Transportation and the Potential for Intermodal Efficiency-Enhancements in Western West Virginia

FINAL PHASE II REPORT

Prepared on Behalf of
The Appalachian Regional Commission,
The West Virginia Department of Transportation, and
West Virginia Planning and Regional Development
Council, Regions II, III, and IV

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Note:

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EXECUTIVE SUMMARY

In November of 1999, the Center for Business and Economic Research and Appalachian Transportation Institute began a comprehensive examination of a 13 county region of West Virginia with the aim of identifying ways to improve the efficiency of transportation to, from, and within this region.[1] Phase I identified commodity and passenger flows and catalogued the infrastructure that supports these flows. Phase II of the analysis, which is summarized in the current document, has been aimed at analyzing transport costs and exploring remedies to transportation disadvantages. Phase II findings are summarized in Table E.1.

Generally, the region features adequate to good transportation facilities. Shippers and motor carriers contacted through the study process lauded the advances made to the region's highway system, and existing deficits in that system are already being addressed. Likewise, the study region's line-haul railroad infrastructure is of a quality and configuration capable of sustaining significant traffic growth. Finally, commercial navigation on the Ohio and Kanawha Rivers is available at costs that provide the region with a genuine transportation advantage. The one possible exception to this general conclusion is in the case of air transport, where observed airfares were significantly higher than fares available elsewhere. However, this outcome is probably only partially attributable to the scope and efficiency of regional airport facilities.

Most of the problems or challenges identified within the study have two sources. First, low traffic volumes for all but the movement of coal tend to handicap regional shippers, almost without regard to modal choice. Users of motor carriage often face equipment shortages that can only be remedied by paying premiums. However, these premiums make it difficult to compete with other nearby regions where equipment and opportunities for backhauls are more plentiful. Low-volume rail users find it difficult to secure the same quality of service that is available to higher-volume shippers or shippers who operate in more densely populated commercial areas. In addition, those shippers who might wish to use commercial airfreight services are thwarted by historically low demands and infrastructure constraints that drastically limit the scope of locally available services.

The second challenge is the rugged terrain that characterizes many of the study region counties. In at least half of the counties, this terrain affects highway grades and alignments. This adds measurably to motor carrier operating costs and the cost of building and maintaining roadways. The same rugged terrain necessitates a number of railroad tunnels along mainline routes. These tunnels, in turn, impose clearance restrictions that make the use of the

[1] The study region includes Boone, Cabell, Clay, Jackson, Kanawha, Lincoln, Logan, Mason, Mingo, Putnam, Roane, Wayne, and Wood Counties.

Table E.1
Summary of Phase II Findings

CONCERN	DESCRIPTION	PROPOSED TREATMENT
Highway Funding	Current estimates suggest that funding desired improvements in the study region's highway system and maintaining existing infrastructure may require more funding than appears to be available.	The further development and strict adherence to a Statewide set of highway funding priorities.
Highway Design	To the extent possible, new highway designs should promote intermodal transport.	New highway designs should include clearances that will not constrain the growth of other transport modes. Moreover, to the extent possible, highway route selections should encourage connections with other modes.
Motor Carrier Equipment Shortages	The relatively small volume of loaded inbound truck movements leads to chronic equipment shortages and increased shipper costs.	The development of an Intermodal Advisory Board (IAB) which, among other functions, will develop informational and cooperative agreements through which additional backhauls are identified and idle equipment is made available
National Motor Carrier Issues	National policy issues that link motor carrier safety, trucking costs, and highway funding are affecting West Virginia.	No immediately available recommendations.
Restrictive Railroad Infrastructure	Current railroad clearances preclude the use of double-stack intermodal equipment and modern tri-level auto carriers within the study region.	A comprehensive engineering and economic study aimed at determining the magnitude of local, State, and national benefits that would be attributable to clearance mitigation projects in West Virginia.
Railroad Service Declines for Small Shippers	Low-volume study region rail shippers complained that transit times, the variability of transit times, and the probability of freight loss and damage have all suffered in recent years.	The IAB (described above) would provide a collective forum through which affected shippers and rail carriers could discuss and resolve service quality issues outside of any formal regulatory environment.
The Effects of Future Railroad Mergers	Further railroad industry consolidation is almost certain. The specific course taken by this consolidation has the potential to measurably affect railroad transportation opportunities within the study region.	State transportation officials should analyze potential remaining railroad mergers, identifying benefits and disadvantages associated with each scenario. The appropriate State department(s) should then be prepared to represent these views in future regulatory / legal proceedings.

Table E.1 (cont.)

CONCERN	DESCRIPTION	PROPOSED TREATMENT
Utilizing Navigation Capacity	Relatively favorable commercial navigation costs are a regional advantage. However, traditional sources of waterway traffic are dwindling, so that new sources of traffic are needed.	State officials should prepare to respond to newly undertaken marketing efforts by encouraging the maintenance of existing dock facilities and assisting in the modification of such facilities should changes be a necessary response to emerging river traffic.
Air Freight Capacity	Currently, there is little demand for airfreight services. There is also very limited (and limiting) airfreight capacity. Without aggressive intervention, the status quo is likely to exist indefinitely.	A new regional airport facility is necessary, but not sufficient to guarantee improvements in the availability of higher-quality airfreight services. If plans for the regional airport move forward, State officials must act aggressively in the search for a stimulus to airfreight capacity.
Rail / Truck Intermodal Facilities	Currently, clearance restrictions make locating rail / truck transload facilities in the study region impossible. Even, however, if these restrictions are treated, local facilities (and the demand necessary to sustain them) are absent.	Any study designed to assess the costs and benefits of mitigating clearance restrictions should also determine whether existing (or future) intermodal traffic could be efficiently diverted to a study region transload facility. Planners may also wish to encourage intermediate steps such as the development of local container loading and unloading facilities.
Air Passenger Facilities and Fares	Current plans to develop a new regional airport facility assume an increase in passenger base that is unlikely under current fare structures.	A regional airport is probably necessary for the improvement of regional air service, but it must be accompanied by aggressive efforts to lower study region fares.
Highway Needs and Pass-Through Truck Traffic	Approximately 92% of West Virginia's truck traffic is comprised of vehicles that neither originate nor terminate in the State. This high volume of pass-through traffic can complicate the planning process.	State planners should begin to associate West Virginia truck volumes with the broader regional and national economic forces that determine the magnitude of this traffic.
Highway Needs for Passenger Vehicles	The gradual decline in heavy industrial employment is likely to diminish average daily commutes. At the same time, the desire for growth in tourism is likely to increase the demand for better highway connections to the eastern seaboard.	Within the priority-setting process, State policy makers should give particular attention to the ways in which increased tourism may affect the demand for highway access to the study region.

most efficient intermodal equipment impossible. Finally, the rugged terrain is directly responsible for the lack of developable land surrounding study region airports. This lack of developable property makes the incremental expansions necessary to accommodate improved passenger and freight air service impossible.

The current study is somewhat unique for two reasons. First, commodity flows are directly linked to the economic circumstances that help motivate them. Second, virtually all transport modes and modal combinations were included. The simultaneous look at all regional transportation provides a unique and enlightening view of the inter-relationship between modal opportunities and challenges. Indeed, to the extent that there are observable regional handicaps, they lie in the inability to efficiently combine modal options in the search for the most efficient transportation choices. Over the coming decades regional prosperity may well hinge on improvements in the ability to combine rail, truck, and water transportation or to effectively and seamlessly blend air freight with motor carriage. The current study would certainly seem to point to such an outcome.

1. INTRODUCTION

In the fall of 1999, the Appalachian Regional Commission, West Virginia's Department of Transportation and three of the State's Regional Planning and Development Districts initiated a multi-modal transportation planning study within a 13 county region. This study, conducted by the Appalachian Transportation Institute and the Center for Business and Economic Research at Marshall University, has consisted of two phases. The first study phase consisted of measuring regional commodity and passenger flows, as well as characterizing the transportation infrastructures that accommodate these flows. Phase II of the year long study has involved an assessment of mode-specific transportation costs to, from, and within the study region, with the aim of identifying ways through which these costs might be reduced. In addition to providing regional planners with necessary information, the study has also been designed to serve as a template for subsequent studies within the State and throughout the Appalachian region.

1.1 SUMMARY OF PHASE I FINDINGS

The 13 county study region, located principally in western West Virginia, is pictured in Figure 1.1. Commodity and passenger flows to, from, and within the region are summarized in Tables 1.1 and 1.2.

Figure 1.1
Transportation Study Region

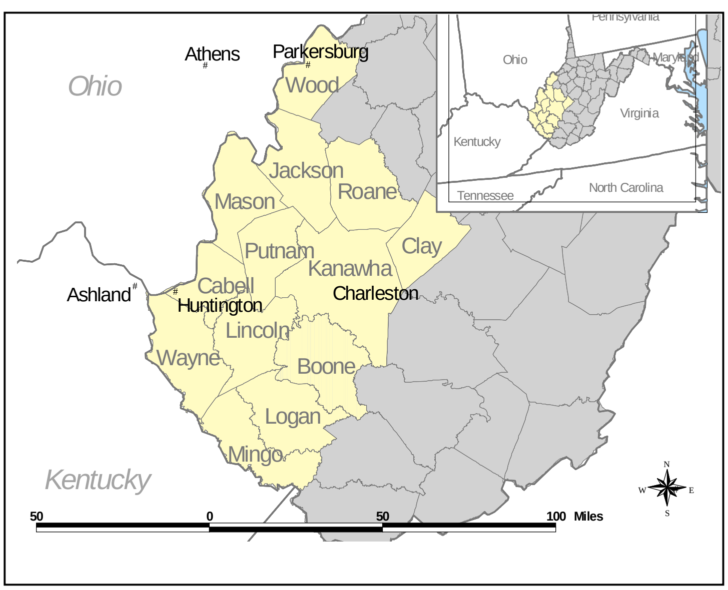

Table 1.1
Summary of Commodity Flows

ORIGINATING TONS (x 1,000)

Mode	Coal	Chemical	Other	Total
Truck (excludes coal)	----	8,871	49,128	57,999
Rail	73,047	1,388	308	74,744
Barge	39,829	53	7,196	47,078
Truck / Rail Intermodal	**D**	**D**	**D**	400
Truck / Barge Intermodal	12,800	----	----	12,800
Pipeline / Barge Intermodal	**D**	**D**	**D**	**D**

TERMINATING TONS (x 1,000)

Mode	Coal	Chemical	Other	Total
Truck (excludes coal)	----	80	18,796	18,876
Rail	24,855	1,620	1,156	27,631
Barge	1,147	699	6,440	8,286
Truck / Rail Intermodal	----	----	----	----
Truck / Barge Intermodal	----	----	----	----
Pipeline / Barge Intermodal	----	----	----	----

Notes: **D** indicates that data were withheld to prevent disclosure of confidential information.
Missing values do not necessarily denote a value of zero.
Motor carrier values do not reflect annual coal movements of approximately 12M tons.
Rail and barge values reflect 1998 traffic levels. Motor carrier and intermodal values reflect 1997 traffic.

Data were drawn from a number of different sources. See Transportation and the Potential for Intermodal Efficiency Enhancements in Western West Virginia: Phase I, Center for Business and Economic Research, Marshall University, June 2000.

Table 1.2
Summary of Commercial Passenger Traffic

	Charleston	Huntington	Parkersburg
Number of Airlines	6	2	1
Number of Daily Flights	45	13	12
Available Destinations	11	2	2
Annual Enplanements	270,000	61,000	57,000
Total FY 1999 Arriving / Departing Amtrak Passengers	9,000	8,000	None

There are a number of salient observations that flow directly from these data and the more disaggregated commodity and passenger flow data provided in the Phase I final report. Some of these observations include:

- A general imbalance in commodity flows, with originating traffic outpacing terminating traffic at ratios that vary from 3:1 for truck and rail to nearly 6:1 for barge.
- A tremendous relative volume (93%) of pass-through motor carrier traffic.
- The dominance of coal as a source of originating rail and barge traffic.
- The dominance of Cabell, Kanawha, and Wood Counties as a source of originating motor carrier traffic and a general paucity of motor carrier traffic to and from the southern-most study region counties.
- Relatively short rail and barge shipment distances.

Phase I also catalogued and generally evaluated the capacity of the transportation infrastructures that are used to provide these transportation services. These include over 1,600 miles of Expressway, Trunkline, and Feeder roads, approximately 600 miles of mainline railroad, roughly 200 miles of navigable waterway and 5 navigation locks, three commercial airports, and literally thousands of miles of natural gas and petroleum pipelines.[2] Again, a number of relevant observations emerged from these tasks. These include, but are not limited to:

- The conclusion that the study-region's system of Expressways and Trunkline highways can efficiently accommodate the line-haul movement of current pass-through and local motor carrier traffic.
- The observation that current railroad trackage within the study region features both the quality and configuration to accommodate additional rail traffic without generating significant congestion.
- The existence of tunnel and bridge clearance restrictions that preclude the use of certain railroad equipment, including both double-stack container cars and tri-level automobile carriers.
- The existence of copious line-haul navigation capacity and a number of unused privately owned dock facilities.

[2] Rail, barge and air transport infrastructure capacity utilization was evaluated within the Phase I report. Highway capacity utilization is provided in Appendix A of the current document.

1.2 PHASE II GOALS AND METHODOLOGY

While the first study phase was designed to identify commodity flows and catalogue infrastructures, the second study phase is designed to identify those factors that may advantage or disadvantage regional transportation users and providers, as well as suggest potential methods for mitigating existing disadvantages and building on observed advantages to improve overall efficiencies.

At the heart of the Phase II work is an extensive analysis of the rate structures currently in evidence. This analysis helps to identify the disadvantages alluded to above and, in many instances, it also provides clues regarding the means through which improved rates might be attained. However, the rate analysis is only one of a complement of tools used within the Phase II study. Additionally, considerable information was gleaned from the shipper surveys described in the Phase I report, from transportation provider interviews, from the experiences of other states within the overall mid-Atlantic region, and from the guidance offered by the regional, State, and federal planners who both oversaw and contributed to the current analysis.

