Commission Briefing Paper 2A-01

2006 C&P Findings: Highway Condition and Performance

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Introduction

This paper is part of a series of briefing papers to be prepared for the National Surface Transportation Policy and Revenue Study Commission authorized in Section 1909 of SAFETEA-LU. The papers are intended to synthesize the state-of-the-practice consensus on the issues that are relevant to the Commission's charge outlined in Section 1909, and will serve as background material in developing the analyses to be presented in the final report of the Commission.

This paper presents information on the characteristics, condition, and performance of the Nation's highway system and its components including roadways, bridges, and intelligent transportation systems. It includes data on system usage, pavement quality, bridge deficiencies, and operational performance. Separate discussions are also presented focusing on the Interstate System and the National Highway System (NHS).

Background and Key Findings

The information and findings presented in this paper are extracted from the 2006 *Status of the Nation's Highways, Bridges, and Transit: Conditions & Performance* Report to Congress, and is based on data from 2004. The figures presented do not include rural minor collectors and rural local and urban local roads, since condition and performance data on these roads is not reported to FHWA. Key findings include:

- Vehicle Miles Traveled (VMT) on pavements with "good" ride quality increased from 39.8 percent of all VMT for 1995 to 44.2 percent in 2004.

- The percent of deficient bridges on the Nation's highway system declined from 32.5 percent in 1994 to 26.7 percent in 2004.

- Average daily Percent of VMT on roads with "acceptable" ride quality (a lower standard that includes roads classified as "good") fell from 86.6 percent in 1995 to 84.9 percent in 2004.

- Average Daily Percent of VMT under congested conditions has increased from 25.9 percent in 1995 to 31.6 percent in 2004, but the rate of increase has slowed in recent years.

- Urbanized areas under 500,000 in population in 2004 experienced approximately the same level of congestion as urbanized areas of 500, 000 to 1 million had in 1995, and approximately the same level as urbanized areas with 1 million to 3 million people experienced in 1987.

- The average duration of congestion (defined as travel conditions at less than free-flow speed) increased from 5.9 hours per day in 1995 to 6.6 hours per day in 2004.

- The annual delay experienced by an average peak period traveler under congested conditions over the course of a year, was 45.7 hours for all urbanized areas in 2004.

System Characteristics

By 2004, the highway system in the Nation consisted of a network of 4.0 million miles of public roads with 594,101 bridges serving 3.0 trillion vehicle miles of travel to meet the mobility needs of the American people. About 75.1 percent of this mileage was located in rural areas (those with populations less than 5,000). While urban mileage constituted only 24.9 percent of total mileage, these roads carried 64.1 percent of the total VMT in the United States for 2004.

Highways

In 2004, about 76.5 percent of highway miles were owned by local governments, while States owned 20.4 percent, and 3.1 percent were owned by the Federal government. Rural roads classified as local (as opposed to arterials or collectors) made up 51.3 percent of total mileage, but carried only 4.4 percent of total VMT. In contrast, urban Interstate highways made up only 0.4 percent of total mileage but carried 15.5 percent of total VMT. Total highway mileage grew at an average annual rate of 0.2 percent between 1995 and 2004, while total VMT grew at an average annual rate of 2.5 percent. Rural road mileage has been declining since 1997, partly reflecting the reclassification of some Federal roads as nonpublic and the expansion of urban area boundaries (thus subsuming roads previously classified as rural) as a result of the 2000 decennial Census.

Rural VMT grew at an average annual rate of 1.4 percent from 1995 to 2004, compared with an average annual increase of 1.8 percent in small urban areas (population 5,000 to 50,000) and 2.3 percent in urbanized areas (greater than 50,000 population). Rural VMT declined from 2002 to 2004 primarily as a result of boundary changes associated with the decennial Census; boundary changes also tend to inflate urban VMT growth.

Bridges

In 2004, approximately 50.6 percent of bridges were locally owned, States owned 47.6 percent, 1.4 percent were owned by the Federal government, and 0.5 percent were either privately owned (including highway bridges owned by railroads) or had unknown or unclassified owners. The average age of highway bridges is 40 years old.

