Introduction

This is the ninth in a series of combined documents prepared by the U.S. Department of Transportation (DOT) to satisfy requirements for reports to Congress on the condition, performance, and future capital investment needs of the Nation's highway and transit systems. This report incorporates highway, bridge, and transit information required by 23 U.S.C. §502(h), as well as transit system information required by 49 U.S.C. §308(e). Beginning in 1993, the Department combined two separate existing report series that covered highways and transit to form this report series; prior to this, 11 reports had been issued on the condition and performance of the Nation's highway systems, starting in 1968. Five separate reports on the Nation's transit systems' performance and conditions were issued beginning in 1984.

This *2010 Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance* report to Congress (C&P report) draws primarily on 2008 data. The 2008 C&P report, transmitted on January 14, 2010, was based primarily on 2006 data.

In assessing recent trends, many of the exhibits presented in this report present statistics for the primary data years reflected in the last five C&P reports (2000, 2002, 2004, 2006, and 2008). Other charts and tables cover different time periods depending on data availability and years of significance for particular data series. The data presented within this report generally reflect the latest available information as of December 2009 or the date the individual chapters were written. The prospective analyses presented in this report generally cover the 20-year period ending in 2028.

Report Purpose

This document is intended to provide decision makers with an objective appraisal of the physical conditions, operational performances, and financing mechanisms of highways, bridges, and transit systems based both on the current state of these systems and on the projected future state of these systems under a set of alternative future investment scenarios. This report offers a comprehensive, data-driven background to support the development and evaluation of legislative, program, and budget options at all levels of government. It also serves as a primary source of information for national and international news media, transportation associations, and industry.

This C&P report consolidates conditions, performance, and financial data provided by States, local governments, and mass transit operators to provide a national-level summary. Some of the underlying data are available through the DOT's regular statistical publications. The future investment scenario analyses are developed specifically for this report and provide national-level projections only.

Report Organization

This report begins with a "Highlights" section that summarizes key findings of the overall report, which is followed by an Executive Summary that highlights the key findings in each individual chapter. These two sections will also be published as a separate stand-alone summary document.

The main body of the report is organized into four major sections. The six chapters in Part I, "Description of Current System," contain the core retrospective analyses of the report. Chapters 2 through 6 each include separate highway and transit sections discussing each mode in depth. This structure is intended to accommodate report users who may primarily be interested in only one of the two modes.

- **Chapter 1** provides a broad overview of the functions served by the Nation's highways and transit systems.
- **Chapter 2** describes recent trends in highway, bridge, and transit system characteristics.
- **Chapter 3** depicts the current physical conditions of highways, bridges, and transit systems.
- **Chapter 4** describes the current operational performance of highways and transit systems.
- **Chapter 5** discusses issues relating to the safety of highways and transit.
- **Chapter 6** discusses highway and transit revenue sources and expenditure patterns for all levels of government, as well as recent innovations in highway finance.

The four chapters in Part II, "Investment/Performance Analysis," contain the core prospective analyses of the report, including 20-year future capital investment scenarios. The Introduction to Part II provides critical background information and caveats that should be considered while interpreting the findings presented in Chapters 7 through 10.

- **Chapter 7** projects the potential impacts of different levels of future highway, bridge, and transit capital investment on the future performance of various components of the system.
- **Chapter 8** describes selected capital investment scenarios in more detail and relates these scenarios to the current levels of capital investment for highways, bridges, and transit.
- **Chapter 9** provides supplemental analysis relating to the primary investment scenarios, comparing the future investment scenario findings to previous reports, relating past investment to the current conditions and operational performance of the system, discussing scenario implications, and exploring selected policy alternatives.
- **Chapter 10** discusses how some future highway and transit investment scenarios would be affected by changing the assumptions about travel growth and other key variables.

Part III, "Sustainable Transportation Systems," includes a set of three new chapters exploring sustainability, climate change adaptation, and livability. Some of the topics discussed have been referenced in previous editions of this report, but this edition is the first to explore these issues in a concentrated fashion.

