

Transportation Satellite Accounts: A Look at Transportation's Role in the Economy



Transportation Satellite Accounts: A Look at Transportation's Role in the Economy



Research and Innovative Technology Administration
Bureau of Transportation Statistics

To obtain *Transportation Satellite Accounts: A Look at Transportation's Role in the Economy* and other BTS publications

Mail: Product Orders
Research and Innovative Technology Administration
Bureau of Transportation Statistics
U.S. Department of Transportation
1200 New Jersey Avenue, SE
Washington, DC 20590

Internet: www.bts.gov

BTS Information Service

Email: RITAinfo@dot.gov

Phone: 800-853-1351

Recommended citation

U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics, *Transportation Satellite Accounts: A Look at Transportation's Role in the Economy*, Washington, DC: 2011.

All material contained in this report is in the public domain and may be used and reprinted without special permission. Source citation is required.

Acknowledgments



Ray H. LaHood
Secretary

Research and Innovative a Technology Administration

Peter H. Appel
Administrator

Robert Bertini, Ph.D.
Deputy Administrator

Bureau of Transportation Statistics

Patricia S. Hu
Director

Steven K. Smith, Ph.D.
Deputy Director

Produced under the direction of:

David M. Chien, Ph.D.
Assistant Director

Project Manager

Theresa Firestine

Principal Author

Theresa Firestine

Major Contributor

Bingsong Fang,
MacroSys Research and Technology

Other Contributors

David Luskin, FHWA
Randal Matsunaga, FAA
Rolf Schmitt, RITA
Karen White, FHWA

RITA Editor

William H. Moore

RITA Visual Information Specialist

Alpha Wingfield

Table of Contents

Summary	1
Introduction	9
Purpose of the TSAs	9
Measures of Transportation Activities	10
Conceptual Overview of the TSAs	12
Components of the TSAs	15
Make Table	15
Use Table	16
Direct Requirements Table	16
Industry-by-Commodity Total Requirements Table	16
Methodology	27
Methodological Overview	27
Changes in Method in the 1997 TSAs and Comparability	30
The Role of Transportation in the Economy	31
Findings From 1997 TSAs	31
Comparison of 1997 TSAs to the 1992 TSAs	37
Introduction	37
Findings from the 1997 and 1992 TSAs	39
Future Work	47

List of Tables

Table 1. Contribution of Transportation Services to Gross Domestic Product (GDP): 1997	2
Table 2. Top Three Users of Transportation Services: 1997.	3
Table 3. Contribution of Transportation Services to Gross Domestic Product (GDP): 1992 and 1997 ..	5
Table 4. Top Four Users of Transportation Services: 1992 and 1997.	6
Table 5. For-Hire and In-House Transportation Industries Included in the 1997 TSAs.	13
Table 6. TSAs' Make of Major Commodity Groups by Industry Sector: 1997.	18
Table 7. TSAs' Use of Major Commodity Groups by Industry Sector: 1997.	20
Table 8. TSAs' Commodity-by-Industry Direct Requirements by Industry Sector: 1997	23

Table 9. TSAs' Industry-by-Commodity Total Requirements by Industry Sector: 1997	25
Table 10. Principal Data Sources	27
Table 11. Transportation-Related Inputs (TRIs)	29
Table 12. Total Industry Output Multipliers for Transportation Industries: 1997	36
Table 13. Significant Changes in the Industrial Classification System Affecting the Comparison of the 1992 and 1997 TSAs at the Sector Level Based on the 1997 TSAs Procedure	38
Table 14. Value Added by Transportation Services: 1992 and 1997	39
Table 15. Use of Transportation Services by Industry: 1992 and 1997	41
Table 16. Transportation Commodity-by-Industry Direct Requirements: 1992 and 1997	42
Table 17. Cost of Transportation Services by Commodity: 1992 and 1997	43
Table 18. Transportation Total Requirements: 1992 and 1997	44
Table 19. Transportation Total Industry Output Multiplier: 1992 and 1997	45

List of Figures

Figure 1. Value Added by Transportation Mode: 1997	31
Figure 2. In-house Air, Rail, Truck, and Water Transportation Used by Industries: 1997	32
Figure 3. For-Hire Air, Rail, Truck, and Water Transportation Used by Industries: 1997	33
Figure 4. Total Transportation Services Cost by Commodities: 1997	34
Figure 5. Transportation Total Requirements: 1997	35

Summary

The Transportation Satellite Accounts (TSAs) provide a means for measuring the contribution of transportation services to the national economy. Prior to the TSAs, the magnitude of transportation services had long been underestimated, as most national measures counted only the value of for-hire services. Measurement of services provided only by for-hire firms misses the sizable contribution of transportation services that take place within nontransportation industries, termed as in-house transportation (see box A).

Box A. For-Hire and In-House Transportation Definitions

For-hire transportation consists of transportation services provided on a fee basis to industries and the public. These services are provided by businesses such as railroads, transit agencies, common carrier trucking providers, and pipeline companies.

In-house transportation consists of the services provided by nontransportation industries for their own use. It includes privately owned and operated vehicles of all body types, used primarily on public rights of way, and the supportive services to store, maintain, and operate those vehicles.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

To more accurately measure transportation services, the Bureau of Transportation Statistics (BTS) of the U.S. Department of Transportation and the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce, jointly developed the Transportation Satellite Accounts (TSAs). The TSAs, as a supplement to the U.S. Input-Output (I-O) Accounts, measure the contribution of both for-hire and in-house transportation. The TSAs include all seven of the for-hire transportation industries reported in the U.S. I-O accounts and four in-house transportation modes as described in table 5 on p. 13.

This report describes the TSAs in detail and provides both summary and detailed tables for the 1997 benchmark TSAs.¹ The 1997 TSAs show the:

- **Contribution of Transportation to Gross Domestic Product:** Transportation services contributed about \$367.9 billion of value-added in 1997, or about 4.4 percent of gross domestic product (GDP):

¹ The 1997 TSAs and the previously published 1992 TSAs are based on benchmark I-O data (the 1996 TSAs are based on annual I-O data). The Bureau of Economic Analysis (BEA) has produced benchmark data for every fifth year beginning with 1958 (the BEA also produced benchmark data in 1947). Usually, there is a lag of several years before the benchmark data is released. At the time of this publication, the 1997 and 2002 benchmark data are the most recent available to the Bureau of Transportation Statistics for creating the TSAs. The 1997 TSAs are being developed first so as to form a complete series. The 2002 TSAs are forthcoming.

- The value-added by in-house air, rail, truck, and water transportation services was \$122.7 billion, or about 1.5 percent of GDP.
- The value-added by for-hire transportation for the same modes (air, rail, truck, and water transportation) was \$245.2 billion, or about 2.9 percent of all GDP (see table 1).

Table 1. Contribution of Transportation Services to Gross Domestic Product (GDP): 1997

	Value-added	
	Billions of dollars	Percent of GDP
For-hire	245.2	2.9
Air, rail, truck, water	152.2	1.8
Other	93.0	1.1
In-house		
Air, rail, truck, water	122.7	1.5
All transportation	367.9	4.4
GDP*	8,345.6	NA

*GDP includes total market value of all final goods and services, not just transportation.

KEY: NA = Not applicable.

NOTES: Numbers may not sum to total due to rounding

For-hire transportation consists of the services provided by transportation firms to industries and the public on a fee basis. Other for-hire transportation includes: transit and ground passenger transportation, including State and local government passenger transit; sightseeing transportation and transportation support; courier and messenger services; and warehousing and storage. In-house transportation consists of the services provided by nontransportation industries for their use. It includes privately owned and operated vehicles of all body types, used primarily on public rights of way, and the supportive services to store, maintain, and operate those vehicles.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

- Truck transportation services contributed the most to the value-added by all transportation services. The value-added by for-hire truck transportation was \$81.4 billion, and the value-added by in-house transportation was \$116.7 billion.
- **Use of Transportation by Industry:** The importance of transportation to the production of goods and services can be measured through the use of transportation by industries. Use can be represented both as an absolute dollar value and as a requirement per dollar of industry output. The latter estimates the importance of transportation relative to all other inputs in producing output and hence the intensity to which transportation is used in the production process. In many cases, the intensity of transportation use leads to a different conclusion about the importance of transportation than the one indicated by the absolute dollar value. This can be seen in the 1997 TSAs. In the 1997 TSAs, manufacturing, wholesale/retail trade, and construction were the largest absolute users of for-hire and in-house transportation services.
 - Manufacturing used the largest amount of transportation services in absolute terms (\$148.9 billion) but of the nontransportation industries,

required only the seventh largest amount of transportation services per dollar of output (4.0¢).

- Wholesale/retail trade was the second largest user of transportation services in absolute terms (\$121.1 billion) and required the fourth largest amount of transportation per dollar of output (8.2¢).
- Construction was the third largest user of transportation services (\$109.3 billion) in absolute terms and required the largest amount of transportation services per dollar of output (14.5¢), making it the most intensive user of transportation services in the production process. The intense use of transportation in the construction sector results primarily from the sectors' significant use of in-house trucking. This significant use reflects the fact that in-house trucking captures more than freight transportation. In-house trucking includes truck transportation services rendered by all truck chassis and the resources required to support them (see table 2).

Table 2. Top Three Users of Transportation Services: 1997

Sector	Use of transportation			
	Billions of dollars		Cents per dollar of industry output	
	Value	Rank	Value	Rank
Manufacturing	148.9	1	4.0	7
Wholesale/retail trade	121.1	2	8.2	4
Construction	109.3	3	14.5	1

NOTES: Transportation sectors excluded from ranking.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

- **Direct Cost of Transportation Services by Commodity:** Many industries produce more than one commodity, and many commodities are produced by more than one industry. Because of this, the importance of transportation costs in the purchasers' price of commodities, such as construction, differs from that revealed by the use of transportation on an industry basis. This can be seen in the 1997 TSAs where, among nontransportation commodities, transportation contributed the most to the cost of producing construction products. In producing construction commodities, in-house transportation accounted for a larger share of the total transportation cost than for-hire transportation costs. This follows from the intense use of in-house trucking in the construction industry.
- **Total Cost of Transportation Services:** The total cost of transportation services is measured through the *direct* and *indirect* effects of transportation on the economy. The *direct* effect is the change in transportation output caused by a change in demand for another product; the *indirect* effect is the change, induced by a change in the demand for transportation, in the output of another industry or industries.

In the 1997 TSAs, transportation costs had the greatest direct effect on a per-dollar basis on construction prices. The second greatest effect was on natural resources and mining products. A \$1 increase in the final demand for construction required 20.2¢ in transportation services; while a \$1 increase in the final demand for the products of natural resources and mining required 16.7¢ of transportation services. These requirements reflect the intense use of transportation services within each industry.

The second component of the total cost of transportation services can be measured through the indirect effect of transportation on the economy. This indirect effect is captured in the total industry output multiplier for each transportation industry. These multipliers show that the economy's response to changes in demand for transportation was larger than that for trade, utilities, information, and all service sectors except leisure and hospitality but smaller (except for pipeline transportation) than that for natural resources and mining, construction, and manufacturing.

The 1997 TSAs additionally show the continued contribution of transportation services to the national economy when compared to the previously published TSAs. The contribution of transportation services in the previously published TSAs cannot be compared directly to that in the 1997 TSAs because of:

1. several methodological changes made in the process of estimating in-house transportation services, and
2. the change in the industrial classification system used in the I-O accounts.

The 1992 and 1996 TSAs are based on the Standard Industrial Classification (SIC) system, and the 1997 TSAs are based on the North American Industrial Classification System (NAICS). To minimize the effect of the change in the industrial classification system, comparisons can be made only at the major group² level after recategorizing the detailed TSAs tables. Recategorization was performed on the 1992 TSAs after re-estimating them under the procedure used for the 1997 TSAs. The re-estimation process did not correct for differences in the modes included in the measure of in-house transportation³ but rather, corrected for the effects of significant changes in the industrial classification system. No recategorization or re-estimation was performed for the 1996 TSAs due to the lack of sufficient detail in the inputs required for the processes (see the full report for details and table 13 on page 38 of this document for a summary).

After accounting for the industrial classification and methodological changes, the TSAs show the:

- **Change in the Contribution of Transportation to GDP:** The contribution of for-hire and in-house transportation services to GDP declined in real dol-

² Major groups differ from the sectors used in the TSAs in that they classify all service sectors into a single service group. Additionally, the utilities and communications sectors are classified as a single group. The major groups are: natural resources and mining, construction, manufacturing, trade (retail and wholesale), utilities and communications, services, for-hire transportation, and in-house truck transportation.

³ In 1992, in-house transportation includes in-house truck and bus transportation; while in 1997, it includes in-house air, rail, truck, and water transportation.

lars between 1992 and 1997 even though a greater proportion of in-house transportation services was measured in 1997. In 1997 dollars, transportation services contributed \$409.1 billion, or 5.5 percent, to GDP in 1992 (based on the 1997 procedure and classification system) and \$367.9 billion, or 4.4 percent, to GDP in 1997. The measured decline is due to a decrease in the value-added by for-hire and in-house truck transportation (see table 3; for further detail, see table 14 on p. 39).

Table 3. Contribution of Transportation Services to Gross Domestic Product (GDP): 1992 and 1997

(Based on comparable methodology)

	Value-added by all transportation services		
	Billions of 1997 dollars	Percent of GDP	GDP (billions of 1997 dollars)
1992	409.1	5.5	7,456.8
1997	367.9	4.4	8,345.6
Real change	-41.3	NA	888.8

KEY: NA = Not applicable.

NOTES: Value-added by all transportation services is different in 1992 and 1997 due to a difference in in-house transportation measurement. In 1992, in-house transportation includes in-house truck and bus transportation; while in 1997, it includes in-house air, rail, truck, and water transportation.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

- **Change in the Use of Transportation by Industry:** In 1992, the manufacturing sector used the most transportation services (\$134.0 billion in 1997 dollars) followed by the services sector (\$113.5 billion in 1997 dollars). In 1997, this relationship reversed, with the services sector using more transportation services than the manufacturing sector (\$166.0 billion and \$148.9 billion respectively in 1997 dollars). The third largest user was the construction sector in 1992 and the trade (wholesale and retail) sector in 1997.

In both 1992 and 1997, the construction sector required the largest amount of transportation per dollar of output, making it the most intense user of transportation services among nontransportation sectors. The construction sector also became more reliant on transportation in the production process as it experienced the largest increase in the use of transportation per dollar of output. Per dollar of output, 11.1¢ of transportation services were required in 1992 (based on the 1997 procedure and classification) and 14.5¢ in 1997. This increase follows from a greater use of in-house truck transportation, which more than offset the decline in the use of for-hire truck transportation (see table 4; for further detail, see tables 15 and 16 on pp. 41-42).

