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Steel Stocks in Use in Automobiles in the United States

The U.S. Geological Survey estimated the quantity of steel stocks in use in the United States to be 4.13 billion metric tons as of 2002 (Sullivan, 2005). Stocks in use include the steel in airplanes, automobiles, bridges, buildings, household appliances, machinery, and many other applications and exclude steel in solid-waste facilities. Continuous use of steel through recycling, remanufacturing, and reuse allows stocks in use to be considered a resource in place. The term "steel" is used here to denote carbon steel, galvanized steel, stainless steel, and high-strength low-alloy steel (HSLA), as well as cast iron and iron.

Automobiles are made from a great variety of materials, including steel, aluminum, copper, and plastics. Steel is still the largest component by weight used in an automobile, accounting for more than 60 percent of an average automobile's weight (table 1). Automakers consider steel a cost-effective material that is highly formable, at the same time maintaining its durability, high strength, and stiffness (Ashley, 1997).

Between 95 and 100 percent of the steel used in automobiles can be recycled or reused as reclaimed parts (American Metal Market, 1993, p. 13A–14A; 1994, p. 6; Great Lakes Institute for Recycling Markets, 1998, p. 10). Steel used in automobile bodies is made with about 25 percent recycled steel, whereas internal steel parts are made with a higher percentage of recycled steel (Steel Recycling Institute, 2005).

This Fact Sheet compares all steel stocks in use with steel stocks in use within automobiles in the United States. Automobiles in use in the United States include domestic and imported passenger cars, sport utility vehicles (SUVs), trucks, light trucks, vans, and minivans in commercial (taxicabs and limousines), government, and private use. Data on vehicles with an average vehicle curb weight greater than 8,500 pounds are not included in the Fact Sheet. The curb weight (CW) is the total weight of a vehicle without passengers or cargo.

During the past 30 to 35 years, the use of steel in automobiles has decreased in terms of (1) the average amount by weight used per vehicle and (2) steel's percentage of the average vehicle curb weight (table 1). In model year 1970, steel made up about 87.3 percent of the average automobile's CW. This percentage dropped to about 78.4 percent by model year 1985, to about 68.4 percent by 2000, and to about 66.4 percent in 2004. The decline in steel usage by weight per vehicle of about 32 percent between model years 1970 and 2004 was due largely to downsizing of the automobile and substitution (1) of aluminum, magnesium, and plastics for steel body parts and (2) of aluminum for cast iron in cylinder heads, engine blocks, and rear-axle and transmission housings.

From 1970 through 2001, the number of automobiles in use increased by more than 120 percent, and the estimated average steel content per vehicle in use decreased by about 28 percent (table 2). In 1970, the average steel content per vehicle in use was 3,050 pounds, 98.1 million vehicles were in use, and the steel stocks in use within automobiles in the United States were about 136 million metric tons (136 Mt), which were 6.2 percent of all steel stocks in use (2,210 Mt). At the end of the 31-year period, 217 million automobiles were in use, but the average steel content per vehicle in use had decreased to 2,210 pounds. Therefore, the percentage of steel stocks in use within automobiles in the United States decreased to about 5.3 percent of all steel stocks in use (4,070 Mt).

Steel contained within all stocks in use increased at a rate of about 2.0 percent per year, whereas steel stocks contained in automobiles in use increased at a rate of about 1.5 percent per year from 1970 to 2001. It would appear that the decreased use of steel per vehicle was offset by the increase in the number of automobiles in use and that all steel stocks in use increased, but not as a result of steel's use in automobiles (fig. 1).

