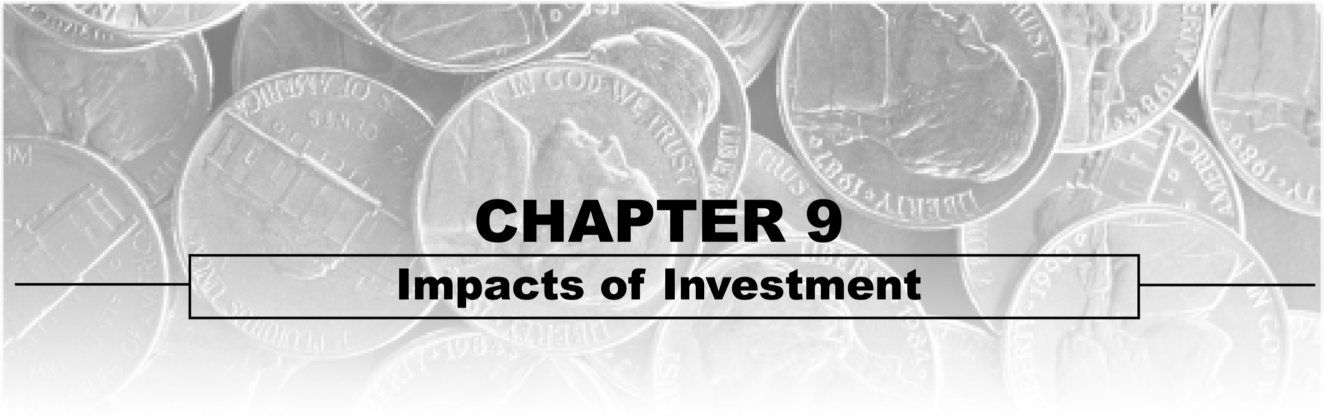


CHAPTER 9

Impacts of Investment

Introduction

This chapter serves two major purposes. The first is to discuss the impacts of historic investment, relating the condition and performance trends reported in Chapters 3 and 4 with the financial trends reported in Chapter 6. The second purpose is to discuss the impacts of future investment, exploring the impacts of investing at different levels of funding, building on the analysis in Chapters 7 and 8.

This chapter is a new addition to the C&P report. In this edition, the chapter focuses on a limited number of topics. Future versions of the report will expand on this analysis, and address other related topics.

The highway portion of this chapter begins by discussing the impacts that future investment patterns would be expected to have on future highway travel growth, travel time costs, vehicle operating costs and crash costs. The section then examines the impacts that recent funding patterns have had on highway conditions and performance. The section concludes with a discussion of innovative means to increase future investment.

The transit portion addresses the projected increase in transit travel that would be accommodated by the estimated investment requirement levels. The recent stability of most condition and performance measures is discussed, and some possible reasons for this phenomenon in the face of estimates of current funding gaps are proposed.

Impact of Highway and Bridge Investment on Conditions and Performance

This section explores some of the impacts that future levels of investment would be expected to have on future travel growth and on future highway user costs. This analysis moves beyond the investment requirements and scenarios defined in Chapter 7, to explore a variety of different investment levels.

This chapter also compares recent trends in highway and bridge investments with the changes in conditions and operational performance described in Chapters 3 and 4. This includes an analysis of whether the “gap” identified in Chapter 8 between current funding and the Cost to Maintain Highways and Bridges is consistent with recent condition and operational performance trends. This section concludes with a discussion of innovative means to increase the resources available for future highway and bridge investment.

Impact of Investment Levels on Future Travel Growth

As discussed in Chapter 7, HERS predicts that the level of future investment on highways will have an impact on future VMT growth. The travel demand elasticity features in HERS assume that highway users will respond to increases in the cost of traveling a highway facility by shifting to other routes, switching to other modes of transportation, or forgoing some trips entirely. The model also assumes that reducing user costs (travel time costs, vehicle operating costs, and crash costs) on a facility will induce additional traffic on that route that would not otherwise have occurred. Future pavement and widening improvements will tend to reduce highway user costs, and induce additional travel. If a highway section is not improved, highway user costs on that section will tend to rise over time due to pavement deterioration and/or increased congestion, which will tend to suppress travel.

One implication of travel demand elasticity is that each different scenario and benchmark developed using HERS results in a different projection of future VMT. The higher the overall investment level, the higher the projected travel will be. Another implication is that any external projection of future VMT growth will only be valid for a single level of investment in HERS. Thus, the State-supplied 20-year growth forecasts in HPMS would only be valid under a specific set of conditions. HERS assumes the HPMS forecasts represent the level of travel that would occur if a constant level of service is maintained. As indicated in Chapter 7, this implies that travel will occur at this level only if pavement and capacity improvements made on the segment during the next 20 years are sufficient to maintain highway-user costs at current levels.

Q. **Do the travel demand elasticity features in HERS differentiate between the components of user costs based on how accurately highway users perceive them?**

A. No. The model assumes that comparable reductions or increases in travel time costs, vehicle operating costs, or crash costs would have the same effect on future VMT. The elasticity values in HERS were developed from studies relating actual costs to observed behavior that did not explicitly consider perceived cost.