Intelligent Transportation Systems

The deployment of intelligent transportation systems (ITS) has advanced steadily over time. Real-time data collection sensors have been deployed on more than one-third of the total freeway mileage in these areas, and on-call service patrols cover half of the freeway mileage.

Among the 75 metropolitan areas tracked since 1997, the number with a "High" level of progress in the integrated deployment of ITS has risen from 11 to 30 in 2004, while the number of areas ranked "Low" has fallen from 39 to 12 (the remainder are ranked "Medium).

Physical Condition

Poor road surfaces impose costs on the traveling public in the form of increased wear and tear on vehicle suspensions and tires, delays associated with vehicles slowing to avoid potholes, and crashes resulting from unexpected changes in surface conditions. Similarly, poor bridge condition imposes costs for users to increase due to slower speeds and the need to detour around deficient bridges.

Highways

While highway agencies generally consider a variety of pavement distresses in assessing their overall condition, surface roughness most directly affects the ride quality experienced by drivers. Accordingly, the FHWA has adopted the International Roughness Index (IRI) as the metric for ride quality. The IRI is an indicator of the cumulative deviation from a smooth surface in inches per mile of roadway traveled. The IRI data can be collected by vehicles at highway speeds and therefore give a good indication of the ride experienced by drivers. It does not, however, give a good indication of the structural quality of the pavements measured and the problems associated with pavement deterioration due to structural problems.

The FHWA separates pavements into three ride quality groups: Good – IRI less than 95 inches per mile; Acceptable – IRI less than or equal to 170 inches per mile; and Unacceptable – IRI greater than 170 inches per mile. Note pavements with Good ride quality are a subset of pavements with Acceptable ride quality. Pavements in the 'good' ride quality group normally require less agency expenditure to provide and maintain the level of performance. Pavements in the 'unacceptable' ride quality group may require the expenditure of significant funds to return the pavement to the level of 'good' performance.

In 2004, 44.2 percent of travel on arterials and collectors for which data are available occurred on pavements with "good" ride quality, up from 39.8 percent in 1995. The percentage of VMT on roads with "acceptable" ride quality (a lower standard that includes roads classified as "good") fell from 86.6 percent to 84.9 percent over the same period of time.

Pavement ride quality is generally better on higher functional class roads and is better in rural areas than in urban areas. For example, approximately 97.8 percent of rural Interstate VMT in 2004 was on pavements with acceptable ride quality, compared with 72.4 percent for collectors in urbanized areas.

In 2004, 58.3 percent of rural VMT occurred on roads with good ride quality, while 94.5 percent occurred on roads with acceptable ride quality. The comparable percentages for VMT in small urban areas were 41.2 percent good and 84.3 percent acceptable; for VMT in urbanized areas, 36.1 percent was on pavements with good ride quality, while 79.2 percent had acceptable ride quality. Table 1 shows how these measures have changed over time.

Table 1: Percent VMT on Good and Acceptable Pavements with Good and Acceptable Ride Quality

	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%

Bridges

Most bridges are inspected every 2 years and receive ratings based on the condition of various bridge components. Two terms used to summarize bridge deficiencies are “structurally deficient” and “functionally obsolete.”

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 a bridge is “deficient” does not immediately imply that it is likely to collapse or that it is unsafe.

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. 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.

Rural bridges tend to have a higher percentage of structural deficiencies, while urban bridges have a higher incidence of functional obsolescence due to rising traffic volumes. The percentage of bridges classified as deficient fell from 32.5 percent in 1994 to 26.7 percent in 2004. Most of this decline was the result of reductions in the percent of structurally deficient bridges.

Operational Performance

Congestion on the Nation's highways imposes significant costs on drivers and society as a whole in the form of added travel time, vehicle operating costs, and emissions. Congestion results when traffic demand approaches or exceeds the available capacity of the highway system. It is clear that traffic demands vary significantly by time of day, day of the week, season of the year, and for special events. Moreover, the available capacity at any given time is variable, affected by weather, work zones, traffic incidents, and other nonrecurring events. Of the total congestion experienced by Americans, it is estimated that roughly half is "nonrecurring," associated with temporary disruptions in traffic demand and/or in available capacity.

