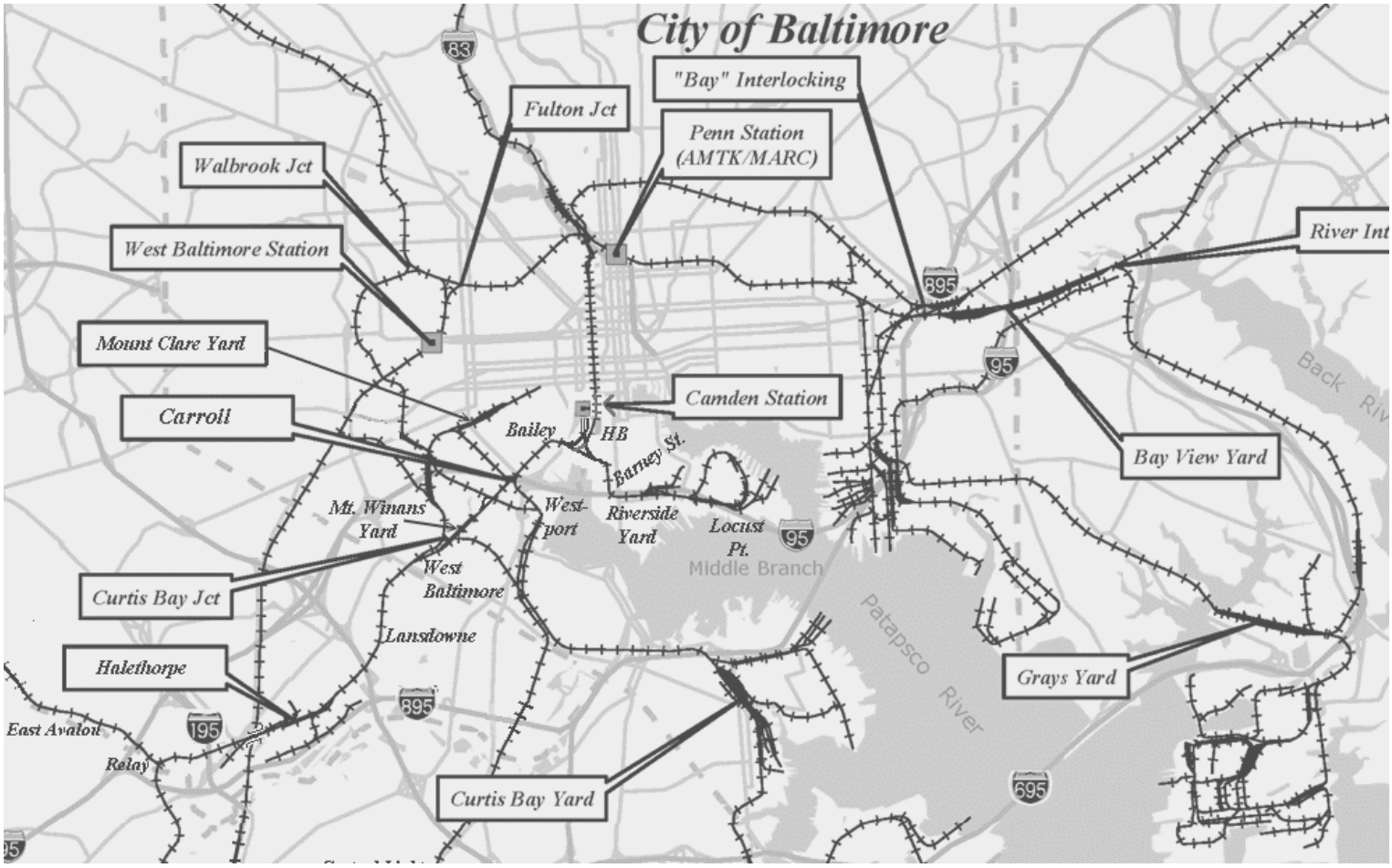
Report to Congress:

Baltimore's Railroad Network: Challenges and Alternatives



U. S. Department of Transportation
Federal Railroad Administration

November 2005

U.S. Department
of Transportation

**Federal Railroad
Administration**

Administrator

**1120 Vermont Ave., NW.
Washington, DC 20590**

NOV 4 2005

The Honorable Thad Cochran
Chairman
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

House Report 107-308, the Conference Report to accompany H.R. 2299, making Appropriations for the Department of Transportation and Related Agencies for the Fiscal Year ending September 30, 2002, and for other purposes, dated November 30, 2001, requested the Federal Railroad Administration to provide to the House and Senate Committees on Appropriations a report on a comprehensive study of problems in the freight and passenger rail infrastructure in the vicinity of Baltimore, Maryland.

I am pleased to submit the report as requested.

Identical letters have been sent to the Ranking Member of the Senate Committee on Appropriations, and to the Chairman and Ranking Member of the House Committee on Appropriations.

Sincerely,

Joseph H. Boardman
Administrator

Enclosure

U.S. Department
of Transportation

**Federal Railroad
Administration**

Administrator

**1120 Vermont Ave., NW.
Washington, DC 20590**

NOV 4 2005

The Honorable Jerry Lewis
Chairman
Committee on Appropriations
United States House of Representatives
Washington, DC 20515

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EXECUTIVE SUMMARY

In November 2001, the Congress requested "a comprehensive study to assess problems in the freight and passenger rail infrastructure in the vicinity of Baltimore, Maryland." In particular, the study was to analyze the condition and capabilities of the railways' fixed facilities and "examine the benefits and costs of various alternatives for reducing congestion and improving safety and efficiency in the [rail] operations" in the Baltimore region.[1]

This report responds to that request.

The report comprises two parts. Tracing the development, current condition, and utilization levels of Baltimore's rail network, Part I ("Challenges") characterizes the dissonance between the network as it has evolved and the demands placed upon it. Part II ("Alternatives") examines the potential for restructuring actions that could raise passenger and freight railway capabilities in the Baltimore region to a new plateau.

PART I: CHALLENGES

INTRODUCTION [Chapter One]

Chapter One describes the study's funding history and scope.

Funding

The Congress envisioned a $3,000,000 study of America's oldest urban railway network, with costs to be shared equally by the Federal Government, the State of Maryland, and the two Class I freight railroads in Baltimore, CSX Transportation (CSXT) and Norfolk Southern (NS). Although the large freight railroads provided no financial support, they did contribute data and expertise, as did Amtrak. Only the Federal Railroad Administration (FRA) provided its full share of funding ($750,000); the State of Maryland was able to budget $250,000 for the effort, thus making a total of $1,000,000 available. Accordingly, the total resources available to this study amounted to one-third of the Congressional intention. Even so, by modifying the study plan and focusing the effort on highest-priority topics, the FRA was able substantially to fulfill the Congressional request.

