Union, South Carolina

Responsible for daily track maintenance on 100 miles of main track, 25 miles of secondary main track, and 5 miles of yard and siding track. Directed a work force of six employees.

November 18, 1968- August 11, 1969
Management Trainee
Columbus, Georgia

Participant in a structured Management Training program under the direction of the Division Engineer at Columbus, Georgia.

1964-1968	**DANIEL CONSTRUCTION COMPANY** Florida Division Jacksonville, Florida
	Field Construction Engineer and Assistant Construction Superintendent on several heavy building construction projects in Jacksonville and Windermere, Florida and St. Mary's Georgia.

EDUCATION

1964	Graduated Southern Technical Institute (Southern Polytechnic State University) – Civil Engineering Degree
1995	Management Development Certificate from Duke University - The Fuqua School of Business

SAFETY TRAINING

1989	Completed the DuPont Safety Training Course developed for Norfolk Southern Railway. Conducted Safety Training/Safety Audit training classes for all M/W personnel on Norfolk Southern's Virginia Division.

PROFESSIONAL ORGANIZATIONS

1973 to Present	Member of American Railway Engineering and Maintenance-Of-Way Association and predecessor organizations American Railway Engineering Association and Roadmasters and Maintenance-Of-Way Association.
2007 to Present	Member of the Board of Governors of American Railway Engineering and Maintenance of Way Association (AREMA).

MICHAEL R. BARANOWSKI

Mr. Baranowski is a Senior Managing Director at FTI Consulting, Inc., an economic and consulting firm with offices located at 1101 K Street, NW, Washington, DC 20005. Since 1980, Mr. Baranowski has been involved in various aspects of transportation analysis including operations, engineering, facility requirements, valuations and costing. Mr. Baranowski is sponsoring portions of Sections III-F, III-G, and III-H of Norfolk Southern's ("NS's") Reply Evidence. Mr. Baranowski has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Baranowski holds a Bachelor of Science degree in accounting from Fairfield University in Fairfield, Connecticut. In 1980, he joined the consulting firm of Wyer, Dick and Company in Livingston, New Jersey as a consultant. He participated in a variety of studies for railroad, shipper and other clients including line abandonments, operations analysis, terminal switching studies, labor protection and rail facility and equipment valuation.

In late 1981, Mr. Baranowski became a consultant with Snavely, King and Associates with offices in Morristown, New Jersey and Washington, D.C. While at Snavely, King, he was involved in rail merger, traffic, switching, liquidation and valuation studies for a variety of rail and rail related clients. He was also responsible for engineering, operating and costing components in a number of Section 229 proceedings.

Mr. Baranowski joined Klick, Kent & Allen ("KK&A") in 1988 as a Senior Consultant. He became a principal of KK&A in 1989 and remained in that position until its acquisition by FTI in 1998. Mr. Baranowski has presented testimony before the Interstate Commerce Commission, Surface Transportation Board, Federal Communications Commission, Federal Regulatory Commission and a variety of state regulatory agencies.

Mr. Baranowski's complete curriculum vitae is attached.

VERIFICATION

I, Michael R. Baranowski, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Michael R. Baranowski

Executed on this 22 day of November, 2012.

Michael R. Baranowski

Senior Managing Director – Economic Consulting

mike.baranowski@fticonsulting.com

FTI Consulting
1101 K Street, NW
Suite B100
Washington, DC 20005
Tel: (202) 312-9100
Fax: (202) 312-9101

Education
B.S. in Accounting, Fairfield University

Supplemental Finance Studies, Kean College

Mike Baranowski provides financial and economic consulting services to the telecommunications and transportation industries. He has special expertise in analyzing and developing complex computer costing models, operations analysis, and transportation engineering. Much of his work involves providing oral and written expert testimony before courts and regulatory bodies.

Some of Mr. Baranowski's representative accomplishments include:

- Overseeing the development of computer cost modeling tools designed to simulate the cost of competitive entry into local telecommunications markets and directing the efforts of a nationwide team of testifying experts presenting the cost model results in multiple proceedings across the country.
- Directing the analysis, critique and restatement of a variety of complex cost models developed by major telecommunications companies designed to simulate the forward-looking cost of competitive entry into local telecommunications markets.
- Designing multiple PC-based spreadsheet models for use in calculating the stand-alone cost of competitive entry into the railroad and pipeline markets. These models have been used to assist clients in all three network industries in making internal pricing decisions that are in compliance with governing regulatory standards.
- Conducting detailed analyses of railroad operations and developing the associated capital requirements and operating expenses attributable to specific movements and the incremental capital and operating expense requirements attributable to major changes in anticipated traffic levels.
- Calculating marginal and incremental costs for a major petroleum products pipeline company, an approach that is now used regularly by the company in making internal day-to-day pricing decisions.

Mr. Baranowski holds a B.S. in Accounting from Fairfield University in Fairfield, Connecticut and has pursued supplemental finance studies at Kean College in Union, New Jersey.

TELECOMMUNICATIONS TESTIMONY

Federal Communications Commission

February 1998	File No. E-98-05. AT&T Corp. v. Bell Atlantic Corp. Affidavit of Michael R. Baranowski.
March 13, 1998	File No. E-98-05. AT&T Corp. v. Bell Atlantic Corp. Supplemental Affidavit of Michael R. Baranowski.
June 10, 1999	CC Docket No. 96-98. Implementation of the Local Competition Provisions of the Telecommunications Act of 1996. Reply Affidavit of Michael R. Baranowski, John C. Klick and Brian F. Pitkin.

July 25, 2001	CC Docket No. 00-251, 00-218. In the Matter of Petition of AT&T Communications of Virginia, Inc. and WorldCom, Inc., Pursuant to Section 252(e)(5) of the Communications Act, for Preemption of the Jurisdiction of the Virginia State Corporation Commission Regarding Interconnection Disputes with Verizon-Virginia, Inc. Panel
June 13, 2005	WC Docket No. 05-25;RM-10593. In the Matter of Special Access Rates for Price Cap Local Exchange Carriers; AT&T Corp. Petition for Rulemaking to Reform Regulation of Incumbent Local Exchange Carrier Rates for Interstate Special Access Services, Joint Declaration on Behalf of SBC Communications, Inc.
July 29, 2005	WC Docket No. 05-25;RM-10593. In the Matter of Special Access Rates for Price Cap Local Exchange Carriers; AT&T Corp. Petition for Rulemaking to Reform Regulation of Incumbent Local Exchange Carrier Rates for Interstate Special Access Services, Joint Reply Declaration on Behalf of SBC Communications, Inc.

Public Service Commission of Delaware

February 4, 1997	PSC Docket No. 96-324. In the Matter of Bell Atlantic - Delaware Statement of Terms and Conditions Under Section 252(F) of the Telecommunications Act of 1996. Testimony of Michael R. Baranowski.

Public Service Commission of the District of Columbia

March 24, 1997	Formal Case No. 962. In the Matter of the Implementation of the District of Columbia Telecommunications Competition Act of 1996. Testimony of Michael R. Baranowski.
May 2, 1997	Formal Case No. 962. In the Matter of the Implementation of the District of Columbia Telecommunications Competition Act of 1996. Rebuttal Testimony of Michael R. Baranowski.

Public Service Commission of the State of Maryland

March 7, 1997	Docket No. 8731, Phase II. In the Matter of the Petitions for Approval of Agreements and Arbitration of Unresolved Issues Arising Under Section 252 of the Telecommunications Act of 1996. Direct Testimony of Michael R. Baranowski.
April 4, 1997	Docket No. 8731, Phase II. In the Matter of the Petitions for Approval of Agreements and Arbitration of Unresolved Issues Arising Under Section 252 of the Telecommunications Act of 1996. Rebuttal Testimony of Michael R. Baranowski.
May 25, 2001	Case No. 8879. In the Matter of the Investigation into Rates for Unbundled Network Elements Pursuant to the Telecommunications Act of 1996. Panel Testimony on Recurring Cost Issues

Public Service Commission of the State of Michigan

January 20, 2004	Case No. U-13531. In the Matter, on the Commission's Own Motion to Review the Costs of Telecommunication Service Provided By SBC Michigan. Initial Testimony of Michael R. Baranowski and Julie A. Murphy.
May 10, 2004	Case No. U-13531. In the Matter, on the Commission's Own Motion to Review the Costs of Telecommunication Service Provided By SBC Michigan. Final Reply Testimony of Michael R. Baranowski and Julie A. Murphy.

New Jersey Board of Public Utilities

December 20, 1996	Docket No. TX 95120631. Notice of Investigation Local Exchange Competition for Telecommunications Services. Rebuttal Testimony of John C. Klick and Michael R. Baranowski.

North Carolina Utilities Commission

March 9, 1998	Docket No. P-100, Sub 133d. In the Matter of Establishment of Universal Support Mechanisms Pursuant to Section 254 of the Telecommunications Act of 1996. Rebuttal Testimony of Michael R. Baranowski.

Pennsylvania Public Utility Commission

January 13, 1997	Docket Nos. A-310203F0002 et al. MFS-III. Application of MFS Intelenet of Pennsylvania, Inc. et. Al. (Phase III). Rebuttal Testimony of Michael R. Baranowski.
February 21, 1997	Docket Nos. A-310203F0002 et al. MFS-III. Application of MFS Intelenet of Pennsylvania, Inc. et. Al. (Phase III). Surrebuttal Testimony of Michael R. Baranowski.
April 22, 1999	Docket Nos. P-00991648, P-00991649. Petition of Senators and CLECs for Adoption of Partial Settlement and Joint Petition for Global Resolution of Telecommunications Proceedings. Direct Testimony of Michael R. Baranowski.
January 11, 2002	Docket No. R-00016683. Generic Investigation of Verizon Pennsylvania, Inc.'s Unbundled Network Element Rates. Panel Testimony on Recurring Cost Issues

State Corporation Commission Commonwealth of Virginia

April 7, 1997	Case No. PUC970005. Ex Parte to Determine Prices Bell Atlantic - Virginia, Inc. Is Authorized To Charge Competing Local Exchange Carriers In Accordance With The Telecommunications Act of 1996 And Applicable State Law. Affidavit of Michael R. Baranowski.
April 23, 1997	Case No. PUC970005. Ex Parte to Determine Prices Bell Atlantic - Virginia, Inc. Is Authorized To Charge Competing Local Exchange Carriers In Accordance With The Telecommunications Act of 1996 And Applicable State Law. Direct Testimony of Michael R. Baranowski.

June 10, 1997	Case No. PUC970005. Ex Parte to Determine Prices Bell Atlantic - Virginia, Inc. Is Authorized To Charge Competing Local Exchange Carriers In Accordance With The Telecommunications Act of 1996 And Applicable State Law. Rebuttal Testimony of Michael R. Baranowski.

Washington State Utilities and Transportation Commission

December 22, 2003	Docket No. UT-033044. In the Matter of the Petition of Qwest Corporation To Initiate a Mass-Market Switching and Dedicated Transport Case Pursuant to the Triennial Review Order. Direct Testimony of Michael R. Baranowski.
February 2, 2004	Docket No. UT-033044. In the Matter of the Petition of Qwest Corporation To Initiate a Mass-Market Switching and Dedicated Transport Case Pursuant to the Triennial Review Order. Response Testimony of Michael R. Baranowski.

Public Service Commission of West Virginia

February 13, 1997	Case Nos. 96-1516-T-PC, 96-1561-T-PC, 96-1009-T-PC, 96-1533-T-T. Petition to establish a proceeding to review the Statement of Generally Available Terms and Conditions offered by Bell Atlantic in accordance with Sections 251, 252, and 271 of the Telecommunications Act of 1996. Testimony of Michael R. Baranowski.
February 27, 1997	Case Nos. 96-1516-T-PC, 96-1561-T-PC, 96-1009-T-PC, 96-1533-T-T. Petition to establish a proceeding to review the Statement of Generally Available Terms and Conditions offered by Bell Atlantic in accordance with Sections 251, 252, and 271 of the Telecommunications Act of 1996. Rebuttal Testimony of Michael R. Baranowski.
June 3, 2002	Case No. 01-1696-T-PC, Verizon West Virginia, Inc. Petition For Declaratory Ruling That Pricing of Certain Additional Unbundled Network Elements (UNEs) Complies With Total Element Long-Run Incremental Cost (TELRIC) Principles. Direct Testimony of Michael R. Baranowski
July 1, 2002	Case No. 01-1696-T-PC, Verizon West Virginia, Inc. Petition For Declaratory Ruling That Pricing of Certain Additional Unbundled Network Elements (UNEs) Complies With Total Element Long-Run Incremental Cost (TELRIC) Principles. Supplemental Direct Testimony of Michael R. Baranowski

RAILROAD TESTIMONY

Interstate Commerce Commission

March 9, 1995	Finance Docket No. 32467. National Railroad Passenger Corporation and Consolidated Rail Corporation -- Application Under Section 402(a) of the Rail Passenger Service Act for an Order Fixing Just Compensation.
October 30, 1995	Docket No. 41185. Arizona Public Service Company and Pacificorp v. The Atchison, Topeka and Santa Fe Railway Company.

Surface Transportation Board

July 11, 1997	Docket No. 41989. Potomac Electric Power Company v. CSX Transportation, Inc. Reply Statement and Evidence of Defendant CSX Transportation, Inc.
August 14, 2000	Docket No. 42051. Wisconsin Power and Light Company v. Union Pacific Railroad Company, Reply Verified Statement of Christopher D. Kent and Michael R. Baranowski.
September 20, 2002	STB Docket No. 42070. Duke Energy Corporation v. CSX Transportation, Inc., Reply Evidence and Argument of CSX Transportation, Inc.
September 30, 2002	STB Docket No. 42069. Duke Energy Corporation v. Norfolk Southern Railway Company, Reply Evidence and Argument of Norfolk Southern Railway Company.
October 11, 2002	STB Docket No. 42072. Carolina Power & Light v. Norfolk Southern Railway Company, Reply Evidence and Argument of Norfolk Southern Railway Company.
November 12, 2002	Docket No. 42070 Duke Energy Corporation v. CSX Transportation, Rebuttal Evidence and Argument of CSX Transportation
November 19, 2002	Docket No. 42069 Duke Energy Corporation v. Norfolk Southern Railway Company, Rebuttal Evidence and Argument of Norfolk Southern Railway Company
November 27, 2002	Docket No. 42072 Carolina Power & Light Company v. Norfolk Southern Railway Company, Rebuttal Evidence and Argument of Norfolk Southern Railway Company
January 10, 2003	STB Docket No. 41185. Arizona Public Service Co. And Pacificorp v. The Atchison, Topeka and Santa Fe Railway Company, Petition of the Burlington Northern and Santa Fe Railway Company to Reopen and Vacate Rate Prescription.
February 19, 2003	STB Docket No. 42077, Arizona Public Service Co. And Pacificorp v. The Burlington Northern and Santa Fe Railway Company, and STB Docket No. 41185, Arizona Public Service Co. And Pacificorp v. The Burlington Northern and Santa Fe Railway Company, Reply of the Burlington Northern Santa Fe Railway Company in Opposition to Petition for Consolidation.
April 4, 2003	Docket No. 42057 Public Service Company of Colorado D/B/A Xcel Energy v. The Burlington Northern and Santa Fe Railway Company, Reply Evidence and Argument of The Burlington Northern and Santa Fe Railway Company
October 8, 2003	Docket No. 42071 Otter Tail Power Company v. The Burlington Northern and Santa Fe Railway Company, Reply Evidence of The Burlington Northern and Santa Fe Railway Company
October 24, 2003	Docket No. 42069 Duke Energy Corporation v. Norfolk Southern Railway Company, Supplemental Evidence of Norfolk Southern Railway Company

October 31, 2003	Docket No. 42069 Duke Energy Corporation v. Norfolk Southern Railway Company, Reply of Norfolk Southern Railway Company to Duke Energy Company's Supplemental Evidence
November 24, 2003	Docket No. 42072 Carolina Power & Light Company v. Norfolk Southern Railway Company, Supplemental Evidence of Norfolk Southern Railway Company
December 2, 2003	Docket No. 42072 Carolina Power & Light Company v. Norfolk Southern Railway Company, Reply of Norfolk Southern Railway Company to Carolina Power & Light Company's Supplemental Evidence
December 12, 2003	Docket No. 42069 Reply of Norfolk Southern Railway Company to Duke Energy Corporation's Petition to Correct Technical Error and Affidavit of Michael R. Baranowski
January 5, 2004	Docket No. 42070 Duke Energy Corporation v. CSX Transportation, Inc., Supplemental Evidence of CSX Transportation, Inc.
January 26, 2004	Docket No. 42058 Arizona Electric Power Cooperative, Inc. v. The Burlington Northern and Santa Fe Railway Company and Union Pacific Railroad Company, Joint Supplemental Reply Evidence and Argument of The Burlington Northern and Santa Fe Railway Company and Union Pacific Railroad Company
March 22, 2004	Docket No. 42071 Otter Tail Power Company v. The Burlington Northern and Santa Fe Railway Company, Supplemental Reply Evidence of The Burlington Northern and Santa Fe Railway Company
April 9, 2004	Docket No. 41185 Arizona Public Service Company and Pacificorp v. The Burlington Northern and Santa Fe Railway Company, The Burlington Northern and Santa Fe Railway Company's Reply Evidence on Reopening
May 24, 2004	Docket No. 41191 (Sub-No. 1) AEP Texas North Company v. The Burlington Northern and Santa Fe Railway Company, Reply Evidence of The Burlington Northern and Santa Fe Railway Company
June 23, 2004	Docket No. 42057 Public Service Company of Colorado d/b/a Xcel Energy v. The Burlington Northern and Santa Fe Railway Company, Petition to Correct Technical and Computational Errors
March 1, 2005	Docket No. 42071 Otter Tail Power Company v BNSF Railway Company, Supplemental Evidence of BNSF Railway Company
April 4, 2005	Docket No. 42071 Otter Tail Power Company v BNSF Railway Company, Reply of BNSF Railway Company to Supplemental Evidence
July 20, 2005	Docket No. 42088 Western Fuels Association, Inc. and Basin Electric Power Cooperative, Inc. v. BNSF Railway Company, Reply Evidence of BNSF Railway Company
May 1, 2006	Docket No. Ex Parte 657 (Sub-No. 1) Major Issues in Rail Rate Cases, Verified Statement Supporting Comments of BNSF Railway Company

May 31, 2006	Ex Parte 657 (Sub-No. 1) Major Issues in Rail Rate Cases; Verified Statement Supporting Reply Comments of BNSF Railway Company
June 15, 2006	Docket No. 42088 Western Fuels Association, Inc. and Basin Electric Power Cooperative, Inc. v. BNSF Railway Company, Reply Supplemental Evidence of BNSF Railway Company
June 15, 2006	Docket No. 41191 (Sub 1) AEP Texas North Company v. BNSF Railway Company, Reply Supplemental Evidence of BNSF Railway Company
June 30, 2006	Docket No. Ex Parte 657 (Sub-No. 1) Major Issues in Rail Rate Cases; Verified Statement Supporting Rebuttal Comments of BNSF Railway Company
February 4, 2008	Docket No. 42099 E.I. DuPont De Nemours and Company v. CSX Transportation, Inc., Opening Evidence of CSX Transportation, Inc.
February 4, 2008	Docket No. 42100 E.I. DuPont De Nemours and Company v. CSX Transportation, Inc., Opening Evidence of CSX Transportation, Inc.
February 4, 2008	Docket No. 42101 E.I. DuPont De Nemours and Company v. CSX Transportation, Inc., Opening Evidence of CSX Transportation, Inc.
May 1, 2008	Docket No. Ex Parte 679 Petition of the AAR to Institute a Rulemaking Proceeding to Adopt a Replacement Cost Methodology to Determine Railroad Revenue Adequacy, Verified Statement of Michael R. Baranowski
July 14, 2008	Docket No. 42088 Western Fuels Association, Inc. and Basin Electric Power Cooperative, Inc. v. BNSF Railway Company, Third Supplemental Reply Evidence of BNSF Railway Company
July 14, 2008	Docket No. AB-515 (Sub-No. 2) Central Oregon & Pacific Railroad, Inc. -- Abandonment and Discontinuance of Service -- in Coos, Douglas, and Lane Counties, Oregon (Coos Bay Rail Line)
August 8, 2008	Docket No. 41191 (Sub-No. 1) AEP Texas North Company v. BNSF Railway Company, Fourth Supplemental Evidence of BNSF Railway Company
August 11, 2008	Docket No. 42014 Entergy Arkansas, Inc. and Entergy Services, Inc. v Union Pacific Railroad Company and Missouri & Northern Arkansas Railroad Company, Inc.; Finance Docket No. 32187 Missouri & Northern Arkansas Railroad Company, Inc. – Lease, Acquisition and Operations Exemption – Missouri Pacific Railroad Company and Burlington Northern Railroad Company, Reply Evidence and Argument of Union Pacific
September 5, 2008	Docket No. 41191 (Sub-No. 1) AEP Texas North Company v. BNSF Railway Company, Fourth Supplemental Reply Evidence of BNSF Railway Company
September 12, 2008	Docket No. AB-515 (Sub-No. 2) Central Oregon & Pacific Railroad, Inc. -- Abandonment and Discontinuance of Service -- in Coos, Douglas, and Lane Counties, Oregon (Coos Bay Rail Line); Rebuttal to Protests
August 24, 2009	Docket No. 42114 US Magnesium, L.L.C. v. Union Pacific Railroad Company, Opening Evidence of Union Pacific Railroad Company
October 22, 2009	Docket No. 42114 US Magnesium, L.L.C. v. Union Pacific Railroad Company, Rebuttal Evidence of Union Pacific Railroad Company

January 19, 2010	Docket No. 42110 Seminole Electric Cooperative, Inc. v. CSX Transportation, Inc., Reply Evidence of CSX Transportation, Inc.
May 7, 2010	Docket No. 42113 Arizona Electric Power Cooperative, Inc. v. BNSF Railway Company and Union Pacific Railroad Company, Joint Reply Evidence of BNSF Railway Company and Union Pacific Railroad Company
November 22, 2010	Docket No. 42088 Western Fuels Association, Inc. and Basin Electric Power Cooperative, Inc. v. BNSF Railway Company, BNSF Comments on Remand, Joint Verified Statement of Michael R. Baranowski and Benton V. Fisher
January 6, 2011	Docket No. 42056 Texas Municipal Power Agency v. BNSF Railway Company, BNSF Reply to TMPA Petition for Enforcement of Decision, Joint Verified Statement of Michael R. Baranowski and Benton V. Fisher
October 28, 2011	Docket No. FD 35506 Western Coal Traffic League - Petition for Declaratory Order, Opening Evidence of BNSF Railway Company, Joint Verified Statement of Michael R. Baranowski and Benton V. Fisher
November 10, 2011	Docket No. 42127 Intermountain Power Agency v. Union Pacific Railroad Company, Reply Evidence of Union Pacific Railroad Company\
November 28, 2011	Docket No. FD 35506 Western Coal Traffic League - Petition for Declaratory Order, Reply Evidence of BNSF Railway Company, Joint Reply Verified Statement of Michael R. Baranowski and Benton V. Fisher
May 10, 2012	Docket No. 42056 Texas Municipal Power Agency v. BNSF Railway Company, BNSF Reply to TMPA Petition to Reopen and Modify Rate Prescription, Joint Verified Statement of Michael R. Baranowski and Benton V. Fisher

US District Court for Northern District of Oklahoma

January 2, 2007	Case No. 06-CV-33 TCK-SAJ, Grand River Dam Authority v. BNSF Railway Company; Report of Michael R. Baranowski
February 2, 2007	Case No. 06-CV-33 TCK-SAJ, Grand River Dam Authority v. BNSF Railway Company; Reply Report of Michael R. Baranowski

Circuit Court of Pulaski County, Arkansas

August 17, 2007	Case No. CV 2006-2711, Union Pacific Railroad v. Entergy Arkansas, Inc. and Entergy Services, Inc., Expert Witness Report of Michael R. Baranowski
December 14, 2007	Case No. CV 2006-2711, Union Pacific Railroad v. Entergy Arkansas, Inc. and Entergy Services, Inc., Reply Expert Witness Report of Michael R. Baranowski

U.S. District Court for the Eastern District of Wisconsin

February 15, 2008	Case No. 06-C-0515, Wisconsin Electric Power Company v. Union Pacific Railroad Company, Expert Reply Report of Michael R. Baranowski

Arbitrations and Mediations

March 7, 2005	Arbitration Case #181 Y 00490 04 BNSF Railway Company and J.B. Hunt Transport, Inc., Expert Report on behalf of BNSF Railway Company
March 28, 2005	Arbitration Case #181 Y 00490 04 BNSF Railway Company and J.B. Hunt Transport, Inc., Rebuttal Expert Report on behalf of BNSF Railway Company
April 12, 2005	Arbitration Case #181 Y 00490 04 BNSF Railway Company and J.B. Hunt Transport, Inc., Supplemental Expert Report on behalf of BNSF Railway Company
April 19, 2005	Arbitration Case #181 Y 00490 04 BNSF Railway Company and J.B. Hunt Transport, Inc., Supplemental Rebuttal Expert Report on behalf of BNSF Railway Company
April/May 2005	Arbitration Case #181 Y 00490 04 BNSF Railway Company and J.B. Hunt Transport, Inc., Hearings before Arbitration Panel
February 20, 2007	In the Matter of the Arbitration between the Detroit Edison Company, et al, and BNSF Railway Company, Expert Report of Michael R. Baranowski
March 19, 2007	In the Matter of the Arbitration between the Detroit Edison Company, et al, and BNSF Railway Company, Supplemental Expert Report of Michael R. Baranowski
February 12, 2009	In the Matter of the Arbitration between Wisconsin Public Service Corporation and Union Pacific Railroad Company, Rebuttal Expert Report of Michael R. Baranowski
October 16, 2009	In the Matter of Arbitration Between Norfolk Southern Railway Company and Drummond Coal Sales, Inc., Expert Report of Michael R. Baranowski
July 25, 2011	American Arbitration Association Case No. 58 147 Y 0031809, BNSF Railway Company and Kansas City Southern Railway Company, Expert Report of Michael R. Baranowski

WILLIE BENTON III

Mr. Benton is a consultant for Scott Bridge Company and president of B-3 Engineering, located at 208 Nathan Thaxton Road, Jackson, Georgia 30233. Since 1974, Mr. Benton has been involved in various aspects of railroad engineering, including work on structures and bridges. Mr. Benton is sponsoring a portion of Section III-F of Norfolk Southern's ("NS's") Reply Evidence regarding Bridges. Mr. Benton has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Benton holds a Bachelor of Science degree in civil engineering from the University of South Carolina. He is a licensed engineer in Georgia and a member of the American Railway Engineering and Maintenance-of-Way Association ("AREMA"). Mr. Benton chaired the Timber Structures Committee and Structure Inspection, Maintenance and Repair Committees.

In 1972, Mr. Benton joined NS's predecessor Southern Railway Company. Mr. Benton held positions as a Track Supervisor and Assistant Engineer. In 1978 he became a Bridge Engineer, a position he held for 12 years. In 1990, Mr. Benton became Engineer Structures, Western Region at NS until his retirement in 2009.

Mr. Benton's complete curriculum vitae is attached.

VERIFICATION

I, Willie Benton III, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Willie Benton III

Executed on this 27 day of November, 2012.

RESUME

October 10, 2012

Willie Benton, III, P.E.
208 Nathan Thaxton Road
Jackson, Georgia 30233

EMPLOYMENT HISTORY:

Scott Bridge Company – Engineer Railroad Structure - September, 2009 – (consultant services) present

B-3 Engineering – President - March, 2009 - present

Norfolk Southern Railway – Engineer Structures Western Region - January 1990 - March, 2009

Southern Railway/Norfolk Southern Railway – Bridge Engineer - April, 1978 – January, 1990

Southern Railway – Assistant Engineer - August, 1974 – April, 1978

Southern Railway – Track Supervisor - January, 1974 – August, 1974

Southern Railway – Management Trainee - August, 1972 – January, 1974

EDUCATION:

1972 Graduate of the University of South Carolina School of Engineering – BS in Civil Engineering

LICENSES AND ASSOCIATIONS:

Licensed Professional Engineer in the State of Georgia

Member of the American Railway Engineering and Maintenance of Way Association

Member of Committee 7, Timber Structures, AREMA, Past Chairman

Member of Committee 10, Structure Inspection, Maintenance and Repair, AREMA, Past Chairman

Member of the American Association of Railroads Bridge Research Steering Committee, 1980 - 1984

F. DOUGLAS BESS

Mr. Bess is an Engineering Specialist with STV Inc., a professional firm offering engineering, architectural, planning, environment and construction management services located at 1201 Peachtree Street NE, Suite 1001, Atlanta, Georgia 30361. Mr. Bess has over 30 years of experience in the railroad industry, working on projects for Norfolk Southern Railway Company ("NS"), CSXT, and Kansas City Southern. Mr. Bess is sponsoring portions of Section III-F of NS's Reply Evidence that relate to Road Property Investment for the DRR. Mr. Bess has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Bess has a Bachelor of Science degree of civil engineering from Marshall University. He joined NS's predecessor, Southern Railway Company, in 1973. Mr. Bess worked in several engineering positions for NS and its predecessor in the Bridges and Structures Department. After leaving the railroad and joining STV, Mr. Bess continued to do special projects for NS and other carriers. This work included assisting in developing a computerized system for bridge, culvert and tunnel inspections, and conducting such inspections. For the past five years, Mr. Bess has been qualified as a Level 1A inspector of Erosion and Sediment Control in Georgia and a qualified Erosion Prevention and Sediment Control Inspector in South Carolina.

Mr. Bess's complete curriculum vitae is attached

VERIFICATION

I, F. Douglas Bess, Jr., declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

F. Douglas Bess, Jr.

F. Douglas Bess, Jr.

Executed on this 19 day of November, 2012.

F. Douglas Bess, Jr.

Engineering Specialist

Mr. Bess is a civil engineer with more than 30 years of experience in railroad line structures, most of which was gained as an engineer with the Norfolk Southern Corporation. His expertise includes structural inspections and the development of computerized systems to manage data on bridge characteristics and conditions.

Office Location
Atlanta, GA

Date joined firm
4/15/08 to present
7/30/04 - 2/29/08

Years with other firms
30

Education
Bachelor of Science, Civil Engineering; Marshall University (1973)

Certifications
Erosion Prevention and Sediment Control Certification; South Carolina Department of Health and Environmental Control (2007)

Computer Skills
BIMS Software, Statistical Analytical System (SAS) Software

Project Experience with STV/RWA

CSX Roadway Worker Training – Senior Engineer
Mr. Bess is qualified for 2009 as a facilitator for contractors working on or near CSX property. The facilitator is responsible to train contractors on Contractor Safety, Security Awareness, Roadway Worker Safety and On-Track Machinery. (02/09 - Present).

Erosion and Sediment Control - Senior Engineer
Mr. Bess qualified as a Level 1A certified inspector in the state of Georgia in 06/07. Mr. Bess was also qualified in the state of South Carolina as an Erosion Prevention and Sediment Control Inspector in 09/07.

The Athens Line Miscellaneous Engineering Services - Project Design Engineer
Responsible for performing visual inspections of the site prior to the jack and bore installation of a 42-inch-diameter steel casing pipe under the main Athens Line track, and the extension of two existing casing pipes under the track in Athens, GA. (4/07)

CSX Inspection Services - Project Design Engineer
Providing inspection services at several locations on the CSX right-of-way while outside contractors install casing pipe under CSX tracks by the jack and bore method. As a field inspector, Mr. Bess is responsible for protecting the right-of-way and making sure that the proper size pipe is used and that it is at the proper depth under the track as outlined in the plans. Mr. Bess is empowered to stop work if he feels the contractor is not performing the installation in a safe and proper manner. (9/06 - Present)

Norfolk Southern Bridge Information Management System (BIMS) - Project Design Engineer
Acting as a liaison with the Norfolk Southern Corporation Bridges and Structures Department in developing a computerized system for Norfolk Southern to use in bridge, culvert, and tunnel inspections. Mr. Bess is providing the bridge, culvert, and tunnel data to the subcontractor, WebTech, who designed the initial inspection program. He tests the programs developed by the subcontractor to ensure they work as requested, and works with the Norfolk Southern Bridge Department to make changes and

enhancements requested by them. Mr. Bess is also works with the Norfolk Southern Engineering Systems group as they implement these changes made by WebTech. (7/04 - Present)

Kansas City Southern Railway BIMS - Project Design Engineer
Helped to design a feature that is currently not a part of the Norfolk Southern Corporation BIMS package for Kansas City Southern Railway's Bridge Information Management System (BIMS) for their bridge inspection program. Mr. Bess has made Norfolk Southern aware of this feature, and they hope to incorporate it into their inspection procedure when the feature becomes available. He is now working to develop an additional inspection feature that Kansas City Southern Railway desired for the inspection of timber bridges. (2004; 12/06 - 2008)

SCDOT Assembly Street Railroad Consolidation and Grade Crossing Elimination Study - Project Design Engineer
Prepared a layout of the existing Norfolk Southern and CSX trackage for a study to determine the feasibility of eliminating at-grade crossings to improve traffic and pedestrian safety, and decrease traffic congestion on Assembly Street in Columbia, SC. The focus of the feasibility study is to grade separate Assembly Street and the Norfolk Southern and CSX's main lines, eliminate at-grade crossings, and relocate new rail alignments. (4/07 - 6/07)

Norfolk Southern Line Structure Inspection Database - Project Design Engineer
Assisted in the recording and filing of bridge, culvert, and tunnel inspection reports and maintained bridge, culvert, and tunnel databases. Mr. Bess organized these records for Norfolk Southern Corporation prior to the implementation of the Bridge Information Management System (BIMS) in 2006. (11/05 - 9/06)

Project Experience with Norfolk Southern

Southern Railway/Norfolk Southern Bridges and Structures Department - Assistant Engineer
Was involved with detailing bridge tie decks and bridge design. Designed bridges, mostly steel ballast trestles, to replace existing bridges that were primarily timber trestles. The new structures had to be built under traffic, so care had to be taken to locate the new structure. (1974-1982)

Mr. Bess was also responsible for maintaining the bridge, culvert, and tunnel inspection reports and databases and ensuring that all structures were inspected yearly. He was in constant communication with Bridge and Building field personnel by phone or e-mail to follow up on delinquent or missing inspection reports. He used SAS computer software to write programs to generate reports for this as well as other aspects of the database, such as length of bridges on the system. Prior to his retirement, Mr. Bess was working with the Norfolk Southern Corporation Bridges and Structures

Department Manager in developing a computerized system for bridge inspections. (1987 – 2003).

Norfolk Southern Underwater Bridge Inspection Program - Assistant Engineer

Contracted the yearly Underwater Bridge Inspection Program for those structures that could not be inspected by Norfolk Southern Corporation Bridge and Building field forces. This included developing the list of bridges to be inspected, preparing plans and specifications, coordinating with the Material Management Department for solicitation of bids and awarding of work, and monitoring work by the contractor until completion. (1999 - 2003)

Norfolk Southern Bridges and Structures Department - Assistant Clearance Engineer

Worked in the Clearance Section in the Bridges and Structures Department of the Norfolk Southern Corporation. This involved travel to measure various obstructions, returning to the office to plot the information from film, and digitizing the plotted information in the mainframe computer for use by the clearance section of the Transportation Department for clearing high and/or wide shipments. (1982 - 1987).

Southern Railway – Management Trainee

Began railroad career in the Management Training Program in September, 1973. Received class and field training covering aspects of track and bridge maintenance, which included roadway basics and operating rules. (1973-1974).

PAUL E. BOBBY

Mr. Bobby is a Project Manager with STV Inc., a professional firm offering engineering, architectural, planning, environment and construction management services located at 200 West Monroe Street, Suite 1650, Chicago, Illinois 60606. Mr. Bobby is sponsoring portions of Section III-F of Norfolk Southern's ("NS's") Reply Evidence related to Earthwork. Mr. Bobby has signed a verification of the truth of the statements contained therein. A copy of the verification is attached hereto.

Mr. Bobby earned his Bachelor of Science degree in civil engineering from the University of Wisconsin/Platteville. He has experience in the design and construction of railroad improvements including rail clearance and grade separation programs. Mr. Bobby has participated in the design of roadway and track alignment, geometry, and right-of-way and utility conflict identification, working on feasibility studies, cost estimation and the development of staging plans for construction. Mr. Bobby's specific projects have included work on a railroad bridge for CSXT over the Hudson River, a railroad bridge for the Wisconsin Central Railroad over a roadway, and planning and design for the reconfiguration of a CSXT coal terminal in Baltimore, among several others.

Mr. Bobby is a member of the American Railway Engineering and Maintenance-of-Way Association ("AREMA"). He is also a member of the Maintenance-of-Way Club of Chicago.

Mr. Bobby's complete curriculum vitae is attached.

VERIFICATION

I, Paul E. Bobby, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Paul E. Bobby

Executed on this 20 day of November, 2012.

Paul E. Bobby, P.E.

Project Manager

Mr. Bobby is a civil engineer and project manager with more than 10 years of experience in the design and construction of railroad and highway improvements, including FTA New Starts projects and rail clearance and grade separation programs. He is adept at the design of roadway and track alignment, geometry, and right-of-way (ROW) and utility conflict identification. Mr. Bobby has experience with feasibility studies, cost estimating, and the development of construction staging plans to maintain traffic and operations. He has also managed a variety of successful track capacity expansion and rail improvement project, for Metra, freight railroads, and as part of the Chicago Region Environmental and Transportation Efficiency Program (CREATE) program, which was established to identify key bottlenecks and conflicts within existing Chicagoland transportation infrastructure.

[cost estimating focus]
Mr. Bobby is a professional engineer with more than 10 years of experience providing capital cost estimating for transit and civil works projects, including FTA New Starts investments. He also brings experience in the design and construction of railroad and highway improvements, including rail clearance and grade separation programs. He served as the civil task manager for the Chicago Transit Authority (CTA) Circle Line Alternatives Analysis, and he led the Phase I engineering design for a commuter rail system for the Northern Indiana Commuter Transit District (NICTD). Mr. Bobby has experience with alignment development and analysis, right-of-way (ROW) and utility conflict identification, alternatives development and plan analyses, and feasibility studies. He also served as the project manager for a blanket contract with Metra to assist in standardizing capital cost methodology and estimates per FTA guidelines.

[track management focus]
Mr. Bobby is a project manager and track designer with more than 10 years of experience in the design and construction of rail improvements. He began his career as a track laborer for the Wisconsin Central Ltd. (now Canadian National Railway Company), and has since earned a solid reputation within the rail industry for his knowledge of light rail, passenger, and freight rail design programs. He served as lead rail engineer for the $120 million Chicago Transit Authority (CTA) Block 37 Station and Tunnel Connector, for which he provided design of a 2-track connection between the Blue and Red transit lines. He has also served as lead rail engineer for several capacity improvement projects, including work for CSX Corporation, Norfolk Southern Railway, and Kansas City Southern. In addition, Mr. Bobby has provided project management

Office Location
Chicago, IL

Date joined firm
8/23/04

Years with other firms
5

Education
Bachelor of Science, Civil Engineering; University of Wisconsin/Platteville (2000)

Professional Registrations
Professional Engineer: Georgia (2009/#PE034469/exp. 12/31/2012), Illinois (2005/Civil/Sanitary Engineering/#062-058268/exp. 11/30/13), Indiana (2007/#PE10708276/exp. 7/31/2012), and Wisconsin (2006/#38452-6/exp. 7/31/14)

Memberships
American Railway Engineering and Maintenance-of-Way Association (AREMA)

Maintenance-of-Way Club of Chicago

for blanket civil/structural and project administration contracts with Metra, including more than 20 assigned tasks, all completed within budget and on schedule.

Project Experience

BRIDGES

IDOT IL 15 over ICG Railroad and IL 13 Reconstruction - Rail Coordinator
Providing railroad coordination services for the $14.4 million replacement of dual structures on IL 15 that span IL 13 and the Illinois Central Gulf (ICG) railroad ROW in St. Clair County, IL. An Illinois Department of Transportation (IDOT) inspection found the dual bridges to be in poor condition. The agency therefore recommended that both structures be replaced. STV provided Phase I and Phase II design engineering services for the structural replacements. Phase I services included the preparation of a crash analysis, geometric studies, environmental coordination, public involvement, and all other work necessary to prepare a Project Report for design approval. Phase II includes the complete design of the new structures. Mr. Bobby communicates closely with the various rail agencies to keep them informed of the project plans and mitigate potential impacts the project may have on their operations. (11/08 - Present)

CSX Bridge 45 - Rail Engineer
Responsible for the rail alignment design and construction staging plans for a new single-track railroad bridge over the Hudson River in Iona, NY. Mr. Bobby prepared staging plans to maintain rail operations during the bridge construction. The bridge was designed with environmental sensitivity to the Hudson River ecosystem. (3/07 - 9/07)

WisDOT Wisconsin Central Railroad Bridge over US 41 - Project Manager
Managed the replacement of the Wisconsin Central Bridge US 41 in Fond du Lac, WI. Mr. Bobby prepared the project work plan, budget, amendments, and schedule; made staff assignments; quality assurance; and managed all coordination with the client. The project encompassed five alternative studies for the new structure, which replaced the existing single-track bridge. The Wisconsin Department of Transportation (WisDOT) and STV determined that two new bridges would best replace the single-track bridge over US 41. The design provided a new industrial spur railroad track off of the main line to the Fond du Lac Southwest Industrial Park. The firm also assisted in executing public information meetings and utilities coordination. Mr. Bobby's responsibilities included coordinating the evaluation of alternatives with WisDOT. (2002 - 2004)

HIGHWAYS/ROADWAYS

IDOT Elgin O'Hare West Bypass - Railroad Coordinator
Responsible for rail coordination with the Union Pacific, Canadian Pacific, and the Canadian National freight railroads, as well as the project team, for the proposed extension of the Elgin O'Hare West Bypass in Cook County, IL. This $3.6 billion project began with an Environmental Impact Statement and

feasibility study analyzing alternatives to improve transportation and ease congestion within the study area. Proposed improvements include widening existing roadways and extending the Elgin O'Hare Expressway east into O'Hare International Airport to provide western airport access. The initial study was completed and presented to the Illinois Department of Transportation (IDOT), who is moving forward with the design of the recommended improvements that have the least impact on the surrounding neighborhoods. Mr. Bobby is overseeing the evaluation of the impacts of the proposed Elgin O'Hare West Bypass on the freight and passenger rail services located within the project area. The primary objectives of his coordination efforts are to keep the railroads informed of the progress of the study and to resolve any potential conflicts at an early stage. Mr. Bobby also has been working with the planning team during the alternative design process and advising them of potential rail impacts. (9/07 - Present)

ISTHA Open Road Tolling Plaza CM - Project Controls
Provided project controls for STV's Phase III engineering services for plaza/roadway improvements for the open road tolling conversions at four mainline plazas on the Tri-State Tollway for the Illinois State Toll Highway Authority (ISTHA). The conversions included the Tri-State Tollway; M.P. 19.5 (83rd Street- Plaza 39); M.P. 19.8 (82nd Street - Plaza 36); M.P. 30 (Cermak - Plaza 35); and M.P. 39 (Irving Park- Plaza 33) in DuPage and Lake Counties in Illinois. Mr. Bobby assisted in cost analysis, construction revisions, quantity changes, and change order requests. (2005 - 2006)

IDOT Dan Ryan Expressway Reconstruction - Project Engineer
Provided interdisciplinary coordination, road grading, and intersection grading design of the frontage road reconstruction from 63rd Street to 47th Street on the Dan Ryan Expressway in Chicago for the Illinois Department of Transportation (IDOT). Mr. Bobby's responsibilities included ramp relocations, writing special provisions, and horizontal and vertical design layout. He also designed 25 cast-in-place retaining walls, which line the frontage roads and ramps. (2/03 - 4/04)

Village of Elwood Drummond Road Relocation - Project Engineer
Completed horizontal and vertical design, earthwork, storm sewer layout, and erosion control for the roadway design for the relocation of Drummond Road in Elwood, IL. (11/02 - 4/03)

RAIL

CSX Curtis Bay Coal Terminal Reconfiguration - Project Manager
Managing the planning and design for the reconfiguration of CSX's Curtis Bay coal terminal in Baltimore. The project will consolidate yard tracks from the existing coal inbound yard and merchandise yard to provide three 130-foot inbound tracks to store unit coal trains. The project will also reconfigure the inbound lead tracks to the west yard in order to separate switching operations and implement new crossover arrangements at the existing three coal dumpers. The work is needed for CSX's planned expansion of ground storage at this facility. Mr. Bobby is overseeing the conceptual layouts and design for the yard reconfiguration. The most challenging aspect is staging the sequence of construction for the maintenance of operations to minimize impacts to CSX service during construction. He is also conducting onsite visits, communicating extensively with the client, and managing the project budget and schedule. (11/11 - Present)

UP CREATE B-2 Project - Project Manager
Oversaw design engineering services for the reconstruction of the Metra's Union Pacific West Line's passenger stations in Berkeley and Bellwood, IL, as part of the CREATE B2 Project. STV provided engineering and architectural design services to modify the stations to accommodate a third mainline track being constructed by Union Pacific Railroad (UP). The station upgrades consist of new center

platforms, warming shelters, and pedestrian underpasses with retaining walls. Mr. Bobby worked closely with the railroads to develop a phased implementation plan to coordinate with the third-track construction. STV completed the design in July 2011, and the project has now moved into the construction phase. Mr. Bobby is overseeing STV's construction phase services. (3/11 - Present)

CSX/Chicago/Gary Regional Airport Authority CSX Fort Wayne Line and NS Gary Branch Consolidation - Project Manager
Overseeing track and civil plans for the consolidation of CSX's Fort Wayne Line and the Norfolk Southern Railway (NS) Gary Branch in Gary, IN. The work is being performed to facilitate the Chicago/Gary Regional Airport Authority's airport runway extension and includes the addition of a new connection from CSX's Barr Subdivision to Canadian National (CN)'s reconfigured Elgin, Joliet & Eastern (EJ&E) Railway Line. A new industrial connection from the CSX Porter Subdivision to the Indiana Sugars manufacturing facility will also be required. In addition, the project includes reconfiguring the Clarke Junction Interlocking between the Barr Subdivision, adding a new connection to the NS Chicago Line, and removing the Pine Junction Interlocking on the Barr Subdivision to improve speeds from 40 mph to 60 mph. Mr. Bobby is coordinating closely with the client while developing the track design. STV is acting as the owner's representative for the project, and Mr. Bobby is reviewing documentation from the airport to the client to assess impacts to CSX. He is identifying potential hazards, such as drainage issues, to make sure the interests of CSX are maintained and their property is not affected during construction. Mr. Bobby is also managing the project budget, schedule, and staff. (2/11 - Present)

GEC Services for CSX CREATE Projects - Project Manager

Overseeing various projects under a general engineering consultant (GEC) contract with CSX. The aim of the Chicago Region Environmental and Transportation Efficiency (CREATE) program is to help CSX expedite freight rail transit through Chicago, the busiest rail freight gateway in the United States. The tasks under the contract involve interlocking, track, and signal modifications, which require civil and track engineering design and construction management services. (4/10 - Present)

CSX CREATE B-9 - Project Manager
Leading the design of a new double-track connection and crossover upgrades in Summit Argo, IL. The project will replace the connection between Canadian National and Baltimore & Ohio Chicago Terminal (B&OCT) tracks and increase the track capacity by extending the B&OCT siding track in Bridgeview, IL. Mr. Bobby is also overseeing improvements to Argo Yard, including realigning switch lead tracks, installing three new yard tracks, and constructing a new industry lead track to avoid switching within the control point. He is developing project reports and plans, specifications, and estimates packages for the client and contractor. Mr. Bobby is also communicating with the railroad to make sure the designs effectively meet their needs while avoiding service disruptions. (5/11 - Present)

CSX CREATE B-16 Thornton Junction Connection Design - Project Manager
Developing a project report and design approval documents for a new track and associated switches to connect the Canadian National Elsdon Sub and Union Pacific Villa Grove Sub in South Holland, IL, as part of a general engineering consultant contract for CSX. This will reestablish a former connection between the Beltway and Western Avenue corridors. (10/10 - Present)

CSX CREATE WA-2 Segment B - Project Manager

Oversaw the design of new crossovers between the Baltimore & Ohio Chicago Terminal (B&OCT) main tracks and modifications to the crossover between the B&OCT track and Norfolk Southern Railway tracks as part of a general engineering consultant contract with CSX for projects within the CREATE program. Mr. Bobby worked closely with the various railroads involved to design new alignments and profiles within the project area. He also developed a project report and plans, specifications, and estimates packages for the contractor and the railroad. (4/11 - 12/11)

CSX CREATE WA-2 Construction Management - Project Manager
Oversaw STV's construction management services during the 4-phase signal installation and construction of interlocking improvements at seven locations on the Western Avenue Corridor in Chicago, from Ogden Junction to 75th Street, where a new centralized traffic control (CTC) signaling system will be installed. The CTC signaling and interlocking improvements will increase train speeds and traffic capacity through better track utilization. The project was part of a general engineering consultant contract with CSX. (6/10 - 7/11)

CSX CREATE B12 Third Main Construction Oversight - Project Manager
Oversaw the construction of a third mainline along the Beltway Corridor from 123rd Street to CP San Francisco in Alsip and Blue Island, IL. This additional mainline will increase freight rail capacity and decrease travel times within the area. STV managed construction of new track, track upgrades, signal work, and a new rail bridge over 127th Street under a general engineering consultant contract with CSX. (4/10 - 8/11)

