SECTION E
WEST VIRGINIA HIGHWAYS

As explained in the main Alliance Report, the specific highways determined to comprise the LATTS Strategic Highway System were identified using a series of criteria to help identify a network of highways which had the greatest significance regarding trade with Latin America. The 22,859-mile mainline LATTS Strategic Highway System shown in Exhibit E-1 is the result of this process.

About three percent of the mainline LATTS Strategic Highway System (710 miles) is located in West Virginia (Exhibit E-2). The West Virginia components[1] include the following:

- All of West Virginia's 545 miles of interstate highways, including:
  - I-64, an important east-west interstate, linking Louisville with Norfolk via Huntington, Charleston, and Richmond
  - I-68 from Morgantown east of I-79
  - I-77, connecting Ohio with Parkersburg, Charleston, Charlotte and Columbia, SC
  - I-79 linking Pennsylvania with Charleston
  - I-81, a major north-south interstate between east Tennessee and Pennsylvania
  - I-70, extending from Baltimore, MD to a connection with I-15 in Utah, and passing through Wheeling
  - I-470, extending from Wheeling across the Ohio River to a connection with I-70
- 165 miles of non-interstate National Highway System (NHS) facilities
  - U.S. 50 between I-77 @ Parkersburg to I-79 at Clarksburg (77 miles), part of Corridor 4 (Columbia, SC to Ohio and Pennsylvania). This highway is multi-laned with partial access control.
  - U.S. 119 from the Kentucky State Line to Charleston (87 miles), part of Corridor 23 (Evansville to Charleston). This is mostly a four-lane highway with partial access control.
- LATTS connectors linking a LATTS Strategic Highway with a LATTS airport or waterport were included in the Strategic Highway System. However, because of database differences, it was not possible to analyze LATTS connectors in the same manner and to the same level of detail as for mainline highways. LATTS connectors are discussed at the conclusion of Section E.

[1] Mileage, number of lanes, pavement condition and other data reported herein were taken from the HPMS Database, as discussed subsequently, and may differ from information in other databases.

Exhibit E-1
LATTS STRATEGIC HIGHWAY SYSTEM

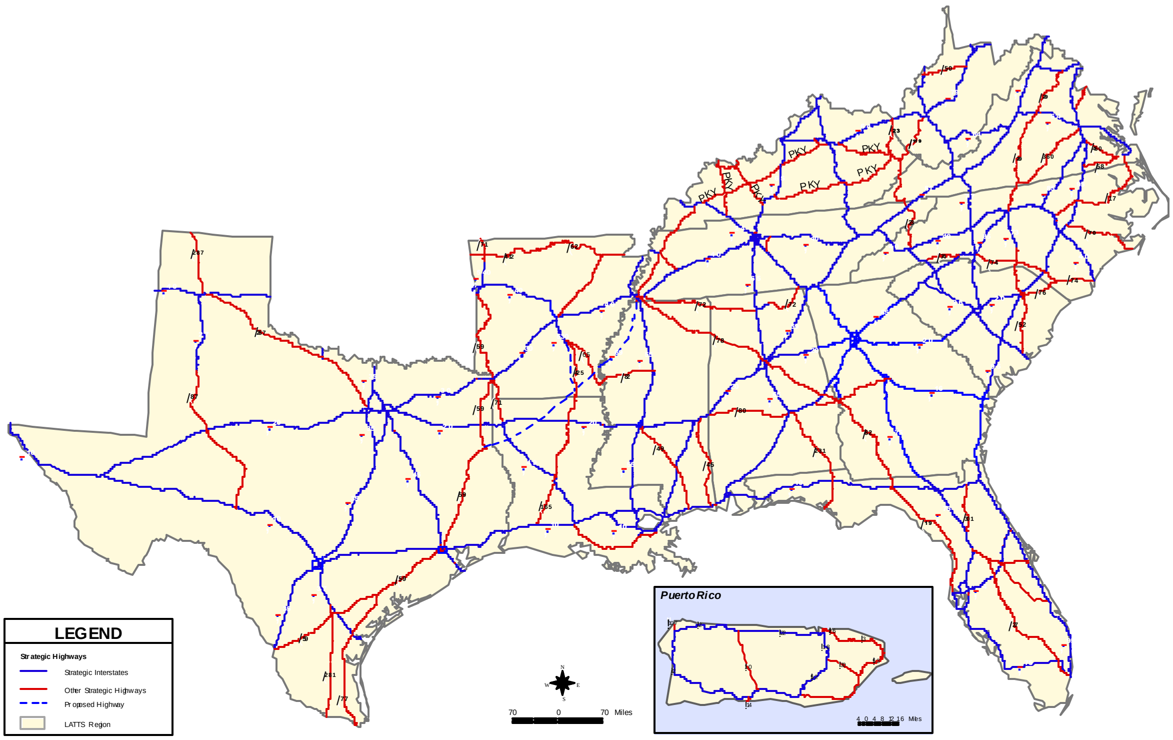
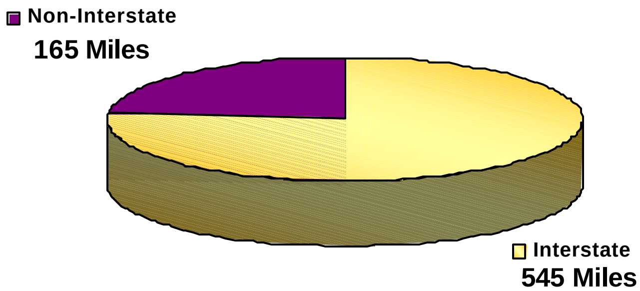


Exhibit E-2
WEST VIRGINIA LATTS HIGHWAY SYSTEM

Exhibit E-3 displays the composition of West Virginia's portion of the LATTS highways by system.

Exhibit E-3
LATTS MAINLINE STRATEGIC HIGHWAY SYSTEM – WEST VIRGINIA PORTION



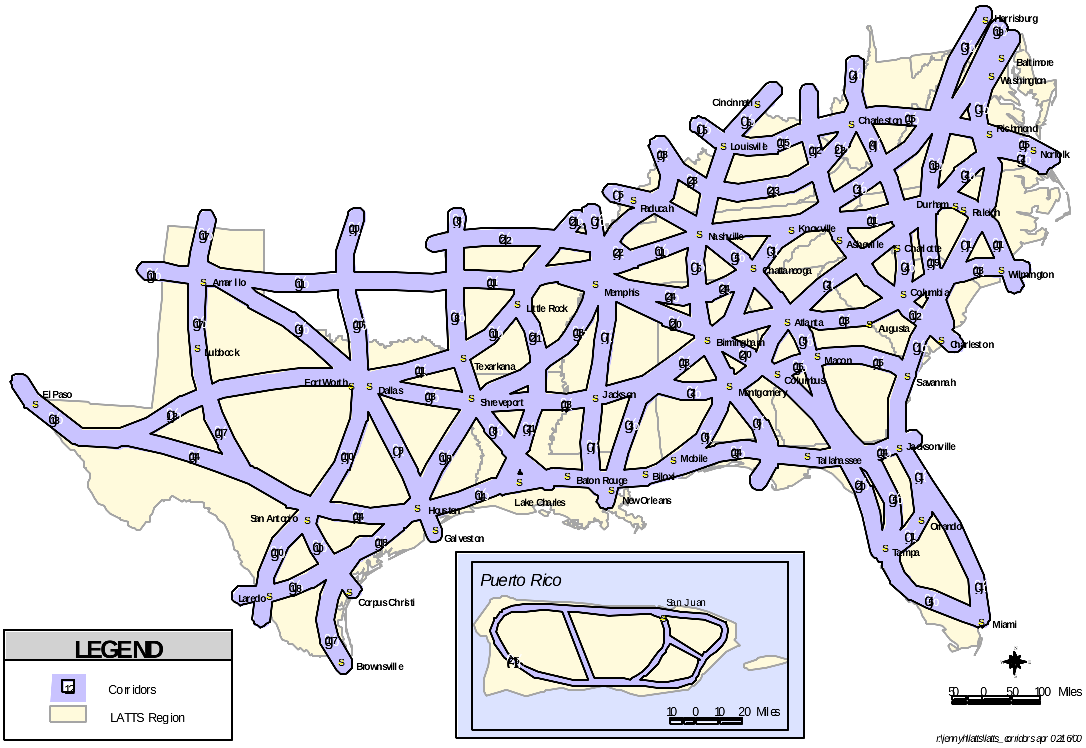
710 Miles Total **Excludes LATTS Connectors**

