

# Introduction

This is the 23<sup>rd</sup> in a series of reports dating back to 1968 that the U.S. Department of Transportation (DOT) has prepared to satisfy requirements for reporting to Congress on system condition, system performance, and future capital investment needs. Beginning in 1993, this report series has covered both highways and transit; previous editions had covered the Nation's highway systems only. A separate series of reports on the Nation's transit systems' performance and conditions was issued from 1984 to 1992.

This report incorporates highway, bridge, and transit information required by 23 United States Code (U.S.C.) §503(b)(8) and transit system information required by 49 U.S.C. §308(e). This edition also includes a report on the conditions and performance of the National Highway Freight Network required by 23 U.S.C. §167(h). The statutory due dates specified in these sections differ; this 23<sup>rd</sup> edition is intended to address the requirements for reports due:

- July 31, 2017, under 23 U.S.C. §503(b)(8);
- December 4, 2017, under 23 U.S.C. §167(h); and
- March 31, 2018, under 49 U.S.C. §308(e).

This 23<sup>rd</sup> edition of the Status of the Nation's Highways, Bridges, and Transit: Conditions and Performance Report to Congress (C&P Report) draws primarily on 2014 data. In assessing recent trends, many of the exhibits presented in this report present statistics for the 10 years from 2004 to 2014. Other charts and tables cover different periods, depending on data availability and years of significance for particular data series. The prospective analyses presented in this report generally cover the 20-year period ending in 2034.

Previous editions of the C&P Report have been identified by year, generally linked to the due date in 23 U.S.C. §503(b)(8). This has caused some confusion due to differences among the due dates, the transmittal date to Congress, and the base year of the data. For example, the 2015 C&P Report drew primarily on 2012 data, and was transmitted to Congress in December 2016. For continuity's sake, previous editions will continue to be referenced based on the year on their cover, but this 23<sup>rd</sup> edition and future editions will be identified based on their numeric sequence in the report series.

Given the data years covered by this edition, the information presented on system conditions and performance do not yet show the impacts of funding authorized by the Fixing America's Surface Transportation (FAST) Act.

## Report Purpose

This document is intended to provide decision makers with an objective appraisal of the physical conditions, operational performance, and financing mechanisms of highways, bridges, and transit systems based on both their current state and their projected future state under a set of alternative future investment scenarios. This report offers a comprehensive, data-driven background context 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 public transit operators to present a national-level summary. Some of the underlying data are available

through DOT's regular statistical publications. The future investment scenario analyses are developed specifically for this report and provide projections at the national level 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 summarizes the key findings in each individual chapter. The main body of the report is organized into four major sections.

The six chapters in Part I, *Moving a Nation*, contain the core retrospective analyses of the report. Most of these chapters include separate highway and transit sections discussing each mode in depth. This structure is intended to accommodate report users who might be interested primarily in only one of the two modes.

- The Introduction to Part I provides background information issues pertaining to transportation performance management, which relates closely to the material presented in Part I.
- Chapter 1 quantifies the Nation's highways, bridges, and transit infrastructure assets.
- Chapter 2 describes highway and transit revenue sources and expenditure patterns for all levels of government.
- Chapter 3 discusses selected topics relating to personal travel.
- Chapter 4 describes trends pertaining to mobility and access.
- Chapter 5 discusses issues relating to the safety of highways and transit.
- Chapter 6 identifies the current physical conditions of the Nation's highways, bridges, and transit assets.

The four chapters in Part II, *Investing for the Future*, 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 presents a set of selected capital investment scenarios, and relates these scenarios to the current levels of capital investment for highways, bridges, and transit.
- Chapter 8 provides supplemental analysis relating to the primary investment scenarios, comparing the findings of the future investment scenarios to findings in previous reports and discussing scenario implications.
- Chapter 9 discusses how changing some of the underlying technical assumptions would affect the future highway and transit investment scenarios.
- Chapter 10 projects the potential impacts of additional alternative levels of future highway, bridge, and transit capital investment on the future performance of various components of the system.