2. MOTOR CARRIAGE

Motor carriage is the study region's most readily observable mode of commodity transport. Even those counties that feature very little commercial activity receive consumer goods by truck. There is, however, a great deal of variation in both the volume and nature of truck traffic within the study region counties. Thus, trucking costs and the potential for increased efficiencies also vary considerably from one county to another.

2.1 MOTOR CARRIER COSTS, RATES, AND SERVICES

The diversity of terrain, Interstate access, and commercial settings exhibited within the study area produces observable variations in motor carrier rates. At the same time, common characteristics negatively influence all truck rates to, from, and within the study region. Moreover, the many national issues that are affecting motor carrier costs throughout the US also obviously affect study region trucking costs.

2.1.1 Introduction to Regional Motor Carrier Rates

Table 2.1 provides sample motor carrier rates for a number of hypothetical movements. These movements include four study region destinations – Charleston, Huntington, Logan, and Madison and three out-of-region origins – Covington, KY, Louisville, KY, and Nashville, TN. The indicated rates also cover four representative commodities – foodstuffs, autoparts, iron, and steel bars, and hand tools. The rate matrix that summarizes the various trucking charges for these hypothetical movements also includes specific values for four different shipment sizes – three less than truckload (LTL) shipments (500 lbs., 1,000 lbs., and 5,000 lbs.), and a truckload rate.[3]

2.1.2 The Rate Influence of Regional Terrain

The southern and eastern portions of the study region are characterized by extremely rugged terrain that affects both the alignments and grades of roadways. This is particularly true on two-lane roadway segments, where these more severe grades and alignments translate into slower transit times and greater fuel consumption – outcomes that measurably increase trucking costs. Both private and common carriers suggested during the interview process that traversing the more mountainous areas of the study region added 18% - 20% to the costs incurred during that portion of the routing. Thus, a truck movement from

[3] As with nearly every transportation scenario, per pound rates fall as the overall shipment size increases. Thus, as expected, the lowest per pound charges in Table 2.1 apply to truckload shipments. It should be noted, however, that the underlying truckload cost structure varies considerably from the cost structure associated with LTL movements.

Table 2.1
Sample Motor Carrier Rate Matrix
(Cents per Hundred-Weight)

ORIGIN – COVINGTON, KENTUCKY

Destination/Commodity	Mileage Basis	Less Than Truck Load			Truckload
		500 lbs.	1,000 lbs.	5,000 lbs.	40,000 lbs.
CHARLESTON, WV	225				
Foodstuffs		2998	2249	1382	197
Auto Parts		2107	1581	962	197
Iron & Steel Bars		1883	1313	799	197
Hand Tools		1997	1498	911	197
HUNTINGTON WV	204				
Foodstuffs		2998	2249	1382	179
Auto Parts		2107	1581	962	179
Iron & Steel Bars		1883	1313	799	179
Hand Tools		1997	1498	911	179
LOGAN WV	257				
Foodstuffs		3412	2558	1572	235
Auto Parts		2398	1798	1094	235
Iron & Steel Bars		1991	1493	908	235
Hand Tools		2271	1703	1036	235
MADISON WV	284				
Foodstuffs		3463	2597	1596	254
Auto Parts		2434	1825	1110	254
Iron & Steel Bars		2021	1516	922	254
Hand Tools		2306	1729	1052	254

Continued on next page.

Table 2.1 (Continued)
Sample Motor Carrier Rate Matrix
(Cents per Hundred-Weight)

ORIGIN – LOUISVILLE, KENTUCKY

Destination/Commodity	Mileage Basis	Less Than Truck Load			Truckload
		500 lbs.	1,000 lbs.	5,000 lbs.	40,000 lbs.
CHARLESTON, WV	273				
Foodstuffs		3261	2445	1503	239
Auto Parts		2292	1719	1046	239
Iron & Steel Bars		1903	1427	868	239
Hand Tools		2171	1628	990	239
HUNTINGTON WV	216				
Foodstuffs		2998	2249	1382	189
Auto Parts		2107	1581	962	189
Iron & Steel Bars		1883	1313	799	189
Hand Tools		1997	1498	911	189
LOGAN WV	269				
Foodstuffs		3413	2559	1573	246
Auto Parts		2399	1799	1095	246
Iron & Steel Bars		1991	1493	908	246
Hand Tools		2272	1704	1036	246
MADISON WV	295				
Foodstuffs		3463	2597	1596	264
Auto Parts		2434	1826	1110	264
Iron & Steel Bars		2021	1516	923	264
Hand Tools		2306	1730	1052	264

Continued on next page.

Table 2.1 (Continued)
Sample Motor Carrier Rate Matrix
(Cents per Hundred-Weight)

ORIGIN – NASHVILLE, TENNESSEE

Destination/Commodity	Mileage Basis	Less Than Truck Load			Truckload
		500 lbs.	1,000 lbs.	5,000 lbs.	40,000 lbs.
CHARLESTON, WV	450				
Foodstuffs		4038	3160	2038	366
Auto Parts		2839	2221	1419	366
Iron & Steel Bars		2357	1844	1177	366
Hand Tools		2687	2104	1344	366
HUNTINGTON WV	393				
Foodstuffs		3914	2935	1804	319
Auto Parts		2751	2064	1256	319
Iron & Steel Bars		2284	1713	1043	319
Hand Tools		2606	1955	1189	319
LOGAN WV	446				
Foodstuffs		4420	3459	2231	396
Auto Parts		3107	2431	1553	396
Iron & Steel Bars		2580	2018	1288	396
Hand Tools		2941	2303	1471	396
MADISON WV	472				
Foodstuffs		4163	3258	2102	390
Auto Parts		2927	2291	1463	390
Iron & Steel Bars		2431	1902	1214	390
Hand Tools		2927	2170	1386	390

Notes: **Based on Southern Motor Carriers 585-L, Table D, plus a 6% Fuel Surcharge. Includes a 40% LTL Discount.**

Truckload rate = $3.50 per loaded mile for shipment distances under 200 miles and $3.25 per loaded mile for shipment distances of 200 miles or greater.

Charleston to a Logan County destination might be 18% - 20% more costly than a similar movement in a less rugged area. It should be noted that none of the sample routes reported in Table 2.1 are exclusively over mountainous terrain. For example, a shipment routed between Louisville and Madison would travel only a relatively few miles over roads that lie in mountainous areas, with the remainder of the shipment distance traversing relatively flat Interstate highways. Consequently, the impact of the mountainous terrain on the overall shipment cost would also be relatively small (approximately 2.2%). Overall, the additions to carrier costs associated with rugged terrain averaged 4.1% for the hypothetical routings considered here.

2.1.3 Equipment Imbalances and Other Issues of Low Traffic Volume

Phase I research included an analysis of current motor carrier commodity flows, as well as an extensive telephone survey of both private shippers and common carriers. The commodity flow data suggest a significant imbalance between originating versus terminating tonnages, with three originating tons for every terminating ton of truck traffic. Within the shipper survey results, one of the effects of this imbalance was the repeated concern over equipment availability.

One important clarification must be made. It is our judgement that any shipper can acquire the use of any piece of equipment at any point in time if that shipper is willing to pay a premium for the equipment's use. Thus, issues of equipment availability actually are questions of availability and affordability. The desired equipment is available if shippers are willing to pay the cost to move that equipment into the region empty. However, the additional cost of doing so represents a competitive disadvantage that is very often unacceptable.

The problems caused by relatively low inbound truck volumes also affect common carrier truckload costs even when equipment is not an issue. The $3.25 to $3.50 rates that form the basis of the values presented in Table 2.1 reflect premium services, with little or no backhaul opportunity. If shippers are willing to compromise on this level of service, it is possible to achieve measurably lower truckload rates (perhaps 33%). The problem for originating shippers within the study region is that the degree of service they must sacrifice to acquire lower rates is greater than the sacrifices that must be made by shippers in regions where there is more overall truck traffic. For example, a Columbus, Ohio shipper who opts to hold his or her shipment until a more favorable truckload rate can be located may have to wait one day to find such a rate. In contrast, a similar shipper in Charleston may have to wait three days to secure an equally favorable rate. The competitive advantage is clear.

2.1.4 Study Region Infrastructure Issues

As noted earlier, many regional shippers and common carriers judged the study region's roadway system to be a transportation asset that helps them to compete effectively with other sellers. This is not to say, however, that all gaps in the current highway system have been fully erased. Moreover, given the potential growth in both local and pass-through traffic (Section 2.1.6), finding the necessary funds to maintain the current highway system may prove challenging to study region policy-makers.

In a July story, the Charleston Gazette indicated that unless funding levels increase measurably, it would take several hundred years to complete the State highway projects already planned.[4] This conclusion, while seeming fantastic, does reflect a number of important truths. First, the planning process is slow. Therefore, it is important that planners begin assessing the costs, challenges, and ultimate feasibility of projects well before the need for these highway projects has been demonstrated. As a consequence, many of the projects that entered the Gazette's calculations will never proceed beyond the planning stage. The extensive highway planning that has occurred within the study region and across the rest of West Virginia also reflects the need to respond rapidly to funding opportunities as they emerge. Increasing competition for highway dollars suggests that those states that are prepared to execute in response to available funds are the most likely to receive those funds. Finally, and unarguably, the availability of funding will almost certainly constrain the State's ability to construct new highway projects, so that some feasible and efficient additions to the highway infrastructure will be foregone.

Within the current study region, there are at least four potential infrastructure projects that are routinely mentioned for their potential importance to future motor carrier and intermodal commodity flows. Three of these projects – upgrades to US 52, US 35, and WV 2 – involve substantial modifications to existing roads, while the fourth project – the potential connection of a regional airport facility to the principal highway network, is less clearly defined. Table 2.2 summarizes the route capacities of the three existing roadways that may be subject to substantial modification within the affected study region counties. Each of the three represents very different circumstances. West Virginia Route 2 is currently designated as an Expressway although the majority of this road is only two lanes wide within the region. Moreover, largely because of the flat terrain and straight alignment, capacity along this route does not currently appear to be an issue. The Expressway designation, however, connotes the functional role this route is intended to play within the State highway system. Thus any planned expansion of this highway is aimed at accommodating the future traffic that a mature State network would likely bring.

[4] See, "Road to Nowhere? State Might Need Centuries to Pay for Highways," Charleston Gazette, July 16, 2000.

Table 2.2
Sample Route Capacities
(A=Best, F=Worst)

County / Route	WV-2	US-35	US-52
Cabell	C	---	B
Jackson	B	---	---
Kanawha	---	F	---
Logan	---	---	E
Mason	C	F	---
Mingo	---	---	E
Putnam	---	E	---
Wayne	---	B	D
Wood	D	---	---

US Highway 35 in Kanawha, Putnam, and Mason Counties presents a very different case. Here, current traffic has already exhausted available capacity, so that planning efforts (currently at the route selection stage) and subsequent construction will not come in time to avoid considerable traffic delays.

Existing capacity along US Highway 52 in Cabell and Wayne Counties appears to be sufficient to accommodate current traffic levels. However, the difficult grades and alignments evident in Logan and Mingo Counties results in a capacity designation of “E”, implying that the US 52 route segments in these counties are not capable of accommodating much additional traffic. This is particularly important, given that US Highway 23 diverts from its parallel route on the west side of the Big Sandy River and moves considerably further west, as the southbound route approaches the lower end of Wayne County.

The ability to adequately fund highway maintenance may also be an issue. There are essentially two factors that contribute to potential shortfalls in maintenance funding. First, the study region’s roadway network continues to expand. As importantly, increasing numbers of existing route segments are reaching the age at which they require more regular resurfacing.

The potential problems have not been fully quantified. However, the State’s system of Interstate highways provides a useful example. Newly constructed concrete Interstate highways can accommodate traffic for approximately 26 years before entering the resurfacing cycle. Beyond year 26, these highway segments must be resurfaced with asphalt once every eight years. In a fully mature Interstate system, this means that one-eighth of all Interstate miles would need to be resurfaced each year. The total life of Interstate highway segments is estimated to be 50 years. Thus, as some Interstate segments approach the end of their projected lives, planners must also consider the cost of more significant rehabilitations or total segment replacement. In the very near future, the need to resurface an increasing number of Interstate lane miles will outstrip the $38 million appropriated annually for Interstate resurfacing and bridge maintenance. After 2005, as more substantive rehabilitation becomes necessary, the deficit between current funding levels and necessary expenditures will "skyrocket to levels that are 200% to 600% of current levels (i.e. $73 to $216 million)."[5] Again, the above discussion is based on Interstate highway maintenance, but similar outcomes are also anticipated for other Expressway, Trunkline, Feeder, and Local roadway segments.

2.1.5 National Issues Affecting Regional Motor Carrier Costs

As noted above, there are a number of inter-related issues that are currently affecting motor carriers across the United States. These issues are no less pressing within the study region. Moreover, while these are national issues, those regions that can develop solutions to these problems will enjoy a competitive advantage over those areas that can not.

At the center of the various national issues facing the trucking industry are the costs of service, safety concerns, and the public sector's ability to continue to accommodate large volumes of motor carrier traffic. The past decade represents the longest period of sustained economic growth in the nation's history. Accordingly motor carrier traffic has grown steadily over this same period, so that issues of safety and congestion that were once important are now at a critical stage.

In order to improve safety, the US Department of Transportation (USDOT) is proposing modifications to the Hours of Service laws – the federal statutes that govern how long drivers may drive and how much they must rest.[6] At the same time, however, motor carriers are concerned that the proposed modifications to the Hours of Service laws will exacerbate already critical driver shortages evident in most regions of the US.[7] Thus, the carriers claim that the proposed US-DOT modifications are guaranteed to increase trucking costs and dampen commerce unless some form of regulatory relief is also forthcoming.

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[5] See Interstate Highway Needs Study: West Virginia 1999 – 2000, January 2000, West Virginia Department of Transportation, Planning and Research Division.

