CHAPTER 3

System Conditions

Summary

Exhibit 3-1 compares key highway and transit statistics discussed in this chapter with the values shown in the last report. The first data column contains the values reported in the 2004 C&P report, which were based on 2002 data. Where the 2002 data have been revised, updated values are shown in the second column. The third column contains comparable values, based on 2004 data.

Exhibit 3-1

Comparison of System Conditions Statistics with Those in the 2004 C&P Report

		2002 Data		
Statistic	**Condition**	**2004 C&P Report**	**Revised**	**2004 Data**
Total VMT on Pavements with Ride Quality of:	Good	43.8%		44.2%
	Acceptable	85.3%		84.9%
Rural VMT on Pavements with Ride Quality of:	Good	58.0%		58.3%
	Acceptable	94.1%		94.5%
Small Urban VMT on Pavements with Ride Quality of:	Good	41.6%		41.2%
	Acceptable	84.4%		84.3%
Urbanized VMT on Pavements with Ride Quality of:	Good	34.1%		36.1%
	Acceptable	79.3%		79.2%
Deficient Bridges as a Percent of Total Bridges		27.5%		26.7%
Structurally Deficient Bridges as a Percent of Total		13.7%		13.1%
Functional Obsolete Bridges as a Percent of Total		13.8%		13.6%
Average Urban Bus Vehicle Condition *		3.19	3.07	3.08
Average Rail Vehicle Condition*		3.47		3.50
Urban Bus Maintenance Facilities	Excellent	7%		17%
	Good	6%		5%
	Adequate	55%		46%
Rail Maintenance Facilities	Excellent	3%		26%
	Good	41%		17%
	Adequate	43%		48%
Rail Maintenance Yards	Excellent	1%		0%
	Good	31%		48%
	Adequate	48%		52%
Rail Stations	Excellent	3%		7%
	Good	22%		28%
	Adequate	18%		14%
Rail Track	Excellent	40%		35%
	Good	34%		39%
	Adequate	12%		18%

* Average Condition. Conditions are rated on ranking of 1 (poor) to 5 (excellent).

Highway Conditions

The pavement conditions reported in this chapter reflect all functional classifications except rural minor collectors and local roads, for which data are not available. Pavement conditions are presented for three population groupings: rural (population less than 5,000), small urban (population 5,000 to 49,999), and urbanized (population equal to or greater than 50,000). Pavement is classified as being in one of two ride quality categories—"acceptable" or "not acceptable." The acceptable category contains a sub-category—"good," which represents a higher level of performance. These ratings are derived from one of two measures: International Roughness Index (IRI) or Present Serviceability Rating (PSR). The definitions for IRI and PSR, the relationship between them, and the ride quality ratings are discussed later in the chapter. This chapter focuses on ride quality on all roads for which data are available; Chapter 12 includes statistics on ride quality on the National Highway System (NHS).

Between 2002 and 2004, the percentage of vehicle miles traveled (VMT) on pavements with good ride quality has increased from 43.8 percent to 44.2 percent. For the same period, there has been a decrease in the percentage of VMT on pavements with acceptable ride quality from 85.3 percent to 84.9 percent. In rural areas, the percentage of VMT on pavements with good ride quality increased from 58.0 percent to 58.3 percent, percentage of VMT on pavements with acceptable ride quality increased from 94.1 percent to 94.5 percent. In contrast, the comparable good and acceptable percentages for small urban areas both declined over this period, from 41.6 percent to 41.2 percent for good and from 84.4 percent to 84.3 percent for acceptable. The situation was mixed for urbanized areas as the percentage of VMT on pavements with good ride quality rose from 34.1 percent in 2002 to 36.1 percent in 2004, while the percent of travel on acceptable pavements fell from 79.3 percent to 79.2 percent.

Bridge Conditions

The Federal Highway Administration (FHWA) has adopted as the performance measure for bridge condition the percent of total deck area that is on deficient bridges on the NHS and the percent of total deck area that is on deficient bridges off the NHS. This statistic is calculated based on the total deck area of deficient bridges, whether structurally deficient or functionally obsolete, divided by the total deck area for all bridges. All ranges of average daily traffic (ADT) are included in the calculation; however, separate and specific performance goals have been set for NHS and non-NHS bridges for performance planning purposes. This chapter focuses on the physical conditions of all bridges; Chapter 12 examines bridge conditions on the NHS in more detail.

The total number of structurally deficient bridges in 2004 was 77,796, which accounted for 9.7 percent of the total deck area on all bridges. The number of functionally obsolete bridges in 2004 was 80,632, which accounted for approximately 17.4 percent of the total deck area. When combined, the total number of structurally deficient and functionally obsolete bridges for 2004 was 158,428 and accounted for 27.1 percent of the total deck area.

The percent of structurally deficient bridges declined from 13.7 percent in 2002 to 13.1 percent in 2004. The percent of functionally obsolete bridges also declined, from 13.8 percent to 13.6 percent, so that the combined percent of structurally deficient and functionally obsolete bridges fell from 27.5 percent to 26.7 percent.

Transit Conditions

The Federal Transit Administration (FTA) estimates conditions for transit vehicles, maintenance facilities, yards, stations, track, structures, and power systems using the Transit Economic Requirements Model (TERM), data collected through the National Transit Database (NTD) and special engineering surveys of transit assets. Since the 2004 C&P report, asset data for approximately 35 percent of the Nation's transit assets have been updated.

The estimated condition of transit vehicles improved between 2002 and 2004, and the average age of transit vehicles declined. On a scale of 1 (poor) to 5 (excellent), bus vehicles had an average condition of 3.08 in 2004 compared with 3.07 in 2002**.** The average age of the bus vehicle fleet was virtually unchanged, declining from 6.2 years in 2002 to 6.1 years in 2004. The average condition of the rail fleet increased from 3.47 in 2002 to 3.50 in 2004. The average age of rail vehicles declined from 20.4 years in 2002 to 19.7 years in 2004. Average rail vehicle age and condition are heavily influenced by the average age and condition of heavy rail vehicles, which account for 60 percent of the U.S. fleet.

The average condition of urban bus maintenance facilities (including facilities for vans and demand response vehicles) improved, increasing from 3.34 in 2002 to 3.41 in 2004. In 2004, 46 percent of urban bus maintenance facilities was in adequate condition, 5 percent was in good condition, and 17 percent was in excellent condition, for a combined total of 69 percent in adequate or better condition. The conditions of rail maintenance facilities increased from 3.56 in 2002 to 3.82 in 2004. This increase reflects updated inventory information collected since the last report from some of the Nation's younger and larger rail agencies. Ninety-two percent of all rail maintenance facilities are estimated to be in adequate or better condition and 8 percent in poor or substandard condition.

The condition of rail stations increased from 2.87 in 2002 to 3.37 in 2004 as a result of a revision in the decay curves and the fact that, on average, rail stations 22 years or older are in much better condition than previously estimated. Based on on-site surveys in 2004, subway stations were also found to be in better condition, on average, than elevated or at-grade stations. (In contrast, asset information collected for the 2004 report found stations to be in worse condition than previously estimated.) Nonrail stations are, on average, in better condition than rail stations. The condition of nonrail stations is estimated to have declined from 4.37 in 2002 to 4.23 in 2004. Surveys of nonrail stations have not been conducted.

Based on preliminary on-site engineering surveys in 2005, the condition of rail communications systems were found to be better than provided in the last report, the condition of train control systems slightly worse, and the condition of traction power systems about the same. These surveys are continuing in 2006; the final results will be discussed in the 2008 C&P report. The estimated conditions of structures, track, and yards have also been revised upwards and are in adequate to good condition.

Road Conditions

Pavement Terminology and Measurements

Pavement condition affects costs associated with travel, including vehicle operation, delay, and crash expenses. Poor road surfaces cause additional wear and tear on, or even damage to, vehicle suspensions, wheels, and tires. Delay occurs when vehicles slow for potholes or very rough pavement; in heavy traffic, such slowing can create significant queuing and subsequent delay. Inadequate road surfaces may reduce road friction, which affects the stopping ability and maneuverability of vehicles. This, and unexpected changes in surface conditions, may result in crashes.

The pavement condition ratings in this section are derived from one of two measures: the International Roughness Index (IRI) or the Present Serviceability Rating (PSR). The IRI measures the cumulative deviation from a smooth surface in inches per mile. The PSR is a subjective rating system based on a scale of 0 to 5. Prior to 1993, all pavement conditions were evaluated using PSR values. A conversion table is used to translate PSR values into equivalent IRI values to classify mileage for the tables in this section.

The FHWA adopted the IRI for the higher functional classifications because it is an objective measurement and is generally accepted worldwide as a pavement roughness measurement. The IRI system results in more consistent data for trend analyses and cross jurisdiction comparisons. *Exhibit 3-2* contains a description of qualitative pavement condition terms and corresponding quantitative PSR and IRI values. The translation between PSR and IRI is not exact; IRI values are based on objective measurements of pavement roughness, while PSR is a subjective evaluation of a broader range of pavement characteristics. For example, a given Interstate pavement section could have an IRI rating of 165, but might be rated a 2.4 on the PSR scale. Such a section would be rated as acceptable based on its IRI rating, but would not have been rated as acceptable had PSR been used. Thus, the mileage of any given pavement condition category may differ depending on the rating methodology. The historic pavement ride quality data in this report go back to 1995, while IRI data only began to be collected in 1993. Caution should be used when making

Q&A

How much of the pavement data reflected in this Chapter is based on IRI data, as opposed to PSR data?

The FHWA's *Highway Performance Monitoring System (HPMS) Field Manual* requires reporting of IRI data for all principal arterials and any other roadway that is part of the NHS. Reporting is required on a sample basis for rural minor arterials. Compliance with this requirement exceeded 99 percent in 2004 for rural Interstate, rural other principal arterials, rural minor arterials, urban Interstate and urban other freeways and expressways. However, IRI values were reported for only 95 percent of urban other principal arterials.

States may choose between reporting IRI or PSR data on a sample basis for rural major collectors, urban minor arterials, and urban collectors, although IRI reporting is recommended. States are gradually shifting over to reporting IRI data. For rural major collectors, the percentage of sample sections for which IRI data were reported rose from 63 percent in 2002 to 69 percent in 2004. In 2004, IRI data were reported for 61 percent of urban minor arterial sample sections.

comparisons with older data from earlier editions of this report and when attempting to make comparisons between PSR and IRI data in general.

The *Federal Highway Administration 1998 National Strategic Plan* introduced a new descriptive term for pavement condition on the National Highway System, "acceptable ride quality," which was defined as pavements having an IRI value less than or equal to 170 inches per mile. To place greater emphasis on the benefits of ride quality to highway users, this metric was subsequently revised and based on the percentage of vehicle miles traveled (VMT) on NHS pavements with acceptable ride quality. The U.S. Department of Transportation has subsequently adopted an even more exacting performance measure, the percentage of VMT on NHS with "good ride quality," defined as having an IRI value less than 95 inches per mile. While these descriptive terms were originally defined in terms of the NHS, in this chapter these IRI measures are applied to all functional classes. Note that "good" represents a subset of "acceptable" and this report does not apply any specific descriptive label to pavements with IRI values greater than or equal to 95 but less than or equal to 170 inches per mile, which fall within the "acceptable" range but outside the "good" range.

Exhibit 3-2

Pavement Condition Criteria

	All Functional Classifications	
Ride Quality Terms*	**IRI Rating**	**PSR Rating**
Good	< 95	≥ 3.5
Acceptable	≤ 170	≥ 2.5
Not Acceptable	> 170	< 2.5

* The threshold for "Acceptable" ride quality used in this report is the 170 IRI value as set by the FHWA Performance Plan for the NHS. Some transportation agencies may use less stringent standards for lower functional classification highways to be classified as "Acceptable."

While this edition of the C&P report retains a summary exhibit based on pavement conditions in terms of mileage to maintain continuity with previous editions, most exhibits are based on the percentage of VMT occurring on pavements with good and/or acceptable ride quality. The conditions of the roadways on the Interstate System and for the NHS are discussed in more detail in Chapters 11 and 12.

