Recently, Nevada's total STP apportionment has averaged $30-$35 million/year, with approximately $2 million of that suballocated to the Washoe County region (Regional Transportation Commission). Reno has received another $2 million or so in CMAQ funding for air quality improvement (a category which is under some heavy pressure in Congress). Annual railroad safety funding, statewide, has averaged about $1 million. Nevada receives the statutory minimum level of CMAQ funding--this was about $4.3 million in FY 1995-96. Of this, Reno's allocation is approximately $1.5-$1.8 million.

Funding through the FRA is limited to small demonstration grants. Nevada last received a grant in 1993 in the amount of $243,000. A small level of funding for economic development and redevelopment purposes is available through the Community Development Block Grant Program ("CDBG"). In Nevada, these funds are controlled at the state level and are not typically allocated to transportation projects.

Outlook

Federal funding authority under ISTEA is due to expire at the end of the current Federal fiscal year (September 30, 1997). At this writing, reauthorization activity in Congress has all but stopped due to intense infighting among competing interests. There are disagreements over issues including but not limited to: (1) the authorized funding level for the entire program, in the context of the year 2002 balanced budget goal; (2) the "return" of the existing 4.3 cents/gallon fuel tax to the highway trust fund (it is now applied to the general fund for deficit reduction); (3) whether to take the highway trust fund "off budget" and restore it to a true trust fund structure; (4) "donor states" who believe they contribute more revenue than they receive back in grants, that wish to establish a firm return-to-source policy; (5) conversion of the present categorical program to one based on formula block grants to states, potentially affecting such programs as CMAQ and the ISTEA; (6) how (or whether) to fund Amtrak operations; and (7) whether to include "demonstration" projects.

At this point, activity in Congress suggests that the annual funding level will be continued at present levels (but not adjusted for inflation), resulting in a slow, inflation-adjusted decline in purchasing power. Those seeking a block grant program are unlikely to succeed, while donor states are likely to obtain some type of new return-to-source guarantee, making the current apportionment formulas complex. A modest amount of project earmarking will be included, though the great majority of the 1,500 projects submitted to Congress in February 1997 will not be included in final legislation.

9.2.3 State Programs

Current Structure and Funding Level

As with virtually every state, Nevada controls transportation investment under a statewide programming process, funded almost entirely through the state's Highway Special Revenue Fund. That fund, in turn, is supported by revenue from a motor fuel tax, vehicle registration fee, vehicle privilege tax (in lieu of a property tax), drivers license fees, and other miscellaneous sources. The

program is permanent under current state law and does not require reauthorization. In addition, the state very occasionally utilizes "non-highway" funding for special projects, including state general funds, bond proceeds, etc. Such allocations are authorized on a case-by-case basis by the State Legislature.

State highway funding is currently just over $300 million annually, and can be used only on the designated state highway system. Projects are classified as (1) capacity, (2) maintenance, and (3) other. Funds are programmed separately for urban counties, rural counties, and other/statewide. Under current practice, all state funds not matched to federally-funded projects are used for maintenance. There are virtually no "state-funded" capital projects.

Outlook

The state transportation program is currently funded at a level sufficient to meet short-term needs through the first part of the next decade. While some form of revenue enhancement will be needed at some point, there is currently no pressure to raise transportation taxes. Aside from interstate highway maintenance, the Nevada DOT has been focused in Washoe County on improvements to US-395 between Reno and Carson City, in concurrence with local officials. This focus is not expected to change in the near term.

9.2.4 Regional and Local Programs

Regional Transportation Commission

Projects within Washoe County that are not directly funded by local or state government are funded through the Regional Transportation Commission ("RTC"), using a mix of federal and locally-generated revenue:

- Federal STP Funds (Urban Suballocation).
- Countywide fuel tax (9¢/gallon).
- Countywide sales tax for transit (¼-cent).
- Regional Road Impact Fees.

Only those projects included in those adopted plans are eligible for Federal and regional funding through the RTC. Projects eligible for funding through RTC include new construction, reconstruction, and overlays on the regional street system. The RTC estimates that there are currently $220 million in identified regional road needs. Current annual income is approximately $12 million from the fuel tax and $10 million from impact fees. All fee revenue has been earmarked to growth-related street projects, while all fuel tax income is currently programmed through the year 2002.

City of Reno and Washoe County

Local street and related improvements within Washoe County and Reno are funded principally through a locally-earmarked share of the state motor fuel tax, and general fund revenue. General fund revenue is generated in approximately equal amounts by the property tax, the sales tax, and all other sources. Total funding in 1996 from these sources for Reno, Sparks, and Washoe County combined totaled only $17 million. Such funds are typically dedicated to street maintenance, repair, and reconstruction. They are not diverted to other uses except under extraordinary circumstances.

The city estimates that it currently has unfunded capital improvement needs (for all types of infrastructure) totaling in excess of $200 million. The County has identified tens of millions of dollars in deferred maintenance on roads and bridges. (These amounts are in addition to the $220 million in regional needs identified by the RTC.) A task force assembled to address regional infrastructure needs (Washoe County Regional Infrastructure Planning Group) identified over $500 million in needs, covering transportation, schools, sewer, justice, and public safety, and including an estimated $180 million for the depressed railway project through downtown Reno.

Nevertheless, local government finance in Nevada is tightly controlled by the state, and neither cities not counties are permitted to raise taxes or otherwise modify the existing fiscal structure without explicit legislation. Indeed, all local government budgets must be reviewed and approved annually by the state Department of Taxation. Local governments can create special assessment districts to fund specific projects but only with special legislation.

The state maintains a statewide sales tax cap of 3 percent, and a property tax cap of 3.64 percent. In addition, the majority of both sales and property tax revenue is earmarked for specific purposes and is not available for transportation use. Gaming license rates have been capped since 1983, and currently yield about $5 million/year to all governments in Washoe County. Reno Redevelopment Agency funds are fully committed at this time to purchasing riverfront land, and the agency is near its 10 percent cap on assessed value (value of land within the agency boundary cannot exceed 10 percent of the city total).

Outlook

At present, based on current economic, legal, and political conditions, there exists little or no funding potential from existing local sources and mechanisms for a major capital mitigation project along the UP line in downtown Reno. Future regional economic growth likely will be modest, at best, and agencies will need to work hard at merely meeting ongoing service commitments and basic facility needs.

9.3 Potential New Local Funding Mechanisms

An excess of 30 local and regional revenue sources and associated mechanisms have received attention from transportation planners in recent years. A few of these sources are considered almost standard tools for funding locally sponsored transportation improvements, while others are much

more speculative in nature. Those most frequently compiled in any "long list"of candidate approaches are listed in Table 9.3-1.

TABLE 9.3-1

FREQUENTLY CONSIDERED LOCAL FUNDING SOURCES AND MECHANISMS

General Taxes	
· Sales Tax · Property Tax	· Income Tax · Payroll/Head Tax
Special Taxes	
· Fuel Tax · Auto Registration Fee (Flat Rate) · Auto License Tax (Value Based) · Driver's License Tax or Fee · "Commuter" Payroll Tax · Real Estate Transfer Tax	· Utility Excise Tax · Parking Tax (Assessment) · Transient Occupancy Tax (Lodging) · Excise Taxes ("Sin") · Business Licenses/Fee
Special Financing Districts	
· Service/User Fees · Ad Valorem Taxes	· Special Benefit · (Dependent or Independent)
Growth-Related Mechanisms	
· Impact Fees · In-Kind Contributions	· Other Exactions · Tax Increment Financing
Public-Private Partnerships	
· Turnkey/Full Service Delivery · Joint Development	· Vendor Financing
Other Mechanisms	

Apart from legal issues, a non-traditional funding strategy should focus on 1) ensuring adequate revenue yield, 2) ensuring a perception of fairness, and 3) evaluating the local precedent in another similar jurisdiction.

Many of the mechanisms shown in Table 9.3-1 are self-explanatory. Descriptions of some of the less-common approaches, however, are summarized immediately below.

- The payroll/head tax is typically a flat rate assessment per employee. It is usually levied on employers operating within a jurisdiction; however, for payroll tax purposes, some jurisdictions split the levy between employer and employee.
- The parking tax is most commonly thought of as a flat or sales-based tax levied on paid commercial parking, typically in downtown commercial districts. As considered by transportation planners, the parking tax has evolved in concept into a per-space assessment to be levied on commercial property owners as a disincentive to free parking and drive-alone behavior. To date, a parking tax in this form has not seen implementation.
- A commuter tax can be structured in the form of a payroll head tax, an income tax, or some other form of payroll tax. The income tax method of taxing commuters is relatively complex and is not widely used.
- Special financing districts are defined and structured to fund specific activities or projects to serve (benefit) a defined geographical area that is smaller than the jurisdiction of the enabling entity. Allowable district powers, uses, and structures vary considerably from state to state; however, the taxing methods used in most districts typically fit into one of three types: Unitary--a flat assessment or assessment based on physical units of area or length; Ad Valorem--a special property tax (based on property value); or Special Benefit--an assessment on property tied to an estimate of actual benefit derived from the proposed project. Districts are often distinguished by their degree of independence from general purpose governmental units and other special districts, and by their primary function--i.e., to fund a specific capital project only, to provide a specific ongoing service (e.g, water supply, mosquito abatement), or both.
- Impact fees are one-time assessments on new development intended to offset the cost of new facilities and infrastructure necessary to serve the new development. They are often calculated as a fixed amount per residential unit or square foot of commercial/industrial space.
- Other land development exactions, including in-kind contributions, are alternatives to the impact fee but typically assessed (negotiated) for the same basic purpose--to fund new infrastructure. In-kind contributions may include land, existing facilities, or outright construction of new facilities by a project sponsor.
- Tax increment financing, as defined for this analysis, would involve an *administrative* allocation of incremental property tax revenue (growth above a specified "baseline") to the transportation program. Such revenue could be used to secure debt through a mechanism known as "Limited Obligation Bonds." Note that this approach is similar in concept to but different in scope from tax increment financing as used in redevelopment project areas (and as used with "Tax Allocation Bonds").
- Turnkey or full service project delivery involves full delegation of project development responsibilities to a single design/build or design/build/operate entity, typically for a fixed price. Cost savings potentially can be realized by internalization of the various functions within the single entity.
- Joint development involves co-location of public-serving improvements (e.g., a transit station) and private, for profit development (e.g., a mixed-use development) in a coordinated manner

on the same site or on adjacent sites. Typically, a public entity will own or control the underlying land and derive lease income from the arrangement, though other structures are possible.

- Vendor financing involves the extension of credit by an equipment vendor, typically at favorable terms.
- Federally tax-exempt debt financing translates the Federal tax exemption into lower interest cost, and is therefore an implicit Federal subsidy.
- Currency swaps and other strategies aimed at profiting from currency exchange rate fluctuations can occasionally yield significant revenue for a sophisticated purchaser of foreign equipment (e.g., transit vehicles).
- Congestion pricing involves the imposition of a schedule of tolls on a presently "free" facility or on an existing toll road with the objective of discouraging use during peak periods. Tolls are set highest during congested periods, and lowest during non-congested periods.

Those mechanisms that have historically received the greatest attention in Nevada include:

- Sales tax.
- Hotel room occupancy tax.
- Real estate transfer tax.
- School-related development impact fees.
- Revision to property tax depreciation schedules.
-

Of these, the sales tax and the hotel room occupancy tax offer the greatest potential revenue yield, along with the greatest potential for acceptance by the public. These issues are addressed in more detail below.

9.4 Potential Funding Strategies

9.4.1 Overview

Four general strategies exist for obtaining funding for complex projects. Each strategy corresponds to a level of government or the private sector. Typically, project proponents must plan on five years to achieve success, at minimum. The strategies are as follows.

Federal

Work through the region's Congressional delegation to secure earmarked transportation or economic development funding.

State

Work with state elected officials and staff to restructure current fund programs, or (more palatably) work to enact a multi-year infrastructure "catch up" investment program that includes the desired project or project type.

Local

Work with local elected officials to create a multi-year, multi-project investment program based on a sales or fuel tax, plus other "equity" mechanisms such as impact fees or special financing districts.

Public-Private Partnerships

Work with downtown business interests and private developers to define land development projects that potentially include all or some of the desired infrastructure. Use this arrangement to "leverage" funds and help secure support for more traditional funding.

The ultimate strategy could involve a combination of all four approaches, given that one or two funding sources are rarely sufficient in today's extremely competitive environment.

9.4.2 Federal and State Strategies

Federal Funding

Traditionally, Federal funding for projects such as railroad grade separations or depressed sections has been very limited. Projects of this type have commonly been viewed as not falling into any of the standard project categories for which funding typically is received (streets and roads, bridges, mass transit, etc.) Given that reauthorization of the Federal surface transportation program is still pending, two possible approaches to obtaining some Federal support are: (1) continue efforts to obtain some kind of funding earmark, even if only for preliminary studies and/or right-of-way acquisition; and (2) work to restructure the federal categorical set-asides such that any increase in funding levels could be applied to far reaching projects for Reno.

Neither of these options is simple or straightforward. Nevada DOT officials also would be involved in any plan to change the distribution of Federal funds with the state. Nevertheless, the current situation in Congress suggests that there is substantial support for an increase in total funding over the next five years, and the city should be prepared to take advantage of Federal fund if they are forthcoming. One element of that preparation should involve promoting the depressed railway project (or other far-reaching solutions) more intensively at local, regional, and state forums such as the Regional Transportation Commission. A recent initiative from the City of Reno to the RTC to add the depressed railway project to the Regional Transportation Plan is a good first step in that direction.

State Funding

As mentioned earlier, there is, at present, no significant pressure on state legislators to increase the fuel tax or other sources of transportation funding. There appears to be general satisfaction that Nevada DOT is "getting the job done" with available resources, and significant revenue shortfalls are not projected for at least another five years or more. Communities in a number of states,

however, have been successful in developing statewide programs capital investment programs designed to rehabilitate and upgrade existing transportation infrastructure. These programs are often couched in terms of economic development, competitiveness, and job creation. They have been approved by legislators and the public by defining a specific program of projects and providing for a firm termination date for the new fuel tax or other revenue mechanism employed.

Given the present institutional setting in Nevada, it appears that seeking enactment of a statewide transportation program to fund something like the depressed railway would be a challenging undertaking. Nevertheless, a proposal for state assistance couched in terms of matching locally generated funds for a locally-sponsored infrastructure program might, if adequately promoted, be viewed as sufficiently important and beneficial to succeed. The key to that success will be to first find a significant source of local funding.

9.4.3 Local and Public-Private Funding Strategies

Desirable Characteristics

If a local funding strategy, (instead of or in addition to a state strategy) is to be pursued, it is important that the promoter be able to show that the project in question will:

1. Generate enough local revenue to demonstrate a firm local commitment.
2. Incorporate the broadest possible group of beneficiaries in order to spread the funding burden equitably and fairly.
3. Pose no major legal challenges.
4. Be sufficiently familiar to legislators and the public to receive maximum favorable consideration.
5. Allow the greatest possible degree of flexibility in future decisions regarding extent, timing, and application of funds.

The funding strategy should include not only specific sources of revenue, but also a plan of specific actions necessary to achieve consensus and necessary approvals, and an institutional structure designed to match roles and responsibilities with appropriate participants.

Most Feasible Funding Sources/Mechanisms

A set of local funding sources or mechanisms, defined to address the required characteristics listed immediately above, almost certainly would be comprised of a mix of affected parties while at the same time meeting minimum standards with respect to revenue sufficiency and reliability. Considering the list of sources outlined in Table 9.3-1, above, the following sources appear to be the most promising:

<u>General/Broad-Based Taxes</u>

- Sales Tax.
- Payroll or Head Tax.

Special/Targeted Taxes

- Fuel Tax.
- Other Auto User Charges.
- Transient Occupancy (Hotel Room) Tax.

Special Financing Districts

- Special Assessment Districts (SADs).

Growth Related Mechanisms

- Tax-increment financing (not tied to RDA).

Public-Private Partnerships

- Negotiated contributions of funds and/or other useful assets (e.g. real property)
- Joint public-private management and implementation structure.

Current Local Initiatives

The City of Reno and Washoe County have begun to take steps in search of a funding plan for the $180 million depressed railway project, and these are already showing results. Among these are:

- Participation in the Regional Infrastructure Planning Group, which has led to consensus among city and county agencies on the relative importance of reducing rail/auto conflict in the downtown.
- Formal submittal of the depressed railway project to the RTC board for inclusion in the Regional Transportation Plan and Transportation Improvement Program, and acceptance by that Board. On June 6, 1997, the Regional Transportation Commission of Washoe County, Nevada ("RTC") approved a resolution to adopt Amendment #4 to the FY 1997-2001 Regional Transportation Improvement Program ("RTIP"), and Amendment #1 to the 2015 Washoe County Regional Transportation Plan ("RTP"). The amendments were added to the short-range and long-range plans, respectively, to permit a downtown Reno railroad grade separation project to qualify for potential future federal and state funding assistance.
- The amendments were adopted with the following significant requirements:
  - That the railroad grade separation project would be placed "at the bottom of the list" of current funding priorities, and would not displace any project already included in the RTIP; and
  - That the City of Reno City Council adopt a resolution in support by no less than a 5/7 margin.

Amendment #4 to the RTIP included the following assumptions regarding funding for the $183 million project (1996 Dollars):

- The Union Pacific Railroad would contribute $100 million (55%) to the project;

- Approximately $62 million (35%) would come from the proceeds of a bond sale backed by a new ¼-cent sales tax, to be implemented in FY 1998.
- The remaining 15% ($21 million) would come from various federal funding programs (discretionary STP, CMAQ, and Federal Railroad Administration programs).

Subsequently, on June 10, 1997, the Nevada State Transportation Board ("STB") also approved Amendment #4 to the Washoe County RTIP, thereby including the project in the State Transportation Improvement Program ("STIP"). Consistent with the position taken by the Washoe County RTC, the STB and the Governor of Nevada emphasized that current priorities for state and federal funding would not be changed, and that the railroad grade separation project would be funded only after all present commitments were met.

- An effort to convert a proposed 1/4 cent local sales tax for sewer and water infrastructure in Clark Co. to a statewide local option funding program for all infrastructure.

In July 1997, the Nevada State Legislature approved Assembly Bill No. 291, authorizing counties within the state to adopt various taxes for various infrastructure purposes. Included in that act were the following provisions relevant to Washoe County:

- Sections 7, 8 and 14 - Authorizes the Washoe County Commission, by a 2/3 majority vote, to impose a retail sales and use tax at a rate not greater than 1/8 of 1 percent, the proceeds of which are to be applied to flood control and public safety projects.
- Section 19 - Authorizes the Washoe County Commission to impose a transient lodging tax at a rate of not more than 1 percent for the purpose of funding "...one or more railroad grade separation projects."
- Section 24 - Authorizes the Washoe County Commission, by a 2/3 majority vote, to impose a retail sales and use tax at a rate not greater than 1/8 of 1 percent for the purpose of funding one or more railroad grade separation projects. Such authority is conditioned on, among other more technical matters:

  1. That the Washoe County Commission also impose the transient lodging tax authorized under Section 19 of this act; and
  2. That the County "receives a written commitment from one or more other sources for the expenditure of not less than one-half of the total cost of a project for the acquisition, establishment, construction or expansion of railroad grade separation projects in Washoe County."

- A proposal to the state legislature to modify the existing residential property tax depreciation schedule, this in order to increase revenue and instill the process with greater equity.
- Active consideration of increases in the hotel room tax (in conjunction with downtown hotel and casino owners, and a possible increase in the real estate transfer tax (supported by the development community).

9.6 Suggested Actions

If the City of Reno and Washoe County decide as a matter of policy that they want to support a joint funding effort to implement the depressed railway project or other joint-funded project, possible steps they could take, would include:

- Establishing a steering committee to oversee the task, comprised of the downtown business community and other interests throughout the city and county.
- Formulating a conceptual funding strategy, or program, with one or more potential allocations of cost among participants/beneficiaries and specific revenue mechanisms. Establish a multi-year timeline for implementation.
- Looking for ways to capture (at least temporarily) "incremental" revenue growth from one or more City general fund sources.
- Creating a financial plan showing how the results of the diverted funding can either generate additional income to the City, or can be repaid over a fixed period of time.
- Obtaining "seed money" contributions early on from stakeholders, including UP. (in addition to the $35 million that UP has agreed to fund)
- Applying investment income to "buy down" some of the project cost.
- Continuing to pursue state and federal funding as described in Section 9.4.2, above.

Section 10
FORMAL CONDITIONS FOR BOARD CONSIDERATION

The preliminary Tier 1 mitigation measures proposed in Section 8 by the Surface Transportation Board's (Board's) Section of Environmental Analysis (SEA) are restated here for public review and comment and for Board consideration as additional conditions to the UP/SP merger decision.

Table 10-1
Preliminary Tier 1 (Fully Funded by UP) Mitigation Measures for Consideration by the Board and Public

Mitigation Measure	Proposed Board Conditions
Increased Train Speeds	1. UP shall make the necessary operating changes and capital improvements such as centralized traffic control (CTC), track reconfiguration, and track rehabilitation, as appropriate in the Reno/Sparks, Nevada area, to enable trains to operate over the rail line segment between the east end of the Sparks yard (approximately Mile Post [MP] 247) and a point just west of Keystone Avenue (approximately MP 242) in Reno at a speed of 30 miles per hour. UP shall then operate, and require BN/SF to operate, all trains over the described rail line segment at a speed of 30 miles per hour **consistent with safe operating practices dictated by conditions present at the time each train traverses the segment.**
Train Location Color Video Displays	2. Subject to the written concurrence of the City of Reno, UP shall install in the new City of Reno emergency communications center (or another location if desired by the City) color video displays coordinated with the UP signal system circuitry showing the location of each train present on the rail line segment from approximately MP 245 on the west side of the Sparks Yard to MP 238 (approximately Woodland Avenue) on the west side of Reno.
Cameras and Video Monitors Showing Rail Line	3. Subject to the written concurrence of the City of Reno, UP shall install television cameras over or near the rail line along with corresponding video monitors at the same emergency communications center location that continuously show real-time conditions on the right-of-way through downtown Reno in the area bounded by and including the grade crossings at Keystone and Lake Streets.
Discontinued Use of the Addition of "Helper" Locomotives in Woodland Area	4. UP shall discontinue the practice of adding "helper" locomotives in the Woodland Avenue area.
Four-quadrant Crossing Gates at Nine Locations	5. UP shall install four-quadrant crossing gates at rail-highway crossings at Sutro, Lake, Virginia, West, Arlington, Ralston, Washington, Vine, and Keystone streets.

Table 10-1
Preliminary Tier 1 (Fully Funded by UP) Mitigation Measures for Consideration by the Board and Public

Mitigation Measure	Proposed Board Conditions
Enhanced Rail Safety Programs	6. UP shall augment its safety training programs for drivers and pedestrians including: A. Supplementing its participation in the "Operation Lifesaver" Program, and B. Supplementing existing school educational programs in Reno and Washoe County (e.g., driver's training), and C. Establishing a safety training program for Reno's downtown employees.
Pedestrian Crossing Gate "Skirts" at Six Locations	7. UP shall install devices known as pedestrian crossing gate "skirts" on pedestrian crossing gates at Lake, Center, Virginia, Sierra, West, and Arlington streets.
Electronic Warning Signs for Pedestrians at Six Locations	8. UP shall install electronic warning signs for pedestrians at Lake, Center, Virginia, Sierra, West, and Arlington streets. These signs shall be designed and constructed so that they are clearly visible and easily read by pedestrians.
Construction of a Pedestrian Grade Separation at Virginia Street	9. UP shall construct a pedestrian overpass or underpass at Virginia Street with street level access on both sides of the tracks
Construction of a Pedestrian Grade Separation at Sierra Street	10. UP shall construct a pedestrian grade overpass or underpass at Sierra Street with street level access on both side of the tracks
Prehistoric and Historic Survey for Pedestrian Underpass(es) and Monitoring During Construction for Archeological Resources	11. Prior to construction of a pedestrian underpass at either Virginia or Sierra streets, UP shall conduct a survey of potential historic and prehistoric resources in consultation with the Nevada State Historic Preservation Office (SHPO). If any such resources are discovered during construction, UP shall cease construction and consult with the SHPO.
Consultation with Native Americans	12. Prior to construction of a pedestrian underpass at either Virginia or Sierra streets, UP shall consult with Native American interests regarding possible impacts to Native American resources from underground construction. If any such resources are discovered during construction, UP shall immediately stop construction and consult with Native American interests and the SHPO.
Installation of a high, wide, shifted load detector at MP 240	13. UP shall install a high, wide, shifted load detector at MP 240 for both mainline tracks.
Installation of a Hot Box Detector at MP 240	14. UP shall install an additional hot box detector on the westbound track at MP 240.

Table 10-1
Preliminary Tier 1 (Fully Funded by UP) Mitigation Measures for Consideration by the Board and Public

Mitigation Measure	Proposed Board Conditions
Establishment of a Community Advisory Panel	15. UP shall establish a Community Advisory Panel, consisting of representatives of the Reno/Sparks/ Washoe County community, including Native Americans, who are willing to work with UP management on a regular basis to review safety, environment, and health issues associated with rail operations, particularly as they relate to the transport of hazardous materials.
Certification to the Board and Notice to the City of Reno and Washoe County of UP's Compliance with Certain Installation Requirements	16. When compliance has been completed for each of the installations required in Conditions 1, 2, 3, 5, 7, 8, 9, 10, 13, and 14 above, UP shall certify such completion to the Board, with copies to the City of Reno, and Washoe County. Each certification shall be made within two weeks of the date of compliance for each condition.
Environmental Mitigation Status in Quarterly Reports	17. UP's quarterly reports to the Board shall include the status of compliance with the environmental mitigation measures pertaining to Reno and Washoe County for the duration of the Board's oversight proceeding. Copies of these reports shall also be provided to the City of Reno and Washoe County.

Appendix A
SURFACE TRANSPORTATION BOARD'S DECISION NO. 44

EXCERPTS RELATING TO RENO MITIGATION STUDY

SURFACE TRANSPORTATION BOARD

Finance Docket No. 32760

UNION PACIFIC CORPORATION, UNION PACIFIC RAILROAD COMPANY, AND MISSOURI PACIFIC RAILROAD COMPANY--CONTROL AND MERGER--SOUTHERN PACIFIC RAIL CORPORATION, SOUTHERN PACIFIC TRANSPORTATION COMPANY, ST. LOUIS SOUTHWESTERN RAILWAY COMPANY, SPCSL CORP., AND THE DENVER AND RIO GRANDE WESTERN RAILROAD COMPANY

Decision No. 44

Decided: August 6, 1996

ENVIRONMENTAL CONSIDERATIONS.

Extensive Environmental Review Process. Under the National Environmental Policy Act (NEPA) and related environmental laws, the environmental effects of the merger and the ancillary abandonment and construction projects that were proposed by applicants must be considered, and we have thoroughly done so. Our environmental staff, the Section of Environmental Analysis (SEA), conducted various public outreach activities to inform the public about the proposed merger and to encourage and facilitate public participation in the environmental review process.[1]

As part of its environmental review, SEA prepared detailed analyses not only of the systemwide effects of the proposed merger, but also of particular merger-related activities that would affect individual rail line segments, rail yards, and intermodal facilities to a degree that would meet or exceed our thresholds[2] for environmental analysis. See 49 CFR

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[1] SEA sent approximately 400 consultation letters to various agencies seeking their comments. In addition, SEA consulted with federal, state, and local agencies, affected communities, UP and SP, and UP/SP's environmental consultants to gather and disseminate information about the proposal, identify potential environmental impacts, and develop appropriate mitigation measures.

[2] These thresholds ensure that those rail line segments and facilities that would experience a substantial increase in traffic as a result of the transaction are thoroughly analyzed for potential air quality, noise, transportation, and safety impacts.

1105.7(e)(5)(i) and (ii).[3] SEA conducted a thorough independent analysis, which included verifying projected rail operations; verifying and estimating noise level impacts; estimating increases in air emissions; assessing potential impacts on safety; and performing land use, habitat, surface water and wetlands surveys, ground water analyses, and historic and cultural resource surveys.

Based on the information provided by the parties and other agencies, SEA issued a comprehensive Environmental Assessment (EA) on April 12, 1996. SEA received approximately 160 comments following issuance of the EA. To address those comments and the other environmental comments received throughout the environmental review process (approximately 400 in total), SEA undertook additional environmental analysis, which culminated in the issuance of a detailed Post Environmental Assessment (Post EA) on June 24, 1996, refining some of the discussion and mitigation recommended in the EA.

As a result of its investigation, SEA concluded that the merger would result in several environmental benefits, including a systemwide net reduction of 35 million gallons of diesel fuel consumption (based on 1994 figures) from rail operations and truck-to-rail operations, systemwide improvements to air quality from reduced fuel use, and a reduction in long-haul truck miles, highway congestion and maintenance, and motor vehicle accidents.

SEA also concluded that the merger and related rail abandonments and constructions could have potential environmental effects regarding safety, air quality, noise, and transportation, including the transportation of hazardous materials, and, in the EA, SEA proposed mitigation measures addressing the environmental concerns that were raised. In the Post EA, based on further analysis and review of the environmental comments, SEA developed more comprehensive and specifically tailored mitigation recommendations. As a result of consultations with SEA, UP/SP agreed to undertake particular mitigation measures. In addition, several local communities negotiated memoranda of understanding with UP/SP to implement mitigation measures and take other appropriate actions to address their particular environmental concerns.

SEA concluded that, with the Post EA mitigation measures, the proposed merger would not significantly affect the quality of the human environment on a systemwide, regional, or local basis. We agree that the conditions recommended in the Post EA will

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[3] SEA and its independent third-party consultant conducted approximately 150 site visits. They also analyzed UP/SP's Environmental Report, operating plan, Preliminary Draft Environmental Assessment and other pleadings, all of the settlement agreements entered into during the environmental review process, and technical studies.

adequately mitigate the potential environmental impacts identified during the course of the environmental review, and we will impose those conditions here (see Appendix G).[4] We also adopt SEA's environmental analysis and the conclusions reached in the EA and the Post EA.

No Need for Environmental Impact Statement. We have considered the arguments of some parties that an environmental impact statement (EIS) is required here, but do not believe that one is needed. An EIS is required only for "major federal actions significantly affecting the quality of the human environment." 42 U.S.C. 4332(2)(C).[5] Under our environmental rules, 49 CFR 1105.6(b)(4), an EA is normally sufficient environmental documentation in rail merger cases to allow us to take the requisite "hard look" at the proposed action.[6] Moreover, interested parties received essentially the same benefits they would have received with an EIS. As the EA and Post EA show, SEA conducted a thorough and comprehensive environmental review. There was extensive notice and opportunity for input from the public and appropriate agencies throughout the process. In addition to the EA, SEA issued a detailed Post EA which contains SEA's individual responses to the comments on the

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[4] We note that the mitigation recommended in the Post EA for two proposed abandonments in Colorado (Sage to Leadville and Malta to Cañon City) has been modified to reflect our decision to permit only discontinuance of rail service, and not abandonment, at this time. Other clarifying changes have been made as well.

[5] The identification of such actions is a matter for the agency to determine, as long as the determination is not arbitrary or capricious. See Goos v. ICC, 911 F.2d 1283, 1292 (8th Cir. 1990), citing Marsh v. Oregon Natural Resources Council, 490 U.S. 360, 377 (1989).

[6] While this merger involves somewhat more trackage than other merger proposals that have come before our predecessor agency, the ICC, that does not mean that the qualitative environmental effects of this merger are greater (or different) than those of the other railroad mergers that have been considered. Similarly, the extensive trackage rights that we are granting in this decision to preserve competition generally will not create additional traffic (or potentially significant environmental impacts). Traffic that can be efficiently handled by train would be handled by train whether or not the trackage rights at issue here were granted.

EA and thus reflects not only the work of SEA but also the critical views of interested parties and agencies.

Finally, the environmental mitigation we are imposing here is far reaching and comprehensive.[7] As appropriate, it addresses impacts on a variety of levels: systemwide, rail corridor-specific, and local. There is mitigation for particular rail line segments, rail yards, intermodal facilities, and rail abandonments and constructions. In short, no EIS is required because our environmental mitigation conditions specifically address the potential environmental impacts associated with the merger and ensure there will be no significant environmental effects.[8]

Reno and Wichita. As discussed in the Post EA, in developing mitigation for two cities, Reno, NV, and Wichita, KS, SEA concluded that further, more focused mitigation studies are warranted, notwithstanding the extensive analysis (including site visits and meetings with city officials, emergency response representatives and business interests) that already has been done to identify environmental concerns and arrive at appropriate mitigation for these two communities. Nothing in the record here, however, suggests that the potential environmental effects of the merger in Reno or Wichita are so severe that implementation of the merger should not proceed prior to the

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[7] For example, with respect to safety, our mitigation includes more frequent track and train car inspections, signs on grade crossings identifying toll free numbers to call in the event of a signal malfunction, and a requirement that UP/SP provide emergency response personnel with information regarding anticipated train movements and work with communities to develop plans to deal with the transportation of hazardous materials, emergencies, and the upgrading of grade crossing signals. In addition, UP/SP will be required to equip certain trains carrying hazardous materials with two-way end-of-train devices to enhance braking capabilities on particular line segments. In response to concerns involving air pollution, UP/SP will have to reduce idling of locomotives, close box car doors on empty cars, and use more efficient locomotives when the equipment becomes available.

[8] See, e.g., Sierra Club v. DOT, 753 F.2d 120, 127 (D.C. Cir. 1985); Cabinet Mountains Wilderness v. Peterson, 685 F.2d 678, 682 (D.C. Cir. 1982).

completion of the studies.[9] To the contrary, in both Reno and Wichita the environmental impacts are limited to the effects of an increase in traffic on existing rail lines. Also, the mitigation conditions that we are imposing now assure that, while SEA conducts these studies, the environmental status quo will essentially be preserved in Reno and Wichita.[10]

As the EA and Post EA show, SEA already has carefully assessed the impact of the merger on Reno and Wichita and identified its likely environmental effects. Based on its analysis, SEA concluded that, with the systemwide and corridor-specific mitigation already imposed and the conditions to be arrived at following the independent mitigation studies, there will be no significant environmental impacts to Reno and Wichita, and we agree.

The sole purpose of the mitigation studies will be to arrive at specifically tailored mitigation plans that will ensure that localized environmental issues unique to these two communities are effectively addressed. For example, with respect to vehicular and pedestrian safety, SEA has determined that separated grade crossings and pedestrian overpasses and/or underpasses will be needed to address safety concerns on the existing rail lines in Reno and Wichita. Accordingly, the studies will identify the appropriate number and precise location

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[9] We note that the Supreme Court has rejected arguments that NEPA demands the formulation and adoption of a plan that will fully mitigate environmental harm before an agency can act. Robertson v. Methow Valley Citizens Council, 490 U.S. 332, 352-53 (1989). Rather, the deferral of a decision on specific mitigation steps until more detailed information is available is embraced in the procedures promulgated under NEPA. See Public Utilities Comm'n of California v. FERC, 900 F.2d 269, 282-3 (D.C. Cir. 1990). NEPA "does not require agencies to adopt any particular internal decisionmaking structure." Baltimore Gas & Electric Co. v. NRDC, 462 U.S. 87, 100 (1983). It is well settled that NEPA does not repeal other statutes by implication and that if the agency meets NEPA's basic requirements, it may fashion its own procedural rules to discharge its multitudinous duties. Vermont Yankee v. NRDC, 435 U.S. 519 (1978); United States v. SCRAP, 412 U.S. 669, 694 (1973).

[10] The courts have recognized that there is no violation of NEPA where proposed actions will not effect a change in the status quo. See Sierra Club v. FERC, 754 F.2d 1506, 1509-10 (9th Cir. 1985).

of highway/rail grade separations and rail/pedestrian grade separations in Reno and Wichita. With respect to air quality, we have imposed mitigation measures that reduce locomotive fuel consumption and air pollution, call for more efficient railroad equipment and operating practices, and require consultation with air quality officials.[11] As further insurance, the studies will consider additional mitigation to address the air quality effects unique to Reno and Wichita. In this merger, noise impacts would result from more frequent exposure to horn noise rather than greater intensity of sound. No additional types of noise would be introduced. To address noise impacts, we are requiring UP/SP to consult with affected counties to develop focused noise abatement plans. As the Post EA notes, however, safety dictates that railroads sound their horns at grade crossings.[12] Any attempt significantly to reduce noise levels at grade crossings would jeopardize safety, which we consider to be of paramount importance.

The studies will be conducted by SEA with the assistance of an independent third party contractor. Although retained by UP/SP, SEA will select the contractor. The contractor will work under the sole supervision, direction, and control of SEA.

The mitigation studies will include consultations with the affected communities, counties, and states, Native American tribes, the FRA, and other appropriate agencies, as well as UP/SP. There will be public notice and participation. The public will be consulted regarding the range of additional mitigation to most effectively address increased rail traffic on the existing rail lines in Reno and Wichita. SEA will prepare draft mitigation studies and make them available to the public for review and comment. After SEA assesses the comments, it will design the most effective mitigation for these particular communities to add to the mitigation that has already been imposed.

SEA's final mitigation studies and its recommended mitigation plans for Reno and Wichita will be made available to

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[11] Because trains are mobile, rather than stationary sources, air quality impacts associated with locomotive emissions are spread over a large area. Therefore, the impacts at any individual location are typically relatively minor.

[12] SEA indicates that FRA has been directed by the Swift Act generally to require that horns be sounded at all grade crossings.

the public and will be submitted to us for our review and approval. We will then issue a decision imposing specific mitigation measures. This entire process will be completed within 18 months of consummation of the merger.

In the meantime, as explained in the Post EA, during the 18-month study period UP/SP will be permitted to add only an average of two additional freight trains per day to the affected rail line segments (Chickasha, OK, to Wichita and Roseville, CA, to Sparks, NV),[13] which is below the threshold level for environmental analysis.[14] UP/SP will be prohibited from increasing traffic to the levels they projected under the merger (11.3 daily trains for Reno and 7.4 trains for Wichita) without our approval.[15] Thus, there will be no significant adverse environmental impacts to these communities while SEA, the Board, and the parties work to arrive at additional tailored mitigation for those cities.

It should be noted that the studies will focus only on the mitigation of the environmental effects of additional rail traffic through Reno and Wichita resulting from the merger.

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[13] For nonattainment areas such as Reno, our rules permit railroads to operate up to three additional trains per day. The threshold for attainment areas such as Wichita is normally an increase of eight trains or more a day. Here, we are taking a more conservative approach and will permit for Wichita only an average increase of two trains per day. In short, these limited increases for Reno and Wichita are at or below the threshold levels, and the environmental status quo will essentially be maintained. This addition of an average of two trains a day includes BNSF trains but does not include Amtrak trains, which are unrelated to the merger.

[14] We note that an existing railroad can increase its level of operations without coming to us, and without limitation. Thus, if UP and SP had not proposed this merger, SP on its own could have increased the number of trains on its line in Reno to any level it considered appropriate. Allowing an increase of up to two trains per day during the interim period takes into account that the number of trains going through Reno and Wichita might have been increased even without the merger.

[15] UP/SP will be required to file verified copies of station passing reports of train movements for Reno and Wichita on a monthly basis with SEA for the duration of the study period. We will review them to ensure compliance.

Mitigation of conditions resulting from the preexisting development of hotels, casinos, and other tourist-oriented businesses on both sides of the existing SP rail line in Reno, or the preexisting switching operations that are a primary source of the congestion associated with the existing UP line in Wichita, are not within the scope of the studies. Similarly, the construction of a new rail line now under consideration by Reno is too preliminary to be assessed now.[16]

The studies will carefully examine private and public funding options, as we believe that the cost of mitigation for Reno and Wichita should be shared. Finally, the studies will provide the parties with additional time to pursue and agree to independent and innovative mitigation plans (such as the memorandum of understanding executed by UP/SP and Truckee, CA, whereby UP/SP will share in the cost of an underpass construction project and contribute to a fund to buy back obsolete wood burning stoves).

In sum, pending determination of the exact mitigation measures to be required for Reno and Wichita, UP/SP will be subject to a traffic cap on the affected rail lines to ensure that no adverse effects to the environment will occur and existing environmental conditions will essentially remain unchanged. Because we already know the nature and general parameters of the appropriate mitigation measures for Reno and Wichita, based on our analysis of the environmental impacts and imposition of systemwide and regional mitigation, we find that, with the more specific mitigation that will be developed, the merger will not significantly affect the quality of the environment in those two locations.

Comments of EPA. On July 12, 1996, we received comments from the United States Environmental Protection Agency (EPA) on various aspects of the EA and the Post EA.[17] EPA notes that, in

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[16] Plans for such a line are only in the development stage. SEA indicates that such a project could take up to 10 years to finalize. If the contemplated construction reaches the stage of an actual proposal requiring our approval, SEA would prepare an appropriate environmental document at that point. See Kleppe v. Sierra Club, 427 U.S. 390, 410 n.20 (1976); Crounse Corp. v. ICC, 781 F.2d 1176, 1193-96 (6th Cir. 1986).

[17] SEA agreed to EPA's request for an extension of time to comment on the Post EA. We welcome EPA's input after reviewing

(continued...)

analyzing air quality, the EA failed specifically to identify "maintenance" areas,[18] which it believes may have caused air quality concerns to be overlooked.[19] But maintenance areas were not ignored in SEA's analysis. For those areas that were not classified as nonattainment SEA applied the EPA conformity emission threshold levels applicable to maintenance areas. This means that SEA analyzed both attainment and maintenance areas under the more rigorous standards applicable to maintenance areas, and that, if anything, the anticipated effects of the proposed merger on air quality are conservative. We believe that air quality has been thoroughly analyzed, and that the mitigation we are imposing here, along with the more specific measures which will be arrived at in the further mitigation studies for Reno and Wichita,[20] adequately mitigates any potential adverse air impacts.

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[17](...continued)
our environmental analysis, since, as EPA notes, it generally does not comment on EAs.

[18] There are three classifications for air quality: attainment areas, in which levels of certain pollutants are considered equal to or better than federal and state ambient air quality standards; nonattainment areas, in which levels of one or more pollutants do not meet federal and state ambient air quality standards; and maintenance areas, which were at one time nonattainment areas but have subsequently improved their air quality and are now in attainment for the relevant pollutant(s).

[19] We note that EPA does not disagree with SEA's determination that the proposed merger is not subject to EPA's regulations entitled "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (General Conformity). The General Conformity criteria do not apply directly to railroad operations, except for future locomotive emission standards. SEA properly concluded that the proposed merger does not meet the definitions in the General Conformity regulations at 40 CFR 51.852 because, as a regulatory agency, the Board does not maintain program control over railroad emissions as part of its continuing responsibilities.

[20] SEA will take into account EPA's concerns and consult with them in conducting its mitigation studies for Reno and Wichita.

EPA further states that the EA used the terms NO_2 and NO_x incorrectly. We recognize that NO_x is not a criteria pollutant under EPA and state ambient air quality standards. In assessing air quality emissions, SEA looked at emission factors applicable to NO_x, instead of NO_2, because NO_x emission factors are readily available through EPA documents and other sources, while NO_2 emissions are not. SEA based its calculations on the conservative assumption that all NO_x emissions are composed of NO_2. This conservative approach, which is widely accepted, ensured that the criteria pollutant NO_2 was adequately assessed in SEA's analysis. Moreover, by using this approach, SEA used higher NO_2 emissions than would actually be emitted.

EPA also expressed some difficulty understanding SEA's estimates of the projected net increase and decrease in air emissions with the mitigation measures we are imposing. While we believe that the text of the Post EA adequately explains the data in Tables 3-5 and 4-4, we have generated and attached as Appendix H an additional table to further clarify the net emissions reflecting mitigation.

EPA notes that some of the proposed rail line abandonments in Colorado run through or near EPA-designated Superfund sites. EPA is troubled that soil in and around the railroad lines could require remediation, that UP/SP might not be obligated to honor a consent decree, and that possible future trail use could expose the public to hazardous substances. These concerns are premature because, as discussed above, we are permitting only the discontinuance of rail service, and not abandonment of the involved lines. Thus there will be no salvage of these lines or opportunity for trail use unless and until UP/SP obtains our authority to abandon these lines.[21]

While trail use requests can be made if the abandonments are granted, any trail arrangement would not supersede the requirements of the specific laws that govern Superfund sites.[22] Nor would we thereby become involved in negotiating or enforcing consent decrees involving remediation of those sites.

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[21] At that point, we will analyze the potential environmental impacts of the proposed abandonments.

[22] See Union Pac. R.R. -- Abandonment -- Wallace Branch, ID, Docket No. AB-33 (Sub-No. 70) (ICC served Dec. 2, 1994).

EPA does not view requiring UP/SP to comply with existing federal, state, and local regulation as mitigation. We believe, however, that requiring compliance with other laws and regulations, such as FRA's safety regulations, can assist in reducing the potential environmental impacts of the actions before us. If the railroad fails to comply with conditions that we have imposed, parties can notify us and request that we (as well as the agency that has promulgated the regulation) take appropriate action.

In any event, the mitigation we are imposing here goes well beyond requiring compliance with other laws and regulations. For example, it includes more frequent track and train car inspections to reduce anticipated safety impacts and reduced idling of locomotives and the use of more efficient locomotives to offset air pollution emissions associated with the merger. Moreover, to enhance safety, UP/SP will be required to equip certain trains carrying hazardous materials with two-way end-of-train devices to improve braking capabilities on particular line segments.

EPA suggests that we failed to discuss the environmental impacts associated with the handling and disposal of waste materials for the proposed abandonments and constructions. But we have included detailed mitigation for these actions. See Appendix G, including conditions #26, #27, #62 and #63.

EPA questions whether SEA considered all the settlement agreements reached with competing railroads and trade associations. SEA specifically took all settlement agreements into account in its analysis, as the EA and Post EA show.

Finally, we disagree with EPA's suggestion that SEA should revisit its consultation efforts with Native American tribes. SEA's efforts to contact and consult with Native American tribes have been extensive. As part of its outreach activities, SEA contacted approximately 11 area offices of the Bureau of Indian Affairs to inform them about the proposed merger; three offices commented and provided the names of tribes that should be contacted. Both the EA and Post EA were distributed to 31 American Indian tribes. In addition, there was newspaper and Federal Register notice to inform all affected tribes and communities about the proposed merger and how they could participate. To ensure continued participation, SEA will contact the affected Native American tribes when initiating its mitigation studies for Reno and Wichita and invite them to participate.

APPENDIX G: ENVIRONMENTAL MITIGATING CONDITIONS

The environmental mitigating conditions imposed in Finance Docket No. 32760 are categorized as follows: (A) Systemwide, (B) Corridor-Specific, (C) Rail Line Segments, (D) Rail Yards and Intermodal Facilities, (E) Proposed Abandonments, and (F) Construction Projects. These mitigation conditions are numbered sequentially.

A. SYSTEMWIDE MITIGATION

The following systemwide mitigation conditions apply to rail line segments, rail yards, intermodal facilities, and rail line construction projects on new right-of-way.

1. UP/SP shall adopt UP's existing formula-based standards for track inspection for all rail lines of the merged system, which will increase the frequency of inspections on SP rail lines.

2. UP/SP shall adopt UP's existing tank car inspection programs for all appropriate facilities on the merged system.

3. For all highway grade crossing signals, UP/SP shall provide visible instructions designating an 800 number to be called if signal crossing devices malfunction.

4. UP/SP shall provide 800 numbers to all emergency response forces in all communities. These numbers shall provide access to UP/SP supervisors who shall provide train movement information and work cooperatively with communities in emergency situations. These numbers are not to be disclosed to the general public.

5. UP/SP shall participate on a systemwide basis in the TRANSCARE program to develop hazardous material and emergency response plans in cooperation with communities.

7. UP/SP shall adopt UP's training program for community and emergency response personnel for locations on the SP rail lines, and include personnel from SP served locations in UP's school at Pueblo, CO, for additional emergency response training.

8. UP/SP shall adopt existing UP training and operating practices that are designed to reduce locomotive fuel consumption and air pollution. These include: throttle modulation, use of dynamic braking, increased use of pacing and coasting trains, isolating unneeded horsepower, shutting down locomotives when not in use for more than an hour when temperatures are above 40 degrees, and maintaining and upgrading SP locomotives to UP standards.

9. As suggested by UP/SP, UP/SP shall extend to SP rail lines UP's program of closing boxcar doors on empty cars before movement on

the system in order to reduce wind resistance and, thereby, fuel consumption.

10. As suggested by UP/SP, UP/SP shall use its own security forces to conduct its own arrests and bookings, reducing reliance on local police forces.

11. UP/SP shall convert all railroad locomotives to the standards for visible smoke reduction that are established in the South Coast Air Quality Basin.

12. UP/SP shall adopt UP's existing policy of using head-hardened rail on curves in mountainous territory for SP rail lines to promote safer operations.

13. UP/SP shall comply with all applicable FRA rules and regulations in conducting rail operations on the merged system.

B. CORRIDOR MITIGATION

General

The following mitigation conditions apply to the Central, Southern, Northern, Illinois-Gulf Coast, and Pacific Coast (I-5) Corridors.

14. UP/SP shall implement the draft emissions standards for diesel-electric railroad locomotives that the Environmental Protection Agency (EPA) has developed. It is the Board's understanding that EPA plans to propose these standards and make them available for public comment in December 1996. Under these standards, UP/SP shall utilize newly manufactured or re-built locomotives that are more fuel efficient and produce less emissions. When this equipment becomes available, UP/SP shall assign these locomotives on a priority basis to the corridors or portions thereof specified below:

- **Southern Corridor:**
  - Fort Worth, TX, to West Colton, CA.

- **Central Corridor:**
  - Cheyenne, WY, to Hinkle, OR.
  - Chicago, IL, to Fremont, NE.
  - Ogden, UT, to Roseville, CA.
  - Denver, CO, to Grand Junction, CO.

- **Pacific Coast (I-5) Corridor:**
  - Seattle, WA, to West Colton, CA.
  - Sacramento, CA, to Bakersfield, CA.

15. To further facilitate the improvement of air quality for specific locations, UP/SP shall consult with appropriate state and local

air quality officials in the States of Arizona, California, Colorado, Illinois, Nevada, Oregon, Texas, Washington, and Wyoming, through which the Pacific (I-5), Southern, Central, and Northern Corridors extend in part. UP/SP shall advise SEA as to the status and the results of these consultations.

16. To address noise impacts, UP/SP shall consult with the affected counties that have communities that would experience an increase of 3 dBA or more as a result of the increased rail traffic over rail lines in the States of California, Colorado, Illinois, Kansas, Louisiana, Nebraska, Nevada, Oklahoma, and Texas. If appropriate, UP/SP shall develop a noise abatement plan. UP/SP shall submit the result of these consultations to SEA who will review these findings with FRA.

Specific

The following mitigation conditions apply to specific rail line segments within the Central, Southern, and Illinois-Gulf Coast Corridors.

17. UP/SP shall give priority to equipping key trains, as defined by Union Pacific Railroad Form 8620, on the corridor segments listed below with two-way end of train devices. This requirement also applies to BNSF key trains operating between Iowa Junction, LA, and Avondale, LA.

- **Central Corridor**
  - North Platte, NE, to Oakland, CA (UP and SP).
  - Cheyenne, WY, to Denver, CO (UP).

- **Southern Corridor**
  - Houston, TX, to Avondale (New Orleans), LA (SP).
  - Iowa Junction, LA, to Avondale, LA, via Kinder and Livonia (UP).
  - Houston, TX, to West Colton, CA (SP).

- **Illinois-Gulf Coast Corridor**
  - St. Louis, MO, and East St. Louis/Salem, IL, to Houston, TX, and Avondale, LA (UP and SP).

C. RAIL LINE SEGMENT MITIGATION

General

The following mitigation conditions apply to all of the rail line segments in the states identified below.

18. UP/SP shall consult with the states and appropriate local officials as well as FRA to develop a priority list for upgrading grade crossing signals, where necessary, due to increases in rail traffic resulting from the proposed merger. This process shall be undertaken for all rail line segments in the States of Arkansas, California, Colorado, Kansas, Nevada, Oregon, and Texas. UP/SP shall advise SEA as to the status and the results of these consultations.

Specific

The following detailed mitigation conditions apply to the specific rail line segments and/or locations identified below.

City of Reno

22a. UP/SP shall operate no more than a daily average count of 14.7 freight trains per day through the City of Reno. (This reflects the Base Year daily average of 13.8 trains -- 12.7 freight trains and 1.1 passenger trains -- plus 2 additional freight trains.) The addition of two freight trains per day does not exceed the Board's threshold for environmental analysis at 49 CFR 1105.7(e)(5)(ii). The 14.7 average freight train count per day does not include the following types of movements: (1) maintenance-of-way trains, (2) light locomotive movements, (3) local and industry switching train movements, (4) emergency trains operated under detour authority, for snow removal, for fire or other natural disaster purposes, and wreck removal purposes. This condition will be effective upon consummation of the merger and will continue in effect for 18 calendar months in total.

22b. For the purpose of monitoring the preceding condition, UP/SP shall file on a monthly basis with the Board verified copies of station passing reports of train movements through Reno, NV, for each day of each preceding month in the specified 18-month period. These reports shall also identify those train movements, specified in the above condition, that are excluded from the 14.7 trains per day average count.

22c. UP/SP, in consultation with and subject to the approval of SEA, shall retain an independent, third-party consultant to prepare a specific mitigation study to address the environmental effects on the City of Reno of the additional rail freight traffic projected as a result of the proposed merger. This study shall be prepared under the sole direction and supervision of SEA. It shall include a final mitigation plan based on a further study of the railway, highway, and pedestrian traffic flows and associated environmental effects on the City of Reno. This study would tailor mitigation to address environmental effects such as safety, hazardous materials transport, air quality, noise and water quality. UP/SP shall comply with the final mitigation plan developed under this study.

The study, which shall be completed within 18 months from the date of consummation of the merger, shall include the following:

- Projected post-merger increases in rail freight traffic on the Sparks to Roseville line segment.
- Consultations with the City of Reno, Washoe County, the Federal Railroad Administration, affected Native American Tribes, and other appropriate Federal, state and local agencies, and other interested parties.
- Consultations with UP/SP.
- Review of all existing information and studies including those prepared by the City of Reno, Washoe County and UP/SP.
- Independent analyses.
- With respect to vehicular and pedestrian safety, mitigation measures that identify the number and location of highway/rail grade separations and rail/pedestrian grade separations in downtown Reno.
- Funding options.
- Submission of a draft study to the public for review and comment and then issuance of a final mitigation study.

22d. SEA will submit the final mitigation study and its recommendations to the Board, which shall then issue a decision imposing mitigation. In the event UP/SP and the City of Reno and other appropriate parties reach agreement on a final mitigation plan, UP/SP and the City of Reno shall immediately notify SEA, and the Board will take appropriate action consistent with such an agreement.