By the mid-1960s, concerns about automobile safety (National Traffic and Motor Vehicle Safety Act and Highway Safety Act, both enacted in 1966) initially increased the use of steel in automobiles. The estimated average content of steel in automobiles in the mid-1960s was 3,000 pounds per vehicle (table 2). By 1975, the average steel content of automobiles in use had increased to 3,160 pounds per vehicle (table 2). Concerns about automobile exhaust emissions and fuel efficiency led to emission controls (Clean Air Act, enacted in 1970) and increased mileage-per-gallon standards expressed as corporate average fuel economy (CAFE) standards (Energy Policy Conservation Act, enacted in 1975). First established in 1978, fuel-efficiency requirements have been changed since then in 1979, 1980, 1981, 1985, 1986, and 1990 (National Highway Traffic Safety Administration, 2005a). As CAFE and emission laws became more stringent in the late 1970s through the mid-1980s, automakers needed to improve fuel economy. This goal was achieved in part by reducing the weight of the automobile by changing construction design and by substituting lighter weight metals and plastics for steel.

In 1980, the average steel content per automobile in use was about 2,950 pounds. By 1990, the average steel content per automobile had decreased to 2,410 pounds. However because of a

Table 1. Steel content of automobiles built in the United States, averaged for selected model years.

[CW, curb weight of automobile. Sources: Ward's Communication, 1977, p. 65; 1982, p. 21; 1985, p. 21; 1987, p. 30; 1989, p. 37; 1990, p. 73; 2002, p. 37; J.F. Lemons, Jr., U.S. Bureau of Mines, written commun., 1989; D.A. Kramer, U.S. Geological Survey, oral and written commun., January 25, 2005; National Highway Traffic Safety Administration, 2005b]

Auto weight and steel content	Model year								
	1970	1975	1980	1985	1990	1995	2000	2001	2004
Average CW, in pounds	3,620	3,730	2,870	2,870	2,910	3,050	3,130	3,150	3,240
Average steel content per vehicle, in pounds	3,160	2,830	2,460	2,250	2,170	2,170	2,140	2,130	2,150
Average steel content per vehicle as a percentage of average CW	87.3	75.9	85.7	78.4	74.6	71.1	68.4	67.6	66.4

Table 2. Automobiles in use and steel stocks in use in automobiles and all applications in the United States, averaged for selected years.

[Mt, million metric tons; each metric ton equals 2,204.6 pounds. Sources: Ward's Communication, 1977, p. 65; 1982, p. 21, 212; 1985, p. 21; 1987, p. 30, 147; 1989, p. 37; 1990, p. 73; 2002, p. 277; J.F. Lemons, Jr., U.S. Bureau of Mines, written commun., 1989; Davis, 1997, p. 3–7; Davis and Diegel, 2004, p. 3–5; Sullivan, 2005; D.A. Kramer, U.S. Geological Survey, oral and written commun., January 25, 2005; The Polk Company, oral commun., April 4, 2005]

Autos and steel stocks	Calendar year								
	Mid-1960s	1970	1975	1980	1985	1990	1995	2000	2001
Automobiles in use, in millions of units	90.6	98.1	120	140	157	179	193	213	217
Average steel content per vehicle in use, in pounds	3,000	3,050	3,160	2,950	2,680	2,410	2,260	2,220	2,210
Steel stocks contained within automobiles in use, in Mt	125	136	172	187	191	196	198	214	217
All steel stocks in use, in Mt	1,702	2,210	2,570	2,920	3,180	3,410	3,660	4,010	4,070
Steel stocks contained within automobiles in use, as a percentage of all steel stocks in use	7.3	6.2	6.7	6.4	6.0	5.7	5.4	5.3	5.3

28 percent increase in the number of automobiles in use from 1980 to 1990, steel stocks in use in automobiles increased by about 5 percent.

Through the 1990s, demand increased for larger vehicles such as vans, SUVs, light trucks, and trucks; use of these larger vehicles led to an 11 percent increase in steel stocks in use in automobiles by 2001. Steel stocks in use in automobiles amounted to about 198 Mt, 5.4 percent of steel contained within all stocks in use in 1995. By 2001, steel stocks in use in automobiles reached 217 Mt, 5.3 percent of steel contained within all stocks in use.