CHSRA Los Angeles-to-Anaheim Project EIR/EIS - QA/QC Review
Conducting a quality assurance/quality control (QA/QC) review, including track and alignments, of a 30-mile segment of high-speed rail line between Los Angeles and Anaheim, CA, for the California High-Speed Rail Authority (CHSRA). The proposed corridor runs adjacent to existing passenger and freight lines and will travel at speeds up to 220 miles per hour. The segment requires the development of solutions for overlaying a new set of track infrastructure into a physically constrained rail corridor, which includes local and regional passenger service as well as local and transcontinental rail freight operating on a limited ROW in a dense urban environment. Mr. Bobby is providing a QA/QC review of the plan and profile drawings, as well as the inclusion of alternatives for at-grade, tunnel, and aerial portions during the evaluation process. (12/09 - Present)

Sunoco Logistics Nederland Rail Facilities Upgrade - Rail Design Lead
Led the design of the rail component of the infrastructure upgrade at the large marine terminal in Nederland, TX, which provides oil loading and unloading facilities for extracting crude oil from rail cars. The site has two short existing tracks with a small number of equipment spots for loading and unloading oil. Mr. Bobby directed the design of the track extension to accommodate multiple 30-car loading and unloading spots. His team's rail plan included typical sections, alignment plan, profiles, cross sections, and track details. The track expansion was designed to be constructed under traffic to allow oil cars to still load and unload while the track extensions are constructed. (3/12 - 4/12)

NICTD Kensington Interlocking Improvements CM Services - Construction Manager
Directed construction management (CM) services for improvements at the Kensington Interlocking on Chicago's south side, including the addition of a second Northern Indiana Commuter Transportation District (NICTD) route across the Canadian National railroad to the Metra Electric Mains. STV provided a precondition survey to identify existing conditions of the rail and ROW within the project limits, including the existing signal system, structures, and track appurtenances, and oversaw all aspects of the contractor's construction methods. Mr. Bobby was responsible for field inspections, contract

administration, project controls, quality assurance, safety monitoring, and procurement assistance. (12/08 - 12/11)

CSX CREATE WA-10 - Project Manager
Managed the final design of a rail interlocking to allow the interchange between the Canadian National and CSX railroads in Blue Island, IL. Expanding this interlocking between these two main lines will increase rail traffic capacity and improve train movement through Chicago. Mr. Bobby coordinated work between the signal designers and each railroad and their respective labor forces. He also prepared plans, specifications, and estimate submittals to the Illinois Department of Transportation. (6/08 - 3/11)

Metra Civil/Structural Blanket Engineering Services - Project Manager
Oversaw rail engineering services for STV's civil/structural blanket project for Metra, for which the firm provided systemwide services on an as-needed basis. STV's project scope varied by task order, and services included field verification of conditions, design of buildings and trackwork, rehabilitation of buildings and retaining walls, construction inspection and plan preparation, environmental assessments, traffic studies, roadway geometry, and property surveys. Mr. Bobby oversaw all 12 tasks associated with this contract, one of which involved conducting a thorough condition inspection, preparing a condition report, and developing the necessary rehabilitation activities for repair of the Rock Island District Turntable in Blue Island, IL. (10/08 - 12/10)

NICTD West Lake Corridor New Starts Studies - Engineering Task Leader
Led Phase I engineering design of a commuter rail system for the Northern Indiana Commuter Transit District (NICTD) extending from Valparaiso to Lowell, IN, to Chicago. Mr. Bobby prepared travel-demand modeling, alternatives development, plan and profile development, and a public outreach campaign. (7/05 - 9/10)

St. Louis Metro East Riverfront Interlocking - Project Engineer
Oversaw the track design for a new diamond interlocking located between St. Louis Metro's existing East Riverfront light-rail station and the Eads Bridge spanning the Mississippi River. The Eads Bridge is a 2-level structure carrying two sets of tracks for the MetroRail transit system on its lower level and a 4-lane highway on the upper level. The new interlocking is located in an area east of the bridge known as the East Arcade. Mr. Bobby and his team designed the new interlocking on a tight schedule and within a restricted area, which made design work challenging. The project required the installation of an asymmetrical double crossover using a combination of No. 6 and No. 8 turnouts on concrete ties to allow single-track operation over the Eads Bridge with minimal disruption to the passenger rail service while the bridge is rehabilitated. This project had an aggressive completion schedule, which required STV to develop an independent material procurement package in advance of the construction contract. Mr. Bobby directed the track design for the new interlocking and reviewed the final plans, successfully meeting the aggressive schedule. (11/09 - 6/10)

Metra Computerized Maintenance Management System Program - Project Manager
Oversaw the selection and implementation of a computerized maintenance management system (CMMS) for Metra's fixed facilities, including passenger train stations, locomotive and car shops, maintenance-of-way facilities, train control centers, and offices throughout Chicago and its surrounding suburbs. Mr. Bobby and his team collaborated with the agency to develop and implement a 2-phase plan to standardize and automate preventive maintenance work orders for Metra's fixed assets. As part of the project, STV evaluated and customized an off-the-shelf Web-based CMMS application that would replace Metra's

paper-based legacy system. Mr. Bobby led site inventories to survey and document Metra's facilities equipment and assets, which were then loaded into the CMMS asset database. During the second phase of the plan, he successfully managed the staggered implementation of the CMMS. Under Mr. Bobby's direction, the CMMS was fully implemented and is utilized across all of Metra's districts. (11/07 - 11/09)

Metra Blanket Project Administration/Management Services - Project Manager
Oversaw the administration of projects for Metra to be designed by outside consultants. Mr. Bobby managed project controls and monitored compliance with approved budgets and schedules. Specific tasks under this blanket included administration and management of parking lot design, construction inspection services, and Standard Cost Category Analysis for New Starts projects. Mr. Bobby was also responsible for making sure Metra's standards and guidelines were adhered to by the project teams and documented according to Metra project management guidelines. (2005 - 6/09)

Metra Standard Cost Category Analysis for New Starts Projects - Project Manager
Managed this project to assist Metra in standardizing the capital cost methodology and estimates for four Chicagoland projects according to FTA guidelines on Standard Cost Categories. These guidelines were required as part of the application process to enter the New Starts program for federal funding. Projects included new service to the STAR Line and Southeast Line; the Union Pacific Railroad (UP) Northwest Line track and signal improvement, as well as extension of service; and the UP West Line track and signal improvements. (12/05 - 5/07)

NS Lakeside Dam Rehabilitation - Rail Engineer
Provided design services for rail alignment and related earthwork as part of the construction of a 1.5-mile realignment in Macon, GA, for the Norfolk Southern Railway (NS). The proposed alignment was partially over a 60-foot-high earthen dam. The project, which required coordination among many stakeholders, involved a complex intersection of the railroad, a major state route, and the dam. (8/08 - 12/08)

CTA Brown Line Tie Renewal - Project Rail/Civil Engineer
Provided engineering and track inspection services for this $18 million project, which included the renewal of dense, composite ties with Pandrol plates, as well as the replacement of timber guards, rail greasers, and contact rail chairs for the Chicago Transit Authority (CTA) Brown Line in Chicago. This project included the complete replacement of timber cross ties and outer guard with plastic composite cross ties and outer guards, all new tie plates, and other track materials. Live train testing was performed on the 50-foot-high elevated track, which spans 3 miles and encompasses eight stations. Mr. Bobby assisted with constructability reviews, project planning, inspection services, and emergency services. (4/08 - 9/08)

CSX Goldsboro Passing Siding - Lead Rail Engineer
Oversaw rail engineering for the design of a 2-mile passing siding on the W&W subdivision of the Atlantic Coast Line in Goldsboro, NC. Work for this project was performed on an accelerated schedule, allowing only four weeks from the start of engineering until the bid documents needed to be complete. Mr. Bobby prepared complete documents, including plans, special provisions, and cost estimates. The project was completed on time and within budget. (6/07)

KCS Meridian Rail Siding - Lead Rail Engineer
Led the design team for a proposed rail alignment and related earthwork as part of the construction of a 3-mile double-track extension on the Meridian Speedway in Meridian, MS. The project had an aggressive schedule, and the line remained operational with staged construction. The project was part of a master

agreement with Kansas City Southern (KCS) to provide professional services on an on-call basis for the main rail lines. (3/07 - 5/07)

KCS Meridian Connection - Lead Rail Engineer
Served as technical lead and managed the design team responsible for the design of the rail alignment and related earthwork as part of the construction of a 4-mile realignment and connection of the Norfolk Southern Railway (NS) and the Kansas City Southern (KCS) railway on the Meridian Speedway in Meridian, MS. The project required extensive coordination between the KCS and NS railroads, resulting in an operational staging plan suitable for both parties. The project was part of a master agreement with KCS to provide professional services on an on-call basis for the main rail lines. (3/07 - 5/07)

NS Heartland Clearance Improvements CM - Rail Engineer
Provided design services in support of construction management (CM) for modifications to the Norfolk Southern Railway (NS) alignment in order to meet clearance requirements and developed an undercutting plan to be executed by the railroad for clearance improvements to 29 tunnels in Virginia, West Virginia, Kentucky, and Ohio known as the "Heartland Corridor." Mr. Bobby contributed to the design of overhead bridge-jacking plans to obtain vertical clearances. He modified slide fences, provided utility coordination, and reviewed track design. Mr. Bobby also created railroad bridge-lowering plans and stormwater pollution prevention plans at tunnel portals for this $191 million project. (7/06 - 8/06)

Michigan State University Rail Feasibility Study - Rail Advisor
Provided technical advisement to Michigan State University (MSU) for a feasibility study to expand its existing coal storage yard to allow for bulk unit trains. The study investigated the possibility of increasing both operational flexibility and capacity to allow MSU to store unit trains and perform switching operations. Mr. Bobby utilized his extensive rail experience to advise the client on geometric and operational solutions, and performed quality assurance for the study. (11/05 - 2/06)

CTA Circle Line Alternatives Analysis - Task Manager
Served as civil task manager for the alternatives analysis of the new Chicago Transit Authority (CTA) Circle Line, which would connect the existing CTA transit lines and several Metra commuter lines by an outer loop track approximately two miles outside of downtown Chicago. Mr. Bobby performed project data collection, horizontal/vertical alignment development and analysis, and ROW and utility-conflict identification. The study focused on a series of elevated structures and underground tunnels required to make the connections. (4/04 - 8/04)

Metra Southwest Service Expansion - Project Engineer
Led the rail design for this $97 million mainline expansion of Metra's Southwest Service Line in Chicago, a Federal Transit Administration New Starts project to support Metra's growing ridership needs. The scope of work included upgrading 3.2 miles of an existing single-track to a double-track to increase the frequency of Metra's service to its existing areas and expand service to Manhattan, IL. The project also included four maintenance-of-way sidings, three interlockings, two new station layouts, and one new yard that included a maintenance facility. Mr. Bobby coordinated with the various project disciplines to develop the rail design according to the project plan. He also produced bid documents. (3/01 - 11/02)

City of Ottawa Illinois Valley Commuter Rail Feasibility Study - Project Engineer
Provided conceptual engineering for the analysis of the physical, operational, and financial feasibility of providing commuter rail service on an existing active railroad ROW and trackage between Joliet and LaSalle/Peru, IL. (4/02)

SITE DEVELOPMENT

Forest City Enterprises Illinois Science and Technology Park Redevelopment - Project Manager
Oversaw the development of the master utility and drainage plan and the Phase I construction documents for this $500 million, 23-acre redevelopment project in Skokie, IL. The scope of work included the demolition of multiple buildings, site utilities disconnection and demolition, partial utility tunnel demolition, site backfill, and temporary site and landscape improvements in preparation for new buildings, structures, and permanent landscape. Mr. Bobby managed the pre-design services, the development of site utility and drainage master plans, and limited interim site engineering for a master plan, all of which addressed current and future buildings, as well as phased development. He oversaw the integration of existing systems with new systems, and attended meetings with the client, utility companies, surveyors, public agencies, construction and demolition contractors, architects, and electrical/mechanical consultants. (2005 - 2007)

TRANSPORTATION FACILITIES

City of Joliet Regional Multimodal Transportation Center - Engineering Lead
Provided railroad coordination and oversaw required infrastructure improvements as part of the development of a multimodal transportation center in Joliet, IL. Several modes of transportation will be relocated into a central facility located within the Joliet Union Depot Interlocking, which includes Union Pacific Railroad, BNSF Railway, Amtrak, and the Metra Rock Island District and Heritage Corridor rail lines, and will connect to the historic Joliet Union Station. Mr. Bobby coordinated with the various rail agencies, keeping them informed of the project plans and mitigating potential impacts the project may have on the railroads. STV provided professional services for the planning and engineering of the center and developed an implementation plan identifying possible funding sources and phasing of project elements over a multi-year timeframe. In addition to rail coordination, Mr. Bobby developed infrastructure improvements related to track realignments, platform configurations, interlocking modifications, bridge rehabilitations, and construction staging for the estimated $42 million facility. (9/09 - 2/11)

Riverview Trenton Rail Road Intermodal Facility - Design Engineer
Prepared plans for conceptual grade crossings, new yard layout, container storage, and trackwork for this intermodal facility in Detroit. (6/01)

Amtrak Detroit Station - Design Engineer
Designed a parking lot, site drainage, and grading plans for the development of this rail station in Detroit. Mr. Bobby was also responsible for utility and rail coordination. (1/01 - 6/01)

City of Lisle Commuter Rail Station - Resident Engineer
Completed inspection, material testing, and construction documentation for a commuter rail station rehabilitation in Lisle, IL. The project included construction of new precast platforms on grade beams, handicap ramps, hand railings, drainage, retaining walls, and stairways. (6/01)

Jefferson Terminal Railroad Auto Mixing Facility - Design Engineer
Provided the conceptual design of an auto mixing facility in Detroit, MI, which incorporated over-the-road auto haulers with a rail yard and staging facility that included plans for conceptual grade crossings, new yard layout, container storage, and trackwork. (5/01)

CSX Piqua Yard - Design Engineer

Provided cost-estimating and design services for a new yard located in Fort Wayne, IN, to accommodate a new steel manufacturer in the area that needed rail service. (6/00 - 12/00)

Metra 47th Street Trainwasher - Project Engineer
Provided on-site project-engineering services during construction for the layout of the yard lead track and new approach to the trainwasher. (5/00 - 7/00)

MWRDGC Stickney Facility Centrifuge - Track Engineer
Designed the layout for additional yard track for the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) centrifuge in Stickney, IL. Mr. Bobby also incorporated a new car-mover with the existing facility. (5/98 - 8/98)

TUNNELS

CTA Block 37 Station and Tunnel Connector - Project Engineer/Lead Rail Engineer
Designed the rail alignment for a mined tunnel in water-bearing soft clay that connects the Chicago Transit Authority (CTA) Blue and Red transit lines in Chicago. Located at Block 37 between State and Dearborn streets, this tunnel links the two subways to a new underground station. Work for this project was performed on an extremely complex and tight schedule, and had to be completed with minimal disruptions to the subway service. Mr. Bobby prepared all special trackwork and details, and established the horizontal geometry for the trackwork and alignment for the entire project. (8/04 - 6/07)

WATER RESOURCES

MWRDGC MUPPS for the North Side Water Reclamation Plant - Project Engineer
Provided overall engineering services to prepare a Master Underground Process Piping Survey (MUPPS) — a comprehensive Geographical Interface System (GIS) database that identifies and locates all underground utilities, process piping, topographic features, and permanent structures — at the North Side Water Reclamation in Skokie, IL, for the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC). The GIS system comprises AutoCAD Civil Map 3-D graphical objects with links to a customized Microsoft Access relational database, and facilitates an inventory and information retrieval on all site utilities. Mr. Bobby was responsible for the development and implementation of the GIS database system and researched and digitized existing district drawings and associated databases. (7/07 - 5/09)

Publications and Presentations

Published and presented "Metra - Southwest Service Expansion" at the American Railway Engineering and Maintenance-of-Way Association (AREMA) International Conference in Chicago. (2003)

CHARLIE BRENNER

Mr. Brenner is the Assistant Vice President for Market Development and Systems of Norfolk Southern Corporation, the parent of Norfolk Southern Railway Company ("NS"), located at 1200 Peachtree Street, Northeast, Atlanta, Georgia 30309. Mr. Brenner is sponsoring portions of Section II-B of NS's Reply Evidence related Qualitative Market Dominance, specifically to sulfuric acid transloading. Mr. Brenner has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Brenner is a veteran of the United States Air Force. He studied chemistry and economics at the University of Delaware, where he also earned his Master of Business Administration. He joined NS's predecessor railroad, Norfolk & Western, in 1975. Mr. Brenner began in the Marketing Department before spending twelve years in Materials Management and Purchasing. He returned to the Marketing Department, where he has served for the past 19 years.

As Assistant Vice President for Market Development and Systems, Mr. Brenner is responsible for the development of systems used in the Industrial Products group and by NS's customers through the access NS program. Mr. Brenner also oversees Industrial Products tariff publication and contract services. He is also responsible for the operation, marketing and management of NS's Distribution Services group.

VERIFICATION

I, Charlie Brenner, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Charlie Brenner

Charlie Brenner

Executed on 11/22, 2012

RICHARD BROWN

Mr. Brown is a Director at FTI Consulting, Inc., an economic and consulting firm with offices located at 1101 K Street, NW, Washington, D.C. 20005. With 28 years of experience in the railroad industry, Mr. Brown specializes in providing financial, economic and analytical consulting services to North America's largest railroads. Mr. Brown is sponsoring portions of Sections III-D of Norfolk Southern's ("NS's") Reply Evidence relating to operating and general and administrative expenses. Mr. Brown has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Brown received a Bachelor of Art degree in economics from Syracuse University in 1963 and a Master of Business Administration from Northwestern University in 1971. Prior to joining FTI, Mr. Brown spent 28 years with The Burlington Northern & Santa Fe Railway ("BNSF"), and its predecessor The Atchison, Topeka and Santa Fe Railway ("ATSF"). While at BNSF, Mr. Brown focused on strategic issues including the negotiation and implementation of the agreements between Union Pacific ("UP") and BNSF that were effected to facilitate the UP and Southern Pacific ("SP") merger. Additionally, he took a lead role in the analysis of the potential impact of regulatory changes on railroad marketing strategy.

Mr. Brown held numerous positions in Strategic Planning and Marketing at ATSF. He was involved in merger analysis and planning and played a key role in the attempted merger between ATSF and SP. Mr. Brown headed ATSF's Bulk Commodity Marketing which included Chemicals and Coal. In this role, he re-engineered a field sales organization with regional directors responsible for coaching and mentoring account managers. He also led ATSF's rail-truck retail efforts and negotiated several joint venture and business partnerships. While in this capacity, he developed a program for using rail truck transfer to increase car utilization. He implemented a joint venture with a major bulk truck line to bring intermodal rail service to dry bulk shippers. Mr. Brown has provided expert testimony in merger proceedings before the Interstate Commerce Commission and the Surface Transportation Board.

Mr. Brown's complete curriculum vitae is attached.

VERIFICATION

I, Richard W. Brown, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Richard W. Brown

Executed on this 26 day of November, 2012.

Richard Brown

Director – Economic Consulting

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Education
MBA from Northwestern University Graduate School of Management

BS in Economics from Syracuse University

Richard Brown is a Director in FTI's Economic Consulting practice. With 28 years of experience in the railroad industry, Mr. Brown specializes in providing financial, economic and analytical consulting services to North America's largest railroads. Mr. Brown has provided expert testimony in merger proceedings before the Interstate Commerce Commission and The Surface Transportation Board. Mr. Brown is assigned to the DC office, however works from his home office at 100 Windwood Circle, Breckenridge, Colorado 80424.

Mr. Brown joined FTI Consulting in 1999. Much of the NIS group's work focuses on the economic and financial analysis of network industries, in particular different aspects of transportation. While at FTI, he has been involved in the analysis of rates, costs, and service in the railroad industry. Mr. Brown has worked extensively to develop expert testimony before the Surface Transportation Board ("STB") examining the reasonableness of railroad rates, railroads' applications for mergers and acquisitions. He also supported railroad internal strategic planning needs with respect to mergers and acquisitions and the impact of potential regulatory changes.

Prior to joining FTI, Mr. Brown spent 28 years with The Burlington Northern & Santa Fe Railway (BNSF), and its predecessor The Atchison, Topeka and Santa Fe Railway (ATSF). While at BNSF, he focused on strategic issues including the negotiation and implementation of the agreements between UP and BNSF that were effected to facilitate the UP-SP merger. Additionally, he took a lead role in the analysis of the potential impact of regulatory changes on railroad marketing strategy.

Mr. Brown held numerous positions in Strategic Planning and Marketing at ATSF. He was involved in merger analysis and planning and played a key role in the attempted merger between ATSF and Southern Pacific. He headed ATSF's Bulk Commodity Marketing which included Chemicals and Coal. In this role, Mr. Brown re-engineered a field sales organization with regional directors responsible for coaching and mentoring account managers; started a subsidiary company to handle tank containers as a retail intermodal options; and expanded on that with a joint venture with Bulkmatic, a major dry bulk truck line, to initiate a retail intermodal option for bulk containers.

Mr. Brown holds a Bachelors Degree in Economics from Syracuse University and an MBA degree from Northwestern University Graduate School of Management.

TESTIMONY

Surface Transportation Board

September 20, 2002 Docket No. 42070. Duke Energy Corporation v. CSX Transportation, Inc., Written Reply Evidence and Argument of CSX Transportation, Inc.

September 30, 2002 Docket No. 42069. Duke Energy Corporation v. Norfolk Southern Railway Company, Written Reply Evidence and Argument of Norfolk Southern Railway Company.

October 11, 2002	Docket No. 42072. Carolina Power & Light v. Norfolk Southern Railway Company, Written Reply Evidence and Argument of Norfolk Southern Railway Company.
January 19, 2010	Docket No. 42110. Seminole Electric Cooperative, Inc. v. CSX Transportation, Inc., Written Reply Evidence of CSX Transportation, Inc.
February 5, 2010	CV No. 3:08-CV-415-BR. -BNSF Railway Company v. Albany and Eastern Railroad Company, et al.
May 7, 2010	Docket No. 42113 Arizona Electric Power Cooperative, Inc. v. BNSF Railway Company and Union Pacific Railroad Company, Joint Reply Evidence of BNSF Railway Company and Union Pacific Railroad Company
November 10, 2011	Docket No. 42127 Intermountain Power Agency v. Union Pacific Railroad Company, Reply Evidence of Union Pacific Railroad Company

PATRICK J. BRYANT

Mr. Bryant is a Civil Engineer with STV, a professional firm offering engineering, architectural, planning, environment and construction management services located at 200 West Monroe Street, Suite 1650, Chicago, Illinois 60606. Mr. Bryant is sponsoring portions of Section III-F of Norfolk Southern's ("NS's") Reply Evidence relating to Earthwork. Mr. Bryant has signed a verification of the truth of the statements contained therein. A copy of the verification is attached hereto.

Mr. Bryant has more than 15 years of experience in rail, roadway, highway and bridge design and construction. He worked as Project Engineer on a CSXT coal terminal reconfiguration and as a Design Engineer for CSXT's Blue Island interchange with CN. He has also worked as a Track Engineer for the Elgin O'Hare West Bypass in Illinois and the City of Joliet's Regional Multimodal Transportation Center. Mr. Bryant worked as a Rail Engineer on the KCS Meridian Connection, performing design for the rail alignment and related earthwork as part of a realignment and connection construction. For Norfolk Southern, Mr. Bryant worked as a Rail Engineer on the Lakeside Dam Rehabilitation, designing the rail alignment and related earthwork as part of a 1.5 mile realignment at the intersection of the railroad, a state road and a dam.

Mr. Bryant earned his Bachelor of Science in civil engineering from the University of Illinois. His complete curriculum vitae is attached.

VERIFICATION

I, Patrick J. Bryant, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company. that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Patrick J. Bryant

Executed on this 19 day of November, 2012.

Patrick J. Bryant, P.E.

Civil Engineer

Mr. Bryant is a civil engineer with more than 15 years of experience in rail, roadway, highway, and bridge design and construction, as well as site/civil and environmental engineering. He is experienced in designing rail alignments and track for light rail, commuter and freight railroads, and in coordinating among freight railroads, transit agencies and departments of transportation for track improvement projects. Mr. Bryant is currently serving as track engineer for the Illinois Department of Transportation (IDOT) Elgin O'Hare West Bypass, where he is providing conceptual track design for potential alignments and impacts to the Union Pacific Railroad, Canadian Pacific Railway, and Canadian National Railway. He has also performed track design for Kansas City Southern, the Northern Indiana Commuter Transportation District, and Norfolk Southern Railway.

Firm
STV

Education
Bachelor of Science, Civil Engineering; University of Illinois, Chicago

Professional Registrations
Professional Engineer: Illinois

Training
Amtrak Contractor Safety

Computer Skills
AutoCAD, Civil3D, MicroStation, GeoPak, HydroFlow, TR20, Paydirt, Visual Basic, AutoLisp, Eaglepoint

Project Experience

RAIL

CSX Curtis Bay Coal Terminal Reconfiguration - Project Engineer
Planning and designing the reconfiguration of CSX's Curtis Bay coal terminal in Baltimore. The project will consolidate yard tracks from the existing coal inbound yard and merchandise yard to provide three 130-foot inbound tracks to store unit coal trains. The project will also reconfigure the inbound lead tracks to the west yard to separate switching operations and implement new crossover arrangements at the existing three coal dumpers. The work is needed for CSX's planned expansion of ground storage at this facility. Mr. Bryant is overseeing the conceptual layouts and design for the yard reconfiguration. The most challenging aspect is staging the sequence of construction for the maintenance of operations to minimize impacts to CSX service during construction. (11/11 - Present)

CSX/Chicago/Gary Regional Airport Authority CSX Fort Wayne Line and NS Gary Branch Relocation - Design Engineer
Preparing track and civil plans for the reconfiguration of CSX's Fort Wayne Line onto the Norfolk Southern Railway (NS) Gary Branch in Gary, IN. The work is being performed as a component of the Chicago/Gary Regional Airport Authority's airport runway extension project and includes the addition of a new connection from CSX's Barr Subdivision to Canadian National's reconfigured Elgin, Joliet & Eastern Railway Line. A new industrial connection from the CSX Porter Subdivision to the Indiana Sugars manufacturing facility will also be added. In addition, the scope of work includes reconfiguring the Clarke Junction Interlocking between the Barr Subdivision, adding a new connection to the NS Chicago Line, and removing the Pine Junction Interlocking on the Barr Subdivision and improving design speed from 40 mph to 60 mph. This work will increase rail traffic capacity

and improve train movement into and out of Chicago. Mr. Bryant is also coordinating the design plans with the various railroads and transportation agencies. (2/11 - Present)

CSX CREATE WA-10 - Design Engineer

Preparing track and civil plans for the final design of the rail interlocking to allow the interchange between the Canadian National (CN) and CSX railroads in Blue Island, IL. As a component of the Chicago Region Environmental and Transportation Efficiency (CREATE) program, the project involves reconfiguring the CSX Vermont Street interlocking to provide a universal connection to the CN main line. Expanding this interlocking between these two main lines will increase rail traffic capacity and improve train movement through Chicago. Mr. Bryant is also coordinating the design plans with the various railroads and transportation agencies. (2011 - Present)

IDOT Elgin O'Hare West Bypass - Track Engineer

Coordinating design plans with various railroads and transportation agencies and preparing staging plans as part of STV's freight rail coordination for the $3.9 billion Elgin O'Hare West Bypass in Cook County, IL. Mr. Bryant developed conceptual track engineering plans and cost estimates for potential track alignments and impacts to the railroads during Phase I of this project. He also developed staging plans, cross-sections, plan profiles, and drainage plans. The project has now moved into Phase II, and STV is coordinating the approved plans among the Union Pacific, Canadian Pacific, and Canadian National freight railroads and the project team. The primary objective of the coordination is to keep the railroads informed of project progress and to resolve any potential conflicts at an early stage. Mr. Bryant is coordinating work with the planning team during the alternative design process and is advising them of potential rail impacts. He is also coordinating plans with signals and highway improvement work being performed simultaneously. (10/08 - Present)

NICTD Kensington Interlocking Improvement CM Services - Track Engineer

Developed track engineering for construction management (CM) services for improvements at the Kensington Interlocking, including the addition of a second Northern Indiana Commuter Transportation District (NICTD) route across the connect to the Metra electric mains. Mr. Bryant made recommendations for alterations to the original track design that are being incorporated into the final design and construction. He also performed office engineering tasks as well as field inspections. STV oversaw all aspects of the contractor's construction methods, and provided a precondition survey to identify existing conditions of the rail and right-of-way in the area of the Kensington Interlocking limits, including the existing signal system, structures, and track appurtenances. (6/09 - 6/12)

UP vs. Intermountain Power Agency Rate Case Litigation Cost Assessments - Project Engineer

Assembled the planning, engineering, and construction costs to build a hypothetical contemporary operating railroad for the Union Pacific Railroad (UP). Services included a complete itemization, justification, and documentation of all transportation, material, and labor construction costs associated with a contemporary construction costing. All submittals were entered as evidence to the Surface Transportation Board to justify contested rates for this coal rate case. The cost assessments Mr. Bryant worked on included major earthwork and culvert construction. (8/11 - 12/11)

CSX CREATE CSX CREATE B-12 Third Main Construction Oversight - Field Inspector

Performed field inspections for the construction of a third mainline along the Beltway Corridor from 123rd Street to CP San Francisco in Alsip and Blue Island, IL, which includes new track and upgrades to existing track. Part of the Chicago Region Environmental and Transportation Efficiency (CREATE) program, this additional mainline will increase freight rail capacity and decrease travel times within the area. A new rail bridge over 127th Street was also constructed, including associated signal work. Mr. Bryant provided inspections to make sure the work was performed according to the project plans and specifications. (9/10 - 7/11)

TTC Transit City LRT Program Project Management Services - Track Design QC

Provided quality control for track and civil plans, as part of the proposed 13.6-km (8.5-mile) Toronto Transit Commission (TTC) underground light rail transit (LRT) line and new Sheppard's Street station in Toronto, Canada. Mr. Bryant verified that the project was designed according to the agency's design criteria and that it is constructible. He checked clearances, materials, profile grades, and drainage design. (4/10 - 2/11)

St. Louis Metro East Riverfront Interlocking - Track Engineer

Prepared track and civil plans for the design of a new interlocking between the East Riverfront MetroRail station and the historic Eads Bridge, which connects St. Louis with East St. Louis, IL, over the Mississippi River. The Eads Bridge is a 2-level structure carrying two sets of tracks for the MetroRail light-rail transit system on its lower level and a 4-lane highway on the upper level. STV designed a new asymmetrical diamond cross-over interlocking within the East Arcade located east of the bridge. To construct the new interlocking, approximately 206 feet of the roadway deck and superstructure was removed. The firm designed the new interlocking on a tight schedule and within a restricted area, making the design work challenging. The interlocking is 185 feet long and the cross-over is confined within an 18-foot-wide area. Mr. Bryant performed track calculations and geometry to develop multiple track alignment options. The plans were then presented to the client, which chose an option most suitable to its needs. Mr. Bryant prepared track and civil design plans using AutoCAD. He also coordinated with other project disciplines to develop conduit plans for multiple systems including electrical, communications, overhead catenary systems, and signals, all of which are located within the restricted area. (11/09 - 6/10)

NS PennDOT SR 0028 Improvement - Track Engineer
Facilitated track design to address Norfolk Southern Railway (NS) capacity issues during the Pennsylvania Department of Transportation (PennDOT) improvement of SR 0028 in Pittsburgh. To allow for single-tracking during roadway improvements, NS Control Point (CP) Herr will be eliminated. For NS to have capacity for this interlocking removal and single-tracking, STV relocated two approaching interlockings: one at CP Etna, and one at CP Sharp. Mr. Bryant designed track geometry, plan and profile for relocation of the interlockings as well as extension of the westward main track No. 2 and controlled siding. The total project will increase block capacity by 2,700 feet. (8/08 - 5/09)

KCS Meridian Connection - Rail Engineer
Performed design for the rail alignment and related earthwork as part of the construction of a 4-mile realignment and connection of Norfolk Southern Railway (NS) and the Kansas City Southern (KCS) railway on the Meridian Speedway in Meridian, MS, as part of an on-call contract. The project required extensive coordination between the KCS and NS, resulting in an operational staging plan suitable for both parties. (10/08 - 7/09)

NS Lakeside Dam Rehabilitation - Rail Engineer
Responsible for the design of the rail alignment and related earthwork as part of the proposed construction of a 1.5-mile realignment of Norfolk Southern Railway (NS) in Macon, GA. The proposed alignment was partially over a 60-foot-high earthen dam. The project, which required coordination among many stakeholders, was a complex intersection of the railroad, a major state route, and the dam. (8/08 - 12/08)

BRIDGES

CSX Manville Bridge Reconstruction - Track Engineer
Prepared track designs to address construction staging for CSX's reconstruction of a railroad bridge over a waterway in Manville, NJ. The new structure increases CSX's capacity from one track to two tracks in the Reading subdivision. Mr. Bryant designed track geometry, plan and profiles, and temporary shoofly alignments for the staging plans and final rail alignment. (7/09 - 8/09)

CDOT Montrose Harbor Bridges and Underpasses - Project Engineer
Provided engineering services for the reconstruction of four concrete arch bridges originally built in the 1930s in Chicago's Montrose Harbor Park. STV evaluated rehabilitation and reconstruction alternatives for each of the structures. Because the bridges are located in a historic park setting, STV coordinated with the project architect to develop a structural system that maintained the existing architectural features while meeting current highway

bridge standards. Mr. Bryant designed maintenance of traffic plans, which included assessing current traffic volume and developing a plan would have minimal impact to commuters during construction. He also assisted with the drainage design plans for the Chicago Department of Transportation (CDOT) project. (4/08 - 1/09)

HIGHWAYS/ROADWAYS

Kane County DOT Fabyan Parkway at Van Nortwick Avenue Phase II Intersection Improvements - QA/QC
Performed QA/QC for STV's Phase II engineering services for the Fabyan Parkway and Van Nortwick Avenue intersection in Batavia, IL, for the Kane County Department of Transportation (DOT). The scope of work included road widening and the addition of a left-turn lane, as well as data collection, geotechnical services, and drainage design. The firm also extended lateral pipes in the widened area, replacing inlets along curb lines and a culvert to correct a drainage problem. STV prepared construction documents in accordance with the IDOT Bureau of Local Roads manual and Kane County design standards. Mr. Bryant performed QA/QC of the final Phase II engineering plans STV submitted. (6/09 - 2/10)

IDOT US 150 Phase I Study - Civil Engineer
Provided civil design for Phase I engineering for the preparation of a Categorical Exclusion Group II report for the widening of US 150 in Tazewell County, IL, to three lanes. Mr. Bryant was responsible for roadway design, including grading, geometric alignments, and easements. (7/08 - 8/08)

Kendall County Highway Department/Sharp Homes Hunter's Ridge Road Widening - Project Engineer
Designed roadway plans, including profiles, horizontal alignments, cross sections, and drainage systems, for the widening of a 2-lane rural road to a 4-lane arterial with multiple intersections to support new residential developments in Joliet, IL. The project included widening a 1.5-mile stretch of roadway to accommodate the 130-acre Hunter's Ridge and 90-acre Jones Road subdivisions developed by Sharp Homes. Mr. Bryant was also responsible for developing site plans for the subdivision projects. (5/05 - 3/06)

Kendall County Highway Department/Lakewood Homes Ridge Road Widening - Project Engineer
Supervised the design of roadway plans, including profiles, horizontal alignments, cross sections, and drainage systems, for 2 miles of a major 4-lane arterial in Joliet, IL. Mr. Bryant was also responsible for developing roadway improvements funded by Lakewood Homes. All plans were submitted to the Kendall County Highway Department for review. (10/04 - 3/05)

ISTHA I-294 Reconstruction - Project Engineer
Managed the design of roadway plans, including profiles, horizontal alignments, cross sections, and drainage systems, for the reconstruction of 6 miles of I-294 in Illinois. Mr. Bryant was also responsible for developing special provisions and preparing project cost estimates for this Illinois State Toll Highway Authority (ISTHA) project. (6/03 - 4/05)

CDOT Racine Avenue Improvements - Project Engineer
Facilitated the design of roadway plans, including profiles, horizontal alignments, cross sections, and drainage systems associated with the improvement of a 0.8-mile segment of Racine Avenue in Chicago. Mr. Bryant was also responsible for developing special provisions and preparing project cost estimates for this Chicago Department of Transportation (CDOT) project. (7/03 - 1/04)

CDOT 37th Street Improvements - Project Engineer
Developed roadway plans, including profiles, horizontal alignments, cross sections, and drainage systems for improvements, to a 0.5-mile stretch of 37th Street in Chicago. Mr. Bryant also developed special provisions and prepared project cost estimates for the Chicago Department of Transportation (CDOT) project. (7/03 - 1/04)

IDOT Higgins Road Rehabilitation - Project Engineer
Responsible for the design of roadway plans, including profiles, horizontal alignments, cross sections, and drainage systems, for the rehabilitation of 4 miles of Higgins Road in Schaumburg, IL. Mr. Bryant was also responsible for developing special provisions and preparing project cost estimates. (12/00 - 1/03)

IDOT Golf Road Rehabilitation - Project Engineer
Designed roadway plans, including profiles, horizontal alignments, cross sections, and drainage systems, for the rehabilitation of 4 miles of Golf Road in Schaumburg, IL. Mr. Bryant also developed special provisions and prepared project cost estimates. (10/00 - 1/03)

DuPage County Highway Department Road Improvement Projects - Construction Engineer
Inspected the resurfacing and repair of numerous county roads in DuPage County, IL, including Bloomingdale Road, Gary Avenue, Glen Ellyn Road, Naperville Road, 75th Street, and 63rd Street. Mr. Bryant also provided QA/QC of contractors' work on these road construction projects. (4/95 - 9/99)

ISTHA I-90 Improvements - Project Engineer
Responsible for the design of roadway plans, including profiles, horizontal alignments, cross sections, and drainage systems, for improvements to I-90 in Illinois. Mr. Bryant was also responsible for developing special provisions

and preparing project cost estimates for this Illinois State Toll Highway Authority (ISTHA) project. (11/97 - 4/98)

Cook County Highway Department Ashland Avenue - Construction Engineer
Inspected the construction of 1.5 miles of Ashland Avenue in Chicago. Mr. Bryant also provided QA/QC of contractors' work on the highway and bridge construction. (4/97 - 11/97)

ISTHA Randall Road/I-90 Interchange - Project Engineer
Designed roadway plans, including profiles, horizontal alignments, cross-sections, and drainage systems, for the Randall Road/I-90 interchange in Elgin, IL. Mr. Bryant was also responsible for developing special provisions and preparing cost estimates for the Illinois State Toll Highway Authority (ISTHA). (10/96 - 4/97)

Cook County Highway Department Lehigh Avenue - Construction Engineer
Responsible for the construction of 1.5 miles of Lehigh Avenue in Morton Grove, IL. Mr. Bryant provided QA/QC of the contractors' work. (3/96 - 12/96)

IDOT Route 59 - Project Engineer
Prepared roadway plans, including profiles, horizontal alignments, cross sections, and drainage systems, as part of the design of 5 miles of Route 59 in Naperville, IL. Mr. Bryant was also responsible for developing special provisions and preparing cost estimates. (9/94 - 4/95)

ISTHA I-294 Improvements - Construction Engineer
Responsible for construction inspection during the repair and resurfacing of 6 miles of I-294 in Rosemont, IL. Mr. Bryant provided QA/QC of contractors' work on this Illinois State Toll Highway Authority (ISTHA) project. (4/94 - 9/94)

SITE PLANNING

Sharp Homes Commercial Development Projects - Project Engineer
Developed site plans for various commercial development projects in Joliet, IL. Mr. Bryant oversaw spur track design, road design, grading design, geometric alignments, storm water management design, easement coordination, and utility design and coordination for the new Sharp Industrial Park, three commercial lots, and a railroad distribution center at the Mound Road Commercial Park. (5/05 - 5/08)

O&S Holdings Bridge Street Mall - Project Engineer
Responsible for site plans for a 320-acre mall development project in Joliet, IL. The proposed mall would contain numerous stores, restaurants, and medical and professional offices. Mr. Bryant was responsible for parking lot,

road, and grading design; geometric alignments; easement coordination; storm water management system design; and utility design and coordination. (10/07 - 4/08)

Taking Care of Business Inc. Crete Marketplace - Project Engineer
Developed site plans for a 100-acre commercial development project in Crete, IL. This commercial development contains two major department stores, a fast-food restaurant, two gas stations, and 12 other useable lots. Mr. Bryant was responsible for parking lot, road, and grading designs; geometric alignments; easement coordination; storm water management design; and utility design and coordination. (3/07 - 4/08)

IDI Rock Run Industrial Park - Project Engineer
Provided road and grading designs, geometric alignments, easement coordination, and utility design and coordination for this 60-acre development in Joliet, IL. (4/07 - 9/07)

Chovan Commercial Subdivision - Project Engineer
Developed site plans for a 20-acre commercial development project in Joliet, IL, consisting of medical and professional offices. Mr. Bryant was responsible for parking lot, road, and grading design; geometric alignments; easement coordination; storm water management design; and utility design and coordination. (2/06 - 9/07)

KB Homes Streams of Plainfield Residential Subdivision - Project Engineer
Provided road design, grading design, geometric alignments, easement coordination, and utility design and coordination for this 80-acre residential subdivision in Plainfield, IL. (6/06 - 4/07)

Gallagher and Henry Parker Road Residential Subdivision - Project Engineer
Responsible for road and grading designs, geometric alignments, easement coordination, and utility design and coordination for this 120-acre residential subdivision in Homer Glen, IL. (2/06 - 1/07)

Sharp Homes Horton Farms Residential Subdivision - Project Engineer
Provided road and grading design, geometric alignments, easement coordination, storm water management, and utility design and coordination for this 80-acre residential subdivision in Joliet, IL. (1/06 - 8/06)

TRANSPORTATION FACILITIES

UP CREATE B-2 Project - Project Engineer
Delivering site design engineering services for the reconstruction of the Metra's Union Pacific West Line's passenger stations in Berkeley and Bellwood, IL, as part of the Chicago Region Environmental and Transportation Efficiency (CREATE) program. STV is providing

engineering and architectural design services to modify the stations to accommodate a third mainline track being constructed by Union Pacific Railroad (UP). The station upgrades consist of new center platforms, warming shelters, and pedestrian underpasses with retaining walls. Mr. Bryant is providing site design, including grading, drainage, signage, and construction staging. The project is currently in the construction phase, and Mr. Bryant is providing construction support services. (3/11 - Present)

City of Joliet Regional Multimodal Transportation Center - Track Engineer
Provided railroad coordination and designs for infrastructure improvements as part of the development of a multimodal transportation center in Joliet, IL. Several modes of transportation were relocated into a central facility that connects to the historic Joliet Union Station. This venture could eventually be a stop on the future high-speed passenger rail line, linking Chicago with St. Louis. The transportation center is located within the Joliet UD Interlocking, which includes Union Pacific, Burlington Northern Santa Fe, Amtrak, and the Metra Rock Island District and Heritage Corridor rail lines. Mr. Bryant developed designs for the infrastructure improvements related to track realignments, platform configurations, interlocking modifications, bridge rehabilitations, and construction staging. (9/09 - 6/11)

MARK L. BURTON

Mr. Burton is an independent consultant and transportation economist located at 1101 Garrison Ridge Boulevard, Knoxville, Tennessee 37922. Mr. Burton is sponsoring portions of Section III-D of Norfolk Southern's ("NS's") Reply Evidence. Mr. Burton has signed a verification of the truth of the statements contained therein. A copy of the verification is attached hereto.

Mr. Burton earned a Bachelor of Arts degree in economics from the University of Missouri and his Ph.D. in economics from the University of Tennessee. He is currently a Research Associate Professor and the Director of Transportation Economics at the University of Tennessee's Center for Transportation Research.

Mr. Burton has previously worked for Burlington Northern Railroad. He has consulted for the U.S. Army Corps of Engineers, the Ohio Attorney General, AT&T, and the Tennessee Valley Authority. He has published numerous articles, book sections and monographs on transportation market analysis, network pricing, barge alternatives to rail, barriers to entry, railroad operations and economics, competition in network industries, and freight mobility.

Mr. Burton is a member of the National Academies of Science's Transportation Research Board Committee on Inland Navigation and has previously served on its Committee on Agricultural Transportation.

Mr. Burton's complete curriculum vitae is attached.

VERIFICATION

I, Mark L. Burton, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Mark L. Burton

Executed on this 12 day of November, 2012.

MARK L. BURTON

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BIOGRAPHY

Mark Burton was awarded a Ph.D. in economics from the University of Tennessee in 1991. His professional career has included both academic and consultative research in the areas of regional, transportation, and telecommunications economics. In addition to authoring a number articles and monographs, Dr. Burton has provided testimony in connection with a variety of judicial and regulatory proceedings. In July of 2004, Dr. Burton was named as Director Transportation Economics at the University of Tennessee's Center for Transportation Research where he continues to provide research support for Tennessee's Department of Transportation (TDOT) Class I and short-line railroads, the US Army Corps of Engineers, and regional economic development organizations.

Dr. Burton has also prepared testimony for a number of State Attorneys General, including Illinois, Indiana, Iowa, Maryland, Ohio, and Texas. Generally, this testimony has been related to rail issues such as the Conrail transaction and the overall level of railroad competition (STB *Ex Parte* 575).

EDUCATION

Ph.D., University of Tennessee, May, 1991.

Dissertation: "Railroad Deregulation and Rail Rates: A Disaggregated Analysis." Supervisor: John W. Mayo.
Major Area of Specialization: Industrial Organization and Regulation.
Minor Area of Specialization: Regional Economics.

B.A., University of Missouri, Columbia, December, 1981, Economics

SELECTED PROFESSIONAL ACADEMIC EXPERIENCE

Research Associate Professor Department of Economics, Director of Transportation Economics, Center for Transportation Research, University of Tennessee – Knoxville, August, 2004 – present.

Research Professor, Center for Business and Economic Research, Marshall University, Huntington, West Virginia, August 2004 – present.

Associate Professor, Division of Finance and Economics and Director, Center for Business and Economic Research

Marshall University, Huntington, West Virginia, July, 1998 – August 2004.

Assistant Director for Program Development and Management, Rahall Transportation Institute, January, 2003 – June, 2004.

Adjunct Professor, Department of Economics, Maryville College, January, 1997 – May, 1998.

Assistant Professor, Department of Economics and Business, Lafayette College, August, 1990 – January, 1996.

Instructor, Department of Economics, University of Tennessee, Knoxville, August, 1989, - August, 1990.

Research Assistant, Center for Business and Economic Research, University of Tennessee, Knoxville May, 1988 – August, 1989.

Research Assistant, Tennessee Valley Authority, Knoxville, Tennessee, September, 1987 - August, 1988.

Instructor, Department of Economics, University of Missouri, Columbia, January, 1987 - May, 1987.

Professional Consulting Experience

Subject Matter Expert (Energy Economics), Michael Baker Associates, September 2004 – present.

Telecommunications Consultant, America One Communications, Alexandria, Virginia, February, 1999 – present.

Visiting Economist, Water Resources and Navigation, Tennessee Valley Authority, Knoxville, Tennessee, June, 1995 – June, 1998.

Telecommunications Consultant, AT&T (Various Jurisdictions), July, 1995 - present.

Office of the Ohio Attorney General, Competitive Effects of the Conrail Transaction, August, 1995 - present.

CSY Liquidating Corp. v. Trinity Industries, Consultant for the Plaintiff, September, 1996 - 1998.

U.S. Army Corps of Engineers, Missouri River Division, Missouri River *Master Control Manual* Review, December, 1989 - present.

U.S. Army Corps of Engineers, Rock Island District, Upper-Mississippi – Illinois Waterway Navigation Feasibility Study, June, 1994 - 1999.

U.S. Army Corps of Engineers, Huntington District, Ohio River Navigation Feasibility Study, August, 1995 - present.

U.S. Army Corps of Engineers, New Orleans District, Port Allen Cut-Off Feasibility Study. October, 1995 - May, 1996.

U.S. Army Corps of Engineers, New Orleans District, Southern Pacific line relocation negotiations, May, 1996.

Other Employment Experience

Representative, Law Department, Burlington Northern Railroad, July, 1982 - June, 1985.

Selected Refereed Journal Publications

"Understanding Participation in Social Programs: Why Don't Households Pick up the Lifeline?" with Jeffrey T. Macher, Georgetown University and John W. Mayo, Georgetown University, *Berkley Electronic Journal of Economic Analysis, 2008.*

"Transportation And Market Feasibility Analysis For Innovative Coal Combustion By-products: WoodBrik™ in Greenbrier County, West Virginia ," with Michael Hicks and Kent Sowards, *International Journal of Environment and Waste Management*, Vol 1, No. 2, 2007.

"Do University Based Biotechnology Centers Impact Regional Biotechnology Related (Commercial) Employment," *International Journal of Technology Transfer and Commercialization*, Vol. 5, No. 4, 2006.

"Network Pricing: Service Differentials, Scale Economies, and Vertical Exclusion in Railroad Markets," with Wesley W. Wilson, University of Oregon, *Journal of Transport Economics and Policy*, May 2006.

"Estimating the Impact of Coal Slurry Impoundments on Residential Property Values," with Michael J. Hicks, *Minerals and Energy*, Fall 2005.

"Willingness to Pay for Water Transportation in the Ohio River Basin," *Transportation Research Record*, No 1871, 2004, pp. 5012.

"Evaluating Comprehensive Tax Reform: Lessons from West Virginia," with Michael J. Hicks and Calvin A. Kent, *State Tax Notes*, November 8, 1999, pp. 1239-55.

"Modeling Entry and Barriers to Entry: A Test of Alternative Specifications," with David L. Kaserman, Auburn University and John W. Mayo, Georgetown University, *The Antitrust Bulletin*, Summer, 1999, pp. 387-420.

"Rail Rates and the Availability of Water Transportation: The Missouri River Region," *Review of Regional Studies*, Summer 1995.

"Railroad Deregulation, Carrier Behavior, and Shipper Response: A Disaggregated Analysis," *Journal of Regulatory Economics*, December, 1993.