Overall Pavement Ride Quality

For those functional classes on which data are collected, the VMT on pavements with good ride quality has increased from 39.8 percent in 1995 to 44.2 percent in 2004. The VMT on pavements meeting the standard of acceptable (which includes the category of good) have shown a steady decrease from 86.6 percent in 1995 to 84.9 percent in 2004. [*Exhibit 3-3*]

Q&A

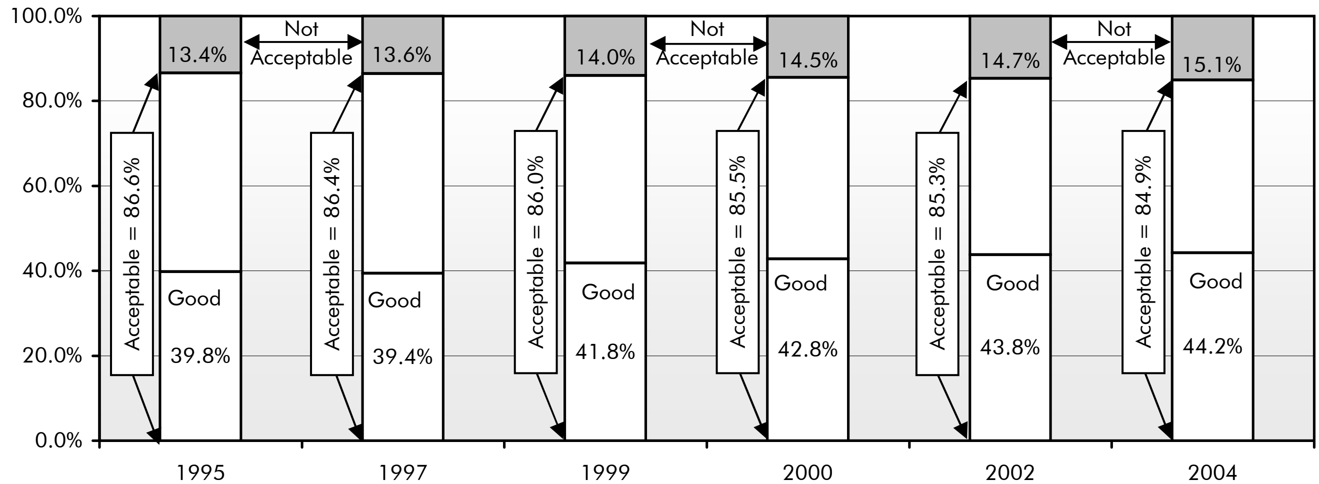
Do other measures of pavement condition exist?

Other principal measures of pavement condition or distress such as rutting, cracking, and faulting exist, but are not reported in HPMS. States vary in the inventories of these distress measures for their highway systems. To continue improving our pavement evaluation, FHWA is undertaking an effort to determine which measures are commonly collected by most states. Adding such measures to FHWA's database would enable the agency to account for pavement needs nationwide more accurately.

It is important to note that the pavement data presented in this chapter do not include rural minor collectors or the rural local and urban local functional classifications, since such data are not collected in the HPMS. These functional classifications account for almost 75.7 percent of the total mileage on the Nation's system and 72.3 percent of the total lane mileage. However, they carry only 14.8 percent of the total daily VMT on the Nation's roadway system, so this omission is less significant since this report has shifted its focus to VMT-based measures of ride quality rather than mileage-based measures.

Exhibit 3-3

Percent of VMT on Pavements With Good and Acceptable Ride Quality, 1995–2004



Note: Excludes Rural Minor Collectors and roads functionally classified as Local, for which data are not available.

Source: Highway Performance Monitoring System.

Rural and Urban Pavement Ride Quality

When discussing ride quality, it is important to note the different travel characteristics between rural and urban areas. As noted in Chapter 2, rural areas contain 75.1 percent of road miles, but only 35.9 percent of annual VMT. In other words, although rural areas have a larger percentage of road miles, the majority of travel is occurring in urban areas. According to 2004 data, the amount of VMT on pavements rated as having good ride quality in rural areas is higher than those in small urban and urbanized areas. *Exhibit 3-4* shows that 58.3 percent of total VMT in rural areas is on pavement with good ride quality, compared with 41.2 percent of VMT in small urban areas and 36.1 percent of the VMT in urbanized areas.

Exhibit 3-4

Percent of VMT on Pavements With Good and Acceptable Ride Quality, by Population Area, 1995–2004

	1995	1997	1999	2000	2002	2004
Rural						
Good (IRI<95)	46.3%	47.9%	53.0%	55.2%	58.0%	58.3%
Acceptable (IRI ≤170)	91.5%	92.5%	93.5%	93.8%	94.1%	94.5%
Small Urban						
Good (IRI<95)	39.8%	39.3%	40.0%	41.2%	41.6%	41.2%
Acceptable (IRI ≤170)	83.9%	84.0%	83.9%	84.1%	84.4%	84.3%
Urbanized						
Good (IRI<95)	35.2%	33.5%	34.1%	34.3%	34.1%	36.1%
Acceptable (IRI ≤170)	83.5%	82.6%	81.0%	79.9%	79.3%	79.2%

Source: Highway Performance Monitoring System.

The percentage of VMT classified as occurring on pavements rated as having good ride quality in the rural areas has steadily increased from 46.3 percent in 1995 to 58.3 percent in 2004. The percentage of VMT on similar pavements in small urban and urbanized areas has fluctuated during the same period. In small urban areas, the percentage of VMT on good pavements increased from 39.8 percent in 1995 to a high of 41.6 percent in 2002 before declining to 41.2 percent in 2004. In urbanized areas, the range of fluctuation is smaller, as the percentage of VMT on good pavements decreased from 35.2 percent in 1995 to 33.5 percent in 1997 before rising to 36.1 percent in 2004.

The percentage of VMT on pavements with acceptable ride quality increased from 91.4 percent for 1995 to 94.5 percent for 2004 in rural areas; in small urban areas the comparable percentage rose from 83.9 percent to 84.3 percent over the same period of time. However, the percentage of VMT on pavements rated in acceptable condition has decreased from 83.5 percent to 79.2 percent in urbanized areas. The declines in urbanized areas more than offset the increases in rural and small urban areas, causing the overall decline shown earlier in Exhibit 3-3.

Pavement Ride Quality by Functional Classification

Roads classified as Interstate have the largest percentage of VMT per lane mile, followed (in order) by other principal arterials, minor arterials, collectors, and locals. Therefore, improving ride quality on a mile of an Interstate route affects more users than improving ride quality on a mile of road on a lower functional classification.

The percentages of VMT on Interstate pavements rated as having acceptable ride quality (includes the higher standard of good) in 2004 were for rural Interstates—97.8 percent, small urban Interstates—95.0 percent, and urbanized Interstates—89.9 percent. When considering the VMT on Interstate pavements meeting the higher standard of good ride quality, 73.7 percent of the VMT on rural Interstates was on pavements rated as good; for small urban Interstates, 65.6 percent of the VMT was on good quality pavements; the comparable percentages for small urban and urbanized Interstates were 65.6 percent and 48.5 percent, respectively. For every functional classification, the same general pattern as shown for Interstates is followed for each combination of population area and pavement rating, as the percent of VMT on pavements with good ride quality is higher for rural roads than urban.

Exhibit 3-5 shows the percent of VMT on good and acceptable pavements for each functional class from 1995 to 2004. Since 1995, the percentage of total rural road VMT on pavements with acceptable ride quality has continued to increase in each of the four functional classes of rural roads for which data are available. For the five functional classifications of roadways in small urban areas, however, one has remained essentially constant—Interstate at 95.0 percent of VMT on pavements with acceptable ride quality, two have shown an increase—other freeways and expressways and other principal arterials, and the remaining two have shown a decrease. For the five functional classes of roads for the urbanized areas, one functional classification—Interstate— has seen an increase in the percentage of VMT on pavements rated as having acceptable ride quality, one functional classification—other freeways and expressways—has remained relatively constant, while the remaining three functional classes—other principal arterials, minor arterials, and collectors—have experienced declines.

The greatest increase in the percentage of VMT on pavements with good ride quality from 1995 to 2004 was on the Interstate System. In rural areas there was an increase from 53.3 percent in 1995 to 73.7 percent in 2004; for small urban areas the increase was from 51.4 percent to 65.6 percent; in urbanized areas the increase was from 39.1 percent to 48.5 percent.

For other functional classifications, in rural areas the percentage of VMT on pavements with good ride quality increased on other principal arterial and minor arterials but decreased on major collector routes. For small urban areas, the percentage of VMT on good ride quality pavements increased on other freeways and

Exhibit 3-5

Percent of VMT on Pavements With Good and Acceptable Ride Quality, by Functional System, 1995–2004

Functional System	1995	1997	1999	2000	2002	2004
Percent Acceptable						
Rural Interstate	94.5%	95.7%	97.4%	97.4%	97.3%	97.8%
Rural Principal Arterial	92.9%	93.8%	95.5%	96.0%	96.2%	96.1%
Rural Minor Arterial	91.2%	92.1%	93.2%	93.1%	93.8%	94.3%
Rural Major Collector	86.4%	87.3%	86.1%	86.9%	87.6%	88.5%
Small Urban Interstate	94.9%	96.1%	95.9%	95.3%	94.6%	95.0%
Small Urban Other Freeway & Expressway	91.1%	92.6%	93.0%	94.4%	95.3%	93.9%
Small Urban Other Principal Arterial	82.1%	80.6%	82.2%	83.3%	83.8%	84.2%
Small Urban Minor Arterial	82.4%	84.0%	81.8%	81.7%	82.1%	77.6%
Small Urban Collector	78.8%	78.7%	76.6%	74.3%	74.9%	66.5%
Urbanized Interstate	88.8%	88.1%	90.4%	91.0%	89.3%	89.9%
Urbanized Other Freeway & Expressway	87.8%	86.9%	87.6%	86.8%	87.4%	87.4%
Urbanized Other Principal Arterial	76.4%	73.3%	68.3%	68.8%	68.8%	70.7%
Urbanized Minor Arterial	83.4%	83.3%	80.2%	75.7%	75.4%	73.1%
Urbanized Collector	82.1%	84.4%	80.1%	76.4%	74.5%	72.4%
Percent Good						
Rural Interstate	53.3%	56.5%	66.8%	69.6%	72.2%	73.7%
Rural Principal Arterial	43.6%	47.0%	54.3%	56.8%	60.2%	61.0%
Rural Minor Arterial	42.8%	43.8%	47.2%	48.9%	51.0%	51.5%
Rural Major Collector	43.9%	41.9%	38.6%	39.9%	42.4%	40.3%
Small Urban Interstate	51.4%	52.9%	59.8%	62.5%	65.1%	65.6%
Small Urban Other Freeway & Expressway	42.9%	38.2%	39.8%	41.6%	48.1%	57.7%
Small Urban Other Principal Arterial	36.0%	32.9%	35.0%	38.0%	37.0%	37.6%
Small Urban Minor Arterial	41.1%	43.6%	39.2%	38.2%	38.5%	33.0%
Small Urban Collector	35.8%	36.6%	36.0%	34.1%	32.8%	30.7%
Urbanized Interstate	39.1%	35.4%	39.7%	42.5%	43.8%	48.5%
Urbanized Other Freeway & Expressway	34.1%	27.4%	31.3%	31.9%	32.8%	37.8%
Urbanized Other Principal Arterial	27.3%	26.1%	24.2%	25.0%	23.8%	24.8%
Urbanized Minor Arterial	39.9%	40.8%	37.8%	33.9%	33.4%	32.2%
Urbanized Collector	35.8%	39.8%	39.9%	38.5%	35.9%	36.4%

Source: Highway Performance Monitoring System.

expressways and other principal arterials. The percentage of VMT on good ride quality pavements decreased on small urban minor arterials and collector routes. In urbanized areas, other freeways and expressways had an increase in the percentage of VMT on good ride quality roads while other principal arterial, minor arterial and collector routes showed decreases in the percentage of VMT on good ride quality pavements.