Highway users can directly observe some types of user costs such as travel time and fuel costs. Other types of user costs, such as crash costs, can only be measured indirectly. In the short run, directly observed costs may have a greater effect on travel choice than costs that are harder to perceive. However, while highway users may not be able to accurately assess the crash risk for a given facility, they can incorporate their general perceptions of the relative safety of a facility into their decision-making process. The model assumes that the highway users’ perceptions of costs are accurate, in the absence of strong empirical evidence that they are biased.

Projected Average Annual Travel Growth

Exhibit 9-1 shows how the effective VMT growth rates in HERS are influenced by the total amount invested in highways, and the location of highway improvements. The highway investment levels shown in the table line up with those in Exhibit 7-3, which defined the highway scenarios and benchmarks used in this report. Each row represents a different minimum benefit-cost ratio (BCR) cutoff point in HERS, as discussed in Chapter 7. The italicized bridge values shown in the second column are interpolated or extrapolated from the $5.8 billion bridge component of the Cost to Maintain Highways and Bridges, and the $10.6 billion Cost to Improve Highways and Bridges. Only these two values are directly obtained from the Bridge Needs and Investment Process (BNIP) model. The remaining bridge values are included in this table to facilitate comparisons with the combined highway and bridge spending projections from Chapter 8. As discussed in Chapters 7 and 8, investment requirements for new bridges are included as “Highway” rather than “Bridge” since BNIP only considers existing bridges.

Exhibit 9-1

Projected Average Annual VMT Growth Rates, 1998-2017, for Different Possible Funding Levels

Average Annual Investment (Billions of 1997 Dollars)			Average Annual VMT Growth			
Highway	Bridge	Total	Rural	Urban	Urbanized > 1 Million Population	Funding Level Description
$83.4	$10.6	**$94.0**	3.03%	2.22%	2.06%	**Cost to Improve Highways & Bridges**
$76.5	*$9.6*	$86.1	3.01%	2.19%	2.03%	
$70.7	*$8.7*	$79.4	2.98%	2.15%	2.01%	
$67.9	*$8.3*	$76.3	2.97%	2.13%	1.99%	**Maintain Travel Time Benchmark**
$65.4	*$7.9*	$73.3	2.95%	2.11%	1.97%	
$60.8	*$7.3*	$68.1	2.92%	2.06%	1.92%	
$56.6	*$6.7*	$63.3	2.88%	2.01%	1.88%	
$53.9	*$6.3*	$60.1	2.85%	1.97%	1.84%	**Maintain User Costs Benchmark**
$52.9	*$6.1*	$59.0	2.85%	1.96%	1.83%	
$50.8	$5.8	**$56.6**	2.82%	1.93%	1.80%	**Cost to Maintain Highways & Bridges**
$49.8	*$5.7*	$55.4	2.80%	1.92%	1.79%	
$46.9	*$5.3*	$52.2	2.76%	1.87%	1.74%	
$44.2	*$4.9*	$49.0	2.72%	1.83%	1.70%	
$41.8	*$4.5*	$46.3	2.68%	1.78%	1.66%	
			2.35%	2.04%	1.86%	**HPMS Baseline**

The weighted average annual growth rate for all HPMS sample sections in rural areas is 2.35 percent. At all levels of investment shown in the table, the travel demand elasticity features in HERS cause additional travel to be induced in rural areas. A new safety module has been added to HERS that has improved the models ability to evaluate the safety impacts of highway improvements, particularly in rural areas (See Appendix G). The model now recommends a larger number of widening and alignment improvements in rural areas to reduce crashes, fatalities, and injuries. By reducing crash costs, these improvements reduce the overall cost of using rural highways, which has the side effect of encouraging additional travel.

The weighted average annual growth rate for all HPMS sample sections in urban areas is 2.04 percent. If average annual highway capital outlay rose to $53.9 billion ($60.1 billion for highways and bridges combined) in constant 1997 dollars, HERS predicts that overall highway user costs would be maintained at 1997 levels. However, at this funding level, the improvements recommended by HERS would reduce user costs on rural highways, while allowing costs on urban highways to rise. The Maintain User Costs Benchmark derived from HERS attempts to maintain the weighted average user costs for all highway sections, but user costs can vary on individual functional classes, and on individual highway sections. Due to the travel demand elasticity features in HERS, the model projects that the increase in user costs in urban areas would limit average annual urban VMT growth to 1.97 percent, below the baseline forecasts in HPMS.

In 1997, all levels of government spent $42.6 billion for highway capital outlay (excluding bridge preservation expenditures), falling between the values in the first column of the last two rows in Exhibit 9-1. If average annual investment remains at this level in constant dollar terms over the next 20 years, urban VMT would be expected to grow at an average annual rate between 1.78 percent and 1.83 percent.

As indicated in Chapter 8, average annual capital investment on highways and bridges by all levels of government from 1998–2003 is expected to grow to $53.6 billion in constant 1997 dollars. Reading down the third column, this amount falls between the $55.4 billion and the $52.2 billion shown in the third and fourth rows from the bottom. Reading across these rows to the average annual urban VMT growth rate in the fifth column, Exhibit 9-1 indicates that if this level of investment were sustained for 20 years, and used in the manner recommended by HERS, the model projects urban VMT growth would rise at an average annual rate between 1.87 percent and 1.92 percent.