SELECTED BOOK SECTIONS AND CHAPTERS

Encyclopedia of Appalachia, Transportation Section Editor and contributor, University of Tennessee Press, 2006.

"Railroad Operations and Economics," with Wesley W. Wilson in *The Transportation Engineers' Handbook*, McGraw – Hill, forthcoming.

"Shakeout or Shakedown? The Rise and Fall of the CLEC Industry," with David Kaserman and John W. Mayo in *Expanding Competition in Regulated Industries*, Michael A. Crew ed., Klouwer Academic Press, 2002.

"Resale and the Growth of Competition in Wireless Telephony," with David Kaserman and John W. Mayo in *Expanding Competition in Regulated Industries*, Michael A. Crew ed., Klouwer Academic Press, 2000.

SELECTED ADDITIONAL PUBLICATIONS AND MONOGRAPHS

"Passenger and Freight Mobility in Tennessee: An Economic and Policy Overview," *An Economic Report to the Governor of the State of Tennessee: 2011*, Center for Business and Economic Research, The University of Tennessee, January 2011.

Focus, Southeastern Transportation Center, Editorial contributor, Quarterly column, "On the Horizon," Fall 2007-present.

"The Heartland Corridor: Opening New Access to Global Opportunity," with David B. Clarke, Appalachian Regional Commission, February 2009.

Economic Analysis of Coal Waste Disposal: Social, Environmental and Commercial Cost Considerations, Committee on Coal Waste Impoundments, National Academies of Science, (with Michael J. Hicks), 2001.

The Fiscal Implications of Judicially Imposed Surface Mining Restrictions in West Virginia, with Michael Hicks and Calvin Kent, Center for Business and Economic Research, Marshall University, February, 2001.

Coal Production Forecasts and Economic Impact Simulations in Southern West Virginia, with Michael Hicks and Calvin Kent, Center for Business and Economic Impact, Marshall University, June, 2000.

Transportation and the Potential for Intermodal Efficiency Enhancements in Western West Virginia: Phase I, Center for Business and Economic Research, Marshall University, June, 2000.

"Calculating the Value of Upper Mississippi River Navigation: Methodological Review and Recommendations," U.S. Army Corps of Engineers, New Orleans District, February, 1999.

"The Incremental Cost of Capacity in Freight Railroading," U.S. Army Corps of Engineers, St. Louis, Missouri, August, 1998.

"Available Navigation and the Incremental Cost of Railroad Capacity: Preliminary Lessons from the Upper Mississippi Basin, Proceedings of the Agricultural Outlook Forum 98, Washington, D.C., pp. 431-437.

"Available Navigation, Fuel Consumption and Pollution, Abatement: The Missouri River Basin," U.S. Army Corps of Engineers, Omaha, Nebraska, July, 1998.

"Rail Rates and the Availability of Barge Transportation: The Missouri River Basin," U.S. Army Corps of Engineers, Omaha, Nebraska, 1996.

Water-Compelled Railroad Rates and the Calculation of Navigation Project Benefits: A Preliminary Application to the Upper Mississippi River Basin," U.S. Army Corps of Engineers, St. Louis, Missouri, December, 1994

Selected Externally Funded Research (1998 – Present)

Includes only those projects where Prof. Burton served as Principal Investigator and when funding amount exceeded $30,000. Funding amounts indicate project totals. In some instances, significant funds were paid to research partners.

"Tennessee State Freight Plan," External Counsel, Tennessee Department of Transportation, $100,000, "April 2009 – present.

"Economic Impact Analysis for Proposed Infrastructure Initiatives," Kansas City Regional Planning Organization, with TransSystems, $50,000,October 2007 – present.

"Evaluating the Regional Economic Impacts of a Truck - Rail Intermodal Facility in Fayette County, Tennessee," Norfolk Southern Corporation, $52,000, September 2007, with William Fox.

"Assessing the Capacity of Class I Railroads as Related to Soo Locks Navigation Traffic," US Army Corps of Engineers, Huntington District, 34,900, September 2007.

"Strategies for Improving Transportation Access for Children's Health Services In Rural Communities," Children's Health Fund, $138,000, July 2006.

"Developing and Implementing an External Technical Assistance Program for Tennessee's Rural Planning Organizations," Tennessee Department of Transportation, $407,000, October 2006, with Mathew Murray.

"Evaluating Regional Economic Modeling Techniques and Software Alternatives," Tennessee Department of Transportation, $60,000, June 2006.

"Improving the Competitiveness of Appalachian Wood Products Producers through Coordinated Transportation," West Virginia Public Port Authority, $100,000, September 2005.

"Benefit and Cost Allocation for the Tennessee Rail Plan," (with Mathew Murray and Robert Bohm), Tennessee Department of Transportation, $180,000, June 2004.

"Broadband: Informing Public Policy," West Virginia Development Office, June 2004, $50,000.

"An Analysis of Opportunities to Improve Efficiencies Through Enhanced Intermodal Capabilities and Increased Utilization of the Appalachian Development Highway System," September 2002, Rahall Transportation Institute, $257,000.

"Expected Flood Damages to Transportation Infrastructures as a Proportion of Total Event Costs: A Methodological Exploration," August 2002, Rahall Transportation Institute and Tennessee Valley Authority, $94,000, with Michael Hicks.

"Transportation and the Potential for Intermodal Efficiency Enhancements in Northern West Virginia," March 2001, Rahall Transportation Institute and the West Virginia Department of Transportation, $106,000.

"West Virginia Double-Stack Initiative," January 2001, Rahall Transportation Institute and Norfolk Southern Corp., $550,000, with David B. Clarke.

"Modal Choice, Fuel Consumption, and Pollutant Emissions: Soo Locks / The Ohio River Basin, September 2000, US Army Corps of Engineers, Huntington District, $45,000.

"Public Support for the Development of Browns Island," September 2000, West Virginia Public Port Authority, $120,000

"Transportation and the Potential for Intermodal Efficiency Enhancements in Western West Virginia," September 1999, Appalachian Regional Commission, $94,000.

"Calculating the Value of Upper Mississippi River Navigation: Methodological Review and Recommendations," January 1999, U.S. Army Corps of Engineers, New Orleans District, $60,000.

SELECTED CONFERENCE PRESENTATIONS, REMARKS AND TESTIMONY

"Strategies for Improving Transportation Access for Children's Health Services In Rural Communities," American Public Health Association, Washington, DC, November 2007.

"Assessing the Role of Freight Railroads in the Search for Multi-Modal Freight Solutions: The Ghost of Railroads Future," SASHTO, Atlanta, Georgia, August 2006.

"The Goodwin Decision and Its Potential Impacts on Economic Conditions in West Virginia, American Coal Council Annual Meetings, St. Petersburg, Florida, September 2004.

"The Economics of Public-Private Partnerships," Transportation Research Board, Washington, DC, January 2004.

"Improving Access to Rail / Highway Intermodal Transport: Lessons from West Virginia," Transportation Research Board, Transportation and Economic Development 2002, Portland Oregon, May 2002.

"Assessing Transportation-Related External Costs: Valuing Decreases in PM-10 Emissions Due to Mode Switching," Transportation Research Board, Transportation and Economic Development 2002, Portland Oregon, May 2002.

"Measuring the Cost of Incremental Railroad Capacity: A GIS Approach," American Economics Association, Transportation and Public Utilities Group, New Atlanta, Georgia, January, 2002.

"Valuing the Air Quality Impacts of Modal Choice: More Evidence from the Ohio River Basin," Transportation Research Board annual meetings, Washington, DC, January 2001.

"Accurately Capturing the Effects of Transportation-Related Externalities," with Michael A. Newsome, U.S. Army Corps of Engineers Conference on Project Benefit Calculations, Knoxville, Tennessee, July, 2000.

"The Accidental Outcome: Ramsey Prices in Rail Served Markets," Western Economics Association, San Diego, California, July 9, 1999.

"An Alternative Treatment of Shipper Demands for Barge Transportation," U.S. Army Corps of Engineers, Economic Analysis Conference, Portland, Oregon, May, 1999.

"Assessment of Emissions and Fuel Use Changes Resulting from Modal Shifts in the Upper Mississippi River Basin," with Martin E. Lipinski (University of Memphis) and David B. Clarke (Clemson University), to be presented, Transportation Research Board annual meetings, Washington, D.C., January, 1999.

"The Incremental Cost of Railroad Capacity: Evidence from the Upper Mississippi Basin," Agricultural Outlook Forum, February, 1998, Washington, D.C.

"Railroad Capacity and the Transportation of Mined Materials," Mineral Economics and Management Society, annual meetings, Boulder, Colorado, March, 1, 1997.

"Railroad Capacity and the Calculation of Navigation Project Benefits," presented, Transportation Research Board annual meetings, Washington, D.C., January, 1997.

"Keeping Tributaries Open: Measuring a Waterway Segment's Economic Value," Panel Discussion, National Waterways Conference, St. Louis, Missouri, September, 1996.

"Network Externalities as an Incentive for Vertical Integration: Evidence from Surface Freight Transportation," Rutgers Conference on Regulatory Economics, Newport, Rhode Island, May, 1995.

"Equalizing Discrimination and Deregulated Railroad Rates," presented to the Eastern Economic Association, March, 1994, Boston.

"Rail Rates and the Availability of Water Transportation: The Missouri Valley Region," presented to the Southern Economic Association, November, 1993, New Orleans.

"Railroad Deregulation, Carrier Behavior, and Shipper Response," presented to the Southern Economic Association, November, 1991, Nashville, Tennessee.

"Railroad Deregulation and Rail Rates: A Disaggregated Analysis," presented to the Western Economic Association, July, 1991, Seattle.

Referee
Journal of Regulatory Economics

Eastern Economic Journal
Review of Regional Studies
Southern Economic Journal
Telecommunications Policy
Management Research Review

SELECTED ACHIEVEMENTS, HONORS, AND SERVICE ACTIVITIES

Board Member, Tennessee Operation Lifesaver, January 2005 – present.

Marshall University *Distinguished Artists and Scholars Awards* Team Research Award (with Michael Hicks), April 2002.

National Academies of Science, Transportation Research Board, Committee on Agricultural Transportation, January, 2004 – 2010.

National Academies of Science, Transportation Research Board, Committee on Inland Navigation, March, 2004 – present.

American Statistical Association / US Energy Information Administration Joint Committee on Energy Statistics, April 2001 – October 2006.

Board Member, West Virginia Operation Life – Railroad Highway Grade Crossing and Pedestrian Safety Promotional Activities, March, 2000 – June 2004.

Walter Melville Bonham (Dissertation) Fellowship, College of Business Administration, University of Tennessee, Knoxville, August, 1989

J. Fred Holly Excellence in Economics Fellowship, Department of Economics, University of Tennessee, Knoxville, August, 1988

"Outstanding Graduate Teaching Award," The Graduate School, University of Missouri, Columbia, May, 1987

KAUSTUV CHAKRABARTI

Mr. Chakrabarti is a Senior Director of Economic Consulting in the Network Industries Strategies ("NIS") Group of FTI Consulting, Inc., an economic and consulting firm with offices located at 1101 K Street, NW, Washington, DC 20005. Mr. Chakrabarti is sponsoring portions of Section III-D of NS's Reply Evidence. Mr. Chakrabarti has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Chakrabarti holds a Bachelor of Science degree in chemistry and economics from the College of William and Mary. He also has a Master of Arts in applied economics from Johns Hopkins University.

Mr. Chakrabarti has provided economic and financial analysis to the transportation, telecommunications, and energy industries. He has worked on transportation industry analysis to estimate and forecast operating expenses, investment costs, and variable costs. He has applied the Board's URCS regulatory costing model in SAC, Simplified SAC and Three-Benchmark rate cases.

Mr. Chakrabarti's curriculum vitae is attached.

VERIFICATION

I, Kaustuv Chakrabarti, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Kaustuv Chakrabarti

Executed on this ___ day of November, 2012.

Kaustuv Chakrabarti

Senior Director – Economic Consulting

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Education
Master of Arts in Applied Economics from the *Johns Hopkins University*

Bachelor of Science in Chemistry and Economics from the College of William and Mary

Kaustuv Chakrabarti is a Senior Director at FTI Consulting in the Network Industries Strategies group within the Economic Consulting practice in the Washington, DC office. Mr. Chakrabarti conducts economic and financial analysis for primarily the transportation, telecommunications, and energy industries. He holds an M.A. in Applied Economics from the Johns Hopkins University and a Bachelor of Science, majoring in Chemistry and Economics, from the College of William and Mary, and is a CFA (Chartered Financial Analyst) charterholder.

Background

Mr. Chakrabarti has developed analyses in the transportation industry to estimate and forecast operating expenses, investment costs, variable costs, and other income-related elements. He has constructed and utilized databases to analyze operational data and in support of strategic decision-making. He has applied the STB's URCS regulatory costing model and the above analyses in rate cases brought before the STB under the Full SAC, Simplified SAC, and Three-Benchmark standards. He has also conducted valuations of firms or business segments outside of the transportation industry. For these valuations, he analyzed financial statements and other income data to develop various discount cash flow models.

Mr. Chakrabarti has conducted numerous business case analyses for the federal government in voice telephony, information technology, and building construction. In these efforts, he worked with clients to design potential investment solutions; compare the costs, benefits, and risks of each; and identify the optimal solution.

XINGANG CLARK CHENG

Mr. Cheng is the Director of Operations Research at Norfolk Southern Corporation, the parent of Norfolk Southern Railway Company ("NS"), located at 1200 Peachtree Street, Northeast, Atlanta, Georgia 30309. Mr. Cheng has been with NS for seventeen years. He is sponsoring portions of Section III-C of NS's Reply Evidence. Mr. Cheng has signed a verification of the truth of the statements contained therein. A copy of the verification is attached hereto.

Mr. Cheng joined NS in 1995. He became an Industrial Engineer in 1999, Manager of Operations Research in 2001 and Director of Operations Research in 2010. As Director, Mr. Cheng leads the Operations Research group in developing planning tools for locomotive fleet sizing, railcar routing and scheduling, network optimization, railcar fleet planning, yard simulation, crew planning, train scheduling, car distribution and demand forecasting.

Mr. Cheng is a member of the Institute for Operations Research and Management Sciences ("INFORMS"), where he has chaired the Rail Applications Section. He earned a Ph.D. of electrical engineering from the Chinese Academy of Sciences in Beijing and a Ph.D. of industrial engineering from Clemson University in South Carolina.

Mr. Cheng's complete curriculum vitae is attached.

VERIFICATION

I, Xingang (Clark) Cheng, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Clark Cheng

Xingang (Clark) Cheng

Executed on this 12 day of November, 2012.

XINGANG (CLARK) CHENG, PH.D.

5550 Tenbury Way
Johns Creek, GA 30022

Phone: (404) 897-3022
Email: clark.cheng@nscorp.com

Summary

- Managing a group of 40+ highly skilled professionals in operations research (OR) and information technology (IT), including 16 Ph.D.s
- Developed a suite of planning tools for network optimization, train service design, locomotive and railcar fleet planning, crew planning, terminal capacity planning, and demand forecasting
- Providing consulting services and technical support to various departments in dozens of studies and projects
- Built arguably the most innovative and productive OR group in the industry. Most of the tools we developed are far ahead of other railroads
- Strong background in optimization models, computer algorithms, simulation, statistical analysis, programming, and software development
- Proven track record in building full life cycle software products starting from requirements, design, construction to implementation, maintenance and user support
- Published a dozen of academic research papers on peer-reviewed journals and conference proceedings. Presented dozens of times at academic and professional conferences
- Hold two Ph.D. degrees in engineering. Went to college at the age of 15

Professional Experience

1995 - Date, Norfolk Southern Corporation, Atlanta, Georgia

Position History: Director Operations Research, 2010-date; Senior Manager Operations Research, 2004 – 2010; Manager Operations Research, 2001 – 2004; Senior OR Specialist, 1999 – 2001; Industrial Engineer, 1999; Associate Designer, 1996 – 1999; Contract Programmer, 1995

Major Accomplishments at Norfolk Southern

- Leading the OR group in the development of a suite of planning tools for locomotive fleet sizing, railcar routing & scheduling, network optimization, car fleet planning, yard simulation, crew planning, train scheduling, car distribution, and demand forecasting. These tools include:
    - Locomotive Assignment and Routing System (LARS), a locomotive fleet sizing model. It estimates the right fleet sizes in order to meet the forecasted demands. It has been used to support locomotive acquisition decisions.
    - ABC Next Generation: a new railcar routing & scheduling algorithm. It finds the best routes to minimize travel distance, transit time, and intermediate handling.
    - Optimal Blocking Model (OBM): a tool for generating an optimal blocking plan. It can also be used in network optimization to identify the most efficient rail network.
    - Optimal Train Model (OTM), a tool for designing train service plan. It generates an optimal train plan to minimize terminal dwell times and train starts.
    - Strategic Fleet Planning Model (SFPM), a tool for railcar fleet planning. The tool recommends the optimal car supply plan and supports railcar acquisition decisions.
    - Crew Planning Model, a tool for planning crew requirements. It evaluates the impact on crew cost and train delay of the changes in crew call rule and train service plan.
    - Terminal Simulator, a 3-D railroad hump yard simulator and animator. It identifies bottlenecks in a hump yard and evaluates various options to improve yard operations.
    - Empty Car Distribution (CDM), a tool for empty car distribution. It recommends the best strategies for empty car distribution in order to improve equipment utilization.
    - Corporate Traffic Forecast (Delphi), a centralized demand forecast system. The built-in statistical models provide Marketing with the initial volume growth projections.

Major Accomplishments at Norfolk Southern (cont.)

- Created Operating Plan Developer (OPD), an operational planning and network optimization system used to generate new operating plans based on traffic demand and rail network. It has the what-if capability which allows a planner to compare potential plans with prior plans, generate alternative operating scenarios, and quantify the impact of operating plan changes on customer service and operating costs prior to implementation. Originally, when NS rolled out its Thoroughbred Operating Plan (TOP) in 2001, it took almost 19,000 man hours to work through various operating scenarios prior to installation. Today, it takes less than 80 man hours to accomplish these tasks. OPD has enabled NS to analyze and respond quickly to ever changing business conditions and provides NS the competitive advantage over other Class I railroads.
- Developed a detailed discrete-event simulation model with 3-D animation for the automotive mixing center in Chicago where finished vehicles were unloaded, re-shuffled and reloaded for destination. The model had been used to determine the proper yard layout, operating strategies, yard throughput, track capacity, resource utilization, and train schedules.
- Built the NS/Conrail combined rail network prior to the Conrail acquisition in 1999, together with the assistance from the ALK Associates. The combined rail network included the NS network at the time and the NS-portion of Conrail and laid the foundation for developing the blocking plan and train service plan to operate the merged NS/Conrail railroad.

1993 - 1995, Clemson University, Clemson, South Carolina.
Research Assistant, Teaching Assistant, and Lab Assistant, Department of Industrial Engineering

- Developed new stochastic dynamic programming algorithms with applications in project scheduling and production planning for flexible manufacturing systems (FMS)
- Assisted professors in teaching statistics and quality improvement methods, and prepared lab instructions on computer numerical control (CNC), robotics, and computer-aid manufacturing

Education

- Ph.D. in Industrial Engineering, Clemson University, Clemson, South Carolina, 1999
- Ph.D. in Electrical Engineering (Automation), Chinese Academy of Sciences, Beijing, 1989

Computer Skills

- Programming Languages: C/C++, Visual Basic, Perl, SQL, HTML/XML, Java, FORTRAN
- Operating Systems: UNIX, Linux, MS Windows, VMS
- Optimization and Simulation: CPLEX, OPL Studio, ARENA, Automod
- DBMS and Other Software: DB2, Sybase, MS Access, Minitab, SAS, MS Office

Achievements

- 1989 Chinese Academy of Sciences President Award, Chinese Science News, October 31, 1989
- Norfolk Southern Quality Award in 2005 for the successful development of OPD
- Published a dozen of research papers on peer-reviewed journals and conference proceedings; and made dozens of presentations in academic and industry conferences

Professional Activities

- Member of Alpha Pi Mu (Industrial Engineering Honor Society)
- Member of Institute of Industrial Engineers (IIE)
- Member of Institute for Operations Research and the Management Sciences (INFORMS)
- Past Chair, Treasurer and Secretary of the Rail Applications Section of INFORMS
- Track Chairs, Winter Simulation Conference (WSC 2011), Joint Rail Conference (JRC 2012)

KELLY EAKIN

Dr. Eakin is Senior Vice President at Christensen Associates, an economic and engineering consulting firm, located at 800 University Bay Drive, Suite 400, Madison, Wisconsin 53705. Dr. Eakin is sponsoring portions of Section II-B of Norfolk Southern's ("NS's") Reply Evidence on Qualitative Market Dominance discussing the proposed limit price methodology, including NS Reply Ex. II-B-7. Dr. Eakin has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Dr. Eakin has a Bachelor of Arts in history from the University of Texas at Austin and a Ph.D. in economics from the University of North Carolina at Chapel Hill. He is an expert in industrial organization, specializing in the economic analysis of competitive and regulated markets. Dr. Eakin was the project manager and a principal author of the November 2008 and January 2010 Christensen Associates studies of the U.S. freight railroad industry commissioned by the Surface Transportation Board.

Prior to joining Christensen Associates in 1994, Dr. Eakin worked at the U.S. Department of Agriculture. Previously, he was an assistant professor of economics at the University of Oregon. His work has been published in scholarly journals including *The Review of Economics and Statistics*, *Journal of Human Resources*, *The Southern Economic Journal*, and *Regulation*. He is the co-editor of two books, *Pricing in Competitive Electricity Markets* and *Electricity Pricing in Transition*.

Dr. Eakin's complete curriculum vitae is attached.

VERIFICATION

I, B. Kelly Eakin, declare under penalty of perjury that I have read the portions of th Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

B. Kelly Eakin

B. Kelly Eakin

Executed on this 15th day of November, 2012.

B. Kelly Eakin

RESUME

January 2012

Address:

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Academic Background:

Ph.D., University of North Carolina at Chapel Hill, 1986, Economics
Dissertation: Estimating Allocative Inefficiency with a Non-Minimum Cost Function: An Application to U.S. Hospitals
B.A., University of Texas at Austin, 1978, History

Positions Held:

Senior Vice President, Laurits R. Christensen Associates, Inc., 2006-present
Senior Vice President, Christensen Associates Energy Consulting, LLC 2006-present
Vice President, Christensen Associates Energy Consulting, LLC, 2005-2006
Vice President, Laurits R. Christensen Associates, Inc., 1997-2005
Senior Economist, Laurits R. Christensen Associates, Inc., 1994-1997
Economist, U.S. Department of Agriculture, Washington, DC, 1992-1994
Assistant Professor, Department of Economics, University of Oregon, 1985-1992

Fields of Specialization:

Applied Microeconomics, Industrial Organization, Regulation, Environmental and Resource Economics, Health Economics

Professional Experience:

I have been at Christensen Associates since 1994. I specialize in the analysis of competitive and regulated markets. My analyses typically use microeconomics, particularly applied theories of demand and production. I have worked on projects involving energy industries, railroads, postal services, and health care markets. I have provided economic analyses and testimony for regulatory matters and in a major collective bargaining process. I have worked on antitrust and business practice cases. As a Senior Vice President, I manage the practice of Christensen Associates Energy Consulting, a subsidiary of Christensen Associates. My major projects in the energy industries include the development of innovative pricing and service designs, assessment of customer price responsiveness and product choice, and analysis of competitive impacts of restructuring proposals.

Major Projects:

Project Manager, "Update to the Study of Competition in the U.S. Freight Railroad Industry"

Supplemental Report to the U.S. Surface Transportation Board on Capacity and Infrastructure Investment

Project Manager, "A Study of Competition in the U.S. Freight Railroad Industry and Analysis of Proposals that Might Enhance Competition"

Consultant to the U.S. Postal Service on the Pricing of Repositionable Notes

Consultant to Aurora Health Care on proposed new hospitals in Waukesha and Ozaukee counties

Consultant to the U.S. Postal Service on Negotiated Service Agreements

Project Manager, Load Resources and Customer Price Responsiveness Study for the Public Utilities Commission of Texas

Project Manager, Comprehensive pricing strategy project for a retail energy provider in a deregulating Canadian market

Project Manager, New strategies for electricity product development and wholesale pricing for a public power entity

Project Manager, EPRI's Product Mix Model: an analytical tool for retail product design and pricing

Project Manager, Costing and pricing of ancillary services in electricity markets

Project Manager, Real-time pricing of electricity at three major U.S. utilities

Testimony:

Sworn Testimony before Presidential Emergency Board 243 (appointed to resolve ongoing dispute between major freight rail carriers and their unions), National Mediation Board Case Nos. A-13569; A-13570; A-13572; A-13574; A-13575; A-13592, October 13, 2012.

Verified Statement, STB Ex Parte No. 705 *Competition in the Railroad Industry*, May 2011 (with Mark E. Meitzen).

Pre-filed Direct Testimony, Georgia Public Service Commission, In Re: Petition of Infinite Energy Inc., to Enforce Provisions of O.C.G.A. § 46-4-153.1, Docket NO. 30446, January 7, 2010.

Final Report Presentation, *A Study of Competition in the U.S. Freight Railroad Industry and Analysis of Proposals that Might Enhance Competition*, Public Hearing Testimony before the U.S. Surface Transportation Board, November 2008.

Rebuttal Verified Statement, STB Ex Parte No. 657 (Sub-No. 1) *Major Issues in Rail Rate Cases*, June 2006 (with Douglas W. Caves, Mark E. Meitzen and Philip E. Schoech).

Verified Statement, STB Ex Parte No. 657 (Sub-No. 1) *Major Issues in Rail Rate Cases*, May 2006 (with Douglas W. Caves, Mark E. Meitzen, and Philip E. Schoech).

"Entry Regulation in Hospital Markets," Statement before the Committee on Health, Children, Families, Aging and Long Term Care, Wisconsin State Senate, March 1, 2005.

Verified Statement, Docket No. 41191 (Sub-No. 1) *AEP Texas North Company v. The Burlington Northern and Sante Fe Railway Company*, March 2004. (with Douglas W. Caves, Mark E. Meitzen, and Philip E. Schoech).

Written and Oral Cross-Examination Testimony before the Postal Rate Commission, "Experimental Changes to Implement the Capital One Negotiated Service Agreement," Docket MC2002-2, February - March, 2003.

Reports:

Report on Productivity and Compensation, submitted to Presidential Emergency Board 243, National Mediation Board Case Nos. A-13569; A-13570; A-13572; A-13574; A-13575; A-13592, October 10, 2012.

"An Update to the Study of Competition in the U.S. Freight Railroad Industry," prepared for the Surface Transportation Board, January 2010.

"A Supplemental Report to the U.S. Surface Transportation Board on Capacity and Infrastructure Investment," prepared for the Surface Transportation Board, March 2009.

"A Study of Competition in the U.S. Freight Railroad Industry and Analysis of Proposals that Might Enhance Competition: Final Report," prepared for the Surface Transportation Board, November 2008.

"Economic Report on Aurora Health Care's Proposed Medical Center in the Town of Summit, Wisconsin," (with Robert H. Haveman), submitted to the Town of Summit Plan Commission, August 5, 2004.

"Preliminary Blueprint for Addressing Generation Market Power Issues," prepared for the National Rural Electric Cooperative Association and submitted to the Federal Energy Regulatory Commission, February 2004 (with M. Morey).

"Erecting Sandcastles from Numbers: The CAEM Study of Restructuring Electricity Markets – or – A Critique of 'Estimating the Benefits of Restructuring Electricity Markets: An Application to the PJM Region'," Prepared for National Rural Electric Cooperative Association, December 2003 (with M. Morey, L. Kirsch and S. Braithwait).

The Fundamentals of Locational Marginal Pricing (LMP): Examples of Pricing Outcomes on the PJM System, Research Project 057180, EPRI, Palo Alto, December 2003 (with B. Borissov and L. D. Kirsch).

The Role of Demand Response in Electric Power Market Design, prepared for the Edison Electric Institute October 2002 (with S. Braithwait).

Encouraging Demand Participation in Texas Power Markets, A report to the Public Utilities Commission of Texas, August 31, 2002 (with S. Braithwait and L. Kirsch).

Accounting for the Environment in Agriculture, U.S. Department of Agriculture, Economic Research Service, Technical Bulletin 1847, October 1995 (with James Hrubovcak and Michael LeBlanc).

Publications:

"Railroad Performance under the Staggers Act," *Regulation*, Winter 2010-2011 (Vol. 33 No. 4), pp. 32-38 (with A. T. Bozzo, M. E. Meitzen, and P. E. Schoech).

"RTOs and Electricity Restructuring: The Chasm Between Promise and Practice," *The Electricity Journal*, January/February 2005 (with M. Morey and L. Kirsch).

"Demand Response and the FERC Standard Market Design NOPR," *EnergyPulse*, January 8, 2003 (with S. Braithwait).

"Market Monitoring and Market Power Mitigation in FERC'S Proposed Standard Market Design," *EnergyPulse*, December 30, 2002 (with L. Kirsch).

Electricity Pricing in Transition, A. Faruqui and K. Eakin, eds., Kluwer Academic Press, Amsterdam 2002.

"Is Market Based Pricing a Form of Price Discrimination?" in *Electricity Pricing in Transition*, A. Faruqui and K. Eakin, eds., Kluwer Academic Press, Amsterdam 2002.

"Bundling Value-Added and Commodity Services in Retail Electricity Markets," *The Electricity Journal*, December 2000, (with A. Faruqui).

"Summer in San Diego: A Shock for Consumers. An Epiphany for Electricty," *Public Utilities Fortnightly*, September 15, 2000, (with A. Faruqui).

Pricing in Competitive Electricity Markets, K. Eakin and A. Faruqui, eds., Kluwer Academic Press, Amsterdam, 2000.

"Pricing Retail Electricity: Making Money Selling a Commodity," in *Pricing in Competitive Electricity Markets*, A. Faruqui and K. Eakin, eds., Kluwer Academic Press, Amsterdam, 2000.

"Mitigating Price Spikes in Wholesale Markets through Market-Based Pricing in Retail Markets," *The Electricity Journal*, April 2000, (with D. Caves and A. Faruqui).

"Environmental Accounting and Agriculture," in *Global Environmental Change and Agriculture: Assessing the Impacts*, G. Frisvold and B. Kuhn (eds.), Edward Elgar Publishing, 1998, (with James Hrubovcak and Michael LeBlanc).

"CAP Reform: Modelling Supply Response Subject to the Land Set Aside," *Agricultural Economics*, Vol. 17, 1997, (with E. Ball, J. C. Bureau, and A. Somwaru).

"The Utility-Maximizing Self-Employed Physician," *Journal of Human Resource*, Vol. 32, No. 1, Winter 1997, (with James Thornton).

"Union Algebra: Unionization, Productivity and Labor Intensity Restrictions," *Journal of Productivity Analysis*, Vol. 5, No. 1, Spring 1994.

"Do Physicians Minimize Cost? A Comparison of Group and Solo Practices" in *The Measurement of Productive Efficiency: Techniques and Applications*, H. Fried, C. A. K. Lovell, and S. Schmidt (eds.), Oxford University Press, 1993.

"Virtual Prices and a General Theory of the Owner-Operated Firm," *Southern Economic Journal*, Vol. 58, No. 4, April 1992, (with James Thornton).

"Estimating a Non-Minimum Cost Function for Hospitals: Reply," *Southern Economic Journal*, Vol. 58, No. 4, April 1992, (with Thomas Kniesner).

"Allocative Inefficiency in the Production of Hospital Services," *Southern Economic Journal*, Vol. 58, No. 1, July 1991.

"Constructing Confidence Intervals Using the Bootstrap: An Application to a Multi-Product Cost Function," *The Review of Economics and Statistics*, Vol. 72, No. 2, May 1990, (with Daniel McMillen and Mark Buono).

"Branching Restrictions and Banking Costs," *Journal of Banking and Finance*, Vol. 14, No. 4, September 1990, (with Mark Buono).

"Estimating a Non-Minimum Cost Function for Hospitals," *Southern Economic Journal*, Vol. 54, No. 3, January 1988, (with Thomas Kniesner).

"Illegal Immigration," Chapter 3 in *Beating the System: The Underground Economy*, by Carl P. Simon and Ann D. Witte, Boston: Auburn House, 1982.

Industry Conference Presentations and Workshops:

Current Issues Facing the U.S. Freight Railroad Industry, A forum hosted by the Neeley School of Business at Texas Christian University, June 23, 2009

"Efficient Pricing of the Continuum of Risk-Differentiated Retail Electricity Products," *Seminar on Retail Pricing: Successful Retail Products from the People Who Made Them So*, Orlando, FL September 2006

"Concepts and Metrics of Market Power," *Edison Electric Institute Transmission Pricing and Market Design School*, Madison, WI, July 2004, July 2005 and July 2006

"There's a Hole in My Bucket: How a Price Hike Led to a Revenue Loss," *Professional Pricing Society 17th Annual Spring Conference*, San Francisco, CA, May 2006

"Performance Based Regulation for Transmission," *Edison Electric Institute Transmission Pricing and Market Design School*, Madison, WI, July 2004

"Demand Response in Competitive Electricity Markets," *Beyond 2006: Making Competition Work*, Institute for Regulatory Policy Studies, Springfield IL, May 20, 2004

"Fixed Bill: Design and Implementation Issues," *Top Line Revenue Growth for Energy Companies*, Electric Utilities Consultants, Denver, November 2003.

"Is Real Time Pricing a Panacea?" Canadian Energy Research Institute 2003 Electricity Conference, Calgary, October 2003.

Connecting Wholesale and Retail Electricity Markets, Conference Organizer and Chair, Electric Utilities Consultants, Denver, 2002.

"Effective Demand Response," Electric Utility Consultants conference on Connecting Wholesale and Retail Markets, Denver August 2002.

Retail Strategies that Connect Wholesale and Retail Market, Workshop Organizer and Instructor, Electric Utility Consultants conference on Connecting Wholesale and Retail Markets, Denver August 2002.

"What Do We Expect Electricity Markets to Achieve?" Edison Electric Institute Market Design School, Madison, WI, July 2002.

"Pricing Issues in Restructured Electricity Markets," Half-day Workshop Presented to the Public Utility Commission of Texas Staff, Austin, TX, March 2002

The Price Builder's Workshop, Developer, Coordinator, and Co-presenter of EPRI Workshop, December 2001.

"Connecting Retail and Wholesale Electricity Markets," Edison Electric Institute Conference of Market Restructuring, Washington, DC, September 2000.

Retail Pricing for Competitive Power Markets: The Fundamentals of Unbundled Pricing (Course 1), and *Designing Market-Based Retail Prices* (Course 2), Course Developer and Co-presenter, Infocast Conference, September 2000.

The Unbundling and Restructuring of Electricity Prices, Developer and Presenter of EPRI Workshop, July 2000.

"The Challenge of Low Cost Power," presentation at EPRI International Energy Pricing Conference, July 2000.

The *Energy Service Provider in a Competitive Retail Market,* Developer, Coordinator and Co-presenter of EPRI Workshop, May 2000.

"Observations on Market-Based Pricing of Retail Electricity Products," Wisconsin Public Power Inc., November 1999

Market-Based Pricing and the Product Mix Model, Developer, Coordinator and Co-presenter of EPRI Workshop, October 1999.

Pricing for Retail Markets, Developer and Co-presenter of pre-conference workshop, The Center for Business Intelligence Conference on *Pricing Power Products and Services*, October 1999.

"*Building* a Retail Portfolio to Meet Diverse Customer Needs," presentation at The Center for Business Intelligence Conference on *Pricing Power Products and Services*, October 1999.

"*Strategic* Pricing of Retail Products in a Competitive Industry," presentation at American Public Power Association (APPA) *Business and Financial Workshop*, September 1999.

Pricing a Retail Product Mix, Developer, Coordinator and Lead Presenter of EPRI Workshops, June and September 1997; February, March, June, and October 1998; April 1999.

"*Risk* Based Pricing: Creating Value by Sharing Risk," International Business Communication Conference on *Unbundling Retail Rates*, Cambridge MA, September 1998.

"*Creating* a Profitable Product Mix," Electric Utility Consultants *Electric Utility Business Environment Conference*, Denver June 1998.

"*Retail* Applications of the Forward Price Curve," presentations at EPRI Forward Price Curve Workshops, May and September 1997; February 1998.

"*Product* Differentiation, Customer Segmentation and Risk-Based Pricing," EPRI Power Markets and Resource Management, *Making Money in Energy Markets*, Houston, October 1997.

"*Products*, Contracts and Profits," EPRI Power Markets and Resource Management, *Achieving Success in Evolving Electricity Markets*, Indianapolis, 1996.

"*Forward* Plus Spot, Alias Two-Part Real Timer Pricing," EPRI Power Markets and Resource Management, *Advanced Market-Based Products Workshop: Constructing Advanced Pricing Products*, Atlanta, October 1996.

Real Time Pricing, Co-developer and Presenter of EPRI Workshops, May and June 1995.

Academic Seminars and Conference Presentations:

"*The Sources and Distribution of U.S. Class I Railroad Productivity Gains,*" PERC Applied Microeconomics Workshop, Department of Economics, Texas A&M University, February 2011.

"Total Factor Productivity Growth in the U. S. Class I Railroad Industry, 1987-2008," North American Productivity Workshop VI, Rice University, June 2010

"A Study of Competition in the U.S. Freight Railroad Industry and Analysis of Proposals that Might Enhance Competition," *Transportation Research Forum*, Portland, OR March 2009.

"Costs, Rates, and the Exercise of Market Power in the U.S. Freight Railroad Industry," Department of Economics, Rice University, March 2009

"Current Industrial Organization Topics in Regulated and Deregulating Industries"

Seminar, Economics Department, University of Wisconsin, October 2001

"Restructuring Electricity Markets," Maxwell School of Public Policy, Syracuse University, November 2000.

Postal *Service Regulatory Reform*, Session Organizer and Session Chair, American Economic Association Meeting, January 2000.

"Duality Properties of Regulatory Cost Functions," Georgia Productivity Workshop, University of Georgia, November 1996.

"Efficient Pricing of Back Up Electricity Services," Southern Economic Association Meetings, November 1995.

"Environmental Accounting: The Impacts of Agriculture," Association of Environmental and Resource Economists, Boulder, CO, June 1994.

"Using the Bootstrap to Derive the Allocative Inefficiency Measure," Southern Economic Association Meetings, Washington, DC, November 1992; Atlantic Economic Society, ASSA Meetings, Anaheim, CA, January 1993.

"Union Algebra: Evidence on Labor Intensity Restrictions," Southern Economic Association Meetings, New Orleans, LA, November 1990, Winter Meetings of the Econometric Society, Anaheim, CA, January 1993.

"Cost Effects of Chemical-Use Restrictions in Agriculture," Atlantic Economic Association Meetings, Philadelphia, PA, October 1993; Southern Economic Association Meetings, New Orleans, LA, November 1993; Association of Environmental and Resource Economists, Boston, MA, January 1994; Seminars at the University of Wyoming, March 1994, Indiana University, January 1996, and Tulane University, March 1996.

"Do Physicians Minimize Cost? A Comparison of Group and Solo Practices," Southern Economic Association Meetings, San Antonio, TX, November 1998; Atlantic Economic Society, ASSA Meetings, New Orleans, LA, January 1992.

"The Self-Employed Utility-Maximizing Physician," Southern Economic Association Meetings, Nashville, TN, November 1991.

"Non-Negative and Second Best Thoughts about Allocative Inefficiency," Atlantic Economic Association Meetings, Washington, DC, October 1991; Southern Economic Association Meetings, Nashville, TN, November 1991.

"Virtual Prices and a General Theory of the Owner-Operated Firm," Southern Economic Association Meetings, New Orleans, LA, November 1990.

"Modelling and Measuring Biased and Induced Technological Change," Conference on Current Issues in Productivity, Graduate School of Management, Rutgers University, December 1989.

"Constructing Confidence Intervals Using the Bootstrap: An Application to a Multi-Product Cost Function," Southern Economic Association Meetings, San Antonio, TX, November 1988; Winter Meetings of the Econometric Society, Atlanta, GA, December 1989.

"Factor Adjustment Costs in Banking: Evidence from a Dynamic Cost Function," Atlantic Economic Society, ASSA Meetings, New York, NY, December 1988.

"Branching Restrictions and Banking Costs," Seminar at Oregon State University, November 1987; Southern Economic Association Meetings, Washington, DC, November 1987; Seminar at The Federal Reserve Bank of Cleveland, December 1987.

"Estimating a Non-Minimum Cost Function for Hospitals," Southern Economic Association Meetings, New Orleans, LA, November 1986; Winter Meetings of the Econometric Society, New Orleans, LA, December 1986.

"Allocative Inefficiency in the Production of Hospital Services," North American Summer Meetings of the Econometric Society, Duke University, June 1986.

Referee:

American Journal of Agricultural Economics
Contemporary Policy Issues
Economic Inquiry
Economic Review (Federal Reserve Bank of Cleveland)
Empirical Economics
European Journal of Operations Research
Journal of Environmental Economics and Management
Journal of Human Resources
Journal of Industrial Economics
Journal of Productivity Analysis
National Science Foundation
Southern Economic Journal
U.S. Dept. of Health and Human Services, Agency for Health Care Policy and Research

BENTON V. FISHER

Mr. Fisher is Senior Managing Director in the Network Industries Strategies ("NIS") Group of FTI Consulting, specializing in the economic analysis of network industries, including railroad transportation. His business address is 1101 K Street, Suite B100, Washington, DC 20005. Mr. Fisher is sponsoring portions of Sections II-A, III-C, and III-D of Norfolk Southern's ("NS's") Reply Evidence. Mr. Fisher has signed a verification of the truth of the statements contained therein. A copy of the verification is attached hereto.

Mr. Fisher is a graduate of Princeton University where he obtained a Bachelor of Science degree of Engineering, from the Civil Engineering and Operations Research department. He graduated with a concentration in Information and Decision Sciences, and also received a certificate for completing the requirements for the Engineering and Management Systems program. After graduating, Mr. Fisher served as the Deputy Controller for the U.S. Senate re-election campaign for Bill Bradley, and since April 1991 has been employed by FTI Consulting and Klick, Kent & Allen, an economic consulting firm that FTI Consulting acquired in 1998.

Much of the NIS group's work focuses on the economic and financial analysis of network industries, in particular different aspects of transportation. Mr. Fisher has spent more than 19 years involved in the analysis of rates, costs, and service, and the factors that affect them. In the rail industry, he has worked extensively to develop expert testimony before the Surface Transportation Board examining the reasonableness of railroad rates, railroads' applications for mergers and acquisitions, and rulemakings regarding the establishment, evaluation, revision, and implementation of rules and regulations. He has managed the development of expert testimony covering a variety of topics in numerous contract disputes in Federal court or Arbitration, requiring the analysis of economic and operating issues and response to service performance or other claims.

Much of Mr. Fisher's work for the railroad industry has required a detailed understanding of the regulations under which railroads operate, the rules by which rates are evaluated, and the costing approaches and models that are used. He has testified numerous times regarding stand-alone costs and URCS costs (Uniform Railroad Costing System, the STB's general purpose costing system) for individual movements, traffic groups, and entire networks. He has extensive experience with these costing approaches, including the detailed inputs and their sources, and the costing methodologies and formulae.

In addition to the rail industry, Mr. Fisher has been engaged with similar issues and disputes regarding the economic and financial analysis of telecommunications, postal, and energy matters. In those matters, as with rail, he has worked closely with detailed price, cost, and operational data and reviewed cost models and analyzed the sensitivity of multiple economic components, in evaluating rates, costs, and service in a variety of different contexts.

Mr. Fisher's complete curriculum vitae is attached.

VERIFICATION

I, Benton V. Fisher, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Benton V. Fisher

Benton V. Fisher

Executed on this 26 day of November, 2012.

Benton V. Fisher

Senior Managing Director – Economic Consulting

benton.fisher@fticonsulting.com

FTI Consulting
1101 K Street, NW
Suite 8100
Washington, DC 20005
Tel: (202) 312-9100
Fax: (202) 312-9101

Education
B.S. in Engineering and Management Systems, *Princeton University*

Benton V. Fisher is a Senior Managing Director of FTI's Economic Consulting group, located in Washington, D.C. Mr. Fisher has more than 20 years of experience in providing financial, economic and analytical consulting services to corporate clients dealing with transportation, telecommunications, and postal subjects.

North America's largest railroads have retained FTI both to assist them in making strategic and tactical decisions and to provide expert testimony in litigation. FTI's ability to present a thorough understanding of myriad competitive and regulatory factors has given its clients the necessary tools to implement and advance their business. Mr. Fisher has worked extensively to develop these clients' applications for mergers and acquisitions and expert testimony justifying the reasonableness of their rates before the Surface Transportation Board. In addition to analyzing extensive financial and operating data, Mr. Fisher has worked closely with people within many departments at the railroad as well as outside counsel to ensure that the railroads' presentations are accurate and defensible. Additionally, Mr. Fisher reviews the expert testimony of the railroads' opponents in these proceedings, and advises counsel on the necessary course of action to respond.

AT&T and MCI retained FTI to advance its efforts to implement the Telecommunications Act of 1996 in local exchange markets. Mr. Fisher was primarily responsible for reviewing the incumbent local exchange carriers' (ILEC) cost studies, which significantly impacted the ability of FTI's clients to access local markets. Mr. Fisher analyzed the sensitivity of multiple economic components and incorporated this information into various models being relied upon by the parties and regulators to determine the pricing of services. Mr. Fisher was also responsible for preparing testimony that critiqued alternative presentations.

Mr. Fisher assisted in reviewing the U.S. Postal Service's evidence and preparing expert testimony on behalf of interveners in Postal Rate and Fee Changes cases. He has also been retained by a large international consulting firm to provide statistical and econometric support in their preparation of a long-range implementation plan for improving telecommunications infrastructure in a European country.

Mr. Fisher has sponsored expert testimony in rate reasonableness proceedings before the Surface Transportation Board and in contract disputes in Federal Court and arbitration proceedings.

Mr. Fisher holds a B.S. in Engineering and Management Systems from Princeton University.

