High-Profile Rail Clearances in the State of Pennsylvania

Reports 1 thru 5

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Report 1

Task 1.0 Identification of Potential "High-Profile" Rail Corridors

Task 3.1 Analysis of "High-Profile" Handling Requirements

Prepared for: Pennsylvania Department of Transportation

Prepared by: Transmode Consultants, Inc. and Apogee Research

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Outline

I. The Clearance Issue

II. Car Designs and Clearance Implications

III. Candidate Corridors

IV. Assessment of Alternatives

I. The Clearance Issue

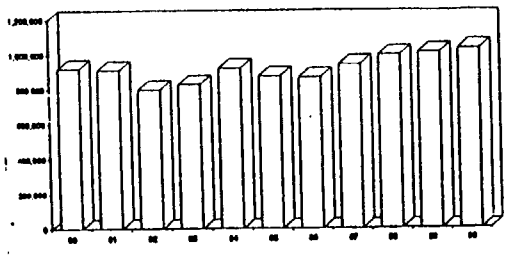
Industry Background

During the past decade, the decade since deregulation, the rail industry has significantly increased its productivity. This increase in productivity has increased the "value" of the transportation services which the industry offers to its customers. Productivity gains have come from a number of sources, including increases in labor productivity and increases in asset utilization. Both are the result of network downsizing and of significantly improved equipment use. However, over the past decade a substantial gain has also been made in the load-hauling "envelope" which the rail industry has offered to its customers. The industry has realized load hauling gains by using larger rail cars (particularly taller cars). Customers, in particular, who ship low density/high value freight, have been able to benefit significantly from these developments. These include customers for intermodal services, who are in the parcel delivery business (UPS/USPS); customers in the consumer packaged product business (Proctor & Gamble, Sears, General Foods, etc.); and customers in the import/export business (Panasonic, Kmart, IKEA, etc.).

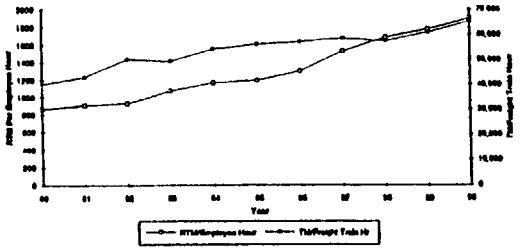
Gains in load-hauling capacity have resulted both from new equipment designs and from new multi-modal operating procedures and techniques. In particular, gains fall into two distinct market segments which the railroads serve: (1) the containerized freight market and (2) the automotive setup market. In both of these markets, rail car configurations, loading techniques and innovative service designs have evolved in ways which allow the railroads to create increased load-hauling "value" for their customers using new, taller cars. These changes took place relatively quickly, in historic railroad terms. Indeed, new "high-profile" equipment designs which were introduced in the early 1980s and then rapidly adopted, testify to the fact that "change" is accelerating in the rail industry. The industry has responded in creative ways to manage this change and to effectively meet intensified competition from truckers. The result: rail market share has stabilized and in specific niche markets it has actually begun to increase.

Gains in Rail Productivity During the 1980s

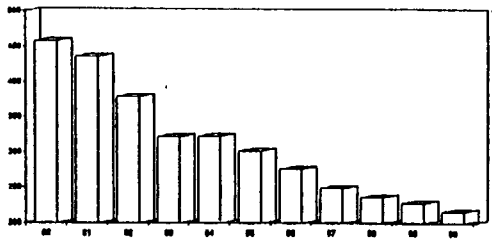
REVENUE TON-MILES



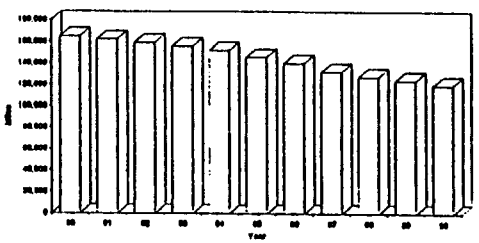
RAILROAD EFFICIENCY IMPROVEMENT



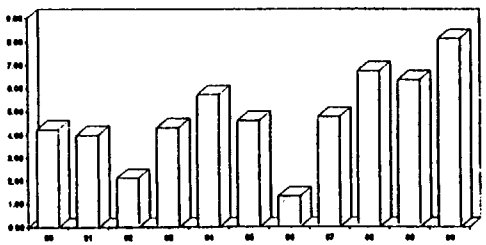
EMPLOYMENT



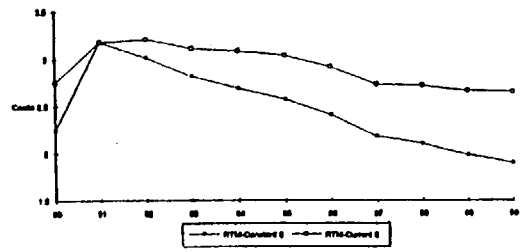
MILES OF ROAD OWNED



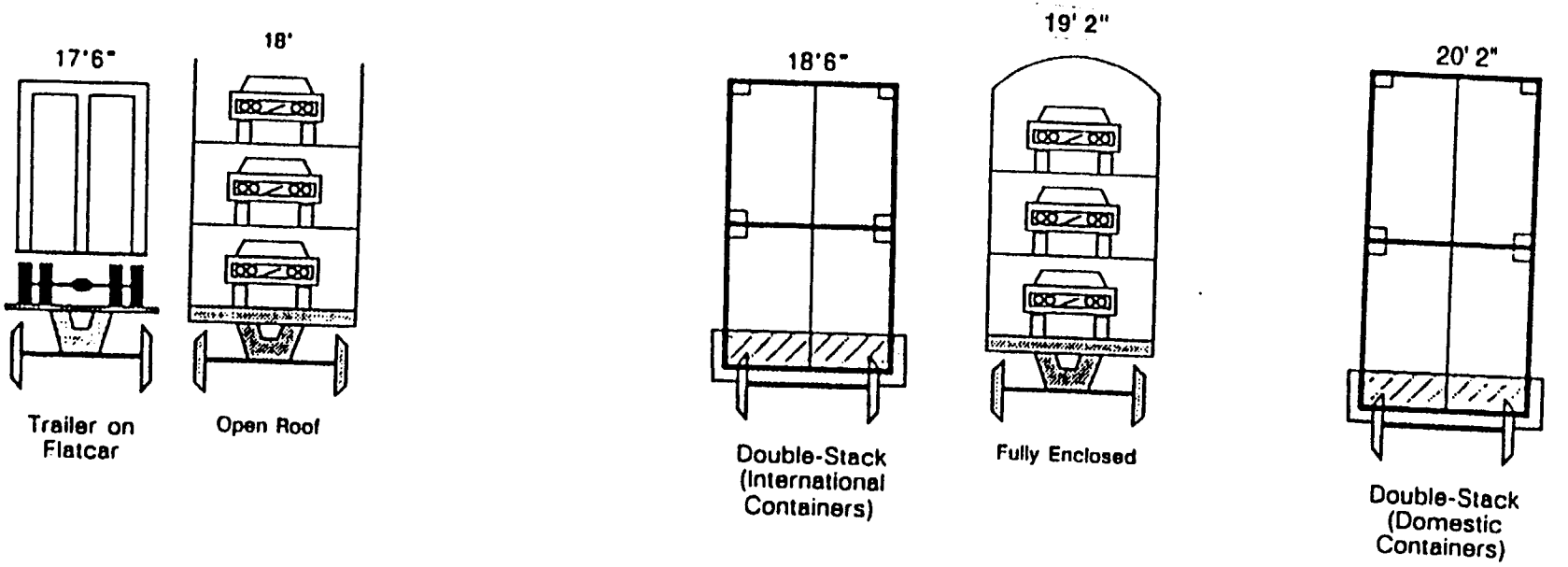
RATE OF RETURN



REVENUE PER TON-MILE



Evolution of the Rail Load Hauling "Envelope"



Industry Background (continued)

The rail industry continues to innovate with new equipment and to explore new service designs which can help it reclaim lost market share. Many of these service innovations are directly connected to the issue of clearances.

At the present time, two sets of service innovations and corresponding equipment designs are being refined and finalized within the rail community. These innovations involve the use of "high-profile" doublestack and auto-hauling tri-level cars. The rail community which implements these changes includes not only railroads, but also rail equipment manufacturers, shippers and financial intermediaries who supply most of the industry's "high-profile" equipment. Most notable among this latter category are Trailer Train Company (now named TTX) and Greenbrier Leasing. Because of the multiple interests involved in new equipment design, the process of design refinement and new equipment specification is somewhat drawn out and the decision process quite complex. It typically entails several levels of decision making, with checks and balances throughout the community. One fact, however, is quite clear: The next generation of "high-profile" rail equipment will push out the clearance envelope further than did the early 1980s generation, as a result of changes in equipment and service design which are now on the drawing board. Specific rail routes and communities served by routes, which were disadvantaged when the previous generation of "high-profile" equipment were introduced in the early 1980s, will be further disadvantaged in the 1990s.

Unfortunately, Pennsylvania rail routes and Pennsylvania-based shippers are among those who did not benefit from "high-profile" rail services in the 1980s. In general, most rail routes within the State of Pennsylvania, still do not exceed the standard profile Plate "C." This standard was established in 1953. It corresponds to the dimensions of a 17' standard boxcar.

Plate "C" Profile

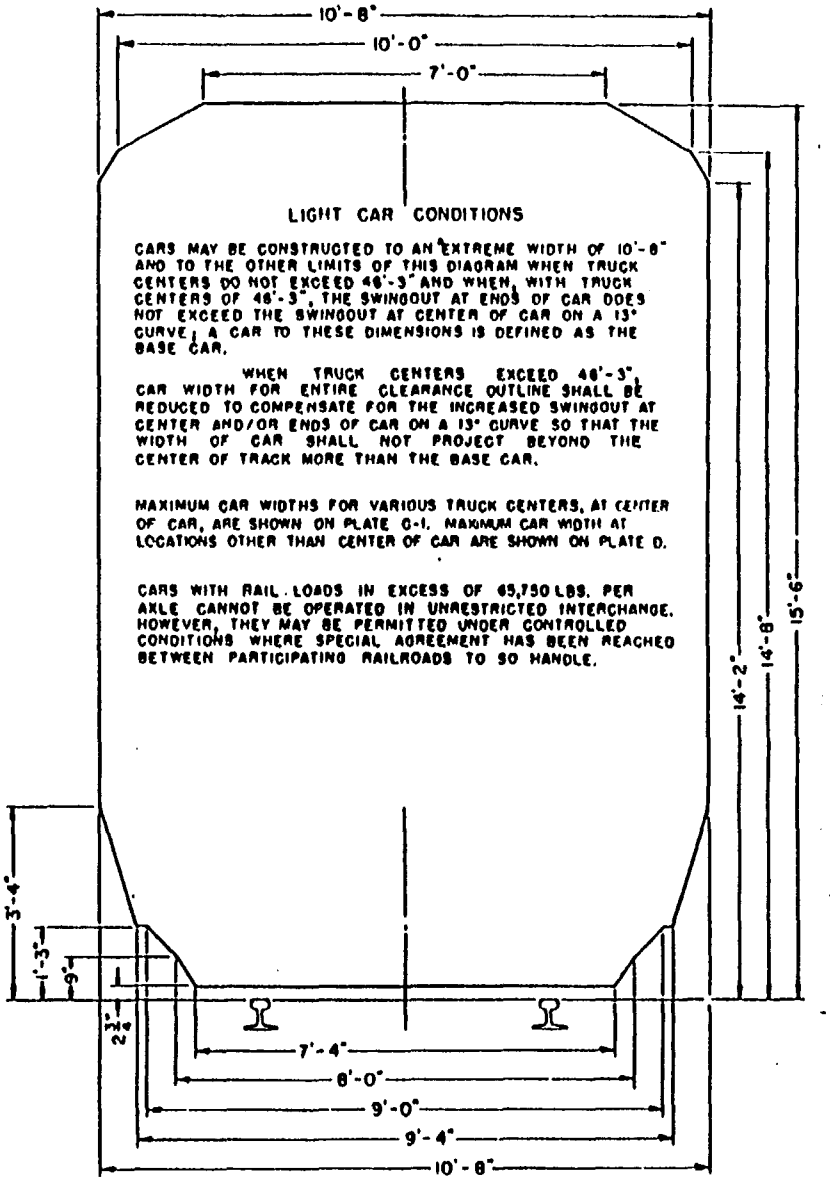
PLATE C
EQUIPMENT DIAGRAM
FOR LIMITED INTERCHANGE SERVICE

Standard

S-2028-91

Adopted 1963, Revised, 1965, 1966, 1967, 1991

Unrestricted on all roads except on certain routes for specific restricted areas on such roads see "Railway Line Clearances"



The 2-3/4" above top of rail is absolute minimum under any and all conditions of lading, operation, and maintenance.

Industry Background (continued)

Since the mid 1980s, Pennsylvania's clearance disadvantage has manifested itself in the circuitous routing of autorack cars through the State, the closing of certain auto distribution terminals and non-participation by the Port of Philadelphia in steamship line-sponsored doublestack train services.

In important ways the pending breakthrough in high-cube rail transportation is different from the equipment breakthroughs of the 1980s and much more significant for economic development. These differences are highlighted in the table on the following page. Most notably, they include a broader array of manufacturing/distribution industries which are likely to be effected by new "high-profile" services. The prior generation of "high-profile" stack train operations affected principally those industries with a strong import/export orientation. The next generation of high-cube, stack train equipment will also benefit those transportation intensive industries which have a domestic market orientation. These industries include parcel delivery companies, warehousing companies, long-haul truckload trucking firms, industrial goods manufacturers, consumer goods manufacturers, wholesale distributors and bulk mailers.

Industry impacts include both short-term and long-term effects. Short-term effects are manifested by marginal distribution cost disadvantages. Long-term effects relate to plant siting decisions. For example, in the 1980s plant siting decisions in the auto industry were materially affected by rail clearances. Indeed, while making plant siting decisions in the late 1970s and early 1980s Nissan, Toyota, Honda, Saturn and Volkswagen considered only plant sites with open 19' 2" plus tri-level rail clearances. Only four auto fabrication plants exist in the Northeast at the present time, in spite of a large local consumer base concentrated in the region. New York State has recently committed funds to improve clearances into the GM Tarrytown Plant with the hope that the State can bolster the economic viability of that plant.

Industrial Consequences of "High-Profile" Rail Service

	Impacts of 1980s "High-Profile" Innovation	Expected Impacts of 1990s "High-Profile" Innovation
Principal Services Affected	• containerized intermodal freight • automotive setups • auto parts	• containerized intermodal freight - dry bulk - fluid bulk - packaged goods - building materials • auto setups
Principal Shipper Beneficiaries	• international container shippers • major auto manufacturers • domestic container shippers in selected "backhaul" lanes	• express package shippers • mainstream domestic packaged goods shippers • Most major industrial manufacturers • selected bulk materials shippers • auto manufacturers
Geographic Incidence of Benefits	• West Coast, Southwest and Midwest benefited • Northeast and to a lesser extent, Southeast penalized	• West Coast, Southwest and Midwest will benefit, again • Southeast will also benefit • Northeast will be penalized

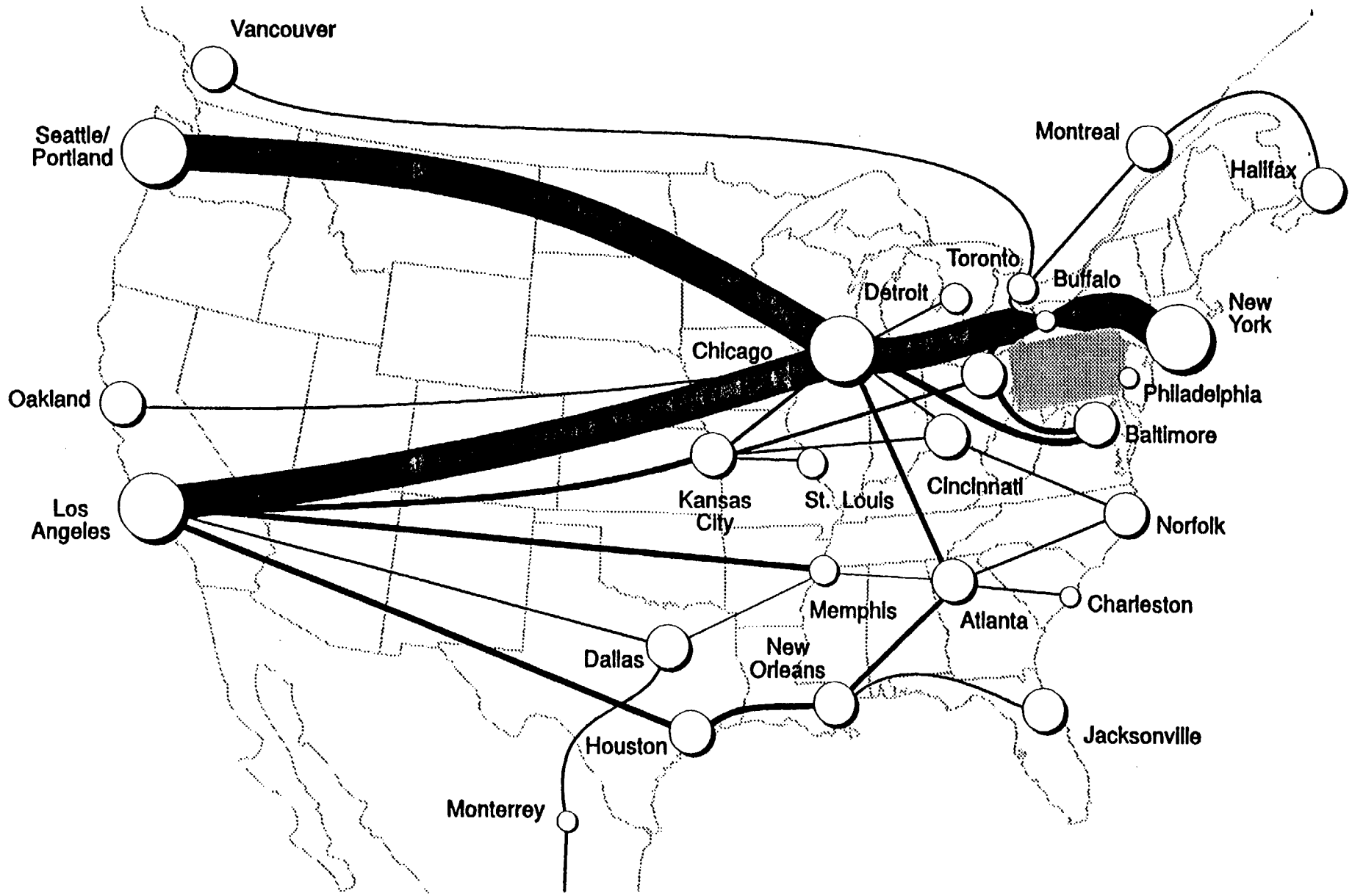
Industry Background (continued)

The East Coast has many clearance restrictions. It is not an accident that the newest auto fabrication plant to be located in the U.S. -- the BMW plant -- will be located on a 20' 3" cleared rail line located in South Carolina. Rail clearances will likely have a material effect not only on auto plant siting decisions in the 1990s but on other "transportation intensive" industries as well.

As the map on the following page demonstrates, Pennsylvania-based shippers are disadvantaged not only *vis-a-vis* shippers located west of Chicago and St. Louis, but also *vis-a-vis* shippers located within the Northeast region itself. To the north of Pennsylvania, Conrail's "water route" through New York State has been cleared to 20' 6" and is currently being cleared further to 20' 8". To the south, CSX's B&O route has been cleared to 19' 6" and CSX is considering further clearance improvements to 20' 6". Also to the south, the Norfolk Southern Railroad has already adopted a 20' 2" equipment clearance standard for all of its intermodal routes, thus allowing for doublestack operations into the Virginia Port Authority's facility in Norfolk.

As a matter of general operating policy, several railroads have adopted system-wide clearance standards. The ATSF and the UP, for example, have cleared, or are in the process of clearing, all of the their routes to 20' 11". CP Rail System has a similar policy in Canada, where 20' 11" has become its clearance standard. In the East, Norfolk Southern is working toward a system-wide clearance standard to allow it to handle 20' 2" equipment. Rails who serve the Pennsylvania market, however, have not yet begun the process of system-wide clearance improvements. Unfortunately, the complexities and the costs of clearance improvement are generally greater in the Northeast where rail infrastructure requires substantial investment in order to handle the new generation of high-cube equipment which is now emerging.

Existing Doublestack Service via Major North American Rail Routes



II. Car Designs and Clearance Implications

Standard Car Profile

The rail industry, through the Association of American Railroads (AAR), establishes car design standards which apply to equipment which railroads interchange freely among themselves. Rail car design standards are characterized by the AAR in terms of standard "plates." As we noted above, Plate "C" is the lowest common denominator for rail clearances. It applies to boxcar equipment which is freely interchanged among railroads throughout the country. Plate "H" is the current domestic doublestack equipment standard. Plate "H" applies to doublestack container cars which can haul two stacked 48' domestic containers. The industry adopted Plate "H" in 1991. As the diagram on the next page demonstrates, the extreme width of the current generation of doublestack container equipment is 10' 8". The maximum height from top of the rail for Plate "H" equipment is 20' 2".

Most rail equipment today fits within the Plate "H" profile. Indeed, as the diagram on the next page demonstrates, the ETTX/GTTX fully enclosed autorack car, which is the "work horse" of the nation's autorack fleet, has a narrower profile than the Plate "H". The overhead clearance requirements for the standard tri-level car are 19' from the top of the rail. The maximum horizontal dimension is 10' 8".

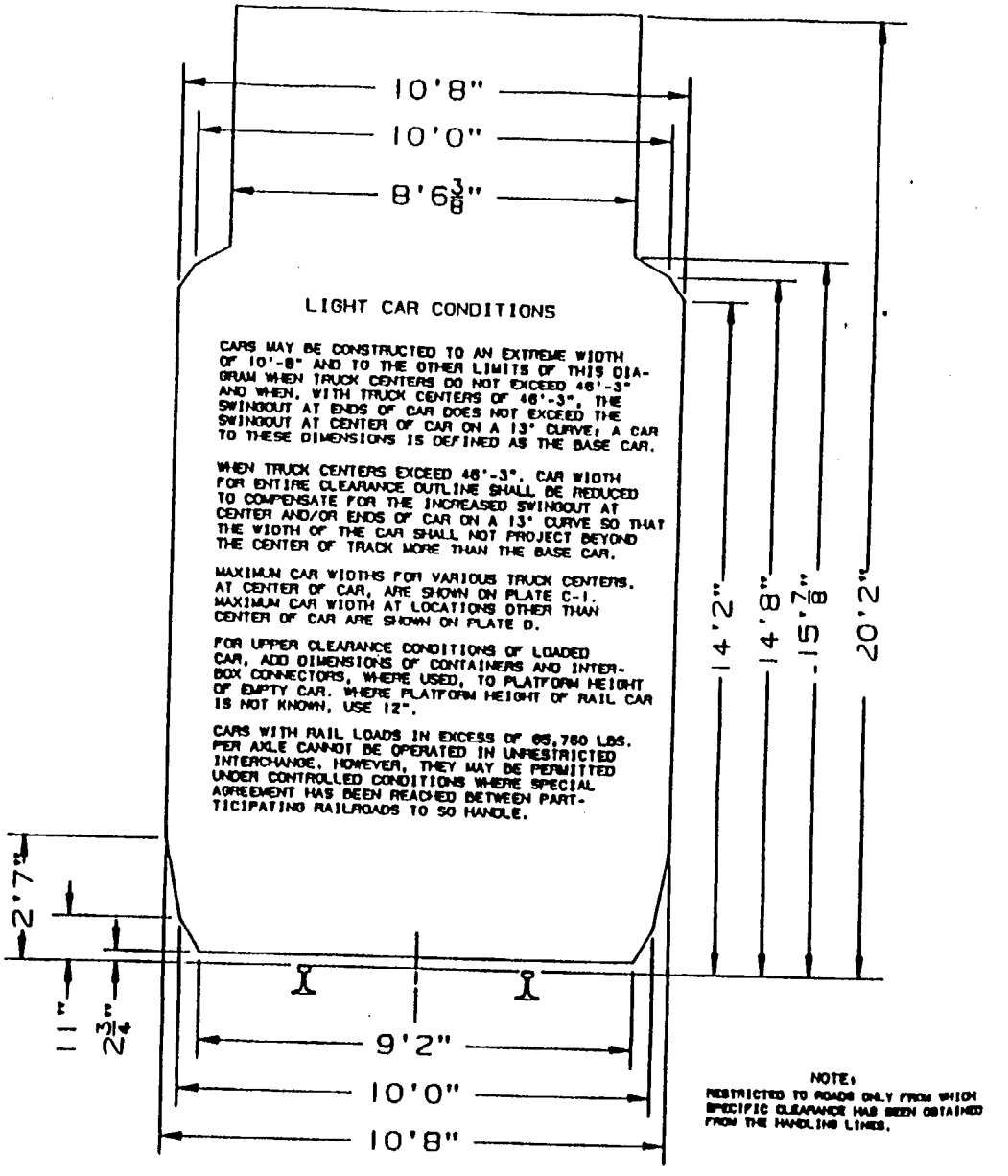
Plate "H" Profile

PLATE H
EQUIPMENT DIAGRAM
FOR DOUBLE-STACK CONTAINER CARS

Standard

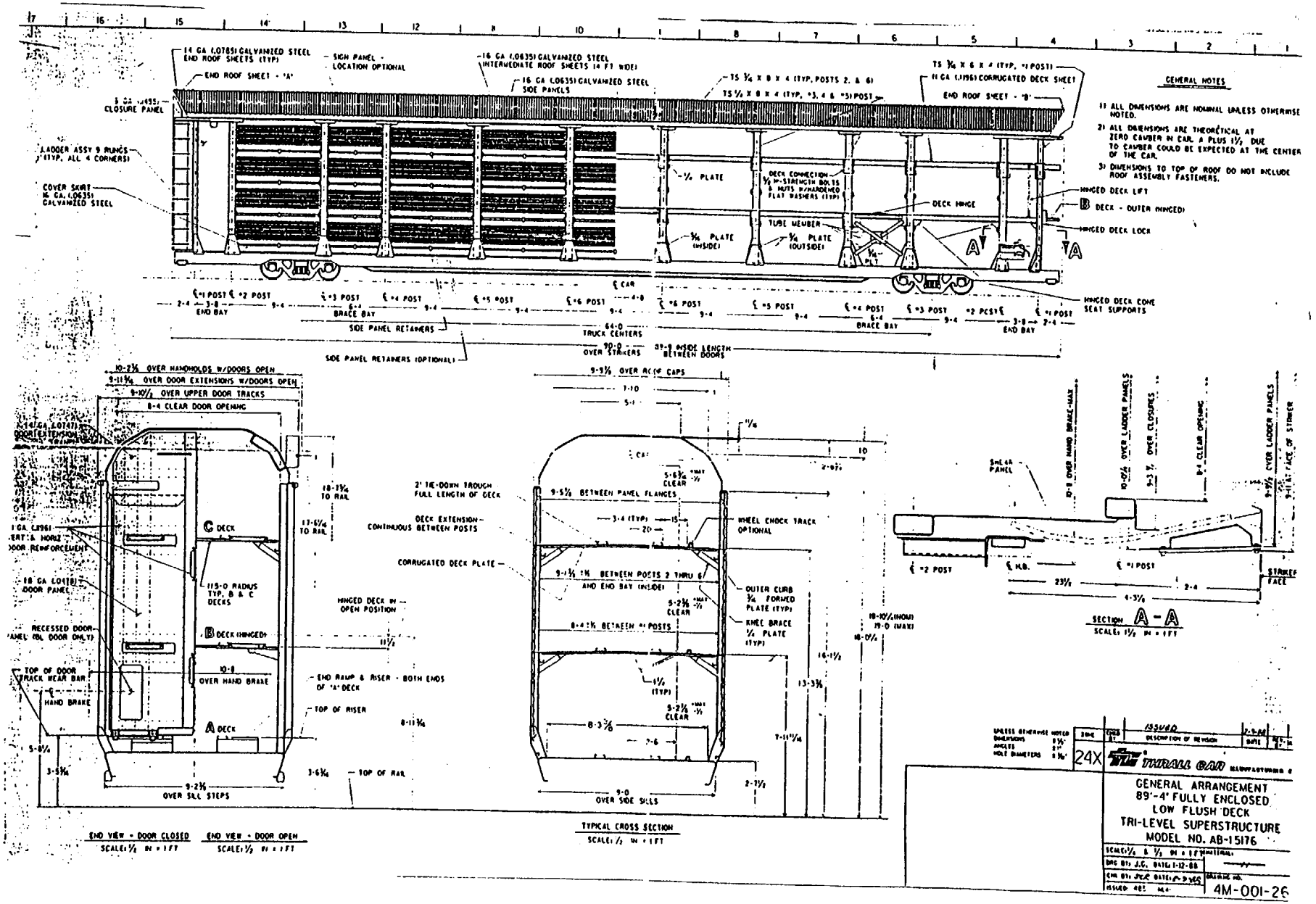
S-2040-91

Adopted 1991



The 2-3/4" above top of rail is absolute minimum under any and all conditions of lading, operation, and maintenance.

Fully-Enclosed Autorack Profile

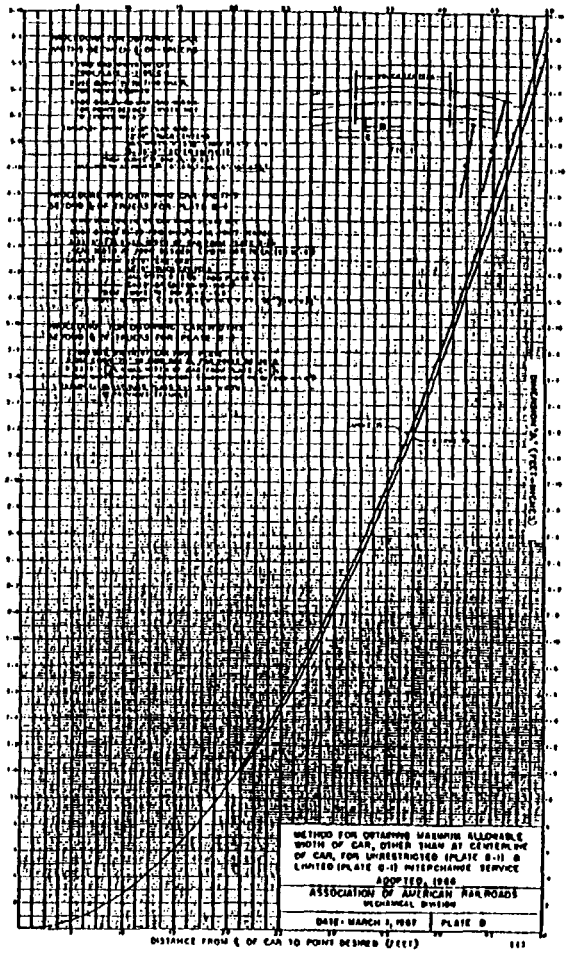


"Chording" Effects

The Association of American Railroads has established a complementary set of standards which apply to car designs for the purpose of determining the "chording" effects which result when cars move around curved trackage. The "worst case" curvature standard for main line, class 3 track is 13°. As the table below and on the next page suggests a tradeoff exists between the length of a car and its maximum design width. The constraining parameter for cars which manifest "chording" effects is the industry's standard 7-1/4" swing-out tolerance.

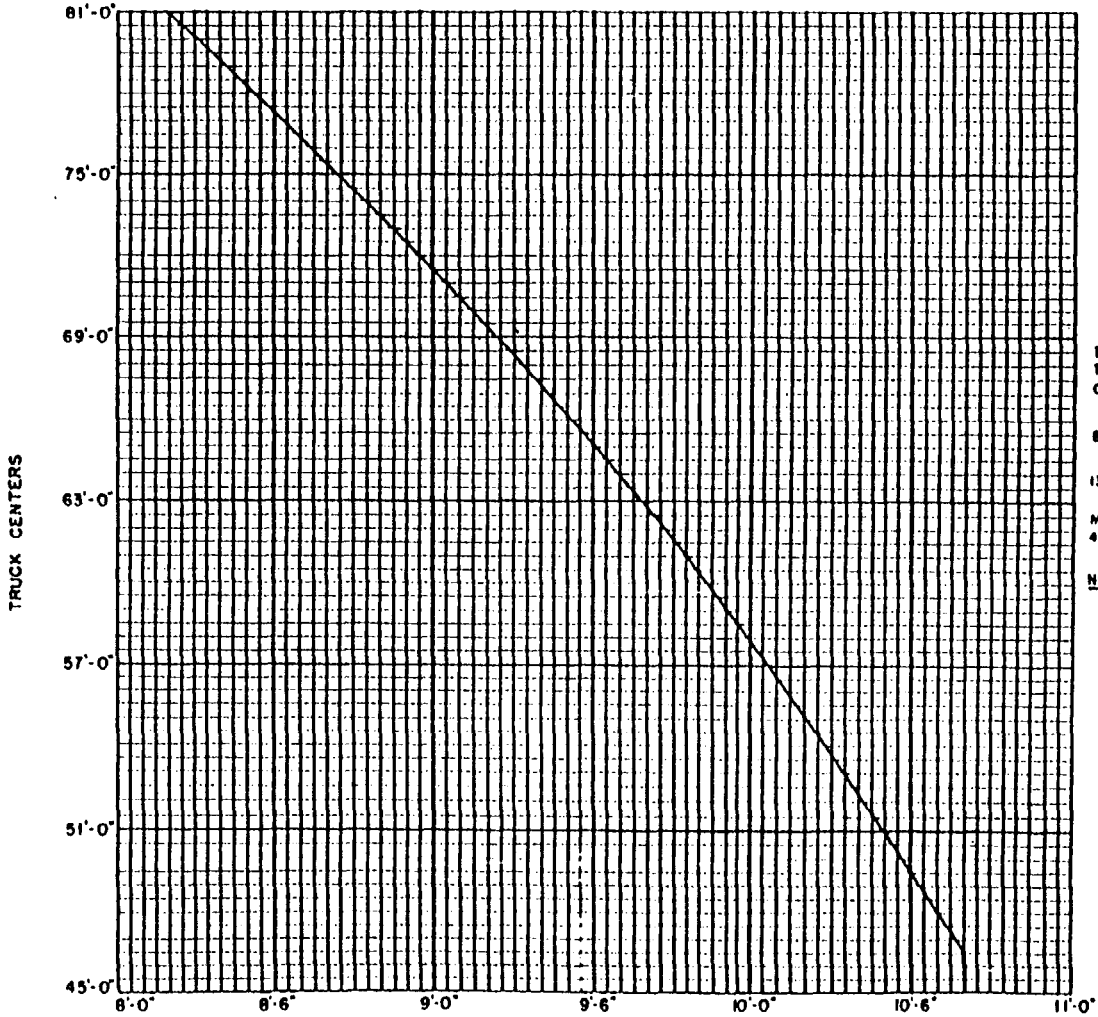
Plate D
Method for Obtaining Maximum Allowable Width of Car, Other Than at Centerline of Car, For Unrestricted (Plate B-1) & Limited (Plate C-1) Interchange Service

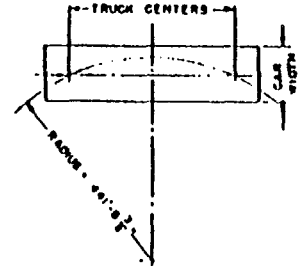
Standard
S-2030-66
Adopted, 1966



MAXIMUM WIDTH OF CARS WITH VARIOUS TRUCK CENTERS

Standard
S-2029-66
Adopted, 1963; Revised 1966





THE REDUCTION IN WIDTH IS PREDICATED ON THE BASE CAR, DEFINED ON PLATE C, AND ON A 13° CURVE.

BASE CAR – { EXTREME WIDTH 10'-8" / TRUCK CENTERS 46'-3"

13° CURVE = 441'-8 3/8" RADIUS.

MAXIMUM SWINGOUT AT CENTER OF CAR WITH 46'-3" TRUCK CENTERS = 7 1/4"

NOTE: THE MAXIMUM WIDTHS SHOWN ARE BASED ON THE SWINGOUT AT CENTER OF CAR WHICH USUALLY GOVERNS. MAXIMUM ALLOWABLE WIDTH OF CAR, OTHER THAN AT CENTER OF CAR, IS SHOWN ON PLATE D. ON CARS WITH LONG OVERHANGS, THE SWINGOUT AT ENDS OF CAR MUST ALSO BE CHECKED.

NOTE: FOR USE WITH PLATE "C"

New Generation of "High-Profile" Equipment

The new generation of high-cube equipment extends beyond the Plate "H" profile. "Project" freight, e.g., high and wide loads which require special train handling, also frequently extend beyond the Plate "H" profile. Project freight requires clearance calibration on a case-by-case, movement-to-movement basis. Hence no "project" freight standards exist. Each "jumbo" project freight movement requires extensive field engineering, particularly if the "chording" effect is significant.

A major autorack redesign effort is currently underway. It will likely extend the clearance envelope of the current generation of tri-level autorack equipment. Thrall Car Manufacturing Company has joined forces with Trailer Train Corporation, the leasing company, to develop a new autorack "work horse" to replace the aging ETTX/GTTX fully enclosed, tri-level car.

The objectives underlying this design effort are multiple: Most importantly, they include reduced loss and damage cost. Loss and damage cost is a primary basis on which rails compete with trucks in the auto setup market. At one point in the early 1980s, claims for damaged cars in rail service exceeded 12% of all movements. Today, they are less than 2%. Still, loss and damage accounts for approximately $100 for each auto handled in rail service. Auto companies are looking for "zero" defect performance. The new car design will help. In the new car, autoracks will be built into the car walls. In addition, the new design will incorporate several innovative lading protection features. A second design objective is to minimize the capital cost of the equipment so that the *per diem* associated with this new equipment is not significantly higher than that of the current generation. The profile of this new autorack car has not yet been finalized. However, preliminary engineering designs which Thrall has developed for TTX include a 19'6" maximum height.

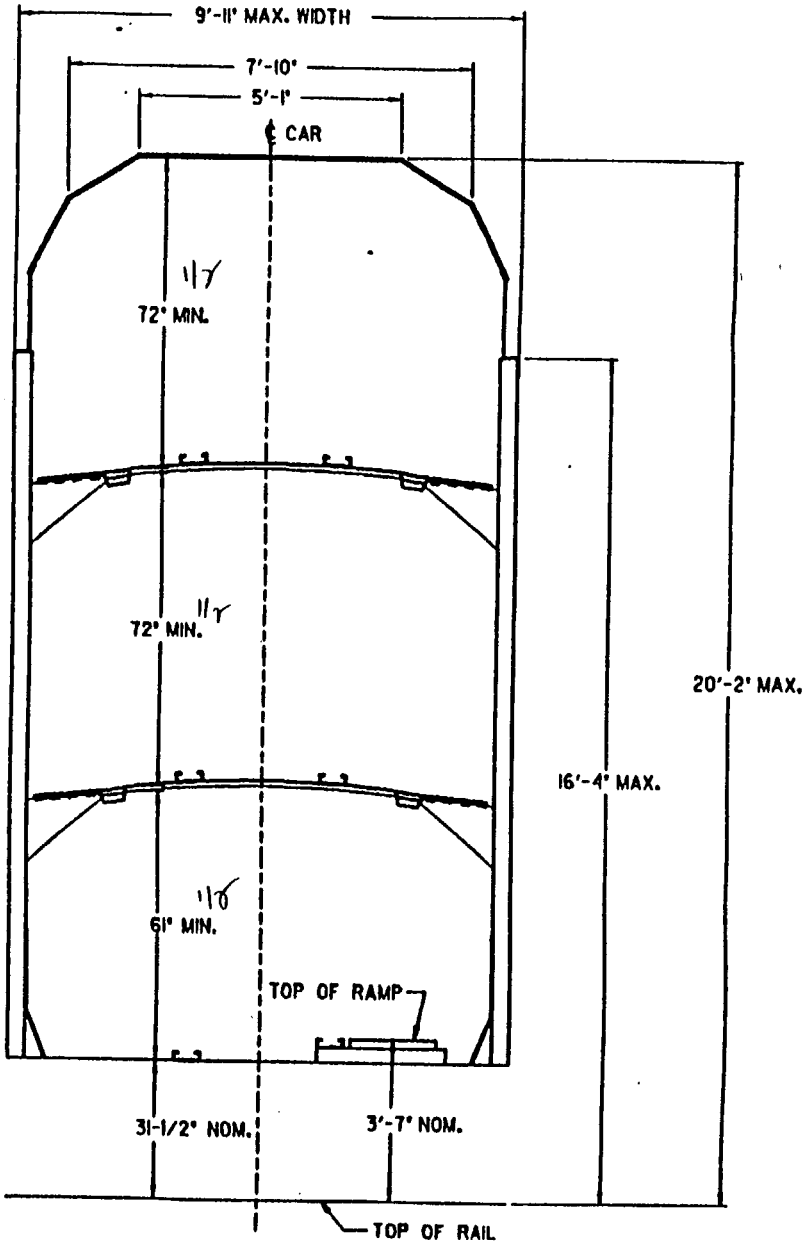
The "High-Cube" Chrysler Autorack

A second high-cube autorack design is already in operation on the nation's rail system. This car has not become an industry standard in the same way that the GTTX/ETTX fully enclosed tri-level has been adopted as a standard conveyance by all the major auto companies. However, it is the tri-level car preferred by one important shipper, Chrysler Motors, and to a lesser extent by a second, Mazda Motors. The Chrysler tri-level has a maximum height of 20'2" and a maximum width of 9'11". At the present time, only 500 of these cars operate in U.S. rail service. Of these, approximately 70 have already been damaged because of restricted clearances. However, Chrysler is insistent that U.S. railroads increase the availability of this car in the future and, as a consequence, 200 to 300 more will be added to the national car fleet in 1992/93. The diagram on the next page presents critical design dimensions of the Chrysler tri-level.

Proposed 20'-2" Chrysler Tri-Level

Proposed Tri-Level with "B & C" Decks Having 72" Clearance

Chrysler Autorack



New Domestic Container Car Designs

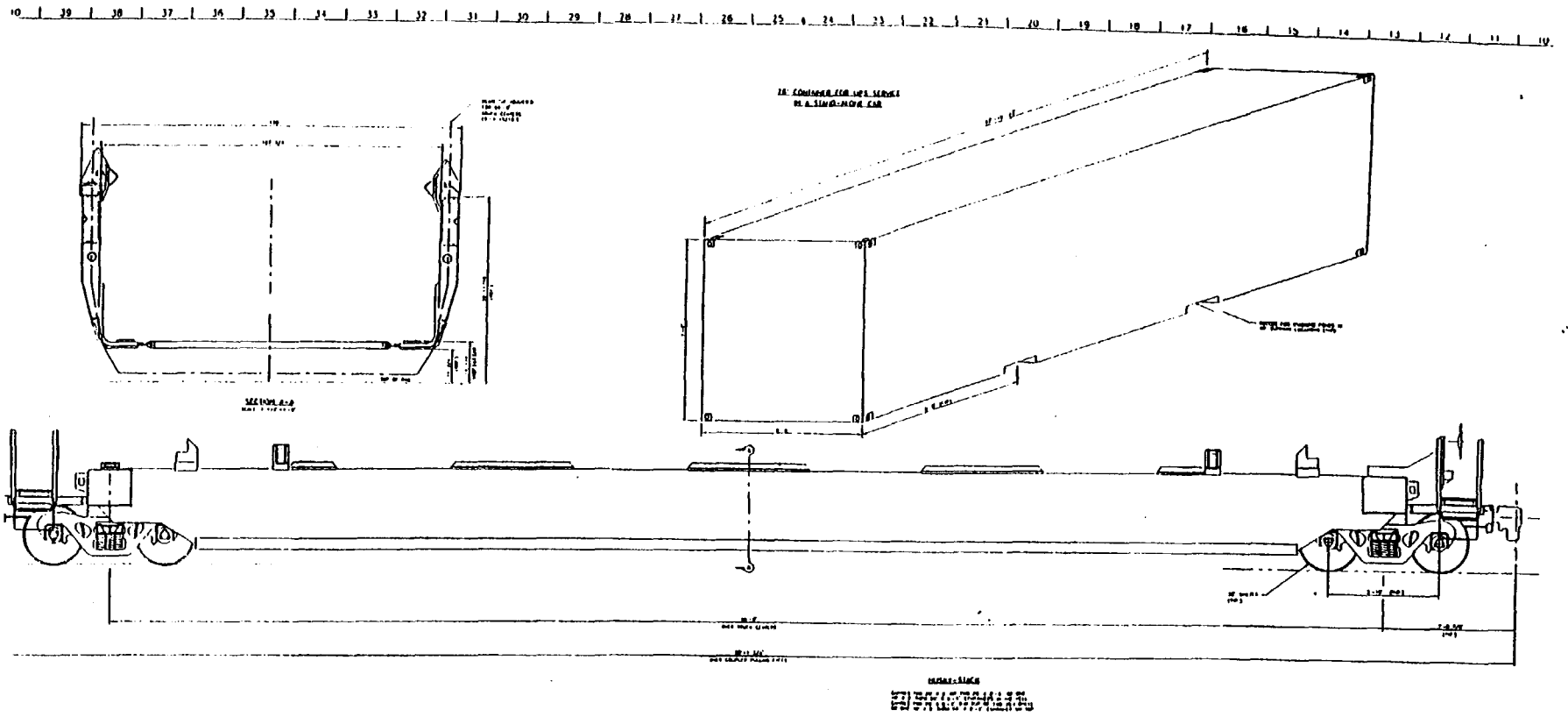
The car design innovation which will push out clearances the most in the decade ahead involves domestic containerization and its use of doublestack loading techniques. Clearance issues involving stack train equipment are more complex than issues surrounding autorack clearances. Doublestack clearance profiles depend on four interrelated parameters: 1) the height and design of the "well" car in which domestic containers sit, 2) the bottom container height, 3) the top container height, and 4) the dimensions of the inter-box connector which ties the two containers together.

A fifth parameter which may affect clearances is the "chording" effect. This effect is related to the length of the "well" itself. In the new generation of stack train cars, container "wells" will increase from 48' to 53' in length. In the case of the "Husky" car, which is being designed for UPS to handled matched sets of 28' domestic containers, the well will be extended to 56'. See the diagram below. In the decade ahead, UPS is preparing to invest heavily in 28' domestic containers which can be sandwiched two-together in a "Husky" car well. The "chording" effects associated with longer wells may create additional vertical clearance issues, over and above these resulting from the current generation of doublestack equipment.

The overhead clearance profile associated with these new domestic container units exceeds the previous design parameter of 20' 2", as the table below explains.

	Traditional Steamship Line Container	New Domestic Container
Bottom Container	9'6" (max.)	9'6-1/2 "(Std.)
Top Container	9'6" (max.)	9'6-1/2 "(Std.)
Inter Box Connector (15 lbs)	1-1/4"	1-1/4"
Well to Top of Rail	1' 3/4"	1' 2"
Total Height	20' 2"	20' 4"

Next Generation "Husky" Well Car Design



Implications for Rail Clearances in Pennsylvania

No generally accepted industry clearance standards exist. Each railroad operating department determines what clearances are adequate to exceed the clearance profile of a specific car type and at the same time assure safe, high-speed operations. This issue is complicated by the "rocking action" of high-profile cars which causes them to sway back and forth while they are being pulled. Fortunately, the rocking action associated with both articulated well cars and with tri-level equipment is minimal. A clearance improvement standard is complicated by "clearance creep" which results when roadways are periodically resurfaced. Clearances tend to erode over time as road beds are built up through multiple resurfacing cycles.

As a rule, railroads rarely allow less than a 4" buffer clearance. However, larger buffers may prove less expensive to maintain over the complete life cycle of the roadway. Hence, a 8" buffer may be preferable to a 6" buffer and both may be preferable to a 4" buffer. For the purpose of developing cost estimates for this study we have set a vertical clearance standard of 20' 8". This exceeds by 2" the clearance standard objective which Conrail set in earlier studies, although it falls below the 20' 11" standards which several western rail carriers have set. In any case, this standard clearance appears to be adequate to handle not only the current generation of high-profile equipment, but also the emerging generation.

III. Candidate Corridors

Corridor Options

Transmode has identified five potential corridors as candidates for clearance improvement within the State of Pennsylvania. All five corridors are main line rail segments which major Class I carriers maintain and operate as portions of their core service networks. In general, they are heavily used by the carriers who own them and represent strategic links within service networks which the carriers are committed to retain. Collectively, they represent a diversity of rail carrier interests within the State and they access a diversity of geographic markets. The candidate corridors include the following:

- **Conrail's Pennsylvania Main Line.** This is the heaviest density line segment within the Conrail system. This line runs from Philadelphia through Reading, Harrisburg, Altoona and Pittsburgh before proceeding to the Ohio State line. At the present time it is constrained in overhead clearance to 17"6."

- **Conrail's Susquehanna and New York Line.** This line includes a segment of the former Pennsylvania Main Line between Harrisburg and Philadelphia. At Harrisburg, however, it branches north along the Susquehanna River to Sunbury and then west to Olean and Buffalo, N.Y. where it ties into Conrail's "water route." The constraining overhead clearance on this line is currently 19' 6". The "water route" offers open clearances from Buffalo to Chicago.

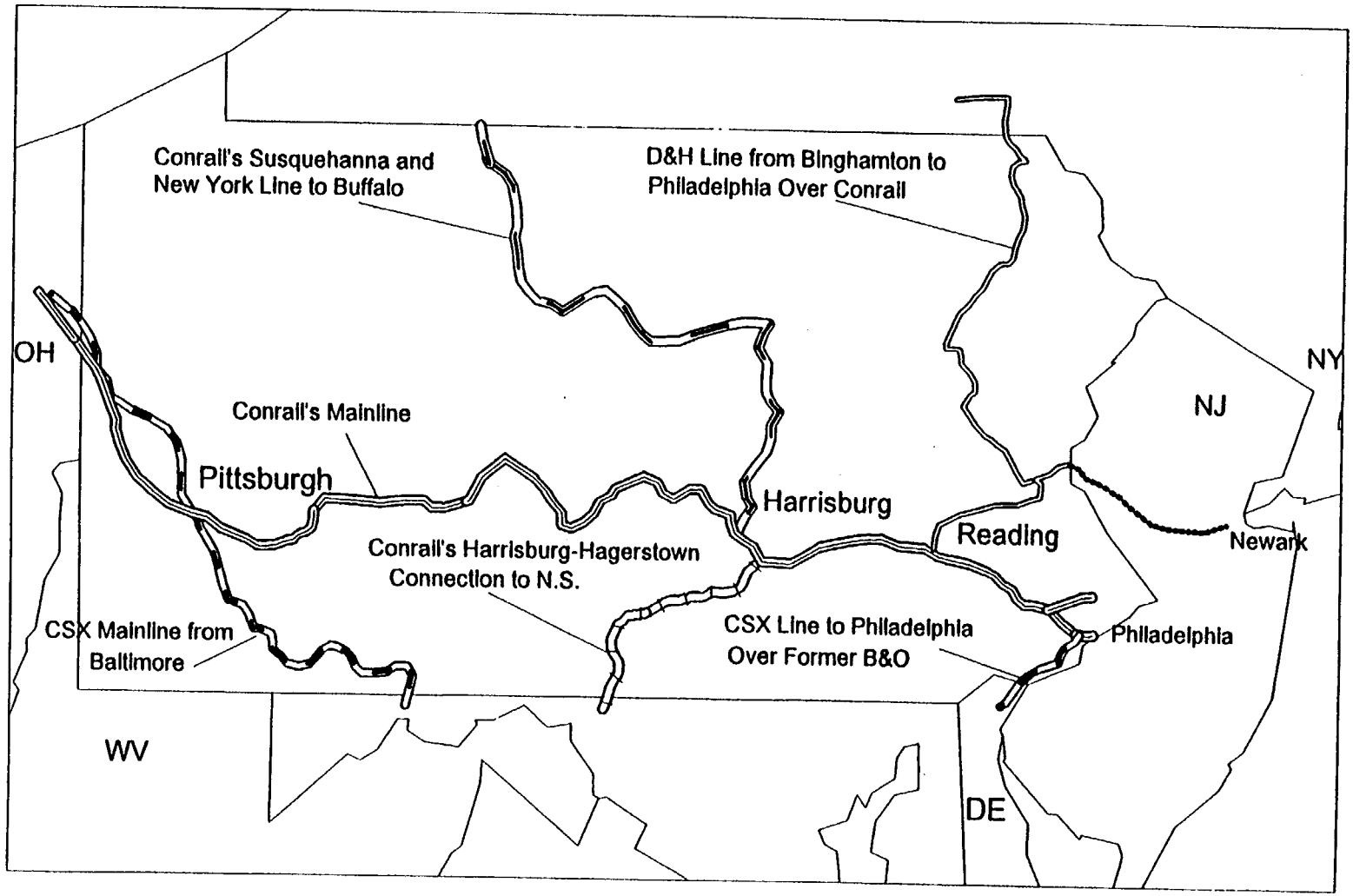
- **Conrail's Southern Line from Harrisburg to Hagerstown.** This line represents the principal "gateway" connecting Conrail to Norfolk Southern and points south. This line is partially clear south of Hagerstown on Norfolk Southern to handle 20' 2" equipment. However, Norfolk Southern has assured us that monies have been budgeted to clear the line to handle 20' 3" cars in 1993/94.

Corridor Options (continued)

- **CSX's line through Baltimore and west through Pittsburgh to Chicago.** CSX's former B&O line from the Delaware State line into South Philadelphia represents CSX's extreme extension into the northeast and serves both its intermodal ramp in South Philadelphia and its principal northeastern auto ramp in Twin Oaks. This line is currently constrained to 19' 3". However, CSX is exploring the feasibility of improving clearances over the entire B&O to handle 20' 2" equipment. Late in the study CSX requested that we reopen the scope of corridor options to include the Western Pennsylvania segment of the B&O which is currently constrained to 18' 2". This segment involves 187 miles of track. Currently it handles 30 trains per day including 5 intermodal trains. CSX has estimated the cost of this corridor, which is an integral part of the B&O Line into South Philadelphia, to be $8.02 million. However, earlier conversations with CSX had indicated that the carrier intended to proceed with this project independent of state investment. Additional, discussion with CSX may be in order regarding the carrier's plans for improving the B&O with and without Pennsylvania subsidy.

- **The CP Rail System's D&H line from Binghamton to Philadelphia.** This line represents the extreme southeastern extension of the CP Rail System and provides that carrier with a direct interchange in Philadelphia with both CSX and NS. The line is currently constrained to 17' 7". This line connects with D&H's east/west line in Binghamton and runs into Northeastern Pennsylvania to Wilkes Barre. The D&H operates over Conrail trackage rights between Dupont and Philadelphia. This route also includes trackage rights over CSX in the Philadelphia terminal. D&H operates into south Philadelphia on CSX between Park Junction and Greenwich Yard.

Rail Corridors Considered for Overhead Clearance



Corridor Options (continued)

In its original direction to Transmode, Penn DOT suggested that the study team explore all feasible alternatives. We believe that the set of corridor options outlined above represent a full set of corridor options. Several other corridor options were considered and dismissed. In the minutes of the August 25, 1992 State Transportation Advisory Committee meeting, Mr. Scott suggested that the study specifically test the feasibility of operating the Amtrak "auto train" into Pennsylvania and beyond Lorton, VA, its current Northeast terminus. However, insurmountable clearance obstacles, including the Potomac Yard Tunnel and the Northeast Corridor Catenary System prohibit the operation of 19' 2" "auto trains" beyond Alexandria, VA. A second member of the Advisory Committee, Mr. Ganell, asked whether short line operations could be considered as viable "high-profile" routes. The possibility of short lines participating in the routing of either doublestack domestic container trains or tri-level autos is extremely remote. For numerous reasons, Class I rail carriers tightly control the routing of intermodal and auto setup traffic. Both of these traffic elements are among the most service sensitive which rail carriers currently handle. "Truck competitive" service reliability requires direct routing, minimum interlining and well-maintained high speed track and structures. As a consequence, short line participation in "high-profile" business segments is simply not viable.