There is no universally accepted definition or measurement of exactly what constitutes a congestion "problem," however a variety of different metrics to explore different aspects of congestion have been developed by The Texas Transportation Institute (TTI). TTI has computed data for the FHWA for several measures, based on data for all 428 of the Nation's urbanized areas in 2004. It should be noted that the values shown for the same measures shown in TTI 2005 *Urban Mobility Study* are somewhat different from the values cited in this paper since that study was based on a subset of 85 urbanized areas that is weighted more heavily to the most heavily populated areas.

The Average Daily Percent of VMT under Congested Conditions is an indicator of the portion of daily traffic on freeways and other principal arterials in an urbanized area that moves at less than free-flow speeds. Free-flow speed is the average speed a vehicle would travel under normal conditions without restrictions due to roadway alignment, weather conditions, or congestion from other vehicles.

The percentage of average daily percent of VMT occurring under congested conditions increased from 25.9 percent to 31.6 percent from 1995 to 2004 for the average urbanized area, and rose for each of four subsets based on population size reported by TTI. However, the rate of growth in this congestion measure has slowed since 1999.

The Average Length of Congested Conditions is a measure of the duration of congestion with congestion, again, being defined as travel conditions at less than free-flow speed. This metric stabilized at approximately 6.6 hours per day in 2002 and 2004, after rising from 5.9 hours per day in 1995.

The Travel Time Index measures the amount of additional time required to make a trip during the congested peak travel period, rather than at other times of the day. The average travel time index for all urbanized areas for 2004 was 1.38, indicating that a trip during congested conditions required 38 percent more time than the same trip during non-congested conditions. This is up slightly from the 1.37 value reported for 2002; the value for 1995 was 1.27.

The "Annual Delay per Peak Period Traveler" is defined as the total delay experienced by an average traveler under congested conditions over the course of a year. In 2004, the average delay experienced by the peak period travelers for all urbanized areas was 45.7 hours, up slightly from 45.4 hours in 2002. In other words, the average peak period urban traveler lost 45.7 hours of the time that he or she could have spent in more constructive uses due to congested conditions in 2004.

The "Annual Delay per Capita" relates the average hours of travel delay experienced by a resident of an urbanized area over the course of a year. This measure includes all residents of a given area, not just peak travelers. This metric rose from 23.8 hours in 2002 to 24.4 hours in 2004.

The congestion levels experienced by larger cities in the late 1980's are now being seen in 2004 in smaller communities. This situation is illustrated in Table 2 based on data developed by TTI for the FHWA Performance Plan Congestion/Mobility Measures. They show a significant worsening of congestion since 1987 in urban areas of all sizes.

Table 2: Comparative Highway Operational Performance Statistics for Urban Areas

Urbanized Area Size	Travel Time Index		Average Daily Pct. Congested VMT		Average Length of Congested Conditions (hours)		Annual Delay per Peak Road Traveler (hours)		Average Annual Delay per Capita (hours)	
	1987	2004	1987	2004	1987	2004	1987	2004	1987	2004
Less than 500,000 pop.	1.05	1.14	6.5	16.6	2.8	4.6	5.5	15.9	2.4	8.6
500,000 to 999,999 pop.	1.10	1.21	13.5	24.8	4.1	6.1	13.5	29.9	6.0	16.1
1,000,000 to 3,000,000 pop.	1.12	1.33	16.8	31.7	4.9	6.8	14.8	38.4	6.4	21.0
Over 3,000,000 pop.	1.37	1.58	31.6	40.7	7.2	7.8	69.3	74.9	28.3	38.9
All Urbanized Areas	1.22	1.38	21.1	31.6	5.4	6.6	30.0	45.7	12.8	24.4

Safety Performance

In the period from 1995 to 2004 the number of fatalities on the Nation's road system has increased 41,817 to 42,636. The fatality rate, the number of fatalities per 100 VMT, has declined from 2.58 to 2.33 for all rural roadways and from 1.16 to 0.98 for all urban roadways. The National fatality rate per 100 million vehicle miles traveled has declined during this period from 1.71 to 1.42.

