Chapter 23

Interstate System

This chapter describes the Dwight D. Eisenhower System of Interstate and Defense Highways, commonly known as the Interstate System. The Interstate System is the backbone of transportation and commerce in the U.S. This chapter provides a snapshot of the physical conditions, operational performance, finance, and investment requirements of the Interstate System. This chapter also represents a supplementary analysis to those of the larger, national road network presented in Chapters 2 through 9 of the report.

History of the Interstate System

On June 26, 1956, President Dwight Eisenhower signed the Federal-Aid Highway Act of 1956, one of his top domestic priorities. President Eisenhower wrote in his memoirs that "more than any single action by the government since the end of the war, this one would change the face of America. Its impact on the American economy—the jobs it would produce in manufacturing and construction, the rural areas it would open up—was beyond calculation."

The 1956 legislation declared that the completion of a "National System of Defense and Interstate Highways" was essential to the national interest. This system was designed to facilitate military transportation during the Cold War, but it had countless other economic and social impacts. The Interstate System, for example, accelerated interstate and regional commerce, increased personal mobility, and led to metropolitan development throughout the United States.

The Federal-Aid Highway Act of 1956 called for new design standards, began an accelerated construction program, and established a new method for apportioning funds among the States. At the same time, the Highway Revenue Act of 1956 introduced a dedicated source for federal highway expenditures. It created a Federal Highway Trust Fund financed by highway users, allowing massive investment in infrastructure projects. Between 1954 and 2001, the federal government invested over $370 billion on Interstates through apportionments to the States.

The National Highway System Designation Act of 1995 included the Interstate System as the core of the NHS, described in Chapter 24.

System and Use Characteristics

Exhibit 23-1 describes the total public road length of the Interstate System (data for all roads can be found in Exhibit 2-8). In 2000, there were 46,675 route miles in the United States. About 71 percent of these miles were in rural communities, or 33,152 route miles. The remaining 29 percent of miles were in urban areas, or 13,523 route miles. By comparison, about 78 percent of all road miles in the United States were in rural areas, while 22 percent of miles were in urban communities.

Between 1993 and 2000, rural Interstate route miles increased by about 0.2 percent annually, while urban Interstate route miles increased by 0.6 percent annually. The 0.3 percent annual growth rate for Interstates was higher than the 0.1 percent growth rate for all roads during that time period.

Exhibit 23-1 describes the number of Interstate lane-miles between 1993 and 2000 (lane mileage data for all functional systems can be found in Exhibit 2-9). In 2000, there were 209,133 lane miles of Interstates in the United States. About 64.5 percent of lane miles were in rural communities, or 135,000 lane miles. About 35.5 percent of lane miles were in urban areas, or 74,133 lane miles. By comparison, about 76.6 percent of all highway lane miles in the United States were in rural areas, and 23.4 percent of lane miles were in urban areas.

Between 1993 and 2000, rural Interstate lane miles grew by 0.3 percent annually, while urban Interstate lane miles grew by 0.8 percent annually. The 0.5 percent annual growth rate for Interstates was more than double the 0.2 percent annual growth rate for all roads in the United States between 1993 and 2000. This growth has occurred due to both new construction and the reclassification of some arterials to Interstate status.

Exhibit 23-1

Interstate Route & Lane Miles, Selected Years 1993-2000

	1993	1995	1997	1999	2000	ANNUAL RATE OF CHANGE 2000/1993
Route Miles						
Rural	32,795	32,703	32,919	33,077	33,152	0.2%
Urban	13,007	13,300	13,395	13,486	13,523	0.6%
Total	**45,802**	**46,003**	**46,314**	**46,563**	**46,675**	**0.3%**
Lane Miles						
Rural	132,559	132,346	133,573	134,611	135,000	0.3%
Urban	69,895	72,134	72,968	74,033	74,133	0.8%
Total	**202,454**	**204,480**	**206,541**	**208,644**	**209,133**	**0.5%**

Source: Highway Performance Monitoring System.

Exhibit 23-2 describes the number of Interstate bridges in 1996, 1998, and 2000 (data for all bridges can be found in Exhibit 2-10). Between 1996 and 2000, the number of rural Interstate bridges dropped from 28,638 to 27,797 bridges, while during the same period, the number of urban Interstate bridges increased from 26,596 to 27,882. The reduction in rural bridges is caused in part by the reclassification of some rural Interstates to urban status as communities have grown in size.

