

# National Cooperative Highway Research Program

## RESEARCH RESULTS DIGEST

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### Updated and Enhanced Database for Macroeconomic Analysis of Transportation Investments and Economic Performance

*This digest summarizes the findings of NCHRP Project 2-17(3)A, "Update and Enhancement of Dataset for Macroeconomic Analysis of Transportation Investments and Economic Performance." The project updated and expanded the database developed in NCHRP Project 2-17(3). Project 2-17(3) developed a disaggregate data set that included information on different types of public infrastructure, private economic activity within different industries, and national data by region or state. This digest is based on a draft final report prepared by Michael E. Bell of MEB Associates, Inc., for the Institute for Policy Studies at The Johns Hopkins University.*

#### INTRODUCTION

This digest provides a summary of the data sets developed under this project and will be of interest to transportation officials responsible for allocating funds for the maintenance and expansion of transportation networks. The database is posted on the U.S. Department of Transportation, Bureau of Transportation Statistics web site at [www.bts.gov/cgi-bin/sted/start.pl](http://www.bts.gov/cgi-bin/sted/start.pl).

The primary goal of NCHRP Project 2-17(3) was to develop a database that could be used to verify, explore, and expand an analysis of the benefits of transportation investments. A disaggregate database that included information on different types of public infrastructure, private economic activity within different industries, and national data by region or state was developed. This project updated and expanded the database.

The data have two major categories. One set of data describes private-sector economic activity, and the second describes public-sector infrastructure investment trends, capital stock, and the level and quality of service provided.

#### PRIVATE-SECTOR DATA

Two measures of private economic activity are included in the data set: gross state product and personal income. The data set also includes two measures of private input: employment and private capital stock. Gross state product, personal

income, and employment data are organized by state and industry, whereas private capital stock estimates are national estimates by industry (see Table 1).

#### Gross State Product

Gross state product (GSP) is the market value of the goods and services produced annually in a specific state. The source of the gross state product is the U.S. Department of Commerce, Bureau of Economic Analysis (BEA), Regional Economic Analysis Division.

#### Personal Income

Personal income by state is defined as the total income received by, or on behalf of, all residents in a state from all sources. It is measured as the sum of wage and salary disbursements, other labor income, proprietorial income, rental income, personal dividend income, and transfer payments, less personal contributions for social insurance.

#### Employment

The employment series included in the data set contains data on the annual number of full- and part-time employees (including proprietors) by two-digit Standard Industrial Classifications code industries and by state for the years 1969 through 1994. The data are prepared by the U.S. Department of Commerce, Bureau of Economic Analysis, Regional Economic Measurement Division.

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**TABLE 1 Private-Sector variables**

<b>Data Set</b>	<b>States</b>	<b>Industries</b>	<b>Time Period</b>
Gross State Product			
1. Revised	50+ D.C.	2-Digit SIC	1977-92
2. Unrevised	50+ D.C.	2-Digit SIC	1963-86
Earnings	50+ D.C.	2-Digit SIC	1969-94
Employment	50+ D.C.	2-Digit SIC	1969-94
Private Capital Stock	National	2-Digit SIC	1947-94

### Private Capital Stock

The above measures of private economic activity are reported exactly as received from BEA, which presents the data by industry and state. BEA does not provide an equivalent data set for private capital stock estimates. BEA calculates and publishes national capital stock estimates (in millions of dollars) by industry, but such estimates are not available by state.

Alternative approaches were considered that would estimate capital stock by state. One estimate used gross state product minus indirect business taxes, and the other used employment and private capital stock. However, both of these approaches implicitly assumed a constant capital-to-labor ratio across states within an industry. This assumption is restrictive. Therefore, the private capital stock estimates are reported instead by national totals, and individual researchers may decide how best to allocate these national totals across states for their individual research purposes.

### PUBLIC-SECTOR DATA

The public-sector data include information on investment flows by infrastructure categories, capital stock estimates by infrastructure categories, and, where available, transportation network characteristics such as capacity measures and the level and quality of service actually provided. Specifically, these data sets include information on the following:

- State and local government total and capital spending on six categories of infrastructure (this information provided by the U.S. Census Bureau). This spending was used to generate state-level capital stock estimates for each infrastructure category.
- Total of all government highway capital and maintenance outlays by state (this information provided by the Federal Highway Administration). These totals were used to generate two highway capital stock estimates by state.

- The level and quality of service provided by the nation's highway network (this information provided by the Federal Highway Administration).
- The level and quality of service provided by the nation's mass transit systems (this information provided by the Federal Transit Administration).
- The level and quality of service provided by the nation's airports and airways (this information provided by the Federal Aviation Administration).

### U.S. Census Data

Two sets of data were received from the U.S. Department of Commerce, Bureau of Census, Governments Division. The first set of data reports state and local spending by individual infrastructure category and by state from 1977 to 1993. Specifically, the data set includes annual information on total spending and on capital outlays by state and local governments for six different categories of infrastructure: highways, mass transit, air transportation, water transportation, water supply, and sewerage. The data represent a comprehensive measure of spending because they include total spending by state and local governments for each category, after intergovernmental transfers and regardless of the source of funds.

The second data set contains total U.S. state and local annual spending and capital outlays for the same six categories of infrastructure from 1902 to 1993, but the data are not broken down by state. The data set includes annual observations from 1952 to 1993, observations every two years from 1932 to 1952, and only four observations between 1902 and 1927.