LATTS HIGHWAYS VS. LATTS TRADE CORRIDORS

The 22,859 miles of "mainline" LATTS Strategic Highways were grouped into 25 LATTS Trade Corridors (Exhibit E-4). The Trade Corridors were established using logical origins/destinations and assigning each highway to only one corridor. Each corridor was assigned a number (1-25) and was referred to by the primary highway within the corridor (i.e., I-40). Portions of four LATTS Trade Corridors cross West Virginia, including:

- Corridor 3 (I-59/66/81) – New Orleans to Washington, D.C. and Pennsylvania
- Corridor 4 (I-77/79) – Columbia, SC to Ohio and Pennsylvania
- Corridor 15 (I-64) – Louisville to Norfolk
- Corridor 23 (U.S. 119, Kentucky Parkways) – Evansville to Charleston, WVA

Exhibit E-4
LATTS TRADE CORRIDORS



HIGHWAY DATABASES

Two main sources of data were used for the analysis of highway investment. The first one, the Highway Performance Monitoring System (HPMS), includes information about the characteristics and conditions of public highways. The second source of data was the LATTS estimates of current and forecasts of future Latin America trade flows.

HPMS Database

The HPMS database was selected for the LATTS analyses of highway system investment needs because (1) it covered the entire Alliance Region, (2) it employs a consistent format and data definitions and (3) no additional primary data collection was necessary. Nevertheless, it was recognized that (1) the data is time sensitive (i.e., since the latest available information at the time of these analyses was for 1997, it is expected that improvements and additions will have occurred subsequently) (2) the HPMS database may have minor differences relative to other databases that individual Alliance members might use for their own planning and system management purposes and (3) information is not always available for every segment of the LATTS Strategic Highway System.

For this study, only that portion of the HPMS database corresponding to the selected LATTS Strategic Highway Network was utilized. For West Virginia, the LATTS HPMS database consisted of 582 records describing 698 miles of highway on the LATTS Strategic Highway Network.

Trade Flows

As explained in the main Alliance report, 1996 and expected 2020 trade volumes with Latin America were estimated and the portion of this trade that would be using highway facilities was translated into truck flows. The truck flows were then assigned to specific highway facilities using GIS generated shortest time paths. The LATTS truck traffic assignment was then merged with the LATTS HPMS database for further analysis.

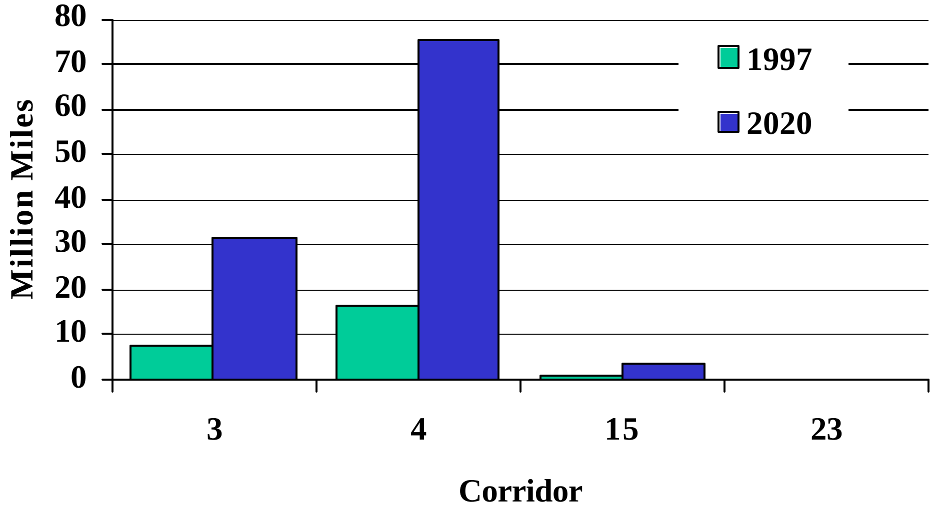
The LATTS procedure for assigning truck flows is appropriate for a macro-scale study such as LATTS. Nevertheless, it should be noted that the procedure produces approximations which may vary slightly from actual conditions. That is, an all-or-nothing assignment on the basis of shortest time paths favors high speed facilities and likely under estimates flows on facilities with lower speeds. In reality, a modest amount of truck flows could choose a lower speed path for a variety of unique reasons. Also, some LATTS trucks undoubtedly will travel on facilities other than those included in the LATTS Strategic Highway System (e.g., a local road to reach a warehouse or plant). Despite these circumstances, the LATTS procedure is deemed to be sufficiently valid for purposes of a regional transportation study.

As a result of this assignment methodology, 539 miles of the Strategic Highway Network in West Virginia were shown to carry LATTS truck traffic. All 539 miles are interstate highways.

LATTS TRUCK TRAFFIC IN WEST VIRGINIA

The LATTS highway database was used to quantify the LATTS truck traffic in terms of annual Vehicle Miles of Travel (VMT) and to compare LATTS truck traffic to total truck traffic (LATTS and others). Results of this analysis by corridor for 1997 and 2020 are illustrated in Exhibit E-5. More detailed information is presented in Exhibit E-6.

Exhibit E-5
LATTS ANNUAL TRUCK VMT IN WEST VIRGINIA



Based on study procedures, of the four LATTS corridors crossing West Virginia, only three were assigned LATTS truck traffic. Corridor 23 (Kentucky Parkways/U.S.1 from Evansville, IN to Charleston, WV) was not assigned any LATTS traffic in any Alliance member. It is comprised mostly of U.S. Routes as opposed to interstates.