- **Chapter 11** examines issues pertaining to the long-term environmental sustainability of the transportation system and the challenges involved in meeting the needs of the present without compromising the ability of future generations to meet their own needs.
- **Chapter 12** explores climate change adaptation, identifies potential impacts of climate change on transportation, and discusses policies and measures intended to promote effective responses in adapting to these changes.
- **Chapter 13** discusses issues pertaining to livability and efforts to foster livable communities in which transportation, housing and commercial development investments have been coordinated so that everyone has access to adequate, affordable, and environmentally sustainable travel options.

The report also contains three technical appendices that describe the investment/performance methodologies used in the report for highways, for bridges, and for transit. A fourth appendix describes ongoing research activities and identifies potential areas for improvement in the data and analytical tools used to produce the analyses contained in this report.

Highway Data Sources

Highway conditions and performance data are derived from the Highway Performance Monitoring System (HPMS), a cooperative data/analytical effort dating from the late-1970s that involves the Federal Highway Administration (FHWA) and State and local governments. The HPMS includes a statistically drawn sample of more than 100,000 highway sections containing data on current physical and operating characteristics, as well as projections of future travel growth on a section-by-section basis. All HPMS data are provided to FHWA through State departments of transportation from existing State or local government databases or transportation plans and programs, including those of metropolitan planning organizations.

The HPMS data are collected in accordance with the *Highway Performance Monitoring System Field Manual for the Continuing Analytical and Statistical Database.* This document is designed to create a uniform and consistent database by providing standardized collection, coding, and reporting instructions for the various data items. The FHWA reviews the State-reported HPMS data for completeness, consistency, and adherence to reporting guidelines. Where necessary, and with close State cooperation, data may be adjusted to improve uniformity. The HPMS data also serve as a critical input to other studies that are cited in various parts of this report, such as the Texas Transportation Institute's *2009 Urban Mobility Report.*

State and local finance data are derived from the financial reports provided by the States to FHWA in accordance with *A Guide to Reporting Highway Statistics.* These are the same data used in compiling the annual *Highway Statistics* report. The FHWA adjusts these data to improve completeness, consistency, and uniformity. Highway safety performance data are drawn from the Fatality Analysis Reporting System (FARS).

Bridge Data Sources

The FHWA annually collects bridge inventory and inspection data from the States and incorporates the data into the National Bridge Inventory (NBI). The NBI contains information from all bridges covered by the National Bridge Inspection Standards (Title 23, Code of Federal Regulations, Part 650) located on public roads throughout the United States and Puerto Rico. Inventory information for each bridge includes descriptive identification data, functional characteristics, structural design types and materials, location, age and service, geometric characteristics, navigation data, and functional classifications; conditions information includes inspectors' evaluations of the primary components of a bridge, such as the deck, superstructure, and substructure. Most bridges are inspected once every 24 months. The archival NBI data sets represent the most comprehensive uniform source of information available on the conditions and performance of bridges located on public roads throughout the United States.

Transit Data Sources

Transit data are derived from the National Transit Database (NTD) and transit agency asset inventories. The NTD provides comprehensive data on the revenue sources, capital and operating expenses, basic asset holdings, service levels, annual passenger boardings, and safety data of the more than 650 urban and 1,300 rural transit operators that receive annual funding support through the Federal Transit Administration's (FTA's) Section 5309 (Urbanized Area) and Section 5311 (Rural Area) Formula Programs. Given the range of measures reported to NTD and its comprehensive coverage of U.S. transit operations, NTD is an excellent source of data for analysis of transit financial, operating, and safety performance.

However, with the exception of fleet vehicle holdings (where NTD provides comprehensive data on the composition and age of transit fleets), NTD does not provide the data required to assess the current physical condition of the Nation's transit infrastructure.

To meet this need, FTA collects transit asset inventory data from a sample of the Nation's largest rail and bus transit operators. In direct contrast to the data in either NTD or HPMS—which local and State funding grantees are required to report to FTA and FHWA, respectively, and which are subject to standardized reporting procedures—the transit asset inventory data used to assess current transit conditions are provided to FTA in response to direct requests submitted to grantees and are not subject to any reporting requirements. At present, there are no reporting requirements or reporting standards for asset inventory data.