Option 1: Conrail's Pennsylvania Main Line

This line connects from Cleveland in the West, where it meets the former New York Central "water route" and runs to Reading in the East and Philadelphia and Newark, New Jersey, beyond. This route is Conrail's most direct route for east/west intermodal service. It is also Conrail's highest density main line. Indeed, the segment between Harrisburg and Reading exceeds 101 million gross tons and represents the highest density rail line in the country. Segments which make up this route are components in two other CR segments, which we considered for clearance improvement.

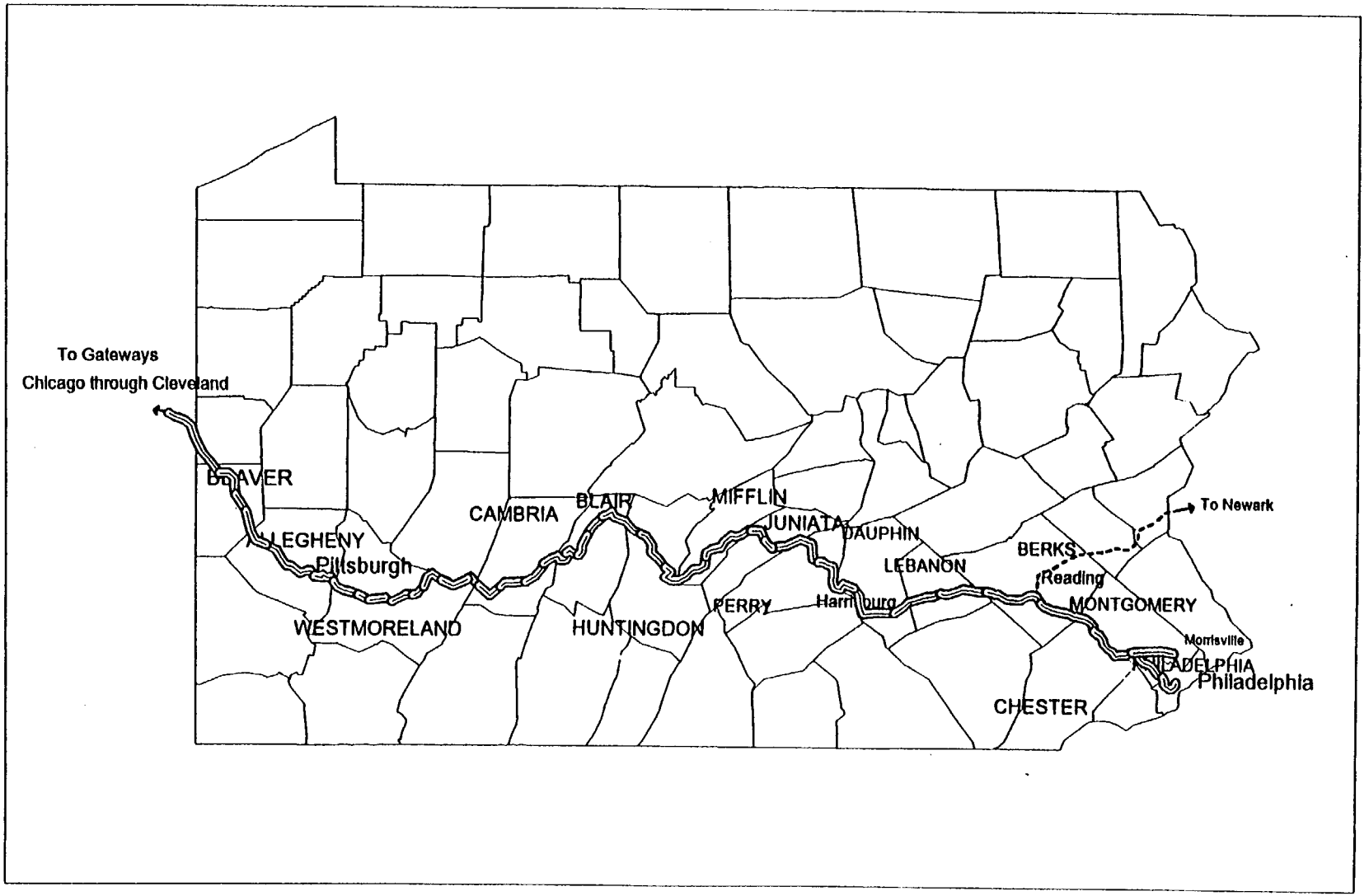
The maps on the following pages show the geography of this route through Pennsylvania and explain connections beyond the Pennsylvania border. The table below identifies the principal population centers and the Pennsylvania counties which the route serves. The table on the following page highlights some of the key aspects of this route which have relevance to a potential public investment in it. Note that among the several Conrail route options under consideration, this option is the one which Conrail management most enthusiastically endorses. Open clearances on the Pennsylvania Main Line offer several benefits to Conrail: 1) A cleared line offers Conrail significantly superior E/W intermodal routes suitable for domestic container operations between Chicago, its principal Western gateway, and southeastern Pennsylvania and northern New Jersey. Conrail plans to open this route not only to Chicago, but also to St. Louis in the near future. 2) A cleared line also offers a more direct and efficient route for repositioning tri-level autorack cars from Delaware and New Jersey ramps. Auto companies are increasingly concerned with equipment utilization and routing efficiency. Conrail routes are currently highly circuitous.

Route Demographics

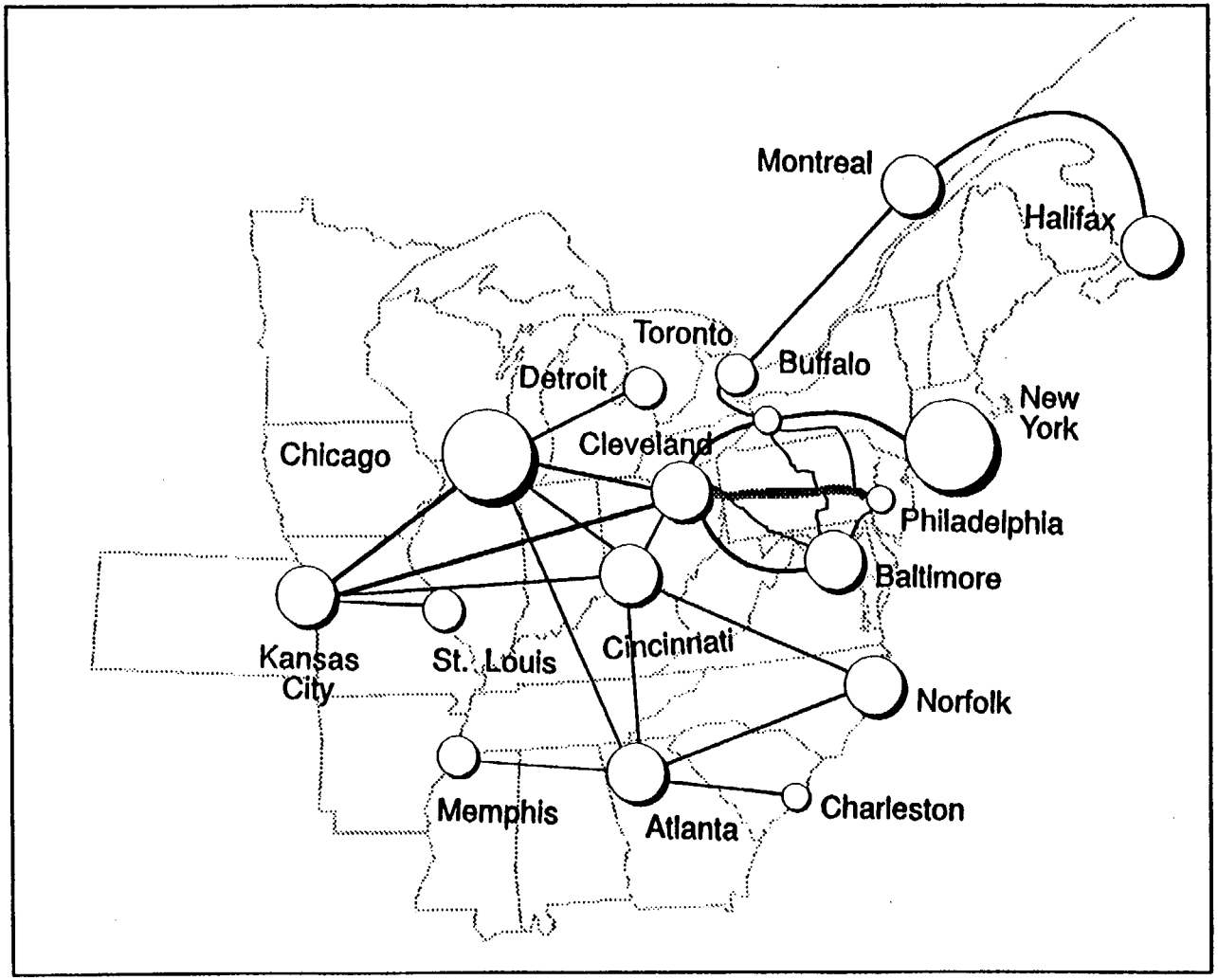
County	Population	Manufacturing No. of Employees	No. of Establishments	Principal Markets
Allegheny	1,336,449	82,802	1,628	Pittsburgh
Beaver	186,093	8,786	174	
Berks	336,523	48,503	613	Reading
Blair	130,542	9,999	141	Altoona
Cambria	163,029	9,215	168	Johnstown
Chester	376.396	30,911	641	
Dauphin	237,813	23,857	240	Harrisburg
Huntingdon	44,164	2,892	66	
Juniata	20,625	2,686	52	
Lebanon	113,744	11,180	195	Lebanon
Mifflin	46,197	6,236	62	
Montgomery	678,111	90,215	1,536	
Perry	41,172	644	32	
Philadelphia	1,585,577	88,981	1,745	Philadelphia
Westmoreland	370,321	23,219	495	
Total	5,666,756	440,126	7,768	

Line Segment	Commercial Rationale	Clearance Constraints Beyond Pennsylvania	Degree of Management Commitment	Strategic Significance
Conrail's Pennsylvania Main Line	Conrail's principal E/W corridor is constrained by clearances so that neither conventional doublestacks nor 19' 2" tri-level autorack cars currently move via this route. Conrail would like to develop a Midwest/ Philadelphia domestic container service and also reclaim lost autorack business. The route offers the potential of linking several established Conrail Terminals -- Morrisville, Allentown, Harrisburg -- with Conrail's principal Western gateway, Chicago. It also offers the potential to route fully enclosed tri-level autorack cars more directly to New Jersey and Delaware plants and auto ramps.	Conrail is prepared to clear Ohio routes beyond the Pennsylvania State Line, at its own cost, which would facilitate the movement of S.E. Pennsylvania traffic to and from the Chicago gateway. The cost of these improvements is approximately $3.1 million. Beyond Chicago rail routes are open to 20' 2" plus. A related set of concerns involves clearances beyond Reading into New Jersey via Allentown. It should be noted that this route extension would allow Conrail to operate more efficiently to and from New Jersey-based intermodal auto facilities which compete with Pennsylvania-based facilities.	Conrail is publicly committed to "open" this corridor. Conrail has underway an "in-house" study to determine what investment levels can be justified for internal financing. The carrier is prepared to commit its own resources up to this level. Conrail has also publicly established the development of motor carrier sponsored domestic container service as a high priority market initiative.	This route should provide both Eastern and Central Pennsylvania with new E/W domestic container services which are superior in transit time to those available anywhere else in the East, including competing services into Northern New Jersey, Baltimore and Norfolk.

Pennsylvania Main Line



Network Context of the Pennsylvania Main Line



Option 2: Conrail's Susquehanna and Buffalo Route

This line runs east from Buffalo through Olean, N.Y., Williamsport and Sunbury into Harrisburg where it joins the Pennsylvania Main Line. This is the route over which tri-level cars currently move to and from Conrail-served ramps and auto plants on the East Coast. This route has medium traffic density, 20 million gross tons between Loch Raven and Williamsport. The merits of this route are twofold: 1) The route offers multiple routing options, including N/S routing via Buffalo into Ontario and E/W routing via Buffalo into Chicago. With investment in a single line the State would open both N/S and E/W corridors. 2) It is also relatively low cost to clear to 20'6", compared with the Pennsylvania Main Line ($18 million vs. $53 million). Indeed, the Susquehanna/New York line is already clear to 19' 6" and it has no major tunnel or bridge obstacles. Altogether only 15 obstacles would require removal on this route. However, the route is more circuitous than the Conrail Main Line which connects the same set of E/W markets. As other competing E/W routes are cleared, this line would create little competitive advantage for Conrail in the emerging domestic container market, based on "superior direct routing capabilities."

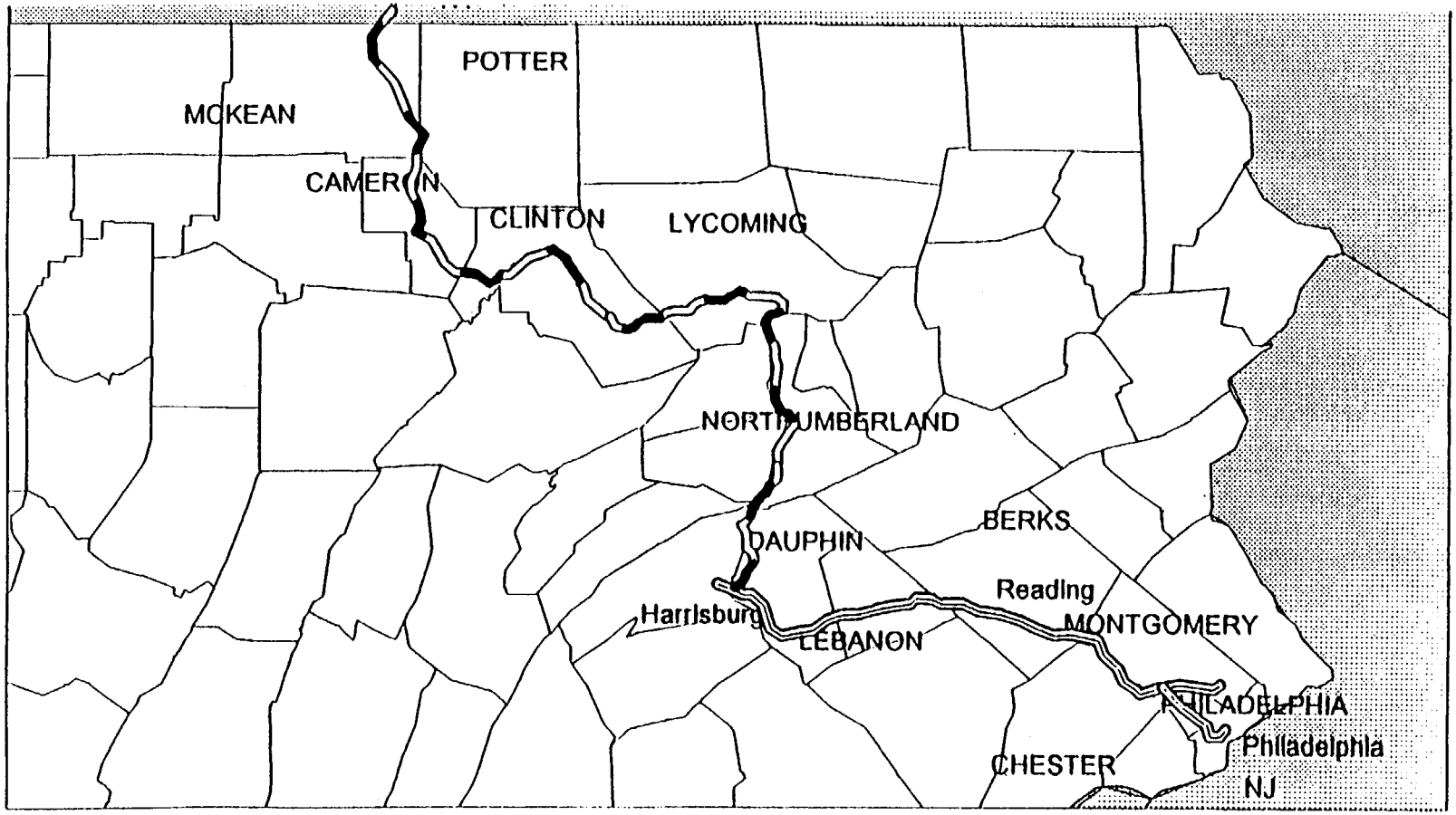
The table below represents the counties and major Pennsylvania population centers which the route serves. The map which follows represents the network context of this line segment including connections beyond the Commonwealth's borders. The table on the next page highlights some of the key aspects of this line which affect its merit as a public investment.

Route Demographics

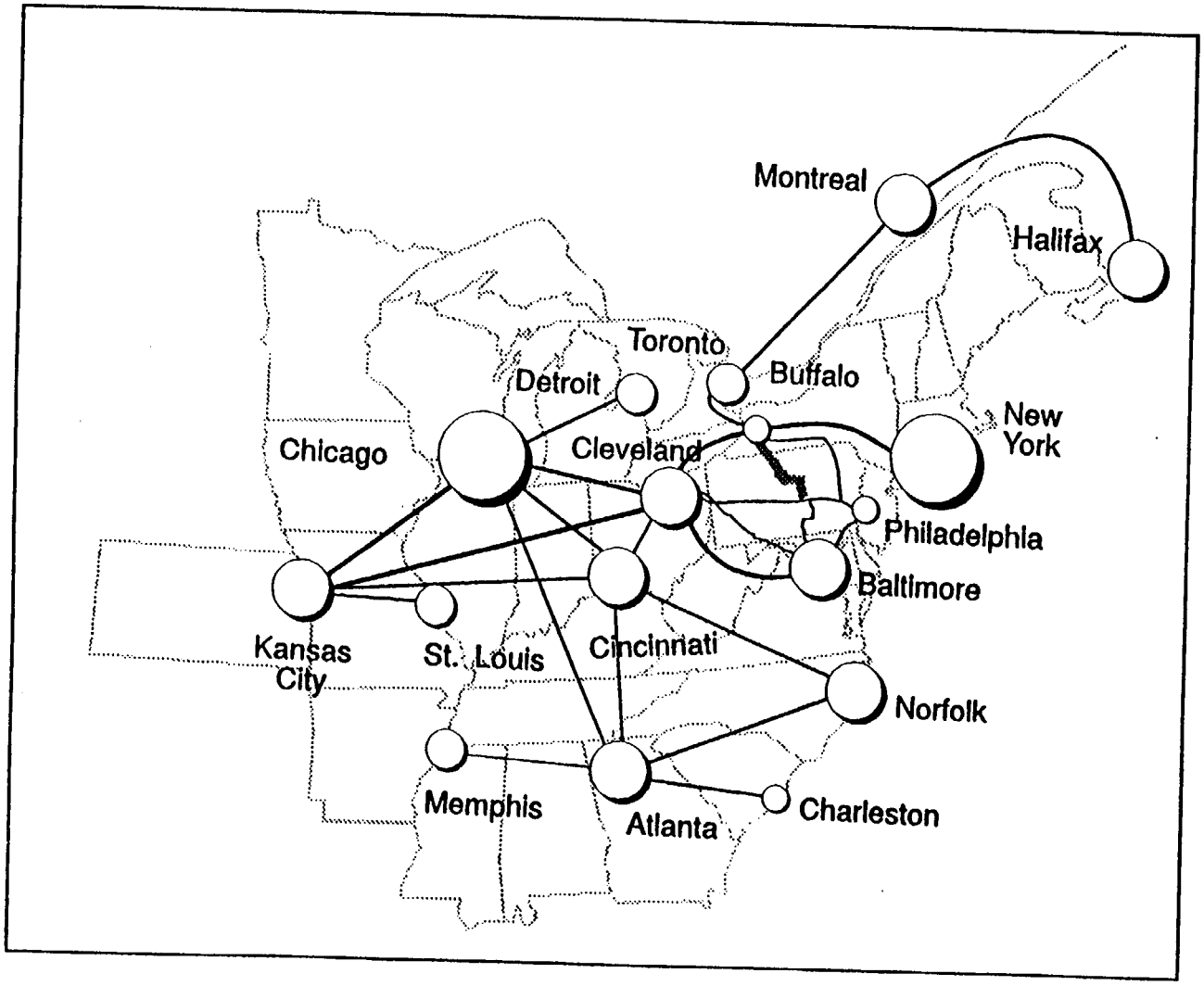
County	Population	Manufacturing No. of Employees	No. of Establishments	Principal Markets
Berks	336,523	48,503	613	Reading
Cameron	5,913	947	18	
Chester	376,396	30,911	641	
Clinton	37,182	3,528	55	
Dauphin	237,813	23,857	240	Harrisburg
Lebanon	113,744	11,180	195	Lebanon
Lycoming	118,710	16,289	219	Williamsport
McKean	47,131	5,240	76	
Montgomery	678,111	90,215	1,536	
North Cumberland	96,771	11,216	128	
Philadelphia	1,585,577	88,981	1,745	Philadelphia
Potter	16,717	1,236	42	
Total	3,650,588	332,103	5508	

Line Segment	Commercial Rationale	Clearance Constraints Beyond Pennsylvania	Degree of Management Commitment	Strategic Significance
Conrail's Susquehanna and New York Line	This line offers a north/south service dimension via Buffalo, as well as an east/west dimension via Chicago. However, this line is significantly more circuitous than the Pennsylvania Main Line in providing east/west intermodal service between eastern/central Pennsylvania and the Midwest. The line is already clear to 19' 6" and is less expensive to clear to 20' 6" than the Pennsylvania Main Line.	This line ties into Conrail's "water route" at Buffalo which is clear to 20' 6" into Chicago. This is the route over which loaded and empty tri-levels are currently routed into New Jersey auto ramps and auto plants.	Conrail's management believes that this route will not allow 2nd morning domestic container services from Chicago -- service levels which are required if Conrail is to be "truck competitive." Conrail's management rejects this route option in favor of the Pennsylvania Main Line E/W	This route would provide Conrail with both north/south and east/west intermodal and auto services comparable to those which D&H could offer via Binghamton/Wilkes Barre/ Reading/Philadelphia. However, it would level the "service quality" advantage which Conrail currently enjoys *vis a vis* D&H and CSX and, if second morning service cannot be guaranteed, it may inhibit domestic container service development, as well.

Conrail's Susquehanna and Buffalo Route



Network Context of Conrail's Susquehanna and Buffalo Route



Option 3: Conrail's Harrisburg to Hagerstown Line

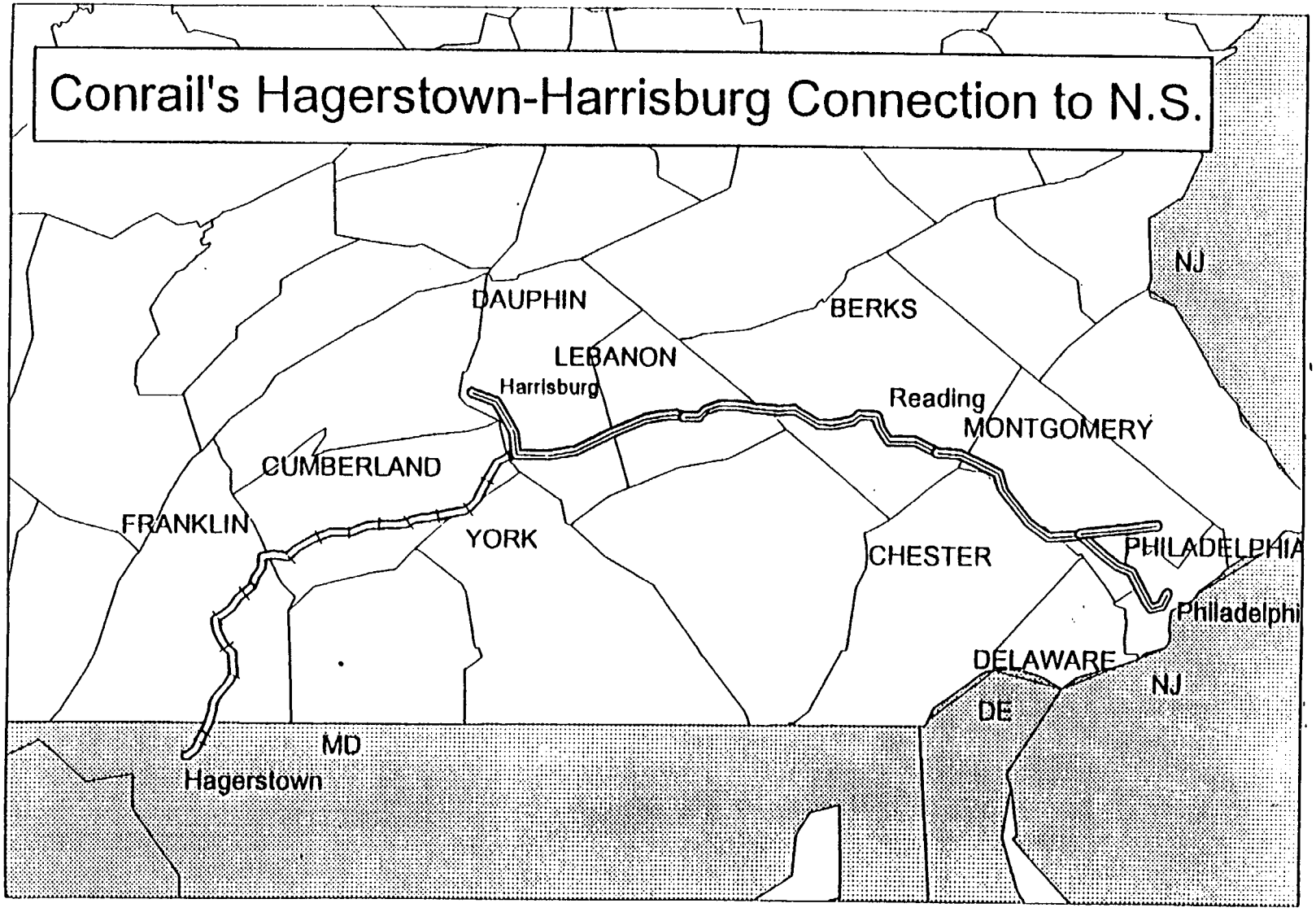
This line represents the principal connection between Conrail and Norfolk Southern. Traffic over this line has increased from 10.0 million gross tons in 1988 to 17.3 million gross tons in 1990. This reflects the growing level of traffic activity between the two carriers. The line remains, however, one of average density in the context of the overall Conrail System. South of Hagerstown, Norfolk Southern is in the process of developing line clearances adequate to handle domestic container equipment. This corridor, in combination with the Pennsylvania Main Line east of Harrisburg could allow the two carriers to develop a new north/south intermodal route from Newark and Philadelphia to Atlanta -- one over which stack trains could operate.

The map on the following page represents the geography of this route and the Pennsylvania counties it traverses. A second map highlights the network connections and service lanes, which would be available for "high-profile" operations if this line were opened. The table on the next page reviews key considerations which affect the viability of this route, as an object for public investment. Note that Conrail's position with regard to this route is that it falls below the Pennsylvania Main Line in importance and should not be considered as a priority option for public investment.

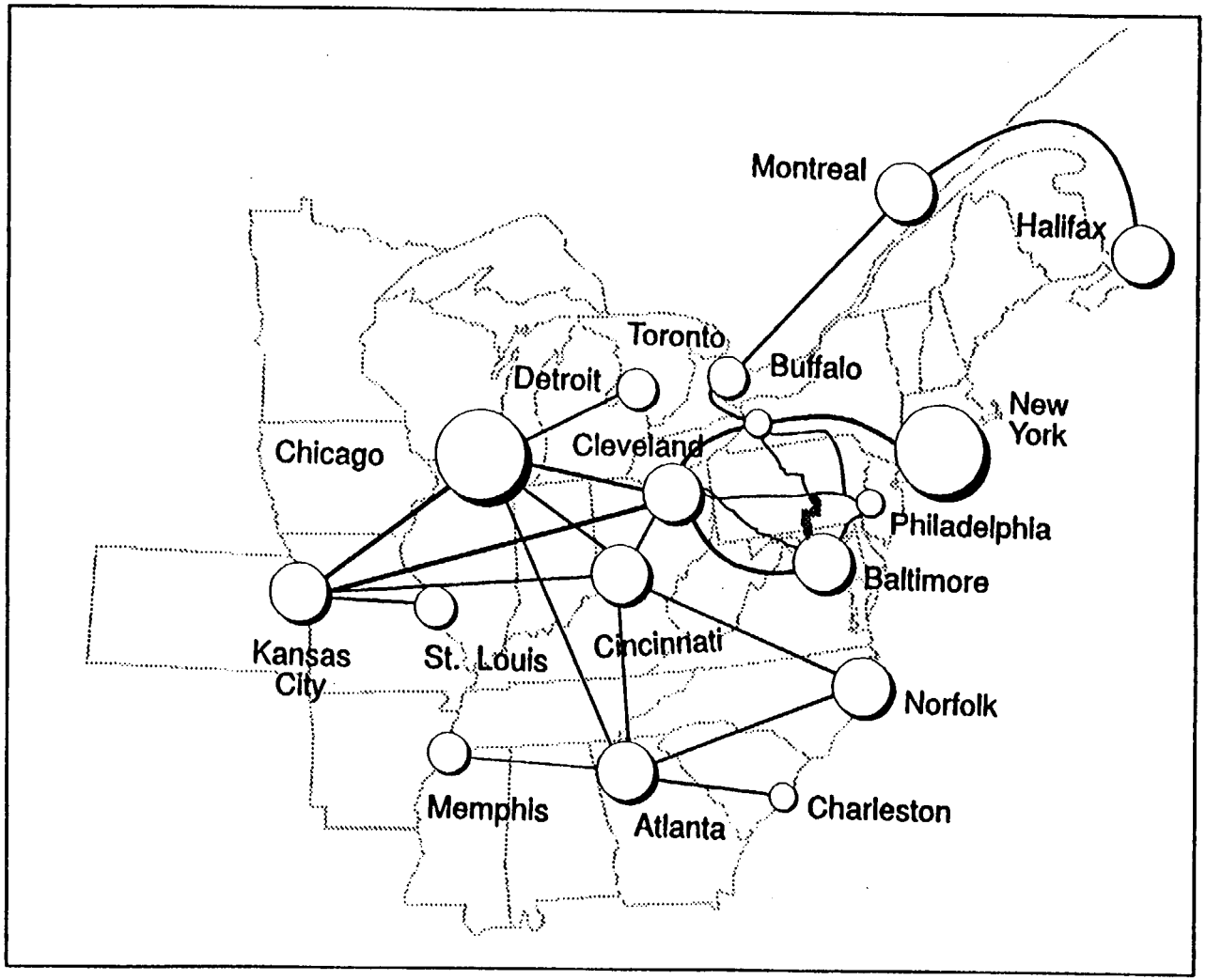
Route Demographics

County	Population	Manufacturing No. of Employees	No. of Establishments	Principal Markets
Berks	336,523	48,503	613	Reading
Chester	376,396	30,911	641	
Cumberland	195,257	16,007	210	
Dauphin	237,813	23,857	240	Harrisburg
Franklin	121,082	13,743	190	
Lebanon	113,744	11,180	195	Lebanon
Montgomery	678,111	90,215	1,536	
Philadelphia	1,585,577	88,981	1,745	Philadelphia
York	339,574	51,889	657	York
Total	3,984,077	375,286	6,027	

Line Segment	Commercial Rationale	Clearance Constraints Beyond Pennsylvania	Degree of Management Commitment	Strategic Significance
Conrail's Harrisburg to Hagerstown Line	The Hagerstown "gateway" with Norfolk Southern has become increasingly important to Conrail in recent years. This gateway is currently constrained to 17' 6". Neither enclosed tri-levels nor TOFC flatcars can be handled via this route. Cincinnati is the easternmost gateway which is "open" for enclosed tri-level traffic. If the corridor were cleared, central and eastern Pennsylvania would be connected to Charlotte and the South via NS. NS apparently is committed to clearing its lines between Hagerstown and Charlotte.	The NS is currently constrained to 19' 3" on the Charlotte line. However, NS is in the process of opening its lines into Hagerstown to handle 20' 2" domestic containers. NS has committed $4 million in its 1993 capital budget to make these improvements.	Conrail has no interest in using public monies to open this route. Conrail's position is that "if the route makes commercial sense" it will be cleared with Conrail's own investment dollars. Conrail management declined to provide either operating or investment data on this segment. Clearly, this line is a "non-starter."	If this route were opened it would allow for the first time an efficient north-south intermodal service in the East. It would also materially improve the movement of tri-level equipment to and from the South. Tri-levels are currently routed Cincinnati/Buffalo/ Harrisburg to the east. This is the only southern corridor option available to the Commonwealth since CSX is constrained by clearance restrictions north of Alexandria, VA. If this corridor were opened it would tilt competitive balances between CSX and NS, in favor of NS.


Conrail's Hagerstown-Harrisburg Connection to N.S.
NJ
DAUPHIN
BERKS
LEBANON
Harrisburg
Reading
MONTGOMERY
CUMBERLAND
FRANKLIN
YORK
CHESTER
PHILADELPHIA
Philadelphi
DELAWARE
NJ
DE
MD
Hagerstown

Conrail's Hagerstown-Harrisburg Connection to N.S.



Option 4: CSX's former B&O Line into South Philadelphia

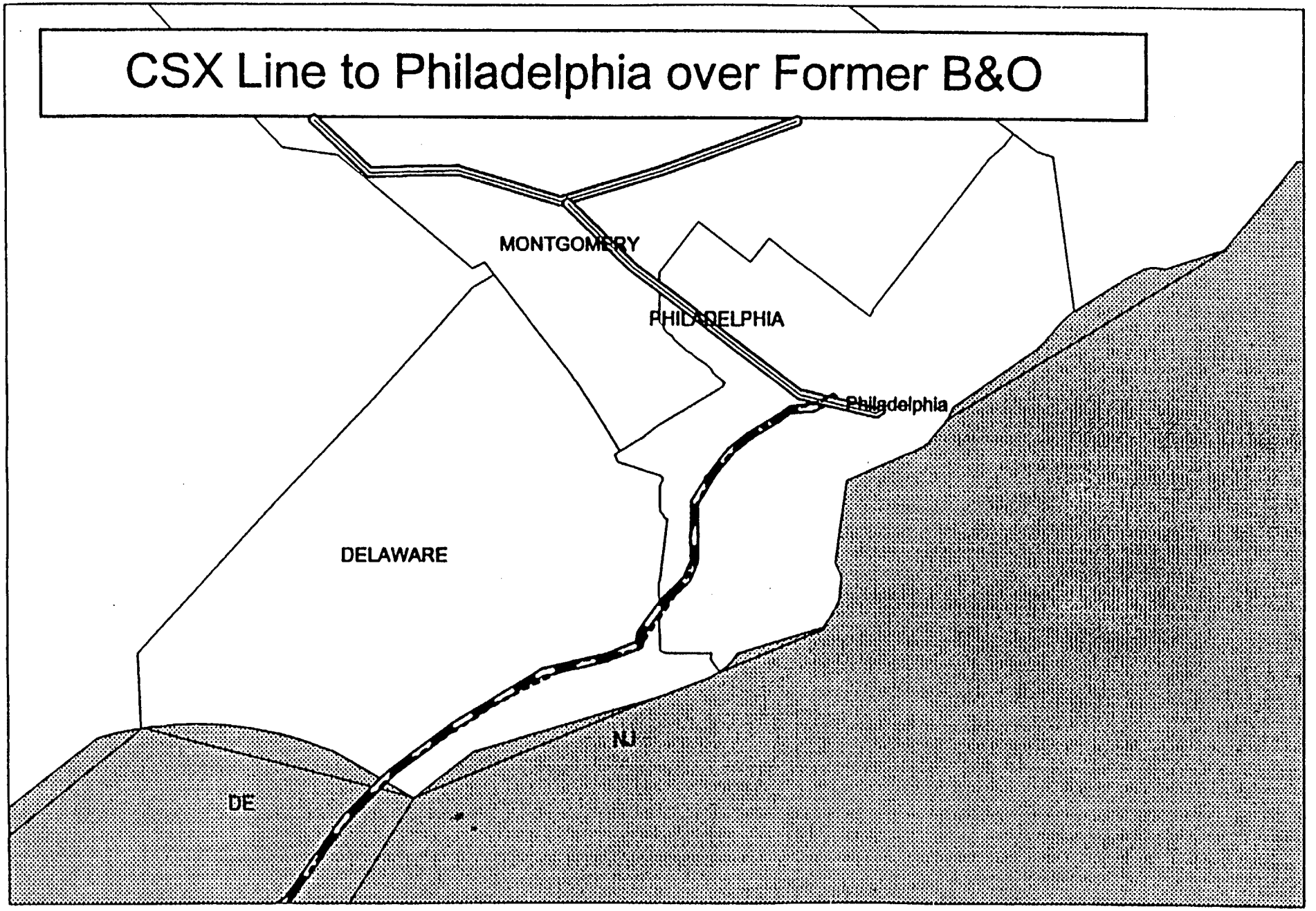
This corridor option could help to secure the position of CSX, the rail carrier whose southeastern Pennsylvania market share -- both in the auto setup and the intermodal markets -- has increased most significantly during the past decade. CSX has a strong position in the E/W intermodal market. It operates two daily intermodal train services in and out of its intermodal terminal at Packer Avenue in South Philadelphia. CSX also operates a large auto ramp in southeastern Pennsylvania at Twin Oaks from which it serves the entire Northeast. Philadelphia represents the Northeast terminus of the CSX system and from this base CSX competes with Conrail for both intermodal and auto traffic throughout the entire region. However, CSX has several competitive disadvantages in serving the southeastern Pennsylvania market. Currently, CSX cannot handle 20' 2" Chrysler tri-levels into its Twin Oaks auto ramp. Neither can CSX operate doublestacked ISO container trains in and out of South Philadelphia. CSX's Twin Oaks is among the most modern and largest capacity auto ramps in the East. CSX's South Philadelphia intermodal terminal is cramped and probably not scheduled for domestic container traffic. Moreover, CSX's intermodal service into South Philadelphia is one day slower than Conrail's service into Morrisville. However, CSX's market share is larger than Conrail's in southeastern Pennsylvania. In both auto and intermodal markets CSX has played the role of "spoiler" *vis a vis* Conrail and has put downward price pressure on that carrier.

The table below represents the counties which the CSX route serves. The map on the following page represents the network context of the CSX route, including connections beyond the border of the Commonwealth. The table on the following page recaps some of the strategically significant aspects of this corridor option.

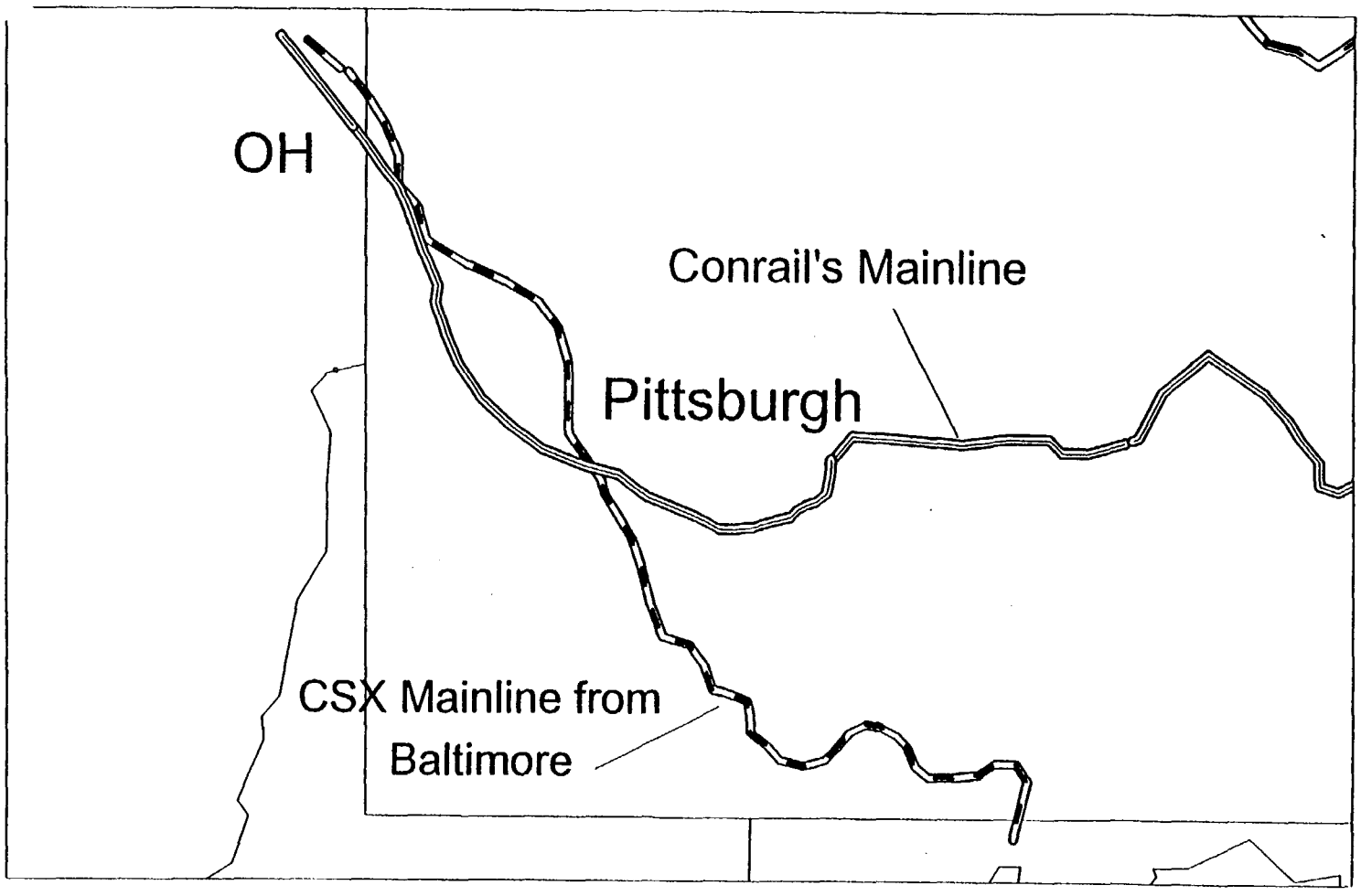
Route Demographics

County	Population	Manufacturing No. of Employees	No. of Establishments	Principal Markets
Delaware	547,651	34,312	590	
Philadelphia	1,585,577	88,981	1,745	Philadelphia
Total	2,133,228	123,293	2,335	

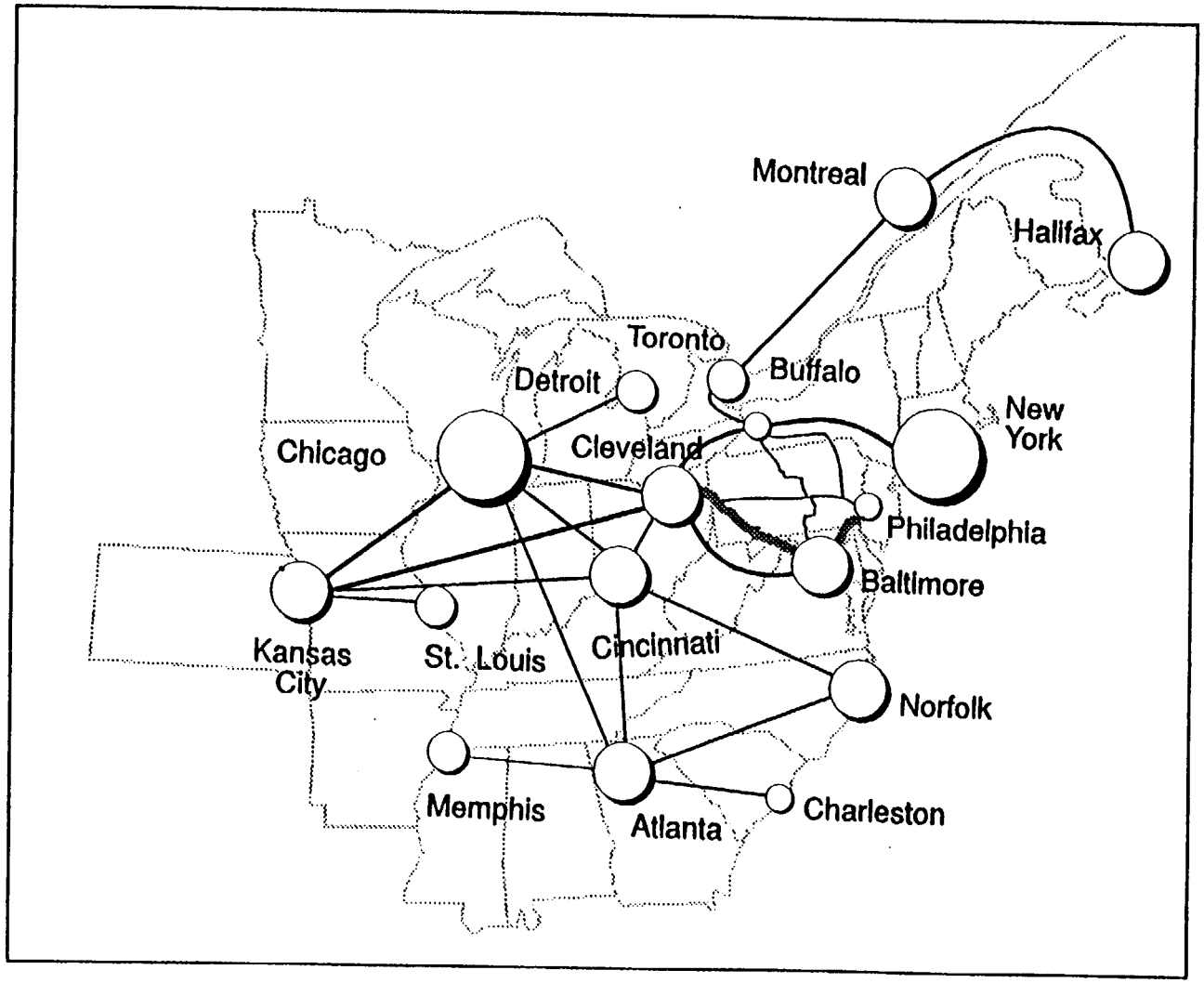
Line Segment	Commercial Rationale	Clearance Constraints Beyond Pennsylvania	Degree of Management Commitment	Strategic Significance
CSX's former B&O line from the Common-wealth line into South Philadelphia CSX's Western Pennsylvania segment of the B&O from the Maryland State line to the Ohio State line.	This line represents the furthest northeast extension of the CSX network. It serves CSX's intermodal terminal in South Philadelphia and the auto ramp in Twin Oaks from which CSX competes with Conrail for traffic throughout the Northeast. This route allows CSX to compete for the Chicago-Philadelphia intermodal traffic and to bring setup autos into the Twin Oaks terminal in South Philadelphia.	CSX has underway a study of clearance constraints between Chicago and Baltimore. This "clearance" project would open the entire route into Chicago. The only question which remains is the viability and cost of opening the Howard Street tunnel under Baltimore. If it proves feasible to clear this tunnel the entire E/W route can be opened to 20'6".	CSX management is interested in opening its Twin Oaks auto terminal to 20' 2" and in interchanging 19' 6" tri-level equipment directly with the D&H. The intermodal business group however is more qualified in its enthusiasm for this project. CSX appears to be shifting its position with regard to changing the entire B&O. Initially, the carrier indicated that it intended to clear the B&O into Baltimore without State subsidy. Subsequently CSX has indicated a need for assistance not only on the Delaware/South Philadelphia segment of the B&O, but on the western Pennsylvania segment as well.	If this route is opened to 20'6" it will provide a second domestic container and/or doublestack container option for southeastern Penna.....this in addition to Conrail. Thus, it would maintain existing competitive balances.


CSX Line to Philadelphia over Former B&O
MONTGOMERY
PHILADELPHIA
Philadelphia
DELAWARE
NJ
DE

CSX Main Line from Baltimore



CSX Line to Philadelphia over Former B&O and Main Line from Baltimore



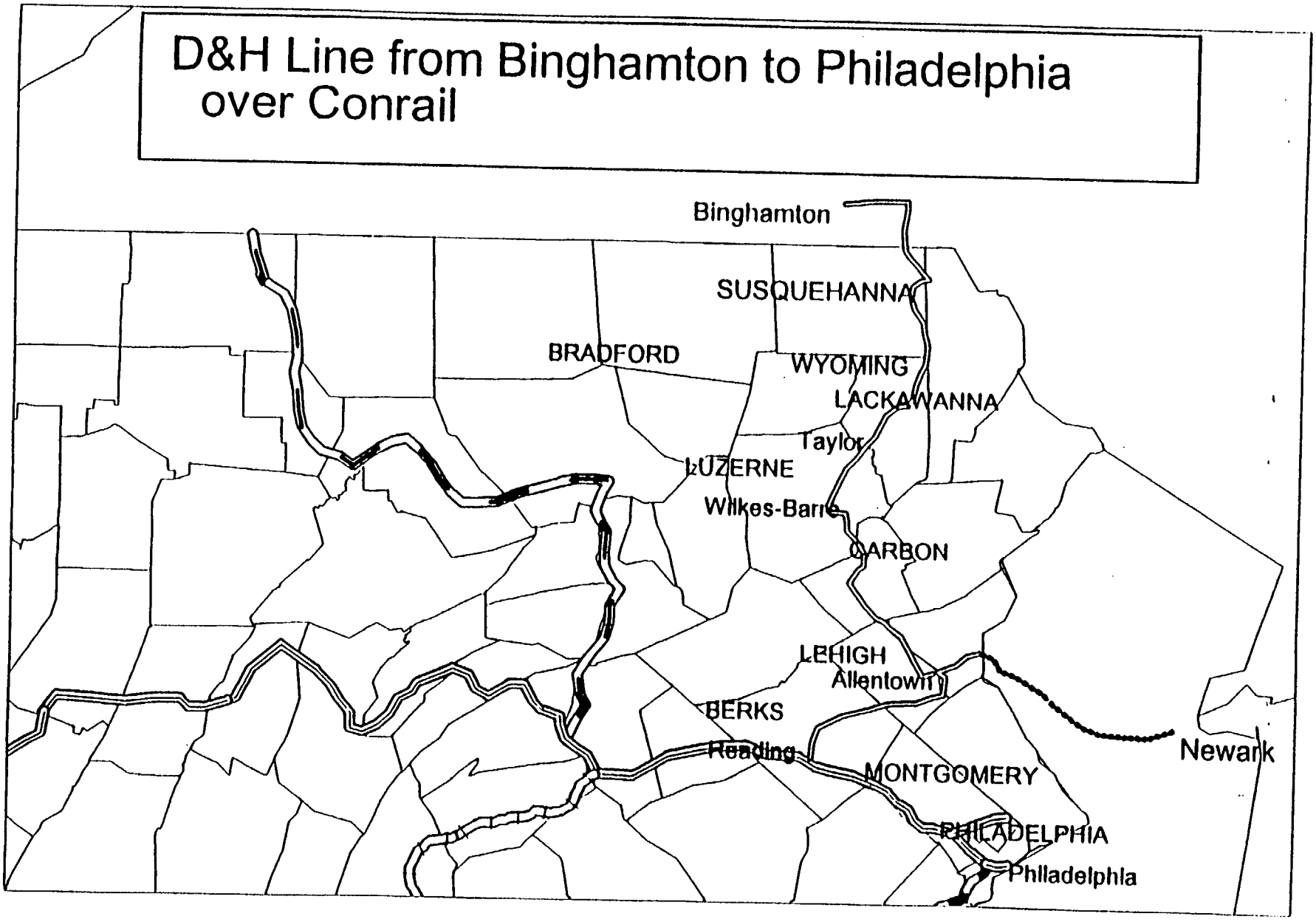
Option 5: D&H's Line from Binghamton, NY to South Philadelphia

This route connects northeastern Pennsylvania "high and wide load" shippers to the Port of Philadelphia. It would also open the Port of Philadelphia to both N/S and E/W doublestack container service and would link southeastern Pennsylvania to auto traffic originating on the Canadian Pacific System, including the Soo Line. Beyond Pennsylvania borders, proposed clearance improvement projects currently on the drawing board would open this route to east/west (Chicago) doublestack service, as well as to north/south service (Boston/Toronto). The D&H subsidiary of CP Rail has a limited local traffic base. Connections beyond Philadelphia with CSX and NS, as well as intermodal and auto traffic developed from a Philadelphia service platform, represent the railroad's most viable traffic growth opportunities. Hence, this project is of essential strategic importance to CP System.

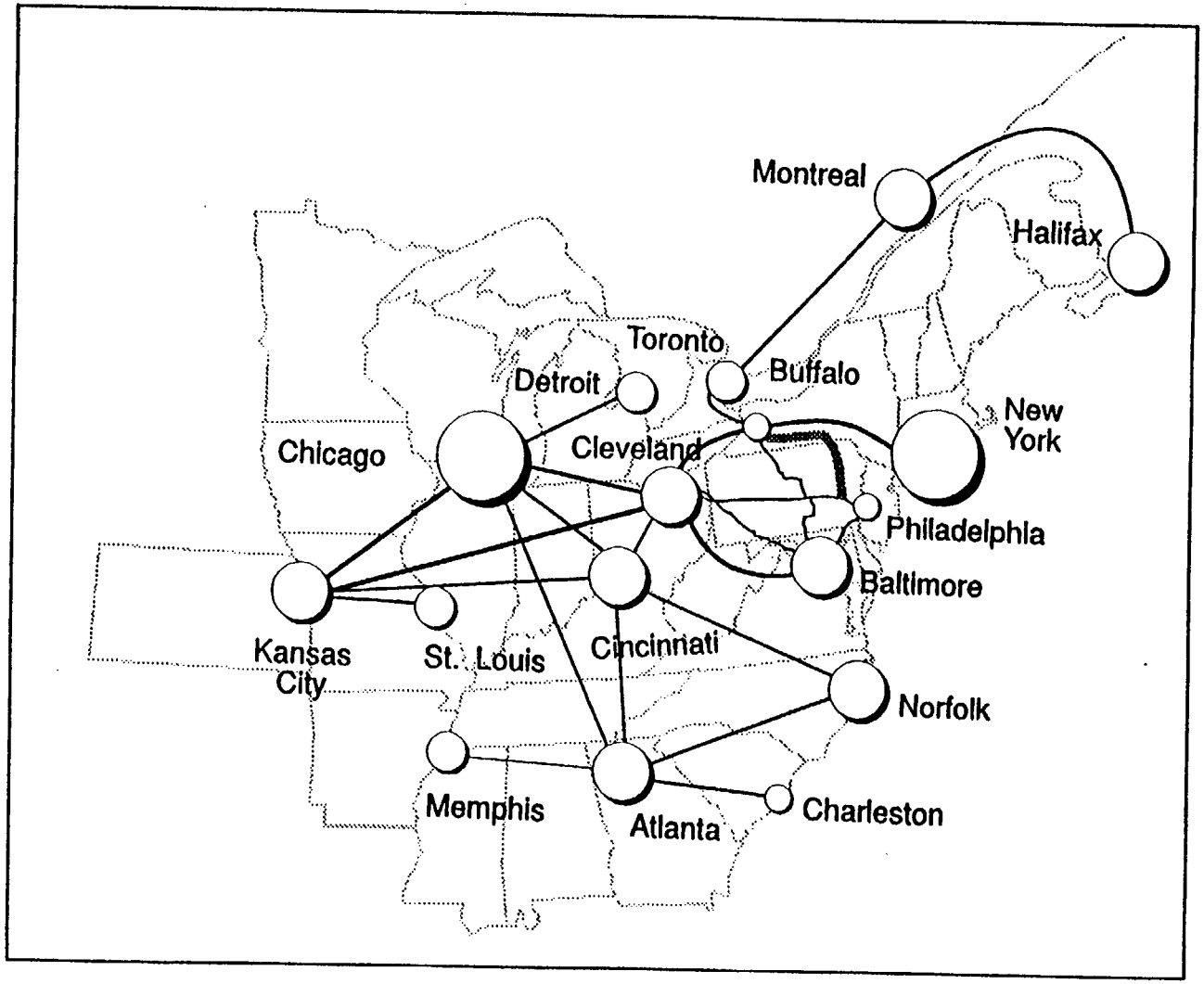
CP Rail pioneered in the domestic container market in North America with its introduction of "single-stack" spine cars in the early 1970s. However, the development of domestic containerization in the U.S. appears to be taking a somewhat different direction than it did in Canada. CP Rail's "head start" in Canada may not prove to be much of an advantage in the U.S. market and the principal thrust of CP Rail marketing programs probably will not take aim initially at domestic containerization. The map which follows represents the counties and population centers within Pennsylvania which are served by this route. The table on the following page represents key factors which affect the merits and viability of this route.