Exhibit E-6
WEST VIRGINIA LATTS TRUCK TRAFFIC

Corridor/ Functional Class	Length (Miles)	1997 Annual Truck VMT (Million Miles) All Trucks Full Network	All Trucks Part. Network(1)	LATTS Trucks Only	LATTS Percent (2)	2020 Annual Truck VMT (Million Miles) All Trucks Full Network	All Trucks Part. Network(1)	LATTS Trucks Only	LATTS Percent (2)
3	I-59, I-81, I-66		New Orleans, LA to DC and Pennsylvania						
R.Interstate	25.09	78.54	78.54	7.20	9.2%	190.31	190.31	30.35	15.9%
U.Interstate	0.91	3.52	3.52	0.26	7.4%	7.94	7.94	1.10	13.9%
TOTAL	26.00	82.07	82.07	7.46	9.1%	198.25	198.25	31.46	15.9%
4	I-77, I-79		Columbia, SC to Ohio and Pennsylvania						
R.Interstate	343.26	536.35	536.35	14.10	2.6%	1,136.64	1,136.64	64.99	5.7%
R.Other PA	65.63	24.77	-	-	0.0%	42.91	-	-	0.0%
U.Interstate	50.98	149.67	129.17	2.33	1.8%	290.74	255.50	10.57	4.1%
U.Other PA	11.59	10.83	-	-	0.0%	15.66	-	-	0.0%
TOTAL	471.46	721.63	665.53	16.43	2.5%	1,485.95	1,392.14	75.55	5.4%
15	I-64		Louisville, KY to Norfolk, VA						
R.Interstate	90.56	118.37	118.37	0.61	0.5%	237.35	237.35	2.25	0.9%
U.Interstate	34.31	123.91	123.91	0.28	0.2%	229.52	229.52	1.32	0.6%
TOTAL	124.87	242.27	242.27	0.89	0.4%	466.87	466.87	3.57	0.8%
23	KY Parkways, US 119		Evansville, IN to Charleston, WV						
R.Other PA	68.70	30.57	-	-	0.0%	56.81	-	-	0.0%
U.Other PA	6.60	7.20	-	-	0.0%	9.04	-	-	0.0%
TOTAL	75.30	37.77	-	-	0.0%	65.85	-	-	0.0%
ALL CORRIDORS									
R.Interstate	458.91	733.26	733.26	21.90	3.0%	1,564.30	1,564.30	97.59	6.2%
R.Other PA	134.33	55.34	-	-	0.0%	99.72	-	-	0.0%
U.Interstate	86.20	277.10	256.60	2.87	1.1%	528.20	492.96	12.99	2.6%
U.Other PA	18.19	18.04	-	-	0.0%	24.70	-	-	0.0%
TOTAL	697.63	1,083.74	989.86	24.77	2.5%	2,216.92	2,057.26	110.58	5.4%

Notes: (1) Total truck VMT for highways carrying LATTS traffic only.
(2) Percentage calculated based on Partial Network.

Corridor 4 (I-77/I-79 from Columbia, SC to Ohio and Pennsylvania) was assigned the most LATTS traffic in terms of VMT, 76 million miles in 2020. However, the highest volume of LATTS trucks is found on Corridor 3 (I-59/I-81/I-66 from New Orleans, LA to Washington D.C. and Pennsylvania) with a 2020 average annual daily LATTS truck volume of 3,315.

Of LATTS truck traffic in West Virginia 88 percent travels on the rural interstate system and the rest on the urban interstate system.

The percentage of LATTS trucks to total trucks is expected to grow from 2.5 percent in 1997 to 5.4 percent in 2020 on those highways carrying LATTS traffic (from 2.3 to 5 percent for the entire LATTS strategic network). This growth in LATTS share of total truck traffic is due to the fact that LATTS truck traffic is expected to increase 4.5 fold between 1997 and 2020 while overall truck traffic would increase by 2 fold only without LATTS trucks. LATTS truck share of total trucks varies from corridor to corridor. The highest shares in West Virginia are 16 percent on Corridor 3 (I-59/I-81/I-66 from New Orleans, LA to Washington D.C. and Pennsylvania) and 5 percent on Corridor 4 (I-77/I-79 from Columbia, SC to Ohio and Pennsylvania).

IMPACT MEASURES

The purpose of the highway analysis portion of this study was to quantify the LATTS Strategic Network total investment needs and the incremental investment needs that could be attributed to LATTS truck traffic specifically. Because of the macro-scale nature of this study, the investment needs analysis focused on capacity and pavement resurfacing needs.

In order to identify needs due to expected traffic (cars and trucks) other than LATTS and needs specifically attributable to LATTS traffic, two sets of capacity and pavement needs were estimated. First, future needs were estimated based on the "normal" traffic as defined by the HPMS database which includes AADT, truck percentages, and growth rate. Future needs were estimated a second time with the same HPMS traffic plus the "additional" LATTS truck traffic above and beyond the traffic that would be estimated using the "normal" growth. The difference in needs between the two was considered the incremental needs due to growth in LATTS traffic.

Minimum tolerable conditions (MTCs) for both congestion (capacity) and pavement conditions were applied uniformly to all segments of the LATTS Strategic Highway System. These MTCs are described in more detail in the main Alliance report and are summarized below.

- Capacity needs were based on Level of Service (LOS) not exceeding:
  - LOC C for rural highways
  - LOS D for urban highways
- Pavement resurfacing needs were based on the following minimum pavement condition rating:
  - Interstate type facilities: PSR 3.0
  - Other facilities: PSR 2.5

The LATTS minimum tolerable conditions are in no way intended to replicate or replace values that individual members of the Alliance might consider to be more appropriate for their circumstances. The LATTS MTCs were established for this study so as to be consistent for all the Alliance members.

To price the identified capacity or pavement needs, the same unit costs were used consistently throughout the Alliance Region. These unit costs were provided by the FHWA and correspond to 1997 national averages. To maintain consistency throughout the Region, no attempt was made to tailor these unit costs to each state beyond the stratification provided by the FHWA.

CAPACITY NEEDS

A needs analysis model was developed to analyze capacity needs for 1997 and 2020. For the year 2020, capacity needs with and without the "additional" LATTS traffic were estimated. The model was then applied to every one of the HPMS records comprising the West Virginia LATTS highway database and the results were summarized. This model applied the same methodology, outlined in the main Alliance report, and found in the HPMS Analytical Package, to calculate capacity needs. The results reflect the information contained in the HPMS Database and do not consider any improvements that may have occurred subsequently or any planned improvements.

Detailed results for West Virginia are presented in Exhibit E-7. The total number of West Virginia LATTS Strategic Highway Network road miles with capacity deficiencies in 1997 and 2020 are shown in columns 4 through 6. For 2020, the amount of capacity deficiencies with and without the "additional" LATTS traffic is shown.

Exhibit E-7
WEST VIRGINIA CAPACITY INVESTMENT NEEDS

Corridor/ Functional Class	Length (Miles)	Existing Lane Miles	Capacity Analysis							
			Deficient Mileage			2020 Needed Lane Miles		2020 Cost in $Million		
			1997	2020 W/O LATTS Added Traffic	2020 With LATTS Added Traffic	Base	With LATTS Added Traffic	Base	With LATTS Added Traffic	% Increase Due to LATTS
3	**I-59, I-81, I-66**		**New Orleans, LA to DC and Pennsylvania**							
R.Interstate	25.09	100.36	-	25.09	25.09	50.18	50.18	56	56	0.0%
U.Interstate	0.91	3.64	-	0.91	0.91	1.82	1.82	6	6	0.0%
TOTAL	26.00	104.00	-	26.00	26.00	52.00	52.00	63	63	0.0%
4	**I-77, I-79**		**Columbia, SC to Ohio and Pennsylvania**							
R.Interstate	343.26	1,380.25	-	128.14	136.01	252.74	268.48	377	400	6.2%
R.Other PA	65.63	262.16	0.18	0.18	0.18	0.72	0.72	1	1	0.0%
U.Interstate	50.98	212.08	-	8.12	8.12	16.84	16.84	58	58	0.0%
U.Other PA	11.59	37.76	2.92	4.15	4.15	9.13	9.13	15	15	0.0%
TOTAL	471.46	1,892.25	3.10	140.59	148.46	279.43	295.17	451	474	5.1%
15	**I-64**		**Louisville, KY to Norfolk, VA**							
R.Interstate	90.56	382.81	-	12.15	16.99	24.30	33.98	28	39	38.6%
U.Interstate	34.31	146.94	-	14.52	14.52	32.20	32.20	112	112	0.0%
TOTAL	124.87	529.75	-	26.67	31.51	56.50	66.18	140	151	7.8%
23	**KY Parkways, US 11**		**Evansville, IN to Charleston, WV**							
R.Other PA	68.70	267.98	1.47	4.59	4.59	8.95	8.95	13	13	0.0%
U.Other PA	6.60	26.40	-	0.88	0.88	1.76	1.76	4	4	0.0%
TOTAL	75.30	294.38	1.47	5.47	5.47	10.71	10.71	17	17	0.0%
ALL CORRIDORS										
R.Interstate	458.91	1,863.42	-	165.38	178.09	327.22	352.64	461	495	7.4%
R.Other PA	134.33	530.14	1.65	4.77	4.77	9.67	9.67	14	14	0.0%
U.Interstate	86.20	362.66	-	23.55	23.55	50.86	50.86	177	177	0.0%
U.Other PA	18.19	64.16	2.92	5.03	5.03	10.89	10.89	19	19	0.0%
TOTAL	697.63	2,820.38	4.57	198.73	211.44	398.64	424.06	670	704	5.1%