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TESTIMONY

Surface Transportation Board

January 15, 1999	Docket No. 42022 FMC Corporation and FMC Wyoming Corporation v. Union Pacific Railroad Company, Opening Verified Statement of Christopher D. Kent and Benton V. Fisher
March 31, 1999	Docket No. 42022 FMC Corporation and FMC Wyoming Corporation v. Union Pacific Railroad Company, Reply Verified Statement of Christopher D. Kent and Benton V. Fisher
April 30, 1999	Docket No. 42022 FMC Corporation and FMC Wyoming Corporation v. Union Pacific Railroad Company, Rebuttal Verified Statement of Christopher D. Kent and Benton V. Fisher
July 15, 1999	Docket No. 42038 Minnesota Power, Inc. v. Duluth, Missabe and Iron Range Railway Company, Opening Verified Statement of Christopher D. Kent and Benton V. Fisher
August 30, 1999	Docket No. 42038 Minnesota Power, Inc. v. Duluth, Missabe and Iron Range Railway Company, Reply Verified Statement of Christopher D. Kent and Benton V. Fisher
September 28, 1999	Docket No. 42038 Minnesota Power, Inc. v. Duluth, Missabe and Iron Range Railway Company, Rebuttal Verified Statement of Christopher D. Kent and Benton V. Fisher
June 15, 2000	Docket No. 42051 Wisconsin Power and Light Company v. Union Pacific Railroad Company, Opening Verified Statement of Christopher D. Kent and Benton V. Fisher
August 14, 2000	Docket No. 42051 Wisconsin Power and Light Company v. Union Pacific Railroad Company, Reply Verified Statement of Christopher D. Kent and Benton V. Fisher
September 28, 2000	Docket No. 42051 Wisconsin Power and Light Company v. Union Pacific Railroad Company, Rebuttal Verified Statement of Christopher D. Kent and Benton V. Fisher
December 14, 2000	Docket No. 42054 PPL Montana, LLC v. The Burlington Northern Santa Fe Railway Company, Opening Verified Statement of Christopher D. Kent and Benton V. Fisher
March 13, 2001	Docket No. 42054 PPL Montana, LLC v. The Burlington Northern Santa Fe Railway Company, Reply Verified Statement of Christopher D. Kent and Benton V. Fisher
May 7, 2001	Docket No. 42054 PPL Montana, LLC v. The Burlington Northern Santa Fe Railway Company, Rebuttal Verified Statement of Christopher D. Kent and Benton V. Fisher

October 15, 2001	Docket No. 42056 Texas Municipal Power Agency v. The Burlington Northern Santa Fe Railway Company, Opening Verified Statement of Benton V. Fisher
January 15, 2002	Docket No. 42056 Texas Municipal Power Agency v. The Burlington Northern Santa Fe Railway Company, Reply Verified Statement of Benton V. Fisher
February 25, 2002	Docket No. 42056 Texas Municipal Power Agency v. The Burlington Northern Santa Fe Railway Company, Rebuttal Verified Statement of Benton V. Fisher
May 24, 2002	Docket No. 42069 Duke Energy Corporation v. Norfolk Southern Railway Company, Opening Evidence and Argument of Norfolk Southern Railway Company
June 10, 2002	Docket No. 42072 Carolina Power & Light Company v. Norfolk Southern Railway Company, Opening Evidence and Argument of Norfolk Southern Railway Company
July 19, 2002	Northern States Power Company Minnesota v. Union Pacific Railroad Company, Union Pacific's Opening Evidence
September 30, 2002	Docket No. 42069 Duke Energy Corporation v. Norfolk Southern Railway Company, Reply Evidence and Argument of Norfolk Southern Railway Company
October 4, 2002	Northern States Power Company Minnesota v. Union Pacific Railroad Company, Union Pacific's Reply Evidence
October 11, 2002	Docket No. 42072 Carolina Power & Light Company v. Norfolk Southern Railway Company, Reply Evidence and Argument of Norfolk Southern Railway Company
November 1, 2002	Northern States Power Company Minnesota v. Union Pacific Railroad Company, Union Pacific's Rebuttal Evidence
November 19, 2002	Docket No. 42069 Duke Energy Corporation v. Norfolk Southern Railway Company, Rebuttal Evidence and Argument of Norfolk Southern Railway Company
November 27, 2002	Docket No. 42072 Carolina Power & Light Company v. Norfolk Southern Railway Company, Rebuttal Evidence and Argument of Norfolk Southern Railway Company
January 10, 2003	Docket No. 42057 Public Service Company of Colorado D/B/A Xcel Energy v. The Burlington Northern and Santa Fe Railway Company, Opening Evidence and Argument of The Burlington Northern and Santa Fe Railway Company
February 7, 2003	Docket No. 42058 Arizona Electric Power Cooperative, Inc. v. The Burlington Northern and Santa Fe Railway Company and Union Pacific Railroad, Opening Evidence of The Burlington Northern and Santa Fe Railway Company and Union Pacific Railroad

April 4, 2003	Docket No. 42057 Public Service Company of Colorado D/B/A Xcel Energy v. The Burlington Northern and Santa Fe Railway Company, Reply Evidence and Argument of The Burlington Northern and Santa Fe Railway Company
May 19, 2003	Docket No. 42057 Public Service Company of Colorado D/B/A Xcel Energy v. The Burlington Northern and Santa Fe Railway Company, Rebuttal Evidence and Argument of The Burlington Northern and Santa Fe Railway Company
May 27, 2003	Docket No. 42058 Arizona Electric Power Cooperative, Inc. v. The Burlington Northern and Santa Fe Railway Company and Union Pacific Railroad, Joint Variable Cost Reply Evidence of The Burlington Northern and Santa Fe Railway Company and Union Pacific Railroad
May 27, 2003	Docket No. 42058 Arizona Electric Power Cooperative, Inc. v. The Burlington Northern and Santa Fe Railway Company and Union Pacific Railroad, Reply Evidence of The Burlington Northern and Santa Fe Railway Company
June 13, 2003	Docket No. 42071 Otter Tail Power Company v. The Burlington Northern and Santa Fe Railway Company, Opening Evidence of The Burlington Northern and Santa Fe Railway Company
July 3, 2003	Docket No. 42058 Arizona Electric Power Cooperative, Inc. v. The Burlington Northern and Santa Fe Railway Company and Union Pacific Railroad, Joint Variable Cost Rebuttal Evidence of The Burlington Northern and Santa Fe Railway Company and Union Pacific Railroad
October 8, 2003	Docket No. 42071 Otter Tail Power Company v. The Burlington Northern and Santa Fe Railway Company, Reply Evidence of The Burlington Northern and Santa Fe Railway Company
October 24, 2003	Docket No. 42069 Duke Energy Corporation v. Norfolk Southern Railway Company Supplemental Evidence of Norfolk Southern Railway Company
October 31, 2003	STB Docket No. 42069 Duke Energy Corporation v. Norfolk Southern Railway Company, Reply of Norfolk Southern Railway Company to Duke Energy Company's Supplemental Evidence
November 24, 2003	STB Docket No. 42072 Carolina Power & Light Company v. Norfolk Southern Railway Company, Supplemental Evidence of Norfolk Southern Railway Company
December 2, 2003	STB Docket No. 42072 Carolina Power & Light Company v. Norfolk Southern Railway Company, Reply of Norfolk Southern Railway Company to Carolina Power & Light Company's Supplemental Evidence
January 26, 2004	STB Docket No. 42058 Arizona Electric Power Cooperative, Inc. v. The Burlington Northern and Santa Fe Railway Company and Union Pacific Railroad Company, Joint Supplemental Reply Evidence and Argument of The Burlington Northern and Santa Fe Railway Company and Union Pacific Railroad Company

March 1, 2004	STB Docket No. 41191 (Sub-No. 1) AEP Texas North Company v. The Burlington Northern and Santa Fe Railway Company, Opening Evidence and Argument of The Burlington Northern and Santa Fe Railway Company
March 22, 2004	STB Docket No. 42071 Otter Tail Power Company v. The Burlington Northern and Santa Fe Railway Company, Supplemental Reply Evidence of The Burlington Northern and Santa Fe Railway Company
April 29, 2004	STB Docket No. 42071 Otter Tail Power Company v. The Burlington Northern and Santa Fe Railway Company, Rebuttal Evidence of The Burlington Northern and Santa Fe Railway Company
May 24, 2004	STB Docket No. 41191 (Sub-No. 1) AEP Texas North Company v. The Burlington Northern and Santa Fe Railway Company, Reply Evidence of The Burlington Northern and Santa Fe Railway Company
March 1, 2005	Docket No. 42071 Otter Tail Power Company v. BNSF Railway Company, Supplemental Evidence of BNSF Railway Company
April 4, 2005	Docket No. 42071 Otter Tail Power Company v BNSF Railway Company, Reply of BNSF Railway Company to Supplemental Evidence
April 19, 2005	Docket No. 42088 Western Fuels Association, Inc. and Basin Electric Power Cooperative, Inc. v. BNSF Railway Company, Opening Evidence of BNSF Railway Company
July 20, 2005	Docket No. 42088 Western Fuels Association, Inc. and Basin Electric Power Cooperative, Inc. v. BNSF Railway Company, Reply Evidence of BNSF Railway Company
July 27, 2004	STB Docket No. 41191 (Sub-No. 1) AEP Texas North Company v. The Burlington Northern and Santa Fe Railway Company, Rebuttal Evidence of The Burlington Northern and Santa Fe Railway Company
September 30, 2005	Docket No. 42088 Western Fuels Association, Inc. and Basin Electric Power Cooperative, Inc. v. BNSF Railway Company, Rebuttal Evidence of BNSF Railway Company
October 20, 2005	Docket No. 42088 Western Fuels Association, Inc. and Basin Electric Power Cooperative, Inc. v. BNSF Railway Company, Surrebuttal Evidence of BNSF Railway Company
June 15, 2006	Docket No. 42088 Western Fuels Association, Inc. and Basin Electric Power Cooperative, Inc. v. BNSF Railway Company, Reply Supplemental Evidence of BNSF Railway Company
June 15, 2006	Docket No. 41191 (Sub-No. 1) AEP Texas North Company v. BNSF Railway Company, Reply Supplemental Evidence of BNSF Railway Company
March 19, 2007	Docket No. 41191 (Sub-No. 1) AEP Texas North Company v. BNSF Railway Company, Reply Third Supplemental Evidence of BNSF Railway Company

March 26, 2007	Docket No. 42088 Western Fuels Association, Inc. and Basin Electric Power Cooperative, Inc. v. BNSF Railway Company, Reply Second Supplemental Evidence of BNSF Railway Company
July 30, 2007	Docket No. 42095 Kansas City Power & Light v. Union Pacific Railroad Company, Union Pacific's Opening Evidence
August 20, 2007	Docket No. 42095 Kansas City Power & Light v. Union Pacific Railroad Company, Union Pacific's Reply Evidence
February 4, 2008	Docket No. 42099 E.I. DuPont De Nemours and Company v. CSX Transportation, Inc., Opening Evidence of CSXT
February 4, 2008	Docket No. 42100 E.I. DuPont De Nemours and Company v. CSX Transportation, Inc., Opening Evidence of CSXT
February 4, 2008	Docket No. 42101 E.I. DuPont De Nemours and Company v. CSX Transportation, Inc., Opening Evidence of CSXT
March 5, 2008	Docket No. 42099 E.I. DuPont De Nemours and Company v. CSX Transportation, Inc., Reply Evidence of CSXT
March 5, 2008	Docket No. 42100 E.I. DuPont De Nemours and Company v. CSX Transportation, Inc., Reply Evidence of CSXT
March 5, 2008	Docket No. 42101 E.I. DuPont De Nemours and Company v. CSX Transportation, Inc., Reply Evidence of CSXT
April 4, 2008	Docket No. 42099 E.I. DuPont De Nemours and Company v. CSX Transportation, Inc., Rebuttal Evidence of CSXT
April 4, 2008	Docket No. 42100 E.I. DuPont De Nemours and Company v. CSX Transportation, Inc., Rebuttal Evidence of CSXT
April 4, 2008	Docket No. 42101 E.I. DuPont De Nemours and Company v. CSX Transportation, Inc., Rebuttal Evidence of CSXT
July 14, 2008	Docket No. 42088 Western Fuels Association, Inc. and Basin Electric Power Cooperative, Inc. v. BNSF Railway Company, Third Supplemental Reply Evidence of BNSF Railway Company
August 8, 2008	Docket No. 41191 (Sub-No. 1) AEP Texas North Company v. BNSF Railway Company, Fourth Supplemental Evidence of BNSF Railway Company
September 5, 2008	Docket No. 41191 (Sub-No. 1) AEP Texas North Company v. BNSF Railway Company, Fourth Supplemental Reply Evidence of BNSF Railway Company
October 17, 2008	Docket No. 42110 Seminole Electric Cooperative, Inc. v. CSX Transportation, Inc., CSX Transportation, Inc.'s Reply to Petition for Injunctive Relief, Verified Statement of Benton V. Fisher
August 24, 2009	Docket No. 42114 US Magnesium, L.L.C. v. Union Pacific Railroad Company, Opening Evidence of Union Pacific Railroad Company

September 22, 2009	Docket No. 42114 US Magnesium, L.L.C. v. Union Pacific Railroad Company, Reply Evidence of Union Pacific Railroad Company
October 22, 2009	Docket No. 42114 US Magnesium, L.L.C. v. Union Pacific Railroad Company, Rebuttal Evidence of Union Pacific Railroad Company
January 19, 2010	Docket No. 42110 Seminole Electric Cooperative, Inc. v. CSX Transportation, Inc., Reply Evidence of CSX Transportation, Inc.
May 7, 2010	Docket No. 42113 Arizona Electric Power Cooperative, Inc. v. BNSF Railway Company and Union Pacific Railroad Company, Joint Reply Evidence of BNSF Railway Company and Union Pacific Railroad Company
October 1, 2010	Docket No. 42121 Total Petrochemicals USA, Inc. v. CSX Transportation, Inc., Motion for Expedited Determination of Jurisdiction Over Challenged Rates, Verified Statement of Benton V. Fisher
November 22, 2010	Docket No. 42088 Western Fuels Association, Inc. and Basin Electric Power Cooperative, Inc. v. BNSF Railway Company, Comments of BNSF Railway Company on Remand, Joint Verified Statement of Michael R. Baranowski and Benton V. Fisher
January 6, 2011	Docket No. 42056 Texas Municipal Power Agency v. BNSF Railway Company, BNSF Reply to TMPA Petition for Enforcement of Decision, Joint Verified Statement of Michael R. Baranowski and Benton V. Fisher
July 5, 2011	Docket No. 42123 M&G Polymers USA, LLC v. CSX Transportation, Inc., Reply Market Dominance Evidence of CSX Transportation, Inc.
August 1, 2011	Docket No. 42125 E.I. DuPont De Nemours and Company v. Norfolk Southern Railway Company, Norfolk Southern Railway's Reply to Second Motion to Compel, Joint Verified Statement of Benton V. Fisher and Michael Matelis
August 5, 2011	Docket No. 42121 Total Petrochemicals USA, Inc. v. CSX Transportation, Inc. , Reply Market Dominance Evidence of CSX Transportation, Inc.
August 15, 2011	Docket No. 42124 State of Montana v. BNSF Railway Company, BNSF Railway Company's Reply Evidence and Argument, Verified Statement of Benton V. Fisher
October 24, 2011	Docket No. 42120 Cargill, Inc. v. BNSF Railway Company, BNSF Railway Company's Reply Evidence and Argument, Verified Statement of Benton V. Fisher
October 28, 2011	Docket No. FD 35506 Western Coal Traffic League - Petition for Declaratory Order, Opening Evidence of BNSF Railway Company, Joint Verified Statement of Michael R. Baranowski and Benton V. Fisher
November 10, 2011	Docket No. 42127 Intermountain Power Agency v. Union Pacific Railroad Company, Reply Evidence of Union Pacific Railroad Company
November 28, 2011	Docket No. FD 35506 Western Coal Traffic League - Petition for Declaratory Order, Reply Evidence of BNSF Railway Company, Joint Reply Verified Statement of Michael R. Baranowski and Benton V. Fisher

December 14, 2011	Docket No. 42132 Canexus Chemicals Canada L.P. v. BNSF Railway Company, BNSF Motion to Permit Consideration of 2011 TIH Movements from BNSF Traffic Data in Selecting Comparison Group, Verified Statement of Benton V. Fisher
February 13, 2012	Docket No. 42132 Canexus Chemicals Canada L.P. v. BNSF Railway Company, Opening Evidence of BNSF Railway Company, Verified Statement of Benton V. Fisher
March 13, 2012	Docket No. 42132 Canexus Chemicals Canada L.P. v. BNSF Railway Company, Reply Evidence of BNSF Railway Company
April 12, 2012	Docket No. 42132 Canexus Chemicals Canada L.P. v. BNSF Railway Company, Rebuttal Evidence of BNSF Railway Company
May 10, 2012	Docket No. 42056 Texas Municipal Power Agency v. BNSF Railway Company, BNSF Reply to TMPA Petition to Reopen and Modify Rate Prescription, Joint Verified Statement of Michael R. Baranowski and Benton V. Fisher

U.S. District Court for the Eastern District of North Carolina

March 17, 2006	Civil Action No. 4:05-CV-55-D, PCS Phosphate Company v. Norfolk Southern Corporation and Norfolk Southern Railway Company, Report by Benton V. Fisher

U.S. District Court for the Eastern District of California

January 18, 2010	E.D. Cal. Case No. 08-CV-1086-AWI, BNSF Railway Company v. San Joaquin Valley Railroad Co., et al.

Arbitrations and Mediations

July 10, 2009	JAMS Ref. # 1220039135; In the Matter of the Arbitration Between Pacer International, Inc., d/b/a/ Pacer Stacktrain (f/k/a/ APL Land Transport Services, Inc.), American President Lines, Ltd. And APL Co. Pte. Ltd. And Union Pacific Railroad Company; Rebuttal Expert Report of Benton V. Fisher

ROB FISHER

Mr. Fisher is a Senior Director – Economic Consulting in the Network Industries Strategies ("NIS") Group of FTI Consulting, Inc., specializing in the economic analysis of network industries, including railroad transportation. His business address is 1101 K Street, Suite B100, Washington, DC 20005. Mr. Fisher is sponsoring portions of Sections III-A, III-G and III-H of Norfolk Southern's ("NS's") Reply Evidence. Mr. Fisher has signed a verification of the truth of the statements contained therein. A copy of the verification is attached hereto.

Mr. Fisher earned his Bachelor of Science from Georgetown University and his Master of Business Administration from the University of Michigan. Mr. Fisher spent ten years as a strategy consultant, working for dozens of telecommunications firms on financial analysis, marketing strategy and operational improvement.

At FTI, Mr. Fisher has provided financial and economic consulting services to the transportation, energy and telecommunications industries. Mr. Fisher has participated in multiple Stand-Alone Cost rate cases before the Surface Transportation Board, including providing testimony.

Mr. Fisher's curriculum vitae is attached.

VERIFICATION

I, Rob Fisher, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Rob Fisher

Rob Fisher

Executed on this 28th day of November, 2012.

Rob Fisher

Senior Director – Economic Consulting

Robert.Fisher@fticonsulting.com

FTI Consulting
1101 K Street, NW
Suite B100
Washington, DC 20005
Tel: (202) 312-9100
Fax: (202) 312-9101

Education
MBA (with distinction) from University of Michigan

BS from School of Foreign Service at Georgetown University

Rob Fisher is a senior director in the Network Industries Strategies group of the FTI Economic Consulting practice and is based in Washington, D.C. Mr. Fisher provides financial and economic consulting services to the transportation, energy and telecommunications industries.

Mr. Fisher has developed expert testimony for railroad clients in litigation disputes involving the delivery of large coal shipments to energy customers. He also has directed financial analysis to demonstrate the reasonableness of railroad rates before the Surface Transportation Board, including leading the analysis for the first small-shipper case before the Board.

In addition, Mr. Fisher has supported a consortium of manufacturers to gain anti-leakage provisions in the pending greenhouse gas legislation. His report, which measured the energy and trade intensity and the emissions of each industry, has been entered into Congressional testimony.

Prior to joining FTI, Mr. Fisher worked for two technology companies, most recently as Vice President of Strategic Marketing, where he held P&L responsibility for the company's largest product. Before that, he spent 10 years as a strategy consultant, working with dozens of telecom clients on financial analysis, marketing strategy and operational improvement.

Mr. Fisher holds an M.B.A. (with distinction) from the University of Michigan and a B.S. from the School of Foreign Service at Georgetown University.

TESTIMONY

Surface Transportation Board

May 7, 2010	Docket No. 42113 Arizona Electric Power Cooperative, Inc. v. BNSF Railway Company and Union Pacific Railroad Company, Joint Reply Evidence of BNSF Railway Company and Union Pacific Railroad Company
November 10, 2011	Docket No. 42127 Intermountain Power Agency v. Union Pacific Railroad Company, Reply Evidence of Union Pacific Railroad Company
September 24, 2012	Docket No. 42130 SunBelt Chlor Alkali Partnership v. Norfolk Southern Railway Company, Norfolk Southern Railway Company's Motion to Hold Case in Abeyance Pending Completion of Rulemaking, Verified Statement of Robert O. Fisher

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RANDALL G. FREDERICK

Mr. Frederick is a Project Manager/Senior Engineer/Associate with STV Inc., a professional firm offering engineering, architectural, planning, environmental and construction management services with offices at 5200 Belfort Road, Suite 400, Jacksonville, Florida 32256. Mr. Frederick has more than 30 years of experience as a project manager and senior engineer managing underground wireline and pipeline utility installations and construction engineering and inspection ("CE&I") services for highway and railway bridges and tunnels. Mr. Frederick is sponsoring portions of Section III-F of Norfolk Southern's ("NS's") Reply Evidence relating to Earthwork. Mr. Frederick has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

As a former CSX Principal Engineer, Mr. Frederick functioned as the primary representative in the mediation of legal proceedings, public safety issues, and other politically sensitive railroad-related matters. He managed the system and network of the company's Computer Aided Dispatching System ("CADS"), Rail-Highway Grade Crossing Warning Systems, and Incremental Train Control Signaling ("ITCS"). Mr. Frederick holds a Bachelor of Arts degree in business administration from Cedarville University.

Mr. Frederick's complete curriculum vitae is attached.

VERIFICATION

I, Randall G. Frederick, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Randall G. Frederick

Executed on this 19 day of November, 2012.

Randall G. Frederick

Project Manager/Senior Engineer
Associate

Mr. Frederick, the office manager for STV's office in Jacksonville, FL, has more than 35 years of experience as a project manager providing construction engineering and inspection (CE&I) services for highway and railway bridges and tunnels. As a former CSX Principal Engineer, he was responsible for management and administration of publicly funded projects in Ohio, Pennsylvania, West Virginia, Virginia, Maryland, and Washington, D.C. Mr. Frederick functioned as the primary representative in the mediation of legal proceedings, public safety issues, and other politically-sensitive railroad-related matters. He managed the system and network of the company's Computer Aided Dispatching System (CADS), and provided guidance for Rail-Highway Grade Crossing Warning System designs and other publicly funded projects.

Office Location
Jacksonville, FL

Date joined firm
9/12/05

Years with other firms
30

Education
Bachelor of Arts, Business Administration; Cedarville University (1987)

Training
FRA Roadway Worker

Environmental and Industrial Safety Course

AREMA Highway Crossing Interconnection

Memberships
NCUTCD Railroad & Light Rail Transit Highway Grade Crossings Technical Committee

Computer Skills
MS PowerPoint, MS Project, MS Access

Project Experience

RAIL

CSX I-370 Bridge Widenings - Construction Manager
Managing CE&I services for the widening of dual highway bridges on I-370 over the CSX right-of-way in Derwood, MD. Mr. Frederick is preparing estimates, coordinating with CSX personnel, and managing the budget. (2006 - Present)

CSX Public Projects GEC Management – Project Manager
Supervising the engineering review, administrative and contract handling, and estimate preparation for third-party overhead bridge and at-grade crossing projects. Mr. Frederick is responsible for ensuring strict compliance with CSX criteria, specifications, and standards. His responsibilities include reviewing CSX operating requirements, railroad force account development, contract management, construction management, and project budget oversight. (2005 – Present)

CSX Wireline and Pipeline Installations - Construction Manager
Managing multiple underground wireline and pipeline utility installations across CSX property in 23 states, some of which go under and others parallel to the CSX right-of-way. Mr. Frederick is preparing estimates, coordinating with CSX personnel, and managing the project budgets. (2005 - Present)

CSX Railroad Bridge over Asbury Road Rehabilitation - Project Manager
Managing preliminary engineering reviews and development of railroad force account estimates and contract management for the rehabilitation of a

single-span railroad bridge over Asbury Road at Erie International Airport in Erie, PA. Mr. Frederick coordinated with CSX personnel and managed the budget until the project was cancelled. (2006 - 2012)

CSX Montgomery Sanitary Sewer Installation - Project Manager
Managed CE&I services for the micro-tunneling and installation of a 96-foot sanitary sewer beneath the CSX main line tracks in Montgomery, AL. Mr. Frederick prepared estimates, coordinated with CSX personnel, and managed the budget. (2007 – 2008)

Republic of China Ministry of Rail ITCS Signal System - Designer
Served as a member of the design management team for a state-of-the-art, GPS-based, ITCS system on 1,400 km of rail line between Beijing and Tibet for the Republic of China's Ministry of Rail. Mr. Frederick led a team of engineers and CAD designers in the application engineering department of GE Transportation Systems in Jacksonville, FL, to ensure on-time project completion within pre-established budgetary constraints. (2004 - 2005)
Performed while employed by GE Transportation Systems.

GE Transportation Systems - Signal Engineer
Directed oversight and management of the grade crossing warning system and as-in-service train control projects. This position required solid knowledge and experience in railroad signal design; inspection and installation; Federal Railroad Administration, Federal Highway Administration, and Manual on Uniform Traffic Control Devices standards; as well as a thorough understanding of the federal (ISTEA/TEA-21/SAFETEA-LU) funding programs. (2000 - 2005)

CSX Public Projects - Former Principal Engineer, Public Projects
Oversaw project management and administration of publicly funded projects, within a 11-state area including Ohio, Michigan, Indiana, Illinois, Pennsylvania, Kentucky, Tennessee, West Virginia, Virginia, Maryland, Washington, D.C., and Ontario, Canada. Mr. Frederick monitored, scheduled, and coordinated key project milestones necessary for successful implementation. His responsibilities necessitated close interaction, communication, and negotiation with state and local government authorities for review and execution of contractual agreements. The position required detailed knowledge and application of state and federal laws and regulations, as they relate to railroad operations, permitting, and associated issues. He periodically appeared as the railroad's expert witness for grade crossing accident and Public Utility Commission hearings and litigation. Mr. Frederick also functioned as the railroad's primary representative in the mediation of legal proceedings, public safety issues, and other politically-sensitive railroad-related matters. (1994 - 2000)

CSX Technology - Former Software Engineer
Managed the system and network of the company's CADS in Jacksonville, FL. His duties included system monitoring, performance tuning, supervision, implementation and management of software/hardware upgrades, and

disaster recovery planning within a high-volume, mission-critical operation. (1992 - 1994)

CSX Technology - Former Electronic Signal Technician
Coordinated and implemented new software to update CADS in Jacksonville, FL. His duties included managing and directing field personnel in the identification, analysis, and resolution of signal code system problems. (1988 - 1992)

CSX Technology - Former Division Signal Maintainer
Performed signal design, installation, maintenance, and electronic trouble shooting of automatic signal and grade crossing warning systems in Newark, OH. (1974 - 1988)

ROBERTO J. GUARDIA

Mr. Guardia is a Vice President with Shannon & Wilson, Inc., a consulting firm dedicated to providing a full range of geotechnical and environmental engineering services located at 13400 Sutton Park Drive South, Suite 1401, Jacksonville, Florida 32224. Mr. Guardia is a geotechnical engineer with 25 years of experience including the last 18 years in tunneling, microtunneling and horizontal directional drilling projects. Mr. Guardia is sponsoring portions of Section III-F of Norfolk Southern's ("NS's") Reply Evidence relating to Tunnels. Mr. Guardia has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Guardia has been involved in the construction and rehabilitation of over 150 tunnels in the U.S. and overseas. Other areas of expertise include tunnel support, grouting, and shotcrete. He has been Resident Engineer for the enlargement of approximately 25 railroad tunnels. Mr. Guardia has served as Project Manager for the design and plans and specifications for construction, enlargement and rehabilitation of railroad, highway and conveyance tunnels. Mr. Guardia has both a Bachelor of Science degree in civil engineering and a Master of Science degree in (geotechnical) civil engineering from the University of Illinois.

Mr. Guardia's complete curriculum vitae is attached.

VERIFICATION

I, Roberto J. Guardia, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

R J Guardia

Roberto J. Guardia

Executed on this 12 day of November, 2012.

Roberto J. Guardia, PE | Vice President

GEOTECHNICAL ENGINEER

EDUCATION

MS, (Geotechnical) Civil Engineering, University of Illinois, 1978
BS, Civil Engineering, University of Illinois, 1976

REGISTRATION

Professional Engineer, Washington, 26086, 1989
Professional Engineer, Oregon, 66833PE, 2001
Professional Engineer, California, C63333, 2002
Professional Engineer, Florida, 63761, 2006
Professional Engineer, Georgia, PE032289, 2007
Professional Engineer, Alabama, 30515
Professional Engineer, South Carolina, 27552
Professional Engineer, Panama, 81-006-053, 1981
Approved Examiner and Trainer for American Concrete Institute Shotcrete Nozzlemen Certification

ADDITIONAL TRAINING

Health and Safety Training for Hazardous Waste Operations (40-Hour 29 CFR, 1910.120)
Short Course - Applied Rock Mechanics, ASCE, 1998
Short Course – Deep Foundations, Deep Foundation Institute, 1993
Short Course – Mechanical Excavation and Ground Support, Colorado School of Mines, 1994
Short Course- Project Delivery System, Transpeed, 2001
Various Short Courses organized by the Seattle Section of ASCE

Roberto Guardia is a geotechnical engineer with 25 years of experience including the last 18 years in tunneling, microtunneling and horizontal directional drilling projects. Roberto has been involved in the construction and rehabilitation of over 150 tunnels in the US and overseas. Other areas of expertise include tunnel support, grouting, and shotcrete. He has been Resident Engineer for the enlargement of approximately 25 railroad tunnels. Mr. Guardia has served as Project Manager for the design and plans and specifications for construction, enlargement and rehabilitation of railroad, highway and conveyance tunnels including the Elk Creek, Cape Creek and Edwards Tunnels for ODOT.

Microtunneling

Health Ministry/ Nippon Koei, Panama, Sewer Collection Tunnel, Panama City, Panama. As Project Geotechnical Manager, Roberto provided Geotechnical services for the 8-kilometer 3.0-meter diameter sewer collector tunnel. The first phase of exploration included 22 deep borings up to 40 meters deep in soil and rock and a preliminary engineering report of conditions encountered and recommendations for design and tunneling machine selection. The rock samples were characterized by performing unconfined compressive strength tests, tri-axial tests, point load tests and slake durability tests. In-place permeability tests were performed at the bottom of the boreholes utilizing packer tests. The second phase included 42 deep borings to further explore difficult areas and included the preparation of tunneling specifications and a Geotechnical

Baseline Report for the Design-Build project. Tunneling machine is an earth pressure balance tunneling machine and support provided with a segmental concrete lining.

King County, Henderson Combined Sewer Overflow (CSO), Seattle, Washington. A 1,000-foot segment of the project consisted of a 72-inch-diameter concrete pipe that was installed by microtunneling under an eight-lane section of Interstate-5 and the BNSF and Union Pacific Railroad corridor into Seattle. Three-dimensional tomography methods were utilized to identify potential obstructions. Horizontal directional drilling was used to install three 4 ½-inch high-density polyethylene (HDPE) pipes around the future tunnel to run the tomography probes. Roberto managed the exploration program, prepared a geotechnical baseline report, and plans and specifications related to the 72-inch crossing. Obstructions found during tunneling confirmed the anticipated obstructions identified by the three-dimensional tomography.

King County, Henderson Combined Sewer Overflow (CSO), Seattle, Washington. Roberto was Project Manager assisting Construction Management Team in reviewing geotechnical related submittals, weekly progress meetings, assessing construction methods, special inspections for shotcrete supported circular shafts and monitoring and analyzing ground behavior while tunneling under two important water mains. The 3,500-foot-long, 15-foot diameter storage tunnel was excavated with an earth pressure balance machine and supported with gasketed segmental liner. Compaction grouting was utilized for an area of excessive ground settlement and as a precautionary measure under the main waterlines. Five microtunnels ranging from 48- to 78-inch-diameter and up to 750 feet long were part of the project connecting between shafts.

Bonneville Power Administration, Pipe Jacking, Vancouver, Washington. As Project Engineer, Roberto provided design and plans and specifications for the construction of a 48-inch pipe jack to replace an existing distressed concrete pipe at the Cold Creek diversion pipeline of the Bonneville Power Administration in Vancouver. The design-construct contract was structured to allow concrete, fiberglass, and steel pipe as alternates. A Data Report and a Baseline Report were provided as part of the project documents. Lateral loads were provided for the design of three shafts up to 80 feet deep connecting the three segments of the 2,250 feet long pipeline. Provided Engineer's cost estimate, submittal review, and overseeing construction activities with participation in progress meetings as required. A slurry excavation microtunneling machine and a closed shield machine were used simultaneously in different segments.

Burns & McDonnell, Lake Ft. Smith Water Supply Intake Works, Fort Smith, Arkansas. The water supply intake structures consisted of an intake tower built in a shaft on the shore of Lake Ft. Smith, a 1,300 feet long multi-use tunnel and outlet portal structure. The shaft and tunnel were excavated by drill and blast methods and supported by steel fiber reinforced shotcrete and rock dowels. The tunnel was lined with cast-in-place concrete and will be used for flood control discharge. There are two water supply pipes below the invert of the tunnel. Two lake taps of 72-inch-diameter and 300 feet aggregate length were excavated from the intake shaft below lake level utilizing microtunneling methods. Roberto served as Project Manager/Designer for this project preparing plans and specifications.

Cascade Water Alliance, Waterline Central Segment, Seattle, Washington The Cascade Water Alliance, composed by several utilities and cities of eastern Seattle are building a new 42-inch diameter waterline to meet the needs of the growing east side communities. The 10-mile long Central segment has four undercrossings that will be excavated by microtunneling methods installing 48 to 56-inch diameter casings. Obstacles include a BNSF railroad line/ Jenkins Creek, four-lane with median SR-18, Little Soos Creek and a major avenue Kent-Kangley Road. Roberto was Project Manager for the exploration consisting of eight borings and Geotechnical recommendations for the new crossings with lengths between 135 to 355 feet utilizing microtunneling methods. Slug tests in cased boreholes were conducted to estimate the groundwater inflow during dewatering of the alluvial deposits at Jenkins Creek. Both slurry pressure balanced and auger microtunneling methods were recommended. Recommendations were provided for shafts, thrust blocks and construction dewatering.

City of Seattle Duwamish River Crossing, Seattle, Washington. As Project Engineer, Roberto provided submittal reviews for two 80-foot-deep frozen ground shafts and 10-foot-diameter concrete pipes installed by pipe-jacking with a slurry-circulation microtunneling machine. The 540-foot-long crossing traversed saturated silts and fine sands. Participated in construction monitoring during the difficult shaft construction due to freeze-pipe complications and evaluated instrumentation including inclinometer/magnetic switch extensometers, piezometers, and thermistor strings.

City of Everett, I-5 Crossing, Everett, Washington. Roberto was Project Engineer for a 60-inch steel pipe jacked under I-5 near Everett. Provided construction monitoring during chemical grouting of the heading material consisting of soft organic soils and hydraulically placed fill. Performed cube compression test on grouted sand samples. The pipe was jacked with an open face shield and spoils removed with an auger.

City of Kennewick, Kennewick Treatment Plant, Kennewick, Washington. Roberto was Project Engineer for the design, plans, and specifications for 10-foot-diameter jacked steel pipe crossing a BNSF mainline embankment. Also provided the engineer's cost estimate and lateral pressures for the design of the reaction shoring. The 160 feet long pipe jack will be used to convey a 2-foot-diameter treated sewer line and pedestrian traffic.

BNSF, Pipe Jacking, Tacoma, Washington. As Project Engineer, Roberto reviewed submittals and provided partial construction monitoring for a 540-foot-long, 68-inch-diameter steel pipe jacked under a BNSF railyard in Tacoma. The tunnel was driven with a slurry microtunneling machine excavating through consolidated silts, sands, and clays with the ground water located 3 feet below the ground surface. Logs were encountered in the course of the excavation, which were crushed by the slurry machine. The project was completed without significantly disturbing the railyard tracks as verified by survey settlement points.

Tunnels

CSX Transportation, National Gateway Initiative Project, Pennsylvania, West Virginia and Maryland. Roberto served as Project Manager for the National Gateway Project that included double-stack container clearance improvements for seven tunnels in Phase 1 of the project. Roberto coordinated the work of three full time Tunnel Resident Engineers and other rotating staff providing Construction Management services. Clearance improvement work included notching of concrete and brick liners and removal and replacement of existing brick liners with shotcrete and rock dowels or steel sets.

Oregon Department of Transportation, In-Depth Tunnel Inspections, Oregon. As Project Manager, Roberto performed in-depth tunnel inspections of nine highway tunnels in Oregon and provided tunnel inspection training to their engineering and maintenance personnel. The inspection reports had detailed information regarding tunnel design and detailed tunnel maps. Tunnel portals, adjacent slopes, and tunnel drainage systems were also evaluated during the tunnel inspections. Recommendations were provided for immediate, short-term and long-term maintenance and the scope and budget of the anticipated repairs. A tunnel inspection training manual was prepared with basic tunnel design concepts, descriptions of tunnel liners, and specific tunnel inspection procedures adapted to each kind of tunnel liner. One-day and half-day long training seminars were developed for engineering and maintenance personnel respectively. The seminars included examples of liner distress for various kinds of liners, as identified during the tunnel inspections, and discussion of tunnel maintenance and rehabilitation recommendations for each tunnel.

Washington State Department of Transportation, Interstate 90 Tunnel Feasibility, Hyak, Washington. Roberto was Project Manager for the feasibility study and preliminary cost estimate for the 3,000-feet long, 36-foot wide roadway twin tunnels through volcanic and sedimentary rocks. Geologic reconnaissance of the portals and terrain over the tunnel alignment provided basic geologic information that was used in the preliminary rock support design. The preliminary design of the 190 foot high west portal rock cut was developed based on existing topography and existing highway constraints. An engineer's cost estimate was developed for construction of the tunnel and portals based on unit costs and estimated quantities. A geotechnical exploration program for final design including core drilling along the alignment and portals and the use of the boring optical televiewer and a pilot bore along the tunnel alignment was developed.

Oregon Department of Transportation, Cape Creek Tunnel Rehabilitation, Florence, Oregon. Roberto was Project Manager for the geotechnical investigation, testing, design, plans, specifications, and construction observation for Cape Creek Tunnel Rehabilitation. The 714-foot-long tunnel built in 1933 has approximately 450 feet of timber lining that was later covered with a reinforced concrete lining. The rest of the tunnel was left unlined. Geotechnical investigations included drill probes through the concrete lining and six coreholes drilled through the arch form within the tunnel to a depth of 25 feet. The concrete linings were also tested with ground penetration radar and sonic testing to determine the strength and thickness of the lining, and to get an indication of loose rock and voids above the lining. The investigation found that a segment of the concrete lining had areas of thinner concrete and signs of distress and corrosion with high rock loading. The lining near the south portal was designed for replacement with lattice girders and shotcrete and cement grouting in the tunnel arch. The rest of the concrete linings will be backfilled with lightweight grout to fill the existing voids. The unlined areas will be supported with rock bolts and shotcrete.

Union Pacific, Clearance Improvements for Double-Stack Cars of Coos Bay Tunnels, Oregon. Roberto is Project Manager for the ongoing evaluation of 9 tunnels in the Coos Bay area to determine preliminary feasibility and construction costs for providing double-stack container car clearance. The condition of the tunnels was assessed and surveyed cross-sections were evaluated to determine the depth of tunnel clearance required by location. Concrete notching, complete timber set removal with new tunnel support and track lowering are under consideration to obtain the clearance improvements.

RailAmerica, Tunnel 13, Siskiyou, Oregon. Tunnel 13 had extensive damage due to a fire and after rehabilitation there were two segments of the tunnel that did not meet State requirements for vertical and side clearance. Roberto was Project Manager for determining the impediments by laser survey and developing the design and specifications for the tunnel clearance improvements. Existing steel sets had to be removed and replaced with new steel sets located in a new centerline. The work involved the use of steel fiber reinforced shotcrete, steel dowels and new steel sets. We also participated during construction with submittal review and construction observation on a full-time basis.

Union Pacific Railroad, Tunnel No. 2, Keddie, California. Roberto served as resident engineer for the mining of a collapsed tunnel in foliated schist providing additional support with spilling, grouting and shotcrete as required for the Union Pacific Railroad. A top heading excavation method was utilized in a portion of the tunnel that collapsed up to the ground surface. Liner consisted of steel sets and channel lagging backfilled with concrete.

Union Pacific Tunnel Clearance Improvements, Feather River and Fremont, California. Roberto served as resident engineer for notching railroad tunnels to improve clearance. Notching was performed with a roadheader mounted on a rail car. Resin encapsulated rock bolts were installed through the existing concrete liners to provide additional liner support or to replace existing rock bolts located in the notched area. Responsible for measuring air flows and toxic gases during the operation. Notching was performed in 10 tunnels located in the Feather River Canyon and one tunnel in Fremont.

Southern Pacific, Tehachapi Tunnel Clearance Improvement Project, Caliente and Tehachapi, California. Roberto served as resident engineer for this project. Twelve tunnels between Caliente and Tehachapi were enlarged to accommodate double-stack container trains. The work consisted of installing crown rock bolts and sidewall tiebacks, pumping cement grout behind the concrete liner to fill voids, and notching with a roadheader.

Conrail, Tunnel Enlargement, Gallitzin, Pennsylvania. The brick liner of the 3,600-foot-long tunnel was removed and the tunnel enlarged from a single-track to a double-track configuration. Coal mines were present over the tunnel and caused several collapses. Support consisted of rock dowels and pre-stressed rock bolts with steel-fiber-reinforced wet mix shotcrete. Provided construction management services and supervised six engineers and technicians on three shifts per day. Roberto served as Resident Engineer.

ICF-Kaiser, Berry Street Tunnel Rehabilitation and Enlargement Project, Pittsburgh, Pennsylvania. The project involved enlargement of a 100-year-old brick railroad tunnel and conversion to a bus tunnel, excavation of shale and sandstone, lattice girder, shotcrete and rock dowel support, and new drainage systems. Roberto collaborated in the design approach, plans and specifications, engineer's cost estimate, and Geotechnical Design Summary Report. He also reviewed contractor's value engineering proposal.

La Nacional, Loma Larga Tunnels, Monterrey, Mexico. Project Manager for alternate design and blasting recommendations for the construction of the tunnels. The 2,350 feet long twin highway tunnels have a semi-circular shape with a horizontal diameter of 58 feet making it a large underground cavern. Reviewed available borings and site geology and provided design for various support categories based on the RMR and Q methods. Proposed liner was of fiber-reinforced shotcrete and rock bolts in lieu of the original design of wire mesh and plain shotcrete. Further analysis of the benefits of utilizing rock bolt was conducted by numerical methods (FLAC). Provided tunnel blasting recommendations for optimizing drillhole diameter, spacing and blast sequence of the benched heading. The perimeter of the tunnel was blasted by innovative smooth blasting methods.

Wheeling & Lake Erie, Robertsville Tunnel Rehabilitation, Robertsville, Ohio. The 550-foot-long railroad tunnel supported by timber sets has erodible shales, which weaken the sidewalls and requires continuous ditch maintenance. Roberto served as Project Manager and provided field investigation and alternative recommendations with cost estimates followed by plans and specifications for shotcreting the sidewalls and providing shotcrete and rock bolt support to one portal and a new portal excavation.

Oregon Department of Transportation (DOT), Elk Creek Highway Tunnel, Elkton, Oregon. Roberto was Project Manager for the rehabilitation of the 1,150 feet long Elk Creek highway tunnel. Performed tunnel exploration by probes through wood liner and ground penetration radar methods. Accomplished geological mapping and rock mass classification of the tunnel including Schmidt rebound hammer and point load testing of the rock. Developed design of tunnel ground support for the new clearance envelope, consisting of fiber-reinforced shotcrete, rock bolts, lattice girders, and steel sets. Prepared plans and specifications for Oregon DOT for the ground support and portal structures. Included engineer's cost estimate, which was within 10 percent of successful bidder's proposal.

BNSF, Tunnel Enlargement, Martinez, California. As Project Manager, Roberto provided preliminary design and cost estimate for the enlargement of three tunnels in Martinez. The concrete-lined tunnels were enlarged in 1989 for double stack clearance by performing notches that exceeded 2 feet and undercutting. The proposed notching is to achieve Chrysler car clearance. The work will involve notching with a road header and installing new resin-grouted rock bolts above and below the new notch.

Union Pacific, Clearance Improvement Program of the Donner Pass Tunnels, Sacramento, California to Reno, Nevada. As Project Manager, Roberto prepared plans and specifications for enlarging 25 tunnels for double stack and Chrysler car clearance. Several of the tunnels will require remining or undercutting. Prior to notching with a road header the tunnels will be grouted and reinforced with rock bolts. Construction costs were estimated in the order of $12 million.

BNSF, Ostrander Tunnel Rehabilitation, Kelso, Washington. The timber set and lagging supported tunnel was burned to ashes after a forest fire. The 430-foot-long tunnel built in vesicular basalt was literally cooked by the fire and had to be scaled by mechanical methods. Final support was achieved with the installation of resin-grouted rock bolts and steel fiber-reinforced shotcrete. Bidding documents were prepared in an accelerated schedule and the work was completed in 28 working days. Roberto was Project Manager.

Puget Sound Energy, Lower Baker Tunnel In-Depth Inspection, Concrete, Washington. The Lower Baker Tunnel has had a long history of water flows on the downstream abutment partially originating from the concrete lined tunnel. When the 22-foot-diameter tunnel is dewatered inflows are in the order of 800 gallons per minute originating in cracks and previously installed grout pipes. The tunnel was mapped indicating existing cracks, construction joints, and areas of seepage and leaks. Nondestructive testing consisting of ground penetration radar and sonic/ultrasonic methods were utilized to determine the extent of poor concrete and the location of voids in the concrete and between the concrete and rock. Probe holes drilled through the concrete liner verified and calibrated the ground penetration radar and sonic measurements. Roberto served as Project Manager for this project.

Puget Sound Energy, Lower Baker Tunnel Rehabilitation, Concrete, Washington. Roberto served as Project Manager for this project. Based on the results of the Lower Baker Tunnel In-Depth Inspection, a rehabilitation program was implemented consisting of cement and chemical grouting of voids behind the concrete liner and within the concrete liner. A valve attached to a steel plate anchored to the concrete was used to seal one grout pipe that was leaking approximately 300 gallons per minute. Once the flow was stopped, polyurethane grout was injected into the grout pipe successfully stopping the flow. Significant cracks were grouted through holes drilled into the liner. Other work consisted of surface repairs of cavitation areas and sealing cracks on the surface.

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PROFESSIONAL ASSOCIATIONS

American Society of Civil Engineers
American Shotcrete Association; Individual Member
American Railway Engineering and Maintenance of Way Association; Associate Member

MICHAEL P. HEDDEN

Mr. Hedden is Managing Director in the Real Estate Solutions Group of FTI Consulting, specializing in providing valuation and appraisal of industrial, commercial, residential, real, and special purpose property. His business address is 750 Third Avenue, 27th Floor, New York, New York 10017. Mr. Hedden is sponsoring portions of Section III-F of Norfolk Southern's ("NS's") Reply Evidence related to Road Property Investment and Real Estate. Mr. Hedden has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Hedden has over 30 years of experience in all aspects of real estate market analysis and valuation. He has appraised properties across the United States for purposes of property tax, financial reporting, financing, purchase or sale, insurance, fair rental, tax reporting condemnation and donation. He is certified as a real estate appraiser in 13 states.

Mr. Hedden is a member of the Appraisal Institute, Counselors of Real Estate and Royal Institute of Chartered Surveyors. He previously served as Managing Director of the American Appraisal Associates. He earned his Bachelor of Science of Marking from the University of Bridgeport and a Master of City and Regional Planning at Rutgers University.

Mr. Hedden's complete curriculum vitae is attached.

VERIFICATION

I, Michael P. Hedden, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Michael P. Hedden

Executed on this 26 day of November, 2012.

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Michael P. Hedden is a managing director in the FTI Real Estate Solutions practice and is based in New York. Mr. Hedden specializes in providing valuation, litigation support and expert testimony services for clients. He is a knowledgeable real estate expert with over 30 years of experience in all aspects of the market analysis and valuation of real property. Mr. Hedden has experience in the appraisal of industrial, commercial, residential and special purpose property including hospitality, hospital and healthcare facilities. He has developed broad experience in the valuation of properties with detrimental conditions and is a recognized expert in the valuation of property suffering from environmental contamination.

Mr. Hedden has experience in the valuation of investment and user-based specialized real estate and real estate-related enterprises. He has appraised properties in many U.S. states. Purposes have included property tax, financial reporting, financing, purchase or sale, insurance, fair rental, tax reporting, condemnation, and donation. Advisory services performed by Mr. Hedden have included appraisal review, market research, appraisal management, and offer/option analysis

Mr. Hedden has significant expert testimony experience and has appeared before the U.S. District Court, Superior Court of New Jersey, U.S. Bankruptcy Court, New Jersey State Tax Court, New Jersey Legislature Committee, and various condemnation and zoning boards.

Prior to joining FTI Consulting, Mr. Hedden was a managing director with American Appraisal Associates where he provided expert testimony and litigation support for clients as well as prepared valuations used for financial reporting. Prior to that, he was a director for CBIZ Valuation Group, LLC. Before joining CBIZ, Mr. Hedden was president of Realty Economics Group, a real estate consulting and appraisal firm working for various government, public, and private entities throughout the New York metropolitan area.

A member of the Appraisal Institute (MAI) and the Counselors of Real Estate (CRE) and a distinguished Fellow of the Royal Institute of Chartered Surveyors (FRICS), Mr. Hedden earned a Master of City and Regional Planning (M.C.R.P.) degree from The Edward J. Bloustein School of Planning and Public Policy at Rutgers University and a Bachelor of Science degree in marketing from the University of Bridgeport. He has been a licensed real estate broker in New Jersey since 1978. In addition, Mr. Hedden holds general certified real estate appraiser licenses in New York, New Jersey, Connecticut, Massachusetts, Pennsylvania, Delaware, Maryland, Virginia, Georgia, Florida, California and Washington.

Expert Testimony/Depositions

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"Condemnation Valuation - Its Impact on Your Property and Your Projects," Eminent Domain Conference, CLE International, Princeton, New Jersey, October 2006

"Valuation of Contaminated Property," New Jersey County Tax Board Administrators, March 2002

"Appraisal Process Considering Environmental Impairments," Realtors' Tri-State Convention and Trade Show, Atlantic City, New Jersey, December 2000 (panelist)

"Residual Redevelopment of Brownfields: What are the Valuation Issues?," The Bloustein School of Planning and Public Policy at Rutgers University, November 1999 (leader of symposium)

"How to Buy and Sell Contaminated Property - Appraising Contaminated Properties," Institute of Continuing Legal Education in New Jersey (presenter)

"Litigation Issues Relating to MTBE Drinking Water Contamination," Institute of Continuing Legal Education in New Jersey (presenter)

"Transactional and Litigation Pitfalls in the Sale of Residential and Commercial Real Estate," New Jersey Institute for Continuing Legal Education, New Brunswick, New Jersey, January 14, 2010.

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"Commercial Property Assessing in Distressed Markets," Society of Professional Assessors - Annual New Jersey Seminar, East Rutherford, New Jersey, April 9, 2010.

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"Case Studies in Valuation for Financial Reporting," Appraisal Institute-Appraisal Institute of Canada, Summer Conference, Toronto, Canada, June 27, 2004

Instruction

"Highest & Best Use and Market Analysis," Appraisal Institute Course

"Real Estate Finance, Statistics, and Valuation Modeling," Appraisal Institute Course

"Valuation for Financial Reporting," Appraisal Institute Course

"How to Buy and Sell Contaminated Property," New Jersey Institute for Continuing Legal Education Seminar

"Litigating Regulatory Takings Cases," New Jersey Institute for Continuing Legal Education Seminar

Various seminars for the Municipal Tax Assessors Association in New Jersey, New Jersey Association of Realtors, and the National Association of Industrial and Office Parks.