County	Population	Manufacturing No. of Employees	No. of Establishments	Principal Markets
Berks	336,523	48,503	613	Reading
Carbon	56,846	4,728	85	
Chester	376,396	30,911	641	
Lackawanna	219,039	25,280	361	Scranton
Lehigh	291,130	36,389	473	Allentown
Luzerne	328,149	29,418	500	Wilkes-Barre Hazelton
Montgomery	678,111	90,215	1,536	
Philadelphia	1,585,577	88,981	1,745	Philadelphia
Susquehanna	40,380	2,024	54	
Wyoming	28,076	4,602	39	
Total	3,940,227	361,051	6,047	

Line Segment	Commercial Rationale	Clearance Constraints Beyond Pennsylvania	Degree of Management Commitment	Strategic Significance
Canadian Pacific's D&H Route	Currently, the D&H cannot haul either fully enclosed tri-levels or doublestack containers to and from southeastern Pennsylvania. If this route is cleared, it would improve D&H's interchange with CSX and NS in Philadelphia and would facilitate the handling of containers between Philadelphia and Toronto, Chicago and Boston. This route "opening" is critically important to CP Rail's market development plans.	The D&H is currently working with New York State to open its northern route to 20'6" and with the Commonwealth of Massachusetts to do the same thing eastbound into Boston. The CP Rail System is clear to 20'11" throughout Canada. However, it still cannot move doublestack or autorack cars through the Detroit River Tunnel which it owns jointly with Canadian National.	This is a high strategic priority for the D&H. The D&H lacks a local rail customer base. Intermodal and auto set-up traffic are the two most viable ways to "densify" the carrier's service network. Management is committed to cost sharing arrangements with the Commonwealth based on 30/70 or 20/80 formulas. Their position of enthusiastic support for this route is well known.	This line improvement would significantly increase the marketability of CP Rail's north/south services. The Port of Philadelphia would be a direct beneficiary of this service, since the largest market segment which CP has developed to date is import/export container traffic...


D&H Line from Binghamton to Philadelphia over Conrail
Binghamton
SUSQUEHANNA
BRADFORD
WYOMING
LACKAWANNA
Taylor
LUZERNE
Wilkes-Barre
CARBON
LEHIGH
Allentown
BERKS
Reading
MONTGOMERY
PHILADELPHIA
Philadelphia
Newark

Network Context of the D&H Line from Binghamton to Philadelphia over Conrail



IV. Assessment of Alternatives

Baseline Parameters

At this point in the study, we narrowed our focus by evaluating all five of the feasible corridor alternatives broadly and then winnowing these five down to a smaller set of options which will become the focus of cost/benefit analysis in subsequent study phases. The tables on the following pages represent the "rough" user impact and operating parameters for each of the corridor options which were developed early in the study and used to narrow down the options. On the following page we developed several parameters into a corridor scorecard.

Parameters Which Measure Investment Efficiency

Alternative Corridors	Miles	Preliminary Estimated Clearance Cost	Avg. Gross Tons (Mgt)	Average Number of Trains Per Day	Clearance Constraints	"High-Profile" Market Opportunities
Conrail's Pennsylvania Main Line	404	$51,868,000	88	26	17' 6"	
Conrail's Susquehanna & New York Line	332.1	Not Available	20	4	19' 6"	
Conrail's Harrisburg & Hagerstown Line	137.6	Not Available	19	16	20' 3"	
CP Rail D&H's Philadelphia Binghamton	252	17,517,000	10	4	17' 7"	
CSX's Eastern Penn. Line	20	1,733,000	14	16	19' 3"	
CSX's Western Penn Line	187	5,657,000	34	25	18' 2"	

Parameters Which Represent Operating Baseline

Alternative Corridors	Route Miles	Average Speed	Maximum Speed	Controlling Grade	Most Restrictive Curvature	Current Clearance Restrictions	Gross Tons
CR: Penna. Main Line	404	42.4 mph	60 mph	2.27%	9°15"	17'6"	88 million
CR. Susquehanna and Buffalo	332.1	36.1 mph	50 mph	2.1%	11'7"	19'6"	20.2 million
CR: Harrisburg and Hagerstown	137.6	39.0 mph	40 mph	Not Available	Not Available	Not Available	19.4 million
CSX: B&O into S. Philadelphia	20	27.8 mph	50 mph	1.44%	8°19"	19'3"	14.0 million
CSX: B&O Line in Western Pennsylvania	187	40 mph	50 mph	2.0%	10°30"	18' 2"	34
CP Rail: D&H Main Line	252	38.8 mph	60 mph	1.41%	13°	17'7"	7.6 million CP-4.1 mil CR-3.5 mil

Corridor Scorecard

The chart on the following page attempts to evaluate systematically the risks and rewards associated with each of the five alternative corridor strategies. The cells in the matrix are scored on a scale of 0 to 10, with 0 representing the least favorable outcome and 10 representing the most favorable outcome. Intermediate options are scored within these ranges. Also, since not all risk factors are equally important, we ranked individual factors on a scale of 1(least important) to 6(most important). The scores under each criterion were weighted by the significance of each criterion to arrive at a weighted total score.

The key risk factors which we used are discussed below:

- **Local Economic Development Benefits.** Scale of importance is 6. Economic benefits are directly related to traffic volume and the market potential likely to result under each corridor option. This is a rough and, at this point, subjectively determined criterion which was refined in the next phase of the study. The greater the number of users of "high-profile" rail service, the greater is the net social benefit. Under this criterion scores range from 10 for Option 1 to 3 for Option 3.

- **Rail Commitment.** Scale of importance is 5. Without a genuine commitment from participating rail carriers neither matching funds nor subsequent service development efforts are likely to be forthcoming. Under this criterion we determined the interest and importance of specific corridor clearance projects to specific carriers. Under this criterion, scores range from 10 for Option 1 to 0 for Options 2 and 3.

Corridor Score Card (continued)

- **Cost of Improvements.** Scale of importance is 4. The cost associated with individual clearance projects is an important factor which directly affects the risk and social benefit payback of Commonwealth investment. Of all the alternatives, Option 1 represents the most costly option. Option 4 represents the least costly option.

- **Collateral Traffic Benefits.** Scale of importance is 3. Scores under this criterion reflect Transmode's judgment of the degree to which rail carriers will realize collateral benefits over and above benefits in auto and intermodal traffic growth which were factored into the first criterion. Under this criterion the highest score was assigned to Options 1 & 3, the corridor options which offer the greatest benefit to Pennsylvania's high and wide load shippers. The lowest scores were assigned to Option 3. Little dimensional freight originates or terminates in territory served by this option.

- **Increased Rail Service Competitiveness.** Scale of importance is 2. This criterion relates to increases in the number of competitive routing alternatives and of multiple service options which result when a second competitor enters an established market.

- **Linkage With Other State Infrastructure Improvement Projects.** Scale of importance is 1. Clearly, linkage with the highway improvement activities of Penn DOT is an important criterion. Linkage with Pennsylvania port projects is equally important. However, this is a somewhat difficult criterion to evaluate, particularly at this early phase of the project. All options rated the same under this criterion.

Assessment of Corridor Alternatives
Based on Multiple Criteria

Importance	1	2	3	4	5	6	
Corridor Options	Linkage with Other State Infra-structure Projects	Increased Competitive-ness	Collateral Network Benefits	Cost of Improve-ments	Rail Commit-ment	Local Economic Develop-ment Benefits	Overall Score
Option 1: CR Penna., Main Line	0	6	10	4	10	10	173
Option 2: CR Susquehanna & Buffalo	0	2	7	7	0	6	94
Option 3: CR Harrisburg & Hagerstown	0	8	6	0	0	3	57
Option 4: CSX	0	8	6	10	8	6	155
Option 5: CP Rail	0	9	10	7	10	5	151

Recommendations for Phase 2 Assessment

Based on the evaluation summarized above we decided to proceed in phase 2 with an in-depth evaluation of 3 of the 5 feasible corridors. These include the following:

- Conrail's Pennsylvania Main Line
- D&H's North/South Route
- CSX's Route through western Pennsylvania and Baltimore into South Philadelphia

High-Profile Rail Clearances in the State of Pennsylvania

Report 2

Task 2 Line of Road Clearance Cost Estimates
Task 3 Identification and Costing of Supporting Rail Facilities

Prepared for: Pennsylvania Department of Transportation
Prepared by: Transmode Consultants, Inc. and Apogee Research

October 1992

Outline

I. Clearance Costing Methodology

II. Summary of Conclusions

III. Comparisons of Consultant's with Rail-Furnished Costs

IV. Case Study Comparisons

V. Detailed Cost Estimates

VI. Terminal Improvements

I. Clearance Costing Methodology

Methodology

The Transmode project team used a five step approach to analyzing rail clearance costs for the three rail corridors which we analyzed. This three step methodology included the following:

Step 1: **Reviewed clearance plans furnished by the major Pennsylvania rail carriers.** All three rail carriers - Conrail, CP Rail and CSX - furnished us with baseline clearance and clearance cost data.

Step 2: **Compared costs and costing assumptions across carriers.** The project team decomposed "sample" clearance remediation analysis furnished by individual carriers, into cost elements and compared these among carriers.

Step 3: **Characterized remediation strategies into discrete solution categories.** The team divided all clearance improvement projects into remediation categories whose cost structure is comparable from project to project.

Step 4: **Developed remediation cost standards for each solution category.** On the basis of our comparative analysis we developed a set of standard unit costs and reapplied these to each project.

Step 5: **Reviewed results and compared conclusions with the engineering departments of the respective railroads.** The team reviewed its findings with the engineering departments of individual carriers to assure that no "extraordinary" circumstances applied to any specific project.

Assumptions and Basis for Cost Estimates

The Transmode team used the following assumptions in applying the methodology described above:

- All vertical clearances are designed to 20' 8". All horizontal clearances, unless otherwise noted, were designed to handle Plate H rail cars.

- The "best" remediation strategy offered by the individual engineering departments of respective rail carriers was accepted as submitted in their working papers.

- We readjusted all of the cost data submitted by individual carriers on the basis of uniform overhead and project fixed cost estimates. As a result, some cost estimates were adjusted upward and others were adjusted downward.

- Assumptions with regard to outside contracting and work performed by railroad forces were accepted as submitted by individual carriers.

II. Summary of Conclusions

Summary of Conclusions

As the table below suggests, substantial variability exists between cost estimates developed by the consultant and estimates developed by the respective carriers. For this reason we attempted to bracket our cost estimates between upper and lower limits. Best estimates represent figures which include consistent and standard costing assumptions across specific lines and among all three carriers.

	Upper Limit	Lower Limit	Best Estimate
Conrail Main Line	58,406,000	49,855,000	51,868,000*
CP Rail/D&H Line	18,665,000	16,413,000	17,517,000**
CSX Line into S. Phila.	2,038,000	1,359,000	1,700,000
CSX Line through W. PA	6,787,000	4,525,000	5,657,000
CSX Lines Total	8,876,000	5,884,000	7,357,000
Air Products Horizontal Clearances	1,080,000	1,080,000	1,080,000
Total			**77,872,000**

* Includes 10,897,000 on trackage joint with D&H (Birdsboro-S. Phila.)

** 1,520,000 on trackage joint with CSX (CP Park - Penrose)
&8,884,000 (Reading to Park JCT) D&H Estimate

Conrail Cost Estimates

Segment	Upper Limit	Lower Limit	Best Estimate
Ohio Line to Pittsburgh	$89,000	$66,000	$75,000
Pittsburgh-Harrisburg	32,273,000	27,890,000	28,895,000
Harrisburg-Wyomissing Jct.	2,391,000	1,951,000	2,136,000
Wyomissing Jct. - Birdsboro	1,317,000	1,209,000	1,243,000
Reading Belt	500,000	400,000	400,000
Birdsboro - S. Philadelphia	11,813,000	9,698,000	10,583,000
Reading-Morrisville	2,300,000	1,700,000	2,000,000
Remedial Work - Tunnels	7,723,000	6,565,000	7,144,000
Total	**58,406,000**	**49,855,000**	**51,864,000**

*JT with D&H

CP/D&H Cost Estimates*

Segment	Upper Limit	Lower Limit	Best Estimate
Binghamton - Dupont	590,000	450,000	520,000
Dupont - Allentown	2,655,000	2,580,000	2,618,000
Allentown - Reading	1,464,000	1,243,000	1,354,000
Reading - Belmont	9,372,000	8,342,000	8,884,000
Belmont - Greenwich Yd.	2,534,000	2,166,000	2,350,000
Alt. Belmont-Penrose	2,050,000	1,632,000	1,841,000
Total	**18,665,000**	**16,413,000**	**17,567,000**

*The Right-of-Way is shared by CP and CR from Reading to Philadelphia
CP and CR from CP Park to Penrose

CSX Cost Estimates, Philadelphia to Delaware State Line

Segment	Upper Limit	Lower Limit	Best Estimate
Pennsylvania State Line - East Philadelphia	$2,038,500	$1,359,000	$1,700,000
West Pennsylvania - Maryland Line - New Castle	$6,787,500*	$4,525,000	$5,657,000
Total	**$8,826,000**	**$5,884,000**	**$7,358,000**

Horizontal Clearances Cost Estimates*

Segment	Upper Limit	Lower Limit	Best Estimate
Wilkes Barre to Allentown	750,000	750,000	750,000
Allentown - Reading	45,000	45,000	45,000
Reading - Park	285,000	285,000	285,000
Total	**1,080,000**	**1,080,000**	**1,080,000**

* Horizontal clearances only Wilkes Barre to South Philadelphia

III. Comparisons of Consultant's with Rail-Furnished Costs

Points of Commonalty

The following points of agreement existed among all three carriers:

- The basic engineering approach to project planning was common among the three carriers.
  - This involves independent estimates of labor and materials and the development of a detailed project-by-project design and budget plan.

- In two cases, carrier engineering departments preferred "undercutting" to "structural changes" as an obstacle remediation strategy; one preferred structural changes.

- The three carriers also agreed on the percent of fringes added to labor and material for state and federal projects.

- All three carriers operate under similar labor agreements. Consequently, similar contract restrictions apply in all three cases which affect in-house vs. outside contract work decisions.

Points of Difference

The following differences caused costs to vary among the three carriers:

- All three carriers used different percentages in calculating overhead additions and contingencies.
- Each carrier used different assumptions in estimating the schedule needed to perform work.
- Each carrier differed in its estimate of project fixed costs.

Conclusions

	Transmode Estimate	Carrier Estimate	Reasons for Differences
Conrail	$51,868,000	$58,406,000	Additives to labor, material & equipment. Differences in scheduling, particularly for undercutting.
CP Rail*	$17,567,000	$18,665,000	Conrail portion of route scaled down. D&H portion scaled up.
CSX**	$7,357,000	$8,826,000	Marginal differences in labor hours.

* Does not include Air Products Horizontal Clearances

** Includes both B&O East end from Philadelphia to the Delaware State Line and West end through Pittsburgh from the Maryland State Line to the Ohio Line.

IV. Case Study Comparisons

Case Study #1: Conrail Lower Bridge

Location South Broad Street - Philadelphia, PA

Description of Obstacle: Overhead Vehicular Bridge

Remediation Strategy: Remove signal brackets, improve drainage and lower three (3) tracks 4, 5 & 6 inches

Transmode Cost	Conrail Cost
Unit Costs: $103,000	Unit Costs: $526,000
Explanation of Differences: Additives plus contingencies and time schedules	

Case Study #2: Conrail Raise Signal Bridges

Location: System - Various Locations

Description of Obstacle: Raise 21 Signal Bridge

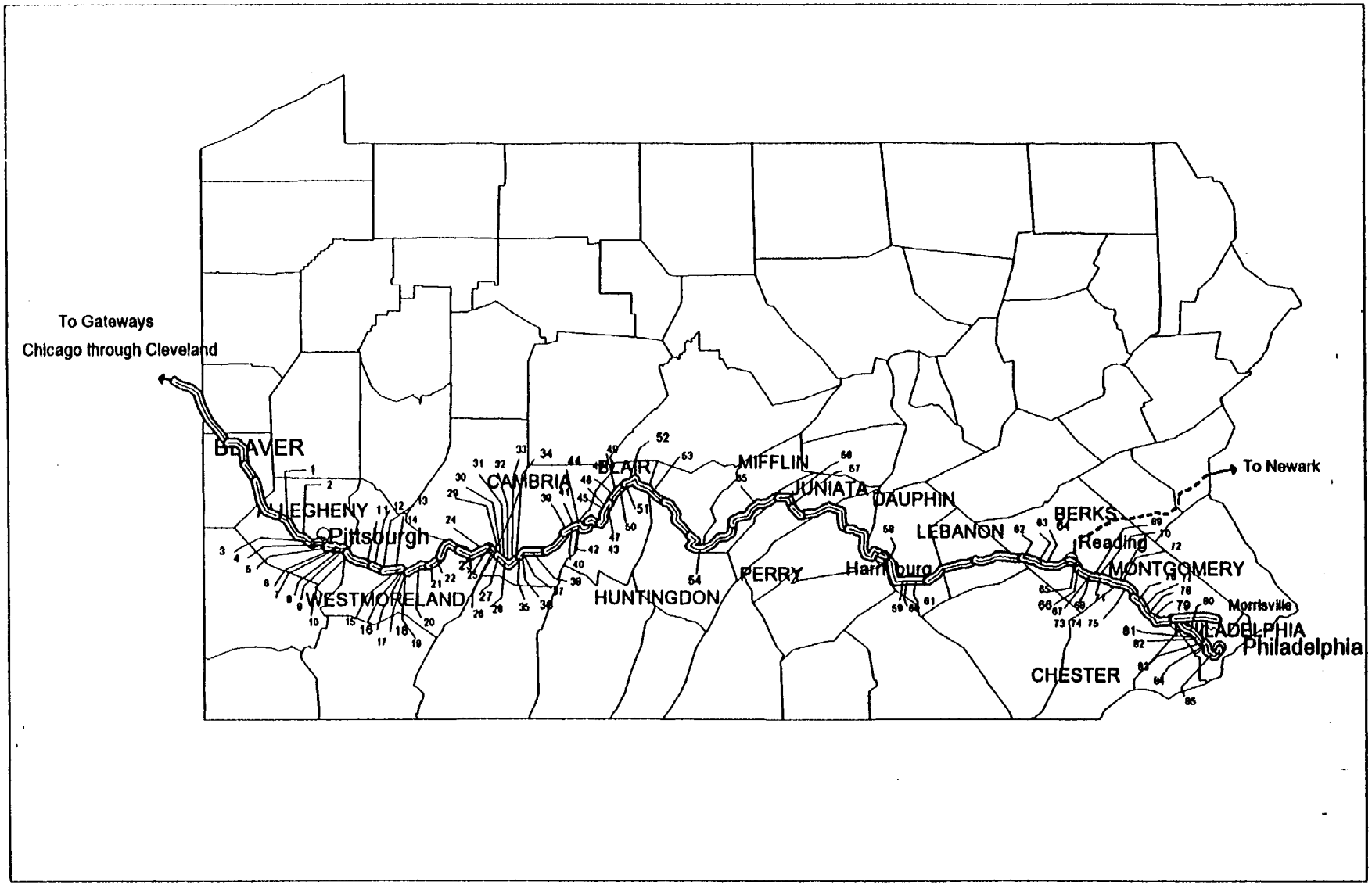
Remediation Strategy: Shims & Prefab Blocks

Transmode Cost	Conrail Cost
Unit Costs: $33,000	Unit Costs: $44,300
Explanation of Differences: Labor, material and equipment same Some deviation in project time Fixed costs the principal difference	

V. Detailed Cost Estimates

Conrail Clearances
20'8" Ohio State Line
to South Philadelphia

Pennsylvania Main Line



Pennsylvania Main Line

Conrail: Ohio State Line to Pittsburgh - (2 Structures)

Map Reference	Structure No.	Name	Location	Existing Clearance	Recommendations	Conrail Estimated Cost	Re-estimated Cost
1	18.99	Signal Br.	Harmony, PA	Track 1 20'-5" Track 2 19'-10" Track 3 20'-1" Track 4 20'-2"	Raise Bridge	$ 44,300	33,000
2	10.70*	Signal Br.	Haysville, PA	Track 1 20'-8" Track 2 20'-0" Track 3 20'-0"	Raise Bridge	44,300	33,000
Total						$ 88,600	66,000

Conrail Mainline: Pittsburgh to Harrisburg: (53 Structures)

Map Reference	Structure No.	Name	Location	Existing Clearance		Recommendations	Conrail Estimated Cost	Re-estimated Cost
3	0.51*	Former Corliss Branch	Pittsburgh, PA	Track 1	19'-7"	Remove Jumpover Span (Possible Busway)	143,000	86,000
4	0.14	Liberty Ave.	Pittsburgh, PA	Track 1	19'-9"	Lower Track	202,000	169,000
5	0.70*	10th St. Foot Br.	Pittsburgh, PA	Track 1	19'-11"	Raise Bridge	85,000	55,000
6	0.87*	12th St.	Pittsburgh, PA	Track 1	19'-2"	Lower Track	238,000	208,000
7	5.09*	CSXT R.R.	Pittsburgh, PA	Track 1 Track 2	19'-3" 18'-9"	Lower Tracks	716,000	646,000
8	7.21*	Carnegie St. Foot Br.	Pittsburgh, PA	Track 1 Track 2	20'-2" 20'-2"	Lower Tracks	275,000	192,000
9	10.19*	Monon. River Thru Truss	Port Perry, PA	Track 1	19'-8"	Modify Structure	57,000	57,000
10	10.61	Port Perry Tunnel	Port Perry, PA	Track 1	20'-6"	No Work	---	

Conrail Main Line: Pittsburgh to Harrisburg (53 Structures)

Map Reference	Structure No.	Name	Location	Existing Clearance	Recommendations	Conrail Estimated Cost	Re-estimated Cost
11	338.88*	Spring Hill Rd.	Spring Hill, PA	Track 1 18'-4" Track 2 18'-6" SCS 17'-8"	Lower Tracks	$1,302,000	$1,318,00
12	336.00	Signal Br.	Trafford, PA	Track 1 20'-5" Track 2 20'-7"	Raise Bridge	44,300	33,000
13	330.69*	Bridge St.	Shafton, PA	Track 1 18'-1" Track 2 18'-4"	Raise Bridge	365,000	290,000
14	326.56*	Seventh St.	Jeannette, PA	Track 1 18'-1" Track 2 18'-5" Siding 18'-3"	State Project (Compl. 1990)	----	
15	321.89*	Maple Ave.	Greensburg, PA	Track 1 19'-7" Track 2 20'-3"	Lower Tracks Modify Ped. Tunnel	941,000	753,000
16	318.56*	LR 65135	Donohoe, PA	Track 1 19'-10" Track 2 19'-11"	Raise Bridge (State Project for 1991)	280,000	278,000
17	317.00*	Carney Rd.	Donohoe, PA	Track 1 19'-9" Track 2 19'-6"	Raise Bridge	278,000	278,000
18	314.06*	Private Rd.	Beatty, PA	Track 1 20'-3" Track 2 20'-2"	Remove Bridge (Closed)	45,500	45,500
19	312.90	Signal Br.	Latrobe, PA	Track 1 20'-1" Track 2 19'-11"	Raise Bridge	44,300	33,000
20	312.60	Signal Br.	Latrobe, PA	Track 1 21'-0" Track 2 20'-7" Siding 20'-9"	Raise Bridge	$44,300	$33,000

Conrail Mainline: Pittsburgh to Harrisburg (53 Structures)

Map Reference	Structure No.	Name	Location	Existing Clearance	Recommendations	Conrail Estimated Cost	Re-estimated Cost
21	305.57*	Millwood Rd.*	Millwood, PA	Track 1 19'-4" Track 2 21'-1"	Raise Bridge	351,000	280,000
22	304.40	Signal Br.	Millwood, PA	Track 1 20"-4" Track 2 21'-1"	Modify Bridge	18,500	18,500
23	292.70*	Signal Br.	Lockport, PA	Track 1 20'-0" Track 2 19'-5"	Raise Bridge	44,300	33,000
24	290.60*	E.B. Signal Br.	Conpitt Jct., PA	Track 1 18'-6" Track 2 18'-6"	Raise Bridge	44,300	33,000
25	284.39*	SR 56	Seward, PA	Track 1 22'-1" Track 2 20'-0"	Lower Track 2	265,000	185,000
26	277.20	Signal Br.	Johnstown, PA	Track 1 20'-3" Track 2 20'-4" Track 3 19'-11"	Raise Bridge	44,300	33,000
27	275.88	Brownstown Rd.	Johnstown, PA	Track 1 20'-6" Track 2 20'-3" Siding 22'-7"	Lower Track 2 (City Project for 1991)	155,000	144,000
28	273.76*	Pedestrian Br.	Johnstown, PA	Track 1 20'-2" Track 2 20'-2" Track 3 20'-10"	Raise Bridge Span	142,000	109,180

Conrail Mainline: Pittsburgh to Harrisburg (53 Structures)

Map Reference	Structure No.	Name	Location	Existing Clearance	Recommendations	Conrail Estimated Cost	Re-estimated Cost
29	273.70*	E.B. Home Signal at "C"	Johnstown, PA	Track 1 19'-8" Track 2 20'-0" Track 3 20'-3"	Raise Bridge	44,300	33,000
30	272.81*	Main St. Truck Rte. 271	E. Conemaugh, PA	Track 1 20'-0" Track 2 18'-11" Track 3 19'-2" Track O 20'-3"	Lower Tracks	751,000	612,000
31	272.20*	Signal Br.	Conemaugh, PA	Track 1 21'-1" Track 2 19'-10" Track 3 19'-5"	Raise Bridge	44,300	33,000
32	271.30	Signal Br.	Conemaugh, PA	Track 1 20'-0" Track 2 20'-9" Track 3 21'-6"	Raise Bridge	44,300	33,000
33	271.00*	W.B. Signal at "AO"	Conemaugh, PA	Track 1 19'-3" Track 2 20'-1" Track 3 20'-3"	Raise Bridge	44,300	33,000
34	269.40*	Signal Br.	Conemaugh, PA	Track 1 20'-4" Track 2 20'-6" Track 3 20'-10"	Raise Bridge	44,300	33,000
35	267.70*	Signal Br.	Conemaugh, PA	Track 1 19'-7" Track 2 19'-5" Track 3 19'-5"	Raise Bridge	44,300	33,000
36	266.30*	E.B. Home Signal at "SO"	South Fork, PA	Track 1 20'-0" Track 2 20'-1" Track 3 20'-1"	Raise Bridge	44,300	33,000
37	265.85	Signal Br.	South Fork, PA	Track 1 20'-5" Track 2 21'-5" Track 3 22'-0" Siding 22'-0"	Raise Bridge	44,300	33,000

Conrail Mainline: Pittsburgh to Harrisburg (53 Structures)

Map Reference	Structure No.	Name	Location	Existing Clearance	Recommendations	Conrail Estimated Cost	Re-estimated Cost
38	265.58*	Grant St.	South Fork, PA	Track 1 19'-9" Track 2 20'-3" Track 3 20'-6" Siding -	Lower Tracks 1 & 2 (State Project for 1990)	379,000	371,000
39	250.64*	Cresson Sec. Jump-over	Cresson, PA	Track 1 18'-5" Track 3 18'-2" Track 4 18'-3" Yd. Ld. 19'-10"	Raise Bridge	1,023,000	920,000
40	248.19*	Main St.	Gallitzin, PA	Track 1 20'-0"	Lower Track	179,000	144,000
41	248.19"	Jackson St.	Gallitzin, PA	Track 2 19'-6" Track 3 19'-7"	Lower Tracks	Incl. in tunnel est.	Incl. in tunnel est.
42	247.72*	Gallitzin Tunnel	Gallitzin, PA	Track 3 17'-11"	Lower Track	5,739,000	Incl. in tunnel est.
43	247.72*	Allegheny Tunnel	Gallitzin, PA	Track 2 17'-2"	Lower Track	7,236,000	13,905,000
44	247.55*	Portage Tunnel	Gallitzin, PA	Track 1 18'-8"	Center & Lower Track	2,678,000	Incl. in tunnel est.
45	236.63*	Signal Br.	Altoona, PA	Track 1 22'-0" Track 2 22'-0" Track 3 19'-8"	Modify Structure	18,540	18,540
46	235.91*	7th St.	Altoona, PA	Track 1 18'-3" Track 2 17'-9" 2 Sec. 18'-10" 1 Yard 18'-8" Straight Trk 19'-1"	Shift and Lower Track 1 and 2. (State Project on hold) Clearance Issue in Dispute with PennDot	925,000	925,000

Conrail Mainline: Pittsburgh to Harrisburg (53 Structures)

Map Reference	Structure No.	Name	Location	Existing Clearance		Recommendations	Conrail Estimated Cost	Re-estimated Cost
47	234.28*	8th St.	Altoona, PA	Track 1 Track 2 Sec. Trk. Yard Trk	19'-7" 19'-8" 20'-2" 20'-3"	Lower Tracks 1 and 2	582,000	466,000
48	232.99*	Antis Tunnel	Altoona, PA	Track 1 Track 2	18'-2" 18'-8"	Lower Tracks	874,000	787,000
49	232.23	Signal Br.	E. Altoona, PA	Track 1 Track 2 Siding	19'-2" 19'-8" 19'-2"	Raise Bridge	44,300	33,000
50	229.36*	Cambria Street SR 865	Bellwood, PA	Track 1 Track 2 Track 3	18'-7" 18'-6" 18'-11"	Lower Tracks	1,434,000	1,020,000
51	225.10*	Signal Br.	Tipton, PA	Track 1 Track 2 Track 3	18'-11" 19'-4" 19'-4"	Raise Bridge	44,300	33,000
52	223.50	Signal Br.	Tyrone, PA	Track 1 Track 2 Siding	20'-1" 20'-4" 20'-1"	Raise Bridge	44,300	33,000
53	213.72*	Spruce Creek Tunnels	Spruce Creek, PA	Track 1 Track 2	18'-1" 17'-1"	Shift & Lower Both Tracks	3,055,000	2,746,000
54	191.20	Signal Br.	Mt. Union, PA	Track 1 Track 2 Siding	20'-3" 20'-6" 21'-6"	Raise Bridge	44,300	33,000
55	162.60*	Signal Br.	Shawnee, PA	Track 1 Track 2	20'-4" 20'-5"	Raise Bridge	44,300	33,000
56	153.00*	Cross Arm of Telephone Pole	Mifflin, PA	Track 1 Track 2	19'-10" -	Raise Cross Arm	12,360	7,725

Conrail Mainline: Pittsburgh to Harrisburg (53 Structures)

Map Reference	Structure No.	Name	Location	Existing Clearance	Recommendations	Conrail Estimated Cost	Re-estimated Cost
57	151.03	SR 75	Port Royal, PA	Track 1 21'-10" Track 2 20'-2" Track 3 O.O.S.	Lower Track 2	288,000	207,000
Total						$32,273,000	27,890,000

Conrail Mainline: Harrisburg to Wyomissing Jct. (7 Structures)

Map Reference	Structure No.	Name	Location	Existing Clearance	Recommendations	Conrail Estimated Cost	Re-estimated Cost
58	106.04*	Maclay St.	Harrisburg, PA	Track 1 19'-4" Track 2 19'-4" Track 11 19'-4" Track 13 19'-4"	Lower Tracks 1 and 2	444,000	386,000
59	43.87*	Private Rd.	Hummelstown, PA	Track 1 19'-1" Track 2 19'-5"	Raise Bridge & Water Line	273,000	216,000
60	43.00*	O.H. Wire	Hummelstown, PA	Track 1 18'-6" Track 2 19'-0"	Raise Wire	12,500	7,700
61	42.10*	O.H. Wire	Swatara, PA	Track 1 19'-6" Track 2 19'-0"	Raise Wire	12,500	7,700
62	18.22*	Private Rd.	Sheridan, PA	Track 1 18'-11" Track 2 19'-5"	Raise Bridge	212,000	185,000
63	9.27*	Furnace Rd.	Wernersville, PA	Track 1 18'-8" Track 2 18'-8"	Raise Bridge (State Project for 1991)	298,000	295,000
64	8.98*	Hill Rd.	Wernersville, PA	Track 1 18'-9" Track 2 18'-9"	Lower Tracks (Possible State Removal)	1,139,000	912,000
						$2,391,000	2,009,000

Conrail Mainline: Wyomissing Jct. To Birdsboro Via Reading Belt Run-around (7 Structures)

Map Reference	Structure No.	Name	Location	Existing Clearance		Recommendations	Conrail Estimated Cost	Re-estimated Cost
65	0.36	Vanity Fair	Reading, PA	Track 7	20'-1"	Modify Bridge	19,000	19,000
66	3.04	Harrisburg Line	Reading, PA	Track 2 Track 7	19'-10" 19'-10"	Replace Span	519,000	519,000
67	6.84	RDG. Ind'l Trk. (Aband.)	Ridgeville, PA	Track 2 Track 7	20'-3" 18'-7"	Remove Bridge	62,000	45,000
68	69.20	RDG. Ind'l Trk. (Aband.)	Ridgeville, PA	Track 7	18'-4"	Remove Bridge	62,000	45,000
69	51.55*	Farm Rd.	Lorane, PA	Track 1 Track 2	18'-6" 18'-9"	Raise Bridge (Possible Prvt. Ren.)	183,000	170,000
70	51.38*	Nagle Rd.	Lorane, PA	Track 1 Track 2	18'-7" 18'-8"	Raise Bridge	200,000	200,000
71	49.52a	SR 82	Birdsboro, PA	Track 1 Track 2 Track 7	22'-0" 22'-0" 19'-5"	Lower Track 7	272,000	247,000
							$1,317,000	1,245,000

Conrail Mainline: Birdsboro to South Philadelphia (14 Structure)

Map Reference	Structure No.	Name	Location	Existing Clearance		Recommendations	Conrail Estimated Cost	Re-estimated Cost
72	42.24*	Reading Pike	Stowe, PA	Track 1 Track 2 Siding	20'-11" 20'-3" 21'-1"	Lower Track 2	211,000	181,000
73	40.30*	Charlotte St.	Pottstown, PA	Track 1 Track 2	18'-11" 18'-11"	Lower Tracks		
74	40.12*	Franklin St.	Pottstown, PA	Track 1 Track 2	19'-10" 19'-6"	Lower Tracks	1,233,000	986,000
75	40.00*	Washington St.	Pottstown, PA	Track 1 Track 2 Ind. Sdg. Tail Trk.	19'-2" 19'-0" 19'-0" 18'-1"	Lower Tracks		
76	34.71*	Main St.	Linfield, PA	Track 1 Track 2	18'-4" 18'-10"	Lower Tracks	897,000	808,000
77	28.50*	Black Rock Tunnel	Phoenixville, PA	Track 1	18'-4"	Excavate Arch, Rock Bolt, Close Vents	4,275,000	3,718,000
78	27.94*	Phoenixville Branch	Phoenixville, PA	Track 1 Track 2	18'-11" 18'-11"	Shift O.H. Trk. & Raise Bridge	194,000	181,000
79	21.47*	L.R. 463	No. Abrams, PA	Track 1 Track 2 Track 3	19'-10" 20'-4" 20'-7"	Lower Tracks 1 & 2	508,000	453,000

Conrail Mainline: Birdsboro to South Philadelphia (14 Structure)

Map Reference	Structure No.	Name	Location	Existing Clearance		Recommendations	Conrail Estimated Cost	Re-estimated Cost
80	8.75*	Flat Rock Tunnel	Gladwyne, PA	Track 1	18'-5"	Excavate Arch, Rock Bolt	$1,885,000	1,751,000
81	0.14*	Montgomery Dr.	Philadelphia, PA	Track 1	18'-8"	Lower Track, Rebuild Concrete Culvert	630,000	536,000
82	1.15*	Girard Ave.	Philadelphia, PA	Track 1	20'-2"	Lower Track Raise U.G. Br.	372,000	181,000
83	1.30/* 1.33	Belmont Tunnel	Philadelphia, PA	Track 1	18'-6"	Lower Track		
84	2.10*	34th St.	Philadelphia, PA	Track 1 Track 2 Track 3	18'-8" 19'-3" 18'-8"	Lower Tracks (City Project for 1993)	1,082,000	1,082,000
85	1.21*	So. Broad St.	Philadelphia, PA	Track 1 Track 2 Track 3	20'-4" 20'-2" 20'-3"	Lower Tracks & Remove Signal Catwalk	526,000	103,000
Total							$11,813,000	$9,980,000

NOTES

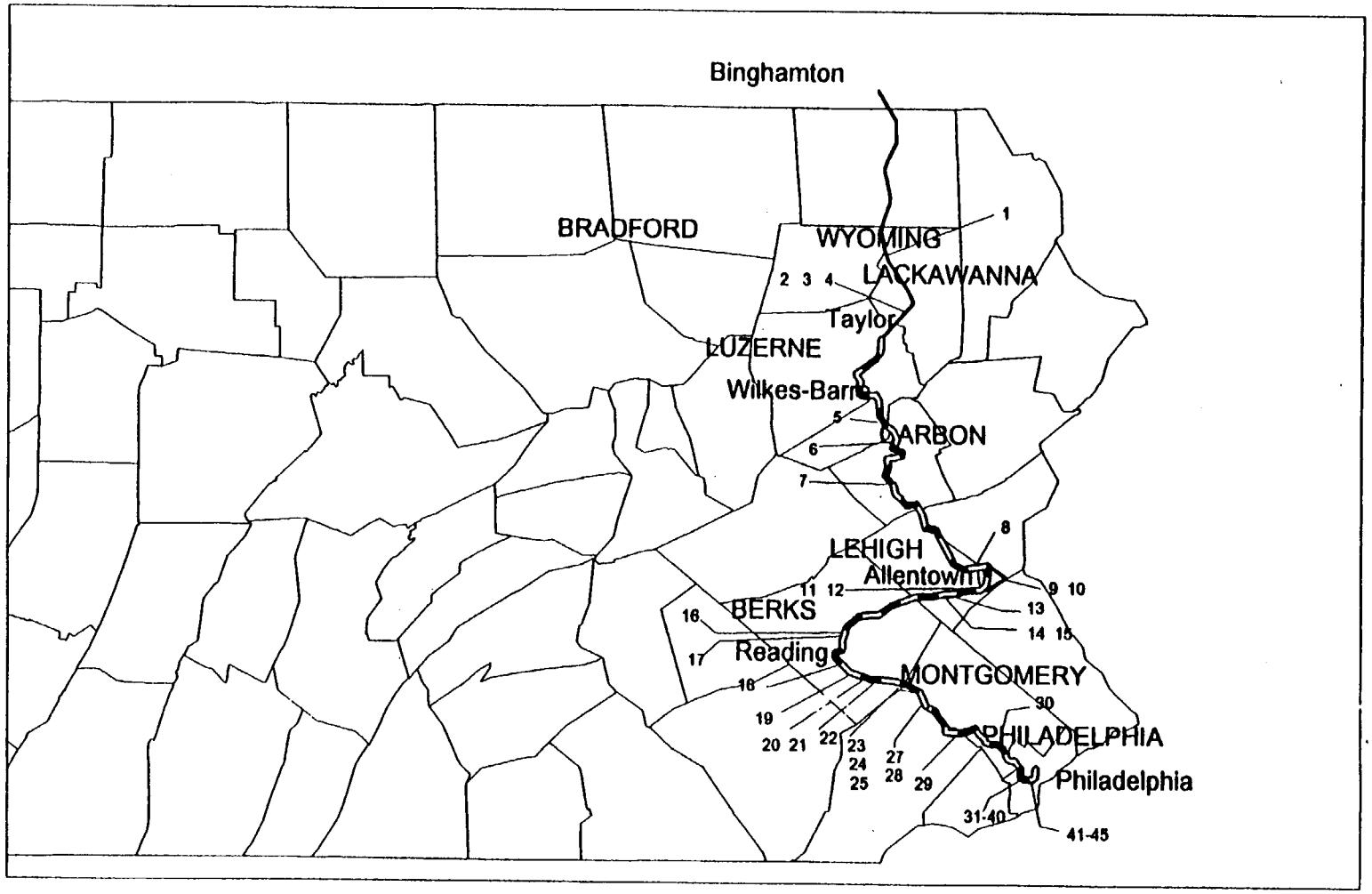
1. Estimate based on 1990 Dollars inflated to allow for construction sequence.
2. Estimate prepared utilizing BT-1000 probes but without field surveys.
3. Clearance Estimate based on FHPM additives.

* Indicates structures originally on Project List estimated to cost $37.8 million (1987 Dollars).

** Does not include FOC relocation costs.

CP/D&H Rail Clearances to
20'8" Ohio State Line
to South Philadelphia

D&H Line from Binghamton to Philadelphia over Conrail



D&H Mainline: Binghamton to Dupont (4 Structures)

Map Reference	Structure	Name	Location	Existing Clearance	Recommendation	D&H Estimated Cost	Re-estimated Cost
1	T 656.00	Nicholson Tunnel	Nicholson	SINGLE 19'3"	Lower Track	250,000	350,000
2	OH 670.88	Linden St. (134.13)	Scranton	SINGLE 20'3"	Lower Track	50,000	60,000
3	OH 671.01	Lackawanna (133.98)	Scranton	SINGLE 20'4"	Lower Track	50,000	60,000
4	OH 671.81	Eynon St. (143.79	Taylor	SINGLE 19'6"	Lower Track	100,000	120,000

Conrail Lehigh Line: Dupont to Allentown (4 Structures)

Map Reference	Structure	Name	Location	Existing Clearance	Recommendation	D&H Estimated Cost	Re-estimated Cost
5	T 147.36	White Haven Tunnel	Frasher	SINGLE 18'6"	Excavate Arch Lower Track	1,760,000	1,760,000
6	T 136.89	Rockport Tunnel curve 5D 4M	Drakes Creek	SINGLE 19'4"	Excavate Arch Rock Bolt	530,000	580,000
7	OH 124.16	CNJ Estate	Jim Thorpe	SINGLE 18'9"	Raise Bridge	90,000	75,000
8	OH 93.16	Eugene St.	Catasaugua	SINGLE 18'7"	Lower Track	200,000	240,000

Map Reference	Structure	Name	Location	Existing Clearance	Recommendation	D&H Estimated Cost	Re-estimated Cost
9	TT 0.15	Lehigh River curve 19D OM curve 12D OM	Bethlehem	SINGLE 18'10"	Replace Bridge	2,500,000	2,500,000
10	W.88.50	OH wire CP Beth	Bethlehem	SINGLE 20'0"	Raise Wire	20,000	10,000

Conrail Reading Line: Allentown (CP Allen) to Reading (Valley Jct.)(7 Structures)

Map Reference	Structure	Name	Location	Existing Clearance	Recommendation	D&H Estimated Cost	Re-estimated Cost
11	TT 0.19	Lehigh Canal	Allentown	TRACK 1 20'0" TRACK 2 20"6"	Redesign Portal Bracing	100,000	75,000
12	TT 0.53	Lehighton Branch	Allentown	TRACK 1 Clear TRACK 2 20'0"	Redesign Portal Bracing	50,000	50,000
13	OH 30.09 curve 1D OM	4th Street	Emmaus	TRACK 1 19'6" TRACK 2 19'8"	Lower Tracks	250,000	190,000
14	OH 28.71 curve 1D OM	PA Turnpike	Macungie	TRACK 1 19'6" TRACK 2 Clear	Lower Tracks	250,000	190,000
15	OH 27.88	Private Road	Macungie	TRACK 1 19'4" TRACK 2 19'9"	Remove Bridge	60,000	44,000
16	OH 1.85	Schuylkill Ave.	Reading	TRACK 1 19'4" TRACK 2 20'6"	Lower Tracks	250,000	190,000
17	OH 3.04 CR	Harrisburg Line	Reading	TRACK 1 20'0" TRACK 2 20'0"	Replace Span/ or Reloc. Trk	504,000	504,000

Conrail Harrisburg Line: Reading - Belmont (alternate route)(13 Structures)

Map Reference	Structure	Name	Location	Existing Clearance	Recommendation	D&H Estimated Cost	Re-estimated Cost
18	OH 6.84 CR	Reading Ind. Trk. curve 5D OM	Ridgeville	SINGLE 18'5"	Remove	60,000	60,000
19	OH 69.20	CR Reading Ind. Trk.	Ridgeville	SINGLE 18'5"	Remove	60,000	60,000
20	OH 51.55	Farm Road	Lorane	TRACK 1 18'6" TRACK 2 18'6"	Raise Bridge	178,000	140,000
21	OH 51.38	Nagle Road	Lorane	TRACK 1 18'7" TRACK 2 18'6"	Raise Bridge	194,000	160,000
22	OH 42.24	Reading Pike curve 3D OM	Stowe	TRACK 1 20'9" TRACK 2 20'2"	Lower Track 2	205,000	185,000
23	OH 40.30	Charlot St.	Pottstown	TRACK 1 18'9" TRACK 2 19'1"	Lower Tracks	399,000	340,000
24	OH 40.12	Franklin St. curve 1D OM	Pottstown	TRACK 1 19'6" TRACK 2 19'7"	Lower Tracks	399,000	340,000
25	OH 40.00	Washington St. curve 1D OM	Pottstown	TRACK 1 19'2" TRACK 2 19'2"	Lower Tracks	399,000	340,000
26	OH 34.71	Linfield Road	Linfield	TRACK 1 18'1" TRACK 2 18'9"	Lower Tracks	871,000	790,000
27	T 28.05	Phoenixville Tunnel (Black Rock Tunnel) curve 1D 30M	Phoenixville	SINGLE 18'4"	Excavate Arch Rock Bolt Close Vents	4,150,000	3,619,000
28	OH 27.94	CR Schuylkill Br.	Phoenixville	SINGLE 18'9"	Shift O.H. Track Raise Bridge	188,000	188,000
29	OH 21.47	PA Route 436 curve 1D 40M	North Abrams	TRACK 1 19'10" TRACK 2 clear	Lower Track 1	493,000	420,000
30	T 8.75	Flat Rock Tunnel	Gladwyne	SINGLE 18'4"	Excavate Arch Rock Bolt	1,830,000	1,700,000

Conrail Harrisburg Line: Belmont to CP Park (alternate route)(2 Structures)

Map Reference	Structure	Name	Location	Existing Clearance	Recommendation	D&H Estimated Cost	Re-estimated Cost
31	OH 2.51	Girard Ave.	Philadelphia	SINGLE 18'5"	Lower Track	200,000	200,000
32	OH 2.40	Poplar St.	Philadelphia	SINGLE 18'4"	Lower Track	200,000	200,000

CSX Local Trackage: CP Park to Penrose (alternate route)(8 Structures)

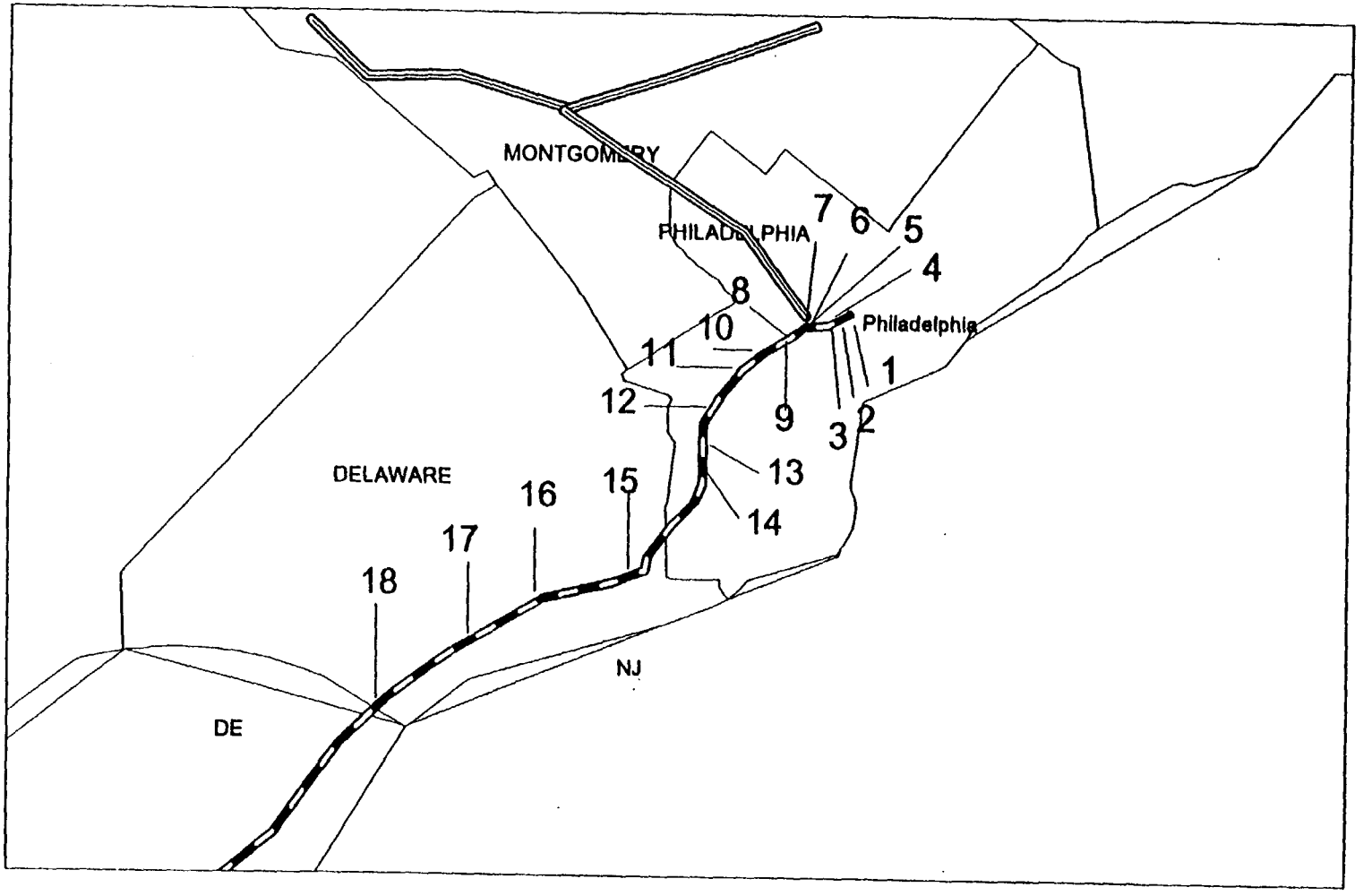
Map Reference	Structure	Name	Location	Existing Clearance	Recommendation	D&H Estimated Cost	Re-estimated Cost
33	T 1.0	Fairmont Park Tunnel curve 8 D OM	Philadelphia	SINGLE 8'10"	Lower Track	330,000	112,000
34	OH 91Y	SEPTA Suburban Line	Philadelphia	TRACK 2 19'6"	Lower Track	100,000	94,000
35	OH 91V	JFK Boulevard	Philadelphia	TRACK 2 20'5"	Lower Track	40,000	40,000
36	OH 91S	Market St. (US 30)	Philadelphia	TRACK 2 19'8"	Lower Track	80,000	117,000
37	OH 91R	Chestnut St.	Philadelphia	TRACK 2 19'2"	Lower Track	100,000	117,000
38	OH 90E	Conrail Hbg Line	Philadelphia	TRACK 4 17'7"	Lower Track	400,000	360,000
39	T 1.6	Gray's Ferry Tunnel curve 4D 30M	Philadelphia	TRACK 4 19'3"	Lower Track	300,000	112,000
40	OH 90A	Warton St.	Philadelphia	TRACK 4 18'3"	Lower Track	300,000	94,000
							$1,046,000

Conrail Harrisburg Line: Belmont to Greenwich Yard/Delaware Ave.(5 Structures)

Map Reference	Structure	Name	Location	Existing Clearance	Recommendation	D&H Estimated Cost	Re-estimated Cost
41	OH 0.14	Montgomery Drive	Philadelphia	SINGLE 18'8"	Lower Track Rebuild Culvert	612,000	520,000
42	OH 1.15	Girard Ave.	Philadelphia	SINGLE 20'2"	Lower Track Raise Bridge	111,000	176,000
43	T 1.30	Belmont Tunnel (ZOO)	Philadelphia	SINGLE 18'6"	Lower Track	250,000	320,000
44	OH 2.10	34th Street (ZOO)	Philadelphia	TRACK 1 18'8" TRACK 2 19'3" TRACK 3 18'8"	Lower Tracks	1,050,000	1,050,000
45	OH 1.21	So. Broad St.	Philadelphia	TRACK 1 20'4" TRACK 2 20'2" TRACK 3 20'3"	Lower Tracks Modify Signals	511,000	100,000

CSX Clearances
to 20'8" Delaware State Line
to South Philadelphia and CSX
Line Through Western Pennsylvania