Scope

The study focused on the principal elements of Baltimore's network of passenger and freight rail lines, extending from Perryville, northeast of Baltimore on the Susquehanna River—the junction of Amtrak's Northeast Corridor with the NS's principal route from Harrisburg and points west—to Halethorpe, southeast of the city, where the CSXT and Amtrak lines from Washington cross.

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[1] U. S. House of Representatives, Report 107-308, Making Appropriations for the Department of Transportation and Related Agencies for the Fiscal Year Ending September 30, 2002, and for Other Purposes, November 30, 2001, p. 100.

CONTEXT AND EVOLUTION OF BALTIMORE'S RAILWAY NETWORK [Chapter Two]

In the Baltimore region, history and topography have combined to create a persistent challenge to efficient railway design and operating economy. At the core of Baltimore City, the Piedmont Plateau meets tidewater, thus constraining the optimal pathway for ground transportation to precisely that area—around the Inner Harbor, Pratt, and Lombard Streets—which achieved full development before the advent of the railroad. Denied the path of least resistance, the railroads were late in completing alignments through the City: the first through route across Baltimore came into being only in 1873, four years after the completion of the Transcontinental Railroad, which was evidently the easier of the two tasks. Intercorporate rivalries between the Pennsylvania and Baltimore & Ohio systems assisted in the dissipation of resources. In the end, each of the competing carriers built its own, inferior right-of-way, compromising even the then-prevailing standards for gradient, curvature, and operating efficiency. Despite subsequent improvements, today's network—still reliant on the Baltimore & Potomac (B&P), Union, and Howard Street Tunnels for connectivity[2]—is essentially the same as the geometrically compromised and operationally handicapped system cobbled together during the post-Civil War decades.

Although convoluted and antiquated, Baltimore's railroads have strategic importance far beyond the confines of their immediate region. Originating and terminating rail freight traffic in the Baltimore region remains significant, largely due to the Port—which ranks fourth among Atlantic Coast ports, and is the closest Atlantic port to major Midwestern markets—and the region's remaining industrial base. Through freight traffic is important on the CSXT's traffic lanes traversing Baltimore between the Northeast on the one hand, and the Midwest and South on the other, despite restrictions due to clearance limitations. Indeed, CSXT owns no alternate north-south route east of the Appalachian Mountains. With respect to intercity passenger service, one-fifth of Amtrak's passenger-trips, one-quarter of its passenger-miles, and one-third of its ticket revenues depend on travel over Baltimore's railways.[3] For all these reasons, the condition, capacity, efficiency, and effectiveness of the Baltimore region's rail network affect the performance of the national transportation grid—as became graphically evident in the massive traffic dislocations caused by the 2001 fire in the Howard Street Tunnel.

TODAY'S INFRASTRUCTURE [Chapter Three]

While Baltimore's railway network includes many important components (main lines, yards, branches, support facilities) and a variety of traffic flows (through, terminating,

[2] The B&P and Union tunnels are part of Amtrak's Northeast Corridor right-of-way and carry mainly passenger traffic. The Howard Street Tunnel belongs to CSXT, which uses it for freight only. It was an extremely disruptive fire in the Howard Street Tunnel in 2001 that catalyzed public interest in the topics addressed in this report. (See Chapter 2.)

[3] Also worthy of note, but primarily of regional significance: rail commuter service in the Baltimore-Washington urban complex has shown marked growth since the 1970s under the sponsorship of the Maryland Department of Transportation.

originating, and within the region)—all of which would merit careful attention should any restructuring take place—the main traffic lane at issue is southwest–northeast across the region, and the principal facilities are two:

- Amtrak's Northeast Corridor (NEC) main line, built by the Pennsylvania Railroad (PRR) and subsidiaries, serving Pennsylvania Station (on the northern edge of the Central Business District (CBD) between Charles and St. Paul Streets), and passing through the Union Tunnels just east of the station and the Baltimore & Potomac (B&P) Tunnel to the station's west. The NEC carries a mixture of intercity passenger, commuter, and freight trains; the relative importance of each service type varies by segment.
- Completed by the Baltimore & Ohio Railroad (B&0) in the 1890s, CSXT's main line (also known as the "Belt Line") proceeds due north from the Camden Station area through the Howard Street Tunnel, then makes a relatively abrupt right turn near the geographic center of Baltimore City and continues due east to Bay View Yard, Wilmington, and Philadelphia. North of the Camden Station area, the line carries freight service only; between Camden Station and Washington, however, both commuter and freight movements take place.

The PRR and B&O designed and built their respective routes as multipurpose facilities, for both freight and passenger service. Since the 19th Century, however, the operating requirements and marketing characteristics of both services have evolved and diverged from each other, while the rail pathways through Baltimore have, in effect, remained constant. As a result, these two facilities increasingly fall short of what the traffic—not to mention the viability of the owning companies—would necessitate. Example of this mismatch between facilities and functions include:

- **Grades and curves.** Both the NEC and the CSXT main line suffer from too many curves that are too sharp, and too many grades that are too steep. The curvature constrains speeds for both passenger and freight trains; the grades—exacerbated by the curves—unduly hamper freight movements in particular.
- **Capacities.** Neither line provides adequate capacity for projected future freight and passenger operations. The CSXT Belt Line route has severe capacity constraints today, in view of its heavy freight traffic, the single-track operations through the Howard Street Tunnel, and the "helper" locomotives that must assist the heaviest trains up the daunting northbound grades and then return against opposing traffic. Although double- or triple-tracked and free of through freight service south of Bay View Yard, the NEC currently carries a voluminous and diverse traffic and even today lacks the capacity to recover from serious operational tie-ups.
- **Clearances.** Neither route can accommodate such modern, high-capacity freight car types as double-stack containers and triple-rack automobile carriers. To move such traffic, the NS must have recourse to its Shenandoah Valley line some 60 miles to the west, and the CSXT makes use of routes that it owns west

of the Appalachian Mountains. The NEC, suffering from particularly constrained clearances, cannot accept cars exceeding "Plate C" dimensions; thus unable to handle modern box cars or single level trailers, the NEC's utility for through freight movements is so limited that the NS was not making use of its NEC trackage rights between Alexandria, Virginia and Baltimore while this report was being prepared. In brief, Baltimore is a severe constraint to national freight traffic lanes up and down the East Coast.[4]

TRAFFIC LEVELS [Chapter Four]

Based on consultations with passenger and freight operators and a review of relevant economic forecasts, the study team analyzed existing, and projected future, traffic levels over the NEC and CSXT main lines in the study region. The results appear in Table ES - 1:

Table ES - 1: Existing and Projected Rail Traffic on Main Lines in the Baltimore Region