If the popularity of larger vehicles continues, automobile manufacturers will need to keep weight increases to a minimum in order to meet emissions and fuel-efficiency requirements. The increased use of light-weight metals and materials such as aluminum, magnesium, and plastics in automobiles is expected to continue; with substitution of these materials where possible, the amount of steel used per vehicle may continue to decline. With more automobiles in use, steel stocks in use contained in automobiles are expected to remain flat or slightly increase.

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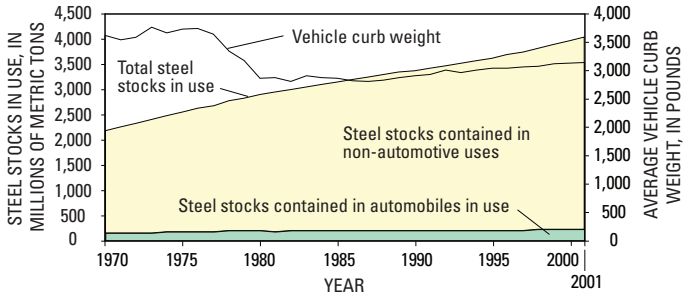

Figure 1. Comparison of steel stocks in use contained in automobiles in use with all steel stocks in use and the average vehicle curb weight in the United States for the years 1970 through 2001. Sources as in tables 1 and 2.

References Cited

American Metal Market, 1993, Steel Monthly—Electric furnace steel: February 18, p. 13A–14A.

American Metal Market, 1994, Steel-funded study knocks aluminum in cars: April 28, p. 6.

Ashley, S., 1997, Steel cars face a weighty decision: Mechanical Engineering, v. 119, no. 2 (February 1997), p. 56–62.

Davis, S.C., 1997, Transportation energy data book; Edition 17: Oak Ridge, Tenn., Oak Ridge National Laboratory, Center for Transportation Analysis, Energy Division, 280 p., available online at http://www.ntl.bts.gov/lib/5000/5800/5844/17th_edition/tedb17.pdf. (Accessed May 23, 2005.)

Davis, S.C., and Diegel, S.W., 2004, Transportation energy data book; Edition 24: Oak Ridge, Tenn., Oak Ridge National Laboratory, Center for Transportation Analysis, Engineering Science & Technology Division, 348 p., available online at http://cta.ornl.gov/data/index.shtml. (Accessed December 5, 2005.)

Great Lakes Institute for Recycling Markets, 1998, Auto recycling demonstration project: Ann Arbor, Mich., 132 p., available online at http://www.deq.state.mi.us/documents/deq-ead-recycle-autofinal.pdf. (Accessed May 17, 2005.)

National Highway Traffic Safety Administration, 2005a, CAFE overview—Frequently asked questions: available online at http://www.nhtsa.dot.gov/cars/rules/CAFE/overview.htm. (Accessed April 29, 2005.)

National Highway Traffic Safety Administration, 2005b, New passenger car fleet average characteristics and Historical passenger car fleet average characteristics: available online at http://www.nhtsa.gov/cars/rules/CAFE/NewPassengerCarfleet.htm and http://www.nhtsa.gov/cars/rules/CAFE/HistoricalCarfleet.htm. (Accessed December 5, 2005.)

Steel Recycling Institute, 2005, Recycling scrapped automobiles: Pittsburgh, Pa., 1 p., available online at http://www.recycle-steel.org/pdfs/brochures/auto.pdf. (Accessed May 17, 2005.)

Sullivan, D.E., 2005, Metal stocks in use in the United States: U.S. Geological Survey Fact Sheet 2005–3090, 2 p., available online at http://pubs.usgs.gov/fs/2005/3090. (Accessed December 5, 2005.)

Ward's Communication, 1977–2002 (selected years), Ward's automotive yearbook: Southfield, Mich., 1977, 382 p.; 1982, 247 p.; 1985, 242 p.; 1987, 264 p.; 1989, 304 p.; 1990, 304 p.; 2002, 350 p.

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