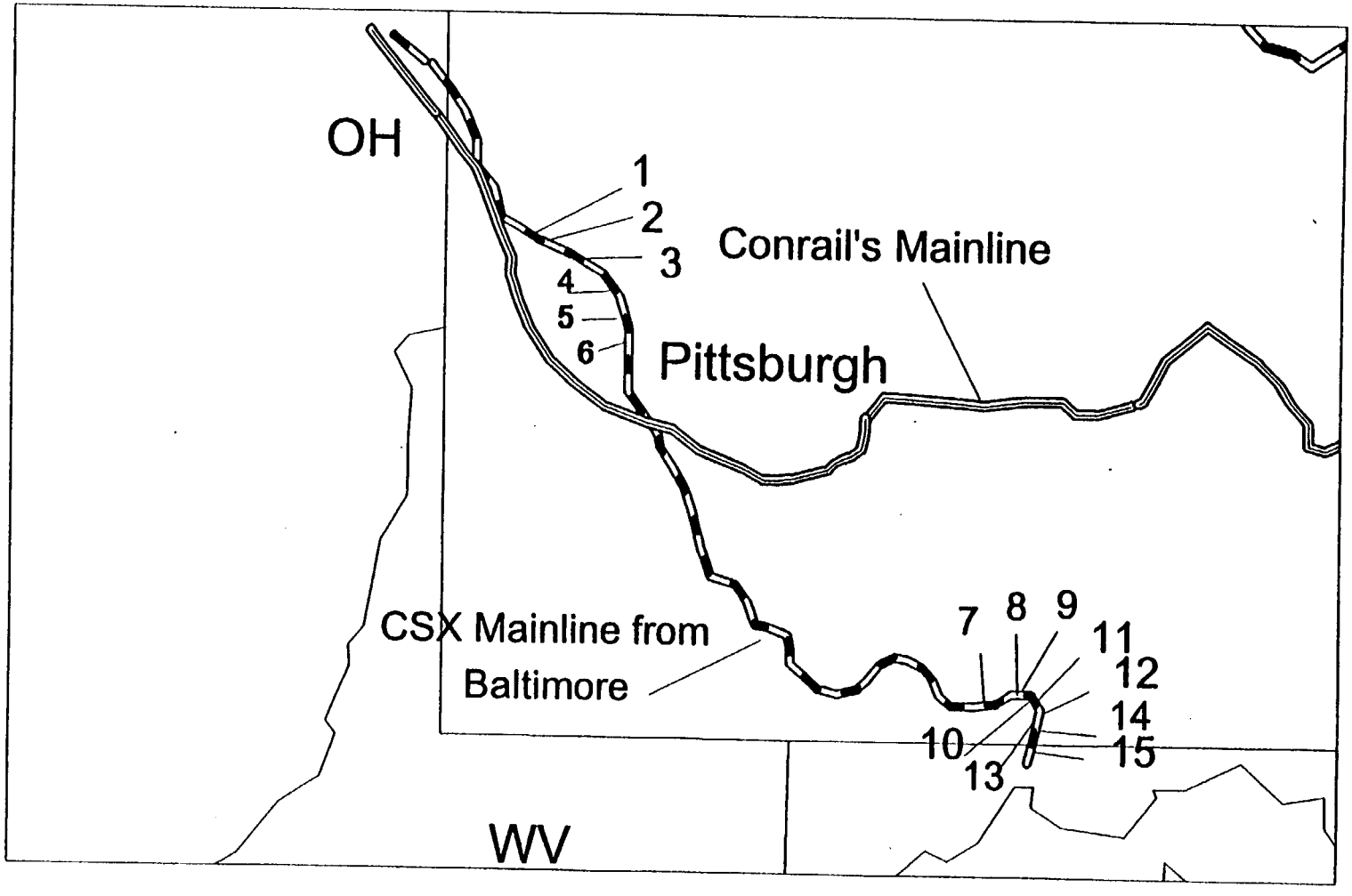
CSX Line to Philadelphia over Former B&O



CSX: Philadelphia to Delaware State Line

Map Reference	Structure	Name	Location	Existing Clearance	Recommendation	CSX Estimated Cost	Re-estimated Cost
1	-1.0 MD	Fairmont Park Tunnel	Philadelphia	18'3"	Lower Track	$120,700	111,800
2	0.6 MD	Market Street	Philadelphia	TRACK 1 19'6" TRACK 2 19'6"	Lower Track	126,300	117,000
3	0.7 MD	Chestnut Street	Philadelphia	TRACK 1 19'7"	Lower Track	126,300	117,000
4	1.0 MD	CR OH Bridge	Philadelphia	TRACK 1 18'6" TRACK 2 18'6"	Lower Track	101,000	93,600
5	1.6 MD	Greys Ferry Tunnel	Philadelphia	TRACK 1 19'0	Lower Track	120,700	111,800
6	1.7 MD	Wharton Rd.	Philadelphia	TRACK 2 18'5"	Lower Track	101,000	93,600
7	Dela. Lead	Broad St.	Philadelphia	20'2"	Lower Track	84,100	78,000
8	1.9 MD	Schuykill T.T. Br.	Philadelphia	20'3"	Adjust Braces	70,100	65,000
9	2.4 MD	Lindbergh Rd.	Philadelphia	17'10"	Lower Track	115,000	106,600
10	3.1 MD	Woodland Ave.	Philadelphia	17'10"	Lower Track	115,000	106,600
11	3.4 MD	61st St.	Philadelphia	18'1"	Lower Track	115,000	106,600
12	3.6 MD	Cemetery RD	Philadelphia	17'9"	Lower Track	115,000	106,600
13	3.8 MD	65th St.	Philadelphia	18'6"	Lower Track	115,000	106,600
14	4.1 MD	68th St.	Philadelphia	19'1"	Lower Track	115,000	106,600
15	5.4 MD	Pine St.	Darby	18'4"	Lower Track	115,000	106,600
16	5.6 MD	Boones Tunnel	Darby	17'8"	Lower Track	115,000	106,600
17	10.1 MD	Crum Lynne Lane	Chester	20'5"	Lower Track	70,100	65,000
18	16.5 MD	Chichester Rd.	Feltonville	20'0"	Lower Track	115,000	106,600
Total						1,956,000	1,810,000

CSX Line Through Western Pennsylvania



CSX Transportation
Pennsylvania Clearance Project
To Provide 20' 6" Vertical Clearance
Penn/MD State Line - Penn/OH State Line (15 Structures)

Map Reference	Structure	Name	Location	Existing Clearance	Recommendation	Best Estimate
1	29.0	OH Bridge	P&LE	19'11"	Lower Track	60,000
2	40.7	OH Bridge	P&LE	19'8"	Lower Track	65,000
3	7.1Y	OH Foot Bridge	Pittsburgh	20'4"	Lower Track	40,000
4	2.2Y	J&L Tunnel	Pittsburgh	19'0"	Lower Track	1,700,000
5	2.0Y	OH RR Bridge	Pittsburgh	20'4"	Lower Track	10,000
6	0.1Y	OH Bridge	Pittsburgh	20'0"	Lower Track	50,000
7	5.0	Benford Tunnel	Keystone Sub	19'1"	Lower Track	100,000
8	198.5	Falls Cut Tunnel	Keystone Sub	TRACK 1 - 18'7" TRACK 2 - 18'8"	Lower Track	2,000,000
9	209.7	Sand Patch Tunnel	Keystone Sub	TRACK 1 - 20'6" TRACK 2 - 20'3"	Lower Track #2	80,000
10	212.9	OH RR Bridge	Keystone Sub	TRACK 1 - 20'6" TRACK 2 - 20'4"	Lower Track #2	50,000
11	215.4	Pinkerton Tunnel	Keystone Sub	19'8"	Lower Track	80,000
12	216.3	OH Bridge	Keystone Sub	TRACK 1 - 20'3" TRACK 2 - 18'6"	Raise Bridge	50,000
13	220.0	OH Bridge	Keystone Sub	TRACK 1 - 20'6" TRACK 2 - 20'6"	Lower Track (Recheck Measurements)	50,000
14	236.8	Shoofly Tunnel	Keystone Sub	19'3"	Lower Track	80,000
15	239.2	Brook Tunnel	Keystone Sub	19'8"	Lower Track	100,000
Total						5,315,000

CSX Line Through Western Pennsylvania

VI. Terminal Improvements

Complementary Network Improvements Beyond Pennsylvania Borders (000)

	Description of Network Extension	Estimated Incremental Cost	Status	Expected Carrier Commitments
Conrail Project	Clearance Work in Ohio	3.1 Million	Design & Estimation	In conjunction with Penn. Project
CP Project	0			
CSX Project	Maryland Clearance	7.3 Million	Design & Estimation	Intermodal Justification in Capital Budget
	Howard 3T Tunnel Est. made by third party	24.8 Million		
	Increase Track Capacity in Maryland & Delaware	2.5 Million		

Complementary Network Improvements Within Pennsylvania Borders (000)

	Description of Network Improvements	Estimated Incremental Cost	Status	Expected Carrier Commitments
Conrail Project	Construct Intermodal Term at Pittsburgh	9 million	Design	Recommended in Connection With Pennsylvania Clearance Project
	Upgrade Intermodal Term at Harrisburg	3 million	Design	
CP Project	Improve Intermodal Term in Scranton	.5 million	Designed	Authorized to Proceed
CSX Project	Improvements to existing facilities in Philadelphia & Additional Track Capacity	9.3 million	Review Design	Recommended

High-Profile Rail Clearances in the State of Pennsylvania

Report 3

Task 4.0 Definition of Baseline Markets
Task 5.0 Competitiveness Analysis and Market Impact Assessment
Task 5.1 Analysis of Potential Demand for High-Profile Service

Prepared for: Pennsylvania Department of Transportation
Prepared by: Transmode Consultants, Inc. and Apogee Research

October 1992

OUTLINE

I. Regional Market for "High-Profile" Transportation Services

II. High and Wide Load Shippers and Services

III. Auto Transport Markets in the Northeast

IV. Intermodal Market Profile in the Northeast

V. Recent Market Development Issues

I. Regional Market for "High-Profile" Transportation Services

Transport/Manufacturing Linkages

The Pennsylvania economy is composed of a number of economic sectors which collectively account for $188 billion in "valued-added" activity. This total is made up of wages, interest payments, profits and taxes. The table below reviews the top 15 sectors of the Pennsylvania economy and characterizes the contribution of each to the State's overall economic performance. Note that several of the "top 15" sectors are potential beneficiaries of high-profile rail service in Pennsylvania.

Principal Sectors of Pennsylvania Economy
($ Millions)

Economic Sectors	Payroll	State Taxes	Local Taxes	Total Value Added
Coal Mining	21,645.9	81.5	32.9	2,811.8
Health Services	11,825.4	218.2	194.2	16,428.4
Wholesale Durable Goods	4,071.1	26.3	53.4	9,196.3
Business Services	5,742.0	150.2	140.1	7,837.7
Electric & Gas Utilities	2,253.5	31.7	51.6	7,835.1
Heavy Construction Contractors	4,545.1	97.3	81.8	6,367.1
Primary Metal Product Manufacturing	3,482.6	37.3	20.2	4,730.9
Banking	2,819.3	50.9	33.4	4,256.0
Misc. Services	2,958.9	82.9	75.6	4,211.5
Industrial Machinery Manufacturing	3,354.0	28.5	17.5	4,205.0
Processed Food Manufacturing	2,311.3	43.9	19.0	4,066.3
Insurance	2,457.2	52.7	32.4	4,058.5
Chemicals & Allied Products	2,336.3	34.6	16.3	3,632.7
Electrical Equipment Manufacturing	2,834.1	26.2	15.1	3,642.8
Wholesale-Nondurables	2,296.8	36.7	19.2	3,584.8
Trucking & Warehousing	2,374.3	32.4	19.1	3,391.9
Total	128,014	1981	1535	188,331

Potential Beneficiaries of High-Profile Rail Service

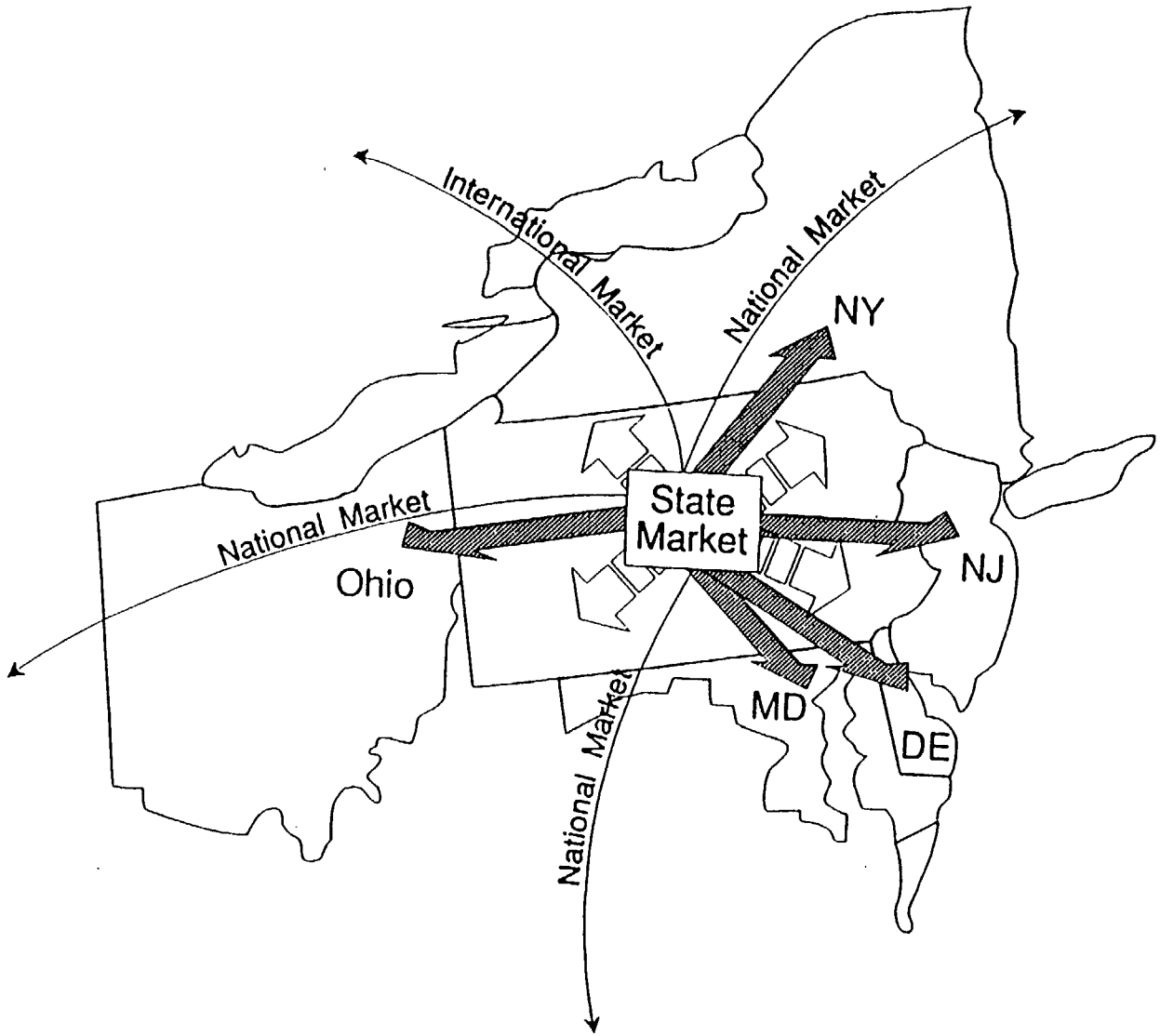
Transport/Manufacturing Linkages

One meaningful way to view the Pennsylvania economy is to analyze it in terms of its market relationship to other States and other regional economies. In this context it is helpful to characterize the Pennsylvania economy in terms of its net inputs and outputs. In general, State economies which "export" more products than they "import" create wealth for their citizens. On the other hand, State economies which "import" more than they "export" have the opposite effect. Import-dominated State economies dissipate the wealth of the local population in exchange for "imported" goods and services. The table below compares the Pennsylvania state economy with that of neighboring States, in terms of its external inputs and outputs and the balances between the two. Note that within the region Pennsylvania demonstrates the weakest net export performance of those considered.

External Economics Dependence of Selected Regional Economies

State	Total State Product ($ Millions)	Imports from Outside the State ($ Millions)	Exports to Outside the State ($ Million)	Net Export/Import Balance ($ Million)	Export/Import Ratio
Pennsylvania	$360,012	$159,659	$135,601	($24,058)	.85
Ohio	$294,706	$136,106	$128,517	($7,589)	.94
New Jersey	$266,435	$129,066	$124,993	($4,073)	.97
New York	$502,218	$190,196	$197,375	$7,179	1.04
Delaware	$23,717	$15,232	$14,573	($659)	.96
Maryland	$104,819	$49,531	$52,778	$3,247	1.07

Markets Served By Pennsylvania Producers



Transport /Manufacturing Linkages

The table below identifies the strongest "export" sectors of the Pennsylvania economy in terms of the internal and external markets which they serve. As we noted above, those economic sectors which generate the largest net exports are the "engines" which power the State's economy. These export sectors together with those which are most dependent on external inputs are most likely to benefit from improved "high-profile" transportation service within the State. The table below characterizes the top thirty export sectors of the Pennsylvania economy.

Key Export Sectors
$ Million

Industrial Sector	State Supply	Interregional Demand (Exports)	Interregional Supply (Imports)	Intrastate Demand	Export/ Import Ratio
Coal Mining	48,593	16,305.2	2,526.8	34,815.4	6.95
Drugs and Pharmaceuticals	3,805.1	2,628.0	667.2	1,844.3	3.94
Chocolate Products	1,640.8	1,484.7	32.3	178.4	46.26
Blast Furnaces & Steel Mills	8,441.9	1,470.2	897.9	7,869.6	1.64
Misc. Plastic Products	2,885.0	1,435.8	938.7	2,387.9	1.53
Electronic Components, NEC	1,657.2	1,081.0	452.4	1,028.7	2.39
Sanitary Paper Products	1,147.6	961.3	83.0	269.4	11.58
Food Prep, NEC	989.2	766.6	75.2	297.9	10.19
Radio & TV Communic. Equip.	852.3	653.6	182.4	381.1	3.58
Confectionery Products	762.9	597.7	62.8	227.9	9.52
Electronic Computing Equip.	769.0	542.5	270.7	497.2	2.00
Mechanical Measuring Devices	930.7	518.6	272.9	684.9	1.90
Railroad Equipment	938.5	506.5	94.8	526.8	5.34
Copper Rolling & Drawing	791.9	501.4	92.8	383.1	5.42
Canned Specialties	684.8	487.5	49.9	247.2	9.76
Cold Finishing of Steel Shapes	901.9	413.9	111.4	610.4	3.38
Glass & Glass Products	920.2	389.0	2.7	533.9	142.29
Non Ferrous Roll & Draw	581.3	368.9	87.0	299.3	4.24
Dog, Cat & Other Pet Food	454.6	334.7	42.0	161.8	7.98
Chemical Preparations	609.5	333.0	201.7	478.2	1.65
Frozen Specialties	373.2	300.4	38.6	111.4	7.79
Cookies & Crackers	424.0	268.7	89.0	244.3	3.02
Periodicals	690.4	263.2	116.0	543.2	2.27
Paper Coating	389.8	235.8	123.0	277	1.92
Primary Metal Prod, NEC	375.7	230.1	56.4	202.0	4.08
Converted Paper Products	303.2	221.1	62.5	143.6	3.55
Metal Office Furniture	272.0	182.0	31.1	121.6	5.86
Tobacco Stem Products	219.5	169.7	.3	50.1	661.97
Metal Partitions & Fixtures	281.4	161.2	36.9	157.1	4.36
Total					NA

Transport/Manufacturing Linkages

The Pennsylvania economy is transportation intensive. Both the manufacturing and the construction sectors of the Pennsylvania economy depend heavily on transportation services, as do the wholesale trades, and the mining sectors. Manufacturing accounts for fully 60% of the State's total transport bill. Construction accounts for an additional 11%. In the table below we review two key transportation-related characteristics for each of the most transportation-intense sectors of the Commonwealth's economy: 1) shipments per employee, and 2) the total transport cost. We also compare transport cost to labor cost for each key industry. Note that transportation cost accounts for more than 10% of labor costs in several manufacturing sectors, including several which have a strong export orientation. In Pennsylvania, five manufacturing industries, including primary metals, processed foods, metal products manufacturing, machinery manufacturing and chemical product manufacturing, account for fully 32% of the State's total transportation bill. Importantly, these industries will benefit directly from improved rail clearances.

Transportation Requirements of Key Industrial Sectors

Industry Sector	Shipments per Employee (lbs)	Total Transportation Cost ($000)	Transport Cost/ Payroll Cost	Beneficiary of High-Profile Transport
Coal Mining	1,516,769	$38,058	.065	
Glass Product Manufacturing	870,120	$111,644	.102	
Paper Product Manufacturing*	560,429	$211,741	.193	
Wood Product Manufacturing*	533,916	$87,267	.149	
Processed Foods Manufacturing*	335,577	$387,176	.203	
Rubber Product Manufacturing*	278,621	$10,073	.011	
Primary Metal Manufacturing*	193,685	$447,357	.166	
Transport Equipment Manufacturing*	190,783	$228,308	.140	
Nonmetallic Mining	162,963	$7,475	.056	
Electric Equipment Manufacturing*	117,775	$179,831	.10	
Chemical Products Manufacturing*	67,849	315,360	.24	
Metal Products Manufacturing*	24,320	371,264	.15	
Machinery Manufacturing*	36,319	319,190	.12	
Total for the Entire Economy	**NA**	**$5,871,081**	**NA**	

*Direct Beneficiaries of Rail Clearance Improvement

Most Transport Intensive

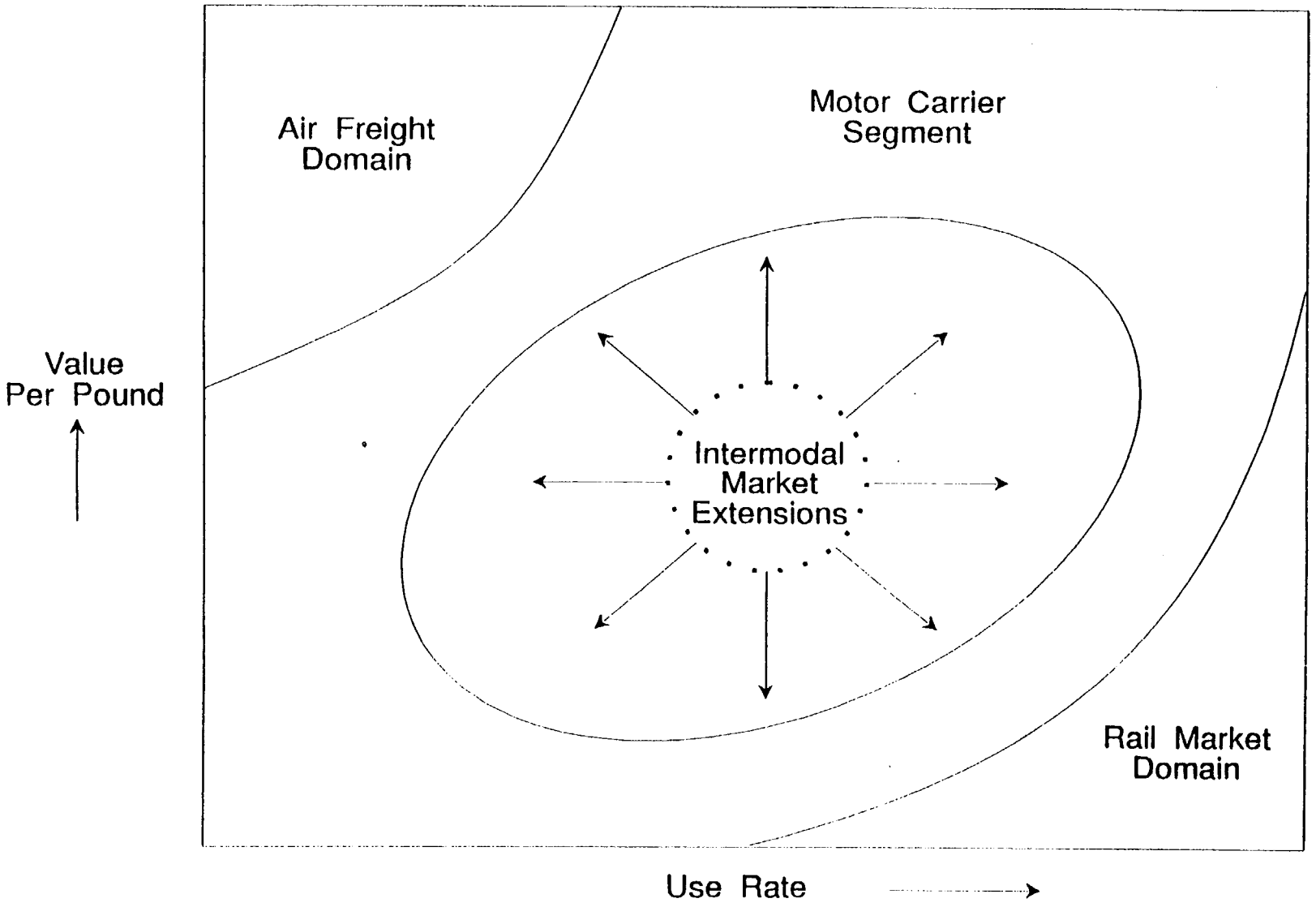
Modal Requirements of Specific Sectors

As the table above noted, industries located within the State generate an annual transportation bill of approximately $5.87 billion. Of this total, rail services account for approximately $2.0 billion or 34%. Most of the remainder represents trucking services. Railroad markets are characterized by large shipment sizes, long hauls and products with low value-to-weight ratios. Rail-compatible shipments also typically involve heavy dense products. The table below reviews transportation-relevant attributes of products used by and/or produced by the key industries which we discussed above. The diagram on the following page represents schematically the relative competitive advantages of truck vs. traditional rail services, as these apply in specific segments of the overall freight market. As the diagram suggests, transport user segments can be distinguished in terms of their modal compatibility, by two parameters: 1) commodity attributes (density and value-to-weight ratio) and 2) buyer/seller use rates.

Transport Relevant Commodity Attributes

Industry Sector	Product Input Density (lbs. per cu ft.)	Product Input Values ($ per lb.)	Product Output Density (lbs per cu.ft.)	Product Output Value ($ per lb.)	Representative Shipment Size (Tons)
Coal Mining	20	3.00	100	.04	10,000
Glass Products	70	.04	40	.07	20
Paper Products	20	.09	20	.14	75
Wood Products	25	.07	25	.10	25
Processed Foods	40	.20	40	.26	60
Rubber Products	13	.80	13	1.19	75
Primary Metals	100	1.53	25	2.57	1000
Transport Equipment	30	.23	6	.38	1500
Non-Metallic Mining	20	3.00	100	.30	2500
Electric Equipment	10	.41	6	.62	20
Chemical Products	32	.80	32	1.20	100
Machinery	70	1.00	50	1.68	50
Metal Products	100	1.53	25	2.57	75

Freight Market Segments



Modal Requirements of Specific Sectors (continued)

The market schematic above also demonstrates the unique utility of those transportation services which combine the low cost of rail transportation with the shipper flexibility of motor carrier transportation. This is the utility of "intermodal" services. Intermodal services, which railroads have developed and refined in recent years, are designed to overcome some of the traditional user constraints which have previously limited rail carload services to large-throughput, low-value and high-density product markets. If we view intermodal services as a response to changing shipper needs, the innovative intermodal services which rails have developed in recent years have been designed to open the door into non-traditional service realms where rail participation had been limited.....and to expand the "envelope" of rail market feasibility. In the 1990s these services will increasingly entail a large load hauling "envelope" or car/container and increased roadway clearances.

Transportation Needs of Pennsylvania "Export" Industries

As we noted above, industries which produce a net export surplus -- industries whose interregional outputs exceed their interregional inputs -- create wealth for the Commonwealth of Pennsylvania. The table below focuses on several of these industries. The table characterizes each industry based on several economic parameters, including importantly their transportation intensity. Transportation intensity is simply the ratio of transportation cost to product value. It is a good proxy measure for the strategic importance of transportation to a specific industry. Note that the competitiveness of several key Pennsylvania "export" sectors is linked directly to the cost of transportation, as demonstrated by high levels of transport intensity. These transport sensitive industries include manufacturers which serve an interregional or national market from a Pennsylvania manufacturing base, and service industries which provide warehousing and distribution services to a broad regional market, from a Pennsylvania base. Note that these industries are also the same industries which "power" the Pennsylvania economy.

Major "Export" Sectors of the Pennsylvania Economy

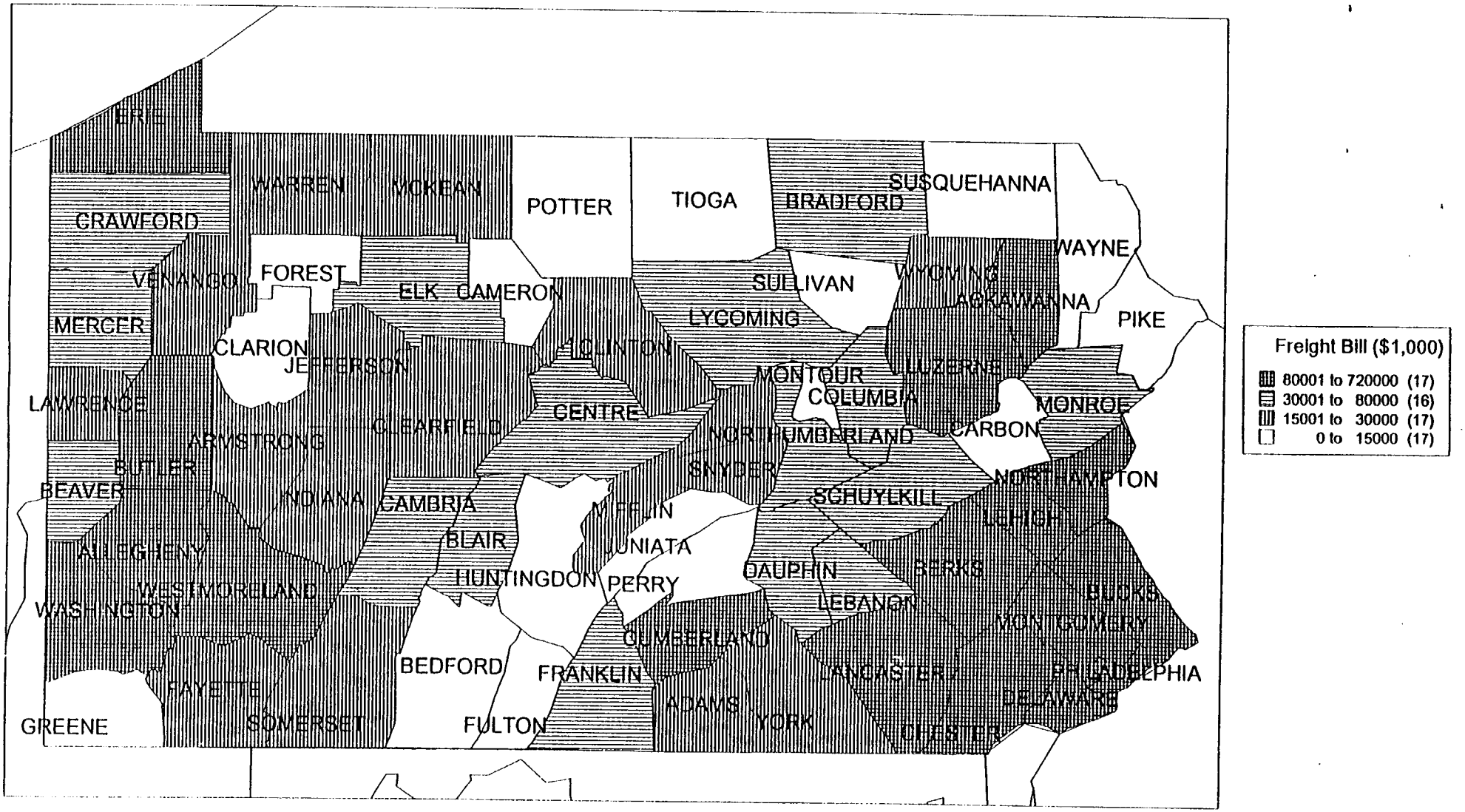
Industry Sector	Number of Firms	Employment	Export/Import Ratio	Transport Intensity
Coal Mining	551	18,462	6.45	.0306
Heavy Construction Contractors	1074	34,473	18.25	NA
Food Products Manufacturing	1081	80,977	1.16	.0548
Misc. Specialized Manufacturing	645	20,640	1.46	.0392
Primary Metals Manufacturing	513	84,106	1.04	.0597
Stone, Clay & Glass	830	40,842	1.28	.0462
Wholesale Durables	12,967	164,614	2.28	.0340

Transport/Manufacturing Linkages

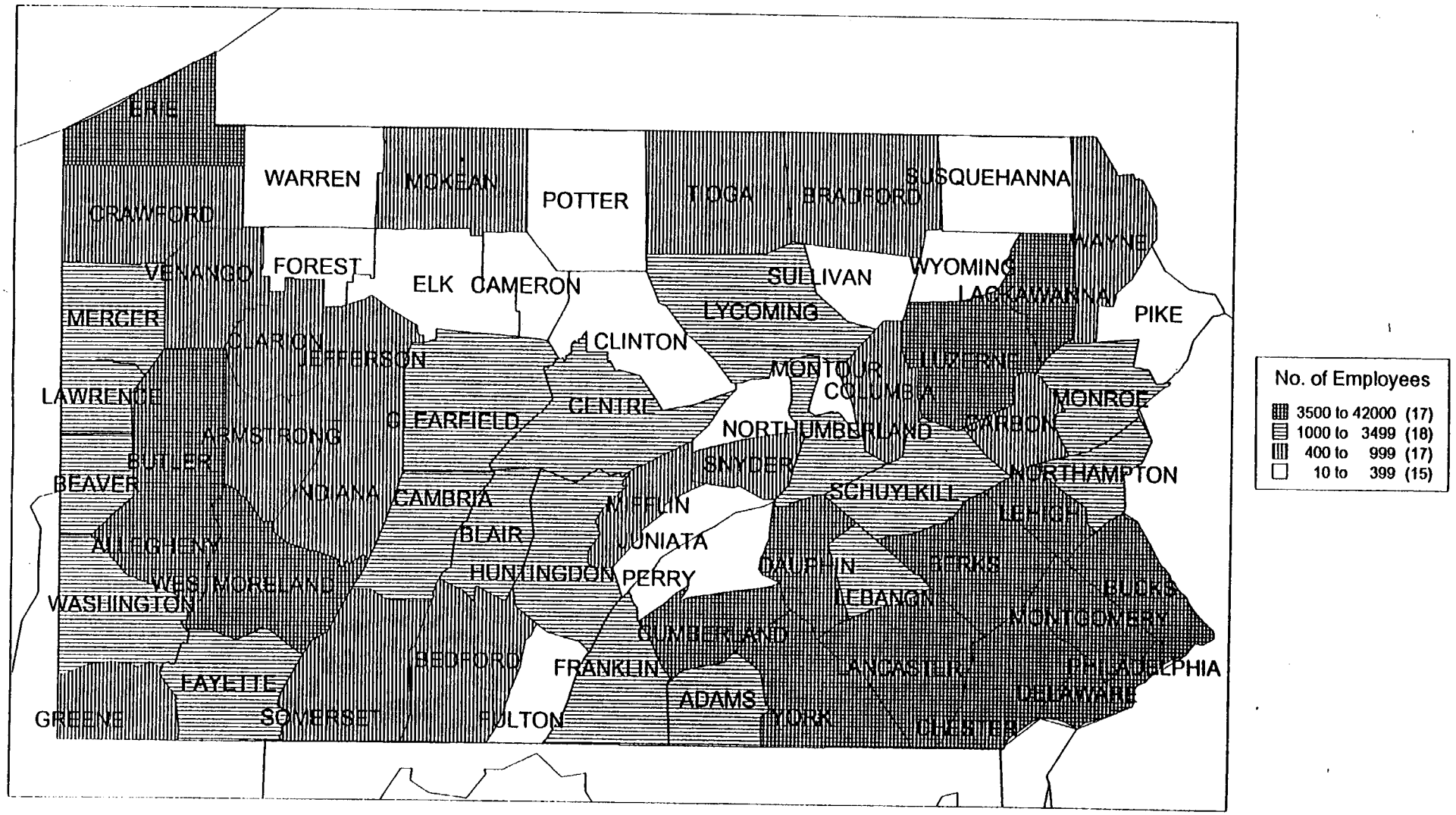
The map on the following page represents the geographical distribution of transportation demand throughout the Commonwealth. Note that demand for transportation is heavily concentrated in southeastern Pennsylvania where the counties of Philadelphia, Montgomery, Delaware, Chester and Bucks account for fully 33% of the Commonwealth's transportation bill. The south-central counties of Lancaster and York represent the second largest concentration of transportation-intense industries, including notably a cluster of distribution- and truck-related service companies centered around York and Harrisburg. South-central Pennsylvania accounts for approximately 17% of the State's transportation bill. Western Pennsylvania, including both Allegheny and Westmoreland counties, represents a third concentration of transportation-intense industries. These counties account for fully 14% of the Commonwealth's transport budget. The fourth concentration of transportation-intense industry is in northeastern Pennsylvania. Luzerne and Lackawanna counties together account for 7% of the Commonwealth's local transportation bill.

The second map represents the concentration of wholesale service employees throughout the Commonwealth. Note that the heaviest concentration of these employees exists in the major urban centers, including Allegheny, Philadelphia and Montgomery counties. Together these three counties make up fully 40% of the Commonwealth's total wholesale service payroll.

The Total Freight Bill for the Counties in Pennsylvania



Number of Employees in Wholesale by Pennsylvania County



Summary of State Transport Activity by County

County	Population	Manufacturing Number of Employees	Number of Establishments	Total Output ($1000)	Wholesale Number of Employees	Number of Establishments	Freight Bill ($1000)	Transport Intensity
Adams	78,724	7,295	99	349,824	1,172	94	25,518	0.0366
Allegheny	1,336,449	82,802	1,628	4,496,009	41,366	2,916	604,528	0.0277
Armstrong	73,478	3,000	88	170,512	544	68	17,311	0.0311
Beaver	186,093	8,786	174	665,426	1,422	164	52,654	0.0369
Bedford	47,919	2636	61	133,623	633	48	10,791	0.0330
Berks	336,523	48,503	613	3,491,402	7,893	464	240,279	0.0393
Blair	130,542	9,999	141	531,766	3,040	204	47,029	0.0248
Bradford	60,967	7,554	88	508,196	717	75	32,874	0.0416
Bucks	541,174	48,887	1,180	3,083,512	15,864	1,208	276,162	0.0331
Butler	152,013	16,535	223	1,169,846	3,535	235	85,504	0.0426
Cambria	163,029	9,215	168	659,359	2,093	204	59,636	0.0344
Cameron	5,913	947	18	57,027	10	2	3,776	0.0488
Carbon	56,846	4,728	85	136,975	461	31	9,899	0.0343
Centre	123,786	8,703	144	491,707	1,139	135	39,889	0.0310
Chester	376,396	30,911	641	2,176,768	12,583	963	212,114	0.0311
Clarion	41,699	2,561	54	155,990	551	59	12,557	0.0331
Clearfield	78,097	4,894	115	270,001	1,125	121	22,521	0.0300
Clinton	37,182	3,528	55	268,871	214	30	17,387	0.0446
Columbia	63,202	10,000	122	635,525	491	65	42,744	0.0457
Crawford	86,169	9,237	237	639,330	813	103	42,750	0.0433
Cumberland	195,257	16,007	210	1,084,030	6,404	290	101,806	0.0304
Dauphin	237,813	23,857	240	351,113	8,323	420	75,615	0.0246
Delaware	547,651	34,312	590	2,101,479	11,215	893	226,354	0.0324
Elk	34,878	7,970	115	575,837	299	36	33,134	0.0458
Erie	275,572	35,324	534	2,390,369	4,134	377	172,326	0.0415
Fayette	145,351	5,320	121	296,119	2,437	167	29,855	0.0308
Forest	4,802	255	8	14,805	20	3	1,153	0.0424
Franklin	121,082	13,743	190	734,949	1,732	125	50,791	0.0397
Fulton	13,837	1,017	23	58,435	54	14	4,197	0.0411
Greene	39,550	391	20	16,920	409	47	7,157	0.0273

Summary of State Transport Activity by County (continued)

County	Population	Manufacturing Number of Employees	Manufacturing Number of Establishments	Manufacturing Total Output ($1000)	Wholesale Number of Employees	Wholesale Number of Establishments	Freight Bill ($1000)	Transport Intensity
Huntingdon	44,164	2,892	66	166,275	1,182	38	13,351	0.0376
Indiana	89,994	4,671	100	252,436	858	103	25,808	0.0330
Jefferson	46,083	4,775	88	267,034	719	76	17,970	0.0386
Juniata	20,625	2,686	52	145,288	181	22	8,882	0.0422
Lackawanna	219,039	25,280	361	1,283,607	5103	348	96,506	0.0331
Lancaster	422,822	61,845	832	3,664,948	13,280	701	274,467	0.0381
Lawrence	96,246	7,157	155	335,494	1,422	140	28,642	0.0380
Lebanon	113,744	11,180	195	657,733	2,071	139	49,531	0.0374
Lehigh	291,130	36,389	473	2,180,241	7,882	585	171,496	0.0336
Luzerne	328,149	29,418	500	1,514,695	7,268	492	127,619	0.0337
Lycoming	118,710	16,289	219	975,376	2,194	185	68,209	0.0397
McKean	47,131	5,240	76	314,954	812	67	20,743	0.0424
Mercer	121,003	11,153	167	818,775	2,046	173	60,517	0.0409
Mifflin	46,197	6,236	62	413,654	786	52	26,347	0.0440
Monroe	95,709	5,018	108	311,539	1,222	108	31,344	0.0306
Montgomery	678,111	90,215	1,536	6,248,662	32,699	2,239	606,192	0.0341
Montour	17,735	2,061	22	120,665	263	27	14,928	0.0326
Northampton	247,105	24,807	372	1,697,307	3,438	295	119,792	0.0390
Northumberland	96,771	11,216	128	746,906	2,309	120	49,249	0.0450
Perry	41,172	644	32	28,024	151	25	2,751	0.0266
Philadelphia	1,585,577	88,981	1,745	5,786,726	36,212	2,068	715,998	0.0291
Pike	27,966	534	19	43,712	96	9	5,420	0.0286
Potter	16,717	1,236	42	63,797	68	13	4,411	0.0323
Schuylkill	152,585	17,423	252	979,419	2,698	181	68,990	0.0422
Snyder	36,680	4,793	71	309,936	581	36	19,940	0.0415
Somerset	78,218	5,170	124	272,379	968	113	22,908	0.0357
Sullivan	6,104	490	22	24,025	40	12	1,579	0.0355
Susquehanna	40,380	2,024	54	144,214	287	33	8,798	0.0349
Tioga	41,126	3,674	52	8,131	403	41	2,298	0.0192
Union	36,176	4,117	36	270,380	359	44	20,167	0.0400
Venango	59,381	4,383	89	304,170	980	71	24,908	0.0393
Warren	45,050	4,642	88	375,448	228	41	27,763	0.0458
Washington	204,584	12,237	259	771,711	3,159	277	82,602	0.0367
Wayne	39,944	1,858	68	88,356	444	49	10,569	0.0302
Westmoreland	370,321	23,219	495	1,362,762	6,089	431	119,083	0.0349
Wyoming	28,076	4,602	39	330,372	150	27	25,131	0.0564
York	339,574	51,889	657	330,374	7,891	509	25,131	0.0564
Total	11,882,093	1,049,361	17,641	61,325,250	277,232	19,451	5,558,351	

Markets Served by Pennsylvania Manufacturers

The amount of transportation which individual firms require relates to the specific geographic markets which they serve. This determination is difficult to make with a simple input/output model. However, it is possible to estimate the transportation needs of Pennsylvania's most aggressive exporting industries by comparing the supply capabilities of their Pennsylvania-based manufacturing platforms, first with intrastate demand and then with broader regional demand. The surplus production, which remains after local and regional markets are served, is available for sale into national and international markets. In national and international markets Pennsylvania-based manufacturers compete with other regional manufacturers. The table below isolates only those markets in which a net regional export imbalance exists. The table represents the largest Pennsylvania industries (at the 3-digit SIC level) which compete in regional markets and compares their level of supply with both local (intrastate) and regional demand/supply. The "region" analyzed includes Ohio, New Jersey, New York, Maryland and Delaware.

Major Regional Exporting Industries
($ Million)

Primary Candidates for Domestic Container Service	Industry	State Output	State Demand	Regional Demand	Regional Output
√	Chocolate Products	1,640.8	178.4	219.0	570.1
√	Food Preparation	989.2	297.9	1042.5	2,466.2
√	Sanitary Paper	1,147.6	269.4	829.8	1,289.6
√	Periodicals	690.4	543.2	2,647.0	6,817.0
√	Chemical Preps.	609.5	478.2	2,082.7	3,529.0
	Drugs	3,805.1	1,844.3	5,896.4	11,676.3
√	Glass & Glass Products	920.2	533.9	1,603.4	1,916.2
	Cold Finished Steel Shapes	901.9	610.4	1,173.7	1,298.7
√	Copper Rolling & Drawing	791.9	383.1	953.2	1,123.3
	Electronic Computing Equip.	769.0	497.2	2,478.0	4,106.8
√	Radio & TV Commun. Equip.	852.3	381.1	4,782.5	11,521.7

Case Studies: Industries Affected

As part of this study, we surveyed the transport needs of specific Pennsylvania-based manufacturers and attempted to relate the needs of these Pennsylvania-based companies to high-profile rail service. The discussion below attempts to relate the utility of "high-profile" rail services to specific firms, located within the State.

- **Dana Corp's Parish Division is located in Reading, Pennsylvania**. It employs 2700 people. The firm assembles frames for passenger cars and pickup trucks. It also manufactures component parts for heavy-duty, over-the-road trucks. Dana Corp could ship more than 2000 "high-cube" boxcar loads from its Reading plant to Arlington, Texas to Willow Pen, Michigan and to Pontiac, Michigan. However, Conrail clearance restrictions between Enola Yard (Harrisburg) and Conway Yard (Pittsburgh) currently restrict Dana to "low-cube" rail cars which are more costly to load and ship than "high-cube" equipment.
- **PQ Corporation operates a plant in Chester**. This plant manufactures specialty chemicals. PQ Corporation ships 60 container loads per year of its products to Los Angeles, California and Laredo, Texas. It would benefit from reduced damage, improved transit lines and lower transport rates if domestic container service were available from a southeastern Pennsylvania terminal.
- **Rohm & Haas Co. operates two plants in Pennsylvania -- one in Philadelphia and one in Bristol.** Rohm & Haas uses doublestack container services in other parts of the country where it operates. The firm estimates that it would ship 700 containers per year from its southeastern Pennsylvania base, if domestic container services were available within the region. The company's traffic manager believes that significant benefits, in the form of lower transport costs, safer handling, lower loss and damage and faster service would result from domestic container service. Rohm & Haas's major markets include Chicago, Atlanta and Toledo.

Case Studies: Industries Affected (continued)

- **Fuller Corporation operates three plants in Pennsylvania -- one in Allentown, one in Catasauqua and one in Manheim.** The first two of these plants produce approximately 14 "oversized" loads per year. Rail clearances currently restrict their movement and force Fuller to use either heavy-load trucks or to forfeit business. Fuller is interested in serving both export markets (via the Port of Philadelphia) and domestic markets via Conrail's Hagerstown and East St. Louis gateways. Fuller also has a need for doublestack container service for some of its smaller sized shipments.

- **Eastern America Transportation and Warehousing operates two warehouses within the State -- one in Philadelphia and one in Harrisburg.** The firm uses doublestack container services in other parts of the country where they are available and would ship 1000 domestic containers per year between Los Angeles, Oakland and the Pacific Northwest, on the one hand, and Philadelphia/Harrisburg, on the other, if doublestack services were available. Eastern America currently employs 210 employees. Its management cited improved equipment supply, faster loading/unloading, sturdier equipment and better freight rates, as expected benefits from domestic containerization.

- **ARMCO's Advanced Materials Division employs 2800 people in Butler, Pennsylvania.** ARMCO's traffic manager has used doublestack services in other parts of the country where they are available and would ship 100 to 200 containers per year from Pittsburgh to Philadelphia, Baltimore, Los Angeles and San Francisco if doublestack services were available in Pennsylvania. The expected benefits of doublestack service include reduced transit time and lower cost.

Case Studies: Industries Affected (continued)

- **Air Products operates three manufacturing facilities in Pennsylvania**....One in Wilkes Barre, one in Tamaqua and one in Manchester (York). Air Products employs 564 people at these three plants. The company would ship 300 containers per year to the West Coast, Midwest and Southwest from York/Harrisburg if doublestack services were available. However, Air Products' most critical concern is with extremely long and wide heat exchangers which are produced in Wilkes Barres. These involve loads for export (possibly via Philadelphia), as well as domestic loads. The company currently ships 12 large loads per year. Some of these are so large in dimension that they require rail movement. The company has averaged one to two rail dimensional loads per year over the past five years.
- **Armstrong World Industries operates four manufacturing plants in Pennsylvania**....One in Lancaster which employs 2240 workers; one in Marietta which employs 640 workers; one in Beaver Falls which employs 260; and one in Beech Creek. Armstrong produces a diversity of floor coverings, ceiling systems, office furniture and miscellaneous industrial products for both domestic and overseas markets. If Pennsylvania doublestack train service were available, it could ship 500 containers per year from Harrisburg to Los Angeles. The benefits which Armstrong expects from doublestack service include improved transit time reliability and lower rates. In addition, the company would like to have mini-land bridge services available in and out of Harrisburg.
- **Copper Power Systems operates two plants in Pennsylvania**....One in Canonsburg and one in East Stroudsburg. The company employs 1100 workers at these two plants, where it produces transformers and related electrical equipment. The company uses doublestack services in other parts of the country where these services are available and would ship 70 containers per year to the Southeast, West Coast and to Texas if doublestack services were available from Pennsylvania. In addition, the company ships 50 high and wide loads per year from Canonsburg. Rail bridges and tunnel clearances currently constrain these loads.

Case Studies: Industries Affected (continued)

- **The Sun Company Inc., operates two refineries and two distribution centers in Pennsylvania.** The company's refineries are located in Morristown and Philadelphia. Altogether Sun Company, Inc. employs 2025 workers in Pennsylvania. If stack train service were available, the company would use domestic container services. Management estimates a need for 20 containers per year. Sun traffic managers have used doublestack services previously and would expect to realize benefits in the form of reduced claims and improved service, if similar services were available in Pennsylvania.

- **Lukens Steel Co. produces and distributes flat steel plate at two locations within the State:** Coatesville where Lukens employs 1800 workers and western Pennsylvania, where the firm employs 450. Lukens ships 500 to 800 high and wide loads each year from Coatesville to points throughout the country. Currently, the company is constrained from using rail by two sets of obstructions: Amtrak's catenary over the northeast corridor near its Coatsville plant and CSX's tunnel in Brunswick, Maryland.

- **Aristech Chemical Corp. operates a plant at Neville Island, Pennsylvania where it produces specialty chemicals.** If rail clearances were improved in the Commonwealth, Aristech's traffic manager would use doublestack domestic container services from Pittsburgh to Boston and Los Angeles. Aristech estimates that it could generate 200 container loads per year.

Survey Results

As part of this study, we surveyed all of the members of the Pennsylvania National Industrial Traffic League. From the 120 surveys that we mailed to NIT League members we received 20 responses. The table on the following page summarizes our survey results. Respondents included both large and small manufacturing firms; however, large firms dominated the survey, as might have been expected since the NIT League represents principally large manufacturers. NIT League members represent the kind of manufacturers who produce for interregional national and international markets. Fully 50% of the survey respondents stated that they would benefit from domestic container/intermodal services if these services were available within the State. Surprisingly, 20% of the respondents stated that they would benefit from high and wide load transportation if clearances were improved in Pennsylvania.

Based on survey results we estimate that a market in excess of 80,900 container units per year may exist within Pennsylvania for domestic container services. Surprisingly, the survey results suggest that a market for 7,700 "dimensional" loads may exist within the State, as well. In the subsequent section we will test and refine these figures.

Survey Results

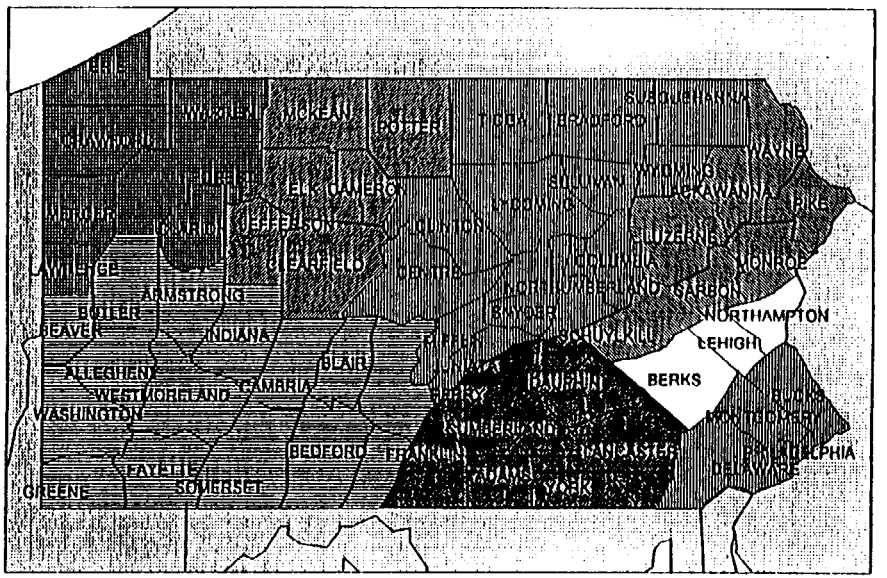
	Number In Sample	No. of Employees	Percent of Respondents	State Total
Respondents	20	19,254	100%	1,049,000
Have Used Domestic Container Services	11	NA	55%	NA
Would use Pennsylvania-Centered Domestic Container Services	11	NA	55%	NA
Would Benefit from Pennsylvania-Centered Domestic Container Services	10	NA	50%	NA
No. of Domestic Container Loads Which Would Ship Per Year, If Service Available	2970	NA	NA	80,900
Ship "High & Wide" Loads, Frequently	4	NA	20%	NA
"High & Wide" Load Shipping Would Benefit from Improved Rail Clearances	4	NA	20%	NA
Number of Additional "High & Wide" Loads Which Would Ship, If Rail Clearances Improved	566	NA	NA	7,700

Baseline Traffic Patterns

Transportation flows within the Commonwealth of Pennsylvania are composed of two distinct sets of traffic: 1) local traffic which originates or terminates within the Commonwealth and 2) overhead traffic which originates and terminates outside of the Commonwealth's borders. The latter category supports the requirements of consumers located within the Commonwealth, as well as the needs of industries who operate from Pennsylvania-based manufacturing platforms. The overhead traffic results from Pennsylvania's "crossroads" location within the regional transport network. These former traffic patterns are not linked as directly to the Commonwealth's economic well being as the local traffic. High levels of both rail and truck traffic activity take place to and from the New York metro market.

The maps on the following page represent modal activity and origin/destination characteristics of freight traffic which moves in and out of the State. In developing these maps we relied on several freight flow information resources, including principally the ICC Waybill database and the Association of American Railroad's National Motor Transport Data Base (NMTDB). Note that traffic flow data for both rail and truck modes generally confirm the conclusions which we developed above regarding the geography of freight generation activity within the Commonwealth. Industrial shippers are concentrated heavily in the southeast corner of the State. The notable exception is coal shippers and receivers. Coal shippers located in central Pennsylvania imbalance rail tonnage originations and coal utilities located throughout the Commonwealth imbalance tonnage terminations. General merchandise traffic, however, is heavily concentrated in southern, central and western Pennsylvania, as well as in southeastern, Pennsylvania.