Interstate System

In 2006, the Dwight D. Eisenhower National System of Interstate and Defense Highways, commonly known as the Interstate System, turned 50 years old. The Interstate System serves as the backbone of transportation and commerce in the United States, consisting of 46,747 route miles in 2004 and including 55,315 bridges. During 2004, Americans traveled a total of 727 billion vehicle miles on the Interstate System.

System Characteristics

About 67.1 percent of the route miles of the Interstate System are in rural areas, slightly less than 4.5 percent were in small urban areas, and 28.3 percent are in urbanized areas. By comparison, of the total 3,997,462 route miles for all roads in the United States, slightly more than 75.1 percent were in rural areas, slightly less than 4.7 percent were in small urban areas, and the remaining approximately 20.2 percent were in urbanized areas.

The number of Interstate route miles in rural areas declined from 33,107 in 2002 to 31,477 in 2004. During the same period, the number of Interstate System miles in small urban areas increased from 1,808 in 2002 to 2,088 in 2004 and the number of route miles in urbanized areas increased from 11,832 in 2002 to 13,270 in 2004. Rural Interstate route miles declined due to the expansion of small urban and urbanized boundaries resulting from the 2000 decennial census, causing some formerly rural areas to be reclassified as urban.

Between 1995 and 2004, rural Interstate route miles decreased by an average of 0.4 percent annually, small urban Interstate route miles increased at an average annual rate of 2.1 percent, and Interstate route miles in urbanized areas increased 1.5 percent annually. The 0.2 percent overall annual growth rate for Interstates roughly matches that for all roads during that time period.

In 2004, there were 212,029 lane miles of Interstate highway in the United States. Slightly less than 60.4 percent were in rural communities, just less than 4.2 percent were in small urban areas, and 35.4 percent were in urbanized areas. By comparison, about 73.4 percent of all highway lane miles in the United States were in rural areas, 4.8 percent of lane miles were in small urban areas, and 21.8 percent of lane miles were in urbanized areas.

Between 1995 and 2004, rural Interstate lane miles decreased by 0.4 percent annually, small urban Interstate lane miles grew at 2.3 percent annually, and urbanized Interstate lane miles increased by 1.6 percent annually. The annual growth rate of lane miles from 1995 to 2004 for the total Interstate System was 0.5 percent annually or almost double the annual growth rate of lane miles for all roads in the United States over the same period. This growth in Interstate lane miles has occurred due to both new construction and the reclassification of some arterials to Interstate status.

Between 1996 and 2004, the number of rural Interstate bridges decreased from 28,638 to 27,648 bridges, while during the same period, the number of urban Interstate bridges increased from 26,596 to 27,667. 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.

Interstate Use Characteristics

The Interstate system is facing increasing demands. Interstate travel has continued to represent the fastest-growing portion of VMT between 1995 and 2004. Interstate VMT grew at an average annual rate of approximately 2.8 percent during this period, while VMT on all roads grew by about 2.3 percent annually. Between 1995 and 2004 combination truck travel grew by 3.9 percent annually on urban Interstates and by 4.1 percent on rural Interstates. By comparison, combination truck travel on all roads increased by 2.6 percent annually during the same period.

In 2004, Americans traveled more than 267 billion vehicle miles on rural Interstates, 25.7 billion vehicle miles on small urban Interstates, and in excess of 433.9 billion vehicle miles on urban Interstates. From 1995 to 2004, the Daily Vehicle Miles Traveled (DVMT) per lane mile increased from 4,329 to 5,707 on rural Interstate highways, from 6,254 to 7,925 on small urban Interstate highways, and from 13,826 to 15,783 on Interstate highways in urbanized areas.