Table 4. Top Four Users of Transportation Services: 1992 and 1997

(Based on comparable methodology)

Major group	Use of transportation in 1992				Use of transportation in 1997			
	Billions of 1997 dollars		Cents per dollar of industry output		Billions of 1997 dollars		Cents per dollar of industry output	
	Value	Rank	Value	Rank	Value	Rank	Value	Rank
Manufacturing	134.0	1	3.6	5	148.9	2	4.0	5
Services	113.5	2	2.2	6	166.0	1	2.6	6
Construction	94.7	3	11.1	1	109.3	4	14.5	1
Trade	88.0	4	6.4	3	121.1	3	8.2	4

NOTES: Transportation major groups excluded from ranking. Rank for 1997 differs from that in table 2 as it uses major groups. Major groups differ from the sectors used in the TSAs in that they classify all service sectors into a single service group. Additionally, the utilities and communications sectors are classified as a single group.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

- **Change in the Direct Cost of Transportation Services by Commodity:** Among nontransportation commodities, transportation content tended to increase more for those commodities produced primarily in the sectors that used significantly more transportation services in 1997 than in 1992. The in-house truck transportation⁴ content of construction commodities increased most significantly, growing from 9.1 percent in 1992 to 12.4 percent in 1997. In both 1992 and 1997, for-hire transportation and in-house trucking together contributed the most to the cost of producing construction products.
- **Change in the Total Cost of Transportation Services:** The total cost of transportation services consists of two parts. The first part captures the *direct* effect of transportation on the economy, which grew between 1992 and 1997. This growth indicates a greater dependency on transportation services in the production process. This can be seen in the increase in total transportation output caused by a dollar increase in the demand for nontransportation commodities, particularly construction commodities for which this multiplier effect increased the most. In 1992, a dollar increase in the demand for construction commodities caused an increase of 16.2¢ in total transportation output and in 1997 caused a 20.2¢ increase. This increase reflects the intense use of transportation in construction.

The second part of the total cost of transportation services captures the *indirect* effect of transportation on the economy. The change in the indirect effect of transportation can be seen through the total sector output multipliers for each for-hire transportation sector and in-house truck transportation. The for-hire air, truck, and water and in-house truck transportation⁵ sector multipliers grew between 1992 and 1997. This growth indicates that an investment in any of these modes has a greater economic impact in 1997 than in 1992. In

⁴ In-house truck transportation in 1992 includes the in-house bus transportation. Contribution of in-house bus transportation is negligible.

⁵ Ibid.

contrast, the for-hire rail and warehousing multipliers declined and the total industry output multiplier for for-hire pipelines remained nearly constant.

In all, the 1997 TSAs show the significant role of both for-hire and in-house transportation services in the national economy. The measured contribution is more complete than that made in the 1992 and 1996 TSAs as it includes the in-house contribution of private air, rail, truck, and water transportation (the 1992 and 1996 TSAs counted only the in-house contribution of private bus and truck transportation). However, the picture is not yet complete as other transportation services, such as in-house use of automobiles, have not been measured by the TSAs. In addition, the TSAs do not capture the economic contribution of personal transportation. These are two possible future directions for the TSAs.

Introduction

PURPOSE OF THE TSAs

To provide a more comprehensive measure of transportation services and their contribution to the national economy, the U.S. Department of Transportation's Bureau of Transportation Statistics (BTS) and the U.S. Department of Commerce's Bureau of Economic Analysis (BEA) jointly developed the Transportation Satellite Accounts (TSAs) as a supplement to the U.S. Input-Output (I-O) accounts.⁶ The TSAs, unlike other national economic data, explicitly estimate the value of transportation services undertaken to support the activities of a business in a not-for-hire transportation industry (termed as in-house transportation) and include the value in the national measure of transportation services. Most other measures count only the value of for-hire transportation and thus miss the contribution of in-house transportation services to the U.S. economy.

In providing a comprehensive measure of transportation services, the TSAs provide the framework for conducting studies related to the role of transportation in the economy. The TSAs provide a way to answer questions such as:

- How much do transportation services (both for-hire and in-house) contribute to U.S. gross domestic output and gross domestic product?
- What industries rely heavily on transportation services, and what modes do these industries depend more heavily on?
- What transportation costs do industries incur during production?
- What is transportation's share in the total cost of commodities purchased by consumers and other end-users?
- How much must transportation services increase to meet an increase in the final demand of particular goods and services?
- What is the effect of a change in the amount of transportation services produced on the economy?

Before demonstrating how the TSAs can be used to answer such questions, the following first discusses how the TSAs improve other measures of transportation activities. This is followed by an overview of the data inputs and method used to develop the TSAs, which concludes with a presentation of results from the 1997 TSAs and a discussion on future work.

⁶ For a description of the U.S. input-output (I-O) accounts, see: Ann M. Lawson et al., "Benchmark Input-Output Accounts of the United States, 1997," *Survey of Current Business*, 2002, 82(12) p.19, available at <http://www.bea.gov/scb/pdf/2002/12December/12021-OAccounts2.pdf> as of Mar. 15, 2011.

MEASURES OF TRANSPORTATION ACTIVITIES

The TSAs facilitate analyses, such as industrial and modal evaluation of the impact of transportation consumption and expenditure on industries and the economy, because they provide data not available from other sources. Other data sources primarily provide transportation statistics on:

- **What is transported:** Statistics on the conveyance of goods (freight transportation) and the conveyance of people (passenger transportation).
- **Transportation modes:** Statistics about the means of transportation, such as air, highway, pipeline, rail, urban transit, and water.
- **Industry providers of transportation:** Statistics on businesses or establishments that sell transportation services in the market-place as a primary commodity. Establishments selling the same primary transportation commodity, for example, air, rail, truck, or water transportation, typically are referred to as an industry.

While useful for many analyses, statistics in the above categories have weaknesses. For instance, statistics on what is transported and on transportation modes preclude direct comparison when expressed in physical units, such as ton-miles, passenger miles, or vehicle-miles instead of dollars or other statistical units. As such, these statistics often cannot be combined across modes to form a single measure of the transportation system. Furthermore, these statistics often lack the industry detail needed to analyze the relationship between transportation modes (as well as the transportation system) and specific industries.

Statistics on industry providers of transportation provide a means for measuring the relationship between transportation and industries; however, they often do not capture transportation activities for which there are no corresponding market transactions, as in the U.S. input-output (I-O) accounts. The U.S. I-O accounts provide information only for for-hire transportation services⁷, for example, air transportation purchased or provided by an industry. These transactions mainly are derived from data collected by the Census Bureau⁸ at the establishment level of detail and are classified (as of 1997) according to the North American Industry Classification System (NAICS). NAICS groups establishments according to the similarities among the production process for establishments' primary source

⁷ Transportation industries in the I-O accounts include the following: air transportation, rail transportation, truck transportation, water transportation, transit and passenger ground transportation, pipeline transportation, sight-seeing transportation and transportation supportive services, courier and messenger services, and warehousing and storage.

⁸ The Census Bureau collects information, such as revenues, payroll, employment, and other data, for all for-hire transportation industries, except air and rail transportation, as part of the Economic Census. Air data in the I-O accounts are derived from the U.S. Department of Transportation, Air Carrier Financial Statistics Quarterly and rail data from U.S. Department of Transportation, Surface Transportation Board Association of American Railroads, 1998 Railroad Facts. For more information, see Ann M. Lawson et al., "Benchmark Input-Output Accounts of the United States, 1997," *Survey of Current Business*, 2002, 82(12) pp.19-109, available at <http://www.bea.gov/scb/pdf/2002/12December/1202I-OAccounts2.pdf> as of Mar. 15, 2011.

of revenue (primary product).⁹ As such, only establishments using a similar production process to produce primarily transportation services are recognized as providing transportation services. Transportation services, however, may be conducted as a support activity by establishments within nontransportation enterprises. These activities are referred to as in-house transportation.

In-house transportation is not separately measured under the NAICS. Under the NAICS, a portion of in-house transportation is captured under for-hire transportation when it is provided by an establishment, owned and operated by a nontransportation enterprise, that is large enough to be identified as a separate establishment producing primarily transportation services. For example, fleet truck transportation owned by a grocery store chain to move food stuffs from distribution centers to local stores may be classified as for-hire when it is large enough to be counted in the Economic Census. Transportation provided by smaller scale establishments within nontransportation enterprises and transportation incidental to a business establishment (e.g., delivery service provided by a local furniture store) are not separately measured in the NAICS and, hence, not measured as transportation in the standard I-O accounts (the I-O accounts would capture the value added by these types of in-house transportation under the industry to which the establishment provides the services).¹⁰ In the supplementary I-O accounts, the BEA reassigns some of the secondary products to industries in which the products are primary.¹¹ This reassignment, however, does not provide a complete or separate measure of in-house transportation services. As such, the most prominent data sources on industry providers of transportation services do not fully capture all transportation activities.

The TSAs are a relatively new source for transportation statistics that provide not only detailed industry use of transportation services but also measure in-house transportation activities. The TSAs follow from the recommendation set forth in the 1993 manual of the System of National Accounts (SNA)¹² to, when necessary for analysis, measure economic ancillary activity through satellite accounts. The SNA defines ancillary activity as services rendered for immediate consumption within the same enterprise. The United Nations handbook of I-O accounts likewise recommends measuring these in-house activities, specifically in-house transportation, through satellite accounts.¹³ Satellite accounts measuring in-

⁹ The NAICS differs from the Standard Industrial Classification System (SIC) in that it groups industries according to similarities among their production process rather than their products. As such, NAICS, unlike SIC, does not distinguish between operating establishments (those that primarily produce goods or services for personal or household use or for use by other enterprises) and auxiliary establishments (those that primarily perform management or provide supportive services to an industry) but rather, classifies establishments based on what they do rather than whom they serve.

¹⁰ For information on how the treatment of transportation in NAICS differs from that in the Standard Industrial Classification System (SIC), see the section "Changes in Method in the 1997 TSAs and Comparability" in this report.

¹¹ For information on the treatment of secondary products in the 1997 U.S. I-O accounts, see: Ann M. Lawson et al., "Benchmark Input-Output Accounts of the United States, 1997," *Survey of Current Business*, 2002, 82(12) p. 27, available at <http://www.bea.gov/scb/pdf/2002/12December/1202I-OAccounts2.pdf> as of Mar. 15, 2011.

¹² Commission of European Communities, International Monetary Fund, Organization for Economic Cooperation and Development, United Nations, World Bank, *System of National Accounts 1993*, p. 490, available at <http://unstats.un.org/unsd/nationalaccount/sna1993.asp> as of Mar. 15, 2011.

¹³ United Nations, Statistics Division, *Handbook of National Account – Input-Output Table Compilation and Analysis*, November 1997, pp. 149-50, available at <http://unstats.un.org/unsd/EconStatKB/Knowledgebase-Article10053.aspx> as of Mar. 15, 2011.

house transportation have been developed in other countries, such as France¹⁴ and Belgium¹⁵, and have been scoped in others, such as Australia. Development and standardization of transportation satellite accounts have become an international topic, most recently considered by the International Transport Forum during the Joint Transport Research Committee Conference in Paris, France, Mar. 23-24, 2010.

CONCEPTUAL OVERVIEW OF THE TSAs

Box B. Satellite Accounts

Satellite accounts expand the analytical capacity of basic economic accounts for selected areas of social concern, such as transportation and tourism, without overburdening them with details or interfering with their general-purpose orientation. As such, satellite accounts supplement rather than replace existing accounts. While they maintain links to the existing national accounts, satellite accounts may use definitions and classifications that differ from those in the existing accounts.*

* For a discussion of the purposes and characteristics of satellite accounts, see Commission of European Communities, International Monetary Fund, Organization for Economic Co-operation and Development, United Nations, World Bank, *System of National Accounts 1993*, available at <http://unstats.un.org/unsd/nationalaccount/sna1993.asp> as of Mar. 15, 2011.

As satellite accounts to the 1997 benchmark I-O accounts, the TSAs primarily provide a systematic and consistent framework and dataset for conducting analytical studies on the role of transportation in the economy, both on an industry and commodity basis (see box B for information on satellite accounts). The TSAs cover all activities related to the use of vehicles (e.g., aircraft, railcars, trucks, and water vessels) and related structures (e.g., airports, railroad stations, highways, and port facilities). The contribution of these activities is measured for both in-house and for-hire transportation services. In-house transportation consists of the services provided by nontransportation industries for their own use. It includes that from privately owned and operated vehicles of all body types, used primarily on public rights of way, and the supportive services to store, maintain, and operate those vehicles. For-hire transportation consists of the services provided by transportation firms to industries and the public on a fee-basis. The TSAs include the seven for-hire transportation industries reported in the U.S. I-O accounts (see table 5). For both in-house and for-hire transportation services, the TSAs present detailed industry use.

¹⁴ France's Ministry of Transportation and Tourism developed, for 1992, a national Transportation Satellite Account, which provides estimates of transportation expenditures by transportation modes. See Commission of National Accounts, Ministry of Transportation and Tourism, *Transportation Satellite Accounts 1992*, March 1996.

¹⁵ For information and data, see Belgium Transport Satellite Accounts, Federal Planning Bureau, <http://transport.plan.be>

Table 5. For-Hire and In-House Transportation Industries Included in the 1997 TSAs

	NAICS sub-sector	Description
For-hire transportation services		Services provided by transportation firms to industries and the public on a fee-basis.
Air transportation	481	Scheduled and non-scheduled air transportation of passengers and/or cargo using aircraft. Does not include scenic and sightseeing air transportation or air courier services.
Rail transportation	482	Rail transportation of passengers and/or cargo using railroad rolling stock. Does not include scenic and sightseeing rail transportation and street railroads, commuter rail, and rapid transit.
Water transportation	483	Deep water, sea, coastal, Great Lakes, and inland water transportation of passengers and cargo using watercraft, such as ships, barges, and boats. Does not include scenic and sightseeing water transportation.
Truck transportation	484	General and specialized, over-the-road transportation of cargo using motor vehicles, such as trucks and tractor trailers.
Transit and ground passenger transportation	485	Passenger transportation activities, such as urban transit systems; chartered bus, school bus, and interurban bus transportation; and taxis. Does not include scenic and sightseeing transportation. Includes, by redefinition, State and local passenger transit.
Pipeline transportation	486	Transmission of products, such as crude oil, natural gas, refined petroleum products, and slurry via pipeline. Includes the storage of natural gas.
Other transportation	487, 488, 492, 493	Scenic and sightseeing transportation; support activities for transportation; couriers and messengers; warehousing and storage.
In-house transportation services		Private air, rail, water, and truck transportation operations in all non-transportation industries for their own use. For these operations, in-house transportation covers vehicles of all body types used primarily on public rights of way. Supportive services to store, maintain, and operate those vehicles also included.
In-house transportation ^a		

^a In-house transportation in the 1997 TSAs differs from that in the 1992 and 1996 TSAs. In 1992 and 1996, in-house transportation comprised private bus and truck transportation. In 1997, in-house transportation comprises private air, rail, truck, and water transportation.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics

I-O Account Approach to the TSAs

To measure in-house transportation services, the TSAs rearrange the I-O data. The I-O accounts provide detailed estimates of intermediate purchases by industries such as for-hire transportation industries. The I-O accounts also provide an analytical framework with detailed linkages among and between industries and final demand.