These analyses indicate that only 5 of the LATTS roadway miles in West Virginia have existing capacity problems. The analyses also show that the majority of the capacity deficiencies will occur in the next 20 years unless capacity is added.

With the expected "normal" growth (as defined by the HPMS database), a total of 199 road miles or 28 percent of the LATTS network will have congestion problems by 2020. The "additional" LATTS trucks are expected to increase the total to 211 miles or 30 percent of total mileage as noted in Exhibit E-8. In other words, LATTS truck will increase congested miles of roadway and the number of needed lane miles by about 6.4 percent. These percentages are significant but they also indicate that the majority of the congestion problems in West Virginia are not due solely to LATTS traffic but expected overall growth in total traffic. However, unless these capacity needs are met, LATTS truck traffic will be affected by these capacity deficiencies regardless of the source of traffic. As congestion increases, LATTS trucks like other traffic, will experience lower operating speeds, frequent speed changes, lower reliability, and increased operating costs.

Exhibit E-8
WEST VIRGINIA 2020 CAPACITY NEEDS
LATTS Strategic Network

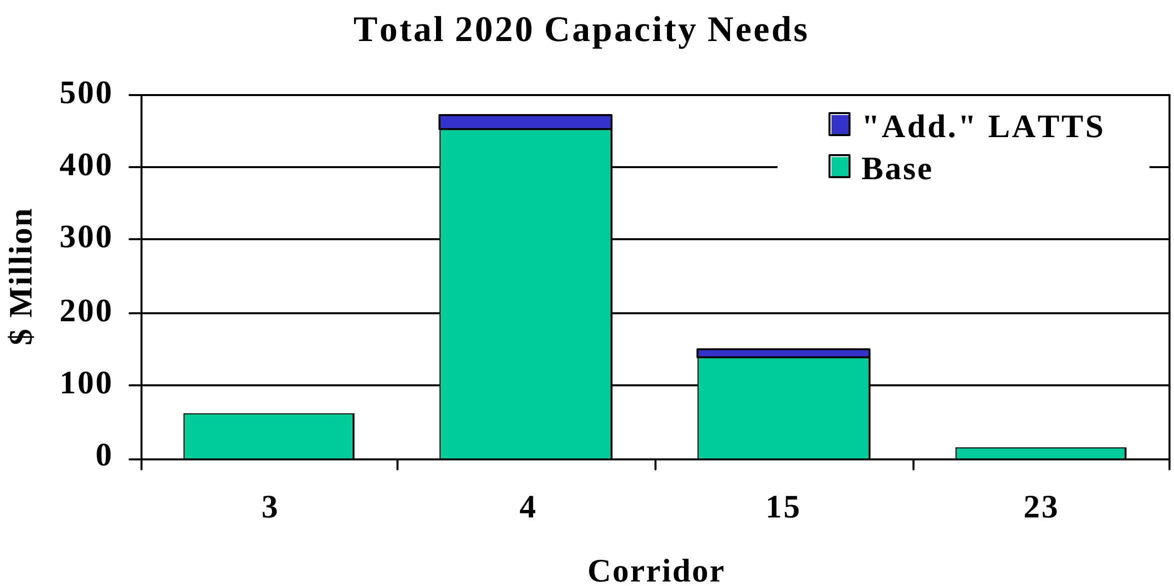
	Deficient Miles	% of Total Miles	Needs (Million)
"Normal" Growth	199	28%	$670
"Additional" LATTS Traffic	13	2%	$34
Total	211	30%	$704

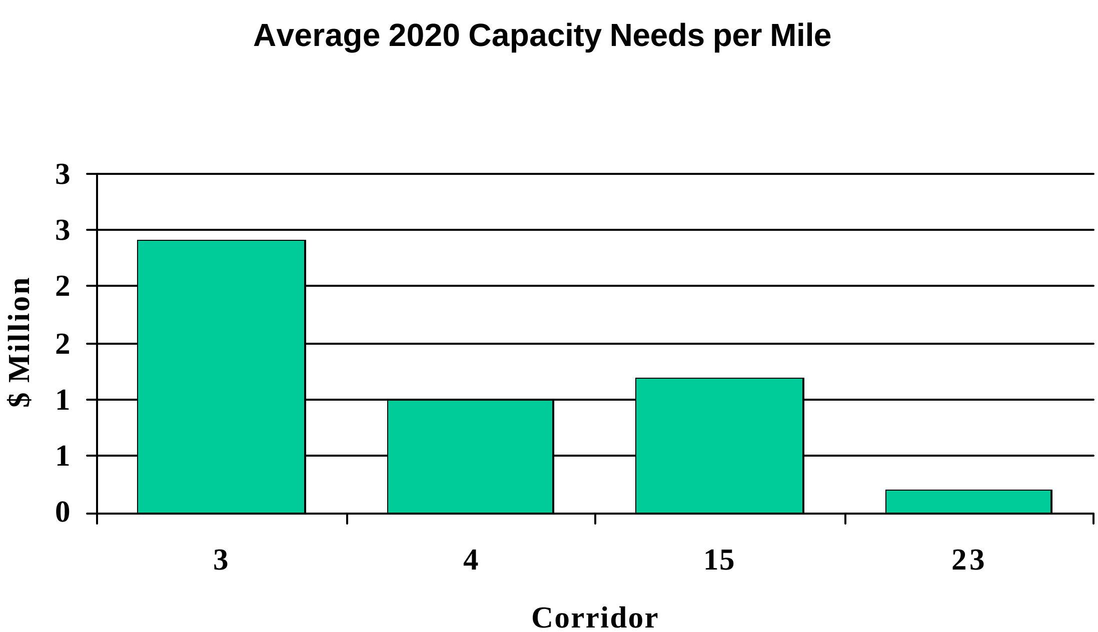
Based on the HPMS expected growth in traffic, nearly $670 million will be required in the next 20 years to address congestion problems on the West Virginia portion of the LATTS Strategic Network. The "additional" LATTS traffic will bring that total to $704 million, a 5 percent increase. The dollar increase in capacity needs due to LATTS traffic is lower than the corresponding increase in terms of needed lane miles because a majority of LATTS truck traffic occurs on rural highways which are less expensive to improve than urban highways.