[6] See, "Hours of Service, Notice of Proposed Rule Making: Background and Synopsis," Federal Motor Carrier Safety Administration, U.S. Department of Transportation, June 16, 2000.

[7] West Virginia motor carriers, interviewed during the study process, suggest that the national driver shortage is less of an issue in West Virginia than elsewhere. The relative availability of drivers within the study region is important. See, George Hohmann, "West Virginia Keeps Trucking Along, Charleston Daily Mail, July 31, 2000.

The trucking industry seeks relief by gaining permission to use longer and heavier trailers and trailer combinations.[8] While safety opponents oppose easing weight and length restrictions, there is no clear empirical evidence to support their claims that longer and heavier trailers or trailer combinations lead to a greater number of accidents. The real issue appears to be the greater degree of damage that increased axle loads do to roadway surfaces and bridges. Thus, the study region infrastructure issues discussed in Section 2.1.4 can not be isolated from national issues.

Finally, the notes to Table 2.1 indicate that a 6% fuel surcharge was applied in the calculation of motor carrier rates. Currently, national diesel prices average $1.66 per gallon. This represents a 34.9% increase over similar prices last year. Recently, OPEC has taken steps to loosen crude oil supplies. However, fuel industry analysts suggest that the effects of increased OPEC production may not be fully realized until sometime during 2001.[9] In the interim, increased fuel prices will continue to place upward pressure on motor carrier rates.

2.1.6 The Potential Issue of Pass-Through Traffic Congestion

As the Phase I report describes, a substantial proportion of the truck traffic observed on study region highways is pass-through traffic that neither originates nor terminates within the region. 1993 estimates suggest that 89% of all truck traffic was pass-through in nature. Currently, we estimate this figure has grown to 92%. 1993 Figures for West Virginia and neighboring states are provided in Table 2.3.

The dominance of pass-through traffic as a source of commercial vehicle activity has important implications for planners in the study region and State. Unlike many states, the future demand for Expressway infrastructure will be determined by economic forces that are largely exogenous to the West Virginia economy. Thus, planners must attempt to estimate the level of future economic activity in other (sometimes remote) locations, as well as determine how changing traffic volumes may affect routing decisions. Overall, this dominance of pass-through traffic makes the task of regional planners much more complex than it would be if commercial traffic was dominated by local activity.

[8] While perhaps more treatable, the proposed modifications to the Hours of Service laws would also further aggravate already serious truck parking problems. Even now, rest stops, truck stops, and other parking areas are crowded. Because the proposed modifications would require additional periods of rest, the currently observed over-crowding would be made worse.

[9] Dwindling US petroleum reserves combined with tensions in the middle east have raised real crude oil prices to levels approaching those observed in 1980. See, "Crude Oil Prices Rise 8.5 Percent," Washington Post, October 13, 2000, p. E01.

Table 2.3
Percentage of Pass-Through Truck Traffic
(Based on Ton-Miles)

State	Percentage Pass-Through Traffic
Kentucky	54.4%
Maryland	40.7%
Ohio	40.7%
Pennsylvania	47.0%
Virginia	55.2%
West Virginia	**89.2%**

Source: US Department of Transportation, Bureau of Transportation Statistics, 1997.

2.2 POTENTIAL TOOLS FOR MODAL EFFICIENCY ENHANCEMENTS

The current analysis is aimed at identifying opportunities for increased efficiency that will better enable regional producers to compete in regional, national, and international markets. Therefore, the strategies outlined below attempt to reinforce perceived regional advantages and mitigate the effects of disadvantages. However, the concepts and suggestions introduced here are merely a starting point for what should be extensive policy discussions.

2.2.1 Infrastructure Development

Regional and State policy-makers must carefully balance the desire to develop additional highway infrastructures with the need to adequately maintain the highways that are already in place. As Section 2.1.4 makes clear, the anticipated level of future funding is not sufficient to maintain the existing roadway network and simultaneously engage unfettered network expansions. The State should develop, publicize, and strictly adhere to a set of long-run priorities that include adequate maintenance funding. Over the last several decades, State highway planners, with the help of numerous federal partners, have done a masterful job of opening the study region to regional and national markets. The preservation of these accomplishments must be a high priority. To the extent that the recommended long-run plan identifies budgetary shortfalls, policy-makers should also be prepared to offer fiscal remedies.

The controlled development of emerging highway corridors can also be an important element in new highway capacity development. Even the most advanced highway design cannot accommodate high traffic flows if there is a curb cut every 100 feet. In this light, coordinated planning and development efforts such as the one surrounding the reconstruction of US 35 in Putnam County appear to be an important tool.

Finally, new highway infrastructures should be developed with particular attention to the ways they are likely to enhance intermodal commodity flows. This consideration has implications for both route location and highway and bridge design. All else equal, route selections should seek to minimize the distance between railroad, port, or airport facilities and new Trunkline or Expressway routes. Also, new roadways should be designed so that they provide adequate clearances for other transport modes.

2.2.2 Efficiency Through Increased Coordination

The principal opportunity for increased efficiency in motor carriage probably lies with the pursuit of increased coordination and cooperation among shippers, private carriers, and common carriers. Toward this end, we recommend the development of an Intermodal Advisory Board (IAB) similar in nature to the like-named organization in Kentucky.

While the IAB may initially require a significant degree of governmental involvement, as a mature organization, it should consist almost entirely of private sector representatives that are actively engaged in the purchase and/or provision of transportation services. The IAB, so formed, would be able to contribute to increased efficiency in a number of ways, including, but not limited to:

- Equipment Utilization The traffic imbalance evidenced within the study region contributes to chronic equipment shortages. No amount of additional coordination can fully mitigate this outcome. However, increased cooperation and coordination could, at least, help. Accordingly, one of the chief functions of the IAB would be to identify opportunities for backhauls and/or equipment sharing arrangements that would help shippers and carriers to better utilize the equipment that is available within the study region.[10] Ultimately, it may be possible to develop a formal equipment cooperative arrangement under the direction of the IAB that is structured in much the same way as agricultural cooperatives.[11] This structure would almost certainly encourage participation by making cost savings explicit.

[10] Federal restrictions on the activities of private carriers may impact both the form and magnitude of equipment sharing agreements.

[11] There have already been private sector attempts to promote increased efficiency through better equipment utilization. Unfortunately, the most recent of these – an internet-based national firm recently ceased operations. See, "Transportal.dot.closed," Traffic World, October 16, 2000, p. 30.

- Infrastructure Development As envisioned, the IAB would provide a permanent forum in which transportation users could express concerns and desires regarding future infrastructure development. The IAB, so informed, could proffer recommendations and provide counsel to State and federal transportation planners.

- Policy Development The future efficiency of motor carriage, like all transport modes, depends on the successful resolution of many complex policy issues. The IAB would be responsible for supplying specific policy recommendations that reflect its constituents' best interests.

- Advancing Intermodal Opportunities The current study process has revealed an amazingly resourceful set of transportation practitioners within the study region. In most cases, however, these practitioners are narrowly focused on one transport mode or modal combination. By gathering a diverse set of transportation users and providers within a single setting, it is hoped that, heretofore unexplored, intermodal opportunities will emerge.

3. RAIL CARRIAGE

The movement of coal dominates rail carriage both from and within the study region. Still, both of the Class I rail carriers that serve the study region possess main-line infrastructures that are well suited to nearly all forms of rail traffic, including coal traffic, mixed freight, intermodal movements, and passenger transportation. Consequently, the potential role of railroad service in producing more efficient transportation is not restricted to coal movements, but may instead extend to a number of commodities.

3.1 RAIL CARRIER COSTS, RATES, AND SERVICES

Unlike the motor carrier costs described above, the discussion of railroad rates is based on actual observations of rail traffic to, from, and within the study region during 1998. Therefore, in order to ensure the confidentiality of both shippers and carriers, railroad rates are described at a significantly aggregated level and are only discussed relative to variable costs estimated under the Uniform Rail Costing System (URCS). Where necessary, conclusions based on the disaggregated data will be discussed without reference to actual rate levels.

3.1.1 Introduction to Regional Rail Rates

Table 3.1 provides a summary of observed railroad rates relative to estimated variable costs. It also provides summary information describing shipment distances, as well as national figures for comparison.

Two important factors immediately become clear. First, the rates for study region traffic are much greater than national average rates when expressed as a percentage of variable cost. Second, the shipment distances for study region traffic are often significantly shorter than the national average. In fact, the latter observation explains the former. Because URCS estimates only variable costs, capital and administrative costs are not included. If revenues from all shipments must contribute to the recovery of these fixed costs, one would expect the ratio of revenues to variable costs to increase as shipment distances decline. This simply suggests that the ratio of fixed to variable costs increases as the number of route miles grows smaller.

Having said this, the rate data developed within the current study also suggests that the region's railroads possess and exercise a significant amount of pricing power in some rail-served markets.[12] First, the revenue to cost values for

[12] Here, as in most cases, origin, destination, and commodity define markets.

Table 3.1
Summary of Railroad Rates

ORIGINATING STUDY REGION TRAFFIC

	Coal	Chemicals	All Other Commodities
Study Region Revenue / Variable Cost	284%	250%	197%
National Revenue / Variable Cost	199%	195%	149%
Study Region Shipment Distance	387	525	430
National Shipment Distance	584	885	760

TERMINATING STUDY REGION TRAFFIC

	Coal	Chemicals	All Other Commodities
Study Region Revenue / Variable Cost	356%	276%	162%
National Revenue / Variable Cost	199%	195%	149%
Study Region Shipment Distance	92	463	401
National Shipment Distance	584	885	760

Source: 1998 Carload Waybill Sample

coal and movements for originating study region traffic are measurably higher than for other commodities. This observation is consistent with the large regional coal volumes that, very often, leave area coal shippers with very few non-rail alternatives.[13]

The results also suggest that, where coal and chemical shippers do have viable non-rail alternatives, railroad rates are made lower. For example, if an all-water or water/truck routing reasonably serves an origin-destination pair, railroad prices fall measurably.[14] Again, this simply demonstrates that both Norfolk Southern and CSXT possess and exercise some degree of market power in many study region markets.

[13] Contrary to what one might suspect, the very best rail rates for moving coal do not necessarily go to the largest shipper. In fact, smaller shippers who can very easily opt for alternative transport modes very often enjoy these rates. See, Mark L. Burton, “Assessing the Need for Competitive Reforms in Rail-Served Transport Markets: The Question of Access,” prepared for the Attorneys General of Ohio, Texas, Illinois, and Iowa, STB Ex Parte 575, March, 1998.

[14] For a detailed discussion of similar results, see Rail Rates and the Availability of Barge Transportation: The Upper Mississippi Basin, U.S. Army Corps of Engineers, Rock Island District, 1998.

The railroads refer to pricing practices that reflect both demand-side characteristics and incremental costs as “demand-based” or “differential” pricing. While this pricing practice has invoked the wrath of both shippers and many academic economists, the US Department of Transportation has defended the practice as necessary to ensure that railroads earn revenues sufficient to guarantee necessary investments. Moreover, a US Government Accounting Office investigation, while questioning this practice, did not openly recommend policies that would prohibit it.[15]

3.1.2 Restrictive Infrastructure

The Phase I report notes that both regional Class I railroads (CSXT and Norfolk Southern) face clearance restrictions that preclude the use of double-stack container cars and tri-level automobile carriers.[16] Particularly in the case of the double-stack equipment, restrictions that limit car heights to less than 23 feet indirectly elevate the rates faced by study region shippers because the clearance problems largely preclude bringing stack cars into the area. This, in turn, virtually guarantees that regional shippers wishing to use containers in any rail/truck combination will face a minimum 150 mile truck segment. Thus, regional shippers face an immediate disadvantage when compared to shippers who are more proximate to intermodal facilities that can accommodate double-stack equipment. The actual magnitude of this disadvantage is discussed in Section 5.1.1, but from a forward-looking vantage that strongly embraces the need for international trade, the clearance restrictions may represent one of the region’s greatest transportation impediments.

3.1.3 Service Issues for Small Rail Shippers

The region’s rail shippers generally fall into two categories – large volume coal shippers and small volume shippers of chemicals and non-chemical dry-bulk materials. As noted above, the rates faced by coal shippers vary considerably based on the availability of non-rail alternatives. For small volume, non-coal shippers the most prevalent issue appears to be the quality of service rather than actual rates. Indeed, the revenue to cost ratios faced by regional shippers for non-coal movements appear to differ from the national average only slightly when lower shipment distances are also considered. Repeatedly, however,

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[15] See Statement of the United States Department of Transportation Before the Surface Transportation Board, STB Ex Parte No. 575, March 26, 1998. Also see, “Railroad Regulation: Current Issues Associated with the Rate Relief Process, United States Government Accounting Office, February 1999, (GAO/RCED 99-46).

[16] Conventional international double-stack equipment requires a minimum clearance of 18’6”. Modern (fully enclosed) autoracks require a clearance of 19’6” and domestic doublestacks require a minimum clearance of 20’2”. Given the degree to which track curvature can increase these clearances, an operative minimal clearance for accommodating all such equipment is 20’8”. However, 20’11” is viewed by the industry as more practical.

small volume shippers complained of abysmal transit times, extreme variability in transit times, freight loss and damage, as well as other service-related problems.

Several points are worth noting. First, the shipper complaints lodged against CSXT and NS have come at a time when both carriers continue to struggle with the impacts of the Conrail purchase. Thus, the significant level of dissatisfaction voiced in shipper survey responses and interviews may reflect transitory problems. Maintaining service quality for the region's smaller rail shippers is also made difficult by the geographical dispersion of these rail users. Certainly, in both Huntington and Charleston, some low-volume rail users are clustered together, but it also appears that many of the most disappointed shippers operated from outside these clusters. In this latter case, providing adequate switching services is both difficult and relatively costly.