In rearranging the I-O data, the TSAs maintain the following I-O accounts approach:

- Classification of industries and commodities using the I-O industry and commodity classification system and the special definitions and conventions in the I-O accounts, with the only exception made to form in-house transportation as a new industry and a new commodity.
- The reassignment—or using I-O terminology, the “redefinition”—of secondary products to industries in which they are the primary products. Reassignment

in the TSAs involves moving all intermediate and value-added inputs of in-house transportation from the industry in which production is secondary to the newly defined in-house transportation industry.

- Valuation of transactions in producers' prices.

The TSAs additionally maintain the following measures made in the I-O accounts:

- The total value-added (or GDP) by all industries.
- The valuations of purchases for final use, transportation costs (the costs to move commodities from producers to intermediate or final users), and trade margins.

The TSAs only differ from the I-O accounts in that they separately measure in-house transportation. In the TSAs, in-house transportation is treated as a separate industry where the only output is in-house transportation service. This service covers the storage, maintenance, and operation of an industry's own aircraft, railcars, trucks, and/or water vessels to move the industry's intermediate inputs or output. This coverage differs from for-hire transportation coverage in the I-O accounts. In the I-O accounts, the use of for-hire transportation by an industry includes only transportation expenses associated with moving intermediate inputs to the industry plus the expenses for certain direct transportation services. For example, if a for-hire truck carries wheat from a farm to a mill, the I-O use table credits this activity to the mill, even though the farm may have purchased the transportation service. However, if an in-house truck of the mill transports the wheat from the farm, the TSAs use table shows the mill as providing the services and credits the activity to the farm only when an in-house truck of the farm transports the wheat to the mill.

Components of the TSAs

The TSAs consist of four tables: make (production), use (consumption), direct requirements, and industry-by-commodity total requirements table. The TSAs make and use tables present I-O data with in-house transportation added as an additional commodity and industry. The TSAs direct requirements table shows data on industry use of intermediate and value-added inputs as a percentage of industry output. The TSAs total requirements table provides industry-by-commodity multipliers. The following discusses each table in further detail and presents data at the summary-level. Detailed data can be found in the online appendix to this report: http://www.bts.gov/publications/transportation_satellite_accounts/2011/appendicies. Further information on the units in the make and use tables can be found in box C.

Box C. Producers' and Purchasers' Prices

In the make and use tables, the values are presented in millions of dollars at producers' prices. Producers' prices include excise and sales taxes collected and remitted by producers' but exclude the markup on commodities that final users must pay in consuming goods and services. Final users pay the purchasers' price for goods and services, which is the producers' price plus the trade margins and transportation costs incurred in delivering the goods and services to final consumers.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

MAKE TABLE

The make table in the TSAs (see table 6) is an I-O make table with additional columns for each in-house transportation mode as a commodity and additional rows for each in-house transportation mode as a new industry. As in an I-O make table, the TSAs' make table shows the values, in producers' prices, of each commodity produced by each industry. In each row, the cell on the main diagonal shows the value of the commodity for which the industry has been designated as the primary producer. The other cells in each row show the value of commodities for which the industry is a secondary producer. The sum of all entries in a row is the total output for the industry.

The data in all cells of the TSAs' make table is the same as in the 1997 I-O make table, with the exception of the added in-house transportation column and row for each mode. For each in-house mode, the cell value at the intersection of the in-house transportation column and row equals the total output of in-house transportation; the value for all other cells in the in-house transportation column and row equals zero.

USE TABLE

Table 7 shows the TSAs' use table, which is an I-O use table with an additional row for the in-house transportation services provided by each in-house mode and an additional column for the redefined in-house transportation activities for each in-house mode. Through this additional column, the TSAs' use table shows the values, in producers' prices, of in-house transportation next to all other intermediate and value-added inputs consumed by other industries or final users. The cell in each row is the amount, as a dollar value, of the commodity used by each industry or final user of the commodity. In the in-house transportation row, the following cells equal zero:

- the cell at the intersection of each in-house transportation row and column (the use of in-house transportation services to support in-house transportation activities), and
- the cell values at the intersections between each in-house transportation row and the for-hire transportation columns (the use of the in-house transportation services to support for-hire transportation activities).

These cells take a zero value as in-house transportation services are provided only by nontransportation industries for their own use.

For all rows, the sum of all entries equals the total output of the commodity. For all columns, the sum of all entries equals the total output for the corresponding industry (see box C for further information on total commodity and total industry output).

DIRECT REQUIREMENTS TABLE

The direct requirements table (see table 8) presents the direct requirement coefficients for each commodity and industry. These values show the amount of a commodity (on a row) required by an industry (on a column) to produce a dollar of the industry's output. The sum of the coefficients for an industry for all intermediate and value-added categories equals one.

The direct requirement coefficients in the table are derived from the TSAs' use table by dividing each industry's commodity and value-added inputs by that industry's total output. This is done for all industries in the TSAs' use table but not for the components of final use or GDP.

INDUSTRY-BY-COMMODITY TOTAL REQUIREMENTS TABLE

Table 9 presents the industry-by-commodity total requirements coefficients. These values show the production directly and indirectly required to deliver a dollar's worth of goods and services to consumers and other final users. Each column shows the commodity delivered to final users, and each row shows the demand for an industry's output in response to a dollar increase in the final

demand for the commodity. The values in the columns and rows are derived from the TSAs' make and use tables.

The last row shows the sum of all the changes in industry outputs that are required to deliver a dollar's worth of goods and services to final users. Because each of these sums is a dollar multiple of the initial dollar spent of an industry's output, the sum often is referred to as an "output multiplier." These multipliers can be used to estimate the impact of changes in the final demands of commodities on total industry output.¹⁶ Hence, the table shows the interdependence among producers and consumers in the economy and can be used to derive estimates of the direct and indirect effects of changes in final demand on for-hire and in-house transportation industries and commodities. For instance, the table can be used to analyze the relative effects on transportation and nontransportation industries from an increase in government expenditures on transportation or from a change in the composition of fixed investment that results from a change in business activity.¹⁷

Box D. Total Commodity and Total Industry Output in the Transportation Satellite Account Tables

In the make and use table, both the total commodity output and the total industry output are given. Separate totals for both commodity outputs and industry outputs are needed as most industries produce more than one commodity. This can be seen in table 6, which, for example, shows (reading across an industry row) that the natural resources and mining industry produces not only natural resources and mining as a primary product but also manufacturing products and leisure and hospitality services as secondary products.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

¹⁶ For more information on the derivation of the industry-by-commodity total requirements table, see: United Nations, *Handbook of National Accounting--Input-Output Table, Compilation and Analysis*, 1999, available at <http://unstats.un.org/unsd/EconStatKB/KnowledgebaseArticle10053.aspx> as of Mar. 15, 2011.

¹⁷ When deriving the TSAs' industry-by-commodity total requirements coefficients, the underlying I-O assumptions were maintained. This includes the assumption that the technology and relative prices defining the relationships between producers and consumers within a given year remain constant. For more information, see: U.S. Department of Commerce, Bureau of Economic Analysis, *Concepts and Methods of the U.S. Input-Output Accounts*, September 2006, updated April 2009, available at http://www.bea.gov/papers/pdf/IOmanual_092906.pdf as of Mar. 15, 2011.

1997 TSA TABLES

Table 6. TSAs' Make of Major Commodity Groups by Industry Sector: 1997
(Millions of dollars at producers' prices)

Industry sector	Commodity										
	Natural resources and mining	Construction	Manufacturing products	Trade	Utilities	Information	Financial services	Professional and business services	Education and health services	Leisure and hospitality	Other services
Natural resources and mining	443,306	—	9,815	—	—	—	—	—	—	1,149	—
Construction	—	754,091	—	—	—	—	—	—	—	—	—
Manufacturing products	727	—	3,718,807	—	259	717	19	29,244	—	—	309
Trade	—	—	—	1,482,678	—	—	—	—	—	—	—
Utilities	381	—	—	—	271,168	—	—	—	—	—	—
Information	—	—	1,251	—	—	553,857	—	91,331	1,163	25	31
Financial services	—	—	—	—	—	—	2,480,754	704	—	270	—
Professional and business services	410	—	—	66	—	4,311	—	1,432,049	716	—	18
Education and health services	—	—	—	—	—	—	—	—	908,873	—	88
Leisure and hospitality	—	—	—	—	—	—	1,823	1,795	—	552,977	—
Other services	—	—	—	—	—	—	—	377	—	—	446,616
Transportation:											
Air	—	—	—	—	—	—	—	—	—	—	—
Rail	—	—	—	—	—	—	—	—	—	—	—
Water	—	—	—	—	—	—	22	—	—	—	—
Truck	—	—	—	—	—	—	—	16	—	—	—
Transit and ground passenger transportation ^a	—	—	—	—	—	—	—	—	1	—	—
Pipeline transportation	—	—	—	—	—	—	—	—	—	—	—
Other ^b	—	—	—	—	—	—	—	—	1	—	—
In-house:											
Air	—	—	—	—	—	—	—	—	—	—	—
Rail	—	—	—	—	—	—	—	—	—	—	—
Water	—	—	—	—	—	—	—	—	—	—	—
Truck	—	—	—	—	—	—	—	—	—	—	—
Other ^c	—	—	55	3,587	62,190	97	13,388	—	—	2,306	1,193
Total commodity output	444,824	754,091	3,729,928	1,486,331	333,617	558,982	2,496,006	1,555,515	910,754	556,728	448,255

continued next page

Table 6. TSAs' Make of Major Commodity Groups by Industry Sector: 1997 (continued)

Industry sector	Commodity											Total industry output		
	Transportation						In-house							
	For-hire			Transit and ground passenger transportation ^a			Air	Rail	Water	Truck	Other ^c		Noncomparable imports	
	Air	Rail	Water	Truck	Transit and ground passenger transportation ^a	Pipeline transportation	Other ^b	Air	Rail	Water	Truck	Other ^c	Noncomparable imports	Total industry output
Natural resources and mining	—	—	—	—	—	—	—	—	—	—	—	—	—	454,271
Construction	—	—	—	—	—	—	—	—	—	—	—	—	—	754,091
Manufacturing products	—	—	—	—	—	—	—	—	—	—	—	3,669	—	3,753,751
Trade	—	—	—	—	—	—	—	—	—	—	—	729	—	1,482,678
Utilities	—	—	—	—	—	—	—	—	—	—	—	—	—	647,658
Information	—	—	—	—	20	—	—	—	—	—	—	—	—	2,481,748
Financial services	—	—	—	—	—	—	—	—	—	—	—	1,721	—	1,439,291
Professional and business services	—	—	—	—	—	—	—	—	—	—	—	—	—	908,961
Education and health services	—	—	—	—	—	—	—	—	—	—	—	100	—	556,695
Leisure and hospitality	—	—	—	—	—	—	—	—	—	—	—	—	—	446,993
Other services	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Transportation:	119,445	—	—	—	—	—	—	—	—	—	—	—	—	119,445
Air	—	37,967	—	—	—	—	—	—	—	—	—	—	—	37,967
Rail	—	—	24,259	—	—	—	116	—	—	—	—	—	—	24,397
Water	—	—	—	169,259	—	—	122	—	—	—	—	—	—	169,397
Truck	—	8	—	—	32,003	—	127	—	—	—	—	—	—	32,139
Transit and ground passenger transportation ^a	—	—	—	—	—	27,284	—	—	—	—	—	—	—	27,284
Pipeline transportation	4,367	899	331	2,184	53	—	107,512	—	—	—	—	—	—	115,347
Other ^b	—	—	—	—	—	—	—	—	—	—	—	—	—	—
In-house:	—	—	—	—	—	—	—	17,552	—	—	—	—	—	17,552
Air	—	—	—	—	—	—	—	—	932	—	—	—	—	932
Rail	—	—	—	—	—	—	—	—	—	4,517	—	—	—	4,517
Water	—	—	—	—	—	—	—	—	—	—	334,092	—	—	334,092
Truck	—	75	38	—	—	—	5,279	—	—	—	—	—	—	1,138,488
Other ^c	123,812	38,949	24,628	171,443	32,076	27,284	113,156	17,552	932	4,517	334,092	1,050,280	—	15,219,970
Total commodity output														

^a "Transit and ground passenger transportation" includes State and local government passenger transit.

^b "Other" transportation includes: sightseeing transportation and transportation support; courier and messenger services; and warehousing and storage.

^c "Other" consists of government enterprise (except State and local government passenger transit) and other input-output special industries. See Ann M. Lawson et al., "Benchmark Input-Output Accounts for the U.S. Economy, 1992: Make, Use, and Supplementary Tables," *Survey of Current Business*, 1997, 77(11), pp. 58-62, available at <http://www.bea.gov/scb/pdf/2002/12December/12021-OAaccounts2.pdf> as of Mar. 15, 2011.

KEY: — = number too small to report.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

Table 7. TSA's Use of Major Commodity Groups by Industry Sector:1997

(Millions of dollars at producers' prices)

Commodity	Industry sector										
	Natural resources and mining	Construction	Manu- facturing products	Trade	Utilities	Information	Financial services	Profes- sional and business services	Education and health services	Leisure and hospitality	Other services
Natural resources and mining	94,631	6,672	265,345	80	52,470	1	1,170	3,552	480	8,325	172
Construction	1,115	165	7,329	4,928	4,103	1,978	22,333	5,449	6,248	3,916	2,807
Manufacturing products	66,901	212,501	1,365,971	53,298	10,769	50,814	31,445	53,058	83,741	92,214	68,743
Trade	13,443	58,649	214,164	22,647	1,931	7,607	11,953	13,614	14,545	16,081	11,247
Utilities	8,000	2,412	52,257	17,967	358	2,936	22,822	10,564	7,410	11,006	5,069
Information	170	1,067	26,788	15,914	515	107,595	17,952	35,733	14,800	6,754	7,099
Financial services	41,906	12,305	99,396	90,917	5,713	26,245	407,206	72,432	81,990	39,194	28,883
Professional and business services	18,510	55,226	267,030	201,478	11,445	57,251	159,009	163,725	80,459	30,998	27,861
Education and health services	30	11	1,526	1,052	744	732	514	1,116	7,488	406	427
Leisure and hospitality	1,947	906	17,348	8,782	1,869	7,914	14,883	15,326	12,656	15,870	2,892
Other services	2,338	6,648	43,844	9,554	587	7,642	14,926	14,003	5,776	4,367	4,287
Transportation:											
Air	460	1,439	14,904	4,943	285	1,433	6,982	7,861	3,385	1,578	1,697
Rail	2,137	1,358	12,371	260	5,848	220	269	276	268	509	279
Water	366	537	2,624	113	599	96	73	206	75	59	43
Truck	4,167	10,381	57,427	2,036	895	1,307	1,336	1,899	2,013	3,112	1,594
Transit and ground passenger transportation ^a	55	88	1,036	1,044	34	904	2,286	1,365	1,522	613	489
Pipeline transportation	671	64	6,601	51	16,871	1	14	34	13	5	6
Other ^b	2,306	1,965	17,197	22,539	734	1,949	9,413	4,876	2,466	1,623	1,148
In-house:											
Air	2,152	—	3,751	3,721	347	593	2,300	3,200	487	807	194
Rail	79	6	717	13	117	—	—	—	—	—	—
Water	2,379	116	1,969	—	—	—	—	53	—	—	—
Truck	29,498	93,296	30,303	86,350	1,593	6,375	6,217	24,370	14,950	19,709	21,431
Other ^c	161	1,189	23,658	10,033	693	3,713	7,814	9,351	10,345	2,664	4,231
Noncomparable imports	346	0	16,452	4,955	15	10,582	10,145	3,226	7	21	12
Total intermediate inputs	293,768	466,999	2,550,010	562,675	118,536	297,886	751,063	445,291	351,124	259,832	190,612
Compensation of employees	44,143	253,419	684,835	534,083	33,268	145,915	373,855	675,631	458,283	178,674	157,224
Indirect business tax and nontax liability	16,942	5,688	44,627	229,584	28,708	33,415	206,808	17,491	4,294	32,198	9,677
Other value added ^d	99,417	27,984	474,280	156,337	91,766	170,441	1,150,023	300,878	95,260	85,992	89,480
Total value-added	160,502	287,092	1,203,741	920,003	153,742	349,771	1,730,685	994,000	557,837	296,864	256,381
Total industry output	454,271	754,091	3,753,751	1,482,678	272,278	647,658	2,481,748	1,439,291	908,961	556,695	446,993

continued next page

Table 7. TSA's Use of Major Commodity Groups by Industry Sector:1997 (continued)