Capacity needs by corridor are illustrated in Exhibit E-9. Total capacity needs by corridor are related to the total length of the corridor: the longer the corridor, the higher the needs. Corridor 4 (I-77/I-79 from Columbia, SC to Ohio and Pennsylvania), which is the longest in West Virginia, has the highest capacity needs ($474 million by 2020). However, in terms of average capacity needs by roadway mile, Corridor 3 (I-59/I-81/I-66 from New Orleans, LA to Washington D.C. and Pennsylvania) has proportionally higher capacity needs: $ 2.4 million per roadway mile versus $ 1.0 million average for the state. It should be noted that by 2020, 100 percent of Corridor 3 in West Virginia will require capacity improvements.

Corridor 4 (I-77/I-79 from Columbia, SC to Ohio and Pennsylvania) and Corridor 15 (I-64 from Louisville, KY to Norfolk, VA) will experience incremental capacity needs due to LATTS "additional" traffic, 5.1 percent, and 7.8 percent increase respectively.

Exhibit E-9
WEST VIRGINIA STRATEGIC HIGHWAY NETWORK
Capacity Needs by Corridor





PAVEMENT NEEDS

For purposes of this study, average annual pavement needs in 2020 were estimated. The number of years it would take for the pavement to deteriorate from new in 2020 to a deficient PSR rating (as defined by the minimum tolerable conditions presented earlier) was calculated for each highway segment. As an indicator of the existing condition of the network, pavement deficiencies were identified for 1997.

Pavements typically are designed to last for a fairly long time. However, as they age and are subjected to traffic loads, they deteriorate. The pavement life measure used in these analyses is dependent on the amount of traffic using the highway and, more specifically, truck traffic (car traffic is a factor in the pavement deterioration rate but it has far less impact). The type of pavement (for example high flexible versus high rigid) is also an important factor affecting pavement deterioration rates. The pavement type on each highway segment, as indicated by the 1997 HPMS database, was used in the estimation of the deterioration rates. The number of lanes indicated for 1997 was used in the calculation of pavement deterioration rate and resurfacing costs. No attempt was made to measure the impact on pavement needs of adding lanes to address the congestion problems identified earlier. Finally, the HPMS-AP methodology for deteriorating pavement was applied in this study. It is based on the concept of 18Kip Equivalent Single Axle Loads. Weather condition or type of subsoil can also influence pavement deterioration rates but, for this study, no other factors beyond traffic and pavement type were used to differentiate pavement deterioration rates between sections.

Each highway segment pavement life was calculated twice. An initial calculation was made using the "base" car and truck traffic from the West Virginia HPMS database. The second calculation was made with the "additional" LATTS traffic added to it. The difference in the two pavement lives is a measure of the impact of LATTS traffic.

Results of West Virginia pavement needs for the LATTS Strategic Highway Network are presented in Exhibit E-10. Based on the HPMS data, about 16 percent or 109 miles of the West Virginia overall LATTS Strategic Highway Network had existing (1997) pavement deficiencies. These pavement deficiencies are concentrated on the rural interstate system used by LATTS trucks with more than 20 percent of the rural interstate system having existing pavement deficiencies. Existing pavement deficiencies are most widespread on Corridor 4 (I-77/I-79) from Columbia, SC to Ohio and Pennsylvania) where 21 percent of this corridor length deficient.

Exhibit E-10
WEST VIRGINIA PAVEMENT RESURFACING INVESTMENT NEEDS

Corridor/ Functional Class	Length (Miles)	Existing Lane Miles	Pavement Analysis: 1997 Deficient Mileage	2020 Pavement Life (Years): W/O LATTS Added Traffic	2020 Pavement Life (Years): With LATTS Added Traffic	2020 Average Annual Cost ($1,000): W/O LATTS Added Traffic	2020 Average Annual Cost ($1,000): With LATTS Added Traffic	2020 Average Annual Cost ($1,000): % Increase Due to LATTS
3	**I-59, I-81, I-66**		**New Orleans, LA to DC and Pennsylvania**					
R.Interstate	25.09	100.36	0.07	4.3	3.9	2,494	2,728	9.4%
U.Interstate	0.91	3.64	-	3.6	3.5	206	207	0.5%
TOTAL	26.00	104.00	0.07	4.3	3.9	2,699	2,935	8.7%
4	**I-77, I-79**		**Columbia, SC to Ohio and Pennsylvania**					
R.Interstate	343.26	1,380.25	87.00	5.4	5.2	37,060	38,017	2.6%
R.Other PA	65.63	262.16	0.02	14.5	14.5	1,802	1,802	0.0%
U.Interstate	50.98	212.08	9.56	3.6	3.6	11,905	11,923	0.2%
U.Other PA	11.59	37.76	2.97	11.5	11.5	481	481	0.0%
TOTAL	471.46	1,892.25	99.55	6.6	6.4	51,248	52,223	1.9%
15	**I-64**		**Louisville, KY to Norfolk, VA**					
R.Interstate	90.56	382.81	6.58	8.4	8.4	6,537	6,540	0.0%
U.Interstate	34.31	146.94	2.94	3.7	3.7	8,214	8,214	0.0%
TOTAL	124.87	529.75	9.52	7.1	7.1	14,751	14,754	0.0%
23	**KY Parkways, US 119**		**Evansville, IN to Charleston, WV**					
R.Other PA	68.70	267.98	-	13.7	13.7	1,990	1,990	0.0%
U.Other PA	6.60	26.40	-	12.7	12.7	301	301	0.0%
TOTAL	75.30	294.38	-	13.6	13.6	2,291	2,291	0.0%
ALL CORRIDORS								
R.Interstate	458.91	1,863.42	93.65	5.9	5.8	46,091	47,285	2.6%
R.Other PA	134.33	530.14	0.02	14.1	14.1	3,792	3,792	0.0%
U.Interstate	86.20	362.66	12.50	3.6	3.6	20,325	20,344	0.1%
U.Other PA	18.19	64.16	2.97	12.0	12.0	782	782	0.0%
TOTAL	697.63	2,820.38	109.14	7.3	7.2	70,990	72,203	1.7%

One would expect that the corridors with the highest concentration of LATTS truck traffic would show the largest impact from LATTS. Exhibit E-10 confirms this expectation. Corridor 3 (I-59/I-81/I-66 from New Orleans, LA to Washington, D.C. and Pennsylvania) has the highest concentration of LATTS trucks in terms of daily traffic and the highest reduction in pavement life from 4.3 years to 3.9 years.

Total resurfacing costs are a function of the average pavement life and the length of the highways. Corridor 4 (I-77/I-79 from Columbia, SC to Ohio and Pennsylvania), the longest corridor in West Virginia, has the highest average annual resurfacing needs, $ 52 million with LATTS traffic. With the largest reduction in average pavement life due to LATTS, Corridor 3 (I-59/I-81/I-66 from New Orleans, LA to Washington, D.C. and Pennsylvania) has proportionally the largest incremental resurfacing needs due to LATTS trucks, $0.2 million annually or 8.7 percent.

Future (2020) pavement needs are summarized in Exhibit E-11. Pavement life for the West Virginia portion of the LATTS Strategic Highway Network will average 7.3 years in 2020 without the "additional" LATTS truck traffic and 7.2 years with it. The annual resurfacing costs for the West Virginia portion of the LATTS Strategic Highway Network is estimated to be about $71 million without LATTS "additional" truck traffic and $72 million with it, an increase which is less than two percent.

Exhibit E-11
WEST VIRGINIA 2020 PAVEMENT NEEDS
LATTS Strategic Network

	Pavement Life (Years)	Annual Resurfacing Cost ($Million)
"Normal" Growth	7.3	$71
With "Additional" LATTS Traffic	7.2	$72

OPERATING SPEEDS

Truck operating speed was chosen as a key study performance measure for the LATTS Strategic Highway Network. Truck operating speeds were estimated for each LATTS roadway segment based on the conditions of the roadway, including roadway geometry and alignment, pavement condition, speed limit and traffic volumes. The operating speed calculation for each sample segment or link was based on the methodology of the HPMS Analytical Package used by FHWA to estimate highway needs.