Finally – particularly in the case of lower-volume customers, the service problems alluded to by regional shippers merely reflect the localized impacts of a national problem. Indeed, for the past four years, after the latest round of railroad mergers, shippers across the whole of the US have complained repeatedly about the quality of railroad service. This has resulted in numerous Surface Transportation Board (STB) hearings and even occasional regulatory intervention.[17] In the long-run, service quality issues may lead to the permanent diversion of some rail traffic to other transport modes. This can, however, simply be a natural market outcome that reflects changed economic conditions.[18]

3.1.4 The Impact of Further Rail Consolidation

In 1980, the year in which the Staggers Rail Act was signed into law, there were approximately 20 Class I US rail carriers. Currently, there are six such railroads. Earlier this year, in response to an application for further rail consolidations, the STB imposed a 15 month moratorium on further rail mergers while the Board reconsiders its rules and procedures for merger approvals. Having survived judicial appeal, the STB moratorium appears to have slowed the rush toward what many believe will be a system of two rail carriers, serving the whole of the United States and Canada.

Inevitably, further railroad mergers will occur and, just as inevitably, some regions will benefit from these consolidations, while other regions will be relative losers. Consequently, the study region would do well to consider which potential mergers are to its advantage and which are not. Fully, investigating this issue is

[17] See Surface Transportation Board Ex Parte 575, March 1998.

[18] Similar circumstances occurred in the early 1980's immediately after the implementation of the 1980 Staggers rail act. Class I railroads simply found it unprofitable to provide some low-volume shippers with the quality of service those shippers demanded. As a result, there were a large number of shipper complaints and a non-trivial diversion of rail traffic to non-rail alternatives. What followed were unprecedented increases in railroad productivity, significant real rate declines, and measurably improved rail service for remaining customers.

clearly beyond the scope of the current analysis. However, a few examples will serve to underscore its importance.

First, consider the impact of potential mergers on intermodal routings. As noted in Section 3.1.2, most intermodal traffic currently bypasses the study region and there are no truck transload facilities within any of the 13 study region counties. Whether or not this remains the case for the foreseeable future depends not only on the clearance restrictions that preclude the use of double-stack equipment. The future development of intermodal capacity within the study region also will be affected by the course of future mergers. Specifically, a rail merger between the Canadian National (and its Illinois Central subsidiary) and either the Burlington Northern – Santa Fe (BNSF) or the Union Pacific (UP) would likely divert a significant portion of international intermodal traffic from both CSXT and NS. Reduced intermodal volumes would, in turn, diminish the benefits of developing an intermodal routing that traverses West Virginia and the current study region.

A similar scenario may also exist for the movement of coal to Canadian markets. Currently, West Virginia exports approximately seven million tons of coal to Canada each year. This represents roughly 18.0% of total exports and 4.0% of total production. The ability to access Canadian customers through single-line rail service would benefit the region's coal producers, particularly if western US carriers are unable to establish their own single-line service. Of course, the reverse is also true.

3.2 POTENTIAL TOOLS FOR MODAL EFFICIENCY ENHANCEMENTS

In discussing the potential for improved railroad efficiency within the study region, observers should realize that, in spite of the numerous issues currently at hand, the quality and pricing of rail service is markedly improved over that which was available only two decades ago. By encouraging and enabling competition, the Staggers Rail Act of 1980 resulted in tremendous railroad productivity gains.[19] The challenge to regional policy-makers is to ensure that these competitive pressures are sustained and to see that competitive benefits accrue to study region residents just as they might be expected to accrue to the whole of the US.

3.2.1 Mitigating Height / Width Restrictions

From the standpoint of promoting the growth of intermodal traffic within the study region there is, perhaps, no issue that is more important than mitigating the tunnel and bridge clearance restrictions that preclude the use of double-stack equipment. This having been said, observers must also realize that eliminating

[19] See, Wilson, Wesley W., "Cost Savings and Productivity in the Railroad Industry," Journal of Regulatory Economics, 11(1), January 1997, pages 21-40.

these restrictions, while necessary, is by no means sufficient to ensure the development of regional transload facilities or robust intermodal traffic volumes.[20]

Norfolk Southern estimates that the cost of mitigating the clearance restrictions on its property to be approximately $104 million. Similar cost estimates for CSXT are not currently available. It is clear, however, that any plan to mitigate clearance restrictions for either (or both) railroads would require a significant monetary sum.

In the early 1990's the state of Pennsylvania faced a somewhat similar situation wherein no Pennsylvania routings could accommodate either double-stack equipment or modern tri-level autoracks. These restrictions significantly impacted the ability of regional manufacturers to utilize railroad container services. Moreover, the clearance problems also hurt the Port of Philadelphia. The State, in conjunction with three participating railroads, worked to eliminate the clearance restrictions on three of five potential routings. Costs, cost shares and projected benefit figures for the Pennsylvania projects are summarized in Table 3.2.

While the Pennsylvania example provides a useful precedent for State involvement in clearance mitigation projects, there are a number of important distinctions between the Pennsylvania projects and any potentially similar projects in West Virginia. Most importantly, a sizable Philadelphia-area traffic base existed in advance of the projects, so that predicting their economic benefits to Pennsylvania was relatively simple compared to the effort that would be necessary to predict the impact of clearance mitigation projects in West Virginia. In addition, intermodal transload facilities existed in both the Pittsburgh and Philadelphia areas prior to the clearance projects, thereby minimizing the necessary amount of additional infrastructure construction. On the other hand, the Pennsylvania projects required additional efforts in both New York and Maryland, so that the geographic scope of potential West Virginia projects would be considerably smaller.

Section 5.1.2 continues the discussion of potential clearance mitigation projects within the study region and their future importance to the efficiency of regional transportation. However, the current analysis clearly points to a need for additional study in this area.

[20] The current document distinguishes between necessity and sufficiency in a number of places. Very often project proponents suggest that additions or modifications to infrastructure will bring about certain positive outcomes. In most cases, however, the projects in question, while necessary to the desired outcomes, are not sufficient by themselves to assure the desired impacts. This is an important distinction.

Table 3.2
Summary of Pennsylvania Clearance Mitigation Projects
(Dollar Values X $1M)

	Conrail mainline trackage, Philadelphia to the Ohio border.	Canadian Pacific trackage, Binghamton to Buffalo	CSXT trackage through Baltimore and Western Pennsylvania
Estimated Railroad Costs (in Pennsylvania	$58.4	$18.7	$8.9
Estimated (Pennsylvania) State Cost	$25.1	$9.3	$3.0
Projected Total Cost (Pennsylvania Segments)	$58.4	$12.6	$9.9
Net Present Value of Cost Savings (Pennsylvania)	$224.5	$25.4	$132.4
Railroad Expenditures in Other States	$3.1	$1.0	$32.0
Number of Affected Structures (Pennsylvania	84	25	18

Source: High-Profile Rail Clearances in the State of Pennsylvania, Report 6, Executive Summary, Transmode Consultants, Inc., November, 1992.

Notes: Vertical clearances only. Costs of horizontal clearances was estimated at $1.01 million. Neither these costs nor projected benefits are included in these figures.

All values are assumed to be in 1992 dollars.

3.2.2 Efficiency Through Increased Coordination

Section 2.2.2 describes the recommended formation of an Intermodal Advisory Board (IAB). As in the case of motor carriage, it is our judgment that the IAB could significantly contribute to efficiency gains in regional railroad transport. In the case of rail carriage, it is less likely that the IAB would have a direct role in coordinating equipment use. However, it could very easily play an active role in infrastructure planning, regional policy development, and fostering new intermodal initiatives. Additionally, in the case of rail, a more cohesive group of rail shippers might find it easier to secure the service improvements that many shippers seek.

3.2.3 Sufficiency of Competition

As Section 3.1.1 clearly illustrates, the Class I railroads that provide service within the study region both possess and exercise a degree of market power that would be absent under perfect competition. However, the relevant question is whether any identifiable lack of competition is imposing economic losses sufficient to warrant policy intervention.[21]

Given the current dominance of coal within study region transport markets and the transportation alternatives available to regional shippers, it is our judgement that regional shippers would benefit little from policies proposed to increase direct rail-to-rail competition.[22] Specifically, the availability of barge transportation on the Ohio and Kanawha Rivers, coupled with extremely competitive end-user coal markets significantly reduces the market power through which CSXT and Norfolk Southern might hope to affect supra-competitive prices. Consequently, the current analysis recommends no action within this policy area.

3.2.4 The Impact of Further Consolidations

While the STB moratorium on railroad mergers may or may not result in significant changes in the regulatory process for evaluating proposed mergers, it very clearly affords regional planners the time necessary to distinguish between the possible railroad combinations that would help their constituents and those which might bring them harm. As suggested above, the current study region is, by no means, immune to the impacts of further railroad merger activity. Consequently, the current analysis recommends that regional planners carefully study potential merger outcomes, so that they may intervene in the region's interest at the appropriate time.

[21] Within economics, markets that feature enough competition to preclude the efficient intervention of government are referred to as "effectively competitive."

[22] There are currently a number of proposals for regulatory reforms in the railroad industry, including several within US Senate Bill 621, co-sponsored by West Virginia's Jay Rockefeller.

4 COMMERCIAL NAVIGATION

Each year, more than a quarter-billion tons of freight is transported over the Ohio River navigation system. Much of this traffic originates in, terminates in, or at least passes through the study region. In addition to providing efficient transport to regional shippers, the mere availability of commercial navigation on the Ohio and its tributaries works to constrain the pricing behavior of other transport modes.

4.1 INTRODUCTION TO REGIONAL BARGE RATES

Table 4.1 provides a representative set of rates for actual barge movements to, from, and within the study region. This table also provides similar statistics for other Ohio Basin barge shipments and for a wide cross-section of barge movements throughout the inland waterways system.

Typically, because fixed costs are averaged across a greater quantity of output, we would expect per-ton-mile rates to decline as shipment distances increase. Here, however, we observe something very different. Overall, Ohio Basin movements travel the shortest average distance. At the same time, line-haul barge charges are also, the lowest. Conversely, the set of national movements travels the greatest average distance and has the greatest per-ton-mile line haul charges. This seems to imply that, in a very general way, commercial navigation

Table 4.1
Average Barge Distances and Rates
(Distances in Miles, Monetary Values in 1998 Dollars)

	Study Region Movements	Ohio Basin Movements	Inland Waterway Movements
Barge Line-Haul Distance	**577**	422	660
Associated Truck Distance	**35**	16	13
Barge Line-Haul Charges	**$5.09**	$3.38	$6.84
Associated Truck Charges	**$2.75**	$0.97	$1.30
Water Route Handling Charges	**$3.19**	$3.13	$3.33
Total Water Route Charges	**$11.88**	$10.82	$12.30
Line-Haul Water Route Charges per Ton-Mile	**$0.009**	$0.008	$0.010
Total Water Route Charges per Ton-Mile	**$0.021**	$0.026	$0.019
Number of Observations	**223**	1,585	4,996

Source: US Army Corps of Engineers / Tennessee Valley Authority. Handling costs and motor costs reflect the sum of origin and destination values.

rates are lower on the Ohio River than on other parts of the inland navigation system. The per-ton-mile rates and average shipment distance specific to the current study region fall somewhere between the Ohio Basin averages and the national averages. This implies that barge movements to and from the study region are less expensive than rates for similar moves on other reaches of the inland navigation system, but not as low as rates elsewhere on the Ohio.[23]

In general, the lower rates observed on the Ohio main-stem and its tributaries result from two principal factors. First, like many segments of the inland navigation system, the Ohio features navigation locks and dams that separate the river into "pools". However, unlike most other portions of the inland navigation system, the Ohio's navigation locks feature 1,200 foot chambers that can accommodate a 15 barge tow and towboat in a single lockage. Thus, lockage times and associated delays are typically lower on the Ohio than elsewhere. The second factor that lowers Ohio River barge rates is the more widespread availability of backhauls. Across the whole of the inland navigation system, roughly 75% of all barges return to their origins as empties. On the Ohio, however, the empty return ratio is only a little more than 60%.

Returning to the current study region, the data within Table 4.1 also point to another interesting outcome. The truck distances associated with study region barge movements are more than double the national and Basin-specific averages. This relatively large value is a direct result of the numerous truck movements of coal to transload facilities.

4.2 PUBLIC AND PRIVATE PORTS AND DOCKS

As the Phase I report describes, line haul navigation infrastructures are provided by the US Army Corps of Engineers. However, a mixture of private firms and local, regional, and state governments provide barge terminal facilities. Typically, large volume barge users develop private dock facilities. Occasional barge users may either choose to route shipments over private general commodities terminals or over public terminals, where such facilities exist.

4.2.1 Private Dock Facilities

The Phase I report notes more than 120 commercial private docks within the study region, though roughly one-third of these facilities are currently unused. The cost of operating these private docks vary widely, depending on the generation of loading and unloading equipment, the number of barges that can be accommodated, and the characteristics of the commodities handled. Within

[23] This is an extremely simplified analysis that ignores a number of factors, including differing commodity mixes on various reaches of the inland navigation system. Still, it provides the reader with some sense of rate differentials.

the course of the current investigation, we observed nothing to suggest that terminal operating costs within the study region vary from the national norm in which loading and unloading costs range between $1.00 and $3.00 per ton.[24]

4.2.2 Public Port Facilities

Public port development is an extremely complex and often controversial topic. A comprehensive treatment of the many issues inherent within this subject is well beyond the scope of the current analysis.[25] There is also considerable variation in design and operation of public port facilities. In some instances, regional authorities simply develop waterfront industrial parks, wherein, they provide roads and utility access, but leave the development of additional port infrastructure to private concerns. In other instances, the degree of public involvement is much greater. Under this latter model, public entities will develop dock, loading, and storage facilities, in addition to providing the underlying roadway and utility infrastructure. Finally, in some cases, governing authorities directly operate public ports once they are developed, while in other instances, developing authorities choose to lease operations to private firms or to entirely relinquish control of the facilities by selling them.

