Sheet metal workers in construction may experience periods of unemployment, particularly when construction projects end and economic conditions dampen construction activity. Nevertheless, employment of sheet metal workers is less sensitive to declines in new construction than is the employment of some other construction workers, such as carpenters. Maintenance of existing equipment—which is less affected by economic fluctuations than is new construction—makes up a large part of the work done by sheet metal workers. Installation of new air-conditioning and heating systems in existing buildings continues during construction slumps, as individuals and businesses adopt more energy-efficient equipment to cut utility bills. In addition, a large proportion of sheet metal installation and maintenance is done indoors, so sheet metal workers usually lose less worktime due to bad weather than other construction workers do.

Earnings

In 2000, median hourly earnings of sheet metal workers employed in all industries were $15.31. The lowest 10 percent of all sheet metal workers earned less than $8.90, and the highest 10 percent earned more than $27.54.

The median hourly earnings of the largest industries employing sheet metal workers in 2000 are shown below.

Federal Government	$18.85
Plumbing, heating, and air-conditioning	16.06
Roofing, siding, and sheet metal work	15.37
Fabricated structural metal products	14.11
Aircraft and parts	13.47

Apprentices normally start at about 40 percent of the rate paid to experienced workers. As apprentices acquire more skills throughout the course of their training, they receive periodic increases until their pay approaches that of experienced workers. In addition, union workers in some areas receive supplemental wages from the union when they are on layoff or shortened workweeks. Many sheet metal workers are members of the Sheet Metal Workers' International Association.

Related Occupations

To fabricate and install sheet metal products, sheet metal workers combine metalworking skills and knowledge of construction materials and techniques. Other occupations in which workers lay out and fabricate metal products include assemblers and fabricators; machinists; machine setters, operators, and tenders—metal and plastic; and tool and die makers. Construction occupations requiring similar skills and knowledge include glaziers and heating, air-conditioning, and refrigeration mechanics and installers.

Sources of Additional Information

For more information about apprenticeships or other work opportunities, contact local sheet metal contractors or heating, refrigeration, and air-conditioning contractors; a local of the Sheet Metal Workers; a local of the Sheet Metal and Air-Conditioning Contractors National Association; a local joint union-management apprenticeship committee; or the nearest office of your State employment service or apprenticeship agency.

For general information about sheet metal workers, contact:

➤ International Training Institute for the Sheet Metal and Air-Conditioning Industry, 601 N. Fairfax St., Suite 240, Alexandria, VA 22314.

➤ Sheet Metal and Air-Conditioning Contractors National Association, 4201 Lafayette Center Dr., Chantilly, VA 20151-1209. Internet: **http://www.smacna.org**

➤ Sheet Metal Workers International Association, 1750 New York Ave. NW., Washington, DC 20006. Internet: **http://www.smwia.org**

Structural and Reinforcing Iron and Metal Workers

(O*NET 47-2171.00, 47-2221.00)

Significant Points

- Most employers recommend a 3- or 4-year apprenticeship.
- During economic downturns, workers can experience high rates of unemployment.
- The danger of injuries due to falls is great; therefore, those who work at great heights do not work during wet, icy, or extremely windy conditions.

Nature of the Work

Builders use materials made from iron, steel, aluminum, fiberglass, or precast concrete to construct highways, bridges, office and other large buildings, and power transmission towers. These structures have frames made of steel columns, beams, and girders. In addition, reinforced concrete—concrete containing steel bars or wire fabric—is an important material in buildings, bridges, and other structures, as the steel gives the concrete additional strength. Moreover, metal stairways, catwalks, floor gratings, ladders, window frames, lampposts, railings, fences, and decorative ironwork increase the functionality and attractiveness of these structures. Structural and reinforcing iron and metal workers fabricate, assemble, and install these products. They also repair, renovate, and maintain older buildings and structures, such as manufacturing plants, highways, and bridges.

Even though the primary metal involved in this work is steel, workers often are known as *ironworkers*. Before construction can begin, ironworkers must erect steel frames and assemble the cranes and derricks that move structural steel, reinforcing bars, buckets of concrete, lumber, and other materials and equipment around the construction site. The structural metal arrives at the construction site in sections. There, it is lifted into position by a crane. Ironworkers then connect the sections and set the cables to do the hoisting.