In practice, these data requests are only made to the Nation's 20 to 30 largest transit agencies because these agencies account for roughly 85 percent of the Nation's total transit infrastructure by value. At the same time, given the slow rate of change in transit agency asset holdings over time (excluding fleet vehicles and major expansion projects), FTA only requests this data from any given agency once every 3 to 5 years. The asset inventory data collected through these requests typically document the age, quantity, and replacement costs of the grantees' asset holdings by asset type. Meanwhile the non-vehicle asset holdings of smaller operators are estimated using a combination of (1) the fleet-size and facility-count data reported to NTD and (2) the actual asset age data of a sample of smaller agencies that respond to asset inventory requests similar to those provided to the larger operators. While this method of obtaining asset data has served FTA well in the past (and the quality of the reported data has improved over time), the accuracy and comprehensiveness of FTA's estimates of current asset conditions and capital reinvestment needs would nonetheless benefit from a standardized reporting requirement comparable to those for NTD and HPMS.

Other Data Sources

This report also relies on data from a number of other sources. For example, the National Household Travel Survey (NHTS) collected by the FHWA provides information on the characteristics, volume, and proportion of passenger travel across all modes of transportation. Information on freight activity is collected by the Census Bureau through the Commodity Flow Survey and the Vehicle Inventory and Use Survey, and then merged with other data in FHWA's Freight Analysis Framework.

Investment/Performance Analytical Procedures

The earliest versions of the reports in this combined series relied exclusively on engineering-based estimates for future investment/performance analysis, which considered only the costs of transportation agencies. This philosophy failed to adequately consider another critical dimension of transportation programs, such as the impacts of transportation investments on the costs incurred by the users of the transportation system. Executive Order 12893, *Principles for Federal Infrastructure Investments,* dated January 1994, directs each executive department and agency with infrastructure responsibilities to base investments on " . . . systematic analysis of expected benefits and costs, including both quantitative and qualitative measures . . . ." New approaches have been developed to address the deficiencies in earlier versions of this report and to meet the challenge of this Executive Order. The analytical tools now used in this report have added an economic overlay to the development of future investment scenarios.

The highway investment scenarios presented in this report are developed in part from the Highway Economic Requirements System (HERS), which uses benefit-cost analysis to optimize highway investment. The HERS model quantifies user, agency, and societal costs for various types and combinations of

improvements, including travel time and vehicle operating, safety, capital, maintenance, and emissions costs. Bridge investment scenario estimates are developed from the National Bridge Investment Analysis System (NBIAS) model. Unlike earlier bridge models (and similar to HERS), NBIAS incorporates benefit-cost analysis into the bridge investment/performance evaluation.

The transit investment analysis is based on the Transit Economic Requirements Model (TERM). The TERM consolidates older engineering-based evaluation tools and introduces a benefit-cost analysis to ensure that investment benefits exceed investment costs. TERM identifies the investments needed to replace and rehabilitate existing assets, improve operating performance, and expand transit systems to address the growth in travel demand.

While HERS, NBIAS, and TERM all utilize benefit-cost analysis, their methods for implementing this analysis are very different. The highway, transit, and bridge models are all based on separate databases that are very different from one another. Each model makes use of the specific data available for its part of the transportation system and addresses issues unique to each mode. These three models have not yet evolved to the point where direct multimodal analysis is possible. For example, HERS assumes that when lanes are added to a highway, this causes highway user costs to fall, resulting in additional highway travel. Under this assumption, some of this increased traffic would be newly generated travel and some could be the result of travel shifting from transit to highways. However, HERS does not distinguish between different sources of additional highway travel. At present, there is no truly accurate method for predicting the impact that a given level of highway investment would have on the future performance of transit systems. Likewise, TERM's benefit-cost analysis assumes that some travel shifts from automobile to transit as a result of transit investments, but cannot project these investments' impact on highways.

In interpreting the findings of this report, it is important to recognize the limitations of these analytical tools and the potential impacts of different assumptions that have been made as part of the analysis. Appendix D and the Introduction to Part II both contain information critical to contextualizing the future investment scenarios, and these issues are also discussed in Q&A boxes located in Chapters 7 through 10.

What Does it Mean to "Maintain?"

For each broad component of the transportation system considered in this report–i.e., highways, bridges, and transit–selecting a summary measure of overall conditions and performance presents a choice among various alternative metrics each of which are partial to some extent; no single metric captures all aspects of conditions and performance. The "Maintain" scenarios presented in this report each consider a level of capital investment that could keep overall conditions and performance, as measured by a particular metric, at the same level 20 years from now as it is today. The metrics selected differ among system components because the highway, bridge, and transit systems differ from each other in their characteristics, the data available to measure these characteristics are limited, and the analytical tools used to analyze these characteristics in this report differ in their capabilities.