Exhibit 23-2

Number of Interstate Bridges, 1996, 1998, and 2000

	1996	1998	2000
Rural	28,638	27,530	27,797
Urban	26,596	27,480	27,882
Total	**55,234**	**55,010**	**55,679**

Source: National Bridge Inventory

Exhibit 23-3 describes vehicle miles traveled (VMT) on Interstate highways between 1993 and 2000. Use data for all roads can be found in Exhibits 2-13, 2-14, and 2-15. In 2000, Americans traveled 270 billion vehicle miles on rural Interstates and 397 billion vehicle miles on urban Interstates. Interstate travel represented the fastest growing portion of VMT between 1993 and 2000. Interstate VMT grew at an average annual rate of 3.4 percent between 1993 and 2000, while VMT on all roads grew by about 2.7 percent annually.

Exhibit 23-4 describes Interstate highway travel by vehicle type between 1993 and 2000. In 2000, 80.3 percent of travel on rural Interstates was by passenger vehicles; 3.1 percent was by single-unit trucks; and 16.6 percent was by combination trucks. About

Exhibit 23-3

Interstate Vehicle Miles Traveled (VMT), 1993-2000, (Millions of VMT)

	1993	1995	1997	1999	2000	ANNUAL RATE OF CHANGE 2000/1993
Rural	209,470	224,705	241,451	261,485	270,314	3.7%
Urban	319,621	344,640	364,769	386,874	397,291	3.2%
Total	**529,091**	**569,345**	**606,220**	**648,359**	**667,605**	**3.4%**

Source: Highway Performance Monitoring System.

91.8 percent of urban Interstate travel was by passenger vehicles; 2.2 percent was by single-unit trucks; and 6 percent was by combination trucks. By contrast, passenger vehicle travel represented 92.5 percent of travel on all roads in 2000. Single-unit truck travel comprised 2.6 percent of travel, and combination truck travel represented 4.9 percent.

Exhibit 23-4

Interstate Miles Traveled by Vehicle Type, 1993-2000, Millions of VMT

	1993	1995	1997	1999	2000	ANNUAL RATE OF CHANGE 2000/1993
Rural						
PV	169,500	180,031	188,969	207,046	214,175	3.4%
SU	5,982	6,708	7,667	8,073	8,260	4.7%
Combo	32,826	36,644	41,642	42,976	44,377	4.4%
Urban						
PV	294,703	315,888	330,668	348,531	358,906	2.9%
SU	6,513	7,148	7,906	8,494	8,719	4.3%
Combo	16,183	18,492	20,641	23,792	23,472	5.5%

PV = Passenger vehicles (including buses and 2-axle, 4-tire vehicles)
SU = Single Unit Trucks (6 tires or more)
Combo = Combination Trucks (trailers and semi-trailers)
Note: Table does not include VMT for Puerto Rico

Source: Highway Statistics, Summary to 1995, Table VM-201; Highway Statistics, 1997, VM-1; November 2001 HPMS.

Travel on rural and urban Interstates grew faster than on any other functional system. Between 1993 and 2000, for example, combination truck travel grew by 5.5 percent annually on urban Interstates and by 4.4 percent on rural Interstates. By comparison, combination truck travel on all roads increased by 3.9 percent annually between 1993 and 2000.

Physical Conditions

Chapter 3 describes the physical conditions of highways throughout the United States. There are numerous ways to examine physical conditions. This section looks at pavement condition; lane width; and alignment adequacy.

Pavement Condition

Exhibit 23-5 shows the percentage of total Interstate miles with "Acceptable" or better ride quality by population group for select years from 1993 to 2000. Also shown is the amount of Interstate pavement meeting a standard of "Good" ride quality. Since 1995, the number of Interstate miles rated as having "Good" ride quality has increased in all three population groups. (See Exhibit 23-6).

In 2000, rural area Interstates had the greatest percentage of miles with "Acceptable" or better ride quality. About 98 percent of rural area Interstates met this standard. As a subset of the miles with "Acceptable" ride quality, 68.5 percent of rural Interstate miles met standards required for classification as "Good" ride quality.

Exhibit 23-5

Percent of Interstate Miles with Acceptable Ride Quality for Selected Years

LOCATION OF INTERSTATES	1993	1995	1997	1999	2000
Rural Areas	93.5%	94.5%	95.9%	97.6%	97.8%
Small Urban Areas	93.5%	94.4%	95.8%	95.4%	95.8%
Urbanized Areas	89.8%	90.0%	90.0%	92.2%	93.0%

Source: Highway Performance Monitoring System.

For small urban Interstate miles, 95.8 percent met the criteria for "Acceptable" ride quality. As a subset of the miles with "Acceptable" ride quality, 61.6 percent met the standards to be classified as "Good" ride quality in the year 2000.

Exhibit 23-6

Percent of Interstate Miles with Good Ride Quality for Selected Years

LOCATION OF INTERSTATES	1995	1997	1999	2000
Rural Areas	51.8%	56.9%	65.4%	68.5%
Small Urban Areas	49.8%	51.4%	58.2%	61.6%
Urbanized Areas	41.4%	39.3%	45.0%	48.2%

Source: Highway Performance Monitoring System.