In 2004, 81.3 percent of travel on rural Interstates was by passenger vehicle; 2.9 percent was by single-unit truck; and 15.9 percent was by combination truck. About 92.8 percent of urban Interstate travel was by passenger vehicle; 2.1 percent was by single-unit truck; and 5.1 percent was by combination truck. By contrast, passenger vehicle travel represented approximately 92.3 percent of travel on all roads in 2004. Single-unit truck travel was just above 2.7 percent of travel, and combination truck travel represented slightly more than 4.9 percent. Approximately 30.9 percent of the total Nation's total VMT by combination trucks is on the Interstate System.

Physical Condition

Since 1995, the percentage of VMT on Interstate pavements with good ride quality has increased in rural areas, small urban areas, and urbanized areas. Among the three population area subsets, rural Interstates had the highest percentage of VMT on pavements with good ride quality in 2004, at 73.7 percent. A total of 97.8 percent of all VMT on the rural Interstate System occurred on pavements with acceptable ride quality.

On small urban Interstates, the percentage of VMT occurring on pavements with good ride quality was 65.6 percent in 2004. VMT on small urban Interstate pavements classified as having acceptable ride quality was 95.0 percent. For urbanized Interstates, the percentage of VMT on pavements with good ride quality was 48.5 percent in 2004, while the percentage of VMT on acceptable ride quality pavements was 89.9 percent.

Lane Width, Alignment, and Access Control

Roadway 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 geometric alignment, horizontal (curvature) and vertical (gradient), which can be evaluated for their adequacy. More than 92.6 percent of rural Interstate miles fall into the "best" category for vertical alignment adequacy, and 95.4 percent are in that category for horizontal alignment.

Lane width can have an impact on highway safety and operational performance. Higher functional systems such as Interstates are expected to have 12-foot wide travel lanes.

Approximately 99.7 percent of rural Interstate miles and 98.3 percent of urban Interstate miles have the minimum 12-foot lane widths.

The vast majority of the Interstate mileage consists of divided highways with a minimum of four lanes and full access control. The exceptions are on Interstate highways in Alaska and Puerto Rico, which are not required to meet this standard, but instead are simply required to be adequate for current and probable future traffic demands and the needs of the locality.

Bridge Age and Condition

Of the bridges currently on the Interstate highway system, approximately 17.4 percent were constructed during the 1950s, 44.0 percent were constructed during the 1960s and 20.0 percent were constructed during the 1970s. Since such a large percentage of these bridges are in approximately the same period in their service lives, this poses a challenge for long-term strategies relating to the rehabilitation or replacement of Interstate bridges.

Approximately 15.9 percent of all rural Interstate bridges were deficient in 2004, including 1,163 structurally deficient, 4.2 percent of the total number, and 3,224 functionally obsolete, 11.7 percent of the total number. This represented an improvement from the 18.5 percent of Interstate bridges that were deficient in 1994. Among rural functional systems, the rural Interstate System had the lowest percentage of structurally deficient bridges and the lowest number of functionally obsolete bridges and deficient bridges.

Approximately 26.5 percent of all urban Interstate bridges were deficient in 2004, down from 30.6 percent in 1994. This included 1,667 structurally deficient bridges, 5.1 percent of total urban Interstate bridges, and 5,617 functionally obsolete bridges, 20.5 percent of the total. Among urban functional systems, the Interstate System had the lowest percentage of deficient bridges.

Safety Performance

While the number of fatalities has increased on both rural and urban Interstates, these roads are still safer on average than those in other functional classes. For 2004, the fatality rate on rural Interstates continued to be lower than any other rural functional class at 1.21 fatalities per 100 million VMT, and the fatality rate on the urban Interstate System of 0.55 fatalities per 100 million VMT for 2004 was the lowest of any functional class. For the period from 1995 to 2004, the rural Interstate fatality rate has been almost double that of the urban Interstate System.

National Highway System

System Characteristics

The National Highway System (NHS) has five components: (1) the Interstate System, (2) selected other principal arterials deemed most important for commerce and trade, (3) the Strategic Highway Network (STRAHNET), (4) STRAHNET connectors, and (5) intermodal connectors that provide access between major intermodal passenger and freight facilities and other NHS components. There are currently 162,158 route miles on the NHS (excluding some sections not yet open to traffic).