Valuation and Special Courses

"Analyzing Distressed Real Estate," Appraisal Institute

"Environmental & Property Damages: Standards, Due Diligence, Valuation & Strategy," Appraisal Institute

"Environmental Risk and the Real Estate Process," Appraisal Institute

"Measuring the Effects of Property Contamination from Hazardous Materials on Real Estate Prices: Techniques and Applications," Appraisal Institute

"Valuation of Detrimental Conditions in Real Estate," Appraisal Institute

State Certifications

State of California, Certified General Real Estate Appraiser, #AGO36595

State of Connecticut, Certified General Real Estate Appraiser, #RCG0001042

State of Delaware, Certified General Real Property Appraiser, #X1-0000397

State of Florida, Certified General Appraiser, #RZ3081

State of Georgia, Certified General Real Property Appraiser, #280761

State of Illinois, Certified General Real Property Appraiser, #553.002184

State of Maryland, State Certified General Appraiser, #11924

Commonwealth of Massachusetts, State Certified General Appraiser, #100962

State of New Jersey, Certified General Appraiser, #RG00206

State of New Jersey, Real Estate Broker, #RB7814861

State of New York, Real Estate General Appraiser, #46000041828

Commonwealth of Pennsylvania, Certified General Appraiser, #GA001660R

Commonwealth of Virginia, Certified General Real Estate Appraiser, #4001009126

State of Washington, Certified General Real Estate Appraiser, #1101650

Professional Affiliations

Appraisal Institute, MAI Designated Member #7357

Counselors of Real Estate, CRE Member # 2158

Royal Institute of Chartered Surveyors, FRICS Member # 1227210

Employment History

American Appraisal Associates, New York, *Managing Director* — 2007 – 2010

Mr. Hedden served as a Managing Director and the Northeast Practice Leader for the U.S. Real Estate and related assets practice of American Appraisal.

CBIZ Valuation Group, New Jersey, *Director of Real Estate* — 2003 - 2007

Mr. Hedden served as the Director of Real Estate for CBIZ Valuation group. In this capacity he ran the real estate valuation, consulting and litigation practice on a national level.

Michael P. Hedden, MAI Inc., d/b/a Realty Economics Group, *President*	1990 – 2002
Mr. Hedden served as the President and leader of this Real Estate Consulting and Appraisal firm for various government, public and private entities throughout New Jersey.	
Martin, Benner, Pintinalli, Hedden, Inc., *Vice President*	1988 – 1990
Mr. Hedden served as a Real Estate Consultant for various government, public and private entities.	
Hedden – Izenberg Appraisal Associates, *President*	1987 – 1988
Mr. Hedden ran this Real Estate appraisal and consulting firm which provided a full spectrum of narrative appraisals and documents.	
Landauer Associates, Inc., *Vice President*	1985 – 1987
Mr. Hedden was part of the valuation and technical services division which was responsible for national real estate counseling.	
Glander Bates Associates, *Appraiser/Consultant*	1983 – 1985
Barkan Associates, *Staff Appraiser*	1982 – 1983
Patrick L. Hedden Realty Company, Vice President	1976 – 1981
Mr. Hedden was actively involved with this full service brokerage company servicing central New Jersey.	

GORDON R. HEISLER

Mr. Heisler is a Principal of his own transportation consulting firm, Heislog LLC. The Firm's offices are located at 98 McConkey Drive, Washington Crossing, PA 18977. Mr. Heisler is sponsoring Section II-B and supporting exhibits of Norfolk Southern's ("NS's") Reply Evidence regarding qualitative market dominance. Mr. Heisler has signed a verification of the truth of the statements contained therein. A copy of the verification is attached hereto.

Mr. Heisler has 40 years of experience in surface transportation and logistics, including 30 years in liquid and dry petroleum and chemical distribution for Sunoco, Inc. ("Sunoco") and for FMC Industrial Chemicals. He directed Sunoco's transportation group for approximately 13 years before retiring from that company in 2005. As a consultant, Mr. Heisler developed and implemented supply chains for the delivery of ethanol, mineral products and crude oil. He also developed a bulk truck carrier performance management program for a chemical producer.

Mr. Heisler has made presentations regarding logistics business issues to the Surface Transportation Board, to members of the Senate and House of Representatives, and before a number of industry groups, including the National Industrial Transportation League, the Council of Logistics Management, and the American Coalition for Ethanol. He is also a former Member of the Board of Directors of the American Plastics Council-Transportation and Logistics Committee. He has been engaged in independent bulk logistics consulting since 2006 and has designed distribution networks for ethanol and petroleum coke as well as consulting in several other bulk logistics projects.

Mr. Heisler's complete curriculum vitae is attached.

VERIFICATION

I, Gordon R. Heisler, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Gordon R. Heisler

Executed on this 13th day of November, 2012.

Gordon R. Heisler
President
Heislog LLC
98 McConkey Drive
Washington Crossing, Pa 18977
215 620 4247 cell
heislog@yahoo.com

Background

-40 years in surface transportation and logistics. 30 years in liquid and dry petroleum and chemical distribution with Sunoco Inc. and FMC Industrial Chemicals. Seven years as a logistics consultant performing a variety of bulk rail and trucking projects.

-Managed Sunoco's transportation group (1992-2005) with annual freight and equipment spending exceeding $150mm and management of 25 staff plus contractors. Retired from Sunoco in 2005.

-Experienced presenter of logistics business issues to Surface Transportation Board, Senate and Congressional members and local politicians, as well as many industry groups including NITL, CLM and Am. Coalition for Ethanol.

-Developed industry leading solutions to problems of truck & rail scheduling, and transportation supplier performance management. Innovations documented in industry publications.

-Founded Heislog LLC, a bulk logistics consulting firm in 2005 and have led consulting projects involving bulk chemicals, oils and minerals distribution networks and supply chains, due diligence for logistics asset acquisition, and intermodal terminal site establishment.

Recent Consulting Projects

Developed and implemented optimized multi modal supply chains for delivery of ethanol, mineral products and crude oil.

Conducted rail negotiation strategy and tactical consulting project with a worldwide chemical producer in preparation for a rail RFP exceeding $80 million/year in rail revenue.

Developed a bulk truck carrier performance management program for a chemical producer who is currently implementing the initiative.

Expert witness in the area of market dominance for two major eastern rail carriers in polymer and chemical rail rate challenge cases currently pending decisions by the Surface Transportation Board

Presented a research paper on "Crude Oil by Rail" at the Bakken Oil Shale Logistics Conference in March 2012. Also presented an Ethanol Logistics paper to American Coalition for Ethanol in 2009.

Led the rail transportation portion in the establishment of three bulk intermodal terminals for transloading ethanol, slurry minerals and crude oil.

Led the introduction and establishment of bulk rail logistics supply chains for two oil producers/processors. Previously both companies were all truck or marine/pipeline.

Education and Training

Rider University - BS Business Administration 1972

Northwestern University – Transportation and Logistics Management courses

DONALD E. HILTON

Mr. Hilton is an engineer with other 40 years of experience in civil and underground construction. His business address is 195 E. Rush Drive, Eagle, Idaho 83703. Mr. Hilton is sponsoring portions of Section III-F of Norfolk Southern's ("NS's") Reply Evidence related to Tunnels. Mr. Hilton has signed a verification of the truth of the statements contained therein. A copy of the verification is attached hereto.

Mr. Hilton's construction, engineering management and estimating experience includes domestic and international mine development, lock and dam, bridge, tunnel and cut and cover projects. He has worked as field engineer, quality control inspector and project engineer for underground and surface projects. His experience includes reviewing costing methods for a rail road tunnel repair project in Montana.

Mr. Hilton earned his Bachelor of Science of civil engineering in 1972 from the University of Arkansas. He is a member of the American Society of Civil Engineers, National Society of Professional Engineers, and has previously served on the Executive Committee of the Rapid Excavation and Tunnel Conference.

Mr. Hilton's complete curriculum vitae is attached.

VERIFICATION

I, Donald E. Hilton, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Donald E. Hilton

Donald E. Hilton

Executed on this 12th day of November, 2012.

RESUME
DONALD E. HILTON P.E.

Donald Hilton & Associates Inc.
195 E. Rush Dr.
Eagle, ID 83703
Ph.: 208-939-4798
E-mail DEHilton@AOL.COM

EDUCATIONAL BACKGROUND

May 1963	Graduate Public High School - Pine Bluff Arkansas
May 1972	Graduate BSCE University of Arkansas

PROFESSIONAL LICENSES

Professional Engineer - State of New York - #59875 (inactive)
Professional Engineer - State of Georgia - #15149 (inactive)

PROFESSIONAL ORGANIZATIONS

American Society of Civil Engineers
National Society of Professional Engineers
Society for Mining Engineering
Disputes Review Board Foundation
Executive Committee Rapid Excavation and Tunneling Conference (past member)

PUBLICATIONS

Economics - When to go Trenchless {Recipient of AUA- Ken Lane Award.}
Editor 1999 RETC Proceedings

EXPERIENCE SUMMARY

Mr. Hilton has more than 40 years of experience in many aspects of heavy civil and underground construction. The varied nature of this experience gives a broad knowledge of different construction and management methods to apply to a particular project. His construction, engineering management and estimating experience includes mine development, lock and dam, bridge, tunnel and cut and cover projects in the United States as well as foreign assignments. He has worked as a field engineer, quality control inspector and project engineer for underground as well as surface construction projects. The knowledge of construction methods gained from these projects has been applied to estimating, corporate cost control systems and constructibility reviews for tunnel engineering firms. His corporate management experience includes responsibilities of Chief Estimator, Assistant Division Engineer Area Engineer and Chief Engineer.

EXPERIENCE DETAIL

ENGINEERING AND MANAGEMENT

- Mr. Hilton's engineering and management experiences have been both for owner and contractor. He has served as the owner's representative for the construction of The Entrenchment Creek Tunnel in Atlanta, Georgia. He was responsible for the over sight of inspection staff assuring compliance with contract specifications. The duties included approval of pay estimates, coordination of submittal reviews, negotiation of change orders with the contractor and maintenance of project progress records.
- His positions as Assistant Division Engineer and Area Engineer for the Morrison Knudsen Corporation required the management of estimating functions as well as support of engineering staff on tunnel construction projects in the Southern and Western United States.
- As Chief Estimator for both Walsh Northwest and Frontier-Kemper Constructors he managed a diversified staff of estimators and consultants in the bidding efforts for various projects. He also coordinated the efforts of Joint Venture Partners.
- As an independent consultant he has prepared bid level estimates for both contractors and engineering firms. He assisted in change order preparation for the Hudson Bergen Light Rail project in North East New Jersey. He provided constructibility reviews and cost estimates for various alternatives for the 6.4 billion dollar East Side Access Project in New York City, water tunnel repair projects for New York City as well as various options for the New Croton water treatment system in New York City. He also provided constructibility review and engineers estimate for outlet tunnels and shafts for a water supply dam and lake in Denver, sewer tunnels in Seattle and post bid alternative evaluations Sound Transit tunnels in Seattle as well as Preliminary Engineering estimates for the future North Link Transit Tunnels in Seattle Washington.

DOMESTIC CONSTRUCTION

- Mr. Hilton has been involved in the construction of lock and dam projects with positions of Draftsman, Field Engineer as well as Quality Control Inspector. These projects were part of the Arkansas River Navigation System the De Gray Re-regulating Dam on the Quachita River in Arkansas and the Little Sunflower River Dam in Mississippi. He was involved field operation for both the excavation and concrete construction portion of the projects.
- Experience in construction of highways and bridges were gained as Project Engineer for the building of two concurrent interstate highway projects in Birmingham, Alabama. The projects involved the construction of 29 Bridges. Earthwork involved moving of four million CY of embankment using truck haul across town on one project, the second project required the cut and fill of over six million CY of soil, using scrapers. Both projects included the construction of numerous smaller structures such as retaining walls and culverts. Duties included formwork design, purchasing and cost engineering.
- Additional bridge construction experience was gained during construction of 19 interstate bridges north of Atlanta, Georgia. The project included building reinforced earth retaining walls. His duties were the same as above with the addition of surveying.
- Mr. Hilton's underground construction experience includes several projects:
  He has acted as Project Manager / Engineer for a small pipe jacking project in East St. Louis,

Illinois. This assignment required that he perform a wide variety of functions including purchasing, payroll, cost accounting as well as normal engineering duties. During the construction of Buffalo Subway project his initial position was Field Engineer with subsequent promotion to Project Engineer. His duties included supervision of surveying and engineering staff, management of subcontractor's staff and coordination of engineering functions with field supervisory personnel. The project was the construction of twin ten thousand-foot rock tunnels. Excavation was accomplished with two Robbins TBM's.

INTERNATIONAL PROJECTS

- Mr. Hilton has international construction and estimating experience in several countries. The first is Kuwait. The project was the construction of a cooling water intake plant. The facilities built included an Intake Structure built in a dry dock and floated into position, four 10 ft Diameter Pipe Lines 2000 lf into the Gulf, and an On-Shore Pumping Plant and Discharge Lines. His position was originally Area Engineer and later Project Engineer. The construction included on-sight fabrication of rebar, casting of the concrete intake pipes, fabrication of all formwork and batching of concrete. He was also Project Engineer for a concurrent project for the discharge of spent cooling water.
- The second location was Taipei, Taiwan. The work here involved the initial phase of a soft-ground subway project. He developed CPM schedule for submittal to the owner and assisted in the selection of subcontractors and basic construction methods.
- Construction cost estimate for contractor bidding Vancouver, BC Subway project.
- Construction cost estimate for contractor bidding a design, build and operate Subway Line in Dublin Ireland.

ESTIMATING

- A varied background of estimating and building heavy civil projects provides an excellent base for cost estimates for both contractors and owners. More than 40 years of experience provides a solid base to draw on in determining cost and production rates for a wide range of projects. Estimating experience includes Bridges, Tunnels of all types, Cut and Cover Subway Line and Station Projects as well as Mine Development Projects such as Conventional Shafts, Raise Bore Shafts and Drill-Shoot Slopes. The estimating required the tracking of projects to bid, evaluation of the probability of being successful. The responsibilities included leading of teams in the development of technical as well as commercial proposals to the owners.
- Tunnel Projects include a wide spectrum of those requiring excavation and support methods varying from soft ground compressed air or EPB shields to rock tunnels excavated using conventional drill & blast methods or TBM's. These projects were located throughout North America and the Far East. They incorporated innovative methods such as temporary precast segments for preliminary support on successful bids in Houston Texas and Tucson Arizona. The use of continuous conveyors for muck removal was used on other successful bids in Milwaukee Wisconsin, Colorado Springs Colorado and Tucson Arizona. The list of successful bids include Tunnels for Subways for the City of Los Angles, California and Design Build Interceptor Sewers in Toronto, Canada.
- Preparation of bids for Cut and Cover Subway Projects include work in Washington, D.C.,

Atlanta, Boston and Los Angeles. The bidding required the preliminary design of excavation support systems, street decking as well as underpinning of existing structures. The projects were simple line sections, basic station structure as well as fully finished stations.
Cut and Cover Projects were not limited to those for Subways. Mr. Hilton also successfully bid the very large cut and cover "Experimental Halls" for the Super Collider Project near Dallas Texas.

- Bids for Mine Development Projects encompassed a wide range of minerals including Coal, Limestone, Lead, Salt as well as precious metals such as Gold and Platinum. The scopes of these jobs varied from simple unlined raise bore shafts to those requiring multiple shafts, underground processing facilities as well as surface product packaging and shipping facilities.
- Bids for bridges construction projects were located in Alabama, Georgia, Missouri, Illinois and Idaho. The types of bridges were simple precast concrete or steel beams with cast-in-place decks as well as complex river crossing bridges with steel truss superstructures. The construction sites were rural, urban and those in environmentally sensitive areas.
- As an independent consultant estimates Mr. Hilton has prepared cost estimates for several projects including:
  1. Underground storage caverns for liquefied natural gas storage.
  2. Cut and cover station and line excavation and support for a Boston subway project.
  3. A highway enlargement project in Phoenix.
  4. Change order for the Hudson-Bergen Light Rail project in Northeast New Jersey.
  5. Tunnel enlargement and station construction in Wehawken NJ for the Hudson - Bergen Light Rail Project.
  6. Cost estimates based on conceptual design thru final design for the East Side Access Project in NY City.
  7. Preliminary engineering level cost estimates for tunnel and underground stations #7 Line Subway extension New York City.
  8. Repair of Delaware Aqueduct NY State
  9. Intake tunnels, shafts and outlet tunnels for an existing water supply lake in Denver, Co.
  10. Various tunnel and shaft options for the Croton Water Treatment Facilities in New York City.
  11. Repair and stabilization of collapsed water supply tunnel north of Denver Co.
  12. Large diameter sewer tunnel Milwaukee Wisconsin
  13. Conceptual Estimates for National Engineering Labs for underground experimental facilities requiring tunnels and shafts at various locations in the United States.
  14. Cost estimates and Constructability reviews for preliminary engineering of "THE Tunnel", a new passenger rail tunnel for service from Newark New Jersey to Pen Station New York City for New Jersey Transit

CONSTRUCTABILITY REVIEWS & VALUE ENGINEERING

- He has provided constructability reviews for the Hudson-Bergen Light Rail project. This involved review of 30% design drawings to determine possible problems with sequencing and construction methods proposed or a major change order significantly changing the scope of the project.

- ❖ Constructability review input was provided for various configurations proposed in the preliminary design phases of the East Side Access project. These reviews were for several different areas of the project including, underpinning of existing rail facilities, construction of underground station and tunnels, excavation of mixed face tunnels and cut and cover excavation.
- ❖ Reviewed proposed construction methods #7 Line Subway extension New York City.
- ❖ Reviews of the proposed construction methods for repairs to be proposed for one of the Delaware Aqueduct Tunnels in New York State were provided along with the cost and schedule analysis.
- ❖ Participated in peer review panel and value engineering panel for the bright water sewer tunnels in Seattle.
- ❖ Value engineering team member block 39 subway project Chicago Illinois
- ❖ Contract packaging peer review Seattle North Link Subway project.
- ❖ Owners estimate review for State of Washington of the Alaskan Way Tunnel Project.

DISPUTES REVIEW BOARDS

He has as served as a member of the following DRB panels on these completed projects.

- ❖ Chattahoochee Sewer Tunnel in Atlanta GA
- ❖ Capital Peak Tunnel Complex in New Mexico
- ❖ Idaho Transportation Department multiple projects.
- ❖ Big Walnut Interceptor Sewer project in Columbus Ohio.
- ❖ Riverbank Tunnel project Louisville KY.
- ❖ Belmont North Interceptor Indianapolis, IN
- ❖ South River Tunnel and Pump Station Atlanta, GA
- ❖ 3 Sewer Tunnel projects in Austin, Texas

DRB Training Completed

1. DRB Foundation administration and practice workshop March 17, 2001
2. Completed DRB Foundation chairing workshop March 18, 2001
3. DRBF practice & procedures update training May 23, 2006

Expert Witness Reports

- ❖ Contractors estimate review regarding a claim on Seattle Transit Tunnel Project.
- ❖ Review Corps of Engineers evaluation of contractors cost and experience proposal for a bid protest New Orleans, LA.
- ❖ Construction methods review for Rail Road Tunnel repair in Montana, for the Rail Owner vs. Insurance Company.

DAVID HUGHES

Mr. Hughes has over 30 years of experience as a professional engineer in railroad engineering and railroad operations and maintenance supervision. Mr. Hughes' business address is 1401 S. Ocean #601, Hollywood, Florida 33019. Mr. Hughes is sponsoring Section III-D-4 relating to Maintenance-of-Way costs of Norfolk Southern's ("NS's") Reply Evidence. Mr. Hughes has signed a verification of the truth of the statements contained therein. A copy of the verification is attached hereto.

From 1967 to 1975, Mr. Hughes had numerous responsibilities at Southern Pacific Railroad, including first line supervision of track maintenance and bridge and building maintenance. Mr. Hughes served as Vice President of Engineering for the Boston and Maine Railroad from 1975 to 1980, where he had responsibility for track structures, signal systems maintenance, and reconfiguring and reconstructing 155 route miles of mainline. Mr. Hughes next served as President of Pandrol, Inc. and Speno Rail Services, where he assisted railroads in developing high-performance track components and mechanized rail and ballast maintenance practices. In 1985, Mr. Hughes became President of the Bangor & Aroostook Railroad, a regional railroad in the northeastern United States. He later served as Chief Engineer for the National Railway Passenger Corp ("Amtrak") and as its Acting President and Chief Executive Officer.

Mr. Hughes has previously served as Chairman of the Regional Railroads of America. He was a director of the American Railway Engineering Association ("AREA"). He has served on the Association of American Railroads Board of Directors.

Mr. Hughes' curriculum vitae is attached.

VERIFICATION

I, David J. Hughes, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company. that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

David J. Hughes

Executed on this 12th day of November, 2012.

David Hughes

David Hughes is an independent railroad consultant with broad consulting and executive experience in railroad infrastructure and railroad operations. He specializes in identifying strategies through which railroads can manage their infrastructure, operations, and investments to realize strategic objectives, optimize asset reliability and maximize the long term cash flow. Recent or on-going consulting assignments include:

- Currently providing technical and economic advice to Norfolk Southern Corporation regarding the design, construction and maintenance of a 7000 mile stand-alone railroad in the US as part of a proceeding before the US Surface Transportation Board

- Recently advised a major owner and operator of regional railroads in the US on track, bridge and signaling issues related to their planned acquisition of RailAmerica, the largest operator of regional railroads in the world.

- Worked with the Peruvian Ministry of Transportation to develop a methodology for evaluating the economic feasibility of building new rail lines in the Peruvian Andes, including investment requirements and operating costs and applying the methodology to evaluate several proposed projects.

- Advised a major iron ore hauling railroad in Canada on infrastructure capacity expansion requirements necessary to increase annual iron ore throughput by 250%.

- Recently advised a major African heavy haul railroad regarding infrastructure investment requirements as part of a long term integrated corridor commercial strategy. The project included estimating infrastructure capacity expansion costs, operating costs and financial feasibility of the required investments.

- Recently advised the Dedicated Freight Corridor Corporation of India on design and contracting standards for construction of a new national heavy haul rail network, as a member of a panel of international experts.

- Assisted a major private equity firm in performing infrastructure due diligence on $2 billion acquisition of a US railroad company. Later, provided estimates of capital investment requirements to support refinancing of the acquisition.

- In a dispute involving economic damages due to rail service irregularities on a U.S. heavy haul railroad, Mr. Hughes provided an expert verified testimony regarding the adequacy of coal line maintenance practices and expenditures and an assessment of the reasons for infrastructure failure.

- For a standalone rate case in the western U.S., provided an expert verified statement determining the maintenance and operating costs a new heavy haul rail line for a standalone railroad in a standalone rate case before the Surface Transportation Board

- In a proceeding before the Surface Transportation Board, provided an expert verified statement regarding the adequacy of a light density railroad to transport heavy haul coal unit trains and the scope of work and cost to upgrade the infrastructure of the line

- Evaluated the capital investment and ongoing infrastructure maintenance necessary to introduce 18,000 ton coal trains on a light density branch line for a major US railroad.

- Prepared an infrastructure maintenance and investment plan for 2,000 miles of high density coal railroad in conjunction with litigation about coal transportation rate reasonableness for two major western railroads.

- Assessed the long term infrastructure investment requirements as part of a due diligence for a major railroad financial transaction.

In addition to the recent assignments above, Mr. Hughes has been engaged in dozens of assignments in over 27 countries, including Chile, Peru, Bolivia, Uruguay, Argentina, Brazil Kazakhstan, Poland, Czechoslovakia, Hungary, Africa, Asia and North America.

Mr. Hughes also has extensive executive experience in the railroad industry. Most recently he served as Acting President and CEO of Amtrak 2005-2006. He served four years as chief engineering officer of Amtrak before becoming Acting CEO. He also served as President of the Bangor and Aroostook Railroad, President of Pandrol Incorporated, a manufacturer of track fastening products for the railroad industry and President of Speno Rail Services, a railroad track maintenance contractor. Earlier in his career he was vice president engineering and Acting President of the Boston & Maine railroad and held numerous engineering and management positions with Southern Pacific railroad, including bridge and building supervisor and general track foreman.

His industry and community activities have included:

- Director, The Association of American Railroads
- Director, American Railway Engineering and Maintenance Association
- Member, AAR Track Research Committee
- Member, various engineering and operating committees of AAR
- President and cofounder, Regional Railroads of America
- President, New England Transportation Research Form
- Director, Transporting the Elderly and Handicapped in New England
- President, Maine Chamber of Commerce

Mr. Hughes has testified before the United States Congress on numerous occasions regarding railroad passenger and freight financing and infrastructure issues. He has testified in Federal District court and before the Interstate Commerce Commission (now STB) on legal and commercial matters.

Mr. Hughes holds a B.S degree in civil engineering from the University of Texas and a Masters Degree in business administration from the Harvard Business School and has over 30 years of experience as a registered professional civil engineer. He is fluent in English and has a working knowledge of Spanish and Brazilian Portuguese.

Contact information:

David Hughes
4622 Fisher Island Drive
Miami Beach, FL 33109, USA
+1 (954) 616-9742 (cell)
david.hughes@foxglove.us.com

Mr. Hughes' professional experience uniquely qualifies him to accurately assess the MOW work load and resource requirements of the DRR.

He has hands on field experience as a General Track Foreman in Utah and a Bridge and Building Supervisor in Texas. As general track foreman, he actually inspected track for defects and either personally made repairs or scheduled the repairs by a maintenance gang. He also supervised the work of section gangs, smoothing gangs and welders.

As bridge and building supervisor on the UP (former SP) in Houston, he was personally responsible for performing annual bridge inspections and prioritizing bridge maintenance. He also was responsible for maintenance of equipment maintenance facilities and other railroad facilities in the Houston Terminal.

In addition to his first line experience, Mr. Hughes has served as chief engineer of the Boston and Maine (B&M) Railroad and, more recently, chief engineer of Amtrak. As the B& M was in bankruptcy reorganization when Mr. Hughes was chief engineer, he gained valuable experience in effectively maintaining track and structures at the lowest possible cost.

Mr. Hughes has also benefited from his experience in the railroad track supply and track maintenance industry. As president of Pandrol, Inc. (a manufacturer of track fastening systems) and as president of Speno Rail Services (a railroad track maintenance contractor) he spent extensive time in the field on every class I railroad in north America, observing first hand maintenance problems and devising solutions that could be applied.

Mr. Hughes' experience goes far beyond the class I railroads of North America. He has extensive experience with regional and short line railroads and railroads internationally.

As co-founder and first chairman of Regional Railroads of America, he has testified before Congress on several occasions about the capital and maintenance requirements of small railroads. He had personal relationships with the leaders of the small railroad industry and had frequent discussions with them about their techniques for profitably operating railroads that class Is had sold to them.

Mr. Hughes had another window into the MOW practices of small railroads. In a consulting capacity, he has performed due diligence reviews of dozens of MOW plans on behalf of lenders or buyers of lines being spun off by class Is or of existing lines being bought or sold by private parties. These due diligence studies generally involved hi-rail inspection trips over the lines and interviews of MOW officials regarding their organizations and plans for maintaining the lines. The reports that resulted included an assessment of the adequacy of the MOW plan and suggestions of ways it could be strengthened.

In addition to his work with class I and small railroads in North America, he has many years of experience working with MOW organizations in over 25 railroads in Mexico, South America, South Africa, Europe and countries from the former Soviet Union.

Furthermore, Mr. Hughes has a long history of participation in professional engineering organizations and keeps those contacts current. He has been a director of the Engineering Division of the AAR, a director and member of the Board of Governors of the American Railway Engineering and Maintenance Association, president of the Transportation Research Forum of New England. He has served on the AAR committee prioritizing new research investments and has attended several annual meetings of the International Heavy Haul Association. He has been a frequent visitor to the Facility for Accelerated Service Testing (FAST) in Pueblo, Colorado where he followed the performance of various track components under heavy haul conditions. He has over 30 years' experience in the railroad industry as a professional engineer.

RONNIE D. JOHNSON

Mr. Johnson is the founder of R & D Johnson Enterprises LLC, a consulting firm with offices located at 1324 Gulfprot Run, Grayson, Georgia 30017. Prior to founding R & D Johnson Enterprises, Mr. Johnson was employed at Norfolk Southern Railway Company ("NS"), where he developed extensive experience in railroad operations. Mr. Johnson is sponsoring portions of Section III-C NS' Reply Evidence relating to Train Schedules, Yard Structure, and Car Blocking Plans. Mr. Johnson has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Johnson's railroad operations experience stems from over 40 years in varied and increasingly responsible operations positions with the Illinois Terminal Railroad, Norfolk and Western Railroad, and Norfolk Southern Railway. Mr. Johnson held various positions at these railroads throughout his career including Terminal Supervisor, Trainmaster, Terminal Superintendant, Senior Director of Automotive Service and Distribution. Mr. Johnson also has experience in railroad logistics and support for Premium Operations as well as service design. Mr. Johnson studied Economics and Business at Southern Illinois University. Mr. Johnson holds certificates from the University of Tennessee College of Business' Supply Chain Management Program and the University of Virginia's Darden Executive Development Program.

VERIFICATION

I, Ronnie D. Johnson, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Ronnie D. Johnson

Executed on November 12, 2012

DAVID A. MAGISTRO

Mr. Magistro is a Senior Engineer/Project Manager with STV, a professional firm offering engineering, architectural, planning, environmental and construction management services with offices located at 6405 Metcalf Avenue, Suite 516, Overland Park, Kansas 66202. Mr. Magistro has more than 14 years of experience with structural design, almost all of which have been focused on movable bridges and railroad structures. Mr. Magistro is sponsoring portions of Section III-F of Norfolk Southern's ("NS's") Reply Evidence relating to Bridges. Mr. Magistro has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Magistro's experience includes structural steel design, steel bridge rehabilitation, fixed bridge and moveable bridge inspection, fixed bridge and movable bridge design including structural and mechanical aspects, plan production, and project management for numerous railroad and transportation agency clients. Mr. Magistro holds a Bachelor of Science, Civil Engineering from Kansas State University and is a member of the American Railway Engineering and Maintenance-of-Way Association (AREMA).

Mr. Magistro's resume with additional project experience is attached hereto.

VERIFICATION

I, David A. Magistro, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

David A. Magistro

Executed on this ___ day of November, 2012.

David A. Magistro, P.E.

Senior Engineer/Project Manager

Mr. Magistro has more than 14 years of experience with structural design, almost all of which has been focused on railroad structures. His is well versed in structural steel design, steel bridge rehabilitation, fixed bridge and movable bridge inspection and design, including structural and mechanical aspects, plan production, and project management for numerous railroad and transportation agency clients.

Project Experience

BNSF Bridge 6.3 Rail Joint Replacement – Project Manager
Design project to replace the rail joints and steel ties on this double-track bascule span. The project includes structure modification for the new steel ties and rail joints, and providing a construction sequence to complete the work. (6/12 – Present)

BNSF Bridge 6.3 Operating Strut Reinforcement – Project Manager
Providing fabrication and installation recommendations for the replacement of the bearings the support the main pinions inside the operating struts on this double-track bascule span. The project includes review of fabrication shop drawings and construction sequence to complete the work. (8/12 – Present)

NS Vs. DuPont Rate Case – Project Engineer
Project Engineer responsible for the bridge evidence in this chemical rate case, officiated by the Surface Transportation Board (STB). Responsible for evaluating Opening Evidence generated by DuPont, and compiling Reply Evidence on behalf of NS to establish the construction cost of a Stand Alone Railroad system, upon which NS's shipping rates are based. (5/12 – Present)

BNSF Bridge 231.4 Inspection – Project Manager
Inspection of structural repairs that were made in 2008 to verify that the as-repaired condition merits the as-repaired structural rating. (10/11 – 1/12)

IPA Vs. BNSF/UPRR Rate Case – Project Engineer
Project Engineer responsible for the bridge evidence in this coal rate case, officiated by the Surface Transportation Board (STB). Responsible for evaluating Opening Evidence generated by IPA, and compiling Reply Evidence on behalf of BNSF and UPRR to establish the construction cost of a Stand Alone Railroad system, upon which BNSF's and UPRR's shipping rates are based. (9/11 – 11/11)

BNSF/UPRR Precast Specification Update – Project Manager
Evaluation of the shared standard specification for the manufacture of precast and prestressed concrete components for BNSF and UPRR. The project included bringing the standard specification into accordance with current fabrication practice. (3/11 – 1/12)

Employee No.
04910

Department No.
53

Office Location
Overland Park, KS

Date joined firm
3/30/09

Years with other firms
11

Education
Bachelor of Science, Civil Engineering, Kansas State University (1998)

Professional Registrations
Professional Engineer: Missouri (2003/#2003001064/exp. 12/31/13), Kansas (2009/#20754/exp. 4/30/13), Oklahoma (2009/#24155/exp. 8/31/14)

Memberships
American Railway Engineering and Maintenance-of-Way Association (AREMA) (2005 - Present)

AREMA Committee 15, Subcommittee 6 Chairman (2012-Present)

Heavy Movable Structures (HMS) Registrar (2001 - 2010), Treasurer (2010-Present)

BNSF Kansas City Movable Bridge Inspection – Project Manager
Provided walk-through maintenance inspection of the two movable bridges owned by BNSF in the Kansas City area, ASB and Hannibal. The walk-through maintenance inspections included observing all mechanical and electrical equipment in-use, noting deficiencies and areas that will require maintenance or repair. The project ended with a report containing recommendations for all maintenance and repair work. (4/11 – 7/11)

KCPL LaCygne Station Siding Addition – Project Manager
Provided survey of existing track and topography upon which to base the design of the new siding addition. Provided track design for the new siding. Provided roadway design for a roadway overpass alignment that utilized a steel plate arch structure to remove the at-grade crossing. Provided shop drawing review of the fabrication drawings for the steel plate arch structure. (9/10 – 11/11)

AEPCO Vs. UPRR Rate Case – Project Engineer
Project Engineer responsible for the bridge evidence in this coal rate case, officiated by the Surface Transportation Board (STB). Responsible for evaluating Opening Evidence generated by AEPCO, and compiling Reply Evidence on behalf of UPRR to establish the construction cost of a Stand Alone Railroad system, upon which UPRR's shipping rates are based. (2/10 – 5/10)

AEPCO Vs. BNSF Rate Case – Project Engineer
Project Engineer responsible for the bridge evidence in this coal rate case, officiated by the Surface Transportation Board (STB). Responsible for evaluating Opening Evidence generated by AEPCO, and compiling Reply Evidence on behalf of BNSF to establish the construction cost of a Stand Alone Railroad system, upon which BNSF's shipping rates are based. (2/10 – 5/10)

Seminole Electric Vs. CSX Transportation Rate Case – Project Engineer
Project Engineer responsible for the bridge evidence in this coal rate case, officiated by the Surface Transportation Board (STB). Responsible for evaluating Opening Evidence generated by Seminole Electric, and compiling Reply Evidence on behalf of CSX Transportation to establish the construction cost of a Stand Alone Railroad system, upon which CSXT's shipping rates are based. (7/09 – 5/10)

ODOT Robinson Street Grade Crossing - Project Manager
Managing the construction of a detour for rail and vehicular traffic that will be used during construction of a permanent Burlington Northern Santa Fe (BNSF) Railroad grade separation at Robinson Street in Norman, OK. This railroad corridor receives heavy freight traffic and is also an Amtrak corridor. STV's shoofly design will permit rail and roadway traffic to continue during construction. In addition, the firm is assisting the contractor with the design of shoring for the permanent bridge structure. (3/10 - Present)

UPRR Oklahoma City I-40 - Project Engineer
Reviewed project plans for the realignment of train tracks along this highway corridor in Oklahoma City. Mr. Magistro reviewed the overhead structures and foundation configuration at each grade separation to determine if the arrangements, clearances, and structural designs met American Railway Engineering and Maintenance-of-Way Association (AREMA) and Union Pacific Railroad (UPRR) requirements. He provided reviews through the duration of the project and interacted with UPRR, the Oklahoma Department of Transportation, utility owners, and construction contractors. (6/09 - 9/10)

New England Central Railroad Bridge 15.21 Modification - Project Engineer
Provided mechanical and structural design services for the conversion of a swing-span bridge from manual to mechanical operation in Swanton, VT. The bridge, which had been operated manually using a capstan, is protected as a state historic resource. The project team successfully incorporated the electric-powered system without altering the appearance or function of the bridge. (5/09 - 10/10)

VDOT Coleman Bridge Cable Replacement - Project Engineer
Designed emergency repairs to the structural and mechanical systems on this 3,750-foot, double swing-span bridge that crosses the York River between Yorktown and Gloucester Point, VA. A tug boat struck the bridge and damaged several cables. Mr. Magistro's work enabled VDOT to restore service to this important toll crossing, which carries the 4-lane U.S. 117 and connects the Peninsula and Middle Peninsula areas of Virginia's Tidewater region. (10/09 - 6/10)

South Central Florida Express Moore Haven Bridge Rehabilitation - Project Engineer
Prepared design plans for new mechanical equipment on this swing-span railroad bridge in Moore Haven, FL, which remained in operation during construction. Engineers completed the transition between the old and new system in a week without causing interruptions to train service. (5/10 - 9/10)

BNSF Bridge 231.4 Structural Inspection, Load Rating, and Structural Repairs - Project Manager/Field Inspector/Design Engineer
Responsible for the comprehensive structural inspection and load rating of the floor system for the roadway portions of this double-deck structure over the Mississippi River in Fort Madison, IA, for the Burlington Northern Santa Fe (BNSF) Railroad. The inspection and load rating was followed by a phase of structural repairs. Mr. Magistro was responsible for the design and construction sequencing of the structural steel repairs for an approach span through plate girders and floor system components, including stringers and floorbeams. (6/08 - 3/09)

Norfolk Southern Bridge 6.66 Rehabilitation - Design Engineer
Managed the structural design for the replacement of curved segments on the rolling girders of this double-track rolling bascule span over the South Branch Elizabeth River in Gilmerton, VA. The project included structural

design and detailing, plan production, construction specifications, construction sequencing and contractor coordination. (5/07 - 1/09)

BNSF Bridges 5.8, 6.2, and 6.7 Structural Inspection, Load Rating and Structural Repairs - Project Manager/Field Inspector

Directed the comprehensive inspection and load rating analysis of these three structures over north Willamette Boulevard, north Lombard Street, and north Fessenden Street in Portland, OR. All three structures consist of a combination of deck plate girder spans and deck truss spans resting on either structural steel towers or concrete piers. Mr. Magistro also managed the follow-up project to design structural retrofits to increase the load capacity of these structures. (1/08 - 12/08)

BNSF Bridge 117.35 Electrical/Mechanical Rehabilitation - Project Manager

Responsible for the replacement of the drive system on this span drive vertical lift bridge over the Illinois River in Beardstown, IL. The project included replacing the existing central reducer, drive motors, auxiliary drive system, shafts, bearings, and couplings. (9/07 - 11/08)

Canadian Pacific Rail Bridge 283.27 Bearing Repair and Truss Jacking - Project Manager/Design Engineer

Responsible for design and detailing of jacking frames used to longitudinally jack two approach spans through trusses adjacent to this 360-foot swing span over the Mississippi River in La Crosse, WI. The project included construction sequencing and field assistance during construction. (5/07 - 12/07)

VDOT I-264 Berkley Bridge Rehabilitation - Design Engineer

Participated in the rehabilitation of a 4-leaf bascule bridge over the New Elizabeth River in Norfolk, VA, for VDOT. The project consisted of design and integration of a new drive system and machinery on top of an existing system of equipment and machinery. The design includes two complete designs to accommodate the original 2-leaf bascule built in 1950 and the second bascule pair built in 1992. Mr. Magistro's responsibilities included design of the new mechanical equipment, as well as structural retrofits required for installation of the new equipment. (6/06 - 9/07)

BNSF Abo Canyon Double Track Capacity Design Project - Lead Bridge Engineer

Responsible for bridge layouts, design, quantity calculations and cost estimates for nine bridge structures along a 5-mile stretch of second mainline track for the Burlington Northern Santa Fe (BNSF) Railroad through Abo Canyon, NM. (10/04 - 3/06)

BNSF Bridge 0.80 Emergency Stringer Replacement - Project Manager/Design Engineer

Supervised the emergency replacement of eight stringers in the movable span floor system of this 450-foot swing span over the Missouri River in Kansas

City, MO. The scope of the project also included shop inspection during fabrication of the fracture critical stringers. (8/04 - 10/04)

Canadian Pacific Rail Bridge 283.27 Span Alignment Lock Design - Project Manager
Led the design and detailing of a new span alignment and span locking device for this 360-foot swing span over the Mississippi River in La Crosse, WI. The project included structural modifications to the approach span where the new device was located. (12/03 - 10/04)

BNSF Bridge 37.0 Fender Replacement - Project Manager/Design Engineer
Oversaw design and detailing of a new fender system for the 260-foot swing span over the Snohomish River in Everett, WA. (5/03 - 4/04)

BNSF Bridge 14.2 Pier Rehabilitation - Project Engineer
Assisted in development and design of rehabilitation details for the rest pier, bridge bearings, lift tower structural support steel, and end floorbeam top flange replacement for this bridge located near Steilacoom, WA. The rest pier was rehabilitated and the live load bearing was replaced while maintaining both rail and navigation traffic. (3/02 - 11/03)

BNSF Richmond Turntable Rehabilitation - Project Engineer
Responsible for design of the new mechanical components in the rehabilitation of this 110-foot turntable structure in Richmond, CA. The project included design and details for new end trucks, new enclosed gear reducer to replace open gear set, new shafts and bearings, and new structural supports. (8/02 - 5/03)

EJE Railway Bridge 728 Rehabilitation - Design Engineer
Responsible for the mechanical rehabilitation of this Scherzer single-leaf rolling bascule span over the East Chicago Canal in Gary, IN, for Elgin, Joliet and Eastern (EJE) Railway. The project included replacement of the drive motor and central reducer, and all associated shafts, bearings, and couplings; installation of a new auxiliary motor and clutch; and upgrade of the control system. Mr. Magistro was also responsible for the design of the structural support system rehabilitation for new mechanical components, and construction sequencing and field assistance during construction. (4/01 - 5/03)

CSX Transportation Bridge L653.4 Span Replacement - Project Engineer
Participated in the inspection to evaluate the existing condition of the movable span for purposes of the United States Coast Guard Cost Apportionment. Mr. Magistro was responsible for the new bridge deck details, including timber ties, steel ties, and rail joints for this on-line swing span replacement with a new 360-foot vertical lift span over the Mobile River near Hurricane, AL. (5/00 - 2/03)

Elgin, Joliet and Eastern Railway Bridge 198 Inspection and Rehabilitation - Design Engineer
Led the mechanical rehabilitation of this skewed 306-foot-long tower drive vertical lift bridge over the Des Plaines River in Joliet, IL. This Elgin, Joliet and Eastern (EJE) Railway project included the replacement of an open gear set with an enclosed gear reducer, as well as the replacement of all impacted shafts, pinions, bearings, and couplings. Mr. Magistro was also responsible for the design of new mechanical system components, construction sequence, and field assistance during construction. (5/01 - 11/02)

BNSF Bridge 1136.3 Rail Joint Replacement - Design Engineer
Responsible for the replacement of the rail joints on this Abbott Style single-leaf bascule bridge over the Old River in Orwood, CA. The project also involved installation of steel ties under the new joints, replacement of one approach span, and rehabilitation of the span lock. Mr. Magistro's responsibilities also included engineering design, plan production, and field assistance during construction. (5/00 - 4/01)

MICHAEL MATELIS

Mr. Matelis is a Senior Director in the Network Industries Strategies ("NIS") Group of FTI Consulting, Inc., an economic and consulting firm with offices located at 1101 K Street, NW, Washington, DC 20005. Mr. Matelis is sponsoring portions of Sections III-C and III-A of Norfolk Southern ("NS's") Reply Evidence, including NS Reply Exhibit III-C-7 related to Data Sufficiency. Mr. Matelis has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Matelis holds a Bachelor of Arts degree in economics from the University of North Carolina at Chapel Hill. He provides financial and economic consulting services to the transportation, energy, and telecommunications industries. Mr. Matelis has led efforts assessing data quality and performed complex economic and financial analysis.

Mr. Matelis previously worked as a management consultant for a number of government and private organizations, providing quantitative analysis.

Mr. Matelis's curriculum vitae is attached.

VERIFICATION

I, Michael Matelis, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Michael Matelis

Michael Matelis

Executed on this 26 day of November, 2012.

Michael Matelis

Senior Director – Economic Consulting

michael.matelis@fticonsulting.com

FTI Consulting
1101 K Street, NW
Suite B100
Washington, DC 20005
Tel: (202) 312-9100
Fax: (202) 312-9101

Education
BA in Economics from University of North Carolina at Chapel Hill

Michael Matelis is a Senior Director in the Network Industries Strategies group of the FTI Economic Consulting group, located in Washington, D.C. Mr. Matelis provides financial and economic consulting services to the transportation, energy and telecommunications industries.

Mr. Matelis has developed and managed complex database systems incorporating data from various sources to generate enterprise-level information for analysis. He has worked with clients to define data requirements and identify appropriate data sources for various projects. He has led efforts assessing data quality – ensuring proper configurations, linkages, and values contained within data sets. He has performed economic and financial analysis and developed methodologies to model operations, examine costs, establish pricing rates, and ensure compliance with regulations.

Prior to joining FTI Consulting, Mr. Matelis worked as a management consultant leading projects specializing in analytical and data-driven efforts for various government and private organizations. These efforts included: creating data collection and analysis tools, developing and analyzing performance measures, designing and implementing national surveys, and developing information systems. His core skills include quantitative analysis, data management, and information system development.

TESTIMONY

Surface Transportation Board

August 1, 2011	Docket No. 42125, E.I. DuPont De Nemours and Company v. Norfolk Southern Railway Company, Norfolk Southern Railway Company's Reply to Second Motion to Compel, Joint Verified Statement of Benton V. Fisher and Michael Matelis

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CRITICAL THINKING AT THE CRITICAL TIME™

MARK D. MATHEWSON

Mr. Mathewson is the Founder and President of Mathewson Right of Way Company, a land acquisition services company, with offices located at 30 North LaSalle Street, Suite 1726, Chicago, Illinois 60602. Mr. Mathewson is sponsoring portions of Section III-F of Norfolk Southern's ("NS's") Reply Evidence relating to Real Estate Acquisition Costs. Mr. Mathewson has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Mathewson received his Bachelor of Science degree in political science from Loyola University of Chicago and his Juris Doctor from Loyola University of Chicago School of Law. He has approximately 25 years of experience in the land acquisition field.

For six years, Mr. Mathewson has headed Mathewson Right of Way Company, which concentrates on right of way consulting and project management, negotiations, and relocation assistance. Mr. Mathewson has provided negotiation services for numerous state agencies, municipalities, and County Agencies, including for several transportation projects. Mr. Mathewson is on the state of Illinois' Department of Transportation list of Approved Negotiators.

Mr. Mathewson's complete curriculum vitae is attached.

VERIFICATION

I, Mark D. Mathewson, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Mark D. Mathewson

Executed on this 21st day of November, 2012.

MROWCO
MATHEWSON RIGHT OF WAY

Mark D. Mathewson
President

Mark D. Mathewson founded Mathewson Right of Way Company in 2006 with a mission of providing the highest quality land acquisition services in the State of Illinois.

Mr. Mathewson is a licensed attorney and has worked in the land acquisition field since 1987. During his career he has acquired thousands of parcels of property across much of the State of Illinois. Mr. Mathewson remains one the most highly qualified and experienced negotiators in Illinois. Further, Mr. Mathewson provides project management capabilities that result in projects being completed in a timely and budget conscious manner.

Mr. Mathewson has been on the list of Approved Negotiators published by the Illinois Department of Transportation since it was first prepared in 1989.

Education

Juris Doctor, 1985
Loyola University of Chicago, School of Law

B.S. Political Science, 1982
Loyola University of Chicago

Professional Registrations

Attorney at Law; Admitted to the State of Illinois Bar, November 7, 1985
IDOT Approved Fee Negotiator

Areas of Concentration

Right of Way Consulting & Project Management
Negotiations
Relocation Assistance

Representative Projects

Provided land acquisition negotiation services for the following projects

- *Algonquin Road, 78 parcels;* McHenry County Division of Transportation
- *Irene Road and I-90 Interchange, 3 parcels acquired by negotiation;* Boone County
- *I-294 South Tri-State Widening, 170 parcels;* Illinois State Toll Highway Authority
- *Wacker Drive Reconstruction, 2 parcels acquired by negotiation ($2 million);* Chicago Department of Transportation
- *Hillside Strangler (I-290), 99 parcels;* Illinois Department of Transportation – District 1
- *Naperville Road at East-West Tollway, 1 parcel acquired by negotiation ($3.75 million);* DuPage County Division of Transportation
- *IL Route 32/33 Effingham, 46 parcels acquired by negotiation (no condemnation);* Illinois Department of Transportation – District 7
- *FAP 310 (IL 255) Turn-Key Project, 75 parcels;* Illinois Department of Transportation – District 8

Provided land acquisition negotiation services for the following State Agencies

- Illinois Department of Transportation, District 1
- Illinois Department of Transportation, District 4
- Illinois Department of Transportation, District 7
- Illinois Department of Transportation, District 8
- Illinois Tollway

MROWCO
MATHEWSON RIGHT OF WAY

Mark D. Mathewson
President

Representative Projects (Continued)

Provided land acquisition negotiation services for the following County Agencies

- Boone County
- Cook County
- DuPage County (Appointed Special Assistant State's Attorney, 1998)
- Kane County
- McHenry County
- Will County

Provided land acquisition negotiation services for the following Local Agencies

- Village of Addison
- Village of Arlington Heights
- City of Batavia
- Village of Beecher
- Village of Bensenville
- Village of Berkeley
- Village of Buffalo Grove
- Village of Bull Valley
- Village of Cary
- City of Chicago (Special Assistant Corporation Counsel)
- Town of Cicero
- City of Country Club Hills
- Village of Crete
- City of Crystal Lake
- Village of Deerfield
- Village of Elk Grove Village
- Village of Evergreen Park
- Village of Fox Lake
- Village of Franklin Park
- Village of Glen Ellyn
- Village of Gurnee
- Village of Homewood
- Village of Itasca
- Village of Johnsburg
- City of Lockport
- Lockport Township
- Village of Matteson
- Village of Monee
- Village of Morton Grove
- Village of Northbrook
- Village of Oak Brook
- City of Oak Forest
- Village of Orland Park
- Village of Palatine
- Village of Plainfield
- Village of Robbins
- Village of Romeoville
- Village of Schaumburg
- Village of Sugar Grove
- Village of Vernon Hills
- City of West Chicago
- Village of Westmont
- City of Wheaton
- Village of Winfield
- Village of Woodridge
- City of Woodstock

MARK MEITZEN

Dr. Meitzen is a Vice President at Christen Associates, an economic and engineering consulting firm, located at 800 University Bay Drive, Suite 400, Madison, Wisconsin 53705. Dr. Meitzen is sponsoring portions of Section II-B of Norfolk Southern's ("NS's") Reply Evidence on Qualitative Market Dominance discussing the proposed limit price methodology, including NS Reply Ex. II-B-7. Dr. Meitzen has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Dr. Meitzen has a Ph.D. in economics from the University of Wisconsin-Madison. He is an expert in the economic analysis of network industries including railroads, telecommunications, and electricity. Dr. Meitzen was a principal author of the November 2008 and January 2010 Christensen Associates studies of the U.S. freight railroad industry commissioned by the Surface Transportation Board. He was also the projected manager and a principal author of the supplemental report to the Surface Transportation Board on railroad capacity and investment issues. Dr. Meitzen also served as the principal investigator on the Transportation Research Board project, *Preserving and Protecting Freight Infrastructure and Routes*. He has extensive experience in the railroad industry including analyzing railroad mergers and the application of the Surface Transportation Board's Constrained Market Pricing standards, including the Stand Alone Cost Methodology.