In 2000, 93.0 percent of urbanized Interstate miles met the criteria for "Acceptable" ride quality. As a subset of this group meeting "Acceptable" ride quality, 48.2 percent of the urbanized Interstate miles met the standards to be classified as having "Good" ride quality.

Lane Width, Alignment, and Access Control

Another way of examining Interstate condition is by lane width. Currently, higher functional systems such as Interstates are expected to have 12-foot lanes. Approximately 97.1 percent of rural Interstate miles and 98.2 percent of urban Interstate miles have minimum 12-foot lanes widths (see also Exhibits 3-14 and 3-15 in Chapter 3).

Another way of examining Interstate condition is by alignment. As described in Chapter 3, alignment affects the level of service and safety of the highway system. Inadequate alignment may result in speed reductions as well as impaired sight distance. In particular, trucks are affected by inadequate roadway alignment with regard to speed.

There are two types of alignment: horizontal (curvature) and vertical (gradient) . Alignment adequacy is evaluated on a scale from Code 1 (best) to Code 4 (worst). Exhibit 23-7 summarizes alignment for rural Interstates (alignment is normally not an issue in urban areas). More than 92.8 percent of rural Interstate miles are classified as Code 1 for vertical and 95.6 percent are classified as Code 1 for horizontal alignment.

The vast majority of the Interstate mileage consists of divided highways with a minimum of four lanes and with full access control. The Interstate Systems for Alaska and Puerto Rico are not required to meet this standard.

Exhibit 23-7

Rural Interstate Vertical/Horizontal Alignment Status for 2000 Percent Miles

	VERTICAL	HORIZONTAL
Code1: All curves and grades meet appropriate design standards.	92.8%	95.6%
Code 2: Some curves or grades are below design standards for new construction, but curves can be negotiated safely at prevailing speed limits. Truck speed is not substantially affected.	6.0%	1.3%
Code 3: Infrequent curves or grades occur that impair sight distance or severely affect truck speeds. May have reduced speed limits.	0.4%	1.1%
Code 4: Frequent grades occur that impair sight distance or severely affect truck speeds. Generally, curves are unsafe or uncomfortable at prevailing speed limit, or the speed limit is severely restricted due to the design speed limits of the curves.	0.7%	2.0%

Source: Highway Performance Monitoring System.

For these States, the requirement is that construction is adequate for current and probable future traffic demands and the needs of the locality. In Alaska, 1,034 miles of rural Interstate are not required to have a minimum of four lanes and full access control. For urban Interstates, 104 miles do not meet the specified criteria for access control; 53 of these miles are in Puerto Rico and the remainder are in Alaska.

Bridge Conditions

Detailed information about Interstate bridge conditions is found in Chapter 3. Exhibit 3-29 notes, for example, that approximately 16 percent of all rural Interstate bridges were deficient in 2000. More specifically, 1,076 of all rural Interstate bridges were structurally deficient (about 3.9 percent of the total number) and 3,384 were functionally obsolete (12.2 percent of the total number). Among rural functional systems, only other principal arterials had a lower percentage of bridge deficiencies.

About 27 percent of all urban Interstate bridges were deficient in 2000. More specifically, 1,809 of all urban Interstate bridges were structurally

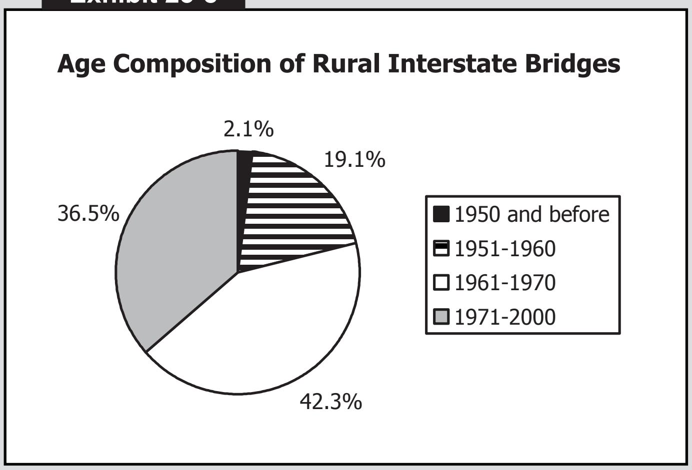
Q. **How old are most Interstate bridges?**

A. The aging of Interstate bridges is a significant concern for the Federal Highway Administration and its State and local partners.

Exhibit 23-8 describes the age of rural Interstate bridges. About 42.3 percent of rural Interstate bridges were built during the early years of the Interstate System, from 1961 to 1970. Approximately 63.5 percent of all rural Interstate bridges in 2000 were at least 30 years old.