Pavement Ride Quality by Mileage

Exhibit 3-6 shows the pavement ride quality by functional classification from 1995 to 2004 based on mileage, rather than on VMT. Comparing these figures with those in Exhibit 3-5 shows that rural pavement ride quality generally appears worse when measured as a percentage of miles with good or acceptable ride quality rather than as the percentage of VMT on such roads, although this is not true for all functional classes. For urbanized areas, the situation is reversed; the percentage of miles with acceptable ride quality is generally higher than the percentage of VMT on roads with acceptable ride quality.

Exhibit 3-6

Percent of Mileage With Good and Acceptable Ride Quality, by Functional System, 1995–2004

Functional System	1995	1997	1999	2000	2002	2004
Percent Acceptable						
Rural Interstate	94.5%	95.9%	97.6%	97.8%	97.8%	98.0%
Rural Other Principal Arterial	91.4%	93.7%	95.4%	96.0%	96.6%	95.8%
Rural Minor Arterial	85.1%	89.8%	92.0%	92.0%	93.8%	93.9%
Rural Major Collector	82.5%	84.0%	79.7%	82.1%	85.9%	85.8%
Small Urban Interstate	94.4%	95.8%	95.4%	95.7%	95.3%	95.0%
Small Urban Other Freeway & Expressway	90.2%	91.2%	92.8%	93.7%	94.8%	93.9%
Small Urban Other Principal Arterial	82.0%	80.5%	81.7%	82.9%	83.0%	84.2%
Small Urban Minor Arterial	82.5%	82.2%	78.1%	80.0%	81.3%	77.6%
Small Urban Collector	76.4%	75.9%	68.3%	68.9%	70.8%	66.5%
Urbanized Interstate	90.0%	90.0%	92.2%	93.0%	91.7%	92.2%
Urbanized Other Freeway & Expressway	87.5%	87.7%	88.8%	88.3%	88.8%	89.7%
Urbanized Other Principal Arterial	75.9%	73.2%	67.6%	67.7%	67.5%	69.3%
Urbanized Minor Arterial	82.1%	82.6%	78.5%	78.3%	75.9%	75.6%
Urbanized Collector	84.4%	86.4%	80.3%	77.4%	77.6%	75.5%
Percent Good						
Rural Interstate	51.8%	56.9%	65.4%	68.5%	71.9%	72.9%
Rural Other Principal Arterial	41.0%	47.5%	54.0%	57.4%	60.9%	60.1%
Rural Minor Arterial	40.7%	45.3%	46.9%	47.7%	50.2%	47.6%
Rural Major Collector	47.7%	40.1%	32.5%	36.2%	37.1%	36.3%
Small Urban Interstate	49.8%	51.4%	58.2%	61.6%	64.9%	66.0%
Small Urban Other Freeway & Expressway	41.2%	35.8%	41.3%	43.8%	49.7%	54.6%
Small Urban Other Principal Arterial	36.3%	32.6%	33.7%	36.6%	35.4%	36.0%
Small Urban Minor Arterial	46.8%	45.5%	37.2%	38.1%	42.1%	36.3%
Small Urban Collector	43.4%	44.4%	29.3%	29.8%	33.1%	28.5%
Urbanized Interstate	41.3%	39.3%	45.0%	48.2%	48.7%	53.2%
Urbanized Other Freeway & Expressway	36.8%	31.4%	35.5%	37.9%	39.6%	43.3%
Urbanized Other Principal Arterial	28.7%	26.6%	23.5%	23.9%	22.7%	23.4%
Urbanized Minor Arterial	44.8%	45.2%	37.2%	37.6%	37.7%	35.5%
Urbanized Collector	44.3%	46.6%	30.2%	31.4%	33.4%	32.0%

Source: Highway Performance Monitoring System.

Roadway Alignment

Alignment adequacy affects the level of service and safety of the highway system. There are two types of alignment: horizontal and vertical. Inadequate alignment may result in speed reductions and impaired sight distance. In particular, trucks are affected by inadequate roadway alignment with regard to speed. Alignment adequacy is evaluated on a scale from Code 1 (best) to Code 4 (worst).

Adequate alignment is more important on roads with higher travel speeds and/or higher volumes (e.g., Interstates). Alignment is normally not an issue in urban areas; therefore, only rural alignment issues are presented in this section. The amount of change in roadway alignment is gradual and occurs only during major reconstruction of existing roadways. New roadways are constructed to meet current alignment criteria, vertical and horizontal, and therefore, except under very extreme conditions, do not have alignment problems. [*Exhibit 3-7*]

Exhibit 3-7

Rural Alignment by Functional Class, 2004

	Code 1	Code 2	Code 3	Code 4
Horizontal				
Interstate	95.3%	1.3%	0.8%	2.6%
Other Pricipal Arterial	77.0%	9.0%	8.9%	5.1%
Minor Arterial	70.0%	5.7%	16.6%	7.7%
Major collector	57.5%	18.2%	15.9%	8.5%
Vertical				
Interstate	92.6%	6.3%	0.4%	0.7%
Other Pricipal Arterial	65.1%	24.7%	6.3%	3.9%
Minor Arterial	51.2%	28.5%	12.8%	7.5%
Major collector	51.6%	28.7%	13.0%	6.7%

Code 1	All curves and grades meet appropriate design standards.
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.
Code 3	Infrequent curves or grades occur that impair sight distance or severely affect truck speeds. May have reduced speed limits.
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.

Source: Highway Performance Monitoring System.

Lane Width

Lane width affects capacity and safety; narrow lanes prevent a road from operating at capacity. As with roadway alignment, lane width is more crucial on those functional classifications with higher travel volumes. Over 99 percent of rural Interstate highways had lane widths of 12 feet or greater in 2004. The comparable percentages for urban Interstate highways and urban other freeways and expressways were 98 percent and 94 percent, respectively.

A slight majority (51 percent) of urban collectors have lane widths of 12 feet or greater, but approximately one-fifth have 11-foot lanes, and about one-fifth have 10-foot lanes. Among rural major collectors, a plurality (38 percent) have lane widths of 12 feet or greater, but approximately one-quarter have 11-foot lanes, about one-quarter have 10-foot lanes, and roughly one-tenth have lane widths of 9 feet or less. [*Exhibit 3-8*]

Exhibit 3-8

Lane Width by Functional Class, 2004

	> 12ft	11ft	10ft	9ft	<9ft
Rural					
Interstate	99.66%	0.32%	0.00%	0.00%	0.02%
Other Pricipal Arterial	89.27%	8.75%	1.72%	0.25%	0.02%
Minor Arterial	70.31%	18.60%	9.95%	0.98%	0.16%
Major collector	37.75%	25.88%	27.05%	7.05%	2.27%
Urban					
Interstate	98.31%	1.55%	0.10%	0.00%	0.03%
Other Freeway & Expressway	94.11%	4.93%	0.79%	0.16%	0.01%
Other Prinicpal Arterial	80.91%	12.86%	5.68%	0.38%	0.17%
Minor Arterial	66.51%	17.66%	13.65%	1.76%	0.42%
Collector	50.70%	19.49%	22.09%	5.97%	1.75%

Source: Highway Performance Monitoring System.

Bridge System Conditions

The National Bridge Inspection Standards (NBIS), in place since the early 1970s, requires biennial safety inspections for bridges in excess of 6.1 meters, approximately 20 feet, in total length located on public roads. Information is collected documenting the conditions and composition of the structures. Baseline composition information is collected describing the functional characteristics, descriptions and location information, geometric data, ownership and maintenance responsibilities, and other information. This information permits characterization of the system of bridges on a national level and permits analysis on the composition of the bridges. Safety, the primary purpose of the program, is ensured through periodic hands-on inspections and rating of the primary components of the bridge, such as the deck, superstructure, and substructure. This composition and condition information is maintained in the National Bridge Inventory (NBI) database maintained by FHWA. This database represents the most comprehensive source of information on bridges throughout the United States.

Q&A

How often are the bridges inspected?

Most bridges in the U.S. Highway Bridge inventory are inspected once every 2 years. These inspections are performed by qualified inspectors. Structures with advanced deterioration or other conditions warranting closer monitoring can be inspected more frequently. Certain types of structures in very good condition may receive an exemption from the 2-year inspection cycle. These structures can be inspected once every 4 years. Qualification for this extended inspection cycle is reevaluated depending on the conditions of the bridge. Approximately 83 percent are inspected once every 2 years, 12 percent are inspected annually, and 5 percent are inspected on a 4-year cycle.

See Chapter 15 in the 2004 C&P report for more details on the National Bridge Inspection Program and the Highway Bridge Replacement and Rehabilitation Program.

Explanation of Bridge Deficiencies

From the information collected through the inspection process, assessments are performed to determine the adequacy of the structure to service the current demands for structural and functional purposes. Factors considered include the load-carrying capacity, clearances, waterway adequacy, and approach roadway alignment. Structural assessments together with condition ratings determine whether a bridge should be classified as **structurally deficient.** Functional adequacy is assessed by comparing the existing geometric configurations to current standards and demands. Disparities between the actual and desired configurations are used to determine whether a bridge should be classified as **functionally obsolete.** Structural deficiencies take precedence in the classification of deficiencies, so that a bridge suffering from a structural deficiency and functional obsolescence would be classified as structurally deficient.

Condition Rating Structural Deficiencies

The primary considerations in classifying structural deficiencies are the bridge component condition ratings. The NBI database contains ratings on the three primary components of a bridge: the deck, superstructure, and substructure. A bridge deck is the primary surface used for transportation. The deck is supported by the superstructure. This transfers the load of the deck and the traffic carried to the supports.

Condition ratings are used to describe the existing, in-place status of a component and not its as-built state. Rather, the existing condition is compared with an as-new condition. Bridge inspectors assign condition ratings by evaluating the severity of the deterioration or disrepair and the extent it has spread through the component being rated. They provide an overall characterization of the general condition of the entire component being rated and not an indication of localized conditions. *Exhibit 3-9* describes the bridge condition ratings in more detail.

Exhibit 3-9

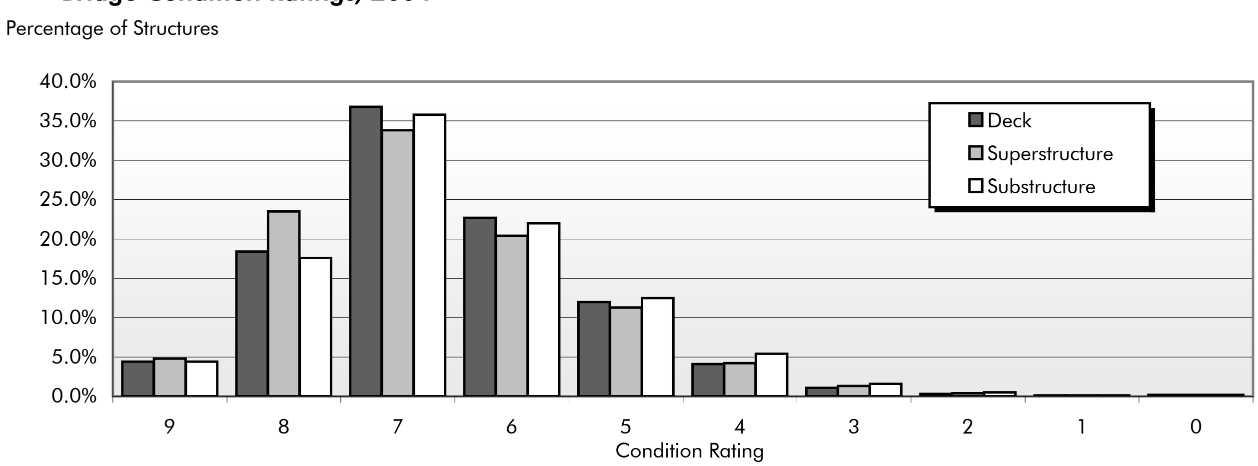
Bridge Condition Rating Categories

Rating	Condition Category	Description
9	Excellent	
8	Very Good	
7	Good	No problems noted.
6	Satisfactory	Some minor problems.
5	Fair	All primary structural elements are sound but may have minor section loss, cracking, spalling, or scour.
4	Poor	Advanced section loss, deterioration, spalling, or scour.
3	Serious	Loss of section, deterioration, spalling, or scour have seriously affected the primary structural components. Local failures are possible. Fatigue cracks in steel or shear cracks in concrete may be present.
2	Critical	Advanced deterioration of primary structural elements. Fatigue cracks in steel or shear cracks in concrete may be present or scour may be removed substructure support. Unless closely monitored, it may be necessary to close the bridge until corrective action is taken.
1	Imminent Failure	Major deterioration or section loss present in critical structural components, or obvious loss present in critical structural components, or obvious vertical or horizontal movement affecting structural stability. Bridge is closed to traffic, but corrective action may put back in light service.
0	Failed	Out of service; beyond corrective action.