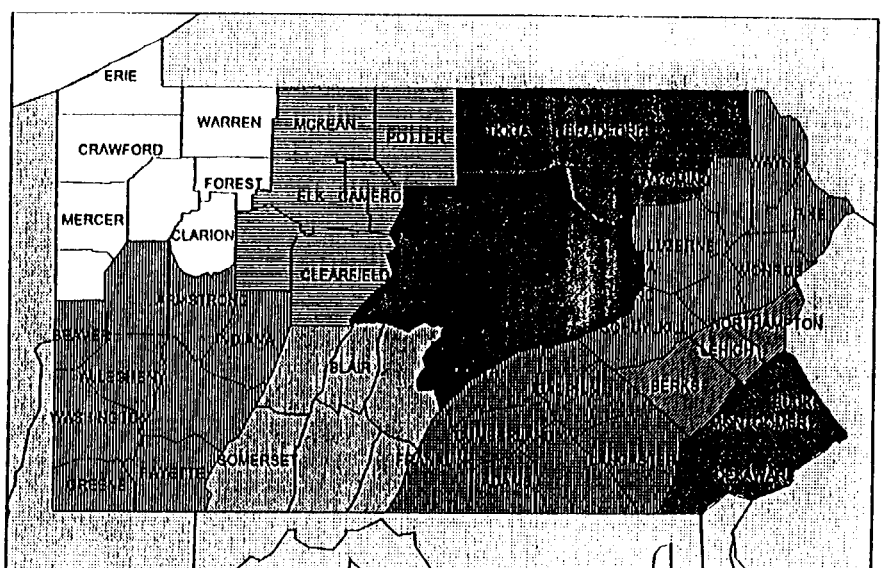
Rail Freight Tonnage: Termination



Rail Freight Tonnage

	300001 to	500000	(10)
	500001 to	540000	(6)
	540001 to	570000	(5)
	570001 to	800000	(7)
	800001 to	2000000	(8)
	2000001 to	5000000	(8)
	5000001 to	7000000	(3)
	7000001 to	8000000	(8)
	8000001 to	11000000	(9)
	11000001 to	13000000	(5)

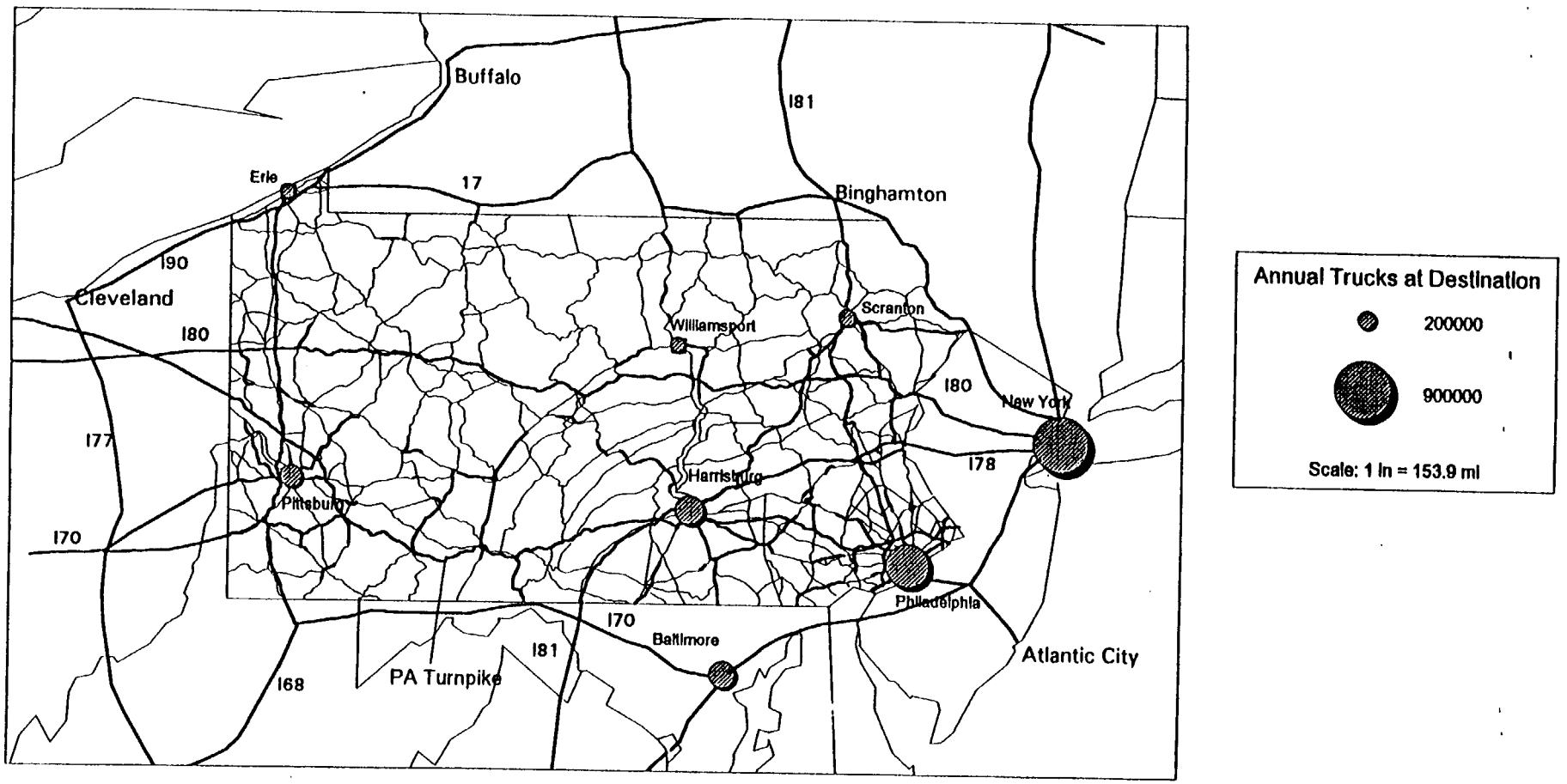
Rail Freight Tonnage: Origination



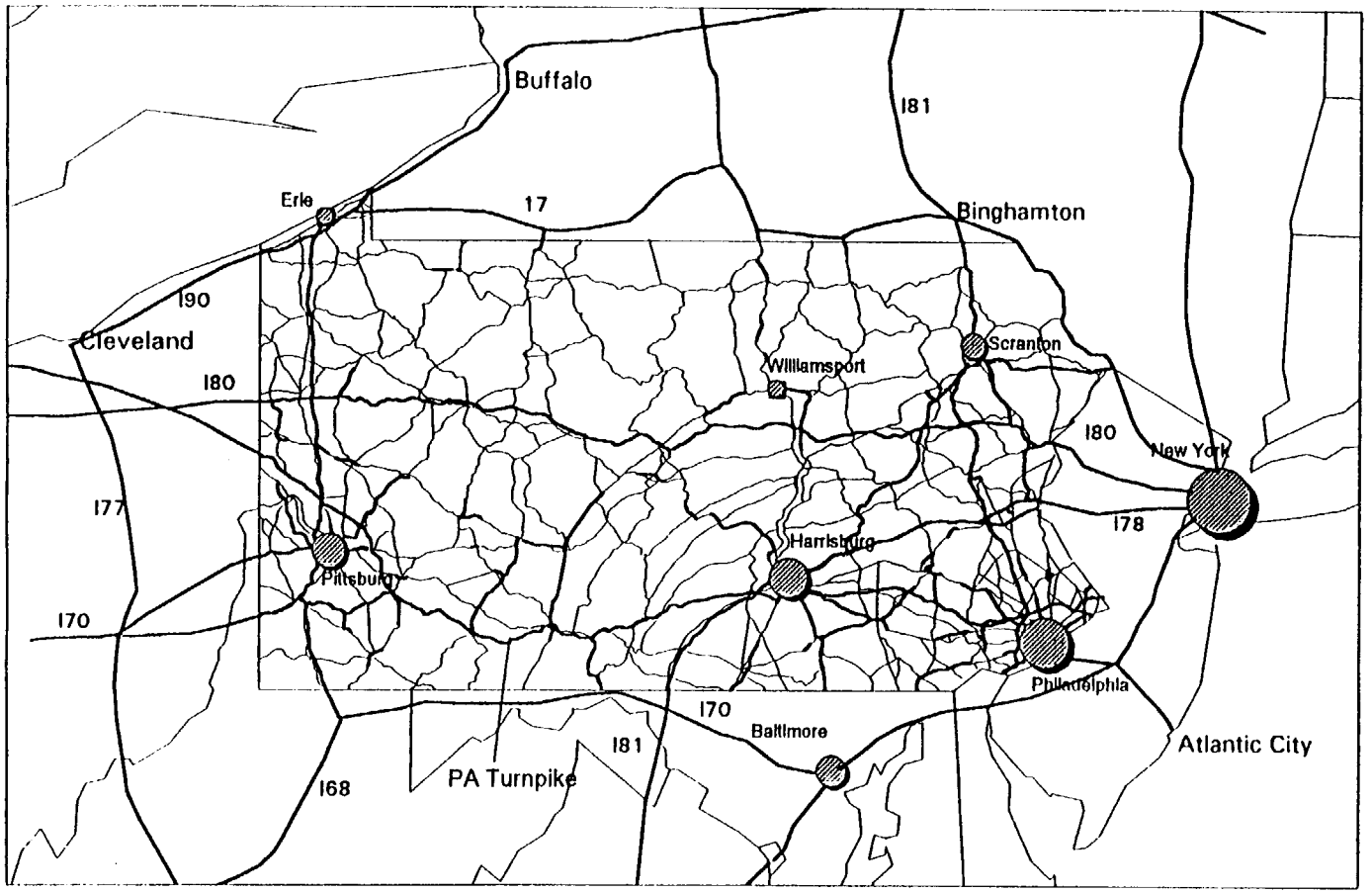
Rail Freight Tonnage

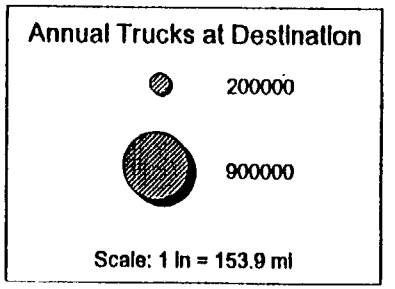
	100000 to	400000	(5)
	400001 to	600000	(10)
	600001 to	800000	(7)
	800001 to	1500000	(8)
	1500001 to	2500000	(3)
	2500001 to	3500000	(8)
	3500001 to	5000000	(5)
	5000001 to	8000000	(6)
	8000001 to	12000000	(8)
	12000001 to	15000000	(9)

Truck Trip Originations



Truck Trip Terminations





Most Significant Containerized Freight Flow Patterns
(thousand units/year)

	Philadelphia & East PA		New Jersey	
	Inbound	**Outbound**	**Inbound**	**Outbound**
Midwest & West	76,722	39,500	126,096	60,044
Canada	9,647	10,563	7,833	9,934
South	9,970	5,850	10,786	8,695

II. High and Wide Load Shippers

High and Wide Load Shipper Profile

In order to analyze high and wide load shippers who move their products through the Commonwealth of Pennsylvania, we interpreted and compiled 12 months of applications for "superload" permits which PennDOT received between July 1991 and July 1992. A permit is required for any oversized load or vehicle which moves over a Pennsylvania highway. An analysis of superload permit requests, we believe, is a more representative and accurate basis for estimating demand for dimensional rail services than the shipper survey that we cited in the previous section. Hence, the review and analysis of permit seeking shippers should be much more inclusive than our NIT League survey. PennDOT defines an oversized load or vehicle to have one or more of the following characteristics:

- Gross weight, including load, which exceeds either 201,000 lbs. or 27,000 lbs./axle;
- Length which exceeds 160 feet; and
- Width which exceeds 16 feet.

The industry characteristics of shippers/products that seek oversized load permits are represented in the table below. Note that most of the loads involve large machined items which were engineered to particular specifications. They included mostly machinery loads destined for installation in manufacturing plants or oversized civil works loads destined for construction sites. Increasingly, the ability to manufacture and to ship large scale industrial products has become a source of competitive advantage to dimensional equipment manufacturers.

Industry	Typical Shipments
Fabricated Metal Products	Steel tanks, steel casting
Industrial Machinery	Compressor, molding machine, coolant vessel, overhead crane trolley
Ship Building	Ship propeller, Internal combustion engine
Heavy Construction	Steel/concrete bridge beams

High and Wide Load Shipper Profile

During the twelve month period which we examined, shippers applied for more than 300 superload permits. Approximately a third of those permits were issued. The others were rejected based on various criteria. Issued permits allowed 660 high and wide loads to move through the Commonwealth. These numbers suggest that the market size, which we estimated by extrapolating data from our NIT League questionnaire, significantly overstated the absolute market size.

The market for high and wide load services is made up of several elements: local traffic which originates and/or terminates within the Commonwealth and overhead traffic which originates and terminates outside the Commonwealth. Hauls which both originate and terminate within the Commonwealth account for fully 46 percent of all oversized hauls. Hauls originating in Pennsylvania with a final destination in other States represent 22 percent of total hauls observed. Slightly over 16 percent of the hauls moving through Pennsylvania, neither originated nor terminated within the Commonwealth. These are termed "overhead" loads. The remainder of the hauls, approximately 15 percent, are hauls originating outside the State with a final destination within.

High and Wide Load Shipper Profile (continued)

As the map on the following page demonstrates, high and wide load shippers within Pennsylvania are concentrated principally in 8 counties. However, York County and Lancaster Counties in south-central Pennsylvania have the highest concentration of dimensional haul originations. Another concentration is found in Allegheny County and several counties along the Pennsylvania/Ohio border.

The map summarizes the concentration of receivers of high and wide loads located in Pennsylvania. York County, again, has the greatest concentration of dimensional load terminations. However, the State's urban centers, including Philadelphia and Allegheny counties, also account for high concentration of large load destinations.

The heaviest volume of large load traffic moves through the State via the following highway routes:

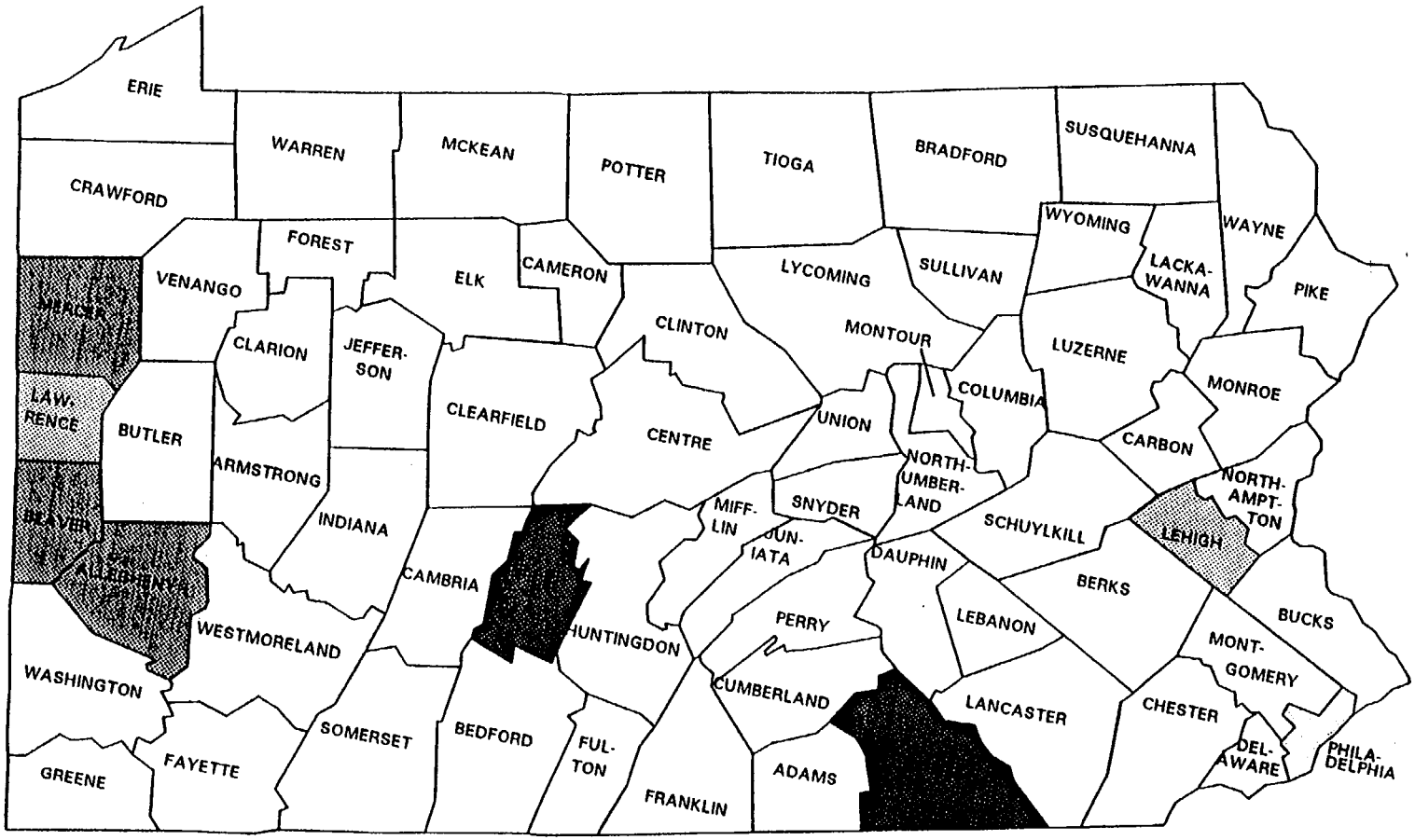
- East/West via I-80
- North/South via I-79
- East/West via I-70/76
- North/South via I-81

High and Wide
Modal Proformas

In applying for dimensional load permits, applicants must provide justification for choosing truck service over rail service. The table below summarizes the reasons given by applicants over the 12 months of superload applications we examined. From this table, it can be seen that limited access to rail service and clearance restrictions related to excess-dimensions are the two leading reasons for choosing truck over rail. Indeed, clearance restrictions alone account for fully 34% of oversized loads which move via the highway.

Reasons for Preferring Motor Carrier to Rail	Percent Response
Cannot obtain rail clearance from the railroad due to excessive dimension	34%
Rail siding too far or not accessible to customer, shipper, or consignee	33%
Due to the nature of the cargo, transport by rail would result in damage	25%
Reliability and transit time required	24%
Rail transport is impractical because of the cargo configuration	5%
Safety	5%
Expense	5%
Time delay waiting for special rail equipment	3%
Time delay due to loading/unloading onto/off of rail equipment	3%

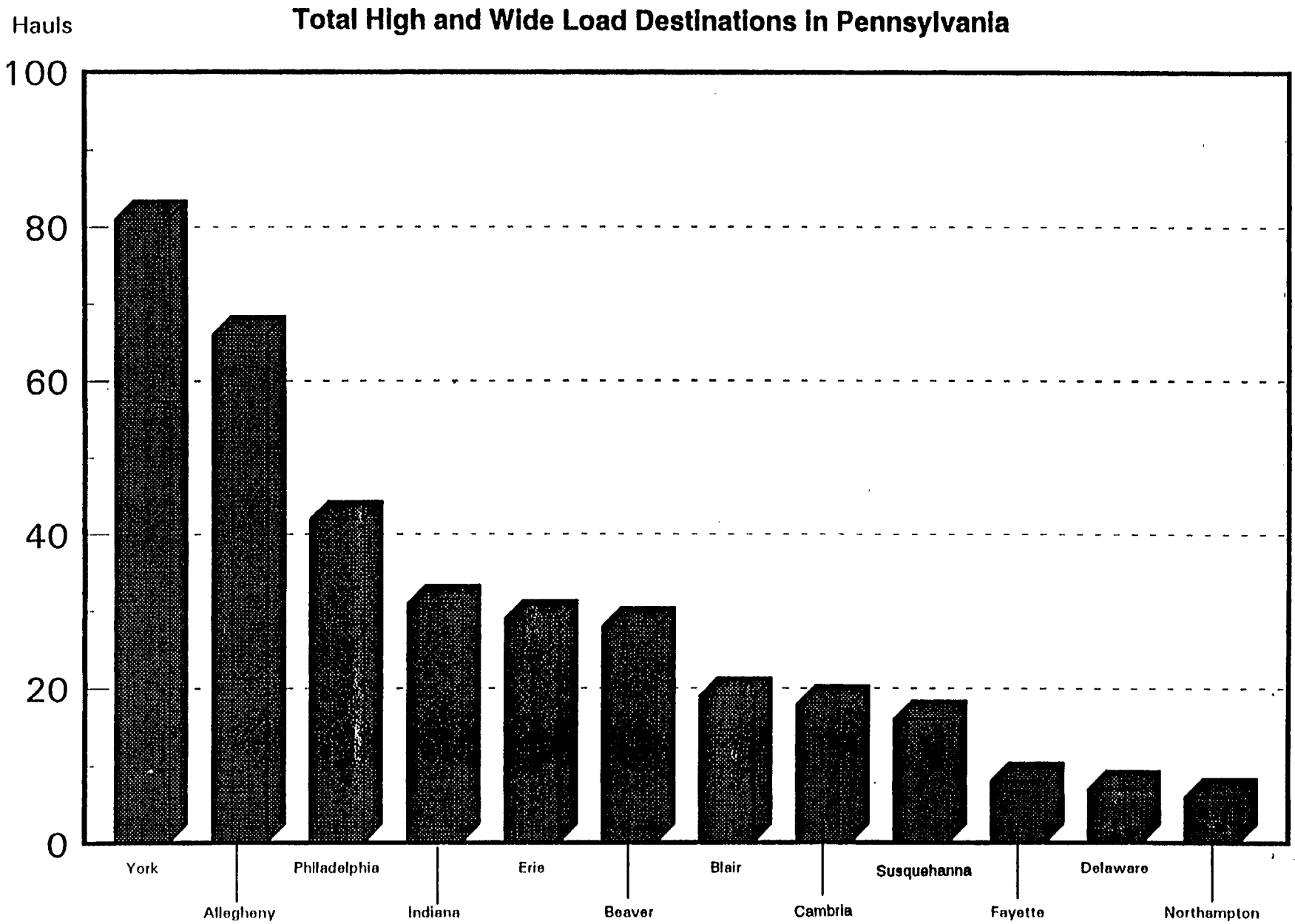
Origins of Intrastate High & Wide Hauls



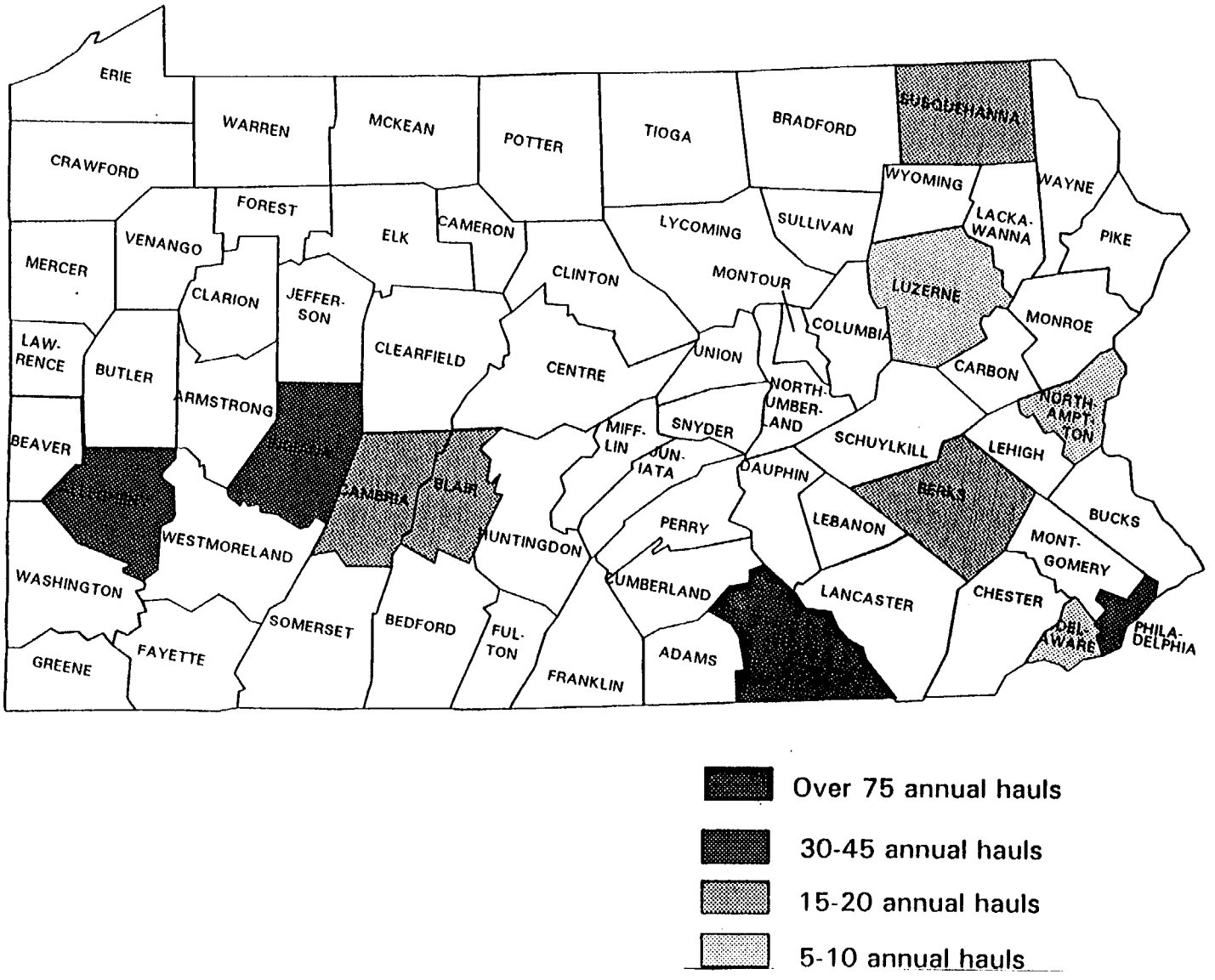
68-80 annual intrastate hauls

19-22 annual intrastate hauls

5-15 annual intrastate hauls

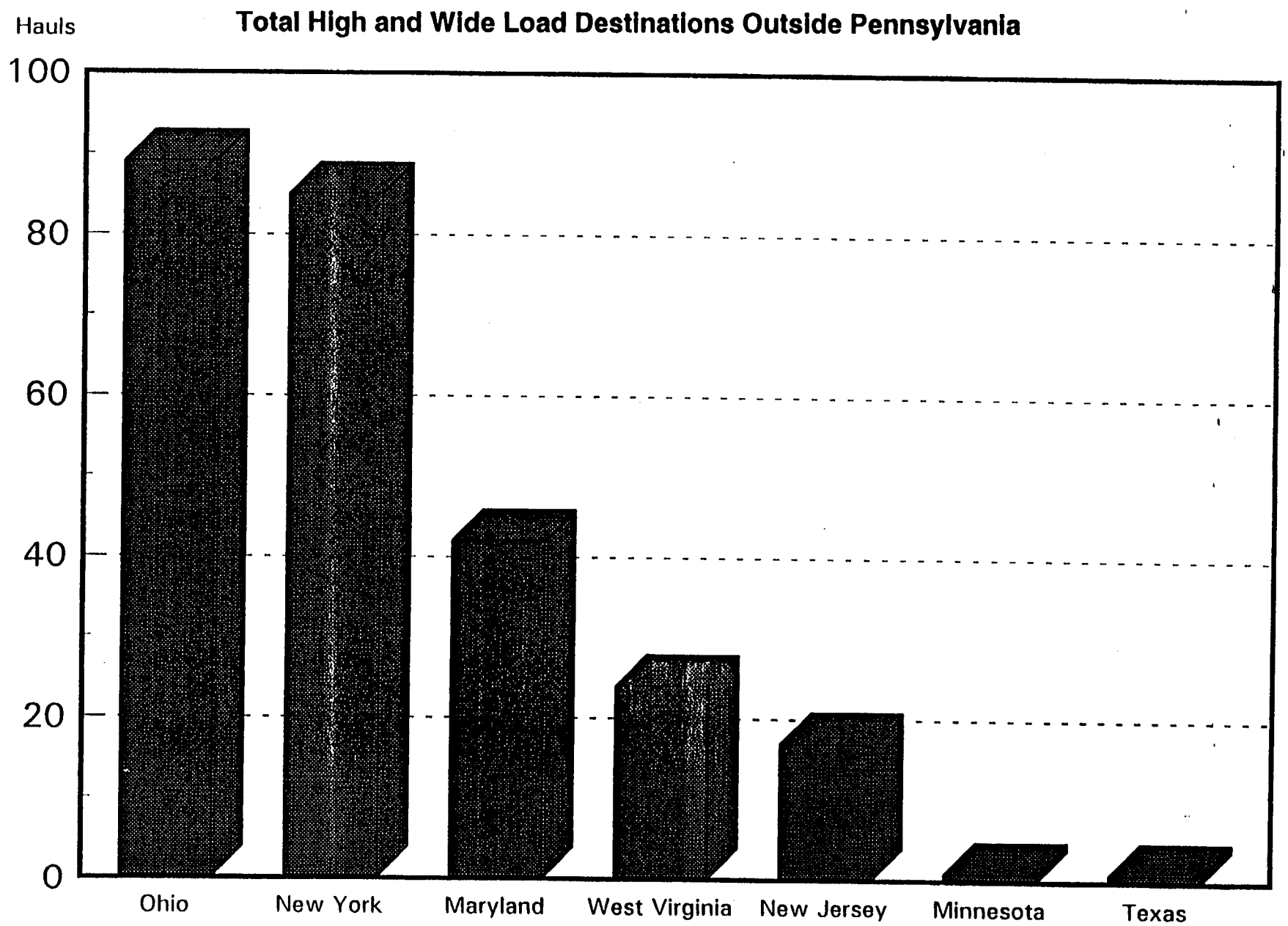

Total High and Wide Load Destinations in Pennsylvania
Hauls
100
80
60
40
20
0
York
Allegheny
Philadelphia
Indiana
Erie
Beaver
Blair
Cambria
Susquehanna
Fayette
Delaware
Northampton

Destinations of Intrastate High & Wide Hauls

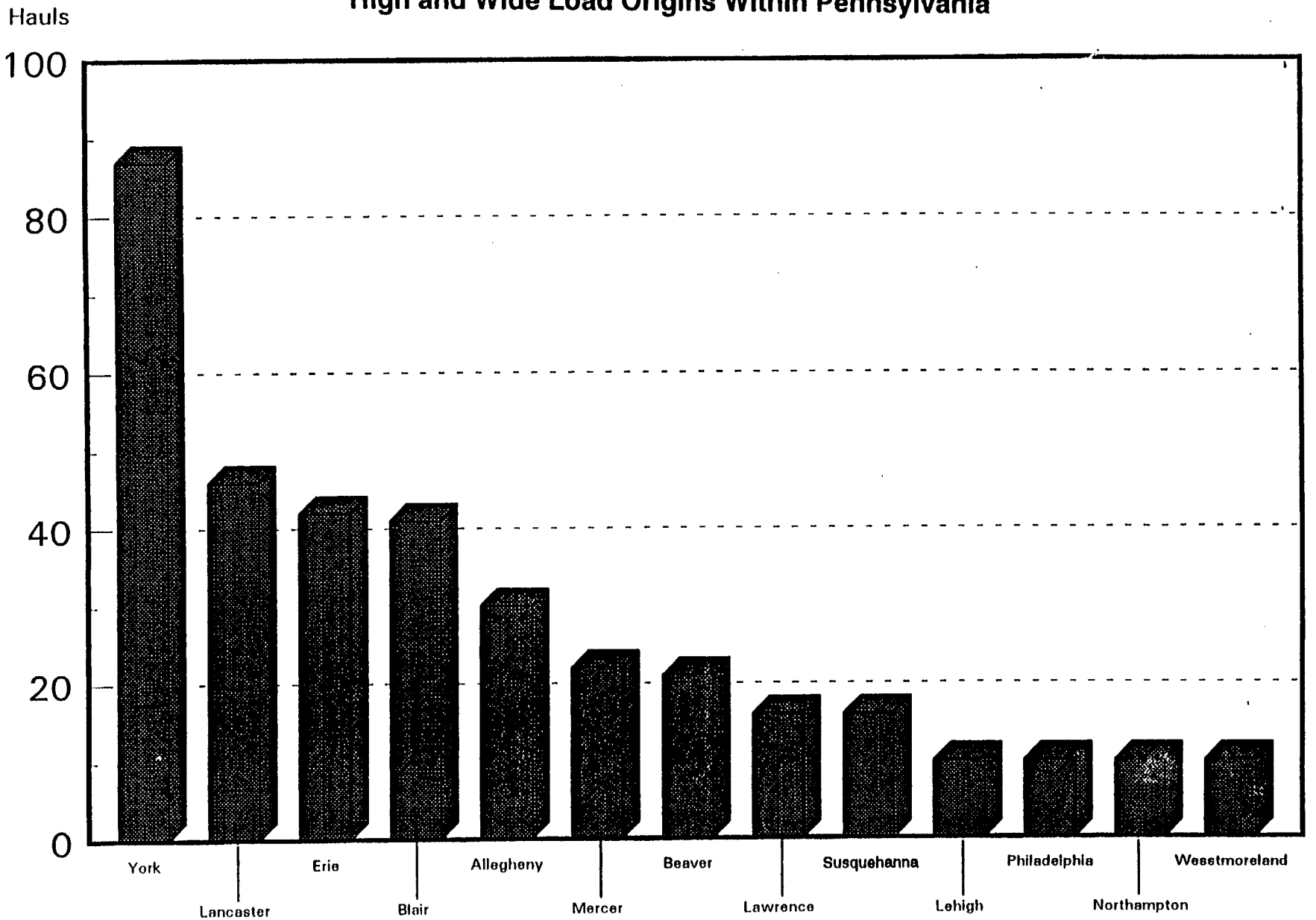


High and Wide Hauls by Truck To/From and Through Pennsylvania

		Destinations					
		Maryland	New Jersey	New York	Ohio	Pennsylvania	Total
Origins	Maryland	0	0	2	9	9	20
	New Jersey	0	0	7	7	32	46
	New York	10	7	1	37	12	67
	Ohio	0	3	10	0	41	54
	Pennsylvania	31	5	66	31	307	440
	West Virginia	1	1		4	8	14
	Total	42	16	86	88	409	641


Hauls
Total High and Wide Load Destinations Outside Pennsylvania
100
80
60
40
20
0
Ohio
New York
Maryland
West Virginia
New Jersey
Minnesota
Texas

High and Wide Load Origins Within Pennsylvania



High and Wide Load Survey Results: Missed Opportunities

At least two of the respondents to the survey indicated that they had lost orders or forfeited markets as a direct result of the current rail clearances.

Voith Hydro, Inc. This company, based in York, Pennsylvania, employees 600 people and manufacturers major components for Hydro-Electric Dams worldwide. Currently, Voith Hydro owns three special rail cars and leases an additional car strictly for the purpose of shipping large and excess-dimension components. They are supportive of any program that increases the opportunity to ship by rail. Within the last year, Voith Hydro provided financing for the removal and replacement of the Penn Street bridge in York to remove height restrictions into York.

Voith Hydro indicated that they have lost orders or forfeited market opportunities as a direct result of the current sub-standard rail clearances. However, they must weigh the potential for market access against increased handling costs. To consider rail would require a reduction in transportation costs of over 20 percent over current truck transport costs, primarily due to the extra labor costs required for handling and securing the material to a railcar.

Voith Hydro handles approximately 80 inbound excess-dimension loads and 150 outbound excess-dimension loads with an average length of haul of over 300 miles. Their primary mode of excess-dimension transport currently is truck, at 80 percent, with rail absorbing the remaining 20 percent. The 13 foot wide rail limitation and rail shipping lead time helps to keep trucking as their primary transport option. The potential incremental volume of excess dimension loads that could be put into rail service was estimated to be 40 containers per year. These loads would be to existing markets originating in York and terminating in Baltimore, New York and California. In addition, most of the loads that they ship or receive

High and Wide Load Survey Results: Missed Opportunities (continued)

through the Port of Baltimore could be diverted to the Port of Philadelphia if rail customer service support were sufficient to meet their needs. Currently, there is no incentive in price, quality of service, or delivery schedule that can be obtained through the Port of Philadelphia.

Transoceanic Shipping Company, Inc. This company is based in Kenner, Louisiana. They are project freight forwarders and custom house brokers. They handle import and export of over-dimensional loads in and out of every port in the country. Basically they ship to wherever their clients have a job. In fact, it is the ability to get the machinery to the job site by whatever means - not price - that drives a sale. Therefore, improvement of rail clearances is seen by this company as improving market access. For Transoceanic Shipping Company, Inc. inadequate rail clearances have directly resulted in lost orders or forfeited market opportunities.

In the past 18 months, Transoceanic has had three jobs in the Commonwealth of Pennsylvania. Each of these jobs required the transport of a generator stator with 17' 9" by 14' 6" by 10' 6" (LWH) and weighing 225,000 lbs. These units had to be trucked primarily due to the width restrictions: the 14' 6" could not be cleared on the rail. Transoceanic uses rail for excess-dimension shipments for approximately 50 percent of all shipments, primarily because they can move heavier loads by rail than truck.

Since access - not cost - is the primary concern for this company, they indicated that less than a 5 percent reduction on total transport costs would cause them to consider increasing their rail use. Furthermore, they indicated that they could divert high and wide loads they currently ship or receive through Baltimore or Norfolk to the Port of Philadelphia.

Economic Impacts

The effects of limited rail service on dimensional load shippers -- including, importantly, rail service which is clearance constrained -- manifest themselves in several ways depending principally on how competitive the markets are in which individual manufacturing firms participate. Under a "highly competitive" set of buyer/seller relations, Pennsylvania-based manufacturers have no choice but to respond with competitive prices based on products delivered to the buyers' plant. Under "highly competitive" market circumstances product designs must comply fully with customer's specifications. Under this scenario, little opportunity exists to redesign "jumbo" products to accommodate rail clearance constraints. However, trucking services can be used in lieu of rail services in 90% of all cases. Although having a rail option may give shippers some additional negotiating leverage when dealing with oversized load truckers, it is usually not essential to moving their product. Indeed, the oversized load trucking industry itself is highly competitive. More than 20 carriers offer services in 48 states. Under this scenario the benefits associated with rail clearance involve productive work for Pennsylvania employees 10% of the time and marginally lower transport charges 50% of the time.

Under an alternative scenario where little competition exists, shippers have additional leverage....not only over the carriers from whom they purchase services, but also over customers to whom they sell their products. Under this scenario the probability of lost orders and of lost work for Pennsylvania orders decreases from 10% to 5%. The set of circumstances under which lower transport charges may be realized remains constant at 50%.

III. Auto Transport Markets in the Northeast

Auto Transport Markets in the Northeast

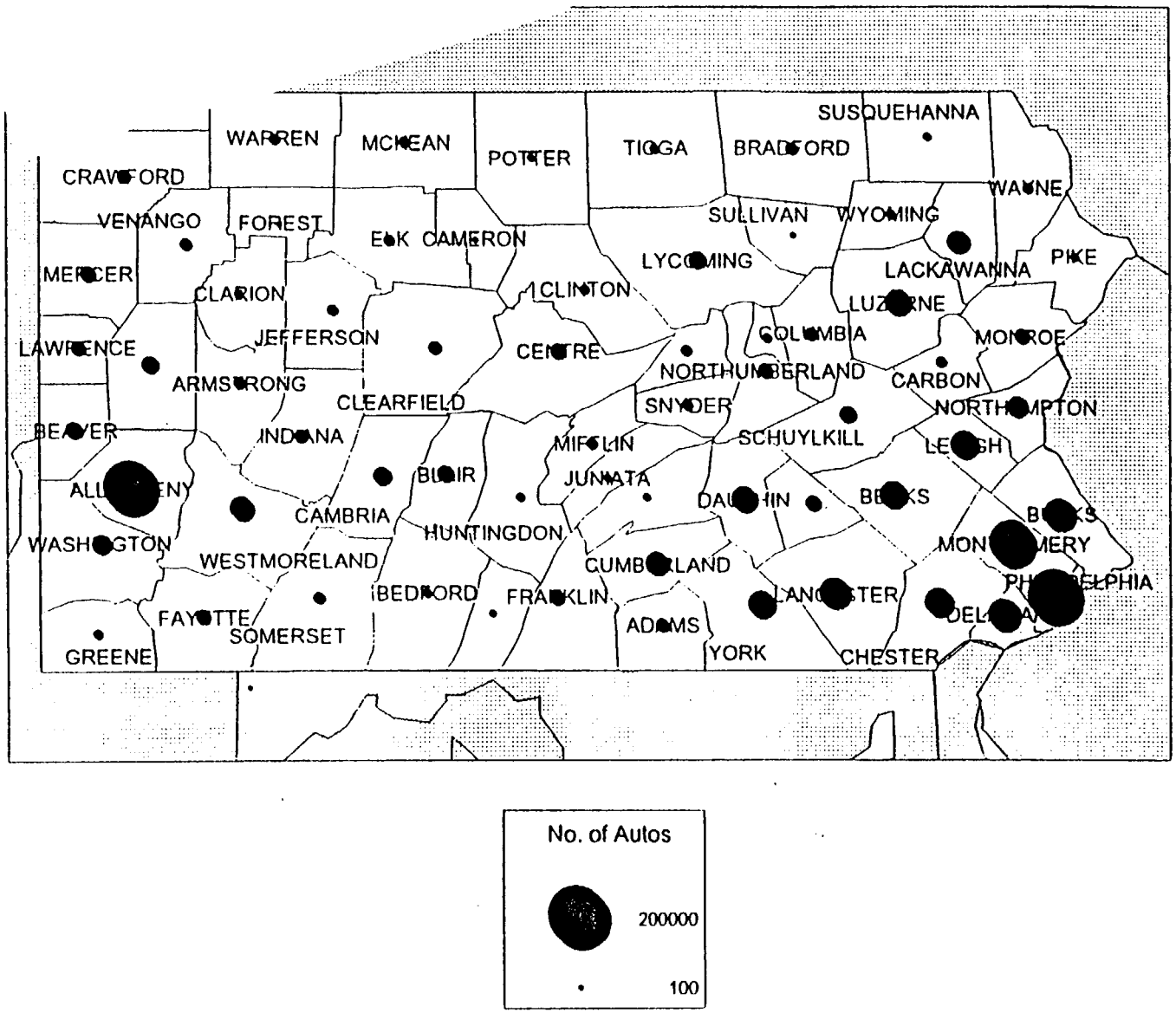
Auto transport markets are essentially different from "high and wide" load markets. In general, auto sales are distributed throughout the U.S. in proportion to the disposable income of consumers. Autos pass through several links in a complex distribution channel on their way to the final consumer. When moves of 450 miles or more are involved, autos frequently move in rail service especially between auto plants and auto ramps, from which they are delivered ultimately in local motor carrier service to dealer destinations.

The auto transport market operates within the constraints of an auto terminal infrastructure which is fixed in place, at least in the short-term. Rail carriers compete with one another in this market based on the quality and location of the terminal facilities which they offer to the auto manufacturing companies, as well as the transit time, loss-and-damage and equipment utilization results which they realize for their customers. Auto terminals are forward storage and interim holding facilities for auto manufacturers and they are typically located so that they can serve dealerships within a broad regional watershed market. Approximately 220 auto terminals are scattered strategically throughout the United States.

Terminal facilities typically consist of a set of stub-ended railroad tracks and a number of "drive away" rampways which are used to unload bi-level and tri-level rail cars. They also typically include a paved apron which is used to store cars. Auto ramps are fully enclosed and lighted. Security is a critical service dimension, as is "defect free" handling and intermodal transfer.

Watershed markets within range of southeastern Pennsylvania are among the largest in the country. As the map on the following page represents, high levels of new auto and light truck sales are concentrated within a 100 mile range of Pittsburgh, Philadelphia and Wilkes Barre. More than half a million autos are sold annually within a 100 mile market range of these three distribution centers.

Number of Autos Sold By County



Principal Auto Plants in the Northeast

Plant/Location	Serving Railroad	Clearance	Loading	Unloading	1991 Carloads
Chrysler Newark Assembly Plant Newark, DE	Conrail*	19' 2"	Chrysler Domestic	Chrysler Imports	2040
General Motors CPC Group Linden, NJ	Conrail*	19' 2"	GM	None	760
Ford Motor Company Edison Assembly Plant Mutuchen, NJ	Conrail*	19' 2"	Ford	Ford	4920
General Motors CPC Group Tarrytown, NY	Conrail*	17' 6"	ADV's/GM	None	240
General Motors T&B Group Baltimore, MD	CSX*	19' 2"	T&B/GM	None	4760

*No reciprocal switching

Principal Auto Ramps Located in the Northeast

Ramp/Location	Serving Railroads	Loading	Unloading	Clearance	1991 Loads Handled
Twin Oaks, Aston, PA	CSX	GM/GM Buybacks	Chrysler, Ford, GM, Suzuki	19' 2"	23,840
Montgomery, PA	CR	NA	NA	19' 2"	680
York, PA	CR	GM/CPCVehicles from Wilmington, Del.	GM	19' 2"	160
Pocono Summit, PA	D&H	Military Vehicles Used Cars	None	17' 6"	440
New Castle, DE	CR	None	Honda	19' 2"	200
Port of Wilmington, Wilmington, DE	CR	Volkswagen	-	19' 2"	1,840
Newark, NJ	CR	Imports	None	19' 2"	15,480
Little Ferry, Ridgefield, N.J.	CR	None	Chrysler, Ford Honda, Imports	19' 2"	9,080
West Borough, NJ	CR	None	GM	19' 2"	NA
Ayer, MA	B&M/CR	None	Ford	19' 2"	4,960
Framingham, MA	CR	None	GM	19' 2"	4,120
Westboro, MA	CR	Used Volkswagen Volkswagen	Chrysler, Saab, Honda, Toyota, Isuzu, Volvo, Mitsubishi	19' 2"	4,160

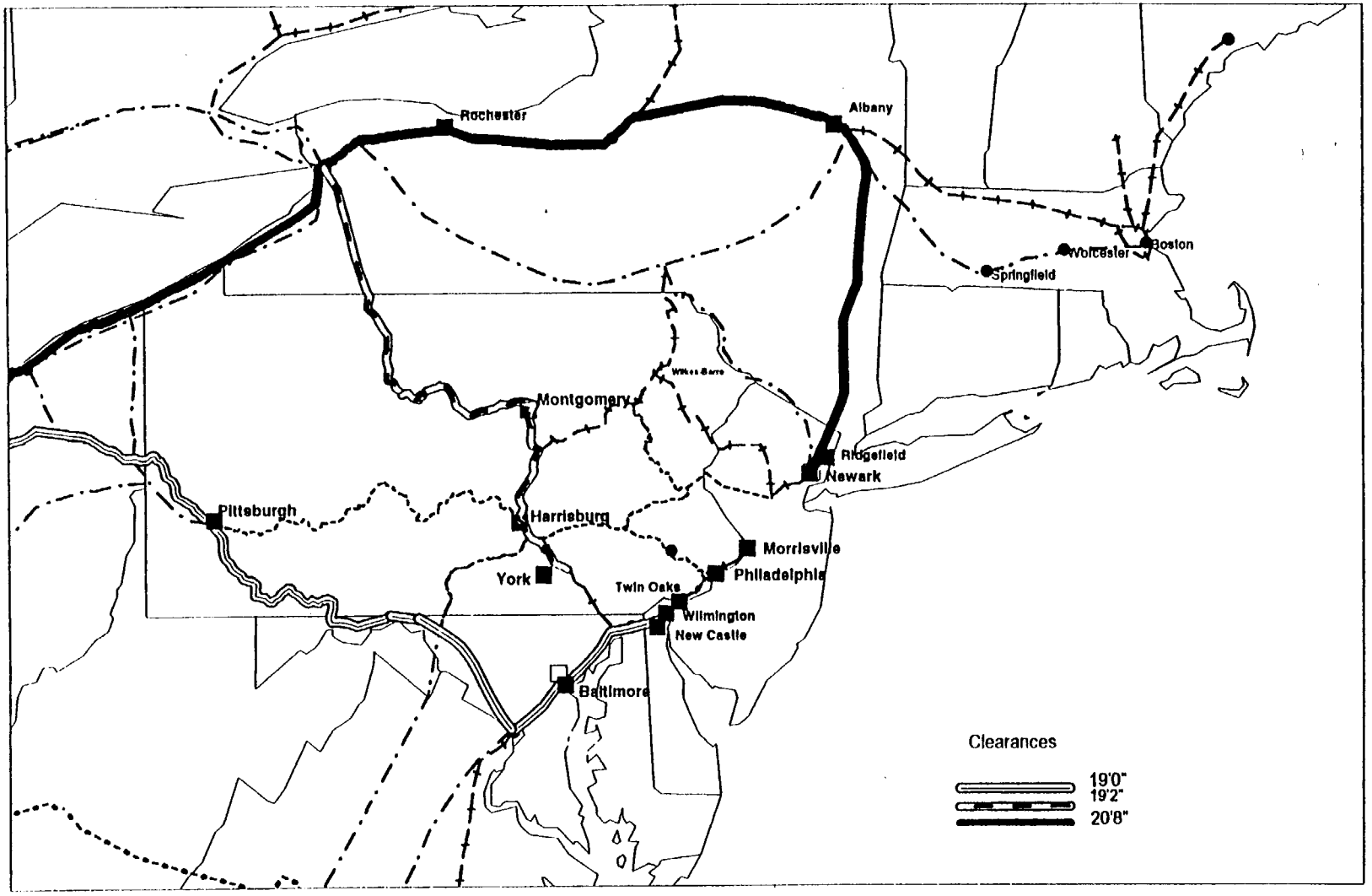
Auto Traffic Routing

Clearance problems in the northeastern quadrant of the country adversely affect autorack traffic flow patterns, equipment utilization and the service competitiveness of specific auto ramp facilities and correspondingly the railroads which serve them. Only one auto ramp in the Northeast -- Conrail's ramp at Selkirk -- can currently accommodate 20' 2" "Chrysler" autorack cars. However, for various reasons not even that ramp receives 20' 2" traffic. No other auto ramp in the States of New York, Pennsylvania, Delaware, New Jersey, Maryland or in New England currently receives 20' 2" equipment. Moreover, clearance constraints inhibit the flexible and free movement of 19' 2" autorack equipment throughout the Northeast. In particular, Pennsylvania routes pose a major obstacle to free movement of autorack equipment in and out of the region. The following points underscore the limitations which current clearances impose on the rail auto business.

- No junction exists on the East Coast through which CSX and CR can interchange 19' 2" autorack traffic directly. This is because the two freight carriers serve customers on opposite sides of Amtrak's northeast corridor. Few crossings exist for 19' 2" equipment under the existing catenary system.
- Traffic to and from the southeast moves via Cincinnati, rather than through Potomac Yard (Philadelphia) or via Hagerstown. The natural north/south gateways to the northeast are closed to high-profile loads. The circuitous route Cincinnati/Buffalo/Harrisburg adds 3 to 4 days to 19' 2" car repositioning.
- All east/west 19' 2" autorack traffic on Conrail must be routed via Buffalo. Some of this traffic moves beyond Buffalo into Pennsylvania via Olean/Sunbury/Harrisburg. Other traffic -- New England and Northern N.J. traffic -- is routed even more circuitiously via Selkirk.

The map on the following page represents autorack movement patterns within the Northeast. Note the circuity of these patterns.

Routing of 19'2" Tri-Level Autorack Cars to Eastern Points



Economic Impacts

In the short-term, circuitous routing of tri-level equipment affects principally the operating efficiency and marketability of specific rail lines. The collateral effects on the local economy are felt by local tow-away motor carriers and local service companies who operate auto terminal facilities. However, these impacts are relatively small in the context of the State's overall economic activity. Towaway costs average $1.80/mile and auto handling charges average $15 per car. Auto traffic levels, through any individual terminal facility, are simply not sufficient to cause a significant economic impact. The longer term economic effects, however, can be significant. Rail clearances can directly affect both the viability and the merit of future auto plant sitings.

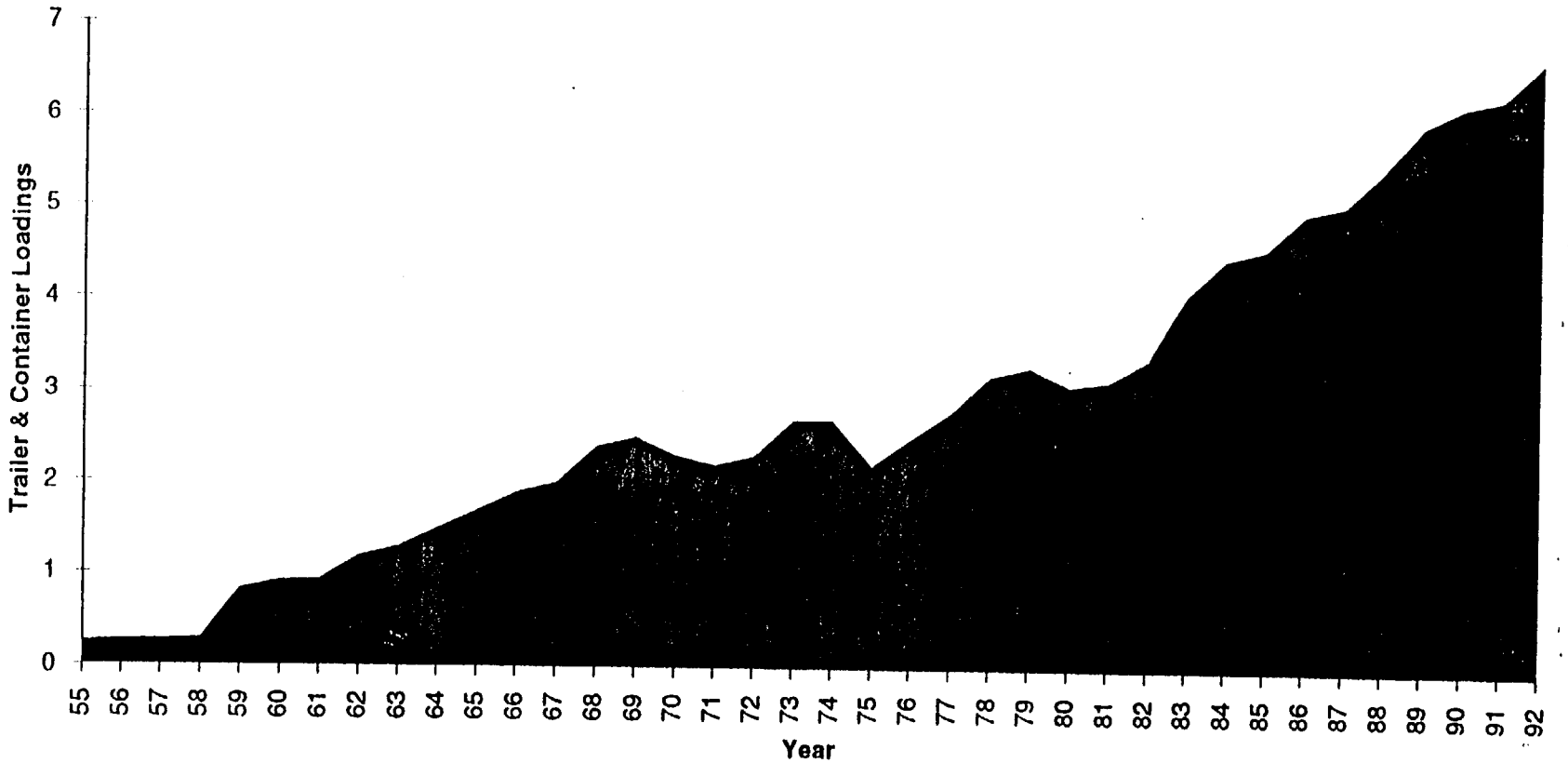
IV. Intermodal Industry Profile

Intermodal Industry Profile

First a few intermodal basics: The intermodal business is distinct and different from both the auto hauling and large load delivery businesses. Importantly, intermodal markets are large and encompass the entire domain of cargoes which can be containerized. Hence, they impact almost every manufacturing and distribution sector of the State's economy. In recent years, the intermodal market has grown at 8% per year. This growth rate, well in excess of overall economic activity, confirms that intermodal services do create significant value for intermodal shippers. See the chart on the following page.