Appendix B
SURFACE TRANSPORTATION BOARD'S DECISION NO. 71

25447
EB

SERVICE DATE - APRIL 17, 1997

SURFACE TRANSPORTATION BOARD

DECISION

Finance Docket No. 32760

UNION PACIFIC CORPORATION, UNION PACIFIC RAILROAD COMPANY, AND MISSOURI PACIFIC RAILROAD COMPANY--CONTROL AND MERGER--SOUTHERN PACIFIC RAIL CORPORATION, SOUTHERN PACIFIC TRANSPORTATION COMPANY, ST. LOUIS SOUTHWESTERN RAILWAY COMPANY, SPCSL CORP., AND THE DENVER AND RIO GRANDE WESTERN RAILROAD COMPANY

[Decision No. 71]

Decided: April 15, 1997

In Decision No. 44 (served August 12, 1996), we approved the common control and merger of the rail carriers controlled by Union Pacific Corporation (Union Pacific Railroad Company and Missouri Pacific Railroad Company) and the rail carriers controlled by Southern Pacific Rail Corporation (Southern Pacific Transportation Company, St. Louis Southwestern Railway Company, SPCSL Corp., and the Denver and Rio Grande Western Railroad Company)(collectively UP/SP), subject to various conditions, including numerous environmental mitigating conditions. As pertinent here, the environmental conditions imposed in Decision No. 44 call for further, more focused, mitigation studies to arrive at specifically tailored mitigation plans for Wichita, KS and Reno, NV, in addition to the environmental mitigation that already has been imposed, to assure that localized environmental issues unique to those two communities are effectively addressed.

After Decision No. 44 was issued, the City of Wichita and the Board of County Commissioners of Sedgwick County, KS (Wichita/Sedgwick) filed an environmental court challenge in the United States Court of Appeals for the District of Columbia Circuit. No. 96-1293, City of Wichita v. Surface Transportation Board (pet. for review filed Aug. 21, 1996) (Wichita).[2] From pleadings filed in that litigation, it became apparent that the Wichita appeal is addressed solely to the sentence in Decision No. 44 (at p. 223) stating, "The [mitigation] studies [that are

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[1] Proceedings pending before the Interstate Commerce Commission (ICC) on January 1, 1996, must be decided under the law in effect prior to that date if they involve functions retained by the ICC Termination Act of 1995, Pub. L. 104-88, 109 Stat. 803. This proceeding was pending with the ICC prior to January 1, 1996, and to functions retained under Surface Transportation Board (Board) jurisdiction pursuant to new 49 U.S.C. 11323-27. Citations are to the former sections of the statute, unless otherwise indicated.

[2] Another environmental court challenge is pending in the D.C. Circuit in No. 96-1418, City of Reno v. Surface Transportation Board (Reno). The D.C. Circuit, on its own motion, ordered the Reno and Wichita appeals consolidated with the petitions for review raising issues other than environmental issues that were filed in that court. The Board and the United States have moved to sever the Reno and Wichita appeals from the other cases seeking review of Decision No. 44 and to hold briefing in abeyance in these two cases because, unlike the other petitions seeking review of Decision No. 44, the Reno and Wichita petitions are environmental court challenges that are not ripe or final for judicial review at this time. That motion remains pending in the court.

now underway for Wichita and Reno] will carefully examine private and public funding options, as we believe that the cost of mitigation for Reno and Wichita should be shared.' Then, following an inquiry looking toward settlement of the Wichita litigation, petitioners' counsel in the Wichita case advised our General Counsel, by letter dated April 7, 1997,' that if the Board issues a decision clarifying that UP/SP will be required to pay 100% of the cost of mandated environmental mitigation, Wichita/Sedgwick will withdraw their appeal.

Petitioners' counsel states that Wichita/Sedgwick understands that, consistent with Decision No. 44, the Board is considering both "base line" mitigation, *i.e.*, mitigation including, but not limited to, the type discussed in Decision No. 44, that UP/SP would be required to implement and fund in order to increase the number of through trains operating through Wichita/Sedgwick, and alternative mitigation, *i.e.*, more expensive options. As to the latter, Wichita/Sedgwick understands that the Board may suggest funding alternatives, but such suggestions would be in no way binding. See Addendum A.

Having ascertained that UP/SP has no objection to the issuance of a decision clarifying the intent of the sentence at page 223 of Decision No. 44, quoted above, in the manner requested by Wichita/Sedgwick, it appears to us appropriate to clarify our intent with respect to developing final mitigation for Wichita and Reno. Specifically, the final environmental mitigation that will be developed for Wichita and Reno following the completion of the ongoing mitigation studies will include (in addition to the mitigation that has already been imposed) both (1) mandated or base line mitigation, which the Board will require UP/SP to implement and entirely fund, and (2) alternative mitigation that might be a more far reaching solution for all concerned, but which will not be binding absent a voluntary agreement by the parties to share costs or expend greater resources.

This action will not significantly affect either the quality of the human environment or the conservation of energy resources.

It is ordered:

1. The discussion of environmental mitigation in Decision No. 44 is clarified as set forth in this decision.

2. This decision is effective on the date of service.

By the Board, Chairman Morgan and Vice Chairman Owen.

Vernon A. Williams
Secretary

' A copy of that letter is attached as Addendum A.

Appendix C
RENO MITIGATION STUDY TASK FORCE MEMBERSHIP LIST

Appendix C
UP/SP MERGER
RENO MITIGATION STUDY TASK FORCE MEMBERSHIP LIST

STB Section of Environmental Analysis **Representatives and/or Contacts** Elaine K. Kaiser Program Director/Legal Counsel	
Harold McNulty Reno Co-Study Director	Vicki Rutson Reno Co-Study Director
Dave Mansen Reno Mitigation Study Project Manager	Kay Wilson Reno Mitigation Study Community Coordinator
City of Reno Representatives **Manager's Office** Merri Belaustegui Deputy City Attorney	**City of Reno Alternates** **Manager's Office** Michael E. Halley Deputy City Attorney
Engineering Steve Varela, City Engineer City of Reno Public Works	**Engineering** Tom Gribbin Pyramid Engineering
Environmental Mark Demuth MADCON Consultation Services	**Environmental** Colleen Henderson Environmental Management Associates
Emergency Services Larry Farr, Fire Marshall Reno Fire Department	**Emergency Services** Chuck Lowden Fire Chief
Jim Weston, Chief of Police Reno Police Department	Tom Robinson Reno Police Department
Reno Citizens Representative **General Interests** Steve Bradhurst	**Reno Citizens Alternates** **General Interests** No Alternate Named
River Banks Homeowners Richard Vitali	**River Banks Homeowners** No Alternate Named
Native American Representatives Paula Berkeley Paula Berkeley and Associates	**Native American Alternate** Arlan Melendez, Director Reno-Sparks Indian Colony

Appendix C
UP/SP MERGER
RENO MITIGATION STUDY TASK FORCE MEMBERSHIP LIST

Business Community Representative Bill Osgood, Chairperson Reno Downtown Improvement Assoc.	**Business Community Alternate** Harry York Reno-Sparks Chamber of Commerce
NFRA Representative Bob Burn, Chairperson Nevadans for Fast & Responsible Action	**NFRA Alternate** John Frankovich
Washoe County Representative Bob Webb, Community Coordinator Washoe Co. Dept. Of Comprehensive Planning	**Washoe County Alternate** Dean Diederich Principal Planner of Washoe County Department of Community Development
Regional Transportation Commission Rep. Greg Krause, Planning Manager Regional Transportation Commission	**Regional Transportation Commission Alt.** Jack Lorbeer
State of Nevada Representative Tim Crowley, Executive Assistant Nevada Governor's Office	**State of Nevada Alternate** No Alternate Named
Nevada Public Service Commission Rep Galen Denio, Commissioner Nevada Public Service Commission	**Nevada Public Service Commission Alt.** Craig Wesner, Mgr. Engineering Svcs. Nevada Public Service Commission
City of Sparks Representative Rob Pyzel, Senior Planner Planning & Community Development	**City of Sparks Alternate** Randy Mellinger Community Development Director
UP Railroad Representative Mike Hemmer Covington & Burling	**UP Railroad Alternate** Joe Guild Union Pacific Railroad
Amtrak Representative Ron Scolaro Amtrak	**Amtrak Alternate** Raymond Lang Amtrak Intercity Rail Service
State Economic Interest Representative Ken Lynn Economic Dev Authority of Western Nevada	**State Economic Interest Alternate** No Alternate Named

Appendix C
UP/SP MERGER
RENO MITIGATION STUDY TASK FORCE MEMBERSHIP LIST

Warehousing/Distribution Representative	Warehousing/Distribution Alternate
David Loring Dermody Properties	Scott L. Hutcherson Eagle-Picher Minerals, Inc.

Appendix D
MATERIALS PROVIDED TO THE PUBLIC AT THE BEGINNING OF THE RENO MITIGATION STUDY

February 1997

Surface Transportation Board
Section of Environmental Analysis
Washington, DC 20423

UP/SP Merger
Reno Mitigation Study Overview

History and Background

The Surface Transportation Board (Board), as part of its approval of the merger of the Union Pacific and Southern Pacific railroads, specified that a mitigation study be completed in Reno. The actions which led up to the mitigation study are set forth below.

November 30, 1995	Union Pacific and Southern Pacific apply to the Interstate Commerce Commission (ICC) for authority to consolidate their operations and those of their subsidiaries into a single railroad.
December 29, 1995	New legislation terminates the ICC and transfers its authority to approve railroad mergers to the newly formed Surface Transportation Board.
April 12, 1996	The Board's Section of Environmental Analysis (SEA) issues the Environmental Assessment for the proposed merger.
June 24, 1996	SEA issues the Post EA, including revised responses to public comments and recommended conditions for the Board's approval.
July 3, 1996	Board votes unanimously to approve the UP/SP merger subject to various environmental mitigation conditions.
August 12, 1996	In its written decision, the Board imposes system-wide and corridor-specific mitigation conditions and directs SEA to conduct an 18-month mitigation study in Reno to develop specifically tailored mitigation plans to address the environmental effects of increased rail traffic resulting from the merger on UP's existing right-of-way. The Board also requires UP/SP to limit increases in train traffic to an average of two additional freight trains per day in Reno during the 18-month study (i.e., a daily average of 14.7 freight trains per day).
September 12, 1996	Merger becomes effective.
October 1996	SEA initiates mitigation study in Reno.

Mitigation Study Goals

The Board authorized SEA to undertake an 18-month mitigation study for Reno to develop a final mitigation plan that will supplement already imposed mitigation measures that pertain to Reno. This study will address the effects of additional rail traffic resulting from the merger on UP's existing rail line through Reno. After public review and comment, SEA will submit its final recommendations to the Board for its review and approval. The Board will then issue a decision requiring UP to comply with those mitigation measures that the Board deems appropriate. The goals of the Reno mitigation study are to:

- Focus on the effects of increased merger-related rail traffic on the existing UP line to arrive at specifically tailored mitigation for communities in and around Reno to ensure that localized environmental issues are effectively addressed.
- Identify number and precise location of highway/rail grade separations and rail pedestrian grade separations.
- Consider additional mitigation to address air quality effects resulting from the merger.
- Examine private and public funding options to share the cost of mitigation.
- Provide a forum to exchange ideas and concerns.
- Explore independent and innovative mitigation options that can be incorporated into SEA's final mitigation plans for Reno and recommended to the Board.
- Facilitate the negotiation of an independent, mutually acceptable agreement among the parties.
- Provide an opportunity for public input throughout the study process.

February 1997

Surface Transportation Board
Section of Environmental Analysis

UP/SP Mitigation Study
Reno Conditions

On August 12, 1996, the Surface Transportation Board (Board) approved the merger of the Union Pacific and Southern Pacific Railroads. The following conditions pertaining to railroad operations in Reno, Nevada were developed by the Section of Environmental Analysis (SEA) and specifically imposed by the Board:

22a. UP/SP shall operate no more than a daily average count of 14.7 freight trains per day through the City of Reno. (This reflects the Base Year daily average of 13.8 trains – 12.7 freight trains and 1.1 passenger trains – plus 2 additional freight trains.) The addition of two freight trains per day does not exceed the Board's threshold for environmental analysis at 49 CFR 1105.7(5)(ii). The 14.7 average train count per day does not include the following types of movements: (1) maintenance-of-way trains, (2) light locomotive movements, (3) local and industry switching train movements, (4) emergency trains operated under detour authority, for snow removal, for fire or other natural disaster purposes, and wreck removal purposes. This condition will be effective upon consummation of the merger and will continue in effect for 18 calendar months in total.

22b. For the purpose of monitoring the preceding condition, UP/SP shall file on a monthly basis with the Board verified copies of station passing reports of train movements through Reno, NV, for each day of each preceding month in the specified 18-month period. These reports shall also identify those train movements, specified in the above condition, that are excluded from the 14.7 trains per day average count.

22c. UP/SP, in consultation with and subject to the approval of SEA, shall retain an independent third party consultant to prepare a specific mitigation study to address the potential environmental effects on the City of Reno of the additional rail freight traffic projected as a result of the proposed merger. This study shall be prepared under the sole direction and supervision of SEA. It shall include a final mitigation plan based on a further study of the railway, highway, and pedestrian traffic flows and associated environmental effects on the City of Reno. This study would tailor mitigation to address environmental effects such as safety, hazardous materials transport, air quality, noise, and water quality. UP/SP shall comply with the final mitigation plan developed under this study.

The study, which shall be completed within 18 months from the date of consummation of the merger, shall include the following:

- *Projected post-merger increases in rail freight traffic on the Sparks to Roseville line segment.*
- *Consultations with the City of Reno, Washoe County, the Federal Railroad Administration, affected Native American Tribes, and other appropriate Federal, state and local agencies, and other interested parties.*

- *Consultations with UP/SP.*
- *Review of all existing information and studies including those prepared by the City of Reno, Washoe County and UP/SP.*
- *Independent analysis.*
- *With respect to vehicular and pedestrian safety, mitigation measures that identify the number and location of highway/rail grade separations and rail/pedestrian grade separations in downtown Reno.*
- *Funding options.*
- *Submission of a draft study to the public for review and comment and then issuance of a final mitigation study.*

22d. SEA will submit the final mitigation study and its recommendations to the Board, which shall then issue a decision imposing mitigation. In the event UP/SP and the City of Reno and other appropriate parties reach agreement on a final mitigation plan, UP/SP and the City of Reno shall immediately notify SEA, and the Board will take appropriate action consistent with such an agreement.

System-wide and Corridor-Specific Mitigation Related to Reno

In its August 12 decision approving the merger, the Board specified various system-wide and corridor-specific mitigation measures based on the results of extensive analysis of the potential local, regional and system-wide impacts of the merger as described in the EA and Post EA. The measures listed below were developed to mitigate potential system-wide and corridor-specific impacts, including impacts in Reno (a complete description of mitigation measures can be found in the August 12 Board decision).

Safety

- UP/SP shall adopt UP's existing formula-based standards for track inspection for all rail lines of the merged system, which will increase the frequency of inspections on SP rail lines.
- UP/SP shall adopt UP's existing tank car inspection programs for all appropriate facilities on the merged system.
- For all highway grade crossing signals, UP/SP shall provide visible instructions designating an 800 number to be called if signal crossing devices malfunction.
- UP/SP shall adopt UP's existing policy of using head-hardened rail on curves in mountainous territory for SP rail lines to promote safer operations.
- UP/SP shall comply with all applicable Federal Railroad Administration (FRA) rules and regulations in conducting rail operations on the merged system.

- UP/SP shall give priority to equipping key trains, as defined by Union Pacific Railroad Form 8620, on the corridor segments listed below with two-way end of train devices. This requirement also applies to BN/SF key trains operating between Iowa Junction, LA, and Avondale, LA.

Central Corridor
North Platte, NE, to Oakland, CA (UP & SP)
Cheyenne, WY, to Denver, CO (UP)

Illinois-Gulf Coast Corridor
St. Louis, MO, & East St. Louis/Salem, IL, to Houston, TX & Avondale, LA (UP & SP)

Southern Corridor
Houston, TX, to Avondale (new Orleans),, LA (SP)
Iowa Junction, LA, to Avondale, LA via Kinder and Livonia (UP)
Houston, TX, to West Colton, CA (SP)

- UP/SP shall consult with the states and appropriate local officials as well as FRA to develop a priority list for upgrading grade crossing signals, where necessary, due to increases in rail traffic resulting from the proposed merger. This process shall be undertaken for all rail line segments in the States of Arkansas, California, Colorado, Kansas, Nevada, Oregon, and Texas. UP/SP shall advise SEA as to the status and the results of these consultations.

- As suggested by UP/SP, UP/SP shall use its own security forces to conduct its own arrests and bookings, reducing reliance on local police forces.

Hazardous Materials and Emergency Response

- UP/SP shall provide 800 numbers to all emergency response forces in all communities. These numbers shall provide access to UP/SP supervisors who shall provide train movement information and work cooperatively with communities in emergency situations. These numbers are not to be disclosed to the general public.

- UP/SP shall participate on a system-wide basis in the TRANSCARE program to develop hazardous material and emergency response plans in cooperation with communities.

- UP/SP shall adopt UP's training program for community and emergency response personnel for locations on the SP rail lines, and include personnel from SP served locations in UP's school at Pueblo, CO, for additional emergency response training.

Air Quality

- UP/SP shall adopt existing UP training and operating practices that are designed to reduce locomotive fuel consumption and air pollution. These include: throttle modulation, use of dynamic braking, increased use of pacing and coasting trains, isolating unneeded horsepower, shutting down locomotives when not in use for more than an hour when temperatures are above 40 degrees, and maintaining and upgrading SP locomotives to UP standards.

- As suggested by UP/SP, UP/SP shall extend to SP rail lines UP's program of closing boxcar doors on empty cars before movement on the system in order to reduce wind resistance and, thereby, fuel consumption.

- UP/SP shall convert all railroad locomotives to the standards for visible smoke reduction that are established in the South Coast Air Quality Basin.

- UP/SP shall implement the draft emissions standards for diesel-electric railroad locomotives that the Environmental Protection Agency (EPA) has developed. It is the Board's understanding that EPA plans to propose these standards and make them available for public comment in December 1996. Under these standards, UP/SP shall utilize newly manufactured or re-built locomotives that are more fuel efficient and produce less emissions. When this equipment becomes available, UP/SP shall assign these locomotives on a priority basis to the corridors or portions thereof specified below:

Southern Corridor	**Central Corridor**
Fort Worth, TX, to West Colton, CA	Cheyenne, WY, to Hinkle, OR
Pacific Coast (I-5) Corridor	Chicago, IL, to Fremont, NE
Sacramento, CA, to Bakersfield, CA	Denver, CO, to Grand Junction, CO
Seattle, WA, to West Colton, CA	Ogden, UT, to Roseville, CA

- To further facilitate the improvement of air quality for specific locations, UP/SP shall consult with appropriate state and local air quality officials in the States of Arizona, California, Colorado, Illinois, Nevada, Oregon, Texas, Washington, and Wyoming, through which the Pacific (I-5), Southern, Central, and Northern Corridors extend in part. UP/SP shall advise SEA as to the status and the results of these consultations.

Noise

- To address noise impacts, UP/SP shall consult with the affected counties that have communities that would experience an increase of 3 dBA or more as a result of the increased rail traffic over rail lines in the States of California, Colorado, Illinois, Kansas, Louisiana, Nebraska, Nevada, Oklahoma, and Texas. If appropriate, UP/SP shall develop a noise abatement plan. UP/SP shall submit the result of these consultations to SEA who will review these findings with FRA.

UP SP
MERGER MITIGATION STUDY
RENO

SURFACE TRANSPORTATION BOARD
SECTION OF ENVIRONMENTAL ANALYSIS

Opportunities for Public Input

Public Meeting

- Provide Verbal or Written Comments at Public Meeting

Written Comments

- Submit Written Comments to:

  Harold McNulty, Reno Co-Study Director
  Surface Transportation Board
  Section of Environmental Analysis
  Room 3219
  12th and Constitution Ave., NW
  Washington, D.C. 20423

Task Force Committee

- Contact any Representative on the Reno Task Force

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SURFACE TRANSPORTATION BOARD
SECTION OF ENVIRONMENTAL ANALYSIS

Reno Mitigation Study - Preliminary Mitigation Options

Grade Separated Crossings

- One or More Grade Separated Crossings
- Public and Agency Input Needed Regarding Possible Locations
- Preliminary Key Issues
  - Number of Vehicular Traffic Lanes
  - Impacts to Properties (e.g., property access) Near Grade Separated Crossings

Depressed Railway

- Preliminary Limits - from Stoker Avenue on the West to Sutro Street on the East
- Preliminary Key Issues
  - Construction Impacts
  - Groundwater Depths Infiltration / Quality -- Possible Need for Treatment

Elevated Railway

- Preliminary Key Issues
  - Visual Barrier
  - Existing Structures over Railroad Right-of-Way
  - Current Air Rights over Railroad Right-of-Way

Other Improvements to be Reviewed

- Improved Grade Crossing Safety Measures
- Train Speed Modifications Noise Suppression Modifications
- Enhanced Landscaping and Beautification Measures
- Improved Pedestrian Safety Measures

NOTE: The above stated preliminary options may involve shared or joint public / private funding.

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Surface Transportation Board
Section of Environmental Analysis

Reno Mitigation Study

Preliminary Mitigation and Evaluation Criteria

Overview and Purpose of Evaluation Criteria

The criteria developed for the Reno Mitigation Study will be used to determine the degree to which the options mitigate the environmental impacts of increased train traffic on the existing right-of-way resulting from the Union Pacific/Southern Pacific merger. Evaluation criteria will be used to (1) determine if the options mitigate the environmental impacts of increased rail traffic and (2) measure the potential environmental impacts resulting from implementing the options. An important consideration in evaluating the mitigation options is the willingness of various parties (UP, City of Reno, Washoe County, State of Nevada, Federal agencies, business and others interests) to participate in implementation. Many mitigation options anticipate shared funding or public/private partnerships.

Evaluation Criteria

Establishing the Merit of Mitigation Options

The evaluation criteria will be used during Phase 2 to determine to what extent an option mitigates the environmental impacts of increased train traffic on the existing right-of-way. If there are several mitigation options that offset the environmental impacts of the increased merger traffic, the evaluation criteria can be used to determine which of the mitigation options achieves the greatest overall benefits with the fewest overall negative environmental impacts. In Phase 2 SEA will include evaluation criteria that: 1) reflect an issue of concern, 2) are objective and 3) are measurable or quantifiable (using readily available information).

Each criterion will be defined by four components: issue, objective, measure, and data source. The first component of the criteria definition is the issue being evaluated. Key issues identified by the public to date are listed below. The study team will develop criteria (according to the principles described above) to evaluate the effectiveness and impact of mitigation options for each of these issues.

Key Issues

- Traffic Delay
- Pedestrian Safety
- Emergency Vehicle Access
- Train/Vehicle Accidents
- Derailments/Spills/Water Quality
- Train Operations
- Native American Issues
- Biological Resources
- Noise/Vibration
- Air Quality
- Property Impacts/Land Use
- Cost
- Feasibility of Implementation

A full definition of each criterion will include the following four components:

1. **Issue** – A central topic of concern such as environmental, technical, and cost impacts.

   Example issue: Impacts on traffic delay at railroad/highway crossings.

2. **Objective** – A definable goal for resolving the issue.

   Example objective: Mitigate traffic delays.

3. **Issue Measure** – A basis for comparing a mitigation option's effectiveness for addressing a specific issue.

   Example measure: Total change (e.g. reduction) in vehicle delay minutes per typical day.

4. **Data Source** – The information sources or calculations used to measure the impact of an option.

   Example data source: Calculated gate down time and vehicle delay using peak-hour traffic counts at selected crossings.

SEA will evaluate the mitigation options based on these criteria and provide a comparison of the mitigation options' overall effectiveness.

SURFACE TRANSPORTATION BOARD
SECTION OF ENVIRONMENTAL ANALYSIS

Reno Mitigation Study - Train Traffic Projections

- The Surface Transportation Board imposed a limit that UP/SP shall operate during the mitigation study no more than a daily average count of 14.7 freight trains per day through the City of Reno. This limit represents the 1995 baseline of 12.7 trains per day plus 2 additional trains. It does not include Amtrak or emergency conditions.

- December 1996 average UP/SP daily trains was 9.7.

1995 and Projected Future Average Daily Train Volumes Through Reno

Source of Train	Number of Trains		
	1995 (1)	Projected for Five Years Following UP/SP Merger (2)	Increase
Amtrak (3)	1.1	1.1	0.0
Burlington Northern / Santa Fe	0.0	4.0	4.0
Union Pacific / Southern Pacific	12.7	20.0	7.3
Daily Total	**13.8**	**25.1**	**11.3**

Notes: (1) Based on Train statistics provided by UP/SP
(2) Based on UP/SP Operating Plan and verified statements filed with the Surface Transportation Board. 1995 and 1996
(3) Amtrak train operations are not under the jurisdiction of the Surface Transportation Board

- These future UP/SP train numbers are not expected to occur all at once. Projected increases depend on changes to the Roseville Rail Yard (in California) and provision for increased tunnel clearance in the mountains west of Reno.

Projected Average Daily UP/SP Trains Through Reno for Five Years Following UP/SP Merger

Predicted Frequency	Number of Trains	Range of Train Lengths in Feet
Daily	15	2,685 - 6,860
One per week	2	6,765
Three per week	1	4,720
Five per week	5	990 - 6,120
Average number of daily trains	**20**	**990 - 6,860**

Based on UP/SP Operating Plan and verified statements filed with the Transportation Board. 1995 and 1996

- Projected future average train length = <5,000 feet (weighted average)
- Projected future doublestack container train height = 20 feet 2 inches (maximum permissible under AAR Mechanical Division standards)
- Current height of doublestack trains through Reno = 19 feet 2 inches

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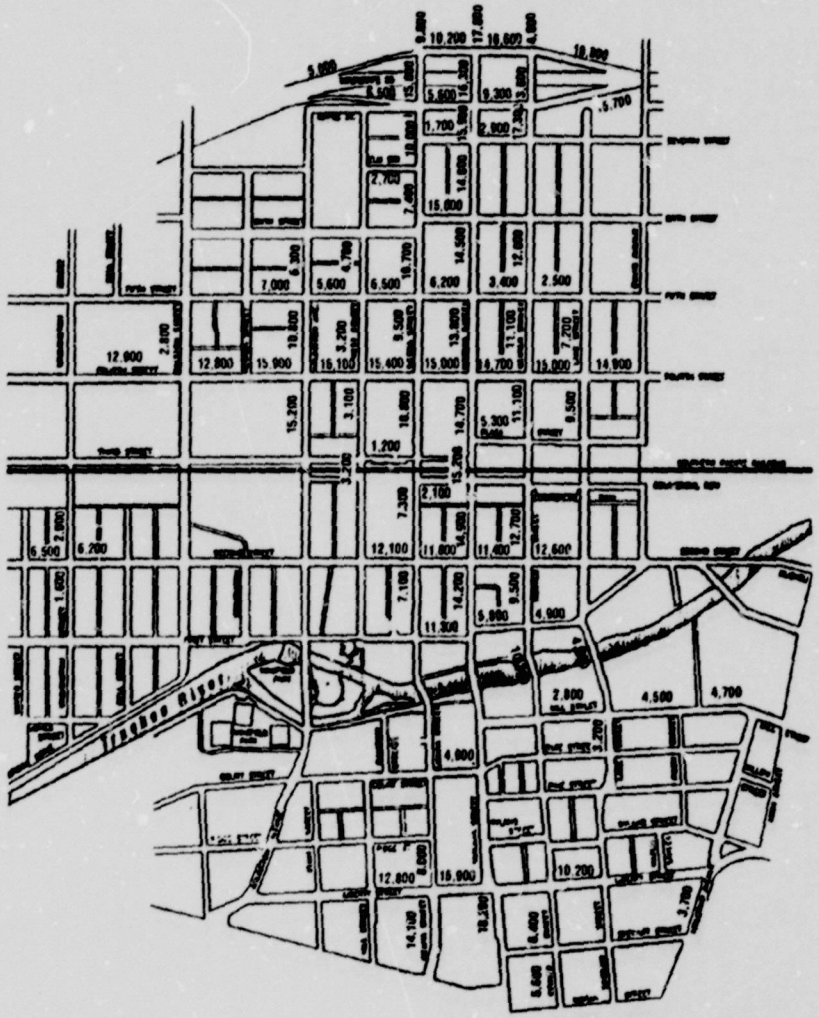
UP SP
MERGER MITIGATION STUDY
RENO

SURFACE TRANSPORTATION BOARD
SECTION OF ENVIRONMENTAL ANALYSIS

Existing Average Daily Traffic Volumes



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Comment Sheet

UP/SP Merger
Reno Mitigation Study

Please use this page to submit your comments about the Reno Mitigation Study. Please be as specific and concise as possible. Identify page numbers where applicable. We thank you for your interest in the UP/SP Merger Reno Mitigation Study.

Name _____ Phone/Fax _____

Organization & Title (if applicable) _____

Address _____

City/State/Zip _____

Please hand in or mail completed comment sheets to: Harold McNulty, UP/SP Merger Reno Mitigation Co-Study Director, Surface Transportation Board, Section of Environmental Analysis, 12th & Constitution Ave., NW, Room 3219, Washington, DC 20423.

(If necessary, please continue your comments on the reverse side.)

Appendix E
LIST OF MAJOR ISSUES RAISED BY THE PUBLIC REGARDING THE STUDY PROCESS TO DATE

Appendix E - Public Comments

SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Merger-related Litigation	EIS		The City of Reno does not agree with the impact analysis in the Environmental Assessment. The city has stated its views that before mitigation can be agreed upon, the impacts have to be agreed upon. The city has filed a lawsuit requesting an EIS.	2.3
			The city has requested that the Council on Environmental Quality (CEQ) comparatively review the Board decision on the EIS process in the Conrail/CSX merger proceedings and those of the UP/SP merger; the city has requested the CEQ review the propriety of conducting a site-specific, 18-month "mitigation study" for Reno, but not an EIS. The city feels the Board should perform a full EIS before mitigation measures can be addressed. The city feels the Board's decision to perform an EIS for the proposed Conrail/CSX proposed merger lends weight to Reno's litigation regarding the lack of an EIS for the Reno area;	2.3
Environmental Impacts	Safety	Emergency Response Delays	Trains more than a mile long may block more than one crossing at a time; how will this affect emergency response?	6.2.3
			What will happen with emergency services and public transportation access for people living downtown?	6.2.1 & 6.2.3
			The study needs to address the potential blockage of tracks during normal operations and during a train accident/and or hazardous material spill for isolated communities served by Woodland Avenue, Stag Lane, Del Curto Lane, and Canal Road	6.2.1, 6.2.3, & 6.2.5
			Residents and business owners should be informed of the emergency access road which provides secondary access should Woodland Avenue be blocked at the railroad crossing	7.2.6
			The Old Reno Casino has fire truck access problems	7.2.3
		Pedestrian Safety	Tourists may need to cross tracks to go from one casino to another; pedestrian safety is key	6.2.2 & 7.2.6
			Pedestrian safety during major tourist events needs to be addressed	6.2.2 & 7.2.6
			What is the impact of speeding as the trains on as the trains on pedestrian safety?	6.2.2 & 7.2.1

Appendix E - Public Comments
SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Environmental Impacts (Cont'd.)	Safety (Cont'd.)	Vehicle & Pedestrian Traffic Delays	What is the estimated amount of time each crossing will be closed to vehicle traffic each day?	6.2.1
			Pedestrian delay inconveniences tourist; trains cut off pedestrian traffic	6.2.2
			In the Woodland area, roads are blocked 20-30 minutes at a time by trains; why is the blockage so long?	6.2.6
			Casino employees choose to work near the trains; no one is making them do so	Comment noted
			Construction (non-railroad related) has been a source of traffic delays downtown; when the Silver Legacy was built, entire blocks were closed to vehicular traffic, including the fire department	7.21, 7.2.2 & 7.2.3
			Train blockage often is the fault of people/objects on the tracks;	6.2.1 & 6.2.2
			Some citizens noted that delays due to trains are minimal and do not present as big a problem as city officials seem to make it	6.2.1
			With so much of Reno's recent development south of the downtown area, most newcomers do not have any reason to be downtown where the tracks are	3.2
			Many traffic lights last as long as (or longer than) the waits required while trains pass	6.2.1
		Train/Vehicle Accidents	The study needs to determine if increased train speeds will increase likelihood of accidents	7.2.1
	Air Quality		Reno does not met Federal air quality standards; idling traffic at train tracks will further exacerbate Reno's air pollution problems	6.2.11 & 9
			What are the air quality impacts of increased train traffic?	6.2.11 &7.2.1
			Impacts of switch yard railroad traffic on air quality should be considered (e.g., switching engines, adding additional engines for the climb up Donner summit)	6.2.11
			Freight by rail produces less pollution than freight by truck	6.2.11
			Casinos, not the railroad, bring more cars, which have negative air quality impacts	Comment noted
	Noise & Vibration		Woodland Avenue near W. 4th St. has a "low grade" crossing which requires trains to blow their horns for a mile before approaching; this is a large source of noise pollution in the residential neighborhood	6.2.6 & 7.2.6
			The rumbling of the trains (especially those traveling at slow speeds) and train horns are both a source of annoyance, especially during evening hours; can train horn noise be mitigated?	6.2.9 & 7.2.6

Appendix E - Public Comments
SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Environmental Impacts (Cont'd.)	Noise & Vibration (Cont'd.)		Noise from train horns affects residents along the tracks, especially in the Verdi area	6.2.9
			The Eldorado Hotel/Casino has had customer complaints about train noise	6.2.9
			Tall buildings adjacent to the tracks shield noise, but the noise reverberates up the buildings and causes noise impacts higher up in the structures	6.2.9 & 6.2.10
			People who bought homes near tracks knew there would be noise	6.2.9
			Does the FRA require horn blowing for safety reasons?	6.2.9 & 7.2.6
			If you live near the trains, you quickly become accustomed to the noise, and it is not a problem	Comment noted
	Water Quality		Potential contamination of surface water and groundwater supplies, including contamination due to normal operations should be considered (e.g., oil leaks from engines on the railroad bed)	6.2.5
			What steps has UP taken to address the integrity of the rail bed in east and west Truckee River canyons? What will be the impact of additional rail traffic on an old rail bed, sitting on saturated earth along river banks that have been eroded by flood? The Truckee River is the prime water source for the area and water quality impacts should be considered.	6.2.5 & 7.2.6
			What steps has UP taken regarding the potential for future flooding? What impact will FEMA regulations have on the integrity of rail bed in the Truckee River canyons?	Beyond scope of study
	Hazardous Materials		Increased hazardous materials shipments on the Feather River route and potential impacts to the Gerlach community should be considered	6.2.5
			What measures are in place for cleaning up spills in the case of a hazardous materials accident in the Truckee River?	6.2.5 & 7.2.6
			UP needs specific plans to address hazardous materials spills; it is not enough to say that Federal requirements will be met	6.2.5 & 7.2.6
			Clean up of hazardous materials spills and leaks along the tracks, even if accumulation of small amounts occurs over a long period of time, should be considered	6.2.5
			An accident in Reno will affect fewer people than if trains are rerouted and an accident happens in more heavily populated California	Comment noted

Appendix E - Public Comments

SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Environmental Impacts (Cont'd.)	Hazardous Materials (Cont'd.)		Hazardous materials not on trains will be on trucks and highways, where they pose higher risks	6.2.5
	Native American Issues		There are rail tracks through the Reno-Sparks Indian Colony; key issues are: water; noise levels at Colony residences; delays at crossings; potential water pollution from hazardous materials transport;	6.2.7
			The city supports complete involvement and consultation with Native Americans during the study; the Reno-Sparks Indian Colony plans to join the City of Reno's lawsuit;	6.2.7
	Biological Resources		SEA should provide information regarding consultation with US Fish and Wildlife Service (USFWS) regarding endangered species	6.2.8
Other Potential Impacts	Property Value and Business Impacts	Downtown	Some parties feel that the casinos built too close to the tracks; if the tracks were moved elsewhere, they expect their property values to increase, which is why they want tracks moved	3.2
			If trains are a problem downtown, why do the casinos continue to expand?	3.2
			As recently as the 1990s, the city approved the construction of the National Bowling Stadium not more than 50 feet from the tracks; some residents feel that the city should not keep approving construction by the tracks if train traffic is considered bothersome	3.2
			UP is important to Reno's economy; it is one of the largest taxpayers in the county and provides nearly 300 families with jobs	6.2.12
			Nevada communities owe their existence to the railroad	Comment noted
			Warehousing and distribution, which play a large economic role in Nevada, depend on financially viable transportation modes such as the railroad	3.2 & 4.2
			Perception affects tourism – if people think there is a train problem, they will choose somewhere else for vacation	Comment noted
			The railroad bisects a major tourist destination	3.3

Appendix E - Public Comments

SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Other Potential Impacts (Cont'd.)	Property Value & Business Impacts (Cont'd.)	Downtown (Cont'd.)	Impacts of special events in downtown Reno should be considered	6.2.2 & 7.2.6
			Impacts will be felt on valet parking, airport shuttles and the entire tourist industry	6.2.1
			Impact on parking and access to parking need to be considered	7.2.2 & 7.2.3
			Potential negative publicity and loss of tourism in the event of a major traffic accident or hazardous materials spill should be considered	6.2.5
		Residential	A citizen noted that the railroad and the "ugly warehouses near it" have a negative impact on the property along the north side of the river in West Reno	Comment noted
	Problems in Surrounding Areas		The City of Reno Planning Commission should not have approved the building of subdivisions, homes, or businesses in areas where trains might potentially block access of emergency vehicles	3.2 & 6.2.3
			The Woodland Area crossings should be addressed	6.2.6 & 7.2.6
			None of the mitigation options seems to address blocked access to the 27 residences in the West 4th St. via Del Curto neighborhood	7.2.6
			What are the issues pertaining to Sparks?	3 & 4.2
Train Operations	Increased Train Numbers		Although in the past there were more trains coming through Reno and no complaints, it should be noted that Reno was much smaller then, with less pedestrian and vehicle traffic, and freight trains did not carry the toxic materials they carry today	Comment noted
			How many trains and of what length and of what height are expected per day and per hour?	4.0
			Flooding does not make Reno want to get rid of the river, why should train traffic make Reno want to get rid of UP?	Comment noted
			Before the merger, UP could run as many trains as it wanted and no one could have complained about traffic delays	Comment noted
	Projections		What is meant by "future" projections?	4.4
			What was the methodology used by UP for determining the train traffic projections for 5 years following the merger?	4.4
			Will UP increase train traffic after the five-year period?	4.4.1
			What assurances does the city have that train traffic will not increase after 5 years?	4.4.1
			Do UP's train traffic models include the marketing growth of the Port of Oakland or the opening of a facility in Oakland, CA? Do they include analyses for other ports to be served over the Central Corridor?	4.4.4

SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Train Operations (Cont'd.)			One citizen noted that restricting UP to 9.7 trains/day will debilitate the railroad; UP should run as many trains as needed	Comment noted
			How many other towns have similar problems because of the merger?	Beyond scope of study
	System Operation		The positive effects of the merger can be seen by the ability of the railroad to survive the January 1997 floods and the increased daily activity in the Sparks intermodal yard	Comment noted
			What are the roles of the FRA and the Nevada Public Service Commission? Do other government agencies play a role in governing train operations? What operating constraints and opportunities does the railroad have?	4.1 & 2.2
			Who regulates train frequency, timing, and routes? What are the requirements regarding these issues?	4.1 & 2.2
			Intermodal transportation, to which UP has a commitment, is in the best interest of Reno/Sparks economy, ecology, and highway congestion	Comment noted
			What is the future of the Reno Branch line and of the Reno intermodal facility at Parr Boulevard?	4
Involved Parties	Cooperation		Many citizens stated that UP, local businesses, and Federal and local government should all work together to find a viable and affordable solution	2.8
			Residents noted the city and UP should work together to address safety, noise, and pollution issues	2.8
	Union Pacific/City of Reno Relations		The city stated that UP's private openhouse held on Feb. 4, 1997 was "heavy-handed" and "showed a gross lack of good faith" by not inviting city officials and by urging railroad employees to speak in favor of the railroad at SEA's Feb. 13th public meetings	Comment noted
			UP offered $35 million to partially fund the depressed railway; the city requested UP pay $100 million and UP declined. The city feels UP has negotiated in bad faith; UP has expressed its willingness to still meet with the city and other affected parties;	2.9
			According to city staff, "UP has reportedly attempted to meet privately with downtown businesses to 'buy them off'" and the city objects to this.	2.9

Appendix E - Public Comments
SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Involved Parties (Cont'd.)	UP/City of Reno Relations (Cont'd.)		The city requested that UP provide detailed information to the task force regarding compensation and fees paid to third-party contractors and related issues regarding other contracts and limitations imposed by the Board	2.6.1
	Citizen Views on city Actions		Citizens have expressed various views about the city actions pertaining to the railroad. These views are as follows: • The city and local newspaper have created a "controlled news event" about the merger with the goal of removing train traffic from downtown hotel and gaming district; they do not show all of the economic good created by the railroad • The city needs to find ways to coexist with UP; officials need to be responsive and get results for the community • The city created the problem by building on the north side of tracks • The city management seems to be speaking for the casinos and not for the masses of Reno citizens • Community leaders should take action on solving the train problem issue once and for all; it has been studied too many times in the past with no action being taken • The city should drop its lawsuit and focus on mitigation • Airport issues are more important than railroad issues, and the city should address them first	2.8
	Third-Party Contractor		The city has stated there may be a potential conflict of interest regarding SEA's independent third-party contractor and/or its subcontractors;	2.6.1
			The city requested that the third-party contractor project director discuss with the task force and provide detailed information concerning potential conflicts of interest of all parties involved in the Board's environmental investigation in connection with the preparation of the EA, the Post-EA, and/or the Reno Mitigation Plan	2.6.1
Mitigation Study	General Scope		Will the study address groundwater, air, safety, and hazardous materials issues?	6.2
			SEA should define and establish the study process for air quality, biological resources, cultural resources, hazardous materials transport, land use, noise, safety, socioeconomics, traffic, and water quality	6.2

Appendix E - Public Comments
SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Mitigation Study (Cont'd.)	General Scope (Cont'd.)		Does the study area include the city and the county?	6
			The study should examine the history of land development decisions and the development history of railroads in Reno	3
			Will the study include economic impacts or solely environmental impacts?	6.3
			Is BN/SF included in the study?	4.4
	Methodology & Process	NEPA Study Scheduling	The City of Reno requested SEA extend the study time period and the period for review of documents	6.2.2
			The City of Reno submitted the following comments on methodology and study process. • Determination of the "affected environment" requires "description of environment of the area(s) to be affected or created by the alternatives" (§ 1502.15) • "Environmental consequences" requires review of scientific and analytic bases of elements required by NEPA section 102(2)(c)(I-v) and sections (a)-(k) (1502.16) • Review of "alternatives" build on the definition and description of affected environment and environmental consequences (§1502.14) • Overall methodology of the Reno Mitigation Study should be designed to ensure professional integrity (§1502.24) • Cost-benefit analysis of alternative choices is also a material consideration (§1502.23) • There should be a concise public record of decisions (§1505.2) • Pending conclusion of the process, an agency is admonished to take no action which will limit the choice of reasonable alternatives or otherwise prejudice the ultimate decision or the program (§1506.1) • The city staff stated its views that the Board and UP have "shown little real concern for the health and safety of the residents of Reno, and total disregard for the use of public monies to seek mitigation;" the Board seems to be ignoring Reno's concerns and just "going through the motions" with a mitigation study whose results have already been determined in July. The city stated it fears the mitigation study is biased.	Comment noted

Appendix E - Public Comments
SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Mitigation Study (Cont'd.)	Methodology & Process (Cont'd.)	Historical Data/ Preexisting Conditions	The UP submitted a study and letter indicating that development patterns allowed by the city have contributed to the existing land use and train conflicts, long before the merger. The UP letter notes that the City of Reno voted down the funding of a depressed railway in 1980.	3
	Study Data		UP notes, that in Decision No. 44, the Board said the UP/SP should not be required to mitigate conditions created by "the preexisting developments of hotels, casinos, and other tourist oriented business on both lines of the existing SP rail line in Reno." UP feels that preexisting development is the primary cause of the conditions SEA has bee studying, and therefore, UP cannot be required to mitigate the effects of preexisting development.	2.4
			Regarding SEA's data collection during the emergency conditions, were double observers used? Did the study team check on margin of error? Were there reliability tests of the observers?	5
			The study should examine population growth and account for normal population growth in the mitigation plan	3
		Trains	Using 25.1 as the average number of trains is misleading because 33% of the time there will be more trains than that, so mitigation to address 25.1 trains will be inadequate 33% of the time	Comment noted
			What data is available for train speeds?	7.21
			The study should provide a range of train numbers in addition to average train numbers	4.4.5
			The train data regarding number, speed, height, and length of trains discussed in the public arena are quite variable and should be reconciled and clarified in the study.	4
			If the study investigates the effective mitigation potential of manipulation of train speed, a similar evaluation of the manipulation of train numbers per day and length of trains should also be performed	in 7.1
		Vehicle Traffic	If total vehicle delay is being used as a measurement, there needs to be a sensitivity analysis of where all the traffic is going downtown	6.2.1
			Traffic delay methodology should be made available for review	Appendix J

Appendix E - Public Comments

SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Mitigation Study (Cont'd.)	Study Data (Cont'd.)	Vehicle Traffic (Cont'd.)	Why is vehicle traffic being projected to the Year 2000? Using the Year 2000 is not baseline and does not address pre-merger conditions; a variety of traffic vehicular delay scenarios should be prepared using 1995, 2000, and 2020 as a base and 12.7 trains per/day (pre-merger), 24.0 trains (Board worst case), and 38.0 (Reno worst case)	6.2.1
	Public Involvement/ Public Review Schedule	Noise	What is the Board's definition of noise receptors? It seems the Board uses a very narrow definition; noise receptor analysis should include consideration of hotels and other commercial properties adjacent to UP's trackage in Reno	6.2.9
			Night-weighted averages are not relevant in Reno because it is a 24-hour/day city	6.2.9
			The sensitive receptor inventory should be provided for review	6.2.9
		Quality of Life	The study team should talk to tourists and consider impacts that affect the tourist experience	6.2.12
			To meet the needs of Reno as a "24-hour town," the meetings should each be held twice (once early in the afternoon and once in the evening)	2.7.3
			A structured public participation program should be used to maximize citizen involvement in the preparation and review of the Mitigation Plan	2.7.2
			An artist's rendering of the different mitigation options would be helpful for the public to see	9 & appendix
			Will the Preliminary Mitigation Plan suggest one mitigation option or discuss the pros and cons of various options?	7 & 8
			Will members of the public have the opportunity to disagree with recommended mitigation measures during the mitigation study?	2.7.6
			The mitigation study and task force schedule should be extended up to 90 days; can SEA recommend to the Board that the study schedule be extended?	2.7.2
			The comment period on the Preliminary Mitigation Plan should be extended beyond 30 days.	2.7.2
		Task Force	The Reno City Manager's Office should serve as the office "primary conduit" for information exchange between the task force and SEA	2.7.2
			The city stated its view that "The mission of the task force should be to ensure that all adverse impacts associated with the merger are mitigated to less than significant levels, and that mitigation proposals do not in and of themselves create additional adverse impacts."	2.7.2

Appendix E - Public Comments
SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Mitigation Study (Cont'd.)	Public Involvement/ Public Review Schedule (Cont'd.)	Task Force (Cont'd.)	The task force should meet the requirement of the Nevada Open Meeting Law (NRS 241)	2.7.2
			Materials should be available in advance to task force members for their review and discussion with the groups they represent in order to facilitate discussion at the meetings	2.7.2
			The city wrote a letter stating their view that the task force meetings seem to focus on mitigation options and do not include full discussion of possible merger-related environmental impacts in Reno;	2.7.2
			Why is there a noticeable difference in the level of detail in information given to the Wichita Mitigation Committee and the Reno's task force?	2.7.2
			The task force should be given information regarding pre-merger and post-merger figures for train and traffic data and unmitigated impacts so that they may be discussed before publication of the Preliminary Mitigation Plan	2.7.2
			UP should present to the task force details regarding potential rail traffic changes over the next 20 years along the Central Corridor and the Reno/Sparks area specifically as well as information regarding the Port of Oakland, CA	4.4.4
			The task force should be given a presentation regarding a cost-benefit analysis of (1) UP's proposal to depress the tracks paid for by the railroad and the state of Nevada and (2) other mitigation options	7.0
			The Sparks industrial community should be represented on task force	2.7.2
			A citizen noted that the task force seems to have mostly members who are known to be anti-railroad	2.7.2
			A citizen noted that the task force seems uninterested in the concerns of the warehousing and distribution community	2.7.2
Board Jurisdiction			What is the Board's general jurisdiction? What mitigation options are under the Board's jurisdiction and which mitigation options are not?	2.2
			The Board's authority to control train operations should be clarified	2.2
			Can the Board control train speeds? Length of trains? Numbers of cars?	2.2
			What is meant by the Board's statement regarding "feasible and reasonable" mitigation?	8
			Can the Board impose further caps or limitations on the number of trains as a long-term solution?	2.2
			What are the interstate commerce rules that apply in this instance?	2.2

SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Board Jurisdiction (Cont'd.)			What is meant by the terms "baseline mitigation" and "alternative mitigation" regarding the Board's Decision 71?	2.2 & 8
			Is the I-80 option under the Board's jurisdiction?	7.2.5
Mitigation	Evaluation Criteria		The city should look ahead 20-40 years when thinking about mitigation options	Comment noted
			Choose the best solution for tourists and the whole community	Comment noted
			How will the Board determine if it is going to require 100% mitigation or only 80% mitigation?	8
			Solutions that work for one area may not work in another (e.g., downtown needs a different solution than the Woodland and Del Curto areas)	Comment noted
	Impacts of Mitigation		Consider time and costs necessary to build various mitigation options; some parties noted that five years of construction is "unthinkable"	7 & 8
			Construction impacts such as noise, dust, and traffic may drive tourists away	7
			Do not study mitigation options which might prevent local businesses from operating	7
			The noise and safety impacts of mitigation options must be considered	6.2.9 & 6.2.2
	Mitigation Options	City Preference	In the early phases of the study, the City of Reno supported relocation of the rail line to I-80 corridor.	7.2.5
			Later in the study, the Reno City Council endorsed the depressed railway as the primary option that the city would pursue.	2.8 & 7.2.3
			In task force meetings, the city stated that underpass/overpass mitigation options are unacceptable and the city expressed reservations about speeding up the trains.	2.8
			The city feels the Board's Decision 71, limits Reno's mitigation options	2.2 & 8
		Depressed Rail Corridor	The depressed corridor is the best long-term solution; the city asked Southern Pacific to study it years ago	7.2.3
			Benefits of the depressed railway: • Solves noise impacts by providing sound buffer and eliminating need for horn blowing • Provides potentially unlimited capacity that UP may need in several decades • Unites the community • Improves downtown streets and leaves autos and pedestrians with access to businesses • Would allow for containment of hazardous materials	7.2.3 & 8

Appendix E - Public Comments
SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Mitigation (Cont'd.)	Mitigation Options (Cont'd.)	Depressed Rail Corridor (Cont'd.)	Potential Problems of the depressed railway: • Groundwater problems: Will the railway create a barrier to ground water movement? What is the range of unanticipated costs/delays regarding groundwater? What dewatering provisions are planned during construction and for the long-term? • Lengthy time for construction causes inconvenience and loss of revenue for area businesses • Flooding • Litter (e.g., "trash, beer cans, bodies") may end up in the trench	7.2.3 & 8
			An enclosed tunnel would be ideal for mitigating impacts	Comment noted
			If the trains are put in a trench, the trench should extend farther west than currently planned to accommodate Reno's growth to the west	Comment noted
			Rescue operations access in the event of an accident should be considered	Comment noted
			Are there examples of successful uses of depressed corridor in other cities?	Beyond study scope
			Can all of the traffic be rerouted to the Feather River route during construction? What factors determine the maximum capacity of the Feather River route, and what is required to increase the capacity if necessary?	
			Regarding construction impacts of the depressed railway: • Would a communication plan be included so that all affected employees, businesses, and tourists are informed of changes? Who will be responsible for this plan? • How could a flexible plan be devised to adapt to changing construction traffic blockages? • When will timelines for construction be finalized? • What are uncertainty of construction impacts on economic development, property values, lease rates, and project cost estimates? • What degree of detail will the plans regarding temporary rerouting of traffic have? • How will the reroute plan and changes be disseminated? • Will the plan consider access for emergency vehicles for St. Mary's and police, and fire emergency vehicles? • Who will develop a long-term marketing plan to emphasize positive effects of the trainway and create a special event with a "railroad" theme? What is needed from UP to help create and maintain this "railroad" theme?	7 & 8

SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Mitigation (Cont'd.)	Mitigation Options (Cont'd.)	Depressed Rail Corridor (Cont'd.)	Regarding Amtrak: • Where will the Amtrak station be located during construction to facilitate detraining of approximately 100,000 visitors to downtown Reno? • What is the plan for upgrading of the Amtrak station with the depressed railway?	Beyond study scope
			Regarding the shoofly to be used during construction: • Where will the shoofly be? • What will be the impacts of the shoofly on affected businesses? • What provisions will be made for mitigating impacts to businesses and how will this be included in project cost? • How will north/south vehicle access, safety, and railroad horn abatement be maintained while the shoofly is in operation?	7.2.3
			Regarding covering the railway: • What is the cost-benefit of constructing a covered railway through the downtown portion of the trainway as opposed to leaving "a noisy, dirty, unsightly ditch in the downtown area? • What is the cost difference in covering the railway during construction or waiting until a later time? • Will covering the railway make the right-of-way available for development, and could this offset construction costs? • Would covering the railway lessen noise impacts?	7.2.3
		Rerouting of Trains to a New Rail Line on the I-80 Corridor	In San Francisco, removing the Embarcadero Freeway was a very big project, but they did it; Reno could undertake the big project of rerouting	Comment noted
			First choice for mitigating impacts is to reroute trains along the I-80 corridor	7.2.5
			Remove tracks from downtown to remove environmental impacts	7.2.5
			Moving to I-80 does not reduce air pollution, it just moves it to another location	7.2.5
		Options for Mitigating Noise Impacts	A controlled fence and crossing gate arrangement would eliminate crossing whistle signals	7.2.6
			The study should address appropriate sounds, directions, decibels, and length of time of train warning horns	7.2.6 & 8
			Noise impacts can be mitigated by creating sound buffers	7.2.6
			A new, quiet roadbed should be built	7.2.6

Appendix E - Public Comments
SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Mitigation (Cont'd.)	Mitigation Options (Cont'd.)	Options for Mitigating Noise Impacts (Cont'd.)	Possible mitigation measures for horn noise: • Automate horns with a uniform length of time so they are not too long • Make horn noise directional • Make the horns melodious (2 or 3 nice notes) • Make the horns only as loud as necessary, not too loud	7.2.6 & 8
			If directional horns are considered, it is necessary to look at additional pedestrian barrier systems	7.2.6
		Scheduling Trains	Decrease number of trains at night	8
			Noted in the study a system should be provided which alerts emergency responder dispatch centers as to when trains are on the tracks	7.2.6
		Train Speed	It may be helpful to raise the train speed limit through Reno	7.2.1
			Use pre-cast beams to improve the rails	Comment noted
			What is the impact of increased train speeds on pedestrian safety, especially at Sierra, Virginia, and Center Streets which are key downtown locations?	6.2.1, 7.2.1, & 8
			How would a train speed increase be implemented?	7.2.1 & 8
			Methodology for plans for speeding up trains should be documented in writing	7.2.1
			Faster trains mean longer braking distances in case of vehicles or pedestrians on tracks	7.2.1
			The City of Reno opposes any mitigation strategy which would potentially increase the threat of vehicle or pedestrian accidents and has serious reservations about increasing train speeds.	2.8
			Several crossings in downtown have preempted traffic signals that will to be adjusted if train speeds are changed	Comment noted
		At-Grade Crossings	Eliminate at-grade crossings as much as possible	
			Close the crossing at Virginia and the area could be turned into a mall	
			Currently there are substandard at-grade crossings in Reno/Washoe County; those which do not meet appropriate regulations should be repaired	
		Grade separations	Underpasses, such as the one on W. Second St., make people feel "trapped" and "at-risk"	
			Sparks, Las Vegas, and other cities have successful overpasses – Reno can too	

Appendix E - Public Comments
SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Mitigation (Cont'd.)	Mitigation (Cont'd.)	Grade Separations (Cont'd.)	Underpasses should be built at the following streets one at a time to avoid inconvenience: Keystone, Arlington, Washington, Ralston, and Evans	Comment noted
			How did the study team decide on the idea of grade separations at Keystone and Sutro?	7.2.2
			Property impact and necessary acquisitions should be taken into account when deciding where to build underpasses	7.2.2
			Grade separations do not seem practical at Sierra, Center, and Virginia Streets because of the land uses which already exist at these locations	7.2.2
			A combination of underpasses and overpasses would avoid creating too many overpasses through the downtown area	7.2.2
			How would this option affect speed limitations?	7.2.2
			Trash and graffiti accumulate in underpasses	Comment noted
			Lowered streets under underpasses have a tendency to flood	7.2.2
			Will double-stack container trains be possible? Grade separations may be more viable further away from downtown	4 & 7.2.2
			City stated that underpass/overpass mitigation options are unacceptable and may create engineering problems	Comment noted
		Elevated Railway	The Downtown Improvement Association recommends eliminating this option from consideration because if would provide a highly visible barrier through the tourist destination south of the Truckee River to I-80; the issue of air rights would be a problem with this option	7.2.4 & 8
			Elevated tracks would allow for normal entrance/exit for Woodland area	7.2.4 & 7.2.6
			Added problems of engineering and excessive noise	7.2.4 & 7.2.6
		Other	Creating a single track would reduce time and costs	Comment noted
			The city could use electronic signs to advertise various city events while people wait for trains to pass	7.2.6
			Build more fire stations to eliminate emergency response delays Synchronized traffic lights would lower automobile emissions and compensate for increased emissions from cars waiting for trains to pass	2.11

Appendix E - Public Comments

SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Mitigation (Cont'd.)	Funding (Cont'd.)	Costs	What are the costs of the different mitigation options?	7
			Is cost the only deterrent to implementing the I-80 option?	7.2.5 & 8.5.4
			Will the study look at costs vs. UP's merger-related profits?	6.3
			Regardless of the official decision, the costs will pass to taxpayers and consumers	Comment noted
			Options that are too expensive should not be studied	Comment noted
		Responsibility	UP has committed $35 million, now it is time for Nevada to decide how it will contribute to funding	Comment noted
			Some feel UP is responsible for funding, others feel the railroad is not responsible	2.8
			What percentage is UP legally obligated to pay?	8
			Can the Board require UP to fund more than $35 million of the depressed corridor?	8
			The Federal government should help pay to move tracks to the I-80 corridor	7.2.5
			Can UP pressure the government not to build a military base in Reno and use that money instead to fund mitigation measures?	Comment noted
			The casinos should pay since they contributed to the problem and they are the ones benefiting	9
			The study timetable should be expedited to meet legislative budgeting timelines for state funding	9
			The downtown area should not have to deal with the issue alone because it affects everyone	Comment noted
			What is the methodology used for the cost-sharing analysis?	8
			"Poor planning and management on the part of Reno should not be the responsibility of UP nor this country's tax payers."	3
			Perhaps the Reno City Development Agency can help with funding	9
			Will the same funding criteria apply to UP as to other parties?	9
			Will the Board consider UP's business advantage and financial conditions as part of the mitigation determination?	6.3
	Monitoring & Compliance		How will the following system-wide mitigation measures be implemented in Reno? 800 number for signal malfunctions	8
			800 number for emergency response forces Development of hazardous material and emergency response plans	
			Emergency response training program for communities Implementation plan for UP security forces in the Truckee Meadows	8

SUMMARY OF KEY ISSUES RAISED BY PUBLIC AGENCIES AND INTERESTED PARTIES[1]

Key Issue Area	Topic	Sub-Topic	Specific Comment/Question/or Issue	Discussed in PMP Section
Mitigation (Cont'd.)	Monitoring & Compliance		UP should be given incentive to implement mitigation as soon as possible	8
			Who is responsible for ensuring that UP complies with the mitigation measures and conditions of merger approval?	8
			If increased train speeds is implemented as a mitigation measure, how will it be ensured that the trains will continue to run at the new higher speeds?	8

1. This summary provides a listing of key issues raised in correspondence, public meetings, consultations, and task force meetings.

