National Rail Freight Infrastructure Capacity and Investment Study

presented to
Railroad Energy Transportation Advisory Committee

presented by
Lance R. Grenzeback
Cambridge Systematics, Inc.

September 17, 2008

CAMBRIDGE SYSTEMATICS

National Rail Capacity Study

- Requested by the National Surface Transportation Policy and Revenue Study Commission
- Commissioned by the Association of American Railroads
- Prepared by Cambridge Systematics, Inc.

CAMBRIDGE SYSTEMATICS

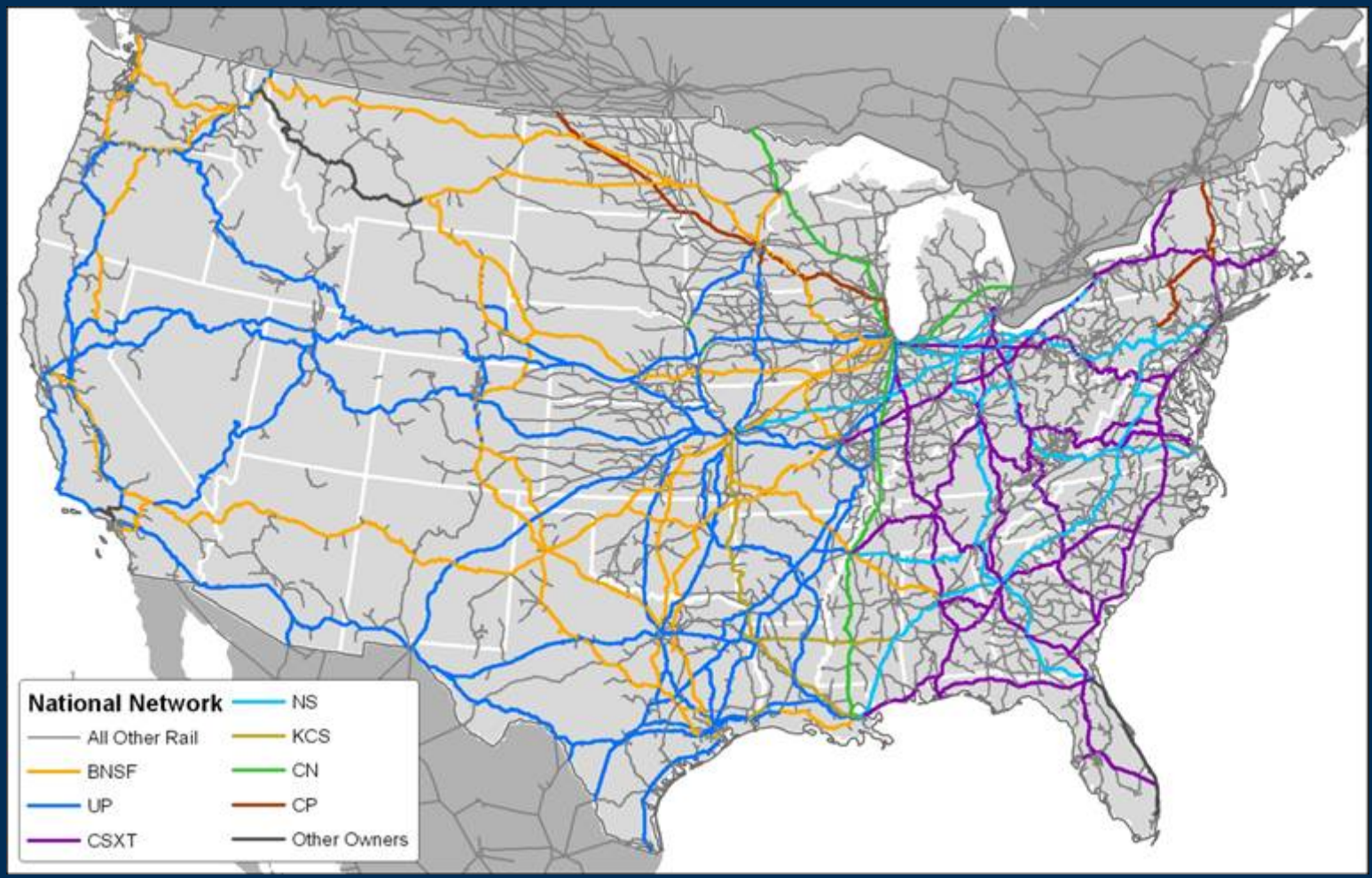
Purpose

- **Estimate the rail freight infrastructure improvements and investments needed to meet the U.S. Department of Transportation's projected demand for rail freight transportation in 2035**
  - **The U.S. DOT estimates that the demand for rail freight transportation – measured in tonnage – will increase 88 percent by 2035**