From a theoretical vantage, there is no reason to believe that a public port can provide port services more efficiently than a privately operated facility. Likewise, there is little to suggest that market failures constrain private port development. There are, however, circumstances under which a public port can function as a viable economic development tool by diverting economic activity to the region where the port is located.[26] Thus, from a regional standpoint, supporting public port development may be a desirable policy

Within the study region, Jackson County has developed a public port facility inside its industrial park. This facility was subsequently sold to a private port operator. There have also been extensive studies of potential public port development in Huntington, Parkersburg, and Buffalo. At this point, the course of these facilities seems uncertain.

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[24] In various locations across the country, labor costs are made measurably higher by strict union work rules and relatively high wages. This circumstance was not observed within the study region.

[25] CBER, in conjunction with the ATI and West Virginia's Department of Transportation, is in the initial stages of a comprehensive study aimed at outlining the efficient role of government within the provision of port facilities.

[26] The dichotomy between national and regional economic benefits rests principally upon the distinction between actual efficiency gains and regional income transfers.

4.3 POTENTIAL TOOLS FOR MODAL EFFICIENCY ENHANCEMENTS

As noted above, the cost of barge transportation to, from, and within the study region already compares favorably with other regions of the US. Furthermore, there is no evidence that landside charges within in the region in any way disadvantage waterborne transport users. Consequently, the current analysis offers no recommendations for improvements.

5. INTERMODAL FREIGHT TRANSPORTATION

Historically, searches for new transportation efficiencies have focussed on improving infrastructures, equipment, or operating practices within individual modes. Over the past decade, this relatively narrow focus has given way to a broader approach that also incorporates the study of intermodal efficiency enhancements.

5.1 TRUCK/RAIL INTERMODAL TRANSPORT

Truck / rail intermodal movements typically consist of line-haul rail movements of 1,000 miles or more sandwiched between truck movements of up to 250 miles at origin and / or destination. Depending on the commodity and origin / destination pair, the commodities may be shipped in either modified truck trailers or in containers. In the years since the implementation of the 1980 Staggers rail act, rail / truck combinations have proven to be one of the steadiest sources of railroad traffic growth. Indeed, since 1980, the intermodal movement of trailers and containers has grown by 184%[27].

5.1.1 The Cost of Accessing Truck/Rail Facilities

Within the current setting, charges for the line-haul railroad movement are of little importance because study region shippers and their broader regional competitors are virtually certain to utilize the same truck / rail transload facility.[28] Consequently, regional variations in drayage rates form the focus here. Table 5.1 summarizes drayage charges from both Columbus and Cincinnati to three study region destinations.

Two important points emerge from this table. First, the drayage rates from Columbus to the study region are roughly 30% higher on a per-mile basis. Perhaps, this points to stronger competition among trucking firms that serve the Cincinnati market. More importantly from the current perspective, shippers within the study region are significantly disadvantaged by their lack of proximity to a transload facility. The additional costs associated with this lack of proximity are based on a hypothetical 1,000 mile railroad line-haul movement and would

[27] Source: Association of American Railroads (AAR) annual CR-54 reports. According to the AAR, intermodal traffic now accounts for 16% of railroad revenues.

[28] Because the rail portion of these intermodal moves typically involves operating relatively light trains at relatively high speeds, railroad rates are relatively high compared to the rates for moving bulk commodities such as grain or coal. Intermodal rates are likely to range between 8-10 cents per ton-mile, while the rates for the movement of dry-bulk commodities typically range between 1-3 cents per ton-mile.

Table 5.1
Sample Drayage Rates

Origin	Destination	Total Charge	Distance	Per-Mile Charge	Overall Movement Cost Disadvantage
Cincinnati	Huntington	$435	206	2.11	62.6%
	Charleston	$585	251	2.33	70.8%
	Beckley	$750	310	2.42	76.5%
Columbus	Huntington	$438	140	3.13	62.8%
	Charleston	$515	162	3.18	67.5%
	Beckley	$721	221	3.26	75.6%

Note: The overall movement cost disadvantage is calculated based on an assumed railroad line-haul of 1,000 miles, a line-haul rate of $0.10 per ton-mile, 20 ton loadings, and local drayage rates of $100.

decline slightly as the rail leg is increased in distance.[29] The difficulties encountered by study region shippers who wish to combine railroad and truck extend beyond the simple rate disadvantage depicted in this table. Study region shippers who do use such services are likely to have much less time to load and unload trailers and containers. Shippers who are proximate to transload facilities may have as much time as they wish to unload or load containers or trailers, so long as they are willing to pay demurrage charges on the equipment. However, study region shippers are typically expected to load or unload within a four hour period. Any failure to do so, can result in a second set of drayage charges stemming from a second trip to retrieve the container or trailer.

5.1.2 Opportunities for Enhanced Efficiency – Truck / Rail

The ability to efficiently receive and dispatch containers is essential to any region's ability to compete for international commerce. Thus, mitigating the cost disadvantages depicted above is of paramount importance to the study region.

Section 3.2.1 discusses the possibility of mitigating the clearance restrictions that preclude the use of double-stack equipment within the study region and recommends further study on the topic. Three further points must also be considered. First, the mere ability to move containers efficiently through the study region does not guarantee an improvement in the pricing of rail / truck movements to and from the study region. This latter outcome would also require the development of a transload facility that is proximate to study region

[29] The cost disadvantage estimates are based on a hypothetical rail line-haul movement of 1,000 miles at a rate of $0.10 per ton-mile. Containers/trailers are assumed to be loaded to 22 tons.

commerce. Thus, a study of projected transload capacity at existing CSXT and NS facilities and the opportunity to efficiently divert some amount of future traffic from these facilities to a new location within the study region should be included in any assessment of clearance mitigation projects.[30]

Second, any further study of clearance mitigation projects must also carefully consider whether or not there are non-traditional methods of securing intermodal service. Specifically, the potential use of roadrailers – truck trailers that can be directly placed into railroad trains – should be thoroughly investigated. Currently, Norfolk Southern operates a fleet of such equipment through its Triple Crown service. However, the study region falls well outside existing Triple Crown service areas. Moreover, given Norfolk Southern's interest in mitigating clearance restrictions, it is unlikely that the carrier would be willing to explore roadrailer service to the study region. Alternatively, it might be possible to develop some form of non-traditional rail / truck service in combination with Amtrak's passenger service to the study region. Amtrak currently uses some roadrailer equipment in combination with its passenger services elsewhere and Amtrak's chairman has recently voiced a desire to expand the carrier's role in high-end freight and express services.[31]

Finally, there may be intermediate steps that regional businesses can take to (at least) improve the quality of rail / truck services to and from the study region. For example, numerous study region shippers indicated that they currently ship via conventional motor carrier to transload locations where their commodities are then loaded into intermodal containers.[32] Thus, they have very little control over the packing and/or blocking of these loads. It may, however, be possible to develop in-region facilities for the local loading of containers. The chief advantage of performing this service locally is that it would allow shippers to inspect their loads in the containers just before the containers are sealed. This concept is being widely discussed by a number of study region shippers and carriers. The further exploration of a local container loading and unloading facility could easily be undertaken by the Intermodal Advisory Board described above.

[30] We assume that, at least initially, the study region would not be able to generate sufficient inbound and outbound intermodal traffic to sustain an in-region facility. Therefore, the ability to efficiently divert traffic bound for other location over the new facility would likely be important to that facilities sustainability.

[31] See the testimony the Honorable Tommy Thompson, Chairman, Amtrak Reform Board before the Senate Appropriations Subcommittee on Transportation and Related Agencies, 3/9/00. Gov. Thompson also notes that mail and express business increased by 18% during fiscal year 1999.

[32] The practice of moving shipments to transload locations prior to placing them in intermodal containers or trailers may, in part, reflect the level of drayage rates relative to the cost of alternative motor carriage.

5.2 TRUCK / AIR INTERMODAL TRANSPORT

5.2.1 The Cost of Study Region Air Freight Services

Efforts to improve the efficiency of study region truck / air intermodal transport face many of the same challenges that were described in conjunction with truck / rail service. The current level of study region traffic, combined with the physical limits of in-region airports significantly constrains the range of available airfreight services. As a result, regional shippers who wish to utilize truck / air combinations must either accept the restricted set of services that are available or truck their shipments a relatively long distance from an airport where better service is available. Both options impose transport costs on study region traffic that are higher than the costs enjoyed by shippers elsewhere. The Less-than-Truckload (LTL) portion of Table 2.1 – particularly for Covington, KY origins – provide some measure of the relative disadvantage faced by study region shippers. Of course, it is necessary to adjust these values to reflect the trucking charges that local Cincinnati shippers face.

5.2.2 Opportunities for Enhanced Efficiency – Truck / Air

Table 5.2 provides 1996 airfreight and airmail enplanement tonnage for airport facilities located in Metropolitan Statistical Areas (MSAs) with populations of less than 750,000. In terms of population, a combined Charleston-Huntington MSA would rank eighth among the 44 MSAs.

A statistical analysis of the data contained within this table demonstrates only a very modest correlation between the volume of airfreight traffic and population, business demographics, or spatial separation from competing facilities.[33] Some relatively small MSAs, such as Cedar Rapids, Iowa have a relatively large volume of originating airfreight, while some relatively large MSAs, such as Baton Rouge, Louisiana have a remarkably small volume of airfreight traffic. If the quantity of airfreight service can act as a proxy for the availability and pricing of airfreight services, this finding may encourage optimism. The Omaha, Nebraska MSA has a population and number of business establishments that is very similar to the combined Charleston-Huntington MSA. Moreover, Omaha is only 61 miles from a competing airport in Lincoln and less than 170 miles from Kansas City International Airport. Yet in 1996, Omaha's Epley Field originated almost 34,000 tons of combined airfreight and airmail.

[33] Population, the number of business establishments, and the distance to the nearest hub airport are all positively correlated with the volume of both mail and airfreight. However, regression equations based on these explanatory variables explained less than 25% of the variation in airfreight and airmail traffic volumes.

Table 5.2
1996 Airfreight and Airmail Traffic for MSAs with Populations of 750,000 or Less

MSA	Enplaned Freight (Tons)	Enplaned Mail (Tons)	Total Airfreight and Mail	MSA Population	Number of Business Estbab.
Syracuse, New York	13,885	3,753	17,638	743,851	16,777
Omaha, Nebraska MSA	10,665	23,066	33,731	679,876	17,881
El Paso, Texas MSA	29,600	2,115	31,715	674,005	11,963
Albuquerque, New Mexico	15,750	9,747	25,497	667,210	16,817
Knoxville, Tennessee	9,104	1,309	10,413	655,104	17,661
Harrisburg/York, Pennsylvania	14,721	2,685	17,406	613,636	14,724
Allentown/Bethlehem/Easton, PA	4,513	2,117	6,630	612,655	14,490
Combined Charleston / Huntington MSAs	**1,591**	**43**	**1,634**	**574,000**	**18,000**
Baton Rouge, Louisiana	355	1,292	1,647	565,519	13,535
Little Rock, Arkansas	2,005	5,568	7,573	546,269	15,122
Sarasota/Bradenton, Florida	348	1,526	1,874	528,917	15,597
Wichita, Kansas MSA	10,460	3,292	13,752	526,111	13,357
Charleston, South Carolina	4,093	1,145	5,238	522,700	12,307
Mobile, AL/Pascagoula, Miss MSA	4,461	372	4,833	520,705	12,507
Columbia, South Carolina	12,515	1,263	13,778	495,607	12,917
Colorado Springs, Colorado	6,732	4,194	10,926	472,429	11,826
Melbourne, Florida	249	2	251	453,418	10,739
Daytona Beach, Florida	264	3	267	452,713	10,958
Lexington/Frankfort Kentucky	539	809	1,348	439,506	11,453
Des Moines, Iowa	11,803	10,208	22,011	427,844	12,450
Jackson,Vicksburg, Mississippi	5,651	2,053	7,704	421,371	10,452
Madison, Wisconsin	3,436	390	3,826	415,209	11,413
Spokane, Washington MSA	14,540	4,205	18,745	404,173	11,260
Pensacola, Florida	475	1,905	2,380	383,139	8,270
Corpus Christi, Texas	507	532	1,039	380,728	8,892
Fort Myers, Florida MSA	3,247	3,472	6,719	379,584	10,785
Boise, Idaho	10,605	2,526	13,131	372,596	10,844
Newburgh, New York	12,789	1,330	14,119	361,901	7,900
Huntsville, Alabama	5,291	1,102	6,393	330,329	7,524
Brownsville/Harlingen/San Benito, TX MSA	10,527	4	10,531	311,522	5,530
Eugene, Oregon	894	987	1,881	306,326	9,170
Reno, Nevada	7,496	3,127	10,623	298,395	9,729
Savannah, Georgia MSA	1,592	989	2,581	280,804	6,871
South Bend, Indiana	5,007	1,402	6,409	257,496	6,611
Portland, Maine	3,923	858	4,781	250,134	9,181
Midland/Odessa, Texas	910	492	1,402	237,449	7,157
Lubbock, Texas	8,067	26	8,093	230,932	6,351
Green Bay/Clintonville, Wisconsin	83	84	167	212,415	5,671
Amarillo/Borger, Texas	236	357	593	204,692	5,437
Burlington, Vermont	2,431	231	2,662	189,588	6,189
Cedar Rapids/Iowa City, Iowa	11,864	4,939	16,803	179,829	5,081
Myrtle Beach, South Carolina MSA	467	0	467	163,784	6,271
Sioux Falls, South Dakota	5,715	2,836	8,551	156,784	5,240
Billings, Montana	837	3,686	4,523	125,551	4,479

Continuing to use Omaha as an example, the data in Table 5.2 reveal an exceptionally large volume of mail. This is the direct result of the US Postal Service (USPS) sorting center located at Omaha. The presence of the USPS almost certainly encourages non-mail airfreight traffic volumes. The USPS generally employs the airfreight services of private carriers. Routinely, these carriers will sell unused capacity, previously held for USPS movements, to private shippers. Thus, the presence of a US Postal Service facility helps to provide low-cost air transport services to other users.