Appendix F
RECENT RENO CITY COUNCIL ACTIONS REGARDING UP/SP MERGER MITIGATION OPTIONS

RENO CITY COUNCIL
BRIEF OF MINUTES
MARCH 12, 1996
(Official Minutes in City Clerk's Office)

The Regular Meeting of the Reno City Council was called to order at 12:05 p.m. on March 12, 1996 in the Council Chambers at City Hall.

PRESENT: Council Members Hascheff, Pearce, Dalske, Pilzner and Mayor Griffin.

ABSENT: Council Members Herndon and Pruett.

ALSO PRESENT: Assistant City Manager Jaeck, City Attorney Lynch and City Clerk Cook.

Agenda Item No.

2 Approval of the Minutes - February 27, 1996.

Recommended: Council approve the Minutes as submitted.

It was moved by Councilperson Hascheff, seconded by Councilperson Pilzner to approve the February 27, 1996 Regular Meeting Minutes as submitted.

Motion carried with Councilpersons Herndon and Pruett absent.

3 Approval of the Agenda - March 12, 1996.

Recommended: Council approve the March 12, 1996 Regular Council Meeting Agenda as submitted.

Mayor Griffin indicated that Items 6L and 13A have been withdrawn from the Agenda and Item 90 has been moved to Item 14E.

It was moved by Councilperson Hascheff, seconded by Councilperson Pearce to approve the March 12, 1996 Regular Meeting Agenda as amended.

Motion carried with Councilpersons Herndon and Pruett absent.

4 Cash Disbursements - February 12, 1996 through February 25, 1996.

Recommended: Council approve Cash Disbursements as submitted.

It was moved by Councilperson Hascheff, seconded by Councilperson Pilzner to approve the Cash Disbursements as submitted.

Motion carried with Councilpersons Herndon and Pruett absent.

Agenda Item No.

15 **CITY CLERK**

15A1 Boards and Commissions - Financial Advisory Board.

NO ACTION WAS TAKEN ON THIS ITEM.

15A2 Boards and Commissions - Ward 1 - Southwest District Council.

NO ACTION WAS TAKEN ON THIS ITEM.

15A3 Boards and Commissions - C.I.T.Y. 2000 Arts Commission.

Councilperson Pearce nominated Peter Stremmel to serve on the C.I.T.Y. 2000 Arts Commission.

It was noted that Mr. Stremmel does not live in the City of Reno.

It was the consensus of the Council to direct the City Clerk to no longer accept applications from residents outside the City of Reno limits.

NO ACTION WAS TAKEN ON THIS ITEM.

16 **MAYOR AND COUNCIL**

16A Liaison Report and appropriate direction to staff.

NO ACTION WAS TAKEN ON THIS ITEM.

16B Mayor's Liaison Report

NO ACTION WAS TAKEN ON THIS ITEM.

16C Report and follow-up on the Railroad Merger Meetings.

Mayor Griffin provided the Council with an overview of the meeting with the Congressional Delegation and Union Pacific Railroad representatives.

It was moved by Councilperson Pilzner, seconded by Councilperson Pearce to approve the following recommendations as outlined in the memo from the City Manager:

1. The City of Reno designate the I-80 alternative as its preferred alternative because it provides the least safety and environmental impact to the community and vigorously pursue its implementation.

2. The railroad bear the full cost of whatever mitigation is approved by the City, including construction, planning and design.

3. If the railroad refuses to find a mitigation alternative acceptable to the City, that the city go on record opposing the merger.

Agenda Item No. 16C

Report and follow-up on the Railroad Merger Meetings, continued:

4. That the City Council direct the City Manager to take the lead in all aspects of negotiating an agreement with the railroad consistent with the City Council's policy position and report back to the Council on a regular basis.

5. The City make contact with other communities affected by the proposed merger to determine what, if any, opportunities exist to undertake joint efforts.

Motion carried with Councilpersons Haschcff, Herndon and Pruett absent.

17 Request from the Independent American Party of Nevada to discuss a proposed resolution regarding the changing of names of streets and boulevards named in honor of past leaders.

This matter was deferred to the March 26, 1996 Council Meeting Agenda at 4:30 p.m.

13A Appeal of denial of liquor license for Andrew Del Pozzo.

This item was deferred to the March 26, 1996 Council Meeting.

The meeting was adjourned at 8:10 p.m.

CITY OF RENO
OFFICE OF THE CITY CLERK
INTER-OFFICE MEMO

DATE: February 19, 1997

TO: Charles McNeely, City Manager

FROM: Donald J. Cook, City Clerk

SUBJECT: UP/SP Railroad Merger Negotiations Update and Council Consideration of Depressed Trainway Alternative

At a regular meeting held February 18, 1997, the City Council directed the City Manager to negotiate with UP representatives emphasizing the Downtown Depressed Trainway as the City's primary objective and work with the UP to develop all forms of funding sources for the construction of a Downtown Depressed Trainway. The Council further directed that litigation be continued, the I-80 corridor not be ruled out, and that the City Manager include up-to-date costs borne by the City every time this matter comes before the Council.

Donald J. Cook
City Clerk

DJC:cdg

xc: Kris Forest, Agenda Coordinator

RESOLUTION NO. 5368

INTRODUCED BY Hascheff

RESOLUTION DECLARING THE DEPRESSED TRAINWAY PROJECT AS A PRIORITY FOR THE CITY OF RENO

WHEREAS, on February 18, 1997, the Reno City Council unanimously directed the City Manager to negotiate with the Union Pacific representatives emphasizing the depressed trainway project as the City's primary objective and to work with the Union Pacific to develop all forms of funding sources for the construction of the depressed trainway; and

WHEREAS, on June 6, 1997, the Regional Transportation Commission unanimously approved Amendment No. 4 to the FY 1997-2001 Regional Transportation Improvement Program (RTIP) which placed the depressed trainway project on the RTIP on the condition that the Council for the City of Reno declare, by not less than a 5/7th vote, that the depressed trainway is a priority for the City of Reno.

NOW, THEREFORE, BE IT RESOLVED, that the City Council of the City of Reno hereby declares that the depressed trainway project is a priority for the City of Reno.

BE IT FURTHER RESOLVED that the City Clerk be directed to forward a copy of this Resolution to Celia G. Kupersmith, Executive Director, Regional Transportation Commission.

On motion of Councilmember Hascheff, seconded by Councilmember Aiazzi, the foregoing Resolution was passed and adopted this 17th day of June, 1997 by the following vote:

AYES: Hascheff, Aiazzi, Herndon, Pearce, Newberg, Griffin NAYS: Pruett

ABSENT: None ABSTAIN: None

Approved this 17th day of June, 1997.

JEFF GRIFFIN, Mayor

ATTEST:

DONALD J. COOK, City Clerk
Clerk of the Reno City Council

CITY OF RENO · INCORPORATED · WASHOE COUNTY, NEVADA

Train.way

Appendix G
TRAIN SURVEY DATABASE

Reno Train Information

07-Mar-97

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
1.0	2/3/97	07:02:00	wb	39	4539	3	freight							
								Center		00:03:38	2	0	0	0
								Virginia		00:03:35	5	5	5	7
								Sierra		00:03:07	0	12	3	1
								Arlington		00:03:14	11	7	1	0
								Keystone		00:02:50	81	70	2	10
2.0	2/3/97	08:22:00	wb	0		2	lite							
								Center		00:01:00	0	0	0	0
								Virginia		00:00:50	5	0	2	9
								Sierra		00:00:40	0	8	0	3
								Arlington		00:00:50	3	2	0	0
								Keystone		00:00:50	42	14	0	0
3.0	2/3/97	09:32:00	wb	77	5130	4	freight							
								Center		00:04:05	13	0	2	2
								Virginia		00:04:20	17	25	18	24
								Sierra		00:04:10	0	33	4	8
								Arlington		00:04:21	31	15	3	0
								Keystone		00:04:00	83	60	1	0
4.0	2/3/97	10:26:00	wb	60	5578	2	freight							
								Center		00:03:49	6	0	0	0
								Virginia		00:03:59	13	36	17	23
								Sierra		00:04:00	0	34	5	6
								Arlington		00:04:06	10	27	8	0
								Keystone		00:03:25	80	50	1	0
4.1	2/3/97	11:05:10	eb	0		0	hi-rail							
								Virginia		00:01:35	15	19	0	0
								Keystone		00:01:20	14	18	1	0
4.2	2/3/97	11:22:40		0		0	gate event							
								Virginia		00:00:15	0	0	0	0
4.3	2/3/97	11:27:32		0		0	gate event							
								Virginia		00:00:38	3	6	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data			
											Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
4.4	2/3/97	11:32:45		0		0	gate event							
								Virginia		00:00:22	3	2	4	4
5.0	2/3/97	11:35:00		0		0	hi-rail							
								Center		00:00:50	10	0	8	0
								Virginia		00:04:55	13	12	4	7
								Keystone		00:01:20	48	23	0	0
6.0	2/3/97	11:49:00	eb	78	4280	2	freight							
								Center		00:02:44	8	0	0	0
								Virginia		00:02:51	16	47	14	35
								Sierra		00:02:50	0	19	0	1
								Arlington		00:03:14	24	17	5	2
								Keystone		00:03:20	109	70	0	0
7.0	2/3/97	12:07:00	eb	98	5993	4	freight							
								Center		00:05:35	28	0	1	2
								Virginia		00:05:42	41	49	50	70
								Sierra		00:05:40	0	41	16	22
								Arlington		00:06:01	35	35	3	7
								Keystone		00:06:25	108	68	2	0
8.0	2/3/97	13:00:00	wb	75	4801	3	freight							
								Center		00:04:58	16	0	6	2
								Virginia		00:05:00	67	80	40	40
								Sierra		00:05:00	0	40	13	8
								Arlington		00:05:08	40	21	1	0
								Keystone		00:04:40	108	83	1	0
8.1	2/3/97	13:20:20	eb	0		0	Hi-rail							
								Keystone		00:00:25	5	5	0	0
9.0	2/3/97	13:48:00	eb	31	6079	3	freight							
								Center		00:03:18	19	0	0	3
								Virginia		00:03:30	16	39	37	32
								Sierra		00:03:30	0	43	7	5
								Arlington		00:03:44	31	19	0	2
								Keystone		00:03:50	117	95	0	1
9.1	2/3/97	13:49:15	wb	0		0	Hi-rail							
								Keystone		00:00:45	10	10	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
10.0	2/3/97	16:00:00	eb	96	5945	3	freight							
								Center		00:07:30	40	0	4	5
								Virginia		00:07:15	117	75	61	63
								Sierra		00:07:35	0	104	18	24
								Arlington		00:06:42	48	33	4	1
								Keystone		00:04:45	115	90	1	2
11.0	2/3/97	16:15:00	wb	74	4554	5	freight							
								Center		00:03:11	19	0	0	2
								Virginia		00:03:20	17	46	24	30
								Sierra	12	00:10:19	0	111	26	22
								Arlington	12	00:09:41	26	50	2	6
								Keystone	12	00:03:58	120	85	2	3
12.0	2/3/97	16:20:00	eb	44	4894	4	freight							
								Center		00:07:19	24	0	4	5
								Virginia		00:07:30	150	93	42	60
								Sierra	11	00:00:00	0	0	0	0
								Arlington	11	00:00:00	0	0	0	0
								Keystone	11	00:00:00	0	0	0	0
13.0	2/3/97	17:22:00	wb	3	420	3	freight							
								Center		00:00:55	10	0	0	0
								Virginia		00:01:26	14	8	8	12
								Sierra		00:00:45	0	16	1	4
								Arlington		00:00:45	9	3	0	1
								Keystone		00:00:45	28	22	0	0
14.0	2/3/97	18:30:00	eb	20		2	Work							
								Center		00:01:10	7	0	0	0
								Virginia		00:01:19	8	9	4	7
								Sierra		00:01:15	0	7	1	2
								Arlington		00:01:21	10	2	8	2
								Keystone		00:01:10	45	30	0	0
15.0	2/3/97	19:03:30		11		2	Amtrak							
								Center		00:08:50	7	0	0	0
								Virginia		00:01:05	13	8	7	4
								Sierra		00:01:05	0	6	0	0
								Arlington		00:01:19	1	1	1	4
								Keystone		00:01:02	8	8	2	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
16.0	2/3/97	20:36:15	eb	79	4292	7	freight							
								Center		00:02:40	9	0	2	0
								Virginia		00:02:44	19	7	6	6
								Sierra		00:02:45	0	27	0	6
								Arlington		00:03:25	3	4	3	1
								Keystone		00:03:13	27	23	0	0
17.0	2/3/97	20:52:30	eb	21	1448	2	freight							
								Center		00:01:50	3	0	0	0
								Virginia		00:01:50	12	4	1	20
								Sierra		00:01:40	0	3	2	6
								Arlington		00:01:58	3	2	0	0
								Keystone		00:02:04	9	20	0	0
18.0	2/3/97	22:42:40	wb	62	3865	3	freight							
								Center		00:03:10	6	0	0	0
								Virginia		00:03:10	15	2	25	4
								Sierra		00:03:15	0	12	2	4
								Arlington		00:03:39	5	4	2	2
								Keystone		00:02:41	5	10	1	0
19.0	2/4/97	01:08:30	eb	34		3	freight							
								Center		00:01:30	1	0	0	0
								Virginia		00:01:25	3	2	3	1
								Sierra		00:01:50	0	7	0	0
								Arlington		00:01:50	1	0	0	0
								Keystone		00:01:44	2	0	0	0
20.0	2/4/97	01:19:45	eb	35	5636	2	freight							
								Center		00:03:40	1	0	0	0
								Virginia		00:03:40	1	1	2	1
								Sierra		00:03:20	0	8	0	1
								Arlington		00:03:44	0	1	0	0
								Keystone		00:03:39	6	4	0	0
21.0	2/4/97	02:53:55	wb	39	4838	3	freight							
								Center		00:03:25	2	0	0	0
								Virginia		00:03:30	4	2	4	3
								Sierra		00:03:30	0	6	6	0
								Arlington		00:03:50	0	3	0	0
								Keystone		00:02:50	2	0	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
22.0	2/4/97	03:08:30	wb	78	4353	3	freight							
								Center		00:03:15	3	0	0	0
								Virginia		00:03:15	3	2	1	3
								Sierra		00:03:10	0	4	0	1
								Arlington		00:03:20	0	0	2	0
								Keystone		00:02:56	0	2	0	0
23.0	2/4/97	05:10:00	eb	91	5592	2	freight							
								Center		00:03:25	8	0	0	0
								Virginia		00:03:25	4	4	1	3
								Sierra		00:03:25	0	2	2	0
								Arlington		00:03:30	3	2	0	0
								Keystone		00:03:58	3	8	0	0
24.0	2/4/97	06:06:55	eb	66	4154	3	freight							
								Center		00:03:05	2	0	0	0
								Virginia		00:02:50	4	2	2	3
								Sierra		00:03:15	0	6	0	0
								Arlington		00:03:15	2	1	1	1
								Keystone		00:03:34	13	9	0	0
25.0	2/4/97	06:33:00	eb	81	5729	2	freight							
								Center		00:03:30	6	0	1	0
								Virginia		00:03:35	2	6	4	5
								Sierra		00:03:25	0	10	4	0
								Arlington		00:03:30	8	2	1	1
								Keystone		00:04:09	34	16	0	0
26.0	2/4/97	06:44:45	wb	55	5551	3	freight							
								Center		00:04:00	6	0	0	0
								Virginia		00:04:00	8	9	1	2
								Sierra		00:03:55	0	21	4	3
								Arlington		00:04:00	7	4	2	2
								Keystone		00:03:13	25	30	0	0
27.0	2/4/97	08:09:00	wb	28	1675		freight							
								Center		00:01:57	6	0	0	1
								Virginia		00:01:56	11	12	3	5
								Sierra		00:01:20	0	22	1	5
								Arlington		00:02:15	14	4	0	0
								Keystone		00:01:30	34	23	1	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data			
											Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
28.0	2/4/97	08:16:00	eb	0		3	lite							
								Center		00:00:38	3	0	0	0
								Virginia		00:00:40	5	1	1	3
								Sierra		00:00:40	0	9	1	2
								Arlington		00:00:40	6	0	0	0
								Keystone		00:00:35	25	18	0	0
29.0	2/4/97	08:34:00	eb	78	6211	4	freight							
								Center		00:04:05	7	0	5	0
								Virginia		00:04:07	15	15	18	6
								Sierra		00:04:05	0	40	7	7
								Arlington		00:04:04	20	25	2	0
								Keystone		00:04:30	53	50	0	4
30.0	2/4/97	10:06:00	eb	49	4571	2	freight							
								Center		00:04:40	11	0	4	1
								Virginia		00:04:25	12	30	13	43
								Sierra		00:04:20	0	24	2	8
								Arlington		00:04:30	26	14	1	2
								Keystone		00:04:20	43	25	0	1
30.1	2/4/97	10:37:20	wb	0		0	gate event							
								Virginia		00:00:50	6	4	8	8
31.0	2/4/97	10:37:00	wb	11		2	Amtrak							
								Center		00:09:09	8	0	6	2
								Virginia		00:02:15	10	12	5	3
								Sierra		00:01:01	0	24	1	6
								Arlington		00:01:04	6	1	0	1
								Keystone		00:01:10	32	25	0	1
31.1	2/4/97	11:17:30	eb	0		0	Hi-rail							
								Keystone		00:00:20	7	7	0	0
32.0	2/4/97	11:32:00	eb	12		1	work							
								Center		00:01:13	8	0	0	2
								Virginia		00:01:00	12	25	8	22
								Sierra		00:01:00	0	24	0	0
								Arlington		00:01:00	0	4	1	1
								Keystone		00:00:55	13	16	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data			
											Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
33.0	2/4/97	11:46:00	wb	30		2	work							
								Center		00:01:54	8	0	1	1
								Virginia		00:02:00	16	28	7	22
								Sierra		00:01:45	0	24	1	4
								Arlington		00:02:08	13	11	4	5
								Keystone		00:01:30	45	35	0	1
34.0	2/4/97	12:02:00	wb	75	4505	3	freight							
								Center		00:04:20	15	0	3	0
								Virginia		00:04:21	56	45	27	37
								Sierra		00:04:20	0	39	1	8
								Arlington		00:04:42	34	24	3	1
								Keystone		00:02:50	85	80	0	0
35.0	2/4/97	12:55:00	wb	16		2	work							
								Center		00:01:04	9	0	0	1
								Virginia		00:01:15	14	13	14	10
								Sierra		00:00:45	0	16	0	3
								Arlington		00:01:15	12	19	0	0
								Keystone		00:00:55	10	17	1	0
36.0	2/4/97	13:07:00	eb	102	5802	4	freight							
								Center		00:04:00	13	0	1	2
								Virginia		00:04:10	15	37	40	40
								Sierra		00:04:00	0	36	13	11
								Arlington		00:04:10	18	32	1	4
								Keystone		00:04:00	110	103	1	0
37.0	2/4/97	14:10:00	eb	48	5409	3	freight							
								Center		00:03:53	23	0	2	2
								Virginia		00:03:45	18	22	38	43
								Sierra		00:03:55	0	53	8	6
								Arlington		00:04:00	31	24	14	7
								Keystone		00:04:45	85	70	1	0
38.0	2/4/97	15:00:00	wb	58	5980	3	freight							
								Center		00:03:55	10	0	6	1
								Virginia		00:04:00	13	37	33	31
								Sierra		00:03:50	0	44	11	20
								Arlington		00:04:16	25	18	2	0
								Keystone		00:03:20	85	75	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
39.0	2/4/97	15:25:00	eb	12		2	Amtrak							
								Center		00:13:10	19	0	2	0
								Virginia		00:02:15	8	21	6	7
								Sierra		00:01:10	0	14	5	0
								Arlington		00:01:15	4	7	1	1
								Keystone		00:01:10	45	32	0	0
40.0	2/4/97	16:10:00	wb	75	4510	4	freight							
								Center		00:05:10	18	0	4	1
								Virginia		00:05:20	12	41	30	35
								Sierra		00:05:15	0	39	11	8
								Arlington		00:05:00	36	40	5	2
								Keystone		00:03:55	73	57	4	6
41.0	2/4/97	16:50:00	wb	5		1	local							
								Center		00:00:57	5	0	0	0
								Virginia		00:01:00	6	4	17	11
								Sierra		00:01:00	0	11	2	0
								Arlington		00:01:29	9	8	0	0
								Keystone		00:00:45	22	25	0	0
42.0	2/4/97	17:15:00	wb	9		3	lite							
								Center		00:00:36	11	0	0	0
								Virginia		00:00:46	12	10	12	7
								Sierra		00:00:41	0	12	5	2
								Arlington		00:01:16	31	5	0	4
								Keystone		00:00:35	10	10	1	0
43.0	2/4/97	17:52:00	eb	5		1	local							
								Center		00:00:35	2	0	0	0
								Virginia		00:00:47	6	3	3	12
								Sierra		00:00:47	0	9	0	0
								Arlington		00:00:50	6	3	3	0
								Keystone		00:00:45	30	25	0	2
44.0	2/4/97	20:02:45	wb	50	4475	3	freight							
								Center		00:03:20	8	0	0	0
								Virginia		00:03:15	7	5	17	21
								Sierra		00:03:15	0	17	14	0
								Arlington		00:03:40	8	14	0	0
								Keystone		00:03:01	24	40	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
45.0	2/4/97	20:26:30	wb	38	3571	2	freight							
								Center		00:02:45	5	0	4	0
								Virginia		00:03:00	13	12	14	21
								Sierra		00:02:45	0	7	5	6
								Arlington		00:03:10	9	7	5	0
								Keystone		00:02:39	18	18	0	0
46.0	2/4/97	20:45:20	eb	59	5159	3	freight							
								Center		00:03:10	5	0	0	0
								Virginia		00:03:10	8	6	9	23
								Sierra		00:03:15	0	20	4	3
								Arlington		00:03:35	7	6	0	5
								Keystone		00:03:30	25	20	0	1
47.0	2/4/97	21:00:10	eb	92	5627	3	freight							
								Center		00:04:05	3	0	0	0
								Virginia		00:04:00	18	5	17	19
								Sierra		00:04:00	0	12	8	9
								Arlington		00:03:50	7	2	5	0
								Keystone		00:04:01	27	12	1	1
48.0	2/4/97	21:35:15	eb	33	3794	4	freight							
								Center		00:02:30	2	0	0	0
								Virginia		00:02:30	12	5	2	12
								Sierra		00:02:30	0	10	4	3
								Arlington		00:02:15	5	8	0	0
								Keystone		00:02:57	15	17	0	0
49.0	2/4/97	22:12:55	wb	68	4280	3	freight							
								Center		00:03:40	3	0	0	0
								Virginia		00:03:15	9	8	12	23
								Sierra		00:03:10	0	6	4	6
								Arlington		00:03:35	4	4	0	1
								Keystone		00:02:25	10	18	0	0
50.0	2/4/97	23:54:20	wb	40	4677	3	freight							
								Center		00:03:20	2	0	0	0
								Virginia		00:03:20	4	7	10	6
								Sierra		00:03:05	0	8	2	3
								Arlington		00:03:20	3	3	0	0
								Keystone		00:02:20	3	3	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
51.0	2/5/97	01:19:55	wb	98	5350	3	freight							
								Center		00:04:35	2	0	1	0
								Virginia		00:04:45	5	8	5	7
								Sierra		00:04:35	0	6	1	1
								Arlington		00:04:55	3	2	2	2
								Keystone		00:04:10	2	1	0	0
52.0	2/5/97	04:00:20	wb	62	5427	3	freight							
								Center		00:04:05	0	0	0	0
								Virginia		00:04:10	1	1	6	3
								Sierra		00:04:04	0	3	0	0
								Arlington		00:04:20	1	0	0	0
								Keystone	53	00:06:00	3	2	0	0
53.0	2/5/97	04:07:25	eb	92	5550	2	freight							
								Center		00:03:00	0	0	0	0
								Virginia		00:03:00	0	0	0	0
								Sierra		00:02:55	0	3	0	0
								Arlington		00:03:00	1	0	1	0
								Keystone	52	00:00:00	0	0	0	0
54.0	2/5/97	05:57:15	wb	77	4673	3	freight							
								Center		00:03:35	5	0	0	0
								Virginia		00:03:35	4	1	3	3
								Sierra		00:03:25	0	7	2	1
								Arlington		00:03:10	4	2	0	0
								Keystone		00:02:49	7	5	0	0
55.0	2/5/97	07:25:00	eb	70	5160	4	freight							
								Center		00:04:05	5	0	0	0
								Virginia		00:04:01	11	12	10	3
								Sierra		00:04:05	0	40	1	6
								Arlington		00:03:56	27	12	3	0
								Keystone		00:04:15	45	40	0	0
56.0	2/5/97	07:43:00	wb	5		1	work							
								Center		00:00:52	1	0	0	0
								Virginia		00:01:00	7	3	2	7
								Sierra		00:01:02	0	12	2	0
								Arlington		00:01:16	10	11	0	1
								Keystone		00:00:40	15	13	1	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data			
											Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
57.0	2/5/97	07:55:00	eb	0		8	lite							
								Center		00:00:38	5	0	0	0
								Virginia		00:00:45	2	4	6	3
								Sierra		00:00:55	0	22	0	1
								Arlington		00:00:52	9	5	3	0
								Keystone		00:00:50	15	13	1	0
58.0	2/5/97	08:21:00	wb	75	4434	4	freight							
								Center		00:05:34	17	0	0	2
								Virginia		00:05:39	17	40	11	24
								Sierra		00:05:25	0	72	8	6
								Arlington		00:05:20	33	27	1	4
								Keystone		00:04:25	75	70	1	0
59.0	2/5/97	10:20:00	wb	79	4609	3	freight							
								Center		00:05:16	23	0	2	1
								Virginia		00:05:13	13	35	21	39
								Sierra		00:05:15	0	40	11	5
								Arlington		00:05:10	19	21	2	5
								Keystone		00:05:05	55	48	0	0
60.0	2/5/97	11:55:00	eb	80	6134	3	freight							
								Center		00:04:15	12	0	6	4
								Virginia		00:04:00	17	40	25	55
								Sierra		00:04:00	0	40	10	9
								Arlington		00:04:14	29	24	3	2
								Keystone		00:04:55	92	90	0	1
61.0	2/5/97	12:01:00	wb	65	3865	3	freight							
								Center		00:03:04	18	0	1	0
								Virginia		00:03:15	15	41	26	26
								Sierra		00:03:05	0	51	8	7
								Arlington		00:03:32	25	22	3	4
								Keystone		00:03:25	77	55	0	2
62.0	2/5/97	12:14:00	wb	74	4687	3	freight							
								Center		00:05:18	14	0	2	3
								Virginia		00:05:05	38	50	55	70
								Sierra		00:05:20	0	34	1	10
								Arlington		00:05:00	39	22	5	6
								Keystone		00:03:40	55	70	0	1

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
63.0	2/5/97	15:50:00	eb	42	3855	2	freight							
								Center		00:02:35	5	0	2	0
								Virginia		00:02:25	16	31	10	35
								Sierra		00:02:20	0	24	7	6
								Arlington		00:02:37	15	11	2	3
								Keystone		00:02:45	78	70	0	0
64.0	2/5/97	16:50:00	eb	12		2	Amtrak							
								Center		00:11:09	33	0	0	0
								Virginia		00:01:15	17	5	10	7
								Sierra		00:01:15	0	12	3	2
								Arlington		00:01:44	14	8	0	4
								Keystone		00:01:05	57	42	0	0
65.0	2/5/97	17:01:00	wb	41		3	freight							
								Center		00:01:34	25	0	0	0
								Virginia		00:01:27	15	11	16	9
								Sierra		00:01:40	0	12	3	4
								Arlington		00:01:51	22	12	2	3
								Keystone		00:01:20	50	35	0	0
66.0	2/5/97	18:00:00	eb	89	5593	4	freight							
								Center		00:03:08	20	0	0	0
								Virginia		00:03:13	15	33	16	21
								Sierra		00:02:20	0	12	20	12
								Arlington		00:03:32	25	20	6	0
								Keystone		00:03:30	53	56	3	2
67.0	2/5/97	19:15:25	wb	48	4512	2	freight							
								Center		00:03:25	7	0	0	0
								Virginia		00:03:30	14	19	19	6
								Sierra		00:03:23	0	29	15	4
								Arlington		00:03:45	11	8	3	0
								Keystone		00:02:49	0	0	0	0
68.0	2/5/97	20:29:20	wb	58	3632	3	freight							
								Center		00:03:15	7	0	2	0
								Virginia		00:03:20	17	17	9	24
								Sierra		00:03:14	0	7	8	6
								Arlington		00:03:20	2	8	2	3
								Keystone		00:02:19	0	0	0	2

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data			
											Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
69.0	2/5/97	20:47:10	eb	56	5805	4	freight							
								Center		00:03:30	10	0	0	0
								Virginia		00:03:25	14	10	24	23
								Sierra		00:03:40	0	17	5	9
								Arlington		00:03:55	7	5	2	1
								Keystone		00:03:50	21	13	0	0
70.0	2/5/97	22:02:10	eb	18		3	freight							
								Center		00:01:05	4	0	0	0
								Virginia		00:01:00	5	1	2	1
								Sierra		00:01:10	0	6	0	3
								Arlington		00:01:15	1	0	1	0
								Keystone		00:01:23	4	5	0	0
71.0	2/5/97	22:22:25	eb	61		4	freight							
								Center		00:03:25	5	0	0	0
								Virginia		00:03:25	8	5	15	13
								Sierra		00:03:23	0	11	2	5
								Arlington		00:03:45	6	5	1	0
								Keystone		00:03:41	6	10	0	0
72.0	2/6/97	00:20:55	eb	42	2457	4	freight							
								Center		00:02:00	3	0	0	0
								Virginia		00:02:00	2	3	6	2
								Sierra		00:02:07	0	5	1	1
								Arlington		00:02:11	3	5	0	0
								Keystone		00:01:51	2	4	0	0
73.0	2/6/97	02:11:05	wb	87	5643	3	freight							
								Center		00:04:15	6	0	0	0
								Virginia		00:04:35	3	0	3	2
								Sierra		00:04:19	0	2	0	3
								Arlington		00:04:39	0	2	0	1
								Keystone		00:03:53	3	4	0	0
74.0	2/6/97	02:27:25		0		0	work							
								Center		00:01:05	1	0	0	0
								Virginia		00:01:05	2	0	0	2
								Sierra		00:01:09	0	3	0	0
								Arlington		00:01:11	0	1	0	0
								Keystone		00:00:51	0	1	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data			
											Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
75.0	2/6/97	03:47:00	wb	39	4022	3	freight							
								Center		00:03:00	1	0	0	0
								Virginia		00:03:10	0	1	1	0
								Sierra		00:03:03	0	1	2	5
								Arlington		00:03:10	0	0	0	0
								Keystone		00:02:13	3	1	0	0
76.0	2/6/97	04:42:35	eb	78	4900	4	freight							
								Center		00:03:05	3	0	0	0
								Virginia		00:03:10	1	2	2	2
								Sierra		00:03:14	0	4	0	1
								Arlington		00:03:35	2	3	0	0
								Keystone		00:03:23	2	0	0	0
77.0	2/6/97	07:05:00	wb	55	4535	5	freight							
								Center		00:03:27	10	0	0	2
								Virginia		00:03:30	9	18	3	5
								Sierra		00:03:33	0	16	5	3
								Arlington		00:03:49	16	12	1	0
								Keystone		00:02:50	37	20	0	0
78.0	2/6/97	07:38:00	wb	78	4353	3	freight							
								Center		00:02:59	7	0	0	0
								Virginia		00:03:01	13	13	6	3
								Sierra		00:03:02	0	15	2	1
								Arlington		00:03:21	27	8	0	0
								Keystone		00:02:40	52	59	0	0
78.1	2/6/97	10:04:05	wb	0		0	gate event							
								Virginia		00:01:15	11	5	5	4
79.0	2/6/97	10:05:00	wb	10		2	Amtrak							
								Center		00:07:37	13	0	0	1
								Virginia		00:01:13	15	15	1	7
								Sierra		00:01:00	0	12	4	10
								Arlington		00:01:00	3	1	1	0
								Keystone		00:01:00	17	17	0	0
79.1	2/6/97	10:43:25	wb	0		0	gate event							
								Virginia		00:01:10	3	7	4	5

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data			
											Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
80.0	2/6/97	10:43:00	wb	12		2	Amtrak							
								Center	81	00:14:38	21	0	2	4
								Virginia	81	00:00:00	0	0	0	0
								Sierra	81	00:00:00	0	0	0	0
								Arlington	81	00:04:40	23	18	1	3
								Keystone		00:01:20	45	25	1	1
81.0	2/6/97	10:55:00	eb	89	6134	4	freight							
								Center	80	00:00:00	0	0	0	0
								Virginia	80	00:03:40	16	36	11	32
								Sierra	80	00:03:47	0	46	1	15
								Arlington	80	00:00:00	0	0	0	0
								Keystone		00:04:45	75	55	2	0
82.0	2/6/97	11:15:00	eb	87	5644	4	freight							
								Center		00:05:00	24	0	2	0
								Virginia		00:05:00	6	41	28	44
								Sierra		00:05:02	0	27	6	6
								Arlington		00:05:10	40	22	5	1
								Keystone		00:04:55	65	42	4	0
83.0	2/6/97	11:20:00	wb	72	4473	3	freight							
								Center		00:04:40	23	0	2	0
								Virginia		00:04:30	13	44	43	40
								Sierra		00:04:20	0	55	12	6
								Arlington		00:04:10	27	19	6	3
								Keystone		00:03:00	45	30	0	0
83.1	2/6/97	13:16:45		0		0	hi-rail							
								Keystone		00:00:45	23	20	0	0
84.0	2/6/97	14:08:00	wb	28	2631	4	freight							
								Center		00:03:10	14	0	3	2
								Virginia		00:03:18	11	25	30	31
								Sierra		00:03:02	0	33	4	7
								Arlington		00:02:40	29	4	1	0
								Keystone		00:02:30	85	70	6	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
85.0	2/6/97	14:42:00	wb	7	650	3	freight							
								Center		00:01:11	3	0	0	0
								Virginia		00:01:20	12	8	15	11
								Sierra		00:01:10	0	33	0	4
								Arlington		00:01:00	9	4	1	0
								Keystone	86	00:04:25	70	57	0	0
86.0	2/6/97	14:46:00	eb	22	2885	2	freight							
								Center		00:02:56	10	0	1	0
								Virginia		00:02:35	18	25	30	30
								Sierra		00:02:30	0	39	5	10
								Arlington		00:02:35	23	17	1	3
								Keystone	85	00:00:00	0	0	0	0
87.0	2/6/97	15:40:00	wb	68	4312	3	freight							
								Center		00:03:24	13	0	0	10
								Virginia		00:03:35	9	35	23	33
								Sierra		00:03:15	0	33	21	7
								Arlington		00:03:55	35	18	3	5
								Keystone		00:03:30	52	52	1	1
88.0	2/6/97	16:38:00	eb	61	6270	4	freight							
								Center		00:03:44	18	0	1	0
								Virginia		00:03:45	13	29	25	29
								Sierra		00:03:45	0	31	9	6
								Arlington		00:04:11	20	26	2	0
								Keystone		00:04:00	108	95	3	0
89.0	2/6/97	17:57:00	eb	85	6114	5	freight							
								Center		00:05:30	20	0	2	[illegible]
								Virginia		00:05:30	17	26	40	30
								Sierra		00:05:35	0	48	5	11
								Arlington		00:05:24	24	23	2	1
								Keystone		00:04:20	96	80	1	0
90.0	2/6/97	18:27:00	wb	82	5028	3	freight							
								Center		00:04:11	13	0	0	0
								Virginia		00:04:15	15	30	15	15
								Sierra		00:04:10	0	40	11	9
								Arlington		00:04:23	21	11	4	3
								Keystone		00:03:25	60	60	3	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
91.0	2/6/97	21:01:10	eb	69	6698	3	freight							
								Center		00:03:55	6	0	4	0
								Virginia		00:04:00	7	11	17	14
								Sierra		00:04:10	0	15	10	9
								Arlington		00:04:10	17	7	0	1
								Keystone		00:04:24	41	25	0	0
92.0	2/6/97	21:20:05	wb	97	5387	3	freight							
								Center		00:03:45	12	0	0	4
								Virginia		00:03:55	18	8	24	16
								Sierra		00:03:40	0	14	3	5
								Arlington		00:03:48	12	5	0	0
								Keystone		00:03:00	0	0	0	0
93.0	2/6/97	22:58:15	wb	15	1071	2	freight							
								Center		00:01:50	4	0	0	0
								Virginia		00:01:45	4	3	4	7
								Sierra		00:01:45	0	5	1	0
								Arlington		00:02:00	1	1	0	0
								Keystone		00:01:34	5	6	0	0
94.0	2/6/97	23:21:20	eb	65	4132	4	freight							
								Center		00:02:25	5	0	0	0
								Virginia		00:02:45	5	11	5	2
								Sierra		00:02:51	0	9	0	5
								Arlington		00:03:00	4	2	1	0
								Keystone		00:02:50	11	14	0	0
95.0	2/7/97	00:18:05	eb	90	5710	4	freight							
								Center		00:03:45	1	0	1	0
								Virginia		00:03:50	6	7	9	2
								Sierra		00:03:53	0	9	3	16
								Arlington		00:04:10	6	4	0	0
								Keystone		00:03:38	4	10	0	0
96.0	2/7/97	00:35:20	wb	76	4949	3	freight							
								Center		00:03:35	4	0	0	0
								Virginia		00:03:35	5	2	10	6
								Sierra		00:03:32	0	7	2	5
								Arlington		00:03:49	2	4	0	0
								Keystone		00:03:42	2	5	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data			
											Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
97.0	2/7/97	01:09:35	wb	58	5651	3	freight							
								Center		00:04:10	6	0	0	0
								Virginia		00:04:15	11	8	9	6
								Sierra		00:04:12	0	6	2	4
								Arlington		00:04:30	0	2	2	0
								Keystone		00:03:12	4	3	0	0
98.0	2/7/97	02:31:00	eb	79	5461	3	freight							
								Center		00:03:15	1	0	0	0
								Virginia		00:03:25	3	2	5	0
								Sierra		00:03:21	0	2	1	4
								Arlington		00:04:05	0	1	0	0
								Keystone		00:03:25	2	0	0	2
99.0	2/7/97	05:14:45	eb	66	4373	5	freight							
								Center		00:02:45	1	0	0	2
								Virginia		00:02:55	3	1	2	5
								Sierra		00:02:52	0	2	0	3
								Arlington		00:03:00	0	0	0	0
								Keystone		00:03:00	2	2	0	0
100.0	2/7/97	06:51:35	eb	61	5512	4	freight							
								Center		00:03:30	3	0	0	0
								Virginia		00:03:30	8	4	4	0
								Sierra		00:03:31	0	9	1	3
								Arlington		00:03:55	14	8	0	0
								Keystone		00:03:25	31	25	0	0
100.1	2/7/97	10:28:40	wb	0		0	gate event							
								Virginia		00:01:05	15	1	4	5
101.0	2/7/97	10:29:00	wb	10		2	Amtrak							
								Center		00:11:00	14	0	2	2
								Virginia		00:01:15	13	9	9	8
								Sierra		00:01:15	0	9	1	0
								Arlington		00:00:55	5	7	0	0
								Keystone		00:00:55	15	18	0	3
101.1	2/7/97	11:20:20	eb	0		0	hi-rail							
								Virginia		00:01:15	9	3	8	8
								Keystone		00:00:50	14	15	1	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data			
											Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
102.0	2/7/97	12:47:00	wb	68	6066	3	freight							
								Center	103	00:04:03	18	0	2	1
								Virginia	103	00:04:26	10	32	20	40
								Sierra	103	00:04:50	0	68	9	5
								Arlington	103	00:05:30	40	48	10	3
								Keystone		00:03:05	93	70	1	1
103.0	2/7/97	12:50:00	eb	100	5955	4	freight							
								Center	102	00:00:00	0	0	0	0
								Virginia	102	00:00:00	0	0	0	0
								Sierra	102	00:00:00	0	0	0	0
								Arlington	102	00:00:00	0	0	0	0
								Keystone		00:04:10	101	81	3	4
104.0	2/7/97	12:58:00	wb	40	3835	3	freight							
								Center		00:02:51	10	0	1	2
								Virginia		00:02:50	18	20	27	20
								Sierra		00:02:45	0	22	10	14
								Arlington		00:02:55	12	24	4	1
								Keystone		00:02:15	65	56	0	0
105.0	2/7/97	14:20:00	wb	85	4857	3	freight							
								Center		00:04:58	22	0	0	4
								Virginia		00:04:54	15	51	26	40
								Sierra		00:04:50	0	62	8	18
								Arlington		00:04:24	19	28	1	2
								Keystone		00:03:00	55	55	0	1
106.0	2/7/97	16:13:00	eb	83	4841	6	freight							
								Center	107	00:06:14	26	0	3	6
								Virginia	107	00:06:50	70	92	30	70
								Sierra	107	00:07:07	0	84	23	16
								Arlington		00:04:25	11	20	9	6
								Keystone		00:05:20	95	70	2	1
107.0	2/7/97	16:15:00	wb	91	5776	3	freight							
								Center	106	00:00:00	0	0	0	0
								Virginia	106	00:00:00	0	0	30	0
								Sierra	106	00:00:00	0	0	0	0
								Arlington		00:03:25	39	33	4	2
								Keystone		00:02:55	65	55	1	1

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
108.0	2/7/97	16:32:00	eb	13		2	Amtrak							
								Center		00:11:42	29	0	3	2
								Virginia		00:01:18	16	22	6	1
								Sierra		00:01:10	0	15	5	2
								Arlington		00:01:21	11	3	0	0
								Keystone		00:00:50	33	34	0	0
109.0	2/7/97	17:14:00	wb	66	6110	3	freight							
								Center		00:04:13	26	0	0	3
								Virginia		00:04:10	15	38	50	40
								Sierra		00:04:05	0	93	8	7
								Arlington		00:04:25	41	27	1	2
								Keystone		00:03:25	95	70	1	8
110.0	2/7/97	18:25:00	eb	24	4200	3	freight							
								Center		00:02:20	11	0	0	0
								Virginia		00:02:30	12	27	35	35
								Sierra		00:02:50	0	43	10	12
								Arlington		00:03:07	24	14	0	0
								Keystone		00:02:55	85	70	0	0
111.0	2/7/97	19:19:05	wb	72	4527	4	freight							
								Center		00:05:20	15	0	0	0
								Virginia		00:05:15	15	15	65	51
								Sierra		00:05:00	0	40	0	10
								Arlington		00:04:50	17	6	4	2
								Keystone		00:03:35	48	25	1	2
112.0	2/7/97	19:49:50	eb	63	6380	3	freight							
								Center		00:00:00	10	0	0	4
								Virginia		00:05:50	14	40	27	49
								Sierra		00:05:30	0	32	18	8
								Arlington		00:05:35	14	12	6	2
								Keystone		00:05:40	47	25	0	2
113.0	2/7/97	21:28:45	eb	59	3099	4	freight							
								Center		00:03:35	5	0	0	0
								Virginia		00:03:50	15	56	18	30
								Sierra		00:03:39	0	26	2	1
								Arlington		00:03:50	15	4	1	4
								Keystone		00:03:35	18	14	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
114.0	2/7/97	21:35:45	wb	53	3164	4	freight							
								Center		00:02:50	7	0	0	0
								Virginia		00:02:55	15	56	24	31
								Sierra		00:02:40	0	26	14	12
								Arlington		00:03:10	15	8	0	2
								Keystone		00:02:07	15	2	0	0
115.0	2/7/97	22:10:50	eb	78	4353	3	freight							
								Center		00:02:40	11	0	0	0
								Virginia		00:02:45	61	22	27	43
								Sierra		00:02:46	0	22	3	2
								Arlington		00:03:10	10	5	0	2
								Keystone		00:02:48	20	16	0	1
116.0	2/7/97	23:27:25	eb	80	4866	2	freight							
								Center		00:02:55	7	0	0	0
								Virginia		00:03:00	14	25	8	24
								Sierra		00:03:20	0	26	5	0
								Arlington		00:03:15	2	4	1	2
								Keystone		00:03:15	15	3	1	0
117.0	2/8/97	00:45:45	wb	39	4183	2	freight							
								Center		00:03:10	6	0	0	0
								Virginia		00:02:50	10	7	5	18
								Sierra		00:02:55	0	13	0	2
								Arlington		00:03:10	8	6	0	0
								Keystone		00:02:50	10	10	0	0
118.0	2/8/97	01:29:00		14		2	Amtrak							
								Center		00:20:40	6	0	0	0
								Virginia		00:01:30	0	4	4	1
								Sierra		00:01:25	0	5	0	3
								Arlington		00:00:45	3	4	0	0
								Keystone		00:01:15	1	2	0	0
119.0	2/8/97	01:55:40	wb	18	1282	2	freight							
								Center		00:01:40	3	0	0	0
								Virginia		00:01:40	0	2	2	3
								Sierra		00:01:30	0	9	0	0
								Arlington		00:02:00	1	1	0	0
								Keystone	120	00:03:30	5	10	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data			
											Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
120.0	2/8/97	02:01:25	eb	70	4542	3	freight							
								Center		00:03:10	6	0	0	0
								Virginia		00:03:35	6	12	2	7
								Sierra		00:03:40	0	9	4	4
								Arlington		00:03:30	3	7	0	0
								Keystone	119	00:00:00	0	0	0	0
121.0	2/8/97	02:19:55	eb	74	4510	4	freight							
								Center		00:03:15	3	0	0	0
								Virginia		00:03:20	8	4	2	0
								Sierra		00:03:24	0	7	0	1
								Arlington		00:03:25	2	2	0	0
								Keystone		00:03:14	4	1	0	0
122.0	2/8/97	03:22:00	eb	76	4694	2	freight							
								Center		00:02:40	3	0	0	0
								Virginia		00:02:45	2	3	0	11
								Sierra		00:02:45	0	7	0	0
								Arlington		00:02:55	1	2	0	0
								Keystone		00:03:10	0	7	0	0
123.0	2/8/97	05:10:05	eb	86	5150	3	freight							
								Center	124	00:08:25	10	0	0	6
								Virginia		00:03:05	1	2	0	0
								Sierra		00:02:50	0	2	0	0
								Arlington		00:03:20	0	1	0	0
								Keystone		00:02:58	1	1	0	0
124.0	2/8/97	05:10:05	wb	72	4567	4	freight							
								Center	123	00:00:00	0	0	0	0
								Virginia		00:06:15	7	7	5	7
								Sierra		00:06:05	0	5	4	3
								Arlington		00:05:50	2	1	2	0
								Keystone		00:04:29	4	4	0	0
125.0	2/8/97	05:52:20	eb	43	2595	3	freight							
								Center		00:02:25	0	0	0	0
								Virginia		00:02:20	4	3	8	4
								Sierra		00:02:25	0	3	0	0
								Arlington		00:02:10	2	2	0	2
								Keystone		00:02:08	1	3	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data			
											Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
126.0	2/8/97	06:16:15	eb	15	3035	3	freight							
								Center		00:05:25	2	0	0	0
								Virginia		00:05:45	5	4	3	7
								Sierra		00:06:05	0	9	0	1
								Arlington		00:06:25	6	0	0	0
								Keystone		00:07:01	7	3	0	0
127.0	2/8/97	10:34:00	eb	0		9	lite							
								Center		00:00:50	1	0	0	0
								Virginia		00:00:55	6	4	11	10
								Sierra		00:01:00	0	8	2	0
								Arlington		00:00:50	6	6	2	0
								Keystone		00:00:50	23	14	0	0
127.1	2/8/97	11:12:35	eb	0		0	hi-rail							
								Keystore		00:00:55	25	22	0	0
128.0	2/8/97	11:23:00	wb	67	4261	4	freight							
								Center		00:03:06	13	0	3	2
								Virginia		00:03:13	13	42	39	40
								Sierra		00:03:10	0	15	8	3
								Arlington		00:03:30	12	11	6	5
								Keystone		00:02:40	55	58	1	0
129.0	2/8/97	12:16:00	wb	47	4419	2	freight							
								Center		00:03:05	12	0	0	0
								Virginia		00:03:05	17	56	45	70
								Sierra		00:03:05	0	27	3	8
								Arlington		00:02:10	21	10	3	7
								Keystone		00:02:30	40	25	1	0
130.0	2/8/97	14:48:00	wb	64		3	freight							
								Center		00:02:57	18	0	0	0
								Virginia		00:03:15	15	34	30	50
								Sierra		00:02:55	0	34	27	11
								Arlington		00:03:00	14	12	3	3
								Keystone		00:02:35	31	39	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
131.0	2/8/97	15:23:00	wb	99	6615	5	freight							
								Center		00:04:14	18	0	3	5
								Virginia		00:04:15	36	52	80	80
								Sierra		00:04:10	0	43	26	18
								Arlington		00:04:20	22	16	12	7
								Keystone		00:03:10	45	40	4	0
132.0	2/8/97	15:51:00		40		2	work							
								Center		00:01:49	7	0	0	2
								Virginia		00:02:00	14	26	35	42
								Sierra		00:01:55	0	16	29	11
								Arlington		00:02:05	5	12	3	2
								Keystone		00:01:35	28	20	0	0
133.0	2/8/97	17:05:00	eb	11		2	Amtrak							
								Center		00:08:53	29	0	1	0
								Virginia		00:01:08	12	16	19	8
								Sierra		00:01:00	0	21	11	17
								Arlington		00:01:00	5	4	7	5
								Keystone		00:01:00	19	20	0	0
134.0	2/8/97	17:22:00	eb	57	6114	3	freight							
								Center		00:04:21	25	0	4	1
								Virginia		00:04:10	14	27	40	70
								Sierra		00:04:20	0	76	38	7
								Arlington		00:04:10	26	25	5	1
								Keystone		00:03:50	45	25	0	0
135.0	2/8/97	18:06:00	eb	63	5922	3	freight							
								Center	136	00:04:32	22	0	2	2
								Virginia	136	00:04:25	15	43	50	60
								Sierra	136	00:04:30	0	38	20	35
								Arlington	136	00:04:55	20	18	2	0
								Keystone		00:04:50	55	55	0	0
136.0	2/8/97	18:08:00	wb	5		1	local							
								Center	135	00:00:00	0	0	0	0
								Virginia	135	00:00:00	0	0	0	0
								Sierra	135	00:00:00	0	0	0	0
								Arlington	135	00:00:00	0	0	0	0
								Keystone		00:00:40	13	13	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
137.0	2/8/97	19:03:50	wb	36	3005	2	freight							
								Center	138	00:02:30	10	0	0	1
								Virginia	138	00:03:45	18	32	21	24
								Sierra	138	00:03:30	0	26	14	20
								Arlington	138	00:03:10	13	7	0	0
								Keystone		00:02:13	24	17	2	0
138.0	2/8/97	19:03:50	eb	5		1	local							
								Center	137	00:00:00	0	0	0	0
								Virginia	137	00:00:00	0	0	0	0
								Sierra	137	00:00:00	0	0	0	0
								Arlington		00:00:00	0	0	0	0
								Keystone		00:00:57	9	8	3	0
139.0	2/8/97	20:23:50	eb	73	4581	4	freight							
								Center		00:02:45	3	0	0	0
								Virginia		00:02:55	18	40	31	28
								Sierra		00:02:55	0	21	15	12
								Arlington	137	00:03:00	8	7	0	2
								Keystone		00:03:07	31	23	0	2
140.0	2/8/97	20:34:20	eb	27	4420	2	freight							
								Center		00:05:30	24	0	0	0
								Virginia		00:05:45	14	58	51	80
								Sierra		00:05:15	0	33	32	10
								Arlington		00:05:00	9	4	4	
								Keystone		00:03:54	17	23	6	0
141.0	2/8/97	21:20:50		40	1746	5	work							
								Center		00:02:00	10	0	0	0
								Virginia		00:02:00	11	31	38	32
								Sierra		00:01:55	0	23	8	8
								Arlington		00:02:00	2	3	4	4
								Keystone		00:01:48	12	8	0	2
142.0	2/8/97	22:09:20	eb	73	4612	3	freight							
								Center		00:05:50	26	0	0	0
								Virginia		00:05:55	13	58	54	85
								Sierra		00:06:05	0	31	25	56
								Arlington		00:06:10	13	12	0	0
								Keystone		00:05:44	30	27	2	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data			
											Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
143.0	2/9/97	00:27:20		0		3	lite							
								Center		00:00:50	4	0	0	0
								Virginia		00:00:45	4	1	3	2
								Sierra		00:00:30	0	3	3	0
								Arlington		00:00:55	0	0	0	0
								Keystone		00:00:45	1	2	0	0
144.0	2/9/97	01:35:05	wb	18	1062	3	freight							
								Center		00:01:20	7	0	0	0
								Virginia		00:01:40	5	8	0	0
								Sierra		00:01:30	0	3	3	5
								Arlington		00:01:35	5	8	0	0
								Keystone		00:01:08	4	2	0	1
145.0	2/9/97	01:52:55	eb	64	5819	3	freight							
								Center		00:03:15	5	0	0	0
								Virginia		00:03:20	14	18	18	18
								Sierra		00:03:25	0	7	7	1
								Arlington		00:03:30	5	3	4	0
								Keystone		00:03:38	4	1	0	0
146.0	2/9/97	01:58:55	wb	38	4719	3	freight							
								Center		00:03:30	9	0	0	0
								Virginia		00:03:40	20	14	3	9
								Sierra		00:03:40	0	8	12	9
								Arlington		00:03:50	3	1	6	0
								Keystone		00:02:41	3	0	0	0
147.0	2/9/97	04:11:40	wb	29	2444	3	freight							
								Center		00:02:15	1	0	0	0
								Virginia		00:02:20	3	7	1	3
								Sierra		00:02:25	0	3	0	1
								Arlington		00:02:30	1	0	0	0
								Keystone		00:02:01	3	2	0	0
148.0	2/9/97	04:51:15	eb	76	4424	4	freight							
								Center		00:02:40	3	0	0	0
								Virginia		00:02:25	5	2	9	6
								Sierra		00:02:25	0	2	0	0
								Arlington		00:02:45	2	2	0	0
								Keystone		00:02:58	0	3	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data			
											Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
149.0	2/9/97	05:30:45		0		3	lite							
								Center		00:00:45	0	0	0	0
								Virginia		00:00:45	0	0	0	0
								Sierra		00:00:42	0	1	0	0
								Arlington		00:00:55	0	0	0	0
								Keystone		00:00:46	1	0	1	0
150.0	2/9/97	05:52:25	wb	37	3717	2	freight							
								Center		00:02:30	2	0	0	0
								Virginia		00:02:40	2	1	1	5
								Sierra		00:02:40	0	2	0	0
								Arlington		00:03:00	2	2	0	0
								Keystone		00:02:04	1	2	0	0
151.0	2/9/97	06:44:00	wb	30	1998	2	freight							
								Center	152	00:03:05	3	0	0	0
								Virginia	152	00:03:05	4	0	3	6
								Sierra	152	00:03:25	0	5	2	3
								Arlington		00:01:40	2	1	0	0
								Keystone		00:01:22	3	2	0	0
152.0	2/9/97	06:44:00	eb	79	5071	5	freight							
								Center	151	00:00:00	0	0	0	0
								Virginia	151	00:00:00	0	0	0	0
								Sierra	151	00:00:00	0	0	0	0
								Arlington		00:03:30	2	2	1	2
								Keystone		00:03:27	2	4	0	0
153.0	2/9/97	08:20:00	eb	57	5071	3	freight							
								Center	154	00:05:08	15	0	3	2
								Virginia	154	00:00:00	10	27	19	27
								Sierra	154	00:06:00	0	27	8	10
								Arlington		00:03:26	10	3	3	3
								Keystone		00:02:30	22	20	0	0
154.0	2/9/97	08:22:00	wb	46	4324	2	freight							
								Center	153	00:00:00	0	0	0	0
								Virginia	153	00:00:00	0	0	0	0
								Sierra	153	00:00:00	0	0	0	0
								Arlington		00:03:15	7	4	6	0
								Keystone		00:02:50	10	12	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data			
											Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
155.0	2/9/97	08:49:00	eb	91	5658	3	freight							
								Center		00:03:14	11	0	1	1
								Virginia		00:03:20	14	12	19	27
								Sierra		00:03:30	0	22	2	6
								Arlington		00:04:00	7	7	1	0
								Keystone		00:03:50	40	39	2	0
156.0	2/9/97	08:53:00	wb	0		3	lite							
								Center		00:00:42	5	0	1	0
								Virginia		00:00:40	3	5	4	15
								Sierra		00:00:40	0	12	3	0
								Arlington		00:01:00	3	2	0	1
								Keystone		00:00:40	5	6	0	0
156.1	2/9/97	10:47:00	wb	0		0	gate event							
								Virginia		00:01:00	7	4	7	3
157.0	2/9/97	10:52:00	wb	15		2	Amtrak							
								Center		00:14:55	15	0	4	1
								Virginia		00:01:00	10	12	14	20
								Sierra		00:01:10	0	12	5	10
								Arlington		00:01:15	4	4	4	2
								Keystone		00:01:15	13	16	0	0
157.1	2/9/97	11:36:05	wb	0		0	gate event							
								Virginia		00:01:00	13	10	7	15
158.0	2/9/97	11:35:00	wb	14		2	Amtrak							
								Center		00:09:57	13	0	0	3
								Virginia		00:01:27	13	18	12	24
								Sierra		00:01:35	0	14	2	0
								Arlington		00:01:10	15	5	0	3
								Keystone		00:02:15	29	25	0	0
159.0	2/9/97	12:13:00	wb	84	4621	3	freight							
								Center		00:03:15	23	0	0	17
								Virginia		00:03:20	13	31	40	60
								Sierra		00:03:15	0	20	14	10
								Arlington		00:03:30	11	8	6	4
								Keystone		00:02:55	30	25	3	4