Establish Current Trains/Day

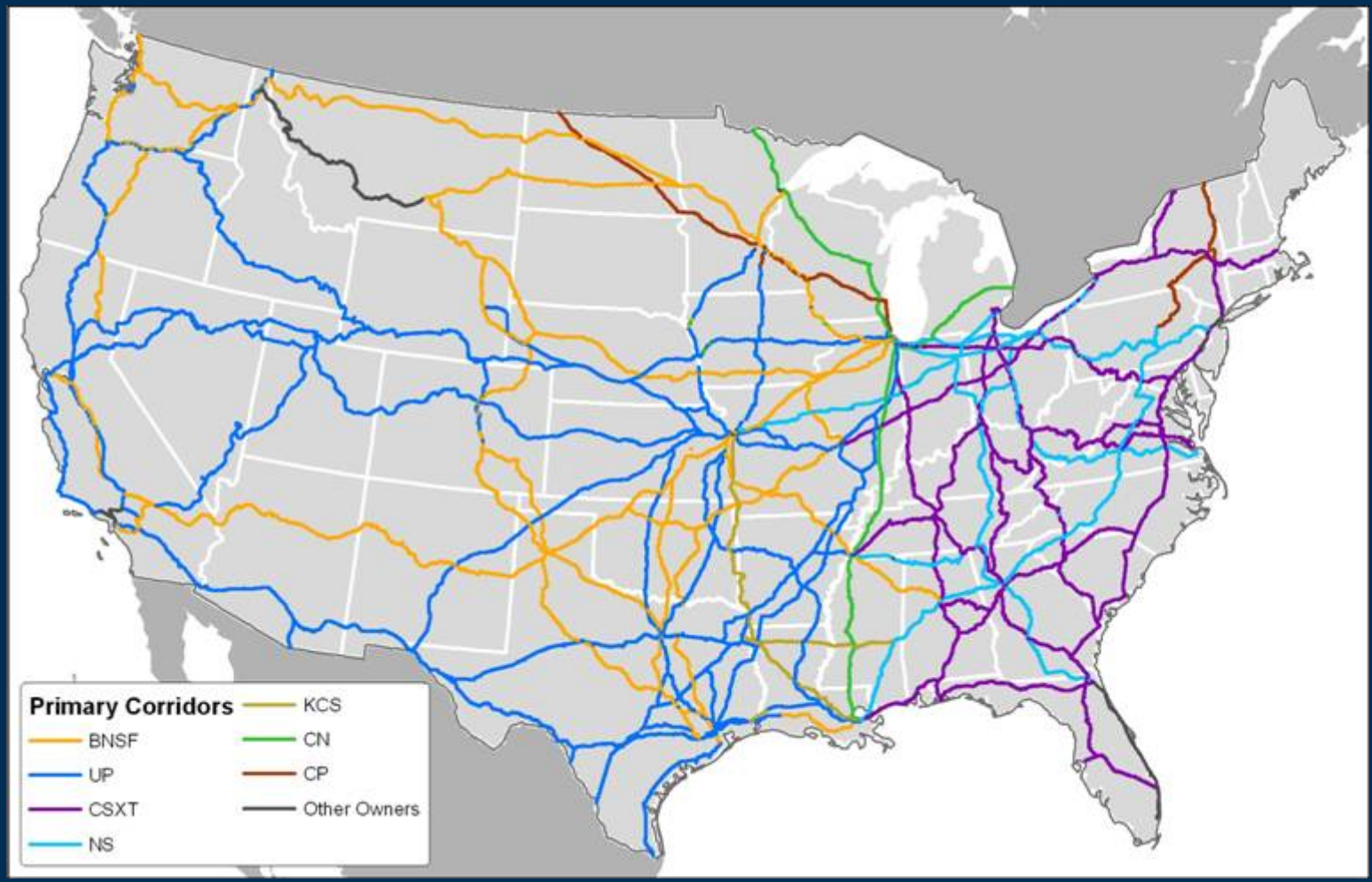
- Railroads designated *primary rail corridors* (e.g., high volume, trade-critical corridors)
- Used *current loaded railcars* from 2005 STB Carload Waybill Sample data for an 85th percentile day
- Estimated empty railcar movements from empty return rates in the Uniform Rail Costing System
- Converted from railcars/day to trains/day using average train lengths by service type
- Added current passenger trains/day from public timetables
- Sent to railroads for review and corrections