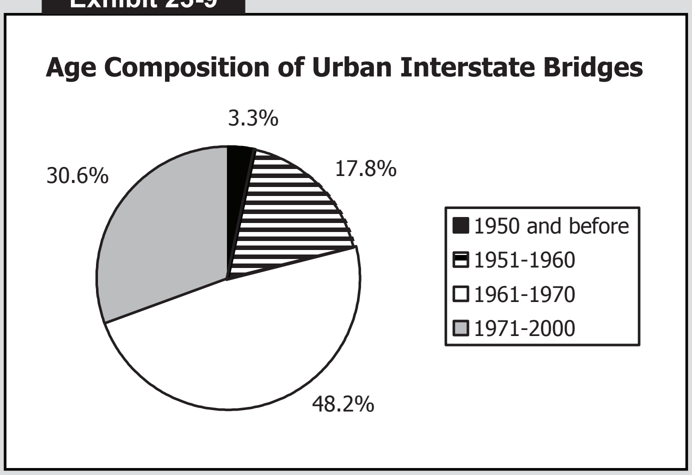
Exhibit 23-9 describes the age of urban Interstate bridges. About 48.2 percent of urban Interstate bridges were built between 1961 and 1970. Approximately 69.3 percent of all urban Interstate bridges in 2000 were at least 30 years old.

Exhibit 23-8



Source: National Bridge Inventory.

Exhibit 23-9



Source: National Bridge Inventory.

deficient (6.5 percent of the total) and 5,727 were functionally obsolete (20.5 percent of the total). Among urban functional systems, the Interstate System had the lowest percentage of deficient bridges.

The number of deficient bridges has steadily declined. In 1994, for example, 18.5 percent of rural Interstate bridges were deficient. That number had declined to 16.0 percent by 2000. The number of deficient urban Interstate bridges also declined, from 30.6 percent in 1994 to 27 percent in 2000.

Another way of examining bridge deficiencies is by the percent of deficient deck area. About 17.9 percent of rural Interstate bridge deck area was deficient in 1996. This number had decreased to 15 percent by 2000, the lowest of any rural functional system. The percent of deficient deck area on urban Interstate bridges declined from 34.2 percent in 1996 to 31.6 percent in 2000.

Operational Performance

Within urban areas, the level of operational performance for the Interstate system is a major concern and a growing problem. Based on the new performance measures adopted by the Federal Highway Administration (FHWA) and described in Chapter 4, congestion has continued to worsen between 1997 and 2000.

Each of the three new metrics—the percent of additional travel time, annual hours of delay, and the percent of travel under congested conditions—worsened since 1997 for the Interstate System in urban areas. Exhibit 23-10 presents the data from 1997 through 2000.

Exhibit 23-10

Urbanized Interstate Operational Performance Measures

	YEAR			
	1997	**1998**	**1999**	**2000**
Travel Time Index	1.559	1.572	1.599	1.627
Percent of Congested Daily Travel	26.650	27.360	28.170	29.130
Annual Delay per Person (hours)	10.131	10.189	10.969	11.430
Annual Delay (billion hours)	2.010	2.050	2.230	2.350
Annual Cost ($billion)	33.460	34.220	38.350	42.880

Source: Texas Transportation Institute

In rural areas, the level of operational performance on Interstates functioning under normal conditions is generally not a significant concern. However, there are some rural corridors that are becoming congested for increasing lengths of time during periods of heavy intercity travel.

Safety

Exhibits 23-11 and 23-12 describe the number of fatalities and the fatality rate for Interstates between 1994 and 2000. While the number of fatalities has increased on both rural and urban Interstates, these roads are still the safest functional systems. The most interesting distinction, however, is on Interstates, where the rural Interstate fatality rate in 2000 was double that of urban Interstates. More detailed information about highway safety can be found in Chapter 5.

Exhibit 23-11

Number of Fatalities on the Interstate System, 1994 - 2000

	1994	1995	1996	1997	1998	1999	2000
Rural Interstates	2,577	2,676	2,967	3,083	3,167	3,300	3,429
Urban Interstates	2,159	2,192	2,338	2,304	2,299	2,372	2,507

Source: Fatality Analysis Reporting System.

Exhibit 23-12

Fatality Rates (per 100 Million VMT) on the Interstate System, 1994 - 2000

	1994	1995	1996	1997	1998	1999	2000
Rural Interstates	1.2	1.2	1.3	1.3	1.3	1.3	1.3
Urban Interstates	0.7	0.6	0.7	0.6	0.6	0.6	0.6

Source: Fatality Analysis Reporting System.

Finance

All levels of government spent $14.1 billion for capital improvements on Interstate highways and bridges in 2000, which constituted 21.8 percent of the $64.6 billion of capital outlay on all functional classes. Exhibit 23-13 categorizes this total by type of improvement. System preservation expenditures constituted 53.7 percent of total capital spending on Interstates, with the remainder split between system expansion (39.6 percent) and system enhancements (6.7 percent). See Chapter 6 for definitions of the 3 improvement types.