Most large railroads offer intermodal services through a distinct and separate business unit. This is possible because train operations and facilities required to provide intermodal service are distinct from those which support other railroad services. Dedicated intermodal train service and specialized intermodal terminals are essential prerequisites to modern intermodal service delivery systems. Domestic container services, in particular, require specialized facilities and dedicated doublestack container trains. In order to justify these major commitments, a threshold volume of business must exist within a particular service lane. The "break-even" threshold associated with a new train service can range between 60 units/day/train and 100 units/day/train depending on a number of parameters which effect the per unit profit margin. Markets which generate less than this volume typically cannot justify doublestack service. However, southeastern Pennsylvania is a proven intermodal market and a natural market "anchor" for new domestic container service. Five intermodal trains originate and terminate in the southeastern Pennsylvania market each day. Converting all or a portion of this existing conventional intermodal traffic to lower cost doublestack container service represents a "low risk" project from a rail perspective. The economic viability of other terminals in northeastern, south-central and western Pennsylvania is more questionable.

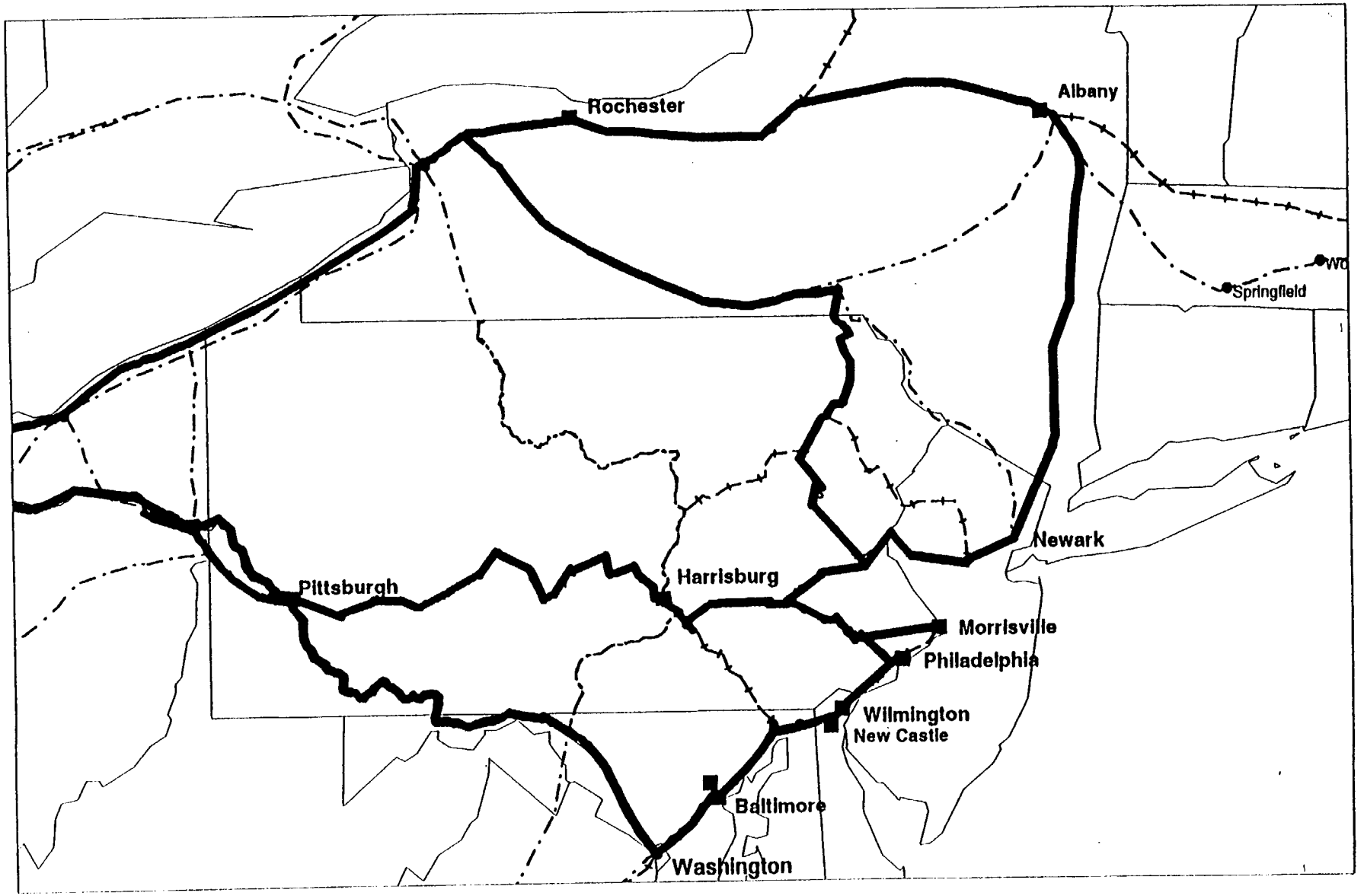
Intermodal Growth 1955-1992



Intermodal Industry Profile (continued)

The predominant direction of existing Pennsylvania intermodal flows is east/west. All of Conrail's intermodal service offerings from Morrisville, Allentown, Harrisburg and Pittsburgh are aligned along an E/W axis. CSX offers both E/W services, which compete directly with Conrail (at Morrisville) and N/S services, both from its South Philadelphia ramp at Snyder Ave. D&H also offers both E/W services, which compete with Conrail and CSX, and N/S services which compete only with truckers. The map on the following page represents the premier intermodal service corridors within the State. Note that these existing intermodal service corridors correspond to the three corridor options which we have under consideration for Commonwealth investment.

Routing of Intermodal Moves to Eastern Points



Intermodal Industry Profile (continued)

Intermodal transportation--the movement of trailers and containers on flat cars--has historically required shippers to develop specialized traffic management expertise in order to convert railroad ramp-to-ramp service offerings into door-to-door services which corporate shippers actually need. In the past, for-hire trucking companies have been more flexible in designing their service offerings to meet specific shipper needs than have intermodally oriented railroads. Corporate shippers have found motor carriers more service-oriented and generally easier to deal with. For this reason, railroads have elected to sell their intermodal services through third party intermediaries who bundle rail services, together with prior and subsequent drayage services, into an integrated door-to-door service package. These third parties simplify and streamline the basic rail service. For example, they generate a single freight bill for their customers, and they manage service quality on a door-to-door basis. Because shippers have traditionally perceived intermodal services to be "second best" to direct truck services, rail carriers have also had to discount their intermodal prices below those of competing truckers in order to win traffic. In general, railroads sell their services at volume-discounted "wholesale" price levels to third party intermediaries who rebundle and resell them to shippers at "retail" prices.

Rail intermodal customers fall into a number of distinct groups or segments. These include the following:

- **International Container Steamship Lines** - Rails sell container services principally to steamship lines, which include the rail inland transportation component in their own trans-ocean intermodal service packages. In some cases, rails sell entire trains -- "hook and pull deals" -- to steamship lines.

Industry Profile (continued)

- **Freight Consolidators, Shippers Agents and Forwarders** - Rails sell their domestic trailer and domestic container services principally through "third party" consolidators and shippers agents. These "third parties" specialize in putting together door-to-door movements which they resell to retail customers under a single bill.

- **Large Volume Corporate Shippers** - A few extremely large shippers with specialized intermodal management expertise, such as Sears (eg. Terminal Freight), deal directly with railroads. In recent years, intermodal corporate shippers have declined in both number and in volume. "Volume discounts" and well-engineered intermodal service management systems give third parties a substantial edge in this market and, as a result, most corporate shippers prefer to deal with railroads through third party intermediaries.

- **Large Volume Express Parcel Shippers** - UPS and USPS, together with the nationwide Less-Than-Truckload (LTL) motor carriers are large volume users of intermodal services. In most major markets train service schedules are designed to meet the exacting service requirements of these highly service-sensitive customers.

- **Trucking Companies** - A few railroads have recently developed relationships with truckload motor carriers, who have traditionally been the arch competitors of railroads. This new "door opening" represents the greatest single growth opportunity available to rail intermodal carriers since the introduction of doublestack train technology. The truck "conversion" market and the active involvement of "advanced" truckload carriers like J.B. Hunt and Schneider National represent the commercial bedrock on which a new domestic container market is being built.

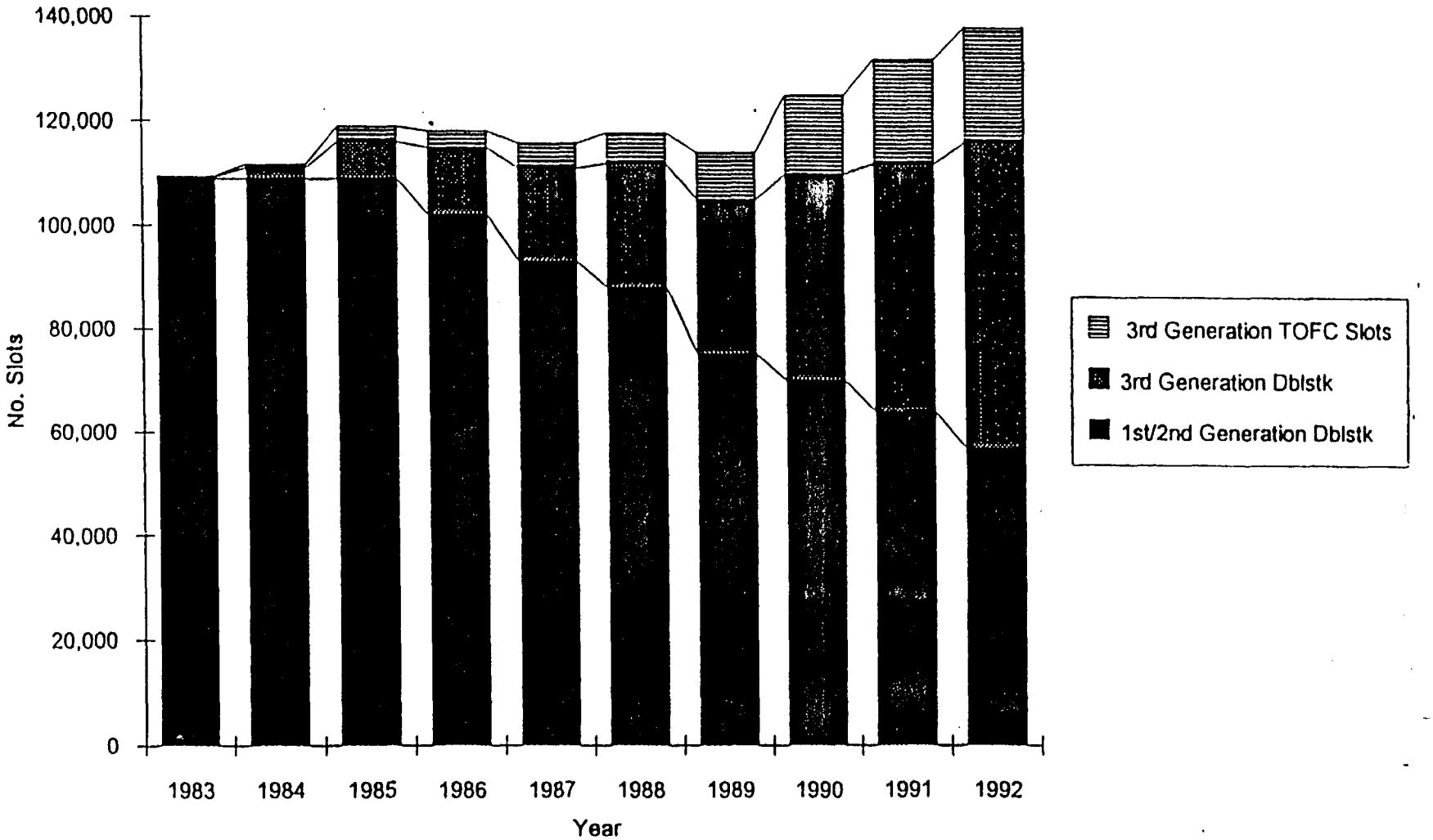
The Emergence of Domestic Containerization

As we suggested above, an important breakthrough in transportation technology and transportation service delivery is currently underway. This breakthrough involves domestic containerization. The market for domestic container services will be propelled by a large gain in load-hauling productivity. For example, new fifty-three foot domestic containers offer shippers a 43% gain in cubic hauling capacity vs. conventional 40' ISO containers and a still quite substantial 12.8% gain vs. the current generation of 48' domestic containers. The equipment required to launch this service will be furnished by advanced truckload motor carriers like J.B. Hunt and Schneider National. In its recent stock offering prospectus, J.B. Hunt explained to potential investors:

> "The Company believes that one of its greatest opportunities involves cooperation between the historically competitive trucking and railroad industries. The Company currently has agreements with seven railroads which allow for the transportation of freight using both mediums for a single load. These agreements couple J.B. Hunt's door-to-door truckload service with the cost efficiencies of railway shipping while maintaining reliable service typically available only from truck transportation. To date, J.B. Hunt has entered into various types of intermodal agreements with Atchison, Topeka and Santa Fe Railway Company, Burlington Northern Railroad Company, Consolidated Rail Corporation, Union Pacific Railroad Company, Southern Pacific Transportation Company, Wisconsin Central Transportation Corporation and Florida East Coast Railway Company.
>
> Under these agreements, J.B. Hunt markets the intermodal service through its nationwide marketing capabilities, picks up and delivers freight to and from the rail heads, makes all billings and satisfies all inquiries or claims arising from the transaction. Substantially all of the freight carried under these agreements is guaranteed space on trains and receives preferential loading and unloading at the rail head. The intermodal agreements give the Company flexibility to offer its customers the optimal method of delivery, whether exclusively by truck or through a combination of tractor and rail.
>
> The Company expects to begin offering doublestack container service as part of its intermodal operations in the fourth quarter of 1992. This will allow the Company to offer its customers a single multi-purpose container which mirrors current state-of-the-art trailer technology for over-the-road transportation and simultaneously provides doublestack capabilities for intermodal movements utilizing enhanced size and weight characteristics relative to existing containers. The Company believes the cost reduction benefits of the doublestack equipment will be substantial.

The table on the following page represents the current and projected capacity of the U.S. rail system to handle domestic containers.

Intermodal Equipment Capacity in 1992



Economic Impacts

Domestic containerization promises to offer substantial economic gains to a wide set of carriers and shippers. The specific incidence of gains will depend on the negotiating coverage and effective market power of specific participants in individual distribution channels. In some cases, proportionally larger gains will accrue to shippers or to carriers, either rail or motor, depending on the nature of specific buyer/seller relations within the channel. Because containerized transportation is the preferred mode for most manufacturers and distributors, benefits resulting from this technology will be broad and will pervade the entire State economy. Also, because of the large size of the market for containerized transport services, economic gains realized in this arena should prove to be much larger than gains realized in either the dimensional freight market or the auto setup market.

V. Recent Market Development Issues

Strategic Market Development Issues

The traditional revenue base of railroad companies is constantly eroding. Each year railroads lose a portion of their market as long-standing customers terminate business operations or refocus their distribution strategies and in the process discontinue their rail service. Competition with other rail carriers, further accelerates this revenue erosion process.

To offset revenue erosion, railroads continuously attempt to rebuild their traffic bases. In general these efforts proceed in one of four ways: 1) through the development and growth of new end markets in cooperation with established customers; 2) through the development of new customers served by competing rail carriers by opening these customers to competing service or reciprocal switching; 3) through industrial development efforts which actually create new customers and new demand for traditional rail services; and 4) through intermodal service innovation. All four of these processes -- new market growth openings for established customers, rail-to-rail diversion, industrial development of new customers and intermodal service innovation -- are underway within the Commonwealth of Pennsylvania.

Major Class I rail carriers which serve the Commonwealth have applied various combinations of the market development techniques described above to "grow" the markets which they serve. In Pennsylvania, and indeed throughout the Northeast, Conrail enjoys superior access to traditional carload shippers. Conrail also enjoys a strong market position in most of the region's commodity markets. Hence, Conrail has limited flexibility in developing new market openings for established customers, lest the carrier tilt established competitive balances and thereby disadvantage customers of long standing. Conrail is also limited in its ability to access additional customers by opening the stations of competing railroads to competitive access. Conrail has more to lose than to gain by aggressively pursuing competitive rail access in major terminals which it serves jointly with competing carriers. Indeed, through

Strategic Market Development Issues (continued)

its short line "spin off" program Conrail is moving in the opposite direction--toward a smaller core of large volume shippers. Conrail has been aggressive, however, in its industrial development efforts. Recently it has demonstrated an ability to innovate and to develop new intermodal and multimodal services.

Conrail is fully committed to domestic container services and the carrier has laid the commercial foundation to expand rapidly in this new market through contracts with advanced truckload motor carriers. Significantly, Conrail enjoys an A+ reputation for service quality within its regional market. Conrail offers the kind of high quality intermodal service which advanced truckload motor carriers will require from their new railroad partners.

Compared with Conrail, the D&H has a relatively thin base of traditional carload customers. Most of D&H's traffic is interlined from CP origins to southeastern carriers (CSX/NS) via the D&H. Hence, most of its carload traffic does not originate or terminate in Pennsylvania. However, an important and rapidly growing local market for the D&H is the intermodal market. The D&H is strongly committed to increase the traffic base it inherited. The intermodal business and the auto setup business offer the most viable short-term growth options for that carrier.

CSX is in a situation similar to that of the D&H. CSX is different principally in that its market development efforts are more mature in Pennsylvania. Over the past ten years, CSX has developed a number of new multimodal and intermodal service offerings, particularly for markets based in southeastern Pennsylvania, which the carrier has used successfully to expand beyond its traditional carload markets. CSX has used a combination of intermodal, multimodal and integrated truck/train services to access the New York/New Jersey metro market from a Pennsylvania base. Among the three carriers only Conrail serves the New York metro market directly. Southeastern Pennsylvania represents

Strategic Market Development Issues (continued)

CSX's furthest extension into the Northeast and hence, a natural staging platform for that carrier's multimodal services.

Within the Commonwealth the following rail market development activities are underway under the auspices of one or more of the major rail carriers. These activities relate to the issue of rail clearance:

- **Development of New Markets for Established Customers** - Because of its strong Pennsylvania market franchise, CR is best positioned to develop new markets for traditional carload shippers. Conrail in particular has recently reorganized its marketing effort to focus on the needs of "high and wide load" shippers. CSX is similarly committed to re-energize this market. Clearance constraints, however, severely limit both carriers' abilities within the Commonwealth of Pennsylvania to haul dimensional cargo. Indeed, as we discovered from our shipper survey, dimensional loads for many Pennsylvania shippers are more clearance constrained, in many instances, via rail than via competing motor carriage.

- **Rail-to-Rail Diversion** - The issue of clearance constraints has little relationship to a traditional rail-to-rail diversion. Rail-to-rail diversion is principally an access issue. Clearance constraints affect access only indirectly. They affect the desirability and merit of competing rail routes. Even when rates are equal via competing routes, car loading capacity can differ because of clearance constraints. The greatest effect of rail-to-rail diversion is probably on the auto setup market. Small differences in service parameters in this market can divert large volumes of traffic. Within the region, the auto setup market is CR's to lose and D&H/CSX's to gain.

Strategic Market Development Issues (continued)

- **Industrial Development** - Plant siting decisions are frequently made with the objective of securing as many "degrees of freedom" in the transport purchasing arena as possible. Said another way, even when new potential shippers don't need open clearances, they want them "just-in-case." Thus, clearance constraints are parameters which affect industrial siting more or less directly. Among the three carriers, Conrail is most active in its industrial development efforts within Pennsylvania and has the broadest array of potential sites to offer prospective industries, because of its greater service coverage.

- **Intermodal Service Innovation** - In recent years, the intermodal competitive dimension has been the most important basis for expanding rail markets. The increased productivity of intermodal services and the cost of providing intermodal services are both directly related to clearances. All three rail carriers are well-positioned to take advantage of improved clearances in the design and "roll out" of new doublestack intermodal services. Conrail is already out of the "starting blocks" with domestic containerization. CSX and D&H are oriented toward more traditional doublestack services--ones adapted principally to ISO containers and to import/export service requirements. This latter market, however, is limited by the level of steamship line activity already taking place through the Port of Philadelphia. Conrail's focus is clearly on the domestic market for containerized services.

Market Development Tactics

	Expand New Markets for Existing Customers	Competitive Access: Rail-to-Rail Diversion	Industrial Development	Intermodal Service Innovation
Conrail	√		√√	√√√
CP Rail	√√	√√√		√√
CSX	√√		√	√√

	Multiplies social benefits resulting from improved clearances
√√√	Major strategic emphasis
√√	Focused and effective programs
√	Active, but undistinguished, programs

High-Profile Rail Clearances in the State of Pennsylvania

Report 4

Task 5.2 Analysis of Potential Demand for High-Profile Service
Task 5.3 Break-even Analysis of New Services
Task 6.0 Long Term Economic Development Impacts
Task 7.0 Employment Impacts

Prepared for: Pennsylvania Department of Transportation
Prepared by: Transmode Consultants, Inc. and Apogee Research

November 1992

Outline

I. General Approach

II. Diversion Analysis Methodology

III. Analysis of the Results

IV. Benefit/Cost Computations

V. Impacts of the Project on Pennsylvania's Economy

I. General Approach

This report analyzes the potential traffic demand for high-profile rail service, assesses the potential savings of transportation and logistics costs associated with the diversion of this traffic to doublestack rail and traces the incidence of these benefits to determine the likely impacts on Pennsylvania's economy. We then identify the impact on jobs, as well as other secondary consequences of the project, both positive and negative.

The analysis begins by identifying individual market segment "sources" of traffic that could potentially be diverted from other modes and/or other transport services to doublestack rail. Each market segment within the source traffic is identified by origin, destination, type of product, type of shipper and specific characteristics of importance to the maximum extent possible. These individual segments of source traffic are then examined individually to determine which traffic segments can be diverted from the source mode to doublestack. A computerized shipment size and modal choice model is used to perform this portion of the analysis. The model, Transmode's Shipper Logistics Cost Model, is described in detail later in this section of the report.

Savings are computed by developing the difference in total logistics costs associated with the movement of a freight segment from consignee to the consignor on the original source mode and the alternate movement by doublestack rail. Where there is no saving the traffic will not divert. Savings for each movement are summed over each market segment and over all market segments for each option being considered for each year of the analysis.

Individual market segments will grow at differential rates over time depending on the nature of the traffic in the economy, but the diversion of the traffic to the subject mode (in this case doublestack) will occur at different rates depending on the size of the potential savings and other factors which are difficult

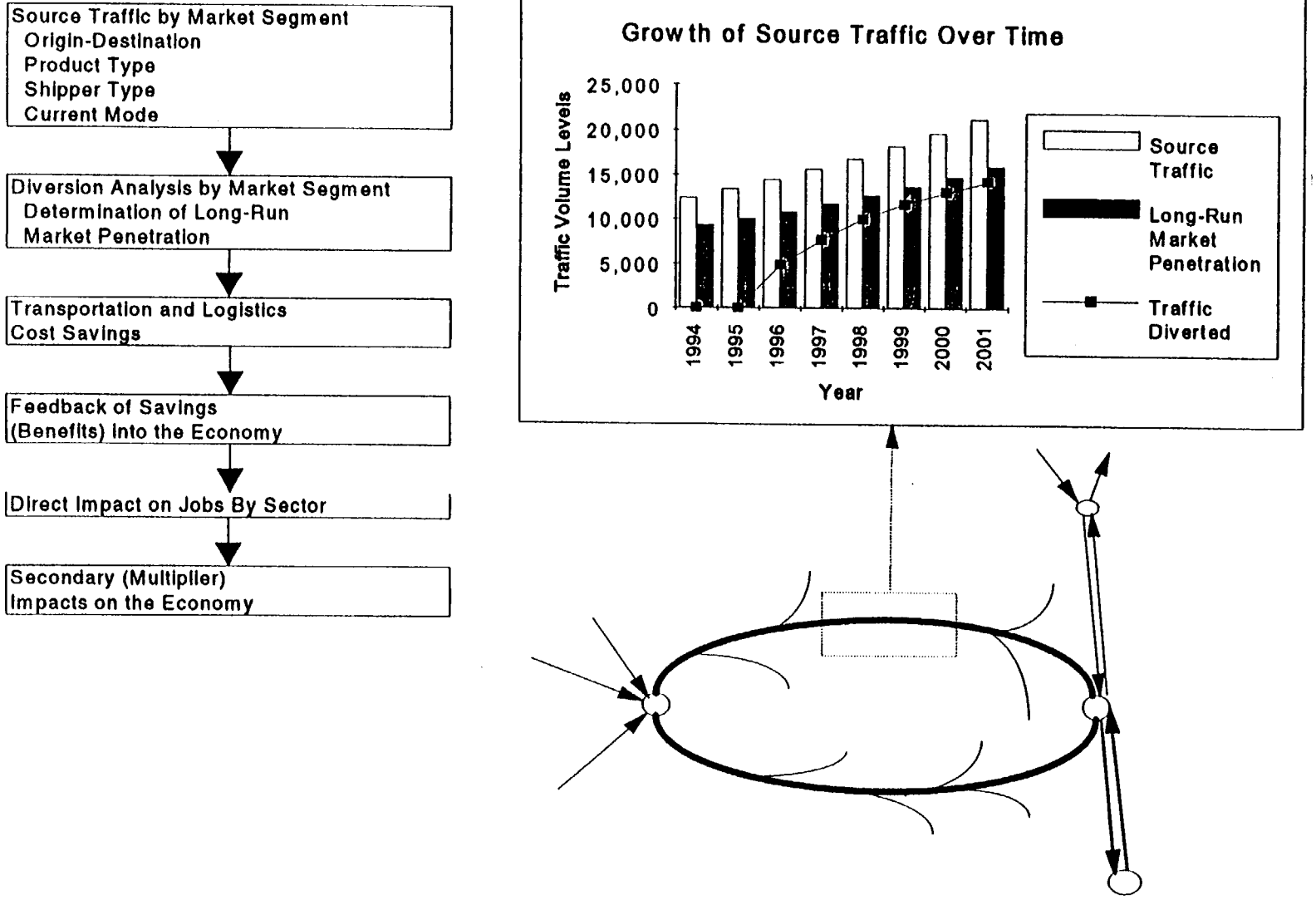
to model. These differential rates of growth of the base traffic source and maximum diversion potentials are incorporated into the analysis over time using separate computations for each year. A diagram showing the diversion process is shown as Figure 1.

Once transportation and logistics cost savings have been determined for each of the options, by region and by year the impact on the economy can be determined. Where disaggregate flow data are available, the beneficiaries of these cost savings can be determined industry by industry, or even shipper by shipper. Where disaggregate data are unavailable the beneficiaries must be inferred from data such as the County Business Patterns. This can be done where necessary; however it is sufficient in many cases to recognize that once these savings are available they are "transferred" broadly throughout the economy. The carrier has an incentive to share the transport savings with the shipper to entice him to use the new transport service. The shipper is induced to share his savings with the receiver to increase his competitiveness with suppliers from other regions. Competitiveness between carriers and between suppliers merely increases the amount of benefits which are transferred and increases the rate of growth of those segments of the economy which receive benefits.

Direct savings lead the benefited industries to reinvest a portion of their savings in plant and equipment and to increase their labor force to produce the increased output that is demanded by industries in other regions. This increase in employment leads to secondary growth in service industries and indeed in the overall level of economic activity in the affected areas. These so-called multiplier effects can be captured by multiplying the benefits of on-the-job impacts by the appropriate multipliers as determined by the U.S. Department of Commerce, Bureau of Economic Analysis. These multipliers have been used here.

Other impacts, such as impact on highway maintenance, congestion, air pollution, etc. can be inferred from the diversion figures that are available in the analysis.

Figure 1
General Approach to Benefit Analysis



Diversion Analysis Methodology

Background

The diversion analysis performed here using Transmode's Shipper Logistics Cost Model uses a discrete analysis of aggregated commodity movements drawn from two basic sources: The Rail Carload Waybill Sample and the National Motor Transport Data Base. The individual truck movements in the sample are taken from the National Motor Transport Data Base (NMTDB). Each observation in this database consists of an individual commodity movement from a given origin to a given destination by a particular type of equipment. The movements to and from each region were aggregated for use here. The total cost per ton for a movement traveling by single trailers and by doubles is used to decide which mode the shipment will take.

The methodology employed here has been used in many of Transmode's projects. It has evolved both in concept and in scope since the original elements were developed at the Massachusetts Institute of Technology almost 20 years ago[1]. It consists of several separate, but related, elements which are used together. These component elements consist of the following:

- Identification of individual market segments involved in the movements under study at the most disaggregate level possible.
- Development of the size, commodity make-up, user characteristics and current mode of each of these traffic segments.
- Determination of the modal attributes of the existing traffic, including the distance, transit time, reliability, loss and damage and transportation charges for each of the existing modes and the potential changes in modal attributes.

The data to support these elements can come from a variety of sources. The principal data types are: rail movement data, truck movement data and geographical data concerning the distribution and makeup of industry and population. These data elements will be addressed in detail in a subsequent section.

The Determinants of Freight Modal Choice

The factors influencing the shipper's choice of mode are complex and highly interdependent. They obviously involve tradeoffs between the cost of transportation and overall transit time, but there are more subtle underlying factors. These factors are currently being studied by a Transportation Research Board Study of Freight Demand. They have been previously analyzed in studies conducted by researchers at the Massachusetts Institute of Technology.[2] The M.I.T. findings have been incorporated into modal choice models used in a number of freight policy studies. One such model, the Intermodal Competitive Model, has been used by the Association of American Railroads to investigate the potential diversion from rail that could occur if Longer Combination Vehicles were allowed to operate on the nation's Interstate Highway System.[3]

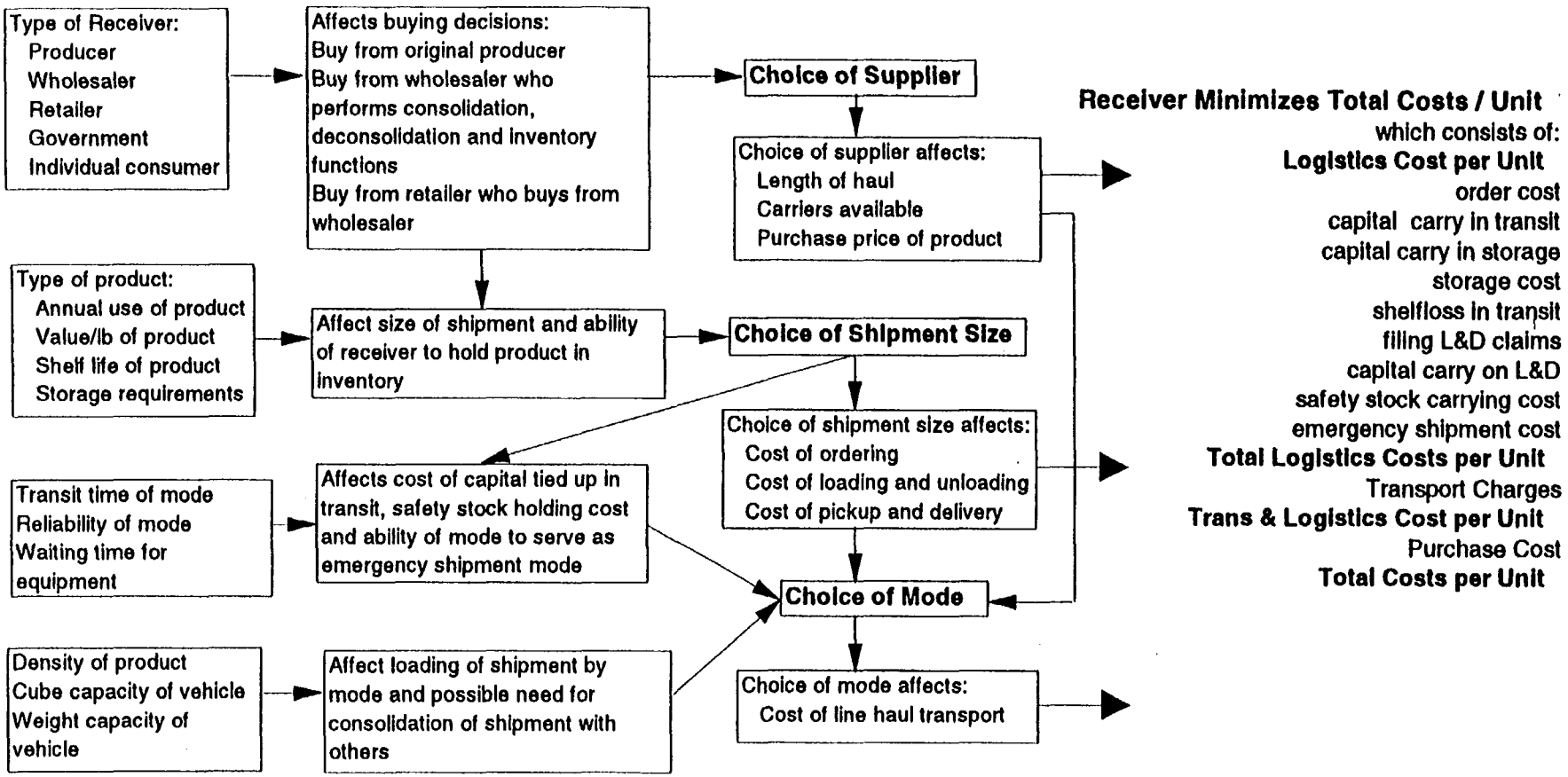
Research reveals that the principal decisions are those that affect the receiver of the goods rather than the shipper. The most important tradeoffs involve the annual use of a product by the receiver. High annual uses allow the receiver to order large replacement shipments and to take advantage of low transport costs associated with large shipment sizes. High value of the product imposes a penalty to ordering more than can be used readily by tying up capital in inventory. Excess inventory can be avoided by ordering more frequently in smaller shipment sizes. Small shipment sizes carry their own penalties. Ordering itself is costly, and if the shipment size is smaller than a full vehicle load the load must be picked up by the freight carrier and consolidated before shipment, then deconsolidated and delivered at the destination end. LTL trucking, parcel carriers and air freight all typically involve this

consolidation/deconsolidation of smaller shipments into full vehicle loads. The process itself is costly, typically overwhelming the cost of linehaul transportation. The variables typically involved are shown in Figure 2.

The variables affecting the choices of the receiver have been incorporated into the Shipper Logistics Cost Model, developed by Transmode for use in freight transportation studies. The program develops the tradeoffs that would be made by a receiver who was attempting to minimize the total logistics costs associated with maintaining an inventory of the product for use in manufacturing or wholesale trade. The variables are used to develop each of the individual cost factors listed on the right hand side of the figure. They include the type of receiver, variables which describe the product, information on the current mode of transport and potential new modes and the attributes of the product being carried. These variables are used to write equations for each of the components of the receiver's total logistics costs as a function of the principal choice variables (i.e. choice of supplier, choice of shipment size and shipment size). Total logistics costs can be expressed in cost per unit, cost per hundred-weight or annual cost of the strategy. Transport charges are added to logistics costs to give the total transportation and logistics cost of the strategy. If different suppliers are considered, with different purchase costs, the total delivered cost per unit or per hundred-weight is given. Most receivers will select that strategy with the minimum total delivered cost. This program has been used to examine those circumstances under which doublestack will be chosen over other modes.

Figure 2

Variables Affecting Choice of Supplier, Shipment Size and Mode in Freight Transportation



Tradeoffs Made By The Shipper

Truck to truck diversion involves decisions made by carrier management as to what equipment to use to accomplish the movement. Rail to truck diversion, or truck to rail by contrast, involves a decision by the shipper to use another entirely different mode of transport. This second type of decision between modes is more complex, involving the evaluation of tradeoffs in equipment availability, transit time and reliability of delivery, freight loss and damage experience and the size of the potential shipment and its suitability for movement on the mode in question. The shipper's rationale for making these decisions must be modeled if these tradeoffs are to be evaluated properly.

Cost of Movement to the Receiver

The criteria used by the person responsible for making the modal decision can be rationalized as criteria used to select that mode and shipment size which will minimize the total logistics cost of the goods being shipped to the receiver. Demand for transportation service may grow or shrink in response to changes in service or cost, depending on its impact on the individual shipper's own business and the other alternatives available.

Several key variables underly the shipper's choice of mode and carrier. In the model these may be grouped into three major groups:

1) Shipper attributes
2) Commodity attributes
3) Transport attributes

As described earlier, the most important variable appears to be one of the shipper attributes, the annual use of the product by the receiver. Clearly, rail as a mode is uniquely capable of handling larger individual shipments than truck. The typical carload can handle shipment weights up to 200,000 pounds, while a maximum single unit truckload payload is around 25 tons, rail carload shipments of 100 tons are possible and multicar shipments of 1200 tons or more can be handled on the same bill of lading. Unit trains moving as much as 10 million pounds (5000 tons) are also possible. By contrast, if a shipper must take a 200,000 pound shipment in order to use rail instead of the 20,000 pound shipment he would like to take, it could result in thousands of dollars of unwanted inventory cost. Shipper modal choice behavior, then, depends importantly on the amount of product used annually.

Commodity attributes are also important determinants of shipper behavior. The product being shipped determines the loading and handling requirements as well as the maximum size of shipment that can be accommodated in a given piece of equipment. These variables include:

- density
- value per pound
- shelf life
- typical packaging

Transmode's Commodity Attribute File furnishes these variables to the model.[4] The relevant data are appended to the individual observation.

Variables describing transport attributes of the modes under consideration have also proven to be important. These include

- availability of equipment

- transit time
- reliability
- loss and damage experience

These and other variables are incorporated into the "shipper's utility function." Models for estimating level of services attributes have been employed where their direct observation is impossible.[5] The obvious choice for the shipper's utility function is the "total logistics cost" associated with the ordering, transport, inventory and use of the product being shipped. Total logistics cost is the item which the shipper is attempting to minimize when he selects one mode of transportation over another or one shipment size over another. This approach has been employed in numerous studies of truck diversion for the last several years. Similar versions of the model have been used by Transmode in litigation support before the ICC and the Canadian Transport Commission as well as in marketing studies for a number of freight carriers.

The components included in the model's shipper's total logistics cost function include:

- ordering cost
- capital carrying cost in transit
- capital carrying cost in inventory
- warehousing cost
- loading and unloading cost
- safety stock carrying cost
- cost of claims
- loss of shelf life
- cost for emergency shipments
- reloading and/or rehandling costs

These variables detail the total logistics costs of acquiring, shipping and storing the product as a function of these variables and other descriptive variables that affect the total. By describing the shipper's costs in a single utility function the "value" attached to the variables in the utility function can be estimated econometrically.[6]

Description of the NMTDB

The observations in the NMTDB database are obtained through interviews of truck drivers, taken at one of twenty-three different truck stops located at key points in the highway system across the United States and Canada. Each interview records the type of carrier, the type of vehicle and the annual mileage traveled by the vehicle. Each interview also contains the vital statistics on the two most recent, loaded moves -- the current move and the prior move. For each of these moves, the origin city, destination city and the commodity carried are recorded.

The interviews are conducted by experienced interviewers, with up to 2000 interviews per year at each of the interview stations. In total, interviews are available on more than 36,000 truckload movements per year. The interviews are supplemented by a week-long passing count at each interview station which records the number of trucks passing the station by direction, type of carrier and type of equipment and extrapolates this figure to an estimate of the annual volumes.

Some of the sampling stations are more representative of trips over the U.S. as a whole than others, however, each observation influences the results of only that cell in the overall database which has the same type of carrier, type of equipment and length of haul. So, the key factor in using the data is making sure that each cell contains a statistically adequate number of observations. It is possible, however, to use the observations from more than one year to increase the number of observations in

each of the cells of the database and improve the statistical validity of the results. This has been done here.

Disaggregate Sample

Although any disaggregate sample of movements could be used as input to the model the Carload Waybill Sample is uniquely appropriate for representing movements over the nation's rail system. The Carload Waybill Sample was formerly referred to as the One Percent Waybill Sample because each waybill with an identification number ending in 01 was selected for reporting. This practice was replaced in 1983 by a stratified sampling scheme which provided a more accurate way of obtaining the tonnage moving on the system. Some shipments, namely large single waybill shipments, such as those associated with coal traveling in unit trains had been under-sampled. The new stratified sampling scheme corrected these inadequacies in the process.

Waybill samples are required to be submitted by all U.S. railroads over a certain size. Canadian railroads are not included. Consequently, rail imports are covered. Rail exports to Canada are not covered. Fortunately, export movements terminating at ports are covered.

Each waybill record contains a wealth of information. The freight station accounting code, along with the 6-digit standard point location code (SPLC) at the origin and destination are shown, along with the name of the railroad which originates and terminates the movement. The intermediate railroads and the interchange gateways are also shown. A detailed commodity code shows the commodity that is traveling and the weight of the shipment is included. The mileage between gateways is shown and the total freight charges are presented for most tariff-carrying shipments. Contract movements carry an estimate of the freight charges. In the interest of confidentiality the name of the consignee and consignor are not shown. Many facts can be deduced from the basic information carried on the waybill sample.

Development of the Transport Savings

Each market segment (origin to destination, product type, use rate class) has different total logistics costs for each mode, or potential mode. The difference between the cost of the mode currently being used and the mode under consideration represents the potential savings associated with changing modes. Objective estimates of these savings can be developed using the Shipper Logistics Cost Model. That has been done here.

Different market segments grow at different rates. Conventional TOFC has grown slowly, if at all. International maritime movements have been growing at rates that have been recorded as high as 15-20% per annually. Longhaul truckload has grown at over 8% per year over the decade of the 1980s. In the 1990s this growth is expected to slow to 5% or so. In this study an individual growth rate has been assumed for each segment as follows:

Domestic intermodal	1.5%
International intermodal	8.0%
Domestic truckload	5.0%
Refrigerated	8.0%
Auto traffic	1.5%

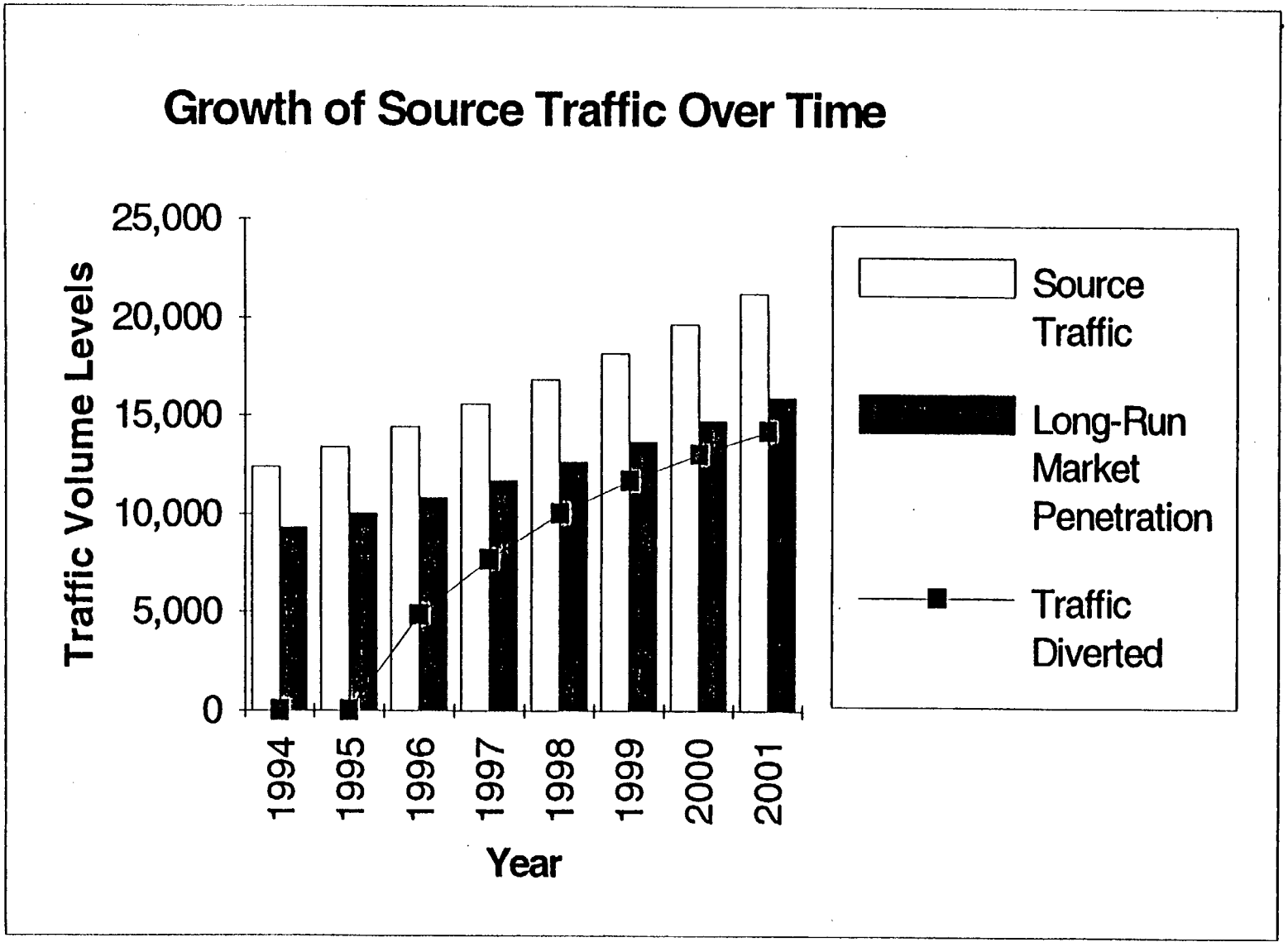
Diversion of a movement to the new mode is assumed to occur when the shipper's total transportation and logistics cost using the new mode is lower than the same cost by one of the existing modes. Determination of the total transportation and logistics costs of each of the alternatives is done using Transmode's Shipper Logistics Cost Model. Ideally, the model should be run at the totally disaggregate level, that is shipment by shipment. Where individual movement records are available this can be done. Where disaggregate information is unavailable more aggregate information can be used, as

long as these essential elements of the difference between movements are preserved (i.e. origin/destination/distance, product type, receiver's use rate, etc.)

Potential market penetration of one mode into the traffic of another is related to both the size of the potential savings and the diversity of the market. Where there is substantial diversity in the market place (i.e. many different products, shippers/receivers requirements origins/destinations, etc.) it is difficult to achieve 100% market penetration by a new mode. There will always be some set of shippers/receivers who cannot make effective use of the new offering, no matter how cost beneficial. Where savings are large and diversity small, penetration can be high. In those cases where one technology dominates another, penetration can reach close to 100%. The diagram on the next page shows how the growth of source traffic interacts with the long run market penetration. For those segments of the market that divert to the target mode we have assumed a different ultimate potential rate of penetration of the source traffic for each market segment as follows:

TOFC/COFC to Doublestack	45% in 1 year, 90% in 5 years
Truckload to Doublestack	7.5% in 1 year, 15% in 5 years
19' Autorack to 20' 2" Autorack	73% in 1 year, 99% in 5 years

Savings between total logistics cost for the new mode and the existing mode are captured market segment by market segment by the model. These primary benefits of the new service offering consist of all savings, to whomsoever they accrue (carrier, shipper, public). The conditions which prevail in the market will ultimately determine who first gets these primary savings. They are, however, passed from the primary beneficiary to secondary and tertiary beneficiaries, throughout the economy. A savings by the carrier is likely to be shared with the shipper to entice him to use the new service. The shipper is likely to share the savings with the receiver to encourage him to purchase his inputs from the shipper. The


Growth of Source Traffic Over Time
Traffic Volume Levels
25,000
20,000
15,000
10,000
5,000
0
1994
1995
1996
1997
1998
1999
2000
2001
Year
Source Traffic
Long-Run Market Penetration
Traffic Diverted

receiver may also enjoy direct non-transport logistics costs savings associated with the fact that the new, larger equipment can transport more product for the same or lower cost.

Primary and Secondary Benefits

Direct savings of transport and logistics costs by the users of the transport system are typically referred to as direct benefits or primary benefits. There are also transferred or secondary benefits. These occur when transport and/or logistics cost savings enjoyed by a direct receiver of primary benefits are passed on to another participant in the economic system through a price discount or a service improvement. Direct transportation and logistics savings tend to feed back into the economy by allowing the same goods to be transported for less. This is, in effect, a price reduction for the goods and in most cases more goods are sold. This typically requires more transport which capitalizes on the same potential savings per unit observed in the original movements. More goods sold means a larger economy. A larger economy has more industry overall and thus more participants. This effect is typically referred to as the multiplier effect.

We will in this study quantify the primary benefits associated with the transportation improvements under investigation. However, we will not attempt to trace out the distribution of transferred benefits. This would require the use of a model of the regional economy. In fact, it would require the use of a multi-regional model of the economy to be able to identify the regional advantage realized as the result of the transport savings put into play by the changes. We will instead identify the multiplier effect that is likely to take place in the economy and its impact on jobs and income for the population of the region.[7]

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5 "Predicting Freight Transport Level of Service Attributes," P.O. Roberts, Co-authored with Kung Wang, M.I.T. Center for Transportation Studies, CTS Report 79-17, Cambridge, Massachusetts, December, 1979.

6 "Development of a Policy Sensitive Model for Forecasting Freight Demand," P.O. Roberts, Co-authored with Y.S. Chiang, U.S. Department of Transportation, Assistant Secretary for Policy and International Affairs, DOT-P-30-81-04, Washington, D.C., March, 1981.

7 Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II), U.S. Department of Commerce, Economics and Statistics Administration, Bureau of Economic Analysis, Washington, D.C., 1 May 1992. Regional multipliers used in this study are developed from the RIMS model, published by the BEA.

II. Analysis of the Results

This section describes and then presents the results of the traffic growth effects which are likely to result from improved clearances. Traffic growth is the clear and unmistakable signal that economic value has been created and that public funds have been productively invested. Traffic growth projections drive our estimate of net economic benefits. In general, the higher the levels of market acceptance and the greater the traffic growth, the more productive the investment in improved clearances.

We believe that a market by market approach to traffic projections is the best way to proceed. As we discussed in previous sections of the final report, the dynamics of each transport market are unique and must be independently analyzed. The three markets whose growth is estimated as a result of improved clearances include the following:

- "Dimensional" Cargoes
- Auto Setups
- Containerized Intermodal Freight

Each of these markets has unique defining characteristics as well as a unique competitive environment. As we explain in the remainder of this section, each requires a somewhat different methodology for estimating traffic growth.

"High and Wide" Traffic Potential

Like the services which they support, growth estimates for High and Wide Traffic (also called Super Load Traffic) must be performed at the micro level. In order to estimate incremental demand for rail high and wide services which would result from improved clearance restrictions within the Commonwealth, we assessed the full traffic generating potential associated with specific industrial shippers who would benefit from rail line clearance improvements. This set is based on a review of 12 months of highway use permits. We supplemented it with additional survey information which we collected from permit applicants concerning their Super Load transportation needs which we collected from permit applicants. The table below summarizes the needs of specific shippers and identifies the alignment of specific movements with one or more of the three rail corridors under consideration.

Shippers Who Are Constrained by Existing Penna Rail Clearances

Company	Location	"Super Loads" Per Year	Average Shipment Size	Market Lanes
Air Products	Allentown, PA	1	221,000	Route 2
Alliance Machine Co.	Alliance, OH	4	129,250	Route 1
AMCO Industries, Inc.	Ford City, PA	2	80,000	Route 1
Ayock, Inc.	Camp Hill, PA	14	80,000	Route 4
CNG Transmission Corporation	Clarksburg, WV	2	348,000	Route2 & Route 1
Elgood Mayo Corp.	Lancaster, PA	18	15,480	Route 3
Fuller Company	Harrisburg, PA	13	220,462	Route 2
General Electric	Philadelphia, PA	3	227,750	Routes 1, Route 2 & Route 3
IvorjLee, Inc.	Sharon, PA	2	80,000	Route 1
Joy Power Products	Easton, PA	9	80,000	Route 1, Route 2, & Route 4
Karnan, Inc.	Pittsburgh, PA	1	80,000	Route 3
Keystone Shipping	Philadelphia, PA	1	154,000	Route 1

"High and Wide" Traffic Potential (continued)

Company	Location	"Super Loads" Per Year	Average Shipment Size	Market Lanes
Kiewitt/Shea	Baltimore, MD	3	138,000	Route 3
Lovat Tunnel Equip.,	Ontario CN	2	120,000	Route 2
Miller Transfer & Rigging Co.	Cuyahoga Falls, OH	1	275,000	Route 1 Route 2 & Route 4
Mitrans Corporation	Elk Grove Village, IL	2	224,000	Route 1 & Route 4
Mitsubishi International Corp.	New York, NY	1	253,200	Route 2
Mobil Oil Corporation	Fairfax, VA	1	216,000	Route 1
Nissho Ivvai American Corp.	New York, NY	1	252,000	Route 3
Polysius Corp.	Atlanta, GA	2	116,000	Route 3
Reichard Industries, Inc.	Columbiana, OH	2	135,000	Route 1
Schneley Industrial Park	Schneley, PA	2	80,000	Route 1
SMS Concast, Inc.	Montvale, NJ	1	80,000	Route 1
Steelfabco	Ontario, CN	2	220,000	Route 1 & Route 4
Transoceanic Shipping Co., Inc.	Kenner, LA	1	354,000	Route 2 & Route 4
Valmet Paper Machinery	Charlotte, NC	1	252,000	Route 1
VME Equipment of Canada, Ltd.	Ontario, CN	1	80,000	Route 2
West Homestead Engineering & Machine Co.	Homestead, PA	5	174,000	Route 1
Western Pennsylvania Steel Fabricating, Co.	New Castle, PA	2	80,000	Route 1
Westinghouse Electric Corp.	Sharon, PA	1	224,600	Route 4

High and Wide Traffic Potential

The table below summarizes the incremental traffic potential associated with each of the rail route alternatives under consideration. From the permit data it appears that the greatest potential is associated with the east/west route from the Ohio State line through Pittsburgh, Harrisburg and Philadelphia and the north/south route from Philadelphia through Reading, Allentown, and Wilkes-Barre to the Pennsylvania State line. The results summarized below are drawn from the permit data. The markets that require "Superloads" often are specialized and spotty. For example, one customer of Joy Power Products in Easton may require 9 shipments of excess-dimension loads over a period of two weeks and then not again for an extended period of time - if ever. The low to high ranges provided in the following table are estimates of a market that is rapidly and constantly changing and only provide a benchmark for comparison. For example, Options 1 and 2 include loads from Joy Power Products, Fuller Company and Air Products. These options are expected to be in the mid to high potential to have their volume diverted to rail. Options 3 and 4 represent a more uncertain market with less potential - low to mid range - to be diverted to rail.

Route	Loads/Year	Average Length Haul	Potential Diversion from Highway (miles/year)			Rail Revenue Potential
			Low	Mid	High	
Option 1	42	161	68	338	1014	202,860
Option 2	34	132	45	225	675	126,720
Option 3	28	70	20	98	292	58,800
Option 4	30	100	30	150	450	90,000
Total	134	121	163	811	2431	478,380

Automotive Traffic Potential

Automotive traffic follows the consumer market. Auto ramps are usually located to serve large concentrations of auto consumers. Three natural distribution hubs exist within the Commonwealth: One located in southeastern Pennsylvania; one in western Pennsylvania; and one in northeastern Pennsylvania. In order to estimate the traffic potential associated with these three hubs the consumer auto market which surrounds each was estimated.