EXISTING SERVICE Daily Train Movements (Total Both Directions, Round Trip = 2 Movements)	**Via CSXT Main Line**		**Via NEC Main Line**		**Total Both Routes**	
	Aikin - Baltimore	**Baltimore-Washington**	**Perryville - Baltimore**	**Baltimore-Washington**	**Northeast of Baltimore**	**Southwest of Baltimore**
Passenger:						
Intercity	0	0	89	89	89	89
Commuter	0	22	16	45	16	67
Total Passenger	0	22	105	134	105	156
Freight	21	31	9	2	30	33
Grand Total Operations	**21**	**53**	**114**	**136**	**135**	**189**
PROJECTED SERVICE, 2050 Daily Train Movements (Total Both Directions, Round Trip = 2 Movements)	**Via CSXT Main Line**		**Via NEC Main Line**		**Total Both Routes**	
	Aikin - Baltimore	**Baltimore-Washington**	**Perryville - Baltimore**	**Baltimore-Washington**	**Northeast of Baltimore**	**Southwest of Baltimore**
Passenger:						
Intercity	0	0	110	110	110	110
Commuter	0	37	38	78	38	115
Total Passenger	0	37	148	188	148	225
Freight	37	56	27	13	64	69
Grand Total Operations	**37**	**93**	**175**	**201**	**212**	**294**
PROJECTED PERCENTAGE GROWTH 2003 – 2050	**Via CSXT Main Line**		**Via NEC Main Line**		**Total Both Routes**	
	Aikin - Baltimore	**Baltimore-Washington**	**Perryville - Baltimore**	**Baltimore-Washington**	**Northeast of Baltimore**	**Southwest of Baltimore**
Passenger:						
Intercity	no service	no service	24%	24%	24%	24%
Commuter	no service	68%	138%	73%	138%	72%
Total Passenger	no service	68%	41%	40%	41%	44%
Freight	76%	81%	200%	550%	113%	109%
Grand Total Operations	**76%**	**75%**	**54%**	**48%**	**57%**	**56%**

As Table ES - 1 indicates, the demand for train movements of all types is expected to increase by over 50 percent by 2050 from 2003 levels, with even greater proportional

[4] Washington's Virginia Avenue Tunnel constitutes a similar clearance constraint and would need to be addressed as part of a solution to the limitations on East Coast rail freight traffic.

increases on the already congested CSXT line. Thus by mid-century, a heightened pressure for transport would place a huge incremental load on an antiquated rail network that would, if left unchanged,[5] continue to detract from the speedy, efficient, and economic movement of passengers and goods along the East Coast.

The balance of the report develops and describes alternatives that would reverse these inherent difficulties by improving train routings, expanding freight clearances, and enhancing freight and passenger operations and capacities in the Baltimore region.

PART II: ALTERNATIVES

STUDY OBJECTIVES, STANDARDS, AND METHODS [Chapter Five]

After synthesizing the objectives of the analysis, the study team developed specific standards for developing and evaluating alternatives.

Study Objectives

The study objectives were as follows:

1. Make the service quality and capability of the system, both as a whole and in its important parts, no worse than it is today.

Beyond doing no harm:

2. Remove all through freight service from the Howard Street Tunnel.
3. Provide high-cube, double-stack clearance routes through Baltimore for both NS and CSXT freight trains.
4. Provide grades for freight trains that are less than those now encountered—preferably much less.
5. Provide a replacement for the B&P Tunnel.
6. Increase speeds for both passenger and freight trains wherever economically feasible.
7. Provide capacity to support traffic levels for freight, intercity passenger and commuter services based on reasonable projections for the year 2050, for each existing and projected route—while making every effort to reduce the future cost of providing still more capacity, should traffic grow beyond the design level.
8. Maintain access to all freight and passenger yards, port facilities, maintenance facilities, as well as CSXT Camden and Amtrak Pennsylvania Stations.
9. Provide for CSXT and NS intra-terminal moves in Baltimore.

[5] This statement assumes that the physical facilities can survive for another half-century—an assumption for which no conclusive engineering backup presently exists. As explained later in this report, the design life for new tunnels is 120 years.

10. Identify any relatively near-term improvements that could benefit users while long-term projects are progressed.

11. Avoid, minimize, and/or mitigate any significant adverse environmental impacts caused by Corridor improvements.

12. In making changes to accomplish all the above objectives, assure that railway operating expenses in the study area will not increase on a unit basis—and will, preferably, decrease.

Standards for Alternatives

Baltimore's topography and railway configuration, coupled with inherently different requirements for the movement of goods and people, inevitably lead to standards that differ for passenger and freight service. Indeed, it is one of the study's main conclusions that separate—rather than joint—freight and passenger facilities would be key to resolving the Baltimore challenge once and for all.

Chapter Five contains a very detailed exposition of the standards. Highlights follow:

- **Grades.** For freight, a one percent maximum (0.8 percent desirable maximum) would be established. As grades have a lesser impact on lighter and more highly-powered passenger trains, the ruling grade on the NEC (1.9 percent in the New York Tunnels, say two percent) would be acceptable as a maximum.

- **Curves.** Curvature needs to be reduced so that both services can achieve their maximum design speeds over as much trackage as possible. As curvature enters into the calculation of effective grades, easing the curvature could help to reduce the ruling grades for freight service.

- **Maximum Design Speeds.** The facilities should be designed to support maximum speeds of 60 and 55 mph for intermodal and merchandise freight trains, respectively. Maximum passenger speeds should be in the range of 125-150 mph. [6]

- **Clearances.** Plate H (allowing for double-stack containers and tri-level auto racks) would be established for freight service. To benefit most traffic flows, such a clearance upgrade would require improvement in Washington D.C.'s Virginia Avenue Tunnel, as well as investigation and correction of all undue clearance restrictions (e.g., overhead bridges) in the study area. For passenger service, only clearances equal to or better than those in the New York Tunnels would be required, unless interoperability of either passenger or freight trains over both the passenger and freight facility is mandated.[7]

[6] The cost-effectiveness of expanding the NEC mileage subject to a 150 mph top speed limit has yet to be determined. Use of this theoretical 150 mph top speed in this report does not imply FRA endorsement of such an expansion, which would require Office of Safety approval.