Projected Average Annual Travel Growth in Large Urbanized Areas

Exhibit 9-1 shows that the weighted average annual growth rate for all HPMS sample sections in urbanized areas with population over 1 million is 1.86 percent. A separate survey of metropolitan planning organizations (MPOs) indicates that they are projecting average annual VMT growth of only 1.68 percent. The source of the differences between these two sets of forecasts appear to stem from their underlying assumptions. The MPO forecasts incorporate the effects of actions the MPOs are proposing to shape demand in their areas to attain air quality and other development goals. The MPO plans may include transit expansion, congestion pricing, parking constraints, capacity limits, and other local policy options. The forecasts in HPMS may not similarly account for these effects.

As discussed in Chapter 7, the travel demand elasticity features in HERS mimic the effects that these types of Transportation Demand Management (TDM) programs would have. ***(See the Q&A box on page 7-13)***. As shown in Exhibit 9-1, HERS predicts that if current funding levels were sustained, user costs in large urbanized areas would increase, reducing VMT growth from the 1.86 percent rate projected in HPMS to an average annual growth rate between 1.66 percent and 1.70 percent. The 1.68 percent growth rate obtained from the MPO survey falls within this range. This appears to be logical since the MPO forecasts have to factor in funding availability, while HERS assumes HPMS forecasts are not funding-constrained, and that they represent the level of travel that would occur only if investment is high enough to maintain a constant level of service.

Prior to the addition of travel demand elasticity features into the HERS, the HPMS forecasts for sections in large urbanized areas were manually reduced to make them consistent with the MPO projections. This adjustment was necessary, since the model could not simulate the effects that TDM policies would be likely to have on future travel growth. Since travel demand elasticity has been added to HERS, this adjustment is no longer required, and has been discontinued in this report. This change is discussed in more detail in Appendix G. Chapter 10 explores the effect that reducing the projected VMT growth rate in large urbanized areas would have on the overall investment requirements.

Historic Travel Growth

Exhibit 9-2 shows annual VMT growth rates for the 20-year period from 1977 to 1997. The average annual VMT growth rate over this period was 2.84 percent. Travel growth varied significantly in individual years, ranging from a decline of 1.01 percent in 1979 to an increase of 5.45 percent in 1988. Highway travel growth is typically lower during recessions, or periods of slow economic growth, and higher during periods of economic expansion. VMT growth was below average during the 1980, 1981–1982 and the 1990–1991 recessions. From 1983 through 1989, annual VMT growth was higher than 3 percent every year. Exhibit 9-2 shows that travel has grown more slowly during the current economic expansion, than in the 1980s, reflecting a long term trend towards lower VMT growth rates.

Q. **What are the implications of the higher VMT growth rates under the Cost to Improve Highways and Bridges?**

A. The HERS analysis suggests that the MPO travel projections are consistent with current funding levels. If highway investment were to rise substantially, VMT growth could be higher than the MPOs are accounting for in their plans to meet Clean Air Act requirements. This might require States and MPOs to invest a greater share of resources in congestion mitigation and air quality programs, and/or to take more aggressive measures in regulating emissions from vehicular and non-vehicular sources with what would occur If total investment requirements rose.

Exhibit 9-2

VMT Growth Rates, 1977-1997

Year	Growth Rate	Year	Growth Rate	Year	Growth Rate	Year	Growth Rate
1978	5.29%	1983	3.62%	1988	5.45%	1993	2.19%
1979	-1.01%	1984	4.08%	1989	3.48%	1994	2.67%
1980	-0.12%	1985	3.17%	1990	2.28%	1995	3.43%
1981	1.83%	1986	3.38%	1991	1.29%	1996	2.59%
1982	2.55%	1987	4.71%	1992	3.46%	1997	2.61%
avg. annual 1977-1982	1.69%	avg. annual 1982-1987	3.79%	avg. annual 1987-1992	3.18%	avg. annual 1992-1997	2.70%

Overall Projected Travel, Year-by-Year

The future travel growth projections in HPMS indicate future levels of VMT, but don't provide any information as to how travel will grow year-by-year within the 20-year forecast period. The 2.16 percent overall average annual projected travel growth derived from HPMS is well below the 1997 growth rate of 2.61 percent, or the 2.84 percent average annual VMT growth rate from 1977 to 1997. Rather than assuming that VMT growth will suddenly drop to 2.16 percent in 1998, and remain constant for the next 20 years, the HERS model now assumes that VMT growth rates will gradually decline over the 1997 to 2017 period. The model accomplishes this by assuming that VMT growth will be linear, and will grow by a constant amount annually, rather than growing by a constant rate. For example, if travel grows at an average annual rate of 2.16 percent, this would result in an increase in travel between 1997 and 2017 of 1.37 trillion vehicle miles. The HERS model would assume that VMT will increase by 1/20 of this amount, 68.4 billion vehicle miles, during each of the 20 years. As VMT grows each year, the fixed annual increase will represent a smaller percentage of the existing VMT base.