Two types of operating speeds were calculated. One was the average daily operating speed and the other was the peak hour operating speed as defined by the peak hour factor or "K" factor for each road segment. Because it is not known when a truck would travel over a specific highway section during the peak hour, the peak hour operating speed assumed that every section was traveled during peak hour. As a result, the calculated peak hour speed and travel time for an entire corridor is probably somewhat overstated, as it is unlikely that a truck would travel every section during peak hour conditions.

Truck operating speeds were calculated for each LATTS roadway section. Operating speeds over a combination of segments were then calculated by adding travel time and distance for each segment and calculating the new speed.

Truck operating speeds on the West Virginia portion of the LATTS Strategic Highway Network are presented on Exhibit E-12. In this exhibit, West Virginia truck operating speeds estimates are presented by functional class. The total lengths of all the segments, which were used in the analysis of the corridor, are listed first. This is followed by items describing the characteristics of the segments, including average number of lanes, speed limit, and AADT. The purpose of listing these items is to facilitate better understanding of the calculated operating speeds. For example, two/three-lane highways have lower operating speeds than equivalent four-lane highways because of passing difficulties. Similarly, low speed limits will result in low operating speeds on facilities no matter what the road conditions are.

Average daily and peak period speeds/travel times for trucks also are presented for the base year (1997). Further, truck operating speeds are listed twice for year 2020. The first time, truck operating speeds were calculated assuming the base growth rate, i.e. the growth rate indicated by the HPMS database. The second time, truck operating speeds were calculated with the LATTS "additional" traffic. Overall results for the entire corridor within West Virginia are then listed, as well as the overall time required to travel the entire corridor. By comparing these speed and travel time values (based on present conditions), it is possible to determine which facilities are most efficient today, which facilities are going to experience deteriorating conditions due to traffic growth regardless of LATTS impact, and finally which facilities are going to be most affected by LATTS traffic.

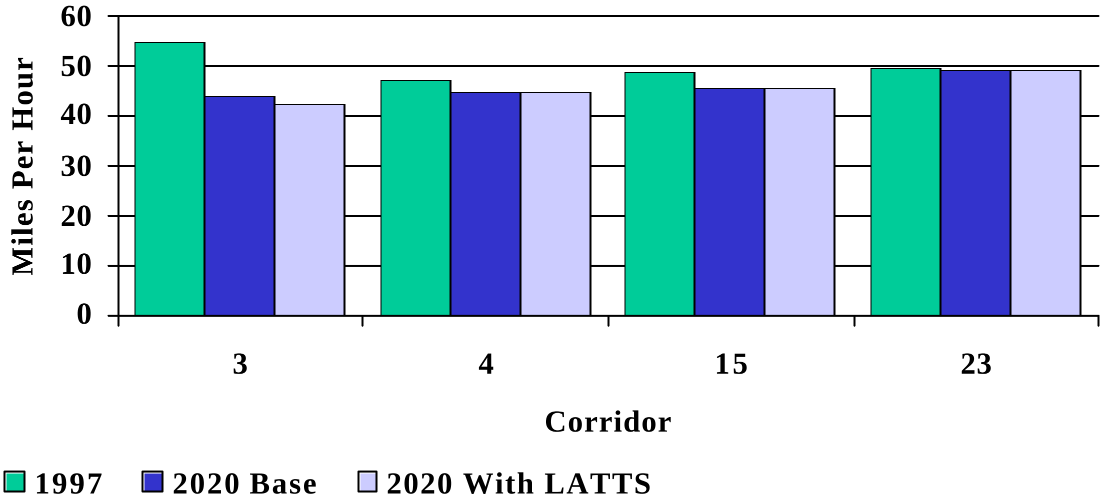
Exhibit E-12
WEST VIRGINIA TRUCK OPERATING SPEEDS

Corridor/ Functional Class	Length (Miles)	Average No. Lane	Speed Limit (MPH)	Average 1997 AADT	1997 Truck Speed (MPH) Daily Average	1997 Truck Speed (MPH) Peak Hour	2020 Truck Speed (MPH) W/O Added LATTS Traffic Daily Average	2020 Truck Speed (MPH) W/O Added LATTS Traffic Peak Hour	2020 Truck Speed (MPH) With Added LATTS Traffic Daily Average	2020 Truck Speed (MPH) With Added LATTS Traffic Peak Hour
3	**I-59, I-81, I-66**		**New Orleans, LA to DC and Pennsylvania**							
R.Interstate	25.10	4.0	70.0	40,841	54.6	50.5	43.9	26.3	42.5	26.3
U.Interstate	0.90	4.0	70.0	48,192	60.9	59.3	43.0	15.6	38.5	15.6
TOTAL	**26.00**	**4.0**	**70.0**	**41,098**	**54.8**	**50.8**	**43.9**	**25.7**	**42.3**	**25.7**
Time (HR)					**0.5**	**0.5**	**0.6**	**1.0**	**0.6**	**1.0**
4	**I-77, I-79**		**Columbia, SC to Ohio and Pennsylvania**							
R.Interstate	343.30	4.0	69.6	20,385	46.8	46.0	44.6	33.2	44.5	33.0
R.Other PA	65.60	4.0	64.9	8,043	53.9	53.7	53.8	53.5	53.8	53.5
U.Interstate	51.00	4.2	63.3	36,752	49.3	48.2	47.1	22.6	47.1	22.6
U.Other PA	11.60	3.3	43.4	23,278	26.0	22.0	23.6	21.2	23.6	21.2
TOTAL	**471.50**	**4.0**	**67.2**	**20,508**	**47.0**	**45.9**	**44.9**	**32.8**	**44.8**	**32.7**
Time (HR)					**10.0**	**10.3**	**10.5**	**14.4**	**10.5**	**14.4**
15	**I-64**		**Louisville, KY to Norfolk, VA**							
R.Interstate	90.60	4.2	69.4	17,075	47.6	47.2	47.1	39.4	47.1	39.4
U.Interstate	34.30	4.3	65.2	45,085	51.5	44.7	42.8	25.0	42.8	25.0
TOTAL	**124.90**	**4.2**	**68.2**	**24,771**	**48.6**	**46.5**	**45.8**	**34.0**	**45.8**	**34.0**
Time (HR)					**2.6**	**2.7**	**2.7**	**3.7**	**2.7**	**3.7**
23	**KY Parkways, US 119**		**Evansville, IN to Charleston, WV**							
R.Other PA	68.70	3.9	64.0	9,499	53.1	52.5	52.7	49.4	52.7	49.4
U.Other PA	6.60	4.0	50.0	27,182	29.5	28.2	29.4	18.6	29.4	18.6
TOTAL	**75.30**	**3.9**	**62.5**	**11,049**	**49.6**	**48.8**	**49.3**	**43.2**	**49.3**	**43.2**
Time (HR)					**1.5**	**1.5**	**1.5**	**1.7**	**1.5**	**1.7**

Average daily truck operating speeds on West Virginia LATTS corridors are summarized in Exhibit E-13.

Three of the four LATTS corridors in West Virginia have average daily truck operating speed less than 50 MPH. Only Corridor 3 (I-59/I-81/I-66 from New Orleans, LA to Washington D.C. and Pennsylvania) has estimated average daily truck operating speed close to 55 MPH.