Part III, *Highway Freight Transportation Conditions and Performance*, explores issues pertaining specifically to freight movement.

- Chapter 11 discusses freight transportation in general, focusing on the National Highway System (NHS).
- Chapter 12 examines the conditions and performance of the National Highway Freight Network.

Part IV, *Recommendations for HPMS Changes*, provides information on the status and planned direction of the Highway Performance Monitoring System (HPMS).

The C&P 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 an ongoing research effort for *Reimagining the C&P Report in a Performance Management-Based World*.

## Highway Data Sources

Highway characteristics and conditions data are derived from HPMS (<https://www.fhwa.dot.gov/policyinformation/hpms.cfm>), a cooperative data/analytical effort dating from the late 1970s that involves the Federal Highway Administration (FHWA) and State and local governments. HPMS includes a random sample of roughly 120,000 sections of Federal-aid highways selected by each State using instructions provided by DPT. HPMS data include current physical and operating characteristics and projections of future travel growth on a highway 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 (MPOs).

FHWA annually collects bridge inventory and inspection data from the States, Federal agencies, and Tribal governments and incorporates the data into the National Bridge Inventory (NBI) (<https://www.fhwa.dot.gov/bridge/nbi.cfm>). NBI contains information from all bridges covered by the National Bridge Inspection Standards (Title 23, Code of Federal Regulations, Part 650, Subpart C) 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; condition information includes inspectors' evaluations of the primary components of a bridge, such as the deck, superstructure, and substructure.

State and local finance data are derived from the financial reports States provide to FHWA in accordance with *A Guide to Reporting Highway Statistics* (<https://www.fhwa.dot.gov/policyinformation/hss/guide/>). These data are the same as those used in compiling FHWA's annual Highway Statistics report. Highway safety performance data are drawn from the Fatality Analysis Reporting System (<https://www.nhtsa.gov/research-data/fatality-analysis-reporting-system-fars>).

Highway operational performance data are drawn primarily from the National Performance Management Research Data Set (NPMRDS) ([https://ops.fhwa.dot.gov/perf\\_measurement/](https://ops.fhwa.dot.gov/perf_measurement/)). This database compiles observed average travel times, date and time, and direction and location for freight, passenger, and other traffic. The data cover the period after the Moving Ahead for Progress in the 21st Century Act (MAP-21) for the NHS plus arterials at border crossings. The dataset is made available to States and MPOs monthly to assist them in performance monitoring and target setting. Because NPMRDS data are available only for 2012 onward, historical time series data are drawn from the Texas Transportation Institute's Urban Mobility Scorecard (<https://mobility.tamu.edu/ums/>).

Under MAP-21, FHWA was charged with establishing a national tunnel inspection program. In 2015, development began on the National Tunnel Inventory database system (<https://www.fhwa.dot.gov/bridge/inspection/tunnel/inventory.cfm>), and inventory data were collected for all highway tunnels reported. Concurrently, FHWA implemented an extensive program to train inspectors nationwide on tunnel inspection and condition evaluation. The annual collection of complete inventory and condition data for all tunnels began in 2018; these data will be available for use in future C&P Reports.

## Transit Data Sources

Transit data are derived from the National Transit Database (NTD) (<https://www.transit.dot.gov/ntd>) and transit agency asset inventories. NTD comprises comprehensive data on the revenue sources, capital and operating expenses, basic asset holdings, service levels, annual passenger boardings, and safety data for more than 800 urban and 1,300 rural transit agencies. NTD also provides data on the composition and age of transit fleets.

NTD does not currently provide data required to assess the physical condition of the Nation's transit infrastructure. To meet this need, the Federal Transit Administration (FTA) collects transit asset inventory data from a sample of the Nation's largest rail transit operators. In direct contrast to the data in NTD and HPMS—which local and State funding grantees must 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 subject to no reporting requirements.