Q. **If future travel growth doesn't slow as quickly as the forecasts assume, how would this affect future investment requirements?**

A. If travel growth is higher than expected, additional investment would be required to maintain and improve highways and bridges. Chapter 10 shows what would happen to the investment requirements if average annual VMT growth for the next 20 years matched the 2.84 percent rate observed over the last 20 years.

Exhibit 9-3 shows projected year-by-year VMT derived from HERS for five different funding levels. If average annual investment were to reach the Cost to Improve Highways and Bridges level, VMT would be expected to grow to 4.2 trillion in 2017. If average annual investment remains at 1997 levels in constant dollar terms, VMT would grow to only 3.9 trillion.

Note that projected travel growth for each of these funding levels is well below the historic growth rate over the last 20 years.

Exhibit 9-3

Annual Projected Highway VMT at Different Funding Levels (VMT in Millions; Funding in Billions of 1997 Dollars)

Funding Level Description		Cost to Improve Highways and Bridges	Highway Maintain Travel Time Benchmark	Highway Maintain User Costs Benchmark	Cost to Maintain Highways and Bridges	Actual 1997 Capital Outlay
Funding Level $ Billions	**Highway**	**$83.4**	**$67.9**	**$53.9**	**$50.8**	**$42.6**
	Bridge	$10.6	*$8.3*	*$6.3*	$5.8	$6.1
	Combined	$94.0	*$76.3*	*$60.1*	$56.6	$48.7
Projected Annual VMT By Year	**1997**	**2,566,958**	**2,566,958**	**2,566,958**	**2,566,958**	**2,566,958**
	1998	2,650,942	2,647,620	2,642,104	2,640,562	2,634,928
	1999	2,734,925	2,728,283	2,717,251	2,714,167	2,702,898
	2000	2,818,909	2,808,945	2,792,397	2,787,771	2,770,867
	2001	2,902,893	2,889,607	2,867,544	2,861,375	2,838,837
	2002	2,986,876	2,970,269	2,942,690	2,934,980	2,906,807
	2003	3,070,860	3,050,932	3,017,836	3,008,584	2,974,777
	2004	3,154,844	3,131,594	3,092,983	3,082,188	3,042,747
	2005	3,238,827	3,212,256	3,168,129	3,155,793	3,110,717
	2006	3,322,811	3,292,918	3,243,276	3,229,397	3,178,686
	2007	3,406,795	3,373,581	3,318,422	3,303,001	3,246,656
	2008	3,490,778	3,454,243	3,393,568	3,376,605	3,314,626
	2009	3,574,762	3,534,905	3,468,715	3,450,210	3,382,596
	2010	3,658,745	3,615,567	3,543,861	3,523,814	3,450,566
	2011	3,742,729	3,696,230	3,619,007	3,597,418	3,518,535
	2012	3,826,713	3,776,892	3,694,154	3,671,023	3,586,505
	2013	3,910,696	3,857,554	3,769,300	3,744,627	3,654,475
	2014	3,994,680	3,938,217	3,844,447	3,818,231	3,722,445
	2015	4,078,664	4,018,879	3,919,593	3,891,836	3,790,415
	2016	4,162,647	4,099,541	3,994,739	3,965,440	3,858,385
	2017	**4,246,631**	**4,180,203**	**4,069,886**	**4,039,044**	**3,926,354**

Impact of Investment Levels on Different Types of Highway User Costs

The HERS model defines benefits as reductions in highway user costs, agency costs, and societal costs. Highway user benefits are defined as reductions in travel time costs, crashes, and vehicle operating costs. Chapter 7 defined a highway Maintain User Cost benchmark, indicating that an average annual investment of $53.9 billion would be required to maintain highway user costs at their baseline 1997 levels. The highway Maintain Travel Time benchmark, defined as the average annual investment required to maintain travel time costs at current levels, was projected to be $67.9 billion.

Exhibit 9-4 describes how travel time costs, vehicle operating costs and crash costs are influenced by the total amount invested in highways. The highway investment levels shown in the table line up with those in Exhibit 7-3, which defined the highway scenarios and benchmarks used in this report. Each row represents a different minimum BCR cutoff point in HERS, as discussed in Chapter 7. As in Exhibit 9-1, the italicized bridge values shown in the second column are interpolated or extrapolated from the two bridge investment requirement scenarios to facilitate comparisons with the combined highway and bridge spending projections from Chapter 8.