Condition rating distributions are shown in *Exhibit 3-10* for the deck, superstructure, and substructure. Condition ratings of 4 and below indicate poor or worse conditions and result in structural deficiencies. Approximately 5.8 percent of all bridge decks are deficient based on condition rating, and 6.2 percent of all superstructures and 7.8 percent of all substructures are deficient. These classifications are not mutually exclusive, and an individual structure may have one or more than one deficient component.

Exhibit 3-10

Bridge Condition Ratings, 2004



Source: National Bridge Inventory.

Appraisal Rating Structural Deficiencies

Condition ratings are the primary criteria used in the classification of structural deficiencies; 80 percent of all structurally deficient bridges have condition rating deficiencies in their decks, superstructures, substructures, or culvert ratings. The remaining 20 percent of structural deficiencies are classified based on inadequate structural appraisal ratings and/or inadequate waterway adequacy ratings. These appraisal ratings evaluate a bridge in relation to the level of service it provides on the highway system on which it is located**. The appraisal ratings compare the existing conditions with the current standards used for highway bridge design.** *Exhibit 3-11* describes appraisal rating codes in more detail.

Load-carrying capacity does not influence the assignment of the condition ratings, but it does factor into the structural evaluation appraisal rating. This is calculated according to the capacity ratings for various categories of traffic in terms of average daily traffic (ADT). A rating of 2 or less indicates the carrying capacity is too low and the structure should be replaced. In this case, the bridge is classified as structurally deficient.

Q&A

What makes a bridge structurally deficient, and are structurally deficient bridges unsafe?

Bridges are considered structurally deficient if significant load-carrying elements are found to be in poor or worse condition due to deterioration and/or damage, or the adequacy of the waterway opening provided by the bridge is determined to be extremely insufficient to the point of causing intolerable traffic interruptions. The fact that a bridge is "deficient" does not immediately imply that it is likely to collapse or that it is unsafe. With hands-on inspection, unsafe conditions may be identified and, if the bridge is determined to be unsafe, the structure must be closed. A "deficient" bridge, when left open to traffic, typically requires significant maintenance and repair to remain in service and eventual rehabilitation or replacement to address deficiencies. To remain in service, structurally deficient bridges are often posted with weight limits to restrict the gross weight of vehicles using the bridges to less than the maximum weight typically allowed by statute.

Exhibit 3-11

Bridge Appraisal Rating Categories

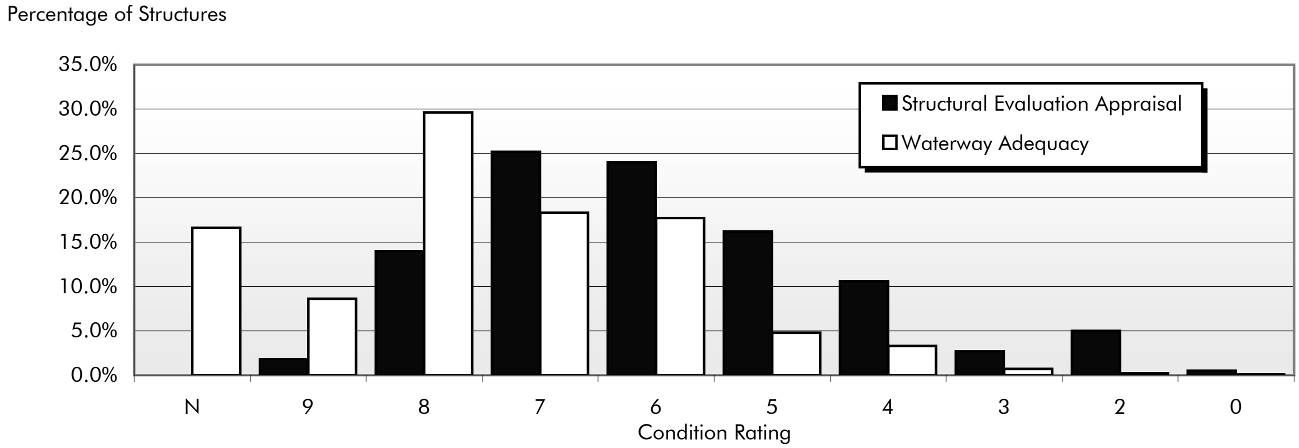
Rating	Description
N	Not applicable.
9	Superior to present desirable criteria.
8	Equal to present desirable criteria.
7	Better than present minimum criteria.
6	Equal to present minimum criteria.
5	Somewhat better than minimum adequacy to tolerate being left in place as is.
4	Meets minimum tolerable limits to be left in place as is.
3	Basically intolerable requiring a high priority of corrective action.
2	Basically intolerable requiring a high priority of replacement.
1	This value of rating code is not used.
0	Bridge closed.

The waterway adequacy appraisal rating assesses the opening of the structure with respect to the passage of flow through the bridge. This factor, which considers the potential for overtopping of the structure during a flood event and the potential inconvenience to the traveling public, is assigned based on criteria assigned by functional classification. Waterway adequacy appraisal ratings of 2 or less categorize a bridge as structurally deficient.

The distribution of structural evaluation appraisal and waterway adequacy ratings is shown in *Exhibit 3-12.* Roughly 5.5 percent of bridges are structurally deficient based on inadequate structural evaluation appraisal ratings, indicating the existing deficiencies require replacement of the structure. Waterway adequacy impacts a much smaller percentage of structures, with 0.3 percent of the bridges in the network classified as structurally deficient resulting from ratings of 2 or below.

Exhibit 3-12

Structural Evaluation/Waterway Adequacy Ratings, 2004



Source: National Bridge Inventory.

The structural evaluation appraisal ratings, as mentioned, are used as a factor for determining whether a bridge has a structural deficiency. Descriptions of the ratings are given in Exhibit 3-11. A rating of 3 indicates the load-carrying capacity is too low; however, the situation can be mitigated through corrective action. In this case, the bridge is classified as functionally obsolete. Likewise, waterway adequacy appraisal ratings of 3 result in functional obsolescence. Ratings of 2 or below for either the structural evaluation or waterway adequacy appraisals result in a bridge being classified as structurally deficient as these ratings typically are not correctable without replacement.

Q&A

How does a bridge become functionally obsolete?

Functional obsolescence is a function of the geometrics of the bridge in relation to the geometrics required by current design standards. While structural deficiencies are generally the result of deterioration of the conditions of the bridge components, functional obsolescence results from changing traffic demands on the structure. Facilities, including bridges, are designed to conform to the design standards in place at the time they are designed. Over time, improvements are made to the design requirements. As an example, a bridge designed in the 1930s would have shoulder widths in conformance with the design standards of the 1930s. However, the design standards have changed since the 1930s. Therefore, current design standards are based on different criteria and require wider bridge shoulders to meet current safety standards. The difference between the required, current-day shoulder width and the 1930s designed shoulder width represents a deficiency. The magnitude of these types of deficiencies determines whether the existing conditions cause the bridge to be classified as functionally obsolete.

Appraisal Rating Functional Obsolescence

The primary considerations for functional obsolescence focus on functional- and geometric-based appraisal ratings. Ratings considered are the deck geometry appraisal rating, the underclearance appraisal rating, and/or the approach roadway alignment appraisal rating.

Deck geometry ratings consider the width of the bridge, the ADT, the number of lanes carried by the structure, whether two-way or one-way traffic is serviced, and functional classifications. The minimum desired width for the roadways is compared with the actual widths and used as a basis for appraisal rating assignment. Minimum vertical clearances are also considered by functional classification. Underclearance appraisals consider both the vertical and horizontal underclearances as measured from the through roadway to the nearest bridge component. The functional classification, Federal-aid designation, and defense categorization are all considered for the underpassing route. Approach alignment ratings differ from the deck geometry and underclearance appraisal rating philosophy. Instead of comparing the approach alignment with current standards, the alignment of the approach roadway is compared with the alignment of the bridge spans. Deficiencies are identified where the bridge route does not function adequately because of alignment disparities.

The distribution of structural evaluation appraisal and waterway adequacy ratings is shown in Exhibit 3-12. Approximately 5.5 percent of bridges are classified as functionally obsolete based on structural evaluation appraisal ratings. Waterway adequacy impacts a much smaller percentage of structures, with 0.7 percent of bridges classified as functionally obsolete resulting from a rating of 3, indicating corrective actions are required to mitigate the inadequate waterway capacities.

Functional obsolescence occurs primarily because of the deck geometry, underclearance, and approach alignment appraisals. Distributions of the number of structures classified as functionally obsolete by appraisal ratings are given for these factors in *Exhibit 3-13.*

Overall Bridge Condition

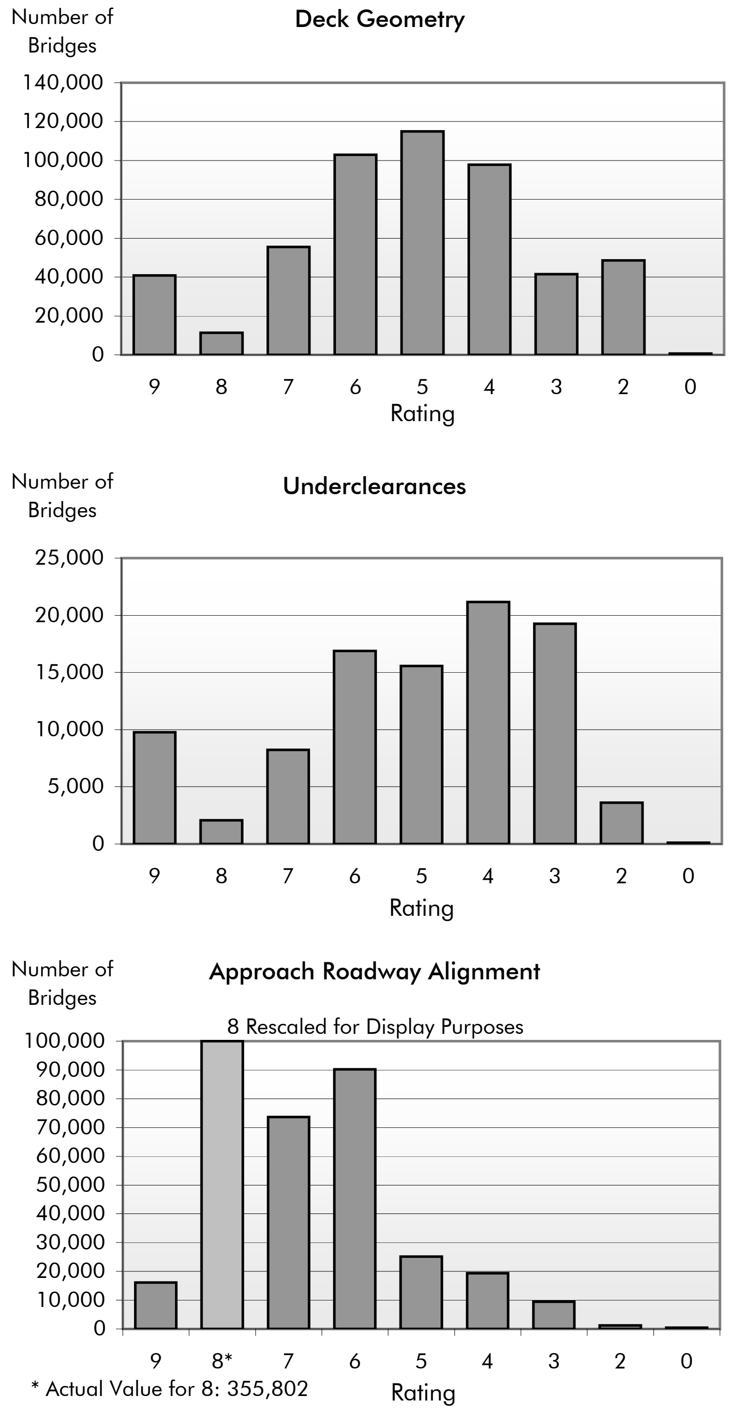
Structural deficiencies and functional obsolescence are not mutually exclusive, and a bridge may have both types of deficiencies. When deficiency percentages are presented, however, bridges are indicated as being in one of three categories—structurally deficient, functionally obsolete, or non-deficient. As structural deficiencies may imply safety problems, they are considered more critical; thus, **a bridge that is both structurally deficient and functionally obsolete is identified only as structurally deficient**. Approximately 50 percent of the structurally deficient population also will have functional issues to be corrected. Bridges indicated as functionally obsolete do not have structural deficiencies.