Auto market Watershed
(1000 auto units/year)

	20 Mile	50 Mile	100 Mile
Southeastern Pennsylvania (Philadelphia-centered)	523,190	716,960	2,137,841*
Western Pennsylvania (Pittsburgh-centered)	172,777	254,574	316,719*
Northeastern Pennsylvania (Wilkes Barre-centered)	55,487	169,032	2,022,638

*Numbers of autos sold in MD, OH, and WV are not included.

Autos Moving Into the Region (1995)

Eastern Auto Markets	Traffic Diverted to Doublestack				
	Existing Autos		Truck		
	Inbound	Outbound	Inbound	Outbound	Total
Pittsburgh	0	6,687	20,317	20,317	47,321
Harrisburg	32,593	11,801	13,798	13,798	71,990
Philadelphia	302,332	53,948	268,032	268,032	892,344
Newark	347,289	84,855	51,687	51,687	535,519
Subtotal	682,214	157,291	353,834	353,834	1,547,173

Automotive Traffic Potential (continued)

Automotive potential is limited not only by the size of the underlying market for new cars, but also by the economic viability of alternative modes of transportation. The tables below show the economics of modal competition within the auto setup market. The first presents the total logistics costs from Ford's manufacturing facility in Dearborn, Michigan to Conrail's New York, Pennsylvania, auto ramp. The second shows the total logistics costs for delivery to CSX's Twin Oaks facility.

After the rail clearance program is completed, it will be possible to bring tri-level autorack cars all the way to Philadelphia over each of the three lines. See the map following the two tables. This should dramatically improve the ability to move set up automobiles by rail both inbound and outbound. Since Conrail has never had the ability to serve Philadelphia proper this will represent quite a step forward. It should also remove transportation impediments that currently exist which discourage the location of auto production in eastern Pennsylvania.

SHIPPER LOGISTICS COST MODEL-- Base Case Scenario

Observation No. 7

Commodity Description: Dearborne, MI to Philadelphia, PA via CR's York Facility

Shipper/Commodity Characteristics

units presented in Tons

units/year	10,000	lbs/year =	20,000,000
pounds/unit	2,000	lbs/cuft =	2.50
cube/unit	800	$/lb =	7.50
$/unit	15,000		
shelf life (days)	365		
warehouse sqft/unit	250		
warehouse $/sqft	2		
cost per order	25		
internal cost of capital %	15.00%		
LTL discount	25.00%		

Shipment Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
line-haul miles	736	736	618	618	736
pickup miles	0	1	0	20	25
delivery miles	0	76	0	30	25
target order	99	25	24	5	25

Modal Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube limit	7,200	14,400	8,800	2,142	4,615
weight limit	198,200	50,000	48,000	10,000	50,000
cost/ship	$300.00	$100.00	$119.01	$200.00	$100.00
cost/mile	$0.80	$1.30	$1.50	$1.12	$0.45
load ratio	0.60	1.00	1.00	0.70	0.95
pickup $/ship	$0.00	$97.00	332	$100.00	$97.00
pickup $/mile	$0.00	$1.44	$0.00	$1.00	$1.44
delivery $/ship	$0.00	$97.00	-234	$100.00	$97.00
delivery $/mile	$0.00	$1.44	$0.00	$1.00	$1.44

Modal Performance	Rail	Intermodal	Truckload	LTL Truck	Dblstack
wait time	1	0.5	0.5	0.5	0.5
transit time	5.4	2.8	1.0	2.5	0.8
reliability	8.1	2.3	0.5	2.3	0.4
probability of L&D claim	0.1	0.05	0.01	0.02	0.01
$/claim	$50.00	$50.00	$50.00	$50.00	$50.00
claim payment days	90	90	60	30	90

Shipment Output	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube-limited ship	9	18	11	3	6
weight-limited ship	99	25	24	5	25
target order	99	25	24	5	25
final units/ship	9	18	11	3	6
transport charges/ship	$1,481.33	$1,361.45	$1,144.01	$3,517.80	$717.67
no. shipments/yr	1,111	556	909	3,735	1,733
transport charges/yr	1,645,926	756,361	1,040,009	13,138,388	1,243,958

Logistics Cost per Unit	Rail	Intermodal	Truckload	LTL Truck	Dblstack
order cost	$2.78	$1.39	$2.27	$9.34	$4.33
capital carry in transit	$33.12	$17.51	$6.46	$15.69	$5.24
capital carry in storage	$1.01	$2.03	$1.24	$0.30	$0.65
storage cost	$0.45	$0.90	$0.55	$0.13	$0.29
shelfloss in transit	$0.00	$0.00	$0.00	$0.00	$0.00
filing L&D claims	$0.56	$0.14	$0.05	$0.37	$0.09
capital carry on L&D	$0.02	$0.01	$0.00	$0.00	$0.00
safety stock carrying cost	$2.03	$4.05	$2.48	$0.60	$1.30
emergency shipment cost	$0.00	$0.00	$0.00	$0.00	$0.00
Total Logistics Costs per Unit	$39.96	$26.01	$13.04	$26.44	$11.90
Transport Charges	$164.59	$75.64	$104.00	$1,313.84	$124.40
Transportation & Logistics Cost per Unit	$204.56	$101.65	$117.05	$1,340.28	$136.29
Purchase Cost	$15,000.00	$15,000.00	$15,000.00	$15,000.00	$15,000.00
Total Costs per Unit	$15,204.56	$15,101.65	$15,117.05	$16,340.28	$15,136.29
Transportation & Logistics Cost per Cwt	$10.23	$5.08	$5.85	$67.01	$6.81
Total Costs per Cwt	$760.23	$755.08	$755.85	$817.01	$756.81

SHIPPER LOGISTICS COST MODEL-- Base Case Scenario

Observation No. 8

Commodity Description: Dearborne, MI to Philadelphia, PA via CSX's Twin Oaks Facility

Shipper/Commodity Characteristics

units presented in Tons

units/year	10,000	lbs/year =	20,000,000
pounds/unit	2,000	lbs/cuft =	2.50
cube/unit	800	$/lb =	7.50
$/unit	15,000		
shelf life (days)	365		
warehouse sqft/unit	250		
warehouse $/sqft	2		
cost per order	25		
internal cost of capital %	15.00%		
LTL discount	25.00%		

Shipment Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
line-haul miles	741	741	618	618	741
pickup miles	0	1	0	20	25
delivery miles	0	10	0	30	25
target order	99	25	24	5	25

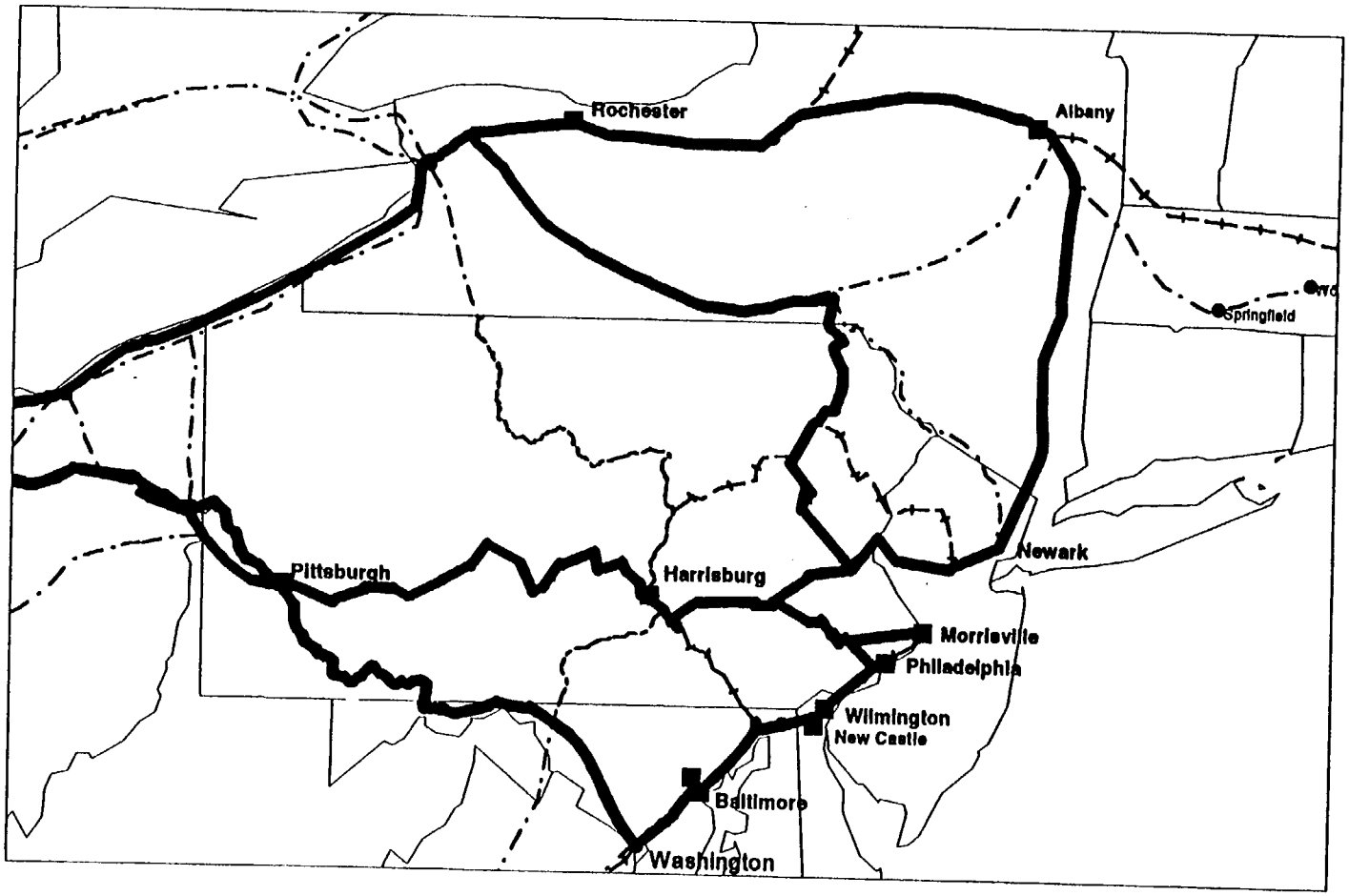
Modal Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube limit	7,200	14,400	8,800	2,142	4,615
weight limit	198,200	50,000	48,000	10,000	50,000
cost/ship	$300.00	$100.00	$119.01	$200.00	$100.00
cost/mile	$0.80	$1.30	$1.50	$1.12	$0.45
load ratio	0.60	1.00	1.00	0.70	0.95
pickup $/ship	$0.00	$97.00	332	$100.00	$97.00
pickup $/mile	$0.00	$1.44	$0.00	$1.00	$1.44
delivery $/ship	$0.00	$97.00	-234	$100.00	$97.00
delivery $/mile	$0.00	$1.44	$0.00	$1.00	$1.44

Modal Performance	Rail	Intermodal	Truckload	LTL Truck	Dblstack
wait time	1	0.5	0.5	0.5	0.5
transit time	5.4	2.9	1.0	2.5	0.9
reliability	8.1	2.3	0.5	2.3	0.4
probability of L&D claim	0.1	0.05	0.01	0.02	0.01
$/claim	$50.00	$50.00	$50.00	$50.00	$50.00
claim payment days	90	90	60	30	90

Shipment Output	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube-limited ship	9	18	11	3	6
weight-limited ship	99	25	24	5	25
target order	99	25	24	5	25
final units/ship	9	18	11	3	6
transport charges/ship	$1,488.00	$1,273.11	$1,144.01	$3,517.80	$719.19
no. shipments/yr	1,111	556	909	3,735	1,733
transport charges/yr	1,653,333	707,282	1,040,009	13,138,388	1,246,593

Logistics Cost per Unit	Rail	Intermodal	Truckload	LTL Truck	Dblstack
order cost	$2.78	$1.39	$2.27	$9.34	$4.33
capital carry in transit	$33.26	$17.58	$6.46	$15.69	$5.26
capital carry in storage	$1.01	$2.03	$1.24	$0.30	$0.65
storage cost	$0.45	$0.90	$0.55	$0.13	$0.29
shelfloss in transit	$0.00	$0.00	$0.00	$0.00	$0.00
filing L&D claims	$0.56	$0.14	$0.05	$0.37	$0.09
capital carry on L&D	$0.02	$0.01	$0.00	$0.00	$0.00
safety stock carrying cost	$2.03	$4.05	$2.48	$0.60	$1.30
emergency shipment cost	$0.00	$0.00	$0.00	$0.00	$0.00
Total Logistics Costs per Unit	$40.11	$26.09	$13.04	$26.44	$11.92
Transport Charges	$165.33	$70.73	$104.00	$1,313.84	$124.66
Transportation & Logistics Cost per Unit	$205.44	$96.82	$117.05	$1,340.28	$136.58
Purchase Cost	$15,000.00	$15,000.00	$15,000.00	$15,000.00	$15,000.00
Total Costs per Unit	$15,205.44	$15,096.82	$15,117.05	$16,340.28	$15,136.58
Transportation & Logistics Cost per Cwt	$10.27	$4.84	$5.85	$67.01	$6.83
Total Costs per Cwt	$760.27	$754.84	$755.85	$817.01	$756.83

Automotive Traffic Potential



Intermodal Traffic Potential

As we noted above, the intermodal market is divided into a number of distinct segments. Doublestack train services operated into Pennsylvania offer the opportunity to realize benefits for participants in several of these segments. The competitive economics within each segment are somewhat different. The end result should be traffic growth which comes from three sources: 1) an increase in absolute market size, 2) diversions from highway, 3) diversions from other regional intermodal facilities. The table below outlines the principal sources of traffic which are candidates for diversion to doublestack service.

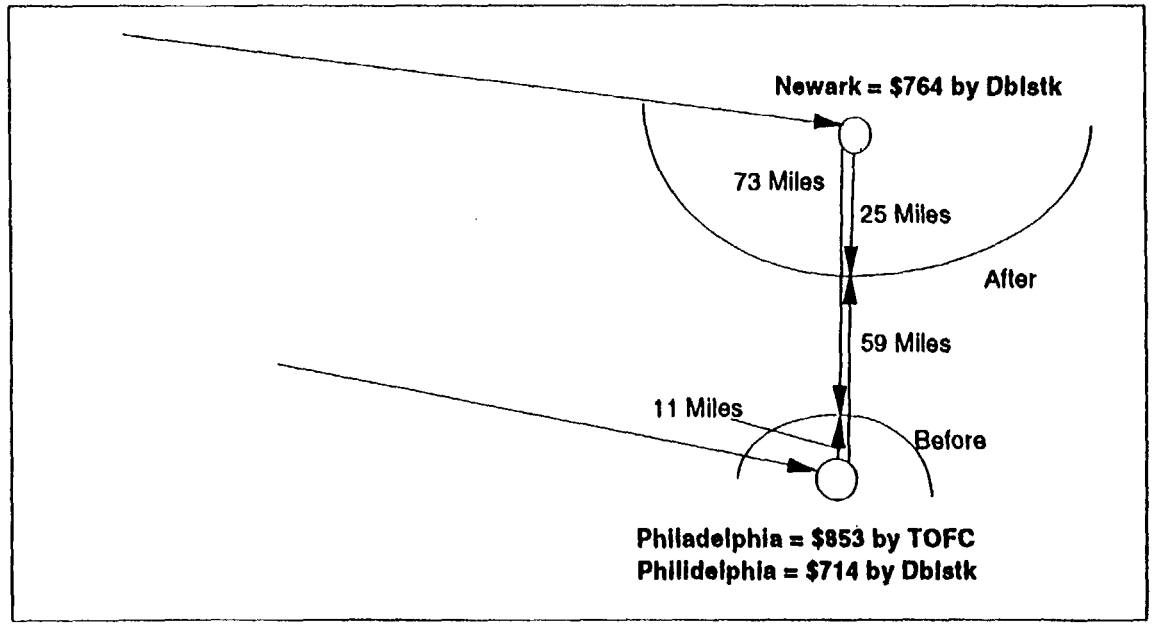
Sources of Doublestack Traffic

Traffic Source or Segment	Total Traffic Base (1000 loads/year)	In	Out	Rationale for Diversion
Longhaul Truckload Motor Carriers	E. PA. W. PA	858,900 186,096 1,044,966	608,508 342,012 950,520	Lower transportation charges/superior capacity equipment/superior transit time and trip reliability
Existing TOFC/COFC traffic currently moving to and from Pennsylvania intermodal ramps	Pittsburgh Harrisburg Allentown Morris Philadelphia	10,000 45,000 9,000 38,000 61,000	12,000 24,000 6,000 29,000 29,000	Lower transportation costs and superior service quality. Quality advantages include 1) lower loss and damage and 2) improved transit time reliability
Intermodal traffic (all kinds) currently moving via competing regional ramps		285,896	143,921	Lower cost door-to-door operation

Intermodal Traffic Potential

One effect of doublestack services anchored within the Commonwealth will be the expansion of Pennsylvania's watershed market into New Jersey, Delaware and Maryland -- areas currently served by doublestack trains which originate/terminate outside the Commonwealth's boundaries. The figure below represents the expected shift in the "traffic gathering domain" of Pennsylvania-based doublestack services.

Change in "Breakeven" Drayage Distance Between Philadelphia and New York



Intermodal Traffic Potential

Transmode analyzed the total logistics costs associated with doublestack container movements via Pennsylvania terminals and compared these with logistics costs associated with the "next best" transportation option. For each "feasible" routing option Transmode developed logistics cost calculations like the ones shown below. On this basis we compared the economic viability of Pennsylvania-centered container services and compared these with the "next best" routing and modal option. Based on segment specific and lane specific calculations we proceeded to develop defining parameters which collectively scope the entire Pennsylvania market potential.

Example Computation: Total Logistics Cost

To illustrate the type of computations which have been performed to develop the total logistics cost in each of the markets the output of the Logistics Cost Model is shown in the tables which follow for five specific domestic intermodal markets. These are:

1. Chicago to Newark via the Conrail water level route
2. Chicago to Newark via the cleared Conrail Main Line
3. Chicago to Philadelphia via the Conrail water level route (note that this involves TOFC drayage to/from Newark)
4. Chicago to Philadelphia via the cleared Conrail Main Line (doublestacks can now use the route)
5. Chicago to Philadelphia via CSX's line through Baltimore

Examination of the differences in costs among the different alternatives reveals much about the types of cost savings that are available in other markets which use the cleared lines.

SHIPPER LOGISTICS COST MODEL-- Base Case Scenario

Observation No. 1

Commodity Description: Chicago, IL to Newark, NJ via CR WL

Shipper/Commodity Characteristics

units presented in Tons

units/year	1,000	lbs/year =	2,000,000
pounds/unit	2,000	lbs/cuft =	5.00
cube/unit	400	$/lb =	2.50
$/unit	5,000		
shelf life (days)	365		
warehouse sqft/unit	20		
warehouse $/sqft	2		
cost per order	25		
internal cost of capital %	15.00%		
LTL discount	25.00%		

Shipment Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
line-haul miles	1,003	916	815	815	1,003
pickup miles	0	25	0	20	25
delivery miles	0	25	0	30	25
target order	99	25	24	5	25

Modal Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube limit	7,200	3,634	4,280	2,142	4,615
weight limit	198,200	50,000	48,000	10,000	50,000
cost/ship	$300.00	$100.00	$119.01	$200.00	$100.00
cost/mile	$0.80	$0.62	$1.05	$1.12	$0.41
load ratio	0.60	1.00	1.00	0.70	0.95
pickup $/ship	$0.00	$97.00	332	$100.00	$97.00
pickup $/mile	$0.00	$1.44	$0.00	$1.00	$1.44
delivery $/ship	$0.00	$97.00	-234	$100.00	$97.00
delivery $/mile	$0.00	$1.44	$0.00	$1.00	$1.44

Modal Performance	Rail	Intermodal	Truckload	LTL Truck	Dblstack
wait time	1	0.5	0.5	0.5	0.5
transit time	6.6	3.3	1.5	3.0	1.1
reliability	9.9	2.6	0.8	2.7	0.5
probability of L&D claim	0.1	0.05	0.01	0.02	0.01
$/claim	$50.00	$50.00	$50.00	$50.00	$50.00
claim payment days	90	90	60	30	90
Shipment Output	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube-limited ship	18	9	11	5	12
weight-limited ship	99	25	24	5	25
target order	99	25	24	5	25
final units/ship	18	9	11	5	12
transport charges/ship	$1,837.87	$933.46	$1,073.58	$5,382.21	$800.09
no. shipments/yr	56	110	93	200	87
transport charges/yr	102,104	102,754	100,340	1,076,443	69,341
Logistics Cost per Unit	Rail	Intermodal	Truckload	LTL Truck	Dblstack
order cost	$1.39	$2.75	$2.34	$5.00	$2.17
capital carry in transit	$13.56	$6.76	$3.18	$6.24	$2.20
capital carry in storage	$6.75	$3.41	$4.01	$1.88	$4.33
storage cost	$0.72	$0.36	$0.43	$0.20	$0.46
shelfloss in transit	$0.00	$0.00	$0.00	$0.00	$0.00
filing L&D claims	$0.28	$0.28	$0.05	$0.20	$0.04
capital carry on L&D	$0.01	$0.01	$0.00	$0.00	$0.00
safety stock carrying cost	$13.50	$5.41	$1.59	$3.75	$1.10
emergency shipment cost	$4.26	$4.26	$4.26	$4.26	$4.26
Total Logistics Costs per Unit	$40.47	$23.23	$15.85	$21.53	$14.57
Transport Charges	$102.10	$102.75	$100.34	$1,076.44	$69.34
Transportation & Logistics Cost per Unit	$142.57	$125.99	$116.19	$1,097.97	$83.91
Purchase Cost	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
Total Costs per Unit	$5,142.57	$5,125.99	$5,116.19	$6,097.97	$5,083.91
Transportation & Logistics Cost per Cwt	$7.13	$6.30	$5.81	$54.90	$4.20
Total Costs per Cwt	$257.13	$256.30	$255.81	$304.90	$254.20

SHIPPER LOGISTICS COST MODEL-- Base Case Scenario

Observation No. 2

Commodity Description: Chicago, IL to Newark, NJ via CR ML

Shipper/Commodity Characteristics

units presented in Tons

units/year	1,000	lbs/year =	2,000,000
pounds/unit	2,000	lbs/cuft =	5.00
cube/unit	400	$/lb =	2.50
$/unit	5,000		
shelf life (days)	365		
warehouse sqft/unit	20		
warehouse $/sqft	2		
cost per order	25		
internal cost of capital %	15.00%		
LTL discount	25.00%		

Shipment Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
line-haul miles	916	916	815	815	916
pickup miles	0	25	0	20	25
delivery miles	0	25	0	30	25
target order	99	25	24	5	25

Modal Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube limit	7,200	3,634	4,280	2,142	4,615
weight limit	198,200	50,000	48,000	10,000	50,000
cost/ship	$300.00	$100.00	$119.01	$200.00	$100.00
cost/mile	$0.80	$0.62	$1.05	$1.12	$0.42
load ratio	0.60	1.00	1.00	0.70	0.95
pickup $/ship	$0.00	$97.00	332	$100.00	$97.00
pickup $/mile	$0.00	$1.44	$0.00	$1.00	$1.44
delivery $/ship	$0.00	$97.00	-234	$100.00	$97.00
delivery $/mile	$0.00	$1.44	$0.00	$1.00	$1.44

Modal Performance	Rail	Intermodal	Truckload	LTL Truck	Dblstack
wait time	1	0.5	0.5	0.5	0.5
transit time	6.2	3.3	1.5	3.0	1.0
reliability	9.3	2.6	0.8	2.7	0.5
probability of L&D claim	0.1	0.05	0.01	0.02	0.01
$/claim	$50.00	$50.00	$50.00	$50.00	$50.00
claim payment days	90	90	60	30	90
Shipment Output	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube-limited ship	18	9	11	5	12
weight-limited ship	99	25	24	5	25
target order	99	25	24	5	25
final units/ship	18	9	11	5	12
transport charges/ship	$1,720.67	$933.46	$1,073.58	$5,382.21	$772.33
no. shipments/yr	56	110	93	200	87
transport charges/yr	95,593	102,754	100,340	1,076,443	66,935
Logistics Cost per Unit	Rail	Intermodal	Truckload	LTL Truck	Dblstack
order cost	$1.39	$2.75	$2.34	$5.00	$2.17
capital carry in transit	$12.73	$6.76	$3.18	$6.24	$2.05
capital carry in storage	$6.75	$3.41	$4.01	$1.88	$4.33
storage cost	$0.72	$0.36	$0.43	$0.20	$0.46
shelfloss in transit	$0.00	$0.00	$0.00	$0.00	$0.00
filing L&D claims	$0.28	$0.28	$0.05	$0.20	$0.04
capital carry on L&D	$0.01	$0.01	$0.00	$0.00	$0.00
safety stock carrying cost	$13.50	$5.41	$1.59	$3.75	$1.03
emergency shipment cost	$3.93	$3.93	$3.93	$3.93	$3.93
Total Logistics Costs per Unit	$39.31	$22.90	$15.52	$21.20	$14.01
Transport Charges	$95.59	$102.75	$100.34	$1,076.44	$66.93
Transportation & Logistics Cost per Unit	$134.90	$125.66	$115.86	$1,097.64	$80.95
Purchase Cost	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
Total Costs per Unit	$5,134.90	$5,125.66	$5,115.86	$6,097.64	$5,080.95
Transportation & Logistics Cost per Cwt	$6.75	$6.28	$5.79	$54.88	$4.05
Total Costs per Cwt	$256.75	$256.28	$255.79	$304.88	$254.05

SHIPPER LOGISTICS COST MODEL-- Base Case Scenario

Observation No. 3

Commodity Description: Chicago, Il to Philadelphia, PA via CR WL

Shipper/Commodity Characteristics

units presented in Tons

units/year	1,000	lbs/year =	2,000,000
pounds/unit	2,000	lbs/cuft =	5.00
cube/unit	400	$/lb =	2.50
$/unit	5,000		
shelf life (days)	365		
warehouse sqft/unit	20		
warehouse $/sqft	2		
cost per order	25		
internal cost of capital %	15.00%		
LTL discount	25.00%		

Shipment Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
line-haul miles	1,003	916	785	785	1,003
pickup miles	0	25	0	20	25
delivery miles	0	25	0	30	100
target order	99	25	24	5	25

Modal Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube limit	7,200	3,634	4,280	2,142	4,615
weight limit	198,200	50,000	48,000	10,000	50,000
cost/ship	$300.00	$100.00	$119.01	$200.00	$100.00
cost/mile	$0.80	$0.62	$1.05	$1.12	$0.41
load ratio	0.60	1.00	1.00	0.70	0.95
pickup $/ship	$0.00	$97.00	332	$100.00	$97.00
pickup $/mile	$0.00	$1.44	$0.00	$1.00	$1.44
delivery $/ship	$0.00	$97.00	-234	$100.00	$97.00
delivery $/mile	$0.00	$1.44	$0.00	$1.00	$1.44

Modal Performance	Rail	Intermodal	Truckload	LTL Truck	Dblstack
wait time	1	0.5	0.5	0.5	0.5
transit time	6.6	3.3	1.5	3.0	1.2
reliability	9.9	2.6	0.8	2.7	0.6
probability of L&D claim	0.1	0.05	0.01	0.02	0.01
$/claim	$50.00	$50.00	$50.00	$50.00	$50.00
claim payment days	90	90	60	30	90
Shipment Output	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube-limited ship	18	9	11	5	12
weight-limited ship	99	25	24	5	25
target order	99	25	24	5	25
final units/ship	18	9	11	5	12
transport charges/ship	$1,837.87	$933.46	$1,042.47	$5,314.43	$907.86
no. shipments/yr	56	110	93	200	87
transport charges/yr	102,104	102,754	97,432	1,062,886	78,681
Logistics Cost per Unit	Rail	Intermodal	Truckload	LTL Truck	Dblstack
order cost	$1.39	$2.75	$2.34	$5.00	$2.17
capital carry in transit	$13.56	$6.76	$3.13	$6.09	$2.42
capital carry in storage	$6.75	$3.41	$4.01	$1.88	$4.33
storage cost	$0.72	$0.36	$0.43	$0.20	$0.46
shelfloss in transit	$0.00	$0.00	$0.00	$0.00	$0.00
filing L&D claims	$0.28	$0.28	$0.05	$0.20	$0.04
capital carry on L&D	$0.01	$0.01	$0.00	$0.00	$0.00
safety stock carrying cost	$13.50	$5.41	$1.56	$3.75	$1.21
emergency shipment cost	$4.26	$4.26	$4.26	$4.26	$4.26
Total Logistics Costs per Unit	$40.47	$23.23	$15.78	$21.38	$14.89
Transport Charges	$102.10	$102.75	$97.43	$1,062.89	$78.68
Transportation & Logistics Cost per Unit	$142.57	$125.99	$113.21	$1,084.27	$93.57
Purchase Cost	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
Total Costs per Unit	$5,142.57	$5,125.99	$5,113.21	$6,084.27	$5,093.57
Transportation & Logistics Cost per Cwt	$7.13	$6.30	$5.66	$54.21	$4.68
Total Costs per Cwt	$257.13	$256.30	$255.66	$304.21	$254.68

SHIPPER LOGISTICS COST MODEL-- Base Case Scenario

Observation No. 4

Commodity Description: Chicago, IL to Philadelphia, PA via CR ML

Shipper/Commodity Characteristics

units presented in Tons

units/year	1,000	lbs/year =	2,000,000
pounds/unit	2,000	lbs/cuft =	5.00
cube/unit	400	$/lb =	2.50
$/unit	5,000		
shelf life (days)	365		
warehouse sqft/unit	20		
warehouse $/sqft	2		
cost per order	25		
internal cost of capital %	15.00%		
LTL discount	25.00%		

Shipment Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
line-haul miles	845	845	785	785	845
pickup miles	0	25	0	20	25
delivery miles	0	25	0	30	25
target order	99	25	24	5	25

Modal Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube limit	7,200	3,634	4,280	2,142	4,615
weight limit	198,200	50,000	48,000	10,000	50,000
cost/ship	$300.00	$100.00	$119.01	$200.00	$100.00
cost/mile	$0.80	$0.62	$1.05	$1.12	$0.43
load ratio	0.60	1.00	1.00	0.70	0.95
pickup $/ship	$0.00	$97.00	332	$100.00	$97.00
pickup $/mile	$0.00	$1.44	$0.00	$1.00	$1.44
delivery $/ship	$0.00	$97.00	-234	$100.00	$97.00
delivery $/mile	$0.00	$1.44	$0.00	$1.00	$1.44

Modal Performance	Rail	Intermodal	Truckload	LTL Truck	Dblstack
wait time	1	0.5	0.5	0.5	0.5
transit time	5.9	3.1	1.5	3.0	0.9
reliability	8.8	2.5	0.8	2.7	0.5
probability of L&D claim	0.1	0.05	0.01	0.02	0.01
$/claim	$50.00	$50.00	$50.00	$50.00	$50.00
claim payment days	90	90	60	30	90
Shipment Output	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube-limited ship	18	9	11	5	12
weight-limited ship	99	25	24	5	25
target order	99	25	24	5	25
final units/ship	18	9	11	5	12
transport charges/ship	$1,626.00	$889.44	$1,042.47	$5,314.43	$750.69
no. shipments/yr	56	110	93	200	87
transport charges/yr	90,333	97,909	97,432	1,062,886	65,059
Logistics Cost per Unit	Rail	Intermodal	Truckload	LTL Truck	Dblstack
order cost	$1.39	$2.75	$2.34	$5.00	$2.17
capital carry in transit	$12.06	$6.39	$3.13	$6.09	$1.93
capital carry in storage	$6.75	$3.41	$4.01	$1.88	$4.33
storage cost	$0.72	$0.36	$0.43	$0.20	$0.46
shelfloss in transit	$0.00	$0.00	$0.00	$0.00	$0.00
filing L&D claims	$0.28	$0.28	$0.05	$0.20	$0.04
capital carry on L&D	$0.01	$0.01	$0.00	$0.00	$0.00
safety stock carrying cost	$13.50	$5.11	$1.56	$3.75	$0.97
emergency shipment cost	$3.67	$3.67	$3.67	$3.67	$3.67
Total Logistics Costs per Unit	$38.38	$21.98	$15.18	$20.78	$13.56
Transport Charges	$90.33	$97.91	$97.43	$1,062.89	$65.06
Transportation & Logistics Cost per Unit	$128.71	$119.89	$112.61	$1,083.67	$78.62
Purchase Cost	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
Total Costs per Unit	$5,128.71	$5,119.89	$5,112.61	$6,083.67	$5,078.62
Transportation & Logistics Cost per Cwt	$6.44	$5.99	$5.63	$54.18	$3.93
Total Costs per Cwt	$256.44	$255.99	$255.63	$304.18	$253.93

SHIPPER LOGISTICS COST MODEL-- Base Case Scenario

Observation No. 6

Commodity Description: Chicago, IL to Philadelphia via CSX

Shipper/Commodity Characteristics

units presented in Tons

units/year	1,000	lbs/year =	2,000,000
pounds/unit	2,000	lbs/cuft =	5.00
cube/unit	400	$/lb =	2.50
$/unit	5,000		
shelf life (days)	365		
warehouse sqft/unit	20		
warehouse $/sqft	2		
cost per order	25		
internal cost of capital %	15.00%		
LTL discount	25.00%		

Shipment Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
line-haul miles	920	920	785	785	920
pickup miles	0	25	0	20	25
delivery miles	0	25	0	30	25
target order	99	25	24	5	25

Modal Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube limit	7,200	3,634	4,280	2,142	4,615
weight limit	198,200	50,000	48,000	10,000	50,000
cost/ship	$300.00	$100.00	$119.01	$200.00	$100.00
cost/mile	$0.80	$0.62	$1.05	$1.12	$0.42
load ratio	0.60	1.00	1.00	0.70	0.95
pickup $/ship	$0.00	$97.00	332	$100.00	$97.00
pickup $/mile	$0.00	$1.44	$0.00	$1.00	$1.44
delivery $/ship	$0.00	$97.00	-234	$100.00	$97.00
delivery $/mile	$0.00	$1.44	$0.00	$1.00	$1.44

Modal Performance	Rail	Intermodal	Truckload	LTL Truck	Dblstack
wait time	1	0.5	0.5	0.5	0.5
transit time	6.2	3.3	1.5	3.0	1.0
reliability	9.3	2.6	0.8	2.7	0.5
probability of L&D claim	0.1	0.05	0.01	0.02	0.01
$/claim	$50.00	$50.00	$50.00	$50.00	$50.00
claim payment days	90	90	60	30	90

Shipment Output	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube-limited ship	18	9	11	5	12
weight-limited ship	99	25	24	5	25
target order	99	25	24	5	25
final units/ship	18	9	11	5	12
transport charges/ship	$1,727.07	$936.44	$1,042.05	$5,313.50	$773.79
no. shipments/yr	56	110	93	200	87
transport charges/yr	95,948	103,082	97,393	1,062,700	67,062

Logistics Cost per Unit	Rail	Intermodal	Truckload	LTL Truck	Dblstack
order cost	$1.39	$2.75	$2.34	$5.00	$2.17
capital carry in transit	$12.78	$6.78	$3.13	$6.09	$2.06
capital carry in storage	$6.75	$3.41	$4.01	$1.88	$4.33
storage cost	$0.72	$0.36	$0.43	$0.20	$0.46
shelfloss in transit	$0.00	$0.00	$0.00	$0.00	$0.00
filing L&D claims	$0.28	$0.28	$0.05	$0.20	$0.04
capital carry on L&D	$0.01	$0.01	$0.00	$0.00	$0.00
safety stock carrying cost	$13.50	$5.43	$1.56	$3.75	$1.03
emergency shipment cost	$3.95	$3.95	$3.95	$3.95	$3.95
Total Logistics Costs per Unit	$39.37	$22.97	$15.46	$21.07	$14.04
Transport Charges	$95.95	$103.08	$97.39	$1,062.70	$67.06
Transportation & Logistics Cost per Unit	$135.32	$126.05	$112.86	$1,083.77	$81.10
Purchase Cost	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
Total Costs per Unit	$5,135.32	$5,126.05	$5,112.86	$6,083.77	$5,081.10
Transportation & Logistics Cost per Cwt	$6.77	$6.30	$5.64	$54.19	$4.06
Total Costs per Cwt	$256.77	$256.30	$255.64	$304.19	$254.06

International Intermodal Traffic Potential

Transmode analyzed the total logistics costs for international movements through the Port of Philadelphia. The source market segments identified were:

Existing COFC
Truck
Other Ports
Mini Land Bridge
International Auto Traffic
Refrigerated Traffic

For each of these sources of traffic flows, the following Philadelphia inbound and outbound markets were developed:

Midwest
South
Far West
Canada

Logistics cost computations were performed for each of the markets above. As with the domestic markets described previously, some typical cost computations have been shown in the tables which follow for:

1. Toronto to Philadelphia via the D&H Line
2. Toronto to Halifax via the CN
3. Toronto to Newark via Conrail

SHIPPER LOGISTICS COST MODEL-- Base Case Scenario

Observation No. 5

Commodity Description: Toronto, ON to Philadelphia, PA via D&H

Shipper/Commodity Characteristics

units presented in Tons

units/year	1,000	lbs/year =	2,000,000
pounds/unit	2,000	lbs/cuft =	5.00
cube/unit	400	$/lb =	2.50
$/unit	5,000		
shelf life (days)	365		
warehouse sqft/unit	20		
warehouse $/sqft	2		
cost per order	25		
internal cost of capital %	15.00%		
LTL discount	25.00%		

Shipment Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
line-haul miles	580	580	458	458	580
pickup miles	0	25	0	20	25
delivery miles	0	25	0	30	25
target order	99	25	24	5	25

Modal Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube limit	7,200	3,634	4,280	2,142	4,615
weight limit	198,200	50,000	48,000	10,000	50,000
cost/ship	$300.00	$100.00	$119.01	$200.00	$100.00
cost/mile	$0.80	$0.62	$1.05	$1.12	$0.49
load ratio	0.60	1.00	1.00	0.70	0.95
pickup $/ship	$0.00	$97.00	323	$100.00	$97.00
pickup $/mile	$0.00	$1.44	$0.00	$1.00	$1.44
delivery $/ship	$0.00	$97.00	-224	$100.00	$97.00
delivery $/mile	$0.00	$1.44	$0.00	$1.00	$1.44

Modal Performance	Rail	Intermodal	Truckload	LTL Truck	Dblstack
wait time	1	0.5	0.5	0.5	0.5
transit time	4.7	2.5	0.9	2.1	0.7
reliability	7.0	2.0	0.5	1.9	0.4
probability of L&D claim	0.1	0.05	0.01	0.02	0.01
$/claim	$50.00	$50.00	$50.00	$50.00	$50.00
claim payment days	90	90	60	30	90

Shipment Output	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube-limited ship	18	9	11	5	12
weight-limited ship	99	25	24	5	25
target order	99	25	24	5	25
final units/ship	18	9	11	5	12
transport charges/ship	$1,273.87	$725.70	$699.37	$4,417.86	$670.43
no. shipments/yr	56	110	93	200	87
transport charges/yr	70,770	79,884	65,365	883,572	58,104

Logistics Cost per Unit	Rail	Intermodal	Truckload	LTL Truck	Dblstack
order cost	$1.39	$2.75	$2.34	$5.00	$2.17
capital carry in transit	$9.58	$5.04	$1.88	$4.41	$1.48
capital carry in storage	$6.75	$3.41	$4.01	$1.88	$4.33
storage cost	$0.72	$0.36	$0.43	$0.20	$0.46
shelfloss in transit	$0.00	$0.00	$0.00	$0.00	$0.00
filing L&D claims	$0.28	$0.28	$0.05	$0.20	$0.04
capital carry on L&D	$0.01	$0.01	$0.00	$0.00	$0.00
safety stock carrying cost	$13.50	$4.03	$0.94	$3.75	$0.74
emergency shipment cost	$2.68	$2.68	$2.68	$2.68	$2.68
Total Logistics Costs per Unit	$34.90	$18.55	$12.32	$18.11	$11.90
Transport Charges	$70.77	$79.88	$65.37	$883.57	$58.10
Transportation & Logistics Cost per Unit	$105.67	$98.43	$77.69	$901.68	$70.00
Purchase Cost	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
Total Costs per Unit	$5,105.67	$5,098.43	$5,077.69	$5,901.68	$5,070.00
Transportation & Logistics Cost per Cwt	$5.28	$4.92	$3.88	$45.08	$3.50
Total Costs per Cwt	$255.28	$254.92	$253.88	$295.08	$253.50

SHIPPER LOGISTICS COST MODEL-- Base Case Scenario

Observation No. 9

Commodity Description: Toronto to Halifax via CN

Shipper/Commodity Characteristics

units presented in Tons

units/year	10,000	lbs/year =	20,000,000
pounds/unit	2,000	lbs/cuft =	5.00
cube/unit	400	$/lb =	2.50
$/unit	5,000		
shelf life (days)	365		
warehouse sqft/unit	20		
warehouse $/sqft	2		
cost per order	25		
internal cost of capital %	15.00%		
LTL discount	25.00%		

Shipment Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
line-haul miles	1,172	1,172	1,199	1,199	1,172
pickup miles	0	25	0	20	25
delivery miles	0	25	0	30	25
target order	99	25	24	5	25

Modal Characteristics	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube limit	7,200	3,634	4,280	2,142	4,615
weight limit	198,200	50,000	48,000	10,000	50,000
cost/ship	$300.00	$100.00	$119.01	$200.00	$100.00
cost/mile	$0.80	$0.62	$1.05	$1.12	$0.39
load ratio	0.60	1.00	1.00	0.70	0.95
pickup $/ship	$0.00	$97.00	40	$100.00	$97.00
pickup $/mile	$0.00	$1.44	$0.00	$1.00	$1.44
delivery $/ship	$0.00	$97.00	-234	$100.00	$97.00
delivery $/mile	$0.00	$1.44	$0.00	$1.00	$1.44

Modal Performance	Rail	Intermodal	Truckload	LTL Truck	Dblstack
wait time	1	0.5	0.5	0.5	0.5
transit time	7.4	3.9	1.9	4.0	1.2
reliability	11.1	3.1	0.9	3.6	0.6
probability of L&D claim	0.1	0.05	0.01	0.02	0.01
$/claim	$50.00	$50.00	$50.00	$50.00	$50.00
claim payment days	90	90	60	30	90
Shipment Output	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube-limited ship	18	9	11	5	12
weight-limited ship	99	25	24	5	25
target order	99	25	24	5	25
final units/ship	18	9	11	5	12
transport charges/ship	$2,062.13	$1,092.24	$1,185.16	$6,143.29	$850.58
no. shipments/yr	556	1,101	935	2,000	867
transport charges/yr	1,145,630	1,202,330	1,107,690	12,286,584	737,161
Logistics Cost per Unit	Rail	Intermodal	Truckload	LTL Truck	Dblstack
order cost	$1.39	$2.75	$2.34	$5.00	$2.17
capital carry in transit	$15.14	$8.07	$3.83	$8.21	$2.49
capital carry in storage	$0.68	$0.34	$0.40	$0.19	$0.43
storage cost	$0.07	$0.04	$0.04	$0.02	$0.05
shelfloss in transit	$0.00	$0.00	$0.00	$0.00	$0.00
filing L&D claims	$0.28	$0.28	$0.05	$0.20	$0.04
capital carry on L&D	$0.01	$0.01	$0.00	$0.00	$0.00
safety stock carrying cost	$1.35	$0.68	$0.80	$0.38	$0.87
emergency shipment cost	$0.00	$0.00	$0.00	$0.00	$0.00
Total Logistics Costs per Unit	$18.92	$12.17	$7.46	$14.00	$6.05
Transport Charges	$114.56	$120.23	$110.77	$1,228.66	$73.72
Transportation & Logistics Cost per Unit	$133.48	$132.40	$118.23	$1,242.66	$79.76
Purchase Cost	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
Total Costs per Unit	$5,133.48	$5,132.40	$5,118.23	$6,242.66	$5,079.76
Transportation & Logistics Cost per Cwt	$6.67	$6.62	$5.91	$62.13	$3.99
Total Costs per Cwt	$256.67	$256.62	$255.91	$312.13	$253.99

SHIPPER LOGISTICS COST MODEL– Base Case Scenario

Observation No. 10

Commodity Description: Toronto to Newark via CR

Shipper/Commodity Characteristics

units presented in Tons

units/year	10,000	lbs/year =	20,000,000
pounds/unit	2,000	lbs/cuft =	5.00
cube/unit	400	$/lb =	2.50
$/unit	5,000		
shelf life (days)	365		
warehouse sqft/unit	20		
warehouse $/sqft	2		
cost per order	25		
internal cost of capital %	15.00%		
LTL discount	25.00%		

Shipment Characteristics

	Rail	Intermodal	Truckload	LTL Truck	Dblstack
line-haul miles	613	613	516	516	613
pickup miles	0	25	0	20	25
delivery miles	0	25	0	30	25
target order	99	25	24	5	25

Modal Characteristics

	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube limit	7,200	3,634	4,280	2,142	4,615
weight limit	198,200	50,000	48,000	10,000	50,000
cost/ship	$300.00	$100.00	$119.01	$200.00	$100.00
cost/mile	$0.80	$0.62	$1.05	$1.12	$0.48
load ratio	0.60	1.00	1.00	0.70	0.95
pickup $/ship	$0.00	$97.00	332	$100.00	$97.00
pickup $/mile	$0.00	$1.44	$0.00	$1.00	$1.44
delivery $/ship	$0.00	$97.00	-234	$100.00	$97.00
delivery $/mile	$0.00	$1.44	$0.00	$1.00	$1.44

Modal Performance	Rail	Intermodal	Truckload	LTL Truck	Dblstack
wait time	1	0.5	0.5	0.5	0.5
transit time	4.8	2.5	1.0	2.3	0.7
reliability	7.2	2.0	0.5	2.1	0.4
probability of L&D claim	0.1	0.05	0.01	0.02	0.01
$/claim	$50.00	$50.00	$50.00	$50.00	$50.00
claim payment days	90	90	60	30	90

Shipment Output	Rail	Intermodal	Truckload	LTL Truck	Dblstack
cube-limited ship	18	9	11	5	12
weight-limited ship	99	25	24	5	25
target order	99	25	24	5	25
final units/ship	18	9	11	5	12
transport charges/ship	$1,317.87	$746.16	$759.33	$4,602.07	$680.44
no. shipments/yr	556	1,101	935	2,000	867
transport charges/yr	732,148	821,364	709,692	9,204,134	589,711

Logistics Cost per Unit	Rail	Intermodal	Truckload	LTL Truck	Dblstack
order cost	$1.39	$2.75	$2.34	$5.00	$2.17
capital carry in transit	$9.89	$5.21	$1.98	$4.71	$1.54
capital carry in storage	$0.68	$0.34	$0.40	$0.19	$0.43
storage cost	$0.07	$0.04	$0.04	$0.02	$0.05
shelfloss in transit	$0.00	$0.00	$0.00	$0.00	$0.00
filing L&D claims	$0.28	$0.28	$0.05	$0.20	$0.04
capital carry on L&D	$0.01	$0.01	$0.00	$0.00	$0.00
safety stock carrying cost	$1.35	$0.68	$0.80	$0.38	$0.77
emergency shipment cost	$0.00	$0.00	$0.00	$0.00	$0.00
Total Logistics Costs per Unit	$13.66	$9.30	$5.61	$10.49	$4.99
Transport Charges	$73.21	$82.14	$70.97	$920.41	$58.97
Transportation & Logistics Cost per Unit	$86.88	$91.44	$76.58	$930.90	$63.96
Purchase Cost	$5,000.00	$5,000.00	$5,000.00	$5,000.00	$5,000.00
Total Costs per Unit	$5,086.88	$5,091.44	$5,076.58	$5,930.90	$5,063.96
Transportation & Logistics Cost per Cwt	$4.34	$4.57	$3.83	$46.55	$3.20
Total Costs per Cwt	$254.34	$254.57	$253.83	$296.55	$253.20

Domestic Intermodal Traffic for 1995

The table below summarizes the projected domestic intermodal traffic levels for the first year of the five-year period beginning in the year that clearance work is completed in Pennsylvania.

	Traffic Diverted to Doublestack					
	TOFC/COFC to/from Region			Truckload to/from Region		
	Inbound	Outbound	Total	Inbound	Outbound	Total
Option 1 CR Pennsylvania Main Line						
Serving Pennsylvania and New Jersey to and from the West						
Pittsburgh	4,780	6,304	11,084	17,206	17,746	34,952
Harrisburg	21,621	11,545	33,165	15,700	18,447	34,146
Allentown	4,312	2,827	7,139	7,850	9,223	17,073
Philadelphia	15,948	10,607	26,555	27,474	32,282	59,756
New Jersey	136,882	68,739	205,621	75,097	70,895	145,992
Subtotal	183,543	100,022	283,565	143,328	148,592	291,920
Option 4 CSX Philadelphia via Baltimore						
Serving Philadelphia to and from the West						
Philadelphia	24,855	10,202	35,057	27,474	32,282	59,756
Option 5 CP/D&H via Binghamton						
Serving Philadelphia and New Jersey to and from Canada						
Philadelphia	3,916	4,967	8,884	2,637	3,347	5,984
New Jersey	7,833	9,934	17,767	5,962	4,740	10,703
Subtotal	11,749	14,902	26,651	8,599	8,088	16,687

International Intermodal Traffic Potential

The table below summarizes the projected international intermodal traffic levels for the first year (1995) after clearance work is completed in Pennsylvania.

		Traffic Diverted to Doublestack					
	Existing COFC	Truck	Oth Ports	Mini Land Bridge	Int Auto Traffic	Refrig Traffic	Total
Philadelphia Outbound Markets							
Midwest	5,850	6,837	932	0	26,691	1,380	41,690
South	821	1,276	406	0	5,338	690	8,531
Far West	1,301	2,431	272	587	0	0	4,591
Canada	821	4,376	4,775	0	0	1,592	11,564
Subtotal	8,794	14,920	6,385	587	32,030	3,661	66,377
Philadelphia Inbound Markets							
Midwest	4,805	3,419	466	0	26,691	0	35,380
South	191	638	203	0	5,338	0	6,370
Far West	1,184	1,216	136	12,968	0	0	15,504
Canada	1,433	2,188	4,298	0	0	0	7,919
Subtotal	7,613	7,460	5,102	12,968	32,030	0	65,173
Total Philadelphia Markets							
Midwest	10,655	10,256	1,397	0	53,383	1,380	77,070
South	1,013	1,914	608	0	10,677	690	14,902
Far West	2,486	3,647	408	13,555	0	0	20,095
Canada	2,254	6,564	9,073	0	0	1,592	19,483
Subtotal	16,407	22,381	11,487	13,555	64,059	3,661	131,549

IV. Benefit/Cost Computations

Summary of the Benefits

A complete accounting of the benefits by option, for each year is shown in the appendix. A summary of the benefits for the first year of operation is shown in the table below.

	Rail	Truck	Totals
Setup Auto Movements			
CR Main Line	3,155,853	9,771,895	12,927,748
CSX via Baltimore	2,185,777	9,091,647	11,277,424
CP via Binghamton	0	0	0
Totals	5,341,631	18,863,542	24,205,172
International Intermodal Movements			
CR Main Line	3,945,140	93,283	4,038,424
CSX via Baltimore	4,465,802	99,366	4,565,168
CP via Binghamton	2,260,236	317,249	2,577,485
Totals	10,671,179	509,898	11,181,078
Domestic Intermodal Movements			
CR Main Line	16,802,279	27,613,286	44,415,565
CSX via Baltimore	10,298,541	11,334,141	21,632,682
CP via Binghamton	2,884,531	1,133,610	4,018,142
Totals	29,985,352	40,081,037	70,066,389
High and Wide Load Movements			
CR Main Line	0	249,633	0
CSX via Baltimore	0	26,970	26,970
CP via Binghamton	0	60,000	60,000
Totals	0	336,603	86,970
Total Benefits Accruing in Pennsylvania			
CR Main Line	11,951,636	18,864,049	30,815,685
CSX via Baltimore	8,475,060	10,276,062	18,751,122
CP via Binghamton	2,572,384	755,430	3,327,814
Totals	22,999,081	29,895,540	52,894,621

Benefit/Cost Justification

Using the accumulated savings over each of the markets for each of the route options a net present value computation was performed on the time streams of costs and benefits. These cost and benefit streams are shown in the table below. Discounting was performed at an interest rate of 6.5%, the rate at which state revenue bonds might be expected to yield. The time period considered was somewhat short (5 years) for such a computation, however, the results are quite dramatic. The present discounted value of the benefit stream is substantially larger than that of the cost stream. The Net Present Value numbers are shown for the year 1992 as enclosed in borders. The results are also shown graphically in the diagram which follows. The results indicate that the project (all three options) are very worthwhile.

The Rationale for Investment

The Commonwealth of Pennsylvania is justified in contributing public funds to the investment for a variety of very compelling reasons:

1. All three projects show total public benefits far in excess of costs, though the benefit to cost ratio varies from 3.84 for the Conrail main line through Pennsylvania, to 2.02 for the CP's D&H Line through Binghamton and 13.37 for CSX's line through Baltimore and western Pennsylvania. Note that if the costs of clearing obstructions in Maryland are included, the CSX ratio goes to 3.16.
2. The Commonwealth's share of the investment is required if the individual railroads are to realize a reasonable return on their direct share of the investment.
3. The presence of all three railroads creates a competitive situation which insures that maximum benefits flow through to users and to the public. For port traffic, no other eastern port has a similar situation.

The Benefits of the Project Greatly Exceed the Costs

Net Present Value of Costs and Benefits

Net Present Value of Cost

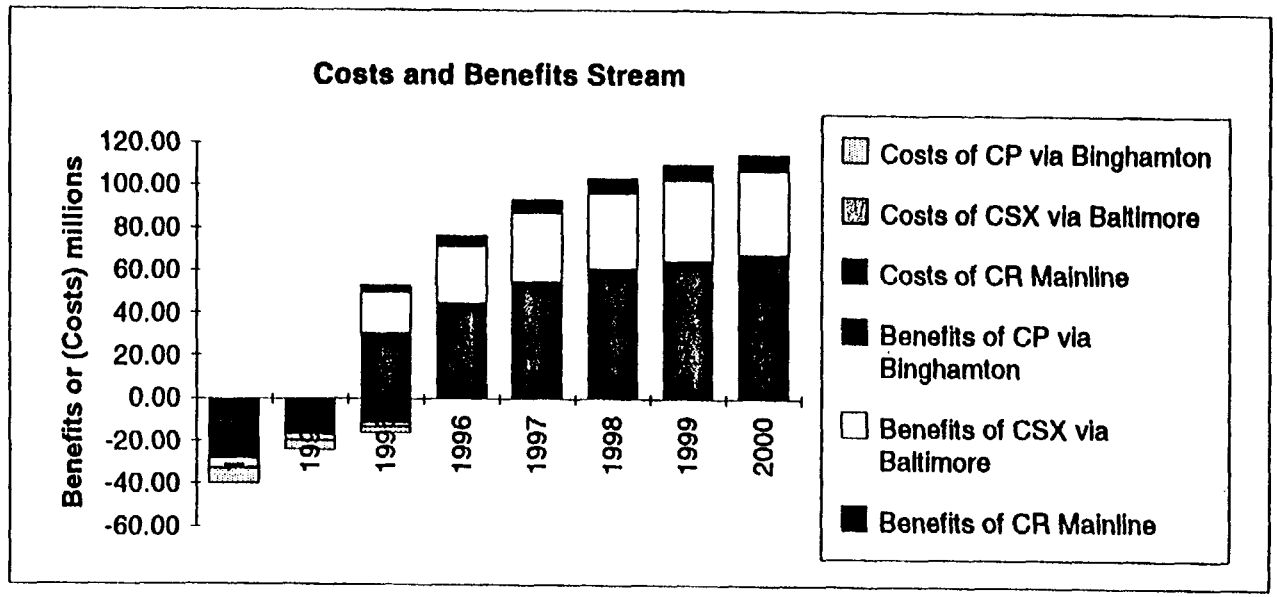
	1992	1993	1994	1995
CR Mainline	50.88	28.28	16.97	11.31
CSX via Baltimore	8.87	4.93	2.96	1.97
CP via Binghamton	13.10	7.28	4.37	2.91
Totals	72.85	40.49	24.29	16.20

Net Present Value of Benefit Stream

	1992	1993	1994	1995	1996	1997	1998	1999	2000
CR Mainline	224.46	0.00	0.00	30.82	44.79	54.76	60.80	64.68	67.66
CSX via Baltimore	132.39	0.00	0.00	18.75	26.74	32.32	35.65	37.75	39.34
CP via Binghamton	25.45	0.00	0.00	3.33	5.01	6.23	6.97	7.43	7.77
Totals	382.30	0.00	0.00	52.89	76.53	93.32	103.42	109.86	114.77

Note: Net present values computed with discount rate of 6.5%

Costs and Benefits Stream



4. The more quickly all three projects can be placed into operation the better the competitive position of the Commonwealth *vis a vis* other States and other regions.
5. The Commonwealth's presence in the negotiations helps to insure full participation and fair play among shippers, carriers and the public.
6. Because of the unusually large percentage of through truck traffic in Pennsylvania, small investments in railroads can save much larger expenditures for highways, bridges and their maintenance. They also reduce the congestion created by this through traffic.