National Rail Freight Network and Primary Rail Freight Corridors



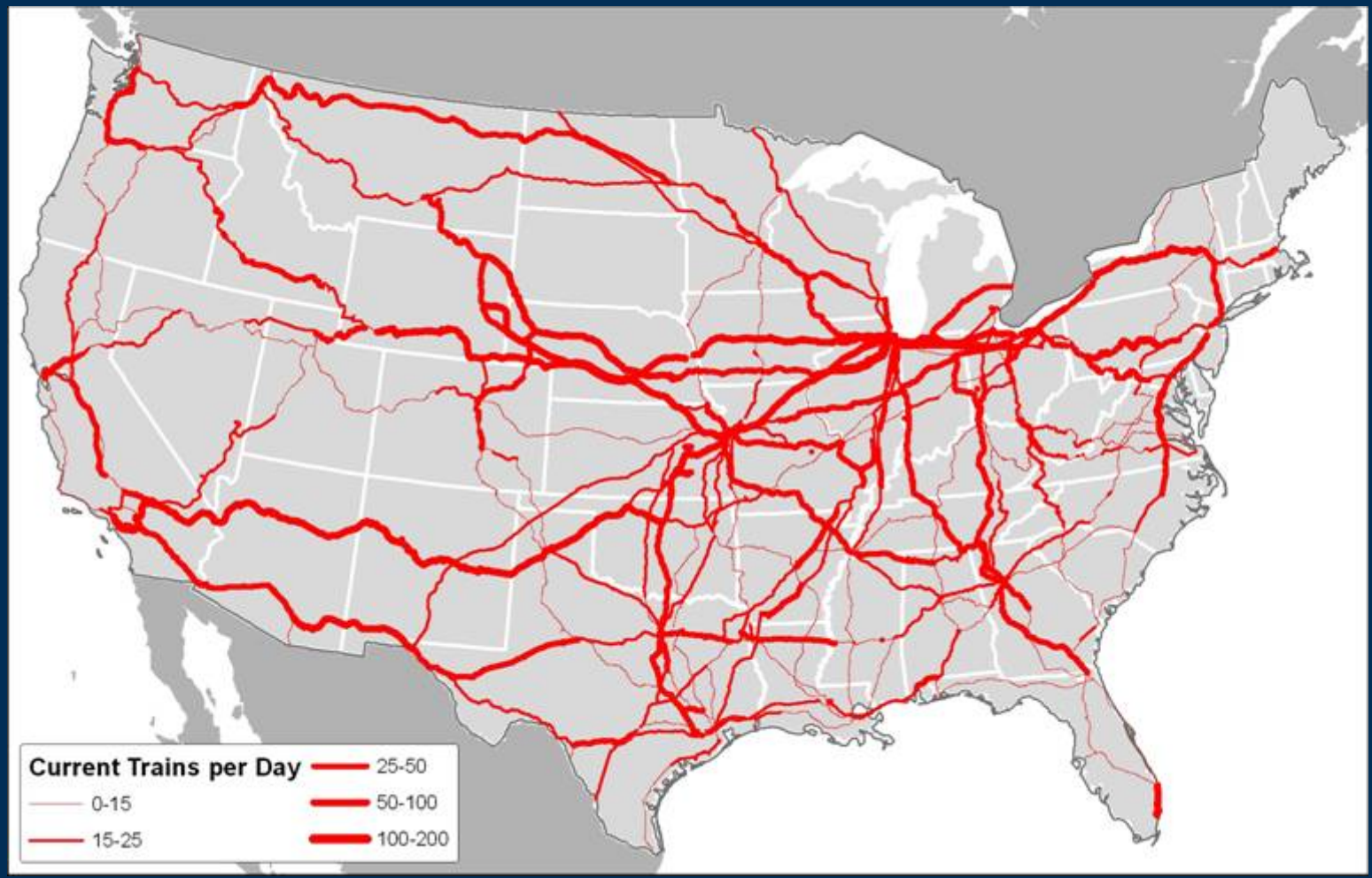
CAMBRIDGE SYSTEMATICS

Primary Rail Freight Corridors



CAMBRIDGE SYSTEMATICS

Current Corridor Volumes
2005 Freight Trains and 2007 Passenger Trains per Day