Number of Deficient Bridges

One commonly cited indicator of bridge condition is the number of deficient bridges. Of the 594,101 bridges listed in the inventory in 2004, 158,428, or slightly less than 26.7 percent, are classified as deficient for either structural or functional reasons. Of these, 77,796 are classified as structurally deficient and 80,632 are classified as functionally obsolete. Thus, roughly half of the deficiencies are structural and half are functional.

Exhibit 3-13

Functional Obsolescence: Deck Geometry, Underclearance, and Approach Alignment Ratings, 2004



Source: National Bridge Inventory.

Exhibit 3-14 shows the trend of deficiency percentages from 1994 through 2004. Bridge deficiencies have been reduced primarily through reduction in the numbers of structurally deficient bridges. The percentage of functionally obsolete bridges has remained relatively static over this time period.

As indicated earlier, structural deficiencies and functional obsolescence are considered mutually exclusive, with structural deficiencies taking precedence where ratings classify a given bridge as both structurally deficient and functionally obsolete. Roughly half of the structurally deficient bridges have no functional obsolescence issues and are deficient solely on the basis of structural safety and deteriorated bridge component conditions. The remaining structurally deficient bridges also have some type of functional obsolescence.

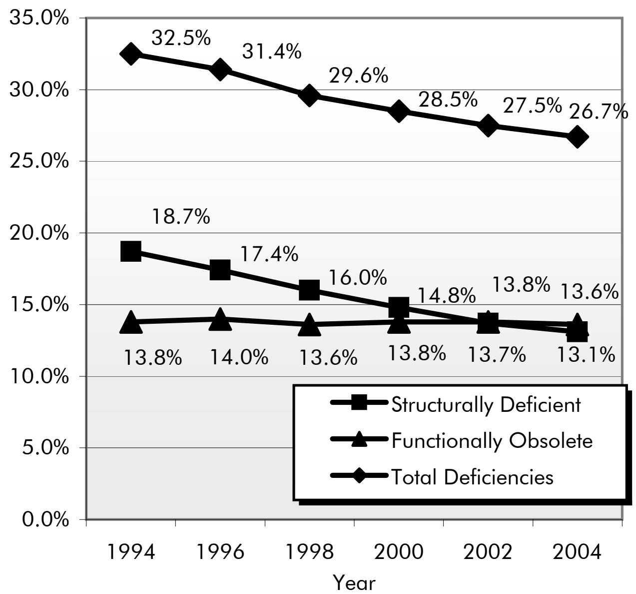
Deficient Bridges by Deck Area and Traffic Carried

The FHWA has adopted the percent of deficient deck area on bridges on the NHS and the percent of deficient deck area on non-NHS bridges as primary performance measures for bridge condition. See Chapter 12 for additional information on NHS bridge conditions.

The 77,796 bridges identified as structurally deficient in 2004 comprised 9.7 percent of the total deck area of all bridges on and off the NHS. The 80,632 functionally obsolete bridges in 2004 accounted for approximately 17.4 percent of the total deck area on all bridges. Taken together, the 158,428 bridges classified as structurally deficient or functionally obsolete bridges in 2004 accounted for 27.1 percent of the total deck area on all bridges. [*Exhibit 3-15*]

Exhibit 3-14

Bridge Deficiency Percentages, 1994–2004



Source: National Bridge Inventory.

The 158,428 deficient bridges in 2004 represent approximately 26.7 percent of the total inventory of highway bridges when bridges are weighted equally. When weighted by traffic carried, this percentage is slightly lower, as 26.6 percent of daily bridge traffic is carried by bridges that are classified as either structurally deficient or functionally obsolete.

Deficient Bridges by Owner

Bridge deficiencies by ownership are examined in *Exhibit 3-16.* For Federally owned bridges, the number of bridges classified as functionally obsolete outweighs the number classified as structurally deficient by almost a 2 to 1 ratio. Similar percentages are seen for State-owned bridges. These bridges constitute a much more significant proportion of the overall inventory of structures, since State agencies own approximately 48 percent of all bridges. Locally owned and private bridges have opposite trends, with the number of structurally deficient bridges outweighing the number of functionally obsolete bridges.

Examination of ownership percentages for structurally deficient and functionally obsolete bridges reveals that the majority of structurally deficient bridges are owned by local agencies, while the majority of functionally obsolete bridges are owned by State agencies. These percentages can be contrasted with the ownership percentages for all bridges [Exhibit 3-16]. The percentages are dominated by State and local ownership, with only small percentages of the total population of all structures attributable to Federal, private, and other owners. However, it should be noted that 45 percent of privately owned bridges are deficient: 24 percent are structurally deficient and 21 percent are functionally obsolete.

Exhibit 3-15

Bridge Deficiencies by Number, Percent of Deck Area on Deficient Bridges, and Percent of ADT Carried on Deficient Bridges, 2004

	Total
Total Number of Bridges	**593,416**
Number of Structurally Deficient Bridges	77,720
Percent of Structurally Deficient Bridges	13.1%
Percent of Deck Area of Structurally Deficient Bridges	9.7%
Percent of ADT on Structurally Deficient Bridges	7.2%
Number of Functionally Obsolete Bridges	80,462
Percent of Functional Obsolete Bridges	13.6%
Percent of Deck Area of Functionally Obsolete Bridges	17.4%
Percent of ADT on Functionally Obsolete Bridges	19.3%
Total Number of Deficient Bridges	158,182
Total Percent of Deficient Bridges	26.7%
Total Percent of Deck Area on Deficient Bridges	27.1%
Total Percent of ADT on Deficient Bridges	26.5%

Note: Differences in total values are due to coding omissions or submission obmission.

Source: National Bridge Inventory

Exhibit 3-16

Bridge Deficiencies by Owner, 2004

	Federal	State	Local	Private/Other	Total
Numbers					
Total Bridges	8,425	282,552	300,444	2,680	594,082
Total Deficient	2,085	67,702	87,447	1,194	158,423
Structurally Deficient	708	24,061	52,390	637	77,793
Functionally Obsolete	1,377	43,641	35,057	557	80,630
Percentages					
% of Total Inventory for Owner	1%	48%	51%	0%	100.0%
% Deficient	25%	24%	29%	45%	26.7%
% Structurally Deficient	8%	9%	17%	24%	13.1%
% Functionally Obsolete	16%	15%	12%	21%	13.6%

Note: Differences in total values are due to coding omissions or submission obmission.

Source: National Bridge Inventory

Rural and Urban Deficient Bridges by Functional Classification

As noted in Chapter 2 and as shown in *Exhibit 3-17*, the majority of bridges in terms of numbers are located in rural environments. With rural bridges, the number of structural deficiencies (65,577) outweighs the number of bridges classified as functionally obsolete (50,276). Urban roadways carry significantly higher volumes of traffic, as noted in Chapter 2. With urban bridges, the number of structurally deficient bridges (12,176) is significantly lower than the number of functionally obsolete bridges (29,675). Overall, a higher percentage of urban structures are classified as deficient; however, the majority of these deficiencies result from functional obsolescence. While the percentage of rural bridges classified as deficient is lower, the

Exhibit 3-17

Bridge Deficiencies by Functional System, 2004

Functional Class	Total Number of Structures	Structurally Deficient	Functionally Obsolete	Total Deficiencies
Rural Interstate	27,648	1,163	3,224	4,387
Rural Other Principal Arterial	36,259	1,934	3,238	5,172
Rural Minor Arterial	40,197	3,317	4,354	7,671
Rural Major Collector	94,079	10,825	9,826	20,651
Rural Minor Collector	49,391	6,560	5,470	12,030
Rural Local	208,641	41,778	24,164	65,942
Total Rural	456,215	65,577	50,276	115,853
Urban Interstate	27,667	1,667	5,617	7,331
Urban Other Freeways of Expressway	17,112	985	3,431	4,419
Urban Other Principal Arterial	24,529	2,194	5,428	7,659
Urban Minor Arterial	24,802	2,508	6,402	8,965
Urban Collector	15,548	1,685	3,783	5,590
Urban Local	27,940	3,137	5,014	8,520
Total Urban	137,598	12,176	29,675	42,484
Total Identified by Functional Class	593,813	77,753	79,951	158,337
Unknown	288	21	9	30
Total, Including Unknown	**594,101**	**77,774**	**79,960**	**158,367**

Source: National Bridge Inventory.

population and hence the number of deficiencies is larger. Structural deficiencies are more prevalent, in terms of percentages, in rural environments.

Bridge conditions in rural and urban areas have steadily improved over the past decade. As seen in *Exhibit 3-18,* overall deficiencies and structural deficiencies have both decreased. Functional obsolescence percentages, however, have not decreased and have remained relatively static in both rural and urban environments.