Exhibit 23-13

Interstate Capital Expenditures, 2000

	Total Invested (Billions of Dollars)			Percent of Total	Percent of Total for all Functional Classes		
	RURAL	URBAN	TOTAL	INTERSTATE	RURAL	URBAN	TOTAL
System Preservation							
Highway Preservation	$2.8	$3.2	$5.9	42.1%	10.7%	12.2%	22.8%
Bridge Preservation	$0.4	$1.2	$1.6	11.6%	5.7%	15.7%	21.4%
Subtotal	**$3.2**	**$4.4**	**$7.6**	**53.7%**	**9.6%**	**13.0%**	**22.5%**
System Expansion							
Additions to Existing Roadways	$0.7	$1.8	$2.5	17.8%	5.0%	13.2%	18.3%
New Routes	$0.3	$2.4	$2.7	18.9%	2.6%	21.5%	24.1%
New Bridges	$0.0	$0.4	$0.4	2.9%	2.3%	32.6%	34.9%
Subtotal	**$1.0**	**$4.6**	**$5.6**	**39.6%**	**3.9%**	**17.6%**	**21.5%**
System Enhancements	**$0.2**	**$0.7**	**$0.9**	**6.7%**	**4.8%**	**13.7%**	**18.5%**
Total Investment	**$4.5**	**$9.6**	**$14.1**	**100.0%**	**6.9%**	**14.9%**	**21.8%**

Capital Investment Requirements

Exhibits 7-2 and 7-3 show the estimated average annual Cost to Improve Highways and Bridges and Cost to Maintain Highways and Bridge for 2001-2020, categorized by functional class and improvement type. For the Cost to Improve scenario, investment requirements for rural and urban Interstates total $5.8 billion (5.5 percent of total) and $21.1 billion (19.8 percent of the total), respectively. At this level of investment, all cost beneficial improvements would be implemented. See Chapter 7 and Appendix A for more on the investment requirements methodology used in this report.

For the Cost to Maintain scenario, the portion of estimated investment requirements on Interstates totals $4.5 billion for rural and $18.4 billion for urban. These amounts comprise 5.9 and 24.2 percent, respectively, of the total Cost to Maintain Highways and Bridges. At this level of investment, average user costs on all highways in 2020 would be maintained at their 2000 levels. User costs would increase on some sections and functional classes and would decrease on others. In the case of Interstate highways, average user costs in rural areas would increase and average user costs in urban areas would decrease slightly.

Exhibits 23-14 through 23-17 show the impacts of different levels of future capital spending on the physical conditions and operational performance of rural and urban Interstates. The first line in each exhibit shows current values for each of the measures, and the second line corresponds to the maximum economically efficient level of investment. All investment levels are in constant 2000 dollars.

Exhibits 23-14 and 23-16 show the impact of different levels of highway preservation spending on pavement condition, and Exhibits 23-15 and 23-17 show the impact of combined highway preservation and expansion outlays on measures of operational performance. Highway preservation and system expansion investment requirements are modeled by the Highway Economic Requirements System (HERS) (see Appendix A).

Expenditures on system enhancements (including traffic operational improvements, safety improvements and environmental enhancements) are not directly modeled, and are not included in the totals shown in the exhibits. Bridge preservation investment requirements are discussed separately below.