The primary "Maintain" scenarios for highways focus on maintaining average speeds over 20 years at the base year level. (The impact on other conditions and performance metrics would vary; for example, on a systemwide basis, average pavement condition improves a little under this scenario, while average delay gets a little worse). The "Maintain" scenarios for bridges target the size of the backlog of economically justifiable bridge improvements (measured in constant dollars); and identify the level of investment needed to keep this backlog from growing above its base year level. Some of the transit scenarios include components reflecting the estimated level of investment that would be sufficient to maintain at the base year level the average occupancy rate for each transit mode, as measured by passenger miles per peak vehicle.

In each case, the investment scenarios outlined in this report represent an estimate of what level of performance could be achieved with a given level of funding, not what would be achieved with it. While the models assume that projects are prioritized based on their benefit-cost ratios, that assumption is not consistent with actual patterns of project selection and funding distribution that occur in the real world.

While the "Maintain" scenarios presented in this report focus on maintaining conditions at base-year levels, the base year is different for each edition of the report; i.e., the prevailing conditions and performance in the 2008 base year analyzed in this report differ from those for the 2006 base year presented in the 2008 edition of the report. Hence, as the level of current system conditions and performance varies over time, the investment scenarios that are based on maintaining the status quo are effectively targeting something different each time. It is important to recognize this when comparing the results of different reports in the series.

What Does it Mean to "Improve?"

In theory, spending anything more than the cost to maintain overall conditions and performance at the base year level will produce overall conditions and performance at the end of the 20-year analysis period that are an improvement over the base year level. Thus, any number of scenarios to "Improve" conditions and performance" could have been considered for this report, each associated with a particular level of capital investment. Among this range of alternatives, this report focuses on a limited number of illustrative "Improve" scenarios.

The two "Improve" scenarios for highways envision spending at levels sufficient to implement all potential capital improvement projects with benefit-cost ratios of 1.5 or 1.0, respectively. The scenarios reflecting a minimum benefit-cost ratio of 1.0 can be viewed as an "investment ceiling" above which additional investment would not be cost beneficial, even if unlimited funding were available. In reality, available funding is not unlimited, and many decisions on highway funding levels must be weighed against potential cost beneficial investments in other government programs as well as private sector investments, which can also be evaluated from a societal cost-benefit perspective. Thus, the less expensive scenario reflecting the higher minimum benefit-cost ratio of 1.5 is also included in this report as a point of reference.

One of the "Improve" scenarios presented for bridges is consistent with the highway scenario, applying a minimum benefit cost ratio of 1.0 to estimate the level of investment that would be sufficient to eliminate the backlog of economically justifiable bridge improvements by the end of 20 years. Due to limitations in data availability and current analytical modeling capabilities, the other "Improve" scenario for bridges assumes a rate of spending growth consistent with the corresponding highway scenario, rather than applying an alternative minimum benefit-cost ratio. Some of the transit scenarios include components reflecting the estimated level of investment that would be sufficient to bring transit assets up to a state of good repair.

It is important to recognize several key limitations of the "Improve" scenarios presented in this report. First, while the models assume that projects are prioritized based on their benefit-cost ratios, that assumption is not consistent with actual patterns of project selection and funding distribution that occur in practice. Consequently, if investment rose to the levels identified in the "Improve" scenarios, there are few mechanisms to ensure that these funds would be invested in projects that would be cost beneficial. As a result, the impacts on actual conditions and performance may be considerably smaller than what is projected for these scenarios. Second, these scenarios do not address practical considerations concerning whether the highway and transit construction industries would be capable of absorbing such a large increase in funding within the 20-year analysis period. Such an expansion of infrastructure investment could significantly increase the rate of inflation within these industry sectors, a factor that is not considered in the constant dollar investment analyses presented in this report. Third, the legal and political complexities frequently associated with major highway capacity projects might preclude certain improvements from being made, even if they could be justified on benefit-cost criteria.