Exhibit 3-18

Percent Deficient Bridges by Functional Class and Area, 1994-2004

Year		1994	1996	1998	2000	2002	2004
Interstate							
Rural	Deficient Bridges	18.5%	19.1%	16.4%	16.0%	15.8%	15.9%
	Structurally Deficient	4.0%	4.4%	4.1%	3.9%	4.0%	4.2%
	Functionally Obsolete	14.5%	14.7%	12.2%	12.2%	11.8%	11.7%
Urban	Deficient Bridges	30.6%	30.8%	26.8%	27.0%	26.3%	26.5%
	Structurally Deficient	8.3%	7.8%	6.7%	6.5%	6.1%	6.0%
	Functionally Obsolete	22.3%	23.0%	20.1%	20.5%	20.1%	20.5%
All Bridges on	Deficient Bridges	24.2%	24.7%	21.6%	21.5%	21.1%	21.2%
Interstates	Structurally Deficient	6.0%	6.0%	5.4%	5.2%	5.1%	5.1%
	Functionally Obsolete	18.2%	18.7%	16.2%	16.4%	16.0%	16.1%
Other Arterials							
Rural	Deficient Bridges	21.7%	21.5%	19.4%	18.2%	17.5%	16.8%
	Structurally Deficient	9.5%	9.1%	8.3%	7.3%	7.1%	6.9%
	Functionally Obsolete	12.1%	12.4%	11.1%	11.0%	10.4%	9.9%
Urban	Deficient Bridges	36.0%	35.1%	33.6%	32.9%	32.2%	31.7%
	Structurally Deficient	12.7%	11.7%	10.6%	9.5%	9.0%	8.6%
	Functionally Obsolete	23.3%	23.4%	22.9%	23.4%	23.2%	23.0%
All Bridges on	Deficient Bridges	28.0%	27.6%	25.8%	24.9%	24.4%	23.7%
Other Arterials	Structurally Deficient	10.9%	10.2%	9.3%	8.3%	8.0%	7.7%
	Functionally Obsolete	17.0%	17.3%	16.5%	16.6%	16.4%	16.0%
Collectors							
Rural	Deficient Bridges	26.7%	25.8%	24.7%	24.3%	23.6%	22.8%
	Structurally Deficient	16.0%	14.8%	13.9%	13.2%	12.6%	12.1%
	Functionally Obsolete	10.7%	10.9%	10.8%	11.0%	11.0%	10.7%
Urban	Deficient Bridges	40.3%	40.2%	38.2%	37.3%	36.4%	36.0%
	Structurally Deficient	16.4%	15.7%	14.4%	12.7%	11.5%	10.8%
	Functionally Obsolete	23.9%	24.5%	23.8%	24.7%	24.9%	24.3%
All Bridges on	Deficient Bridges	27.9%	27.1%	26.0%	25.5%	24.8%	24.1%
Collectors	Structurally Deficient	16.1%	14.9%	14.0%	13.2%	12.5%	12.0%
	Functionally Obsolete	11.9%	12.2%	12.0%	12.3%	12.3%	12.0%
Locals							
Rural	Deficient Bridges	40.9%	38.5%	36.5%	34.7%	33.0%	31.6%
	Structurally Deficient	29.2%	27.1%	24.6%	23.0%	21.1%	20.0%
	Functionally Obsolete	11.7%	11.4%	11.8%	11.7%	11.9%	11.6%
Urban Bridges	Deficient Bridges	35.5%	34.0%	32.6%	31.6%	30.7%	30.5%
	Structurally Deficient	16.5%	15.5%	14.4%	13.0%	11.8%	11.2%
	Functionally Obsolete	19.0%	18.5%	18.2%	18.5%	18.8%	17.9%
All Bridges on	Deficient Bridges	40.3%	38.0%	36.1%	34.3%	32.7%	31.5%
Local Functional	Structurally Deficient	27.9%	25.9%	23.5%	21.9%	20.0%	19.0%
Classes	Functionally Obsolete	12.4%	12.1%	12.5%	12.5%	12.7%	12.3%

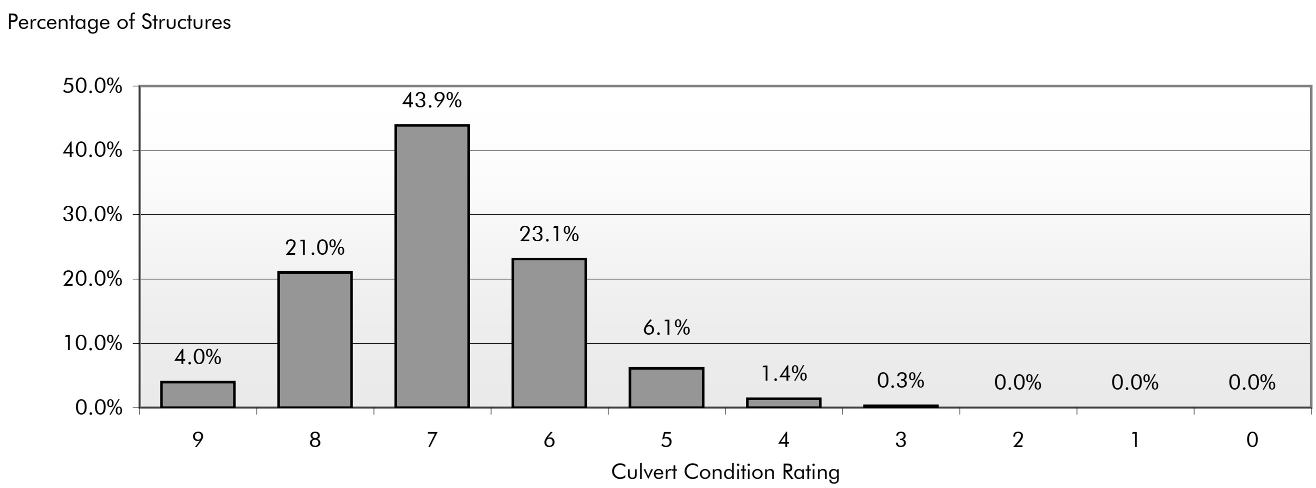
Source: National Bridge Inventory.

Culvert Deficiencies

There are 121,668 culverts in the bridge inventory. These structures do not have a deck, superstructure, or substructure, but rather are self-contained units located under roadway fill. Culverts are typically constructed of concrete or corrugated steel. Multiple pipes or boxes placed side-by-side are considered given that together they span a total length in excess of 6.1 meters and carry a public roadway. As these structures lack decks, superstructures, and substructures, individual ratings are provided to indicate the condition of the culvert as a whole. The distribution of culvert condition ratings is shown in *Exhibit 3-19.* Of all 121,668 culverts in the inventory, approximately 1.7 percent are classified as structurally deficient based on condition ratings less than or equal to 4 (poor conditions).

Exhibit 3-19

Culvert Condition Ratings, 2004



Source: National Bridge Inventory.

Transit System Conditions

The condition of the U.S. transit infrastructure can be evaluated based on the quantity, the age, and the physical condition of the assets that comprise it. This infrastructure includes vehicles in service; maintenance facilities and the equipment they contain; and other supporting infrastructure such as guideways, power systems, rail yards, stations, and structures such as bridges and tunnels.

The Federal Transit Administration (FTA) uses a numerical scale ranging from 1 to 5 to describe the condition of transit assets. This scale corresponds to the Present Serviceability Rating formerly used by the Federal Highway Administration to evaluate pavement conditions. A rating of 5, or "excellent," is synonymous with no visible defects or nearly new condition. At the other end of the scale, a rating of 1 indicates that the asset needs immediate repair and may have a seriously damaged component or components [*Exhibit 3-20*].

Exhibit 3-20

Definitions of Transit Asset Conditions

Rating	Condition	Description
Excellent	5	No visible defects, near new condition.
Good	4	Some slightly defective or deteriorated components.
Fair	3	Moderately defective or deteriorated components.
Marginal	2	Defective or deteriorated components in need of replacement.
Poor	1	Seriously damaged components in need of immediate repair.

The FTA uses the Transit Economic Requirements Model (TERM) to estimate the conditions of transit assets. This model comprises a database of transit assets and deterioration schedules that express asset conditions principally as a function of an asset's age. Vehicle condition is based on an estimate of vehicle maintenance history and capital nonreplacement expenditures in addition to vehicle age; the conditions of wayside control systems and track are based on an estimate of use (revenue miles per mile of track) in addition to age. [*See Appendix C.*]

The deterioration schedules for vehicles; maintenance facilities; stations; and train control, electrification, and communication systems have been estimated by FTA with special on-site engineering surveys. Transit vehicle asset conditions also reflect the most recently available information on vehicle age, use, and level of maintenance from the National Transit Database (NTD) and data collected through special surveys. The information used in this report is for 2004. Age information is available on a vehicle-by-vehicle basis from the NTD and collected for all other assets through special surveys. Average maintenance expenditures and nonreplacement capital expenditures by vehicle are also available on an agency and modal basis. For this reason, for the purpose of calculating conditions, average agency maintenance and nonreplacement capital expenditures for a particular mode are assumed to be the same for all vehicles operated by an agency in that mode. Because agency maintenance expenditures may fluctuate from year to year, TERM uses a 5-year average.

The deterioration schedules for guideway structures and track are based on much earlier studies. The methods used to calculate deterioration schedules, and the sources of the data on which deterioration schedules are based, are discussed in Appendix C.

Condition estimates in each new edition of the C&P report are based on updated asset inventory information and reflect updates in TERM's asset inventory. Since the 2004 C&P report, asset data for approximately 35 percent of the Nation's transit assets have been updated. Vehicle data from the NTD were used to update 21 percent of the TERM data. An additional 14 percent of TERM data were updated with inventory data provided by 25 of the nation's larger rail transit agencies. Appendix C provides a more detailed discussion of TERM's data sources.

Bus Vehicles (Urban Areas)

Bus vehicle age and condition information is reported according to bus vehicle type for 1995 to 2004 in *Exhibit 3-21.*

Exhibit 3-21

Urban Transit Bus Fleet Count, Age, and Condition, 1995 –2004

						<-Revised Basis->	
YEAR	**1995**	**1997**	**1999**	**2000**	**2002**	**2002**	**2004**
Articulated Buses *							
Total Fleet	1,716	1,523	1,967	2,078	2,307	2,765	3,060
Percent Overage Vehicles**	33%	61%	46%	29%	15%	17%	7%
Average Age	10.7	11.8	8.7	6.9	6.7	7.1	4.9
Average Condition	2.55	2.49	3.10	3.33	3.17	3.11	3.38
Full-Size Buses							
Total Fleet	46,335	47,149	49,195	49,721	50,294	46,685	46,090
Percent Overage Vehicles**	23%	25%	26%	25%	22%	19%	18%
Average Age	8.6	8.2	8.7	8.5	7.7	7.5	7.3
Average Condition	2.83	2.86	2.90	2.93	2.99	3.02	3.00
Mid-Size Buses							
Total Fleet	3,879	5,328	6,807	7,643	8,914	7,304	7,114
Percent Overage Vehicles**	23%	18%	14%	15%	21%	34%	23%
Average Age	6.8	5.6	5.7	5.7	5.6	8.1	8.1
Average Condition	3.08	3.30	3.30	3.30	3.30	2.93	2.93
Small Buses							
Total Fleet	5,447	7,081	8,461	9,039	10,096	14,857	15,981
Percent Overage Vehicles**	13%	13%	13%	12%	14%	18%	13%
Average Age	4.0	3.7	4.0	4.2	4.1	4.5	4.8
Average Condition	3.55	3.56	3.51	3.47	3.53	3.39	3.37
Vans							
Total Fleet	11,969	13,796	14,539	16,234	17,300	17,300	19,164
Percent Overage Vehicles**	21%	22%	5%	6%	11%	11%	7%
Average Age	3.2	2.3	3.2	3.2	3.2	3.2	3.5
Average Condition	3.71	3.75	3.71	3.71	3.62	3.62	3.61
Total Fleet	69,346	74,877	80,969	84,715	88,911	88,911	91,409
Percent Overage Vehicles**	22%	24%	20%	19%	19%	19%	15%
Weighted Average Age	7.3	6.6	7.0	6.8	6.2	6.2	6.1
Weighted Average Condition	2.88	2.94	3.01	3.05	3.09	3.07	3.08

*An articulated bus has two passenger-carrying sections connected by a flexible section that allows the vehicle to bend and passengers to move from one section to the other.

**Percent over FTA minimum required replacement age.

Source: Transit Economic Requirements Model and National Transit Database.

Conditions have gradually improved for all bus vehicle types from 1995 to 2002 and declined slightly between 2002 and 2004. In 2004, the estimated average condition of the urban bus fleet was 3.08 compared with 3.09 in 2002 and 2.88 in 1995. [Note that all condition estimates prior to 2002 are based on a different bus vehicle classification system. The reclassification of vehicles had only a very marginal impact on the condition estimates for the total bus fleet.] The improvement in conditions between 1995 and 2004 reflects a decrease in the average age of the bus vehicle fleet from 7.3 to 6.1 years. Since 1995, larger vehicles *(articulated, full-size, and mid-size buses)* have tended to have, on average, slightly lower-rated conditions than smaller vehicles (small buses, vans). Vans, paratransit vehicles, and small buses, in general, decay more rapidly than full-size buses. Vans typically reach a condition of 2.5 in 7 years, compared with 14 years, on average, for a 40-foot bus. Average bus fleet conditions vary considerably from agency to agency. Average bus fleet conditions ranged from 2.30 to 4.40 for the 31 agencies that participated in the most recent FTA bus vehicle conditions assessment.