Exhibit E-13
WEST VIRGINIA STRATEGIC HIGHWAY NETWORK
Average Daily Truck Operating Speeds



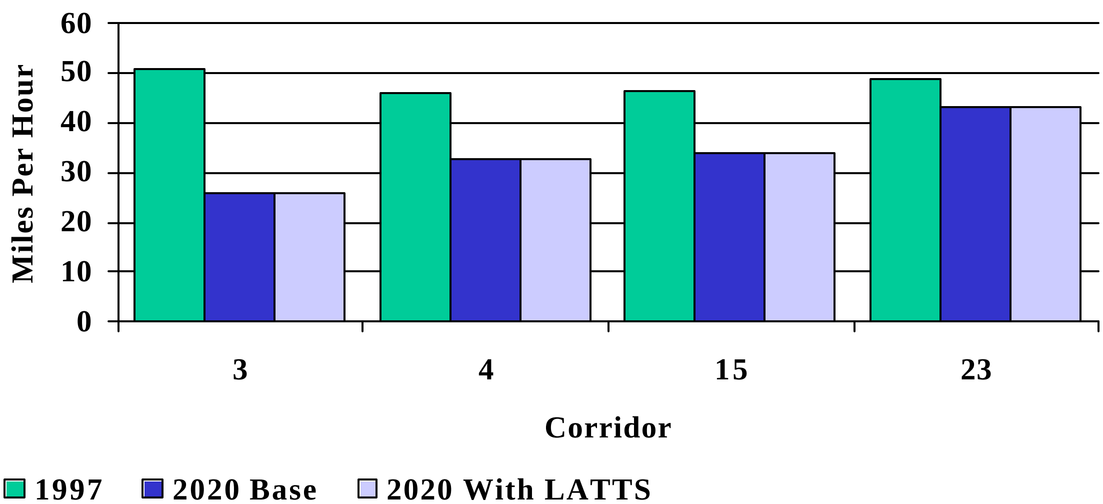
The projected growth in traffic between 1997 and 2020 will affect this measure of performance. Unless additional capacity is provided, the average daily speed on Corridor 3 (I-59/I-81/I-66 from New Orleans, LA to Washington D.C. and Pennsylvania) will be reduced by 11 MPH and by slightly more than 2 MPH on Corridor 4 (I-77/I-79 from Columbia, SC to Ohio and Pennsylvania) and Corridor 15 (I-64 from Louisville, KY to Norfolk, VA).

Compared to the impact of the expected traffic growth between 1997 and 2020, the impact of the "additional" LATTS traffic on average daily truck travel speed appears minor. Even the worse case, Corridor 3, will only experience an additional reduction in average daily speed of 1.3 MPH. Corridor 4 (I-77/I-79 from Columbia, SC to Ohio and Pennsylvania) and Corridor 15 (I-64 from Louisville, KY to Norfolk, VA) will have negligible operating speeds impact from LATTS traffic. One may wonder why there would be such an apparent small impact on average speeds when the impact of LATTS traffic on capacity appeared much more significant. The reason is due to the selected minimum tolerable standards used to identify capacity needs. The capacity needs are based on not exceeding LOS C on rural highways and LOS D on urban highways during peak hour. However, traveling speeds are most affected (change rapidly) when the LOS reaches E and F. In other words, capacity needs are based on explicit standards that are higher than those used implicitly in the LATTS speed calculation.

The expected traffic growth on West Virginia LATTS corridor will affect "peak hour" speeds more significantly: up to 25 MPH reduction for Corridor 3 (I-59/I-81/I-66 from New Orleans, LA to Washington D.C. and Pennsylvania) and around 13 MPH reduction for Corridor 4 (I-77/I-79 from Columbia, SC to Ohio and Pennsylvania) and Corridor 15

(I-64 from Louisville, KY to Norfolk, VA) as illustrated in Exhibit E-14. As mentioned earlier, these travel speeds were estimated assuming no change in capacity on any section of the LATTS highway network and traffic peaking patterns the same as they are today. This is unlikely given the severity of the estimated resulting congestion on some highways.

Exhibit E-14
WEST VIRGINIA STRATEGIC HIGHWAY NETWORK
"Peak-Hour" Truck Operating Speeds



The impact of LATTS "additional traffic" is slightly more pronounced on "peak hour" speeds than on average daily speeds but still very mild compared to the impact of overall growth in total traffic.

CONCLUSIONS FOR LATTS MAINLINE HIGHWAYS

(1) LATTS truck traffic in West Virginia is expected to grow at a much higher rate than the rest of the traffic in the state. From 1997 to 2020, LATTS truck traffic will increase by 346 percent while all other traffic is expected to increase by 97 percent.

(2) About 30 percent of the LATTS Strategic Highway Network in West Virginia will require additional capacity by 2020 at a cost of $ 704 million. More than 95 percent of these capacity needs are for the interstate system (65 percent for the rural interstate system alone). The majority of these needs are due to expected growth in total traffic and not to LATTS trucks only.

(3) LATTS truck traffic will have an increasing impact on the state highway investment needs for the Strategic Highway Network. By 2020, LATTS "additional" truck traffic will have resulted in:

- 6.4% more highway miles needing capacity improvements.
- 5.1% additional costs to address these capacity needs.

- 1.7% increase in annual pavement resurfacing costs.

(4) In West Virginia, Corridor 4 (I-77/I-79 from Columbia, SC to Ohio and Pennsylvania) and Corridor 3 (I-59/I-81/I-66 from New Orleans, LA to Washington D.C. and Pennsylvania) will be proportionally most affected by LATTS trucks.

(5) If these investment needs are not met, the West Virginia portion of the LATTS Strategic Highway Network will experience significant deterioration in operating speeds especially during "peak hour."

WATERPORT AND AIRPORT INTERMODAL CONNECTORS

The focus of the highway analysis was, appropriately, on the mainline portion of the LATTS Strategic Highway System. This is the portion of the highway network carrying the vast majority of truck travel (vehicle miles) and has "needs" that could be quantified using existing databases. Additionally, the portion of the highway system connecting the LATTS mainline system with the LATTS waterports and airports also were assessed. While these highway intermodal connectors sometimes are overlooked, their deficiencies can significantly impact the efficient movement of vehicles, especially large trucks.

LATTS intermodal connectors are the highways that link the mainline LATTS Strategic System with LATTS intermodal facilities (waterports and airports). To avoid costly new data collection activities, a recently compiled database was used to conduct the connectors analysis. This database, the *NHS Connectors*, was populated by the state DOTs and compiled by the Federal Highway Administration. It includes a high quality sample of the LATTS intermodal connectors. However, it does not contain information for every LATTS intermodal connector. These analyses utilized information for those LATTS intermodal connectors for which information was available in the NHS connectors database at the time the analyzes were performed.

West Virginia has 10 NHS intermodal connectors which total 24.4 miles. These are:

- Yeager Airport (Charleston)
- Charleston Greyhound Intercity Bus Station
- Charleston Amtrak Station
- Huntington-Ashland Tri-State Airport
- Huntington-Ashland Riverports (2 connectors)
- Huntington-Ashland Public Transit/Greyhound Facility
- Martinsburg Public Transit/Rail Facility
- Wheeling Public Transit/Bus Facility

Of these 10 connectors, the two Huntington-Ashland Riverports connectors link a LATTS intermodal facility with the mainline LATTS Strategic Highway System (i.e., I-64, exits 8 and 15). Information regarding these connectors was not available in the NHS Connectors Inventory Database used for purposes of the LATTS analyses.

