



U.S. Freight on the Move: Highlights From the 2012 Commodity Flow Survey Preliminary Data

by Michael Margreta, Chester Ford, and Ryan Grube

According to preliminary estimates from the 2012 Commodity Flow Survey (CFS), nearly 11.7 billion tons of freight, valued at \$13.6 trillion, was transported about 3.3 trillion ton-miles in 2012 by shippers in manufacturing, wholesale trade, and mining in the United States¹ (see box A for description of the CFS).

Said another way, on a typical day in 2012, 32.0 million tons of goods, valued at \$37.3 billion, moved nearly 9.1 billion ton-miles² on the Nation's transportation network.

¹ Preliminary data tables 1 through 6 from the 2012 Commodity Flow Survey are available online at: http://www.bts.gov/publications/commodity_flow_survey/preliminary_tables_december_2013/index.html

² A ton-mile is defined as 1 ton of freight transported 1 mile.

Box A The Commodity Flow Survey (CFS)

The 2012 CFS, a sample survey of 102,565 shippers sponsored by the Bureau of Transportation Statistics (BTS) in partnership with the Census Bureau, provides a detailed, multimodal picture of national freight flows by the manufacturing, wholesale trade, and mining sectors. The survey is the only publicly available source of national commodity flow data for the highway mode. CFS data are collected every 5 years as a component of the national Economic Census and provide a benchmark on the value, tonnage, ton-miles, distance shipped, and mode used to transport commodities. Previous surveys were conducted in 1993, 1997, 2002, and 2007. Final CFS data are scheduled for release in December 2014. Analysis and research utilizing CFS data are used to make decisions in the public and private sectors involving policy, infrastructure, and the economy.

Table 1: Value, Tonnage, and Ton-Miles of U.S. Shipments by Mode of Transport, Percent of Total: 2012

Transportation mode	Value (million \$)	Percent of total	Tons (thousands)	Percent of total	Ton-miles (millions)	Percent of total	Average miles per shipment
All modes	13,625,059	100	11,695,463	100	3,319,666	100	586
Truck	10,038,086	74	8,190,126	70	1,264,346	38	216
Rail	455,114	3	1,851,276	16	1,477,623	45	811
Water	280,916	2	510,654	4	208,316	6	842
Air (includes truck to/from airport)	397,445	3	4,676	–	6,341	–	1,229
Pipeline	607,227	4	720,067	6	NA	NA	56
Parcel, USPS, or courier	1,578,261	12	26,747	–	20,581	1	879
Multiple modes	265,980	2	321,037	3	290,171	9	NA
Other and unknown modes	2,030	0	70,880	1	279	–	2

NOTE: A percent below 0.5 percent is marked by a dash (–) in the table.
NA = not available due to high sampling variability or poor response quality.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2012 Commodity Flow Survey, preliminary data table 1, December 2013.

Box B How to Interpret Value of Shipments

As defined by the Commodity Flow Survey (CFS), the value of shipments is the net selling dollar value of the entire shipment, exclusive of freight charges and excise taxes. The CFS total value of shipments and the U.S. Gross Domestic Product (GDP) provide different measures of economic activity and as such, are not directly comparable. Three important differences can be identified between value of shipments and GDP:

1. GDP captures goods and services produced by all establishments located in the United States, while the CFS measures goods shipped from a subset of establishments.
2. GDP measures the value of goods produced and of services performed, while the CFS measures the value of goods shipped.
3. GDP counts only the value added at each step in the production of a product, whereas the CFS determines the value of materials used in the production or manufacturing of a product, as well as the value of the finished product itself. Therefore, the value of a commodity may be counted by the CFS more than once during its distribution cycle.