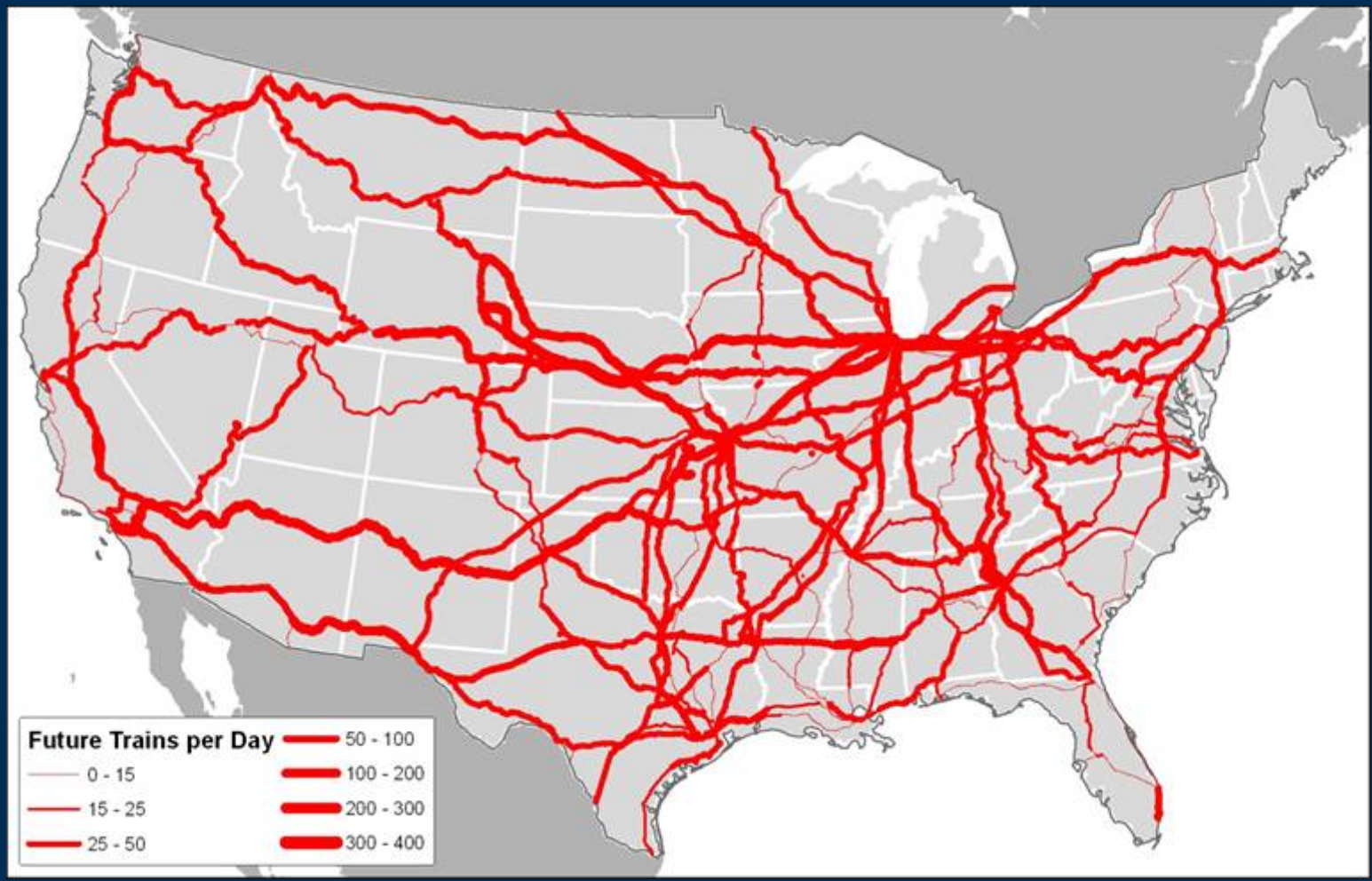


CAMBRIDGE SYSTEMATICS

Establish Future Trains/Day

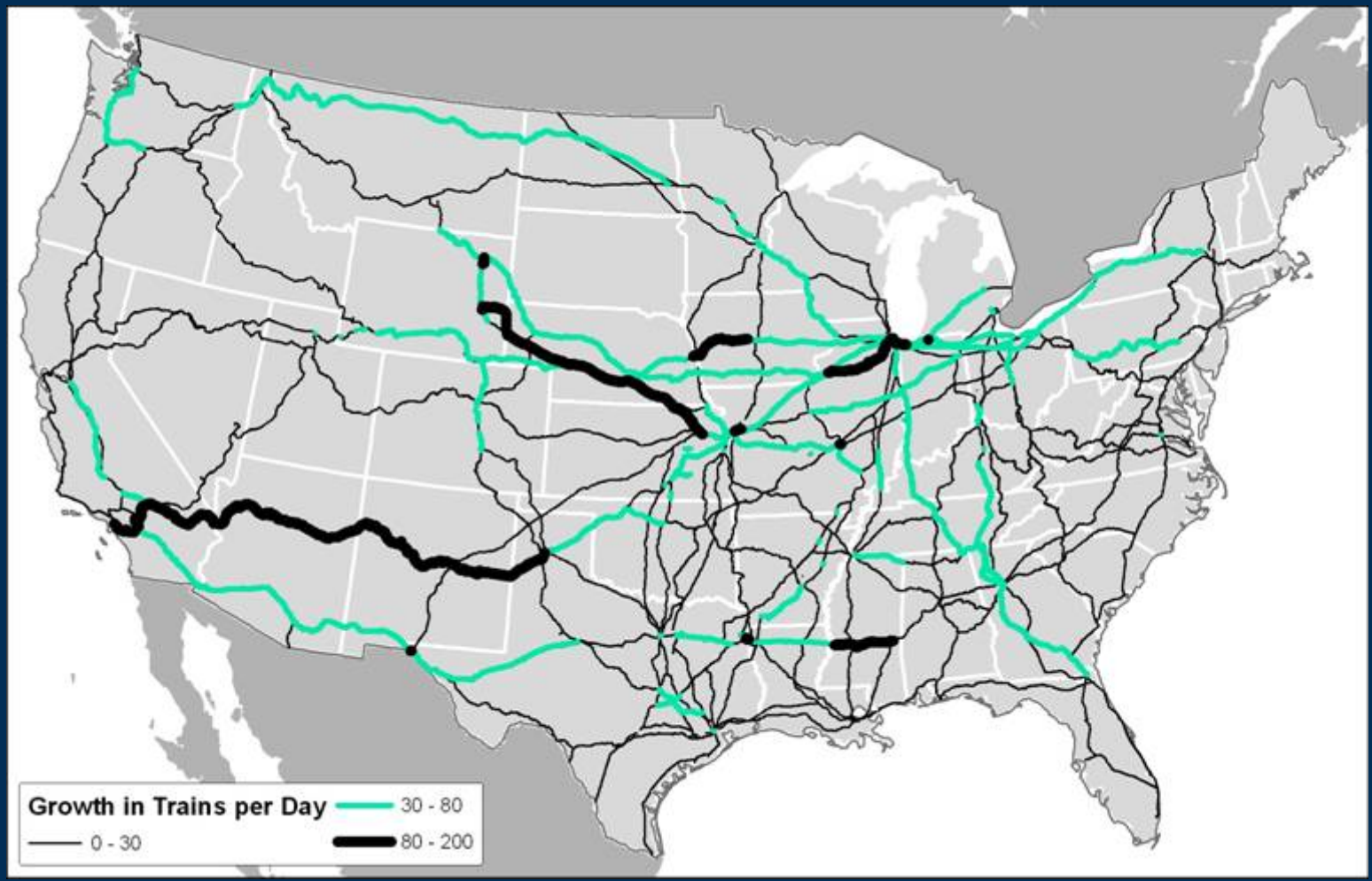
- Estimated *future train volumes* using U.S. DOT FAF$^{2.2}$ rail commodity growth forecasts to 2035
- Added current passenger trains (no forecast)