Current and foreseeable study region demands for airfreight service will not support the development of additional airfreight capacity. Thus, if regional planners wish to increase this capacity as an economic development tool, they must identify some non-demand-based method of attracting additional aircraft to the region. This may mean inducing federal or private entities to locate sorting or distribution facilities in the region or, perhaps, inducing carriers to locate aircraft maintenance facilities here. The final conclusion, however, is the same. Significant improvements in the quality, pricing, and availability of airfreight services are not likely to emerge within the course of undirected regional commerce.

As a final note, many of the inducements alluded to above will require developable property. However, the study region's three commercial airports – Yeager, Tri-State, and Wood County – do not have proximate developable lands. Thus, it would appear that improving the efficiency of airfreight service within the study region would require the development and construction of a new regional airport. It must, however, be emphasized that the construction of a regional airport is not, sufficient to bring about improved airfreight services. Instead the development of a new regional airport facility is only one component of what must be a much broader strategy.

5.3 INTERMODAL MOVEMENTS INVOLVING BARGE TRANSPORTATION

In 1998, the study region originated more than 47 million tons of barge traffic. However, virtually none of this traffic began its journey by being loaded onto a barge. Nearly all originating study region barge traffic reached the river through another transport mode – approximately 25 million tons by rail, 13 million tons by truck, and six million tons by pipeline.[34] Thus, current patterns of regional commerce routinely involve intermodal routings that contain a barge segment.

[34] See Transportation and the Potential for Intermodal Efficiency Enhancements in Western West Virginia: Phase I, Center for Business and Economic Research, Marshall University, June 2000.

5.3.1 The Cost of Accessing Commercial Navigation

With the possible exception of truck / highway movements to dock facilities, there is no indication that the costs of accessing the study region's navigation facilities are measurably higher than similar costs incurred in other parts of the country. Moreover, as Table 4.1 illustrates, the average study region water-route handling cost, $3.19, is very competitive with the $3.33 national average. So, based on existing traffic patterns, there appear to be no inherent inefficiencies at dock or port facilities. Finally, as noted several times, line-haul barge rates to and from the region are very competitive. Therefore, the current analysis must conclude that intermodal routings involving barge transport is an area in which the study region currently enjoys a competitive advantage over, at least some, producers in other regions.

5.3.2 Enhanced Efficiency – Barge-Inclusive Movements

The ability to efficiently combine commercial navigation with other transport modes is a distinct regional advantage. However, the importance of this advantage to regional economic prosperity may well depend on identifying new uses for existing capacity. Traditionally, the study region has used water-inclusive intermodal transport to move coal, chemicals, and petroleum products. However, regional production within all three commodity groupings continues to decline. Moreover, if new judicial restrictions on surface mining methods are upheld, the volume of coal traffic originating within the region could drop significantly.[35] Thus, the real challenge for planners may be in identifying ways to best use the available commercial navigation capacity.

Currently, work is underway within the mid-Ohio River basin to identify new commodity flows that would benefit from intermodal routings that rely on commercial navigation.[36] This work has direct implication for transportation planning within the study area. The most important link between the development of new Ohio River traffic and regional planning efforts involves the need to preserve and / or modify dock facilities. As noted, there are numerous private dock facilities that are capable of handling coal, other dry-bulk materials, and chemicals. Presumably, these facilities would be capable of handling new traffic as well. Therefore, it may be beneficial to preserve the capacity of these dock facilities for later use. This may require a system of dock banking similar to the rail-banking program currently in use within the State. Also, to the extent that new Ohio River intermodal traffic does emerge, it may be desirable to help private dock owners modernize and otherwise modify these preserved structures.

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[35] See Michael J. Hicks, Mark L. Burton, and Calvin A. Kent, "Coal Production Forecasts and Economic Impact Simulations in Southern West Virginia," Marshall University, Center for Business and Economic Research, June, 2000.

[36] The ongoing study supported by the Appalachian Regional Commission is a good example of these efforts. This study is considering both traditional and non-traditional sources of new Ohio River Traffic, including container-on-barge movements.

6 EFFICIENCY IN PASSENGER TRANSPORTATION

As noted above, many of the heavy and extractive industries that have served as the mainstay of study region commerce have evidenced declines in production over the past several decades. Moreover, this pattern of economic change shows little probability of changing in the foreseeable future. As commercial patterns evolve, the nature of passenger transportation demands are also changing.

6.1 PASSENGER VEHICLE TRANSPORTATION

As the Phase I study report describes, residents in 12 of 13 study region counties drive daily mileages that are nearly double the national average. This largely reflects commute distances that are greater than the norm. However, these longer than average commutes do not necessarily indicate higher commuting costs. Because of the widely dispersed population and adequate roadway network regional residents face less congestion and fewer traffic related delays, so that overall commuting costs – measured both in dollars and in time – are not significantly greater in the study region.

Certainly, part of the reason for longer daily commutes lies in the geographically dispersed nature of the study region's population. These longer commutes also result from the area's geographic concentration of commerce. As the commercial focus continues to shift from large industrial operations to smaller service-oriented activity, it is likely that the current geographic concentration will diminish. Thus, changing economic patterns within the study region may begin to mitigate the need for long commutes.

While a reduction in economic concentration may be working to reduce the demand for passenger vehicle transportation, other economic changes are simultaneously increasing this demand. Specifically, tourism within the State (including many study region counties) is an ever-increasing source of economic activity. Moreover, industry spokespeople suggest that this growth could accelerate if potential tourists outside the region gain improved highway access to area attractions. Thus, the current analysis suggests a comprehensive plan designed to improve highway access is needed – particularly from the eastern seaboard into central West Virginia.

6.2 OTHER PASSENGER TRANSPORTATION

In addition to highway transportation, regional travelers can enter or leave the study region via three area airports located at Charleston, Huntington, and Parkersburg. The region is also served by Amtrak passenger rail service with stations at Charleston and Huntington and by commercial bus service to and from a variety of study region cities and towns.

6.2.1 Air Transportation, Air Fares, and Regional Airport Facilities

One of the most controversial transpiration topics within the study region is the proposed development of a regional airport that would replace current passenger operations at Yeager Airport in Charleston and Tri-State Airport in Huntington. The proposed regional airport would likely be built south of Interstate 64 in Lincoln County. The project's supporters hope to vastly improve both the quality and pricing of commercial air service to and from the study region.

Assessing the financial feasibility of the proposed regional airport facility is a complex task. To date, efforts have produced far more speculation and bickering than actual evidence. The principal questions revolve around the projected level of passenger enplanements at the new facility. However, economic theory suggests that passenger volumes to and from a new facility are almost sure to be a function of the available fares relative to the fares that are evidenced at other airports accessible to study region residents.

Table 6.1 provides current enplanements for the three study region airports, as well as projected enplanements for the new regional airport facility. This table suggests that passenger volumes at the new facility, when opened, will be roughly double the volume currently observed at existing study region airports. Given that both population and regional commerce are projected to see very little growth over the construction period, the sizeable difference between current and

Table 6.1
Actual and Projected Airport Enplanements

Airport Facility	Enplanements
Yeager Airport – 1998	270,000
Tri-State Airport – 1998	61,000
Wood County Airport – 1998	57,000
Regional Airport (Projected) – 2006	750,000[37]

[37] See "Master Plan, Regional Airport, Working Paper Number 1," Kimley-Horn and Associates, January 2000, Appendix D. The Kimley-Horn study actually contains a second set of enplanement projections based on more conservative assumptions. However, the 750,000 figure is used within their feasibility calculations.

projected passenger loads can have only one source – the recapture of study region travelers who currently drive to Cincinnati, Columbus, or Pittsburgh in conjunction with air travel.[38]

However, as noted above, the ability to stem the use of out-of-region airports will almost certainly be affected by relative in-region and out-of-region air fares. In short, unless air services to and from the new regional airport are priced competitively with services offered from Cincinnati, Columbus, and Pittsburgh, the projected passenger growth at the new facility is unlikely to materialize.

Tables 6.2 and 6.3 provide an informal comparison of current airfares available from Charleston, Huntington, Cincinnati, and Columbus. Charleston and Huntington fares are noted explicit, while the column titled “Best Fare” indicates the lowest of either Cincinnati or Columbus fares. Table 6.2 is indicative of fares faced by business travelers. Table 6.3 is more representative of fares attainable by leisure travelers.

Clearly, current fare structures favor travel from either Cincinnati or Columbus. While some Charleston fares are very competitive with the two out-of-region alternatives, most are not. Business travelers flying to and from Charleston face fares that are, on average, 77% higher than the Cincinnati or Columbus alternative, while leisure fares are 70% greater. Business travelers who choose to fly to and from Tri-State pay fares that average 257% more than out-of-region fares. Leisure travel fares, as measured here, are 132% greater than the Cincinnati or Columbus alternative. As long as this current fare structure is in evidence, it will be difficult for any study region airport to dissuade air travelers from using out-of-region alternatives. Thus, absent a plan for improving regional airfares, the enplanement projections used in support of the proposed regional airport seem very suspect.

[38] Use of the word “recapture” is not accidental. Airports such as Columbus have engaged in aggressive “catchment” campaigns for years. See, Kathy L. Woodward, “Airport Cruising for Out-of-Town Passengers,” Business First – Columbus, 16, No. 3, p. 47.

Table 6.2
Sample Study Region Business Round-Trip Air Fares

Destination	Charleston	Huntington	Best Fare	Percentage Difference Charleston	Percentage Difference Huntington
Atlanta, GA	$584	$815	$303	92.74%	168.98%
Austin, TX	411	1,342	371	10.78%	261.73%
Birmingham, AL	536	840	176	204.55%	377.27%
Charleston, SC	529	857	435	21.75%	97.24%
Chicago (O)	255	837	99	157.58%	745.45%
Dallas/Ft Worth, TX	583	1,220	406	43.60%	200.49%
Denver, CO	675	1,341	324	108.33%	313.89%
Detroit, MI	334	810	184	81.52%	340.22%
Jackson, MS	402	405	236	70.34%	71.61%
Kansas City, MO	252	222	207	21.74%	7.25%
Little Rock, AR	572	568	201	184.58%	182.59%
Los Angeles, CA	413	424	413	0.00%	2.66%
Miami, FL	559	668	302	85.41%	121.56%
Minneapolis/St. Paul, MN	384	1,069	215	78.60%	397.21%
Mobile, AL	870	1,250	617	41.00%	102.59%
New Orleans, LA	345	363	345	0.00%	5.22%
New York (L)	482	912	474	1.69%	92.61%
Norfolk, VA	534	846	350	52.79%	142.06%
Oklahoma City, OK	743	1,301	251	196.02%	418.13%
Omaha, NE	378	2,114	207	82.61%	921.24%
Pittsburgh, PA	445	664	425	4.71%	56.24%
Portland, OR	516	552	473	9.09%	16.70%
Salt Lake City, UT	874	1552	419	108.59%	270.41%
San Francisco, CA	513	1,232	468	9.62%	163.25%
Spfd. / Hartford, CT	552	1,033	308	79.22%	235.39%
Spokane, WA	1,286	2,825	561	129.23%	403.57%
St. Louis, MO	210	832	116	81.03%	617.24%
Tucson, AZ	961	2,145	539	78.29%	297.96%
Tulsa, OK	706	1,298	212	233.07%	512.35%
Washington, DC (R)	306	810	306	0.00%	164.71%
AVERAGES	**$540**	**$1,038**	**$331**	**75.62%**	**256.93%**

Note: Fares based on seven day advance purchase and no Saturday night stay as reported by Travelocity.com.

Table 6.3
Sample Study Region Leisure Round-Trip Air Fares

Destination	Charleston	Huntington	Min Fare	Percentage Difference Charleston	Percentage Difference Huntington
Atlanta, GA	$325	$512	$154	111.04%	232.47%
Austin, TX	299	299	299	0.00%	0.00%
Birmingham, AL	485	485	152	219.08%	219.08%
Charleston, SC	234	409	229	2.18%	78.60%
Chicago (O)	318	443	71	347.89%	523.94%
Dallas/Ft Worth, TX	415	440	333	24.62%	32.13%
Denver, CO	323	351	288	12.15%	21.88%
Detroit, MI	320	430	170	88.24%	152.94%
Jackson, MS	399	405	236	69.07%	71.61%
Kansas City, MO	166	222	142	16.93%	56.37%
Little Rock, AR	558	585	142	293.02%	312.06%
Los Angeles, CA	413	424	321	28.66%	32.09%
Miami, FL	348	356	253	37.55%	40.71%
Minneapolis/St. Paul, MN	344	552	197	74.62%	180.20%
Mobile, AL	515	599	313	64.54%	91.37%
New Orleans, LA	280	363	234	19.66%	55.13%
New York (L)	299	449	203	47.29%	121.18%
Norfolk, VA	254	438	191	32.98%	129.32%
Oklahoma City, OK	288	297	174	65.55%	70.43%
Omaha, NE	297	751	176	68.78%	326.49%
Pittsburgh, PA	237	371	206	15.05%	80.10%
Portland, OR	402	422	366	9.84%	15.30%
Salt Lake City, UT	373	421	338	10.36%	24.56%
San Francisco, CA	298	304	298	0.00%	2.01%
Spfd. / Hartford, CT	460	563	246	86.99%	128.86%
Spokane, WA	455	926	408	11.52%	126.96%
St. Louis, MO	206	438	71	190.14%	516.90%
Tucson, AZ	396	407	326	21.47%	24.85%
Tulsa, OK	327	333	142	130.33%	134.56%
Washington, DC (R)	164	412	153	7.19%	169.28%
AVERAGES	**$340**	**$447**	**$228**	**70.22%**	**132.38%**

Note: Fares based on seven day advance purchase and no Saturday night stay as reported by Travelocity.com.