Box C Mileage Calculations for the Commodity Flow Survey

A critical measurement calculated from the CFS data is the mileage traveled by each shipment, which is used in estimating modal ton-miles of freight. Consequently, the Bureau of Transportation Statistics (BTS) developed GeoMiler^{*}, an innovative software tool to calculate the distance traveled by mode from origin to destination of any given shipment for which valid and consistent information was provided by the CFS respondent. If for any reason modal mileage calculations are not obtainable for a given shipment, GeoMiler sets pre-arranged codes that explain the problem for possible correction. This new tool for distance estimation uses Geographic Information System (GIS) technology and a robust spatial data network to create a unique and effective routing tool.

^{*} A detailed explanation of the development of GeoMiler may be found in BTS Technical Report TR – 001, *How Freight Moves: Estimating Mileage and Routes Using an Innovative GIS Tool*, June 2007.

How Did Freight Move?

By Truck³

Trucking is the predominant mode in both value and tonnage of CFS shipments. In the 2012 CFS preliminary data, truck shipments accounted for:

- about \$10.0 trillion worth of goods and 73.7 percent of the total value of all shipments (figure 1);
- about 8.2 billion tons of goods and 70.0 percent of all tonnage (figure 2);
- about 1.3 trillion ton-miles, representing approximately 38.1 percent of all ton-miles (figure 3); and
- an average distance of 216 miles per shipment (see table 1).

The CFS distinguishes between two categories of truck: for-hire⁴ and private.⁵ For-hire trucks handled more than

³ The type of truck shipments under discussion is single mode; that is, the shipments were not transported in combination with any other mode, such as rail, water, or air.

⁴ For-hire means that the truck was operated on behalf of, or by, a non-governmental business entity that provides transport services to its customers for compensation.

⁵ Private means that the truck is not available to any other business entity, nor the public, and is owned and/or operated by an individual, group, or non-governmental business entity for its own purposes or benefits.

half the tonnage and two-thirds the total value of goods moved by truck (table 2). Based on past surveys, truck moved the most total tonnage, largely comprised of gravel and crushed stone, gasoline, natural sands, fuel oils, and most mixed freight.

Goods moved by private truck typically travel much shorter distances than goods carried by for-hire trucks. The average miles per shipment by private truck in the 2012 CFS was 46 miles, compared to 489 miles by for-hire truck.

Table 2: Value and Tonnage of U.S. Highway Shipments: 2012

Highway transportation mode	Value (million \$)	Percent of total	Tons (thousands)	Percent of total
Total ¹	10,038,086	100	8,190,126	100
For-hire truck	6,609,327	66	4,390,790	54
Private truck	3,428,759	34	3,799,335	46

¹ Results are for highway shipments that were single mode and not transported by any other mode.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2012 Commodity Flow Survey, preliminary data table 1, December 2013.

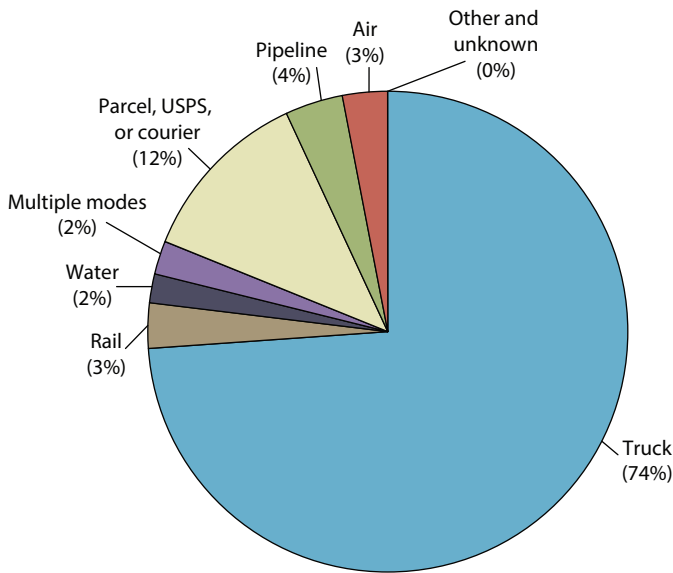
By Rail⁶

In the 2012 CFS, rail shipments accounted for:

- \$455.1 billion worth of goods, 3.3 percent of the total value of shipments by all modes (figure 1);

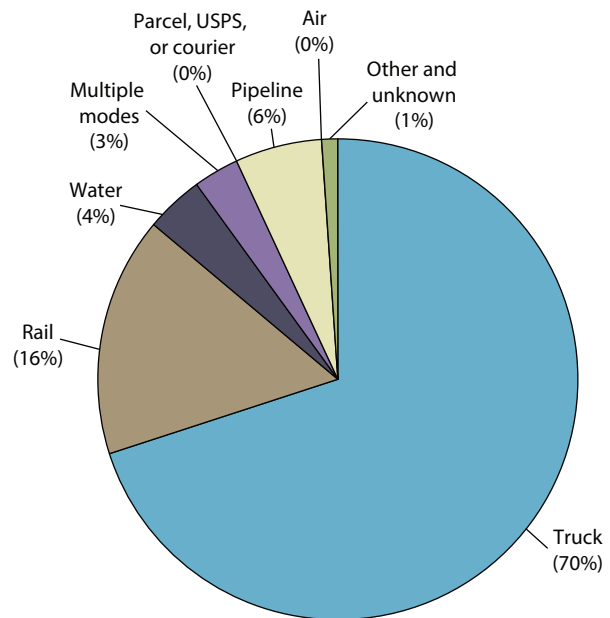
⁶ The type of rail shipments under discussion is single mode; that is, the shipments were not transported in combination with any other mode, such as truck, water, or air.

Figure 1: Value of U.S. Shipments by Mode of Transport, Percent of Total: 2012



SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2012 Commodity Flow Survey, preliminary data table 1, December 2013.

Figure 2: Tonnage of U.S. Shipments by Mode of Transport, Percent of Total: 2012



SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2012 Commodity Flow Survey, preliminary data table 1, December 2013.

- almost 1.9 billion tons of goods, about 15.8 percent of the total tonnage (figure 2);
- about 1.5 trillion ton-miles, 44.5 percent of all ton-miles (figure 3); and
- an average distance of 811 miles per shipment, showing the long-haul nature of the rail mode.

Based on past surveys, single-mode rail traffic is largely composed of heavy, bulk shipments, such as cereal grains, metallic ores, coal, and chemicals.

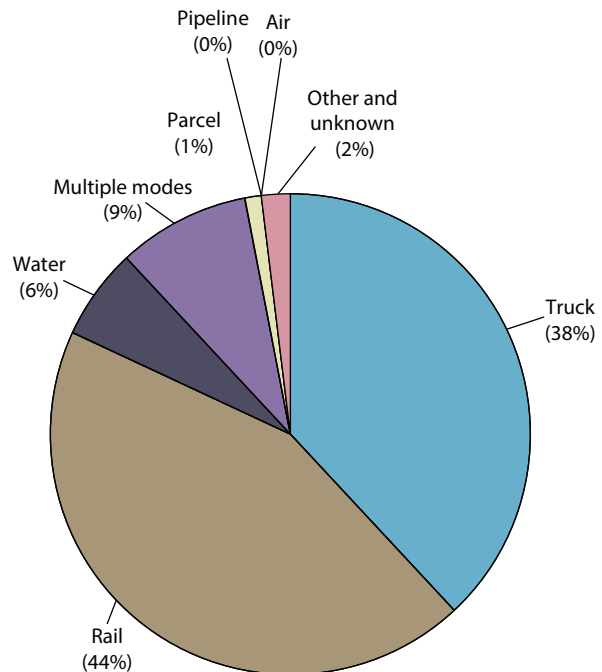
By Water⁷

Whether traveling on inland waterways, deep sea waterways, or the Great Lakes, waterborne shipments in the 2012 CFS preliminary data accounted for:

- about \$280.9 billion worth of goods (table 3), 2.1 percent of the total value of all shipments (figure 1);
- approximately 510.7 million tons of goods, 4.4 percent of all tonnage (figure 2);
- about 208.3 billion ton-miles, 6.3 percent of all ton-miles (figure 3); and
- an average distance of 842 miles per shipment.

