

Structural Steel: An Industry Overview

American Institute of Steel Construction

November 2008 (A)

The United States structural steel industry annually supplies fabricated and erected structural steel framing to over 50,000 buildings through a network of producers, service centers, steel fabricators and erectors. Total industry employment is estimated to be in excess of 300,000 individuals in 4,000 firms. Total industry revenue in 2008 is estimated to be in excess of 20 billion dollars.

Structural Steel Supply Chain

The four distinct components of the structural steel industry are:

- *Producers* of structural steel products including hot-rolled structural shapes (wide flange beams, plate, channels and angles) and manufacturers of hollow structural sections (formerly known as tubular steel).
- *Service Centers* that function as warehouses and provide limited preprocessing of structural material prior to fabrication.
- *Structural Steel Fabricators* that physically prepare the structural steel for a building through a process of developing detailed drawings (the work of a detailer) based upon the construction drawings provided by a structural engineer; material management; cutting; drilling; shop fitting (bolting and welding); painting (when required); and shipping.
- *Erectors* that construct the structural steel frame on the project site by bolting and field welding structural steel components together according to the construction documents.

Producers (* denotes AISC member company)

Three major mill producers (Nucor-Yamato Steel/Nucor Berkeley*, Gerdau-Ameristeel* and Steel Dynamics Inc.*) account for over 90% of all wide flange steel produced in the United States. Five producers, including the three major mills, supply the market with miscellaneous hot-rolled shapes such as angles and channels. All hot-rolled products are produced utilizing electric arc furnaces utilizing ferrous scrap as the primary feed stock. The use of scrap results in an average recycled content of 88% for all hot-rolled structural material produced in the United States.

Structural steel, long considered the premier green construction material, is continuing to improve its environmentally friendly position by reducing greenhouse gas emissions. While numerous legislative and regulatory efforts have targeted emissions, energy efficiency, and related environmental concerns in recent years, the structural steel industry has been proactive in pursuing measures of its own that typically exceed regulatory requirements.

The results of structural steel industry efforts are evident in recent Environmental Protection Agency findings on greenhouse gasses, which show that the iron and steel industry reduced carbon emissions by 47% between 1990 and 2005 along with the highest overall emissions reduction of any major industry of 67%. By comparison, initiatives such as the Kyoto Protocol would have required U.S. industries to reduce emissions by 5.2% by 2012.



At the same time, the industry remains the world leader in the use of recycled material and end-of-life recycling, with the recycled content of the structural steel beams and columns produced at U.S. mills averaging 88% and a recycling rate of 98%. The steel industry has also continually pursued methods for reducing energy consumption and has reduced energy intensity per ton of steel by 29% since 1990. The industry also has committed to the Climate Vision program, which seeks to reduce energy usage by an additional 10 percent by 2012.

Production of hot-rolled structural steel in the United States in 2007 exceeded 8 million tons of which nearly 10% was exported. Approximately 6 million tons represented wide flange sections. This production was supplemented by imports representing 10% of total domestic consumption. During the first half of 2008 domestic shape production exceeded 4.3 million tons with over 3 million tons of that total being wide flange sections. Imports and exports were at equivalent levels during the first half of 2008. It is estimated that 65% of domestic consumption of structural steel is utilized in building projects under roof, 16% in non-building structures and 19% for non-structural applications.

Domestic demand for hot-rolled sections showed a decrease of 1% during the first 5 months of 2008 compared to 2007.

Pricing of mill material is typically posted on the web sites of the producing mills. Typical mill pricing for November 2008 FOB mill is \$869 per ton. The price compares to a price level of \$787 per ton in November of 2007.

Hollow Structural Sections (HSS) for building applications are produced by a significant number of manufacturers including Atlas*, Independence Tube* and EXLTUBE*, who account for more than 65% of the HSS production for buildings in the U.S. HSS are manufactured from sheet steel that may be produced in either a basic oxygen furnace or an electric arc furnace. The recycled content of these sections would be either 29% or 88% respectively. The domestic market for hollow structural sections in 2007 was approximately 3 million tons.