The difficulties faced by Yeager, Tri-State, Wood County, or a new regional airport facility are altogether too common among smaller regional airports. At the same time, however, the experiences of regional airports elsewhere suggest that it is possible to induce competition, lower fares, and retain local patronage.[39] Indeed, anecdotal evidence suggests that Yeager has, in fact, made some progress in these areas. The key strategies currently in evidence include:

- Attracting discount carriers
- Broadening the range of available commuter carriers
- Negotiating lower business fares with large carriers
- Improving the set of ancillary services available to local air travelers

The successful pursuit of these strategies generally requires airports to grant concessions to airlines in the form of lowered landing fees, increased gate and ticket counter access, assistance in the development of aircraft maintenance facilities, etc. Moreover, both airport concessions to airlines and the development of ancillary services for local customers routinely require developable property. Consequently, the development of the proposed regional airport again is not, by itself, sufficient to provide improved passenger air services.

The current analysis points to the need for a thorough and conservative analysis of the economic feasibility of the proposed regional facility – one which carefully accounts for the potential to secure lower fares and the relationship this fare structure would have on the ability to retain regional patrons.

6.2.2 Rail and Bus Transportation

Table 6.4 provides a set of sample Amtrak fares between Charleston / Huntington and a variety of destinations. While the percentage of intercity passengers entering and departing the study region by rail (3.8%) is considerably higher than the national average (less than 1.0%), the overall importance of passenger rail service to the region is still minimal.

Increasingly, the national model represented by the historical Amtrak (operation) is giving way to regional passenger operations like those found in Virginia and the Carolinas (Amtrak, itself has been divided into largely regional operating units). Though many of these regional operations are developed through federal funds and are closely connected to Amtrak, they nonetheless operate independently. Whether or not corridor-based passenger rail operations might be economically feasible within the study region may be a relevant policy issue in the future. Currently, however, such operations seem unlikely

[39] A list of the cities that have enjoyed success in bringing about measurably lower fares includes, but is not limited to: Colorado Springs, CO, Flint, MI, Jackson, MS, Reading, PA, Sanford, FL, Sarasota, FL, Tucson, AZ, and Wichita, KS.

Table 6.4
Sample One-Way Amtrak Fares

Destination	From Charleston	From Huntington
Chicago, IL	$70	$64
Cincinnati, OH	$30	$23
Miami, FL	$149	$156
New York, NY	$117	$117
Seattle, WA	$188	$182
Washington, DC	$71	$78

One-Way, Off-Peak, Coach Fares for travel on 11/01/00.

Commercial Bus Service is available from four study region origins – Charleston, Huntington, Parkersburg, and Ripley – to a variety of North American destinations. Sample fares are summarized in Table 6.5

Table 6.5
Sample One-Way Bus Fares

Destination	From Charleston	From Huntington
Chicago, IL	$74	$71
Cincinnati, OH	$57	$49
Miami, FL	$122	$122
New York, NY	$72	$72
Seattle, WA	$152	$152
Washington, DC	$53	$53

One-Way, Off-Peak, Fares for travel on 10/26/00.

7 SUMMARY AND RECOMMENDATIONS

7.1 MAJOR STUDY RECOMMENDATIONS

Phase II of the current study has attempted to quantify the magnitude of the transportation advantages and disadvantages faced by shippers and carriers within the 13 county study region. This process has revealed a number of potential avenues for capturing transportation efficiencies and, thereby, improving the competitive position of regional producers. Major recommendations and potential action items are summarized in Table 7.1

Table 7.1
Study Recommendations

Recommendation	Action Items
Further development of and adherence to a comprehensive, State-wide, multi-modal infrastructure priorities list.	• Estimate expenditures necessary to maintain current infrastructures. • Subject proposed infrastructure improvements to a formal benefit-cost analysis in order to determine priorities. • Assess potential impact of pass-through traffic growth on infrastructure needs. • Undertake only those transportation projects that can be funded without disrupting maintenance expenditures.
Development of an Intermodal Advisory Board (IAB) charged with addressing regional transportation issues.	• Identify State office that should be tasked with IAB development. • Develop preliminary governance structure and governmental interaction processes. • Identify and solicit potential IAB participants. These should be almost exclusively from the private shipper and carrier community.
Assess benefits and costs of State participation in projects to mitigate railroad clearance restrictions.	• Develop study design that effectively captures regional, State, and national project benefits. • Study design should also include an assessment of potential traffic diversions from existing intermodal facilities to a facility located within the study region. • Solicit railroad participation and contribution of cost information. • Subject railroad cost estimates to independent third-party review. • Based on study results, place project(s) within the priority list described above.

Table 7.1 (cont.)

Recommendation	Action Items
Develop a railroad consolidation response strategy.	• Review the ways that past railroad consolidations have affected the study region. • Explore further potential consolidation scenarios. • Identify which scenarios are most likely to help / harm study region shippers. • Identify appropriate State agency / office for regulatory / legal response to further proposed railroad industry mergers.
Embrace and actively support regional efforts to increase regional barge traffic.	• Support ARC Mid-Ohio basin marketing efforts through continued in-kind contributions. • Survey owners of active / inactive dock facilities to determine planned maintenance / usage. • If indicated, develop incentive structure to encourage the maintenance / modification of currently available dock facilities.
Continue to investigate the potential efficiency gains associated with a regional airport facility.	• Commission a thorough benefit-cost analysis that accurately weighs the potential benefits of improved passenger and airfreight transportation services against the cost of facility development. • Include within such a study reasonable estimates of enplanements under the currently observed fare structure and under fares that might be attainable at a new facility. • Carefully catalogue the methods through which regional airports elsewhere have effectively lowered fares, indicating which such efforts might enjoy success within the study region. • Explore methods of expanding airfreight capacity in the absence of demand growth.

7.1 CONTINUING CHALLENGES AND EMERGING OPPORTUNITIES

The recommendations detailed above treat many of the challenges identified during the study process. There are, however, issues for which no immediate policy prescription is available. In particular, the current analysis offers no suggestions regarding the numerous national issues faced by regional motor carriers or the detrimental effects of rugged terrain on transport costs to and from some study region counties. In the case of the national motor carrier issues, the study region’s interests would not seem to vary materially from those of the State or the nation as a whole. With regard to the rugged terrain, the study region counties and the State of West Virginia have worked together to gradually develop roadways that are less severe in grade and alignment than those observed historically. The cost of mitigating the effects of the mountainous terrain are staggering. Nonetheless, progress is being made.

It is important to realize, too, that other regions also face their own unique sets of transportation challenges. There are certainly other mountainous regions scattered throughout the United States. Many western states, while sometimes featuring less formidable terrain, generally lack a commercial navigation option. Moreover shippers and passengers wishing to access these states routinely face significantly longer transit distances that translate into higher costs. Many northern states must endure weather conditions that routinely lengthen transit times and threaten the dependability of both passenger and freight transport services.

It is also worth noting that the demand for transportation, the productivity of transportation equipment and infrastructure, and the practices of transportation providers continue to evolve at an ever-increasing pace. Electronic commerce and improved communications capabilities are significantly changing both the nature of the transportation services demanded and the ways in which providers can address shipper and passenger needs. Intelligent transportation systems (ITS) are emerging as a means of securing necessary new transportation capacity without devoting more physical space to network infrastructures. Ever-evolving regulatory regimes and the business practices they can engender hold the promise of increased competition that can, in turn, yield lower, more efficient prices and an even broader array of transportation options. All of these advances represent a new set of tools available to study region planners.

7.2 STUDY IMPLICATIONS FOR FUTURE WORK

From its inception, the current study has been intended as a testing ground from which a template for further regional investigations would emerge. Toward this end, we have learned a great deal. Some of the lessons stemming from the current work are organizational, while others are more directly linked to transportation.

First, the partnership between federal, State, and local community leaders has been extremely valuable and is, in fact, essential to the success of such efforts. In particular, the local and regional development authorities have proven to be a tremendous resource. Future efforts would also likely benefit if the guidance structure is broadened to include shippers and transportation providers.[40] From a temporal standpoint, the current study's division of time between data collection and analytical tasks was almost completely backwards. Future efforts should devote roughly twice the time for data collection that is allocated for analysis. Finally, the response rate of shippers and carriers to the study's survey was measurably better when potential respondents were already aware of the study

[40] Including shippers and carriers within the Steering Committee was suggested early in the current study. I rejected this idea because I feared their inclusion would bias the study process. I now feel, however, that this judgment was in error.

process. Consequently, future study efforts should include various processes for cultivating potential participants prior to of the survey.

These organizational lessons would likely be useful in almost any research setting that involves a large number of constituencies. However, the study process also yielded numerous lessons that are more specific to transportation. There were certainly technical achievements. For example, the study significantly improved our ability to allocate state-to-state commodity flows to the county level, based on other economic criteria. We also learned to reconcile flow data from disparate sources in order to verify outcomes.

There were more general transportation lessons too. First, there was an a priori expectation that most challenges and remedies would involve infrastructure. However, while the study did identify infrastructure issues, there were also numerous non-structural concerns involving both equipment and shipping practices. Identifying appropriate recommendations in response to this latter group of issues was particularly challenging. Finally, and perhaps most importantly, the current study underscored the value of considering multiple transport modes within a single analysis. The concept of intermodal transportation is very much in vogue. Nonetheless, policy-makers, practitioners, and researchers all too often cling to analytical methods that isolate individual modes. The current analysis suggests that to do so unnecessarily restricts the array of available options and opportunities.

Appendix A – Study Region Highway Service Levels

The current study's Phase I report included a capacity analysis for most transport modes. However, the material describing highway capacities did not formally measure component route Levels of Service (LOS). These calculations have now been completed for 781 route segments for Interstate, Expressway, Trunkline, and Feeder route segments within the 13 county study region. These calculations were based on methods outlined in the Transportation Research Board's Report 209, "Highway Capacity Manual." Necessary parameter estimates and methodologies are provided at the end of this Appendix. Disaggregated results are available upon request. Findings from these calculations are summarized in Table A.1.

Table A.1
Summary of Average Segment Level of Service
(Averages were weighted by segment length)

County	Rural / Urban	Interstate	Other Expressway	Trunkline	Feeder
Boone	(Rural)	----	A	D	E
	(Urban)	----	----	----	----
Cabell	(Rural)	D	C	E	D
	(Urban)	C	D	B	D
Clay	(Rural)	C	----	B	D
	(Urban)	----	----	----	----
Jackson	(Rural)	C	C	C	B
	(Urban)	----	----	----	----
Kanawha	(Rural)	D	B	D	D
	(Urban)	D	B	C	D
Lincoln	(Rural)	----	A	C	D
	(Urban)	----	----	----	----
Logan	(Rural)	----	B	D	E
	(Urban)	----	----	----	----
Mason	(Rural)	----	C	D	B
	(Urban)	----	----	----	----
Mingo	(Rural)	----	A	E	E
	(Urban)	----	----	----	----
Putnam	(Rural)	E	----	E	E
	(Urban)	D	----	D	E
Roane	(Rural)	B		C	B
	(Urban)	----	----	----	----
Wayne	(Rural)	C	----	D	C
	(Urban)	C	----	----	C
Wood	(Rural)	B	B	E	D
	(Urban)	B	E	----	D

Beginning with the Interstate route segments, Putnam is the only county where route segments averaged an LOS of “E” or worse.[1] Individual records indicate this is likely attributable to high traffic volumes along I-64 between Teays Valley and the Putnam / Kanawha County line. This area is certainly well known to State and regional planners and is already receiving attention. With regard to other Expressway segments the only identifiable problems appear to be in Wood County where, again, some sections of US 50 are estimated to have “E” and “F” service levels. However, the completion of Appalachian Development Highway System Corridor D (US 50) in the Parkersburg area should alleviate most of these problems.

Four of the 13 study region counties had Trunkline route segments where the weighted average LOS was “E”. In every case, problems appear to be in rural locations. In Cabell County, the only identifiable problem is WV 10 south of I-64. Problems in Mingo County are confined to US 52. In Putnam County, the most serious capacity problems appear to be along a roughly 10-mile segment of US 35. Again, many of these problem are already being addressed. Finally, in Wood County insufficient Trunkline route capacity appears to be limited to a section of WV 14 that is approximately five miles in length.

As with Trunkline segments, four study region counties had Feeder route segments where the weighted average LOS was “E”. These include Boone, Logan, Mingo, and Putnam Counties. In the case of Boone County, the worst Feeder route problems appear to be along WV 3, where estimated service levels are generally either “E” or “F”. There are, however, also limited segments of WV 85 that also exhibit service levels of “E”. Similarly, within Logan County, the most extensive capacity constraints appear to be along a relatively long portion of WV 44. However, a roughly 6.5 mile segment of WV 10 also has a LOS rating of “E”. Finally, in Wood County, Feeder route capacity constraints appear to be more widespread, with problems observed along segments of WV 14, WV 47, WV 68, WV 95, and WV 892.

Parameters and Methods

The following pages contain worksheets summarizing parameters and methods used within the LOS calculations.

[1] Very often Service Levels of “D” or worse are considered problematic. However, given the more general methods that were applied within the current analysis, only Service Levels of “E” or “F” are treated as remarkable.