Prior to joining Christensen Associates, Dr. Meitzen was a regulatory economist at Southwestern Bell Telephone Company and an assistant professor of economics at Eastern Michigan University and the University of Wisconsin-Milwaukee.

Dr. Meitzen's complete curriculum vitae is attached.

VERIFICATION

I, Mark E. Meitzen, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Mark E. Meitzen

Executed on this 15th day of November, 2012.

Mark E. Meitzen

RESUME

April 2012

Address:

Laurits R. Christensen Associates, Inc.
800 University Bay Drive, Suite 400
Madison, Wisconsin 53705-2299
Telephone: 608.231.2266
Fax: 608.231.2108
Email: memeitzen@LRCA.com

Academic Background:

Ph.D., University of Wisconsin-Madison, 1982, Economics
M.S., University of Wisconsin-Madison, 1979, Economics
B.S., University of Wisconsin-Oshkosh, 1976, Economics

Positions Held:

Vice President, Laurits R. Christensen Associates, Inc., 1998-present
Director-Telecommunications, Laurits R. Christensen Associates, Inc., 1993-1998
Senior Economist, Laurits R. Christensen Associates, Inc., 1990-1993
Regulatory Economist, Southwestern Bell Telephone Company, 1988-1990
Regional Economist, Southwestern Bell Telephone Company, 1986-1988
Adjunct Faculty, Saint Louis University, St. Louis, Mo., 1987-1990
Visiting Assistant Professor of Economics, University of Wisconsin-Milwaukee, 1984-1985
Assistant Professor of Economics, Eastern Michigan University, 1981-1984

Professional Experience:

I have expertise in the economic analysis of network industries including telecommunications, railroad, electricity and postal. I was the Principal Investigator for the Transportation Research Board study, *Preserving and Protecting Freight Infrastructure and Routes*. I was a primary author of the study of the U.S. freight railroad industry commissioned by the U.S. Surface Transportation Board (STB), and was the project manager and a primary author of the study of freight railroad capacity issues also commissioned by the STB. I also have experience in network industry regulatory matters, including incentive regulation, economic costing and productivity measurement. I have been an expert in civil litigation cases, including antitrust, intellectual property (e.g., patent, copyright, trade secret) and employment discrimination cases.

Publications:

"NCFRP Report 16: Preserving and Protecting Freight Infrastructure and Routes," Transportation Research Board of the National Academies, 2012.

"Preserving and Protecting Freight Infrastructure and Routes," *Proceedings of the ASME/ASCE/IEEE 2012 Joint Rail Conference*, April 2012 (with L. Loftus-Otway, R. Grow, N. Hutson, and A. Bruening).

"Railroad Performance Under the Staggers Act," *Regulation,* Vol. 33, No 4 – Winter 2010-2011 (with B.K. Eakin, A.T. Bozzo, and P.E. Schoech).

"Incentive Regulation in Network Industries: Experience and Prospects in the U.S. Telecommunications, Electricity and Natural Gas Industries," *Review of Network Economics*, Vol. 2, Issue 4 - December 2003, pp. 316-337, (with R. C. Hemphill and P. E. Schoech).

"Total Factor Productivity in the Telecommunications Industry," in *International Handbook on Telecommunications Economics*, G. Madden and S. Savage, eds., 2003, (with L. R. Christensen and P. E. Schoech).

"Pricing Network Elements Under the Telecommunications Act of 1996: Back to the Future," *Comm/ENT*, Summer 2001, (with S. Massa and S. G. Parsons).

"Controlling for Cross Subsidization in Electric Utility Regulation," Edison Electric Institute, September 1998, (with L. Kaufmann and M. Lowry).

"Where Do We Go From Here?" *Public Utilities Fortnightly*, June 15, 1993, (with L. R. Christensen and P. E. Schoech).

"Recent State Legislation for Telecommunications: Brave New World or Bad Public Utility Law?" *George Mason University Law Review*, Vol. 14, No. 1, Fall 1991, (with A. C. Larson). Reprinted in *Public Utility Law Anthology*, Vol. 15, Part 2, July-December 1992, Allison P. Zabriske, ed., (Gaithersburg MD: International Library Book Publishers, Inc.) 1992, pp. 433-491.

"The Uses and Abuses of Stand-Alone Costs," *Utilities Policy*, April, 1992, (with A. C. Larson). Shorter, nontechnical version appeared as "The Use of Stand-Alone Cost in Public Utility Regulation," *National Estimator*, spring 1992.

"The Shared Cost Problem and Cash Cow Economics: Who Gets Milked?" *Public Utilities Fortnightly*, April 1, 1991.

"Diversification of Telephone Company Service Offerings and Cash Cow Economics: Who Gets Milked?" *Utilities Policy*, October 1990.

Cost *and Pricing Principles for Telecommunications: An Anthology*, Washington: United States Telephone Association, September 1990, (co-edited with A. C. Larson).

"The LEC's Transition to Full Competition: The Response of Regulation," *The Computer Lawyer*, July 1990, (with T. J. Schroepfer).

"Differential Compensation and Worker Turnover," *Journal of Economics*, 1989, (with L. Brannman).

"Differences in Male and Female Job Quitting Behavior," *Journal of Labor Economics*, 1986.

"The Impact of Unionism on Exit and Voice Decisions in the Labor Market," *Journal of Economics*, 1984, (with S. Hayworth).

"Empirical Analysis of the Rate of Worker Separation," in *Subsidizing On-the-Job Training*, Columbus, OH: National Center for Research in Vocational Education, 1982.

Presentations at Workshops and Professional Meetings:

"Preserving and Protecting Freight Infrastructure and Routes, Findings from NCFRP 24," Transportation Research Board Annual Meetings, January 2012.

"Preserving and Protecting Freight Infrastructure and Routes, Findings from NCFRP 24," Federal Highway Administration, Talking Freight Seminar, August 2011.

"Preserving and Protecting Freight Infrastructure and Routes," NCFRP24 Workshop, January 2011.

"Preserving and Protecting Freight Infrastructure and Routes," Minnesota Freight Advisory Committee, October, 2010.

"An Update to the Study of Competition in the U.S. Freight Railroad Industry," Midwest Association of Rail Shippers, July, 2010.

Overview of the Christensen Associates' Railroad Industry Studies," National Coal Transportation Association, September, 2009.

"Overview of the Christensen Associates' Railroad Industry Studies," Midwest Association of Rail Shippers, July, 2009.

"A Study of Competition in the Railroad Industry and Analysis of Proposals to Enhance Competition, A Progress Report," National Coal Transportation Association, April, 2008.

"A Study of Competition in the Railroad Industry and Analysis of Proposals to Enhance Competition, A Progress Report," Midwest Association of Rail Shippers, January, 2008.

"Economics of Price Erosion Using Available Data," Law Seminars International Patent Damages Workshop, Chicago, IL, April 2004.

"Economics of Price Erosion and Lost Convoyed Sales Using Available Data," Law Seminars International Patent Damages Workshop, Chicago, IL, April 2003 (with J. Cordray).

"Local Exchange Competition," Wisconsin Public Utility Institute, Madison, WI, April 2003.

"Patent Damages: Analyzing the Market But-For Infringement," presented to the Milwaukee Bar Association's Intellectual Property Section, May 2000, (with C. Degen).

"Implementation of Price Cap Regulation–The FCC Experience," Wisconsin Public Utility Institute, Madison, WI, September 1999.

"Costs of Universal Service," Wisconsin Public Utility Institute, Madison, WI, March 1997.

"Unbundled Network Elements and Economic Cost Standards," Wisconsin Institute of Certified Public Accountants, Madison, WI, October 1997.

"The Uses and Abuses of Stand-Alone Costs," Second Prize winner in the Research Awards Competition of the Eleventh Annual Southeastern Public Utilities Conference, Atlanta, GA, September 23, 1991.

"Diversification of Telephone Company Service Offerings and Cash Cow Economics: Who Gets Milked?" First Prize winner in the Research Awards Competition of the Tenth Annual Southeastern Public Utilities Conference, Atlanta, GA, August 1990. Also presented at the Third Annual Western Conference of the Rutgers University Advanced Workshop in Regulation and Public Utility Economics, San Diego, CA, July 1990.

"Financial Market Implications of Competition and Regulation in the Telecommunications Industry," Eighth Annual Conference of the Rutgers University Advanced Workshop in Regulation and Public Utility Economics, Newport, RI, May 1989.

"Foreign Trade in Telecommunications Equipment," Second prize winner in the papers competition held in conjunction with the Eleventh Annual Midwestern Telecommunications Conference, Minneapolis, MN, October 1988.

"Perspectives on Local Exchange Competition," Presented at the Seventh Bi-Annual Conference of the International Telecommunications Society, Cambridge, MA, June 1988.

"The Effects of Market Signals on the Construction of Incentive Contracts in a Principal-Agent Model: The Case of the Academic Labor Market," 1984 Atlantic Economics Society Conference, Montreal, Canada, (with B. Woodland).

"The Role of Voice Mechanisms in Workers' Participation in and Satisfaction with Unions," 1984 Midwest Economics Association Convention, Chicago, IL.

"Hedonic Wage Models and Worker Turnover," 1984 Midwest Economics Association Convention, Chicago, IL.

"The Impact of Unionism on Exit and Voice Decisions in the Labor Market," 1984 Missouri Valley Economics Association Convention, Kansas City, MO, (with S. Hayworth).

"Differences in Male and Female Job Quitting Behavior," 1983 Midwest Economics Association Convention, St. Louis, MO.

Non-Confidential Consulting Reports and Research Papers:

"Revisiting the CPI-Based Price Cap Formula for the U.S. Postal Service," 2012 Eastern Conference of the Center for Research in Regulated Industries, May 2012 (with P. Schoech and M. Kubayanda).

"An Update to the Study of Competition in the U.S. Freight Railroad Industry," prepared for the U.S. Surface Transportation Board, January 2010 (Christensen Associates).

"Supplemental Report to the U.S. Surface Transportation Board on Capacity and Infrastructure Investment," prepared for the U.S. Surface Transportation Board, March 2009 (Christensen Associates).

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"The Ameritech Illinois Total Factor Productivity Study," June 2000, Illinois Commerce Commission Docket 98-0252, (with P. E. Schoech and S. M. Schroeder).

"Market Power Study of the Potomac River, Benning Road, and Buzzard Point Power Plants," Final Report to Potomac Electric Power Company, April 2000, (with F. L. Alvarado, L. D. Kirsch, S. D. Braithwait, B. K. Eakin, S. L. Greene, R. Rajaraman, and J. D. Reaser).

"Price Cap Design and X Factor Estimation for Peruvian Telecommunications Regulation," Final Report to OSIPTEL, May 1999, (with L. R. Christensen, P. E. Schoech, L. D. Kirsch, C. A. Herrera, and S. M. Schroeder).

"Analysis of Benchmark Cost Proxy Model 3.0, Hatfield Model, Version 5.0 and Hybrid Cost Proxy Model," Federal Communications Commission, CC Docket 96-45, January 1998, (with A. T. Bozzo, T. Rutkowski, and T. Grau).

"Analysis of Benchmark Cost Proxy Model and Hatfield Release 3.1," Federal Communications Commission, CC Docket 96-45, April 1997, (with L. R. Christensen, P. E. Schoech, A. T. Bozzo, and T. Rutkowski).

"The TFPRP Provides the Best Basis for Determining the Rate of LEC TFP Growth," Federal Communications Commission, CC Docket 94-1, February 1997, (with L. R. Christensen and P. E. Schoech).

"Appropriate Standards for Cost Models and Methodologies," Federal Communications Commission, CC Docket 96-45, Final Report to United States Telephone Association, February 1997.

"Updated Results for the Simplified TFPRP Model and Response to Productivity Questions in FCC's Access Reform Proceeding," Federal Communications Commission, CC Docket 94-1, January 1997, (with L. R. Christensen and P. E. Schoech).

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"A Survey of X-Factor Experience in the United States," filed with Canadian Radio and Telecommunications Commission on behalf of Stentor Member Companies, June 1996, (with L. R. Christensen and P. E. Schoech).

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"Total Factor Productivity Methods for Local Exchange Carrier Price Cap Plans: Reply Comments," Federal Communications Commission, CC Docket 94-1, March 1996, (with L. R. Christensen and P. E. Schoech).

"Total Factor Productivity Methods for Local Exchange Carrier Price Cap Plans," Federal Communications Commission, CC Docket 94-1, December 1995, (with L. R. Christensen and P. E. Schoech).

"Productivity of the Local Operating Telephone Companies Subject to Price Cap Regulation 1993 Update," Federal Communications Commission, CC Docket 94-1, January 1995, (with L. R. Christensen and P. E. Schoech).

"Productivity Growth in the Cable Television Industry," filed with Federal Communications Commission on behalf of the National Cable Television Association, June 1994, (with L. R. Christensen and P. E. Schoech).

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Expert Testimony – Regulatory Proceedings

Before the U.S. Surface Transportation Board, "Joint Verified Statement of B. Kelly Eakin and Mark E. Meitzen," STB Ex Parte No. 705, Competition in the Railroad Industry, May 2011.

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Client: Coal Shippers Coalition (2006)
Proceeding: Surface Transportation Board Ex Parte No. 657 (Sub-No. 1)

Client: AEP Texas North (2004)
Proceeding: Surface Transportation Board Docket No. 41191

Client: OSIPTEL (2003)
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Client: Ameritech Illinois (2001)
Proceeding: ICC Docket No. 98-0252
Client: Texas Municipal Power Agency (2001)
Proceeding: Surface Transportation Board Docket No. 42056

Client: Reliant Energy HL&P (2000)
Proceeding: Texas SOAH Docket No. 473-00-1020, Texas PUC Docket No. 22355

Client: Frontier Communications (1999)
Proceeding: MPSC Case No. U-12049

Client: TDS Telecom (1998)
Proceeding: MPSC Case No. U-11815

Client: Mid-Plains Telephone (1997)
Proceeding: PSCW Dockets 3650-MA-100 and 5845-MA-100

Client: Washington Independent Telephone Association (1997)
Proceeding: WUTC Docket UT-960369

Client: Michigan Exchange Carriers Association (1997)
Proceeding: MPSC Case No. U-11448

Client: Wisconsin State Telephone Association (1996)
Proceeding: PSCW Docket 05-TI-137

Client: Ameritech Illinois (1995)
Proceeding: ICC Docket 95-0458

Client: Southwestern Bell Corporation Media Ventures (1994)
Proceeding: Maryland PSC Docket 8659

Client: Ameritech Illinois (1993)
Proceeding: ICC Docket 92-0211

Client: Urban Telephone Company (Wisconsin) (1992)
Proceeding: PSCW Docket 6050-TI-100

JOSEPH C. OSBORNE, JR.

Mr. Osborne is a consultant with RELX LLC with extensive expertise in railroad operations following a career at Norfolk Southern. Mr. Osborne is sponsoring portions of Section III-D of Norfolk Southern's ("NS's") Reply Evidence relating to police and environmental staffing. Mr. Osborne has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Osborne's railroad experience includes over 30 years in the railroad industry, first as an employee of Penn Central, then Conrail, and later at NS. Mr. Osborne was an integral part of the NS Management Team that oversaw the Conrail acquisition and integration. Mr. Osborne most recently served as Vice President – Coal Transportation and Planning and prior to that as Group Vice President – Chemicals for NS. Mr. Osborne's experience includes years with various marketing and business development units within both NS and Conrail. Mr. Osborne holds both Masters and Bachelor of Arts degrees in History from the University of Delaware.

Mr. Osborne's resume with additional project experience is attached hereto.

VERIFICATION

I, Joseph C. Osborne Jr., declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Joseph C. Osborne, Jr.

Executed on this 26th day of November, 2012.

2611470

Joseph C. Osborne, Jr.
1550 Strawberry Mountain Drive, Roanoke, VA 24018
(540) 725-1118

Profile - Retired June 1, 2011 from Norfolk Southern. Currently consulting under RELX LLC.

Member of the Norfolk Southern Management Team that successfully integrated the Conrail acquisition. Held various senior level positions in marketing, coal operations and equipment management. Successfully increased profitability across various business segments while minimizing regulatory impact. Implemented a series of commercial agreements to better manage the risks of handling hazardous materials by rail.

Member of the Conrail Management Team that delivered one of the most notable corporate turnarounds in history at that time. Held various senior level positions in marketing, operations, and equipment management, areas key to achieving a yield of 27% ROE. Demonstrated success by focusing cross-functional teams on clear measures and delivery of results. Achieved significant improvements in asset return while maintaining high levels of employee satisfaction and motivation.

Experience - **Norfolk Southern** (NS), Roanoke, VA **1998 - 2011**
A railroad generating $9.5 billion in annual revenue and providing freight transportation to the eastern half of the U.S.

Coal Business Group
GVP – Coal Transportation & Planning **2009 - 2011**

Business Manager for all aspects of Transportation and railcar fleet supply in support of NS' coal business.

- In the face of an unprecedented increase in 2010 demand, tailored available transportation capacity such that no coal customer experienced a critical, NS caused shutdown
- Increased transparency of coal transportation performance for producers and receivers
- Provided key input as NS' spokesperson to the STB's RETAC Committee and Coal Industry groups on service performance and capacity expansion plans

Industrial Products Group
GVP - Chemicals **2000 - 2009**

Business Unit Manager responsible for $1.1 billion in annual revenue for over 600 chemical commodities

- Increased profitability by over 145% on a declining (-10%) carload base through a complete rate restructuring while minimizing NS' rate regulatory risk
- Successfully marketed NS' superior service and safety record in the handling of hazardous materials while contractually achieving risk management goals
- Achieved the Thoroughbred Award as Leader of the SMART Pricing Team, which restructured pricing across the entire Industrial Products Group
- Lead the TVA Coal Ash clean-up project which was delivered on time, without any regulatory incidents, and with 100% profitability above standard for this business segment; this Team won the 2010 Chairman's Award

Merchandise Marketing Group
Director Construction Marketing **1998 - 2000**

Business Unit Manager responsible for $260 million in annual revenue for highway and building construction related products.

- Successfully increased profitability across the business unit portfolio while reducing rail fleet asset base.

Consolidated Rail Corporation (Conrail), Philadelphia, PA **1974 - 1998**
A railroad generating $3.86 billion in annual revenue and providing freight transportation to the Northeast and Midwest, U.S.

CORE SERVICE GROUP
AVP - Service, Equipment and Shortline Network **1995 - 1998**

Service and Equipment Management responsibility for distributing 58,000 freight cars per day and managing a $500 million annual equipment budget.

- Lead a cross-functional team to reduce equipment rents as a percent of Conrail revenue from 11% to 9% by instituting common and clear measures focusing on performance
- Reduced Equipment Management costs by 60% by standardizing car ordering and empty waybilling procedures
- Established new car allocation process which increased utilization by 7%
- Increased order fill rate from 65 to 85% by developing new freight car ordering technology
- Directed a staff of 53 employees, covering the functional areas of Equipment Management and Planning, Service Design, Car Accounting and Deprescription, and Conrail's Shortline Network

CORE SERVICE GROUP
AVP - Metals **1994 - 1995**
Director - Metals Marketing **1993 - 1994**

Business Unit manager responsible for $350 million in annual revenue. Conrail was the largest transporter of steel in North America

- Increased market share and revenue by $70 million by locating seven new steel mills on Conrail through a combination of competitive service/rate packages, leveraging Conrail's scrap steel franchise, and coordination of both electric power suppliers and state and local government agencies
- Improved margins on steel business by 19% over two years through improved freight car supply and quality, applying yield management techniques to the car allocation process, and selling the value of Conrail's steel franchise to all suppliers of the steel production process
- Saved $182 million in equipment acquisition costs by coordinating a 30% utilization improvement on 10,000 gondolas and coil cars
- Directed a staff of 72 employees, covering the functional areas of marketing, sales, equipment planning and pricing specialists

AUTOMOTIVE BUSINESS GROUP
Director - Auto Parts Marketing **1990 - 1993**

Line of Business manager in charge of $230 million in annual revenue for the largest transporter of auto parts in North America

- Successfully launched a $57 million annual revenue project for GM's Tarrytown Assembly plant. Team leader of key Conrail, General Motors, Metro North Rail, and New York State personnel. Completed entire commercial plan, service design for both inbound auto parts and outbound finished vehicles. Coordinated the engineering efforts for the Hudson Line Clearance Project and the Tarrytown Auto Loading facility
- Lead a cross-functional team that designed and implemented a guaranteed service product which stabilized Conrail's auto parts market share
- Recognized as Chairperson of the Conrail Marketing Department Quality Council

AUTOMOTIVE BUSINESS GROUP
Various Marketing, Business Development, Service Planning and Equipment Management positions **1986 - 1990**

TRANSPORTATION and OPERATIONS
Division Road Foreman - New Jersey Division **1984 - 1986**

- Managed five Road Foreman and 350 Locomotive Engineers for service and safety performance over almost 1,000 miles of railroad. Responsible for Locomotive Utilization and Road Train operations

Road Foreman - Harrisburg Division **1981 - 1984**
Trainmaster, Road Foreman - Philadelphia Division **1980 - 1981**
Locomotive Engineer **1974 - 1980**

Education - University of Delaware - Masters in History **1979**
- B.A. in History **1973**

Training Programs (62 Programs completed) **1983 - 2011**

Computer Skills - Familiar with Mainframe Applications for Railroad Operations; Outlook, Word, Excel, Power Point

MARK A. PETERSON

Mr. Peterson is a Vice President and Architect with STV, a professional firm offering engineering, architectural, planning, environmental and construction management services with offices located at 1055 West Seventh Street, Suite 3150, Los Angeles, California 90017. Mr. Phillips has more than 25 years of experience in the design and oversight of new and renovated transportation, healthcare, and laboratory facilities. Mr. Peterson is sponsoring portions of Section III-F of Norfolk Southern's ("NS's") Reply Evidence relating to Facilities. Mr. Peterson has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Peterson's transportation work has included master planning, programming, and design for vehicle maintenance, service and inspection, parking, operations and administrative, and communications facilities for state and regional transit agencies as well as for railroads. Mr. Peterson holds a Bachelor of Arts, Architecture from Washington University and is a member of the American Institute of Architects.

Mr. Peterson's resume with additional project experience is attached hereto.

VERIFICATION

I, Mark A. Peterson, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Mark A. Peterson

Executed on this 26th day of November, 2012.

Mark A. Peterson, AIA

Architect
Vice President

Mr. Peterson is an architect and project manager with more than 25 years of experience in the design and oversight of new and renovated transportation, healthcare, and laboratory facilities. His transportation work has included master planning, programming, and design for vehicle maintenance, service and inspection, parking, operations and administrative, and communications facilities for state and regional transit agencies and railroads. Mr. Peterson also has particular expertise providing design for healthcare facilities, as well as for life safety systems and ADA compliance upgrades. He brings a high degree of knowledge and experience in the resolution of challenging construction projects within operating facilities.

Office Location
Los Angeles, CA

Date joined firm
12/3/07

Years with other firms
23

Education
Bachelor of Arts, Architecture; Washington University (1984)

Professional Registrations
Architect: California (1994/#C25229/exp. 5/31/13)

Memberships
American Institute of Architects (AIA), Los Angeles Chapter

Project Experience

HEALTH & SCIENCE

LACDPW Olive View – UCLA Medical Center - Architect-of-Record
Provided architectural oversight for the design of a new cleanroom and anteroom at the Olive View – University of California, Los Angeles (UCLA) Medical Center in Sylmar, CA. Under an architectural and engineering design services task-order contract with the Los Angeles County Department of Public Works (LACDPW), STV designed a renovation of an existing pharmacy area at this 377-bed hospital to accommodate an International Organization for Standardization (ISO) Class 5 intermediate cleanroom for intravenous compounding and chemotherapy, an ISO Class 7 anteroom, and a Talyst machine. Mr. Peterson oversaw design plans, which encompassed architectural, mechanical, and structural disciplines. As part of this complex renovation, the firm designed a standalone HVAC system with separate exhaust; electrical, plumbing, and fire protection system improvements; a horizontal and vertical flow hood; and upgrades to the pharmacy restroom, in accordance with ADA requirements. STV also designed the anchorage for three carousel prescription dispensers planned for installation and verified that the pharmacy's floor could support their load, strengthening the floor beams, as required. The California Office of Statewide Health Planning and Development approved STV's plans for the project. (7/08 - 7/10)

VA Building 99 Seismic Upgrade and HVAC Systems Replacement - Architect
Led initial building evaluation and formulation of the design approach, phasing, and costing for the seismic retrofit of a single-story, long-term U.S. Department of Veterans Affairs (VA) care facility in Sepulveda, CA. The project scope for this occupied 50,000-sf facility included full replacement of

the HVAC system, slab-on-grade and foundation wall moisture sealing, and replacement of all interior finishes. (1996)

VA Long Beach Campus ADA and Life Safety Systems Upgrades - Project Architect
Provided design for the upgrade of numerous structures for compliance with ADA guidelines and life safety codes on the U.S. Department of Veterans Affairs (VA) campus in Long Beach, CA, as part of an open-ended contract. The project included initial evaluation of deficiencies within fire-rated existing systems, reporting, and the development of construction documents detailing corrective measures. (1995)

U.S. FamilyCare Medical Center Expansion - Project Manager/ Architect
Provided design for the seismic upgrade and expansion of a 101-bed acute care facility in Montclair, CA. The project goals included a seismic upgrade and market-driven expansion of the hospital from 72,000 to 100,000 sf while avoiding impact to the census or services at any time. Mr. Peterson's design included phased upgrades to all departments and complete redesign of the site. All mechanical and electrical systems were replaced to comply with current standards, including life safety and critical branch power requirements. (1993)

LABORATORY & HIGH-TECH

NASA Jet Propulsion Laboratory Improvements - Contract Manager/Project Architect
Responsible for the administration and direction of projects under an open-ended contract with the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory in Pasadena, CA. Projects typically ranged from $700,000 to $1.5 million and included optical, flight hardware development, and super-computing laboratories; administrative and records archiving units; and cafeterias. Other projects included clean rooms, specialized utility delivery requirements, and addressing security issues. (1995 - 2007)

MULTIMODAL

BNSF Railway Intermodal and Automotive Facility Expansions - Project Manager/Project Architect
Led design for numerous rail and building projects in Los Angeles associated with a $150 million expansion of the world's largest intermodal facility. One project was the complete redesign of secure parking facilities, which included security systems; gate reconfiguration; and supporting administrative, repair, and mechanical structures. Mr. Peterson helped develop a complete master plan corresponding to the rolling 5-year goals of the BNSF Railway. He was responsible for the programming and design of a

new 30,000-sf operations and administrative command center serving the nearly 500 employees and contractors at the Los Angeles facility, as well as a new, secure communications hub built to emergency services standards in Stockton, CA, to provide connectivity between operations centers in Los Angeles; Fort Worth, TX; and Northern California. Mr. Peterson assumed a similar design role for the BNSF Memphis Intermodal Yard Expansion, which was one of the first in the nation to employ European wide-span crane technology. (1995 - 2007)

POLA/BNSF Railway Southern California International Gateway - Task Manager/Project Architect

Worked with the Port of Los Angeles (POLA) and BNSF Railway to plan a new intermodal facility, the Southern California International Gateway (SCIG), on a sustainable design basis in Los Angeles. The SCIG will provide much-needed near-dock capacity with direct access to the Alameda Corridor, a 20-mile-long, grade-separated rail line between the ports and downtown Los Angeles. The design, which progressed to the Environmental Impact Report process and is presently awaiting approval, is based on minimizing the environmental footprint and employs highly efficient wide-span cranes capable of serving up to eight intermodal tracks. The cranes are electric and use cogeneration of power in their operation. All hostling equipment will utilize either compressed natural gas or liquefied natural gas to reduce emissions. Yard lighting is designed to virtually eliminate light trespass and utilizes highly efficient lamps. Yard operations are designed to provide the utmost in efficiency and further reduce hostling operations and third-party truck dwell time. This efficiency also reduces the overall area of impact for stormwater management. (2005)

TRANSPORTATION FACILITIES

WRTA Bus Maintenance, Operations, and Storage Facility - Lead Designer

Overseeing architectural design for the construction of a new vehicle maintenance, operations, and storage facility in Worcester, MA, for the Worcester Regional Transit Authority (WRTA). The 2-story, 150,000-sf facility will have a capacity for 125 vehicles and space for 155 employees. It will include bus lifts, wash and fueling bays, a body shop and paint booth, fluid dispensing systems, general parts and tire storage operations and retrieval, operations and maintenance personnel welfare areas, bus and van dispatch space, and office and administration spaces. (7/11 - Present)

City of Los Angeles LADOT CNG Fueling and Bus Maintenance Facility Feasibility Study - Project Manager

Leading a feasibility study of three locations for a proposed new Los Angeles Department of Transportation (LADOT) fueling and maintenance facility for its 60-vehicle compressed natural gas (CNG) Downtown Area Short Hop bus fleet, with layover area for up to 64 Commuter Express buses. The facility will include vehicle storage, CNG fueling stations, maintenance bays, office space, parking for employees and non-revenue vehicles, welfare facilities, and a dispatch center. In addition to determining minimum site size and configuration, the conceptual feasibility evaluation will include environmental and accessibility requirements, capacity for future expansion, general floor plans, rendered elevations, and cost estimates. Issues Mr. Peterson is addressing include the maneuvering and parking needs of the 30-foot-long and 40-foot-long vehicles, traffic patterns and impacts in and around the sites, and the availability of adequate quality natural gas, as well as integration with and support for planned future high-speed rail service in the region. (8/11 - Present)

Omnitrans East Valley Vehicle Maintenance Facility Modifications - Project Manager
Leading architectural and engineering services for project development — including preliminary engineering and final design; engineering support services during construction; and development of plans and procedures for start-up, commissioning, operations, and maintenance — of the Omnitrans East Valley Vehicle Maintenance Facility in San Bernardino, CA. The facility needs to be modified to accommodate the introduction of up to 23 sixty-foot-long articulated buses associated with the sbX bus rapid transit project. All maintenance services must remain operational throughout the construction period. (1/11- Present)

CHSRA Los Angeles-to-Anaheim Project EIR/EIS - Facilities Programming and Design Manager
Leading the team for preliminary design of three stations and a rolling stock vehicle maintenance facility for a 30-mile high-speed train corridor between Los Angeles and Anaheim, CA, for the California High Speed Rail Authority (CHSRA). The maintenance facility will provide Class 1-3 vehicle maintenance services for 28 trainsets daily. The contextual nature of the proposed facilities is seen as critical in terms of aesthetic, scale, massing, and traffic impact. Early on, Mr. Peterson led the team's effort to generate projections for vehicle design, operations, ridership numbers, and demographics: parameters that CHSRA had not yet defined. These projections distilled down into sensible design solutions. Despite significant changes to the project due to immense political pressures, Mr. Peterson's leadership enabled the team to complete deliverables on time. Currently, design is progressing toward a 30% design deliverable in support of the Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the design-build procurement package. Mr. Peterson is meeting and coordinating with numerous agencies and cities along the corridor. He is also addressing the complex integration with the proposed Anaheim Regional Transit Intermodal Center. (6/09 - Present)

SCRRA On-Call Professional Engineering Design Services - Project Manager
Directed design to 30% and preparation of design-build bridging documents for the consolidation of several Southern California Regional Rail Authority (SCRRA) properties into a single campus in Pomona, CA. The campus

consists of a 64,000-sf maintenance support facility and a 28,000-sf train control center (TCC), which houses a modified Metrolink operations center that will remain online during the project as a back-up to the new facility. Upon approval at a public hearing, the project was praised by the City of Pomona Planning Commission as a "very attractive" building that will be an asset to the community. The TCC was designed according to the strict standards of California's essential services building regulations and includes a dispatch center and a significant data center. It will provide several modes of wireless communications including a microwave array and two cellular towers. The design team secured environmental clearances for the NEPA and the California Environmental Quality Act. The project also includes positive train control systems, which are mandated to be installed on all railroads in California by 2015. (2/09 - Present)

POLA Pacific Harbor Line Maintenance Facility - Project Manager
Managing the design of an 8,200-sf maintenance facility and a 5,000-sf prefabricated office building at the Port of Los Angeles (POLA) in Wilmington, CA, to accommodate the Pacific Harbor Line. The maintenance facility will provide two covered inspection pits, a fueling track, sanding facility, and an oil/water separator. In addition to the service areas, the building will house a storage area, machine shop, tool corral, break room, office area, locker room, and restrooms. The office building will house administrative offices, a dispatching center, support spaces, a conference room, and employee welfare spaces. The design for the $90 million project features a broad range of sustainable strategies and project-specific innovations to comply with the California Green Building Code. Due to uncertainty in the economy, the project has been put on-hold several times, after which Mr. Peterson has successfully regrouped the project team and gotten them back up to speed. As a result, STV's team has met all submittal deadlines in a timely and material fashion. (7/08 - Present)

OCTA Metrolink Capital Improvement Program Study - Project Manager
Oversaw a comprehensive assessment for the Orange County Transportation Authority (OCTA) of its 12 Metrolink commuter rail stations to evaluate current conditions and prioritize potential enhancements. STV's study provided a comprehensive inventory of station facilities and amenities, and highlighted issues associated with public safety; station accessibility; and ease of transfer between rail, bus, and other modes of surface transportation. Mr. Peterson and his team ranked the recommended improvements to the Metrolink stations based on priority and implementation timeframe. (11/11 - 1/12)

[consolidated description]
OCTA On-Call Design and Construction Support Services - Project Manager
Directed personnel, development of proposals, and fees and budgets for an on-call contract with the Orange County Transportation Authority (OCTA) for improvements to its Southern California bus maintenance facilities.

Projects included modifications to steam cleaning facilities to replace siding panels and lighting fixtures damaged by the corrosive environment; replacement of piping and structural elements in bus wash areas, and the design of a roof access ladder; the addition of an uninterruptible power system at a fuel building; upgrades to restroom and employee break rooms; and the addition of a mezzanine for parts storage. (12/07 - 11/09) [Client Contact: Sara Strader, Contract Administrator, (714) 560-5633]

[individual description]

OCTA Worker Fall Protection at Three Sites - Project Manager/Project Architect

Managed and led the design of new fall protection systems at the Orange County Transportation Authority (OCTA) Santa Ana, Garden Grove, and Anaheim, CA, bus maintenance facilities to allow OCTA personnel to safely access the bus roofs. The design met the needs for servicing several bus designs, which range in length from 40 feet to 60 feet. The primary challenge was retrofitting fall protection systems into the repair bays to allow for effective bus maintenance while limiting the impact on existing overhead utility systems. In addition, Mr. Peterson's team of designers had to keep the number of support system types to a minimum to reduce the cost of the installations. (12/07 - 6/08)

Metro Union/Patsaouras Plaza Busway Station - Architect

Coordinated with project design architects and the engineering group to define the aesthetics for and functionality of a new bus station at Patsaouras Plaza adjacent to Union Station and US 101 in Los Angeles for the Los Angeles County Metropolitan Transportation Authority (Metro). Mr. Peterson participated in a number of design charrettes and worked with Metro to develop the signage and wayfinding design package. He also participated on the art component selection committee, which entertained proposals from 120 internationally recognized artists. (10/09 - 7/10)

[consolidated description]

NCTD On-Call Projects - Project Manager

Oversaw design for a number of on-call engineering, planning, and design projects for the North County Transit District (NCTD) in San Diego County. Projects included development and site adaptation of a bus shelter prototype design, modifications to the Oceanside Transit Center site, expansion of the East Division Maintenance Facility, a replacement study for the Fallbrook Junction Maintenance-of-Way Facility, the Vista Del Ray Transit Center, the remodel of the 810 Mission Street office's board rooms, and security office renovations and roof replacement at the Oceanside Transit Center. (2000 - 2009)

[individual description]

NCTD Bus Shelter Prototype - Project Manager

Worked with a prefabricated bus shelter manufacturer to develop a prototypical design for bus shelters to be deployed at several transit centers for the North County Transit District (NCTD) in San Diego County. These large shelters are designed to provide shade and cover from the weather for up to 30 passengers. The design provides the basic canopy elements and is then clad to work with the established aesthetic and context of the transit centers. Mr. Peterson's responsibilities include assisting the NCTD with site layout of the canopies for each location. (2007 - 2009)

[individual description]

NCTD Oceanside Transit Center Modifications - Project Manager

Managed the completion of several North County Transit District (NCTD) projects to update this intermodal facility in Oceanside, CA. Tasks included new wayfinding and signage installation to assist the public in locating transit center services and to access the various rail and bus lines that serve the facility. Additional services included new landscape and hardscape design, new site lighting, the addition of emergency power, structural evaluation of canopies and other structures, and a complete renovation of the transit center's security center. Mr. Peterson also oversaw the renovation of the center's canopies, including nearly 1 acre of polycarbonate panels. (2007 - 2009)

[individual description]

NCTD East Division Bus Maintenance Facility Expansion - Project Manager/Project Architect

Provided project design and management for the expansion of this North County Transit District (NCTD) facility in Escondido, CA, to accommodate compressed natural gas-fueled buses. The project involved the addition of eight new bays and the renovation of the existing maintenance building to provide support services and storage for maintenance operations. Challenges included maintaining maintenance operations through construction via phasing, and developing a site layout that could accommodate the increased bus count and provide safe and adequate circulation to service facilities without an increase in available property. (2004 - 2007, 1/08 - 5/09)

[individual description]

NCTD Sprinter DMU Maintenance Facility - Construction Manager

Provided personnel management and technical review associated with the construction of the $25 million North County Transit District (NCTD) Sprinter Maintenance Facility in Escondido, CA. The facility was built to house operations and maintenance functions for 12 diesel multi-unit (DMU) commuter vehicles serving communities from Oceanside to Escondido. (2006)

[individual description]

NCTD 810 Mission Avenue Board Room Remodeling - Project Manager

Managed this project to remodel the public board room at the North County Transit District (NCTD) offices in Oceanside, CA. The design also included a private, break-out meeting room adjacent to the main conference area. Mr. Peterson led the design for revised casework for board members, upgrades to IT and communications systems, HVAC system and lighting modifications, and furnishing specifications. (2004)

[individual description]

NCTD West Division Fuel System Replacement - Project Manager
Oversaw design for the removal of underground diesel and gasoline storage tanks for North County Transit District (NCTD) buses and other non-revenue vehicles at the West Division Bus Maintenance Facility in Oceanside, CA. The final design included several aboveground diesel fuel and one gasoline tank as well as new fuel distribution and management systems. (2004)

[individual description]
NCTD San Luis Rey Transit Center - Project Manager
Worked with the North County Transit District (NCTD) and a transit-oriented development (TOD) developer to integrate bus services into a new mixed-use development in Oceanside, CA, that includes multifamily residences, offices, and other business functions. The design includes pedestrian and vehicular circulation to serve 12 bus bays, a ticket office with restrooms, and 4 covered shelters with seating and restroom facilities. Particular effort was dedicated to the interface with the TOD and its aesthetic and to the site's vertical challenges for accessibility. (2003)

SJRRC Altamont Commuter Express Authority Equipment Storage and Maintenance Facility - Project Manager
Oversaw the design of a new service and inspection facility in Stockton, CA, for the San Joaquin Regional Rail Commission (SJRRC) Altamont Commuter Express rail service. Mr. Peterson managed a team of approximately 100 people, including various subconsultants. The site is bordered to the north by a residential community, and Mr. Peterson worked throughout the development of the project to mitigate the massiveness of the facility through design, coordinating closely with the City of Stockton and the neighboring community. The project is also the first vehicle maintenance shop of its type pursuing LEED® certification and includes a 110,000-sf shop with areas for maintenance, wheel truing, fueling, service, and inspection; 12,000-sf of office and welfare areas; and a 1,840-sf trainwasher. The industrial nature of the facility, which services diesel locomotives, made it an unusual LEED candidate, and many of the sustainable design techniques considered conflicted with building codes. Despite these challenges, Mr. Peterson proposed several sustainable techniques including water reclamation from industrial processes for reuse in pressure washers and as grey water in toilets, and strategies that use automatic processes to minimize energy consumption. One such process uses air quality monitors to control exhaust fans to run as-needed. Other sustainable strategies include photovoltaic panels, rainwater harvesting for irrigation, and drought tolerant plants. Mr. Peterson suggested significant design changes to the client that would have netted cost savings, had they been adopted. This LEED-registered project is pursuing Silver certification. (12/07 - 6/09)

Amtrak Seattle Interim Improvement - Project Manager
Managed the proposed modification of track configurations in a Seattle rail maintenance facility in response to a mainline shift by BNSF Railway and to improve storage. This shift also required modifications to the existing drop table and drop table building. Mr. Peterson developed a plan to separate the

stormwater and sewage, which commingled in an outdated drainage system. This involved massive underground water storage tanks. He also customized the preliminary design so that all modifications satisfied the initial project requirements as well as the needs of anticipated build outs in the future. Using a highly successful design-build team approach, Mr. Peterson delivered plans that met all project goals. However, the project was never constructed due to budget constraints. (12/07 - 3/09)

Amtrak Southampton Drop Table Study - Project Manager
Oversaw the design of several studies to add a new drop table and progressive maintenance track to a maintenance facility serving the northern terminus of Amtrak's Acela service in Boston. The project posed several challenges, including a severely constrained site, a high water table, and differential settlement issues. Mr. Peterson helped develop innovative foundation concepts to minimize construction impacts to yard operations and capacity. To address the storage shortage on the site, the team developed a design scheme for storing full locomotive truck sets on a mezzanine level created in the drop pit. The project also required a comprehensive fire response and suppression system plan with the Boston Fire Department. There was no existing fire plan prior to the study and the department initially wanted a fire access road constructed adjacent to the facility. Through Mr. Peterson's coordination efforts and the assistance of a property risk management consultant, the fire department agreed to a standpipe system. The standpipe was a much safer solution, considering the extensive catenary system, and created minimal impact to yard operations compared to the fire access road originally requested. (5/08 - 1/09)

Arlington County Department of Environmental Services Division of Transportation ART House Master Plan - Project Director
Performed a concept study under an on-call contract for a temporary and subsequent permanent bus maintenance facility in Crystal City, VA, to house the Arlington Transit (ART) bus fleet, as a task under an on-call contract for the Arlington County Department of Environmental Services Division of Transportation. The project, which included planning, civil, architectural, and engineering services, was accomplished in four phases. Mr. Peterson assisted in site assessment, site and facility design, and vehicle circulation analysis. Subsequent to the original study, the master plan was updated to accommodate an additional land purchase and a larger fleet. (2006 - 2009)

UPRR Intermodal and Welfare Facility Projects - Principal-in-Charge/Project Architect
Responsible for overseeing design and providing overall direction for numerous improvements projects at Union Pacific Railroad (UPRR) facilities. Mr. Peterson led the design efforts to improve the UPRR intermodal yard in Salt Lake City. Improvements included new automated gate system inbound and outbound gates with canopies, an office and gate control building, welfare facilities, and hostler facilities. He also served as the principal-in-charge of architectural and engineering services for two new welfare and office buildings at UPRR intermodal yards in Southern

California and a new maintenance-of-way crew building in Oxnard, CA. Other projects included replacement of HVAC systems at the UPRR Los Angeles Police Department building; a new yard crew facility in Martinez, CA; and a warehouse expansion in Roseville, CA. (2004 - 2007)

Amtrak Passenger Platform Expansion - Project Manager
Worked with Amtrak, BNSF Railway, and the City of Hanford to develop an 800-foot second passenger platform to support a second mainline in Hanford, CA. Platform and shelter designs reflected the historic context of the Hanford Depot and interfaced with the city's adjacent intermodal transit facilities. The 7th Street at-grade crossing and pedestrian safety were major considerations in the design solution. (6/04 - 6/05)

NCTD Fallbrook Junction MOW Facility Replacement - Project Manager
Oversaw preliminary design and pricing for the replacement of the North County Transit District (NCTD) maintenance-of-way (MOW) building and yard north of Oceanside, CA. The study looked at several sites to satisfy environmental impact requirements and ultimately was developed to conform to a specific site. The facility included four vehicle bays, welfare facilities for business operations and employees, a partially covered spur track, and parking and material laydown areas. (2004)

Caltrans/Amtrak National City Car Service Facility and Passenger Platform - Project Manager
Led the design of a service and inspection facility for Amtrak trains at a layover storage yard in National City, CA. The facility includes a 2-track inspection service and fueling facility designed for joint use with BNSF Railway. On-site improvements for this joint California Department of Transportation (Caltrans)/Amtrak project also included storage for six trainsets and a train wash, administrative shop, and storage building. The project also entailed the design of a new passenger platform and trans-load dock, as well as 6 miles of track improvements through downtown San Diego. Complexities of this project included the number of rail lines servicing the area as well as working with the city to get the facility to conform with its vision of growth for the community. (1999)

ROBERT C. PHILLIPS

Mr. Phillips is Vice President of the Rail Division of STV, a professional firm offering engineering, architectural, planning, environmental and construction management services. Mr. Phillips has more than 35 years of experience with track design and maintenance, grade crossings, bridge construction, construction management of rail projects, maintenance and protection of traffic, and the installation of fiber-optic cable within railroad rights-of-way. Mr. Phillips is sponsoring portions of Section III-F of NS's Reply Evidence relating to Earthwork. Mr. Phillips has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Phillips is responsible for overseeing and directing STV's commuter and freight rail planning and engineering projects. Mr. Phillips joined STV in 1994. Prior to his employment with STV, Mr. Phillips worked for Norfolk Southern in various capacities for 12 years, where he gained operating experience in engineering, track maintenance, and train operations. His responsibilities included managing track maintenance, supervising and training train crews, ensuring operating rules compliance, and investigating accidents and injuries. Mr. Phillips holds a Bachelor of Science, Civil Engineering from Virginia Polytechnic Institute and a Master of Business Administration from Averett College.

Mr. Phillips' resume with additional project experience is attached hereto.

VERIFICATION

I, Robert Phillips, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Robert Phillips

Executed on this 26th day of November, 2012.

Robert C. Phillips, P.E.

Vice President/Project Manager

Mr. Phillips, Vice President of the Rail Division, is responsible for overseeing and directing STV's freight rail planning and engineering projects. He has more than 35 years of experience with track design and maintenance, grade crossings, bridge construction, construction management of rail projects, maintenance and protection of traffic, and the installation of fiber-optic cable within railroad rights-of-way. Mr. Phillips worked for Norfolk Southern Railway (NS) in various capacities for 12 years, during which he gained operating experience in engineering, track maintenance, and train operations. His responsibilities included managing track maintenance, supervising and training train crews, ensuring operating rules compliance, and investigating accidents and injuries.