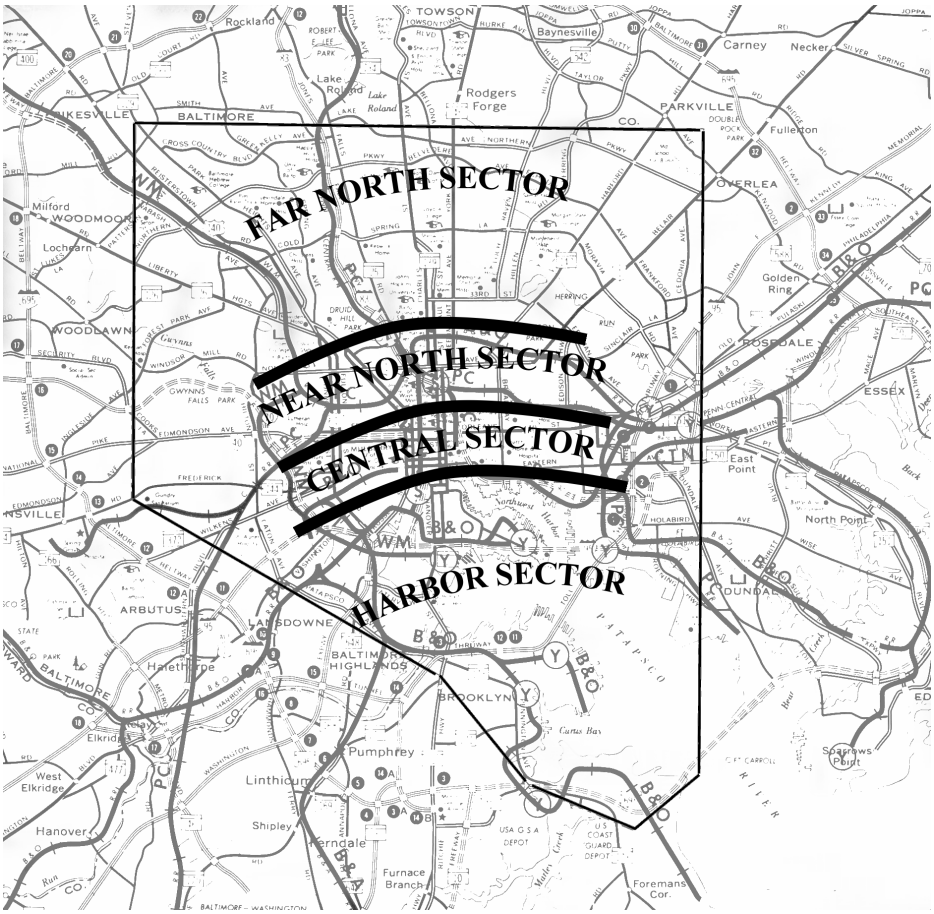
[7] The issue of interoperability is highly complex and would require additional study if Baltimore restructuring possibilities receive further attention.

- **Capacity.** For the first time ever, a double-track, dedicated freight main line route—meeting the clearance and all other standards—would be provided through the Baltimore region. Similarly, a double-track, dedicated passenger route would exist. For both services, additional tracks and support facilities would be in place where necessary to support the requirements of the traffic.

CONCEPTUAL FRAMEWORK FOR THE ALTERNATIVES [Chapter Six]

Since the primary flow of traffic across the Baltimore region is southwest to northeast and vice-versa, all alternative approaches would fall into one of four concentric sectors—Far North, Near North, Central, and Harbor—as depicted in Figure ES - 1**:**

Figure ES - 1: The Sectors



A preliminary screening of the four sectors for their suitability as sites for passenger and freight alternatives yielded the following results (Table ES - 2):

Table ES - 2: Initial Screening of Sectors for Passenger and Freight Service

Sector	Passenger	Freight
Far North	~~Does not serve Central Baltimore~~	~~Crosses built-up areas, grades likely to be heavy, lacks connectivity with existing network and yards~~
Near North	Possible	Possible
Central	Likely excessively expensive, but possible; more central station location for businesses	~~Too expensive, grade problems, and no need for freight to be in CBD~~
Harbor	Expensive and no closer to CBD than present station	Possible

Legend:	***May meet all initial standards***	***Has obvious difficulties***	~~***Ruled out at outset***~~

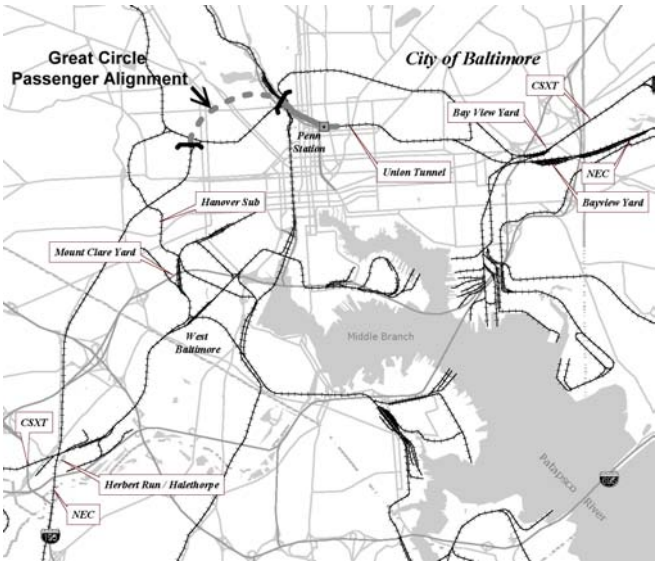
As Table ES - 2 reveals, the Near North Sector—the area selected by both major railroads for their main lines in the late 1800s—affords promising options for both freight and passenger restructuring. The Harbor Sector may offer an opportunity for freight. All other sectors are either ruled out entirely due to "fatal flaws," or only marginally attractive on the initial screening.

PASSENGER ALTERNATIVES [Chapter Seven]

Near North Sector—Great Circle Passenger Tunnel

Of the alternatives examined in the Near North Sector, a Great Circle Passenger Tunnel (GCPT) showed the most promise (Figure ES - 2). With portals not far removed from those of the B&P Tunnel, the GCPT would follow a large arc north of the existing alignment.

Figure ES - 2: Great Circle Passenger Alignment



The Great Circle alignment would have a number of advantages. First, because of its gradual curvature, trains would be operated at much greater speeds than through the existing alignments. Initial train performance analyses have concluded that the Great Circle alternative, albeit longer than the extant route, would save about two minutes in comparison

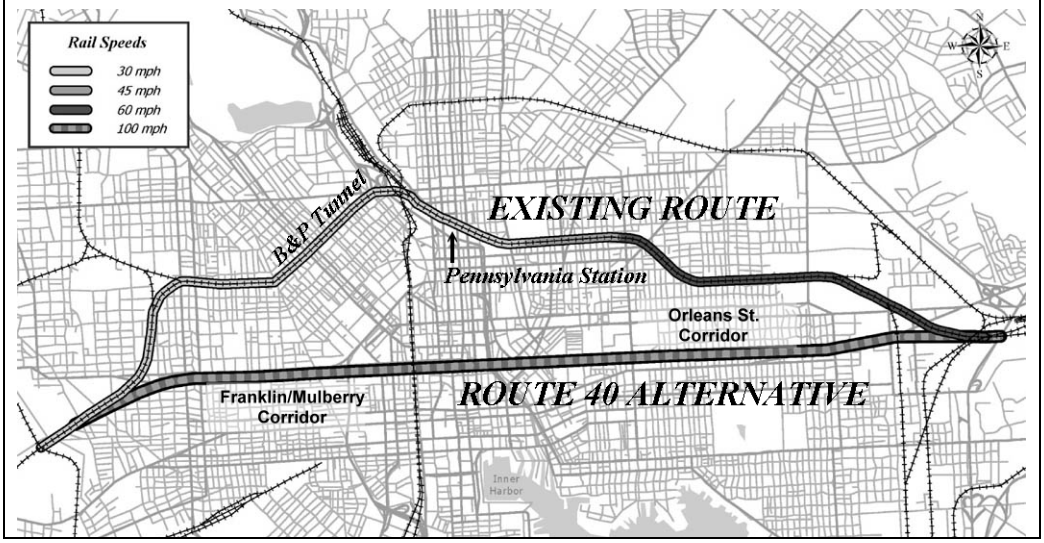
with the B&P Tunnel alignment.[8] Second, and much more importantly, as the Great Circle route follows the ridgeline, the tunnel can be deeper below the surface—in rock strata that would reduce construction costs by enabling a tunnel-boring machine (TBM) to be used.