Q&A

How were bus vehicles reclassified in 2002?

The 2002 NTD collected information on buses according to length and seating capacity. Previously, bus information had been collected according to the number of seats only, except for articulated buses, which were reported separately. Two condition estimates are reported for 2002 in *Exhibit 3-21*. The first column reports average conditions based on bus categories determined by seating capacity only (old classification system), and the second column reports conditions based on bus categories determined first by length, and when length was not available, by seating capacity (new classification system). The 2002 NTD data on length revealed that a larger percentage of buses were 45 feet or longer than was previously estimated. All buses 45 feet or longer must be articulated for structural reasons. Four hundred and fifty-eight vehicles were shifted from the full-size bus category to the articulated bus category. A considerable number of buses that were previously categorized as full-size and mid-size (4,761) were reclassified as small. The number of articulated buses increased by 20 percent as a result of the reclassification, the number of full-sizes buses decreased by 7 percent, the number of mid-size buses decreased by 18 percent, and the number of small buses increased by 47 percent. Vans were not affected by the reclassification.

Articulated buses experienced the largest fluctuations in conditions between 1995 and 2004, ranging from 2.49 in 1997 to 3.38 in 2004. The fluctuations in articulated bus conditions are most likely the result of a 12-year industry replacement policy and the fact that the bulk of articulated buses was purchased between 1983 and 1984. [Note that vehicle age frequently exceeds the recommended replacement age, so that the gradual replacement of articulated buses starting around 1997 would be consistent with the 12-year replacement policy.] This replacement cycle is evidenced by a peak in the percentage of articulated buses that were overage at 61 percent in 1997 and the subsequent decline in this percentage to 7 percent in 2004. Mid-size buses had maintained an average condition above 3.0 in all years based on the old bus classification systems. However, based on the new classification system, their average condition fell from 3.30 in 2000 to 2.93 in both 2002 and 2004 as a considerable number of these vehicles in better-than-average condition for this category were reclassified as small buses. Both small buses and vans have consistently maintained an average condition of close to 3.5 or higher. However, vehicles reclassified from the full- and mid-size bus categories to the small bus category lowered the average conditions of small buses to 3.39 in 2002 and 3.37 in 2004. Full-size buses, which were on average consistently just below "adequate" condition between 1995 and 2000, reached an "adequate" average condition of 3.02 in 2002, under the new classification system, which was maintained at a condition of 3.00 in 2004.

Bus Maintenance Facilities (Urban Areas)

The number of urban maintenance facilities for bus, vanpool, and demand response systems for directly operated and purchased transit services declined from 1,219 in 2002 to 1,207 in 2004. *Exhibit 3-22* provides the estimated age distribution of these maintenance facilities in 2004. This distribution is based on age information collected by the 1999 and 2002 National Bus Condition Assessments and applied to the total national bus maintenance facilities in 2004 as reported in the NTD. In 2004, 10 percent of bus maintenance facilities were less than 10 years old (compared with 12 percent in 2002), 42 percent were 11 to 20 years old (compared with 33 percent in 2002), 24 percent were 21 to 30 years of age (compared with 31 percent in 2002), and 24 percent were 31 years or older (the same as in 2002). Individual facility ages may not relate well to condition, since substantive renovations are made to facilities at varying intervals. However, the increase in the percentage of maintenance facilities aged 20 years or less between 2002 and 2004 contributed to an increase in bus maintenance facility conditions during this period.

Exhibit 3-22

Urban Bus Maintenance Facility Ages, 2004 *

Age (Years)	Number	Percent
0–10	126	10%
11–20	505	42%
21–30	285	24%
31+	291	24%
Total	**1,207**	100%

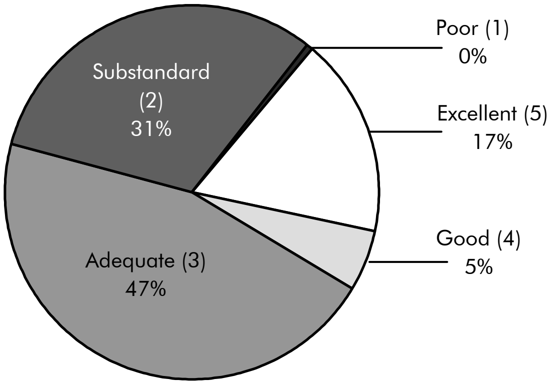
* Includes motorbus, demand response, Publico, trolleybus, and vanpool.

Source: TERM, National Transit Database.

The average condition of bus maintenance facilities, including those used for vans and demand response vehicles, improved from 3.34 in 2002 to 3.41 in 2004. In 2004, 17 percent of all urban bus maintenance facilities were in excellent condition (compared with 7 percent in 2002), 5 percent in good condition (compared with 6 percent in 2002), and 47 percent in adequate condition (compared with 55 percent in 2002). Combined, 69 percent of all urban bus maintenance facilities were in adequate or better condition in 2004 and 31 percent in unacceptable condition in 2004, compared with 67 percent in adequate or better condition and 33 percent in unacceptable condition in 2002 *[Exhibit 3-23].*

Exhibit 3-23

Conditions of Urban Bus Maintenance Facilities, 2004*



*Includes motorbus, demand response, Publico, trolleybus, and vanpool.

Source: Transit Economic Requirements Model.

	2004	
CONDITION	NUMBER	PERCENT
Excellent (5)	208	17%
Good (4)	62	5%
Adequate (3)	551	46%
Substandard (2)	379	31%
Poor (1)	6	0%
Total	1,207	100%

Rail Vehicles

The average rail vehicle condition increased from 3.47 in 2002 to 3.50 in 2004, reflecting a decline in the average age from 20.4 years in 2002 to 19.7 years in 2004. By comparison, in 1995 the average rail vehicle condition was 3.48 with an average age of 19.1 years *[Exhibit 3-24]*. Average rail vehicle age and condition are heavily influenced by the average age and condition of heavy rail vehicles, which in 2004 accounted for 56 percent of the total U.S. rail fleet. All rail vehicles combined have been, on average, in slightly better condition than all bus and bus-type vehicles over the 1995 to 2004 period.

Exhibit 3-24

Urban Transit Rail Fleet Count, Age, and Condition, 1995–2004

Year	1995	1997	1999	2000	2002	2004
Commuter Rail Locomotives						
Total Fleet	570	586	644	591	709	772
Percent Overage Vehicles**	21%	22%	17%	19%	23%	22%
Average Age	15.6	16.5	16.1	15.8	16.9	18.0
Average Condition	3.77	3.70	3.82	3.77	3.72	3.72
Commuter Rail Passenger Coaches						
Total Fleet	2,402	2,470	2,886	2,793	2,985	3,549
Percent Overage Vehicles**	36%	33%	32%	29%	34%	32%
Average Age	20.1	19.8	18.5	17.7	19.0	17.8
Average Condition	3.63	3.68	3.74	3.76	3.68	3.78
Commuter Rail Self-Propelled Passenger Coaches						
Total Fleet	2,645	2,681	2,455	2,472	2,389	2,447
Percent Overage Vehicles**	24%	25%	60%	61%	68%	62%
Average Age	19.7	22.0	24.3	25.2	27.1	23.6
Average Condition	3.68	3.62	3.57	3.55	3.50	3.69
Heavy Rail						
Total Fleet	10,157	10,173	10,366	10,375	11,093	11,046
Percent Overage Vehicles**	37%	36%	40%	40%	36%	33%
Average Age	19.3	21.0	22.5	23.0	20.0	19.8
Average Condition	3.39	3.31	3.26	3.25	3.41	3.35
Light Rail						
Total Fleet	955	1,132	1,400	1,524	1,637	1,884
Percent Overage Vehicles**	12%	10%	15%	13%	14%	13%
Average Age	14.8	14.6	18.9	18.4	16.1	16.5
Average Condition	3.55	3.63	3.62	3.63	3.61	3.60
Total Rail						
Total Fleet	16,729	17,042	17,751	17,755	18,813	19,698
Percent Overage Vehicles**	33%	32%	39%	38%	37%	34%
Weighted Average Age	19.1	20.4	21.6	21.8	20.4	19.7
Weighted Average Condition	3.48	3.42	3.40	3.38	3.47	3.50

**Percent over FTA minimum required replacement age.

Sources: Transit Economic Requirements Model and National Transit Database.

Changes in ages and conditions of all rail vehicles appear to fall within the range of normal depreciation, rehabilitation, and replacement cycles. Although condition is often correlated with age, it is also correlated with preventive maintenance expenditures and vehicle rehabilitations. For this reason, a slight increase in average age may be accompanied by a slight decrease in condition or vice versa. It is interesting to note that, although 62 percent of commuter rail self-propelled passenger coaches were overage in 2004, their average condition was 3.69.

Rail Maintenance Facilities

In 2004, 51 percent of all rail facilities were estimated to be 10 years old or less (compared with 30 percent in 2002), and 13 percent were estimated to be more than 31 years old (compared with 33 percent in 2002.). The percentage estimated to be 11 to 30 years old was virtually the same [*Exhibit 3-25*]. These revisions reflect updated inventory information collected since the last report from some of the Nation's younger rail agencies and several of the larger agencies including MARTA, DART, Fort Worth (The "T"), Metro North, Long Island Railroad, New Jersey Transit, and Seattle/King County Metro, which have younger maintenance facilities than previously estimated.

Exhibit 3-25

Rail Maintenance Facility Ages, 2004 *

Age (Years)	Number	Percent
0–10	77	51%
11–20	37	24%
21–30	19	13%
31+	19	13%
Total	**152**	100%

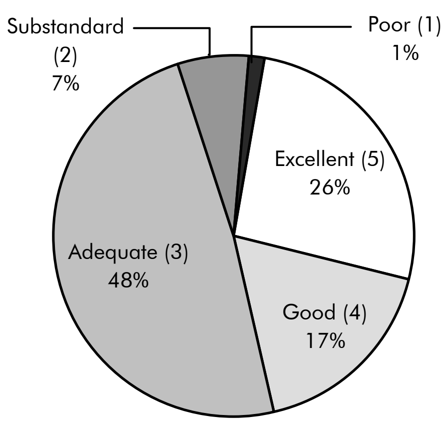
* Includes Alaska rail and inclined plane.

Source: National Rail Assessment.

Based on this new information that shifted the age distribution of rail facilities toward the "younger" 0 to 10 age group, the condition of these facilities increased from 3.56 in 2002 to 3.82 in 2004. In 2004, 26 percent were estimated to be in excellent condition (compared with 18 percent in 2002), 17 percent were estimated to be good condition (compared with 12 percent in 2002), and only 7 percent were estimated to be in substandard condition (compared with 18 percent in 2002) *[Exhibit 3-26].*

Exhibit 3-26

Conditions of Urban Rail Maintenance Facilities, 2004



	2004	
Condition	**Number**	**Percent**
Excellent (5)	40	26%
Good (4)	26	17%
Adequate (3)	74	48%
Substandard (2)	10	7%
Poor (1)	2	1%
Total	**152**	**100%**

Source: Transit Economic Requirements Model.

Rail Stations

The condition of *rail stations* increased from 2.87 in 2002 to 3.37 in 2004 *[Exhibit 3-27]*. Forty-nine percent were in adequate or better condition (compared with 44 percent in 2002) and 51 percent in substandard or worse condition (compared with 56 percent in 2002). The increase in the average condition of rail stations has resulted from a revision in the rail station deterioration schedules based on data collected by FTA on-site surveys in 2004 and updated

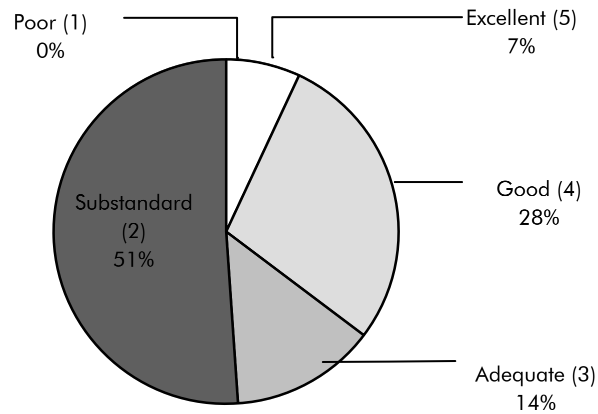
Q&A

How does the condition of nonrail stations compare with the condition of rail stations?