Future Corridor Volumes
2035 Freight Trains and 2007 Passenger Trains per Day



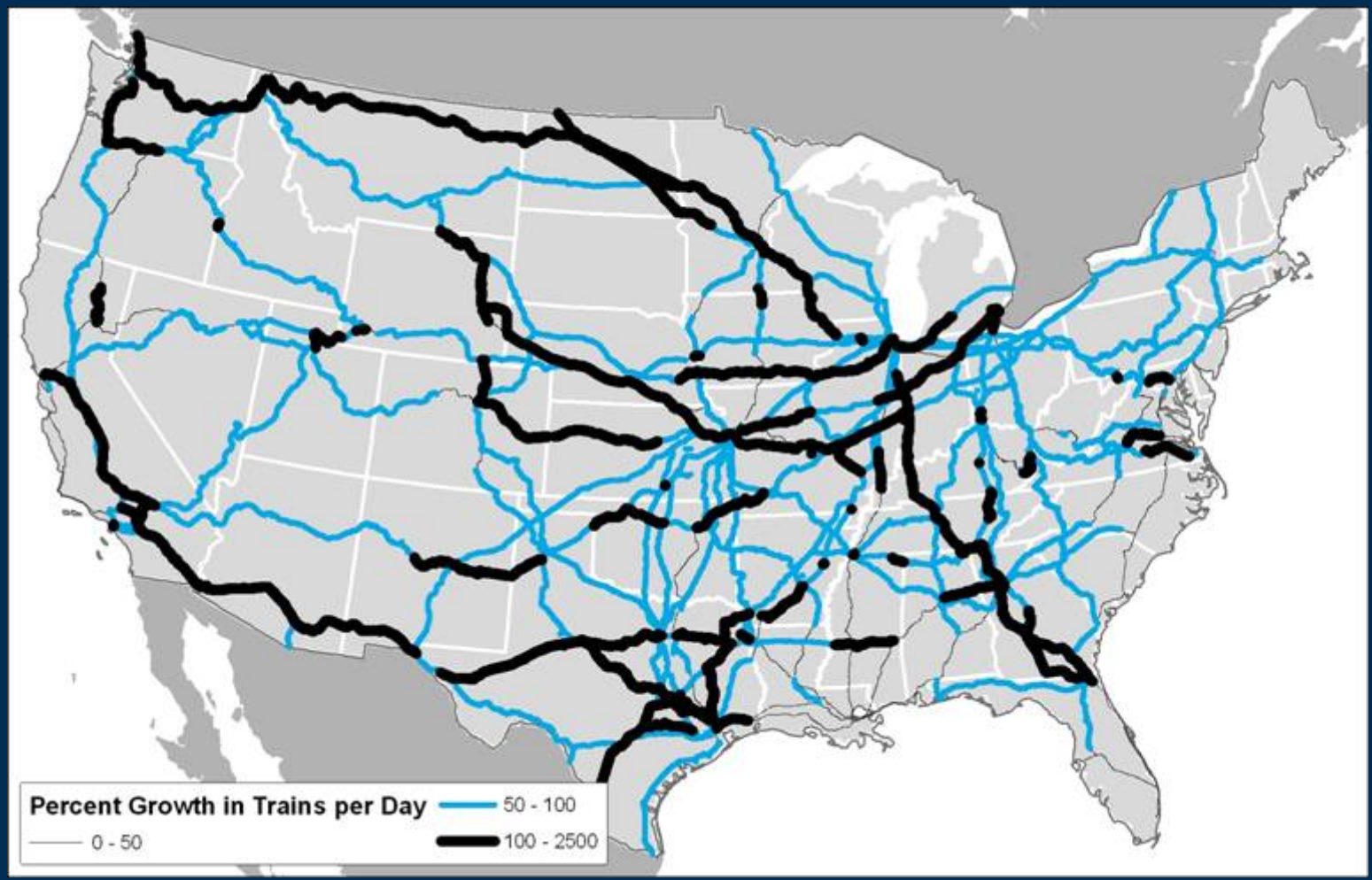
CAMBRIDGE SYSTEMATICS

Growth in Trains per Day
2005 to 2035



CAMBRIDGE SYSTEMATICS

Percentage Growth in Trains per Day
2005 to 2035



CAMBRIDGE SYSTEMATICS

Determine Capacity by Corridor

- Approximated *corridor train capacity* based on number of tracks, type of signal system, and mix of train types
- Worked with railroads to develop capacity tables for archtypical corridors
- Calculated *volume-to-capacity* ratio in trains per day and assigned level-of-service grades to corridor

