

*Materials engineers work with metals, ceramics, plastics, semiconductors, and composites to create new materials.*

### Job Outlook

Employment of materials engineers is expected to grow more slowly than the average for all occupations through 2010. More materials engineers will be needed to develop new materials for electronics and plastics products. However, many of the manufacturing industries in which materials engineers are concentrated—such as primary metals and stone, clay, and glass products—are expected to experience declines in employment, reducing employment opportunities for materials engineers. As firms contract out to meet their materials engineering needs, however, employment growth is expected in many services industries, including research and testing, personnel supply, health, and engineering and architectural services. In addition to growth, job openings will result from the need to replace materials engineers who transfer to other occupations or leave the labor force.

### Earnings

Median annual earnings of materials engineers were \$59,100 in 2000. The middle 50 percent earned between \$47,320 and \$72,900. The lowest 10 percent earned less than \$37,680, and the highest 10 percent earned more than \$87,630.

According to a 2001 salary survey by the National Association of Colleges and Employers, bachelor's degree candidates in materials engineering received starting offers averaging \$49,936 a year.

### Sources of Additional Information

For further information about materials engineers, contact:

- ▶ Minerals, Metals, & Materials Society, 184 Thorn Hill Rd., Warrendale, PA 15086. Internet: <http://www.tms.org>
- ▶ ASM International Foundation, Materials Park, OH 44073-0002. Internet: <http://www.asm-intl.org>

(See introduction to the section on engineers for information on working conditions, training requirements, and other sources of additional information.)

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## Mechanical Engineers

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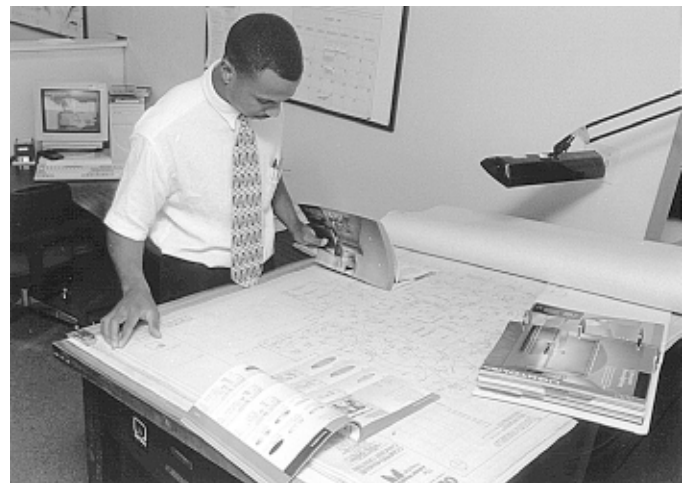
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### Nature of the Work

Mechanical engineers research, develop, design, manufacture, and test tools, engines, machines, and other mechanical devices. They work on power-producing machines such as electric generators, internal combustion engines, and steam and gas turbines. They also develop power-using machines such as refrigeration and air-conditioning equipment, machine tools, material handling systems, elevators and escalators, industrial production equipment, and robots used in manufacturing. Mechanical engineers also design tools needed by other engineers for their work. The field of nanotechnology, which involves the creation of high-performance materials and components by integrating atoms and molecules, is introducing entirely new principles to the design process.

Computers assist mechanical engineers by accurately and efficiently performing computations and by aiding the design process by permitting the modeling and simulation of new designs. Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) are used for design data processing and for developing alternative designs.

Mechanical engineers work in many industries, and their work varies by industry and function. Some specialties include applied mechanics; computer-aided design and manufacturing; energy systems; pressure vessels and piping; and heating, refrigeration, and air-conditioning systems. Mechanical engineering is one of the broadest engineering disciplines. Mechanical engineers may work in production operations in manufacturing or agriculture, maintenance, or technical sales; many are administrators or managers.