(Millions of dollars at producers' prices)

Commodity	Industry sector										
	For-hire					In-house					
	Air	Rail	Water	Truck	Transit and ground passenger transportation ^a	Pipeline transportation	Other ^b	Air	Rail	Water	Truck
Natural resources and mining	...	112	13	—	—	1,112	6	—	2	4	—
Construction	51	6	10	292	45	840	463	2	0	2	2,069
Manufacturing products	17,413	5,632	2,062	16,165	6,232	5,641	8,897	956	130	212	29,492
Trade	2,132	871	501	9,072	2,603	876	1,903	246	20	34	24,664
Utilities	443	40	44	359	710	636	1,593	204	3	22	2,565
Information	2,467	29	120	2,173	169	260	3,081	1,072	2	23	16,288
Financial services	5,352	4,010	2,682	11,784	1,780	1,572	9,134	2,309	83	774	66,130
Professional and business services	20,923	2,416	3,953	9,909	3,093	6,187	10,800	3,989	148	1,305	53,910
Education and health services	24	63	72	131	15	8	202	10	4	40	234
Leisure and hospitality	6,617	92	169	319	68	16	894	2,625	7	41	2,479
Other services	651	46	239	4,252	288	578	1,380	281	4	74	15,649
Transportation:											
Air	238	48	36	621	50	12	268	1	0	0	177
Rail	164	107	13	1,490	60	22	191	1	1	3	265
Water	124	15	6	279	42	16	51	1	0	0	60
Truck	263	145	40	21,163	386	72	540	12	4	6	1,177
Transit and ground passenger transportation ^a	34	5	14	30	944	1	12	—	—	—	—
Pipeline transportation	114	8	6	111	35	190	34	—	—	—	—
Other ^b	9,113	3,147	5,697	8,926	146	103	5,760	—	—	—	—
In-house:											
Air	—	—	—	—	—	—	—	—	—	—	—
Rail	—	—	—	—	—	—	—	—	—	—	—
Water	—	—	—	—	—	—	—	—	—	—	—
Truck	—	—	—	—	—	—	—	—	—	—	—
Other ^c	170	21	7	222	38	705	620	9	0	—	19
Noncomparable imports	9,360	123	2,749	681	—	21	393	2,065	7	300	2,187
Total intermediate inputs	75,651	16,935	18,430	87,978	16,701	18,866	46,222	13,785	415	2,841	217,363
Compensation of employees	35,453	14,056	3,268	48,151	20,234	3,810	49,267	3,060	345	918	69,365
Indirect business tax and nontax liability	5,834	662	633	1,469	1,075	1,163	2,145	494	16	178	2,068
Other value added	2,506	6,314	2,066	31,798	-5,872	3,445	17,714	213	155	580	45,296
Total value-added	43,794	21,032	5,967	81,418	15,437	8,418	69,125	3,767	517	1,676	116,729
Total industry output	119,445	37,967	24,397	169,397	32,139	27,284	115,347	17,552	932	4,517	334,092

continued next page

Table 7. TSA's Use of Major Commodity Groups by Industry Sector:1997 (continued)

(Millions of dollars at producers' prices)

Commodity	Industry Sector	Final Uses										Total commodity output
		Other ^c	Total intermediate inputs	Personal consumption expenditures	Private fixed investment	Change in private inventories	Exports of goods and services	Imports of goods and services	Government expenditures	GDP		
Natural resources and mining		4,055	438,201	36,228	22,536	4,310	32,048	-87,339	-1,161	6,622	444,824	
Construction		7,747	71,898	—	506,254	—	96	—	175,843	682,193	754,091	
Manufacturing products		18,597	2,200,884	986,867	554,541	38,449	515,686	-765,454	198,956	1,529,045	3,729,928	
Trade		2,639	431,440	840,362	107,026	5,338	61,686	19,617	20,862	1,054,891	1,486,331	
Utilities		4,616	152,035	152,776	—	3	576	-1,043	29,269	181,582	333,617	
Information		1,175	261,246	207,394	37,268	1,033	20,420	-2,838	34,460	297,736	558,982	
Financial services		6,891	1,018,688	1,336,539	43,539	—	64,795	-6,129	38,575	1,477,319	2,496,006	
Professional and business services		13,704	1,203,329	117,120	88,321	—	41,819	-5,952	110,879	352,186	1,555,515	
Education and health services		61	14,910	1,005,484	—	—	471	-575	-109,536	895,844	910,754	
Leisure and hospitality		509	114,229	447,255	—	—	558	-260	-5,054	442,498	556,728	
Other services		1,137	138,552	294,846	—	21	136	-1,186	15,886	309,703	448,255	
Transportation:												
Air		1,541	47,957	53,765	2,854	144	28,614	-14,957	5,436	75,855	123,812	
Rail		766	26,878	4,584	1,579	168	4,710	-194	1,226	12,072	38,949	
Water		124	5,511	5,941	19	22	6,588	4,899	1,647	19,116	24,628	
Truck		2,497	112,471	34,462	5,967	917	13,827	-1,985	5,784	58,972	171,443	
Transit and ground passenger transportation		32	10,507	16,807	—	—	—	—	4,762	21,569	32,076	
Pipeline transportation		1,242	26,071	713	—	-1	342	—	159	1,213	27,284	
Other ^b		1,012	100,119	3,573	—	—	6,850	—	2,614	13,037	113,156	
In-house:												
Air		—	17,552	—	—	—	—	—	—	—	17,552	
Rail		—	932	—	—	—	—	—	—	—	932	
Water		—	4,517	—	—	—	—	—	—	—	4,517	
Truck		—	334,092	—	—	—	—	—	—	—	334,092	
Other ^c		1,957	77,619	-18,392	-50,991	11,762	99,363	-5,836	942,974	978,880	1,056,499	
Noncomparable imports		1,038	64,686	45,260	998	—	—	-120,514	9,570	-64,686	—	
Total intermediate inputs		71,341	—	—	—	—	—	—	—	—	—	
Compensation of employees		868,889	—	—	—	—	—	—	—	—	—	
Indirect business tax and nontax liability		1,055	—	—	—	—	—	—	—	—	—	
Other value added		197,203	—	—	—	—	—	—	—	—	—	
Total value-added		1,067,147	—	—	—	—	—	—	—	8,345,646	—	
Total industry output		1,138,488	—	—	—	—	—	—	—	—	15,219,970	

^a "Transit and ground passenger transportation" includes State and local government passenger transit.

^b "Other" transportation includes: Sightseeing transportation and transportation support; courier and messenger services; and warehousing and storage.

^c "Other" consists of government enterprise (except State and local government passenger transit) and other input-output special industries. See Ann M. Lawson et al., "Benchmark Input-Output Accounts for the U.S. Economy, 1992: Make, Use, and Supplementary Tables," *Survey of Current Business*, 1997, 77(11), pp. 58-62, available at <http://www.bea.gov/scb/pdf/2002/12December/1202i-OAaccounts2.pdf> as of Mar. 15, 2011.

^d For all industries except in-house transportation, "other value-added" consists of the following national income and product account components of gross domestic income: consumption of fixed capital, net interest, proprietors' income, corporate profits, rental income of persons, business transfer payments, and subsidies less current surplus of government enterprises. "Other value-added" for in-house transportation consists of consumption of fixed capital.

KEY: — = number too small to report

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

Table 8. TSAs' Commodity-by-Industry Direct Requirements by Industry Sector: 1997

(Direct requirements per dollar of industry output at producers' prices)

Commodity	Industry sector										
	Natural resources and mining	Construction	Manufacturing products	Trade	Utilities	Information	Financial services	Professional and business services	Education and health services	Leisure and hospitality	Other services
Natural resources and mining	0.208	0.009	0.071	0.000	0.193	0.000	0.000	0.002	0.001	0.015	0.000
Construction	0.002	0.000	0.002	0.003	0.015	0.003	0.009	0.004	0.007	0.007	0.006
Manufacturing products	0.147	0.282	0.364	0.036	0.040	0.078	0.013	0.037	0.092	0.166	0.154
Trade	0.030	0.078	0.057	0.015	0.007	0.012	0.005	0.009	0.016	0.029	0.025
Utilities	0.018	0.003	0.014	0.012	0.001	0.005	0.009	0.007	0.008	0.020	0.011
Information	0.000	0.001	0.007	0.011	0.002	0.166	0.007	0.025	0.016	0.012	0.016
Financial services	0.092	0.016	0.026	0.061	0.021	0.041	0.164	0.050	0.090	0.070	0.065
Professional and business services	0.041	0.073	0.071	0.136	0.042	0.088	0.064	0.114	0.089	0.056	0.062
Education and health services	0.000	0.000	0.000	0.001	0.003	0.001	0.000	0.001	0.008	0.001	0.001
Leisure and hospitality	0.004	0.001	0.005	0.006	0.007	0.012	0.006	0.011	0.014	0.029	0.006
Other services	0.005	0.009	0.012	0.006	0.002	0.012	0.006	0.010	0.006	0.008	0.010
Transportation:											
Air	0.001	0.002	0.004	0.003	0.001	0.002	0.003	0.005	0.004	0.003	0.004
Rail	0.005	0.002	0.003	0.000	0.021	0.000	0.000	0.000	0.000	0.001	0.001
Water	0.001	0.001	0.001	0.000	0.002	0.000	0.000	0.000	0.000	0.000	0.000
Truck	0.009	0.014	0.015	0.001	0.003	0.002	0.001	0.001	0.002	0.006	0.004
Transit and ground passenger transportation ^a	0.000	0.000	0.000	0.001	0.000	0.001	0.001	0.001	0.002	0.001	0.001
Pipeline transportation	0.001	0.000	0.002	0.000	0.062	0.000	0.000	0.000	0.000	0.000	0.000
Other ^b	0.005	0.003	0.005	0.015	0.003	0.003	0.004	0.003	0.003	0.003	0.003
In-house:											
Air	0.005	0.000	0.001	0.003	0.001	0.001	0.001	0.002	0.001	0.001	0.000
Rail	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Water	0.005	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Truck	0.065	0.124	0.008	0.058	0.006	0.010	0.003	0.017	0.016	0.035	0.048
Other ^c	0.000	0.002	0.003	0.007	0.003	0.006	0.003	0.006	0.011	0.005	0.009
Noncomparable imports	0.001	0.000	0.004	0.003	0.000	0.016	0.004	0.002	0.000	0.000	0.000
Total value-added	0.353	0.381	0.321	0.621	0.565	0.540	0.697	0.691	0.614	0.533	0.574
Total direct requirement	1	1	1	1	1	1	1	1	1	1	1

continued next page

Table 8. TSAs' Commodity-by-Industry Direct Requirements by Industry Sector: 1997 (continued)

(Direct requirements per dollar of industry output at producers' prices)

Commodity	Industry sector											
	For-hire					In-house						
	Transit and ground passenger transportation ^a					Transportation						
	Air	Rail	Water	Truck	Transit and ground passenger transportation ^a	Pipeline transportation	Other ^b	Air	Rail	Water	Truck	Other ^c
Natural resources and mining	0.000	0.003	0.001	0.000	0.000	0.041	0.000	0.004	0.000	0.002	0.001	0.000
Construction	0.000	0.000	0.000	0.002	0.001	0.031	0.004	0.007	0.000	0.000	0.001	0.006
Manufacturing products	0.146	0.148	0.085	0.095	0.194	0.207	0.077	0.016	0.054	0.140	0.047	0.088
Trade	0.018	0.023	0.021	0.054	0.081	0.032	0.016	0.002	0.014	0.021	0.007	0.074
Utilities	0.004	0.001	0.002	0.002	0.022	0.023	0.014	0.004	0.012	0.003	0.005	0.008
Information	0.021	0.001	0.005	0.013	0.005	0.010	0.027	0.001	0.061	0.002	0.005	0.049
Financial services	0.045	0.106	0.110	0.070	0.055	0.058	0.079	0.006	0.132	0.089	0.171	0.198
Professional and business services	0.175	0.064	0.162	0.058	0.096	0.227	0.094	0.012	0.227	0.159	0.289	0.161
Education and health services	0.000	0.002	0.003	0.001	0.000	0.000	0.002	0.000	0.001	0.005	0.009	0.001
Leisure and hospitality	0.055	0.002	0.007	0.002	0.002	0.001	0.008	0.000	0.150	0.007	0.009	0.007
Other services	0.005	0.001	0.010	0.025	0.009	0.021	0.012	0.001	0.016	0.004	0.016	0.047
Transportation:												
Air	0.002	0.001	0.001	0.004	0.002	0.000	0.002	0.001	0.000	0.000	0.000	0.001
Rail	0.001	0.003	0.001	0.009	0.002	0.001	0.002	0.001	0.000	0.001	0.001	0.001
Water	0.001	0.000	0.000	0.002	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Truck	0.002	0.004	0.002	0.125	0.012	0.003	0.005	0.002	0.001	0.004	0.001	0.004
Transit and ground passenger transportation ^a	0.000	0.000	0.001	0.000	0.029	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pipeline transportation	0.001	0.000	0.000	0.001	0.001	0.007	0.000	0.001	0.000	0.000	0.000	0.000
Other ^b	0.076	0.083	0.234	0.053	0.005	0.004	0.050	0.001	0.000	0.000	0.000	0.000
In-house:												
Air	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rail	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Water	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Truck	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Other ^c	0.001	0.001	0.000	0.001	0.001	0.026	0.005	0.002	0.001	0.000	0.000	0.000
Noncomparable imports	0.078	0.003	0.113	0.004	0.000	0.001	0.003	0.001	0.118	0.007	0.066	0.007
Total value-added	0.367	0.554	0.245	0.481	0.480	0.309	0.599	0.937	0.215	0.554	0.371	0.349
Total direct requirement	1	1	1	1	1	1	1	1	1	1	1	1

^a "Transit and ground passenger transportation" includes State and local government passenger transit.