In recent practice, data requests primarily have been made to the Nation's 20 to 30 largest transit agencies because they account for roughly 85 percent of the Nation's total transit infrastructure by value. Considering the slow rate of change in asset holdings of transit agencies over time (excluding fleet vehicles and major expansion projects), FTA has requested these data from any given agency only every 3 to 5 years. The asset inventory data collected through these requests document the age, quantity, and replacement costs of the grantees' asset holdings by asset type. The nonvehicle asset holdings of smaller operators have been estimated using a combination of the (1) fleet-size and facility-count data reported to NTD and (2) actual asset age data of a sample of smaller agencies that responded to previous asset inventory requests.

Based on changes to Federal transit law made by MAP-21, FTA is currently in the process of significantly expanding the asset inventory and condition information collected through the NTD. The expanded Asset Inventory Module of the NTD opened for voluntary reporting in 2017, and then became part of the mandatory NTD reporting requirements in 2018. As with the longstanding revenue vehicle inventory data collection in the NTD, the reporting burden on the transit industry will be minimized by carrying over asset inventories from one year to the next in the NTD for reporting transit agencies. The expanded asset inventory module will directly collect condition ratings for all passenger stations and maintenance facilities in the NTD. In addition, age and performance data will be collected for both guideway infrastructure and track. This influx of additional asset inventory and condition data in the NTD should significantly improve the transit estimates in future editions of the C&P Report.

## Multimodal Data Sources

Freight data are derived primarily from the Freight Analysis Framework version 4.3 ([https://ops.fhwa.dot.gov/freight/freight\\_analysis/faf/](https://ops.fhwa.dot.gov/freight/freight_analysis/faf/)), which includes all freight flows to, from, and within the United States. The framework is built from a variety of datasets, such as the Census Bureau's Commodity Flow survey (<https://www.census.gov/programs-surveys/cfs.html>) and HPMS.

Personal travel data are derived primarily from the National Household Travel Survey (<https://www.fhwa.dot.gov/policyinformation/nhts.cfm>), which collects detailed information on travel by all modes for all purposes for each household member in the sample. The survey has collected data intermittently since 1969 using a national sample of households in the civilian noninstitutionalized population, and includes demographic characteristics of households and people and information about all vehicles in the household. These data are supplemented by information collected through the annual American Community Surveys and the Consumer Expenditure Surveys.

## Investment/Performance Analytical Procedures

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.” Consistent with this directive, the tools used to analyze future investment and performance in this report include an economic component, which takes into account the impacts of transportation investments on the costs incurred by users of the transportation system, in addition to engineering considerations (the earliest versions of the reports in this combined series relied exclusively on engineering-based estimates and considered only the costs incurred by transportation agencies). This approach failed to adequately consider a critical dimension of transportation programs.

The highway investment scenarios presented in this report are developed in part from the Highway Economic Requirements System (HERS), which models highway investment using benefit-cost analysis. The HERS model quantifies user, agency, and societal costs for various types and combinations of capital improvements. HERS considers costs associated with travel time, vehicle operation, safety, routine maintenance, and emissions. Bridge investment scenario estimates are developed from the National Bridge Investment Analysis System (NBIAS) model, which also incorporates benefit-cost analysis principles.

The transit investment analysis is based on the Transit Economic Requirements Model (TERM). TERM consolidates older engineering-based evaluation tools and uses 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.

HERS, NBIAS, and TERM are not able to be used for direct multimodal analysis. Although the three models use benefit-cost analysis, their methods for implementing this analysis are very different. Each model is based on a separate, distinct database, and uses data applicable to its specific part of the transportation system and addresses issues unique to each mode. For example, HERS assumes that adding lanes to a highway causes highway user costs to decline, which results 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. HERS, however, does not distinguish between different sources of additional highway travel. Similarly, TERM’s benefit-cost analysis assumes that some travel shifts from automobile to transit because of transit investments, but the model cannot project the effect of such investments on highways.