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
160.0	2/9/97	12:21:00	eb	71	4793	3	freight							
								Center		00:02:56	12	0	5	0
								Virginia		00:02:55	25	39	35	70
								Sierra		00:03:00	0	28	10	6
								Arlington		00:03:05	14	6	4	2
								Keystone		00:03:15	42	39	0	5
161.0	2/9/97	12:35:00	eb	84	4495	3	freight							
								Center		00:02:46	7	0	1	1
								Virginia		00:02:55	12	23	32	25
								Sierra		00:02:55	0	29	15	12
								Arlington		00:02:55	14	11	3	2
								Keystone		00:03:15	33	33	0	0
162.0	2/9/97	12:54:00	wb	97	5740	3	freight							
								Center		00:04:04	11	0	15	0
								Virginia		00:04:15	14	51	65	55
								Sierra		00:04:05	0	41	28	30
								Arlington		00:03:46	16	20	6	3
								Keystone		00:03:30	43	35	1	0
163.0	2/9/97	14:48:00	wb	86	5236	3	freight							
								Center		00:03:47	26	0	0	0
								Virginia		00:03:52	12	39	25	50
								Sierra		00:03:55	0	31	13	22
								Arlington		00:03:46	15	13	13	1
								Keystone		00:03:10	44	35	0	0
164.0	2/9/97	15:55:00	eb	59	5687	2	freight							
								Center		00:03:21	21	0	5	1
								Virginia		00:03:25	12	37	37	25
								Sierra		00:03:20	2	31	8	15
								Arlington		00:03:30	16	15	5	1
								Keystone		00:03:35	30	30	1	1
165.0	2/9/97	16:15:00		0		2	lite							
								Center		00:00:36	2	0	0	0
								Virginia		00:00:39	12	4	11	15
								Sierra		00:00:40	0	7	2	0
								Arlington		00:00:45	5	7	0	1
								Keystone		00:00:40	8	7	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data: Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
166.0	2/9/97	16:21:00	wb	79	5041	2	freight							
								Center		00:03:45	20	0	2	0
								Virginia		00:03:50	10	12	50	64
								Sierra		00:03:40	0	24	32	27
								Arlington		00:03:40	17	8	5	7
								Keystone		00:03:00	40	35	0	0
167.0	2/9/97	17:20:00	wb	32	3152	2	freight							
								Center		00:02:27	7	0	1	1
								Virginia		00:02:30	9	20	39	25
								Sierra		00:02:30	0	24	4	4
								Arlington		00:02:40	12	0	3	5
								Keystone		00:02:05	30	38	0	0
168.0	2/9/97	19:15:35	eb	0		8	lite							
								Center		00:01:00	2	0	0	0
								Virginia		00:01:00	2	4	3	2
								Sierra		00:01:05	0	6	2	0
								Arlington		00:01:05	4	2	0	2
								Keystone		00:01:13	10	13	0	0
169.0	2/9/97	19:44:10	eb	92	5939	4	freight							
								Center		00:03:20	7	0	0	0
								Virginia		00:03:25	15	11	31	27
								Sierra		00:03:40	0	15	9	4
								Arlington		00:03:50	6	9	0	0
								Keystone		00:03:53	32	27	0	1
170.0	2/10/97	01:15:10	wb	52	2884	2	freight							
								Center		00:02:20	5	0	0	0
								Virginia		00:02:25	1	2	4	4
								Sierra		00:02:15	0	4	1	0
								Arlington		00:02:35	2	1	2	3
								Keystone		00:01:53	2	0	0	0
171.0	2/10/97	02:05:50	eb	90	5894	4	freight							
								Center		00:03:25	3	0	0	0
								Virginia		00:03:30	6	6	6	19
								Sierra		00:03:35	0	3	3	1
								Arlington	0	00:03:45	0	3	0	0
								Keystone		00:04:01	2	2	0	0

Train/ Event #	Date	Time	Direction	# Train cars	Train Length (Ft.)	# Locomotives	Train Type	Street	Overlap Train #	Observed Elapsed Gate Down Time	Queue Data			
											Cars NB	Cars SB	Pedestrians NB	Pedestrians SB
172.0	2/10/97	02:29:10	wb	87	5290	2	freight							
								Center		00:03:40	1	0	0	0
								Virginia		00:03:50	3	2	6	9
								Sierra		00:03:50	0	4	0	0
								Arlington		00:04:00	1	0	0	0
								Keystone		00:03:21	0	1	2	0
173.0	2/10/97	03:52:40	eb	57	5859	4	freight							
								Center		00:03:25	1	0	0	0
								Virginia		00:03:30	1	2	0	2
								Sierra		00:03:50	0	0	1	1
								Arlington		00:03:45	2	0	0	0
								Keystone		00:03:57	1	3	0	0
174.0	2/10/97	04:14:15	wb	35	2231	2	freight							
								Center		00:02:00	3	0	1	0
								Virginia		00:02:05	1	0	0	0
								Sierra		00:02:02	0	1	0	0
								Arlington		00:02:00	0	1	0	0
								Keystone		00:01:45	0	0	0	0
175.0	2/10/97	05:43:00	wb	49	5857	3	freight							
								Center		00:03:52	6	0	0	0
								Virginia		00:04:05	4	1	2	3
								Sierra		00:03:50	0	3	0	0
								Arlington		00:03:45	2	3	0	0
								Keystone		00:02:57	10	7	0	0
176.0	2/10/97	05:59:00	wb	0		2	lite							
								Center		00:00:43	1	0	0	0
								Virginia		00:00:45	1	0	1	0
								Sierra		00:00:45	0	1	0	0
								Arlington		00:00:55	0	0	0	0
								Keystone		00:00:41	1	1	0	0
177.0	2/10/97	06:33:00	eb	0		2	lite							
								Center		00:00:35	1	0	0	0
								Virginia		00:00:40	0	0	0	0
								Sierra		00:00:50	0	0	0	0
								Arlington		00:00:55	0	0	0	0
								Keystone		00:00:37	4	6	0	0

Appendix H
STREET TRAFFIC VOLUMES BY 15 MINUTE PERIODS DURING THE TRAIN SURVEY

ID Location	Date	0:00 - 0:15	0:15 - 0:30	0:30 - 0:45	0:45 - 1:00	1:00 - 1:15	1:15 - 1:30	1:30 - 1:45	1:45 - 2:00	2:00 - 2:15	2:15 - 2:30	2:30 - 2:45	2:45 - 3:00	3:00 - 3:15	3:15 - 3:30	3:30 - 3:45	3:45 - 4:00	4:00 - 4:15	4:15 - 4:30
KEYSTONE SOUTHBOUND	02/02/97																		
KEYSTONE SOUTH BOUND	02/03/97	48	47	28	29	31	15	18	11	29	14	19	20	22	10	10	20	9	20
KEYSTONE SOUTHBOUND	02/04/97	47	47	39	21	18	18	15	23	18	17	21	26	21	12	9	20	16	5
KEYSTONE SOUTHBOUND	02/05/97	23	22	25	18	19	9	10	18	10	16	8	12	13	16	6	8	10	6
KEYSTONE SOUTHBOUND	02/06/97	29	28	14	17	11	24	12	14	13	10	14	8	8	9	8	11	4	3
KEYSTONE SOUTHBOUND	02/07/97	35	52	37	34	30	26	26	15	21	26	9	23	22	11	5	9	7	12
KEYSTONE SOUTHBOUND	02/08/97	75	70	56	40	37	36	23	33	48	32	25	19	30	22	13	17	22	19
KEYSTONE SOUTHBOUND	02/09/97	63	52	47	36	40	26	26	22	14	11	29	20	20	14	8	13	10	15
KEYSTONE SOUTHBOUND	02/10/97	33	22	6	8	18	13	11	5	12	10	11	12	10	5	5	5	10	3
KEYSTONE NORTHBOUND	02/02/97																		
KEYSTONE NORTHBOUND	02/03/97	26	19	14	19	17	15	13	13	9	15	13	16	7	10	6	10	9	15
KEYSTONE NORTHBOUND	02/04/97	25	25	12	12	14	21	15	11	18	9	7	13	10	8	17	9	9	16
KEYSTONE NORTHBOUND	02/05/97	54	36	34	41	29	16	31	22	19	17	14	28	20	17	19	13	10	20
KEYSTONE NORTHBOUND	02/06/97	37	39	29	35	37	9	25	19	18	11	21	7	8	15	21	19	9	19
KEYSTONE NORTHBOUND	02/07/97	41	33	16	35	7	20	18	16	18	15	16	9	17	13	11	6	7	17
KEYSTONE NORTHBOUND	02/08/97	53	46	67	55	47	39	38	34	37	26	21	31	28	16	9	23	14	17
KEYSTONE NORTHBOUND	02/09/97	114	63	68	71	71	51	60	32	48	32	9	40	29	34	15	33	22	19
KEYSTONE NORTHBOUND	02/10/97	59	34	32	30	24	28	29	12	19	10	16	10	6	21	16	20	23	19
ARLINGTON SOUTHBOUND	02/02/97																		
ARLINGTON SOUTHBOUND	02/03/97	35	25	16	16	21	13	10	15	13	15	9	11	10	6	7	9	6	9
ARLINGTON SOUTHBOUND	02/04/97	10	17	8	5	6	7	8	6	14	11	3	6	5	5	6	3	1	5
ARLINGTON SOUTHBOUNC	02/05/97	13	21	16	13	13	10	6	14	17	16	4	8	9	6	8	8	3	6
ARLINGTON SOUTHBOUND	02/06/97	16	24	11	15	17	14	16	19	10	13	7	4	6	10	7	4	11	3
ARLINGTON SOUTHBOUND	02/07/97	15	24	24	21	20	12	3	21	19	20	4	9	13	6	10	13	5	5
ARLINGTON SOUTHBOUND	02/08/97	42	28	42	30	45	37	29	34	38	30	44	29	28	26	25	23	16	10
ARLINGTON SOUTHBOUND	02/09/97	0	1	0	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0
ARLINGTON SOUTHBOUND	02/10/97	19	16	15	11	9	9	8	6	6	15	5	9	7	8	2	16	5	7
ARLINGTON NORTHBOUND	02/02/97																		
ARLINGTON NORTHBOUND	02/03/97	52	46	20	31	32	27	29	31	26	30	15	15	17	17	9	11	9	12
ARLINGTON NORTHBOUND	02/04/97	40	20	13	16	16	13	5	10	15	10	6	6	4	9	6	6	4	4
ARLINGTON NORTHBOUND	02/05/97	29	20	14	22	19	18	15	13	13	10	6	7	5	9	10	9	7	6
ARLINGTON NORTHBOUND	02/06/97	26	25	20	22	16	9	14	19	9	6	6	7	9	9	9	4	7	9
ARLINGTON NORTHBOUND	02/07/97	18	19	14	27	21	22	25	15	10	10	6	8	6	9	13	11	9	8
ARLINGTON NORTHBOUND	02/08/97	24	29	22	21	22	24	28	21	17	19	20	17	10	8	10	15	10	11
ARLINGTON NORTHBOUND	02/09/97	42	32	30	29	32	27	36	14	25	16	17	13	12	14	12	11	10	15
ARLINGTON NORTHBOUND	02/10/97	14	7	11	11	12	9	9	6	3	9	4	3	3	4	2	4	6	7
SIERRA ONE WAY SOUTHBOUND	02/03/97	79	74	63	67	49	88	63	49	49	65	51	40	35	49	35	42	33	18
SIERRA ONE WAY SOUTHBOUND	02/04/97	71	45	67	53	54	47	62	55	54	51	36	17	20	33	19	39	12	28
SIERRA ONE WAYSOUTHBOUND	02/05/97	44	40	39	34	30	34	28	31	27	24	21	15	16	21	13	12	14	13
SIERRA ONE WAY SOUTHBOUND	02/06/97	33	39	28	32	31	30	40	24	24	28	13	7	13	11	14	13	14	13
SIERRA ONE WAY SOUTHBOUND	02/07/97	34	32	27	29	21	38	27	21	21	28	22	17	15	21	15	18	14	7
SIERRA ONE WAY SOUTHBOUND	02/08/97	82	71	63	48	51	29	50	59	48	34	38	33	35	26	35	30	29	13
SIERRA ONE WAY SOUTHBOUND	02/09/97	79	61	62	63	64	57	59	50	43	33	42	34	32	30	22	28	15	28
SIERRA ONE WAY SOUTHBOUND	02/10/97	37	36	29	26	30	26	31	22	22	29	16	13	10	19	18	12	11	13
VIRGINIA SOUTHBOUND	02/02/97																		
VIRGINIA SOUTHBOUND	02/03/97	49	69	53	40	36	52	31	38	31	34	32	39	26	20	25	18	14	20
VIRGINIA SOUTHBOUND	02/04/97	27	25	20	14	24	24	21	18	17	20	18	12	17	18	11	11	9	9
VIRGINIA SOUTHBOUND	02/05/97	26	24	19	13	23	23	20	17	16	19	17	11	16	17	10	10	9	9
VIRGINIA SOUTHBOUND	02/06/97	35	36	28	32	31	28	22	21	11	15	13	18	21	13	19	8	9	12
VIRGINIA SOUTHBOUND	02/07/97	33	31	33	22	23	36	29	14	28	23	17	17	15	27	15	19	18	14
VIRGINIA SOUTHBOUND	02/08/97	45	39	51	34	27	31	42	26	29	17	29	27	21	14	15	14	10	15
VIRGINIA SOUTHBOUND	02/09/97	95	84	91	65	67	67	60	60	41	41	26	25	21	33	30	24	22	30
VIRGINIA SOUTHBOUND	02/10/97	27	24	23	19	26	12	25	20	12	15	11	14	11	17	19	5	15	9
VIRGINIA NORTHBOUND	02/02/97																		
VIRGINIA NORTHBOUND	02/03/97	37	27	16	28	22	25	20	20	19	15	16	27	21	29	19	30	26	28
VIRGINIA NORTHBOUND	02/04/97	80	62	115	7	10	12	5	6	7	6	9	12	13	14	17	22	19	26
VIRGINIA NORTHBOUND	02/05/97	61	56	75	16	14	15	14	13	11	8	10	13	11	11	12	18	15	18
VIRGINIA NORTHBOUND	02/06/97	41	49	34	24	18	18	22	20	14	10	10	13	8	7	7	13	11	7
VIRGINIA NORTHBOUND	02/07/97	18	21	10	21	87	99	29	21	28	13	7	9	7	9	84	134	16	5
VIRGINIA NORTHBOUND	02/08/97	71	67	50	56	45	41	54	60	46	37	31	33	32	23	37	20	25	18
VIRGINIA NORTHBOUND	02/09/97	127	82	93	95	102	75	82	64	53	52	46	46	39	36	34	36	29	29
VIRGINIA NORTHBOUND	02/10/97	26	31	28	25	24	30	19	13	14	16	12	12	14	15	9	11	8	11
CENTER ONE WAY NORTHBOUN	02/02/97																		
CENTER ONE WAY NORTHBOUN	02/03/97	64	49	60	54	36	30	48	48	47	32	25	23	32	27	25	9	25	22
CENTER ONE WAY NORTHBOUN	02/04/97	32	36	26	25	20	9	17	25	21	15	16	8	18	10	11	7	8	13
CENTER ONE WAY NORTHBOUN	02/05/97	34	39	35	29	30	19	28	24	24	21	16	14	18	14	16	9	13	18
CENTER ONE WAY NORTHBOUN	02/06/97	35	42	44	32	40	28	39	22	25	26	15	20	18	17	20	10	17	22
CENTER ONE WAY NORTHBOUN	02/07/97	48	37	42	54	25	34	29	23	30	37	22	19	18	23	23	11	13	18
CENTER ONE WAY NORTHBOUN	02/08/97	91	104	86	96	80	68	1	40	62	66	49	56	26	41	52	34	42	43
CENTER ONE WAY NORTHBOUN	02/09/97	58	54	44	47	56	52	44	33	41	35	26	23	44	22	22	27	21	32
CENTER ONE WAY NORTHBOUN	02/10/97	39	29	26	31	23	22	21	15	21	29	18	17	8	13	14	16	9	8

TABLE 1. TRAFFIC DATA

ID Location	Date	4:30 - 4:45	4:45 - 5:00	5:00 - 5:15	5:15 - 5:30	5:30 - 5:45	5:45 - 6:00	6:00 - 6:15	6:15 - 6:30	6:30 - 6:45	6:45 - 7:00	7:00 - 7:15	7:15 - 7:30	7:30 - 7:45	7:45 - 8:00	8:00 - 8:15	8:15 - 8:30	8:30 - 8:45	8:45 - 9:00
KEYSTONE SOUTHBOUND	02/02/97																		
KEYSTONE SOUTH BOUND	02/03/97	14	22	28	25	30	40	48	83	143	247	177	207	350	345	301	283	328	305
KEYSTONE SOUTHBOUND	02/04/97	21	48	51	78	127	232	178	242	295	389	252	242	240	252	251	244	278	306
KEYSTONE SOUTHBOUND	02/05/97	7	6	7	12	27	33	24	58	84	175	120	168	189	237	203	198	205	218
KEYSTONE SOUTHBOUND	02/06/97	5	9	9	14	26	28	37	69	84	145	130	158	180	244	199	215	202	218
KEYSTONE SOUTHBOUND	02/07/97	13	12	8	28	62	38	47	107	118	213	157	231	260	307	265	280	261	285
KEYSTONE SOUTHBOUND	02/08/97	13	15	12	16	18	19	12	29	20	33	37	56	63	90	70	78	114	139
KEYSTONE SOUTHBOUND	02/09/97	9	13	7	11	12	15	12	17	18	18	28	25	37	49	37	54	79	98
KEYSTONE SOUTHBOUND	02/10/97	6	6	13	11	21	30	29	62	79	156	114	164	166	241	186	209	142	201
KEYSTONE NORTHBOUND	02/02/97																		
KEYSTONE NORTHBOUND	02/03/97	16	16	24	22	34	47	49	71	152	123	141	162	268	222	210	203	204	265
KEYSTONE NORTHBOUND	02/04/97	19	11	14	16	24	42	46	85	126	152	171	209	287	225	196	218	192	235
KEYSTONE NORTHBOUND	02/05/97	31	18	38	58	62	71	70	106	198	241	228	227	345	384	303	219	354	322
KEYSTONE NORTHBOUND	02/06/97	21	15	16	29	53	82	59	110	183	213	194	243	348	353	287	264	317	294
KEYSTONE NORTHBOUND	02/07/97	18	22	16	33	54	44	59	88	144	139	202	210	304	263	234	261	268	313
KEYSTONE NORTHBOUND	02/08/97	17	27	25	20	40	38	22	51	71	57	72	80	107	116	106	97	153	150
KEYSTONE NORTHBOUND	02/09/97	30	22	15	15	26	14	30	35	55	44	60	82	80	121	81	102	160	157
KEYSTONE NORTHBOUND	02/10/97	29	25	17	28	47	87	97	107	186	192	264	291	419	407	320	292	212	360
ARLINGTON SOUTHBOUND	02/02/97																		
ARLINGTON SOUTHBOUND	02/03/97	6	3	12	10	18	19	21	28	31	63	61	87	113	188	143	120	117	149
ARLINGTON SOUTHBOUND	02/04/97	2	6	2	8	6	15	9	11	12	36	35	39	57	106	62	61	66	77
ARLINGTON SOUTHBOUND	02/05/97	6	7	3	10	13	15	15	17	32	46	44	51	79	142	96	86	86	104
ARLINGTON SOUTHBOUND	02/06/97	8	9	12	12	14	15	22	11	26	42	54	78	94	160	138	105	95	106
ARLINGTON SOUTHBOUND	02/07/97	10	8	4	13	19	14	20	23	51	55	53	62	100	177	130	110	105	131
ARLINGTON SOUTHBOUND	02/08/97	25	15	15	14	6	18	12	16	22	24	11	9	29	35	23	36	44	48
ARLINGTON SOUTHBOUND	02/09/97	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ARLINGTON SOUTHBOUND	02/10/97	4	3	4	5	10	12	12	12	20	32	39	54	68	94	71	78	66	84
ARLINGTON NORTHBOUND	02/02/97																		
ARLINGTON NORTHBOUND	02/03/97	10	13	14	21	27	45	47	60	76	136	97	134	198	259	196	178	207	226
ARLINGTON NORTHBOUND	02/04/97	5	7	6	12	12	21	17	33	36	63	44	65	120	109	98	90	105	118
ARLINGTON NORTHBOUND	02/05/97	9	11	7	14	16	19	20	37	40	60	41	66	113	124	103	94	101	112
ARLINGTON NORTHBOUND	02/06/97	8	7	8	9	13	21	13	34	37	57	43	69	111	142	90	108	121	125
ARLINGTON NORTHBOUND	02/07/97	13	15	8	15	19	17	22	40	44	57	38	67	106	138	107	97	97	106
ARLINGTON NORTHBOUND	02/08/97	10	8	5	7	12	18	15	21	26	32	21	30	30	39	7	36	40	41
ARLINGTON NORTHBOUND	02/09/97	11	5	10	6	15	10	10	17	16	21	22	17	29	39	30	44	53	70
ARLINGTON NORTHBOUND	02/10/97	8	2	9	10	4	14	97	186	38	69	57	62	81	167	97	75	55	82
SIERRA ONE WAY SOUTHBOUND	02/03/97	19	33	28	49	56	49	86	72	95	128	198	209	316	435	354	291	265	289
SIERRA ONE WAY SOUTHBOUND	02/04/97	24	23	25	30	51	42	43	73	77	105	113	163	226	318	234	240	224	214
SIERRA ONE WAYSOUTHBOUND	02/05/97	10	14	16	22	27	25	26	43	52	66	71	95	131	232	181	132	117	128
SIERRA ONE WAY SOUTHBOUND	02/06/97	10	11	20	15	23	21	28	32	26	54	60	92	117	173	175	127	129	117
SIERRA ONE WAY SOUTHBOUND	02/07/97	6	14	12	21	24	21	37	31	41	55	85	90	136	187	152	125	114	124
SIERRA ONE WAY SOUTHBOUND	02/08/97	17	15	17	21	16	23	28	19	30	35	37	57	62	25	65	59	57	65
SIERRA ONE WAY SOUTHBOUND	02/09/97	16	17	15	19	27	19	19	25	29	35	38	32	46	70	65	59	57	65
SIERRA ONE WAY SOUTHBOUND	02/10/97	8	15	16	20	17	24	30	34	40	50	58	99	111	145	131	135	83	95
VIRGINIA SOUTHBOUND	02/02/97																		
VIRGINIA SOUTHBOUND	02/03/97	19	23	17	17	27	25	30	39	43	58	44	59	72	108	78	88	89	80
VIRGINIA SOUTHBOUND	02/04/97	13	11	7	13	8	15	14	14	21	32	37	49	54	61	55	63	53	52
VIRGINIA SOUTHBOUND	02/05/97	12	10	7	12	8	14	13	13	20	30	35	47	51	58	52	60	50	49
VIRGINIA SOUTHBOUND	02/06/97	14	9	18	14	13	17	14	16	22	30	31	40	48	73	59	54	47	49
VIRGINIA SOUTHBOUND	02/07/97	11	8	17	15	21	15	14	11	24	28	37	39	45	63	61	64	48	45
VIRGINIA SOUTHBOUND	02/08/97	8	13	7	12	14	11	13	9	16	13	14	21	20	16	26	24	29	21
VIRGINIA SOUTHBOUND	02/09/97	19	13	12	14	22	22	18	17	25	14	22	32	37	30	44	41	49	35
VIRGINIA SOUTHBOUND	02/10/97	11	5	6	9	9	12	19	15	23	20	37	46	45	58	51	39	48	48
VIRGINIA NORTHBOUND	02/02/97																		
VIRGINIA NORTHBOUND	02/03/97	35	52	57	61	55	57	59	42	56	45	70	125	121	178	172	165	199	187
VIRGINIA NORTHBOUND	02/04/97	25	38	43	43	39	40	50	53	61	115	89	74	86	110	117	122	92	102
VIRGINIA NORTHBOUND	02/05/97	17	24	26	26	29	28	30	34	44	74	61	56	67	85	87	90	72	82
VIRGINIA NORTHBOUND	02/06/97	9	9	9	8	19	16	10	15	26	32	32	38	47	59	56	58	51	61
VIRGINIA NORTHBOUND	02/07/97	10	8	7	9	13	13	15	14	17	27	24	22	38	44	37	37	35	42
VIRGINIA NORTHBOUND	02/08/97	17	21	15	20	21	28	24	20	30	33	43	36	53	35	50	49	55	47
VIRGINIA NORTHBOUND	02/09/97	24	15	19	13	19	12	21	19	30	38	31	30	61	57	63	61	74	52
VIRGINIA NORTHBOUND	02/10/97	8	11	16	16	13	19	24	22	40	35	47	46	75	82	69	73	63	96
CENTER ONE WAY NORTHBOUN	02/02/97																		
CENTER ONE WAY NORTHBOUN	02/03/97	22	24	32	38	39	41	47	54	53	72	62	59	104	116	101	107	104	107
CENTER ONE WAY NORTHBOUN	02/04/97	13	12	9	17	22	25	17	26	28	28	18	45	39	45	47	46	35	52
CENTER ONE WAY NORTHBOUN	02/05/97	12	15	14	25	27	22	24	33	33	43	35	55	49	66	67	61	51	67
CENTER ONE WAY NORTHBOUN	02/06/97	10	18	19	33	32	18	31	39	37	57	52	65	59	86	86	76	66	81
CENTER ONE WAY NORTHBOUN	02/07/97	20	24	21	29	31	43	36	33	33	44	58	72	64	100	90	70	64	76
CENTER ONE WAY NORTHBOUN	02/08/97	29	36	28	74	46	52	54	58	53	67	65	85	74	106	84	74	80	78
CENTER ONE WAY NORTHBOUN	02/09/97	19	15	21	21	19	32	17	28	27	29	32	35	26	39	67	41	56	49
CENTER ONE WAY NORTHBOUN	02/10/97	13	11	11	14	17	19	24	26	20	22	29	32	52	41	53	65	46	35

TABLE 1. TRAFFIC DATA

ID Location	Date	9:00 - 9:15	9:15 - 9:30	9:30 - 9:45	9:45 - 10:00	10:00 - 10:1	10:15 - 10:3	10:30 - 10:4	10:45 - 11:0	11:00 - 11:1	11:15 - 11:3	11:30 - 11:4	11:45 - 12:0	12:00 - 12:1	12:15 - 12:3	12:30 - 12:4	12:45 - 13:0	13:00 - 13:1	13:15 - 13:3
KEYSTONE SOUTHBOUND	02/02/97																		
KEYSTONE SOUTH BOUND	02/03/97	307	251	301	319	212	232	252	244	258	279	289	318	346	354	335	226	324	335
KEYSTONE SOUTHBOUND	02/04/97	303	270	256	297	227	216	272	280	272	265	289	382	389	357	377	370	305	301
KEYSTONE SOUTHBOUND	02/05/97	204	178	208	171	178	157	171	201	185	229	207	221	254	237	245	240	271	248
KEYSTONE SOUTHBOUND	02/06/97	215	185	218	185	185	152	168	152	114	213	223	291	276	229	266	274	260	252
KEYSTONE SOUTHBOUND	02/07/97	269	251	260	288	258	235	237	272	272	258	291	338	352	384	285	284	352	288
KEYSTONE SOUTHBOUND	02/08/97	107	185	189	159	178	194	181	220	162	189	185	240	261	214	211	221	234	225
KEYSTONE SOUTHBOUND	02/09/97	74	128	131	110	122	134	125	152	112	131	128	166	181	148	146	153	162	156
KEYSTONE SOUTHBOUND	02/10/97	190	177	147															
KEYSTONE NORTHBOUND	02/02/97																		
KEYSTONE NORTHBOUND	02/03/97	281	209	180	210	182	151	217	209	182	232	330	251	230	277	322	285	226	238
KEYSTONE NORTHBOUND	02/04/97	350	258	225	245	189	220	264	256	226	255	404	306	301	336	280	274	234	270
KEYSTONE NORTHBOUND	02/05/97	385	255	284	279	249	190	359	281	288	293	460	314	422	344	409	339	334	352
KEYSTONE NORTHBOUND	02/06/97	423	312	288	294	228	266	311	249	212	293	436	420	455	347	458	386	388	324
KEYSTONE NORTHBOUND	02/07/97	350	241	278	290	268	265	248	337	304	362	355	500	486	429	368	307	392	400
KEYSTONE NORTHBOUND	02/08/97	123	181	187	218	205	207	258	254	237	317	334	314	278	235	228	245	352	298
KEYSTONE NORTHBOUND	02/09/97	129	190	198	229	215	217	271	266	249	332	350	329	292	247	239	257	369	310
KEYSTONE NORTHBOUND	02/10/97	388	276	299															
ARLINGTON SOUTHBOUND	02/02/97																		
ARLINGTON SOUTHBOUND	02/03/97	128	132	136	142	121	106	145	160	150	143	165	172	192	175	162	172	181	156
ARLINGTON SOUTHBOUND	02/04/97	75	63	60	61	54	79	70	72	74	67	99	95	81	90	94	100	90	102
ARLINGTON SOUTHBOUND	02/05/97	88	83	85	78	83	86	97	91	105	85	107	122	116	108	112	123	126	120
ARLINGTON SOUTHBOUND	02/06/97	79	97	88	104	95	112	127	99	103	112	162	126	152	126	119	138	146	118
ARLINGTON SOUTHBOUND	02/07/97	96	102	109	95	111	92	124	109	135	102	114	149	150	125	130	145	162	138
ARLINGTON SOUTHBOUND	02/08/97	27	22	21	22	19	28	25	26	26	24	35	34	29	32	33	35	32	36
ARLINGTON SOUTHBOUND	02/09/97	0	0	14	27	32	36	51	46	42	44	38	32	32	42	45	69	55	56
ARLINGTON SOUTHBOUND	02/10/97	59	70	70	54														
ARLINGTON NORTHBOUND	02/02/97																		
ARLINGTON NORTHBOUND	02/03/97	171	178	197	194	173	150	214	207	180	202	246	206	235	217	231	184	117	149
ARLINGTON NORTHBOUND	02/04/97	117	113	80	83	73	111	113	91	80	108	106	104	131	106	120	107	83	122
ARLINGTON NORTHBOUND	02/05/97	109	100	84	95	86	104	104	92	88	113	114	114	132	102	116	98	109	116
ARLINGTON NORTHBOUND	02/06/97	110	102	89	95	88	109	99	96	71	103	102	117	141	124	113	106	102	137
ARLINGTON NORTHBOUND	02/07/97	101	87	88	106	98	96	94	92	95	117	122	123	132	97	112	88	135	109
ARLINGTON NORTHBOUND	02/08/97	36	34	29	31	29	36	33	32	23	34	34	38	46	41	37	35	34	45
ARLINGTON NORTHBOUND	02/09/97	38	111	34	39	31	45	56	30	42	25	38	45	53	262	114	88	66	61
ARLINGTON NORTHBOUND	02/10/97	65	54	66	67	12													
SIERRA ONE WAY SOUTHBOUND	02/03/97	282	251	270	293	291	258	202	330	293	332	311	265	284	324	305	342	343	405
SIERRA ONE WAY SOUTHBOUND	02/04/97	213	199	186	213	142	177	193	157	122	116	110	130	118	125	111	121	138	130
SIERRA ONE WAYSOUTHBOUND	02/05/97	106	119	85	118	121	93	106	114	121	111	104	121	104	118	112	104	119	121
SIERRA ONE WAY SOUTHBOUND	02/06/97	122	118	105	126	121	116	136	108	109	90	117	146	128	115	112	139	156	128
SIERRA ONE WAY SOUTHBOUND	02/07/97	121	108	116	126	125	111	87	142	137	120	129	139	143	137	126	113	181	129
SIERRA ONE WAY SOUTHBOUND	02/08/97	74	83	94	89	101	125	113	113	120	105	98	112	90	110	112	86	99	112
SIERRA ONE WAY SOUTHBOUND	02/09/97	74	83	94	89	101	125	113	113	120	105	98	112	90	110	112	86	99	112
SIERRA ONE WAY SOUTHBOUND	02/10/97	99	111	91	96														
VIRGINIA SOUTHBOUND	02/02/97																		
VIRGINIA SOUTHBOUND	02/03/97	95	90	78	148	180	139	163	189	191	182	162	180	177	190	184	196	198	188
VIRGINIA SOUTHBOUND	02/04/97	60	59	76	61	75	76	77	80	103	88	89	92	94	106	90	101	84	93
VIRGINIA SOUTHBOUND	02/05/97	57	56	72	58	71	72	73	78	98	84	85	87	89	101	86	96	80	88
VIRGINIA SOUTHBOUND	02/06/97	61	81	78	80	84	95	64	88	107	71	114	96	85	115	99	82	99	95
VIRGINIA SOUTHBOUND	02/07/97	55	74	80	72	80	70	98	89	106	103	115	87	101	115	104	71	101	105
VIRGINIA SOUTHBOUND	02/08/97	32	36	29	42	82	81	69	88	88	92	87	89	81	123	83	83	110	95
VIRGINIA SOUTHBOUND	02/09/97	54	61	50	71	82	81	69	88	81	84	80	82	74	113	76	76	101	87
VIRGINIA SOUTHBOUND	02/10/97	53	78	60	69	51													
VIRGINIA NORTHBOUND	02/02/97																		
VIRGINIA NORTHBOUND	02/03/97	210	188	223	166	212	193	194	250	197	243	209	234	205	237	213	234	256	254
VIRGINIA NORTHBOUND	02/04/97	89	111	96	97	112	95	106	123	120	101	107	122	115	118	99	125	129	96
VIRGINIA NORTHBOUND	02/05/97	77	88	82	86	182	141	77	87	88	72	94	138	113	107	102	114	118	104
VIRGINIA NORTHBOUND	02/06/97	65	65	67	74	251	187	47	51	58	45	80	154	110	95	105	103	107	111
VIRGINIA NORTHBOUND	02/07/97	49	43	47	42	50	43	71	55	86	83	121	108	115	106	108	78	110	106
VIRGINIA NORTHBOUND	02/08/97	60	61	59	64	81	68	92	77	107	114	123	116	121	116	116	94	137	120
VIRGINIA NORTHBOUND	02/09/97	71	79	71	86	111	92	113	99	127	145	124	124	127	125	123	109	163	134
VIRGINIA NORTHBOUND	02/10/97	71	103	91	88														
CENTER ONE WAY NORTHBOUN	02/02/97																		
CENTER ONE WAY NORTHBOUN	02/03/97	91	99	114	114	108	108	113	110	101	121	107	101	144	108	151	127	118	137
CENTER ONE WAY NORTHBOUN	02/04/97	55	48	54	62	50	56	32	59	60	52	59	53	57	63	62	71	61	81
CENTER ONE WAY NORTHBOUN	02/05/97	68	59	71	74	51	60	71	47	79	63	74	79	83	75	82	88	79	97
CENTER ONE WAY NORTHBOUN	02/06/97	81	70	87	86	51	104	109	34	98	74	88	105	109	86	101	105	96	112
CENTER ONE WAY NORTHBOUN	02/07/97	69	89	82	87	75	77	41	89	68	96	99	108	114	106	85	81	110	97
CENTER ONE WAY NORTHBOUN	02/08/97	77	77	91	91	92	82	88	76	62	85	61	102	90	95	74	75	95	86
CENTER ONE WAY NORTHBOUN	02/09/97	63	55	67	67	76	56	63	41	55	73	22	97	65	83	63	68	79	75
CENTER ONE WAY NORTHBOUN	02/10/97	84	41	58	48	58	56												

ID Location	Date	13:30 - 13:4	13:45 - 14:0	14:00 - 14:1	14:15 - 14:3	14:30 - 14:4	14:45 - 15:0	15:00 - 15:1	15:15 - 15:3	15:30 - 15:4	15:45 - 16:0	16:00 - 16:1	16:15 - 16:3	16:30 - 16:4	16:45 - 17:0	17:00 - 17:1	17:15 - 17:3	17:30 - 17:4	17:45 - 18:0
KEYSTONE SOUTHBOUND	02/02/97																		
KEYSTONE SOUTH BOUND	02/03/97	316	296	345	298	328	366	342	393	367	290	453	327	367	389	435	447	408	341
KEYSTONE SOUTHBOUND	02/04/97	337	326	301	388	309	324	198	252	234	262	201	258	238	266	266	285	223	240
KEYSTONE SOUTHBOUND	02/05/97	220	238	246	245	228	214	243	286	231	256	282	261	251	247	253	274	256	220
KEYSTONE SOUTHBOUND	02/06/97	236	238	302	287	292	285	344	321	348	331	339	332	312	366	367	356	341	359
KEYSTONE SOUTHBOUND	02/07/97	280	337	355	328	292	335	304	318	334	353	226	322	347	335	360	334	384	323
KEYSTONE SOUTHBOUND	02/08/97	201	228	154	174	167	161	167	162	182	173	171	179	203	165	188	155	163	136
KEYSTONE SOUTHBOUND	02/09/97	139	158	128	164	132	146	164	158	152	155	199	149	149	141	171	152	140	149
KEYSTONE SOUTHBOUND	02/10/97																		
KEYSTONE NORTHBOUND	02/02/97																		
KEYSTONE NORTHBOUND	02/03/97	225	233	326	262	293	271	240	262	291	169	364	269	240	296	353	336	328	265
KEYSTONE NORTHBOUND	02/04/97	246	256	232	311	258	267	252	303	318	319	353	294	377	370	477	463	430	343
KEYSTONE NORTHBOUND	02/05/97	329	340	353	365	358	376	345	369	395	379	385	370	401	402	501	534	397	356
KEYSTONE NORTHBOUND	02/06/97	338	333	336	344	335	375	394	363	331	417	356	356	389	350	508	439	369	322
KEYSTONE NORTHBOUND	02/07/97	362	318	382	425	432	334	423	354	383	379	319	383	379	379	460	438	402	355
KEYSTONE NORTHBOUND	02/08/97	280	237	311	310	285	251	334	220	302	336	302	310	309	277	259	269	303	275
KEYSTONE NORTHBOUND	02/09/97	294	249	345	238	250	256	276	247	269	251	256	244	249	239	283	243	228	239
KEYSTONE NORTHBOUND	02/10/97																		
ARLINGTON SOUTHBOUND	02/02/97																		
ARLINGTON SOUTHBOUND	02/03/97	175	174	180	175	196	178	203	176	207	172	238	157	193	173	225	127	84	61
ARLINGTON SOUTHBOUND	02/04/97	65	69	81	85	74	115	98	101	93	104	91	120	101	95	121	85	81	51
ARLINGTON SOUTHBOUND	02/05/97	108	98	119	109	97	116	113	120	121	115	120	136	128	117	129	134	120	100
ARLINGTON SOUTHBOUND	02/06/97	123	120	112	134	131	167	137	179	109	173	176	141	155	147	157	135	131	78
ARLINGTON SOUTHBOUND	02/07/97	150	127	157	132	119	117	130	139	148	125	148	151	155	139	137	183	159	148
ARLINGTON SOUTHBOUND	02/08/97	23	24	14	18	21	22	22	18	28	16	28	18	28	17	13	15	14	15
ARLINGTON SOUTHBOUND	02/09/97	65	50	48	51	44	45	60	48	45	65	56	49	51	50	62	43	51	40
ARLINGTON SOUTHBOUND	02/10/97																		
ARLINGTON NORTHBOUND	02/02/97																		
ARLINGTON NORTHBOUND	02/03/97	111	123	127	119	128	123	115	129	118	109	145	68	129	136	203	185	150	124
ARLINGTON NORTHBOUND	02/04/97	114	149	109	114	118	124	114	121	118	142	105	140	128	123	185	180	137	128
ARLINGTON NORTHBOUND	02/05/97	117	137	114	116	121	124	119	113	124	132	105	130	121	121	168	159	138	127
ARLINGTON NORTHBOUND	02/06/97	133	110	120	129	104	144	107	139	125	144	138	121	108	127	182	174	143	91
ARLINGTON NORTHBOUND	02/07/97	120	124	118	117	123	124	123	105	129	122	104	120	114	118	151	138	139	125
ARLINGTON NORTHBOUND	02/08/97	44	36	71	72	79	70	85	72	69	83	100	90	99	93	94	78	56	53
ARLINGTON NORTHBOUND	02/09/97	62	62	84	62	56	57	69	83	86	88	75	169	375	334	51	40	34	39
ARLINGTON NORTHBOUND	02/10/97																		
SIERRA ONE WAY SOUTHBOUND	02/03/97	312	327	316	382	365	334	370	420	360	323	380	290	399	342	413	375	334	330
SIERRA ONE WAY SOUTHBOUND	02/04/97	138	137	145	128	127	142	130	152	126	136	100	136	134	135	135	146	131	112
SIERRA ONE WAYSOUTHBOUND	02/05/97	120	119	129	124	118	117	124	132	119	121	108	113	117	125	112	117	121	97
SIERRA ONE WAY SOUTHBOUND	02/06/97	117	137	120	112	115	148	132	141	113	156	166	166	126	123	138	151	142	85
SIERRA ONE WAY SOUTHBOUND	02/07/97	125	161	152	133	133	155	135	137	140	149	113	142	124	117	140	167	140	127
SIERRA ONE WAY SOUTHBOUND	02/08/97	101	100	117	104	118	131	121	99	124	109	136	134	135	118	113	126	131	142
SIERRA ONE WAY SOUTHBOUND	02/09/97	101	100	113	120	108	92	118	112	112	105	111	90	100	115	89	88	111	81
SIERRA ONE WAY SOUTHBOUND	02/10/97																		
VIRGINIA SOUTHBOUND	02/02/97																		
VIRGINIA SOUTHBOUND	02/03/97	176	170	157	196	201	212	190	196	219	170	188	120	198	168	169	155	153	140
VIRGINIA SOUTHBOUND	02/04/97	77	100	67	90	102	104	90	86	111	89	59	100	81	71	82	73	67	70
VIRGINIA SOUTHBOUND	02/05/97	73	95	64	86	97	99	88	82	105	85	56	95	77	67	78	69	64	67
VIRGINIA SOUTHBOUND	02/06/97	103	91	102	102	112	82	95	95	84	98	99	101	84	97	76	97	100	70
VIRGINIA SOUTHBOUND	02/07/97	88	94	110	104	106	102	69	82	83	82	65	86	117	95	88	95	92	84
VIRGINIA SOUTHBOUND	02/08/97	86	94	102	92	97	98	111	82	106	100	86	85	85	88	77	84	75	84
VIRGINIA SOUTHBOUND	02/09/97	79	86	81	99	90	87	106	82	78	72	82	69	73	62	62	76	66	65
VIRGINIA SOUTHBOUND	02/10/97																		
VIRGINIA NORTHBOUND	02/02/97																		
VIRGINIA NORTHBOUND	02/03/97	219	256	197	223	200	167	154	159	115	138	146	135	76	63	52	88	85	65
VIRGINIA NORTHBOUND	02/04/97	146	132	106	153	147	110	102	96	88	101	105	65	39	51	42	42	39	43
VIRGINIA NORTHBOUND	02/05/97	126	119	103	127	129	111	102	109	91	115	106	95	72	73	84	94	117	41
VIRGINIA NORTHBOUND	02/06/97	105	105	99	100	110	111	101	122	94	128	107	124	104	94	125	146	195	38
VIRGINIA NORTHBOUND	02/07/97	99	116	127	95	111	107	102	126	132	128	111	109	149	129	137	124	132	125
VIRGINIA NORTHBOUND	02/08/97	116	127	137	107	125	124	116	116	147	115	120	142	144	124	111	104	145	140
VIRGINIA NORTHBOUND	02/09/97	132	138	139	123	131	100	130	111	116	102	124	112	133	84	130	109	102	81
VIRGINIA NORTHBOUND	02/10/97																		
CENTER ONE WAY NORTHBOUN	02/02/97																		
CENTER ONE WAY NORTHBOUN	02/03/97	111	140	117	153	159	144	133	158	151	139	177	122	167	120	256	185	167	138
CENTER ONE WAY NORTHBOUN	02/04/97	69	82	76	68	75	70	70	54	34	68	64	82	89	76	117	108	87	68
CENTER ONE WAY NORTHBOUN	02/05/97	84	94	96	91	94	83	87	86	65	97	91	112	100	84	144	126	112	86
CENTER ONE WAY NORTHBOUN	02/06/97	98	105	115	113	113	95	103	117	95	125	118	141	111	92	171	144	136	103
CENTER ONE WAY NORTHBOUN	02/07/97	103	104	109	117	90	103	116	118	128	146	148	162	47	196	192	210	180	161
CENTER ONE WAY NORTHBOUN	02/08/97	90	88	56	73	76	85	83	61	70	86	91	91	75	91	52	79	82	92
CENTER ONE WAY NORTHBOUN	02/09/97	77	71	67	86	77	86	97	72	90	71	82	71	75	68	79	71	81	55
CENTER ONE WAY NORTHBOUN	02/10/97																		