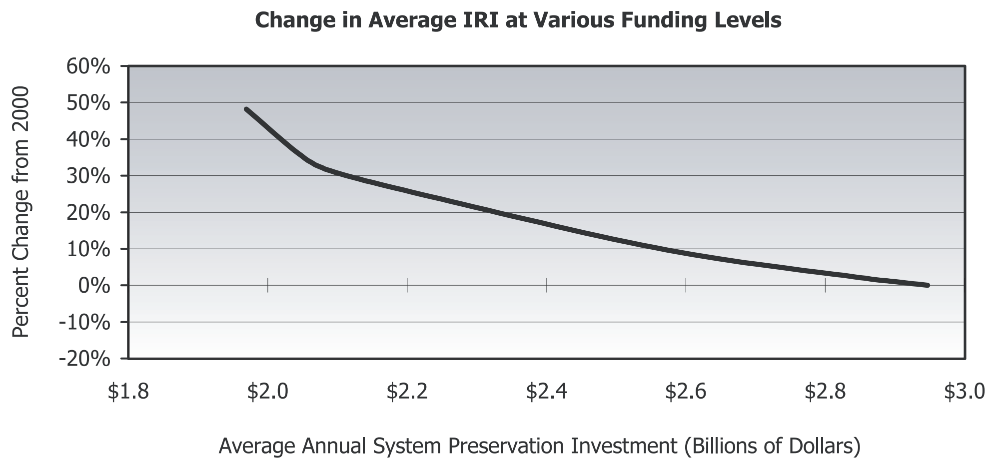
Rural Interstates

Exhibit 23-14 shows projected values for average International Roughness Index (IRI), a measure of average pavement condition, and the percentage of VMT at an IRI below 95 and below 170. These two levels are used to define "Good" and "Acceptable" levels of pavement ride quality. (Chapter 3 provides more information on how pavement condition is defined.) The exhibit shows that an average highway preservation investment of $2.95 billion on rural Interstates would be sufficient to maintain average pavement condition at its current level, while current levels of VMT on pavement with "Good" and "Acceptable" ride quality could be maintained at a lower level of investment. Rural Interstate highway preservation spending in 2000 was $2.78 billion, slightly below the level required to maintain average IRI. However, at this funding level, a larger share of rural Interstate travel would occur on "Good" or "Acceptable" pavements in the future.

Exhibit 23-15 shows how future values for average speed (an indicator of performance), total user costs, and travel time costs on rural Interstates would be affected by different levels of highway preservation and expansion investment. Average user costs on rural Interstates would be maintained at an average annual investment level of $4.65 billion. Average speed on rural Interstates would be maintained at an investment level between $3.90 and $3.68 billion; the 2000 level of highway preservation and expansion investment of $3.78 billion falls into this range. Travel time costs on rural Interstates would be maintained at an investment level slightly above $3.90 billion.

Exhibit 23-14

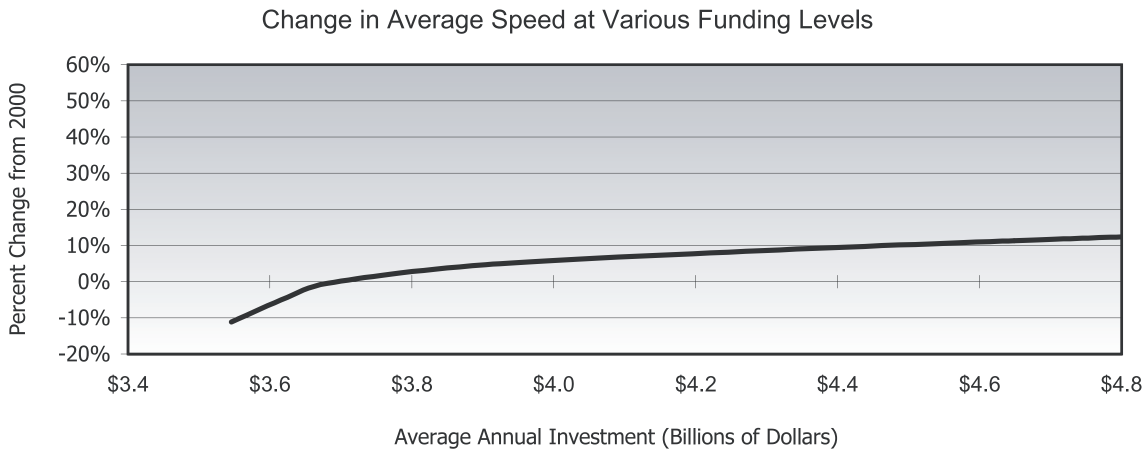
Projected Rural Interstate Pavement Condition in 2020 for Different Possible Funding Levels



AVERAGE ANNUAL HIGHWAY PRESERVATION INVESTMENT (RURAL INTERSTATES) (Millions of 2000 Dollars)	PERCENT CHANGE IN AVERAGE IRI	PERCENT OF VMT ON ROADS WITH IRI<95	PERCENT OF VMT ON ROADS WITH IRI<170	FUNDING LEVEL DESCRIPTION: INVESTMENT REQUIRED TO...
$2.78		**70.3%**	**85.2%**	2000 Values
$2.95	**0.0%**	88.5%	95.8%	...Maintain Average IRI
$2.84	2.4%	85.9%	93.7%	
$2.57	9.6%	**78.1%**	**87.8%**	...Maintain VMT with IRI<95 and <170
$2.26	22.9%	**63.0%**	**76.5%**	
$2.09	31.3%	54.8%	69.8%	
$2.04	36.1%	51.0%	65.8%	
$1.97	48.2%	42.3%	57.4%	