Based on past surveys, bulk and low-value commodities are primarily transported by rail and water modes. In 2012

Figure 3: Ton-Miles of U.S. Shipments by Mode of Transport, Percent of Total: 2012



SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2012 Commodity Flow Survey, preliminary data table 1, December 2013.

⁷ The type of water shipments under discussion is single mode; that is, the shipments were not transported in combination with any other mode, such as truck, rail, or air. Estimates in 2012 are not comparable to those in 2007 because waterborne mileages in the 2012 CFS were calculated using a different methodology.

Table 3: Value and Tonnage of U.S. Waterborne Shipments: 2012

Waterborne transportation mode	Value (million \$)	Percent of total	Tons (thousands)	Percent of total
Total ¹	280,916	100	510,654	100
Inland water	202,245	72	374,186	73
Great Lakes	443	0	23,518	5
Deep sea	54,999	20	63,268	12
Multiple waterways ²	23,229	8	49,682	10

¹ Results are for waterway shipments that were only water mode and not transported by any other mode.

² There are three basic types of waterways shown in the Commodity Flow Survey: inland water, deep sea, and Great Lakes. Those waterway-only shipments that traveled on both inland water and deep sea are classified in Multiple Waterways.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2012 Commodity Flow Survey, preliminary data table 1, December 2013.

Table 4: Value per Ton of U.S. Freight Shipments by Mode of Transportation: 2012

Transportation mode	Value (million \$)	Tons (thousands)	Value per ton ¹ (current dollars)
All modes (includes multiple modes)	13,625,059	11,695,463	\$1,165
Single mode	11,778,787	11,276,799	\$1,045
Truck	10,038,086	8,190,126	\$1,226
Rail	455,114	1,851,276	\$246
Water	280,916	510,654	\$550
Air (includes truck and air)	397,445	4,676	\$84,997
Pipeline	607,227	720,067	\$843
Parcel, USPS, or courier	1,578,261	26,747	\$59,007

¹ Value per ton is defined as the average worth in current dollars of 1 ton of freight. This measure is computed by dividing the total value by the tons of freight originated.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2012 Commodity Flow Survey, preliminary data table 1, December 2013.

water shipments were valued on average at \$550 per ton and rail shipments at \$246 per ton (table 4), the two lowest modal values per ton in the 2012 CFS. Among the major commodity groups shipped in bulk via waterway are grains, gravel and crushed stone, coal, petroleum products, chemicals, and fertilizers.

The 2012 CFS improved the routing process to better reflect freight movement by water. In 2007 shipments that traveled by both river and ocean were primarily tabulated under "Other Multiple Modes." For 2012 shipments were assigned to their dominant waterway segment, and a new category of "Multiple Waterways" was created for shipments that are truly carried on both inland and deep sea vessels.

By Other Modes

In 2012 demand remained steady for time-sensitive delivery modes, such as air and parcel,⁸ capable of providing

⁸ For the 2007 CFS, an air shipment was defined as weighing 100 pounds or more. Otherwise, the mode was changed to parcel on air shipments with weight less than 100 pounds. However, for the 2012 CFS, air shipments were accepted regardless of weight, and a parcel shipment was defined as weighing 150 pounds or less; otherwise, the mode was changed to for-hire truck on parcel shipments with weight more than 150 pounds.

delivery within three business days worldwide.⁹ The combined value of air and parcel shipments in 2012 totaled approximately \$2.0 trillion, about 14.5 percent of total CFS value.

Based on past surveys, commodities shipped by air and parcel are generally high-value and low-weight: electronic and other electrical equipment, precision instruments, and pharmaceutical products.

To illustrate the high-value but low-weight relationship, the value-per-ton ratio for air shipments (including truck drayage to/from the airport) was \$84,997 per ton, while the value-per-ton ratio for parcel shipments was \$59,007 per ton (table 4).