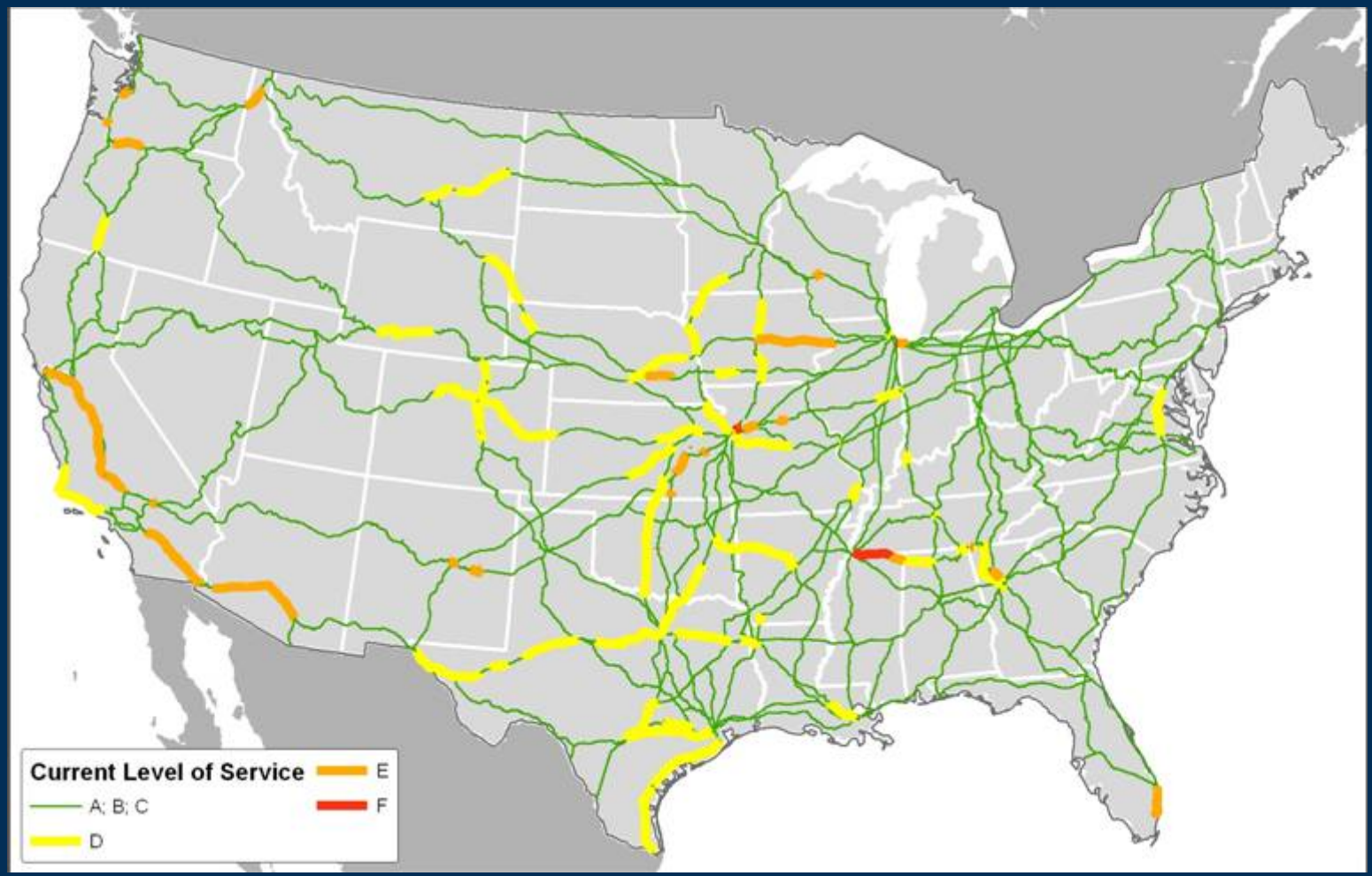
Averaged Capacity Table

Tracks & Control	Practical Max w/Multiple Trains Types	Practical Max w/Single Train Type
1 No signal	16	20
1 ABS	18	25
2 No signal	28	35
1 CTC	30	48
2 ABS	53	80
2 CTC	75	100
3 CTC	133	163

Volume-to-Capacity Ratios and Level of Service (LOS) Grades

LOS Grade	Description		Volume/Capacity Ratio
A	Below Capacity	Low to moderate train flows with capacity to accommodate maintenance and recover from incidents	0.0 to 0.2
B			0.2 to 0.4
C			0.4 to 0.7
D	Near Capacity	Heavy train flow with moderate capacity to accommodate maintenance and recover from incidents	0.7 to 0.8
E	At Capacity	Very heavy train flow with very limited capacity to accommodate maintenance and recover from incidents	0.8 to 1.0
F	Above Capacity	Unstable flows; service break-down conditions	> 1.00

Current Train Volumes Compared to Current Train Capacity



CAMBRIDGE SYSTEMATICS

Primary Rail Corridor Mileage by Current Level of Service Grade

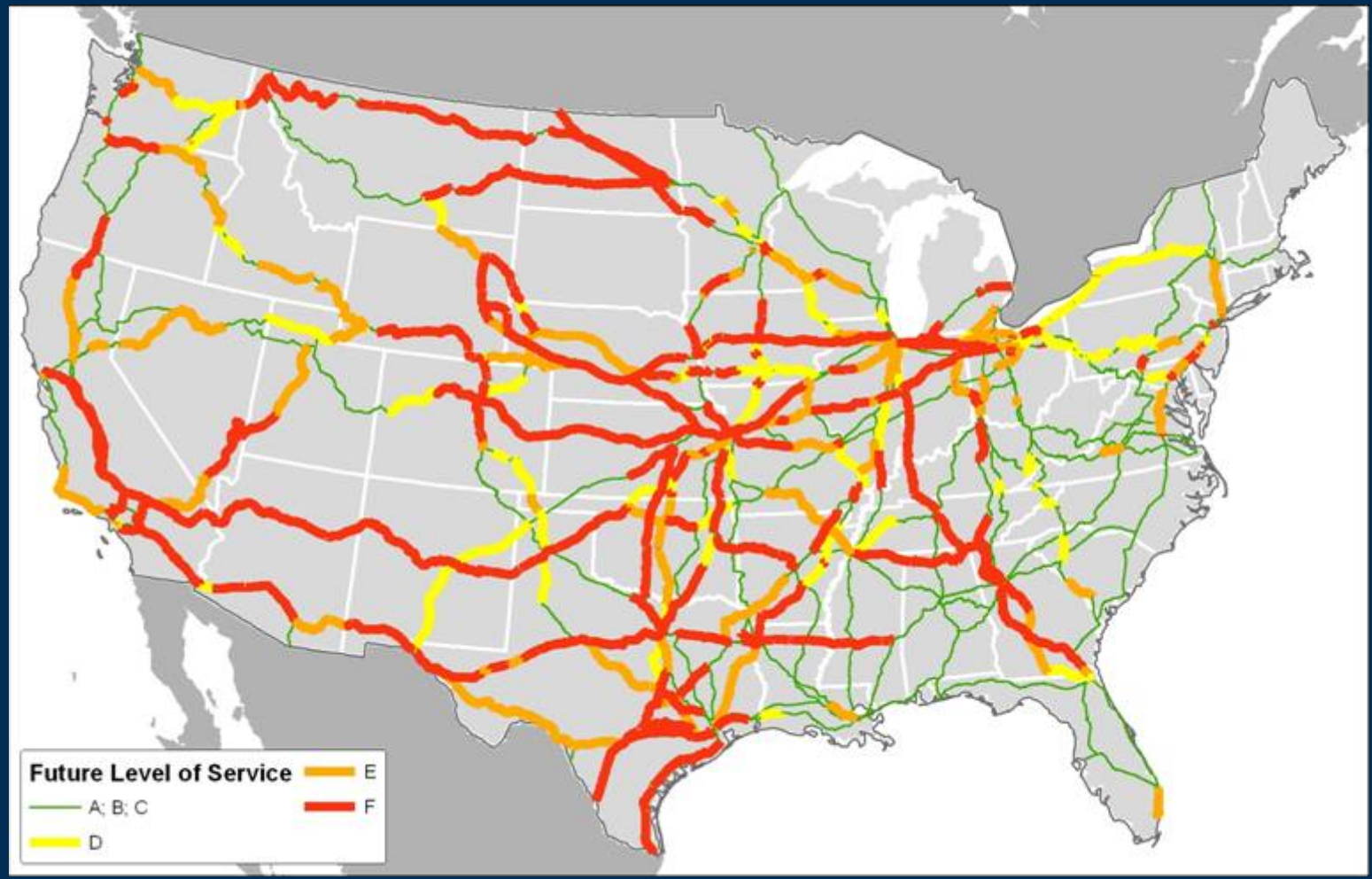
Current Volumes and Current Capacity

LOS Grade	Total Mileage	Percentage
A	9,719	19%
B	15,417	30%
C	20,683	39%
D	4,952	9%
E	1,461	3%
F	108	<1%
Totals	52,340	100%