Office Location
Charlotte, NC

Date joined firm
6/2/94

Years with other firms
19

Education
Master of Business Administration; Averett College (1992)

Bachelor of Science, Civil Engineering; Virginia Polytechnic Institute (1975)

Professional Registration
Professional Engineer: Pennsylvania (2000/#PE056524-E/exp. 9/30/13) and Virginia (1997/#030702/exp. 2/28/13)

Project Experience

BRIDGES

NCDOT NS over U.S. 220 Bridge Replacement - Field Engineer
Provided construction field coordination between NS and the North Carolina Department of Transportation (NCDOT) for the replacement of a Norfolk Southern single-track, single-span railroad bridge with a double-track, 4-span railway bridge over U.S. 220 in Price, NC. (1996 - 1997)

NCDOT NS over U.S. 401 Bridge Replacement - Field Engineer
Handled the construction field coordination between NS and the North Carolina Department of Transportation (NCDOT) for replacement of the Norfolk Southern Bridge over U.S. 401 in Fuquay-Varina, NC. (1995 - 1996)

City of Greensboro Merritt Drive Improvements - Field Engineer
Performed construction observation for a detour bridge and replacement of the Norfolk Southern railroad bridge on Merritt Drive in Greensboro, NC. (1995 - 1996)

VDOT Norfolk Southern over U.S. 250 Bridge Replacement - Project Manager
Provided construction field coordination between NS and the Virginia Department of Transportation (VDOT) for the construction of a temporary detour bridge and a new through-plate girder replacement railroad bridge in Waynesboro, VA. (1994 - 1995)

RAIL

NS Construction Management for Rickenbacker, Birmingham, and Charlotte Airport Intermodal Yards - Senior Project Manager
Assembling and administering construction management (CM) teams for three new NS regional intermodal facilities to handle increases in rail container traffic and to accommodate the classification of double-stack container trains. Each team is managing the construction of $100 million projects at new site locations. Construction includes grading and drainage, classification tracks, storage tracks, new sidings, concrete loading and unloading pads, acres of roller compact concrete for storage, truck gates, yard offices, and crew facilities. CM services include plan review, progress reports, inspection reports, maintenance of contractor's schedule, monthly pay estimates, and project closeout verifications and documentation. (5/09 - Present)

Union Pacific Railroad Miscellaneous Engineering Services – Principal-in-Charge
Managing on-call contract services for an ongoing list of 40 current structural projects from Utah to Chicago for Union Pacific Railroad. Mr. Phillips is overseeing several types of engineering projects, including bridge deck replacements and repair, new track construction, construction and design reviews, and construction oversight. The projects include work on approximately 25 rail bridges. (2006 – Present)

NS On-Call Services Contract - Principal-in-Charge
Responsible for plan review and construction engineering on an on-call, as-needed basis for more than 50 projects involving proposed roadway, bridge, and retaining wall construction affecting railway facilities. Projects to date have included overseeing construction of overhead bridges, underpasses, floodwalls, utility crossings, parallel construction of utilities, roadways, bikeways, and grade crossings. (2/04 - Present)

CSX Transportation General Engineering Consultant Services Contract - Principal-in-Charge
Serving as the point of contact for administration of contract services and appointment of project managers. Mr. Phillips is overseeing track and bridge design and construction, plan review, construction management, and inspection services on an on-call basis for several projects involving proposed roadway, bridge, and retaining wall construction affecting railway facilities throughout the 23-state CSXT system. His contributions so far include the design and construction of bridges, tracks, yards, and capacity-related projects. Public projects includes bridge, track, floodwalls, utility crossings, parallel construction of utilities, roadways, bikeways, and grade crossings. (2/04 - Present)

STB Railroad Coal Rate Case Litigation Cost Assessments - Project Manager
Leading a team assembling the planning, engineering, and construction costs to build a hypothetical contemporary operating railroad. Services include a complete itemization, justification, and documentation of all transportation,

material, and labor construction costs associated with a contemporary construction costing. All submittals were entered as evidence to the Surface Transportation Board (STB) to justify contested rates for several coal rate cases. Cost assessments included major earthwork, bridge and culvert construction, track, communications and signalization, engineering design, construction management, facilities, material costs and logistics, mobilization, and contingencies. Cases included Norfolk Southern (NS) vs. Duke Energy, NS vs. CP&L, CSXT vs. Duke Energy, AEPCO vs. Burlington Northern Santa Fe (BNSF) and Union Pacific, Otter Tail vs. BNSF, AEP Texas North vs. BNSF, Seminole vs. CSXT, IPA vs. UP, DuPont vs. NS, TPI vs. CSXT, M&G vs. CSXT . (2002 – Present)

NS Heartland Corridor Clearance Improvements CM - Senior Project Manager
Oversaw this $191 million project to provide clearance improvements to 28 railroad tunnels and seven bridges on the 530-mile-long Heartland Corridor, which extends from Norfolk, VA, to Columbus, OH. Mr. Phillips' services included creating overhead bridge jacking plans to obtain vertical clearances, modifying slide fences, providing utility coordination, creating Stormwater Pollution Prevention Plans for tunnel portals, creating railroad-bridge lowering plans, and reviewing track designs. His construction management (CM) responsibilities also included conducting preconstruction meetings with contractors as well as weekly progress meetings, reviewing construction schedules, monitoring and documenting contractor work, reviewing monthly contractor pay estimates, and coordinating between the contractor and railroad forces. The project constituted an innovative public-private partnership venture between NS, various participating states, and the Federal Highway Administration. (4/07 - 12/10)

CSX Post-Hurricane Katrina/Rita Emergency Rail Reconstruction Project - Principal-in-Charge
Oversaw design and construction inspection for this $100 million emergency rail reconstruction project. Mr. Phillips was in charge of assessing damage to six major rail bridges ranging to more than 10,000 feet in length, developing repair or replacement plans, providing project management and construction management, and providing on-site inspection during the reconstruction period. In total, more than 75 miles of track was severely damaged and in need of emergency repair. (8/05 - 9/07)

NS Fiber-Optic Cable Installation - Project Manager
Responsible for the construction management of the installation of the fiber backbone along NS right-of-way along several routes: Cleveland, OH, to Boyce, VA, via Pittsburgh and Harrisburg, PA; Kalamazoo to Dearborn, MI; Dearborn, MI, to Toledo, OH; Toledo to Cleveland, OH; Cleveland, OH, to Buffalo, NY; and Cleveland, OH, to Pittsburgh, PA. Mr. Phillips oversaw staffing, permitting, inspection, safety operations, and final route approval. More than 100 managers and inspectors were involved in this major trunk line installation. Mr. Phillips also provided safety training, led NS operations meetings, attended weekly scheduling meetings, coordinated work trains and

flagmen, and provided engineering reviews, change orders, and construction administration. (1999 - 2002)

NS Fiber-Optic Cable Installation in North and South Carolina - Project Manager

Coordinated with NS personnel and monitored the installation of fiber-optic cables belonging to Qwest Communications along several hundred miles of NS right-of-way in North Carolina and South Carolina. All phases of installation were involved, including plow train operations, long directional bores, and bridge attachments. Mr. Phillips provided periodic progress reports to NS and authorized minor changes from the approved construction plans to meet local conditions. He was also responsible for monitoring the railroad safety aspects of the installations. (1998 - 1999)

CSX System-Wide Grade Crossing Sign Project - Team Leader

Led one of seven teams for this project which required the installation of standard identification signs at every roadway grade crossing on the CSX Transportation system. During this process, STV completely updated the CSX grade crossing inventory list. (1997 - 1998)

CSX Systemwide Grade Crossing Inventory - Project Manager

Managed multiple teams to perform a grade crossing inventory encompassing more than 35,000 grade crossings on the CSX Transportation system in 21 states to meet a Federal Railroad Administration deadline. The project included deployment of multiple teams to inventory crossings, installing standard identification signs at every crossing to enhance safety and reporting, and updating CSX's inventory, including digital imagery of each crossing. All work was performed under a tight deadline of 180 days and completed a month ahead of schedule. (10/97 - 6/98)

NS Automobile Mixing Facility - Field Engineer

Oversaw shop inspection of structural steel at the fabrication plant in Colfax, NC, to be utilized in construction of this new automobile mixing facility in Shelbyville, KY. Mr. Phillips managed preliminary and final hydraulic/hydrologic design as well as railway, roadway, highway bridge, and railway bridge design. (1996)

Norfolk Southern - Trainmaster

Supervised train crews and yard personnel, ensured operating rules compliance, investigated all accidents and injuries, scheduled local train and yard engine operations, and trained employees on Federal Railroad Administration and NS operating rules through annual operating rule classes for track and transportation employees in Manassas and Danville, VA. (1981 - 1987)

Norfolk Southern - Track Supervisor

Supervised track maintenance crews and production gangs, responsible for track inspection program, and ensured Federal Railroad Administration (FRA) Track Safety Standards for Class of track were in compliance. Mr. Phillips maintained the NS Safety Program over assigned territory and investigated all accidents and injuries, scheduled track maintenance operations, and trained employees on FRA Track Safety Standards and NS track maintenance policy. (1975 - 1980)

MICHAEL K. QUINN

Mr. Quinn is Director of State Taxes for Norfolk Southern Corporation, the parent of Norfolk Southern Railway Company ("NS"), located at 1200 Peachtree Street, Northeast, Atlanta, Georgia 30309. Mr. Quinn joined NS in 1986. He is sponsoring portions of Section III-D of NS's Reply Evidence regarding Ad Valorem Taxes. Mr. Quinn has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Quinn holds a Bachelor of Science degree in business administration from the University of Dayton. He earned his Juris Doctor degree from the University of Notre Dame Law School. From 1975 to 1986, Mr. Quinn was in private practice in Roanoke, Virginia, specializing in tax, corporate, domestic relations, and commercial matters. He has been a Certified Public Accountant since 1995.

Mr. Quinn joined NS in 1986. He began in the Taxation Department as Assistant Tax Counsel. He then served as Director of Property Taxation. He was elevated to Director of State Taxes in 2000.

VERIFICATION

I, Michael K. Quinn, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Michael K. Quinn
Michael K. Quinn

Executed on this 19th day of November, 2012.

RICHARD RAY

Mr. Ray is the founder of RR Rail Hwy Crossing Consultants, Inc., a corporation that provides consulting services to States and Railroads concerning Rail/Highway crossings with offices located at 506 Fontaine Road, Mableton, Georgia 30126. Mr. Ray is a rail crossings and signals expert with over 40 years of experience. Mr. Ray is sponsoring portions of Section III-F of Norfolk Southern's ("NS's") Reply Evidence relating to Signals. Mr. Ray has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

In addition to operating RR Rail Hwy Crossing Consultants, Inc., Mr. Ray is a contract consultant with STV, a professional firm offering engineering, architectural, planning, environmental and construction management services. Mr. Ray provides consulting services to the rail industry, rail customers, and state and local road authorities for rail/highway crossing projects, signal systems and crossing signal requirements for rail construction projects. Prior to founding RR Rail Hwy Crossing Consultants, Inc., Mr. Ray spent 39 years at Norfolk Southern. Beginning in 1995, Mr. Ray spent 16 years as the Administrator – Highway Grade Crossing at NS, responsible for administering NS's portion of the federal highway grade crossing safety program. Mr. Ray holds a Computer Science degree from Southern Technical Institute and a Masters of Business Administration from West Georgia College.

Mr. Ray's resume with additional project experience is attached hereto.

VERIFICATION

I, Richard Ray, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Richard Ray

Executed on this 13th day of November, 2012.

Richard H. Ray
506 Fontaine Road
Mableton, GA 30126
Residence Phone 678-945-5442
Business Phone 404-529-1234

EDUCATION

1965-1969 Graduated Pebblebrook High School
1978-1980 West Georgia, College - Business Administration Curriculum
1985 Southern Technical Institute – Computer Science Curriculum

MILITARY SERVICE

1969-1971 United States Naval Air
Primary training in aviation electronics and operation of electronic countermeasures
Honorable Discharge, Combat Veteran

EMPLOYMENT

1972 Assistant Signal Maintainer, Central of Georgia Railroad
Assisted Signal Maintainer in maintenance and troubleshooting of signal systems and highway grade crossing warning devices.

1972 Signal Maintainer, Southern Railway
Provided maintenance and troubleshooting of signal systems and highway grade crossing warning devices. Responsibilities included testing and reports pursuant to FRA regulations.

1974-1978 C&S Supervisor, Southern Railway
Supervision of five mainline signal maintainers, one communications maintainer, one electrician and one floating signalman. Responsibilities included troubleshooting, ordering equipment, scheduling of jobs and maintenance of two hot box detectors. Ensure compliance with FRA regulations and railroad operating procedures.

1978-1988 Applications Engineer, Norfolk Southern Railway
Design of signal systems, area of concentration centered on design of highway grade crossing warning devices. Including ordering of materials and estimates for grade crossing signal projects. Instrumental in transition to computer aided drafting design and computerizing grade crossing signal program. Required interaction with state DOT officials within fourteen state territory. Served on Committee D of the AAR.

1988-1993 Signal Engineer, Norfolk Southern Railway
Primarily involved in design of train signal systems and job estimation for installation and removal of track structures. Required interaction with various railway departments.

EMPLOYMENT - CONTINUED

1993-1995 Senior Systems Engineer, Norfolk Southern Railway
Primary responsibilities included review and coordination with other departments of capital improvement projects providing estimates and extent of C&S involvement. Also involved with state and private industry projects.

1995 - 2011 Administrator Highway Grade Crossing, Norfolk Southern Railway
Administer the railroad's portion of the federal highway grade crossing safety program and other grade crossing safety requests. This is accomplished by directing control systems activities and coordinating activities between the railroad, state and other departments concerning projects for installation, up-grade or modification of grade crossing warning devices. Maintain close working relationship and contacts with necessary local, state and federal agencies and authorities to ensure success of programs and projects. Work closely with company claims and legal personnel including giving deposition testimony and testimony at hearings concerning all aspects of the grade crossing program.

2011 - Retired from Norfolk Southern after 39 years.

2011 - Incorporated RR Rail Hwy Crossing Consultants, Inc., a Georgia Corporation to provide consulting services to States and Railroads concerning Rail/Highway crossings.

2011 - Joined STV as a contract consultant to provide consulting services to the Rail Industry, Rail Customers and State and Local Road Authorities. Responsibilities include site and plan review and estimate for proposed rail/highway grade crossing projects to ensure compliance with Federal, State and Rail Industry standards, regulations and guidelines, provide detailed estimate to assist in determining cost benefit analysis of proposed rail/highway crossing projects and project review and estimate for signal systems and crossing signal requirements for rail construction projects involving private or public entities. Also, provide management or assistance with installation of rail/highway grade projects, which includes meeting with necessary road authorities and/or railroad personnel, project engineering, acquisition of material and scheduling of construction forces.

STEFANO RIEPPI

Mr. Rieppi was an industrial engineer with Norfolk Southern's Capacity Planning Group. Rieppi is sponsoring the portions of Part III-C of Norfolk Southern's ("NS's") Reply Evidence that relate to the analysis of the DRR's Yard Requirements. Mr. Rieppi has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

As an industrial engineer in the Capacity Planning Group, Mr. Rieppi's responsibilities included the development of innovative terminal capacity management strategies, the analysis and re-engineering of terminal sizing and enhancement processes; the simulation of proposed infrastructure development projects; and the creation of new analytical tools for capacity requirements analysis.

Mr. Rieppi was employed at NS from 2006 to 2012. Mr. Rieppi has particular experience in overseeing crew utilization, train schedules, and yard operations including freight classification, locomotive utilization and carload freight management. Prior to Mr. Rieppi's promotion to the Capacity Planning Group, he was Lead Trainmaster at Norfolk Southern's Chicago Command Center, responsible for the coordination and control of operations for NS's eight Chicago Hub Terminals. Mr. Rieppi also worked as Assistant Manager for Yard and Local Fleet in NS's Atlanta office, in which he was responsible for the streamlined allocation of over 1,200 locomotives to terminals and customer cites.

Mr. Rieppi received a Bachelor of Sciences in Economics from the London School of Economics and Political Science. Mr. Rieppi also received a Master of Sciences in Transportation from Imperial College, University of London. He holds professional certifications in Transportation and Logistics from the American Society of Transportation and Logistics as well as certification from Norfolk Southern's Six Sigma/Lean Management Certification Program.

Mr. Rieppi's curriculum vitae with additional transportation experience is attached hereto.

VERIFICATION

I, Stefano Rieppi, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Stefano Rieppi

Executed on this 15 day of November, 2012.

STEFANO RIEPPI MSc, CTL	Primary languages spoken: English, Italian, German Nationality: dual citizen, Italy/EU and USA

1. PROFESSIONAL EXPERIENCE

Industrial Engineer – Capacity Planning Group	03/12 to date
Norfolk Southern Railway Company, Atlanta, GA, USA	
Responsibilities	❖ Development of innovative terminal capacity management strategies ❖ Analysis and re-engineering of terminal sizing and enhancement processes ❖ Simulation of proposed infrastructure development projects ❖ Creation of new analytical tools for capacity requirements analysis
Highlights	❖ Created new methodologies for analysis of terminal capacity requirements ❖ Re-engineering core protocols for communication of terminal logistical priorities ❖ Coordinated multiple cross-functional teams ❖ Developing innovative multi-terminal investment resources allocation framework

Lead Trainmaster – Chicago Command Center	09/10 → 03/12
Norfolk Southern Railway Company, Chicago, IL, USA	
Responsibilities	❖ Coordination and control of operations for all 8 Chicago Hub terminals ❖ Planning and monitoring of road and yard crew utilization ❖ Development and control of train schedules for all train types ❖ Management of network of services jointly managed with other carriers
Highlights	❖ Improvement of routing protocols for unit trains ❖ Development of solutions to address crew and locomotive shortages ❖ Improvement of communication channels with other carriers ❖ Development of improved strategies for the movement of high-wide freight

Trainmaster – Chicago Terminals	01/10 → 08/10
Norfolk Southern Railway Company, Chicago, IL, USA	
Responsibilities	❖ Management of intermodal (TOFC/COFC) train operations ❖ Management of mixed freight train classification and forwarding operations ❖ Joint control of approximately 350 employees ❖ Development of workplace and employee safety procedures
Highlights	❖ Development of monitoring protocol for Key Performance Measures ❖ Improvement of connection performance for carload freight ❖ Improvement of on time performance of intermodal trains ❖ Reduction of workplace injuries within Chicago Hub

Assistant Manager Yard and Local Fleet	05/08 → 01/10
Norfolk Southern Railway Company, Atlanta, GA, USA	
Responsibilities	❖ Co-manage the allocation of 1,200+ locomotives to terminals and customer sites ❖ Regularly review equipment requirements and utilization patterns ❖ Review and streamline allocation procedures to improve locomotive availability ❖ Co-develop new IT tools to improve overall level of fleet visibility
Highlights	❖ Developed new process for identifying and processing locomotive requirements ❖ Created portfolio of dedicated locomotive pools at 200+ network locations ❖ Reduction of locomotive pool size via utilization initiatives ❖ Co-managed the deployment of remote control locomotives at 20 key locations

Automotive Services Supervisor – International Customers	05/07 → 05/08
Norfolk Southern Railway Company, Automotive Group, Atlanta, GA, USA	
Responsibilities	❖ Managed the service network dedicated to international automotive customers ❖ Developed and adjusted automotive unit train plans ❖ Monitored unit train network conditions and associated operational issues ❖ Planning of loading and unloading operations throughout the ramp network
Highlights	❖ Implemented new collaborative transportation planning procedures ❖ Minimized equipment shortages ❖ Developed a new dedicated equipment pool for Mercedes-Benz block trains ❖ Restructured shipment delivery process for major rail-served Toyota facility

2006-07 Management Training Program Participant	06/06 → 05/07
Norfolk Southern Railway Company (various terminals/business groups)	
Responsibilities	❖ Worked and analyzed operational processes at various rail freight terminals ❖ Developed analytical tools for a variety of rail operations management processes ❖ Carried out root cause analysis exercises for traffic handling failures ❖ Worked on the development of new management training programs
Highlights	❖ Developed new methodologies for the assessment of switching activities ❖ Used new asset planning tools to generate equipment-related savings ❖ Developed new protocol for analysis of chronic traffic delays ❖ Authored studies on traffic dwell times at various terminals

Transportation Project Advisor (subcontractor)	09/05 → 03/06
PriceWaterhouseCoopers LLP, Transport Team, London, UK	
Responsibilities	❖ Worked as rail market-specific project lead for Transport Team ❖ Developed rail market-specific business plans ❖ Developed studies for various rail sector growth opportunities ❖ Managed overall consulting project execution process
Highlights	❖ Developed rail freight business development plan for pan-European rail operator ❖ Developed market entry strategies for new railcar leasing venture ❖ Developed growth opportunity valuation models ❖ Leveraged results of Masters' Degree thesis in the context of said projects

Analyst/Executive	08/03 → 07/04
PriceWaterhouseCoopers LLP, Transport Team, London, UK	
Responsibilities	❖ Worked on the development of proposals for rail passenger franchise bids ❖ Managed several cost and benefit analysis projects for road and rail clients ❖ Co-built infrastructure project valuation models ❖ Led various market research initiatives
Highlights	❖ Led rail market-related research efforts ❖ Gained valuable exposure to rail franchise concession processes ❖ Developed solid cost and revenue modeling background ❖ Gained experience in the context of development of proposals

Corporate Finance Analyst	07/02 → 08/03
UBS Investment Bank, Transport Team, London, UK	
Responsibilities	❖ Managed transportation market research initiatives for potential clients ❖ Developed rail market entry strategy proposals ❖ Supported the development of key documentation for transportation project bids
Highlights	❖ Developed several strategic studies for various rail operators ❖ Developed solid business modeling background ❖ Gained valuable market trend identification and tracking skills

2. UNDEGRADUATE AND GRADUATE EDUCATION

Master of Sciences ("MSc") in Transportation	10/04 → 09/05
Imperial College, University of London, London, UK	
Description	❖ Graduated with highest honors ("Distinction") ❖ Course focused on transportation economics and project management ❖ Developed innovative thesis on the development of new rail freight operators

Bachelor of Sciences ("BSc") in Economics	09/99 → 07/02
London School of Economics and Political Science, London, UK	
Description	❖ Graduated with second highest honors ("2:1") ❖ Financial analysis internship at UBS Investment Bank, 07/01 to 09/01 ❖ Business development internship at Roche Diagnostics (UK), 07/00 to 09/00

3. PROFESSIONAL CERTIFICATIONS

Certification in Transportation and Logistics ("CTL") program	12/07 → 10/11
American Society of Transportation and Logistics ("AST&L")	
Description	❖ Internationally recognized professional qualification in logistics field ❖ Certifies core competencies in all functional areas of logistics and transportation ❖ Covers all modes of freight transportation

Six Sigma/Lean Management Certification Program	05/07 → 09/08
Norfolk Southern Railway Company, Atlanta, GA and Roanoke, VA, USA	
Description	❖ Internal training course associated to hands-on Six Sigma projects ❖ Led major rail logistics service improvement project in cooperation with Toyota ❖ Reduced railcar placement failures at major destination ramp

DALE A . SCHAUB

Mr. Schaub is an independent consultant with expertise in railroad operations. Mr. Schaub's experience stems from a career in the railroad industry, which included railroad operations. Mr. Schaub is sponsoring portions of Parts III-C and III-D of Norfolk Southern's ("NS's") Reply Evidence relating to Yard Structure and Non-train Operating Personnel. Mr. Schaub has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Schaub has 37 years of railroad experience from the Penn Central, Conrail, and currently with NS. Mr. Schaub's operations experience stems from years in positions including Assistant Vice-President of Train Operations and Transportation Planning at Conrail, as well as General Manager for Intermodal Service. Mr. Schaub's experience at NS has included positions such as Assistant General Manager of the Eastern Region responsible for coordinating interline services at interchanges with other railroads, overseeing railroad operations in large terminals, and monitoring NS's main frame systems. In addition, as Senior Director for Customer Service Operations, Mr. Schaub's responsibilities included overseeing the Merchandise and Automotive National Customer Service Centers, Unit Trains Operations Group, and the Automotive Terminal Group. Mr. Schaub was responsible for directing the development of NS's first Thoroughbred Operating Plan.

Mr. Schaub holds a Bachelor of Arts degree in Criminology from Indian University of Pennsylvania and a Masters of Business Administration from Drexel University. Mr. Schaub also holds certificates from the Transportation Management Program at Penn State University; the Advanced Management Program from the Fuqua School of Business at Duke University; and in Financial Management from the Wharton School, University of Pennsylvania.

VERIFICATION

I, Dale A. Schaub, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Dale A. Schaub

Executed on this 13 day of November, 2012.

SETH SCHWARTZ

Mr. Schwartz is President of Energy Ventures Analysis, Inc. ("EVA"), with offices located at 1800 Beechwood Boulevard, Suite 300, Pittsburgh, Pennsylvania 15217. Mr. Schwartz is sponsoring portions of Section III-A relating to Traffic and Revenue. Mr. Schwartz has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Schwartz directs EVA's coal and utility practice and manages the COALCAST Report Service produced by EVA. Mr. Schwartz has expertise in the analysis of fuel procurement, coal supply and demand, production, productivity and mining costs. In addition Mr. Schwartz has experience in conducting audits of utility fuel procurement practices, system dispatch, and off-system sales. Mr. Schwartz has extensive experience testifying before federal and state courts, arbitration panels and regulatory agencies regarding prevailing market prices, industry practice in the use of contract terms and conditions, market conditions surrounding initial contracts, and damages resulting from contract breach.

Mr. Schwartz holds a Bachelor of Science in Geological Engineering from Princeton University. Mr. Schwartz is a co-founder of EVA and has been a partner at the firm since its founding in 1981.

Mr. Schwartz's resume with additional project experience is attached hereto.

VERIFICATION

I, Seth Schwartz, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Seth Schwartz

Executed on this 27th day of November, 2012.

RESUME OF

SETH SCHWARTZ

EDUCATIONAL BACKGROUND

B.S.E. Geological Engineering, Princeton University, 1977

PROFESSIONAL EXPERIENCE

Current Position

Seth Schwartz is a co-founder of Energy Ventures Analysis. Mr. Schwartz directs EVA's coal and utility, practice and manages the COALCAST Report Service. The types of projects in which he is involved are described below:

Fuel Procurement

Assists utilities, industries and independent power producers in developing fuel procurement strategies, analyzing coal and gas markets, and in negotiating long-term fuel contracts.

Fuel Procurement Audits

Audits utility fuel procurement practices, system dispatch, and off-system sales on behalf of all three sides of the regulatory triangle, i.e., public utility commissions, rate case intervenors, and utility management.

Coal Analyses

Directs EVA analyses of coal supply and demand, including studies of utility, industrial, export, and metallurgical markets and evaluations of coal production, productivity and mining costs.

Natural Gas Analyses

Evaluates natural gas markets, especially in the utility and industrial sectors, and analyzes gas supply and transportation by pipeline companies.

Expert Testimony

Testifies in fuel contract disputes, including arbitration and litigation proceedings, regarding prevailing market prices, industry practice in the use of contract terms and conditions, market conditions surrounding the initial contracts, and damages resulting from contract breach.

Acquisitions and Divestitures

Assists companies in acquisitions and sales of reserves and producing properties, both in consulting and brokering activities. Prepares independent assessments of property values for financing institutions.

Prior Experience

Before founding Energy Ventures Analysis, Mr. Schwartz was a Project Manager at Energy and Environmental Analysis, Inc. Mr. Schwartz directed several sizable quick-response support contracts for the Department of Energy and the Environmental Protection Agency. These included environmental and financial analyses for DOE's Coal Loan Guarantee Program, analyses of air pollution control costs for electric utilities for EPA's Office of Environmental Engineering and Technology, Energy Processes Division, and technical and economic analysis of coal production and consumptions for DOE's Advanced Environmental Control Technology Program.

Publications

Crerar, D.A., Susak, N.J., Borcsik, M., and Schwartz, S., "Solubility of the Buffer Assemblage Pyrite + Pyrrhotite + Magnetite in NaCl Solutions from 200° to 350°", Geochimica et Cosmochimica Acta (42)1427-1437, 1978.

To the best of Mr. Schwartz's recollection, he has testified as an expert at trial or by deposition in the following cases in the last four years (client is underlined):

2011

Elm Street Resources, Inc. v. International Paper Company, U.S. District Court for the Eastern District of Tennessee, Cause No. 3:09-CV-575

Twin Pines Coal Company Inc. v. Colonial Pipeline Company, U.S. District Court for the Northern District of Alabama, Case No. 2:09-cv-1403-SLB

Arbitration between Bachmann, Hess, Bachmann & Garden, PLLC and James C. Justice Companies, Inc., American Arbitration Association Mo. 50 194 T 0037110

Traxys North America v. Concept Mining, U.S. District Court for the Western District of Virginia, Case No. 1:10-cv-29

Mountain State Carbon LLC v. Central West Virginia Energy Company, Circuit Court of Brooke County, West Virginia, Civil Action No. 08-C-160

2010

Arbitration between South Carolina Electric & Gas Company and Sequoia Energy, LLC, American Arbitration Association No. 31 198 Y 00032 09

Administrative Hearing, State of North Carolina, North Carolina Waste Awareness et al v. Duke Energy Carolinas 08 EHR 0771

Seminole Electric Cooperative, Inc. v. CSX Transportation, Inc., Surface Transportation Board Docket No. 42110

2009

TECO Coal Corporation, et al, v. Orlando Utilities Commission, U.S. District Court for the Eastern District of Kentucky, London Division, Case No. 6:07-cv-444

Arbitration between Duke Energy Carolinas LLC and Dynamic Energy, Inc., American Arbitration Association, No. 31 198 Y 00372 08

Arbitration between Bayer Cropscience LP and Central West Virginia Energy, Inc., American Arbitration Association, No. 55 198 Y 00317 08

Final Offer Arbitration between Teck Coal Limited and Canadian Pacific Railway

Arbitration between Central West Virginia Energy and Mountain States Carbon

Philip Morris USA Inc. v. Appalachian Fuels, LLC, U.S. District Court for the Eastern District of Virginia, Case No. 3:08 CV 527 (JRS)

2008

EME Homer City Generation L.P. v. Amerikohl Mining Inc., no. 2001-CD-11119 (Pennsylvania Court of Common Pleas, Indiana County

Gulf Power Company v. Peabody Coalsales Company, U.S. District Court for the Northern District of Florida, Case No. 3:06cv-00270-MCR-MD

The Dayton Power & Light Company v. Appalachian Fuels, LLC, U.S. District Court for the Southern District of Ohio, Case No. 07-CV-118

Bull Creek Coal Corporation v. Alpha Coal Sales Co., LLC, U.S. District Court for the Eastern District of Kentucky, CA No. 7:07-119-GFVT

Lodestar Energy, et. al. v. Tennessee Valley Authority, U.S. Bankruptcy Court for the Eastern District of Kentucky, Case No. 01-50969

Arbitration between the Kanawha-Gauley Coal & Coke Company v. Kanawha Development Corporation et. al., AAA Case No. 55 115 Y 00402 06

2007

Frontier-Kemper Constructors, Inc. v. Elk Run Coal Company, Inc., U.S. District Court for the Southern District of West Virginia, CA No. 2:06-0716

The United Company v. Jeffrey J. Keenan, U.S. District Court for the Western District of Virginia, CA No. 1:06-CV-00071

Virginia Electric and Power Company, v. Massey Coal Sales Company, Circuit Court of the City of Richmond, Virginia, Case No. LT2966-1, Case No. C06-0897

Arbitration between The Detroit Edison Company, et. al. v. BNSF Railway Company

Progress Fuels Corporation v. Sigmon Coal Company, U.S. District Court for the Western District of Virginia, CA No. 2:06-CV-10

Arbitration between BHP Navajo Coal Company v. Arizona Public Service Company

Public Utility Commission of Ohio, Management/Performance Audit of Duke Energy Ohio

Alliance of Xcel Municipalities, Application of Southwestern Public Service Company for Reconciliation of its Fuel Costs, Texas PUC Docket No. 32766

ALAN SHAW

Mr. Shaw is Group Vice President – Chemicals at Norfolk Southern, with offices located at 110 Franklin Road Southeast, Roanoke, Virginia 24011. Mr. Shaw is sponsoring portions of Section II-B relating to Qualitative Market Dominance. Mr. Shaw has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

As Vice President – Chemicals at NS, Mr. Shaw is responsible for marketing, sales and budgeting for Norfolk Southern's $1.5 billion Chemicals business unit. During his 18 years with Norfolk Southern, Mr. Shaw has worked in the Finance and Marketing Departments and held several capacities, including Group Vice President – Coal Transportation Services with responsibility for transportation, origin development, budgeting and equipment planning for the $3.1 billion business unit.

Mr. Shaw holds a Bachelor of Science degree in Aerospace Engineering from Virginia Tech. Mr. Shaw also holds a Masters in Business Administration, with a concentration in Finance, from Virginia Tech and is also a graduate of the General Management Program from Harvard University Business School.

VERIFICATION

I, Alan Shaw, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Alan Shaw

Alan Shaw

Executed on November 26, 2012

DEWEY D. SMITH

Mr. Smith is the Director of Service Design and Interline Management, Transportation Network Services for NS, at its Atlanta, GA offices located at 1200 Peachtree Street Northeast, Atlanta, Georgia 30309. Mr. Smith is sponsoring portions of Section III-C of NS's Reply Evidence relating to NS's MultiRail analysis and has also assisted Mr. Johnson in developing other aspects of the NS train service plan. Mr. Smith has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

As the Director of Service Design and Interline Management at NS, Mr. Smith is responsible for developing and maintaining train plans, developing shipment trip plans, contingency planning in the event of emergencies, such as developing routing contingencies, and disaster recovery management. Mr. Smith also is charged with developing and maintaining Interline Service Agreements that define the operating details for interchange locations. Mr. Smith previously served as the Director of the Automotive Mixing Center Network & Logistics, Assistant Director Mixing Center, Manager Agency Operation Center, and Trainmaster since joining NS in 1978.

Prior to joining NS, Mr. Smith completed five years in the U.S. Air Force. He holds a Bachelor of Science from Georgia State University.

VERIFICATION

I, Dewey D. Smith, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Dewey D. Smith

Executed on November 27th, 2012

KATHLEEN C. SMITH

Ms. Smith is the Director of Market Research and Economics in the Marketing Division of Norfolk Southern Corporation, the parent of Norfolk Southern Railway Company ("NS"), located at 1200 Peachtree Street, Northeast, Atlanta, Georgia 30309. Ms. Smith is sponsoring portions of Section III-A of NS's Reply Evidence. Ms. Smith has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Ms. Smith began her career with NS in 1995 as a management trainee in the Marketing Department. She has held the positions of Economic Analyst, Senior Economic Analyst, Account Manager, Product Manager, Business Development Manager, Manager Yield Analysis, and Director of Market Planning and Analysis in the Industrial Products Group during the course of her career. In 2011, she was elevated to her current role.

As NS's Director of Market Research and Economics, Ms. Smith's responsibilities include overseeing the preparation and analysis of marketing updates for quarterly earnings report; overseeing the analysis and summarization of revenue and volume quarterly forecasts with five year time horizons; managing NS's enterprise forecast and demand planning data system; oversees market research studies and initiatives in support of business development; evaluating and purchasing macro-economic and market research data from external providers on behalf of the NS business groups; and analyzing and summarizing corporate price and yield results and projections including same store sales price impacts, revenue variance drivers, and revenue goal tracking.

VERIFICATION

I, Kathleen C. Smith, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Kathleen C. Smith

Kathleen C. Smith

Executed on this 21 day of November, 2012.

RICHARD L. SMITH

Mr. Smith is a consultant with XORail with expertise in the area of railroad signal engineering and offices located at 5011 Gate Parkway #100-400, Jacksonville, Florida 32256. Mr. Smith is sponsoring portions of Section III-F of NS' Reply Evidence relating to Signals. Mr. Smith has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Smith has over 35 years of experience in railroad operations following a career at NS. Mr. Smith has extensive experience in the area of signals and communications, having served as an engineer in Signals and Communications groups at NS for years, and subsequently being promoted to General Supervisor for Signals and Communications on the Illinois Division. In 2001, Mr. Smith became Chief Engineer, Communications and Signals for the Northern Region, having responsibility for ensuring signal system was rule compliant, safe and efficient. Mr. Smith also has experience developing guidelines used today in hump yard design. With XORail, Mr. Smith has experience developing various Safety Plans for NS to ensure compliance with FRA regulations and has drafted a training manual for basic signal training currently used by NS.

Mr. Smith's resume with additional project experience is attached hereto.

VERIFICATION

I, Richard L. Smith, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Richard L. Smith

Richard L. Smith

Executed on this 12 day of November, 2012.

Richard (Dick) L. Smith - Resume
RLS Consulting, LLC.
238 Paradise Point
Talladega, Al. 35160
Email: DSmith@coosahs.net

Education:

Graduate of Liberty High School, Liberty Illinois, May 1968

Attended the NS program at Darden Business School, 2005

Experience:

August of 1968 = started work for Norfolk and Western Rwy. As a welder helper and was laid off a short time later.

November of 1969 = Joined the United States Naval Reserves.

March of 1970 = returned to work for Norfolk and Western Rwy. as a signal helper on the Decatur Division.

In February 1971 I left for 22 months of active duty in the USN (reserves) being released from active duty in December 1972. I was honorably discharged in 1975.

Upon return to work from active duty I worked various contract positions including: assistant signal maintainer, signal maintainer, signal gang signalman and signal test foreman.

November of 1976 = I was promoted to a position of Supervisor S&C (signal and communications) in Decatur Illinois with responsibilities of supervising employees charged with signal maintenance, testing and inspections responsibilities as well as communication lineman charged with telephone wire, cable, radio and pole line maintenance.

June of 1980 = I was promoted to an Assistant Engineer, Signal Construction headquartered in St. Louis Missouri. Duties of this position included supervising various signal construction installations, cost control and meeting required on time deadlines. This position covered work in several states but primarily in Indiana. The number of employees supervised varied from project to project.

January of 1984 = I was promoted to Engineer Signal Construction with addition construction responsibilities on the Western Region of Norfolk Southern Rwy.

In 1985 my duties as an Engineer Signal Construction included replacing old antiquated dispatching centers with modern computer based systems in FT. Wayne Indiana and Decatur Illinois in 1987. The Ft. Wayne project involved combining two division offices, Ft. Wayne and Muncie Indiana into a single dispatching center in Ft. Wayne and the Decatur project involved combining Decatur and Moberly Missouri. Extensive field work was also involved in both projects to ensure accuracy and efficiency.

September of 1987 = I was promoted to General Supervisor Signals in Decatur Illinois. In that position I managed the operations of the Illinois Division which included signal employee safety, operating budget, signal performance to minimize train delays and enhancements to the signal system necessary to improve operations.

December of 1995 = I was promoted to General Supervisor C&S (Communications and Signals) headquartered in Decatur Illinois with additional responsibilities added for communication based equipment located on the Illinois Division.

February of 2001 = I was promoted to Chief Engineer C&S Northern Region with duties of overseeing the communications and signal responsibilities of the former Conrail properties that made up the Northern Region of Norfolk Southern Railroad. This position was responsible for approximately 350 employees in 9 states. This position oversees budget requirements, division capital projects, works with the three division level department heads on manpower needs and develops subsystem test and maintenance procedures as well as safety and rules compliance. This position also works with the other Chief Engineers in C&S in management hiring and overall departmental guidelines necessary to meet corporate goals. I retired from this position on NS March 1, 2006.

My entire active career was spent with one company. I have spent extensive hours working with FRA to ensure rule compliance. Many hours were spent ensuring signal testing and application complied with FRA and NS guidelines. I have been heavily involved in ensuring signal systems on NS are rule compliant, safe and efficient. I was very involved in developing the guidelines used today in hump yard design on NS. My 36+ years of field experience qualifies me to critique, and evaluate a signal system for accuracy and rules compliance as well as operating efficiency and cost control.

Since retirement I have worked for Southwest Signal Engineers now known as XORail. Projects I have worked on since retirement are: Co-coordinating with the FRA and developing for NS the Railway Safety Product Plan (RSPP) and the Software Management Control Plan (SMCP) and the NS Product Safety Plan (PSP) for compliance with FRA regulations. I have also written a training manual for basic signal training used on NS on the former Norfolk and Western property. I have used this manual for signal training for field employees for the last three years in various locations in Indiana, Illinois, Michigan, Ohio, Virginia and West Virginia.

GERHARD THELEN

Mr. Thelen is Vice President – Operations Planning & Support for Norfolk Southern Corporation, the parent of Norfolk Southern Railway Company ("NS"), located at 1200 Peachtree Street, Northeast, Atlanta, Georgia 30309. Mr. Thelen is sponsoring portions of Section III-F of NS's Reply Evidence related to Positive Train Control. Mr. Thelen has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Thelen earned a Master of Engineering degree from Pennsylvania State University and has attended the Tuck School Executive Program at Dartmouth College. He joined NS's predecessor in 1977, starting as a Manager of Quality Control Materials. He spent ten years as Director – Mechanical Engineering. For four years, Mr. Thelen was the Assistant Vice President – Quality Assurance followed by seven years as Assistant Vice President – Engineering. Since 2006, he has held his current position.

Mr. Thelen has chaired a number of Association of American Railroads committees in the Research and Mechanical Divisions. He is a member of both the American Society of Mechanical Engineers and the American Railway Engineering Association. He holds three patents.

Mr. Thelen's complete curriculum vitae is attached.

VERIFICATION

I, Gerhard Thelen, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Gerhard Thelen

Executed on this 28th day of November, 2012.

NORFOLK SOUTHERN

Date: November 28, 2012

Name:	**Gerhard A. Thelen**
Title:	**Vice President – Operations Planning & Support**
Date and Place of Birth:	October 18, 1949 – Weiler, Germany
Education:	Master of Engineering, Pennsylvania State University Ing (Grad), Fachhochschule, Munich, Germany Tuck School Executive Program, Dartmouth College

Career Summary:

1977 - 1979	Manager Quality Control Materials
1979 - 1987	Director – Mechanical Engineering
1987 - 1991	Assistant Vice President – Quality Assurance
1991 – July 1998	Assistant Vice President – Engineering
July 1998 – December 1998	Assistant Vice President – Research & Tests
1998 - 2004	Assistant Vice President – Mechanical
2004 - 2006	Vice President – Mechanical
2006 – present	Vice President – Operations Planning & Support

Other Activities & Affiliations:	Chaired several committees of the Association of American Ra the Research and Mechanical Divisions Member – American Railway Engineering Association Member – American Society of Mechanical Engineers
Special Recognition:	Three US patents

DAVID R. WHEELER

Mr. Wheeler is the founder of Rail Network Analytics, with offices located at 9222 Nottingham Way, Mason, Ohio 45040. Mr. Wheeler has extensive experience developing railroad operation simulations, including the use of the Rail Traffic Controller ("RTC") program. Mr. Wheeler is sponsoring portions of Section III-B and Section III-C relating to the RTC Simulation. Mr. Wheeler has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto

Throughout his career, Mr. Wheeler has focused on advanced analytical techniques for operational improvements and strategic planning. Prior to founding Rail Network Analysis, Mr. Wheeler was employed at Union Pacific Railroad and held various positions, including General Director of Capacity and Operations Analysis for. Mr. Wheeler has more than fifteen years experience in areas including rail operations analysis, capacity analysis, simulation, stand-alone rate cases litigation, structured problem solving using the Six Sigma methodology, supply chain efficiency and mergers & acquisitions. Mr. Wheeler's simulation experience includes not only railroads, but also other high technology industries including cockpit simulation work on the F-16 and F-22 fighter aircraft.

Mr. Wheeler holds a Bachelor of Science degree in engineering and computer science from Merrimack College as well as a Masters of Business Administration degree in finance and operations management from Miami University. Mr. Wheeler has training in the Six Sigma methodology and holds a Six Sigma Blackbelt certification.

Mr. Wheeler's resume with additional project experience is attached hereto.

VERIFICATION

I, David Wheeler, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

David Wheeler

Executed on this 12th day of November, 2012.

DAVID R. WHEELER

Work products include:

1. Corridor analysis for high density, complex Class 1 rail networks using multiple tools including the Rail Traffic Controller (RTC) model to determine the optimal operating plan.

2. Evaluation of five rail industry critical resources; line, terminal, crews, locomotives and technology

3. Passenger Operations on Freight Railroads

4. Stand-Alone Rate Cases analysis

- CSXT Southeast Corridor simulation, Chicago – Jacksonville, and 5 year capacity growth plan
- Incremental Passenger Service simulation and operating analysis between Las Vegas and Los Angeles
- CSXT Montgomery, AL to Jacksonville simulation as alternate to KCS Meridian speedway
- BNSF Coal Network Analysis; long term coal train capacity development at 5, 10, 15 and 20% volume increase levels - Powder River Basin – Denver – Kansas City – Creston
- Surface Transportation Board Rate Case: FMC v. Union Pacific Railroad
- Surface Transportation Board Rate Case: Wisconsin Power & Light v. Union Pacific Railroad
- Surface Transportation Board Rate Case: Duke Energy v. CSXT Railroad
- Surface Transportation Board Rate Case: Xcel Energy v. BNSF Railroad
- Surface Transportation Board Rate Case: Otter Tail Power v. BNSF Railroad
- Surface Transportation Board Rate Case: Western Fuels v. BNSF Railroad
- Surface Transportation Board Rate Case: Arizona Electric Power v. BNSF Railroad
- Surface Transportation Board Rate Case: Arizona Electric Power v. Union Pacific Railroad
- Surface Transportation Board Rate Case: Arizona Electric Power v. Union Pacific Railroad and BNSF Railroad
- BNSF Alliance Terminal process improvement project
- Discounted Cash Flow and Valuation Analysis: Business model and network model development for the acquisition of the Mexican Railroad concessions
- Union Pacific Railroad - team member - capacity development plan to recover the Houston Gulf Coast infrastructure during the operating crisis of 1998
- Union Pacific Railroad Feather River versus Donner Pass route analysis
- Surface Transportation Board – team member on the Union Pacific / Southern Pacific Mitigation plan including the Reno and Wichita oppositions to the merger
- Surface Transportation Board - Environmental Analysis for the Union Pacific Railroad purchase of the Northeast Kansas & Missouri Railroad (NEKM)

- UP/SP Merger Capacity Plan development and implementation
- Surface Transportation Board for Entergy v. Union Pacific Railroad
- Surface Transportation Board Rate Case for Seminole Energy v. CSXT Railroad
- Surface Transportation Board Rate Case for DuPont v. NS Railroad
- Surface Transportation Board Rate Case for Drummond Coal Sales, Inc v. NS Railroad
- Union Pacific Railroad – Amtrak 7-day service Sunset Limited capacity impact study
- Surface Transportation Board Rate Case for Intermountain Power v. Union Pacific Railroad
- Union Pacific Railroad – San Antonio Commuter Rail Operations simulation study

MICHAEL K. WILLIAMS

Mr. Williams is the Manager of Industrial Engineering for NS, at its Atlanta, GA offices, located at 1200 Peachtree Street Northeast, Atlanta, Georgia 30309. Mr. Williams has over 10 years of experience as an industrial engineer with NS. Mr. Williams is sponsoring portions of Section III-C of NS's Reply Evidence relating to NS's RTC Model and Capacity Analysis. Mr. Williams has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

As the Manager of Industrial Engineering at NS, Mr. Williams is responsible for managing and developing NS's capacity planning and RTC simulation team, as well as handling individual RTC projects. Mr. Williams has over 10 years experience working with RTC simulations. Prior to his appointment as an industrial engineer, Mr. Williams spent 15 years as an Engineer for Public Improvements with NS.

Mr. Williams holds a Bachelor of Sciences in Civil Engineering from Clemson University and a Masters of Business Administration from Kennesaw State University. Mr. Williams is a registered professional engineer in the state of Georgia and is qualified as a Six Sigma Greenbelt.

Mr. Williams's curriculum vitae identifying additional relevant experience is attached hereto.

VERIFICATION

I, Michael K. Williams, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Michael K. Williams

Michael K. Williams

Executed on this 26th day of November, 2012.

Michael K. Williams, P.E.

WORK EXPERIENCE

August 2006 – Present: Manager Industrial Engineering, Norfolk Southern Corp.

- Responsible for managing and developing NS' capacity planning and RTC simulation team as well as handling individual RTC projects

November 2004 – July 2006: Senior Industrial Engineer, Norfolk Southern Corp.

- Responsible for building RTC simulations of across the NS system and developing infrastructure recommendations for NS senior management

June 2002 – October 2004: Industrial Engineer, Norfolk Southern Corp.

- Responsible for various process improvement initiatives and RTC capacity simulations

October 1987 – May 2002: Engineer Public Improvements, Norfolk Southern Corp.

- NS' engineering liaison for state DOT's and public agencies wanting to build public improvements on railway right-of-way

July 1985 – September 1987: Trainee / Asst. Engineer Bridges, Norfolk Southern Corp.

EDUCATION

BS in Civil Engineering - Clemson University (1985)

MBA - Kennesaw State University (2005)

PROFESSIONAL QUALIFICATIONS

Registered Professional Engineer in State of Georgia

Six Sigma Greenbelt

PUBLICATIONS

"Using Simulation to Understand Bottlenecks, Delay Accumulation, and Rail Network Flow" – Presented at the 2011 AREMA Annual Conference

PROFESSIONAL MEMBERSHIPS

Current Chairman - AREMA Committee 16 (Economics of Railway Engineering and Operations)

Member - Institute of Industrial Engineers

ROBERT WILLIG

Dr. Willig is a Professor of Economics and Public Affairs in the Economics Department and the Woodrow Wilson School of Public and International Affairs of Princeton University. He is also a senior consultant to Compass Lexecon, an economics consulting firm, with offices at 1101 K Street NW, 8th Floor, Washington, DC 20005. Dr. Willig is sponsoring Exhibit II-B-8 of Norfolk Southern's ("NS's") Reply Evidence regarding Qualitative Market Dominance. Dr. Willig has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Dr. Willig earned a Bachelor of Arts in mathematics from Harvard University. He earned a Master of Science in operations research a Ph.D. in economics from Stanford University. Dr. Willig was the Supervisor of Economics Research at Bell Laboratories from 1973 to 1977. Since 1978, Dr. Willig has been a Professor of Economics and Public Affairs at Princeton. While on leave from the University, Dr. Willig spent two years as Deputy Assistant Attorney General in the Antitrust Division of the Department of Justice, serving as the Division's Chief Economist.

Dr. Willig has written extensively on industrial organization, including competition and regulatory policy, in publications such as the Yale Journal on Regulations, the Journal of Transport Economics and Policy, Antirust, Antitrust Law Journal, Journal of Economic Perspectives, and the Journal of Law and Economics among numerous others. He has done extensive research and economic analysis of the railroad industry of the course of his career, including testifying before the Surface Transportation Board in many matters, such as the Board's recent hearings on Competition in the Rulemaking Industry, Ex Parte 705.

Dr. Willig's complete curriculum vitae is attached.

VERIFICATION

I, Robert D. Willig, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

Robert Willig

Robert D. Willig

Executed on this 20 day of November, 2012.

December 2011

Curriculum Vitae

Name:	**Robert D. Willig**	
Address:		220 Ridgeview Road, Princeton, New Jersey 08540
Birth:		1/16/47; Brooklyn, New York
Marital Status:		Married, four children
Education:	Ph.D.	Economics, Stanford University, 1973 Dissertation: Welfare Analysis of Policies Affecting Prices and Products. Advisor: James Rosse
	M.S.	Operations Research, Stanford University, 1968.
	A.B.	Mathematics, Harvard University, 1967.

Professional Positions:

Professor of Economics and Public Affairs, Princeton University, 1978-.

Principal External Advisor, Infrastructure Program, Inter-American Development Bank, 6/97-8/98.

Deputy Assistant Attorney General, U.S. Department of Justice, 1989-1991.

Supervisor, Economics Research Department, Bell Laboratories, 1977-1978.

Visiting Lecturer (with rank of Associate Professor), Department of Economics and Woodrow Wilson School, Princeton University, 1977-78 (part time).