Once this job has been completed, workers begin to connect steel columns, beams, and girders according to blueprints and instructions from supervisors and superintendents. Structural steel, reinforcing rods, and ornamental iron generally come to the construction site ready for erection—cut to the proper size, with holes drilled for bolts and numbered for assembly.

Ironworkers at the construction site unload and stack the prefabricated steel so that it can be hoisted easily when needed. To hoist the steel, metal workers attach cables from a crane or derrick. One worker directs the hoist operator with hand signals. Another worker holds a rope (tag line) attached to the steel to prevent it from swinging. The crane or derrick hoists steel into place in the framework, where several workers, using spud wrenches, position the steel with connecting bars and jacks. Workers using drift pins or the handle of a spud wrench—a long wrench with a pointed handle—align the holes in the steel with the holes in the framework. Then, they temporarily bolt the piece in place; check vertical and horizontal alignment with plumb bobs, laser equipment, transits, or levels; and bolt or weld the piece permanently in place.

Reinforcing iron and rebar workers set the bars in the forms that hold concrete, following blueprints showing the location, size, and number of reinforcing bars (rebar). They then fasten the bars together by tying wire around them with pliers. When reinforcing floors, workers place blocks under the rebar to hold the bars off the

Ironworkers connect sections of structural steel.

deck. Although these materials usually arrive ready to use, ironworkers occasionally must cut bars with metal shears or acetylene torches, bend them by hand or machine, or weld them with arc-welding equipment. Some concrete is reinforced with welded wire fabric. Using hooked rods, workers cut and fit the fabric and, while a concrete crew places the concrete, metal workers properly position the fabric in the concrete. Post-tensioning is another technique used in reinforcing concrete; workers substitute cables for reinforcing bars. When the concrete is poured, the ends of the cables are left exposed. After the concrete dries, ironworkers tighten the cable. Post-tensioning allows designers to create larger open areas in a building because supports can be placed further apart. This technique is commonly employed in parking garages and arenas.

Ornamental ironworkers install elevator shafts, stairs, curtain walls (the nonstructural walls and window frames of many large buildings), and other ornamentation pieces after the structure of the building has been completed. As they hoist pieces into position, ornamental ironworkers check that the pieces are properly fitted and aligned before bolting, brazing, or welding them for a secure fit.

Working Conditions

Structural and reinforcing iron and metal workers usually work outside in all kinds of weather. However, those who work at great heights do not work during wet, icy, or extremely windy conditions. Because the danger of injuries due to falls is great, ironworkers use safety devices such as safety belts, scaffolding, and nets to reduce risk.

Some ironworkers fabricate structural metal in fabricating shops, which usually are located away from the construction site. They are covered in the statement on assemblers and fabricators found elsewhere in the *Handbook*.

Employment

Structural and reinforcing iron and metal workers held about 111,000 jobs in 2000. About half worked for structural steel erection contractors. Most of the remainder worked for contractors specializing in the construction of homes; factories; commercial buildings; churches; schools; bridges and tunnels; and water, sewer, communications, and power lines.

Structural and reinforcing iron and metal workers are employed in all parts of the country, but most work in metropolitan areas, where most commercial and industrial construction takes place.

Training, Other Qualifications, and Advancement

Most employers recommend a 3- or 4-year apprenticeship, consisting of on-the-job training and evening classroom instruction, as the best way to learn this trade. Apprenticeship programs usually are administered by committees made up of representatives of local unions of the International Association of Bridge, Structural, Ornamental and Reinforcing Iron Workers or the local chapters of contractors' associations.

Ironworkers must be at least 18 years old. A high school diploma may be preferred by employers and may be required by some local apprenticeship committees. High school courses in general mathematics, mechanical drawing, and shop are helpful. Because materials used in iron working are heavy and bulky, metal workers must be in good physical condition. They also need good agility, balance, eyesight, and depth perception to safely work at great heights on narrow beams and girders. Ironworkers should not be afraid of heights or suffer from dizziness.