CAMBRIDGE SYSTEMATICS

Future Corridor Volumes Compared to Current Corridor Capacity

2035 without Improvements



CAMBRIDGE SYSTEMATICS

Primary Rail Corridor Mileage by Future Level of Service Grade

2035 without Improvements

LOS Grade	Total Mileage	Percentage
A	4,895	9%
B	6,626	13%
C	11,708	23%
D	5,353	10%
E	7,980	15%
F	15,778	30%
Totals	52,340	100%

CAMBRIDGE SYSTEMATICS

Estimated Line Expansion Cost

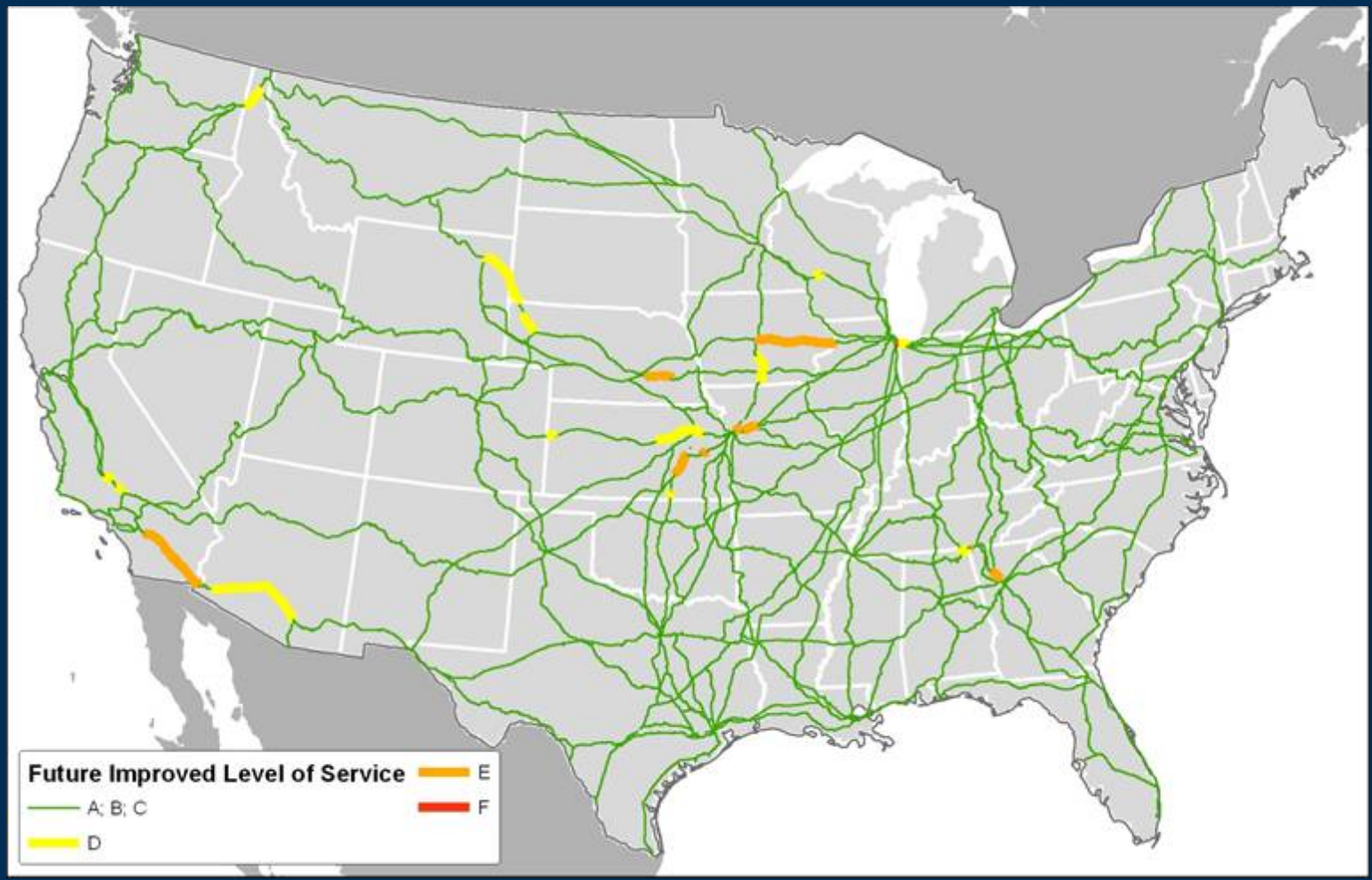
- Programmed line capacity improvements to accommodate future trains at an acceptable level of service
- Worked with railroads to develop unit cost table for line expansion
- Used least cost improvement
- No "catch-up"

Averaged Unit Cost Table For Line Expansion

From		To		Construction Cost (per mile)
Tracks	Control	Tracks	Control	
1	N/S-TWC	1	CTC-TCS	$700,000
2	NS-TWC	2	CTC-TCS	$700,000
1	ABS	1	CTC-TCS	$500,000
2	ABS	2	CTC-TCS	$600,000
1	CTC-TCS	2	CTC-TCS	$3,800,000
2	CTC-TCS	3	CTC-TCS	$4,400,000
3	CTC-TCS	4	CTC-TCS	$4,400,000
4	CTC-TCS	5	CTC-TCS	$4,400,000
5	CTC-TCS	6	CTC-TCS	$4,400,000