INTELLIGENT TRANSPORTATION SYSTEMS (ITS)

While it is clear that improvements in highway infrastructure are required to achieve an economically efficient transportation system, truck operations also can be improved by the implementation of ITS. Transportation technologies help freight transport become more productive and more responsive to the needs of business enterprises, including those which are engaged in Latin American trade. Fortunately, a large portion of current work in the ITS arena is with commercial vehicle operations (CVO). Of significant relevance to LATTS is the Commercial Vehicle Information Systems and Networks (CVISN) that embodies a collection of information systems and communications networks that provide support to CVO.

The national ITS/CVO program encompasses numerous projects undertaken by the individual states. The national program is designed to encourage the development and implementation of technology to enhance the safe movement of commercial vehicles across the United States. There are four main areas within the national program and each of the individual states are striving to meet these goals:

- Safety Assurance – Programs and projects that are designed to assure the safety of commercial drivers, vehicles, and cargo.
- Credentials Administration – Programs and projects that are designed to improve the procedures and systems for managing motor carrier regulation.
- Electronic Screening – Programs and projects that are designed to facilitate the verification of size, weight, safety, and credentials information.
- Carrier Operations – Programs and projects that are designed to reduce congestion and manage the flow of commercial vehicle traffic.

Most of the Alliance member states have completed some type of ITS/CVO Business Plan. Many of these documents are living documents and are continually being updated and revised. Since state's ITS/CVO plans are changing frequently, the information contained below is only a snapshot of ITS information available in early 2001.

West Virginia ITS/CVO Plan

The West Virginia ITS/CVO Mainstreaming Business Plan was developed by the West Virginia Department of Transportation, Division of Motor Vehicles with aid from other State agencies. Responsible agencies included the following: Department of Transportation, Weight Enforcement (WE), Division of Motor Vehicles – Motor Carrier Services (MCS), Division of Highways (DOH) – Transportation Planning Division, Public Services Commission – Transportation Division (PSC), Department of Tax and Revenue (DTR), West Virginia State Police, and Parkways Economic Development and Tourism Authority (Parkways).

The Business Plan is a living document for the identification of programs and projects to support commercial vehicle operations within and throughout West Virginia. This plan is consistent with the objectives that have been set forth by the national ITS/CVO program. The plan provides a guideline for the implementation of ITS/CVO technologies and programs into the early 2000's. The goals included within this plan are as follows:

- Plan improvements to highway safety programs;
- Provide an efficient and electronic administrative system for credentials and tax payments, and safety information;
- Provide productivity improvements for motor carriers; and
- Provide CVO operations consistent with regional and national goals.

West Virginia's current state of ITS/CVO deployment is in the development and initial deployment stage. Many of the current projects are providing valuable information that will be used when statewide implementation occurs. The current ITS/CVO projects include the following:

- Parkway Authority Traffic Management System for CCTV and variable message signs;
- Parkway Authority operation of SCAN system for 24-hour monitoring of roadway conditions at five locations;
- DOH Enforcement use of WIM on I-79 ramp to pass compliant vehicles;
- PSC RADIX hand-held computer support for MSCAP Safety Inspection program to record inspections and upload to SAFER;
- Designed state-of-the-art weigh station for I-68;
- PSC use of brake analyzer during safety inspections;
- DTR access to NLETS STOLEN;
- DTR and DMV EFT program between states; and
- DMV use of IRP Clearinghouse[2].

Besides the above-mentioned existing projects, there are many new projects listed within the West Virginia Business Plan.[3] These projects are divided into the four areas of national interest. Within each of the categories, projects have been ranked according to importance. Currently there are no projects listed under the Carrier Operations category; however, this will be expanded as projects are identified. Exhibit E-15 outlines the timeframe for the projects listed below.

[2] *West Virginia ITS/CVO Mainstreaming Business Plan*, West Virginia Department of Transportation, Division of Motor Vehicles, prepared March/April 2000.
[3] *West Virginia ITS/CVO Mainstreaming Business Plan*, West Virginia Department of Transportation, Division of Motor Vehicles, prepared March/April 2000.

Exhibit E-15
WEST VIRGINIA ITS/CVO BUSINESS PLAN PROJECTS TIMETABLE[a]

Projects	Start Implementation	Testing/Review Period	Production/ Turnover Installation	Completion
1. Dynamic Truck Speed warning for Long Downgrades	1st Quarter CY 1998	1st Quarter CY 1998	3rd Quarter CY 1998	4th Quarter CY 1998
2. Toll Booth Reconstruction and Electronic Collection	1st Quarter CY 1998	1st Quarter CY 1998	2nd Quarter CY 1999	4th Quarter CY 1999
3. Laptop Computer SAFER Inspection and Information Access Support	3rd Quarter CY 1998	1st Quarter CY 1999	2nd Quarter CY 1999	3rd Quarter CY 1999
4. Consolidation Commercial Truck Center	4th Quarter CY 1998	2nd Quarter CY 1999	4th Quarter CY 1999	4th Quarter CY 2000
5. CVISN Readiness and System Integration	4th Quarter CY 1998	3rd Quarter CY 1999	1st Quarter CY 2000	3rd Quarter CY 2000
6. Weigh in Motion Motor Carrier Pre-Clearance	4th Quarter CY 1998	1st Quarter CY 1999	2nd Quarter CY 1999	4th Quarter CY 1999
7. Trucker's Compliance Manual	Mid-1997	Current	1st Quarter CY 1999	Annual Update

a *West Virginia ITS/CVO Mainstreaming Business Plan*, West Virginia Department of Transportation, Division of Motor Vehicles, prepared March/April 2000.

- Safety Assurance
  - Dynamic Truck Speed warning - (Ranked #6 overall) – This project includes the installation of a WIM classification system to warn large vehicles of a safe deceleration speed. This project will be lead by the WVDOT Traffic Engineering Division and a WIM System for vehicle classification. Safety warning will be developed.
  - Laptop Computer for PSC officers - (Ranked #3 overall) - Provide all PSC officers with laptop computer to conduct safety inspections utilizing the SAFER software. This project will be under the guidance of the Public Service Commission, and the FHWA OMC.
- Credentials Issuance and Administration
  - Consolidated Commercial Truck Center - (Ranked #1 overall) - Provide a "one-stop" shop so that motor carriers have access to all state agencies. The Division of Motor Vehicles will be responsible for this project.
  - CVISN Readiness and System Integration - (Ranked #2 overall) - Develop an integrated motor carrier support system with instant access for carriers for credentialing and payment of taxes and to enforce verifications of safety data. The Division of Motor Vehicles, Department of Tax and Revenue and the PSC are responsible for the development of this project.
  - Trucker's Compliance Manual - (Ranked #7 overall) - Under the guidance of the WVDOT Planning division, a manual will be developed to assist motor carriers with business practices and CVO activities within the sate.
- Electronic Screening
  - Toll Plaza Redesign - (Ranked #5 overall) - Modernize toll collection facilities to include ITS transponder collections. Modern, state-of-the-art automated toll

collection equipment will be installed at toll collection plazas thus, allowing motors carriers to remain at highway speeds when passing through toll plazas. The project will be under the direction of the Parkways, Economic Development and Tourism Authority.

- WIM Carrier Pre-Clearance - (Ranked #4 overall) – This program is under the direction of WVDOT and WE. It allows for the adoption and implementation of technology for WIM and transponder activated identification of commercial vehicles. Compliant vehicles will be identified for pre-clearance. A portion of this project has already been completed. At the time of this report, West Virginia had seven operational PrePass locations, all with WIM capabilities.