All Interstates are part of the NHS, as are 84.0 percent of rural other principal arterials, 87.5 percent of urban other freeways and expressways, and 35.9 percent of urban other principal arterials. While only 4.1 percent of the Nation's total route mileage is on the NHS, these roads carry 44.8 percent of VMT. The NHS consists of 559,884 lane miles, or 6.7 percent of the national total of lane miles.

Approximately 94.9 percent of NHS route miles were State-owned in 2004. Only 5.0 percent were locally owned, and the Federal government owned the remaining 0.1 percent. Since the NHS is concentrated on higher functional systems, the percentage of locally owned NHS routes is relatively small.

Physical Condition

Routes on the NHS tend to have better overall pavement condition than the remainder of the highway system pavement. In 2004, the percent of VMT on NHS routes with good ride quality was 52.0, compared with 40.7 percent for all arterials and collectors for which data is available.

The percentage of NHS VMT on pavements with good ride quality has risen sharply over time, from 37 percent in 1996 to 52 percent in 2004. The VMT on NHS pavements meeting the less stringent standard of acceptable ride quality grew more slowly, from 89 percent in 1996 to 91 percent in 2004.

Rural NHS routes tend to have better pavement conditions than urban NHS routes, as 68.0 percent of rural NHS VMT was on pavements with good ride quality while 42.5 percent of the urban NHS VMT was on pavements with good ride quality. However, the total traffic in urban areas was higher than in rural areas.

For 2004 the percent of VMT on rural pavements meeting the standard of acceptable ride quality was 97.0 percent. The percentage of urban NHS VMT on acceptable pavements was 86.9 percent in 2004.

Bridges

The National Bridge Inventory (NBI) lists 115,104 bridges on the NHS. This represents approximately 19.4 percent of the total bridges on the Nation's roadway system. These bridges had approximately 49.5 percent of the total deck area and carried 71.1 percent of the total travel on bridges in the U.S. in 2004. State agencies own over 96 percent of the bridges on the NHS. Local agencies own slightly more than 3 percent of the NHS bridges with the remaining less than 1 percent being owned by Federal agencies and other groups.

Approximately 5.6 percent of NHS bridges were classified as structurally deficient in 2004. The percentage classified as functionally obsolete was 14.9 percent in 2004. The overall percentage of deficient NHS bridges was 20.5 percent in 2004.

While 19.4 percent of all bridges were on the NHS, NHS bridges represented only 14.9 percent of the Nation's total deficient bridges in 2004. Among structurally deficient bridges, NHS bridges made up only 8.2 percent, but among functionally obsolete bridges, NHS bridges constituted 21.4 percent of the total.

CONSOLIDATED COMMENTS FROM MEMBERS OF THE BLUE RIBBON PANEL OF TRANSPORTATION EXPERTS - PAPER 2A-01

One reviewer commented as follows:

- The report is useful for current conditions, and a number of backward-looking comparisons to 1995 to show changes and trends, but it does not assess future needs. It does give useful information on the "backlog" of needs to bring all highways and bridges up to "good" condition.

- Appropriately covers the common, major reporting statistics on condition and performance for the entire public road system – highways and bridges – and separately for the Interstate and for National Highway System. However, generally, there is no interpretation of why there were changes from the last report in 2004 or from the 1995 reference year.

- For highways, surface condition but not structural conditions are reported, so it does not show current or projected needs for 4R work.

- Generally, pavement physical conditions have improved in recent years. Only in urbanized areas was there a decline in the percent of VMT on pavements in "acceptable" condition.

- Several measures of congestion are reported, which is good since there is not an adequate single measure. Several tables were helpful to see changes over a number of points in time, typically from 1995 to 2004.

- One forward-looking observation of interest to the Commission is that since a large percentage of Interstate bridges were constructed in roughly the same time period (1950s-1970s), there will be a "bulge" in bridge 4R or replacement needs in the future.