Future Train Volumes Compared to Future Train Capacity

2035 with Improvements



CAMBRIDGE SYSTEMATICS

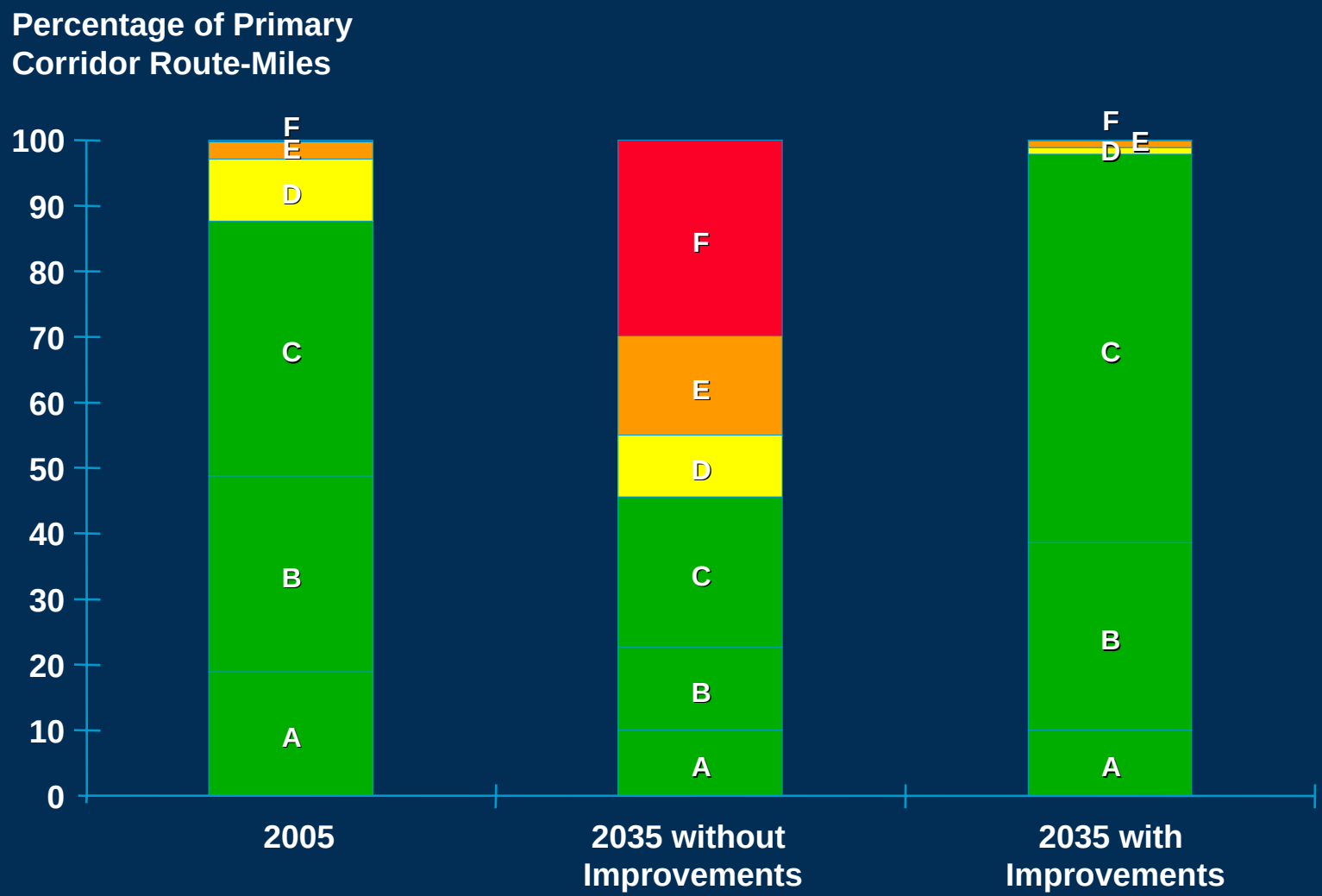
Primary Rail Corridor Mileage by Future Level of Service Grade

2035 with Improvements

LOS Grade	Total Mileage	Percentage
A	4,895	9%
B	15,198	29%
C	31,036	59%
D	608	1%
E	597	1%
F	6	<1%
Totals	52,340	100%

CAMBRIDGE SYSTEMATICS

Percentage of Rail-Freight Primary Corridor Route-Miles by Level of Service Grade



Estimated Investment Requirements

- **Line expansion** approximately two-thirds of total cost
- Calculated **cost of other improvements** (excluding land cost)
  - Significant bridges and tunnels
  - New and expanded carload and intermodal terminals
  - New and expanded support facilities
  - 286,000 lbs upgrades
- Compared **investment needs** to current and anticipated investment capacity
- Calculated **investment requirements**

Investment Needed

Infrastructure Improvement	Class I Freight Railroads	Short Line and Regional Freight Railroads	Totals
Line Haul Expansion	$94,750	$320	$95,070
Major Bridges, Tunnels, and Clearance	$19,400	$5,000	$24,400
Branch Line Upgrades	$2,390	$7,230	$9,620
Intermodal Terminal Expansion	$9,320		$9,320
Carload Terminal Expansion	$6,620		$6,620
Service Facilities	$2,550		$2,550
Totals	$135,030	$12,550	$147,580

CAMBRIDGE SYSTEMATICS

Key Findings

- An investment of $148 billion (in 2007 dollars) for infrastructure expansion over the next 28 years is required to keep pace with economic growth and meet the U.S. DOT's forecast demand
  - Class I freight railroads' share is projected to be $135 billion
  - Short line and regional freight railroads' share is projected to be $13 billion
- Without this investment, 30 percent of the rail miles in the primary corridors will be operating above capacity by 2035, causing severe congestion that will affect every region of the country and potentially shift freight to an already heavily congested highway system

Key Findings (continued)

- The Class I railroads anticipate that they will be able to generate approximately $96 billion of their $135 billion share through increased earnings from revenue growth, higher volumes, and productivity improvements, while continuing to renew existing infrastructure and equipment

- This leaves a balance for the Class I freight railroads of $39 billion or about $1.4 billion per year to be funded from railroad investment tax incentives, public-private partnerships, or other sources