Implementation of a GCPT would imply continued use of the existing Pennsylvania Station in Baltimore for both Amtrak intercity and MARC Penn Line commuter service.

Central Sector—Route 40 Alternative

Figure ES - 3 compares the location and speeds of the present B&P route with a hypothetical alignment for a Route 40 alternative along the Franklin/Mulberry–Orleans Street corridor. By replacing tortuous curves with a nearly straight line, such a Central Sector solution would markedly outperform the existing route. Although a Route 40 alignment would promise optimal performance and a more central station location, it would present three major difficulties: the huge costs and potential environmental consequences of a tunnel beneath Baltimore's core, and of a multi-track station that would likely be sited underground; the implications for Penn Line commuters from points north, who would have to penetrate much farther into the CBD than at present to reach their trains; and the potential community impacts on the Franklin-Mulberry corridor, the remaining residents of which are still living with the effects of highway construction battles of the 1960s and 70s. For all these reasons, the study team did not carry the Route 40 Alternative through to preliminary cost estimation.

Figure ES - 3:
Central Sector, Route 40 Alternative and Existing Route Compared

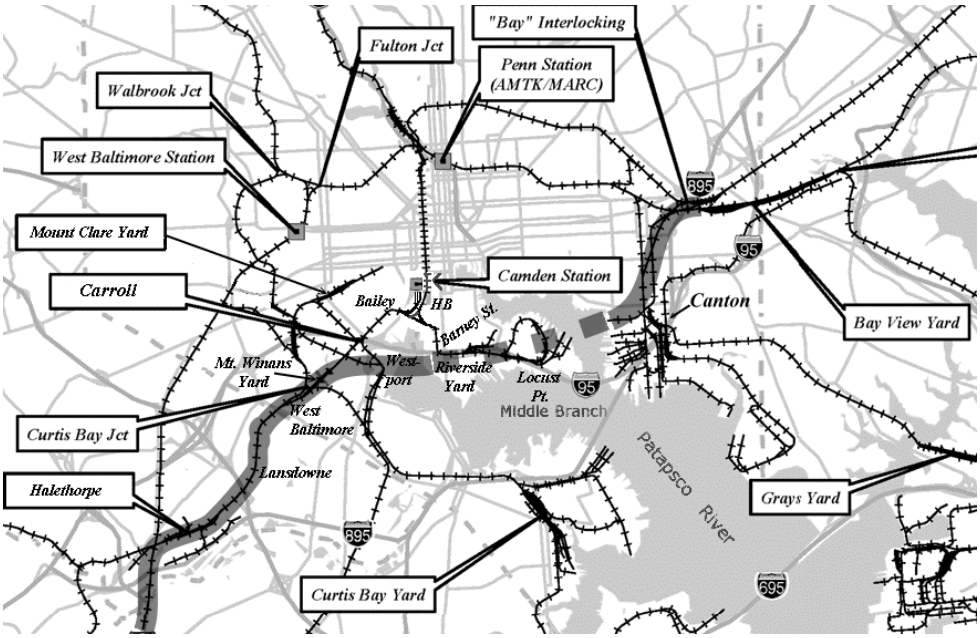


Harbor Sector—Locust Point Alternative

The study team also laid out a hypothetical passenger route between Locust Point and Canton (Figure ES - 4).

[8] It would thus reduce Amtrak's Washington–New York travel time by about one percent, and the Baltimore-Washington travel time by about six percent. (Times are for Acela Express.)

Figure ES - 4: Schematic of Harbor Sector—Locust Point Passenger Alternative



Like the Central Sector route, the Locust Point Alternative would present severe challenges. For example:

- It would entail reconstruction of the I-95 piers and abutments;
- It would involve a new, fixed bridge across the Middle Branch;
- The study team was unable to locate an obvious site for a new main passenger station that would be as accessible from downtown, for pedestrians and others, as the existing Pennsylvania Station;
- The traversal of Canton would be constrained by a host of existing railroad, highway, and industrial facilities;
- The impact on the Penn Line commuter service of a displacement to Locust Point would be even more severe than that of a move to the Central Sector. If the B&P Tunnel must be maintained for Penn Line services, the economics of any Harbor Sector alternative would suffer; and
- Cost estimates for underwater tunnels for freight service (see below) suggest that an underwater passenger tunnel would be far more costly than a land-based alternative.

Therefore, the study team did not carry the Locust Point Alternative through to preliminary cost estimation.

FREIGHT ALTERNATIVES [Chapter Eight]

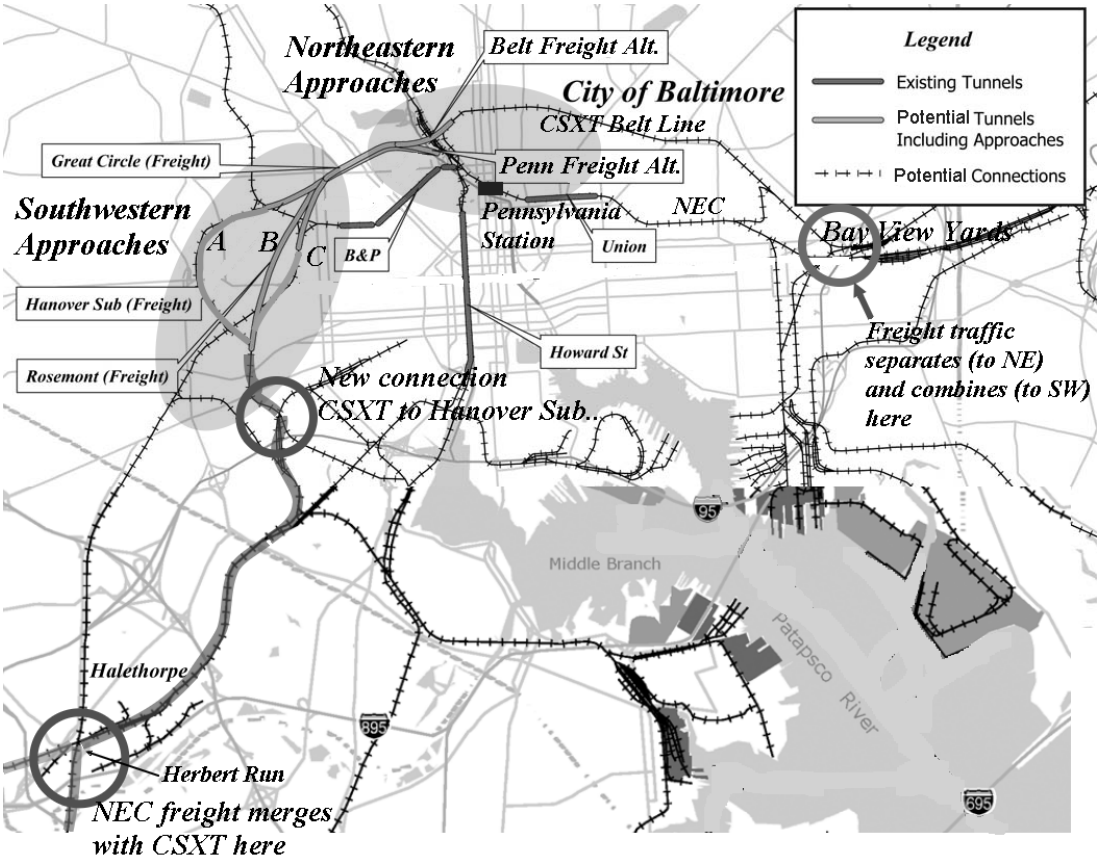
Near North Sector—Great Circle Freight Tunnel