Impact of Financing Structures on Transportation Investment/Performance Analysis

This report has traditionally identified the amount of additional spending above current levels that would be required to achieve certain performance benchmarks, without incorporating the impact of the types of revenues that would support this additional spending. This approach was in keeping with the general philosophy referenced earlier that the assignment of responsibility for the costs associated with a given scenario to any particular level of government or funding source falls beyond the legislative mandate for this report. However, the implicit assumption built into this approach has been that the financing mechanisms would not have any impact on investment scenarios themselves. In reality, raising funding from general revenue sources (such as property taxes, sales taxes, income taxes, etc.) would have different implications than raising funding from user charges (such as fuel taxes, tolls, and fares).

For this report, a set of supplemental highway investment/performance analyses has been developed to compare the implications of funding potential increases in capital spending through user charges imposed on either a per-mile or a per-gallon basis. A feedback loop has been added to the modeling process to account for the impact that changes in the "price" of travel experienced by individual system users would have on projected future travel volumes and overall system performance.

When highway users make decisions about whether, when, and where to travel, they consider both implicit costs (such as travel time and safety risk) and explicit, out-of-pocket costs (such as fuel costs and tolls). Under uncongested conditions, their use of the road will not have an appreciable effect on the costs faced by other users. As traffic volumes begin to approach the carrying capacity of the road, however, traffic congestion and delays begin to set in and travel times for all users begin to rise, with each additional vehicle making the situation progressively worse. However, individual travelers do not take into account the delays and additional costs that their use of the facility imposes on other travelers, focusing instead only on the costs that they bear themselves. To maximize net social benefits, users of congested facilities would be levied charges corresponding to the economic cost of the delay they impose on one another, thereby more efficiently spreading traffic volumes and allowing the diverse preferences of users to be expressed. In the absence of efficient pricing, options for reducing congestion externalities are limited. In addition, the efficient level of investment in highway capacity is larger under the current system of highway user charges (primarily fuel and other indirect taxes) than would be the case with full-cost pricing of highway use. This report includes supplemental analyses that explore the potential impact that the widespread adoption of congestion pricing could have on the level of investment required to achieve certain levels of future conditions and performance.

While the above discussion focuses on highway pricing, the same considerations may apply to transit investments. Anecdotal evidence suggests that transit routes in major metropolitan areas are approaching their passenger-carrying capacities during peak travel hours, with a commensurate deterioration in the quality of service. Some of this crowding could be reduced by increasing fares during peak hours. Certain considerations, however, may limit the ability of transportation authorities to price transit services more efficiently, such as the ability of the fare system to handle peak pricing, and the desire to provide transit as a low-cost service to transit-dependent riders. Additionally, the fact that overcrowded transit lines are often in corridors with heavily congested highways makes a joint solution to the pricing problems on both highways and transit more complicated to analyze, devise, and implement. Measuring the actual crowding on transit systems during peak periods, and the development of a more sophisticated crowding metric than the one currently used by FTA, are areas for further research.

Changes to C&P Report Scenarios From 2008 Edition

The selected capital investment scenarios presented in Chapter 8 are framed somewhat differently from those presented in the 2008 edition of the Conditions and Performance report. While the highway and transit scenario definitions have been modified, the changes to the transit scenarios are much more extensive.

Highway and Bridge Scenarios

The 2008 C&P report had presented two versions of each scenario in Chapter 8, based on alternative assumptions about funding mechanisms. One set assumed the imposition of user charges on a per-mile basis as needed to cover the increased investment above base year levels associated with each scenario; the other assumed the widespread adoption of congestion pricing, with positive or negative adjustments to other user charges up or down as needed to generate the level of investment needed to support each scenario. This type of analysis has been moved to Chapter 9 for this edition; the scenarios presented in Chapter 8 do not make any assumptions regarding funding mechanisms.

The 2008 C&P report included five primary scenarios; one that showed the impacts of sustaining spending at base year levels, one that estimated the level of investment needed to maintain overall conditions and performance at base year levels, and three that identified the level of investment associated with implementing all potential investments which met a specific minimum benefit-cost ratio threshold. The name and definition of the **Sustain Current Spending** scenario remains unchanged. The **Sustain Conditions and Performance scenario** has been renamed the **Maintain Conditions and Performance scenario,** and the target measure used to compute the highway portion of this scenario has been modified. The **MinBCR=1.0 scenario** has been renamed the **Improve Conditions and Performance scenario,** while the **MinBCR=1.2 scenario** has been dropped. The **MinBCR=1.5 scenario** has been renamed the **Intermediate Improvement scenario**, and the method used to compute the bridge portion of this scenario has been modified. The portion of **Improve Conditions and Performance scenario** associated with improvements to the physical conditions of highways and bridges is identified as the **State of Good Repair benchmark**.