Which Industries Were Shipping Goods?

Shipments by manufacturing industries accounted for 41.9 percent of total value (table 5, figure 4) and 37.0 percent of total weight (table 5, figure 5), as surveyed by the CFS.

⁹ FedEx Annual Report 2013, annual report online, pages 17-21, at <http://investors.fedex.com/phoenix.zhtml?c=73289&p=irol-reportsannual> and UPS Annual Report 2012, annual report online, pages 22-24, at http://www.annualreports.com/Click/14356?_SID_=201402261434031f8d090bd5cd13bb313314be231b7e8a

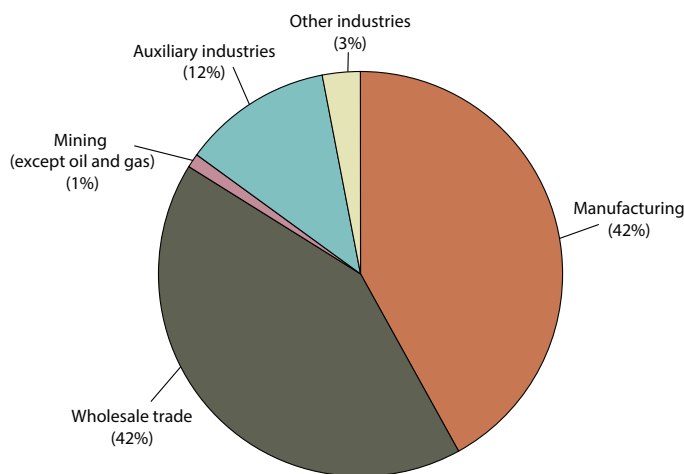
Table 5: Value and Tonnage of U.S. Shipments by Industry, Percent of Total: 2012

Industry	Value (million \$)	Percent of total	Tons (thousands)	Percent of total
All industries	13,625,059	100	11,695,463	100
Mining (except Oil and Gas)	108,982	1	3,231,752	28
Manufacturing	5,702,546	42	4,327,439	37
Wholesale trade	5,719,690	42	3,613,366	31
Auxiliary industries	1,686,696	12	458,900	4
Other industries	407,145	3	64,006	0

NOTE: Industry categories are based on North American Industry Classification System (NAICS) codes, from 2 up to 6 digits. Mining encompasses those establishments with NAICS code 212; Manufacturing is those with NAICS codes 31 thru 33; Wholesale Trade is those with NAICS code 42; Auxiliary Industries are those with NAICS codes 4931 and 551114; Other Industries encompass establishments with any other NAICS codes.

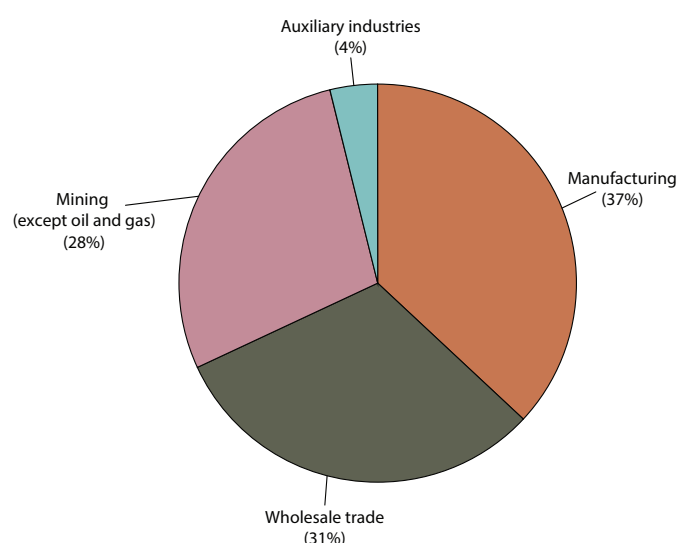
SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2012 Commodity Flow Survey, preliminary data table 5, December 2013.