Steel plate used in building projects is produced by a variety of mills specializing in plate production including mills owned by Nucor*, Arcelor-Mittal* and IPSCO*. Plate is produced in both basic oxygen and electric arc furnaces.

Service Centers

Service Centers stocking all types of structural material are located throughout the United States. 70% of material flows through service centers to fabricators, with the remainder of the material being supplied directly from producing mills to fabricators. A listing of AISC member service centers is available at www.aisc.org/servicecenter.

As of September 2008 service centers are holding 3.0 months of inventory based on recent order volumes down from 3.0 months of inventory in August of 2008 and up from 2.9 months of inventory in September of 2007.

Fabricators

It is estimated that there are more than 2,600 steel fabricators in the United States supplying fabricated structural steel to building projects. The American Institute of Steel Construction represents 750 of these fabricators that produce structural steel. The typical structural steel fabricator is a family owned business employing from 10 to 100 employees. Employee classifications include detailers, shop workers, equipment operators, welders, painters, delivery drivers and administrative personnel. Projects may range from the fabrication of several tons of structural steel for a small retail store to tens of thousands of tons for large, high rise structures. A very rough rule of thumb would indicate one ton of steel would be required for every 200 square feet of building area.

The fabrication process is driven by plans developed and sealed by licensed structural engineers specifying all design aspects of the structural components of a building based on the building layout developed by an architect. Upon award of the project the fabricator is typically responsible for creating detail drawings of each piece of structural steel. These details are produced by a *steel detailer* and refine the design drawings from the structural engineer developing a dimensionally

accurate drawing of the member including all connection details. Steel detailers may either work directly on the staff of the fabricator or on a sub-contract basis. The detail drawings are then submitted to the structural engineer for approval.

Following a determined sequence optimized for erection in the field, the appropriate structural steel members are then cut to the proper length, drilled or punched and all additional shop work is performed on the member. When required, the member is cleaned and coated with paint or galvanized. The members are then grouped in the order in which they will be erected in the field, placed on truck for shipping and delivered to the project site.

A typical fabrication project will require between 10 and 20 hours of shop time per ton of fabricated steel. Material costs account for between 30% and 35% of the final cost of the fabricated and erected structural steel. Fabrication and erection costs for structural steel vary greatly based on the type of structure being constructed, the number of pieces, local labor conditions and the complexity of the connections. An AISC member fabricator in the area of the project (a list of member fabricators is available on the AISC web site www.aisc.org) or the AISC Steel Solutions Center (866.ASK.AISC) is the best source for fabrication costs for a specific project. The practice of minimizing the weight of the structural steel in a building is often short-sighted as lighter sections, while satisfying the strength requirements of the structure, may result in more costly connections and fabrication procedures.

Many fabricators, both AISC members and non-members, have taken the additional step of obtaining AISC Quality Certification. This program, which is administered by the Quality Management Company, is similar to an ISO Certification Program but specialized for the intricacies of steel fabrication. Companies are audited on a regular basis; while the program doesn't look at specific performance it does verify that the fabricator has the processes, equipment, manpower, and experience to perform the necessary work. Currently, 739 fabrication shops are certified. A list of certified fabricators can be seen at www.aisc.org/certification.

Erectors

Erectors are the most visible component of the structural steel supply chain, performing the actual construction work at the project site. Most erection is performed under the same contract as the steel fabrication, with the fabricator either providing in-house erection services or sub-contracting the erection work to a qualified firm. Field erection involves assembling the structural components in proper sequence while maintaining the structural stability of the partially completed structure. Stringent safety standards have significantly reduced the number of injuries occurring during steel erection. The erection team is also responsible for bringing the final structure into "plumb" within the required tolerances.

AISC also offers a Certification Program for erectors and currently 139 erectors are certified. To see a list of certified erectors, visit www.aisc.org/certification.