^b "Other" transportation includes: sightseeing transportation and transportation support; courier and messenger services; and warehousing and storage.

^c "Other" consists of government enterprise (except State and local government passenger transit) and other input-output special industries. See Ann M. Lawson et al., "Benchmark Input-Output Accounts for the U.S. Economy, 1992: Make, Use, and Supplementary Tables," *Survey of Current Business*, 1997, 77(11), pp. 58-62, available at <http://www.bea.gov/iscb/pdf/2002/12December/1201-OAaccounts2.pdf> as of Mar. 15, 2011.

KEY: — = number too small to report

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

Table 9. TSAs' Industry-by-Commodity Total Requirements by Industry Sector: 1997

(Total requirements, direct and indirect, per dollar of delivery to final demand at producers' prices)

Industry sector	Commodity										
	Natural resources and mining	Construction	Manu-facturing products	Trade	Utilities	Information	Financial services	Professional and business services	Education and health services	Leisure and hospitality	Other services
Natural resources and mining	1.300	0.065	0.161	0.015	0.219	0.022	0.009	0.019	0.023	0.059	0.033
Construction	0.008	1.005	0.007	0.007	0.018	0.006	0.012	0.006	0.010	0.011	0.010
Manufacturing products	0.366	0.529	1.668	0.111	0.165	0.195	0.054	0.139	0.196	0.328	0.299
Trade	0.074	0.129	0.111	1.030	0.031	0.033	0.013	0.025	0.036	0.060	0.053
Utilities	0.029	0.015	0.026	0.015	0.823	0.010	0.011	0.010	0.013	0.024	0.017
Information	0.029	0.038	0.040	0.040	0.018	1.208	0.022	0.118	0.042	0.037	0.041
Financial services	0.203	0.108	0.111	0.115	0.078	0.090	1.204	0.090	0.142	0.135	0.124
Professional and business services	0.139	0.179	0.175	0.183	0.095	0.157	0.095	1.072	0.138	0.123	0.125
Education and health services	0.001	0.001	0.001	0.001	0.003	0.002	0.000	0.001	1.007	0.001	0.002
Leisure and hospitality	0.014	0.010	0.015	0.012	0.011	0.020	0.011	0.017	0.020	1.029	0.013
Other services	0.020	0.027	0.027	0.015	0.010	0.021	0.010	0.016	0.014	0.018	1.016
Transportation:											
Air	0.005	0.006	0.009	0.005	0.003	0.005	0.004	0.007	0.006	0.006	0.006
Rail	0.008	0.005	0.007	0.001	0.019	0.002	0.001	0.001	0.002	0.003	0.002
Water	0.001	0.001	0.001	0.000	0.002	0.000	0.000	0.000	0.000	0.001	0.000
Truck	0.021	0.027	0.032	0.005	0.010	0.007	0.002	0.005	0.007	0.014	0.011
Transit and ground passenger transportation ^a	0.001	0.001	0.001	0.001	0.000	0.002	0.001	0.001	0.002	0.002	0.002
Pipeline transportation	0.004	0.002	0.005	0.001	0.052	0.001	0.001	0.001	0.001	0.002	0.002
Other ^b	0.014	0.012	0.016	0.019	0.009	0.007	0.006	0.007	0.007	0.009	0.008
In-house:											
Air	0.007	0.002	0.003	0.003	0.003	0.002	0.002	0.003	0.001	0.003	0.002
Rail	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Water	0.007	0.001	0.002	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Truck	0.097	0.146	0.037	0.068	0.027	0.022	0.009	0.026	0.028	0.052	0.061
Other ^c	0.012	0.011	0.014	0.017	0.195	0.013	0.014	0.012	0.018	0.019	0.020
Total industry output multiplier	2.362	2.318	2.469	1.666	1.793	1.824	1.483	1.580	1.712	1.937	1.847

continued next page

Table 9. TSAs' Industry-by-Commodity Total Requirements by Industry Sector: 1997 (continued)

(Total requirements, direct and indirect, per dollar of delivery to final demand at producers' prices)

Industry sector	Commodity												
	Transportation					In-house							
	For-hire												
	Air	Rail	Water	Truck	Transit and ground passenger transportation ^a	Pipeline transportation	Other ^b	Air	Rail	Water	Truck	Other ^c	Noncomparable imports
Natural resources and mining	0.034	0.032	0.025	0.024	0.042	0.101	0.021	0.028	0.032	0.018	0.026	0.009	—
Construction	0.005	0.004	0.006	0.006	0.005	0.036	0.007	0.006	0.003	0.005	0.012	0.007	—
Manufacturing products	0.307	0.281	0.219	0.230	0.373	0.432	0.169	0.199	0.270	0.141	0.220	0.038	—
Trade	0.047	0.047	0.045	0.083	0.114	0.073	0.033	0.040	0.044	0.025	0.098	0.006	—
Utilities	0.013	0.009	0.011	0.009	0.027	0.030	0.017	0.020	0.010	0.011	0.015	0.005	—
Information	0.060	0.023	0.045	0.040	0.033	0.054	0.051	0.113	0.031	0.048	0.092	0.004	—
Financial services	0.110	0.164	0.190	0.136	0.117	0.136	0.123	0.215	0.143	0.244	0.284	0.013	—
Professional and business services	0.240	0.123	0.237	0.128	0.170	0.312	0.136	0.300	0.211	0.342	0.238	0.020	—
Education and health services	0.001	0.002	0.004	0.001	0.001	0.001	0.002	0.001	0.005	0.009	0.001	0.000	—
Leisure and hospitality	0.063	0.009	0.016	0.009	0.009	0.010	0.013	0.162	0.014	0.018	0.017	0.001	—
Other services	0.016	0.010	0.021	0.036	0.019	0.035	0.018	0.027	0.012	0.025	0.057	0.002	—
Transportation:													
Air	0.970	0.004	0.005	0.007	0.005	0.005	0.004	0.004	0.003	0.003	0.004	0.002	—
Rail	0.003	0.979	0.002	0.011	0.004	0.004	0.003	0.002	0.002	0.002	0.002	0.001	—
Water	0.001	0.001	0.986	0.002	0.002	0.001	0.002	0.000	0.000	0.000	0.000	0.000	—
Truck	0.010	0.011	0.009	1.132	0.022	0.013	0.011	0.007	0.011	0.005	0.010	0.003	—
Transit and ground passenger transportation ^a	0.001	0.001	0.002	0.001	1.028	0.001	0.002	0.001	0.001	0.001	0.001	0.000	—
Pipeline transportation	0.002	0.001	0.001	0.002	0.004	1.010	0.002	0.002	0.001	0.001	0.001	0.002	—
Other ^b	0.116	0.110	0.249	0.081	0.014	0.012	1.002	0.006	0.005	0.005	0.007	0.002	—
In-house:													
Air	0.001	0.001	0.001	0.001	0.001	0.002	0.001	1.002	0.001	0.001	0.002	0.000	—
Rail	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	—
Water	0.000	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	1.000	0.000	0.000	—
Truck	0.016	0.011	0.013	0.014	0.018	0.027	0.010	0.020	0.013	0.013	1.020	0.003	—
Other ^c	0.014	0.013	0.022	0.011	0.013	0.040	0.062	0.012	0.007	0.009	0.011	1.003	—
Total industry output multiplier	2.031	1.835	2.110	1.965	2.025	2.336	1.689	2.167	1.819	1.927	2.119	1.123	—

^a "Transit and ground passenger transportation" includes State and local government passenger transit.

^b "Other" transportation includes: sightseeing transportation and transportation support; courier and messenger services; and warehousing and storage.

^c "Other" consists of government enterprise (except State and local government passenger transit) and other input-output special industries. See Ann M. Lawson et al., "Benchmark Input-Output Accounts for the U.S. Economy, 1992: Make, Use, and Supplementary Tables," *Survey of Current Business*, 1997, 77(11), pp. 58-62, available at <http://www.bea.gov/scb/pdf/2002/12December/1201-OAcounts2.pdf> as of Mar. 15, 2011.

KEY: — = number too small to report

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

Methodology

METHODOLOGICAL OVERVIEW

The TSAs measure the magnitude of in-house transportation services by estimating the inputs used by each industry for its in-house transportation activities. To do this, the TSAs rearrange the I-O accounts using data on transportation from other sources. The following describes the steps involved. The major data sources are identified in table 10.

Table 10. Principal Data Sources

Data	Sources
Estimates of input-output accounts, 1997	U.S. Department of Commerce, Bureau of Economic Analysis, Benchmark Input-Output Accounts for the U.S. Economy, 1997 and detailed underlying data files for the I-O accounts
Air General aviation aircraft (private) by industry	General Aviation Manufacturer's Association (GAMA) proprietary database
Rail Private railcars by private shipper	Official Railway and Equipment Register, Commonwealth Business Media, East Windsor, New Jersey.
Truck Trucks, truck mileage, fuel use by industry and vehicle type, 1997 ^a	U.S. Department of Commerce, Census Bureau, 1997 Census of Transportation, Vehicle Inventory and Use Survey microdata.
Statistics on occupation and industry, 2000	Census Bureau, 2000 Census of Population and Housing Occupation and Industry.
Energy use by industry, 1997	U.S. Department of Energy, Energy Information Administration, <i>Annual Energy Review 2008</i> , tables 5.13a-5.13d.
Energy use by transportation modes, 1997	U.S. Department of Energy, Oak Ridge National Laboratory, <i>Transportation Energy Data Book: Edition 28</i> .
Vehicle-miles of travel by type of vehicles, 1997	U.S. Department of Transportation, Federal Highway Administration, <i>Highway Statistics</i> . Reported in U.S. Department of Transportation, Bureau of Transportation Statistics, <i>National Transportation Statistics</i> , Chapter 1, section C, table 1-32 as of April 2010.
Water Private water vessels by industry	U.S. Department of Defense, Army Corps of Engineers, Vessel Company Summary and Vessel Characteristics from the Waterborne Transportation Lines of the United States (WTLUS).

^a Data for these measures were extracted for all trucks of all chassis except those used for personal use, not used (wrecked, awaiting repair, etc.) for more than 6 months, or used for only off-road purposes (e.g., primary trip is off a public road).

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

Step 1. Estimating Transportation Inputs

Transportation inputs include both intermediate inputs (e.g., motor vehicle gasoline) and value-added inputs (e.g., employee compensation, indirect business tax and nontax liability, and consumption of fixed capital). The value of these inputs for each industry in the U.S. I-O accounts' use table combines that for transportation and nontransportation purposes. The TSAs separate the value from transportation uses from all other uses through the following steps:

- **Identifying the Transportation-Related Inputs and the Dollar Value of In-House Transportation Services:** The TSAs define a set of inputs unique to or mostly used for transportation by a specific mode. These inputs, derived from the underlying items in the I-O accounts, are called “transportation-related inputs” (TRIs). The TRIs used in the 1997 TSAs are presented in table 11.

TRIs may not be used exclusively to produce transportation services or by a specific mode. For example, motor gasoline is required for truck transportation operations. However, motor gasoline is not a TRI exclusive to truck transportation as it is used by other transportation modes and other industries for both transportation and nontransportation-related purposes. For example, motor gasoline is used to carry cargo by watercraft and to operate nontransportation-related machinery. In these cases, the component used for nontransportation purposes, such as gasoline used for heating or for operating machinery, and the component used for transportation modes other than the one for which the TRI was selected, such as gasoline used for transportation modes other than trucking, is removed. The resulting value is used to estimate the total value of in-house air, rail, truck, and water transportation.

- **Developing Industry Distribution Weights and Distributing TRIs:** To measure each industry’s production and use of in-house transportation, the value of in-house transportation for each mode (calculated in the step above) must be distributed across industries. This is done through distribution weights. The weights assign a larger portion of the dollar value of in-house transportation to industries with a larger proportion of the total stock of transportation vehicles (aircraft, railcars, trucks, and water vessels) for a given mode. This assignment is based on the assumption that industries with a larger stock of transportation vehicles produce and consume more in-house transportation. Stock values for the 1997 TSAs were compiled from the sources listed in table 10.
- **Estimating Other Inputs:** Transportation activities require inputs not unique or primary to transportation. For example, office supplies and accounting services are shared across transportation and all other production activities. The TSAs separate transportation and nontransportation use of these inputs by assuming nontransportation industries use these nontransportation related inputs in the same proportion as for-hire industries.¹⁸

Technical documentation containing details on the above steps is available on request: at RITAinfo@dot.gov

¹⁸ Adjustments were made after applying the for-hire relationship to ensure that the value of the transportation and nontransportation component of each commodity used by an industry equals that in the I-O use table.

Table 11. Transportation-Related Inputs (TRIs)

Transportation mode	Transportation related input(s)
Air	Aviation gasoline (except jet fuel) Jet fuel
Rail	Railroad car rental and leasing
Truck	Motor gasoline Light fuel oils Liquefied refinery gases, for uses other than chemical raw material Tire rebuilding and retreading Truck and bus (including off-highway) pneumatic tires
Water	Commercial ships and barges rental and leasing, without crew Marine Cargo Handling Marine hardware (including shackles, rope sockets, tackle blocks, etc.) Navigational services to shipping

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

In the above steps, the TSAs assume the following:

- the TRIs are representative inputs for the production of in-house transportation services,
- the selected distribution weights are reliable predictors of the use of TRIs for in-house transportation, and
- the distribution of nontransportation-related commodity inputs within a for-hire transportation industry is similar to the distribution of the inputs within a nontransportation industry for its transportation-related activities.

Step 2. Deriving the TSAs Make and Use Tables

The second step in the TSAs involves the production of the make and use tables. As noted earlier, the TSAs' make and use tables are I-O make and use tables modified to show estimates of transportation related inputs. First, estimates of transportation inputs for each industry are arranged in a matrix so that the rows and columns correspond to those in the intermediate industry portion of the I-O use table.¹⁹ Second, the estimates in the transportation input matrix are subtracted from the corresponding elements of the I-O use table, resulting in a residual use table that shows the intermediate and value-added inputs used by industries for nontransportation activities. Third, the TSAs use table is derived by combining the residual use table, an in-house transportation column vector for each in-house mode with the row sums from the transportation matrix, an in-house transportation row vector for each in-house mode with column totals from the transportation input matrix, and the final-demand portion of the I-O use table. Finally, the TSAs make table is formed by adding an additional column and

¹⁹ Inputs for for-hire transportation industries in this matrix are all zero because these industries, by assumption, do not have any in-house transportation activities.

an additional row for each in-house mode to the I-O make table. The values for this column and row are derived from row and column totals respectively from the transportation related input matrix.

CHANGES IN METHOD IN THE 1997 TSAs AND COMPARABILITY

The steps in measuring in-house transportation services in the 1997 TSAs follow, in general, those used in the 1992 and 1996 TSAs. However, the 1997 TSAs exclude some of the TRIs used in the 1992 and 1996 TSAs and use a slightly different technique for estimating other inputs used to provide transportation services. Additionally, the 1997 TSAs measure in-house transportation services for four modes (air, rail, truck, and water) and provide separate estimates for each. The 1992 and 1996 TSAs measured in-house transportation services for only two modes (bus and truck operations) and combined the two into a single measure.