*A mechanical engineer works on designs for a hospital building.*

### Employment

Mechanical engineers held about 221,000 jobs in 2000. More than 1 out of 2 jobs were in manufacturing—mostly in machinery, transportation equipment, electrical equipment, instruments, and fabricated metal products industries. Engineering and management services, business services, and the Federal Government provided most of the remaining jobs.

### Job Outlook

Employment of mechanical engineers is projected to grow about as fast as the average for all occupations through 2010. Although overall manufacturing employment is expected to grow slowly, employment of mechanical engineers in manufacturing should increase more rapidly as the demand for improved machinery and machine tools grows and industrial machinery and processes become increasingly complex. Also, emerging technologies in information technology, biotechnology, and nanotechnology will create new job opportunities for mechanical engineers.

Employment of mechanical engineers in business and engineering services firms is expected to grow faster than average as other industries in the economy increasingly contract out to these firms to solve engineering problems. In addition to job openings from growth, many openings should result from the need to replace workers who transfer to other occupations or leave the labor force.

### Earnings

Median annual earnings of mechanical engineers were \$58,710 in 2000. The middle 50 percent earned between \$47,600 and \$72,850. The lowest 10 percent earned less than \$38,770, and the highest 10 percent earned more than \$88,610. Median annual earnings in the industries employing the largest numbers of mechanical engineers in 2000 were:

Personnel supply services .....	\$81,080
Federal government .....	66,320
Engineering and architectural services .....	59,800
Motor vehicles and equipment .....	59,400
Construction and related machinery .....	54,480

According to a 2001 salary survey by the National Association of Colleges and Employers, bachelor's degree candidates in mechanical engineering received starting offers averaging \$48,426 a year, master's degree candidates had offers averaging \$55,994, and Ph.D. candidates were initially offered \$72,096.

### Sources of Additional Information

Further information about mechanical engineers is available from:  
 ► The American Society of Mechanical Engineers, Three Park Ave., New York, NY 10016. Internet: <http://www.asme.org>

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## Mining and Geological Engineers, Including Mining Safety Engineers

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(O\*NET 17-2151.00)

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### Nature of the Work

Mining and geological engineers find, extract, and prepare coal, metals, and minerals for use by manufacturing industries and utilities.



*Mining engineers work with geologists to discuss plans for further mine excavation.*

They design open pit and underground mines, supervise the construction of mine shafts and tunnels in underground operations, and devise methods for transporting minerals to processing plants. Mining engineers are responsible for the safe, economical, and environmentally sound operation of mines. Some mining engineers work with geologists and metallurgical engineers to locate and appraise new ore deposits. Others develop new mining equipment or direct mineral processing operations to separate minerals from the dirt, rock, and other materials with which they are mixed. Mining engineers frequently specialize in the mining of one mineral or metal, such as coal or gold. With increased emphasis on protecting the environment, many mining engineers work to solve problems related to land reclamation and water and air pollution.

Mining safety engineers use their knowledge of mine design and practices to ensure the safety of workers and to comply with State and Federal safety regulations. They inspect walls and roof surfaces, test air samples, and examine mining equipment for compliance with safety practices.

### Employment

Mining and geological engineers, including mining safety engineers, held about 6,500 jobs in 2000. While one-half worked in the mining industry, other mining engineers worked in government agencies or engineering consulting firms.

Mining engineers usually are employed at the location of natural deposits, often near small communities, and sometimes outside the United States. Those in research and development, management, consulting, or sales, however, often are located in metropolitan areas.

### Job Outlook

Employment of mining and geological engineers, including mining safety engineers, is expected to decline through 2010. Most of the industries in which mining engineers are concentrated—such as coal, metal, and mineral mining, as well as stone, clay, and glass products manufacturing—are expected to experience declines in employment.

Although no job openings are expected to result from employment growth, there should be openings resulting from the need to replace mining engineers who transfer to other occupations or leave the labor force. A large number of mining engineers currently