In interpreting the findings of this report, it is essential to recognize the limitations of these analytical tools and the potential impacts of different assumptions made for the analyses. The technical appendices and the Introduction to Part II contain information critical to contextualizing the future investment scenarios.

## Changes to C&P Report Scenarios from the 2015 Edition

The highway scenarios presented in the 2015 C&P Report were “ramped” to assume that spending would increase at a constant annual rate for 20 years beginning in the base year (2012). Most of the highway investment analyses presented in this 23<sup>rd</sup> edition are instead “flat,” assuming investment at a fixed level in constant-dollar terms each year for 20 years. This edition also includes a scenario in which funding is assumed to vary by year depending on the level of investment estimated to be cost-beneficial.

The Maintain Conditions and Performance scenario for highways and bridges presented in the 2015 C&P Report used average pavement roughness, average delay per vehicle mile traveled (VMT), and the percentage of deck area on bridges classified as deficient as primary indicators. This edition substitutes the percentage of deck area on bridges rated as poor for the percentage classified as deficient in defining this scenario.

The 2015 C&P Report presented Sustain 2012 Spending scenarios for both highways and transit, which projected the impacts of sustaining spending at base year 2012 levels in constant-dollar terms over 20 years. Because the base year for the current report is 2014, the scenarios have been renamed Sustain 2014 Spending.

## Key Information for Properly Interpreting This Report

To interpret the analyses presented in this report correctly, it is critical both to understand the framework in which they were developed and to recognize their limitations. This document is not a statement of Administration policy, and the future investment scenarios presented are intended to be illustrative only. **The report does not endorse any particular level of future highway, bridge, or transit investment.** It neither addresses how future Federal programs for surface transportation should look, nor identifies the level of future funding for surface transportation that could or should be provided by the Federal, State, or local governments; the private sector; or system users. Making recommendations on such policy issues is beyond the legislative mandate for this report and would be inconsistent with its objective intent. Analysts outside FHWA and FTA can and do use the statistics presented in the C&P Report to draw their own conclusions, but any analysis attempting to use the information presented in this report to determine a target Federal program size would require a series of additional policy and technical assumptions that are well beyond what is reflected here.

The analytical models assume that projects are prioritized based on their benefit-cost ratios, an assumption that deviates from actual patterns of project selection and funding distribution in the real world. Therefore, the level of investment identified as the amount required for achieving a certain performance level should be viewed as illustrative only—not as a projection or prediction of an actual condition and performance outcome likely to result from a given level of national spending.

Some of the highway and transit scenarios are defined to include all potential investments for which estimated future benefits would exceed their costs. These scenarios can best be viewed as “investment ceilings” above which it would not be cost-beneficial to invest, even if unlimited funding were available. The main value in applying a benefit-cost screen to infrastructure investment analysis is that it avoids relying purely on engineering standards that could significantly overestimate future investment needs.

As in any modeling process, simplifying assumptions have been made to make the analysis practical and to report within the limitations of available data. Because asset owners at the State and local levels primarily make the ultimate decisions concerning highways, bridges, and transit systems, they have a much more direct need to collect and retain detailed data on individual system components. The Federal government collects selected data from States and transit operators to support this report and several other Federal activities, but these data are not sufficiently robust to make definitive recommendations concerning specific transportation investments in specific locations.

Future travel projections are central to evaluating capital investment on transportation infrastructure. Forecasting future travel, however, is extremely difficult because of the many uncertainties related to traveler behavior. Even where the underlying relationships may be correctly modeled, the evolution of key variables (such as expected regional economic growth) could differ significantly from the assumptions made in the travel forecast. Future transit ridership projections have significant implications for estimated system expansion needs, but there is uncertainty regarding long-term growth rates, particularly in light of recent declines in transit ridership. Neither the transit nor highway travel forecasts reflect the potential impacts of emerging transportation technology options such as car share, scooters, and autonomous vehicles.

The Department remains committed to an ongoing program of research to identify approaches for refining, supplementing, and potentially replacing the analytical tools used in developing the C&P Report. Future editions will reflect refined data and modeling.