"Maintain" Scenarios

The 2006 C&P report and several prior editions had used average user costs per VMT as a proxy for the overall conditions and performance of the highway system, and used this measure as a target for their "Maintain" scenarios. Since factors that affects average user costs other than pavement condition and traffic congestion, such as vehicle technology, were held constant in the analysis, decreases in average user costs could be directly associated with improvements in overall system conditions and performance.

This direct relationship between average user costs and system conditions and performance was broken in the 2008 C&P report, as the analysis of future user costs was modified to take into account EIA forecasts of future fuel efficiency of the vehicle fleet. Adding this refinement to the analysis created a situation in which average user costs would decline over time, even if the physical conditions and operational performance of the highway system remained unchanged. In order to net out this effect, the 2008 C&P report introduced a new metric, "adjusted user costs". This statistic was computed by recalculating user costs in the 2006 base year as though the fuel economy improvements projected through the end of the analysis period had already occurred. By netting out the impacts of the fuel economy changes, the adjusted user cost metric represents a better proxy for overall system conditions and performance, and was utilized as the metric for a key scenario in the 2008 C&P report.

One issue with the "adjusted user costs" metric is that it requires a somewhat lengthy discussion to fully explain the concept. For this edition, the "Maintain" scenario targets average speed instead. As discussed more fully in Chapter 9, the cost of maintaining average speed at base year levels is similar to that associated with maintaining adjusted average user costs, and average speed is a more readily understandable metric.

Future editions of this report may revert to using adjusted user costs more prominently or switch to highlighting some other metric, especially if the costs associated with maintaining average speed in future analyses begin to deviate significantly from those associated with maintaining adjusted user costs.

Bridge Scenarios

The bridge components of the combined highway and bridge scenarios presented in this report are generally computed in the same manner as the comparable scenarios from the 2008 C&P report. The exception is the **Intermediate Improvement scenario**. This scenario assumes that the growth of spending on bridges will be consistent with that computed for highways, unless that would result in spending that is higher than that computed for the **Improve Conditions and Performance scenario**. In contrast, the approach taken for the 2008 C&P report was to use the same bridge spending levels in both of the comparable scenarios, based on the level of investment required to address all bridge deficiencies when it is cost-beneficial to do so.

Transit Scenarios

The 2008 C&P report presented several scenarios in Chapter 8, including a **Maintain Current Funding scenario**, that has been renamed as the **Sustain Current Spending scenario** for this edition.

The 2008 C&P report also identified a **Maintain Conditions scenario**, a **Maintain Performance scenario**, an **Improve Conditions scenario** and an **Improve Performance scenario**; combinations of these scenarios were formed to identify the level of investment associated with maintaining both conditions and performance, improving conditions while maintaining performance, maintaining conditions while improving performance, and improving both conditions and performance. For both the **Cost to Maintain Conditions and Performance scenario** and the **Cost to Improve Conditions and Performance scenario**, separate versions were presented assuming the application of minimum benefit-cost ratios of 1.0 and 1.2. Another set of alternative versions of these scenarios were linked to the version of the highway scenarios assuming the widespread adoption of congestion pricing, assuming that some portion of traffic diverted by congestion pricing would shift to transit. None of these scenarios was directly continued in this edition.

This edition presents a standalone **State of Good Repair benchmark** which focuses on needs associated with existing assets only; no assessment of expansion needs is included, and the computation of this benchmark does not apply TERM's benefit-cost test. Two additional scenarios, the **Low Growth scenario** and the **High Growth scenario** incorporate both expansion needs and costs required to bring existing assets to a state of good repair; both apply the TERM benefit-cost test, differing only in the rate of future transit travel growth assumed. For system expansion needs, both of these scenarios apply a similar performance target to that used in the computation of the Maintain Performance scenario in the 2008 C&P report.