Exhibit 9-4

Projected Changes in Highway User Costs Compared to 1997 Levels for Different Possible Funding Levels

Average Annual Investment (Billions of 1997 Dollars)			Percent Change in User Costs				
Highway	Bridge	Total	Travel Time Costs	Vehicle Operating Costs	Crash Costs	Total User Costs	Funding Level Description
$83.4	$10.6	**$94.0**	-0.9%	-3.2%	-2.3%	-1.8%	**Cost to Improve Highways & Bridges**
$76.5	*$9.6*	$86.1	-0.7%	-2.8%	-2.3%	-1.6%	
$70.7	*$8.7*	$79.4	-0.2%	-2.4%	-2.0%	-1.3%	
$67.9	*$8.3*	$76.3	**0.0%**	-2.4%	-2.0%	-1.1%	**Maintain Travel Time Benchmark**
$65.4	*$7.9*	$73.3	0.2%	-2.0%	-2.0%	-1.0%	
$60.8	*$7.3*	$68.1	0.7%	-1.6%	-2.0%	-0.6%	
$56.6	*$6.7*	$63.3	1.1%	-1.2%	-1.6%	-0.3%	
$53.9	*$6.3*	$60.1	1.5%	-1.2%	-1.6%	**0.0%**	**Maintain User Costs Benchmark**
$52.9	*$6.1*	$59.0	1.8%	-0.8%	-1.6%	0.1%	
$50.8	$5.8	**$56.6**	2.0%	-0.8%	-1.6%	0.4%	**Cost to Maintain Highways & Bridges**
$49.8	*$5.7*	$55.4	2.2%	-0.4%	-1.3%	0.5%	
$46.9	*$5.3*	$52.2	2.6%	0.0%	-1.3%	0.9%	
$44.2	*$4.9*	$49.0	3.1%	0.4%	-1.0%	1.3%	
$41.8	*$4.5*	$46.3	3.5%	0.8%	-1.0%	1.6%	

As shown in Exhibit 9-4, while an average annual highway investment of $53.9 billion would maintain overall user costs, the effect on individual user cost components would vary. Travel time costs would rise 1.5 percent, while vehicle operating costs and crash costs would fall by 1.2 percent and 1.6 percent respectively. This indicates that at this investment level, HERS predicts that there would be a relatively greater rate of return on improvements aimed at reducing crashes rather than those aimed at reducing congestion.

The improvements recommended by HERS would reduce crash costs at all levels of investment shown in Exhibit 9-4. Vehicle operating costs would be maintained if average annual investment reached $46.9 billion for highways. Combined with projected bridge investment requirements (extrapolated from the two scenarios derived from BNIP), total highway and bridge investment of $52.2 billion would be required to maintain vehicle operating costs. This is above the $48.7 billion level of 1997 highway and bridge capital outlay, but below the $53.6 billion average annual capital outlay projected for 1998–2003 in Chapter 8. As indicated earlier, maintaining travel time costs would be significantly more expensive.

The percent change in user costs shown in Exhibit 9-4 are tempered by the operation of the elasticity features in HERS. The model assumes that if user costs are reduced on a section, additional travel will shift to that section. This additional traffic volume tends to offset some of the initial reduction in user costs. Conversely, if user costs increase on a highway segment, drivers will be diverted away to other routes, other modes, or will eliminate some trips entirely. When some vehicles abandon a given highway segment, the remaining drivers benefit in terms of reduced congestion delay, which offsets part of the initial increase in user costs.

Recent Condition and Performance Trends Versus Spending Trends

Chapter 6 indicated that there has been a change in the types of highway capital improvements being made in recent years. The percentage of total highway capital outlay used for the construction of new roads and bridges dropped from 22.8 percent in 1993 to 15.2 percent in 1995, rising back to 15.6 percent in 1997. The percentage used for system preservation rose from 44.7 percent to 50.0 percent in 1995, falling back to 47.6 percent in 1997. Over this 4-year period, highway capital outlay has grown 2.2 percent in constant dollar terms.

Q. **Are the recent trends in condition and performance consistent with the "gap" identified in Chapter 8 between current funding and the Cost to Maintain Highways and Bridges?**

A. As indicated in Chapter 8, bridge spending has exceeded the investment requirements for the bridge component of the Cost to Maintain in recent years. This is consistent with the recent decline in the percent of deficient bridges.

Recent highway spending has been below the investment requirements for the highway component of the Cost to Maintain. Average IRI and the percent of pavement in poor condition have both worsened since 1995, though they have improved since 1993.

Chapter 7 discussed the existence of a backlog of pavement improvements that would currently be cost-beneficial to address. As indicated in Chapter 8, some of these deficiencies could be addressed relatively inexpensively in the short term, but will become much more expensive to correct if they are deferred. While current funding levels have been adequate to gradually improve pavement ride quality, continuing this level of investment indefinitely would not allow some pavement deficiencies to be addressed, and would ultimately be expected to drive up the long term cost of keeping average conditions at 1997 levels.

Conditions

The improved highway and bridge conditions reported in Chapter 3 reflect the effects of this shift toward system preservation, and the constant dollar increase in investment. From 1993 to 1995, the percentage of all road miles in poor condition fell from 8.6 percent to 6.4 percent. From 1995, as the percentage of resources devoted to system preservation dipped, the percentage of all road miles in poor condition rose from 6.4 percent to 6.6 percent. The percent of deficient bridges has been reduced each year during this 4-year period, falling from 32.5 percent to 29.6 percent.