TABLE 1 TRAFFIC DATA

ID Location	Date	18:00 - 18:1	18:15 - 18:3	18:30 - 18:4	18:45 - 19:0	19:00 - 19:	19:15 - 19:3	19:30 - 19:4	19:45 - 20:0	20:00 - 20:1	20:15 - 20:3	20:30 - 20:4	20:45 - 21:0	21:00 - 21:1	21:15 - 21:3	21:30 - 21:4	21:45 - 22:0	22:00 - 22:1	22:15 - 22:3
KEYSTONE SOUTHBOUND	02/02/97									174	132	129	134	138	109	94	80	79	91
KEYSTONE SOUTH BOUND	02/03/97	323	294	299	312	236	229	184	160	185	151	159	154	131	142	136	126	66	82
KEYSTONE SOUTHBOUND	02/04/97	208	232	186	188	159	146	137	125	142	119	97	109	118	98	84	80	80	62
KEYSTONE SOUTHBOUND	02/05/97	217	235	218	204	158	123	126	123	118	129	107	92	120	94	76	66	78	63
KEYSTONE SOUTHBOUND	02/06/97	324	270	291	268	245	206	202	185	175	151	160	168	128	133	136	103	91	98
KEYSTONE SOUTHBOUND	02/07/97	342	283	300	290	255	190	201	157	187	169	155	147	167	122	162	152	117	146
KEYSTONE SOUTHBOUND	02/08/97	164	149	155	143	121	121	116	121	95	88	88	106	92	73	76	78	65	88
KEYSTONE SOUTHBOUND	02/09/97	132	116	98	98	92	118	77	91	95	70	79	68	78	59	68	70	52	56
KEYSTONE SOUTHBOUND	02/10/97																		
KEYSTONE NORTHBOUND	02/02/97					117	112	89	92	96	75	82	87	69	66	37	37	47	41
KEYSTONE NORTHBOUND	02/03/97	277	195	249	216	172	148	141	117	151	131	122	108	110	99	85	96	76	68
KEYSTONE NORTHBOUND	02/04/97	373	320	311	260	273	208	189	175	203	185	157	130	193	139	108	96	107	83
KEYSTONE NORTHBOUND	02/05/97	313	327	372	347	266	236	196	178	208	163	136	129	125	171	129	111	120	66
KEYSTONE NORTHBOUND	02/06/97	387	258	289	248	244	191	155	162	182	132	148	109	182	104	89	107	79	66
KEYSTONE NORTHBOUND	02/07/97	350	306	265	317	288	179	173	159	197	141	159	191	187	135	164	142	153	138
KEYSTONE NORTHBOUND	02/08/97	227	271	242	223	187	216	176	162	169	153	139	153	149	136	127	152	109	157
KEYSTONE NORTHBOUND	02/09/97	211	202	190	195	162	115	160	162	157	113	115	117	119	127	110	70	94	69
KEYSTONE NORTHBOUND	02/10/97																		
ARLINGTON SOUTHBOUND	02/02/97					94	65	77	63	63	70	70	46	45	59	40	57	32	42
ARLINGTON SOUTHBOUND	02/03/97	61	40	42	47	34	38	35	27	34	39	30	32	20	30	29	13	26	18
ARLINGTON SOUTHBOUND	02/04/97	51	49	48	34	33	36	34	26	33	37	29	31	19	29	28	12	25	17
ARLINGTON SOUTHBOUND	02/05/97	90	79	77	90	87	52	59	63	66	48	45	34	41	42	46	36	37	43
ARLINGTON SOUTHBOUND	02/06/97	142	88	75	80	74	64	65	64	57	47	46	50	33	39	40	37	20	30
ARLINGTON SOUTHBOUND	02/07/97	195	136	169	105	117	100	95	70	90	64	54	57	43	66	46	39	39	66
ARLINGTON SOUTHBOUND	02/08/97	13	3	2	3	2	2	2	1	0	1	2	0	3	1	1	0	0	0
ARLINGTON SOUTHBOUND	02/09/97	49	44	56	63	56	40	45	35	29	34	30	33	34	24	25	23	14	28
ARLINGTON SOUTHBOUND	02/10/97																		
ARLINGTON NORTHBOUND	02/02/97					122	111	91	119	136	89	86	83	74	74	56	71	59	73
ARLINGTON NORTHBOUND	02/03/97	93	110	103	75	59	56	60	49	48	54	34	40	51	31	50	38	37	36
ARLINGTON NORTHBOUND	02/04/97	104	96	88	76	58	49	60	50	42	49	45	37	42	30	49	42	46	38
ARLINGTON NORTHBOUND	02/05/97	120	102	83	75	76	51	53	69	65	54	33	37	50	44	38	37	47	29
ARLINGTON NORTHBOUND	02/06/97	134	100	105	67	71	55	60	59	42	52	45	57	56	43	35	43	33	38
ARLINGTON NORTHBOUND	02/07/97	101	94	99	83	63	53	65	55	46	54	49	40	46	33	54	46	50	42
ARLINGTON NORTHBOUND	02/08/97	47	69	62	52	50	48	41	45	39	31	42	273	116	98	69	60	165	61
ARLINGTON NORTHBOUND	02/09/97	49	62	39	38	35	40	24	22	46	42	26	19	20	20	23	13	19	22
ARLINGTON NORTHBOUND	02/10/97																		
SIERRA ONE WAY SOUTHBOUND	02/03/97	302	238	283	218	165	163	132	133	114	107	113	92	107	113	114	83	91	104
SIERRA ONE WAY SOUTHBOUND	02/04/97	106	90	100	80	85	74	66	65	76	67	76	47	43	66	56	70	44	61
SIERRA ONE WAYSOUTHBOUND	02/05/97	105	86	96	86	120	89	70	78	84	79	53	65	65	53	55	56	42	55
SIERRA ONE WAY SOUTHBOUND	02/06/97	130	83	116	120	114	100	81	65	74	82	64	52	66	69	63	66	51	32
SIERRA ONE WAY SOUTHBOUND	02/07/97	109	104	122	111	117	108	103	84	85	94	91	94	92	83	88	113	97	92
SIERRA ONE WAY SOUTHBOUND	02/08/97	119	145	119	131	115	118	109	116	118	97	116	102	92	79	101	93	100	102
SIERRA ONE WAY SOUTHBOUND	02/09/97	103	81	91	92	74	80	66	65	72	67	58	61	65	64	52	47	62	53
SIERRA ONE WAY SOUTHBOUND	02/10/97																		
VIRGINIA SOUTHBOUND	02/02/97					134	110	114	117	93	88	110	96	98	89	94	94	86	80
VIRGINIA SOUTHBOUND	02/03/97	153	138	157	169	80	66	65	48	49	57	49	31	52	52	49	52	39	39
VIRGINIA SOUTHBOUND	02/04/97	59	62	53	71	73	61	59	49	50	57	46	47	54	57	48	50	45	44
VIRGINIA SOUTHBOUND	02/05/97	56	59	50	67	69	58	56	47	63	46	64	41	63	52	64	44	38	31
VIRGINIA SOUTHBOUND	02/06/97	87	54	73	71	74	59	60	46	51	65	60	47	60	42	50	49	52	38
VIRGINIA SOUTHBOUND	02/07/97	90	81	94	81	79	75	102	92	91	121	120	142	127	168	127	168	124	140
VIRGINIA SOUTHBOUND	02/08/97	85	84	75	95	84	78	79	78	89	92	91	118	124	93	120	112	96	138
VIRGINIA SOUTHBOUND	02/09/97	75	73	62	51	65	56	53	49	51	57	42	63	56	61	47	47	51	49
VIRGINIA SOUTHBOUND	02/10/97																		
VIRGINIA NORTHBOUND	02/02/97					153	131	107	91	114	92	87	88	71	64	68	112	43	55
VIRGINIA NORTHBOUND	02/03/97	87	102	69	64	68	49	64	59	47	44	54	30	31	34	34	22	29	26
VIRGINIA NORTHBOUND	02/04/97	41	39	37	51	35	26	33	31	39	41	47	32	45	30	34	27	28	29
VIRGINIA NORTHBOUND	02/05/97	60	42	48	56	47	44	37	42	31	38	39	33	58	25	34	32	27	31
VIRGINIA NORTHBOUND	02/06/97	78	45	59	60	58	62	41	53	63	38	31	40	34	46	26	40	31	24
VIRGINIA NORTHBOUND	02/07/97	119	107	118	125	107	76	130	92	126	136	119	144	140	134	97	158	144	150
VIRGINIA NORTHBOUND	02/08/97	112	123	124	137	135	113	126	126	148	114	102	155	158	122	131	142	97	145
VIRGINIA NORTHBOUND	02/09/97	96	111	91	89	93	78	65	74	78	73	72	75	72	88	67	60	82	53
VIRGINIA NORTHBOUND	02/10/97																		
CENTER ONE WAY NORTHBOUN	02/02/97					95	85	88	75	91	79	88	69	68	81	70	72	78	75
CENTER ONE WAY NORTHBOUN	02/03/97	155	121	115	116	79	58	47	43	32	41	29	35	50	40	30	40	38	35
CENTER ONE WAY NORTHBOUN	02/04/97	70	65	51	53	72	66	61	46	59	72	46	40	52	50	53	46	50	48
CENTER ONE WAY NORTHBOUN	02/05/97	94	93	79	67	82	73	66	51	76	54	45	62	63	55	52	63	70	56
CENTER ONE WAY NORTHBOUN	02/06/97	117	120	107	80	91	79	70	55	67	86	57	42	59	65	71	59	54	54
CENTER ONE WAY NORTHBOUN	02/07/97	160	110	131	128	96	96	83	91	92	108	97	96	115	104	78	101	119	141
CENTER ONE WAY NORTHBOUN	02/08/97	86	107	69	80	77	67	67	70	94	61	72	85	62	56	51	64	48	91
CENTER ONE WAY NORTHBOUN	02/09/97	85	74	52	55	52	52	52	37	50	58	34	38	44	35	34	32	46	41
CENTER ONE WAY NORTHBOUN	02/10/97																		

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ID Location	Date	22:30 - 22:4	22:45 - 23:0	23:00 - 23:1	23:15 - 23:3	23:30 - 23:4	23:45 - 24:0	24 Hour
KEYSTONE SOUTHBOUND	02/02/97	70	65	68	42	46	38	1,491
KEYSTONE SOUTH BOUND	02/03/97	91	79	97	66	48	47	16,841
KEYSTONE SOUTHBOUND	02/04/97	54	51	37	43	29	31	17,044
KEYSTONE SOUTHBOUND	02/05/97	52	50	48	58	49	32	13,114
KEYSTONE SOUTHBOUND	02/06/97	110	48	93	60	47	72	15,541
KEYSTONE SOUTHBOUND	02/07/97	128	130	97	104	93	95	16,324
KEYSTONE SOUTHBOUND	02/08/97	70	57	83	77	62	64	10,483
KEYSTONE SOUTHBOUND	02/09/97	54	39	36	33	35	29	7,949
KEYSTONE SOUTHBOUND	02/10/97							2,549
KEYSTONE NORTHBOUND	02/02/97	40	42	47	33	25	30	1,264
KEYSTONE NORTHBOUND	02/03/97	54	40	48	22	35	36	14,508
KEYSTONE NORTHBOUND	02/04/97	57	56	69	39	43	37	17,092
KEYSTONE NORTHBOUND	02/05/97	80	48	56	52	52	32	20,422
KEYSTONE NORTHBOUND	02/06/97	73	47	62	44	53	42	19,658
KEYSTONE NORTHBOUND	02/07/97	113	109	98	84	72	72	20,282
KEYSTONE NORTHBOUND	02/08/97	135	107	138	116	91	94	15,338
KEYSTONE NORTHBOUND	02/09/97	70	63	54	39	58	24	14,077
KEYSTONE NORTHBOUND	02/10/97							4,751
ARLINGTON SOUTHBOUND	02/02/97	34	37	35	23	22	28	1,002
ARLINGTON SOUTHBOUND	02/03/97	14	24	23	21	12	11	7,965
ARLINGTON SOUTHBOUND	02/04/97	13	23	22	20	11	11	4,459
ARLINGTON SOUTHBOUND	02/05/97	33	34	31	18	27	24	6,150
ARLINGTON SOUTHBOUND	02/06/97	28	31	44	31	27	28	7,054
ARLINGTON SOUTHBOUND	02/07/97	46	56	37	40	66	57	7,931
ARLINGTON SOUTHBOUND	02/08/97	2	0	1	0	0	0	1,882
ARLINGTON SOUTHBOUND	02/09/97	19	15	21	18	20	17	2362
ARLINGTON SOUTHBOUND	02/10/97							1,094
ARLINGTON NORTHBOUND	02/02/97	65	56	68	59	55	49	1,806
ARLINGTON NORTHBOUND	02/03/97	37	24	31	18	22	24	9,306
ARLINGTON NORTHBOUND	02/04/97	33	31	44	24	36	30	6,560
ARLINGTON NORTHBOUND	02/05/97	34	24	32	35	31	16	6,616
ARLINGTON NORTHBOUND	02/06/97	28	36	31	32	26	48	6,781
ARLINGTON NORTHBOUND	02/07/97	36	34	48	26	39	33	6,652
ARLINGTON NORTHBOUND	02/08/97	64	45	37	45	40	42	4,336
ARLINGTON NORTHBOUND	02/09/97	21	17	15	15	17	13	4,471
ARLINGTON NORTHBOUND	02/10/97							1,503
SIERRA ONE WAY SOUTHBOUND	02/03/97	101	80	98	97	99	66	18,785
SIERRA ONE WAY SOUTHBOUND	02/04/97	56	51	58	67	44	42	9,659
SIERRA ONE WAYSOUTHBOUND	02/05/97	50	58	48	45	42	48	7,600
SIERRA ONE WAY SOUTHBOUND	02/06/97	61	51	52	51	40	35	7,935
SIERRA ONE WAY SOUTHBOUND	02/07/97	101	105	93	61	109	83	8,805
SIERRA ONE WAY SOUTHBOUND	02/08/97	84	84	102	85	88	83	7,915
SIERRA ONE WAY SOUTHBOUND	02/09/97	42	48	53	48	43	46	6,690
SIERRA ONE WAY SOUTHBOUND	02/10/97							1,908
VIRGINIA SOUTHBOUND	02/02/97	118	87	80	94	60	64	1,906
VIRGINIA SOUTHBOUND	02/03/97	38	34	31	32	30	23	9,180
VIRGINIA SOUTHBOUND	02/04/97	38	35	32	37	33	27	5,097
VIRGINIA SOUTHBOUND	02/05/97	45	40	30	40	33	38	4,908
VIRGINIA SOUTHBOUND	02/06/97	47	37	44	41	42	33	5,504
VIRGINIA SOUTHBOUND	02/07/97	186	135	176	83	92	62	6,980
VIRGINIA SOUTHBOUND	02/08/97	146	134	134	117	116	105	6,278
VIRGINIA SOUTHBOUND	02/09/97	38	35	32	42	36	30	5,394
VIRGINIA SOUTHBOUND	02/10/97							1,118
VIRGINIA NORTHBOUND	02/02/97	34	41	42	45	43	27	1,508
VIRGINIA NORTHBOUND	02/03/97	19	14	28	21	23	18	9,653
VIRGINIA NORTHBOUND	02/04/97	20	19	22	23	28	90	6,156
VIRGINIA NORTHBOUND	02/05/97	20	24	15	25	29	162	6,007
VIRGINIA NORTHBOUND	02/06/97	26	31	28	32	17	15	5,640
VIRGINIA NORTHBOUND	02/07/97	134	129	114	116	132	108	7,563
VIRGINIA NORTHBOUND	02/08/97	143	130	150	119	131	124	8,436
VIRGINIA NORTHBOUND	02/09/97	80	42	44	48	47	33	7,570
VIRGINIA NORTHBOUND	02/10/97							1,426
CENTER ONE WAY NORTHBOUN	02/02/97	72	61	82	54	56	59	1,478
CENTER ONE WAY NORTHBOUN	02/03/97	42	28	43	27	29	29	7,949
CENTER ONE WAY NORTHBOUN	02/04/97	59	40	53	51	31	45	4,513
CENTER ONE WAY NORTHBOUN	02/05/97	79	58	48	73	42	36	5,689
CENTER ONE WAY NORTHBOUN	02/06/97	78	42	63	63	40	57	6,702
CENTER ONE WAY NORTHBOUN	02/07/97	90	118	130	118	161	111	8,065
CENTER ONE WAY NORTHBOUN	02/08/97	74	66	72	69	80	67	6,819
CENTER ONE WAY NORTHBOUN	02/09/97	41	38	42	38	22	33	4,883
CENTER ONE WAY NORTHBOUN	02/10/97							1,234

TABLE 1. TRAFFIC DATA

ID Location	Date	0:00 - 1:00	1:00 - 2:00	2:00 - 3:00	3:00 - 4:00	4:00 - 5:00	5:00 - 6:00	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00	9:00 - 10:00	10:00 - 11:0	11:00 - 12:0	12:00 - 13:0	13:00 - 14:0	14:00 - 15:0	15:00 - 16:0	16:00 - 17:0	17:00 - 18:0
KEYSTONE SOUTHBOUND	02/02/97	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
KEYSTONE SOUTH BOUND	02/03/97	152	75	82	62	65	123	519	1079	1197	1178	940	1144	1261	1271	1335	1392	1536	1631
KEYSTONE SOUTHBOUND	02/04/97	154	74	82	62	88	488	1104	986	1079	1126	995	1188	1493	1269	1320	946	961	1014
KEYSTONE SOUTHBOUND	02/05/97	88	56	46	43	29	79	341	714	824	762	708	842	976	977	933	1016	1041	1003
KEYSTONE SOUTHBOUND	02/06/97	88	61	45	36	21	77	335	712	832	783	635	841	1045	986	1166	1344	1349	1423
KEYSTONE SOUTHBOUND	02/07/97	158	97	79	47	44	138	485	955	1091	1068	1000	1167	1305	1257	1310	1309	1230	1401
KEYSTONE SOUTHBOUND	02/08/97	241	129	124	82	69	63	94	246	401	640	771	776	907	888	656	684	718	642
KEYSTONE SOUTHBOUND	02/09/97	198	114	74	55	47	45	65	139	266	443	533	537	628	615	570	629	638	612
KEYSTONE SOUTHBOUND	02/10/97	89	47	45	25	25	75	328	685	738	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
KEYSTONE NORTHBOUND	02/02/97	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
KEYSTONE NORTHBOUND	02/03/97	78	58	53	33	56	127	395	793	882	880	759	995	1114	922	1152	962	1169	1282
KEYSTONE NORTHBOUND	02/04/97	74	61	47	44	55	96	409	892	841	1078	929	1191	1191	1006	1068	1192	1394	1713
KEYSTONE NORTHBOUND	02/05/97	165	88	78	69	79	229	615	1184	1198	1203	1079	1355	1514	1355	1452	1488	1558	1788
KEYSTONE NORTHBOUND	02/06/97	140	90	57	63	64	183	565	1138	1162	1315	1054	1381	1848	1383	1390	1505	1451	1638
KEYSTONE NORTHBOUND	02/07/97	125	61	58	47	64	147	430	979	1076	1157	1116	1521	1590	1472	1573	1539	1460	1655
KEYSTONE NORTHBOUND	02/08/97	221	158	115	76	75	123	201	375	506	709	924	1202	986	1165	1157	1192	1198	1108
KEYSTONE NORTHBOUND	02/09/97	316	214	129	111	93	70	164	343	500	744	969	1260	1035	1222	1087	1043	988	993
KEYSTONE NORTHBOUND	02/10/97	155	93	55	63	98	179	582	1381	1184	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
ARLINGTON SOUTHBOUND	02/02/97	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
ARLINGTON SOUTHBOUND	02/03/97	92	59	48	32	24	59	143	449	529	538	532	630	701	688	729	758	759	497
ARLINGTON SOUTHBOUND	02/04/97	40	27	34	19	14	29	68	237	266	259	275	335	365	326	355	394	407	338
ARLINGTON SOUTHBOUND	02/05/97	63	43	45	31	21	41	110	316	372	332	357	419	459	452	441	469	501	483
ARLINGTON SOUTHBOUND	02/06/97	66	66	34	27	31	53	101	386	444	368	433	503	535	507	544	598	619	501
ARLINGTON SOUTHBOUND	02/07/97	84	56	52	42	28	50	149	392	476	402	436	500	550	577	525	542	593	627
ARLINGTON SOUTHBOUND	02/08/97	142	145	141	102	71	53	74	84	151	92	98	119	129	115	75	84	91	57
ARLINGTON SOUTHBOUND	02/09/97	1	0	1	1	0	0	0	0	0	41	155	156	188	226	188	221	206	196
ARLINGTON SOUTHBOUND	02/10/97	61	32	35	33	19	31	78	255	299	253	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
ARLINGTON NORTHBOUND	02/02/97	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
ARLINGTON NORTHBOUND	02/03/97	149	119	86	54	44	107	319	688	807	740	744	834	847	500	497	471	478	642
ARLINGTON NORTHBOUND	02/04/97	89	44	37	25	20	51	149	338	411	393	388	398	464	468	465	495	496	630
ARLINGTON NORTHBOUND	02/05/97	85	65	36	33	33	56	157	344	410	388	386	429	448	479	475	488	477	592
ARLINGTON NORTHBOUND	02/06/97	93	58	28	31	31	51	141	365	444	396	392	393	484	482	497	515	494	590
ARLINGTON NORTHBOUND	02/07/97	78	83	34	39	45	59	163	349	407	382	380	457	429	488	482	479	456	553
ARLINGTON NORTHBOUND	02/08/97	96	95	73	43	39	42	94	120	124	130	130	129	159	159	292	309	382	281
ARLINGTON NORTHBOUND	02/09/97	133	109	71	49	41	41	64	107	197	222	162	148	517	251	259	328	953	164
ARLINGTON NORTHBOUND	02/10/97	43	38	19	13	23	37	390	367	309	252	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
SIERRA ONE WAY SOUTHBOUND	02/03/97	283	249	205	161	101	182	381	1158	1199	1096	1081	1201	1255	1387	1397	1373	1411	1452
SIERRA ONE WAY SOUTHBOUND	02/04/97	236	218	158	111	87	148	298	820	912	811	669	478	475	543	542	544	505	524
SIERRA ONE WAYSOUTHBOUND	02/05/97	157	123	87	62	51	90	187	529	558	428	434	457	438	479	488	496	461	447
SIERRA ONE WAY SOUTHBOUND	02/06/97	132	125	72	51	48	79	140	442	548	471	481	462	494	538	495	542	581	516
SIERRA ONE WAY SOUTHBOUND	02/07/97	122	107	88	69	43	78	164	498	515	471	465	525	521	596	573	561	496	574
SIERRA ONE WAY SOUTHBOUND	02/08/97	264	189	153	126	74	77	112	181	246	340	452	435	398	412	470	453	523	512
SIERRA ONE WAY SOUTHBOUND	02/09/97	265	230	152	112	76	80	108	186	246	340	452	435	398	412	433	447	416	369
SIERRA ONE WAY SOUTHBOUND	02/10/97	126	109	80	59	47	77	154	413	444	397	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
VIRGINIA SOUTHBOUND	02/02/97	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
VIRGINIA SOUTHBOUND	02/03/97	211	157	136	89	76	88	170	283	335	411	671	715	747	732	766	775	672	617
VIRGINIA SOUTHBOUND	02/04/97	86	87	67	57	42	43	81	201	223	256	308	372	391	354	383	376	311	292
VIRGINIA SOUTHBOUND	02/05/97	82	83	63	53	40	41	76	191	211	243	292	354	372	336	346	358	295	278
VIRGINIA SOUTHBOUND	02/06/97	131	102	57	61	44	62	82	192	209	300	331	388	381	388	398	372	381	343
VIRGINIA SOUTHBOUND	02/07/97	119	102	85	76	51	68	77	184	218	281	337	411	391	388	422	316	363	359
VIRGINIA SOUTHBOUND	02/08/97	169	126	102	64	46	44	51	71	100	139	320	356	370	385	389	399	344	320
VIRGINIA SOUTHBOUND	02/09/97	335	254	133	108	84	70	74	121	169	236	320	327	339	353	357	338	286	269
VIRGINIA SOUTHBOUND	02/10/97	93	83	52	52	40	38	77	186	186	260	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
VIRGINIA NORTHBOUND	02/02/97	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
VIRGINIA NORTHBOUND	02/03/97	108	87	77	99	141	230	202	494	723	787	849	883	889	985	787	566	420	290
VIRGINIA NORTHBOUND	02/04/97	264	33	34	66	110	185	279	359	433	393	436	450	457	503	516	387	260	166
VIRGINIA NORTHBOUND	02/05/97	208	56	42	52	74	109	182	269	331	333	487	393	436	467	470	417	346	336
VIRGINIA NORTHBOUND	02/06/97	148	76	47	35	36	52	83	176	226	271	536	335	413	428	420	445	429	504
VIRGINIA NORTHBOUND	02/07/97	70	236	57	234	39	42	73	128	151	181	219	398	407	431	440	488	498	518
VIRGINIA NORTHBOUND	02/08/97	244	200	147	112	81	84	107	167	201	244	318	460	447	500	493	494	530	500
VIRGINIA NORTHBOUND	02/09/97	397	323	197	145	97	83	108	179	250	307	415	520	484	567	493	459	450	422
VIRGINIA NORTHBOUND	02/10/97	110	86	54	49	38	64	121	250	301	353	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
CENTER ONE WAY NORTHBOUN	02/02/97	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR
CENTER ONE WAY NORTHBOUN	02/03/97	227	182	127	93	93	150	226	341	419	418	439	430	530	506	575	581	586	746
CENTER ONE WAY NORTHBOUN	02/04/97	119	71	61	46	46	73	99	147	180	219	197	224	253	283	289	226	311	380
CENTER ONE WAY NORTHBOUN	02/05/97	137	101	75	57	58	88	133	205	246	272	249	295	328	354	364	335	387	468
CENTER ONE WAY NORTHBOUN	02/06/97	153	129	86	65	67	102	164	262	309	324	298	385	401	411	436	440	462	554
CENTER ONE WAY NORTHBOUN	02/07/97	181	111	108	75	75	124	148	294	300	327	282	369	386	414	419	508	553	743
CENTER ONE WAY NORTHBOUN	02/08/97	377	189	233	153	150	200	232	330	316	336	338	310	334	359	292	302	348	305
CENTER ONE WAY NORTHBOUN	02/09/97	203	185	125	115	87	93	101	132	213	252	236	247	279	302	316	330	298	288
CENTER ONE WAY NORTHBOUN	02/10/97	125	81	85	51	41	61	92	154	199	231	ERR	ERR	ERR	ERR	ERR	ERR	ERR	ERR

TABLE 2 HOURLY TRAFFIC SUMMARY

ID Location	Date	18:00 - 19:0	19:00 - 20:0	20:00 - 21:0	21:00 - 22:0	22:00 - 23:0	23:00 - 24:0	24 Hours
KEYSTONE SOUTHBOUND	02/02/97	ERR	ERR	569	421	305	196	ERR
KEYSTONE SOUTH BOUND	02/03/97	1228	811	649	535	318	258	18841
KEYSTONE SOUTHBOUND	02/04/97	814	567	467	380	247	140	17044
KEYSTONE SOUTHBOUND	02/05/97	874	530	448	356	243	187	13114
KEYSTONE SOUTHBOUND	02/06/97	1153	838	654	500	345	272	15541
KEYSTONE SOUTHBOUND	02/07/97	1215	803	658	603	519	389	18324
KEYSTONE SOUTHBOUND	02/08/97	611	479	377	319	280	286	10483
KEYSTONE SOUTHBOUND	02/09/97	444	378	310	275	201	133	7949
KEYSTONE SOUTHBOUND	02/10/97	ERR	ERR	ERR	ERR	ERR	ERR	ERR
KEYSTONE NORTHBOUND	02/02/97	ERR	410	340	209	170	135	ERR
KEYSTONE NORTHBOUND	02/03/97	937	578	512	390	238	141	14506
KEYSTONE NORTHBOUND	02/04/97	1264	845	675	536	303	188	17092
KEYSTONE NORTHBOUND	02/05/97	1359	876	638	536	314	192	20422
KEYSTONE NORTHBOUND	02/06/97	1182	752	571	482	265	201	19658
KEYSTONE NORTHBOUND	02/07/97	1258	799	688	628	513	326	20282
KEYSTONE NORTHBOUND	02/08/97	963	761	614	564	508	439	15338
KEYSTONE NORTHBOUND	02/09/97	798	599	502	426	296	175	14077
KEYSTONE NORTHBOUND	02/10/97	ERR	ERR	ERR	ERR	ERR	ERR	ERR
ARLINGTON SOUTHBOUND	02/02/97	ERR	299	249	201	145	108	ERR
ARLINGTON SOUTHBOUND	02/03/97	190	134	135	92	82	67	7965
ARLINGTON SOUTHBOUND	02/04/97	182	129	130	88	78	64	4459
ARLINGTON SOUTHBOUND	02/05/97	336	254	193	165	147	100	6150
ARLINGTON SOUTHBOUND	02/06/97	385	267	200	149	109	128	7054
ARLINGTON SOUTHBOUND	02/07/97	602	382	265	194	207	200	7931
ARLINGTON SOUTHBOUND	02/08/97	21	7	3	5	2	1	1862
ARLINGTON SOUTHBOUND	02/09/97	212	178	126	106	76	76	2362
ARLINGTON SOUTHBOUND	02/10/97	ERR	ERR	ERR	ERR	ERR	ERR	ERR
ARLINGTON NORTHBOUND	02/02/97	ERR	443	394	285	253	231	ERR
ARLINGTON NORTHBOUND	02/03/97	381	224	176	170	134	95	9306
ARLINGTON NORTHBOUND	02/04/97	364	217	173	163	148	134	6560
ARLINGTON NORTHBOUND	02/05/97	380	249	189	169	134	114	6616
ARLINGTON NORTHBOUND	02/06/97	406	245	196	177	135	137	6781
ARLINGTON NORTHBOUND	02/07/97	377	236	189	179	162	148	6652
ARLINGTON NORTHBOUND	02/08/97	230	184	385	343	335	164	4338
ARLINGTON NORTHBOUND	02/09/97	188	121	133	76	79	60	4471
ARLINGTON NORTHBOUND	02/10/97	ERR	ERR	ERR	ERR	ERR	ERR	ERR
SIERRA ONE WAY SOUTHBOUND	02/03/97	1041	593	426	417	376	360	18785
SIERRA ONE WAY SOUTHBOUND	02/04/97	376	290	256	235	212	211	9859
SIERRA ONE WAYSOUTHBOUND	02/05/97	373	357	281	229	205	183	7600
SIERRA ONE WAY SOUTHBOUND	02/06/97	449	360	272	264	195	178	7935
SIERRA ONE WAY SOUTHBOUND	02/07/97	446	412	364	376	395	348	8805
SIERRA ONE WAY SOUTHBOUND	02/08/97	514	458	433	365	370	358	7915
SIERRA ONE WAY SOUTHBOUND	02/09/97	367	285	258	228	205	190	6690
SIERRA ONE WAY SOUTHBOUND	02/10/97	ERR	ERR	ERR	ERR	ERR	ERR	ERR
VIRGINIA SOUTHBOUND	02/02/97	ERR	475	387	375	371	298	ERR
VIRGINIA SOUTHBOUND	02/03/97	615	259	186	205	150	116	9180
VIRGINIA SOUTHBOUND	02/04/97	245	242	200	209	162	129	5097
VIRGINIA SOUTHBOUND	02/05/97	232	230	214	223	154	141	4908
VIRGINIA SOUTHBOUND	02/06/97	285	239	223	201	174	160	5504
VIRGINIA SOUTHBOUND	02/07/97	346	348	474	590	567	413	6986
VIRGINIA SOUTHBOUND	02/08/97	339	319	390	449	514	472	6278
VIRGINIA SOUTHBOUND	02/09/97	261	223	213	211	173	140	5394
VIRGINIA SOUTHBOUND	02/10/97	ERR	ERR	ERR	ERR	ERR	ERR	ERR
VIRGINIA NORTHBOUND	02/02/97	ERR	482	381	315	173	157	ERR
VIRGINIA NORTHBOUND	02/03/97	322	240	175	121	88	90	9653
VIRGINIA NORTHBOUND	02/04/97	168	125	159	136	96	161	6156
VIRGINIA NORTHBOUND	02/05/97	206	170	141	149	102	231	6007
VIRGINIA NORTHBOUND	02/06/97	242	214	172	146	112	92	5640
VIRGINIA NORTHBOUND	02/07/97	469	403	525	529	557	468	7563
VIRGINIA NORTHBOUND	02/08/97	496	500	519	553	515	524	8436
VIRGINIA NORTHBOUND	02/09/97	387	310	298	287	237	172	7570
VIRGINIA NORTHBOUND	02/10/97	ERR	ERR	ERR	ERR	ERR	ERR	ERR
CENTER ONE WAY NORTHBOUN	02/02/97	ERR	343	327	291	288	231	ERR
CENTER ONE WAY NORTHBOUN	02/03/97	507	227	137	160	143	128	7949
CENTER ONE WAY NORTHBOUN	02/04/97	239	245	217	201	197	180	4513
CENTER ONE WAY NORTHBOUN	02/05/97	333	272	237	33	283	199	5689
CENTER ONE WAY NORTHBOUN	02/06/97	424	295	252	254	226	223	6702
CENTER ONE WAY NORTHBOUN	02/07/97	529	366	393	398	466	498	8065
CENTER ONE WAY NORTHBOUN	02/08/97	342	281	312	233	279	268	6819
CENTER ONE WAY NORTHBOUN	02/09/97	266	193	180	145	166	135	4883
CENTER ONE WAY NORTHBOUN	02/10/97	ERR	ERR	ERR	ERR	ERR	ERR	ERR

TABLE 2: HOURLY TRAFFIC SUMMARY

ID Location	Date	AM Peak	Noon Peak	PM Peak	Eve Peak	Daily Peak	Peak Time	Day	Weekly
KEYSTONE SOUTHBOUND	02/02/97				569	569			
KEYSTONE SOUTH BOUND	02/03/97	1259	1468	1679	811	1679	PM	Mon	Mon PM
KEYSTONE SOUTHBOUND	02/04/97	1178	1493	1055	567	1493	Noon	Tue	(16:45-17:45
KEYSTONE SOUTHBOUND	02/05/97	843	1004	1055	530	1055	PM	Wed	
KEYSTONE SOUTHBOUND	02/06/97	860	1298	1430	838	1430	PM	Thur	
KEYSTONE SOUTHBOUND	02/07/97	1113	1365	1413	803	1413	PM	Fri	
KEYSTONE SOUTHBOUND	02/08/97	718	926	735	479	926	Noon	Sat	
KEYSTONE SOUTHBOUND	02/09/97	497	641	664	381	664	PM	Sun	
KEYSTONE SOUTHBOUND	02/10/97	802				802			
KEYSTONE NORTHBOUND	02/02/97				410	410			
KEYSTONE NORTHBOUND	02/03/97	959	1152	1313	578	1313	PM	Mon	
KEYSTONE NORTHBOUND	02/04/97	1078	1347	1740	845	1740	PM	Tue	
KEYSTONE NORTHBOUND	02/05/97	1316	1540	1838	676	1838	PM	Wed	Wed PM
KEYSTONE NORTHBOUND	02/06/97	1346	1680	1686	752	1686	PM	Thur	(16:30-17:30
KEYSTONE NORTHBOUND	02/07/97	1192	1783	1679	799	1783	Noon	Fri	
KEYSTONE NORTHBOUND	02/08/97	888	1243	1257	761	1257	PM	Sat	
KEYSTONE NORTHBOUND	02/09/97	932	1303	1043	599	1303	Noon	Sun	
KEYSTONE NORTHBOUND	02/10/97	1438				1436			
ARLINGTON SOUTHBOUND	02/02/97				299	299			
ARLINGTON SOUTHBOUND	02/03/97	568	764	791	135	791	PM	Mon	Mon PM
ARLINGTON SOUTHBOUND	02/04/97	295	405	437	130	437	PM	Tue	(15:15-16:15
ARLINGTON SOUTHBOUND	02/05/97	410	481	510	254	510	PM	Wed	
ARLINGTON SOUTHBOUND	02/06/97	498	614	645	267	645	PM	Thur	
ARLINGTON SOUTHBOUND	02/07/97	522	595	685	382	685	PM	Fri	
ARLINGTON SOUTHBOUND	02/08/97	155	136	91	7	155	AM	Sat	
ARLINGTON SOUTHBOUND	02/09/97	146	245	221	176	245	Noon	Sun	
ARLINGTON SOUTHBOUND	02/10/97	311				311			
ARLINGTON NORTHBOUND	02/02/97				457	457			
ARLINGTON NORTHBOUND	02/03/97	840	904	654	224	904	Noon	Mon	
ARLINGTON NORTHBOUND	02/04/97	453	494	630	217	630	PM	Tue	
ARLINGTON NORTHBOUND	02/05/97	434	488	592	249	592	PM	Wed	
ARLINGTON NORTHBOUND	02/06/97	464	515	626	245	626	PM	Thur	
ARLINGTON NORTHBOUND	02/07/97	448	494	553	236	553	PM	Fri	
ARLINGTON NORTHBOUND	02/08/97	153	306	382	556	556	Evening	Sat	
ARLINGTON NORTHBOUND	02/09/97	272	530	953	136	953	PM	Sun	Sun PM
ARLINGTON NORTHBOUND	02/10/97	420				420			(16:00-17:00
SIERRA ONE WAY SOUTHBOUND	02/03/97	1396	1451	1529	593	1529	PM	Mon	Mon PM
SIERRA ONE WAY SOUTHBOUND	02/04/97	1018	669	550	290	1018	AM	Tue	(16:30-17:30
SIERRA ONE WAYSOUTHBOUND	02/05/97	676	492	496	357	676	AM	Wed	

TABLE 3. PEAK HOUR TRAFFIC SUMMARIES

ID Location	Date	AM Peak	Noon Peak	PM Peak	Eve Peak	Daily Peak	Peak Time	Day	Weekly
SIERRA ONE WAY SOUTHBOUND	02/06/97	604	540	614	360	614	PM	Thur	
SIERRA ONE WAY SOUTHBOUND	02/07/97	600	596	574	412	600	AM	Fri	
SIERRA ONE WAY SOUTHBOUND	02/08/97	428	475	537	461	537	PM	Sat	
SIERRA ONE WAY SOUTHBOUND	02/09/97	428	471	447	285	471	Noon	Sun	
SIERRA ONE WAY SOUTHBOUND	02/10/97	522				522			
VIRGINIA SOUTHBOUND	02/02/97				475	475			
VIRGINIA SOUTHBOUND	02/03/97	630	817	775	259	817	Noon	Mon	Mon Noon
VIRGINIA SOUTHBOUND	02/04/97	289	391	376	242	391	Noon	Tue	(14:45-15:45
VIRGINIA SOUTHBOUND	02/05/97	274	372	358	230	372	Noon	Wed	
VIRGINIA SOUTHBOUND	02/06/97	337	410	382	239	410	Noon	Thur	
VIRGINIA SOUTHBOUND	02/07/97	320	422	395	619	619	Evening	Fri	
VIRGINIA SOUTHBOUND	02/08/97	274	399	399	552	552	Evening	Sat	
VIRGINIA SOUTHBOUND	02/09/97	335	382	338	227	382	Noon	Sun	
VIRGINIA SOUTHBOUND	02/10/97	260				260			
VIRGINIA NORTHBOUND	02/02/97				482	482			
VIRGINIA NORTHBOUND	02/03/97	808	985	566	240	985	Noon	Mon	Mon Noon
VIRGINIA NORTHBOUND	02/04/97	441	538	390	165	538	Noon	Tue	(13:30-14:30
VIRGINIA NORTHBOUND	02/05/97	491	487	421	231	491	AM	Wed	
VIRGINIA NORTHBOUND	02/06/97	579	536	560	219	579	AM	Thur	
VIRGINIA NORTHBOUND	02/07/97	243	467	539	586	586	Evening	Fri	
VIRGINIA NORTHBOUND	02/08/97	305	503	530	568	568	Evening	Sat	
VIRGINIA NORTHBOUND	02/09/97	402	567	471	310	567	Noon	Sun	
VIRGINIA NORTHBOUND	02/10/97	361				361			
CENTER ONE WAY NORTHBOUN	02/02/97				343	343			
CENTER ONE WAY NORTHBOUN	02/03/97	444	594	746	227	746	PM	Mon	
CENTER ONE WAY NORTHBOUN	02/04/97	222	308	390	245	390	PM	Tue	
CENTER ONE WAY NORTHBOUN	02/05/97	276	375	468	272	468	PM	Wed	
CENTER ONE WAY NORTHBOUN	02/06/97	350	446	554	295	554	PM	Thur	
CENTER ONE WAY NORTHBOUN	02/07/97	333	465	778	503	778	PM	Fri	Fri PM
CENTER ONE WAY NORTHBOUN	02/08/97	377	361	367	312	377	AM	Sat	(16:45-17:45
CENTER ONE WAY NORTHBOUN	02/09/97	266	346	330	197	346	Noon	Sun	
CENTER ONE WAY NORTHBOUN	02/10/97	231				231			

TABLE 3. PEAK HOUR TRAFFIC SUMMARIES

AVERAGE DAILY TRAFFIC

ID Location	Date	0:00 - 1:00	1:00 - 2:00	2:00 - 3:00	3:00 - 4:00	4:00 - 5:00	5:00 - 6:00	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00	9:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00
KEYSTONE SOUTHBOUND		142	83	71	50	46	138	393	634	805	836	774	915	1,089
KEYSTONE NORTHBOUND		159	104	74	63	73	144	420	886	978	1,063	984	1,281	1,348
ARLINGTON SOUTHBOUND		69	55	49	37	27	39	87	258	309	310	368	425	468
ARLINGTON NORTHBOUND		97	78	50	36	35	55	189	333	429	398	413	446	548
SIERRA ONE WAY SOUTHBOUND		191	163	117	88	63	90	163	423	533	498	517	620	629
VIRGINIA SOUTHBOUND		163	130	90	72	55	59	87	177	223	291	393	443	450
VIRGINIA NORTHBOUND		192	149	88	106	77	100	139	250	347	382	491	517	530
CENTER ONE WAY NORTHBOUND		198	123	118	85	80	115	151	237	270	295	290	327	370
TOTAL ACROSS TRACKS		1,212	885	657	538	455	740	1,629	3,198	3,895	4,072	4,231	4,973	5,432

AVERAGE WEEKDAY TRAFFIC

ID Location	Date	0:00 - 1:00	1:00 - 2:00	2:00 - 3:00	3:00 - 4:00	4:00 - 5:00	5:00 - 6:00	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00	9:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00
KEYSTONE SOUTHBOUND		122	72	63	47	46	195	566	842	957	934	835	1,010	1,205
KEYSTONE NORTHBOUND		116	74	59	51	64	156	483	997	1,032	1,127	987	1,285	1,411
ARLINGTON SOUTHBOUND		69	50	43	30	24	46	114	356	417	380	407	477	522
ARLINGTON NORTHBOUND		99	74	44	36	35	65	186	417	496	460	458	502	534
SIERRA ONE WAY SOUTHBOUND		193	175	131	98	70	122	246	730	794	712	674	667	686
VIRGINIA SOUTHBOUND		126	106	82	67	51	60	97	210	239	298	388	448	456
VIRGINIA NORTHBOUND		160	98	51	97	80	120	164	285	373	393	505	492	520
CENTER ONE WAY NORTHBOUND		163	115	91	67	68	107	154	250	291	312	293	337	380
TOTAL ACROSS TRACKS		1,048	763	564	494	435	871	2,009	4,086	4,598	4,616	4,547	5,217	5,715

AVERAGE SATURDAY TRAFFIC

ID Location	Date	0:00 - 1:00	1:00 - 2:00	2:00 - 3:00	3:00 - 4:00	4:00 - 5:00	5:00 - 6:00	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00	9:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00
KEYSTONE SOUTHBOUND		241	129	124	82	69	63	94	246	401	640	771	776	907
KEYSTONE NORTHBOUND		221	158	115	76	75	123	201	375	506	709	924	1,202	986
ARLINGTON SOUTHBOUND		142	145	141	102	71	53	74	84	151	92	98	119	129
ARLINGTON NORTHBOUND		96	95	73	43	39	42	94	120	124	130	130	129	159
SIERRA ONE WAY SOUTHBOUND		264	189	153	126	74	77	112	181	246	340	452	435	398
VIRGINIA SOUTHBOUND		169	126	102	64	46	44	51	71	100	139	320	356	370
VIRGINIA NORTHBOUND		244	200	147	112	81	84	107	167	201	244	318	460	447
CENTER ONE WAY NORTHBOUND		377	189	233	153	150	200	232	330	316	336	338	310	334
TOTAL ACROSS TRACKS		1,754	1,231	1,088	758	605	686	965	1,574	2,045	2,630	3,351	3,787	3,730

AVERAGE SUNDAY TRAFFIC

ID Location	Date	0:00 - 1:00	1:00 - 2:00	2:00 - 3:00	3:00 - 4:00	4:00 - 5:00	5:00 - 6:00	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00	9:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00
KEYSTONE SOUTHBOUND		198	114	74	55	47	45	65	139	266	443	533	537	628
KEYSTONE NORTHBOUND		316	214	129	111	93	70	164	343	500	744	969	1,260	1,035
ARLINGTON SOUTHBOUND		1	0	1	1	0	0	0	0	0	41	165	156	188
ARLINGTON NORTHBOUND		133	109	71	49	41	41	64	107	197	222	162	148	517
SIERRA ONE WAY SOUTHBOUND		265	230	152	112	76	80	108	186	246	340	452	435	398
VIRGINIA SOUTHBOUND		335	254	133	108	84	70	74	121	169	236	320	327	339
VIRGINIA NORTHBOUND		397	323	197	145	97	63	108	179	250	307	415	520	484
CENTER ONE WAY NORTHBOUND		203	185	125	115	87	93	101	132	213	232	236	247	279
TOTAL ACROSS TRACKS		1,848	1,429	882	696	525	462	684	1,207	1,641	2,585	3,252	3,630	3,868

TABLE 4. DAILY TRAFFIC SUMMARIES

AVERAGE DAILY TRAFFIC

ID Location	Date	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00	18:00-19:00	19:00-20:00	20:00-21:00	21:00-22:00	22:00-23:00	23:00-24:00	ONE WAY 24 HR	TWO WAY 24 HR
KEYSTONE SOUTHBOUND		1,021	958	996	990	1,016	852	599	497	408	306	229	13,847	31,358
KEYSTONE NORTHBOUND		1,227	1,248	1,288	1,317	1,454	1,109	703	568	471	326	225	17,511	
ARLINGTON SOUTHBOUND		464	403	433	446	369	275	217	195	151	128	113	5,696	12,419
ARLINGTON NORTHBOUND		438	402	433	543	477	332	243	237	200	176	135	6,724	
SIERRA ONE WAY SOUTHBOUND		695	667	653	655	658	532	400	335	314	292	274	9,570	9,570
VIRGINIA SOUTHBOUND		443	449	429	393	367	349	311	298	322	300	249	6,543	14,075
VIRGINIA NORTHBOUND		583	452	473	432	400	347	359	316	300	255	248	7,532	
CENTER ONE WAY NORTHBOUND		385	318	398	426	502	385	284	263	245	261	240	6,367	6,367
TOTAL ACROSS TRACKS		5,256	4,896	5,104	5,201	5,242	4,181	3,115	2,708	2,411	2,044	1,712	73,788	73,788

AVERAGE WEEKDAY TRAFFIC

ID Location	Date	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00	18:00-19:00	19:00-20:00	20:00-21:00	21:00-22:00	22:00-23:00	23:00-24:00	ONE WAY 24 HR	TWO WAY 24 HR
KEYSTONE SOUTHBOUND		1,122	1,182	1,154	1,145	1,210	1,014	685	556	460	339	247	16,006	34,398
KEYSTONE NORTHBOUND		1,228	1,327	1,337	1,406	1,615	1,200	770	617	514	327	210	18,392	
ARLINGTON SOUTHBOUND		510	519	552	576	489	339	233	185	138	125	112	6,712	13,895
ARLINGTON NORTHBOUND		483	483	490	480	601	382	234	185	172	143	125	7,183	
SIERRA ONE WAY SOUTHBOUND		766	752	755	748	767	578	414	330	323	295	274	11,296	11,296
VIRGINIA SOUTHBOUND		440	459	439	404	378	345	264	259	286	241	192	6,335	13,339
VIRGINIA NORTHBOUND		563	527	461	391	363	281	231	234	216	191	208	7,004	
CENTER ONE WAY NORTHBOUND		396	416	418	460	578	406	281	247	249	259	246	6,584	6,584
TOTAL ACROSS TRACKS		5,507	5,665	5,606	5,611	6,001	4,545	3,111	2,613	2,357	1,918	1,613	79,511	79,511

AVERAGE SATURDAY TRAFFIC

ID Location	Date	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00	18:00-19:00	19:00-20:00	20:00-21:00	21:00-22:00	22:00-23:00	23:00-24:00	ONE WAY 24 HR	TWO WAY 24 HR
KEYSTONE SOUTHBOUND		888	656	684	718	642	611	479	377	319	280	286	10,483	25,821
KEYSTONE NORTHBOUND		1,165	1,157	1,192	1,198	1,106	963	761	614	564	508	439	15,338	
ARLINGTON SOUTHBOUND		115	75	84	91	57	21	7	3	5	2	1	1,862	6,200
ARLINGTON NORTHBOUND		159	292	309	382	281	230	184	385	343	335	164	4,338	
SIERRA ONE WAY SOUTHBOUND		412	470	453	523	512	514	458	433	365	370	358	7,915	7,915
VIRGINIA SOUTHBOUND		385	389	399	344	320	339	319	390	449	514	472	6,278	14714
VIRGINIA NORTHBOUND		500	493	494	530	500	496	500	519	553	515	524	8,436	
CENTER ONE WAY NORTHBOUND		359	292	302	348	305	342	281	312	233	279	268	6,819	6,819
TOTAL ACROSS TRACKS		3,983	3,824	3,917	4,134	3,723	3,516	2,989	3,033	2,831	2,803	2,512	61,469	61,469

AVERAGE SUNDAY TRAFFIC

ID Location	Date	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00	18:00-19:00	19:00-20:00	20:00-21:00	21:00-22:00	22:00-23:00	23:00-24:00	ONE WAY 24 HR	TWO WAY 24 HR
KEYSTONE SOUTHBOUND		615	570	629	638	612	444	378	440	348	253	165	8,235	21,945
KEYSTONE NORTHBOUND		1,222	1,087	1,043	988	993	798	505	421	318	233	155	13,710	
ARLINGTON SOUTHBOUND		226	188	221	206	196	212	238	188	154	111	92	2,583	7,623
ARLINGTON NORTHBOUND		251	259	226	953	164	188	282	264	181	166	146	5,040	
SIERRA ONE WAY SOUTHBOUND		412	433	447	416	309	367	285	258	228	205	190	6,690	6,690
VIRGINIA SOUTHBOUND		353	357	338	286	269	261	349	300	293	272	219	5,867	13,539
VIRGINIA NORTHBOUND		567	493	459	453	422	387	396	340	301	205	165	7,672	
CENTER ONE WAY NORTHBOUND		302	316	330	296	286	266	268	254	218	226	183	5,213	5,213
TOTAL ACROSS TRACKS		3,948	3,703	3,793	4,236	3,311	2,923	2,700	2,463	2,040	1,671	1,314	55,009	55,009

TABLE 4. DAILY TRAFFIC SUMMARIES

AVERAGE WEEKEND TRAFFIC

ID Location	Date	0:00 - 1:00	1:00 - 2:00	2:00 - 3:00	3:00 - 4:00	4:00 - 5:00	5:00 - 6:00	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00
KEYSTONE SOUTHBOUND		220	122	99	69	58	54	80	193	334
KEYSTONE NORTHBOUND		269	186	122	94	84	97	183	359	503
ARLINGTON SOUTHBOUND		72	73	71	52	36	27	37	42	76
ARLINGTON NORTHBOUND		115	102	72	46	40	42	79	114	161
SIERRA ONE WAY SOUTHBOUND		265	210	153	119	75	79	110	184	246
VIRGINIA SOUTHBOUND		252	190	118	86	65	57	63	96	135
VIRGINIA NORTHBOUND		321	262	172	129	89	74	108	173	226
CENTER ONE WAY NORTHBOUND		290	187	179	134	119	147	167	231	265
TOTAL ACROSS TRACKS		1,801	1,330	985	727	565	574	825	1,391	1,943

AVERAGE HOURLY TRAFFIC PER CROSSING

ID Location	Date	0:00 - 1:00	1:00 - 2:00	2:00 - 3:00	3:00 - 4:00	4:00 - 5:00	5:00 - 6:00	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00
ALL LOCATIONS	Monday	130	96	77	61	58	102	261	561	[illegible]
	Tuesday	133	77	65	54	58	137	311	498	543
	Wednesday	123	78	59	50	48	92	225	469	519
	Thursday	119	89	53	46	43	82	201	459	522
	Friday	117	107	70	79	49	88	211	472	529
	Saturday	219	154	136	95	76	86	121	197	256
	Sunday	231	179	110	87	66	58	86	151	230
TOTAL ACROSS TRACKS		1,072	779	571	471	397	644	1,415	2,807	3,208

AVERAGE TOTAL HOURLY TRAFFIC

ID Location	Date	0:00 - 1:00	1:00 - 2:00	2:00 - 3:00	3:00 - 4:00	4:00 - 5:00	5:00 - 6:00	6:00 - 7:00	7:00 - 8:00	8:00 - 9:00
ALL LOCATIONS	02/03/97	1,300	966	814	623	600	1,064	2,355	5,285	6,091
	02/04/97	1,062	615	520	430	462	1,093	2,487	3,980	4,345
	02/05/97	985	625	472	400	385	733	1,801	3,752	4,150
	02/06/97	951	709	426	369	342	659	1,611	3,673	4,174
	02/07/97	937	853	561	629	389	704	1,687	3,779	4,234
	02/08/97	1,754	1,231	1,088	758	605	686	965	1,574	2,045
	02/09/97	1,848	1,429	882	696	525	462	684	1,207	1,841
TOTAL ACROSS TRACKS		8,837	6,428	4,763	3,905	3,308	5,401	11,590	23,250	26,880

TABLE 5. DAILY TRAFFIC SUMMARIES

AVERAGE WEEKEND TRAFFIC

ID Location	Date	9:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00
KEYSTONE SOUTHBOUND		542	652	657	768	752	613	657	678	627
KEYSTONE NORTHBOUND		727	947	1,231	1,011	1,194	1,122	1,118	1,093	1,050
ARLINGTON SOUTHBOUND		67	132	138	159	171	132	153	149	127
ARLINGTON NORTHBOUND		176	146	139	338	205	276	318	668	223
SIERRA ONE WAY SOUTHBOUND		340	452	435	398	412	452	450	470	441
VIRGINIA SOUTHBOUND		188	320	342	355	369	373	369	315	295
VIRGINIA NORTHBOUND		276	367	490	466	534	493	477	492	461
CENTER ONE WAY NORTHBOUND		294	287	279	307	331	304	316	322	296
TOTAL ACROSS TRACKS		2,608	3,302	3,709	3,799	3,966	3,764	3,855	4,185	3,517

AVERAGE HOURLY TRAFFIC PER CROSSING

ID Location	Date	9:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00
ALL LOCATIONS	Monday	557	752	854	918	874	905	860	879	895
	Tuesday	567	525	580	636	595	615	570	581	632
	Wednesday	495	499	568	621	612	621	633	633	674
	Thursday	529	520	581	675	640	668	720	721	759
	Friday	533	529	669	697	703	718	718	706	804
	Saturday	329	419	473	466	498	478	490	517	465
	Sunday	323	407	454	484	494	463	474	530	414
TOTAL ACROSS TRACKS		3,332	3,650	4,178	4,498	4,416	4,468	4,465	4,566	4,643

AVERAGE TOTAL HOURLY TRAFFIC

ID Location	Date	9:00-10:00	10:00-11:00	11:00-12:00	12:00-13:00	13:00-14:00	14:00-15:00	15:00-16:00	16:00-17:00	17:00-18:00
ALL LOCATIONS	02/03/97	6,048	6,015	6,832	7,344	6,989	7,236	6,878	7,031	7,157
	02/04/97	4,535	4,197	4,636	5,089	4,762	4,918	4,560	4,645	5,057
	02/05/97	3,961	3,992	4,544	4,971	4,899	4,969	5,067	5,066	5,395
	02/06/97	4,228	4,160	4,648	5,399	5,123	5,346	5,761	5,766	6,069
	02/07/97	4,267	4,235	5,348	5,579	5,623	5,744	5,742	5,649	6,430
	02/08/97	2,630	3,351	3,787	3,730	3,983	3,824	3,917	4,134	3,723
	02/09/97	2,585	3,252	3,630	3,868	3,948	3,703	3,793	4,236	3,311
TOTAL ACROSS TRACKS		28,254	29,202	33,425	35,980	35,327	35,740	35,718	36,527	37,142

TABLE 5. DAILY TRAFFIC SUMMARIES

AVERAGE WEEKEND TRAFFIC

ID Location	Date	18:00-19:00	19:00-20:00	20:00-21:00	21:00-22:00	22:00-23:00	23:00-24:00	ONE WAY 24 HR	TWO WAY 24 HR
KEYSTONE SOUTHBOUND		528	429	419	338	262	205	9,350	23,664
KEYSTONE NORTHBOUND		881	590	485	400	325	250	14,315	
ARLINGTON SOUTHBOUND		117	161	126	104	74	62	2,350	6,976
ARLINGTON NORTHBOUND		209	249	304	235	222	152	4,627	
SIERRA ONE WAY SOUTHBOUND		441	372	346	297	288	274	7,303	7,303
VIRGINIA SOUTHBOUND		300	339	330	345	353	303	5,954	13,807
VIRGINIA NORTHBOUND		442	431	399	385	308	284	7,853	
CENTER ONE WAY NORTHBOUND		304	272	273	223	244	211	5,978	5,978
TOTAL ACROSS TRACKS		3,220	2,842	2,682	2,326	2,076	1,741	57,729	57,729

AVERAGE HOURLY TRAFFIC PER CROSSING

ID Location	Date	18:00-19:00	19:00-20:00	20:00-21:00	21:00-22:00	22:00-23:00	23:00-24:00	ONE WAY 24 HR
ALL LOCATIONS	Monday	653	383	300	261	191	157	11,392
	Tuesday	457	333	285	244	180	151	8,823
	Wednesday	512	367	292	258	195	168	8,813
	Thursday	566	401	318	272	195	174	9,352
	Friday	655	469	445	437	423	348	10,576
	Saturday	440	374	379	354	350	314	7,684
	Sunday	365	338	311	257	209	162	6,881
TOTAL ACROSS TRACKS		3,647	2,665	2,329	2,082	1,745	1,475	63,520

AVERAGE TOTAL HOURLY TRAFFIC

ID Location	Date	18:00-19:00	19:00-20:00	20:00-21:00	21:00-22:00	22:00-23:00	23:00-24:00	ONE WAY 24 HR
ALL LOCATIONS	02/03/97	5,221	3,066	2,396	2,090	1,529	1,255	96,185
	02/04/97	3,652	2,660	2,277	1,948	1,443	1,207	70,580
	02/05/97	4,093	2,938	2,339	2,060	1,562	1,347	70,506
	02/06/97	4,526	3,210	2,540	2,173	1,561	1,391	74,815
	02/07/97	5,242	3,751	3,556	3,497	3,386	2,786	84,608
	02/08/97	3,516	2,989	3,033	2,831	2,803	2,512	61,469
	02/09/97	2,923	2,285	2,020	1,754	1,433	1,081	53,396
TOTAL ACROSS TRACKS		29,173	20,899	18,161	16,353	13,717	11,579	511,559

Appendix I
DETAILED COMPILATION OF THE BASIC DELAY EQUATIONS

Appendix I
DELAY EQUATIONS AND MODEL DEVELOPMENT

The model for determination of vehicular traffic delay was developed around delay equations derived for uniform traffic flow conditions at bottlenecks.[1] The basic delay equations were derived, then later confirmed from the ITE *Traffic and Transportation Handbook*, as derived by Adolph May at UC Berkeley. The verbal form of the basic equation was as follows, with the algebriac version in the following subsection:

Total grade crossing delay from a train = [Average delay] x [Number of cars delayed]

where:

Average delay = [Gate down time]/2

Number of cars delayed = [Traffic flow rate] x [Event time]

Event time = Time from gate going down to last delayed car crossing tracks

= [Gate down time] + [Queue dissipation time]

which algebra can reduce to:

Number of cars delayed = [Gate down time] x [traffic function]

Thus,

Total delay = {[Gate down time] x [Gate down time] x [traffic function]}/2

or

Total delay = $[\text{Gate down time}]^2$ x [traffic function]/2

where:

$$\text{Traffic function} = \frac{[\text{Traffic flow rate}] \times [\text{traffic dissipation rate}]}{[\text{traffic dissipation rate}] - [\text{traffic flow rate}]}$$

[1]ITE *Transportation and Traffic Handbook*, 2nd Ed, Prentice-Hall, Inc., 1982. p. 467-468.