Figure 4: Value of U.S. Shipments by Industry, Percent of Total: 2012



SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2012 Commodity Flow Survey, preliminary data table 5, December 2013.

Figure 5: Tonnage of U.S. Shipments by Industry, Percent of Total: 2012



SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2012 Commodity Flow Survey, preliminary data table 5, December 2013.

Shipments by wholesalers accounted for 42.0 percent of total value and 30.9 percent of total weight. Auxiliary establishments¹⁰ shipped approximately \$1.7 trillion of freight, accounting for 12.4 percent of total value.

What Were the Leading Goods¹¹ Shipped by Value, Tonnage, and Ton-miles?

The top two commodity groups by value at \$1.4 trillion and \$1.2 trillion, respectively, were mixed freight¹² and

¹⁰ Auxiliary establishments are those specifically involved in warehousing and storage, or as corporate, subsidiary, and regional managing offices.

¹¹ Commodity goods in the CFS are classified by Standard Classification of Transported Goods (SCTG) codes. Developed as a joint effort of the United States and Canada, the SCTG is a hierarchical coding system that groups commodities by transportation characteristics (volume, revenue, value, origin, and destination), similarities of goods, and industry-of-origin considerations, regardless of mode(s) of transport.

¹² Mixed freight includes items (food also) for grocery and convenience stores, supplies and food for restaurants and fast-food chains, hardware or plumbing supplies, and office supplies.

fuels (gasoline, aviation turbine fuel, and ethanol, table 6). These two commodity groups accounted for about 18.8 percent of the total value of goods transported. Other leading commodity groups by value were electronic and electrical equipment, motorized and other vehicles, pharmaceutical products, and machinery, which totaled approximately \$3.5 trillion or 25.8 percent of the total value of goods transported. When combined, the top six commodity groups accounted for about 44.6 percent of the total CFS value (table 6).

By weight, the top commodity group was gravel and crushed stone, accounting for nearly 1.8 billion tons or about 15.2 percent of total tonnage in the 2012 CFS (table 7). Gravel and crushed stone shipments were transported over relatively short distances, with an average mileage per shipment of 34 miles. Gravel and crushed stone shipments had a low bulk value of only \$11 per ton.

Table 6: Value by Two-Digit Commodity Code: 2012

SCTG code ¹ and commodity description	Value ² (million \$)
All commodities	13,625,059
Top 15 commodities	
43: Mixed freight	1,388,304
17: Gasoline, aviation turbine fuel, and ethanol	1,172,425
35: Electronic, electrical equipment & components	974,160
36: Motorized and other vehicles including parts	934,536
21: Pharmaceutical products	849,809
34: Machinery	756,701
18: Fuel oils	642,774
07: Other prepared foodstuffs, fats, oils	597,943
24: Plastics and rubber	540,008
30: Textiles, leather, and such articles	527,595
40: Miscellaneous manufactured products	505,270
32: Base metal in primary, semi-finished forms	467,724
33: Articles of base metal	360,808
38: Precision instruments and apparatus	343,949
23: Chemical products & preparations, nec ³	330,765

¹ Based on 2-digit code for Standard Classification of Transported Goods (SCTG).

² Horizontal lines and color codes are used within the table to group the commodities. Commodities within the same group, or the same color code, cannot be determined to be different statistically from one another. However, from top to bottom, a change in grouping, or a change in color, denotes a statistical decrease in level of value, based on statistical significance testing at the 95 percent confidence level.

³ nec = not elsewhere classified.

NOTE: The Commodity Flow Survey measures commodity traffic in forty-one 2-digit SCTG commodity groups. The top commodity groups by value are presented in this table.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2012 Commodity Flow Survey, preliminary data table 6, December 2013.

In 2012 other leading commodity groups by weight included coal and fuels (gasoline, aviation turbine fuel, and ethanol). When combined, the top three commodity groups accounted for nearly 4.4 billion tons, or 37.6 percent of total tonnage.