Operational Performance

Highway operational performance since 1993 has been mixed, depending on which indicator is used. As indicated in Chapter 4, from 1993 to 1995, average delay in urbanized areas greater than

200,000 in population increased from 11.9 hours to 13.7 hours per thousand VMT. From 1995 to 1997, average delay in urbanized areas fell to 13.0 hours per thousand VMT. The percentage of urban Interstate travel on segments with a V/SF>=0.80 increased from 52.6 percent in 1993 to 53.3 percent in 1997. However, congested travel on other urban principal arterials declined. Traffic density, measured as DVMT per Lane-Mile, increased on all functional systems between 1993 and 1997.

Between 1993 and 1997, the percentage of capital outlay used for system expansion (including new roads, new bridges, and new lanes on existing roads and bridges) fell from 49.4 percent to 44.4 percent. At the same time, spending for traffic operational improvements increased. System expansion and traffic operational improvements both tend to increase capacity and reduce congestion. Since traffic density measured by DVMT per Lane-Mile has been increasing steadily, but overall delay and the V/SF ratios have not gotten substantially worse, this implies that existing roadways are being utilized more effectively. Part of this is the result of increased investment in traffic operational improvements, which add capacity without adding additional lane-miles. Some of this is also the result of changes in driver behavior.

Q. **How do the conditions and performance of Interstate routes with heavy truck traffic compare to those with fewer trucks?**

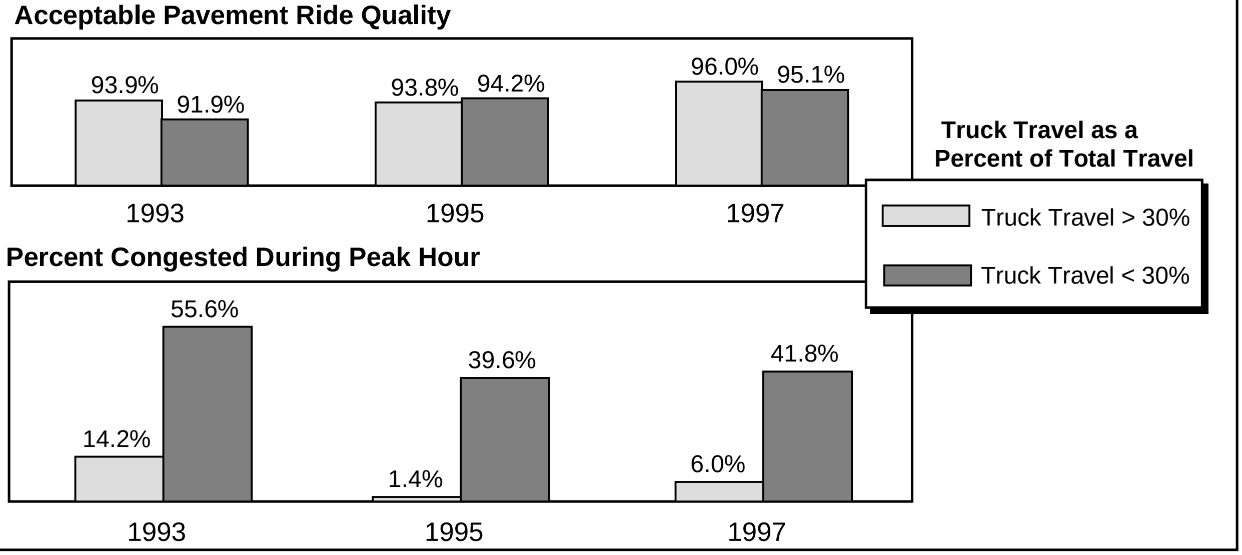
A. Approximately 20 percent of Interstate mileage has truck traffic that exceeds 30 percent of total traffic on these routes. Exhibit 9-5 compares the percent of pavement with acceptable ride quality and the percent of congested travel for Interstate routes with 30 percent or more trucks with those with lighter truck traffic. As indicated in Chapter 3, to meet the FHWA Strategic Plan standard for acceptable ride quality, pavement must have an IRI value of 170 or less. In this exhibit, congested travel includes sections with a V/SF ratio of 0.80 or higher.

This exhibit shows that on the Interstate pavement is in better condition on routes with high truck travel than on those with fewer trucks, and the portion of miles with smooth pavement increased from 1993 to 1997. While heaver vehicles cause more damage to pavement than lighter vehicles, routes most used by trucks are typically those with pavement with a higher strength than average, and that receive more than average attention from the appropriate jurisdictions for rehabilitation and maintenance.

The exhibit also shows that there is less congestion on routes with a high percentage of truck travel, but that the congestion varies from year to year. Truck drivers chose routes with less congestion when feasible. (See Exhibit 9-5)

Exhibit 9-5

Conditions and Performance of Interstate Routes with Heavy Truck Traffic



Transit Investment Impacts

Unlike HERS, TERM does not model transit demand responses to infrastructure investments and the reduction in user costs which they provide (see Appendix I). Accordingly, it is impossible to determine how achieving the investment levels targeted by TERM and discussed in Chapter 7 would affect transit ridership and user costs. Instead, the causality runs the other direction: at the forecast annual transit PMT growth rate of 1.9 percent, the asset expansion investments would accommodate an increase in annual transit passenger miles from 40.2 billion in 1997 to 58.7 billion in 2017 while maintaining the same level of performance that existed in 1997.