Appendix I
DELAY EQUATIONS AND MODEL DEVELOPMENT

ITE Queuing Delay Formulas

Lower case letters represent subscripts for notational convenience. From ITE, total delay under an assumption of uniform flow is the following:

$D = r(q - s_r)t_q/2$ 15.157

where (converting from ITE notation)

t_q = Te = Tm + Tqd = total event time from start of blockage to end of queue

t_o = Tqd = queue dissipation time

q = Va = traffic approach rate

s = Vd = dissipation rate at saturation

s_r = flow rate when gate is down = 0 (applies only to freeway blockage model)

r = Tm = gate down time

Q_m = Qm = maximum queue

D = Dt = total delay

N = N = Qtot = total number of vehicles delayed

Substituting notation reduces the ITE formula to my result (in its many variations) of:

Dt = Tm Va (Tm + Tqd)/2 = Qm (Tm + Tqd)/2 = Tm^2 Va Vd/(Vd-Va)/2

where

^2 denotes raising the previous variable to the power of 2.

Appendix I
DELAY EQUATIONS AND MODEL DEVELOPMENT

Approximate Delay Equations

Two approximate equations were used as a quick field check on delay. A very crude approximation of total delay is the following:

Total delay = Dt ≈ N(Tm+Tqd)/2 ≈ Va(Tm + Tqd)^2/2

by assumption of uniform arrivals where

N = Qtot = total queue, the total number of cars delayed by the train

Qm = maximum queue, the queue at the time the first car starts to cross the tracks after the gates go up.

Tm = the event time associated with the formation of Qm

Tqd = the dissipation time of Qtot = Qm/(Vd-Va)

Vd = dissipation rate

Va = approach traffic rate, and

^2 denotes raising the previous variable to the power of 2.

A better approximation is:

Dt ≈ N1(Tm + Tqd')/2 + N2 Tqd/2

where

N1 = Tm (N1 + N2)/(Tm + Tqd) = Qm, and

Tqd' = Tm Tqd/(Tm + Tqd).

If Tqd in the second term of the main equation is replaced by Tqd', the formula is then exact. We counted Tm, Tqd, and N directly and estimated N1, N2, and Tqd' from the above. N1 = Qm and N = Qtot. For the Keystone sample, this version was just slightly more (about 7%) than my exact algebraic version of :

Appendix I
DELAY EQUATIONS AND MODEL DEVELOPMENT

$Dt = Qm(Tm+Tqd)/2 = Tm^2(VaVd/(Vd-Va))/2.$

The approximate field version is much higher than the exact: about 50% based on the Keystone sample. The 18 second approximation is about 27% low for the Keystone sample. When the queues are very small, i.e., 5 to 15 cars, all of these methods converge.

Other Equations

More equations that are useful:

$S = L/((Tm - Tg) \times C)$ = train speed in mph

where:

L = train length in feet from UP data

Tm = gate closed time in minutes

Tg = gate is closed when train is not blocking crossing ≈ 0.5 minute

C = conversion constant = 88fpm/mph (88 feet per minute = 1 mile per hour)

Likewise:

$Tm = L/(S \times C) + Tg$

$Te = L/S + Tg + Tqd$

$Tqd = Qm/(Vd - Va)$

$Qm = Va (L/S + Tg + Ts)$

$Qtot = TeVa = Qm + VaTqd = Qm + VaQm/(Vd-Va) = QmVd/(Vd-Va)$

Ts = time for queue to start in motion after gate goes up = 3.5 seconds in Wichita, but our Reno observations included that in the gate time, so Ts = 0 in Reno and Qm = VaTm.

Model Calibration

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DELAY EQUATIONS AND MODEL DEVELOPMENT

The check data set was used for calibration. It consisted of about 40 video train observations each for Keystone and Virginia Streets and about 20 video train observations each for the remaining three streets. Keystone and Virginia were sampled much more heavily than the other streets because there was much more delay on those two streets during the survey week. While a range of train and traffic events from high to low delay was sampled, the sample effectively included all of the events with high delay. The calibration procedure for all streets but Center was:

1. Calculate the maximum queue (the queue at the time the gate opens after passage of a train) from components measured in the data check (total cars delayed, gate down time, event time).

2. Apply calibration factors to the 15 minute approach volume from the tube count to force, on the average, maximum queue = [traffic flow rate] x [gate closed time] to equal maximum queue from Step 1 above.

3. Determine the average dissipation rates of queues from the check data, by type of street (Table 7.1).

4. Apply the calibrated traffic flow rate to the delay formula (Section 3.1) where the formula is used with the uncalibrated gate down time from the February survey and compared with the results of the another version with all calibrated variables, including an average dissipation rate.

This calibration corrected for errors in the tube counts as well as discrepancies that came from applying a 15-minute count flow rate to the shorter gate down time within the 15 minutes. That is, on the average, the 15-minute flow rates should give a good approximation of the flow rates during the train events within the specific 15 minutes, but due to variations within the 15-minute period, the average is only an approximation. Video check counts were performed of traffic samples on all streets except Center, for which the video record included only the time during train events instead of running continuously. The resulting calibration was within one percent of the directly measured delay.

There were two variations on the above procedures:

1. The average value of the dissipation rate in Step 4 did not work as well on Virginia Street. An additional calibration factor was consequently used to match the model output to the directly measured delay.

2. The check data for Center Street consisted only of the maximum queue, with survey gate down time, so the calibration procedures used measured maximum queue and calculated total queue (total cars delayed) and queue dissipation time, essentially working the calibration formulas backwards from the other streets. Because the Center Street Bridge over the Truckee River was closed in the winter, traffic and delay were very low on Center Street, leading to a simple situation to model. Dissipation rates were assumed similar to Sierra Street, which is similarly one way with traffic signals at the tracks.

Base Delay from Turns and Traffic Signals

Base intersection delay is not calculated because it factors out of the difference in between pre-merger and post-merger delay. That is, the intersection delay would be a function of approach traffic, signal timing, and percent turns. None of these vary with the number of trains, so the base intersection delay component is a constant with increasing trains.

Application to all Sixteen Streets

The remaining 11 streets were modeled on the basis of similar surveyed streets. The main criterion was the presence or absence of turning movements or traffic signals close enough to the crossing to cause lower queue dissipation rates. The complete list of 16 streets analyzed was as follows:

Street Name	Type for Analysis	Model Street
Woodland Ave	Low volume rural	Keystone adjusted
Stagg	Low volume rural	Keystone adjusted
Del Curto Dr	Low volume rural	Keystone adjusted
Keystone	High volume arterial	Itself with adjusted traffic
Vine	Low volume arterial	Arlington adjusted
Washington	Low volume arterial	Arlington adjusted
Ralston	Low volume arterial	Arlington adjusted
Arlington	Median volume arterial	Itself with adjusted traffic
West St	Low volume arterial	Arlington adjusted
Sierra	Downtown arterial (adjacent signal)	Itself with adjusted traffic
Virginia	Downtown arterial (adjacent signal)	Itself with adjusted traffic
Center	Downtown arterial	Itself with adjusted traffic

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DELAY EQUATIONS AND MODEL DEVELOPMENT

	(adjacent signal)	
Lake	Median volume arterial	Arlington adjusted
Morrill Ave	Low volume industrial	Keystone adjusted
Sutro St	Median volume arterial	Sierra adjusted
Sage St	Low volume arterial	Keystone adjusted

Stagg was included although it is a private crossing because it is of concern to the City of Reno. In general, private crossings were not included because of the lack of public access and very low volumes of traffic.

Overlap Trains

Overlap trains were included in the model, with a weighting procedure developed to include fewer overlap trains at 12.7 trains per day and more at 24 trains per day than were in the sample data set with 20 trains per day. Inclusion of the overlap trains increased the effect of a 10-mph speed change by about 20 percent, making the model more robust.

Queue Dissipation Rates

Table 7.2.1-1 lists the base dissipation rates used in the model. The 16 streets listed in Table 7.2.1-2 indicate how the per lane base dissipation rates were applied to other streets. Saturation dissipation rates were measured for the five base streets and are considered very reliable.

Adjustments for Number of Trains

Total delay was assumed to be linear with the number of trains. That is, while delay is very nonlinear within a train event, the train events are assumed to be independent and therefore linear. Overlapping trains, which are obviously non-linear, were weighted to reflect their average probability of occurring, which depended on the average total number of freight trains expected per day.

This procedure for adjusting for the number of trains in the delay model was simply to ratio the total delay by the number of daily freight trains for the base or merger cases, 12.7 and 24, respectively, as compared with 20 for the model data. Delay from overlapping freight trains received additional ratios of 12.7/20 or 24/20, respectively. The remainder of this section presents the results of this model.

Appendix J
VEHICULAR TRAFFIC DELAY ANALYSIS COMPARING YEAR 1995 VEHICULAR TRAFFIC AND PRE-MERGER TRAINS WITH YEAR 2000 VEHICULAR TRAFFIC AND POST-MERGER TRAINS

Appendix J
PRE-MERGER AVERAGE DAILY VEHICULAR DELAY WITH 1995 TRAFFIC

As a sensitivity test, pre-merger average daily vehicular traffic delay was computed with 1995 traffic volumes instead of 2000 traffic volumes. The results were then compared with pre- and post-merger vehicular delay based on 2000 traffic volumes. Figures 1 through 3 illustrate the results. Instead of 189 hours of total delay with 2000 traffic (Figure 7.1), Figure 1 shows that the pre-merger projected delay with 12.7 trains and 1995 traffic would be 166 hours. Figure 2 corresponding depicts a total daily vehicular delay with 2000 traffic and a post-merger volume of 24 trains per day to be 373 hours, an increase of 207 hours attributable to the increase in trains and the increase in traffic between 1995 and 2000. From Figure 7.2, the increase in vehicular delay from the increase in trains only would be 184 hours (from 189 to 373 hours).

With a 10-mph train speed increase as mitigation, Figure 3 shows that the total daily vehicular delay for a post-merger volume of 24 freight trains per day and 2000 traffic would be 154 hours, 12 hours less than the pre-merger delay of 166 hours with 1995 traffic. Thus, speeding the trains up by 10 mph reduces the post-merger vehicular delay to below pre-merger levels regardless of whether the pre-merger traffic is assumed to correspond to 1995 or 2000.

Figure 1. Delay for Pre-Merger 12.7 Trains

Projected Reno Average Daily Vehicular Delay from Freight Trains - Year 1995 Vehicular Traffic

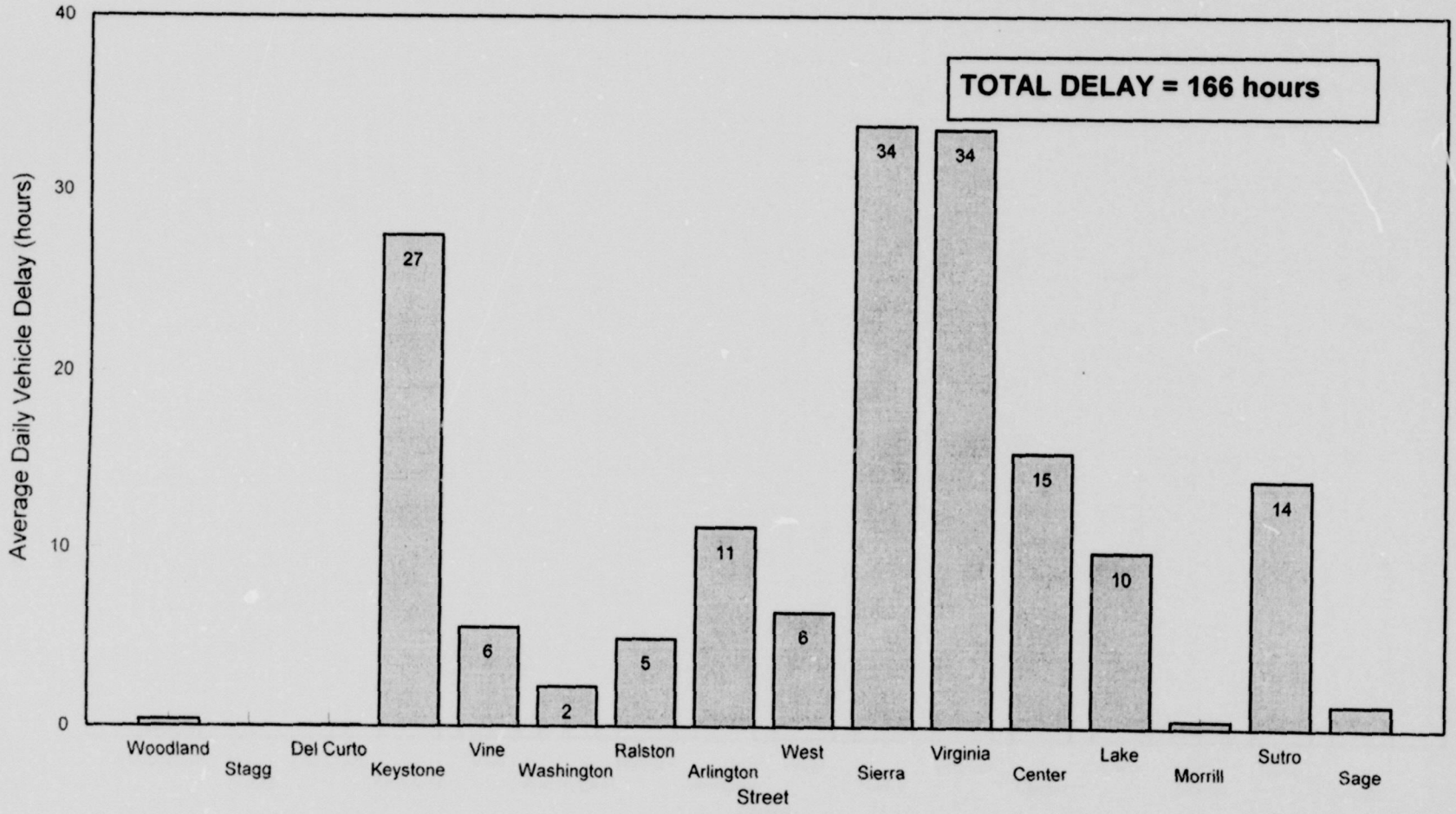

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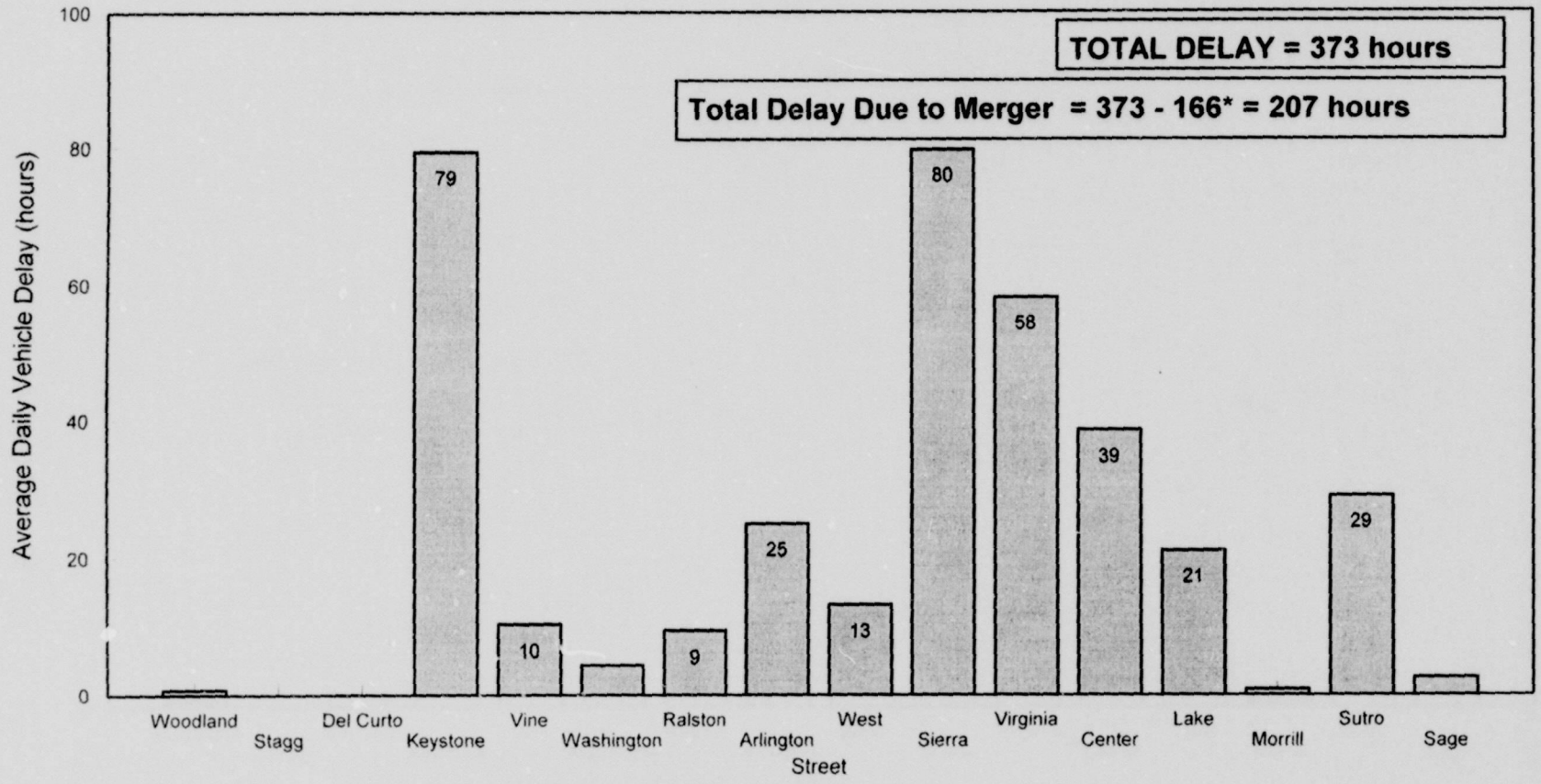
Figure 2. Delay for Post-Merger 24.0 Trains - No Mitigation

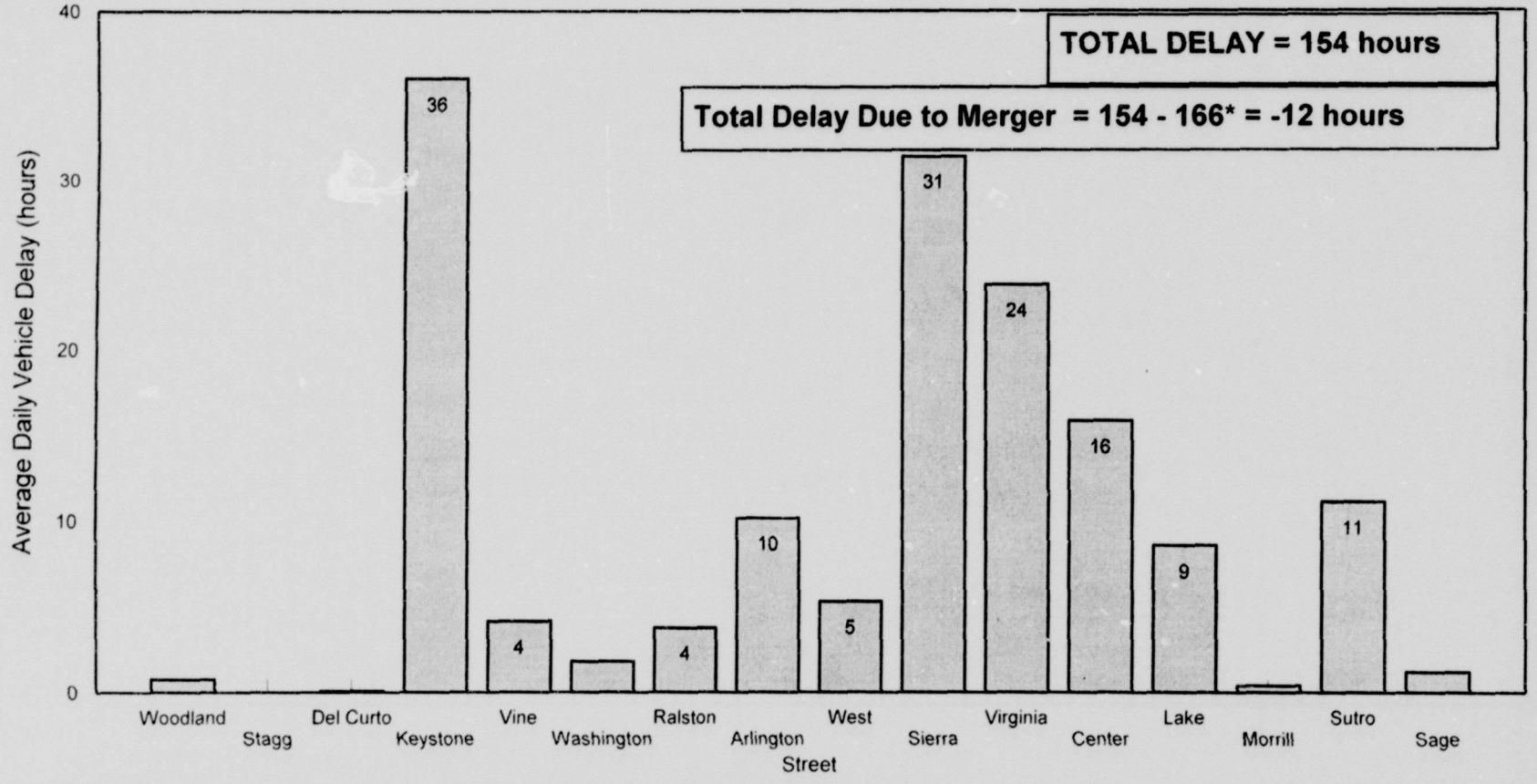
Projected Reno Average Daily Vehicular Delay from Freight Trains - Year 2000 Vehicular Traffic



* 166 hours is pre-merger total delay with 1995 traffic

Figure 3. Delay for 24.0 Trains, Train Speed Increased by 10 mph (Keystone to Sage)

Projected Reno Average Daily Vehicular Delay from Freight Trains - Year 2000 Vehicular Traffic



* 166 hours is pre-merger total delay with 1995 traffic

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Appendix K
FRA GRADE CROSSING ACCIDENT ESTIMATION METHODOLOGY

U.S. Department of Transportation
Federal Railroad Administration

Summary of the DOT Rail-Highway Crossing Resource Allocation Procedure - Revised

Office of Safety
Office of Safety Analysis
Washington DC 20590

Edwin H. Farr

Transportation Systems Center
Cambridge MA 02142

NCHRP
258 Report
G.GREAT.

DOT/FRA/OS-87/05
DOT-TSC-FRA-86-2

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Final Report

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15. Supplementary Notes

16. Abstract

The Highway Safety Acts of 1973 and 1976, and the Surface Transportation Assistance Acts of 1978 and 1982 provide funding authorizations to individual states to improve safety at public rail-highway crossings. The installation of active motorist warning devices, such as flashing lights or flashing lights with gates, is an important part of crossing safety improvements. The U.S. Department of Transportation (DOT) assists states and railroads in determining effective allocations of Federal funds for rail-highway crossing safety improvements. This report is a revision of a previous report which describes the resource allocation procedure developed to assist in the allocation of funds among crossings to achieve maximum crossing safety benefits for a given level of funding.

The procedure consists of two parts. The first is an accident and severity prediction formula which computes the expected number or accidents at each crossing, based on information from the U.S. DOT-AAR National Rail-Highway Crossing Inventory and the Railroad Accident/Incident Reporting System (RAIRS). The second part is a resource allocation model designed to nominate crossings for improvement consideration on a cost-effective basis and to suggest the type of warning device to be installed.

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PREFACE

The Department of Transportation's (DOT) rail-highway crossing accident prediction formula and resource allocation model were developed at the Transportation Systems Center (TSC) under the sponsorship of the Federal Railroad Administration's (FRA) Office of Safety Analysis and the Federal Highway Administration's (FHWA) Office of Research. When used together, these procedures provide a systematic means of assisting in making a preliminary, optimum allocation of funds among individual crossings, considering available improvement options. These procedures provide a ranked listing of crossings which can then be used as a guide for selecting crossings for on-site visits by diagnostic teams. States and railroads are invited to contact the FRA, FHWA, or the author of this report for assistance in using the resource allocation procedures.

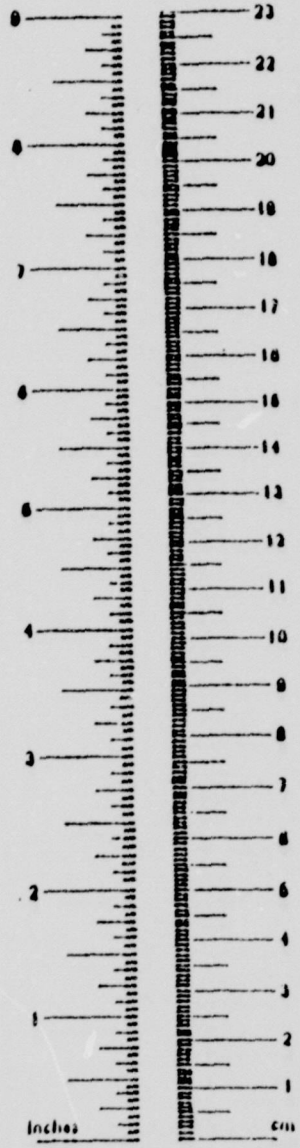
This report provides an overview of the use and output of these procedures. The author had the major role in formulating the resource allocation model while Dr. Peter H. Mengert/TSC had the primary role in developing the DOT rail-highway crossing accident prediction formula.

METRIC CONVERSION FACTORS

Approximate Conversions to Metric Measures

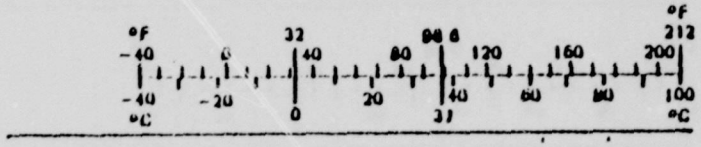
Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
in	inches	*2.5	centimeters	cm
ft	feet	30	centimeters	cm
yd	yards	0.9	meters	m
mi	miles	1.6	kilometers	km
		AREA		
in²	square inches	6.5	square centimeters	cm²
ft²	square feet	0.09	square meters	m²
yd²	square yards	0.8	square meters	m²
mi²	square miles	2.6	square kilometers	km²
	acres	0.4	hectares	ha
		MASS (weight)		
oz	ounces	28	grams	g
lb	pounds	0.45	kilograms	kg
	short tons (2000 lb)	0.9	tonnes	t
		VOLUME		
tsp	teaspoons	5	milliliters	ml
Tbsp	tablespoons	15	milliliters	ml
fl oz	fluid ounces	30	milliliters	ml
c	cups	0.24	liters	l
pt	pints	0.47	liters	l
qt	quarts	0.96	liters	l
gal	gallons	3.8	liters	l
ft³	cubic feet	0.03	cubic meters	m³
yd³	cubic yards	0.76	cubic meters	m³
		TEMPERATURE (exact)		
°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

*1 in. = 2.54 cm (exactly). For other exact conversions and more detail tables see NBS Misc. Publ. 286, Units of Weights and Measures. Price $2.25 SD Catalog No. C13.10:286.



Approximate Conversions from Metric Measures

Symbol	When You Know	Multiply by	To Find	Symbol
		LENGTH		
mm	millimeters	0.04	inches	in
cm	centimeters	0.4	inches	in
m	meters	3.3	feet	ft
m	meters	1.1	yards	yd
km	kilometers	0.6	miles	mi
		AREA		
cm²	square centimeters	0.16	square inches	in²
m²	square meters	1.2	square yards	yd²
km²	square kilometers	0.4	square miles	mi²
ha	hectares (10,000 m²)	2.5	acres	
		MASS (weight)		
g	grams	0.035	ounces	oz
kg	kilograms	2.2	pounds	lb
t	tonnes (1000 kg)	1.1	short tons	
		VOLUME		
ml	milliliters	0.03	fluid ounces	fl oz
l	liters	2.1	pints	pt
l	liters	1.06	quarts	qt
l	liters	0.26	gallons	gal
m³	cubic meters	35	cubic feet	ft³
m³	cubic meters	1.3	cubic yards	yd³
		TEMPERATURE (exact)		
°C	Celsius temperature	9/5 (then add 32)	Fahrenheit temperature	°F



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LIST OF SYMBOLS

A = final predicted number of accidents per year

a = initial predicted number of accidents per year

c = number of highway vehicles per day

d = number of through trains per day during daylight

DT = factor for number of through trains per day during daylight

EI = exposure index factor based on the product of the number of highway vehicles and trains per day

hl = number of highway lanes

HL = factor for number of highway lanes

hp = highway paved?, yes = 1.0, no = 2.0

HP = factor for highway paved

K = basic accident prediction formula constant

ms = maximum timetable speed (mph)

MS = factor for maximum timetable speed

mt = number of main tracks

MT = factor for number of main tacks

N = number of accidents recorded for a crossing in T years

t = number of trains per day

tt = number of through trains per day

TT = factor for number of through trains per day

ts = number of switch trains per day

TS = factor for number of switch trains per day

T = number years of recorded accident data

T_o = weighting factor in DOT accident prediction formula

ur = 1 for urban crossings, 0 for rural crossings

UR = factor for urban-rural

1. INTRODUCTION

This report is a revision of a previous report with the same title. (1) The present report contains a revised accident prediction formula based on recent inventory data and recent accident experience. The report also contains formulas which calculate severity prediction; it contains extended warning device effectiveness data; and it contains the inclusion of the stop sign option in the resource allocation model.

Under Section 203 of the Highway Safety Acts of 1973 and 1976 and the Surface Transportation Assistance Acts of 1978 and 1982, Congress provided funding authorizations for individual states to improve safety at public rail-highway crossings. Included in these authorizations is funding for the installation of active motorist warning devices, such as flashing lights or flashing lights with gates. These devices are an important part of crossing safety improvements. In support of these safety efforts, several projects have been undertaken by the U.S. Department of Transportation (DOT) to assist states and railroads in determining effective allocations of funds for rail-highway crossing safety improvement. One project is the development of a resource allocation procedure which assists in nominating and ranking crossings for safety improvements to assure maximum safety benefits for a given level of funding. DOT's resource allocation procedure is based on two analytical tools: an accident prediction formula and a resource allocation model. The purpose of this report is to describe these tools in non-technical language and to explain the applications for the resource allocation procedure.

A joint U.S. DOT-AAR National Rail-Highway Crossing Inventory (DOT Crossing Inventory) was completed in 1976. Updated inventory data are published annually. (2) The DOT Crossing Inventory contains characteristics of all rail-highway crossings in the United States, gives uniform information on each crossing, and provides an improved basis for rail-highway crossing accident prediction.

A number of crossing hazard formulas have been developed and used extensively in dealing with solutions to the rail-highway crossing safety problem. (3) The DOT accident prediction formula is based on the extensive data in the DOT Crossing Inventory and is an improvement over other hazard formulas.

A flow diagram of the DOT accident and severity prediction formulas, showing the data bases employed, is described in Figure 1. Further information on these procedures is contained in another DOT report. (4) The theory underlying the formulas is contained in a separate report. (5)

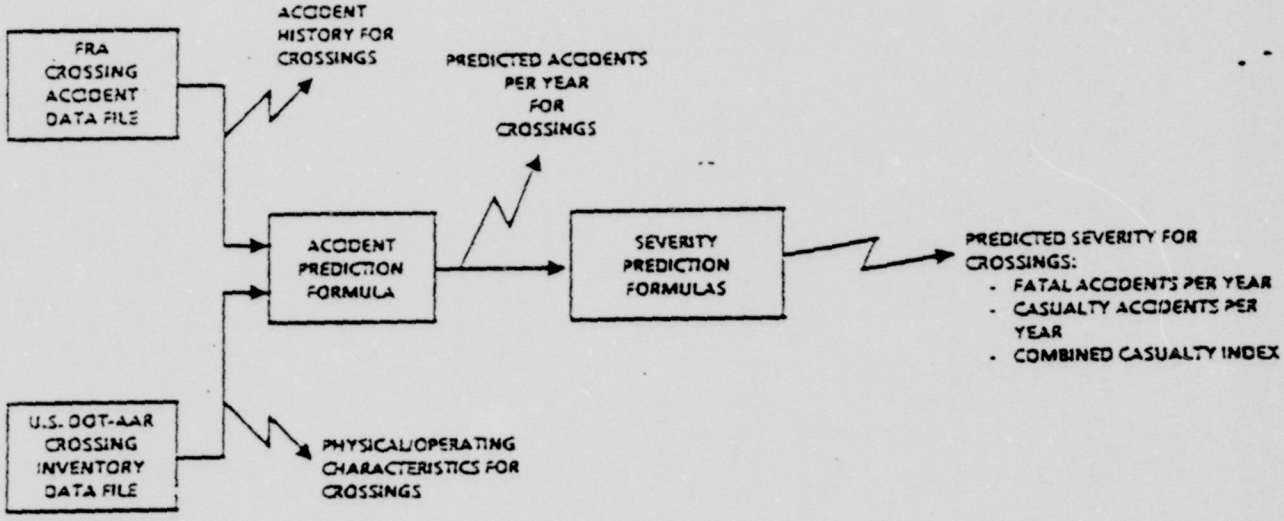

FIGURE 1. DOT RAIL-HIGHWAY CROSSING ACCIDENT AND SEVERITY PREDICTION FORMULAS

2. DOT ACCIDENT PREDICTION FORMULA

The DOT accident prediction formula was developed using the data shown in Figure 1. Three formulas are used to calculate predicted accidents: a basic formula which contains factors from the crossing inventory, a second formula which incorporates accident history as an explicit factor, and a third formula which involves a normalizing constant. The three formulas, given in a general form, are shown in equations [1], [2], and [3] respectively. The output of equation [1] is an input to equation [2]. The output of equation [2] is the input to equation [3]. The output of equation [3] is the predicted accidents per year for the crossing of interest.

$$a = K \times EI \times DT \times MS \times MT \times HP \times HL \qquad [1]$$

$$B = \frac{T_o}{T_o + T}(a) + \frac{T}{T_o + T}(N/T), \quad T_o = 1/(0.05 + a) \qquad [2]$$

1992 P. 2

$$A = \begin{cases} .8644B & \text{Passive Devices} \\ .8887B & \text{Flashing Lights} \\ .8131B & \text{Gates} \end{cases} \rightarrow \text{These constants have changed.} \qquad [3]$$

The basic formula [1] was developed using a nonlinear multiple regression technique as applied to crossing characteristics contained in the DOT Crossing Inventory and to accident data contained in RAIRS. The basic formula consists of a number of multiplicative factors, each factor representing a characteristic of the crossing described in the DOT Crossing Inventory. The numerical value of each factor is related to the statistical influence which the specific crossing characteristic has on the predicted number of accidents. The values of (a) calculated from equation [1] could be considered accident predictions, but they have not been normalized properly. Three sets of equations are used to determine the values of each factor, corresponding to the following categories of warning devices: passive warning devices, flashing lights, and flashing lights with automatic gates. Specific equations for the crossing characteristic

factors by the three warning device categories are shown in Appendix B. Each set of factor equations should only be used for crossings with the warning device category for which it was designed. To calculate the value of (a) at a crossing with crossbucks, for example, the passive set of equations should be used. In lieu of using the actual equations in Appendix B, a very good approximation can be achieved by using the range values for each factor. These values are tabulated in Appendix C.

The predictive capacity of the basic formula is limited because certain important crossing characteristics, such as site distance at the crossing, are not included in the DOT Crossing Inventory. Inclusion of actual accident history at crossings, as is done in equation [2], dramatically improves the predictive capabilities of the formula. Equation [2] calculates a value (B) which is a weighted average of two separately derived predictions. The two predictions are the value (a) from equation [1], which provides a prediction on the basis of a crossing's characteristics (as described in the DOT Crossing Inventory), and the actual accident history at a crossing, which is equal to the number of previous accidents (N) divided by the number of years of data (T). The value of (T) is usually taken to be five. To get the final predicted accidents (A), (B) is multipled by one of three constants as indicated by [3]. The particular constant depends on whether the crossing has a passive device (e.g., crossbuck), a flashing light, or a gate. These constants adjust the predictions to reflect more recent levels of accident experience. They will be recalculated periodically and published annually in FRA's Rail-Highway Crossing Accident/Incident and Inventory Bulletin starting with Bulletin No. 10 to be published in 1988 for Calendar Year 1987.

Values for (B) from equation [2] are tabulated in Appendix A for different values of (a) from equation [1], and the number of accidents (N) for five years of accident history data. The most recent five years of accident history data should be used to ensure good performance from the formula. Accident history information older than five years may be misleading because of changes in crossing characteristics. Tables for one, two, three and four years of accident history are published in the User's Guide, Third Edition [4]. Referring to the table in Appendix A, the value of (B) is determined from the intersection of the appropriate column and row for the values of (a) and (N). For example, if a = 0.10 and N = 1 for five years of data, the value of (B) is 0.143.

Use of the DOT accident prediction formula is illustrated below. Characteristics of a sample crossing from the DOT Crossing Inventory and RAIRS are shown in Table 1.

TABLE 1. CHARACTERISTICS OF SAMPLE CROSSING

CHARACTERISTIC	VALUE
Present warning device	Crossbucks
Annual average daily highway traffic	350
Total number of train movements per day	15
Total number of through trains per day	10
Total number of switch trains per day	5
Number of main tracks	2
Total number of tracks (main and other)	2
Number of through trains per day during daylight	5
Highway paved?	yes
Maximum timetable speed, mph	40
Number of highway lanes	2
Urban - rural location	Rural
Number of years accident data (T)	5
Number of accidents (N) in (T) years	2

The basic formula [1] is first used to determine the value of (a). The values of the formula factors for a passive crossing are determined from Table C-1: K = 0.0006938; EI = 42.39; DT = 1.79; MS = 1.36; MT = 1.00; HP = 1.00 and HL = 1.00. Substituting the factor values in the basic formula yields:

$$a = K \times EI \times DT \times MS \times MT \times HP \times HL$$
$$= 0.0006938 \times 42.39 \times 1.79 \times 1.36 \times 1.00 \times 1.00 \times 1.00$$
$$= 0.072$$

The value of (B) is determined by combining the value of (a) with the crossing's accident history, using either equation [2] or the table in Appendix A for five years of accident data. From Appendix A, with a = 0.072 and an accident history of two accidents (N = 2) during the past five years, the value of (B) is 0.196.* Thus, the final accident prediction value (A) from formula [3] is A = 0.8644 X 0.196 = 0.169 accidents per year. This could be interpreted as one accident in six years.

The accident prediction formula was compared with other rail-highway crossing accident prediction models. Statistical tests which compared these models indicated that the accuracy of DOT's formula is superior for ranking crossings by predicted accident levels. Since the DOT formula is based on the DOT Crossing Inventory, a common data base of crossing characteristics is available to formula users. As the DOT Crossing Inventory is updated and the RAIRS data is expanded, the DOT accident prediction formula will reflect the latest information.

*Linear interpolation was used to obtain this value.

3. DOT SEVERITY PREDICTION FORMULAS

The DOT severity prediction formulas were developed using the data shown in Figure 1. Two basic kinds of severity predictions can be made: fatal accidents per year and casualty accidents per year. Fatal accidents are accidents which result in a fatality, and casualty accidents are accidents which result in either a fatality or an injury. Both kinds of accidents are reported annually by the FRA. (1)

In order to determine fatal accidents per year, given that an accident occurred, the probability that a fatal accident occurred, denoted P(FA|A), is first calculated using the formula:

$$P(FA|A) = 1/(1 + KF \times MS \times TT \times TS \times UR). \qquad [4]$$

The equation for P(FA|A) and numerical values for the multiplicative factors in the denominator are given in Appendix D. The number of fatal accidents per year (FA) is then obtained by the formula FA = A X P(FA|A).

In order to determine casualty accidents per year, given that an accident occurred, the probability that a casualty accident occurred, denoted P(CA|A), is first calculated using the formula:

$$P(CA|A) = 1/(1 + KC \times MS \times TK \times UR) \qquad [5]$$

The equation for P(CA|A) and numerical values for the multiplicative factors in the denominator are given in Appendix D. The number of casualty accidents per year (CA) is then obtained by the formula CA = A X P(CA|A).

In addition to these two predictions of crossing accident severity, a combined casualty index (CCI) can be calculated. If this measure is specified, the user must provide a constant which establishes how many injury accidents are equivalent to a fatal accident overall. If it is assumed that 50 injury accidents provide the same societal loss as one fatal accident, noting that CA - FA is the number of injury accidents per year, then

$$CCI = 50\ FA + CA - FA \qquad [6]$$
$$= 49\ FA + CA$$

Use of the DOT severity prediction formulas is illustrated by the example in Table 1. From Table D-1 values of the factors needed to calculate the fatal accident probability are: KF = 440.9, MS = 0.025, TT = 0.811, TS = 1.169, and UR = 1.000. Substituting in formula [4] yields:

$$P(FA|A) = 1/(1 + 440.9 \times 0.025 \times 0.811 \times 1.169 \times 1.000) = .087.$$

This produces:

$$FA = A \times P(FA|A) = 0.16 \times 0.087 = 0.014 \text{ fatal accidents per year.}$$

This could be interpreted as one fatal accident in 71 years.

From Table D-2, values of the factors needed to calculate the casualty accident probability are: KC = 4.481, MS = 0.282, TK = 1.259, and UR = 1.000. Substituting in formula [5] yields:

$$P(CA|A) = 1/(1 + 4.481 \times 0.282 \times 1.259 \times 1.000) = 0.386$$

This produces:

$$CA = A \times P(CA|A) = 0.16 \times 0.386 = 0.062 \text{ casualty accidents per year.}$$

This could be interpreted as one casualty accident in 16 years.

Using the value of 50 injury accidents being equivalent to one fatal accident, the combined casualty index, using [6], is:

$$CCI = 49\ FA + CA$$
$$= 0.75$$

This value of CCI could be interpreted as being equivalent to one injury accident every 1.3 years.

4. RESOURCE ALLOCATION MODEL

The resource allocation model, shown as part of the resource allocation procedure in Figure 2, is designed to nominate crossings for improvement and suggest installation of the types of warning devices which maximize safety in the most cost effective manner. (6) Input to the resource allocation model includes the number of accidents predicted for each crossing, the severity predictions, the cost and effectiveness of different safety improvement options, and the budget level available for crossing safety improvement. Accident predictions can be made for a crossing by using any accident prediction formula which computes the expected number of accidents per year.

The resource allocation model requires estimated costs for flashing lights at a passive crossing, flashing lights and gates at a passive crossing, and for gates at a crossing already equipped with flashing lights. The required cost data may be specified by the user of the model, or data from a recent DOT study, shown in Table 2, may be used. (7) The cost data may be total life-cycle costs - the sum of procurement, installation, and maintenance - or those associated with a particular component of life-cycle costs. The cost data may also be installation costs.

TABLE 2. COST PARAMETERS FOR CROSSING WARNING DEVICES IN 1983 DOLLARS

IMPROVEMENT ACTION	LIFE CYCLE COSTS	INSTALLATION COSTS
Passive to Flashing Lights	$54,500	$43,800
Passive to Flashing Lights with Gates	$84,000	$65,300
Flashing Lights to Flashing Lights with Gates	$77,400	$58,700

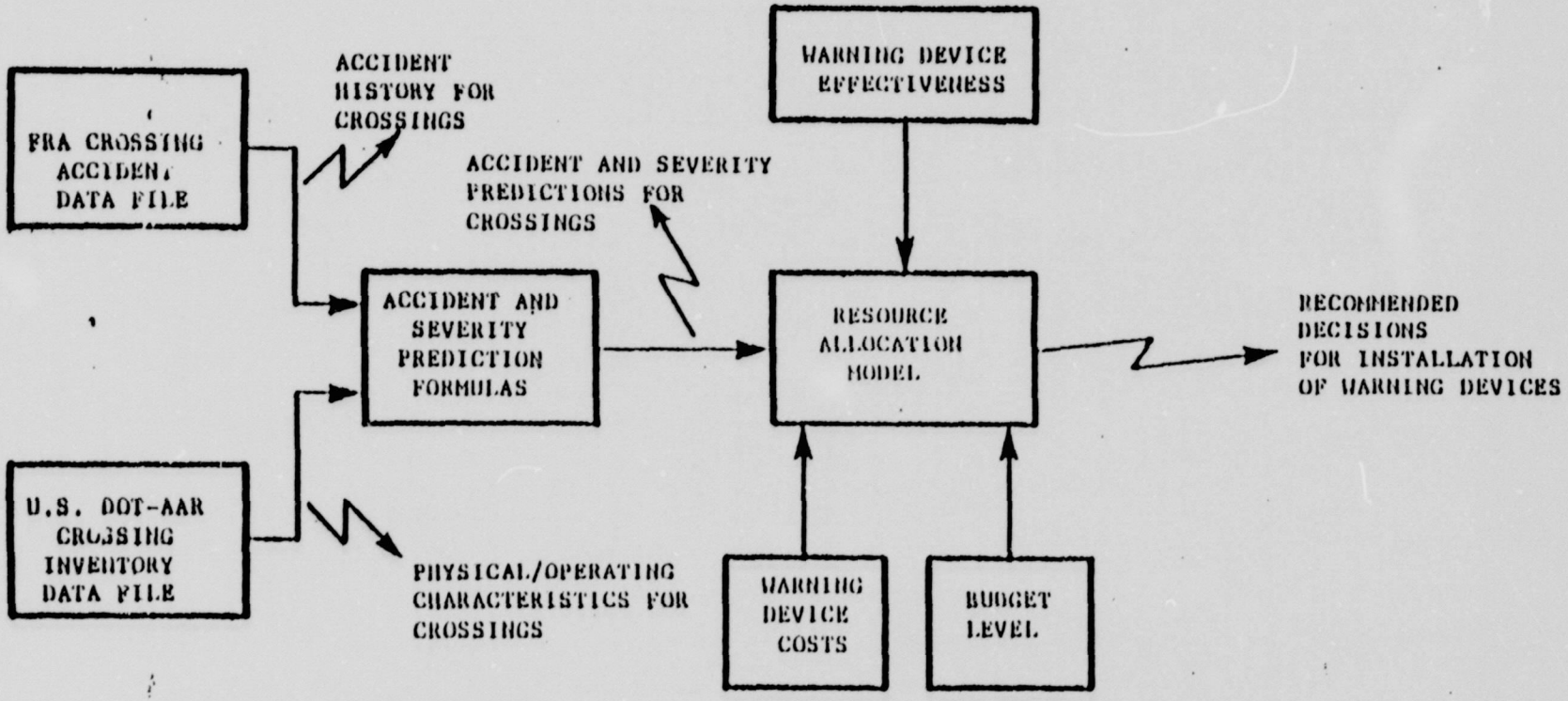

FIGURE 2. RAIL-HIGHWAY CROSSING RESOURCE ALLOCATION PROCEDURE

Similarly, the effectiveness of these warning device improvement options must be specified. Effectiveness is the decimal amount by which accidents are reduced with installation of the given warning device. Values of warning device effectiveness have been obtained by the DOT study. (7) Three standard effectiveness values have been determined which are based only on the present warning devices and the proposed warning devices. In addition, twelve extended effectiveness values have been determined which depend on the present and proposed warning devices, on whether the crossing has a single track or multiple tracks, and whether the number of trains per day is less than or equal to 10 or greater than or equal to 11. The user of the resource allocation model can choose which set of values to use. The DOT effectiveness values are shown in Table 3. Alternatively, if users have other effectiveness values which they believe are preferable, these may be specified in either the standard or extended format.

TABLE 3. EFFECTIVENESS VALUES FOR CROSSING WARNING DEVICES

IMPROVEMENT ACTION	STANDARD EFFECTIVENESS	EXTENDED EFFECTIVENESS			
		TRAINS $\leq$ 10		TRAINS $\geq$ 11	
		SINGLE TRACK	MULTIPLE TRACK	SINGLE TRACK	MULTIPLE TRACK
Passive to Flashing Lights	.70	.75	.65	.61	.57
Passive to Flashing Lights with Gates	.83	.90	.86	.80	.78
Flashing Lights to Flashing Lights with Gates	.69	.89	.65	.69	.63

The resource allocation model is used initially to develop a ranked list of benefit/cost ratios, representing improvement project decisions for each of the crossings and options under consideration. For a crossing with multiple tracks, the model specifies gates as the only improvement option. The benefit is the predicted number of accidents prevented per year, the predicted number of fatal accidents prevented per year, or the predicted reduced combined casualty index.

The cost is that specified for the warning device to be installed. The model is an aid for the decision maker in his/her determination of the most cost-beneficial crossing improvements. Using the model, the decision-maker is provided with a list of possible improvement projects that maximize estimated benefits for the available funding.

An example of an application of the resource allocation model is shown in Table 4. This table shows the results for a given set of crossings for a budget of $1,000,000, assuming the installation costs of Table 2 and the extended effectiveness values of Table 3. The list shows the recommended improvements sorted by benefit/cost ratio, where benefit is the expected accident reduction. The ID, the present warning device, the predicted accidents per year, and the improvement costs for each crossing are also included. The sum of the improvement costs is $994,400, which is just under the budget of $1,000,000. If one more crossing improvement were added to the list, the budget would be exceeded.

These results are indicative of the computer output that is available. Software is available that will show additional crossing characteristics that enter into the model. The software will also produce the output list sorted by crossing ID and provide a convenient summary of all the input parameters (4).

An optional feature has been added to the resource allocation model pertaining to stop signs. In the DOT study it was found that stop signs, when installed at passive crossings, have an effectiveness of 0.35 and an average installation cost of $400. (7) The FHWA has established guidelines for the selection of candidate crossings for stop signs. (8) With such a high benefit/cost ratio it is important to know which crossings meet these guidelines. Therefore the resource allocation procedure identifies passive crossings which satisfy the following criteria:

1. Less than 400 AADT for rural roads. Less than 1500 AADT for urban roads.
2. Single track.
3. Greater than 10 trains per day.

Crossings so identified may also be recommended for an active warning device by the resource allocation model. The judgment of the crossing diagnostic team would be used at this point to make the best improvement decision.

TABLE 4. RAIL-HIGHWAY CROSSING RESOURCE ALLOCATION RESULTS

Crossing ID	Benefit/Cost Ratio	Recommended Improvement	Improvement Cost	Present Warning Device	Predicted Acc./Year
284M	3.60	Gate	$58,700	Flashing Lt.	.306
636R	2.68	Gate	65,300	Passive	.195
368H	2.61	Gate	58,700	Flashing Lt.	.172
365M	2.61	Gate	58,700	Flashing Lt.	.172
358C	2.44	Gate	58,700	Flashing Lt.	.161
639L	1.95	Flashing Lt.	43,800	Passive	.114
249Y	1.89	Flashing Lt.	43,800	Passive	.111
377G	1.45	Gate	58,700	Flashing Lt.	.095
382D	1.44	Gate	58,700	Flashing Lt.	.095
175X	1.39	Gate	65,300	Passive	.105
337J	1.25	Gate	58,700	Flashing Lt.	.082
158G	1.21	Flashing Lt.	43,800	Passive	.070
164K	1.21	Flashing Lt.	43,800	Passive	.070
651T	1.21	Flashing Lt.	43,800	Passive	.087
631G	1.21	Flashing Lt.	43,800	Passive	.087
389B	1.18	Flashing Lt.	43,800	Passive	.069
640F	1.12	Flashing Lt.	43,800	Passive	.066
370J	1.06	Gate	58,700	Flashing Lt.	.070
158M	0.98	Flashing Lt.	43,800	Passive	.058

APPENDIX A

TABLE VALUES FOR ACCIDENT HISTORY FORMULA

Table A-1 gives the value of (B) for a crossing from equation [2] based on the output (a) of equation [1] and the crossing's five year accident history. For example, if the value of (a) is 0.20 and the crossing experienced two accidents during the past five years, the value of (B) would be 0.311.