The 1997 TSAs also differ significantly from the 1992 and 1996 TSAs because of a change in the industry classification system used in the I-O accounts. Prior to 1997, the I-O accounts were based on the Standard Industrial Classification System (SIC) and since 1997, have been based on the North American Industry Classification System (NAICS). NAICS differs from its predecessor SIC in that it:

- classifies industries according to similarities in their production process rather than similarities in the primary products produced,
- treats auxiliaries as establishments and hence explicitly measures the economic activities of auxiliaries rather than including them in the value added of the industry using the services,
- provides additional detail for the services sector, and
- introduces the “information sector”.²⁰

The changes introduced by NAICS have resulted in most industries in the 1997 benchmark I-O accounts not being comparable to those in prior I-O accounts and, hence, in most industries in the 1997 TSAs not being comparable to those in prior TSAs.

To enable comparisons between the 1997 TSAs and 1992 TSAs, this report presents revised numbers for the 1992 TSAs using the 1997 TSAs procedure at the sector level. The 1996 TSAs were not re-estimated using the 1997 TSAs procedure due to a lack of sufficient detail in the inputs.

²⁰ For information on the treatment of secondary products in the 1997 U.S. I-O accounts, see: Ann M. Lawson et al., “Benchmark Input-Output Accounts of the United States, 1997,” *Survey of Current Business*, 2002, 82(12), p. 2, available at <http://www.bea.gov/scb/pdf/2002/12December/12021-OAccounts2.pdf> as of Mar. 15, 2011.

The Role of Transportation in the Economy

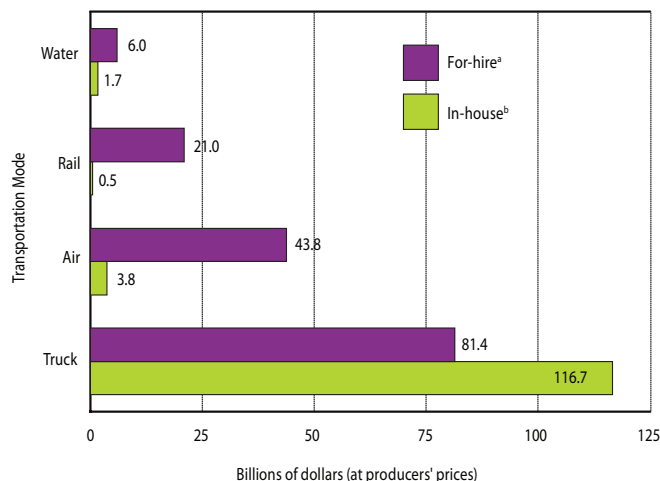
FINDINGS FROM 1997 TSAs

As mentioned, the TSAs can be used for conducting studies related to the role of transportation in the economy. The following discusses findings from the 1997 TSAs as applied to analyses examining the contribution of transportation to GDP, the use of transportation services by industry, the direct cost of transportation services by commodity, and the total cost of transportation services by commodity.

Contribution of Transportation to GDP

The TSAs can be used to assess the size and impact of transportation on the U.S. economy. The TSAs show that all transportation services (all for-hire and in-house modes) contributed about \$367.8 billion of value-added in 1997. Of this \$367.8 billion, for-hire air, rail, truck, and water transportation generated \$152.2 billion, or about 1.8 percent of all GDP. In-house transportation activities for these same four modes (air, rail, truck, and water transportation) generated \$122.7 billion of value-added in 1997, or 1.5 percent of total GDP. In both for-hire and in-house transportation, truck transportation services contributed the most to GDP: \$81.4 billion and \$116.7 billion respectively (see figure 1).

Figure 1. Value Added by Transportation Mode: 1997
(Billions of dollars at producers' prices)



^a For-hire transportation consists of the services provided by transportation firms to industries and the public on a fee-basis. Other for-hire transportation includes: transit and ground passenger transportation, including State and local government passenger transit; sightseeing transportation and transportation support; courier and messenger services; and warehousing and storage.

^b In-house transportation consists of the services provided by nontransportation industries for their use. It includes privately owned and operated vehicles of all body types, used primarily on public rights of way, and the supportive services to store, maintain, and operate those vehicles.

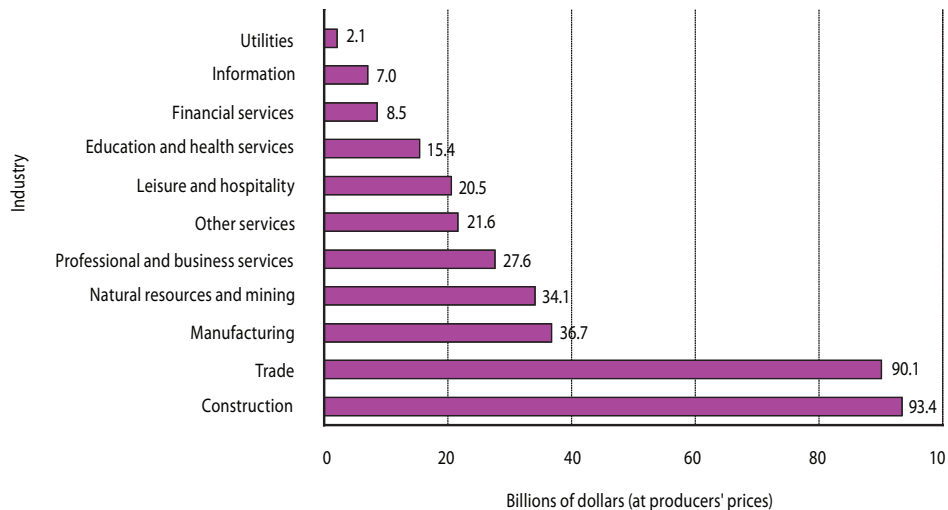
SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

Use of Transportation Services by Industry

The TSAs additionally reveal which industries rely most on for-hire and in-house transportation and for each, what mode(s). Reliance can be represented both as an absolute dollar value and as a requirement per dollar of industry output. The latter estimates the importance of transportation relative to all other inputs in producing output and hence the intensity to which transportation is used in the production process. In many cases, the intensity of transportation use leads to a different conclusion about the importance of transportation than the one indicated by the absolute dollar value.

In 1997, the manufacturing industry was the largest user of all transportation services at \$148.9 billion, while the construction industry was the largest user of in-house transportation services. In 1997, the construction industry used \$93.4 billion of in-house transportation services (primarily in-house trucking) and used a smaller amount of for-hire transportation services (\$13.7 billion) provided by the same modes included in the in-house transportation estimate (air, rail, truck, and water). The next largest user of in-house transportation was trade (wholesale and retail), which used \$90.1 billion of the service and only \$7.4 billion of for-hire transportation services for the same modes (air, rail, truck, and water). The smallest user of in-house transportation (excluding the group “other”) was utilities. The utilities sector uses relatively less in-house transportation as it includes establishments engaged primarily in transmitting and distributing natural gas to final consumers and hence establishments using a large amount of for-hire pipe transportation (see figures 2 and 3).

Figure 2. In-house Air, Rail, Truck, and Water Transportation Used by Industries: 1997
(Billions of dollars at producers' prices)

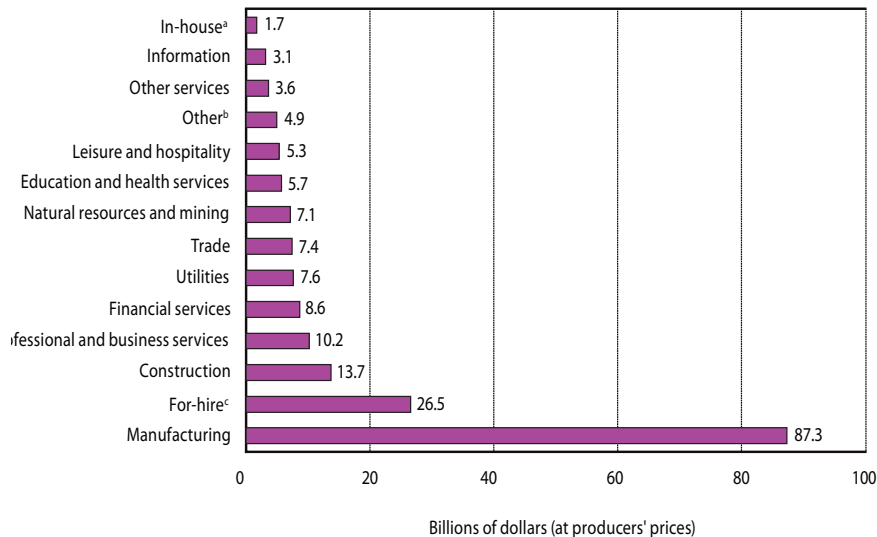


^a “Other” consists of government enterprises (except State and local government passenger transit) and other I-O special industries. For a description of I-O special industries, see Ann M. Lawson et al., “Benchmark Input-Output Accounts for the U.S. Economy, 1992: Make, Use, and Supplementary Tables,” *Survey of Current Business*, 1997, 77(11) pp. 46-47, available at <http://www.bea.gov/scb/pdf/2002/12December/12021-OAccounts2.pdf> as of Mar. 15, 2011.

NOTES: In-house transportation consists of the services provided by non-transportation industries for their use. It includes privately owned and operated vehicles of all body types, used primarily on public rights of way, and the supportive services to store, maintain, and operate those vehicles.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

Figure 3. For-hire Air, Rail, Truck, and Water Transportation Used by Industries: 1997
(Billions of dollars at producers' prices)



^a In-house transportation consists of the services provided by non-transportation industries for their use. It includes privately owned and operated vehicles of all body types, used primarily on public rights of way, and the supportive services to store, maintain, and operate those vehicles.

^b "Other" consists of government enterprises (except State and local government passenger transit) and other I-O special industries. For a description of I-O special industries, see Ann M. Lawson et al., "Benchmark Input-Output Accounts for the U.S. Economy, 1992: Make, Use, and Supplementary Tables," Survey of Current Business, 1997, 77(11), pp. 46-47, available at <http://www.bea.gov/scb/pdf/2002/12December/12021-OAccounts2.pdf> as of Mar. 15, 2011.

^c For-hire transportation includes for-hire air, rail, truck, water, and pipeline transportation; transit and ground passenger transportation, including State and local government passenger transit; sightseeing transportation; transportation supportive services; courier and messenger services; and warehousing and storage.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

In looking at the use of all in-house transportation as a share of an industry's total output (in I-O terminology, the direct requirements for in-house transportation), it further can be seen that the construction industry required the most in-house air, rail, truck, and water transportation (12.4¢) to produce a dollar of output. The next most intensive user of all in-house transportation services was natural resources and mining, which required 7.5¢ of in-house transportation to produce a dollar of output, even though the natural resources and mining industry was only the fourth largest user of all in-house transportation services in absolute terms. In-house air, rail, truck, and water transportation accounted for the smallest share of financial services' total output, making it the least intensive user of all in-house transportation (see table 8).

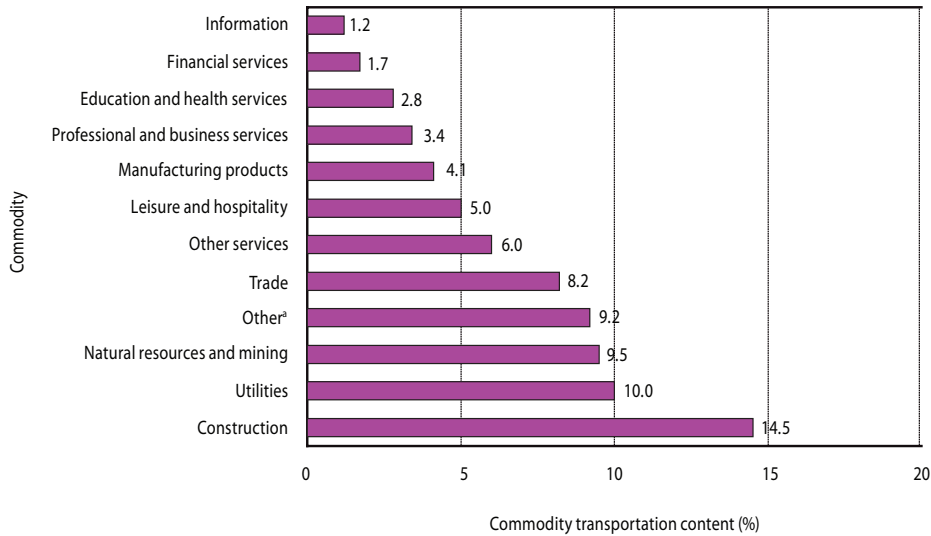
Among nontransportation industries, the utilities industry was the most intensive user of for-hire transportation. The utilities industry required 2.8¢ per dollar of output of for-hire air, rail, truck, and water transportation. This intense use reflects the fact that the utilities sector includes, per the NAICS, establishments engaged primarily in transmitting and distributing natural gas to final consumers. These establishments use a large amount of for-hire pipe transportation. The second most intensive user of for-hire transportation was manufacturing, which required 2.3¢ of for-hire air, rail, truck, and water transportation per dollar of output. The

industries: trade, information services, financial services, professional and business services, education and health services, leisure services, and other services each required less than 1.0¢ of for-hire air, rail, truck, and water transportation per dollar of output, making them the least intensive users of for-hire transportation.

Direct Cost of Transportation Services by Commodity

The TSAs also enable the analysis of transportation service costs. This type of analysis differs from the examination of the use of transportation on an industry basis for two reasons. First, many industries produce more than one commodity, and second, many commodities are produced by more than one industry. Thus to analyze the importance of transportation costs in the purchasers' prices of commodities, both for-hire and in-house transportation costs were distributed on a commodity-by-commodity basis.²¹

Figure 4. Total Transportation Services Cost by Commodities: 1997
(Cents per dollar of commodity output)



^a "Other" consists of government enterprises (except State and local government passenger transit) and other I-O special industries. For a description of I-O special industries, see Ann M. Lawson et al., "Benchmark Input-Output Accounts for the U.S. Economy, 1992: Make, Use, and Supplementary Tables," *Survey of Current Business*, 1997, 77(11) pp. 46-47, available at <http://www.bea.gov/scb/pdf/2002/12December/12021-OAccounts2.pdf> as of Mar. 15, 2011.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

Among nontransportation commodities in 1997, construction commodities required the most transportation to be produced (14.5¢ per dollar of commodity produced), followed by utilities (10.0¢ per dollar of commodity produced). For construction commodities, in-house transportation costs contributed to a larger

²¹ Costs of transportation services are distributed to commodities using the TSAs make and direct requirements tables. For commodities in the TSAs make table produced only by a single industry, the cost of all for-hire and in-house transportation services equals the sum of the for-hire and in-house transportation direct requirement coefficients in the TSAs direct requirements table for the producing industry. For commodities in the TSAs make table produced in more than one industry, the cost of all for-hire and in-house transportation services equals the sum of all for-hire and in-house transportation direct requirement coefficients from the TSAs direct requirements table weighted by the ratio of the commodity value to total commodity output for the producing industry (from the TSAs make table).