Marketplace Demand for Structural Steel

Structural steel is the leading structural framing material in the United States, with a 55% market share through the 3rd quarter of 2008 for non-residential and multi-story (greater than 4 story) residential construction. The market share for the closest competing material, concrete, is only 21% indicating a market preference exceeding 2 to 1 for structural steel.

Market share values for all structural framing materials over the past 4 years for non-residential construction based on square footage are:

	2004	2005	2006	2007	2008Q3
Structural Steel	51.7%	51.9%	52.2%	53.4%	55.2%
Pre-engineered Buildings (Steel)	5.6%	5.3%	4.9%	4.6%	5.0%
Wood	6.6%	6.8%	6.9%	5.5%	5.8%
Masonry	7.4%	7.5%	6.8%	6.2%	6.0%
Concrete	20.8%	22.1%	23.1%	24.5%	21.4%
All Other	7.9%	6.5%	6.1%	5.8%	6.6%

Source: McGraw-Hill Analytics

Non-residential construction represents 51% of the overall demand of structural steel with each point of market share being equivalent to 107,000 tons of structural steel based on a survey taken of 2006 utilization.

Often assumed to be a market in which structural steel does not compete, multi-story residential construction accounts for 14% of the overall demand for structural steel. Structural steel's multi-story residential (including hotels and dormitories) market share has grown significantly over the past 5 years and is currently 39% with each point of share representing 26,000 tons of structural steel.

The remaining demand for structural steel is comprised of two market segments. The first is non-building structures (any structure without a roof) including open air stadiums, process and chemical plants, power plants, petroleum refineries, etc. Structural steel maintains a dominant share in these markets with these non-building structures generating approximately 16% of the demand for structural steel. Non-structural applications such as rack systems, marine applications, trailers, transportation and mobile homes comprise 19% of the overall demand for structural products. Bridges are a special case in that the majority of bridge structures are fabricated from plate steel rather than hot-rolled sections or hollow structural sections. Plate steel is not considered in the supply or demand calculations presented above. Hot-rolled sections for bridges comprise 4% of the overall market for structural steel and are included in the non-building structures referenced above.

Marketplace Growth

Non-residential and multi-story residential construction accounts for 65% of the structural steel demand in the United States. In 2007 these two markets represented a total of 1.7 billion square feet of construction, the fourth highest total in U.S. history. Following peaks of 1.893 billion square feet in 1999 and 1.941 billion square feet in 2000, the market declined to a trough of 1.526 billion square feet in 2003. 2008 3rd quarter results point to a significant decline in the non-residential and multi-story residential market. This decline may be in the order of 14% for the entire year of 2008.

Project Type	2001	2002	2003	2004	2005	2006	2007	2008Q3
Industrial (Manufacturing under roof)	93	68	75	86	77	80	83	54
Commercial (Retail, warehouses, other)	526	453	471	503	527	498	534	295
Office	225	156	144	164	166	198	215	130
Parking	184	161	136	159	177	191	175	100
Assembly (Schools, arenas, churches)	404	377	353	320	323	333	317	244
Medical (Hospitals, healthcare)	92	97	92	94	107	109	101	78
Public (Courthouses, jails, other)	44	37	35	34	33	34	48	23
Other	27	26	26	27	29	32	25	35
Non Residential Total	1,594	1,373	1,331	1,387	1,440	1,475	1,498	959
Residential > 4 stories	171	161	196	244	336	344	217	97
Overall Total	1,765	1,534	1,527	1,631	1,776	1,819	1,696	1,056

Source: McGraw-Hill Analytics

US Construction Market in Millions of Square Feet

Key Marketplace Advantages of Structural Steel

The growing demand for structural steel demonstrates the continuing recognition of the advantages structural steel brings to building projects. Architects, structural engineers, general contractors and building owners choose structural steel because:

- Structural steel is fabricated off-site under controlled conditions, ensuring a high-quality product and reducing the number of costly fixes at the job site. This also allows for just-in-time delivery, accelerating overall project schedules.
- Structural steel is reliable and predictable. It's produced to precise tolerances in size and strength. This makes steel easier to design and use. And, because it's at full strength as soon as it's erected, project schedules are predictably shorter.
- Structural steel leads the construction industry with a fully integrated supply chain using advanced technology at all stages of design and construction. This technology has been proven to reduce or eliminate errors, improve safety and lower project costs.
- Today's modern mills produce steel containing an average of 88% recycled material. At the end of a building's life cycle, 100% of the steel frame can be recycled (the current recycling/reuse rate for structural steel is 98%). Steel is the choice for environmentally conscious projects.
- Structural steel provides owners with buildings that generate revenue earlier, maximize the amount and use of floor space, are easy to modify and easier to sell, and are aesthetically pleasing.
- Structural steel is the most economical building framing material.

The American Institute of Steel Construction

The American Institute of Steel Construction, headquartered in Chicago, is a not-for-profit technical institute and trade association established in 1921 to serve the structural steel design community and construction industry. AISC's mission is to make structural steel the material of choice by being the leader in structural steel-related technical and market-building activities, including: specification and code development, research, education, technical assistance, quality certification, standardization, and market development.

AISC's current membership includes:

Full (Producers, Service Centers, Fabricators)	764 firms
Professional (Architects and Engineers)	24,202 individuals
Affiliate (Construction professionals and building code officials)	2,910 individuals
Educators & Students	3,262 individuals
Associate (Allied firms & organizations)	702 firms

AISC has developed and administers a certification program for both member and non-member fabricators and erectors. AISC Certification sets a standard for the steel industry. Companies that are AISC Certified have been through a rigorous initial evaluation, and are subject to yearly reviews. Our independent auditing company, Quality Management Company, LLC, confirms that companies have the personnel, knowledge, organization, equipment, experience, capability, procedures, and commitment to produce the required quality of work for a given category, whether they are a fabricating plant, erector or metal building company. There are currently 739 AISC certified fabricators and 139 AISC certified erectors.

AISC has a long tradition of service to the steel construction industry of providing timely and reliable information. Designers, builders, and developers are encouraged to contact the AISC Steel Solutions Center with any questions related to the use of structural steel. The Steel Solutions Center can be contacted at 866.ASK.AISC or via email at solutions@aisc.org.

Structural Steel Quick Facts

American Institute of Steel Construction
November 2008

2006 Domestic Shape Production	8.4 million tons
2007 Domestic Shape Production	8.5 million tons
2008 Domestic Shape Production (1 st 6 months)	4.3 million tons
2006 Domestic Shape Consumption	8.7 million tons
2007 Domestic Shape Consumption	8.5 million tons
2008 Domestic Shape Consumption (1 st 6 months)	4.3 million tons
Hot-rolled Structural Shape producers	5
Hollow Structure Shape producers	12
Service Center locations	500+
Fabricators	2,600
Detailers (individuals)	6,000
Total industry employment	300,000+
External industry sales (fabricator to market)	\$20+ billion
Distribution	
% of producer sales direct to fabricators	30%
% of producer sales to Service Centers	70%
Current months of inventory stocked at Service Centers	3.0 months
Change in producer pricing	
current versus last month	down 9%
current versus 3 months ago	down 25%
current versus last year	up 10%
Change in BLS index for fabricated structural steel (reported through September of 2008)	
current versus last month	down 1%
current versus 3 months ago	up 2%
current versus last year	up 10%
Market for Structural Steel	
Non-residential Buildings	51% of demand
2006 square footage	1.475 billion sq ft
2007 square footage	1.498 billion sq ft
2008Q3 square footage	0.959 billion sq ft
Current market share	55%
Residential Buildings greater than 4 stories	14% of demand
2006 square footage	344 million sq ft
2007 square footage	217 million sq ft
2008Q1 square footage	97 million sq ft
Current market share	39%
Non-building structures	16% of demand
Non-structural uses	19% of demand