TABLE A-1. VALUES OF (B) CALCULATED FROM VALUES OF (a) AND ACCIDENT HISTORY (FIVE YEARS OF ACCIDENT DATA)

PREDICTION FROM BASIC MODEL[A] (a)	NUMBER OF ACCIDENTS (N)														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
0.00	0.000	0.040	0.080	0.120	0.160	0.200	0.240	0.280	0.320	0.360	0.400	0.440	0.480	0.520	0.560
0.01	0.008	0.054	0.100	0.146	0.192	0.238	0.285	0.331	0.377	0.423	0.469	0.515	0.562	0.608	0.654
0.02	0.015	0.067	0.119	0.170	0.222	0.274	0.326	0.378	0.430	0.481	0.533	0.585	0.637	0.689	0.741
0.03	0.021	0.079	0.136	0.193	0.250	0.307	0.364	0.421	0.479	0.536	0.593	0.650	0.707	0.764	0.821
0.04	0.028	0.090	0.152	0.214	0.276	0.338	0.400	0.462	0.524	0.586	0.648	0.710	0.772	0.834	0.897
0.05	0.033	0.100	0.167	0.233	0.300	0.367	0.433	0.500	0.567	0.633	0.700	0.767	0.833	0.900	0.967
0.06	0.039	0.110	0.181	0.252	0.323	0.394	0.465	0.535	0.606	0.677	0.748	0.819	0.890	0.961	1.032
0.07	0.044	0.119	0.194	0.269	0.344	0.419	0.494	0.569	0.644	0.719	0.794	0.869	0.944	1.019	1.094
0.08	0.048	0.127	0.206	0.285	0.364	0.442	0.521	0.600	0.679	0.758	0.836	0.915	0.994	1.073	1.152
0.09	0.053	0.135	0.218	0.300	0.382	0.465	0.547	0.629	0.712	0.794	0.876	0.959	1.041	1.124	1.206
0.10	0.057	0.143	0.229	0.314	0.400	0.486	0.571	0.657	0.743	0.829	0.914	1.000	1.086	1.171	1.257
0.20	0.089	0.200	0.311	0.422	0.533	0.644	0.756	0.867	0.978	1.089	1.200	1.311	1.422	1.533	1.644
0.30	0.109	0.234	0.364	0.491	0.618	0.745	0.873	1.000	1.127	1.255	1.382	1.509	1.636	1.764	1.891
0.40	0.123	0.262	0.400	0.538	0.677	0.815	0.954	1.092	1.231	1.369	1.508	1.646	1.785	1.923	2.062
0.50	0.133	0.280	0.427	0.573	0.720	0.867	1.013	1.160	1.307	1.453	1.600	1.747	1.893	2.040	2.187
0.60	0.141	0.294	0.447	0.600	0.753	0.906	1.059	1.212	1.365	1.518	1.671	1.824	1.976	2.129	2.282
0.70	0.147	0.305	0.463	0.621	0.779	0.937	1.095	1.253	1.411	1.568	1.726	1.884	2.042	2.200	2.358
0.80	0.152	0.314	0.476	0.638	0.800	0.962	1.124	1.286	1.448	1.610	1.771	1.933	2.095	2.257	2.419
0.90	0.157	0.322	0.487	0.652	0.817	0.983	1.148	1.313	1.478	1.643	1.809	1.974	2.139	2.304	2.470
1.00	0.160	0.328	0.496	0.664	0.832	1.000	1.168	1.336	1.504	1.672	1.840	2.008	2.176	2.344	2.512
1.10	0.163	0.333	0.504	0.674	0.844	1.015	1.185	1.356	1.526	1.696	1.867	2.037	2.207	2.378	2.548
1.20	0.166	0.338	0.510	0.683	0.855	1.028	1.200	1.372	1.545	1.717	1.890	2.062	2.234	2.407	2.579
1.30	0.168	0.342	0.516	0.690	0.865	1.039	1.213	1.387	1.561	1.735	1.910	2.084	2.258	2.432	2.606
1.40	0.170	0.345	0.521	0.697	0.873	1.048	1.224	1.400	1.576	1.752	1.927	2.103	2.279	2.455	2.630
1.50	0.171	0.349	0.526	0.703	0.880	1.057	1.234	1.411	1.589	1.766	1.943	2.120	2.297	2.474	2.651
1.60	0.173	0.351	0.530	0.708	0.886	1.065	1.243	1.422	1.600	1.778	1.957	2.135	2.314	2.492	2.670
1.70	0.174	0.354	0.533	0.713	0.892	1.072	1.251	1.431	1.610	1.790	1.969	2.149	2.328	2.508	2.687
1.80	0.174	0.356	0.537	0.717	0.898	1.078	1.259	1.439	1.620	1.800	1.980	2.161	2.341	2.522	2.702
1.90	0.177	0.358	0.540	0.721	0.902	1.084	1.265	1.447	1.628	1.809	1.991	2.172	2.353	2.535	2.716
2.00	0.178	0.360	0.542	0.724	0.907	1.089	1.271	1.453	1.636	1.818	2.000	2.182	2.364	2.547	2.729
2.10	0.179	0.362	0.545	0.728	0.911	1.094	1.277	1.460	1.643	1.826	2.009	2.191	2.374	2.557	2.740
2.20	0.180	0.363	0.547	0.731	0.914	1.098	1.282	1.465	1.649	1.833	2.016	2.200	2.384	2.567	2.751
2.30	0.180	0.365	0.549	0.733	0.918	1.102	1.286	1.471	1.655	1.839	2.024	2.208	2.392	2.576	2.761
2.40	0.181	0.366	0.551	0.736	0.921	1.106	1.291	1.475	1.660	1.845	2.030	2.215	2.400	2.585	2.770
2.50	0.182	0.367	0.553	0.738	0.924	1.109	1.295	1.480	1.665	1.851	2.036	2.222	2.407	2.593	2.778

[A]For values of (a) between those listed, linear interpolation is recommended.

APPENDIX B

EQUATIONS FOR BASIC FORMULA

Table B-1 lists equations for determining values of crossing characteristic factors used in the basic formula [1]. A different set of equations is provided for each of the warning device categories: passive, flashing lights, and gates. Each set of factor equations should only be used for crossings with the warning device category for which it was designed. To calculate (a) at a crossing with crossbucks, for example, the passive set of equations would be used. For cases indicated in the table where the equation is shown as a constant 1.0, it was found that the characteristic did not have a statistical relationship to predicting crossing accidents.

If the warning devices at a particular crossing were upgraded in the last five years, it is preferable to use the set of equations for the warning device existing prior to upgrading and multiply the resulting value of (a) by the appropriate effectiveness factor from Table 3. In calculating (B) for such a crossing, only accident history since the upgrading should be considered. For example, if the warning devices at a crossing were upgraded from crossbucks to gates two years ago, the value of (a) should be calculated using the equation for "passive" crossings and the result should be multiplied by 1 - 0.83 = 0.17. Though five years of accident history may be available, only the accidents and the time elapsed since the upgrade (T = 2) should be used in arriving at a value of (B). The final accident prediction (A) would be obtained from the equation A = 0.8131 X B.

TABLE B-1. EQUATIONS FOR CROSSING CHARACTERISTIC FACTORS

GENERAL FORM OF BASIC FORMULA: $a = K \times EI \times DT \times MS \times MT \times HP \times HL$

CROSSING CHARACTERISTIC FACTORS							
CROSSING CATEGORY	FORMULA CONSTANT	EXPOSURE INDEX FACTOR	DAY THROUGH TRAINS FACTOR	MAXIMUM SPEED FACTOR	MAIN TRACKS FACTOR	HIGHWAY PAVED FACTOR	HIGHWAY LANES FACTOR
	K	EI	DT	MS	MT	HP	HL
PASSIVE	0.0006938	$((a \times t + 0.2)/0.2)^{0.37}$	$((d + 0.2)/0.2)^{0.178}$	$e^{0.0077ms}$	1.0	$e^{-0.5966(hp-1)}$	1.0
FLASHING LIGHTS	0.0003351	$((a \times t + 0.2)/0.2)^{0.4106}$	$((d + 0.2)/0.2)^{0.1131}$	1.0	$e^{0.1917mt}$	1.0	$e^{0.1826(hl-1)}$
GATES	0.0005745	$((a \times t + 0.2)/0.2)^{0.2942}$	$((d + 0.2)/0.2)^{0.1781}$	1.0	$e^{0.1512mt}$	1.0	$e^{0.1420(hl-1)}$

a = number of highway vehicles per day

t = number of trains per day

mt = number of main tracks

d = number of through trains per day during daylight

hp = highway paved? yes = 1.0 and no = 2.0

ms = maximum timetable speed, mph

hl = number of highway lanes

APPENDIX C

TABLE VALUES FOR BASIC FORMULA FACTORS

Tables C-1, C-2, and C-3 provide numerical values for the crossing characteristic factors of the basic formula [1] for the various characteristic levels. A different table is provided for each of the categories: passive, flashing lights, and gates. The values are to be used only for crossings with the warning device category for which it was designed. To calculate the value of (a) at a crossing with flashing lights, Table C-2 would be used to obtain the factor values for substitution into the basic formula.

If the warning devices at a particular crossing were upgraded in the last five years, it is preferable to use the set of equations for the warning device existing prior to upgrading and multiply the resulting value of (a) by the appropriate effectiveness factor from Table 3. In calculating (B) for such a crossing, only accident history since the upgrading should be considered. For example, if the warning device at a crossing were upgraded from crossbucks to gates two years ago, the value of (a) should be developed using Table C-1 and the result should be multiplied by 1 - 0.83 = 0.17. Though five years of accident history may be available, only the accidents and the time elapsed since the upgrade (T = 2) should be used in arriving at a value of (B). The final accident prediction (A) would be obtained from the equation A = 0.8131 X B.

TABLE C-1. FACTOR VALUES FOR CROSSINGS WITH PASSIVE WARNING DEVICES

GENERAL FORM OF BASIC FORMULA: $a = K \times EI \times DT \times MS \times MT \times HP \times HL$

K	"c" x "t"		EI
0.0006938	0*		1.00
	1 -	5	2.43
	6 -	10	3.95
	11 -	20	4.96
	21 -	30	5.99
	31 -	50	7.12
	51 -	80	8.51
	81 -	120	9.98
	121 -	200	11.88
	201 -	300	14.00
	301 -	400	15.85
	401 -	500	17.39
	501 -	600	18.73
	601 -	700	19.93
	701 -	1000	22.01
	1001 -	1300	24.61
	1301 -	1600	26.81
	1601 -	2000	29.05
	2001 -	2500	31.28
	2501 -	3000	33.98
	3001 -	4000	37.15
	4001 -	6000	42.39
	6001 -	8000	48.01
	8001 -	10000	52.69
	10001 -	15000	59.49
	15001 -	20000	67.38
	20001 -	25000	73.95
	25001 -	30000	79.65
	30001 -	40000	87.08
	40001 -	50000	95.57
	50001 -	60000	102.93
	60001 -	70000	109.50
	70001 -	90000	118.24
	90001 -	110000	128.42
	110001 -	130000	137.38
	130001 -	180000	151.02
	180001 -	230000	167.48
	230001 -	300000	187.14
	300001 -	370000	200.86

Day Through Trains	DT
0	1.00
1	1.37
2	1.53
3	1.64
4	1.72
5	1.79
6	1.84
7	1.89
8	1.94
9	1.98
10	2.01
11-10	2.16
21-30	2.37
31-40	2.51
41-60	2.67

Maximum Timetable Speed	MS
0	1.00
5	1.04
10	1.08
15	1.12
20	1.17
25	1.21
30	1.26
35	1.31
40	1.36
45	1.41
50	1.47
55	1.53
60	1.59
65	1.65
70	1.71
75	1.78
80	1.85
85	1.92
90	2.00

Main Tracks	MT
0	1.00
1	1.00
2	1.00
3	1.00
4	1.00
5	1.00
6	1.00

Highway Paved	HP
1 (yes)	1.00
2 (no)	0.55

Highway Lanes	HL
1	1.00
2	1.00
3	1.00
4	1.00
5	1.00
6	1.00
7	1.00
8	1.00
9	1.00

K = formula constant
"c" x "t" - number of highway vehicles per day, "c", multiplied by the number of trains per day, "t"
EI = exposure index factor
MT = main tracks factor
DT = day through trains factor
HP = highway paved factor
MS = maximum timetable speed factor
HL = highway lanes factor

*Less than one train per day.

TABLE C-2. FACTOR VALUES FOR CROSSINGS WITH FLASHING LIGHT WARNING DEVICES

GENERAL FORM OF BASIC FORMULA: A = K x EI x DT x MS x MT x HP x HL

K	"c" x "t"	EI	Day Through Trains	DT	Maximum Timetable Speed	MS	Main Tracks	MT	Highway Paved	HP	Highway Lanes	HL
0.0003351	0* -	1.00	0	1.00	0	1.00	0	1.00	1 (yes)	1.00	1	1.00
	1 - 5	3.12	1	1.22	5	1.00	1	1.21			2	1.20
	6 - 10	4.59	2	1.31	10	1.00	2	1.47	2 (no)	1.00	3	1.44
	11 - 20	5.92	3	1.37	15	1.00	3	1.78			4	1.72
	21 - 30	7.28	4	1.41	20	1.00	4	2.15			5	2.08
	31 - 50	8.82	5	1.45	25	1.00	5	2.61			6	2.49
	51 - 80	10.76	6	1.47	30	1.00	6	3.16			7	2.99
	81 - 120	12.54	7	1.50	35	1.00					8	3.59
	121 - 200	15.57	8	1.52	40	1.00					9	4.31
	201 - 300	18.70	9	1.54	45	1.00						
	301 - 400	21.46	10	1.56	50	1.00						
	401 - 500	23.79	11-20	1.63	55	1.00						
	501 - 600	25.84	21-30	1.73	60	1.00						
	601 - 700	27.67	31-40	1.79	65	1.00						
	701 - 1000	30.89	41-60	1.87	70	1.00						
	1001 - 1300	34.97			75	1.00						
	1301 - 1600	38.47			80	1.00						
	1601 - 2000	42.04			85	1.00						
	2001 - 2500	46.07			90	1.00						
	2501 - 3000	50.03										
	3001 - 4000	55.23										
	4001 - 6000	63.94										
	6001 - 8000	73.42										
	8001 - 10000	81.40										
	10001 - 15000	93.15										
	15001 - 20000	106.95										
	20001 - 25000	118.58										
	25001 - 30000	128.76										
	30001 - 40000	142.17										
	40001 - 50000	157.62										
	50001 - 60000	171.16										
	60001 - 70000	183.31										
	70001 - 90000	199.62										
	90001 - 110000	218.78										
	110001 - 130000	235.78										
	130001 - 180000	261.91										
	180001 - 230000	293.77										
	230001 - 300000	326.42										
	300001 - 370000	359.40										

K = formula constant
"c" x "t" = number of highway vehicles per day, "c", multiplied by the number of trains per day, "t"
EI = exposure index factor
MT = main tracks factor
DT = day through trains factor
HP = highway paved factor
MS = maximum timetable speed factor
HL = highway lanes factor

*Less than one train per day.

TABLE C-3. FACTOR VALUES FOR CROSSINGS WITH GATE WARNING DEVICES

GENERAL FORM OF BASIC FORMULA: a = K x EI x DT x MS x MT x HP x HL

K	"a" x "t"	EI	Day Through Trains	DT	Maximum Timetable Speed	MS	Main Tracks	MT	Highway Paved	HP	Highway Lanes	HL
0.0005745	0*-	1.00	0	1.00	0	1.00	0	1.00	1 (yes)	1.00	1	1.00
	1 - 5	2.26	1	1.38	5	1.00	1	1.16			2	1.15
	6 - 10	2.98	2	1.53	10	1.00	2	1.35	2 (no)	1.00	3	1.32
	11 - 20	3.57	3	1.64	15	1.00	3	1.57			4	1.53
	21 - 30	4.15	4	1.72	20	1.00	4	1.83			5	1.76
	31 - 50	4.76	5	1.79	25	1.00	5	2.13			6	2.03
	51 - 80	5.99	6	1.84	30	1.00	6	2.48			7	2.34
	81 - 120	6.23	7	1.89	35	1.00					8	2.70
	121 - 200	7.15	8	1.94	40	1.00					9	3.11
	201 - 300	8.15	9	1.98	45	1.00						
	301 - 400	9.00	10	2.01	50	1.00						
	401 - 500	9.69	11-20	2.16	55	1.00						
	501 - 600	10.28	21-30	2.37	60	1.00						
	601 - 700	10.79	31-40	2.51	65	1.00						
	701 - 1000	11.68	41-60	2.68	70	1.00						
	1001 - 1300	12.77			75	1.00						
	1301 - 1600	13.67			80	1.00						
	1601 - 2000	14.57			85	1.00						
	2001 - 2500	15.55			90	1.00						
	2501 - 3000	16.20										
	3001 - 4000	17.71										
	4001 - 6000	19.67										
	6001 - 8000	21.72										
	8001 - 10000	23.39										
	10001 - 15000	25.76										
	15001 - 20000	28.44										
	20001 - 25000	30.67										
	25001 - 30000	32.49										
	30001 - 40000	34.87										
	40001 - 50000	37.55										
	50001 - 60000	39.83										
	60001 - 70000	41.84										
	70001 - 90000	44.48										
	90001 - 110000	47.49										
	110001 - 130000	50.11										
	130001 - 180000	54.03										
	180001 - 230000	58.24										
	230001 - 300000	63.26										
	300001 - 370000	67.78										

K = formula constant
"a" x "t" = number of highway vehicles per day, "a", multiplied by the number of trains per day, "t"
EI = exposure index factor
MT = main tracks factor
DT = day through trains factor
HP = highway paved factor
MS = maximum timetable speed factor
HL = highway lanes factor

*Less than one train per day.

APPENDIX D

EQUATIONS AND TABLE VALUES FOR SEVERITY PREDICTION FORMULAS

The equation for P(FA|A) is:

$$P(FA|A) = 1/(1 + KF \times MS \times TT \times TS \times UR),$$

where

$$KF = 440.9,\ MS = ms^{-0.9981},\ TT = (tt + 1)^{-0.0872},$$
$$TS = (ts + 1)^{0.0872},\ UR = e^{0.3571ur}$$

The equation for P(CA|A) is:

$$P(CA|A) = 1/(1 + KC \times MS \times TK \times UR),$$

where

$$KC = 4.481,\ MS = ms^{-0.343},\ TK = e^{0.1153tk},\ UR = e^{0.2960ur}$$

Tables D-1 and D-2 provide the numerical values of the severity prediction formulas [4] and [5]. These formulas apply to all crossings regardless of the type of warning device present.

TABLE D-1. FACTOR VALUES FOR FATAL ACCIDENT PROBABILITY FORMULA

Fatal Accident Probability Formula: $P(FA\|A) = 1/(1 + KF \times MS \times TT \times TS \times UR)$								
FORMULA CONSTANT KF	MAXIMUM TIMETABLE TRAIN SPEED	MS	THROUGH TRAINS PER DAY	TT	SWITCH TRAINS PER DAY	TS	URBAN RURAL CROSSING	UR
440.9	1	1.000	0	1.000	0	1.000	0 (rural)	1.000
	5	0.201	1	0.941	1	1.062	1 (urban)	1.344
	10	0.100	2	0.908	2	1.101		
	15	0.067	3	0.886	3	1.128		
	20	0.050	4	0.869	4	1.151		
	25	0.040	5	0.855	5	1.169		
	30	0.034	6	0.844	6	1.185		
	40	0.025	7	0.834	7	1.199		
	50	0.020	9	0.818	9	1.222		
	60	0.017	10	0.811	10	1.233		
	70	0.014	20	0.767	20	1.304		
	80	0.013	30	0.741	30	1.349		
	90	0.011	40	0.723	40	1.382		
	100	0.010	50	0.710	50	1.409		

TABLE D-2. FACTOR VALUES FOR CASUALTY ACCIDENT PROBABILITY FORMULA

CASUALTY ACCIDENT PROBABILITY FORMULA: $P(CA|A) = 1/(1 + KC \times MS \times TK \times UR)$						
FORMULA CONSTANT KC	MAXIMUM TIMETABLE TRAIN SPEED	MS	TOTAL NUMBER OF TRACKS	TK	URBAN-RURAL CROSSING	UR
4.481	1	1.000	0	1.000	0 (rural)	1.000
	5	0.576	1	1.122	1 (urban)	1.429
	10	0.454	2	1.259		
	15	0.395	3	1.413		
	20	0.358	5	1.780		
	25	0.332	6	1.997		
	30	0.308	7	2.241		
	40	0.282	8	2.515		
	50	0.261	9	2.823		
	60	0.246	10	3.168		
	70	0.233	15	5.638		
	80	0.222	20	10.034		
	90	0.214				
	100	0.206				

GLOSSARY

AAR - Association of American Railroads

accident prediction formula - A hazard function which calculates predicted accidents per year at a crossing.

active warning device - A warning device activated by an approaching train; e.g., gates, flashing lights, highway signals, wig-wags, and bells.

basic accident prediction formula - Provides an initial prediction of a crossing's accidents based on its characteristics in the DOT Crossing Inventory. Results of the basic formula are used as input for the DOT accident prediction formula.

benefit/cost ratio - Ratio of benefit expressed in the number of accidents, fatalities, or casualties prevented per year to the cost of the warning systems ($).

combined casualty index (CCI) - A measure of accident severity which combines fatal and injury accidents into a single index.

effectiveness - Accident reduction factor for a warning device relative to the present warning device. It is a number between zero and one; zero means no effectiveness and one is total effectiveness.

flashing lights - An active warning device consisting of flashing red lights that are either cantilevered or mast-mounted.

gates - An active warning device consisting of automatic gates and flashing lights.

hazard function - Any function which gives a numerical value of the likelihood of a motor vehicle/train collision at a rail-highway crossing.

life-cycle costs - The total net present value that is needed to procure, install, and maintain a warning device over its useful service.

optimum safety improvement - An improvement which maximizes safety benefits, in terms of reduced accidents, fatalities, or casualties, for a given amount of funding.

passive warning device - A warning device not activated by an approaching train.

RAIRS - Railroad Accident/Incident Reporting System

severity prediction formula - A formula which calculates predicted fatal accidents per year or predicted casualty accidents per year.

warning device - A device which warns highway users that the roadway crosses railroad trackage.

warning device categories - The following types of warning devices are included in the three warning device categories established for the DOT resource allocation procedure:

1. passive warning devices: crossbucks, stop signs, other signs, and no signs or signals. These devices are classes 1, 2, 3 and 4 in the DOT Crossing Inventory.

2. flashing light warning devices: flashing lights, both cantilevered and post-mounted; highway signals, wig-wags, or bells; and special warnings such as flagmen. These devices are classes 5, 6, and 7 in the DOT Crossing Inventory.

3. gate warning devices: automatic gates with flashing lights. This device is class 8 in the DOT Crossing Inventory.

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2. "Rail-Highway Crossing Accident/Incident and Inventory Bulletin," U.S. Department of Transportation, Federal Railroad Administration, Washington, DC, June 1986.

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4. E.H. Farr, "Rail-Highway Crossing Resource Allocation Procedure - User's Guide, Third Edition," U.S. Department of Transportation, Federal Railroad Administration, Washington, DC. To be published in 1987.

5. P. Mengert, "Rail-Highway Crossing Hazard Prediction Research Results," U.S. Department of Transportation, Transportation Systems Center, Washington, DC, March 1980, FRA-RRS-80-02.

6. E.H. Farr, "Rail-Highway Crossing Resource Allocation Model," U.S. Department of Transportation, Transportation Systems Center, Washington, DC, April 1981, FRA-RRS-81-001.

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8. "Manual on Uniform Traffic Control Devices," U.S. Department of Transportation, Federal Highway Administration, Washington, DC, 1983, Section 8B-9.

*U.S. Government Printing Office 1987—762-638/60068

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Abbreviation Key
—for Accident Prediction Lists

RANK: On the first list, crossings are listed, and ranked, inversely. The highest accident prediction is ranked number "1" (lowest), the next highest as number "2," etc.

PRED ACCDS: Predicted Accidents. This is the probability that a collision between on-track equipment (e.g., a train) and a highway user (e.g., an automobile) will occur at the identified crossing within one year. The reciprocal of this number estimates the time in years between accidents. For example, an accident prediction of .17853 indicates an accident every 5.6 years.

XING ID #: Every crossing in the country has been assigned a unique Inventory number.

ST: State, two character alphabetic abbreviations.

RR: Railroad, four character alphabetic abbreviations.

NUM OF ACC: Number of accidents reported to the FRA in each of the years indicated.

DATE OF CHG: The last time a change was made at the crossing, e.g., an upgrade to the warning devices, which would impact the accident prediction. Accident history prior to the indicated year-month is not considered in arriving at the accident prediction.

WD CL: Warning Device Class: GT, gates; FL, flashers; WW, wigwags, traffic signals and/or bells; XB, crossbuck signs; SS, STOP signs; OT, other signs; NO, no signs or signals.

TOTL SWIT TRNS: Average Total Switching Trains which transit the crossing in a 24-hour day.

DAY THRU TRNS: Average number of through trains which transit the crossing between 6 AM and 6 PM.

TOTL THRU TRNS: Average Total Through Trains which transit the crossing in a 24-hour day.

TOTL TRKS: Total Tracks at the crossing.

MAIN TRKS: Number of mainline tracks at the crossing.

TTBL SPD: Maximum time table speed of trains using the crossing.

HWY PVD:	Are the highway approaches to the crossing paved, Yes or No?
HWY LNS:	Number of highway lanes crossing the tracks.
URBN RURL:	Is the crossing in an urban or rural environment, U or R.
AADT:	Average Annual Daily Traffic which uses the highway across the crossing.
OBS:	On the second list, stands for "Observation" or line number, an irrelevant function of the computer software.
RRID:	Railroad's identification for the crossing (optional).
MILEPOST:	Up to six character, usually numerals, with an understood decimal point between positions four and five. For example, 039745 indicates milepost 397.45. (Optional)

1992/3 ACCIDENT PREDICTION AND RESOURCE ALLOCATION PROCEDURE CONSTANTS

The U.S. DOT Highway-Rail Crossing Resource Allocation Procedure, described in the Rail-Highway Crossing Resource Allocation Procedure User's Guide, Third Edition, DOT/FRA/OS-87/10, August 1987, uses three "normalizing constants" in the accident prediction formulas, Formula A, Section 3.2.4, Page 17. These constants have been adjusted periodically in order to keep the formulas matched with current accident trends. The last readjustment was made for Calendar Year 1992 and was published in Bulletin No. 14.

The process of determining the three (3) current normalizing constants for 1992 was performed so that the sum of the December 1991, predictions using only accident history data for Calendar Years 1986 to 1990 for the top 20 percent of each of the three classes of crossings (gates, flashing lights, passive) for the respective three formulas is made equal to the actual number of accidents that occurred for those same crossings in 1991. This process was performed for each of the three warning device groups, (1) passive, (2) flashing lights, and (3) gates.

These constants were redetermined for the "national" model using the crossings in the inventory as of December 31, 1991. Organizations using the "DOT Model" should update their models by replacing the old constants with the recalculated constants. The constants referenced here are located in the computer program ACPD.NEW as shown in the coding at the top of page A-4, Appendix A1 of the User's Guide Third Edition and in RESAL.NEW on page B-3, Appendix B1.

These constants will be used in fulfilling requests for accident prediction and resource allocation procedure listings. The table below lists the current and prior constants.

ACCIDENT PREDICTION AND RESOURCE ALLOCATION PROCEDURE NORMALIZING CONSTANTS

New Constants.

WARNING DEVICE GROUPS		CURRENT 1992	PRIOR YEARS 1990	1988	1986
(1)	Passive	.8239	.9417	.8778	.8644
(2)	Flashing Lights	.6935	.8345	.8013	.8887
(3)	Gates	.6714	.8901	.8911	.8131

The Resource Allocation Procedure is currently being reviewed and, if merited, may be revised. (This project is one of 55 actions identified within the Department of Transportation's recently released Highway-Rail Crossing Safety Action Plan.) As such, recalculation of the "normalizing constants" for the existing accident prediction formulas has been deferred until this review is complete. Users of the "DOT Model" should continue to use the 1992 constants detailed above.

Points to note while applying the FRA Method:

1) Five years of accident history is considered.

2) In the data from FRA "DATE OF CHANGE" doesnt necessarily imply a change in safety device.

3) Depending on whether the 'change' is a change in safety device or other change the formula is applied differently.

4) If the change is a change in safety device, then:

- Use Constant K value for the device prior to the change in calculating a.
- Use accident history from the date of change in calculating 'B'. (i.e. if the device was upgraded in 94 then T = 2 and N = number of accidents since 94).
- In calculating 'A' use the constant for the new device(i.e. the presently existing device).

5) If the change is not a change in safety device then:

- Use constant K for the existing device.
- Use accident history from the date of change in calculating 'B'. (i.e. if the device was upgraded in 94 then T = 2 and N = number of accidents since 94).
- In calculating 'A' use the constant for the existing device.

6) It will be necessary to replicate the FRA's accident prediction number for each crossing to find out if the "date of change " refers to a change in device or other change.

7) FRA data may not necessarily have the most recent devices etc.

Appendix L

RELEVANT PORTIONS OF USDOT, RESEARCH AND SPECIAL PROGRAMS ADMINISTRATION REPORT ON UNINTENTIONAL RELEASES OF REGULATED HAZARDOUS MATERIALS BEING TRANSPORTED FOR COMMERCE SINCE 1971

BBBBBBBBBB 3333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333 BBBBBBBBBB
BBBBBBBBBB 3333333333333333333333 Digital Equipment Corporation - OpenVMS AXP Version V6.2 3333333333333333333333 BBBBBBBBBB
BBBBBBBBBB 3333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333333 BBBBBBBBBB