Transit Investment and Historical Trends

The forecast travel growth rate of 1.9 percent is well above the average growth rate in transit PMT of 1.0 percent that was observed between 1987 and 1997. However, it is below the average growth rates in the most recent years, between 1993 and 1997 (2.6 percent) and 1995–1997 (2.9 percent). The metropolitan planning organizations appear to be predicting that future transit growth will be faster than recent long-term growth, but slower than the sharp increase observed most recently.

As indicated in Chapter 3, the average condition of bus vehicles has been relatively constant over the last several years, while the average condition of the aging rail vehicle fleet (particularly the heavy rail vehicle fleet) has declined. As Exhibit 8-15 indicates, previous reports have estimated that then-current capital spending levels would fall well short of the amount required to maintain both conditions and performance. However, these amounts have been slightly higher than the pure replacement and rehabilitation levels, as shown in Exhibit 9-6. Over the same 10-year period (1987–1997), the two primary system performance measures, average speed and vehicle utilization rates, have also been relatively constant (see Chapter 4). Thus, actual conditions and performance (with the possible exception of heavy rail vehicles) do not appear to have been strongly affected by the funding gap.

Exhibit 9-6

Current Capital Spending Levels versus Rehabilitation and Replacement Needs, 1993-1997

	Billions of Current Dollars	
Analysis Year	Current Capital Spending	Estimated Replacement and Rehabilitation Needs
1993	5.7	5.1
1995	7.0	7.0
1997	7.6	7.0

Future Analyses of Spending Impacts

This is the second reporting cycle that has used TERM to model asset conditions and forecast investment needs. Several important modifications and additions have been made to TERM during its early development, and it is anticipated that many more such improvements will continue to be made in the future. Of particular interest would be additions to TERM that would allow a more complete analysis of investment impacts. For example, it would be helpful to be able to quantify the year-to-year performance improvements that are made and changes in conditions that occur over the analysis period. Another effort will be made to incorporate demand elasticity into PMT growth, and to allow for some degree of interaction between the HERS and TERM models. One additional effort currently underway is to adapt TERM to allow for annual spending caps to be imposed. This would allow for an analysis of how asset conditions would change if funding levels were held at some particular value (such as current spending).

Q. **Why haven't transit conditions and performance diminished substantially if there has been a capital investment gap?**

A. There are several possible reasons for this. One is the simple fact that the investment requirements are forward-looking, rather than historical. Their intention is to forecast future investment needs, rather than to describe past patterns of investment and its impact. As a result, while past and current spending levels may be sufficient to have maintained the condition and performance levels currently observed, they may not be adequate to continue to do so in the future.

It is also possible, as surmised in the highway section of this chapter, that recent investments have provided short-term maintenance fixes while larger, more expensive replacement needs have simply been deferred to the future. TEA-21 attempts to address this possibility by eliminating most operating costs from eligibility for Section 5307 Urbanized Area Formula funding in large cities (i.e., urbanized areas over 200,000 in population), while specifically allowing preventative maintenance costs as an eligible expense. It is hoped that this change may result in a more-optimal allocation of capital funds by transit agencies.

Another possibility for the perceived insensitivity of conditions to the funding gap is that capital funds have been sufficient to cover pure rehabilitation and replacement needs, while not allowing for capacity expansion to maintain current performance levels. However, this assumes that all capital funds are being used on rehab and replacement. In actuality, much of this funding has gone toward new vehicles for system expansion and new, performance-improving rail systems. The performance measures have also stayed relatively constant.

Two features of the data and modeling in TERM should also be noted. First, for many transit systems, increases in vehicle utilization may be a sign of improved system efficiency, rather than a stress on system capacity. If current vehicles are being underutilized (as may especially be the case for new rail systems in their start-up periods), then there will be excess capacity in the system, and travel growth can easily be handled by existing assets, so long as they are properly rehabilitated and replaced. Second, the Rehabilitation and Replacement module in TERM (see Appendix I) invests sufficient amounts to maintain conditions on the existing asset base. As new assets for system expansion are purchased, the average condition of all assets will increase, even if the condition of existing assets remains constant. Some of this may be reflected in the stability of bus vehicle conditions even as investment appears to be inadequate to do so.

Methods for Increasing Future Investment for Transportation Projects

Chapter 6 describes the broad revenue categories that have traditionally provided most funding for highways. Buried within these numbers are a variety of new financing mechanisms that have come on line in recent years. These innovative finance strategies leverage existing Federal, State, and local transportation funds, and draw on the resources of the private sector as well. Innovative finance is a broadly defined term that refers to methods of financing transportation infrastructure other than relying on conventional highway user fees and taxes.