Nonrail stations are in better condition than rail stations. The condition of nonrail stations is estimated to have declined from 4.37 in 2002 to 4.23 in 2004. Surveys of nonrail stations have not been conducted. Nonrail stations are assumed to have the same deterioration schedules as light rail. The condition of stations for all modes combined increased from 2.99 in 2002 to 3.43 in 2004. Rail stations dominate this average.

Exhibit 3-27

Conditions of Urban Rail Passenger Stations, 2004



	2004	
Condition	**Number**	**Percent**
Excellent (5)	207	7%
Good (4)	834	28%
Adequate (3)	407	14%
Substandard (2)	1,510	51%
Poor (1)	3	0%
Total*	**2,961**	**100%**

**Excludes Alaska rail.*

Source: Transit Economic Requirements Model.

information on station assets collected directly from transit agencies. These surveys found that, after 10 years of age, light rail stations are, on average, in better condition than heavy rail stations; subway stations are, on average, in better condition than elevated rail stations, which are, on average, in better condition than at-grade stations. Based on these new decay curves, rail stations 22 years or older are in much better condition than previously estimated. This, combined with the finding that subway stations are, on average, in better condition than elevated or at-grade stations and account for roughly 78 percent of the value of the rail station assets, led to the large increase in condition between 2002 and 2004.

Rail Systems

Exhibit 3-28 provides estimates of the current conditions of rail systems. System data are based on the dollar amounts spent on different asset types (in constant dollars) rather than a numeric count of the assets. For this reason, condition results for these assets are displayed as percentages across condition levels. The system asset categories presented in this table differ from earlier reports. Conditions are reported for four categories—communications, train control, traction power, and revenue collection systems—assets that have been considered by TERM, but have not been reported in earlier editions of this report. The traction power category combines estimates for substations, overhead wire, and third rail, reported separately in earlier reports. This recategorization of systems in this report reflects FTA on-site engineering inspections

Exhibit 3-28

Conditions of U.S. Transit Rail Systems — Selected Years, 1997–2004

	Condition																			
	1 Poor				2 Substandard				3 Adequate				4 Good				5 Excellent			
	1997	2000	2002	2004	1997	2000	2002	2004	1997	2000	2002	2004	1997	2000	2002	2004	1997	2000	2002	2004
Communication	10%	12%	8%	0%	12%	14%	6%	0%	16%	12%	10%	25%	61%	62%	69%	63%	0%	0%	7%	12%
Train Control	13%	10%	8%	12%	11%	10%	10%	14%	16%	17%	11%	29%	52%	56%	66%	45%	9%	7%	6%	0%
Traction Power	14%	7%	4%	0%	7%	7%	3%	1%	10%	11%	11%	45%	44%	55%	45%	47%	25%	21%	37%	8%
Revenue Collect	12%	4%	1%	3%	10%	18%	7%	8%	18%	18%	2%	10%	33%	31%	56%	54%	27%	30%	34%	26%

Source: Transit Economic Requirements Model.

of systems conducted at seven agencies in 2005. [These surveys achieved a 75 percent level of statistical accuracy. Surveys are continuing in 2006. The 2008 C&P report will provide average condition estimates for each system asset based on a larger and more statistically significant sample of system assets.]

Based on the preliminary 2005 surveys, the condition of communications systems was better than indicated in the 2004 C&P report, the condition of train control systems slightly worse, and the condition of traction power systems about the same. The percentage of communications systems estimated to be in adequate or better condition increased from 86 percent in 2002 to 100 percent in 2004, and the percentage of train control systems estimated to be in adequate or better condition decreased from 83 percent in 2002 to 74 percent in 2004. Ninety-nine percent of traction power systems were estimated to be in adequate or better condition in 2004 compared with 93 percent in 2002; however, the percentage in excellent condition decreased and the percentage in adequate condition increased. Surveys were not undertaken of revenue collection systems. Changes in conditions of revenue collection systems reflect updated inventory information. Ninety percent of the revenue collection systems were estimated to be in adequate or better condition in 2004, compared with 92 percent in 2002.

Other Rail Infrastructure

Exhibit 3-29 provides conditions for other rail infrastructure. As for rail systems, data for other rail infrastructure are based on the dollar amounts spent on different asset types (in constant dollars) rather than a numeric count of the assets. Earlier versions of this report, therefore, only provided condition results for these assets displayed as percentages across condition levels. This information is believed to be more accurate than average condition estimates. Bearing this in mind, however, this report also provides estimates of average condition by asset type.

The estimated conditions of *structures* improved. The average condition of *elevated structures* increased from 4.27 in 2002 to 4.31 in 2004. The percentage of elevated structures in adequate or better condition decreased from 91 percent in 2002 to 84 percent in 2004, and the percentage in substandard or worse condition increased from 9 to 16 percent. The average condition of *underground tunnels* increased from 4.09 in 2002 to 4.23 in 2004. The percentage of underground tunnels in adequate or better condition increased from 84 percent in 2002 to 86 percent in 2004. The percentage of underground tunnels in substandard and poor condition decreased from 17 percent in 2002 to 13 percent in 2004.

Exhibit 3-29

Conditions of U.S. Transit Rail Infrastructure—Selected Years, 1997–2004

				Condition																				
Condition Estimates				**1 Poor**				**2 Substandard**				**3 Adequate**				**4 Good**				**5 Excellent**			
	'00	**'02**	**'04**	**'97**	**'00**	**'02**	**'04**	**'97**	**'00**	**'02**	**'04**	**'97**	**'00**	**'02**	**'04**	**'97**	**'00**	**'02**	**'04**	**'97**	**'00**	**'02**	**'04**
Structures																							
Elevated Structures	4.02	4.27	4.31	1%	2%	2%	2%	29%	22%	7%	14%	12%	16%	3%	4%	59%	59%	83%	77%	0%	2%	5%	3%
Underground Tunnels	3.75	4.09	4.23	9%	12%	8%	7%	19%	11%	9%	6%	18%	19%	13%	12%	47%	46%	37%	48%	7%	12%	34%	26%
Track	4.06	4.17	4.27	7%	7%	6%	4%	10%	10%	9%	4%	10%	12%	12%	18%	49%	45%	34%	39%	24%	26%	40%	35%
Yards	4.00	3.64	3.80	0%	0%	0%	0%	0%	0%	20%	0%	37%	50%	48%	52%	63%	50%	31%	48%	0%	0%	1%	0%

Source: Transit Economic Requirements Model.

Track conditions are estimated to have improved from an average condition of 4.17 in 2002 to 4.27 in 2004, principally on the basis of updated asset information. The percentage of track in excellent or good condition was unchanged at 74 percent, the percentage in adequate condition increased from 12 to 18 percent, and the percentage in substandard or poor condition declined from 15 to 8 percent.

Q&A

What is a storage yard?

Rail vehicles are held in storage yards when they are not in service. Storage yard records in TERM consist entirely of track. The next edition of this report will combine storage track with regular track because it is not clear that all agencies consistently report their storage track separately to the NTD. Storage yard information has been reported separately because it was a separate line item in the 1987 *Rail Modernization Study,* which helped to set the groundwork for this report.

Q&A

Why did the average condition of structures increase while the percentage in adequate or better condition declined?

The average condition of an asset may decline even when the percentage in a higher condition category increases. This counterintuitive result occurs because of changes in the distribution of conditions of individual agency/mode assets within each condition category.

The condition of *yards* (vehicle storage yards) increased from 3.64 in 2002 to 3.80 in 2004. In 2004, 100 percent of all yards were in adequate or good condition, compared with 79 percent in 2002. The percentage in substandard condition decreased from 20 percent in 2002 to 0 percent in 2004. No yards were reported as being in poor condition in either 2002 or 2004.

The Value of U.S. Transit Assets

The value of the transit infrastructure in the United States is estimated to be $402.7 billion in 2004, compared with $347.7 billion in 2002 *[Exhibit 3-30]*. These estimates in current dollars are based on the information contained in TERM and on data collected through the NTD and the other data collection efforts discussed in this chapter. They exclude the value of assets that belong to rural and special service operators that do not report to the NTD. Sixty-four percent of the increase since the last report is a result of updated asset inventory information collected directly from transit agencies, 7 percent is a result of new vehicle count numbers from the NTD and updated vehicle costs, and 29 percent is a result of revisions to generated assets. FTA developed new algorithms to estimate generated assets, which led to the increase.

Rail assets are estimated to be $315 billion in 2004 (compared with $265 billion in 2002) and nonrail $79.5 billion in 2004 (compared with $66.7 billion in 2002). Joint assets are estimated to be $7.9 billion, compared with $16.4 billion in 2002. Station assets formerly classified as joint have been reassigned to a specific rail or nonrail mode. Joint assets comprise assets that serve more than one mode within a single agency. Joint assets include administrative facilities, the external structure and furniture and equipment within, intermodal transfer centers, agency communications systems (such as PBX, radios, and computer networks), and vehicles used by agency management (such as vans and autos).

Q&A

What revisions were made to the generated assets component of TERM?

A comprehensive review was undertaken of TERM's capacity to generate assets for nonvehicle data. TERM has consistently generated assets for new agencies, but did not have a standardized mechanism checking the consistency of the asset base for older systems. An algorithm was developed to generate assets by comparing TERM's current asset inventory with listings of station counts, facility counts, and track miles by grade as reported to the NTD.

Exhibit 3-30

Estimated Valuation of the Nation's Transit Assets, 2004

(Billions of current dollars)	Nonrail	Rail	Joint Assets	Total
Maintenance Facilities	$41.3	$16.1	$3.3	$60.8
Guideway Elements	$7.1	$136.0	$0.7	$143.7
Stations	$2.2	$52.3	$1.4	$55.9
Systems	$1.6	$51.6	$1.3	$54.5
Vehicles	$27.2	$59.4	$1.2	$87.7
Grand Total	**$79.5**	**$315.3**	**$7.9**	**$402.7**

Source: Transit Economic Requirements Model.

Rural Transit Vehicles and Facilities

All rural transit vehicles are buses. (Rail transit does not serve rural areas.) Data on the conditions of rural vehicles and maintenance facilities have not been updated since the 2002 edition of the report. The most recent data available were collected from surveys funded by the FTA and conducted by the Community Transportation Association of America. The information was collected between June 1997 and June 1999. The responses of the 158 rural operators that responded to these surveys have been combined. Note that, for the purpose of these surveys, rural operators are defined as those operators outside urbanized areas, a different definition than used by the U.S. Census. These surveys found that more than 50 percent of the rural transit fleet was overage. Forty-one percent of small buses, 34 percent of medium-size buses, 27 percent of full-size buses, and 60 percent of vans and other vehicles were found to be overage [*Exhibit 3-31*]. Small buses more than 7 years old, medium buses more than 10 years old, large buses more than 12 years old, and vans more than 5 years old were categorized as overage.

These surveys also found that 30 percent of bus rural maintenance facilities were in excellent condition, 50 percent in good condition, 19 percent in poor condition, and 1 percent in very poor condition.

Exhibit 3-31

Average Vehicle Age and Percent of Overage Vehicles in Rural Transit

1997–1999	Total Fleet	Average Age	Percent Overage
Full-Size Buses	767	7.8	27%
Medium-Size Buses	1,727	7.6	34%
Small Buses	4,413	5.7	41%
Vans and Other	11,991	7.0	60%
Total	**18,898**	**6.8**	**52%**

Source: Community Transportation Association of America.

Special Service Vehicles

No information is available on the age and condition of special service vehicles. FTA estimated that in 2002 nearly 60 percent of special service vehicles were more than 5 years old.