Economics Research Department, Bell Laboratories, 1973-77.

Lecturer, Economics Department, Stanford University, 1971-73.

Other Professional Activities:

ABA Section of Antitrust Law Economics Task Force, 2010-2012

Advisory Committee, Compass Lexecon 2010 -,

OECD Advisory Council for Mexican Economic Reform, 2008 -2009,

Senior Consultant, Compass Lexecon, 2008 -,

Director, Competition Policy Associates, Inc., 2003-2005

Advisory Board, Electronic Journal of Industrial Organization and Regulation Abstracts, 1996-.

Advisory Board, Journal of Network Industries, 2004-.

Visiting Faculty Member (occasional), International Program on Privatization and Regulatory Reform, Harvard Institute for International Development, 1996-2000.

Member, National Research Council Highway Cost Allocation Study Review Committee, 1995-98.

Member, Defense Science Board Task Force on the Antitrust Aspects of Defense Industry Consolidation, 1993-94.

Editorial Board, Utilities Policy, 1990-2001

Leif Johanson Lecturer, University of Oslo, November 1988.

Member, New Jersey Governor's Task Force on Market-Based Pricing of Electricity, 1987-89.

Co-editor, Handbook of Industrial Organization, 1984-89.

Associate Editor, Journal of Industrial Economics, 1984-89.

Director, Consultants in Industry Economics, Inc., 1983-89, 1991-94.

Fellow, Econometric Society, 1981-.

Organizing Committee, Carnegie-Mellon-N.S.F. Conference on Regulation, 1985.

Board of Editors, American Economic Review, 1980-83.

Nominating Committee, American Economic Association, 1980-1981.

Research Advisory Committee, American Enterprise Institute, 1980-1986.

Editorial Board, M.I.T. Press Series on Government Regulation of Economic Activity, 1979-93.

Program Committee, 1980 World Congress of the Econometric Society.

Program Committee, Econometric Society, 1979, 1981, 1985.

Organizer, American Economic Association Meetings: 1980, 1982.

American Bar Association Section 7 Clayton Act Committee, 1981.

Principal Investigator, NSF grant SOC79-0327, 1979-80; NSF grant 285-6041, 1980-82; NSF grant SES-8038866, 1983-84, 1985-86.

Aspen Task Force on the Future of the Postal Service, 1978-80.

Organizing Committee of Sixth Annual Telecommunications Policy Research Conference, 1977-78.

Visiting Fellow, University of Warwick, July 1977.

Institute for Mathematical Studies in the Social Sciences, Stanford University, 1975.

Published Articles and Book Chapters:

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Unpublished Papers and Reports:

"Airline Network Effects, Competition and Consumer Welfare" (with Bryan Keating, Mark Israel and Daniel Rubinfeld), working paper, 2011.

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"The Consumer Benefits from Broadband Connectivity to U.S. Households," (with Mark Dutz and Jon Orszag), submitted for publication.

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"An Economic-Demographic Model of the Housing Sector," (with B. Hickman and M. Hinz), Center for Research in Economic Growth, Stanford University, 1973.

Invited Conference Presentations:

Georgetown Center for Business and Public Policy, Conference on the Evolution of Regulation
"Reflections on Regulation" 2011

Antitrust Forum, New York State Bar Association
"Upward Price Pressure, Market Definition and Supply Mobility" 2011

American Bar Association, Antitrust Section, Annual Convention
"The New Merger Guidelines' Analytic Highlights" 2011

OECD and World Bank Conference on Challenges and Policies for Promoting Inclusive Growth
"Inclusive Growth From Competition and Innovation" 2011

Villanova School of Business Executive MBA Conference
"Airline Network Effects, Competition and Consumer Welfare" 2011

NYU School of Law Conference on Critical Directions in Antitrust
"Unilateral Competitive Effects" 2010

Conf. on the State of European Competition Law and Enforcement in a Transatlantic Context
"Recent Developments in Merger Control" 2010

Center on Regulation and Competition, Universidad de Chile Law School
"Economic Regulation and the Limits of Antitrust Law" 2010

Center on Regulation and Competition, Universidad de Chile Law School
"Merger Policy and Guidelines Revision" 2010

Faculty of Economics, Universidad de Chile
"Network Effects in Airlines Markets" 2010

Georgetown Law Global Antitrust Enforcement Symposium
"New US Merger Guidelines" 2010

FTI London Financial Services Conference
"Competition and Regulatory Reform" 2010

NY State Bar Association Annual Antitrust Conference
"New Media Competition Policy" 2009

Antitrust Law Spring Meeting of the ABA
"Antitrust and the Failing Economy Defense" 2009

Georgetown Law Global Antitrust Enforcement Symposium
"Mergers: New Enforcement Attitudes in a Time of Economic Challenge" 2009

Phoenix Center US Telecoms Symposium
"Assessment of Competition in the Wireless Industry" 2009

FTC and DOJ Horizontal Merger Guidelines Workshop
"Direct Evidence is No Magic Bullet" 2009

Northwestern Law Research Symposium: Antitrust Economics and Competition Policy
"Discussion of Antitrust Evaluation of Horizontal Mergers" 2008

Inside Counsel Super-Conference
"Navigating Mixed Signals under Section 2 of the Sherman Act" 2008

Federal Trade Commission Workshop on Unilateral Effects in Mergers
"Best Evidence and Market Definition" 2008

European Policy Forum, Rules for Growth: Telecommunications Regulatory Reform
"What Kind of Regulation For Business Services?" 2007

Japanese Competition Policy Research Center, Symposium on M&A and Competition Policy
"Merger Policy Going Forward With Economics and the Economy" 2007

Federal Trade Commission and Department of Justice Section 2 Hearings
"Section 2 Policy and Economic Analytic Methodologies" 2007

Pennsylvania Bar Institute, Antitrust Law Committee CLE
"The Economics of Resale Price Maintenance and Class Certification" 2007

Pennsylvania Bar Institute, Antitrust Law Committee CLE
"Antitrust Class Certification – An Economist's Perspective" 2007

Fordham Competition Law Institute, International Competition Economics Training Seminar
"Monopolization and Abuse of Dominance" 2007

Canadian Bar Association Annual Fall Conference on Competition Law
"Economic Tools for the Competition Lawyer" 2007

Conference on Managing Litigation and Business Risk in Multi-jurisdiction Antitrust Matters
"Economic Analysis in Multi-jurisdictional Merger Control" 2007

World Bank Conference on Structuring Regulatory Frameworks for Dynamic and Competitive South Eastern European Markets
"The Roles of Government Regulation in a Dynamic Economy" 2006

Department of Justice/Federal Trade Commission Section 2 Hearings
"(Allegedly) Monopolizing Tying Via Product Innovation" 2006

Fordham Competition Law Institute, Competition Law Seminar
"Monopolization and Abuse of Dominance" 2006

Practicing Law Institute on Intellectual Property Antitrust
"Relevant Markets for Intellectual Property Antitrust" 2006

PLI Annual Antitrust Law Institute
"Cutting Edge Issues in Economics" 2006

World Bank's Knowledge Economy Forum V
"Innovation, Growth and Competition" 2006

Charles University Seminar Series
"The Dangers of Over-Ambitious Antitrust Regulation" 2006

NY State Bar Association Antitrust Law Section Annual Meeting
"Efficient Integration or Illegal Monopolization?" 2006

World Bank Seminar
"The Dangers of Over-Ambitious Regulation" 2005

ABA Section of Antitrust Law 2005 Fall Forum
"Is There a Gap Between the Guidelines and Agency Practice?" 2005

Hearing of Antitrust Modernization Commission
"Assessment of U.S. Merger Enforcement Policy" 2005

LEAR Conference on Advances in the Economics of Competition Law
"Exclusionary Pricing Practices" 2005

Annual Antitrust Law Institute
"Cutting Edge Issues in Economics" 2005

PRIOR Symposium on States and Stem Cells
"Assessing the Economics of State Stem Cell Programs" 2005

ABA Section of Antitrust Law – AALS Scholars Showcase
"Distinguishing Anticompetitive Conduct" 2005

Allied Social Science Associations National Convention
"Antitrust in the New Economy" 2005

ABA Section of Antitrust Law 2004 Fall Forum
"Advances in Economic Analysis of Antitrust" 2004

Phoenix Center State Regulator Retreat
"Regulatory Policy for the Telecommunications Revolution" 2004

OECD Competition Committee
"Use of Economic Evidence in Merger Control" 2004

Justice Department/Federal Trade Commission Joint Workshop
"Merger Enforcement" 2004

Phoenix Center Annual U.S. Telecoms Symposium
"Incumbent Market Power" 2003

Center for Economic Policy Studies Symposium on Troubled Industries
"What Role for Government in Telecommunications?" 2003

Princeton Workshop on Price Risk and the Future of the Electric Markets
"The Structure of the Electricity Markets" 2003

2003 Antitrust Conference	
"International Competition Policy and Trade Policy"	2003
International Industrial Organization Conference	
"Intellectual Property System Reform"	2003
ABA Section of Antitrust Law 2002 Fall Forum	
"Competition, Regulation and Pharmaceuticals"	2002
Fordham Conference on International Antitrust Law and Policy	
"Substantive Standards for Mergers and the Role of Efficiencies"	2002
Department of Justice Telecom Workshop	
"Stimulating Investment and the Telecommunications Act of 1996"	2002
Department of Commerce Conference on the State of the Telecom Sector	
"Stimulating Investment and the Telecommunications Act of 1996"	2002
Law and Public Affairs Conference on the Future of Internet Regulation	
"Open Access and Competition Policy Principles"	2002
Center for Economic Policy Studies Symposium on Energy Policy	
"The Future of Power Supply"	2002
The Conference Board: Antitrust Issues in Today's Economy	
"The 1982 Merger Guidelines at 20"	2002
Federal Energy Regulatory Commission Workshop	
"Effective Deregulation of Residential Electric Service"	2001
IPEA International Seminar on Regulation and Competition	
"Electricity Markets: Deregulation of Residential Service"	2001
"Lessons for Brazil from Abroad"	2001
ABA Antitrust Law Section Task Force Conference	
"Time, Change, and Materiality for Monopolization Analyses"	2001
Harvard University Conference on American Economic Policy in the 1990s	
"Comments on Antitrust Policy in the Clinton Administration"	2001
Tel-Aviv Workshop on Industrial Organization and Anti-Trust	
"The Risk of Contagion from Multimarket Contact"	2001
2001 Antitrust Conference	
"Collusion Cases: Cutting Edge or Over the Edge?"	2001
"Dys-regulation of California Electricity"	2001

FTC Public Workshop on Competition Policy for E-Commerce
"Necessary Conditions for Cooperation to be Problematic" 2001

HIID International Workshop on Infrastructure Policy
"Infrastructure Privatization and Regulation" 2000

Villa Mondragone International Economic Seminar
"Competition Policy for Network and Internet Markets" 2000

New Developments in Railroad Economics: Infrastructure Investment and Access Policies
"Railroad Access, Regulation, and Market Structure" 2000

The Multilateral Trading System at the Millennium
"Efficiency Gains From Further Liberalization" 2000

Singapore – World Bank Symposium on Competition Law and Policy
"Policy Towards Cartels and Collusion" 2000

CEPS: Is It a New World?: Economic Surprises of the Last Decade
"The Internet and E-Commerce" 2000

Cutting Edge Antitrust: Issues and Enforcement Policies
"The Direction of Antitrust Entering the New Millennium" 2000

The Conference Board: Antitrust Issues in Today's Economy
"Antitrust Analysis of Industries With Network Effects" 1999

CEPS: New Directions in Antitrust
"Antitrust in a High-Tech World" 1999

World Bank Meeting on Competition and Regulatory Policies for Development
"Economic Principles to Guide Post-Privatization Governance" 1999

1999 Antitrust Conference
"Antitrust and the Pace of Technological Development" 1999
"Restructuring the Electric Utility Industry" 1999

HIID International Workshop on Privatization, Regulatory Reform and Corporate Governance
"Privatization and Post-Privatization Regulation of Natural Monopolies" 1999

The Federalist Society: Telecommunications Deregulation: Promises Made, Potential Lost?
"Grading the Regulators" 1999

Inter-American Development Bank: Second Generation Issues In the Reform Of Public Services

"Post-Privatization Governance" 1999

"Issues Surrounding Access Arrangements" 1999

Economic Development Institute of the World Bank -- Program on Competition Policy

"Policy Towards Horizontal Mergers" 1998

Twenty-fifth Anniversary Seminar for the Economic Analysis Group of the Department of Justice

"Market Definition in Antitrust Analysis" 1998

HIID International Workshop on Privatization, Regulatory Reform and Corporate Governance

"Infrastructure Architecture and Regulation: Railroads" 1998

EU Committee Competition Conference – Market Power

"US/EC Perspective on Market Definition" 1998

Federal Trade Commission Roundtable

"Antitrust Policy for Joint Ventures" 1998

1998 Antitrust Conference

"Communications Mergers" 1998

The Progress and Freedom Foundation Conference on Competition, Convergence, and the Microsoft Monopoly

Access and Bundling in High-Technology Markets 1998

FTC Program on The Effective Integration of Economic Analysis into Antitrust Litigation

The Role of Economic Evidence and Testimony 1997

FTC Hearings on Classical Market Power in Joint Ventures

Microeconomic Analysis and Guideline 1997

World Bank Economists --Week IV Keynote

Making Markets More Effective With Competition Policy 1997

Brookings Trade Policy Forum

Competition Policy and Antidumping: The Economic Effects 1997

University of Malaya and Harvard University Conference on The Impact of Globalisation and Privatisation on Malaysia and Asia in the Year 2020

Microeconomics, Privatization, and Vertical Integration 1997

ABA Section of Antitrust Law Conference on The Telecommunications Industry
Current Economic Issues in Telecommunications 1997

Antitrust 1998: The Annual Briefing
The Re-Emergence of Distribution Issues 1997

Inter-American Development Bank Conference on Private Investment, Infrastructure Reform and Governance in Latin America & the Caribbean
Economic Principles to Guide Post-Privatization Governance 1997

Harvard Forum on Regulatory Reform and Privatization of Telecommunications in the Middle East
Privatization: Methods and Pricing Issues 1997

American Enterprise Institute for Public Policy Research Conference
Discussion of Local Competition and Legal Culture 1997

Harvard Program on Global Reform and Privatization of Public Enterprises
"Infrastructure Privatization and Regulation: Freight" 1997

World Bank Competition Policy Workshop
"Competition Policy for Entrepreneurship and Growth" 1997

Eastern Economics Association Paul Samuelson Lecture
"Bottleneck Access in Regulation and Competition Policy" 1997

ABA Annual Meeting, Section of Antitrust Law
"Antitrust in the 21st Century: The Efficiencies Guidelines" 1997

Peruvian Ministry of Energy and Mines Conference on Regulation of Public Utilities
"Regulation: Theoretical Context and Advantages vs. Disadvantages" 1997

The FCC: New Priorities and Future Directions
"Competition in the Telecommunications Industry" 1997

American Enterprise Institute Studies in Telecommunications Deregulation
"The Scope of Competition in Telecommunications" 1996

George Mason Law Review Symposium on Antitrust in the Information Revolution
"Introduction to the Economic Theory of Antitrust and Information" 1996

Korean Telecommunications Public Lecture
"Market Opening and Fair Competition" 1996

Korea Telecommunications Forum
"Desirable Interconnection Policy in a Competitive Market" 1996

European Association for Research in Industrial Economics Annual Conference
"Bottleneck Access: Regulation and Competition Policy" 1996

Harvard Program on Global Reform and Privatization of Public Enterprises
"Railroad and Other Infrastructure Privatization" 1996

FCC Forum on Antitrust and Economic Issues Involved with InterLATA Entry
"The Scope of Telecommunications Competition" 1996

Citizens for a Sound Economy Policy Watch on Telecommunications Interconnection
"The Economics of Interconnection" 1996

World Bank Seminar on Experiences with Corporatization
"Strategic Directions of Privatization" 1996

FCC Economic Forum on the Economics of Interconnection
Lessons from Other Industries 1996

ABA Annual Meeting, Section of Antitrust Law
The Integration, Disintegration, and Reintegration
of the Entertainment Industry 1996

Conference Board: 1996 Antitrust Conference
How Economics Influences Antitrust and Vice Versa 1996

Antitrust 1996: A Special Briefing
Joint Ventures and Strategic Alliances 1996

New York State Bar Association Section of Antitrust Law Winter Meeting
Commentary on Horizontal Effects Issues 1996

FTC Hearings on the Changing Nature of Competition in a Global and Innovation-Driven Age
Vertical Issues for Networks and Standards 1995

Wharton Seminar on Applied Microeconomics
Access Policies with Imperfect Regulation 1995

Antitrust 1996, Washington D.C.
Assessing Joint Ventures for Diminution of Competition 1995

ABA Annual Meeting, Section of Antitrust Law
Refusals to Deal -- Economic Tests for Competitive Harm 1995

FTC Seminar on Antitrust Enforcement Analysis
Diagnosing Collusion Possibilities 1995

Philadelphia Bar Education Center: Antitrust Fundamentals
Antitrust--The Underlying Economics 1995

Vanderbilt University Conference on Financial Markets
Why Do Christie and Schultz Infer Collusion From Their Data? 1995

ABA Section of Antitrust Law Chair=s Showcase Program
Discussion of Telecommunications Competition Policy 1995

Conference Board: 1995 Antitrust Conference
Analysis of Mergers and Joint Ventures 1995

ABA Conference on The New Antitrust: Policy of the '90s
Antitrust on the Super Highways/Super Airways 1994

ITC Hearings on The Economic Effects of Outstanding Title VII Orders
"The Economic Impacts of Antidumping Policies" 1994

OECD Working Conference on Trade and Competition Policy
"Empirical Evidence on The Nature of Anti-dumping Actions" 1994

Antitrust 1995, Washington D.C.
"Rigorous Antitrust Standards for Distribution Arrangements" 1994

ABA -- Georgetown Law Center: Post Chicago-Economics: New Theories - New Cases?
"Economic Foundations for Vertical Merger Guidelines" 1994

Conference Board: Antitrust Issues in Today's Economy
"New Democrats, Old Agencies: Competition Law and Policy" 1994

Federal Reserve Board Distinguished Economist Series
"Regulated Private Enterprise Versus Public Enterprise" 1994

Institut d'Etudes Politiques de Paris
"Lectures on Competition Policy and Privatization" 1993

Canadian Bureau of Competition Policy Academic Seminar Series, Toronto.
"Public Versus Regulated Private Enterprise" 1993

CEPS Symposium on The Clinton Administration: A Preliminary Report Card
"Policy Towards Business" 1993

Columbia Institute for Tele-Information Conference on Competition in Network Industries, New York, NY
"Discussion of Deregulation of Networks: What Has Worked and What Hasn't" 1993

World Bank Annual Conference on Development Economics
"Public Versus Regulated Private Enterprise" 1993

Center for Public Utilities Conference on Current Issues Challenging the Regulatory Process
"The Economics of Current Issues in Telecommunications Regulation" 1992
"The Role of Markets in Presently Regulated Industries" 1992

The Conference Board's Conference on Antitrust Issues in Today's Economy, New York, NY
"Antitrust in the Global Economy" 1992
"Monopoly Issues for the '90s" 1993

Columbia University Seminar on Applied Economic Theory, New York, NY
"Economic Rationales for the Scope of Privatization" 1992

Howrey & Simon Conference on Antitrust Developments, Washington, DC
"Competitive Effects of Concern in the Merger Guidelines" 1992

Arnold & Porter Colloquium on Merger Enforcement, Washington, DC
"The Economic Foundations of the Merger Guidelines" 1992

American Bar Association, Section on Antitrust Law Leadership Council Conference, Monterey, CA
"Applying the 1992 Merger Guidelines" 1992

OECD Competition Policy Meeting, Paris, France
"The Economic Impacts of Antidumping Policy" 1992

Center for Public Choice Lecture Series, George Mason University Arlington, VA
"The Economic Impacts of Antidumping Policy" 1992

Brookings Institution Microeconomics Panel, Washington, DC,
"Discussion of the Evolution of Industry Structure" 1992

AT&T Conference on Antitrust Essentials
"Antitrust Standards for Mergers and Joint Ventures" 1991

ABA Institute on The Cutting Edge of Antitrust: Market Power
"Assessing and Proving Market Power: Barriers to Entry" 1991

Second Annual Workshop of the Competition Law and Policy Institute of New Zealand
"Merger Analysis, Industrial Organization Theory, and Merger Guidelines" 1991
"Exclusive Dealing and the Fisher & Paykel Case" 1991

Special Seminar of the New Zealand Treasury
"Strategic Behavior, Antitrust, and The Regulation of Natural Monopoly" 1991

Public Seminar of the Australian Trade Practices Commission
"Antitrust Issues of the 1990's" 1991

National Association of Attorneys General Antitrust Seminar
"Antitrust Economics" 1991

District of Columbia Bar's 1991 Annual Convention
"Administrative and Judicial Trends in Federal Antitrust Enforcement" 1991

ABA Spring Meeting
"Antitrust Lessons From the Airline Industry" 1991

Conference on The Transition to a Market Economy - Institutional Aspects
"Anti-Monopoly Policies and Institutions" 1991

Conference Board's Thirtieth Antitrust Conference
"Antitrust Issues in Today's Economy" 1991

American Association for the Advancement of Science Annual Meeting
"Methodologies for Economic Analysis of Mergers" 1991

General Seminar, Johns Hopkins University
"Economic Rationales for the Scope of Privatization" 1991

Capitol Economics Speakers Series
"Economics of Merger Guidelines" 1991

CRA Conference on Antitrust Issues in Regulated Industries
"Enforcement Priorities and Economic Principles" 1990

Pepper Hamilton & Scheetz Anniversary Colloquium
"New Developments in Antitrust Economics" 1990

PLI Program on Federal Antitrust Enforcement in the 90's
"The Antitrust Agenda of the 90's" 1990

FTC Distinguished Speakers Seminar
"The Evolving Merger Guidelines" 1990

The World Bank Speakers Series	
"The Role of Antitrust Policy in an Open Economy"	1990
Seminar of the Secretary of Commerce and Industrial Development of Mexico	
"Transitions to a Market Economy"	1990
Southern Economics Association	
"Entry in Antitrust Analysis of Mergers"	1990
"Discussion of Strategic Investment and Timing of Entry"	1990
American Enterprise Institute Conference on Policy Approaches to the Deregulation of Network Industries	
"Discussion of Network Problems and Solutions"	1990
American Enterprise Institute Conference on Innovation, Intellectual Property, and World Competition	
"Law and Economics Framework for Analysis"	1990
Banco Nacional de Desenvolvimento Economico Social Lecture	
"Competition Policy: Harnessing Private Interests for the Public Interest"	1990
Western Economics Association Annual Meetings	
"New Directions in Antitrust from a New Administration"	1990
"New Directions in Merger Enforcement: The View from Washington"	1990
Woodrow Wilson School Alumni Colloquium	
"Microeconomic Policy Analysis and Antitrust--Washington 1990"	1990
Arnold & Porter Lecture Series	
"Advocating Competition"	1991
"Antitrust Enforcement"	1990
ABA Antitrust Section Convention	
"Recent Developments in Market Definition and Merger Analysis"	1990
Federal Bar Association	
"Joint Production Legislation: Competitive Necessity or Cartel Shield?"	1990
Pew Charitable Trusts Conference	
"Economics and National Security"	1990
ABA Antitrust Section Midwinter Council Meeting	
"Fine-tuning the Merger Guidelines"	1990
"The State of the Antitrust Division"	1991

International Telecommunications Society Conference
"Discussion of the Impact of Telecommunications in the UK" 1989

The Economists of New Jersey Conference
"Recent Perspectives on Regulation" 1989

Conference on Current Issues Challenging the Regulatory Process
"Innovative Pricing and Regulatory Reform" 1989
"Competitive Wheeling" 1989

Conference Board: Antitrust Issues in Today's Economy
"Foreign Trade Issues and Antitrust" 1989

McKinsey & Co. Mini-MBA Conference
"Economic Analysis of Pricing, Costing, and Strategic Business Behavior" 1989
1994

Olin Conference on Regulatory Mechanism Design
"Revolutions in Regulatory Theory and Practice: Exploring The Gap" 1989

University of Dundee Conference on Industrial Organization and Strategic Behavior
"Mergers in Differentiated Product Industries" 1988

Leif Johanson Lectures at the University of Oslo
"Normative Issues in Industrial Organization" 1988

Mergers and Competitiveness: Spain Facing the EEC
"Merger Policy" 1988
"R&D Joint Ventures" 1988

New Dimensions in Pricing Electricity
"Competitive Pricing and Regulatory Reform" 1988

Program for Integrating Economics and National Security: Second Annual Colloquium
"Arming Decisions Under Asymmetric Information" 1988

European Association for Research in Industrial Economics
"U.S. Railroad Deregulation and the Public Interest" 1987
"Economic Rationales for the Scope of Privatization" 1989
"Discussion of Licensing of Innovations" 1990

Annenberg Conference on Rate of Return Regulation in the Presence of Rapid Technical Change
"Discussion of Regulatory Mechanism Design in the Presence
of Research, Innovation, and Spillover Effects" 1987

Special Brookings Papers Meeting
"Discussion of Empirical Approaches to Strategic Behavior" 1987
"New Merger Guidelines" 1990

Deregulation or Regulation for Telecommunications in the 1990's
"How Effective are State and Federal Regulations?" 1987

Conference Board Roundtable on Antitrust
"Research and Production Joint Ventures" 1990
"Intellectual Property and Antitrust" 1987

Current Issues in Telephone Regulation
"Economic Approaches to Market Dominance: Applicability of Contestable Markets" 1987

Harvard Business School Forum on Telecommunications
"Regulation of Information Services" 1987

The Fowler Challenge: Deregulation and Competition in The Local Telecommunications Market
"Why Reinvent the Wheel?" 1986

World Bank Seminar on Frontiers of Economics
"What Every Economist Should Know About Contestable Markets" 1986
Bell Communications Research Conference on Regulation and Information
"Fuzzy Regulatory Rules" 1986

Karl Eller Center Forum on Telecommunications
"The Changing Economic Environment in Telecommunications: Technological Change and Deregulation" 1986

Railroad Accounting Principles Board Colloquium
"Contestable Market Theory and ICC Regulation 1986

Canadian Embassy Conference on Current Issues in Canadian -- U.S. Trade and Investment
"Regulatory Revolution in the Infrastructure Industries" 1985

Eagleton Institute Conference on Telecommunications in Transition
"Industry in Transition: Economic and Public Policy Overview" 1985

Brown University Citicorp Lecture
"Logic of Regulation and Deregulation" 1985

Columbia University Communications Research Forum
"Long Distance Competition Policy" 1985

American Enterprise Institute Public Policy Week
"The Political Economy of Regulatory Reform" 1984

MIT Communications Forum
"Deregulation of AT&T Communications" 1984

Bureau of Census Longitudinal Establishment Data File and Diversification Study Conference
"Potential Uses of The File" 1984

Federal Bar Association Symposium on Joint Ventures
"The Economics of Joint Venture Assessment" 1984

Hoover Institute Conference on Antitrust
"Antitrust for High-Technology Industries" 1984

NSF Workshop on Predation and Industrial Targeting
"Current Economic Analysis of Predatory Practices" 1983

The Institute for Study of Regulation Symposium: Pricing Electric, Gas, and Telecommunications Services Today and for the Future
"Contestability As A Guide for Regulation and Deregulation" 1984

University of Pennsylvania Economics Day Symposium
"Contestability and Competition: Guides for Regulation and Deregulation" 1984

Pinhas Sapir Conference on Economic Policy in Theory and Practice
"Corporate Governance and Market Structure" 1984

Centre of Planning and Economic Research of Greece
"Issues About Industrial Deregulation" 1984
"Contestability: New Research Agenda" 1984

Hebrew and Tel Aviv Universities Conference on Public Economics
"Social Welfare Dominance Extended and Applied to Excise Taxation" 1983

NBER Conference on Industrial Organization and International Trade
"Perspectives on Horizontal Mergers in World Markets" 1983

Workshop on Local Access: Strategies for Public Policy
"Market Structure and Government Intervention in Access Markets" 1982

NBER Conference on Strategic Behavior and International Trade
"Industrial Strategy with Committed Firms: Discussion" 1982

Columbia University Graduate School of Business, Conference on Regulation and New Telecommunication Networks
"Local Pricing in a Competitive Environment" 1982

International Economic Association Roundtable Conference on New Developments in the Theory of Market Structure
"Theory of Contestability" 1982
"Product Dev., Investment, and the Evolution of Market Structures" 1982

N.Y.U. Conference on Competition and World Markets: Law and Economics
"Competition and Trade Policy--International Predation" 1982

CNRS-ISPE-NBER Conference on the Taxation of Capital
"Welfare Effects of Investment Under Imperfect Competition" 1982

Internationales Institut fur Management und Verwalturg Regulation Conference
"Welfare, Regulatory Boundaries, and the Sustainability of Oligopolies" 1981

NBER-Kellogg Graduate School of Management Conference on the Econometrics of Market Models with Imperfect Competition
"Discussion of Measurement of Monopoly Behavior: An Application to the Cigarette Industry" 1981

The Peterkin Lecture at Rice University
"Deregulation: Ideology or Logic?" 1981

FTC Seminar on Antitrust Analysis
"Viewpoints on Horizontal Mergers 1982
"Predation as a Tactical Inducement for Exit" 1980

NBER Conference on Industrial Organization and Public Policy
"An Economic Definition of Predation" 1980

The Center for Advanced Studies in Managerial Economics Conference on The Economics of Telecommunication
"Pricing Local Service as an Input" 1980

Aspen Institute Conference on the Future of the Postal Service
"Welfare Economics of Postal Pricing" 1979

Department of Justice Antitrust Seminar
"The Industry Performance Gradient Index" 1979

Eastern Economic Association Convention
"The Social Performance of Deregulated Markets for Telecom Services" 1979

Industry Workshop Association Convention
"Customer Equity and Local Measured Service" 1979

Symposium on Ratemaking Problems of Regulated Industries
"Pricing Decisions and the Regulatory Process" 1979

Woodrow Wilson School Alumni Conference
"The Push for Deregulation" 1979

NBER Conference on Industrial Organization
"Intertemporal Sustainability" 1979

World Congress of the Econometric Society
"Theoretical Industrial Organization" 1980

Institute of Public Utilities Conference on Current Issues in Public Utilities Regulation
"Network Access Pricing" 1978

ALI-ABA Conference on the Economics of Antitrust
"Predatoriness and Discriminatory Pricing" 1978

AEI Conference on Postal Service Issues
"What Can Markets Control?" 1978

University of Virginia Conference on the Economics of Regulation
"Public Interest Pricing" 1978

DRI Utility Conference
"Marginal Cost Pricing in the Utility Industry: Impact and Analysis" 1978

International Meeting of the Institute of Management Sciences
"The Envelope Theorem" 1977

University of Warwick Workshop on Oligopoly
"Industry Performance Gradient Indexes" 1977

North American Econometric Society Convention
"Intertemporal Sustainability" 1979
"Social Welfare Dominance" 1978
"Economies of Scope, DAIC, and Markets with Joint Production" 1977

Telecommunications Policy Research Conference

"Transition to Competitive Markets"	1986
"InterLATA Capacity Growth, Capped NTS Charges and Long Distance Competition"	1985
"Market Power in The Telecommunications Industry"	1984
"FCC Policy on Local Access Pricing"	1983
"Do We Need a Regulatory Safety Net in Telecommunications?"	1982
"Anticompetitive Vertical Conduct"	1981
"Electronic Mail and Postal Pricing"	1980
"Monopoly, Competition and Efficiency": Chairman	1979
"A Common Carrier Research Agenda"	1978
"Empirical Views of Ramsey Optimal Telephone Pricing"	1977
"Recent Research on Regulated Market Structure"	1976
"Some General Equilibrium Views of Optimal Pricing"	1975

National Bureau of Economic Research Conference on Theoretical Industrial Organization

"Compensating Variation as a Measure of Welfare Change"	1976

Conference on Pricing in Regulated Industries: Theory & Application

"Ramsey Optimal Pricing of Long Distance Telephone Services"	1977

NBER Conference on Public Regulation

"Income Distributional Concerns in Regulatory Policy-Making"	1977

Allied Social Science Associations National Convention

"Merger Guidelines and Economic Theory"	1990
Discussion of "Competitive Rules for Joint Ventures"	1989
"New Schools in Industrial Organization"	1988
"Industry Economic Analysis in the Legal Arena"	1987
"Transportation Deregulation"	1984
Discussion of "Pricing and Costing of Telecommunications Services"	1983
Discussion of "An Exact Welfare Measure"	1982
"Optimal Deregulation of Telephone Services"	1982
"Sector Differentiated Capital Taxes"	1981
"Economies of Scope"	1980
"Social Welfare Dominance"	1980
"The Economic Definition of Predation"	1979
Discussion of "Lifeline Rates, Succor or Snare?"	1979
"Multiproduct Technology and Market Structure"	1978
"The Economic Gradient Method"	1978
"Methods for Public Interest Pricing"	1977
Discussion of "The Welfare Implications of New Financial Instruments"	1976
"Welfare Theory of Concentration Indices"	1976
Discussion of "Developments in Monopolistic Competition Theory"	1976
"Hedonic Price Adjustments"	1975

"Public Good Attributes of Information and its Optimal Pricing" 1975
"Risk Invariance and Ordinally Additive Utility Functions" 1974
"Consumer's Surplus: A Rigorous Cookbook" 1974

University of Chicago Symposium on the Economics of Regulated Public Utilities
"Optimal Prices for Public Purposes" 1976

American Society for Information Science
"The Social Value of Information: An Economist's View" 1975

Institute for Mathematical Studies in the Social Sciences Summer Seminar
"The Sustainability of Natural Monopoly" 1975

U.S.-U.S.S.R. Symposium on Estimating Costs and Benefits of Information Services
"The Evaluation of the Economic Benefits of Productive Information" 1975

NYU-Columbia Symposium on Regulated Industries
"Ramsey Optimal Public Utility Pricing" 1975

Research Seminars:

Bell Communications Research (2)
Bell Laboratories (numerous)
Department of Justice (3)
Electric Power Research Institute
Federal Reserve Board
Federal Trade Commission (4)
Mathematica
Rand
World Bank (3)
Carleton University
Carnegie-Mellon University
Columbia University (4)
Cornell University (2)
Georgetown University
Harvard University (2)
University of California, San Diego
University of Chicago
University of Delaware
University of Florida
University of Illinois
University of Iowa (2)
Universite Laval
University of Maryland
University of Michigan
University of Minnesota
University of Oslo
University of Pennsylvania (3)
University of Toronto
University of Virginia
University of Wisconsin

Hebrew University
Johns Hopkins University (2)
M. I. T. (4)
New York University (4)
Northwestern University (2)
Norwegian School of Economics and
  Business Administration
University of Wyoming
Vanderbilt University
Yale University (2)
Princeton University (many)
Rice University
Stanford University (5)
S.U.N.Y. Albany

GEORGE T. ZIMMERMAN

Mr. Zimmerman is a Project Manager/Senior Engineer with STV, a professional firm offering engineering, architectural, planning, environmental and construction management services with offices located at 3505 Koger Boulevard, Suite 205, Duluth, Georgia 30096. Mr. Zimmerman is a railway engineer and project manager with more than 30 years of experience on roadway and bridge projects and has particular expertise in freight planning, design, and construction management. Mr. Zimmerman is sponsoring portions of Section III-F of Norfolk Southern's ("NS's") Reply Evidence relating to Track Construction and the Construction Schedule. Mr. Zimmerman has signed a verification of the truth of the statements contained therein. A copy of that verification is attached hereto.

Mr. Zimmerman's resident engineering and inspection experience includes grade crossings and roadway, railway, and highway bridges. Mr. Zimmerman manages STV's relationship with Norfolk Southern, working with the railroad on a daily basis and assisting in the preparation of proposals and contracts. In addition, Mr. Zimmerman provides structural design and plan reviews for railway and bridge projects. Mr. Zimmerman holds a Bachelor of Science, Civil Engineering from West Virginia University and is a member of the Roadway and Ballast Committee of the American Railway Engineering and Maintenance of Way Association (AREMA).

Mr. Zimmerman's resume with additional project experience is attached hereto.

VERIFICATION

I, George T. Zimmerman, declare under penalty of perjury that I have read the portions of the Reply Evidence of Norfolk Southern Railway Company that I have sponsored (as described in the foregoing Statement of Qualifications), that I know the contents thereof, and that the evidence I have sponsored is true and correct. Further, I certify that I am qualified and authorized to file this statement.

George T. Zimmerman

Executed on this 19 day of November, 2012.

George T. Zimmerman, P.E.

Project Manager/Senior Engineer

Mr. Zimmerman is a railway engineer and project manager with more than 30 years of experience on roadway and bridge projects and particular expertise in freight planning, design, and construction management. His resident engineering and inspection experience includes grade crossings and roadway, railway, and highway bridges. Mr. Zimmerman manages STV's relationship with Norfolk Southern, working with the railroad on a regular basis and assisting in the preparation of proposals and contracts. In addition, he provides structural designs and plan reviews for railway and bridge projects.

Office Location
Duluth, GA

Date joined firm
5/16/79

Years with other firms
0

Education
Bachelor of Science, Civil Engineering, West Virginia University (1979)

Professional Registrations
Professional Engineer: Georgia (1992/#019811/exp. 12/31/14), Kansas (2002/ #17069/exp. 4/30/13), Missouri (2003/ #2003000042/exp. 12/31/13), Ohio (2001/#65833/exp. 12/31/13), South Carolina (1989/#12625/exp. 6/30/14)

Memberships
Roadway and Ballast Committee Member, American Railway Engineering and Maintenance of Way Association (AREMA)

American Society of Civil Engineers (ASCE)

Project Experience

BRIDGES

Norfolk Southern Jeffersonville Road Widening - Project Manager
Managed the preliminary layout and design of a 4-span, 93.5-meter-long steel deck plate girder railroad bridge in Macon, GA. The single-track bridge will carry Norfolk Southern over Jeffersonville Road, which was widened from two to five lanes. The project included track realignment to allow off-line construction. (2002 - 2007)

GDOT Railroad Bridges over Butler Street and Piedmont Avenue - Senior Engineer
Provided bridge design for the widening of two CSX Railroad bridges over Butler Street and Piedmont Avenue in Fulton County, GA, and two retaining walls for the Georgia Department of Transportation (GDOT). (2002 - 2006)

GDOT S.R. 3 Connector - Senior Engineer
Designed a replacement bridge and adjoining roadway over I-75 on the S.R. 3 connector in Whitfield County, GA. The 8-lane bridge replaced a 2-lane structure of insufficient capacity. Work included horizontal and vertical design, construction plans, right-of-way plans, and construction staging plans, as well as pavement marking and signing plans. All design work for this Georgia Department of Transportation (GDOT) project was done in metric. (1995)

CSX Railroad over Monroe Road - Resident Engineer
Provided construction management and coordination with the railroad for this through-girder, single-track railroad structure in Charlotte, NC. The project included a temporary detour trestle, track realignment, staged construction, and coordination with the highway portion of the project. The underpass is located in what was one of the emerging growth corridors of the Charlotte area. (6/87 - 12/88)

COMMERCIAL

Private Developer Silas Creek Crossing Shopping Center - Resident Inspector
Provided construction observation for a 200,000-sf retail shopping center, highway bridge, and concrete box culvert in Winston Salem, NC. (7/88 - 3/89)

HIGHWAYS/ROADWAYS

Piper Glen Development Corporation Rea Road Extension - Engineer
Provided construction coordination and management for 1.65-mile roadway extension to serve as the main thoroughfare for Piper Glen Development in Mecklenburg County, NC. The $2.5 million roadway and highway bridge project were built to be taken into the North Carolina Department of Transportation system and connected to the Charlotte Outer Beltway. (6/87 - 6/89)

INDUSTRIAL

IBM Research and Manufacturing Facility University Research Park - Engineer
Provided staging and design, earthwork, and site plan staging for balancing of cuts and fills for recreational facilities during construction of the building site and railway in Charlotte, NC. (5/79 - 11/79)

RAIL: COMMUTER RAIL

Central Midlands Council of Governments Camden to Columbia Corridor Alternatives Analysis – Senior Rail Engineer
Contributed to the alternatives analysis for potential mass transit technologies and corridors between Camden, SC, and Columbia, SC. Mr. Zimmerman assisted the planning team by providing rail information, traffic potential, and operational layouts in Columbia where rail lines intersect. He also identified areas of structural conflict requiring further study and analysis. (6/09 - 6/11)

FTA PMO Denver RTD/CDOT Capital Program - Senior Engineer
Identified locations along proposed alignments where changes would be made to the Burlington Northern Santa Fe and Union Pacific Railroad tracks as part of project management oversight (PMO) services to the Federal Transit Administration (FTA) for the Denver Regional Transportation District (RTD)/Colorado Department of Transportation (CDOT) commuter rail system in Denver. Mr. Zimmerman also determined if the work could be considered a required railroad change or betterment for the railroad involved. To determine this, the trackwork and civil improvements to the rail system and track roadbed were evaluated as individual projects, but with a larger area view if there were track changes or replacements involved. (8/10 - 1/11)

CSX Ronald Reagan Parkway - Project Manager/Resident Engineer
Managed the construction engineering inspection of the CSX Railroad bridge over Ronald Reagan Parkway near Lawrenceville in Gwinnett County, GA. (2/92 - 12/93)

Norfolk Southern I-64 over Norfolk Southern - Resident Engineer
Observed construction field activities and represented the Norfolk Southern Railroad for two bridges over the railway, one at milepost 4.43 VB, and one at milepost 5.04 NS in Norfolk, VA. (1/90 - 2/92)

City of Virginia Beach Pungo Ferry Bridge - Resident Engineer
Provided construction management and inspection services and represented the City of Virginia Beach for the construction of the replacement of this obsolete swing span with a 3,400-foot-long highway bridge over the Intracoastal Waterway in Virginia Beach, VA. The project included roadway approaches and the placement of a geosynthetic stabilized embankment over adjacent wetlands. (1989 - 1992)

Norfolk Southern over Harris Boulevard - Resident Engineer
Provided construction management for a double-track Norfolk Southern underpass built using a temporary detour alignment in Newell, NC. (7/88 - 6/89)

City of Charlotte Tyvola Road Extension - Resident Structural Inspector
Inspected this 3.6-mile, 5-lane roadway extension in Charlotte, NC, including a new interchange with a 7-lane bridge over Billy Graham Parkway, eight reinforced concrete box culverts, and a 6-lane bridge over Sugar Creek. (6/87 - 6/89)

RAIL: FREIGHT RAIL

Sandersville Railroad Alternate Route Study - Senior Engineer
Providing location, evaluation, and cost estimates for a 12-mile industrial lead in Washington County, GA (10/11 - Present)

Cambridge Systematics CSXT Intermodal Location Feasibility Assistance - Lead Railroad Engineer
Collaborating with the Maryland Department of Transportation (MDOT) in the review and evaluation of preliminary plans for alternate sites for CSXT intermodal transfer facilities in the Baltimore, MD, area. Mr. Zimmerman is assisting MDOT in interpreting CSXT plans and figures, explaining CSXT requirements, and verifiying that provided information is consistent with current CSXT and railroad industry standards of practice. (8/11 - Present)

R. J. Corman Railroad On-Call Services Contract - Project Manager
Managing plan review and construction engineering and inspection services on an on-call, as-needed basis for proposed roadway, bridge, and miscellaneous projects affecting railway facilities throughout various R. J. Corman Railroad lines in the eastern United States. Mr. Zimmerman has overseen construction of overhead bridges, underpasses, utility crossings,

parallel construction of utilities, roadways, and grade crossings since 2007. (2007 - Present)

Norfolk Southern On-Call Services Contract - Project Manager
Managing plan review and construction engineering and inspection services on an on-call, as-needed basis for more than 1000 proposed roadway, bridge, and retaining wall construction projects affecting railway facilities throughout the 22-state Norfolk Southern system. Mr. Zimmerman has overseen construction of overhead bridges, underpasses, floodwalls, and utility crossings, and parallel construction of utilities, roadways, bikeways, and grade crossings since 1992. (1992 - Present)

Norfolk Southern Heartland Corridor Clearance Improvements CM - Project Manager
Coordinated various teams providing construction management (CM) services for portions of the Heartland Corridor Clearance Project, an award-winning, $191 million initiative to improve 28 tunnels and seven through-truss bridges and remove 24 overhead obstacles to provide a direct double-stacked container train route from the ports of Virginia through West Virginia and eastern Kentucky into central Ohio. Mr. Zimmerman oversaw the raising of a bridge at Harding Street in Bluefield, WV; stormwater and erosion control plans at various tunnel sites; and numerous bridge lowering and slide fence clearance tasks. (1/07 - 8/10)

LAMTPO Rail Relocation and Intermodal Facility Feasibility Study - Senior Engineer
Provided design engineering services for the proposed relocation of the Norfolk Southern Railroad mainline through Morristown, White Pine, and Jefferson City, TN, as part of a study for the Lakeway Area Metropolitan Transportation Planning Organization (LAMTPO) to determine the feasibility of relocating the Norfolk Southern A Line and installing an intermodal facility in Morristown. Mr. Zimmerman assisted in gathering information and determining railroad design and operation requirements. The A Line, which runs through downtown Morristown, will be eliminated and either a new line will be built or an existing line will be improved in the county. The intermodal facility will facilitate connections between freight lines along Interstate 81 and the Norfolk Southern Crescent. (3/08 - 4/09)

Rochester & Southern Railroad Silver Springs Connection Track - Project Manager
Reviewed rail design for a Rochester & Southern Railroad connection track in Silver Springs, NY. The connecting track will allow unit coal train movement from Norfolk Southern Railroad to the Rochester & Southern Railroad. Mr. Zimmerman's responsibilities included coordination with Norfolk Southern. (2007 - 2009)

Vulcan Materials Company Skippers Quarry Loop Track - Project Manager
Provided project administration and coordinated staff in multiple offices for the preliminary and final design of a 0.75-mile loop track, including a 100-

foot-long open deck railroad trestle, for Vulcan Materials Company at Skippers Quarry in Skippers, VA. The track is used for loading unit rail trains with railroad ballast and other crushed aggregate materials. (1/07 - 1/09)

STB Railroad Coal Rate Case Litigation Cost Assessments - Project Manager

Determined values for track work items and construction staging of the work plan for this Surface Transportation Board (STB) project, which included assembling the planning, engineering, and construction costs to build a hypothetical contemporary operating railroad in North Carolina, as part of a cost assessment for a several coal rate cases. Cost assessments included major earthwork, bridge and culvert construction, track, communications and signalization, engineering design, construction management, material costs and logistics, mobilization, and contingencies. Cases included Norfolk Southern versus Duke Energy, Norfolk Southern versus Carolina Power & Light, CSX versus Duke Energy, Burlington Northern Santa Fe (BNSF) and Union Pacific versus AEC, BNSF versus Otter Tail, and AEP Texas North versus BNSF. (2000)

Norfolk Southern Automobile Mixing Facility - Project Manager

Provided preliminary and final hydraulic/hydrologic, railway, roadway, highway, and railway bridge design for this Ford automobile mixing facility in Shelbyville, KY. The project included 2.5 million cubic yards of earthwork, 18 miles of track installation, a 45-acre paved vehicle storage yard, 3 bridges, and 2 access roads. (8/96 - 12/97)

CSX Double-Track Program - Project Manager

Designed 7 miles of track parallel to the CSX Railroad main line in Marietta, GA. The project included a study of several grade-crossing eliminations and retaining wall structures. (1995)

Norfolk Southern Third Mainline Track - Project Manager

Managed engineering services for the design and construction of a 2.9-mile third main track from adjacent to CSX's Queensgate Yard to Mitchell Avenue in Cincinnati. Mr. Zimmerman provided project management as well as the design of all earthwork, track work, and retaining structures. (6/94 - 7/95)

USACE Omaha District Wharf Track Military Ocean Terminal - Senior Engineer

Provided engineering services for track material research for the rehabilitation of 3.5 miles of railroad track on concrete wharfs in Sunny Point, NC, for the U.S. Army Corps of Engineers (USACE). (1994)

CSX Railroad Relocation, Consolidation, and Grade Crossing Elimination - Contract A Resident Engineer, Contract B Assistant Resident Engineer

Supervised the $16.7 million construction of a railway roadbed, including 7,600 linear feet of grading, in Columbia, SC. The project included drainage, dewatering, utilities, and retaining walls. (4/83 - 4/87)

Graham County Development Corporation Graham County Railroad - Resident Engineer
Provided construction management and testing services for the $1.65 million rehabilitation of 12.65 miles of track and 13 small railroad bridges, including drainage improvements and 1.25 miles of track relayed with heavier rails on a steep mountainous grade, for this railroad between the re-established connection to the Southern Railway at Totpon, NC, to the Bemis Lumber Company yard in Robbinsville, NC. (1/81 - 4/83)

RAIL: LIGHT RAIL

CATS LYNX Blue Line Extension Light Rail Project - Senior Engineer
Responsible for the coordination and resolution of issues generated by the preliminary design in areas along the corridor that involve Norfolk Southern, North Carolina and the Aberdeen, Carolina, and Western Railroads as part of the a new 9.3-mile light rail transit line extension in Charlotte, NC. Mr. Zimmerman is working with the Charlotte Area Transit System (CATS) to successfully integrate transit and land use, and to solve challenges associated with crossing and running along existing freight railroad right-of-way. The plans must satisfy the requirements of four different railroads so the city can secure necessary agreements. (2008 - Present)

SITE DEVELOPMENT

Statesville Redevelopment Authority Newtonville Subdivision - Resident Engineer
Provided construction management, inspection, and field testing services for the redevelopment of the $500,000 Newtonville Subdivision for the City of Statesville, NC. This project included the total removal of all existing facilities and the construction of all new infrastructure including excavation, drainage, utility installation, and street construction. (11/79 - 7/80)