These data were used to construct an estimated capital stock series by state for each of the six categories of infrastructure from 1977 to 1992. First, the national capital outlay series was used to construct an estimated national capital stock series for each of the six infrastructure categories using the perpetual inventory method and data dating as far back as 1932. The 1976 capital stock estimate was then divided up among states based on each state's average share of total

TABLE 2 U.S. Census data

Data Set	States	Infrastructure Categories	Time Period
Infrastructure Spending by State/Local Governments	50+ D.C.	6	1977-93
Infrastructure Spending by State/Local Governments	National	6	1902-93
Infrastructure Capital Stock Estimates	50+ D.C.	6	1977-92
Infrastructure Capital Stock Estimates	National	6	1952-92

expenditures for each category from 1977 to 1992. Then, using state-level capital outlay data from 1977 to 1992, the perpetual inventory approach was used to estimate capital stock for each inventory category for every state. The product is a state-by-state capital stock estimate for each of the six categories of infrastructure (see Table 2).

#### Federal Highway Administration Data

The Federal Highway Administration annually publishes data on all government expenditures for all streets and highways. These data include annual observations of both capital and maintenance outlays by all levels of government by state from 1957 to 1994. The data were used to construct an alternative series of capital stock estimates by state.

Since this series uses only data that dates as far back as 1957, it was necessary to use data from other sources to extend the series back beyond 1957 and generate capital stock estimates for 1970 to 1989. Data from annual reports on financing highways were collected by counties, cities, and rural local governments. These data were used to construct a comparable series from 1931 to 1956 by adding together the component parts from each individual data series.

A similar process was used to estimate an all-government maintenance series going back to the early 1930s. In both cases, the differences in the 1957 values

between the constructed series and the actual series were minor.

These series of actual capital and maintenance outlays were then used to construct two highway capital stock estimates by state, one based solely on capital outlay data and the other combining capital and maintenance expenditures. Three important features of these series enhance the series' credibility compared with other estimates of highway capital stock. First, different average asset lives were assumed for different components of the roadway. Second, current expenditures were converted into constant dollars using the Federal Highway Administration's composite price index rather than some general GNP deflator. Third, maintenance expenditures were added to capital outlays as another component of highways and were assumed to have an average life of four years (see Table 3).

#### Network Characteristics

While private investment flows are good substitutes for the estimated current value of future benefits from private capital goods, public-sector investment flows may not be good substitutes for the estimated current value of future benefits from public capital facilities. Therefore, included in the data set, to the extent possible, are measures of various characteristics of the nation's transportation networks, including network capacity as well as the level and quality

TABLE 3 Federal Highway Administration data

Data Set	States	Type of Expenditure	Time Period
Total Receipts All Highways, All Units of Government	50+ D.C.	Annual Capital and Maintenance Outlays	1957-94
Constructed Total Receipts All Highways, All Government	50+ D.C.	Annual Capital and Maintenance Outlays	1931-58
Capital Stock Estimates Capital Outlays, Maintenance Outlays	50+ D.C.	Annual Capital Stock Estimates	1931-94
State Highway Administration Capital Outlays, Maintenance Outlays	50+ D.C.	Annual Capital and Maintenance Outlays	1921-95

**TABLE 4 Network characteristics**

Data Set	States	Variables	Time Period
Federal Highway Statistics and Highway Performance Monitoring System	50+ D.C.	Lane-Miles, Vehicle Miles Traveled, Capacity Flow Ratios, etc.	Various Series, All Through 1995
Federal Transit Administration – Section 15	50+ D.C.	Various Measures of Service and Finances	1984-94
Federal Aviation Administration	50	Enplanement, Freight, Departures Performed and Scheduled	1972-94

of infrastructure services provided by highways, mass transit, and airports. These characteristics data, used in conjunction with traditional public capital stock estimates, give a more complete picture of the benefits from the nation's transportation networks.

#### *Highways*

This category includes data describing various characteristics of the nation's highway network and the level and quality of service it provides. The data come from information published annually by the Federal Highway Administration in Highway Statistics.

#### *Transit*

This category includes data describing characteristics of the nation's transit network and the level and quality of service it provides. The data are in five major categories: maintenance data, mileage data, accident and fatality rates, measures of service supplied and consumed, and performance indicators.

#### *Airports and Airways*

This category includes data describing the level of service provided by the nation's airports and airways. The data set includes information on domestic and international annual operations by state from 1972 to 1994 (see Table 4).

#### **DATA SET**

The data set that was initially documented in *NCHRP Report 389* and updated under this project contains the following 12 data files:

- Gross State Product (Revised: 1977-1992, Unrevised 1963-1986)
- Earnings by Industry (1969-1994)
- Employment by Industry (1969-1994)
- Private Capital Stock Estimates by Industry—National Totals (1947-1994)
- State Level Infrastructure Spending on Six Categories of Infrastructure (1977-1993)
- National Infrastructure Spending on Six Categories of Infrastructure (1902-1993)
- State-Level Public Capital Stock Estimates for Six Categories of Infrastructure (1977-1992)
- Highway Capital and Maintenance Outlays by State from Federal Highway Administration Data (1931-1994)
- Highway Capital Stock Estimates by State Using Federal Highway Administration Data (1931-1992)
- Highway Characteristics by State (various time series through 1995)
- Transit Characteristics by State (1984-1994)
- Airport and Airways Characteristics by State (1972-1994)

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