Exhibit 23-15

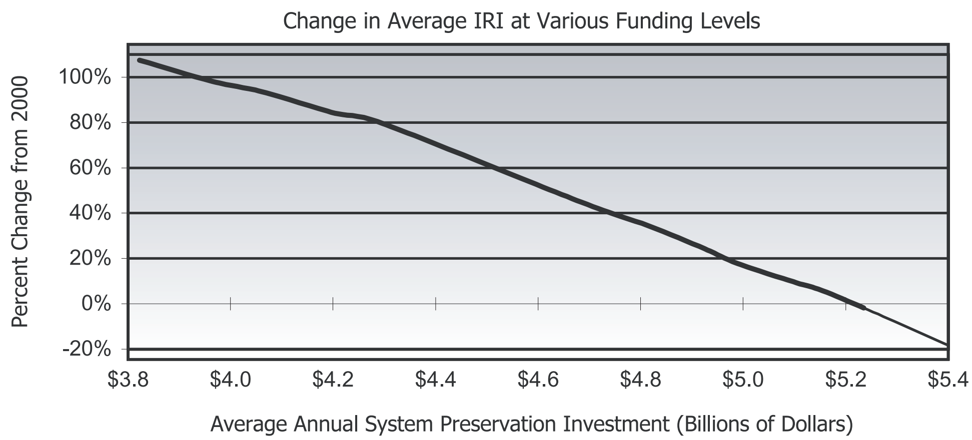
Projected Rural Interstate Conditions and Performance in 2020 for Different Possible Funding Levels



AVERAGE ANNUAL HIGHWAY PRESERVATION + EXPANSION INVESTMENT (RURAL INTERSTATES) (BILLIONS OF 2000 DOLLARS)	PERCENT CHANGE IN AVERAGE SPEED	TOTAL USER COSTS	TRAVEL TIME COSTS	FUNDING LEVEL DESCRIPTION: INVESTMENT REQUIRED TO...
$3.78				2000 Values
$4.80	12.4%	-0.1%	-3.5%	
$4.65	11.4%	**0.0%**	-3.2%	...Maintain Average User Costs
$4.29	8.6%	0.5%	-1.9%	
$3.90	4.7%	1.5%	**0.6%**	...Maintain Average Travel Time Costs
$3.68	**-0.5%**	2.3%	3.2%	...Maintain Average Speeds
$3.62	-4.3%	2.7%	4.5%	
$3.55	-11.2%	4.1%	8.4%	

Exhibit 23-16

Projected Urban Interstate Pavement Condition in 2020 for Different Possible Funding Levels



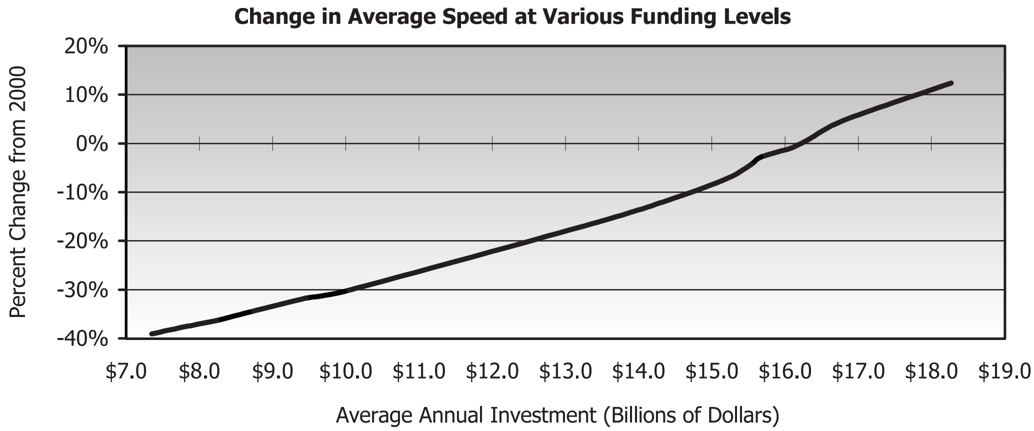
AVERAGE ANNUAL HIGHWAY PRESERVATION INVESTMENT (URBAN INTERSTATES) (BILLIONS OF 2000 DOLLARS)	PERCENT CHANGE IN AVERAGE IRI	PERCENT OF VMT ON ROADS WITH IRI<95	PERCENT OF VMT ON ROADS WITH IRI<170	FUNDING LEVEL DESCRIPTION: INVESTMENT REQUIRED TO...
$3.15		45.3%	52.8%	2000 Values
$5.41	-19.63%	88.9%	89.9%	
$5.24	**-1.87%**	69.7%	72.2%	...Maintain Average IRI
$5.15	6.54%	62.3%	65.2%	
$5.10	9.35%	60.4%	63.2%	
$4.99	17.76%	53.8%	57.1%	
$4.93	24.30%	**47.2%**	**50.9%**	...Maintain VMT with IRI<95 and <170
$4.81	34.58%	40.0%	43.7%	
$4.68	44.86%	34.1%	38.0%	
$4.29	80.37%	20.8%	24.1%	
$4.20	84.11%	20.0%	23.3%	
$4.06	93.46%	18.5%	21.5%	
$3.96	98.13%	17.2%	20.2%	
$3.82	107.48%	16.3%	19.3%	