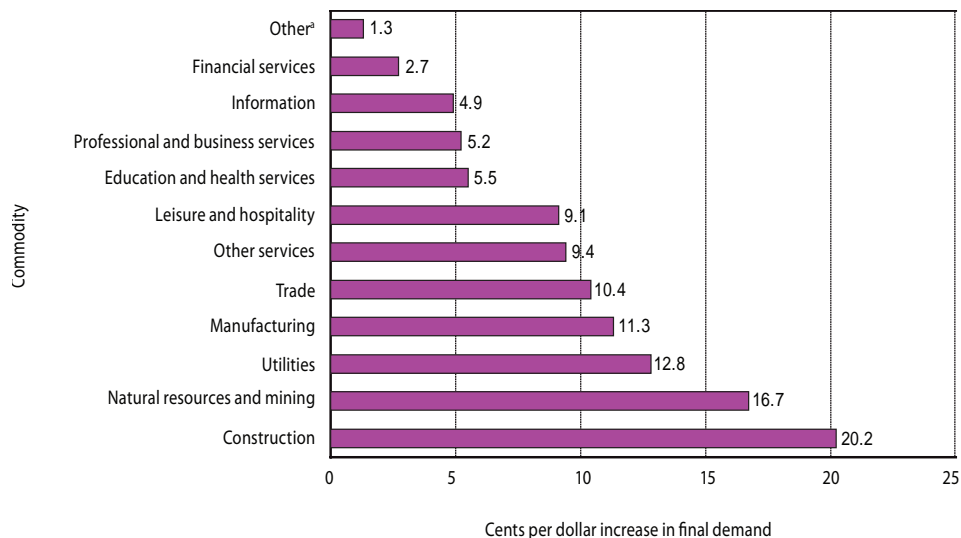
share of the total transportation cost than the for-hire transportation cost. This follows from the intense use of in-house trucking in the construction industry, which is the only industry that produces construction commodities. Likewise, the intense use of for-hire trucking in producing utilities commodities caused the for-hire transportation cost to contribute more toward the total transportation cost of utilities commodities than in-house transportation (see figure 4).

Total Cost of Transportation Services

The TSAs additionally measure the total cost of transportation services. The total cost of transportation services is captured in the direct and indirect effect of transportation on the rest of the economy. The direct effect is the change in transportation output caused by a change in demand for another product; while the indirect effect is the change, induced by a change in the demand for transportation, in the output of another industry, or industries. These effects can be seen in the TSAs total requirements table.

In the total requirements tables, the coefficients listed under each commodity can be used to determine the direct relationship between production of the commodity and the demand for transportation services, because they show the amount of transportation output needed to meet a dollar increase in the final demand for the commodity. For instance, a \$1 increase in the final demand for construction sector commodities requires an increase of 20.2¢ in total transportation services output. Of this 20.2¢ increase, 14.8¢ of in-house; 3.9¢ of for-hire air, rail, truck, and water; and 1.5¢ of other for-hire transportation services would be required. The least amount of transportation services (excluding the “other” category) is needed to meet a \$1 in financial services, for which only 2.7¢ is required.

Figure 5. Transportation Total Requirements: 1997
(Cents per dollar increase in final demand)



^a “Other” consists of government enterprises (except State and local government passenger transit) and other I-O special industries. For a description of I-O special industries, see Ann M. Lawson et al., “Benchmark Input-Output Accounts for the U.S. Economy, 1992: Make, Use, and Supplementary Tables,” *Survey of Current Business*, 1997, 77(11) pp. 46-47, available at <http://www.bea.gov/scb/pdf/2002/12December/12021-OAccounts2.pdf> as of Mar. 15, 2011.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

The TSAs total requirements table also shows the indirect effect of changes in demand for for-hire and in-house transportation. These changes can be measured by the total industry output multiplier. Across all for-hire and in-house transportation modes, the output multiplier was smallest for in-house rail transportation at 1.82 and, except for for-hire rail, above 1.90 for all transportation modes (excluding the for-hire “other” group). Overall, the economy’s response to changes in the demand for all for-hire and in-house transportation modes was larger than that for trade and utilities but smaller than that for natural resources and mining and manufacturing. This means that an investment in either for-hire or in-house transportation will have a greater economic impact than an equally sized investment in trade or utilities but a smaller impact than one in natural resources and mining or manufacturing (see table 12).

Table 12. Total Industry Output Multipliers for Transportation Industries: 1997

		Total industry output multiplier
For-hire transportation	Air	2.031
	Rail	1.835
	Water	2.110
	Truck	1.965
	Transit and ground passenger transportation ^a	2.025
	Pipeline transportation	2.336
	Other ^b	1.689
In-house transportation	Air	2.167
	Rail	1.819
	Water	1.927
	Truck	2.119

^a “Transit and ground passenger transportation” includes State and local government passenger transit.

^b “Other” transportation includes: sightseeing transportation and transportation support; courier and messenger services; and warehousing and storage.

NOTES: For-hire transportation consists of the services provided by transportation firms to industries and the public on a fee-basis. Other for-hire transportation includes: transit and ground passenger transportation, including State and local government passenger transit; sightseeing transportation and transportation support; courier and messenger services; and warehousing and storage.

In-house transportation consists of the services provided by nontransportation industries for their use. It includes privately owned and operated vehicles of all body types, used primarily on public rights of way, and the supportive services to store, maintain, and operate those vehicles.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

Comparison of 1997 TSAs to the 1992 TSAs

INTRODUCTION

The 1997 TSAs cannot be compared to prior TSAs because of the change in the method for estimating in-house transportation and in the industrial classification system for the I-O accounts, as previously mentioned. To allow for comparison, the 1992 TSAs were re-estimated using the 1997 TSAs procedure. The re-estimation procedure does not remove the contribution of in-house bus transportation services from the measure of in-house transportation but, rather, corrects for the effects of significant changes in the industrial classification system. The following presents the results from the re-estimation at the major group level.²² Comparisons at levels more detailed than the sector level cannot be made with confidence because of the change in the industrial classification system.

Even at the sector level, the change in the industrial classification system has some effect on the comparisons presented below. In particular, the 1997 classification system classifies scenic and sightseeing transportation as transportation, but the 1992 classification identifies only a portion of this industry as transportation (spread across several transportation industries, including air, rail, water, and transportation services) and the remainder as amusement and recreation. Additionally, the 1997 classification system classifies couriers and messengers as a separate transportation industry, while the 1992 classification system includes these services (except those provided by air) in the for-hire truck transportation industry. As such, the 1992 for-hire truck transportation sector is larger than the 1997 for-hire truck transportation sector as it includes a larger number of industries. The pipeline transportation sector in 1992 also is larger than that in 1997, as it includes the natural gas transportation industry, which was classified under the utility sector in 1992. Finally, the 1997 classification system classifies broadcasting and telecommunications as information (and, hence, under the service sector), while the 1992 classification system classifies this industry as communications. Table 13 provides a summary of these changes and indicates where an adjustment was made to the 1992 TSAs based on the 1997 TSAs procedure. The 1996 TSAs were not re-estimated using the 1997 TSAs procedure due to a lack of detailed information for the year.

²² Major groups differ from the sectors used in the TSAs in that they classify all service sectors into a single service group. Additionally, the utilities and communications sectors are classified as a single group. The major groups are: natural resources and mining, construction, manufacturing, trade (retail and wholesale), utilities and communications, services, for-hire transportation, and in-house truck transportation.

Table 13. Significant Changes in the Industrial Classification System Affecting the Comparison of the 1992 and 1997 TSAs at the Sector Level Based on the 1997 TSA Procedure

Industry	Sector(s) in 1992 TSA affected	Sector(s) in 1997 TSA affected	Description	Adjustment performed
Scenic and sightseeing transportation	Air; rail; water; pipeline, freight forwarders, and other transportation services	Pipeline, freight forwarders, and other transportation services	Scenic and sightseeing transportation industry classified as a separate transportation industry in 1997 and included in the pipeline, freight forwarders, and other transportation services sector. In 1992, services in the scenic and sightseeing transportation industry are distributed across several industries, including air, rail, water, transportation services, and amusement and recreation services.	None
Couriers and messengers	For-hire truck transportation	Pipeline, freight forwarders, and other transportation services	In 1997, couriers and messengers (except by air) identified as a separate industry and included in the pipeline, freight forwarders, and other transportation services sector. In 1992, couriers and messengers (except by air) included as part of the truck transportation industry/sector in 1992.	None
Natural gas transportation	Utilities and communications	Pipeline, freight forwarders, and other transportation services	Natural gas transmission and distribution was included in the pipeline industry and in the pipeline, freight forwarders, and other transportation services sector in 1997. In 1992, only part of this industry was included in the pipeline industry and in the pipeline, freight forwarders, and other transportation services sector. The remainder was included in the utilities and communications sector in 1992.	The natural gas transportation industry was moved from the utilities and communications sector to pipeline, freight forwarders, and other transportation services in the 1992 TSAs.
Telephone and telegraph; cable and other pay television; radio and television broadcasting	Utilities and communications	Service	Broadcasting and telecommunications industries were included in the information industry (except for the few included in the administration and support service industry and the other service industry) and as part of the service sector in 1997. In 1992, these industries were included in the utilities and communications sector.	Telephone and telegraph; cable and other pay television; radio and television broadcasting in 1992 TSAs moved from the utilities and communications sector to the services sector.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

FINDINGS FROM THE 1997 AND 1992 TSAs

Changes in the Contribution of Transportation to GDP

The previously published 1992 TSAs showed that for-hire transportation services and in-house trucking contributed \$374.6 billion (in 1997 dollars), or 5.0 percent, to GDP. Based on the 1997 procedure for estimating the in-house portion of transportation, these same services contributed \$409.1 billion (in 1997 dollars), or 5.5 percent, to GDP in 1992. The \$26.9 billion difference between these two estimates for 1992 results primarily from the larger value of in-house truck transportation estimated under the procedure for the 1997 TSAs.

Under the 1997 TSAs' procedure, the value added by for-hire truck transportation services and in-house trucking collectively declined, in real 1997 dollars, by \$67.2 billion between 1992 and 1997. This decline is a result of a decline in the contribution of for-hire and in-house truck transportation to GDP. Between 1992 and 1997, the value added by for-hire truck transportation declined, in real 1997 dollars, from \$93.1 billion to \$81.4 billion. The value added by in-house truck transportation also declined, in real 1997 dollars, from \$172.3 billion to \$116.7 billion.

Although the contribution of for-hire and in-house truck transportation decreased by \$67.2 billion (in 1997 dollars) between 1992 and 1997, the value added by all transportation services fell only by \$41.2 billion (in 1997 dollars). This smaller decline results from a real growth in the value added by other for-hire transportation services and from the inclusion of the value added by other in-house transportation services in 1997. In 1997, the value added by other in-house transportation services (air, rail, and water) was \$6.0 billion (see table 14).

Table 14. Value Added by Transportation Services: 1992 and 1997

(In 1997 billions of dollars)

	Total transportation	For-hire truck	Other for-hire	In-house truck ^a	Other in-house ^b	Total GDP
1992						
1992 based on 1992 method and 1992 classification	374.6	99.7	129.5	145.4	NA	
1992 based on 1997 method and 1997 classification	409.1	93.1	143.8	172.3	NA	7,456.8
1997						
1997 based on 1997 method and 1997 classification	367.9	81.4	163.8	116.7	6.0	8,345.6

^a In-house truck in 1992 also includes in-house bus operations as these two operations were estimated together in the 1992 TSAs.

^b Other in-house includes in-house air, rail, and water operations.

KEY: NA = Not applicable.

NOTES: Nominal 1992 dollars adjusted using the current series, consumer price index (CPI) published by the U.S. Bureau of Labor Statistics for all transportation. In 1992, CPI for all transportation was 140.3 and in 1997, the CPI for all transportation was 160.5.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

Changes in the Use of Transportation Services by Industry

Based on the 1997 TSAs procedure, the manufacturing sector used the most transportation services (\$134.0 billion in 1997 dollars) followed by the services sector (\$113.5 billion in 1997 dollars) in 1992. In 1997 this relationship reversed, with the services sector using more transportation services than the manufacturing sector (\$166.0 billion and \$148.9 billion respectively in 1997 dollars). In both years the manufacturing sector was the largest user of for-hire truck transportation, and the construction sector was the largest user of in-house truck transportation.

Across all sectors except natural resources and mining and utilities and communications, the use of in-house truck transportation increased in real dollars between 1992 and 1997. For several sectors, the increased use of in-house truck transportation follows from a decline in the use of for-hire truck transportation. In the services sector, in-house truck transportation grew in real 1997 dollars from \$67.7 billion in 1992 to \$93.1 billion in 1997, while for-hire truck transportation declined in real 1997 dollars from \$17.7 billion in 1992 to \$11.3 billion in 1997. For-hire truck transportation use also declined, in real dollars, in the trade (wholesale and retail) and construction sectors, while in-house truck transportation use increased (see table 15).

Looking at the use of transportation as a share of a sector's total output (or in I-O terms, at the direct requirements coefficient), it can be seen that transportation became more important in producing a dollar of output in several sectors between 1992 and 1997. For all nontransportation sectors, the use of all transportation relative to all other commodities grew slightly, with the largest growth occurring in the construction sector. Based on the 1997 procedure and 1997 classification, total transportation services required per dollar of construction output grew from 11.1¢ in 1992 to 14.5¢ in 1997. In both 1992 and 1997, the construction sector was the largest user of all transportation services among nontransportation sectors (see table 16).

Table 15. Use of Transportation Services by Industry: 1992 and 1997
(Billions of dollars at producers' prices)

Major group	1992				1997	
	1992 procedure; 1992 classification ^a		1997 procedure; 1997 classification ^b		1997 procedure; 1997 classification	
	1997 dollars (billions) ^c	Rank	1997 dollars (billions) ^c	Rank	1997 dollars (billions)	Rank
In-house truck transportation^e						
Natural resources and mining	21.36	5	32.85	4	29.50	5
Construction	48.81	3	77.66	1	93.30	1
Manufacturing	27.33	4	20.23	5	30.30	4
Trade	53.66	2	76.50	2	86.35	3
Utilities and communications	1.49	6	2.68	6	1.59	6
Services	53.80	1	67.72	3	93.05	2
For-hire transportation	0.00	NA	0.00	NA	0.00	NA
In-house truck transportation	0.00	NA	0.00	NA	0.00	NA
In-house other transportation	NA	NA	NA	NA	0.00	NA
Other ^e	0.90	7	0.00	7	0.00	7
For-hire truck transportation^a						
Natural resources and mining	5.20	4	4.72	4	4.17	4
Construction	12.91	3	13.18	3	10.38	3
Manufacturing	56.33	1	56.21	1	57.43	1
Trade	4.33	5	3.87	5	2.04	6
Utilities and communications	1.29	7	0.90	6	0.89	7
Services	18.62	2	17.69	2	11.26	2
For-hire transportation	37.31	NA	30.53	NA	22.61	NA
In-house truck transportation	0.99	NA	0.16	NA	1.18	NA
In-house other transportation	NA	NA	NA	NA	0.02	NA
Other	1.68	6	0.43	7	2.50	5
Total transportation^d						
Natural resources and mining	32.05	5	46.70	5	44.27	5
Construction	65.46	3	94.65	3	109.25	4
Manufacturing	127.89	1	133.95	1	148.90	2
Trade	64.89	4	88.04	4	121.07	3
Utilities and communications	12.52	6	14.51	6	27.32	6
Services	93.91	2	113.49	2	165.98	1
For-hire transportation	75.54	NA	76.71	NA	60.89	NA
In-house truck transportation	1.64	NA	0.24	NA	1.68	NA
In-house other transportation	NA	NA	NA	NA	0.03	NA
Other	6.54	7	1.96	7	7.21	7

^a For-hire truck transportation in 1992 (under both the 1992 and 1997 classification) includes courier (except air courier) services. Courier services are not included in the 1997 estimate of for-hire truck transportation. For-hire truck transportation in 1992, under the 1992 procedure and 1992 classification, includes warehousing and storage.