Among the commodity groups, coal generated the most ton-miles (table 8). A total of 1.4 billion tons of coal was moved 982.5 billion ton-miles, which was about 29.6 percent of the total ton-miles recorded in the 2012 CFS. The primary U.S. coal deposits are found in the Powder River basin of Wyoming and the states of Kentucky, West Virginia, and Pennsylvania.¹³

¹³ *Goode's World Atlas*, 22nd Edition, published by Rand McNally & Company, July 2009.

Table 7: Tonnage by Two-Digit Commodity Code: 2012

SCTG code ¹ and commodity description	Tons ² (thousands)
All commodities	11,695,463
Top 15 commodities	
12: Gravel and crushed stone	1,779,590
15: Coal	1,366,054
17: Gasoline, aviation turbine fuel, and ethanol	1,249,882
31: Non-metallic mineral products	861,110
18: Fuel oils	757,539
07: Other prepared foodstuffs, fats, oils	522,932
19: Other coal and petroleum products, nec ³	455,891
02: Cereal grains	453,503
11: Natural sands	407,170
43: Mixed freight	370,781
20: Basic chemicals	362,437
32: Base metal in primary, semi-finished forms	299,691
26: Wood products	292,485
41: Waste and scrap	226,733
03: Other agricultural products	224,771

¹ Based on 2-digit code for Standard Classification of Transported Goods (SCTG).

² Horizontal lines and color codes are used within the table to group the commodities. Commodities within the same group, or the same color code, cannot be determined to be different statistically from one another. However, from top to bottom, a change in grouping, or a change in color, denotes a statistical decrease in level of value, based on statistical significance testing at the 95 percent confidence level.

³ nec = not elsewhere classified.

NOTE: The Commodity Flow Survey measures commodity traffic in forty-one 2-digit SCTG commodity groups. The top commodity groups by tonnage are presented in this table.

SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2012 Commodity Flow Survey, preliminary data table 6, December 2013.

Table 8: Ton-Miles by Two-Digit Commodity Code: 2012

SCTG code ¹ and commodity description	Ton-miles ² (millions)
All commodities	3,319,666
Top 15 commodities	
15: Coal	982,517
07: Other prepared foodstuffs, fats, oils	180,437
02: Cereal grains	162,647
20: Basic chemicals	147,018
18: Fuel oils	126,919
03: Other agricultural products	119,528
32: Base metal in primary, semi-finished forms	109,460
12: Gravel and crushed stone	108,022
17: Gasoline, aviation turbine fuel, and ethanol	97,614
24: Plastics and rubber	94,590
31: Non-metallic mineral products	92,791
19: Other coal and petroleum products, nec ³	78,773
43: Mixed freight	77,239
26: Wood products	74,867
27: Pulp, newsprint, paper, and paperboard	71,945

¹ Based on 2-digit code for Standard Classification of Transported Goods (SCTG).

² Horizontal lines and color codes are used within the table to group the commodities. Commodities within the same group, or the same color code, cannot be determined to be different statistically from one another. However, from top to bottom, a change in grouping, or a change in color, denotes a statistical decrease in level of value, based on statistical significance testing at the 95 percent confidence level.

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SOURCE: U.S. Department of Transportation, Bureau of Transportation Statistics, 2012 Commodity Flow Survey, preliminary data table 6, December 2013.

About this report

This article was a collaborative effort on the part of the following from the Bureau of Transportation Statistics (BTS): Michael Margreta, Survey Statistician; Chester Ford, Transportation Industry Analyst; and Ryan Grube, Transportation Analyst from MacroSys Research and Technology. BTS is a component of DOT's Office of the Assistant Secretary for Research and Technology.

Throughout this report, comparisons are made between different entities (numbers, groups, classifications, categories, etc. developed from a sample), and an increase or decrease is cited as a percentage change or statistical difference. Such a change is only given if statistically significant at the 5 percent level. The 5 percent level means that there is a 5 percent chance that a statistically significant difference will be claimed between two different entities from the sample when, in fact, no such difference truly exists in the entire population.

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