In the vicinity of the existing main lines, the study team developed two land-based tunnel alternatives, both of which would employ a "Great Circle Freight Tunnel" (GCFT) similar in concept to the GCPT.

- In both alternatives, all northeast-bound freight traffic would make use of the CSXT main line and Mount Clare Branch between Halethorpe (Herbert Run) and a new connection to the CSXT Hanover Subdivision. The freight trains would proceed northward to a new tunnel portal in the general vicinity of the existing B&P tunnel entrance (three optional portal locations were examined). The new GCFT would curve gently to the northeast toward the Jones Falls Valley, where it would make one of the two possible connections described below.
- In the **Belt Freight Alternative,** the GCFT route would cross the Jones Falls Valley and would then effect a linkage with the CSXT "Belt Line" eastward to a junction at Bay View affording access to both the CSXT and NEC (Amtrak/NS) main lines.
- In the **Penn Freight Alternative,** the GCFT route would link up with the NEC just northwest of Pennsylvania Station, would employ upgraded freight-only trackage through the station area and a renewed Union Tunnel, and would have direct access at Bay View to both the CSXT and NEC (NS) freight trackage.

Figure ES - 5 depicts the GCFT and the two route alternatives described above.

Figure ES - 5: Great Circle Freight Tunnel, "Belt" and "Penn" Alternatives
[Letters "A," "B," "C" Refer to Optional Southwestern Approaches]



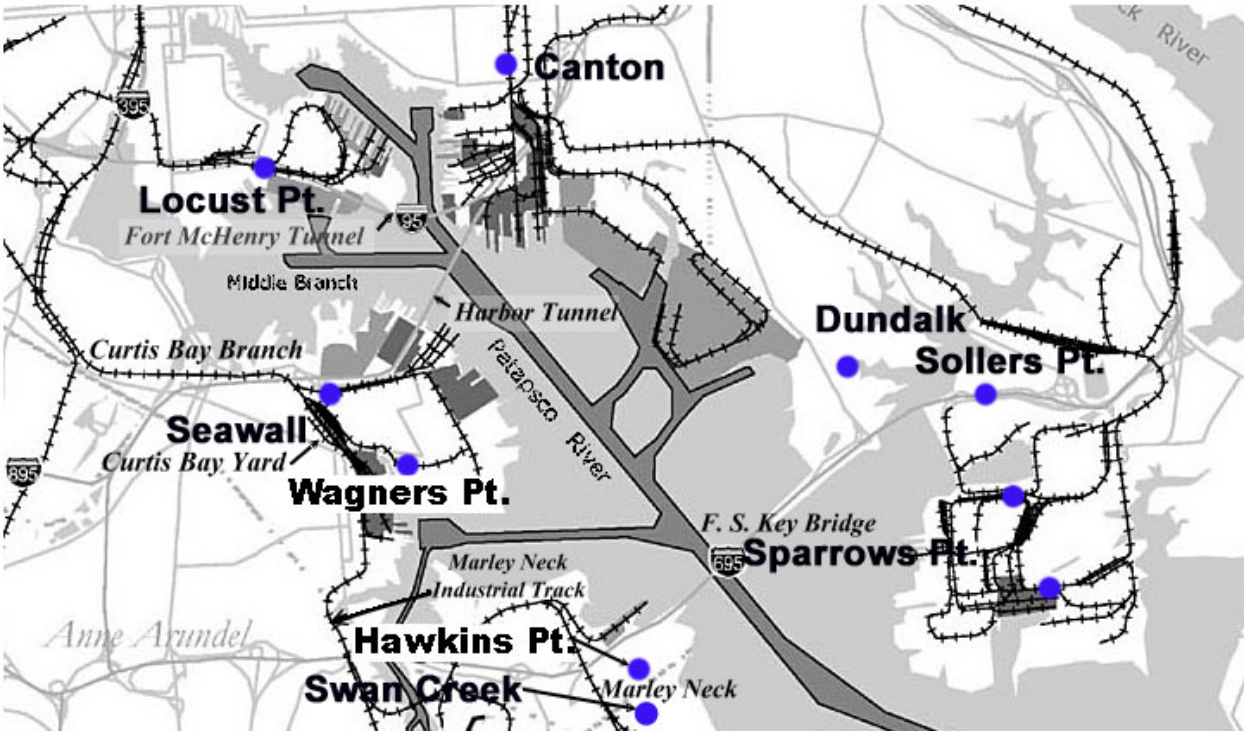
Freight Tunnels Under Baltimore Harbor

The study team considered five potential portal sites on each side of Baltimore Harbor, and all the possible tunnels between these two sets of portals. (See Figure ES - 6.) Of these many permutations, very few survived the limitations established by—

- The one percent grade maximum described in Chapter Five;
- The need to observe a channel depth of fifty feet in the harbor;
- The need to minimize the length of any tunnel;
- The assumed prohibition on tunneling beneath the existing Fort McHenry and Baltimore Harbor tunnels;
- The need to keep takings of residential and industrial real estate to a minimum; and
- The assumption that no harm would be tolerated to existing operations and facilities.

Figure ES - 6: Portals Examined in the Study

(Note: For design reasons, portal locations will sometimes differ from the locations of the features after which they are named.)