^b In estimating the 1992 TSAs per the 1997 procedure, natural gas transportation was moved from the utilities to the pipelines sector as natural gas transportation was classified under the pipelines sector in 1997 and hence considered a for-hire transportation mode.

^c In-house truck in 1992 also includes in-house bus operations as these two operations were estimated together in the 1992 TSAs.

^d Total transportation in 1992 consists of all for-hire transportation and in-house bus and truck transportation under the 1992 procedure and 1992 classification. Under the 1992 procedure and 1997 classification, total transportation in 1992 consists of all for-hire transportation and in-house truck transportation. In 1997, total transportation consists of all for-hire transportation and in-house air, rail, truck, and water transportation.

^e "Other" consists of government enterprise (except State and local government passenger transit) and other input-output special industries. See Ann M. Lawson et al., "Benchmark Input-Output Accounts for the U.S. Economy, 1992: Make, Use, and Supplementary Tables," Survey of Current Business, 1997, 77(11), pp. 58-62.

KEY: NA = Not applicable.

NOTES: Transportation major groups excluded from ranking. Major groups differ from the sectors used in the TSAs in that they classify all service sectors into a single service group. Additionally, the utilities and communications sectors are classified as a single group.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

Table 16. Transportation Commodity-by-Industry Direct Requirements: 1992 and 1997

(Direct requirements per dollar of industry output at producers' prices)

Major sector group	1992				1997	
	1992 procedure; 1992 classification ^a		1997 procedure; 1997 classification ^b		1997 procedure; 1997 classification	
	Direct requirement	Rank	Direct requirement	Rank	Direct requirement	Rank
In-house truck transportation^d						
Natural resources and mining	0.043	5	0.066	4	0.065	5
Construction	0.057	3	0.091	1	0.124	1
Manufacturing	0.007	4	0.005	5	0.008	4
Trade	0.039	2	0.056	2	0.058	3
Utilities and communications	0.002	6	0.008	6	0.006	6
Services	0.011	1	0.013	3	0.014	2
For-hire transportation	0.000	NA	0.000	NA	0.000	NA
In-house truck transportation	0.000	NA	0.000	NA	0.000	NA
In-house other transportation	NA	NA	NA	NA	0.000	NA
Other	0.001	7	0.000	7	0.000	7
For-hire truck transportation^a						
Natural resources and mining	0.011	3	0.010	3	0.009	3
Construction	0.015	2	0.015	1	0.014	2
Manufacturing	0.015	1	0.015	2	0.015	1
Trade	0.003	5	0.003	5	0.001	7
Utilities and communications	0.002	6	0.003	6	0.003	4
Services	0.004	4	0.003	4	0.002	6
For-hire transportation	0.077	NA	0.060	NA	0.043	NA
In-house truck transportation	0.005	NA	0.001	NA	0.004	NA
In-house other transportation	NA	NA	NA	NA	0.001	NA
Other ^f	0.001	7	0.000	7	0.002	5
Total transportation^e						
Natural resources and mining	0.065	2	0.094	2	0.097	3
Construction	0.077	1	0.111	1	0.145	1
Manufacturing	0.035	4	0.036	5	0.040	5
Trade	0.047	3	0.064	3	0.082	4
Utilities and communications	0.019	6	0.043	4	0.100	2
Services	0.019	5	0.022	6	0.026	6
For-hire transportation	0.155	NA	0.151	NA	0.116	NA
In-house truck transportation	0.008	NA	0.001	NA	0.005	NA
In-house other transportation	NA	NA	NA	NA	0.001	NA
Other	0.006	7	0.002	7	0.006	7

^a For-hire truck transportation in 1992 (under both the 1992 and 1997 classification) includes courier (except air courier) services. Courier services are not included in the 1997 estimate of for-hire truck transportation. For-hire truck transportation in 1992, under the 1992 procedure and 1992 classification, includes warehousing and storage.

^b In estimating the 1992 TSAs per the 1997 procedure, natural gas transportation was moved from the utilities to the pipelines sector as natural gas transportation was classified under the pipelines sector in 1997 and hence considered a for-hire transportation mode.

^c Nominal 1992 dollars adjusted using the current series, annual consumer price index (CPI) published by the U.S. Bureau of Labor Statistics for all transportation. In 1992, CPI for all transportation was 140.3 and in 1997, the CPI for all transportation was 160.5.

^d In-house truck in 1992 also includes in-house bus operations as these two operations were estimated together in the 1992 TSAs.

^e Total transportation in 1992 consists of all for-hire transportation and in-house bus and truck transportation under the 1992 procedure and 1992 classification. Under the 1992 procedure and 1997 classification, total transportation in 1992 consists of all for-hire transportation and in-house truck transportation. In 1997, total transportation consists of all for-hire transportation and in-house air, rail, truck, and water transportation.

^f "Other" consists of government enterprise (except State and local government passenger transit) and other input-output special industries. See Ann M. Lawson et al., "Benchmark Input-Output Accounts for the U.S. Economy, 1992: Make, Use, and Supplementary Tables," Survey of Current Business, 1997, 77(11), pp. 58-62.

KEY: NA = Not applicable.

NOTES: Transportation major sector groups excluded from ranking. The major sector group combines several sectors together, e.g., all service sectors.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

Changes in the Direct Cost of Transportation Services by Commodity

Among nontransportation commodities, the transportation content increased the most among those produced primarily in the sectors using significantly more transportation services in 1997 than in 1992. In particular, the total for-hire and in-house truck transportation content of trade (retail and wholesale) commodities increased, after accounting for the change in methodology and the classification system, from 6.4 percent in 1992 to 8.2 percent in 1997. This increase results almost entirely from a real increase in the use of for-hire transportation and in-house trucking in the trade sector (see table 17).

The in-house truck transportation content of construction commodities increased most significantly, which, after accounting for methodology and classification system changes, grew from 9.1 percent in 1992 to 12.4 percent in 1997. The use of in-house trucking in the manufacturing sector grew more quickly than that in the construction sector between 1992 and 1997; however, the in-house truck transportation content of manufacturing commodities grew only marginally. The transportation content of construction commodities increased more significantly than that of manufacturing commodities because transportation accounts for a larger share of total output in the construction sector than in the manufacturing sector (the sectors in which each commodity is produced primarily).

Table 17. Cost of Transportation Services by Commodity: 1992 and 1997

(Per dollar of commodity output at producers' prices)

	Natural resources and mining	Construction	Manufacturing	Trade	Utilities and communications	Services	Other ^a
In-house truck^b							
1992							
1992 procedure; 1992 classification	0.042	0.057	0.008	0.039	0.002	0.011	0.001
1997 procedure; 1997 classification	0.064	0.091	0.007	0.056	0.008	0.013	0.000
1997							
1997 procedure; 1997 classification	0.063	0.124	0.009	0.058	0.006	0.015	0.000
For-hire truck^c							
1992							
1992 procedure; 1992 classification	0.010	0.015	0.015	0.003	0.002	0.004	0.001
1997 procedure; 1997 classification	0.009	0.015	0.015	0.003	0.003	0.004	0.000
1997							
1997 procedure; 1997 classification	0.009	0.014	0.015	0.001	0.003	0.002	0.002
Total transportation							
1992							
1992 procedure; 1992 classification	0.063	0.077	0.036	0.047	0.018	0.021	0.005
1997 procedure; 1997 classification	0.092	0.111	0.038	0.064	0.043	0.023	0.000
1997							
1997 procedure; 1997 classification	0.095	0.145	0.041	0.082	0.100	0.026	0.006

^a "Other" consists of government enterprise (except State and local government passenger transit) and other input-output special industries. See Ann M. Lawson et al., "Benchmark Input-Output Accounts for the U.S. Economy, 1992: Make, Use, and Supplementary Tables," *Survey of Current Business*, 1997, 77(11), pp. 58-62, available at <http://www.bea.gov/scb/pdf/2002/12December/1202I-OAccounts2.pdf> as of Mar. 15, 2011.

^b In-house truck in 1992 also includes in-house bus operations as these two operations were estimated together in the 1992 TSAs.

^c For-hire truck transportation in 1992 (under both the 1992 and 1997 classification) includes courier (except air courier) services. Courier services are not included in the 1997 estimate of for-hire truck transportation. For-hire truck transportation in 1992, under the 1992 procedure and 1992 classification, includes warehousing and storage.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

Changes in the Total Cost of Transportation Services

In both 1992 and 1997, an increase in the final demand for construction had the largest effect on total transportation output (both before and after accounting for the methodology and classification system changes). Across all sectors, a dollar increase in final demand for the services provided by the sector had a larger effect on in-house truck transportation than for-hire truck transportation. This strong reliance on in-house truck transportation relative to for-hire truck transportation to produce a dollar of output can be seen, for each sector, in table 18.

Table 18. Transportation Total Requirements: 1992 and 1997
(Cents per dollar increase in final demand)

	Natural resources and mining	Construction	Manufacturing	Trade	Utilities and communications	Services	Other ^a
In-house truck^b							
1992							
1992 procedure; 1992 classification	0.066	0.073	0.027	0.046	0.018	0.020	0.003
1997 procedure; 1997 classification	0.099	0.111	0.031	0.065	0.035	0.024	0.004
1997							
1997 procedure; 1997 classification	0.099	0.146	0.037	0.068	0.027	0.025	0.003
For-hire truck^c							
1992							
1992 procedure; 1992 classification	0.008	0.006	0.008	0.002	0.027	0.003	0.001
1997 procedure; 1997 classification	0.025	0.031	0.034	0.009	0.056	0.011	0.002
1997							
1997 procedure; 1997 classification	0.022	0.027	0.032	0.005	0.010	0.006	0.004
Total transportation							
1992							
1992 procedure; 1992 classification	0.115	0.119	0.087	0.065	0.079	0.041	0.012
1997 procedure; 1997 classification	0.161	0.162	0.102	0.085	0.135	0.048	0.009
1997							
1997 procedure; 1997 classification	0.168	0.202	0.112	0.105	0.124	0.050	0.013

^a "Other" consists of government enterprise (except State and local government passenger transit) and other input-output special industries. See Ann M. Lawson et al., "Benchmark Input-Output Accounts for the U.S. Economy, 1992: Make, Use, and Supplementary Tables," *Survey of Current Business*, 1997, 77(11), pp. 58-62, available at <http://www.bea.gov/scb/pdf/2002/12December/12021-OAc-counts2.pdf> as of Mar. 15, 2011..

^b In-house truck in 1992 also includes in-house bus operations as these two operations were estimated together in the 1992 TSAs.

^c For-hire truck transportation in 1992 (under both the 1992 and 1997 classification) includes courier (except air courier) services. Courier services are not included in the 1997 estimate of for-hire truck transportation. For-hire truck transportation in 1992, under the 1992 procedure and 1992 classification, includes warehousing and storage.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

With regards to the indirect effect of transportation (the second component of the total cost of transportation services), it can be seen in table 19 that the total industry output multiplier (derived using the 1997 procedure and the 1997 classification system) for for-hire air, truck, and water and in-house truck transportation grew between 1992 and 1997. This growth indicates that an investment in any of these modes has a greater economic impact in 1997 than in 1992. In contrast, the total industry output multiplier for for-hire rail and for warehousing declined and the total industry output multiplier for for-hire pipelines remained nearly constant. The decline in the output multiplier for for-hire rail may be due to the fact that for-hire rail includes scenic and sightseeing rail transportation in 1992 but not in 1997, rather than to a decline in the responsiveness of the economy to a change in the demand for transportation services.

Table 19. Transportation Total Industry Output Multiplier: 1992 and 1997

(Based on 1997 method and 1997 procedure)

	For-hire					In-house		
	Air	Rail; transit and ground passenger transportation	Water	Truck	Warehousing	Pipeline; freight forwarders; and other transportation services ^a	Truck ^b	Air, rail, and water
1992								
1992 procedure; 1992 classification	1.958	1.902	1.942	2.011	NA	1.733	1.499	NA
1997 procedure; 1997 classification	1.976	1.911	2.031	1.944	1.807	1.893	1.608	NA
1997								
1997 procedure; 1997 classification	2.142	1.868	2.311	1.993	1.574	1.895	2.155	2.219

^a Includes arrangement of passenger transportation.

^b In-house truck in 1992 also includes in-house bus operations as these two operations were estimated together in the 1992 TSAs.

SOURCE: U.S. Department of Transportation, Research and Innovative Technology Administration, Bureau of Transportation Statistics.

Future Work

By providing detailed industry use of transportation services and measuring in-house transportation, the TSAs provide a more comprehensive picture of the role of transportation in the U.S. economy. This report provides an update as to this role. Future updates can improve and extend the measured impacts by:

- Updating data sources used in creating distribution weights.
- Adding other modes of in-house transportation, such as the business use of automobiles, when information becomes available.
- Treating in-house transportation in the same manner as the I-O accounts treat the use of for-hire transportation, that is, only transportation expenses associated with moving intermediate inputs to the industry plus the expenses for certain direct transportation services. Doing so would require detailed information on the type of commodities carried by in-house truck and on the origin and destination of the transported commodities.

Future production of the TSAs also can allow for examination of the changing role of transportation in the economy. The TSAs based on the 2002 I-O benchmark accounts are forthcoming.

Online Appendix

The following detailed tables can be accessed online at the BTS website:

- TSA Detailed Make of Commodities by Industries: 1997 http://www.bts.gov/publications/transportation_satellite_accounts/2011/html/appendix_table_01.html
- TSA Detailed Use of Commodities by Industries: 1997 http://www.bts.gov/publications/transportation_satellite_accounts/2011/html/appendix_table_02.html
- TSA Detailed Commodity-by-Industry Direct Requirements: 1997 http://www.bts.gov/publications/transportation_satellite_accounts/2011/html/appendix_table_03.html
- TSA Detailed Industry-by-Commodity Total Requirements: 1997 http://www.bts.gov/publications/transportation_satellite_accounts/2011/html/appendix_table_04.html



Printed on paper containing recycled post
consumer waste paper