In the classroom, apprentices study blueprint reading; mathematics for layout work; the basics of structural erecting, rigging, reinforcing, welding, and burning; ornamental erection; and assembling. Apprentices also study the care and safe use of tools and materials. On the job, apprentices work in all aspects of the trade, such as unloading and storing materials at the job site, rigging materials for movement by crane or derrick, connecting structural steel, and welding.

Some ironworkers learn the trade informally on the job without completing an apprenticeship. These workers generally do not receive classroom training, although some large contractors have extensive training programs. On-the-job trainees usually begin by assisting experienced ironworkers by doing simple jobs, such as carrying various materials. With experience, trainees perform more difficult tasks like cutting and fitting different parts; however, learning through work experience alone may not provide training as complete as an apprenticeship program and usually takes longer.

Some experienced workers are promoted to supervisor. Others may go into the contracting business for themselves.

Job Outlook

Employment of structural and reinforcing iron and metal workers is expected to rise about as fast as the average for all occupations through the year 2010, largely based on the continued growth in industrial and commercial construction. The rehabilitation, maintenance, and replacement of a growing number of older buildings, factories, power plants, and highways and bridges is expected to create employment opportunities. While some new jobs will arise, most openings will result from the need to replace experienced ironworkers who transfer to other occupations or leave the labor force.

The number of job openings fluctuates from year to year as economic conditions and the level of construction activity change. During economic downturns, ironworkers can experience high rates of unemployment. Similarly, job opportunities for ironworkers may vary widely by geographic area. Job openings for ironworkers usually are more abundant during the spring and summer months, when the level of construction activity increases.

Earnings

In 2000, median hourly earnings of structural iron and steel workers in all industries were $17.92. The middle 50 percent earned between $13.34 and $24.16. The lowest 10 percent earned less than $10.05, and the highest 10 percent earned more than $29.62. In 2000, median hourly earnings of reinforcing iron and rebar workers in all industries were $16.78. The middle 50 percent earned between $12.57 and $23.64. The lowest 10 percent earned less than $9.90, and the highest 10 percent earned more than $27.86. Median hourly earnings in the industries employing the largest number of structural iron and steel workers in 2000 were:

Miscellaneous special trade contractors	$19.59
Heavy construction, except highway	17.55
Nonresidential building construction	15.86
Fabricated structural metal products	13.71

Many workers in this trade are members of the International Association of Bridge, Structural, Ornamental, and Reinforcing Iron Workers. According to the union, average hourly earnings, including benefits, for structural and reinforcing metal workers who belonged to a union and worked full time ranged between $18 and $50 in 2000. Structural and reinforcing iron and metal workers in New York, Boston, San Francisco, Chicago, Los Angeles, Philadelphia, and other large cities received the highest wages.

Apprentices generally start at about 50 to 60 percent of the rate paid to experienced journey workers. They receive periodic increases throughout the course of the apprenticeship program, as they acquire the skills of the trade, until their pay approaches that of experienced workers.

Earnings for ironworkers may be reduced on occasion because work can be limited by bad weather, the short-term nature of construction jobs, and economic downturns.

Related Occupations

Structural and reinforcing iron and metal workers play an essential role in erecting buildings, bridges, highways, powerlines, and other structures. Others who also work on these construction jobs include assemblers and fabricators; boilermakers; civil engineers; cement masons, concrete finishers, segmental pavers, and terrazzo workers; construction managers; and welding, soldering, and brazing workers.

Sources of Additional Information

For more information on apprenticeships or other work opportunities, contact local general contractors; a local of the International Association of Bridge, Structural, Ornamental, and Reinforcing Iron Workers Union; a local ironworkers' joint union-management apprenticeship committee; a local or State chapter of the Associated Builders and Contractors; or the nearest office of your State employment service or apprenticeship agency

For apprenticeship information, contact:

➤ International Association of Bridge, Structural, Ornamental, and Reinforcing Iron Workers, Apprenticeship Department, 1750 New York Ave. NW., Suite 400, Washington, DC 20006.

For general information about ironworkers, contact:

➤ The Associated General Contractors of America, 333 John Carlyle St., Suite 200, Alexandria, VA 22314.