Based on the above stringent limiting factors, the study team found that a tunnel between a Marley Neck portal (at Hawkins Point or Swan Creek, at the bottom of Figure ES - 6) and Sparrows Point would appear to offer the most promise of any **underwater** alternative studied. However, in comparing this finding with those regarding the land-based alternatives, planners and decision makers will need to consider that—

- The cost of an underwater tunnel is projected to be approximately three times that of a land-based alternative;
- Considerable circuity is involved in any through routing via Sparrows Point, and detailed local routings are yet to be examined;
- The interface between a Marley Neck–Sparrows Point tunnel and the existing industry at that location—an important part of the region's industrial base—remains to be worked out; and
- No reasonably direct Sparrows Point routing would permit efficient service to the existing Bay View yards; all trains calling at Bay View would need to make time-consuming and costly reverse moves.

Thus, while all the alternatives developed in this study must be regarded as initial concepts, the harbor-based freight tunnel raises special concerns that merit especially attentive preliminary investigation in any further work on a Baltimore restructuring.

CONCLUSIONS AND PATHS FOR ANALYSIS [Chapter Nine]

Illustrative Alternatives

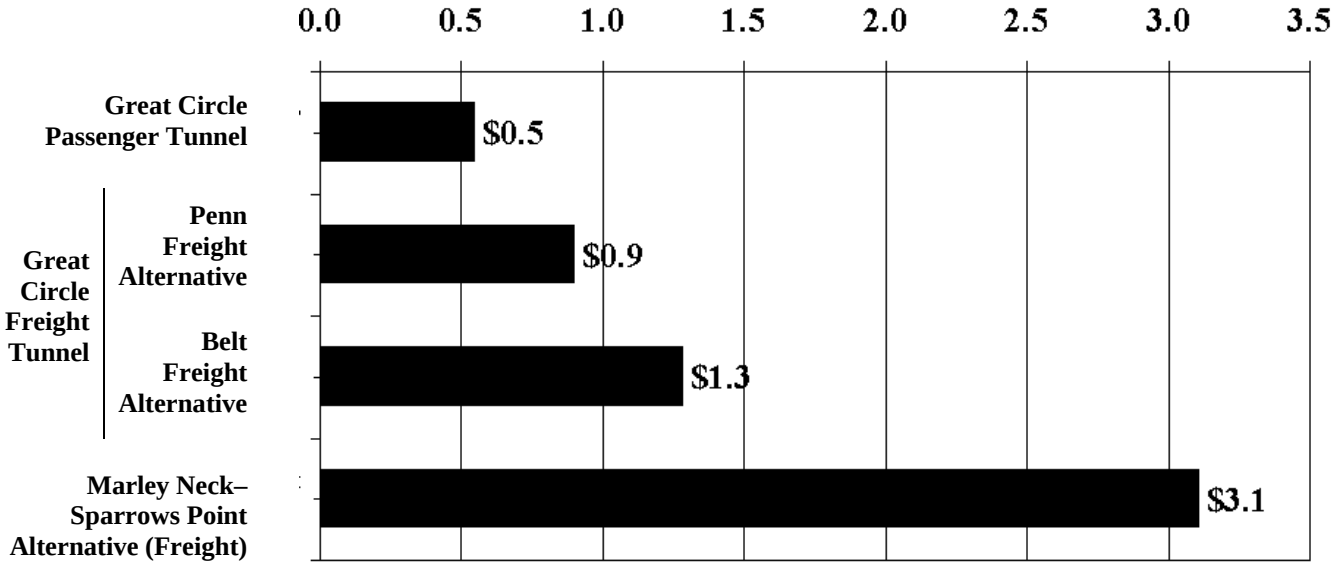
The following alternatives survived the process of elimination inherent in the study:

- **Passenger—Near North Sector: Great Circle Passenger Tunnel**
- **Freight:**
  - **Near North Sector: Great Circle Freight Tunnel (Penn Freight alternative)**
  - **Near North Sector: Great Circle Freight Tunnel (Belt Freight alternative)**
  - **Harbor Sector: Marley Neck–Sparrows Point alternative**

Preliminary cost measures

Figure ES - 7, on the following page, summarizes the preliminary cost estimates for the illustrative alternatives:

Figure ES - 7: Preliminary Costs for Illustrative Alternatives
(Billions of 2003 Dollars)



These preliminary estimates include contingencies of between 30 and 40 percent (with the higher figure applied to tunneling costs), and add-on fees of 18 percent to cover design, construction management, and project management.

The significant difference in cost between the land- and water-based tunnels largely reflects, first, recent advances in the cost-effectiveness of deep boring techniques to which the geology of the Great Circle alternatives is projected to be conducive and, second, the need for elaborate new approaches to the Harbor Sector tunnel alternatives.

Study Conclusions

The principal conclusions of the study are as follows:

- Baltimore's railway network is so antiquated and underdeveloped, and so important to the Nation's transportation system, as to fully justify the Congressional request for this analysis. For example, the B&P Tunnel was completed eight years after the Civil War ended.
- In Baltimore, the needs of freight and passenger service differ so greatly as to justify separate freight and passenger facilities.
- Further incremental repairs to existing facilities, other than for purposes of safety and operational continuity, will not address any of the inherent geometric problems that plague the transit of Baltimore by rail.
- Baltimore City presents severe engineering challenges to the design of new tunnel crossings, whether for freight or passenger service.

- With respect to passenger alternatives: By a process of elimination, only a Near North alternative utilizing the existing Pennsylvania Station appears to provide a cost-effective long-term solution to the challenges posed by the existing B&P Tunnel.[9]
- With respect to freight alternatives:
  - Both the Near North Sector and Harbor Sector appear to offer possibilities for alternative freight routes.
  - Of the Harbor Sector freight alternatives, those farthest from the Inner Harbor have the best chance of meeting the objectives of this study.
  - The cost of a land-based Great Circle Freight Tunnel appears to be one-third that of a Harbor Tunnel.
- If and when the concerned parties wish to progress a restructuring of the railway network in the Baltimore region, significant further analytical work will be unavoidable—and essential to verify this study's conclusions and assure that any possible future investment is wisely and optimally spent.

Possible Analytical Paths

If responsible authorities determine that a restructuring of Baltimore's railways merits further analysis, topics worthy of attention would include (but not be limited to) the following:

- **Refinement of alternatives analyzed in this report**. For example, the relative advantages and disadvantages of the Penn Freight and Belt Freight alternatives could benefit from additional scrutiny based on changes in such assumptions as the immovability of the Central Light Rail Line and its support facilities.
- **Investigation of other passenger alternatives** could include:
  - Additional investigation of a Central Sector alternative with various station sites; and
  - Additional investigation of a Harbor Sector alternative, particularly with respect to finding any suitable station site that is as close and as accessible to Charles Center as the present Pennsylvania Station.
- **Investigation of other freight alternatives:** For example, it may be worthwhile to devote additional attention to the Harbor Sector Locust Point–Canton alternative, with special attention to the effects on passenger infrastructure and operations.