The TEA-21 provides new grants, management flexibility, and project financing opportunities to State DOTs and other project sponsors. Major finance provisions include:

- TIFIA: The Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA) established a new Federal credit program under which the Department of Transportation (DOT) may provide $10.6 billion via three forms of credit assistance – secured (direct) loans, loan guarantees and standby lines of credit – for surface transportation projects of national or regional significance. The program’s fundamental goal is to leverage Federal funds by attracting substantial private and other non-Federal co-investment in critical improvements to the Nation’s surface transportation system.
- SIBs: A State Infrastructure Bank (SIB) pilot program was established under the 1995 National Highway System Designation Act (Section 350) and expanded upon in the 1997 DOT Appropriations Act. Designed to complement traditional transportation funding programs, SIBs can give States significantly increased flexibility in project financing. Much like a private bank, a SIB uses seed capitalization funds to get started and offers customers a range of loans and credit enhancement products. The SIBs can be used to finance eligible surface transportation projects, including both highway construction and transit capital projects. As of September 30, 1999, $516.5 million in Federal funds had been deposited into the highway and transit accounts of the 39 approved State banks. The TEA-21 authorized only four states to use TEA-21 funds to capitalize the SIBs.
- GARVEE: Grant Anticipation Revenue Vehicle, or GARVEE Bond, refers to any financing instrument for which principal and/or interest is repaid with future Federal-aid highway funds. In essence, the debt is issued in anticipation of the receipt of Federal apportionments in subsequent years.

The following are innovative finance concepts and strategies that can be used to increase the state and local transportation revenue streams. It is important to note that controversy surrounds each. For example, questions have been raised about whether some of the strategies listed below are equitable.

- Congestion pricing (“peak hour tolls”): Motorists pay a fee to use congested roadways during peak hour traffic. The fee assessed is reflective of the amount of delay and congestion present on the roadway. The user pays a higher fee during peak hour traffic, when delay is heaviest, and a lower or no fee during less congested non-peak hour traffic. The fee is based on estimated costs and other externalities (e.g., air pollution).
- Value pricing: In contrast to congestion pricing, motorists pay a fee to use “uncongested” roadways, such as existing high-occupancy vehicle (HOV) lanes. A recent concept referred to

as High-Occupancy Toll (HOT) Lanes allows lower occupancy vehicles or solo drivers to pay a fee to use HOV lanes during peak hour traffic. The HOT toll is based on traffic volume and time of day and is set to maintain free flow in the express lane. Motorists have a “choice,” that is if they are in a hurry, they may elect to pay in order to have less delay and improved level-of-service compared to the free general purpose travel lanes.

- VMT fee: A fee based on the number of miles a vehicle travels. Unlike fuel taxes, VMT fees measure overall road use. Some say VMT fees are superior to fuel taxes because of the wide differences in the fuel-efficiency of vehicles. A potential problem is the discouragement of owning fuel-efficient cars.
- Emission fees: A fee based on the air pollution produced by a vehicle.
- Parking charges: A fee collected to offset the costs of providing parking and externalities related to automobile driving. Currently, many employers offer free parking to employees.
- Pay-at-the-pump insurance: Instead of paying set premiums directly to an insurance agent for vehicle liability coverage, a motorist pays a surcharge per gallon of gasoline purchased. This insurance program would not necessarily generate revenue, but it would change insurance payment from a lump sum to an out-of-pocket cost. Lump sum payments lead to the perception that driving an automobile is cheaper than it really is because there is not a frequent reminder of the actual associated cost. A driver would achieve lower insurance rates if he/she drives less or uses a fuel-efficient vehicle.
- Development Impact Fees: States are using Development Impact Fees (DIFs) to finance transportation projects. The DIFs are assessed on new development, and are normally used to improve an area’s infrastructure, such as schools, sewers or roads. Georgia law allows local governments to establish DIFs. In the case of the Foothill/Easterns Toll Road in Orange County, California, DIFs have raised $178 million.

***Q.* Have any of these innovative funding strategies been implemented?**

A. Yes. The following is a sample of some of the innovative financing measures that have been implemented.

Federal Government Sponsored

- TIFIA: An example of TIFIA funding project is the Miami Intermodal Center, estimated at $1.349 billion. Two Federal TIFIA direct loans will be provided: one in the amount of $269 million, secured by State fuel tax revenues, and the other, for the Rental Car Facility (RCF), in the amount of $167 million, secured by rental car fees.
- SIBs: As of September 30, 1999, $516.5 million in Federal funds had been deposited into the highway and transit accounts of the 39 approved State banks. Although States are limited in expanding Federal capitalization of their SIBs (with the exception of the four TEA-21 pilot States), some States are enhancing capitalization with non-Federal revenue sources.
- GARVEEs: Three States – New Mexico, Ohio, and Massachusetts – have already taken advantage of the GARVEE bond issue, by issuing debt backed by pledges of Federal aid. On the transit side, the New Jersey Transit Corporation issued $151.5 million in debt backed solely by a pledge of future Federal Transit Administration (FTA) funding. The debt, which was sold in March 1999, and insured by AMBAC Corporation, will be used to purchase 500 new buses for the mass transit agency.

State Sponsored

- A HOT lane was opened on State Route 91 in Orange County, California. A private company built the lanes and will operate and maintain the facility. After 35 years the lanes revert back to California. Other operational HOT lane projects include the I-15 HOV lanes in San Diego, CA, and the I-10 (Katy) HOV lane in Houston, TX.