By participating in this set of projects the Commonwealth is contributing to improved intermodalism and increased efficiency of the entire productive capacity of the United States.

Incremental Horizontal Clearances

The benefits associated with the incremental costs of horizontal clearances clearly exceed the costs as the table below shows.

Costs: $1.1 million

Benefits:

Sales of LNG process systems and large sintering plants in excess of $60 million annually
500-600 jobs in Wilkes Barre and Catasauqua
State taxes exceeding $7.6 million per year

Impacts of the Project on Pennsylvania's Economy

Transmode developed the secondary impacts, including the job impacts for several of the affected sectors in detail.

- Manufacturing will be able to take advantage of the clearances to use more efficient modes of transportation. The savings will allow manufacturers to expand their plants, increase output and employ a larger work force.
- International trade will be enhanced by having a port that is served by doublestack rail transportation. The access to southern, midwestern and Canadian markets will be greatly improved.
- The Port of Philadelphia can potentially attract trade that is currently being imported or exported through other ports.
- Domestic truckload trucking can take advantage of low cost domestic doublestack to serve the entire Commonwealth with lower cost service.
- Low transportation costs will directly benefit the distribution industry which will continue to concentrate its facilities in Pennsylvania rather than New Jersey, New York or Maryland.
- High and wide shippers will be able to expand their markets.
- The life of existing highways in the State will be lengthened.

The impacts on trucking and wholesale distribution are developed in more detail in the sections which follow.

Employment Impacts of Rail Clearance Improvements

Two types of impacts can be expected from improved rail clearances: first near term effects due to construction work and second, the longer term gains as Pennsylvania industry responds to the transport cost savings. While firms and individuals in other States will gain as well from improved long-haul freight service, the focus here is on the economic impacts that remain within Pennsylvania. This section discusses the construction-related impacts; the next section describes the impacts due to transportation improvements.

The long run economic gains from investment in rail clearance improvements depend on complex market interactions and thus are difficult to quantify. In general, increased heavy construction of rail clearances will affect Pennsylvania's economy positively. The biggest immediate economic impact will be through increased construction activity. However, this effect will spread quickly throughout the Pennsylvania economy to include other sectors that depend directly or indirectly on construction activity.

To quantify this impact, we used the multipliers for Pennsylvania from the Department of Commerce's Regional Input-Output Model, RIMS II[1] The capital investment to improve the rail clearances in Pennsylvania represents a change in final demand that would not have occurred otherwise - at least not as quickly. The following table shows the estimates of the impacts from increasing total final demand in the construction industry by distributing the annual investments between 1993 and 1995 across all construction activities.

Construction Industry	1993 ($40.5 Mil Invested)	1994 ($24.3 Mil Invested)	1995 ($16.2 Mil Invested)	Total
Direct Jobs	460	280	180	920
Indirect & Induced Jobs	1,160	700	470	2,330
Total Jobs	1,620	980	650	3,250

In the very short run, construction workers and firms will receive the greatest benefit from increased rail construction. However, those benefits are not exclusive to construction. The estimates summarized in the table above show the total number of full and part-time jobs Pennsylvania industries will provide, both directly and indirectly. The analysis shows the likely impact for each of the three years of construction investment. For States with large complex economies such as Pennsylvania, construction accounts for less than half of the jobs and output created. A wide range of industries will benefit from the construction spending, including manufacturing industries such as processed food and machinery.

The job impact is greater than that created by direct spending due to what is known as the multiplier effect. That is, the initial recipients of the investment (construction workers, suppliers, etc.) will then spend some portion of it on other goods and services, which will then be spent again, and so forth. In this way the money is recycled through the economy, multiplying the impact of the initial expenditure well beyond the construction industry. One caveat should be mentioned. To the extent that any public share of construction costs represents funds diverted from other programs, the jobs shown above represent transfers rather than net additions. This is probably not a problem for the railroad spending on these improvements in Pennsylvania.

Positive impacts will be felt in the public sector as well. Increased spending on the rail clearances in Pennsylvania will generate increases in state and local taxes. Thus, a portion of the initial expenditure

will be recovered. The amount of state and local tax receipts will increase by $6.5 million over the three years of construction. If the public sector finances 30 percent of the construction costs (or $24 million) some 27 percent of the public expenditure will be recovered through increases in state and local tax revenue. Therefore, roughly 8 percent of the total expenditure - both public and private - will be recovered through increases in state and local tax revenues.

Employment Impacts from Savings in Transportation and Logistics Cost

Much more important than the short-term impacts associated with construction, are long-run benefits that a more efficient transport system should have on the businesses in the Commonwealth. This study examines the reduction of transportation costs related to obtaining material inputs and shipping out products of selected manufacturing industries and the wholesale/distribution industry that rely heavily on transportation services. How manufacturers (and their customers) react to these transportation savings depends on the relationship between their production process and transportation costs. Without a detailed review of the industry organization, cost structure, competitive dynamics, and decision-making processes, it is difficult to estimate precisely how these changes will impact each industry. Reduced losses might bring about any or all of the following: market expansion, increases in the profit margin, higher wages, or changes in the production process.

Several recent studies[2] have examined the link between shifts in employment and measures of profitability. The responsiveness of industries to location differences measured in profitability is key to the development of this analysis. Transportation and logistic costs savings described elsewhere in this report (less adjustments for appropriate taxes) are directly related to changes in profitability at the industry level. That individual industrial output responds rapidly to changes in profitability[3] based on the findings of Rickman and Treyz and our knowledge of the economy of Pennsylvania. The elasticity of transportation costs to final output was set to range between -.75 and -1.00. For each of the study years, transportation

savings were allocated across several manufacturing and wholesale industries as a function of their share of the total Commonwealth transportation bill. After applying a tax adjustment, the transportation costs savings were translated into jobs based directly on changes in output and by applying the RIM's II multipliers (see table).

Employment Generated from Transportation Savings

Industry/Direct Employment:	1995	2000
Processed Food	47-62	101-135
Printed Matter	44-59	96-128
Chemical Products	31-42	68-91
Primary Metals	53-70	114-152
Metal Products	62-83	135-180
Machinery	55-73	119-159
Clothing	34-46	74-99
Wholesale Durables	59-78	127-170
Other Manufactured & Wholesale	234-312	509-677
Total Direct:	619-825	1,343-1,791
Indirect & Induced:	1,794-2,391	3,892-5,189
Total:	2,413-3,216	5,235-6,980

The manufacturing sectors that are most likely to realize growth from freight transportation improvements include processed food, primary metals, metal products, and machinery. Each of these sectors accounts for over 5 percent of the total job growth. Sectors with less than 5 percent of the growth were aggregated and appear above as "Other Manufactured & Wholesale." The wholesale and distribution sector will also experience employment growth.

As with the initial expenditures on the construction, the positive impacts of the logistics cost savings will be felt in the public sector as well. Increased economic activity due to improved rail transportation will generate increases in state and local taxes. The amount of state and local tax receipts will increase from $1.5 to $2.0 million in 1995 to $3.3 to $4.5 million in 2000. Therefore, from 1995 to 2000, there is the potential for increased state and local tax receipts ranging between $15.9 to 21.4 million, approximately 80 percent to over 100 percent of the initial public share of the construction expenditure will be recovered through rises in state and local taxes.

Case Study: Loss Of Export Sales

Industries classified under the special machinery manufacturing sector have indicated that their industry is affected much more dramatically by the lack of horizontal and vertical clearances. This case study examines the result of inadequate rail clearances on this sector. Restricted by horizontal clearances, several industries have forgone export market opportunities in recent years. The export of these manufacturing industries outside of Pennsylvania causes a change in final demand. For example, the loss of one sale[4] from a specialized machinery firm we interviewed was estimated to decrease the annual sales to export markets by $20.0 million. The following table summarizes the estimates of the impacts of decreased exports on all industries in Pennsylvania using RIMS II multipliers.

	Economic Impacts		
	Output (Millions of dollars)	Earnings (Millions of dollars)	Employment (number of jobs)
Machinery, except electric	50	15	570

The types of manufacturing plant that must ship products that need either horizontal or vertical clearance improvements to stay competitive in today's market have indicated that to meet their market demand, they

may consider relocation. If a firm with approximately 300 employees closed, the estimated number of jobs lost across Pennsylvania would be approximately 900 in all industries. This represents a loss of $800,000 in state and local taxes.

References

[1] U.S. Department of Commerce, Bureau of Economic Analysis. Regional Multipliers: A User Handbook for the Regional Input-Output Modeling System (RIMS II), Second edition. May 1992. These numbers exclude economic "leakages" to other states.

[2] See, for example, Connaughton, John E. and Ronald A. Madsen. 1990. "The Changing Regional Structure of the U.S. Economy." Growth and Change, 21, 48-60.

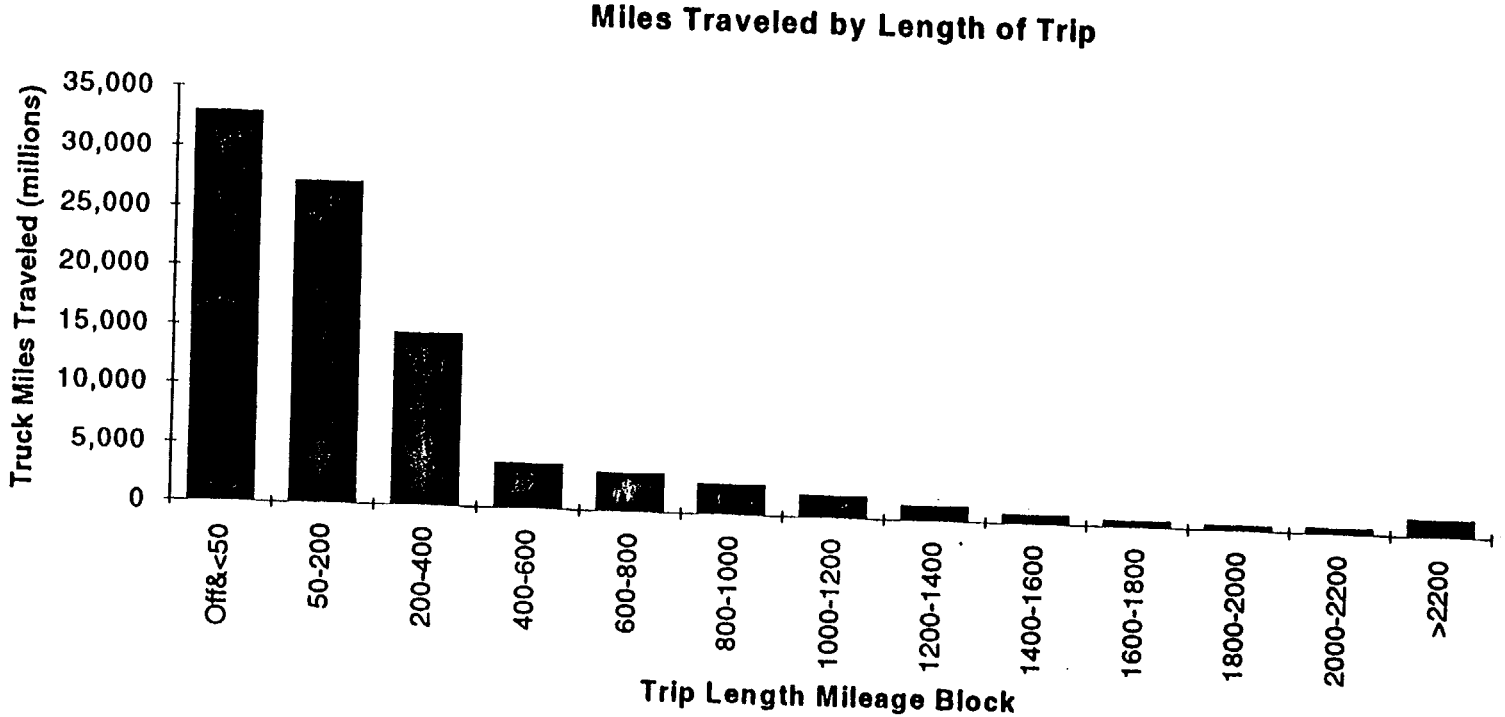
[3] Rickman, Dan S. and George Treyz. 1992. "Industry Level Estimates of Locational Responses to State Differentials in Profitability in the U.S.," unpublished paper.

[4] The industries in this case study are generally engineering manufacturers that "sell" a process as well as a technology. Therefore, it is difficult to quantify their sales strictly in terms of value to weight.

Impact on the Trucking Industry in Pennsylvania

Pennsylvania is the headquarters for 131 Class I and II motor carriers that filed annual reports with the Interstate Commerce Commission in 1990. Other sources indicate that an additional 2098 Class III motor carriers, or Class I or II carriers that did not file reports, are based in the Commonwealth. In addition, there are many motor carriers headquartered in other States which operate within the Commonwealth. Several large, transcontinental and regional, Less-Than-Truckload (LTL) carriers also have drivers that are domiciled in the State. Pennsylvania is a large state and consequently has a large number of employees which constitute a significant portion of the labor force of the Commonwealth. Consequently, it is a legitimate question to be concerned about what the rail overhead clearance project might mean for the continued economic health of this industry.

First, it is useful to understand the length of truck trips and their relationship to the structure of the motor carrier industry. Each has major implications for Pennsylvania. Short trips dominate truck travel. The number of miles traveled by trucks drops rapidly as the length of the trip grows.



The structure of the industry is closely related to the length of trip traveled. Different segments of the industry handle the long trips from those that handle short trips.

The size of the shipment being handled is also an important element in the organization of the industry. If the shipment tendered by the shipper does not fill the entire carrying capacity of the truck then it is important to consolidate other shipments going to the same destination to complete the load. If the shipment always consists of a full truckload this consolidation step is unnecessary. The result is that the industry divides itself into a "Less-Than-Truckload" (LTL) segment and a "Truckload" (TL) segment. The

LTL segment further subdivides into transcontinental, interregional and regional segments based on length of haul. There is also a "Parcel" segment for handling the very small packages.

Finally, the regulatory history of trucking has left its impact on the structure of the industry. All carriers which carry "regulated" commodities for hire are required to obtain a grant of operating authority from the Interstate Commerce Commission (ICC). This is not necessary if the goods carried are unregulated, or if they belong to the party providing transportation. Unregulated goods include most agricultural products. Recently, this exemption from regulation has been extended to goods which are being carried in intermodal service (i.e. truck/rail or truck/air, etc.) and the granting of operating authority has become almost automatic by the ICC. Many states regulate the carriage of goods for hire in intrastate movement. These state level regulations typically mirror the federal regulations.

In summary then, the trucking industry consists of four major segments, each with several subsegments. These are:

1. ICC-Regulated Carriers
   - Parcel carriers
   - Less-Than-Truckload (LTL) carriers
   - Truckload carriers
2. State-Regulated Carriers
3. Unregulated Carriers
   - Intermodal carriers
   - Agricultural exempt carriers
4. Private Carriers

Developing a feeling for the size, length of haul and organization of each of these segments is important to understanding the impact of domestic containerization of the truckload industry and its diversion to rail intermodal.

The size differences can best be appreciated by examining the table below, which shows the characteristics by type of carrier.

Statistics for Carriers of Different Types in 1991

Figures in millions (except vehicles)

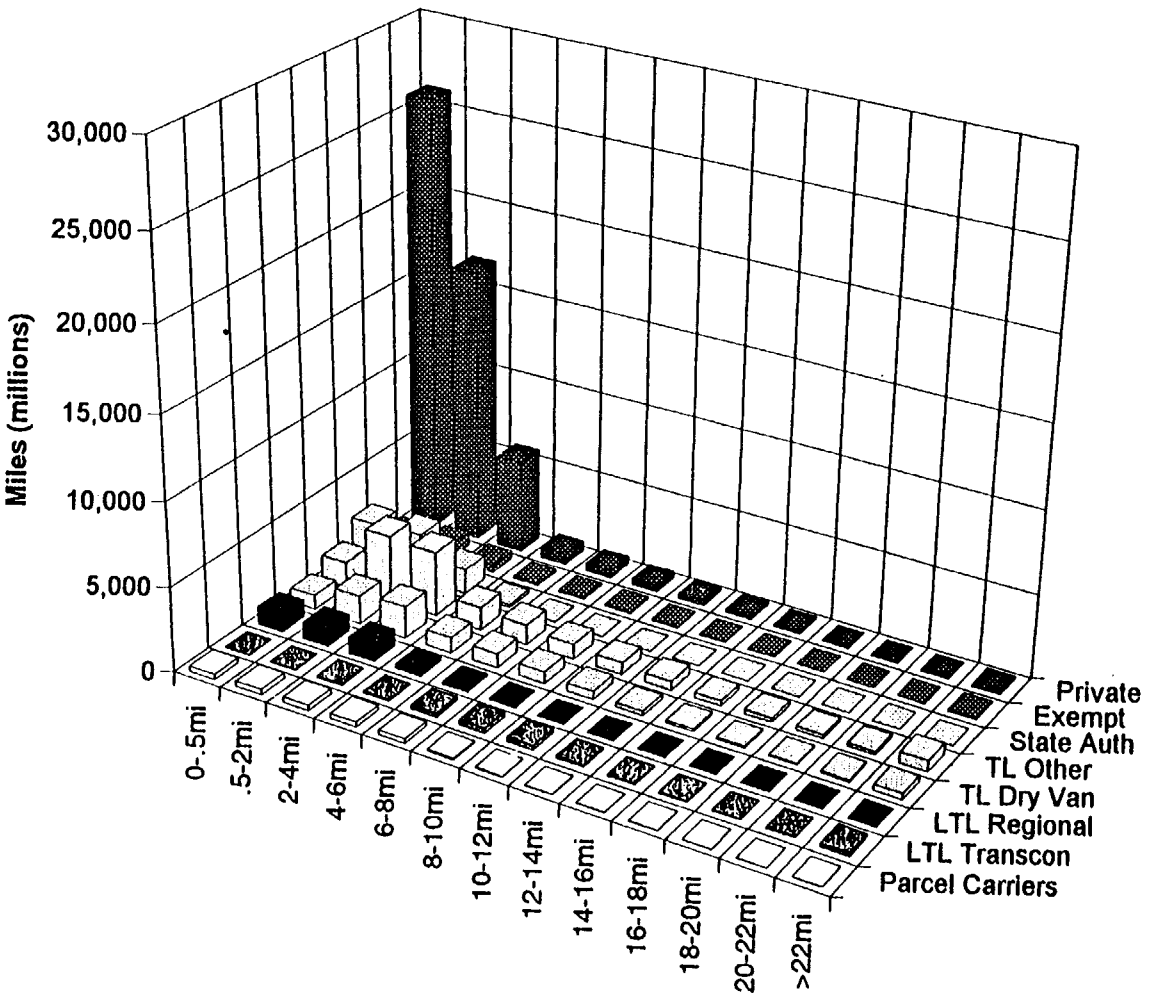
	Type Carrier	Vehicles	Miles	Trips	Tons	Ton Miles	Revenue
ICC	Parcel Carriers	117,452	3,368	25	42,944	421	15
	LTL Transcon	27,841	1,558	1	21,195	24	5
	LTL Regional	74,029	3,663	39	43,584	669	10
	TL Dry Van	115,931	9,851	59	190,073	1,303	17
	TL Other	275,118	18,450	94	290,379	2,238	32
Other	State Auth	258,357	8,934	112	84,161	1,590	25
	Exempt	59,883	3,329	24	42,811	486	5
	Private	4,366,767	63,169	978	328,121	7,577	206
	Total	5,295,378	112,322	1,332	1,043,267	14,308	315

This table shows that private carriage is by far the largest segment of the trucking industry, with more than 80 percent of the vehicles and 60 percent of the miles. In terms of tons carried and vehicle miles traveled the truckload segment is the work horse of the industry.

The length of haul, however, is the other important determinant of driver domicile. Long haul drivers can be based anywhere. Short haul drivers are located where the industry is headquartered. The distribution of miles by length of haul is shown in the following graph. It shows that private trucking is

predominantly a short haul industry, along with state-regulated carriers and regional LTL carriers. The long haul portion of the industry includes truckload, transcontinental LTL carriers and parcel carriers. Exempt carriers include agricultural haulers which haul fresh fruits and vegetables transcontinentally and intermodal drayage carriers which are typically short haul in nature.

Vehicle Miles Traveled by Type of Carrier



The organization of each of the segments of the industry provides the last clue as to the impact on Pennsylvania-based drivers. Parcel carriers and LTL carriers use pickup vehicles to gather shipments over an extended region within a city. These shipments are consolidated at a sort terminal, where each shipment is placed into the appropriate line-haul vehicle for routing within the carrier's system. At the destination end the shipments are deconsolidated and sorted into the proper delivery vehicle. The whole process requires a significant amount of skilled labor and most of the drivers and dock workers are union labor, principally Teamsters. Intermodal could be used throughout the industry for certain long haul movements, but in the past, only UPS has made extensive use of intermodal. The Master Freight Agreement, negotiated every three years between the Teamsters and an organization representing the managements of most LTL carriers, has wording which limits the use of intermodal.

Long haul truckload carriers operate in a totally different way from the LTL and Parcel carriers. First, they do not typically have consolidation/deconsolidation terminals. They typically pick up a full truckload of freight from the shipper and deliver it directly to the consignee. Only one driver is involved. That driver moves from the delivery of one load directly to the next available shipment as directed by his dispatcher. The dispatcher attempts to minimize the amount of mileage devoted to repositioning. As a consequence of this scheme of operation a driver may spend several weeks on the road, sleeping in the sleeper of the truck and eating and fueling at truckstops along the route. Most of the truckload van and flatbed carriers use non-union labor. It is this segment of the trucking industry which has sought out the intermodal industry and negotiated special prices for long-term doublestack services in their longer traffic lanes. Their interest in arranging for doublestack service arises partly out of their continuing difficulty with recruiting, training and retaining drivers. Even the best carriers in the industry have driver turnover of 200 percent per year. Needless to say, the quality of life of a long haul truckload driver is very low by the standards of most workers in this country.

Short haul truckload drivers tend to be domiciled in a specific location and frequently perform specialized transport, such as the transport of petroleum, chemicals, new automobiles, construction materials, oversize equipment or other products. This segment is not a good candidate for diversion to intermodal. Some portion of this industry is unionized, particularly in the northern states, such as Pennsylvania, New Jersey and Ohio. Chemical Leaman, one of the largest specialized carriers based in Pennsylvania, has both long haul and short haul operations. The short haul operations fall clearly into this segment.

Owner operators are common in the agricultural exempt industry. The goods being carried is frequently refrigerated and the driver uses load brokers to arrange for loads in the growing regions. The operations are conducted like the truckload dry van segment. Drivers have no fixed domicile and travel wherever their services are needed. The industry is, for the most part non-union. There is a good potential for using intermodal to replace these trips on certain long haul traffic lanes.

The intermodal drayage segment of the trucking industry tends to use drivers which are domiciled near major intermodal terminals. Short haul drivers pick up loaded intermodal trailers or containers on chassis and deliver them to the surrounding countryside. They then are directed to move the empty trailer to a new shipper which loads it for return to the intermodal terminal. These drivers can be either union or non-union. Pennsylvania Truck Lines (PTL), the largest drayage operator in Pennsylvania, is a Teamster operation.

The last segment, Private Carriage, is also the largest and the most diverse. It tends to be tied closely to individual industries. Many products require specialized handling and knowledge. The movement of hazardous materials is typical. Where common carriers don't have the specialized equipment, or the knowledge required to be able to handle the shipment it may be handled by an in-house private carrier. Store delivery from regional warehouses account for a very large number of the private

fleets in operation. Grocery stores, such as Giant or Safeway, have particularly large delivery fleets. Companies like Frito-Lay also have large private fleets. Private fleets are not good candidates for diversion to intermodal. Their operations tend to be short haul, not long haul and the drivers tend to be domiciled at the central distribution point. Many of the drivers may be closely related to the wholesale distribution industry to be treated in the next section.

The individual segments of the industry in Pennsylvania have been examined individually and estimates made of the impacts on jobs segment by segment. The results are presented in the table below.

Estimated Impact of the Project on Jobs by Segment of the Industry

	Pickup and Delivery	City Terminals	Break Bulk Terminals	Line Haul	% Linehaul Subject to Diversion	Gain (Loss) in Jobs 1995	Gain (Loss) in Jobs 2000	% Union
ICC-Regulated Carriers								
Parcel Carriers	X	X	X	X	20	180	251	95
LTL Transcontinental	X	X	X	X	2	37	52	98
LTL Regional	X	X		X	0	118	165	70
TL Dry Van				X	70	-50	-70	3
TL Other				X	3	-4	-6	10
Other Carriers								
State-Regulated	X	X		X	0	0	0	10
Ag Exempt				X	5	-3	-4	2
Intermodal Drayage				X	0	337	674	20
Private Carriage	X	X	X	X	2	100	139	15
					Totals	715	1201	

It is clear from examining the table that there is a very positive net impact on employment in the trucking industry in Pennsylvania. This would appear to be contrary to common logic. However, it occurs

because the long haul trucking movements (estimated to be 152,000 movements in 1995, employing 1063 long haul drivers) which are diverted from long haul carriers to intermodal are replaced by short haul drayage operators (estimated to be 337 drivers) domiciled within the State. Less than 50 of the 1063 long haul drivers that are displaced are domiciled within Pennsylvania. Secondly, the stimulative effect on the economy that occurs as the consequence of the transportation and logistics savings associated with the project results in a larger number of jobs being shipped which boosts employment in the LTL and parcel segments of the industry.

Impact on the Wholesale Distribution Industry

According to the County Business Patterns there were already more than 19,231 wholesale distribution establishments in Pennsylvania in 1990, employing more than 263,149 employees. By contrast, New Jersey had slightly fewer establishments, 17,028, but employed more workers, 286,269. The largest county in terms of both establishments and employment is Allegheny County, near Pittsburgh in the western part of the Commonwealth. Montgomery County is the largest in the eastern part of the Commonwealth, with 2,239 establishments and 32,669 employees. Then comes Philadelphia County , with 2,068 establishments employing 36,212 workers and Bucks County, with 1,208 establishments and 15,864 employees. All of these counties are contiguous to Philadelphia. Another cluster of wholesale distribution facilities is centered around Harrisburg in Lebanon, Dauphin and Lancaster Counties.

Distributors face increasing pressures to be more efficient. Companies such as Walmart, Toys R Us, the Gap, Safeway, Whirlpool and a host of other "new wave" distributors of consumer products have organized themselves to purchase, assemble and distribute goods profitably. They have all learned how to reduce inventory tied up in their distribution system to an absolute minimum. Part of their secret is the use of mixing warehouses to stage the delivery of products to retail outlets. Another technique is to use the shelf space in each store as the only inventory and to combine this with frequent replenishment of only what is sold. Their strategy is to minimize inventory at every stage in the process without sacrificing service. They view it as increasing inventory "turns."

The incentive to reduce inventory is easily demonstrated with a simple equation which relates Return on Investment (ROI) to profit margin (MARGIN) and number of inventory turns per year (TURNS).

$$ROI = \frac{EARNINGS}{INVESTMENT} = \frac{EARNINGS}{REVENUE} \times \frac{REVENUE}{INVESTMENT}$$

$$ROI = MARGIN \times TURNS$$

The improvement in profitability achieved by increasing the number of turns on inventory can be demonstrated by examining a hypothetical situation in which the profit margins of a very competitive retail market, such as that found in consumer goods, where 2% is a high margin and 6 turns per year is typical. With 6 turns goods are resident in the distribution system for as long as 9 weeks in transit, wholesale storage, store delivery and display shelf storage within the store.

$$ROI = 2\% \times 6 = 12\%$$

By increasing the number of turns to 14 (goods are resident in the system for just short of 3 weeks). The impact is shown as:

$$ROI = 2\% \times 14 = 28\%$$

Clearly, increasing the number of turns is one of the ways that profitability can be improved.

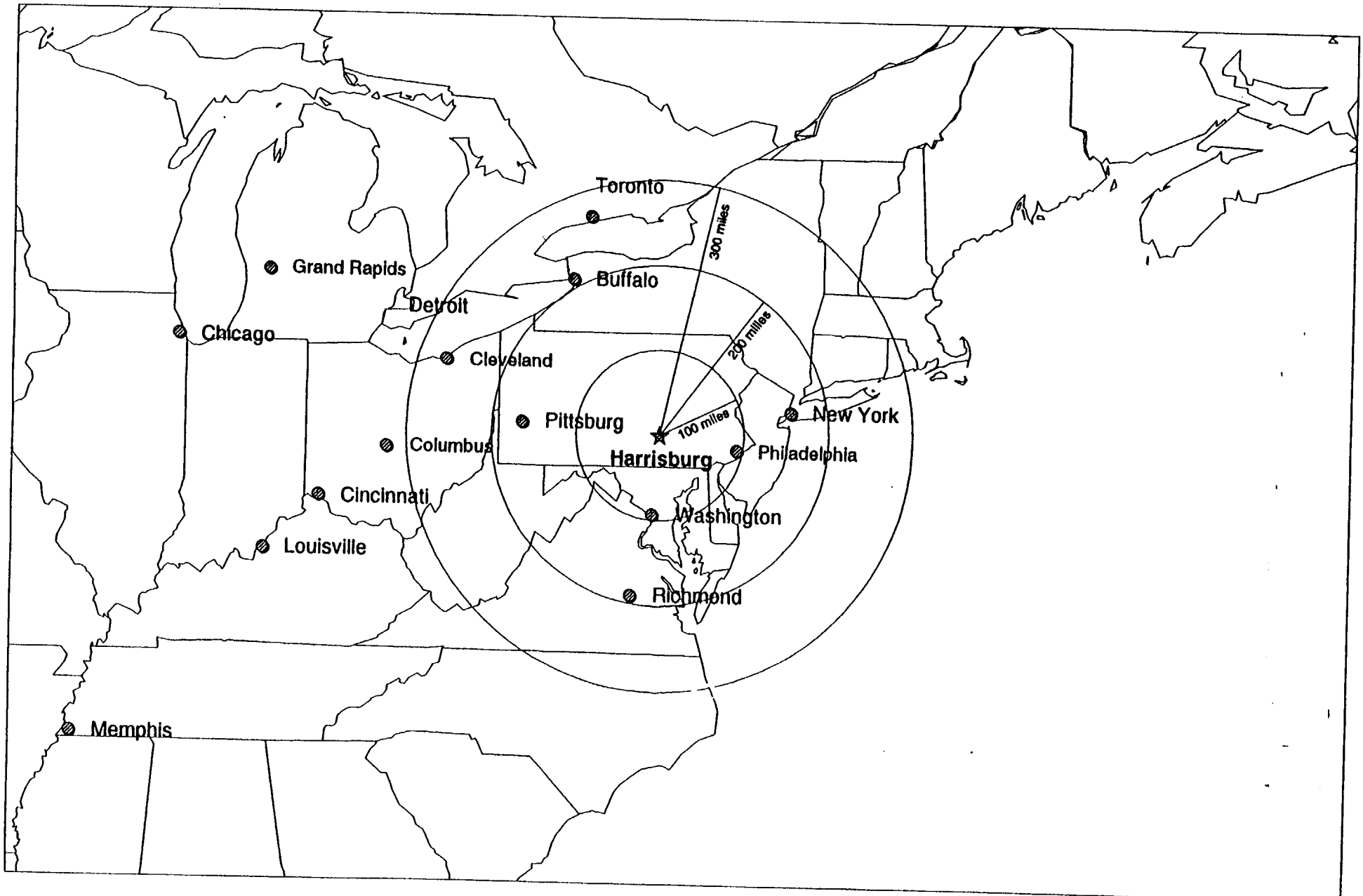
One way to reduce inventory in the system while maintaining an adequate safety stock buffer is to consolidate the inventory of several local warehouses into a single regional warehouse. Fluctuation in the demand of each of the outlying warehouses is smoothed by combining several "use" streams into a single larger stream, with fluctuations which are smaller, percentage-wise. The reduction in the amount of safety stock in the system as whole is $\frac{1}{\sqrt{n}}$, where n is the number of warehouses eliminated. Consequently, replacing 25 warehouses with one, reduces the amount of safety stock inventory to 20% of that required to protect the original 25 warehouses with safety stock held in each individually.

The key to making this strategy work is frequent, on-time transportation. Transport from the factory to the mixing warehouse must be Just-In-Time. If goods arrive early they will crowd the mixing warehouse and add to inventory carrying costs. Replenishment of stocks in the store must be both frequent and

timely if store buffer stocks are to be kept low. This means that store delivery by truck must be well organized and located close enough to be able to handle emergencies. For daily deliveries of fast moving inventories, this distance from regional distribution center to the stores it serves should probably be less than 50 miles. This appears to be the rule of thumb followed by food stores and other retail distributors of highly perishable products. For non-perishable goods moving more slowly the distance from the regional distribution center to the individual stores can be greater. The distance that can be reached in one day of driving with the return on the same driver shift is from 200 to 250 miles. This distance will allow drivers to be domiciled at the distribution center and will not require them to "overnight" on the road. This both lowers costs and facilitates the recruitment of high quality drivers.

Pennsylvania is particularly well-located as a distribution point for the Mid-Atlantic region. A population of 17 million people, for example, resides within 100 miles of Harrisburg. A 200-mile circle will serve 44 million people. See the map on the following page which shows the cities included within radii circles whose around Harrisburg are 100, 200 and 300 miles. The personal consumption expenditures of 44 million people are an astounding $515 billion. Food products alone account for $36.4 billion. There are 1,492 truckloads of food per day. For all personal consumption products delivered to this large a population 7,511 truckloads of products must be delivered per day. Pennsylvania is an ideal site for locating new, larger distribution centers. It has the central location, the road system, the vacant land and the skilled labor force required to function as a major attractor of the distribution facilities which will be upgraded to make them more competitive between now and the year 2000. The market characteristics of Pennsylvania as a potential location for these new centers are shown in the table below.

Estimating the number of wholesale distribution facilities that will be located in Pennsylvania over the next few years is difficult. We have assumed that the number of employees in the three midsize ranges of establishments as reported in the County Business Patterns will grow by 1.5% between now and the year 2000. This amounts to 2,500 new jobs by that date. Since this will require some time to


Toronto
Grand Rapids
Buffalo
Detroit
Chicago
Cleveland
Pittsburg
New York
Columbus
Harrisburg
Philadelphia
Cincinnati
Washington
Louisville
Richmond
Memphis
300 miles
200 miles
100 miles

Markets for Pennsylvania-Based Distribution Centers

Radius from Harrisburg:	100 mile	200 mile	300 miles
Population	17 mil	44 mil	66 mil
Personal Consumption	$205 bil	$515 bil	$685 bil
Food Products	$14.5 bil	$36.4 bil	$48.4 bil
Truckloads of Food/Day	595/day	1492/day	1983/day
Apparel	$4.8 bil	$12.2 bil	$16.2 bil
Truckloads of Apparel/Day	40/day	100/day	133/day
Paper products	$.9 bil	$2.2 bil	$3 bil
Truckloads of Paper Products	73/day	184/day	244/day
Motor Vehicles	$7.9 bil	$19.7 bil	$26.2 bil
Motor Vehicles by Truck	75	188	249
Truckloads All Products/day	2997/day	7511/day	9985/day

reorganize the operations, construct the facilities and to perform the move, we have estimated that 1995 will see only 500 new jobs in distribution but that by 2000 this figure will have grown to 2,500.

We conclude, therefore, that over the next few years many Mom and Pop stores scattered throughout the country will be replaced by more efficient, retail operations using more centralized wholesale distribution centers. Other operations will modernize and update their existing facilities, eliminating inefficient, small, local warehouses and replacing them with larger more efficient operations. Since Pennsylvania is more central than New Jersey, Delaware, Maryland and New York we anticipate that it will increasingly be selected as the site of preference. Whirlpool Corporation, for example, has just announced that it will open a major new facility in Carlisle, Pennsylvania to serve the entire eastern seaboard. The new centers will use modern inventory control procedures, with computer-directed stock picking, loading of trucks and routing of loads to the retail stores. Specialized transportation teams will perform the store delivery and in some cases the installation of equipment. Delivery will be Just-In-Time and frequent.

The result is a potential growth industry for the Commonwealth. These facilities will be new and will be staffed by office staff, warehousemen and truck drivers. They will take advantage of the existence of doublestack operations in their location to minimize the overall transportation. For the State, this will mean more jobs for distribution center personnel and particularly for truck drivers and drayage operations.

Summary of Major Conclusions

The most important findings are summarized below:

- The expenditure of almost $81 million on construction over the next three years will result in some 900 new construction jobs available in 1993. Around 2100 additional jobs in service and support industries will be required to support this additional growth in the economy of the Commonwealth. Construction will require about 3 years to complete.
- The construction of all three projects will result in $53 million of savings in transportation and logistics costs by Pennsylvania industry in 1995. This will rise to more than $114 million in the year 2000--a net present value of $382 million.
- By 1995, about 2,700 new jobs will be available in construction, manufacturing, transportation and distribution as a direct consequence of the transportation and logistics cost savings associated with the project, with an additional 6,400 jobs in secondary services.
- The continuing and growing transportation and logistics cost savings will lead to 6,600 new jobs in manufacturing, transportation and distribution by the year 2000, with 16,000 secondary service and support industry jobs.
- The projects will result in additional tax revenues to the Commonwealth of almost $50 million in net present value.
- The Port of Philadelphia will, for the first time since containerization, have the opportunity to be a full-scale participant in the movement of international marine containers in competition with other major ports on the Mid-Atlantic coast.
- The Commonwealth will participate in the rapidly growing longhaul domestic container markets--the most revolutionary development in surface freight transportation in the last 25 years. The implications for Pennsylvania-based manufacturing and distribution industries are profound.

- There will be the potential for establishing Pennsylvania as the center of a restructured wholesale distribution industry which eliminates excess inventory by consolidating operations into regional centers using modern, computer-directed, overnight distribution operations for "Just-In-Time" delivery. Although Pennsylvania already participates in this industry there could be dramatic growth, with implications for attracting jobs from surrounding states.

If the Commonwealth chooses not to invest in the new facilities a number of things could happen as a result.

1. There would likely be a decision by one or more of the railroads not to invest in the clearances required to compete in the doublestack container market because of an inadequate return on their investment.

2. This would reduce competition in the marketplace and lower the share of savings realized by Pennsylvania-based industries.

3. Some markets might receive no doublestack service. If, for example, CP dropped out, the Port of Philadelphia could not capture any of the Canadian market. If CSX failed to participate, the southern markets could not be reached with service from Philadelphia.

4. Each railroad serves a distinct set of markets as well as common markets. All are needed if competitive service is to be available to Pennsylvania as a whole.

High-Profile Rail Clearances in the State of Pennsylvania

Report 5

Task 8.0 Conclusions and Recommendation

Prepared for: Pennsylvania Department of Transportation
Prepared by: Transmode Consultants, Inc. and Apogee Research

October 1992

Outline

I. Policy Background

II. Critical Policy Dimensions

II.1 Financial Dimensions

II.2 Operational Dimensions

II.3 Administrative Dimensions

III. Recommendations

Policy Objectives

The objectives underlying Commonwealth sponsorship of rail clearance projects should also guide rail clearance policy formulation and implementation. These objectives include the following:

- **Provide high productivity, low cost transportation to manufacturers and distributors who operate from a Pennsylvania platform.** A more fundamental objective follows from this operational objective and that is to expand the markets and to extend the competitive market reach of Pennsylvania-based "export" manufacturers.

- **Develop high productivity rail services which serve multiple interregional markets and develop multiple high productivity service lanes with Pennsylvania at the hub of a comprehensive containerized freight service network.** This objective relates to both domestic and international container service networks which should include "full compass" geographic market access for Pennsylvania shippers, including midwestern, southwestern, Canadian, southeastern and western (via the Midwest) market access.

- **Encourage transportation service "risk taking" and the serial launch of innovative intermodal services from terminal bases in Pennsylvania.** This objective can best be achieved by maintaining a "high tension" competitive balance among the several rail carriers who serve the Commonwealth and, in this way, allow changing shipper needs and unexpected market shifts to dictate service design parameters through competitive pressures.

Policy Objectives (continued)

- **Encourage the diversion of "overhead" motor carrier traffic from Pennsylvania highways to Pennsylvania railways.** Intermodal transportation growth will result in a shift of responsibility for infrastructure maintenance and repair and for capital replacement from the public to the private sector. Effecting this traffic shift for users of Pennsylvania's highway system who do not originate or terminate products within the State and hence do not generate State economic benefits is a fourth program objective.

- **Provide the impetus for relocating modern, computerized, central distribution and warehousing services to wholesale distribution and integrated retail firms operating throughout the region.** Provide the infrastructure needed to attract these firms to use Pennsylvania as their distribution base to serve the very large consumer market located within 200 miles.

"Going-in" Rail Positions

As we discussed and analyzed in previous phases of this study, the market orientation of the three major rail carriers who are principally interested in completing clearance work with State assistance is quite different. Conrail's "high-profile" intermodal service strategy relies heavily on "cutting edge" domestic container technology and on innovative sales distribution techniques, which involve advanced truckload carriers like J.B. Hunt. CP Rail, on the other hand, has a strong international container orientation. CP Rail has an interest in developing new mini-land bridge services, as well as in diverting container steamship lines that currently call on ports from the Canadian Maritimes to the Port of Philadelphia. CSX is more circumspect about its intermodal market and service development plans. However, regardless of the initial point of departure and "going in" market focus of specific rail carriers, the unambiguous lesson of recent intermodal market development is that competitive emulation quickly follows successful new service launches. In competitive intermodal markets, the market itself ultimately determines what form successful intermodal services take. In this regard, southeastern Pennsylvania offers unique advantages over other major eastern metro markets. Southeastern Pennsylvania anchors the services of three directly competitive intermodal carriers. As a result, competitive pressures should make southeastern Pennsylvania extremely "market sensitive."

One corollary of this circumstance is that it is unnecessary for the Commonwealth to attempt to define the intermodal service parameters as part of its investment program. However, it is incumbent on the Commonwealth, to make sure that all rail participants have an equal opportunity to offer high-profile services, to earn Commonwealth financial support, and to compete for new intermodal traffic and new customers. To that end, two principles should guide the Commonwealth's on-going involvement in this project:

"Going-in" Rail Positions (continued)

1. **Competitive equity should be maintained among all participating rail carriers.** Competitive equity includes a comparable basis for cost sharing among carriers and a comparable schedule for project competition, and ultimately a similar schedule for new service kickoffs. Initially, it entails an open dialogue between each carrier and the Commonwealth, in which each has an opportunity to influence and shape the clearance program which the Commonwealth ultimately underwrites.

2. **Latent shipper demand for intermodal services can and should be progressively developed.** Ultimately, shipper demand will determine service design parameters which can and will set the prices paid for new high-profile intermodal services. "Activated" demand, in a three-supplier market, will eventually drive prices down to the variable cost level and will pull a large share of economic rents into the shipper sector as the result of this project. An appropriate role exists for the Commonwealth in "activating" Pennsylvania shippers and in involving them in the process of developing "shipper responsive" intermodal services. "Activation" may be achieved through Commonwealth intervention, through progress reports to the Pennsylvania shipper community on program progress, through a dialogue between carriers and shippers regarding new service designs and "quality service delivery" and possibly through the organization of a shipper-based buying cooperative. User involvement is the best assurance that Pennsylvania-based manufacturers and distributors will fully benefit from the Commonwealth's investment in clearance improvements.

Policy Background

The policy which Conrail articulated in its first proposal to Governor Casey focused subsequent policy dialogue among the several affected rail carriers. Indeed, the Conrail policy framework has served as a centerpiece for all subsequent policy discussions among the three affected rail carriers. As manifested in a recent round table discussion, all three carriers appear to agree on the following points:

- **Agreement on Cost Sharing.** A cost sharing arrangement comparable to Conrail's 30/70 split, with the Commonwealth absorbing 100% of costs over "common use" lines, appears to be acceptable to all three carriers. All three carriers appear to endorse the principle of equal opportunity to participate in the Commonwealth program.

- **PennDOT Overview.** All three carriers have a strong preference that any cost sharing and joint improvement program be administered and managed by PennDOT, as compared with other Commonwealth agencies.

- **Skeletal Legislation.** All three carriers appear to be prepared to endorse "skeletal" legislation which would empower PennDOT to complete more detailed multi-lateral negotiations, including cost sharing arrangements, program administration and shipper/community involvement arrangements with the carriers and to codify these agreements in an operative, "Memorandum of Understanding."

- **Matching Investments.** All three carriers appear to be prepared to commit "matching" funds, not only to complete Commonwealth clearance projects, but also to complete complementary clearance projects, beyond Pennsylvania's borders. These later projects will guarantee high-profile movement for Pennsylvania cargoes beyond Commonwealth borders to key intermodal gateways. They appear to be ready to accomplish all of this within 3 to 4 years.

Carrier Policy Differences

The three carriers appear to agree on the points noted above. However, disagreement on other key points still persists. Key points of differences include the following:

- **Different Costing Conventions**. All three carriers have established different costing and "bill out" conventions for the purpose of performing construction work for "third parties," including local and Commonwealth government. To the extent that cost sharing "equities" are to be preserved among the three parties, comparable costing and "bill out" conventions need to be established for this specific project.

- **Inter-carrier Billing**. A unique set of cross billing complications involves the relationship between Conrail and CP Rail. CP Rail operates on Conrail trackage over a portion of its target high-profile route. Under an existing trackage rights agreement between the carriers, Conrail would perform engineering work for CP Rail on this route and financial responsibility for the work would be shared between the Commonwealth and CP Rail. Importantly, the "bill-out" rate for this work will depend on the costing conventions which the respective parties adopt. Conrail has indicated that the issue of cross billing cost conventions is open for negotiation.

- **Specific Routes to be Cleared.** CP Rail currently operates, at Conrail's convenience, on trackage through Reading over which CP does not currently have trackage rights. Conrail appears unwilling to clear this "everyday operating route," preferring instead to clear a more costly and more circuitous route. The issue of which route through Reading is to be cleared requires explicit agreement among the parties before CP Rail project cost estimates can be finalized. This agreement now appears to have been secured.

Carrier Policy Differences (continued)

- **Third Party Contract vs. Rail Work**. In general, third party contract construction work is less expensive and easier to manage than direct rail work. CP Rail has a strong preference for completing clearance improvement work over Conrail trackage directly through a construction contractor rather than relying on Conrail track gangs and/or Conrail contract supervision. Conrail is constrained in part by its existing labor agreements and may be unwilling to concede to CP Rail's requests.

- **Role of PennDOT**. CP Rail would like to see PennDOT play an ongoing mediating and contract enforcing role throughout the project. Conrail would like to see PennDOT play a less active role, principally that of banker and contract monitor.

Carrier Policy Differences (continued)

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Financial Dimension

The most critical dimension affecting project success is the underlying financial arrangement. Any financial arrangements must be mutually agreed among all parties; it must be transparent and equitable to the participants. Carriers are unlikely to make specific commitments to launch new train services. However, the Commonwealth can expect two types of commitments from rail carriers in return for Commonwealth financial support: 1) general agreement on the kinds of services offered via specific Pennsylvania terminals, and their service role as part of a larger regional service network, 2) agreement to complement Commonwealth-subsidized investment within Pennsylvania, with investment beyond the Commonwealth's borders on critical connecting routes. The following additional financial features may be included in a Memorandum of Understanding negotiated between the Commonwealth and the individual carriers:

- The Commonwealth's share of total project cost should be based on a percentage of total cost or a pre-determined fixed cap, whichever is smaller at project completion.
- Timing of the project should be established. A 3 to 4 year time frame is realistic. Benchmarks for completion of clearance work should include both in-state and out-of-state completion targets.
- Payments should be made over the term of the agreement based on the percentage of the total project completed to date, subject to specific benchmarks being achieved. The table on the following page estimates cash flow and annual budget requirements for the entire project.
- A residual 10% of the Commonwealth's financial share should be reserved until completion of the project.
- Carriers should be required to document and prove the cost of completed construction work subject to State audit.

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Complementary Network Improvements Beyond Pennsylvania Borders
Millions

	Description of Network Extension	Estimated Incremental Cost	Status	Expected Carrier Commitments
Conrail Project **Rick Cartwell** **215-596-2927**	Clearance Work in Ohio	$4.0	Design & Estimation	In Conjunction with Pennsylvania Project
CP Project **Carl Belke** **518-383-7278**	0			
CSX Project **William Higgins** **904-359-7682**	Maryland Clearance Howard Street Tunnel Estimate being made by Third Party Increase Track Capacity in Maryland & Delaware	$7.267 $25-30 $4.5	Design & Estimation	Intermodal Justification in Capital Improvement Budget

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Operational Dimension

An important but less critical set of considerations affects rail operations. Little benefit will result from direct PennDOT involvement in rail engineering, construction design and/or train scheduling. However, significant benefits can result from efforts to "activate" Pennsylvania shippers and to involve transportation intensive manufacturers and distributors in service design and service quality management. The following actions may be taken by the Commonwealth and codified in a Memorandum of Understanding negotiated between the Commonwealth and individual carriers:

- **The PUC Approval Process Adds Significant Delay and Cost to the Entire Program.** The Commonwealth may be able to streamline and simplify the PUC approval process. One suggestion: consolidating more than one hundred separate regional hearings into a single program hearing is desirable for streamlining the initiative.

- **Clearance Route Rationalization Makes Both Operating and Economic Sense.** Efforts should be made to influence the rationalization of rail lines which are being cleared with Commonwealth monies. Two cases in point include dual access to South Philadelphia and dual routes through Reading. Every effort should be made to avoid redundant improvements and costly "parallel" clearance work. There are some cases in which the redundancy is important to preserve service levels.

Operational Dimension (continued)

- **Early Shipper Involvement Will Assure Marketable Services.** Efforts should also be made to involve potential users of high-profile intermodal services early in the process of designing new services. The Commonwealth may consider the establishment of a user "quality service review panel" to track and monitor roadway, terminal and service design work. This panel would assure that Commonwealth-sponsored improvements ultimately translate into high quality service solutions to shipper logistics problems. Linkage between the shipper community and an individual rail carriers who are developing new high-profile intermodal services might be provided through one of several existing shipper associations, including the Pennsylvania NIT League, the Traffic Club of Philadelphia or the Traffic Club of Pittsburgh.

Administrative Dimension

As we noted above this project will proceed in a dynamic and competitive environment. As that environment shifts, an appropriate role exists for the Commonwealth to act as a mediator of conflicting interests and as a project administrator. In this context, administrative flexibility as well as objective hearings and even-handed administration will prove important in achieving the objectives noted above. The following administrative features may be included in a Memorandum of Understanding negotiated between the Commonwealth and individual rail carriers:

- **Open Season.** All carriers whose lines qualify under this study should have an equal window of opportunity to participate in the program. Carrier participation should be formalized by the signing of a Memorandum of Understanding between the State and carriers who offer qualified service within some predefined window of opportunity. The Memorandum of Understanding should obligate the committed carrier to complete specific improvement work within a four-year time frame.

- **Contractual Relationship.** A contractual relationship between the Commonwealth and each of the individual carriers should be structured so that the Commonwealth purchases construction services from the carrier and releases funds for property improvements under the contract as specific milestones are accomplished.

- **Rail Agreements to Perform.** Additional mutually agreed objectives should be set out in the Memorandum of Understanding and should include the following:

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Corridor Evaluation

In Phase 1 of this study we established initial screening criteria for evaluating candidate corridors. In this final phase we revisit and refine our initial assessment. The chart on the following page attempts to systematically evaluate each of three alternative corridors. The cells in the matrix are scored on a scale of 0 to 10, with 0 representing the least favorable outcome and 10 representing the most favorable outcome. Intermediate options are scored within these ranges. Also, since not all risk factors are equally important, we ranked individual evaluation factors on a scale of 1(least important) to 6(most important). The scores under each criterion were weighted by the significance of each criterion to arrive at a weighted total score.

Each of the key risk factors which we used are discussed below:

- **Pennsylvania Economic Development Benefits.** Scale of importance is 6. In Phase 5 of this study, we evaluated the benefit/cost ratio for each of the three corridors. All three appear to generate attractive net social benefits. In this evaluation we have ranked individual corridors based on their ratio of benefit cost. Under this criterion scores range from 9 for Option 1 to 6 for Option 3.

- **Rail Commitment**. Scale of importance is 5. Without a firm commitment from participating rail carriers neither matching funds nor subsequent service development efforts are likely to be successfully completed. Under this criterion, we determined the "committedness" of specific carriers to corridor clearance in Pennsylvania. Under this criteria, scores range from 9 for Conrail and CP Rail to 5 for CSX.

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Assessment of Corridor Alternatives
Based on Multiple Criteria

Importance	3	2	1	4	5	6	
Corridor Options	**Collateral Network Benefits**	**Increased Competitive-ness**	**Linkage with Other State Infra-structure Projects**	**Cost of Improve-ments**	**Rail Commit-ment**	**Local Economic Develop-ment Benefits**	**Overall Score**
Option 1: CR Main Line	8	5	10	7	9	9	171
Option 2: CSX	8	8	5	9	5	7	148
Option 3: CP Rail	8	10	7	8	9	6	159

Findings and Recommendations

The project team recommends that the Commonwealth fully leverage its funding commitment to achieving high-profile rail service by supporting all three corridors which are candidates for improvement. The benefits associated with corridor clearance improvement will multiply with the number of corridors which are actually cleared. This "multiplication" effect results from the following:

- Increased competition among carriers will assure that the individual rail carriers will share the "consumer surplus" which will be realized once high productivity services are implemented in the form of lower prices.

- Increased competition among carriers will assure intensive service innovation and continuous experimentation. Future benefits should result.

- Multi-corridor improvement will offer a broader geographic market access to Pennsylvania-based shippers.

- Multi-corridor improvement will also assure multiple train service schedules and more frequent train departures/arrivals in completing corridors.

In addition, we recommend that the corridor improvement project serve as a cornerstone for a broader and more encompassing Commonwealth intermodal strategy. This strategy would be designed to create competitive advantage for Pennsylvania-based shippers/receivers through a progressively developed service network centered in the State.