[9] Regarding cost effectiveness: analyses by others imply that the cost of a Great Circle Passenger Tunnel could conceivably be less than that of rebuilding of the existing B&P Tunnel. See Chapter Seven, section entitled "Upgrade the B&P Tunnel." Any such inference would, of course, require detailed substantiation in the course of additional investigations.

- **Coordination of passenger and freight alternatives:** While the needs of passenger and freight fundamentally differ, there would be a need to optimize of the design of parallel alternatives, such as the Great Circle tunnels, to reduce points of conflict and lower the total cost of the two projects where possible. In addition, cross-operability of passenger and freight routes might undergo a benefit/cost analysis.
- **Analysis of Washington alternatives:** The full benefits of a Baltimore restructuring, at least for freight traffic up down the East Coast, can only materialize if the clearances in Washington's Virginia Avenue Tunnel are relieved simultaneously with those in Baltimore. In addition, clearances elsewhere in the region between Washington, Philadelphia, and New Jersey would need careful investigation.
- **Operations and facility analyses:** For each alternative under consideration, operational studies would be necessary to verify the degree of improvement they promise, with respect to both the present situation and each other. The techniques employed would include train performance calculator runs, and the modeling of all train movements for purposes of forecasting capacities. Special attention would be applied to signal layouts and support facilities for passenger and freight service. For example, station configurations and midday/overnight car storage facilities would need more careful analysis for passenger service; yard layouts and operations would require attention with respect to freight.
- **Further engineering analyses:** Further development of Baltimore tunnel alternatives would necessarily require ever-more-detailed engineering work, on such topics as:
  - Geology/underground utilities;
  - Confirmation of right-of-way/property lines;
  - Successive levels of design;
  - Construction staging; and
  - Refinement of construction cost estimates
- **Review regional alternatives for freight movement.** It would be most appropriate to examine:
  - Likely performance of the Baltimore network if no improvements are made and the traffic increases are retained in the rail mode;
  - Implications, on other modes' congestion and facility requirements, of handling future traffic increases by other modes, especially highway (and air to the extent of available capacity and likely demand); and

— Alternatives for upgrading or devising other rail freight routes[10] that would bypass the Baltimore region for through traffic in various national traffic lanes; their costs, benefits, and effects upon traffic to, from, and within the study region; their consequences for the various carriers that would be involved.

- **Comprehensive benefit/cost analyses for the alternatives.** Drawing on the operational and other investigations, total life-cycle benefits and costs (and their incidence) would appropriately be calculated for each of the rail restructuring alternatives. The results of these analyses would provide much fuller information to decision-makers and the public at large than estimates of construction costs alone, and would better prepare the way for the environmental documentation.
- **Institutional arrangements.** To effect any thoroughgoing Baltimore restructuring, and to derive all its promised benefits, would require well-designed institutional structures and relationships. Cost sharing would be an issue of profound importance, for example. The creation or adaptation of such institutions, and the resolution of cost and operational issues before any construction begins, would be an analytical task in itself of very high importance.
- **Environmental documentation.** Analyses like those exemplified above would help to support the important task of preparing all necessary environmental documentation for a restructuring, if any, of Baltimore's railway network.

[10] There are no such conceivable options for passenger traffic.

Letter from Robert L. Flanagan,
Secretary, Maryland Department of Transportation

May 6, 2005

Maryland Department of Transportation
The Secretary's Office

Robert L. Ehrlich, Jr.
Governor
Michael S. Steele
Lt. Governor
Robert L. Flanagan
Secretary
James F. Ports, Jr.
Deputy Secretary

May 6, 2005

Mr. Mark Yachmetz
Associate Administrator for Railroad Development
Federal Railroad Administration
Mail Stop 5
1120 Vermont Avenue, N.W.
Washington DC 20590

Dear Mr. Yachmetz:

The Maryland Department of Transportation (MDOT) wants to express its appreciation for the Federal Railroad Administration's (FRA) leadership and oversight of a one million dollar study of aging railroad tunnels in the Baltimore area.

The scope of the study included an evaluation of alternate tunnel routes for both freight and passenger service from, to and through the Baltimore metropolitan area. The study area was defined as Halethorpe to Bay View, Maryland. The final report, prepared by FRA, is entitled "Baltimore's Railroad Network – Challenges and Alternatives." The Maryland Department of Transportation has reviewed the draft copy dated 02-15-05 "Report to Congress." It was agreed MDOT would provide final comments in letter format which would be integrated and incorporated into the final report. We therefore offer the following:

The original appropriation to support this study was as a result of efforts by Maryland Senators Paul S. Sarbanes and Barbara A. Mikulski following the events of the Howard Street Tunnel fire in 2001. However, the deeper discussion of rail tunnel infrastructure limitations—both in capacity and clearances—have been ongoing for many years. The "chokepoints" of both the CSX-owned Howard Street Tunnel and the Amtrak-owned B&P Tunnels present significant rail infrastructure deficiencies for the entire Northeast rail system. The tunnel fire coupled with the 9-11-2001 tragedy and more recent acknowledgements of Amtrak's long-term tunnel issues in Baltimore, have served to heighten the awareness and place even more urgency on efforts to find solutions. The Baltimore Tunnel chokepoints are indeed issues of state, multi-state, even national significance.

My telephone number is 410-865-1000
Toll Free Number 1-888-713-1414 TTY User Call Via MD Relay
7201 Corporate Center Drive, Hanover, Maryland 21076

The report, although lengthy, does provide extensive background information, which is important to the reader's current understandings. As noted in the report, the budget for this project was unfortunately limited from original expectations. Therefore, several options and alignments were not able to be addressed. Also, the level of detailed work for those that were addressed was limited. In addition to the route studies that were provided in the initial scope, and after considerable work had been done on multiple alignments, the option to route both freight and passenger trains via a south harbor I-95 alignment was among those not considered for the purpose of this study. We now are aware of two additional possible tunnel alignments, for which no significant preliminary engineering work has been done. Maryland is continuing in its efforts to better define economic benefits of alternatives not necessarily described in this study.

As a result of these paralleling efforts, we feel this report and other studies are laying the groundwork for next steps. Remaining is a definition of the benefits of each route with an enhanced understanding of local, regional, and national benefits at large. The studies bring focus to the need for yet another corridor analysis to more fully determine which of the six or more tunnel routes would best serve any future investment strategy. When these initial analyses are complete, we could then recommend advancing studies to the 30%+ level of engineering thereby refining costs and impacts as well as benefits. This future detailed engineering analysis will more clearly identify the "most viable" route options for both passenger and freight rail from, to and through Maryland.

In closing, MDOT feels the state and federal partnership funding for this study has set the cornerstone of a good work in progress. We look forward to continuing in these efforts with our federal and private rail partners.

Sincerely,

Robert L. Flanagan, Secretary
Maryland Department of Transportation

cc: Senator Paul S. Sarbanes
Senator Barbara A. Mikulski