NOTE: KEVIN COBURN

```
H   H  M   M   III    SSSS          7777   7777   7777
H   H  MM MM    I    S                 7      7      7
H   H  M M M    I    S                 7      7      7
HHHHH  M   M    I     SSS             7      7      7
H   H  M   M    I        S           7      7      7
H   H  M   M    I        S          7      7      7
H   H  M   M   III   SSSS    _____  7      7      7
```

```
UU      UU  PPPPPPPP                SSSSSSS  PPPPPPPP                NN      NN  VV      VV
UU      UU  PPPPPPPPP               SSSSSSSS PPPPPPPPP               NN      NN  VV      VV
UU      UU  PP      PP             SS       PP      PP              NN      NN  VV      VV
UU      UU  PP      PP             SS       PP      PP              NN      NN  VV      VV
UU      UU  PP      PP             SS       PP      PP              NNNN    NN  VV      VV
UU      UU  PP      PP              SS      PP      PP              NNNN    NN  VV      VV
UU      UU  PPPPPPPPP                SSSSS  PPPPPPPPP               NN NN   NN  VV      VV
UU      UU  PPPPPPPP                  SSSSS PPPPPPPP                NN NN   NN  VV      VV
UU      UU  PP                          SS  PP                      NN  NNNN  VV      VV
UU      UU  PP                          SS  PP                      NN  NNNN  VV      VV
UU      UU  PP                          SS  PP                      NN    NN    VV  VV
UU      UU  PP                          SS  PP                      NN    NN    VV  VV
UUUUUUUUU   PP                  SSSSSSS   PP                      NN    NN      VV
UUUUUUUUU   PP                  SSSSSSS   PP                      NN    NN      VV
```

```
RRRRRRRR    PPPPPPPP    TTTTTTTTTT      ;;;;       11
RRRRRRRR    PPPPPPPPP   TTTTTTTTTT      ;;;;       11
RR      RR  PP      PP      TT          ;;;;     1111
RR      RR  PP      PP      TT          ;;;;     1111
RR      RR  PP      PP      TT                     11
RR      RR  PP      PP      TT                     11
RRRRRRRR    PPPPPPPP        TT          ;;;;       11
RRRRRRRR    PPPPPPPP        TT          ;;;;       11
RR  RR      PP              TT          ;;;;       11
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....RR    RR  PP              TT            ;;       11
....RR    RR  PP              TT            ;;       11
....RR      RR  PP            TT          ;;     111111
....RR      RR  PP            TT          ;;     111111
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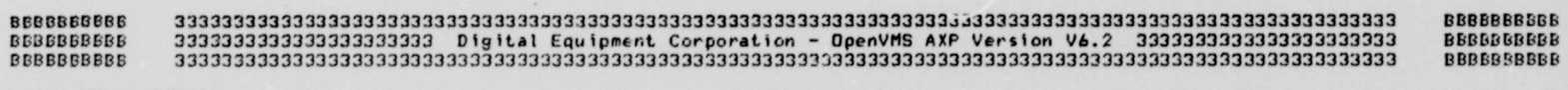
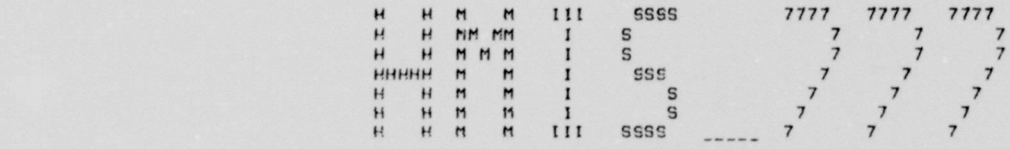
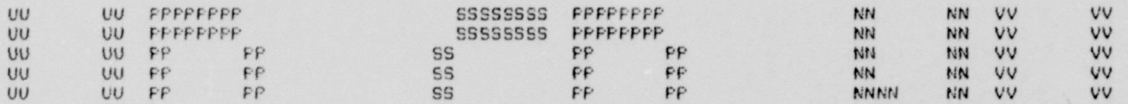
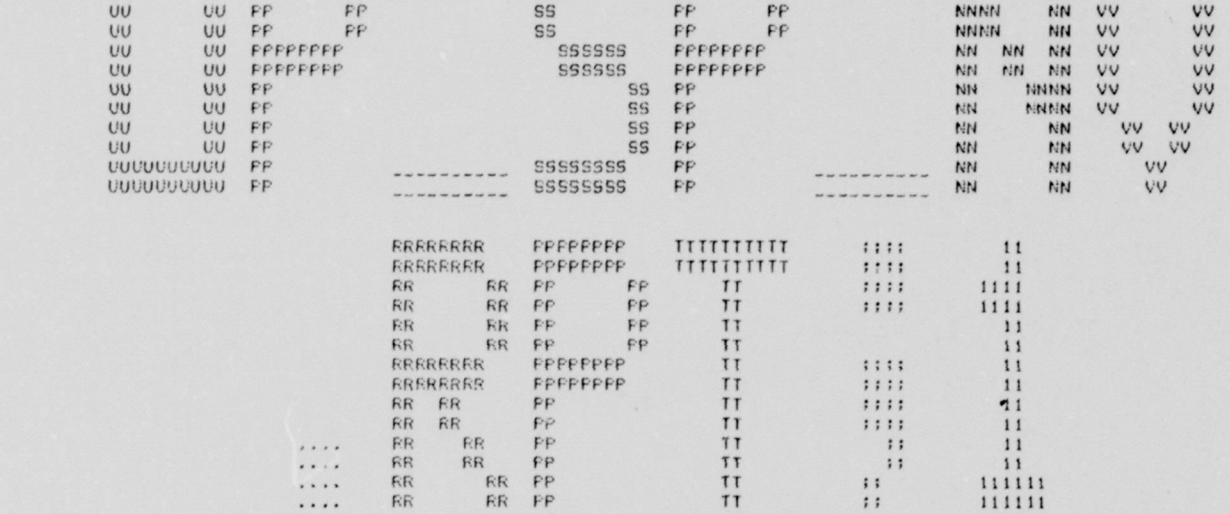


NOTE: KEVIN COBURN







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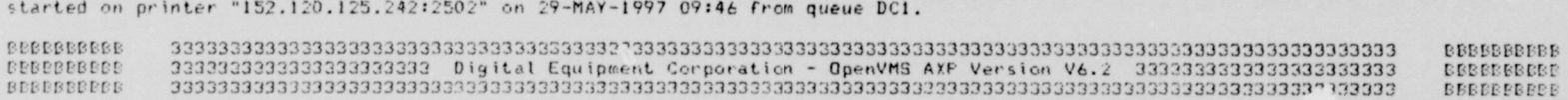

HAZARDOUS MATERIALS INCIDENT REPORT — Report Number: 93050476A

Mode: RAILWAY
Date: 04/08/1993 — Time: 7:00
Location: SPARKS, NV
County: WASHOE — Route: 1 SOUTH PYRAMID WAY

Carrier: SOUTHERN PACIFIC LINES, OAKLAND, CA
Carrier Reporting #: SP

Shipper: MAGMA COPPER CO, SAN MANUEL, AZ

Consignee: ARIMETCO COPPER, YERINGTON, NV

Shipment Origin: SAN MANUEL, AZ
Shipment Destination: YERINGTON, NV
Shipping paper #: SP185690

HAZARDOUS MATERIAL:
Shipping Name: SULFURIC ACID — Trade Name:
Hazard Class: CORROSIVE MATERIAL — UN Number: UN1830
Haz Substance: T — RQ Met?: F

Quantity Released: 1.00 GAL	Fatalities	Major Injuries	Minor Injuries
Number Evacuated: 0	0	0	0

DAMAGES:
Product Loss: $0
Carrier Damage: $0
Pub/Pri Property: $0
Decontam/Cleanup: $1092
Other: $0
Total Damage: $1092

CONSEQUENCES:
T - Spillage — F - Environment
F - Fire — F - Water/Sewer
F - Explosion — F - None
F - Vapor(Gas) — F - Other

TYPE OF VEHICLE:

F - Cargo Tank	F - Rail Car	F - Ship
F - Van Truck/Trailer	F - TOFC/COFC	F - Other
F - Flat Bed Truck/Trailer	F - Aircraft	
T - Tank Car	F - Barge	

Transportation Phase: ENROUTE BETWEEN ORIGIN/DESTINATION
Land Use at Incident Site: INDUSTRIAL
Community Type at Site: URBAN

SPILL WAS RESULT OF ACCIDENT/DERAILMENT: F
Estimated Speed: — Highway Type: — Lanes:

HAZARDOUS MATERIALS INCIDENT REPORT — Report Number: 93050476A

Container Sequence: 1 of 1

Container Type: 111AW — Capacity: 13573.00 GAL

Number Failed: 1 of 1 — Package Markings:

Manufacturer Name: NOT REPORTED BY CARRIER

Serial Number: GATX49066

Label/Placard: CORROS

Registration #:

Date of Last Inspection:

Exemption/Approval/Competent Authority #:

ACTION CONTRIBUTING TO PACKAGE FAILURE			OBJECT CAUSING FAILURE
F - Vehicle Collision	F - Corrosion		F - Other Freight
F - Vehicle Overturn	F - Metal Fatigue		F - Forklift
F - Overload/Overfill	F - Friction/Rubbing		F - Nail/Protrusion
F - Loose Fitting/Valve	F - Fire/Heat		F - Other Vehicle
F - Defective Fitting/Valve	F - Freezing		F - Water/Other Liquid
F - Dropped	F - Venting		F - Ground/Floor/Roadway
F - Struck/Rammed	F - Vandalism		F - Roadside Obstacle
F - Improper Loading	F - Incompat Material		T - None
F - Improper Blocking	T - Other	RUPTURED DISC	F - Other

DESCRIPTION OF PACKAGING FAILURE:

HOW PACKAGE(S) FAILED	AREA THAT FAILED	WHAT FAILED ON PACKAGE(S)
F - Punctured	F - End, Forward	F - Basic Package Material
F - Cracked	F - End, Rear	F - Fitting/Valve
F - Burst Int'l Pressure	F - Side, Right	F - Closure
F - Ripped	F - Side, Left	F - Chime
F - Crushed	T - Top	F - Weld/Seam
F - Rubbed/Abraded	F - Bottom	F - Hose/Piping
F - Ruptured	F - Center	F - Inner Liner
T - Other RUPTURED DISC	F - Other	T - Other SAFETY VENT DISC

CAR WAS DISCOVERED TO HAVE PRODUCT SPILLAGE TO TOP OF THE CAR AT OUR SPARKS YARD FACILITY IN SPARKS, NV. IT WAS DISCOVERED THAT THE SAFETY VENT DISC WAS RUPTURED. THE DISC WAS REPLACED AND THE SPILLAGE NEUTRALIZED AND THEN THE CAR WAS RELEASED TO DESTINATION.

HAZARDOUS MATERIALS INCIDENT REPORT — Report Number: 92060169A

Mode: RAILWAY
Date: 03/18/1992 — Time: 14:15
Location: SPARKS, NV
County: WASHOE — Route: PYRIMID ST

Carrier: SOUTHERN PACIFIC TRANSP CO, ROSEVILLE, CA
Carrier Reporting #: SP

Shipper: ASARCO INC, MAGMA, AZ

Consignee: ARIMETCO COPPER, WABUSKA, NV

Shipment Origin: UNKNOWN, XX
Shipment Destination: UNKNOWN, XX
Shipping paper #: SP#592587

HAZARDOUS MATERIAL:
Shipping Name: SULFURIC ACID — Trade Name:
Hazard Class: CORROSIVE MATERIAL — UN Number: UN1830
Haz Substance: T — RQ Met?: T

Quantity Released: 2.00 GAL | Fatalities | Major Injuries | Minor Injuries
Number Evacuated: 0 | 0 | 0 | 0

DAMAGES:
Product Loss: $100
Carrier Damage: $0
Pub/Pri Property: $0
Decontam/Cleanup: $1000
Other: $0
Total Damage: $1100

CONSEQUENCES:
T - Spillage — F - Environment
F - Fire — F - Water/Sewer
F - Explosion — F - None
F - Vapor(Gas) — F - Other

TYPE OF VEHICLE:
F - Cargo Tank — F - Rail Car — F - Ship
F - Van Truck/Trailer — F - TOFC/COFC — F - Other
F - Flat Bed Truck/Trailer — F - Aircraft
T - Tank Car — F - Barge

Transportation Phase: ENROUTE BETWEEN ORIGIN/DESTINATION
Land Use at Incident Site: COMMERCIAL
Community Type at Site: SUBURBAN

SPILL WAS RESULT OF ACCIDENT/DERAILMENT: F
Estimated Speed: — Highway Type: — Lanes:

HAZARDOUS MATERIALS INCIDENT REPORT Report Number: 92060169A

Container Sequence: 1 of 1

Container Type: 111AW Capacity: 13632.00 GAL

Number Failed: 1 of 1 Package Markings:

Manufacturer Name: NOT REPORTED BY CARRIER

Serial Number:

Label/Placard: CORROS

Registration #:

Date of Last Inspection:

Exemption/Approval/Competent Authority #:

ACTION CONTRIBUTING TO PACKAGE FAILURE		OBJECT CAUSING FAILURE
F - Vehicle Collision	F - Corrosion	F - Other Freight
F - Vehicle Overturn	F - Metal Fatigue	F - Forklift
F - Overload/Overfill	F - Friction/Rubbing	F - Nail/Protrusion
F - Loose Fitting/Valve	F - Fire/Heat	F - Other Vehicle
T - Defective Fitting/Valve	F - Freezing	F - Water/Other Liquid
F - Dropped	F - Venting	F - Ground/Floor/Roadway
F - Struck/Rammed	F - Vandalism	F - Roadside Obstacle
F - Improper Loading	F - Incompat Material	F - None
F - Improper Blocking	F - Other	T - Other
		NO RESPONSE

DESCRIPTION OF PACKAGING FAILURE:

HOW PACKAGE(S) FAILED	AREA THAT FAILED	WHAT FAILED ON PACKAGE(S)
F - Punctured	F - End, Forward	F - Basic Package Material
F - Cracked	F - End, Rear	T - Fitting/Valve
F - Burst Int'l Pressure	F - Side, Right	F - Closure
F - Ripped	F - Side, Left	F - Chime
F - Crushed	T - Top	F - Weld/Seam
F - Rubbed/Abraded	F - Bottom	F - Hose/Piping
F - Ruptured	F - Center	F - Inner Liner
T - Other	F - Other	F - Other
NO RESPONSE		

FRANGIBLE DISC BURST - NEW DISC.
APPLIED - CAR SENT TO DESTINATION.

HAZARDOUS MATERIALS INCIDENT REPORT — Report Number: 92020381A

Mode: RAILWAY
Date: 01/28/1992 — Time: 7:50
Location: RENO, NV
County: WASHOE — Route: 500 FARR BLVD

Carrier: UNION PACIFIC RAILROAD CO, OMAHA, NE
Carrier Reporting #: UP

Shipper: SOUTHERN WATER TREATMENT CO, GREENVILLE, SC

Consignee: G S T CORP, SPARKS, NV

Shipment Origin: GREENVILLE, SC
Shipment Destination: RENO, NV
Shipping paper #: NSWB 0122129704

HAZARDOUS MATERIAL:
Shipping Name: CORROSIVE LIQUIDS N.O.S. — Trade Name: METAL REC 1600
Hazard Class: CORROSIVE MATERIAL — UN Number: UN1760
Haz Substance: F — RQ Met?: F

Quantity Released: 40.00 GAL	Fatalities	Major Injuries	Minor Injuries
Number Evacuated: 0	0	0	0

DAMAGES:

Product Loss: $150	
Carrier Damage: $0	
Pub/Pri Property: $0	
Decontam/Cleanup: $4300	
Other: $0	
Total Damage: $4450	

CONSEQUENCES:

T - Spillage	F - Environment	
F - Fire	F - Water/Sewer	
F - Explosion	F - None	
T - Vapor(Gas)	F - Other	

TYPE OF VEHICLE:

F - Cargo Tank	F - Rail Car	F - Ship
F - Van Truck/Trailer	T - TOFC/COFC	F - Other
F - Flat Bed Truck/Trailer	F - Aircraft	
F - Tank Car	F - Barge	

Transportation Phase: ENROUTE BETWEEN ORIGIN/DESTINATION
Land Use at Incident Site: INDUSTRIAL
Community Type at Site: URBAN

SPILL WAS RESULT OF ACCIDENT/DERAILMENT: F
Estimated Speed: — Highway Type: — Lanes:

HAZARDOUS MATERIALS INCIDENT REPORT — Report Number: 92020381A

Container Sequence: 1 of 1

Container Type: 34 — Capacity: 55.00 GAL

Number Failed: 1 of 8 — Package Markings:

Manufacturer Name: NOT REPORTED BY CARRIER

Serial Number: SOUZ251831

Label/Placard: WHITE

Registration #:

Date of Last Inspection:

Exemption/Approval/Competent Authority #: E6800

ACTION CONTRIBUTING TO PACKAGE FAILURE			OBJECT CAUSING FAILURE
F - Vehicle Collision	F - Corrosion		F - Other Freight
F - Vehicle Overturn	F - Metal Fatigue		F - Forklift
F - Overload/Overfill	F - Friction/Rubbing		T - Nail/Protrusion
F - Loose Fitting/Valve	F - Fire/Heat		F - Other Vehicle
F - Defective Fitting Valve	F - Freezing		F - Water/Other Liquid
F - Dropped	F - Venting		F - Ground/Floor/Roadway
F - Struck/Rammed	F - Vandalism		F - Roadside Obstacle
F - Improper Loading	F - Incompat Material		F - None
T - Improper Blocking	F - Other		F - Other

DESCRIPTION OF PACKAGING FAILURE:

HOW PACKAGE(S) FAILED	AREA THAT FAILED	WHAT FAILED ON PACKAGE(S)
T - Punctured	F - End, Forward	T - Basic Package Material
F - Cracked	F - End, Rear	F - Fitting/Valve
F - Burst Int'l Pressure	F - Side, Right	F - Closure
F - Ripped	F - Side, Left	F - Chime
F - Crushed	F - Top	F - Weld/Seam
F - Rubbed/Abraded	T - Bottom	F - Hose/Piping
F - Ruptured	F - Center	F - Inner Liner
F - Other	F - Other	F - Other

SENIOR SPECIAL AGENT/HAZARDOUS MATERIALS (SSA/HM) D. ALM WAS NOTIFIED THAT TRAILER SOUZ 251831 AT RENO, NV INTERMODAL TRAILER RAMP HAD A WHITE SUBSTANCE ON THE WHEELS AND FLATCAR. SSA/HM ALM RESPONDED AND INSPECTION DETERMINED THAT THE ENTIRE SHIPMENT OF 55 GALLON DRUMS HAD SHIFTED TOWARD THE REAR DOOR DUE TO INADEQUATE BLOCKING AND BRACING. ONE 55 GALLON DRUM OF PRODUCT HAD BEEN PUNCTURED WITH A NAIL DUE TO THE LOAD SHIFT. DISPOSAL CONTROL SERVICES WAS NOTIFIED AND RELOADED THE TRAILER AND DECONTAMINATED THE FLATCAR. NOTIFICATIONS WERE MADE TO NEVADA DEPARTMENT OF EMERGENCY MANAGEMENT, CHEMTREC AND THE SHIPPER.

HAZARDOUS MATERIALS INCIDENT REPORT — Report Number: 91120120A

Mode: RAILWAY
Date: 09/25/1991 — Time: 15:45
Location: SPARKS, NV
County: WASHOE — Route: 1 PYRAMID WAY-S PACIFIC RR

Carrier: SOUTHERN PACIFIC TRANSP CO, OAKLAND, CA
Carrier Reporting #: SP

Shipper: VULCAN MATERIALS CO, WICHITA, KS

Consignee: HONDO CHEM, ROGAS, CA

Shipment Origin: WICHITA, KS
Shipment Destination: ROGAS, CA
Shipping paper #: ATSF 087031

HAZARDOUS MATERIAL:
Shipping Name: SODIUM HYDROXIDE SOLUTION — Trade Name:
Hazard Class: CORROSIVE MATERIAL — UN Number: UN1824
Haz Substance: T — RQ Met?:

Fatalities	Major Injuries	Minor Injuries
0	0	0

Quantity Released: 5.00 GAL
Number Evacuated: 0

DAMAGES:
Product Loss: $50
Carrier Damage: $0
Pub/Pri Property: $0
Decontam/Cleanup: $1500
Other: $0
Total Damage: $1550

CONSEQUENCES:
T - Spillage — F - Environment
F - Fire — F - Water/Sewer
F - Explosion — F - None
F - Vapor(Gas) — F - Other

TYPE OF VEHICLE:
F - Cargo Tank — F - Rail Car — F - Ship
F - Van Truck/Trailer — F - TOFC/COFC — F - Other
F - Flat Bed Truck/Trailer — F - Aircraft
T - Tank Car — F - Barge

Transportation Phase: ENROUTE BETWEEN ORIGIN/DESTINATION
Land Use at Incident Site: INDUSTRIAL
Community Type at Site: URBAN

SPILL WAS RESULT OF ACCIDENT/DERAILMENT: F
Estimated Speed: — Highway Type: — Lanes:

HAZARDOUS MATERIALS INCIDENT REPORT Report Number: 91120120A

Container Sequence: 1 of 1

Container Type: 111AW Capacity: 16524.00 GAL

Number Failed: 1 of 1 Package Markings:

Manufacturer Name: NOT REPORTED BY CARRIER

Serial Number: UCLX 16367

Label/Placard: CORROS

Registration #:

Date of Last Inspection:

Exemption/Approval/Competent Authority #:

ACTION CONTRIBUTING TO PACKAGE FAILURE		OBJECT CAUSING FAILURE
F - Vehicle Collision	F - Corrosion	F - Other Freight
F - Vehicle Overturn	F - Metal Fatigue	F - Forklift
F - Overload/Overfill	F - Friction/Rubbing	F - Nail/Protrusion
F - Loose Fitting/Valve	F - Fire/Heat	F - Other Vehicle
T - Defective Fitting/Valve	F - Freezing	F - Water/Other Liquid
F - Dropped	T - Venting	F - Ground/Floor/Roadway
F - Struck/Rammed	F - Vandalism	F - Roadside Obstacle
F - Improper Loading	F - Incompat Material	T - None
F - Improper Blocking	F - Other	F - Other

DESCRIPTION OF PACKAGING FAILURE:

HOW PACKAGE(S) FAILED	AREA THAT FAILED	WHAT FAILED ON PACKAGE(S)
F - Punctured	F - End, Forward	F - Basic Package Material
F - Cracked	F - End, Rear	F - Fitting/Valve
F - Burst Int'l Pressure	F - Side, Right	F - Closure
F - Ripped	F - Side, Left	F - Chime
F - Crushed	T - Top	F - Weld/Seam
F - Rubbed/Abraded	F - Bottom	F - Hose/Piping
F - Ruptured	F - Center	F - Inner Liner
T - Other DISC	F - Other	T - Other SAFETY VENT DISC

THIS REPORT ALSO CONTAINS ATTACHMENTS THAT ARE NOT ELECTRONICALLY RETRIEVABLE (e.g. PHOTOGRAPHS, DIAGRAMS, ETC.).

CAR HAD A RUPTURED SAFETY VENT DISC. DISC WAS REPLACED. CAR WAS DECONTAMINATED BY DISPOSAL CONTROL SERVICES, 884 FREEPORT, SPARKS, NV. 3 DRUMS OF NEUTRALIZED MATERIAL AND CLOTHING WERE GENERATED AND WAS DISPOSED OF AT LOCKWOOD LANDFILL.

Appendix M

MEMO FROM CLYDE ANDERSON, UNION PACIFIC RAILROAD, REGARDING PROJECTED HAZARDOUS MATERIALS RAIL CARS THROUGH RENO, NEVADA

UNION PACIFIC RAILROAD

1416 Dodge Street, Room 700
Omaha, NE 68179-0700
August 17, 1997

To: Winn Frank
DeLeuw, Cather, Inc.
Washington, D.C. (via FAX - (202) 775-3389)

Mike Hemmer
Covington & Burling
Washington, D.C. (via Lotus Notes)

cc:

Joe Bateman,	UP, via Lotus Notes
Jim V. Dolan,	UP, via Lotus Notes
Wayne Horiuchi,	UP, via Lotus Notes
Tom Ogee,	UP, via Lotus Notes
Arvid Roach,	Covington & Burling, Washington, DC
Lee Roach,	UP, via Lotus Notes
Mike Rock,	UP, via Lotus Notes
Dale Salzman,	UP, via Lotus Notes
Lou Wagner,	UP, via Lotus Notes
Bill Wimmer,	UP, via Lotus Notes

RE: UP-SP Merger: Changes in Haz-Mat Traffic Flows at Reno and Wichita

Mike Hemmer's memo dated August 14 requested the changes in haz-mat volumes through Reno and Wichita resulting from the UP/SP merger using the traffic volumes and operating plan used in preparation of the UP/SP Merger Application. This is to supplement the extensive study of the impact of the merger on haz-mat flows completed on May 31, 1996.

For the May 1996 study, hazardous materials and waste shipments were identified by selecting all loaded units with STCC's beginning with '48' and '49'. The post-merger haz-mat traffic file input to the Multi-Rail model had 1,350 carloads per day with 19% intermodal carloads. Intermodal trailers and containers were converted to carloads dividing by a 1.83 load factor. Although the risks pertaining to haz-mat carloads may be higher than for haz-mat materials moving in intermodal service, our May 1996 study did not make the separation between carload and intermodal loads.

Mike requested that I develop the change in haz-mat volumes for Reno and Wichita separating carload and intermodal while also providing the 1994 Adjusted Base and Post-Merger volumes for all traffic.

Reno, Nevada (using stats from the Multi-Rail Roseville-Sparks segment)

1994 Adjusted Base Volumes	All Traffic	Haz-Mat	Percentage
Non-Intermodal Cars	630	24.6	3.9%
Intermodal Cars	114	0.4	0.4%
	744	25.0	3.4%

Post-Merger Volumes	All Traffic	Haz-Mat	Percentage
Non-Intermodal Cars	588	25.8	4.4%
Intermodal Cars	624	14.2	2.3%
	1,212	40.0	3.3%

Change	All Traffic	Haz-Mat	Percentage
Non-Intermodal Cars	-42	+1.2	8.0% of increase
Intermodal Cars	+510	+13.8	92.0% of increase
	+468	+15.0	

This reflects the shift of intermodal traffic from the UP Feather River Route to the SP route via Reno while some bulk carload traffic is shifted from the SP route to the UP.

Wichita, KS (using stats from the Multi-Rail Wichita - Enid segment)

1994 Adjusted Base Volumes	All Traffic	Haz-Mat	Percentage
Non-Intermodal Cars	313	7.0	2.2%
Intermodal Cars	0	0.0	0.0%
	313	7.0	2.2%

Post-Merger Volumes	All Traffic	Haz-Mat	Percentage
Non-Intermodal Cars	957	7.0	0.7%
Intermodal Cars	0	0.0	0.0%
	957	7.0	0.7%

Change	All Traffic	Haz-Mat	Percentage
Non-Intermodal Cars	+644	0.0	0.0% of increase
Intermodal Cars	0	0.0	0.0% of increase
	+644	0.0	

There is no intermodal traffic through Wichita. The above numbers reflect the original operating plan. I have no Multi-Rail traffic flows for the revised operating plan that was submitted in the verified statement dated March 7, 1997.

If you have any questions on the above, please call me at (402) 271-4478

Yours truly,

Clyde Anderson

Clyde Anderson
Transportation Research
Phone: 402-271-4478
Fax: 402-271-5955

Appendix N
DERAILMENT & HAZARDOUS MATERIALS RELEASE ESTIMATES

DELEUW
CATHER Memorandum

TO: Winn Frank
FROM: Duncan Allen
DATE: September 10, 1997

SUBJECT: Derailment and Hazardous Materials Release Estimates, Reno Vicinity

Methodology

Base Values

A *base value for average annual mainline derailments* for each segment was estimated by applying per-unit derailment rates for various strata of mainline FRA Class 3 or Class 4 trackage to estimated units for each track segment. The derailment rates, one per train-mile and one per car-mile, each were estimated for each stratum from calendar 1994-96 accident/incident reports to the FRA, for mainline tracks (i.e., track type "1" in the accident/incident database). Reported accidents[1] were divided by the estimated nationwide units of operation[2] to obtain nationwide rates, then were adjusted by various factors based on the actual accident experience of the segments. A summary of these calculation results appears as Table 1.

The rates were applied to train traffic in each segment based on the estimated number of trains and cars per train, as follows:

$$D = R_{cdtm}\ TM + R_{citm}\ TM + R_{cicm}\ CM$$

where:

- D is the base value for estimated annual mainline derailments;
- TM is the number of annual train-miles in the segment;
- CM is the number of annual car-miles in the segment; and
- Subscripted R values are the control-dependent (*cd*) or control-independent (*ci*) rates for car-miles (*cm*) or train-miles (*tm*) in Table 1.

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[1] From the FRA's Accident/Incident database of incidents reported pursuant to 49 CFR Part 219.

[2] Total nationwide units as reported in *AAR Railroad Facts*, allocated to strata in proportion to the occurrence of accidents judged to independent of both track class and control method.

Table 1 Estimated Derailment Rates for Classes 3 and 4 Mainlines, 1994-96				
Type(s) of Derailment	**Applicable Operational Unit**	**Estimated Nationwide Units, 1994-96**	**Reported Derailments, 1994-96**	**Estimated National Rate, 1994-96**
Control-dependent ("dark" or unsignaled territory)	train-miles	84,209,000	34	4.04×10^{-7}
Control-independent, Class 3	train-miles	270,574,000	96	3.55×10^{-7}
Control-independent, Class 3	car-miles	17,542,000,000	307	1.75×10^{-8}
Control-dependent (signaled territory)	train-miles	N/A[3]	N/A	2.63×10^{-7}
Control-independent, Class 4	train-miles	336,837,000	74	3.55×10^{-7}
Control-independent, Class 4	car-miles	22,005,953,000	360	1.64×10^{-8}

Adjustment to Historical Experience

The *empirical Bayes* procedure was applied to modify the base value estimate to incorporate knowledge of the actual mainline derailment history. The base value was adjusted to reflect the fact that a number of derailments (N) occurred over a number of years of history (T) as follows:

$$D_{adjusted} = \frac{D\ T_0 + N}{T + T_0}$$

where T_0 is a quantity that depends on the link, and can be estimated as the ratio of the mean accident rate to the variance of the distribution of the accident rate. For a set of randomly-selected links on the UP/SP system, T_0 was estimated as 78. This means that the occurrence of accidents is so random that large differences in accident history can be expected to have a relatively small effect on the expected accident rate. Actual derailment history for 1991-96 was used (i.e., N = 5). This same procedure, although with a different T_0 value, is incorporated in the FRA grade crossing accident prediction formulas.

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[3] This rate was assumed to be 65% of the unsignalled territory rate, rounded up from a ratio of 0.6384 based on examination of Class 3 and Class 4 results combined.

Releases of Hazardous Materials (HM) in Conjunction with Derailments

Conditional release probabilities were used to estimate the incidences of *hazardous materials (HM) release in conjunction with derailments*. Examination of derailment data from the FRA accident/incident database indicated that while the fraction of cars in a consist that derailed tends to increase with speed, the conditional probability of a car's releasing HM given it has derailed is relatively stable, at about 0.16. HM releases were therefore estimated at 0.16 times the fraction of consist likely to derail at the typical freight speed (TFS) for a segment, times the average number of HM cars in a consist. Table 2 shows the TFS values assumed for various values of prevailing freight maximum operating speed (FMOS).

Table 2
TFS vs. FMOS Assumptions

FMOS (mph)	TFS (mph)
60	50
50	40
45	40
40	35
35 and below	FMOS

The fraction of consist derailing was found to vary widely among individual accidents, but the median value did vary consistently with speed. A Poisson regression was employed to fit a logit curve in terms of both TFS and the square of the ratio of TFS to 60 mph; the second term was based on the principle that both the kinetic energy involved and the track forces acting to keep a train on a curved path vary as the square of speed. The estimated fraction was:

$$F_{derailing} = \frac{0.8}{(1.0 + e^{(2.6135 + 0.00385TFS - 0.8075(\frac{TFS}{60})^2)})}$$

The estimate of HM releases was therefore:

$$R_{hm} = 0.16\ D_{adjusted}\ F_{derailing}\ \frac{HMC}{TPD}$$

where:

- Rhm is the estimated annual HM releases associated with mainline derailments;
- HMC is the daily number of estimated HM carloads; and
- TPD is the estimated number of trains per day.

Conditional Probability of River Contamination

Given a HM spill on the mainline, there is some chance that the HM will contaminate the river. This conditional probability of contamination depends on: the proximity of the spill to the river; whether the HM is a solid, liquid, or gas; and the amount of HM released. Each of these factors is addressed in a subsection below. For estimating purposes, the definition of a HM release is a release of "some" HM in conjunction with a mainline railroad accident or incident reportable to the FRA[4].

The analysis presented herein is based on 24 trains west of Sparks and 25.1 trains east of Sparks to reflect post-merger conditions.

Proximity of Spill to the River

The distribution of the distance between the point where a HM spill occurs and the Truckee River depends on two factors: the distance from the tracks to the river, and the distance of the spill from the track centerline.

Examination of USGS map data and railroad track chart data indicate that between mileposts 206 (Truckee, CA) and the state line at MP 228.5, the river is within 200 feet of the tracks for 12.76 miles; between MP 228.5 and MP 257 in Nevada, the river is within 200 feet for a total of 7.46 miles. In California and Nevada respectively, the mileage on bridges over the Truckee or its tributaries is estimated to be about 0.21 and 0.20. These mileage data were used as a bound for potential spills for cars coming to rest more than 200 feet from the track centerline. These considerations were combined into a set of assumptions regarding the *proximity of the tracks to the river*, as shown in Table 3.

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[4] Federal Railroad Administration, *FRA Guide For Preparing Accidents/Incidents Reports*, DOT/FRA/RRS-22, January 1993.

Table 3 Estimated Distribution of Track Proximity to Truckee River		
Proximity of Tracks to River	**Fraction of California Trackage (MP 206- MP 228.5)**	**Fraction of Nevada Trackage (MP 228.5- MP 257)**
On bridge (zero distance to the river)	0.009	0.007
Within 200 feet	0.567	0.262
"Adjacent" but more than 200 feet	0.364	0.441
Not "adjacent"	0.060	0.290

Derailments are the major source of mainline HM releases. Therefore, the *distribution of the lateral displacements of cars which derail* is a reasonable assumption for the upper limit on the distribution for all accidents. Most cars which derail come to rest within 200 feet of the center line of track.

Based on the sketches of 121 derailed freight cars prepared for NTSB accident reports 96-05, 91-04, 83-07, 78-4, and 78-8, (which were selected randomly from a shelf of such reports), the cumulative frequency of the farthest point on a derailed car from the centerline of track on the "prevailing" side of the tracks was determined. The "prevailing" side is either the downslope side or the outside of a curve, toward which derailed cars are more likely to move. These data indicate that no more than half of the derailed cars are likely to move significantly toward the "prevailing" side, principally because there is a tendency for the rails to keep the cars "in line" (i.e., with their farthest point less than 10 feet from the track centerline). A large majority of cars come to rest with their farthest point less than 100 feet from the track centerline.

For the purposes of estimating possible contamination of the Truckee River, a much more "conservative" set of assumptions was adopted than the above data would suggest:

- All derailed cars would tend to move *toward* the Truckee River.
- 25 percent of derailed cars would come to rest with their farthest point 10 feet or less from the track centerline;
- 50 percent of derailed cars would come to rest with their farthest point 25 feet or less from the track centerline;
- 90 percent of derailed cars would come to rest with their farthest point 100 feet or less from the track centerline;
- 95 percent of derailed cars would come to rest with their farthest point 200 feet or less from the track centerline; and
- The distribution of lateral displacement between the points cited above would be uniform (this tends to overstate the distance traveled in comparison to the more curved distribution evident in the freight data).

In effect, the assumptions for river contamination are that all derailed cars would move toward the river, and they would typically travel much farther from the tracks than the derailment data would suggest. Lateral excursions more than 200 feet from the tracks were assumed to be about five times more likely than the empirical derailment data would suggest. (i.e., about five percent versus one percent of derailed cars).

HM State

The following distribution of HM materials by state in cars which release hazardous materials was used:

- 15.8 percent solid;
- 63.4 percent liquid which would remain so upon release; and
- 20.8 percent gas or compressed liquid that could be released as a vapor.

These fractions compare to nationwide HM traffic. The distinction among the states of HM materials has a bearing on how they are released, and the relative risk of contamination.

Severity of HM Releases

Two sources provide some information with respect to two particular commodities:

- A 1979 paper[5] assumed that one percent of propane releases from rail tank cars would be "significant."
- A risk assessment study[6] of the transport of liquefied natural gas (LNG) assumed that: 3.9 percent of railborne releases would be "catastrophic," i.e., near-instantaneous release of a car's entire contents; 19.3 percent would be "serious," i.e., releasing contents over five minutes; and that the remaining 76.8 percent of releases would be "minor."

A further general indication of severity may be inferred from the results of the 59 reported mainline railborne HM releases reported to FRA in 1994-96. Of these, 28 resulted in evacuations of people from the vicinity; it should be noted that in many cases, this was undertaken as a precaution only. Of the 28 which resulted in evacuations, ten (10) caused one or more reported injuries, and two (2) resulted in reportable damages other than to railroad tracks and equipment.

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[5] Geffen, C.A., and Franklin, A.L., "An Assessment of the Risk of Transporting Propane by Truck and Train", DOE Environmental Control Symposium, Reston, VA, presented March 1980.

[6] Arthur D. Little, Inc., "Assessment of Risks and Risk Control Options Associated with Liquefied Natural Gas Trucking Operations from Distrigas Terminal, Everett, Massachusetts", June 1979.

The basis for conditional probabilities for solid HMs is the distribution of the lateral displacement of derailed cars and the likely extent of spillage, as discussed further in this memorandum.

For gases and liquids which may gasify on release, the three categories of release defined in the LNG study were retained, but the fractions were assumed to be slightly higher to retain the "conservative" nature of the analysis: 50 percent were assumed to be "minor" (roughly the nationwide proportion of HM incidents not resulting in evacuations), and the remainder pro-rated according to the LNG study, resulting in 9 percent "catastrophic" and 41 percent "serious."

For liquids, 18 of 28 spills (64.3 percent) were assumed to be "significant," based on the ratio of casualty-causing FRA incidents to total evacuations.

For locations *where the river is within 200 feet of the tracks*, the distribution of the distance of a solid HM release from the tracks was determined as the distribution of the sum of the lateral displacement of the farthest point on the car from the tracks plus the distance the spilled HM would travel from the car. Several "conservative" assumptions were made in this regard:

- The entire HM carload (assumed to be 4,800 cubic feet of material) would be spilled;
- The spill pattern would be characteristic of a spill occurring from the side of a car (i.e., over 180 degrees of arc) located at the farthest point from the tracks; and
- For 50 percent of spills, the ground would slope downwards at a 30-degree angle (i.e., a 33.3 percent grade) toward the river.

Assuming a 40-degree angle or repose for the spilled materials, the distance covered by a 180-degree spill pattern of 4,800 cubic feet would be:

$$D = \sqrt[3]{\frac{9600}{\pi \sin 40}}$$

or about 16.8 feet.

In fifty percent of the assumed cases, however, the effective angle of repose would only be about 10 degrees (40 minus 30), thereby increasing the distance of the spill to:

$$D = \sqrt[3]{\frac{9600}{\pi \sin 10}}$$

or about 26.0 feet.

The estimated fraction of spills contaminating the river from releases when the river is within 200 feet of the tracks was estimated by using a computer spreadsheet to generate 10,000 simulated spills according to the assumptions, i.e., occurring at a distance from the tracks as described above. This indicated that 31.2 percent of derailing cars traveling less than 200 feet from the tracks would release solid HMs into the river. In combination with the assumed 5 percent of cars that would travel beyond 200 feet, the resulting estimate of the conditional probability was 0.346.

For the purposes of estimating conditional release probabilities, different assumptions were made according the state of the HM released and the proximity to the tracks. Table 4 summarizes these assumptions and their bases.

Table 4
Assumed Conditional Contamination Probabilities, Given a HM Release

Proximity of Tracks to River	HM State(s)	Assumed Conditional Probability of Contamination	Basis for Assumption
On Bridge	All	1.000	Release occurs directly over water
Within 200 feet	Solid	0.346	Distribution of lateral displacement of cars
Within 200 feet	Liquid	0.643	All "significant" spills would contaminate
Within 200 feet	Liquid/gas	0.500	All "serious" and "catastrophic" spills would contaminate
"Adjacent" but more than 200 feet	Solid	0.050	All cars coming to rest beyond 200 feet from the tracks would contaminate
"Adjacent" but more than 200 feet	Liquid	0.460	71.5 percent of "significant" spills would contaminate[7]
"Adjacent" but more than 200 feet	Liquid/Gas	0.295	All "catastrophic" spills and 50 percent of "serious" spills would contaminate
Not "adjacent"	All	0.000	

Computation of Conditional Probabilities

[7] 71.5 percent = 5 percent of cars stopping more than 200 feet from tracks + 50 percent of cars within 200 feet assumed to be on ground sloping towards the river + 20 percent of cars within 200 feet close enough to river for underground infiltration into river.

The above assumptions were combined into conditional contamination probabilities for the two sections (CA and NV) as shown in Table 5.

Table 5
Estimation of Conditional Contamination Probabilities by Section

State of HM and Proximity to River	Fraction of Traffic	Conditional Probability	Fraction of CA Segment	Fraction of NV Segment	CA Product	NV Product
All states, on bridge	1.000	1.000	0.009	0.007	0.0090	0.0070
Solids, <200 feet	0.158	0.346	0.567	0.262	0.0310	0.0143
Solids, adjacent and > 200 feet	0.158	0.050	0.364	0.441	0.0029	0.0035
Solids, not adjacent	0.158	0.000	0.060	0.290	0.0000	0.0000
Liquids < 200 feet	0.634	0.643	0.567	0.262	0.2311	0.1068
Liquids, adjacent and > 200 feet	0.634	0.460	0.364	0.441	0.1062	0.1286
Liquids, not adjacent	0.634	0.000	0.060	0.290	0.0000	0.0000
Liquid/gas < 200 feet	0.208	0.500	0.567	0.262	0.0590	0.0272
Liquid/gas, adjacent and > 200 feet	0.208	0.295	0.364	0.441	0.0223	0.0271
Liquid/gas, not adjacent	0.208	0.000	0.060	0.290	0.0000	0.0000
TOTAL					**0.4615**	**0.3145**

Application of Conditional Probabilities to Estimated HM Releases

Table 6 shows the HM release estimates using SEA's methods. The following methods were used to develop this table.

1. The grade-crossing accident results for Nevada were estimated by SEA on a crossing-by-crossing basis as documented separately. The results for the two California crossings (Hirshdale Road and Route 267) were computed by the same methods by the FRA for 15 daily trains in the PCAPS database, then were adjusted upward by $(25/15)^{0.4}$ to reflect the increase in train traffic. Once all other conditions are held constant, the exponent 0.4 closely approximates the density-dependent effects of the FRA grade crossing prediction formulas.
2. Mainline accidents other than derailments and grade crossing accidents were estimated at a rate of 8.26×10^{-7} per train-mile, based on the occurrence of 406 such accidents reported to FRA in 1994-96 for signalized Class 3 and Class 4 track, divided by an estimated 491,451,000 train-miles of such operation during that period.
3. For grade crossing accidents, a breach rate of 0.0081 was applied, based on five releases from 619 HM cars involved in such accidents in 1994-96. For other accidents (i.e., neither

grade crossing accidents nor derailments), a rate of 0.0078 was applied, based on six releases from 765 HM cars involved in such accidents in 1994-96.

Table 6 Comparison of Relative HM Contamination Risk Estimates			
	California	Nevada	Total
Expected Annual Mainline Derailments	0.387	0.521	0.908
Expected Annual Grade Crossing Accidents	0.119	0.950	1.069
Expected Annual Other Mainline Accidents	0.163	0.210	0.373
Expected Annual Breaches of HM Cars	0.0101	0.0264	0.0365
Expected Years Between Breaches	98.5	38.0	27.4
Fraction of Total Breaches Estimated to Contaminate the Truckee River	0.46	0.31	0.35
Expected Years Between Contaminations	213.5	120.7	77.3

Table 7 presents a summary of HM releases and river contamination estimates.

Table 7 Hazardous Materials Release Estimates (Segments of UP's Central Corridor)			
	California (Truckee to California Border)	Nevada (Between California Border and Fernley)	Combined (Between Truckee CA. and Fernley NV.)
Pre-Merger			
Expected releases per year	0.00681	0.01834	0.02514
Fraction of releases estimated to contaminate the Truckee River	0.4615	0.3145	0.3543
Expected years between contamination	318.2	173.4	112.2
Post-Merger			
Expected releases per year	0.01015	0.02635	0.03650
Fraction of releases estimated to contaminate the Truckee River	0.4615	0.3145	0.3543
Expected years between contamination	213.5	120.7	77.3
Difference Between Pre- and Post-merger			
Expected releases per year	0.00334	0.00801	0.01136
Expected years between contamination	104.7	52.7	34.9

Appendix O
SEA LETTERS TO THE CHAIRS
OF THE NATIVE AMERICAN TRIBAL COUNCILS IN RENO AREA

SURFACE TRANSPORTATION BOARD
Washington, DC 20423

Section of Environmental Analysis

May 20, 1997

Mr. Arlan Melendez, Chair
Tribal Council
Reno-Sparks Indian Colony
98 Colony Rd.
Reno, Nevada 89502

Subject: Proposed meeting to review Native American issues/concerns regarding the on-going Reno Mitigation Study in connection with the merger of the Union Pacific and Southern Pacific Railroads

Dear Mr. Melendez:

The Surface Transportation Board's Section of Environmental Analysis (SEA) would like to meet with you to discuss the potential environmental effects of the increased train traffic in the Reno area as a result of the UP/SP merger. The purpose of the meeting is to discuss possible Native American issues that pertain to the Reno Mitigation Study.

In a decision served on August 12, 1996 (Decision No. 44), the Surface Transportation Board (Board) approved the merger of the Union Pacific and Southern Pacific railroads. In its written decision, the Board imposed system-wide and corridor-specific mitigation conditions. The mitigation conditions address safety, hazardous materials, emergency response, air quality, and noise. As part of its decision, the Board directed SEA to conduct an 18-month mitigation study in Reno to develop specifically tailored mitigation plans to further address the environmental effects of merger-related increased rail traffic on UP's existing right-of-way. For background information, I have enclosed two documents which will provide you with more details on the overview of the UP/SP Merger Reno Mitigation Study and the conditions imposed by the Board.

I have asked Ms. Mary Rusco, who is a Native American liaison with Rusco and Rusco Consultant Services, and Mr. Dave Mansen, Project Manager, (De Leuw, Cather & Co, the independent third-party contractor, who is assisting SEA in conducting the Reno mitigation study) to set up a meeting with you. Mary Rusco will contact you sometime following May 20th to arrange such a meeting.

As part of this mitigation study, SEA encourages public participation and has established a Reno Mitigation Task Force. The task force is comprised of 19 members representing a variety of community interests. Ms. Paula Berkeley participates as a task force member representing Native American interests. You may wish to invite Ms. Berkeley to join the meeting.

We appreciate your time and look forward to meeting with you. If you have any questions, please contact Harold McNulty, Co-study Director for SEA, at (202) 565-1539 or Mr. Mansen at (415) 495-6060.

Sincerely yours,

Elaine K. Kaiser

Elaine K. Kaiser
Chief, Section of Environmental Analysis

cc: Dave Mansen
Mary Rusco
Kay Wilson
Winn Frank

Attachments

SURFACE TRANSPORTATION BOARD
Washington, DC 20423

Section of Environmental Analysis

May 20, 1997

Mr. Mervyn Wright, Jr.
Tribal Chair
Pyramid Lake Paiute Tribal Council
P.O. Box 256
Nixon, NV. 89424

Subject: Proposed meeting to review Native American issues/concerns regarding the on-going Reno Mitigation Study in connection with the merger of the Union Pacific and Southern Pacific Railroads

Dear Mr. Wright:

The Surface Transportation Board's Section of Environmental Analysis (SEA) would like to meet with you to discuss the potential environmental effects of the increased train traffic in the Reno area as a result of the UP/SP merger. The purpose of the meeting is to discuss possible Native American issues that pertain to the Reno Mitigation Study.

In a decision served on August 12, 1996 (Decision No. 44), the Surface Transportation Board (Board) approved the merger of the Union Pacific and Southern Pacific railroads. In its written decision, the Board imposed system-wide and corridor-specific mitigation conditions. The mitigation conditions address safety, hazardous materials, emergency response, air quality, and noise. As part of its decision, the Board directed SEA to conduct an 18-month mitigation study in Reno to develop specifically tailored mitigation plans to further address the environmental effects of merger-related increased rail traffic on UP's existing right-of-way. For background information, I have enclosed two documents which will provide you with more details on the overview of the UP/SP Merger Reno Mitigation Study and the conditions imposed by the Board.

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Sincerely yours,

Elaine K. Kaiser

Elaine K. Kaiser
Chief, Section of Environmental Analysis

cc: Dave Mansen
Mary Rusco
Kay Wilson
Winn Frank

Attachments

SURFACE TRANSPORTATION BOARD
Washington, DC 20423

Section of Environmental Analysis

May 20, 1997

Mr. Brian Wallace
Chair
Washoe Tribal Council
919 Highway 395 S
Gardnerville, NV. 89410

Subject: Proposed meeting to review Native American issues/concerns regarding the on-going Reno Mitigation Study in connection with the merger of the Union Pacific and Southern Pacific Railroads

Dear Mr. Wallace:

The Surface Transportation Board's Section of Environmental Analysis (SEA) would like to meet with you to discuss the potential environmental effects of the increased train traffic in the Reno area as a result of the UP/SP merger. The purpose of the meeting is to discuss possible Native American issues that pertain to the Reno Mitigation Study.

In a decision served on August 12, 1996 (Decision No. 44), the Surface Transportation Board (Board) approved the merger of the Union Pacific and Southern Pacific railroads. In its written decision, the Board imposed system-wide and corridor-specific mitigation conditions. The mitigation conditions address safety, hazardous materials, emergency response, air quality, and noise. As part of its decision, the Board directed SEA to conduct an 18-month mitigation study in Reno to develop specifically tailored mitigation plans to further address the environmental effects of merger-related increased rail traffic on UP's existing right-of-way. For background information, I have enclosed two documents which will provide you with more details on the overview of the UP/SP Merger Reno Mitigation Study and the conditions imposed by the Board.

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Sincerely yours,

Elaine K. Kaiser

Elaine K. Kaiser
Chief, Section of Environmental Analysis

cc: Dave Mansen
Mary Rusco
Kay Wilson
Winn Frank

Attachments

Appendix P
TECHNICAL MEMORANDUM ON LAHONTAN CUTTHROAT TROUT AND CUI-UI

Appendix P
STATUS OF THE CUI-UI AND LAHONTAN CUTTHROAT TROUT

Regulatory Framework

Applicable Federal Regulations -- Endangered Species Act

The Endangered Species Act (16 U.S.C. §1531 et seq.) of 1973, as amended (ESA), fully protects those species formally listed as "threatened" or "endangered". The responsibility for the protection and designation of threatened and endangered species is shared by the Secretary of the Interior and the Secretary of Commerce. The Secretary of Commerce is responsible for marine species (e.g., whales, sea turtles, seals and sea lions, and anadromous fish). The Secretary of the Interior is responsible for all other species, including both terrestrial and freshwater species. The Secretary of Commerce has delegated its authority under ESA to the National Marine Fisheries Service (NMFS). The Secretary of the Interior has delegated its authority to administer the ESA to the U.S. Fish and Wildlife Service (USFWS).

The ESA contains two main prohibitions. Section 7 of the ESA prohibits a federal agency, in carrying out its own activities or issuing a permit or license to a private applicant, from "jeopardizing" the continued existence of a threatened or endangered species, or its critical habitat (16 U.S.C. §1536). Section 9 of the ESA prohibits the "taking" of, or trading in, any endangered species of fish, wildlife, or plant (16 U.S.C. §1538(a)).

The first main prohibition contained in the ESA is Section 7's "jeopardy prohibition." This prohibition concerns any action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of either the survival or recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species which by definition jeopardizes its continued existence (50 CFR 402.02). Therefore, under Section 7 of the ESA, Federal agencies may not authorize or fund any project that would have such an effect and must consult with the USFWS whenever a proposed project might affect a threatened or endangered species (such consultation efforts are commonly referred to as "Section 7 consultation" -- see below).

The second main prohibition contained in the ESA is Section 9's "taking prohibition." This prohibition restricts anyone from engaging in conduct that would "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" a threatened or endangered species, or from attempting to engage in any such conduct (16 U.S.C. §1532 (19)). A "take" may include significant habitat modification or degradation where such action actually kills or injures protected species by significantly impairing essential behavioral patterns, including breeding, feeding, or shelter (50 CFR 17.3). As defined in the 1981 amendments to the ESA, habitat modification does not constitute "harm" unless the habitat modification causes death or injury to members of a protected species.

Appendix P
STATUS OF THE CUI-UI AND LAHONTAN CUTTHROAT TROUT

Applicable Surface Transportation Board Regulations

The environmental regulations (49 CFR 1105 (e)(8)(i)) of the Surface Transportation Board (Board) require consultation with the USFWS to determine "whether the proposed action [i.e., the UP/SP merger] is likely to adversely affect endangered or threatened species or areas designated as a critical habitat, and if so, describe the effects." Consultation with state environmental agencies is also conducted to ensure that state-listed biological resources are included in any environmental review.

Status of Section 7 Consultation

SEA's third-party independent contractor and UP's consultants made numerous attempts to gather information about threatened or endangered species in Nevada. No responses were received from contacted agencies indicating the presence of threatened or endangered wildlife species in the vicinity of the Truckee River that would be affected by the proposed merger. A chronology and description of these efforts is presented below.

In September of 1995, the UP's consultant (Dames & Moore, Inc.) prepared the Environmental Report for the proposed UP/SP merger. On behalf of the railroads, Dames & Moore, Inc. requested, from USFWS regional offices and state environmental agencies in the affected states, information on threatened and endangered species (or their critical habitats) occurring within five miles of an UP/SP rail line segment, rail yard, intermodal facility, construction site, or proposed abandonment. No response to this request was received from the USFWS. The Nevada Department of Conservation and Natural Resources (NDCNR), Division of Forestry, responded with a list of endangered plant species present in the state of Nevada. However, no information on the specific locations of these plant species was provided nor was any response received regarding threatened or endangered wildlife species.

On November 30, 1995, UP/SP submitted the Environmental Report, prepared by Dames & Moore, Inc., as a part of the Railroad Merger Application (Finance Docket No. 32760). The Environmental Report included responses from agencies that had been contacted for information in September of 1995. Because no information regarding threatened or endangered wildlife species had been received from the USFWS or from the NDCNR, none were included in the Environmental Report.

On January 29, 1996, in order to comply with the requirements of both the National Environmental Policy Act (NEPA) and the Board, the Board's Section of Environmental Analysis (SEA) submitted formal requests, as scoping packets, pursuant to Section 7 of the ESA to: (a) Mr. Michael J. Spear, Regional Director of the USFWS' Pacific Region (Region 1) office, located in Portland, Oregon, which has responsibility for threatened and endangered species in the state of

Nevada; and (b) Mr. Peter G. Morros, Director of the NDCNR's office, located in Carson City, Nevada. On February 6, 1996, the Board's independent third party contractor, De Leuw, Cather & Company, confirmed the receipt by both the USFWS and the NDCNR of the scoping packet. No response to this request was received from either the USFWS' regional office in Portland or the USFWS' field office in Nevada. The response from NDCNR did not identify any concerns regarding biological resources (including the Cui-ui) in the Truckee River.

On April 12, 1996, the Board published an Environmental Assessment (EA) on the UP/SP merger. The EA document included copies of all responses received from agencies during the consultation process. Because no information regarding threatened or endangered species had been received from the USFWS (either the regional office in Portland, Oregon or the field office in Nevada), none were included in the EA. The comments from the NDCNR's Division of Wildlife did not identify any concerns regarding biological resources in the Truckee River. However, the City of Reno submitted a comment regarding concerns about the impact of hazardous materials spills on threatened and endangered species in the Truckee River.

On June 24, 1996, the Board's SEA submitted the Post Environmental Assessment (Decision ID #19953) on the UP/SP merger. Appendix A for Volume 2 of the Post EA document included comments from agencies and responses to those comments from the Board. The City of Reno (Nevada) commented on the Water Resources section (Section 4.7.5) of the EA. Specifically, Reno was concerned about (1) direct and indirect impacts of catastrophic spills of hazardous materials resulting from train derailments in the vicinity of the Truckee River, which is the primary water source for the City of Reno; and (2) cumulative impacts of incidental spills of hazardous materials during train operations. The Board's response reflected the results of the NEPA consultation process and was consistent with project records. Regarding the catastrophic spills, their response acknowledged Reno's concerns for the potential impacts and referenced the response procedures for hazardous spills as addressed in UP's own hazardous materials emergency response plans. Regarding the cumulative impacts from incidental spills, the Board's response referenced the mitigation measures as presented in Volume 1, Chapter 5 of the Post EA.

In addition, the City of Reno commented on the Biological Resources section (Section 4.7.6) of the EA. Specifically, Reno was concerned about direct and indirect impacts to terrestrial and aquatic wildlife located downstream in the Truckee River that may result from such spills of hazardous materials. Reno was particularly concerned with the federally listed endangered fish, the Cui-ui (*Chasmistes cujus*), and the threatened Lahontan cutthroat trout (*Oncorhynchus clarki henshawi* also known as *Salmo clarki henshaw*), inhabiting Pyramid Lake, into which the Truckee River flows. Again, the Board's response reflected the results of the NEPA consultation process and was consistent with project records. Their response acknowledged Reno's concerns for the impacts to biological species from the spills of hazardous materials from the train derailments and

reiterated that the USFWS had not indicated any particular concerns about the biological resources of the Truckee River during Section 7 consultation efforts.

Status of Indicated Species

Cui-ui

The Cui-ui was federally listed as an endangered species on March 11, 1967 (32 CFR 4001). An "endangered species" is defined as one that is in danger of extinction throughout all or a significant portion of its range (16 U.S.C. §1532(6)). The ESA specifies that endangered species are protected under Sections 7 and 9 (i.e., they are protected by both the "jeopardy prohibition" and the "taking prohibition").

Pursuant to Section 7 of the ESA, the lead Federal agency for coordination regarding non-marine, threatened and endangered species is the USFWS. The USFWS Pacific Region (Region 1) which is responsible for the State of Nevada has its regional office in Portland, Oregon. The lead State agency for Section 7 consultation is the NDCNR) which has a Division of Forestry for coordination on threatened and endangered plants and a Division of Wildlife for coordination on threatened and endangered wildlife.

The USFWS originally approved a Recovery Plan for this species on January 23, 1978. The first update of this plan was approved on May 8, 1980; the first revision of this plan was approved on November 22, 1983, and the second revision was approved on May 15, 1992. The Recovery Plan developed for the Cui-ui ranks the species as Priority 2C (i.e., a species with a high degree of threat and a high recovery potential) under the USFWS' Species Priority System. The goal of this Recovery Plan is to re-establish the Cui-ui in portions of its historic range. Although no critical habitat has been designated and no "special rules" apply, the endangered status of this species applies to the entire population.

Lahontan cutthroat trout

The Lahontan cutthroat trout was federally listed as an endangered species in 1970 but was later reclassified and listed as a threatened species in 1975 (Federal Register 40: 29863) to facilitate management and restoration efforts. A "threatened species" is defined as one that is considered likely to become endangered within the foreseeable future throughout all or a significant portion of its range (16 U.S.C. §1532(6)). Threatened species, like endangered species, are protected under Sections 7 and 9 of the ESA.

Appendix P
STATUS OF THE CUI-UI AND LAHONTAN CUTTHROAT TROUT

The USFWS approved a species recovery plan in January 1995 (Coffin and Cowan, 1995). The plan outlines the management actions necessary to lead to the eventual de-listing of the Lahontan cutthroat trout as a threatened species. Additional information concerning this recovery plan is provided below.

Background on Indicated Species

Cui-ui

Cui-ui (pronounced, in English, "kwee-wee" or, in Paiute, "koo-ee-wee") is the common name for *Chasmistes cujus*, a lakesucker currently found only in Pyramid Lake, Nevada. Pyramid Lake is located in the western portion of the state of Nevada, approximately 25 miles northeast of the City of Reno. This lake is located entirely within the boundaries of the Pyramid Lake Paiute Indian Reservation (the "Reservation"). Much of the economy on the Reservation is centered around fishing and recreational activities at Pyramid Lake. So deeply ingrained in the cultural history of the Native Americans is this particular fish that the Native American name for the Pyramid Lake Paiutes is "Kuyuidokado," meaning "Cui-ui eaters".

Geographic Setting

The only permanent tributary to Pyramid Lake is the Truckee River. This river originates at Lake Tahoe, located approximately 25 miles southwest of the City of Reno. The Truckee River flows approximately 118 miles north-northeasterly, discharging into Pyramid Lake. The river's primary water sources are the mountain ranges of the Sierra Nevada and the Carson. The flow of the Truckee River is largely controlled: Lake Tahoe, which once overflowed directly into the Truckee River, is now regulated by a dam, as are Donner Lake and Independence Lake.

Historically, the Cui-ui were restricted in Nevada to the sister lakes, Pyramid and Winnemucca. Currently, the Cui-ui have been eliminated from Winnemucca Lake which was completely desiccated by 1938. The primary source of water to Winnemucca Lake had been from Pyramid Lake; this overflow virtually ceased with the completion of Derby Dam in the early 1900's.

The lower Truckee River, which encompasses the historical spawning area of the Cui-ui, is a low-gradient stream. Its reaches include the Marble Bluff Dam, the Fish Processing Building, and Pyramid Lake Fishway and its four ladders. At the Fish Processing Building, migrating adult Cui-ui are trapped and released upstream from the dam. With program support from governmental agencies, members of the Pyramid Lake Paiute Tribe have received training in netting, fish transport, and artificial culture techniques so that the tribe can assume more direct responsibility for the operation of fish culture facilities. This fishery has been preserved by the Paiute Tribe. Through the tribe's excellent hatchery program, Pyramid Lake remains the last chance for many

western anglers to catch a large native trout. Although there is "good fishing" in the small upper Truckee River above Lake Tahoe near South Lake Tahoe, the major fishing occurs below Lake Tahoe between Tahoe City (California) and Reno.

Lahontan cutthroat trout

Lahontan cutthroat trout is the common name for *Oncorhynchus clarki henshawi*, the only trout native to the Lahontan subbasin of the American Great Basin (west-central Nevada). The general geographic setting described above for the Cui-ui also applies to the Lahontan cutthroat trout. Historically, the trout was native to the Truckee, Carson, Walker and Quinn Rivers as well as Lake Tahoe and the Pyramid, Walker, Donner, Independence and Summit lakes. Native Lahontan cutthroat trout are now extinct in Lake Tahoe, Pyramid, Walker and Donner lakes but still occur in Independence and Summit Lakes. According to Dr. Gary Vinyard at the University of Nevada at Reno, the trout presently exists in approximately ten percent of its historic stream habitat and one percent of its historic lake habitat.

Native Americans of the great basin, including the northern Paiute, Shoshone and Washoe relied heavily on the trout as a major food source. At the turn of the century, the trout was also an important commercial resource in Lake Tahoe and Pyramid Lake. It is still considered a significant gamefish today.

In the early 1930's, the original Pyramid Lake population of Lahontan cutthroat trout slowly began to decrease. It was determined that the Newlands Irrigation Project, a Bureau of Reclamation project that began in 1905 and diverted water at Derby Dam on the Truckee River approximately 48 km above Pyramid Lake, was contributing to this decline. As the human population increased, so did the demand for more and more water for irrigation and other uses. This caused water levels in the lake as well as the Truckee River to decline. The ability of trout to reproduce successfully diminished because viable spawning habitat was now severed by low water levels. This reduction in spawning habitat, coupled with increased predation and species competition from the indiscriminant introduction of non-native trout species such as rainbow and brook trout, led to the extinction of the Lahontan cutthroat trout in Pyramid Lake and the Truckee River by the early 1940's. The trout also became extinct in Lake Tahoe around the same time that most of the suitable spawning tributaries became dewatered or dammed. In Walker Lake, located well south of Reno, the trout suffered the same fate and was extinct by 1948.

The Lahontan cutthroat trout fishery exists today because of an excellent hatchery program that is rearing large numbers of fish for transplant. These fish are being transplanted into all rivers, tributaries and lakes within its historic range. However, in order for the Lahontan cutthroat trout to recover fully, habitat restoration measures are needed in conjunction with transplanting efforts

to enhance the probability for natural reproduction. Once this is achieved, the trout can naturally sustain its existence.

Species Recovery Plan

Cui-ui

In the original Recovery Plan which was approved in 1978, the Secretary of the Interior proposed that certain lands and waters in the State of Nevada be designated as "essential habitat" for the Cui-ui. The lands and waters included not only the most "important" habitats for the Cui-ui but also the minimal amount of habitat that species needed for survival. As identified in this recovery plan, those particular waters supported the "entire world's population" of Cui-ui. Specifically, those waters were included in three zones: (1) the lower Truckee River zone, consisting of the main channel from Derby Dam (located approximately 10 miles west-southwest of the town of Wadsworth) downstream to its confluence with Pyramid Lake; (2) the Pyramid Lake zone, consisting of the entire area of Pyramid Lake; and (3) the Hardscrabble Creek zone, consisting of Hardscrabble Creek proper from its headwaters downstream to its confluence with Pyramid Lake near the town of Sutcliffe.

The Nevada Department of Fish and Game commented on the 1978 Recovery Plan. They perceived that the historic range of the Cui-ui was proposed as critical habitat; they considered the establishment of such a "critical habitat zone" for the Cui-ui as "inappropriate." They conceded that the portion of the Truckee River lying within the confines of the Reservation could be considered "present critical habitat."

The U.S. EPA, Region IX (California) also commented on this Recovery Plan. It identified the lack of information on the optimum habitat conditions for the Cui-ui, especially water quality and water quantity requirements. The recovery plan had identified that limiting factors to Cui-ui survival were the accelerated accumulation of total dissolved solids within Pyramid Lake and the deterioration of the stream spawning habitat. It also mentioned the comprehensive survey of the biota of Pyramid Lake that was being conducted to determine the effects of increased total dissolved solids on the plant and animal life of the lake. These studies would support efforts to maintain a level of total dissolved solids within limits of tolerance for the Cui-ui.

The concerns of the EPA were addressed in the second revision (1983) of the Recovery Plan. This plan stated that upstream development had created excessive nutrient loading and toxic conditions in the Truckee River and, possibly, in Pyramid Lake. These detrimental conditions had intensified with the growth of the Cities of Reno and Sparks in recent years. Channelization, grazing, and timber harvesting in and along the lower Truckee River had reduced the riparian canopy and increased the bank erosion. These water quantity/quality problems had deteriorated or eliminated

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Cui-ui spawning and nursery areas by permitting elevated water temperatures, increased sedimentation, reduced wetted perimeter, and lowered dissolved oxygen. Sufficient flows were not always available to attract Cui-ui spawners to the Truckee River delta and the Pyramid Lake Fishway, and even to stimulate migration of the fish. The 1983 Recovery Plan hypothesized that the biological productivity of the Pyramid Lake ecosystem might decrease if the lake level continued to decline and the nutrient levels continued to increase.

The 1983 Recovery Plan offered that one way to reduce water pollution was to ensure that U.S. Environmental Protection Agency water quality standards were met at the Reno/Sparks Sewage Treatment Facility. Furthermore, the plan identified that securing and maintaining the flow regime of the Truckee River system would provide optimum flows for spawning and larvae habitat both of which are essential to establish and maintain a self-sustaining population of Cui-ui. Even so, the water diversions for agricultural, municipal, and industrial use had reduced the volume and timing of natural flows in the lower Truckee River to such an extent that the optimum flow regime required for Cui-ui reproduction might not be obtainable.

The 1983 Recovery Plan specifically supported the cooperative enforcement of federal, state, and tribal regulations, including enforcement of the Endangered Species Act, Nevada statutes, and Pyramid Lake Tribal fishing regulations.

Lahontan cutthroat trout

In January 1995, the U.S. Fish and Wildlife Service approved a recovery plan for the Lahontan cutthroat trout. Successful implementation of the plan requires the cooperation of the federal and state agencies, tribal governments and private landowners. The plan is thoroughly described in the U.S. Fish and Wildlife Service publication, "The Lahontan Cutthroat Trout Recovery Plan" written by P. Coffin and W. Cowan, 1995. Key goals of the plan are to:

- improve, manage and secure habitat for existing and proposed populations;
- develop and implement reintroduction plans;
- regulate fish harvesting;
- manage self-sustaining populations outside their historic range during the recovery process;
- conduct population viability studies and other research to validate recovery objectives; and
- revise the recovery plan in the future as necessary.

The overall goal of the plan is to establish wild, self-sustaining populations of Lahontan cutthroat trout that are able to reproduce and perpetuate viable populations within their historic habitat range (the Lahontan Basin.)

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STATUS OF THE CUI-UI AND LAHONTAN CUTTHROAT TROUT

Cooperative efforts to improve the status of the trout population have been ongoing since the early 1940's. These efforts included stream surveys to determine species location and abundance; native species transplants to other streams within their historic range; and surveys to evaluate pure populations of the trout and their overall habitat condition. More recently, habitat improvement projects involving land use restrictions in riparian zones and revegitation/restoration of streambanks and adjacent riparian zones have been underway within the trout's historic range. Additionally, numerous hatcheries are successfully rearing large numbers of fish (over a million) for transplant, an effort which has significantly helped sustain a viable fishery. All of these efforts have brought the Lahontan cutthroat trout one step closer to recovery.

Supplemental Information

Cui-ui

According to Dr. Gary L. Vinyard with the Department of Biology at the University of Nevada in Reno, "There are no Cui-ui in California." The Official World Wildlife Fund Guide to Endangered Species does not contain any information on this species. Similarly, a search of the database of The Nature Conservancy resulted in no findings for this species.

Pursuant to Section 106 of the National Historic Preservation Act, SEA's consultants transmitted a scoping packet of information to the Bureau of Indian Affairs. No specific comments were received regarding the Cui-ui. It is not known whether Pyramid Lake or Truckee River, as a landscape feature, is considered "sacred" or otherwise honored as a "traditional place" by the local Native American tribe, the Paiute.

Lahontan cutthroat trout

The Lahontan cutthroat trout is listed as threatened in California, Utah and Oregon. The Bureau of Indian Affairs had no specific comments regarding the Lahontan cutthroat trout or the lands associated with its historic range.

Follow-on Action

Cui-ui

If suitable habitat for the Cui-ui exists in the project area, a biological survey by a qualified professional should be undertaken during or prior to the environmental review process. The professionai biologist should be familiar with the habitat requirements of the Cui-ui, and should determine whether this species, or habitat suitable for this species, may be affected by the merger.

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STATUS OF THE CUI-UI AND LAHONTAN CUTTHROAT TROUT

The results of this survey should be published in any environmental documents prepared in association with the mitigation study.

If this survey were to determine that Cui-ui occur in the project area and were likely to be affected by the merger, the project proponent, in consultation with the USFWS and the appropriate state natural resource agencies (e.g., the California Department of Fish and Game or the Nevada Department of Conservation and Natural Resources), will develop a plan to mitigate direct and indirect impacts from the project to this species and to compensate for project-related loss of habitat. The mitigation plan should also be included in the environmental document.

Because the merger does not involve a "major construction project," a Biological Assessment (BA) would not be required to be prepared prior to the formal consultation process. If it were to prepare a BA, however, the proposing agency is only required to use the "best scientific and commercial data available" (16 U.S.C. §1536(a)(2)) and is not required to research the topic of concern exhaustively.

The work performed during the EA process meets the requirements of NEPA, including both Section 7 and Section 9 of the ESA, and of the Board. In addition, the work performed to date on the Cui-ui issue, as summarized in this report, is beyond the requirements of informal consultation, as defined in Section 7 of the ESA, and involved the acquisition of best available data.

In summary, although the merger of the UP/SP merger would increase the number of railway operations in the area of the Cui-ui habitat, it is not anticipated that normal rail activity would have a negative direct or indirect effect on this endangered species. Because this fish inhabits Pyramid Lake (approximately 15 miles removed from any railroad track) and only swims upstream to the lower portions of the Truckee River (approximately 30 miles removed from any railroad track) for spawning during 3 months of the calendar year, it is extremely unlikely that this species would be negatively affected by any direct impacts from spills of hazardous materials during catastrophic events along the railway. Furthermore, it is only remotely possible that upstream spills would indirectly affect the Cui-ui by decreasing the available habitat. The response to catastrophic spills is addressed in the materials hazardous emergency response plans, previously prepared for the Board.

Lahontan cutthroat trout

A similar argument can be made for the Lahontan cutthroat trout based on several factors: (1) natural populations of Lahontan cutthroat trout only exist in Independence and Summit Lakes (far removed from the proposed project); (2) hatcheries are producing cultured trout in massive numbers and transplanting them throughout the species' historic habitat range (from southern

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Oregon to east-central California and across Nevada to Utah) which is well beyond the limits of the merger; and (3) restoration efforts are progressing along numerous other rivers and tributaries (Mahogany Creek, Quinn River, Eightmile Creek, Marys River, Maggie Creek among others) within the species' historic range that are unaffected by the merger. Essentially, the historic habitat range for the Lahontan cutthroat trout is quite extensive and significant progress has been made regarding efforts towards the future recovery of this species. Because of these conditions, it is extremely unlikely that the merger will adversely affect the Lahontan cutthroat trout by direct or indirect effects resulting from spills of hazardous materials.

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Appendix Q
PROJECTED NOISE CONTOUR MAPS

UPSP MERGER - RENO
TRAIN NOISE IMPACTS
FIGURE 1A

Acentech

UPSP MERGER - RENO
TRAIN NOISE IMPACTS
FIGURE 2A

Grade crossings

Rail Line

Pre-merger Ldn 65 dB

Post-merger Ldn 65 dB

Train Noise Impact

Residential single unit

Residential 2 units

Residential 3-4 units

Residential 10+ units

Res. mobile homes

Commercial casino

Commercial hotel

Commercial resort

Unaffected Parcels

Acentech

UPSP MERGER - RENO
TRAIN NOISE IMPACTS
FIGURE 3A

Grade crossings

Rail Line

Pre-merger Ldn 65 dB

Post-merger Ldn 65 dB

Train Noise Impact

Residential single unit

Residential 2 units

Residential 3-4 units

Residential 10+ units

Res. mobile homes

Commercial casino

Commercial hotel

Commercial resort

Unaffected Parcels

Acentech

UPSP MERGER - RENO
TRAIN NOISE IMPACTS
FIGURE 4A

Grade crossings

Rail Line

Pre-merger Ldn 65 dB

Post-merger Ldn 65 dB

Train Noise Impact

Residential single unit

Residential 2 units

Residential 3-4 units

Residential 10+ units

Res. mobile homes

Commercial casino

Commercial hotel

Commercial resort

Unaffected Parcels

Acentech

Appendix R
UP RESPONSE TO SEA'S INQUIRY REGARDING POTENTIAL INCREASES TO FREIGHT TRAIN SPEEDS

COVINGTON & BURLING

July 3, 1997

BY FEDEX

To: Members of the Reno Mitigation Task Force

At the last meeting, Union Pacific agreed to investigate whether it could feasibly increase train speeds through Reno by an average of 10 m.p.h. Union Pacific has determined that, with an investment preliminarily estimated at $7.34 million, it could operate trains through downtown Reno at a consistent speed of 30 m.p.h. Enclosed is a memorandum from Union Pacific's Engineering Department outlining the steps necessary to implement this speed increase.

Union Pacific officials will attend the July 9 meeting to discuss this report.

Sincerely,

Mike Hemmer

J. Michael Hemmer

Enclosure

UNION PACIFIC/SOUTHERN PACIFIC MERGER

RENO MITIGATION STUDY

Feasibility of Train Speed Increase - Reno, Nevada

July 2, 1997

Purpose:

To evaluate the feasibility of increasing the freight train speed through Reno, Nevada, from the current 20 mph and 25 mph timetable speeds to 30 mph between MP 242.0 and MP 247.1.

Existing Operation:

Sparks Yard, located between Mileposts 245.3 and 246.8, is a crew change point for both eastbound and westbound trains, where all freight trains stop. The City of Reno is located between Mileposts 237.3 and 244.6.

West of Sparks Yard toward Reno, the operating timetable speed is 30 mph for AMTRAK and 25 mph for freight trains. At Milepost 243.2 the timetable speed changes to 20 mph for both AMTRAK and freight trains. At Milepost 242.0 the speed increases to 45 mph for AMTRAK and 40 mph for freight trains.

The track alignment from Sparks Yard through Reno is essentially tangent with only two curves, both less than 1 degree and central angles less than 30 degrees. Just west of Reno there is a 4 degree curve. The track grade from Sparks Yard to the west is beginning to ascend toward Donner Summit. While there are several grade changes in this stretch, the grade is less than 1 percent.

The wayside signal system for this area is Automatic Block Signals (ABS). All of the public grade crossings through Reno are equipped with flashing lights and gates. Since the merger the circuitry at the crossings has been upgraded so that signals are activated with constant warning time devices, which provide for constant activation of the warning systems regardless of the speed of the train up to 40 mph. The warning time for initial crossing signal activation is 25 seconds prior to the train engine occupying the crossing.

Feasible Operation:

The timetable speed between MP 247.1 at Sparks and MP 242.0 west of Reno could be increased to 30 mph, and trains could operate consistently at that speed with the capital investments described. Sparks Yard would continue to be the crew change point where all freight trains stop.

Required Capital Improvements:

From Vista to west of Sparks Yard, the existing ABS wayside signal system would have to be replaced with Centralized Traffic Control (CTC). The tracks at Sparks Yard that are used for holding trains while crews are changed would have their turnouts changed from size No. 10, which has a maximum speed of 15 mph, to No. 14 power-operated, which has a maximum speed of 30 mph. This would allow trains to accelerate to full speed while exiting the yard instead of waiting until the last car of the train goes through the switch at 15 mph. At MP 245.3 and at MP 246.8, power-operated No. 14 crossovers would be installed to ensure fluid movement into and out of Sparks Yard. Also, at MP 238.0, west of Reno, a universal power-operated No. 20 crossover would be installed to ensure fluid movements can be made through the city. Tie replacement and track surfacing would be accomplished as necessary to facilitate these operating changes. All switches in either of the main tracks through the length of the CTC area either would be power-operated or an electric lock would be installed.

Estimated Cost:

The following is the preliminary estimate of cost:

•	Install CTC from MP 238.0 to MP 249.3	$3,870,000
•	Construct 2 No. 14 Crossovers, 1 No. 20 Universal Crossover and Rearrange Yard Tracks at Sparks	$3,470,000
	TOTAL	$7,340,000

Computer Train Performance Simulation:

To analyze speeds through town, the trains contained in Ron Naro and Clyde Anderson's verified statements were modeled using the Train Performance Simulation (TPS). TPS is utilized by the Union Pacific to determine fuel consumption and running time for a given train across a specific track segment based on physics. The model results confirm, that with the capital improvements proposed, freight trains will be able to achieve the timetable speed on a consistent basis.