Urban Interstates

Exhibits 23-16 and 23-17 show the impacts on the same measures of conditions and performance for different levels of capital spending on urban Interstates. Exhibit 23-16 shows that an average annual highway preservation investment of approximately $5.2 billion is required to maintain average IRI at 2000 levels. As with rural Interstates, the percentage of travel on urban Interstate pavements with "Good" or "Acceptable" ride quality would increase at this level of investment. Note, however, that all of the investment levels shown in Exhibit 23-16 are well above actual 2000 highway preservation expenditures of $3.15 billion. The results suggest that a substantial increase in urban Interstate investment would be necessary to prevent pavement condition on urban Interstates from deteriorating considerably in the future.

Exhibit 23-17

Projected Urban Interstate Conditions and Performance in 2020 for Different Possible Funding Levels



AVERAGE ANNUAL HIGHWAY PRESERVATION + EXPANSION INVESTMENT (URB INTERSTATES) (BILLIONS OF 2000 DOLLARS)	PERCENT CHANGE IN AVERAGE SPEED	PERCENT CHANGE IN TOTAL USER COSTS	PERCENT CHANGE IN TRAVEL TIME COSTS	FUNDING LEVEL DESCRIPTION: INVESTMENT REQUIRED TO...
$7.72				2000 Values
$18.27	12.4%	-7.5%	-13.8%	
$16.80	4.7%	-3.4%	-6.5%	
$16.32	0.8%	-1.3%	-2.8%	
$16.15	**-0.5%**	-0.5%	-1.5%	...Maintain Average Speeds
$16.09	-0.9%	**-0.3%**	-1.0%	...Maintain Average User Costs
$15.67	-2.8%	0.9%	**0.8%**	...Maintain Average Travel Time Costs
$15.53	-4.3%	1.9%	2.5%	
$15.21	-7.2%	3.8%	5.5%	
$14.49	-11.2%	6.6%	10.0%	
$13.51	-15.9%	10.1%	16.0%	
$9.99	-30.3%	23.5%	39.3%	
$9.46	-31.8%	25.1%	42.0%	
$8.68	-34.6%	28.5%	48.0%	
$8.24	-36.3%	30.7%	52.0%	
$7.71	-37.9%	32.9%	55.8%	
$7.35	-39.1%	34.5%	58.8%	

Exhibit 23-17 indicates that an average annual investment level in highway preservation and capacity expansion of between $15.7 and $16.3 billion would be adequate to maintain average speed, total user costs, and travel time costs on urban Interstates at their current levels. These amounts are more than double the comparable 2000 funding level of $7.7 billion. The results suggest that, if average annual funding were maintained (in constant dollars) at 2000 levels through 2020, average speeds on urban Interstates would drop by 38 percent, total user costs would increase by 33 percent, and travel time costs would increase by 56 percent.

Bridge Preservation

As described in Chapter 7, the National Bridge Investment Analysis System (NBIAS) model identifies preservation investment requirements for all bridges, including those on Interstates. The current Interstate bridge preservation backlog is estimated at $9.8 billion.

Exhibit 23-18 describes what the Interstate bridge backlog after 20 years would be at different funding levels. An average annual investment in bridge preservation of between $1.27 and $1.35 billion is required so that the Interstate bridge investment backlog would not increase above its current level over a 20-year period. An average annual investment of $1.82 billion is sufficient to eliminate the existing Interstate bridge investment backlog and correct other deficiencies that are expected to develop over the next 20 years, where it is cost-beneficial to do so.

Exhibit 23-18

Projected Changes in the Interstate Bridge Preservation Backlog Compared to 2000 Levels for Different Possible Funding Levels

AVERAGE ANNUAL INVESTMENT (BILLIONS OF 2000 DOLLARS)	INTERSTATE BRIDGE BACKLOG
$1.64 1/	
$1.82	$0.0
$1.71	$3.3
$1.55	$6.3
$1.41	$8.7
$1.35	$9.3
$1.27	$10.7
$1.03	$12.7
$0.85	$17.2

1/2000 Value

Source: National Bridge Investment Analysis System

Current Spending Versus Investment Requirements

Exhibits 23-14 through 23-18 indicate that current levels of highway preservation and system expansion investment on rural Interstates are close to the levels necessary to maintain conditions and performance in the future. On urban Interstates, however, substantial increases in funding for preservation and expansion would be required to prevent both average physical conditions and operational performance from becoming severely degraded.

Exhibit 23-13 indicates that bridge preservation expenditures on Interstates totaled $1.6 billion in 2000. If this level of funding were maintained in constant dollars over 20 years, the Interstate bridge preservation backlog would decrease below $6.3 billion from the current level of $9.8 billion.