4 and 6 Lane Freeway Worksheet - Interstates

Assumptions for Rural Traffic

Design Speed	K Factor	Dir Split
70 MPH	15%	60/40

Peak HR Traffic=ADT* 15%*60%

Assumptions for Urban Traffic

Design Speed	K Factor	Dir Split
60 MPH	10%	55/45

Peak HR Traffic=ADT * 10% * 55%

Heavy Vehicle Factor Based on Terrain and Percent Trucks

Level	1 TRK=1.5 PCE's
Rolling	1 TRK=3.0 PCE's
Mountainous	1TRK=6.0 PCE's

FHV= 1/(1+%TRUCKS(PCE-1)

Maximum Service Flow
MSF=PEAK HOUR TRAFFIC / (NUMBER OF LANES IN DIRECTION X FHV)

RURAL CONDITONS

	MSF RANGE	LEVEL OF SERVICE
4 LANE	0-700	A
	701-1120	B
	1121-1644	C
	1645-2015	D
	2016-2200	E
	>2200	F

	MSF RANGE	LEVEL OF SERVICE
6 LANE	0-700	A
	701-1120	B
	1121-1644	C
	1645-2015	D
	2016-2300	E
	>2300	F

URBAN CONDITIONS

	MSF RANGE	LEVEL OF SERVICE
4 LANE	0-600	A
	601-960	B
	961-1440	C
	1441-1824	D
	1825-2200	E
	>2200	F

	MSF RANGE	LEVEL OF SERVICE
6 LANE	0-600	A
	601-960	B
	961-1440	C
	1441-1824	D
	1825-2300	E
	>2300	F

Multi-Lane Highways (Expressways) - Non-Interstate

ASSUMPTIONS FOR RURAL TRAFFIC

FREE FLOW SPEED	K FACTOR	DIR SPLIT
62 MPH	15%	60/40

PEAK HR TRAFFIC=ADT * 15% * 60%

ASSUMPTIONS FOR URBAN TRAFFIC

FREE FLOW SPEED	K FACTOR	DIR SPLIT
52 MPH	10%	55/45

PEAK HR TRAFFIC=ADT * 10% * 55%

HEAVY VEHICLE FACTOR BASED ON TERRAIN AND PERCENT TRUCKS

LEVEL	1 TRK=1.5 PCE's
ROLLING	1 TRK=3.0 PCE's
MOUNTANOUS	1 TRK=6.0 PCE's

FHV= 1 / (1+ %TRUCKS (PCE-1)

MAXIMUM SERVICE FLOW

MSF=PEAK HOUR TRAFFIC / (NUMBER OF LANES IN DIRECTION X FHV)

RURAL CONDITIONS

	MSF RANGE	LEVEL OF SERVICE
4 OR 6	0-750	A
	751-1270	B
	1271-1680	C
	1681-2050	D
LANES	2051-2200	E
	>2200	F

URBAN CONDITONS

	MSF RANGE	LEVEL OF SERVICE
4 0R 6	0-630	A
	631-1050	B
	1051-1450	C
	1451-1730	D
LANES	1731-2040	E
	>2040	F

Multi-Lane Highways (Non-Interstate) - Trunklines and Feeder Routes

ASSUMPTIONS FOR RURAL TRAFFIC

FREE FLOW SPEEED	K FACTOR	DIR SPLIT
52 MPH	15%	60/40

PEAK HR TRAFFIC=
ADT * 15% * 60%

ASSUPTIONS FOR URBAN TRAFFIC

FREE FLOW SPEED	K FACTOR	DIR SPLIT
42 MPH	10%	55/45

PEAK HR TRAFFIC=
ADT * 10% * 55%

HEAVY VEHICLE FACTOR BASED ON TERRAIN AND PERCENT TRUCKS

LEVEL 1TRK=1.5 PCE's
ROLLING 1TRK=3.0 PCE's
MOUNTAINOUS 1 TRK=6.0 PCE's

FHV=1 / (1+ %TRUCKS (PCE-1)

MAXIMUM SERVICE FLOW

MSF=PEAK HOUR TRAFFIC / (NUMBER OF LANES IN DIRECTION X FHV)

RURAL CONDITIONS

	MSF RANGE	LEVEL OF SERVICE		MSF RANGE	LEVEL OF SERVICE
	0-630	A		0-700	A
	631-1050	B		701-1120	B
4 LANE	1051-1450	C	6 LANE	1121-1644	C
	1451-1730	D		1645-2015	D
	1731-2040	E		2016-2300	E
	>2040	F		>2300	F

URBAN CONDITIONS

	MSF RANGE	LEVEL OF SERVICE		MSF RANGE	LEVEL OF SERVICE
	0-500	A		0-600	A
	501-860	B		601-960	B
4 LANE	861-1150	C	6 LANE	961-1440	C
	1151-1450	D		1441-1824	D
	1451-1800	E		1825-2300	E
	>1800	F		>2300	F

ASSUMPTIONS FOR RURAL TWO LANE EXPRESSWAY AND TRUNKLINE ROUTES

K = .15,>6' SHLDRS, 60/40 SPLIT, %NO PASSING (LEVEL=40 ROLL=60, MOUNT=80)

				MAXIMUN ADT FOR LEVEL OF SERVICE					
		LANE WIDTH	% TRUCKS	A	B	C	D	E	F
RURAL	LEVEL	12	2	1548	3613	6192	10322	17203	>17203
			7	1476	3444	5904	9839	16399	>16399
			12	1410	3290	5640	9400	15667	>15667
			15	1373	3204	5493	9155	15258	>15258
		11	2	1440	3360	5759	9599	16171	>16170
			7	1373	3203	5491	9150	15415	>15414
			12	1311	3060	5245	8742	14727	>14726
			15	1277	2980	5108	8514	14343	>14343
		10	2	1302	3039	5207	8681	14972	>14966
			7	1241	2896	4965	8275	14272	>14266
			12	1186	2767	4743	7905	13635	>13630
			15	1155	2695	4620	7690	13279	>13274
				MAXIMUN ADT FOR LEVEL OF SERVICE					
		LANE WIDTH	% TRUCKS	A	B	C	D	E	F
	ROLLING	12	2	828	2762	5199	7799	14785	>14785
			7	725	2331	4387	6581	12476	>12476
			12	645	2015	3794	5691	10789	>10789
			15	605	1864	3509	5264	9980	>9980
		11	2	770	2569	4835	7253	13898	>13898
			7	675	2167	4080	6120	11727	>11727
			12	600	1874	3528	5293	10141	>10141
			15	563	1734	3264	4896	9381	>9381
		10	2	696	2320	4367	6551	12863	>12863
			7	609	1958	3685	5528	10854	>10854
			12	542	1693	3187	4780	9386	>9386
			15	508	1566	2948	4422	8682	>8682
				MAXIMUN ADT FOR LEVEL OF SERVICE					
		LANE WIDTH	% TRUCKS	A	B	C	D	E	F
	MOUNTAINOUS	12	2	313	1784	2974	5322	11506	>11506
			7	247	1349	2250	3667	7928	>7928
			12	204	1012	1687	2799	6051	>6051
			15	185	896	1493	2450	5297	>5297
		11	2	291	1659	2766	4949	10816	>10816
			7	230	1255	2092	3410	7452	>7452
			12	189	941	1569	2603	5688	>5688
			15	172	833	1388	2279	4980	>4980
		10	2	263	1499	2498	4470	10010	>10010
			7	207	1134	1890	3080	6897	>6897
			12	171	850	1417	2351	5264	>5264
			15	155	752	1254	2058	4609	>4609

ASSUMPTIONS FOR URBAN TWO LANE EXPRESSWAY AND TRUNKLINE ROUTES

K=.10,>6' SHOULDERS 50/50 SPLIT, %NO PASSING (LEVEL=40, ROLL=60, MOUNT=80)

				MAXIMUM ADT FOR LEVEL OF SERVICE					
		LANE WIDTH	% TRUCKS	A	B	C	D	E	F
URBAN	LEVEL	12	2	2470	5765	9881	16741	27542	>E
			7	2355	5496	9421	15701	26169	>E
			12	2250	5250	9000	15000	25001	>E
			15	2191	5113	8765	14609	24348	>E
		11	2	2297	5362	9189	15318	25805	>E
			7	2190	5111	8762	14601	24599	>E
			12	2093	4883	8370	13950	23501	>E
			15	2038	4755	8152	13586	22887	>E
		10	2	2077	4849	8310	13852	23891	>E
			7	1981	4622	7923	13204	22775	>E
			12	1892	4415	7569	12615	21758	>E
			15	1843	4300	7372	12272	21190	>E

				MAXIMUM ADT FOR LEVEL OF SERVICE					
		LANE WIDTH	% TRUCKS	A	B	C	D	E	F
URBAN	ROLLING	12	2	1321	4407	8296	12445	23593	>E
			7	1157	3719	7000	10501	19908	>E
			12	1030	3216	6054	9081	17216	>E
			15	966	2975	5600	8401	15925	>E
		11	2	1229	4099	7716	11574	22178	>E
			7	1076	3459	6510	9766	18713	>E
			12	958	2991	5630	8446	16183	>E
			15	898	2767	5208	7812	14970	>E
		10	2	1110	3702	6969	10454	20526	>E
			7	972	3124	5880	8821	17320	>E
			12	865	2702	5085	7628	14978	>E
			15	811	2499	4704	7056	13855	>E

				MAXIMUM ADT FOR LEVEL OF SERVICE					
		LANE WIDTH	% TRUCKS	A	B	C	D	E	F
URBAN	MOUNTAINOUS	12	2	499	2847	4746	8493	18361	>E
			7	394	2153	3590	5851	12650	>E
			12	325	1615	2692	4466	9656	>E
			15	294	1429	2382	3910	8453	>E
		11	2	465	2648	4414	7898	17259	>E
			7	366	2003	3338	5442	11891	>E
			12	302	1502	2504	4154	9077	>E
			15	274	1329	2216	3636	7946	>E
		10	2	420	2391	3986	7134	15974	>E
			7	331	1809	3015	4915	11006	>E
			12	273	1357	2261	3752	8401	>E
			15	247	1200	2001	3284	7354	>E

ASSUMPTIONS FOR URBAN TWO LANE FEEDER ROUTES

K=.10, 2' SHLDRS, 50/50 SPLIT, %NO PASSING (LEVEL=40, ROLL=60, MOUNT=80)

				MAXIMUM ADT FOR LEVEL OF SERVICE					
		LANE WIDTH	% TRUCKS	A	B	C	D	E	F
URBAN	LEVEL	12	2	2001	4670	8003	13342	25530	>E
			7	1908	4452	7631	12717	24337	>E
			12	1823	4253	7290	12150	23250	>E
			15	1775	4141	7100	11833	22644	>E
		11	2	1852	4322	7406	12347	24153	>E
			7	1766	4120	7062	11769	23024	>E
			12	1687	3935	6746	11244	21996	>E
			15	1642	3832	6570	10951	21422	>E
		10	2	1681	3923	6723	11207	22243	>E
			7	1602	3739	6410	10682	21203	>E
			12	1531	3572	6123	10206	20257	>E
			15	1491	3479	5964	9928	19728	>E

				MAXIMUM ADT FOR LEVEL OF SERVICE					
		LANE WIDTH	% TRUCKS	A	B	C	D	E	F
URBAN	ROLLING	12	2	1070	3570	6720	10081	21942	>E
			7	938	3012	5670	8506	18514	>E
			12	834	2605	4904	7356	16011	>E
			15	782	2410	4536	6804	14811	>E
		11	2	990	3304	6219	9329	20537	>E
			7	868	2788	5247	7872	17329	>E
			12	772	2411	4538	6807	14986	>E
			15	724	2230	4198	6297	13863	>E
		10	2	898	2995	5638	8457	19110	>E
			7	787	2527	4757	7136	16125	>E
			12	700	2186	4114	6171	13944	>E
			15	656	2022	3806	5709	12899	>E

				MAXIMUM ADT FOR LEVEL OF SERVICE					
		LANE WIDTH	% TRUCKS	A	B	C	D	E	F
URBAN	MOUNTAINOUS	12	2	405	2306	3844	6879	17075	>E
			7	319	1744	2908	4740	11765	>E
			12	263	1308	2181	3618	8980	>E
			15	238	1158	1930	3167	7862	>E
		11	2	374	2134	3557	6366	16156	>E
			7	295	1614	2691	4386	11132	>E
			12	244	1211	2018	3348	8497	>E
			15	221	1071	1786	2931	7438	>E
		10	2	340	1936	3227	5775	14872	>E
			7	268	1464	2441	3979	10247	>E
			12	221	1098	1831	3037	7821	>E
			15	200	972	1620	2659	6847	>E

ASSUMPTIONS FOR RURAL TWO LANE FEEDER ROUTES

K=.15, 2' SHLDRS, 60/40 SPLIT, %NO PASSING (LEVEL=40, ROLL=60, MOUNT=80)

				MAXIMUM ADT FOR LEVEL OF SERVICE					
		LANE WIDTH	% TRUCKS	A	B	C	D	E	F
RURAL	LEVEL	12	2	1254	2927	5016	8361	15999	>E
			7	1196	2790	4782	7970	15251	>E
			12	1142	2665	4568	7614	14570	>E
			15	1112	2595	4449	7416	14190	>E
		11	2	1160	2708	4641	7737	15136	>E
			7	1106	2582	4426	7375	14428	>E
			12	1057	2466	4228	7046	13784	>E
			15	1029	2402	4117	6862	13425	>E
		10	2	1053	2458	4213	7023	13939	>E
			7	1004	2343	4017	6694	13287	>E
			12	959	2238	3837	6395	12694	>E
			15	934	2180	3737	6221	12363	>E

				MAXIMUM ADT FOR LEVEL OF SERVICE					
		LANE WIDTH	% TRUCKS	A	B	C	D	E	F
RURAL	ROLLING	12	2	671	2237	4211	6317	13750	>E
			7	588	1888	3553	5330	11602	>E
			12	523	1632	3073	4610	10033	>E
			15	490	1510	2843	4264	9281	>E
		11	2	621	2070	3897	5846	12870	>E
			7	544	1747	3288	4933	10860	>E
			12	484	1511	2844	4266	9391	>E
			15	454	1397	2631	3946	8687	>E
		10	2	563	1877	3533	5300	11975	>E
			7	493	1584	2981	4472	10105	>E
			12	439	1370	2578	3867	8738	>E
			15	411	1267	2385	3577	8083	>E

				MAXIMUM ADT FOR LEVEL OF SERVICE					
		LANE WIDTH	% TRUCKS	A	B	C	D	E	F
RURAL	MOUNTAINOUS	12	2	254	1445	2409	4311	10701	>E
			7	200	1093	1822	2970	7373	>E
			12	165	820	1367	2267	5627	>E
			15	149	725	1209	1985	4927	>E
		11	2	235	1337	2229	3989	10125	>E
			7	185	1011	1686	2749	6976	>E
			12	153	759	1265	2098	5324	>E
			15	138	671	1119	1837	4661	>E
		10	2	213	1213	2022	3619	9320	>E
			7	168	918	1530	2493	6421	>E
			12	139	688	1147	1903	4901	>E
			15	125	609	1015	1666	4291	>E