

Industrial Engineers



Occupational Brief Title Codes:

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Work Classification Based Related

D.O.T. Occupations:

- Fire Protection Engineers
- Manufacturing Engineers
- Quality Control Engineers
- Systems Analysts
- Time Study Engineers

Interests Based Related

G.O.E. Occupations:

- Cost Analysis Engineers
- Facilities Planners
- Forest Engineers
- Land Surveyors
- Manufacturing Engineers
- Materials Engineers
- Port Engineers
- Production Planners
- Standards Engineers
- Tool Planners

Skills Based Related

O*NET Occupations:

- Aerospace Engineers
- Industrial Engineering Technicians
- Materials Engineers
- Mechanical Engineering Technicians
- Mining and Geological Engineers,
Including Mining Safety Engineers

Noteworthy Quote:

"Industrial engineers help people. We design jobs, workplaces, and systems so that the workers-from the front line to the president-can do their jobs well, can enjoy their jobs, and can serve their customers well. It's really about the people."

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Industrial engineers (in'dus-tri-al en-gi'neers) find ways to help organizations improve production while cutting costs. They develop methods for managing people and processes.

The profession of industrial engineering first began with time and motion studies. These studies led to the development of precise processes, which reduced the number of motions in performing tasks and thus increased output. Henry Ford carried this idea forward with his assembly lines for producing automobiles. These measures for evaluating and increasing production eventually became known as industrial engineering.

Industrial engineers look at the processes in an enterprise and bring together the most effective combination of labor, machines, materials, and information for the most productive and cost-effective processes. They ensure quality in products and services, save money for their employers, and make the workplace safer, more comfortable, and more productive for the employees.

Work Performed

The human element is very important to industrial engineers. They deal with people from all levels in their organization. In their job to make things work better, they spend a great deal of time in gathering and assessing information. They talk to employees about what goes on day to day. They also make their own observations about work activities. Industrial engineers convey their observations, suggestions, recommendations, and proposals to managers and top executives, who use this information to make decisions on operations management.



Industrial engineers find ways to help organizations improve production while cutting costs. They develop methods for managing people and processes. Photo by Darron Murphy

Another high point of industrial engineering is flexibility. Unlike other engineers, who work in very specific fields, industrial engineers work in a wide range of activities in a wide range of industries worldwide. They may work in design and layout, operation planning and scheduling, work measurement and the setting of standards, and operations research. They also work in materials handling, quality assurance, cost analysis, job evaluation, wage and salary scales, and inventory control. They may work in assembly, raw product processing, warehousing, distribution, logistics, or administration.

In building layout and design, industrial engineers may look at proposed new sites from the standpoint of available labor, transportation, and access to raw materials. They study power and utility costs, fuel and water supplies, sanitary and waste disposal systems, and fire protection. They also consider the costs of land, buildings, and taxes.

Industrial engineers may help design or redesign buildings. They decide on the most efficient placement of machines, equipment, and offices in order to achieve the best workflow at the least cost. They ensure that the many systems in the production cycle, such as materials handling, production lines, electrical power, and air-conditioning and heating are integrated into the plans. In designing layouts, industrial engineers allow for changes that may be necessary for new processes. They also ensure that installations and systems meet international, federal, and state guidelines for safety.

In working with office layouts, industrial engineers work with ergonomics. They design work stations to reduce worker fatigue, eliminate needless work patterns, enhance workflow, and increase productivity. They check the fit of chairs and the height of desk surfaces. Industrial engineers may design tests to measure worker fatigue, and they study the effects of fatigue on worker safety and comfort.

In inventory control, industrial engineers consider lead time and the handling and storage of incoming goods. They examine packaging, and shipping and receiving methods to find ways of reducing costs and cycle time.

In work methods analysis and improvement, industrial engineers look for and recommend measures to get the most profit at the least cost. They decide what work methods to use and establish standards on how much work each machine or employee should deliver. They may consider automation or mechanization of processes. They may recommend the use of robotics.

Industrial engineers establish and install controls for workflow, materials, and paperwork. They measure how well the arrangements, methods, systems, and procedures are working. They also help set up quality controls for products and set cost limits.

Industrial engineers also study the effects of operations on the environment. They consider how the disposal methods might pollute air, water, or soil. Results of their

studies may affect the location, industrial processes, and operational costs of the business.

Industrial engineers depend heavily on computers, computer-aided design, information systems, and computer simulations to study questions on production, distribution, equipment, work methods, and transportation systems. With a computer these engineers can work with many combinations of variables to produce models or simulations. They can work these models to answer questions on whether changes or variations would save money, time, or effort.

About 65 percent of all industrial engineers work for manufacturing industries. Since their skills are useful in almost any kind of company, industrial engineers can work in industries that do not employ other kinds of engineers. They may work for insurance companies, banks, hospitals, retail organizations, entertainment industries, distribution and transportation industries, and other large business firms. They also work for construction companies, mining firms, and utility companies.

Working Conditions

The work setting of industrial engineers varies depending on the particular industry in which they are involved. The majority of their time is spent in an office setting. They also spend time in production departments, laboratories, or warehouses, or on the grounds to observe processes and to observe and talk with workers. They may travel to survey possible new locations or to look at construction sites.

Hours and Earnings

Industrial engineers work forty to forty-five hours a week. They may work overtime to meet a project deadline or to conduct studies on different work shifts.

The earnings of industrial engineers vary with years of experience, employers, and geographical location. According to the Bureau of Labor Statistics, in 2000, industrial engineers earned an average of \$58,580 a year. Earnings ranged from a low of \$38,140 to a high of \$86,370 a year. According to a 2001 salary survey by the National Association of Colleges and Employers, Bachelor's degree candidates in industrial engineering received starting offers averaging about \$48,320 a year. Those with master's degrees were offered \$56,256 a year, and those with Ph.D's were initially offered \$59,800.

Geographically, the highest earnings were in the West and South States. By industry, banks paid the highest earnings. Firms that make chemical, pharmaceutical, and allied products were second.

Education and Training

Industrial engineers must have a bachelor's degree in industrial engineering earned for completion of an industrial engineering curriculum approved by the Engineering Accreditation Commission (EAC) and the Accreditation

Board for Engineering and Technology (ABET). Many employers also prefer to hire those with successful experience in this field.

College studies usually begin with basic engineering courses such as physics, chemistry, and mathematics. Liberal arts courses may include history, sociology, psychology, languages, and writing.

Courses for industrial engineering may include statistics, computer skills, ergonomics, management science, economics, finance, labor relations, methods analysis, and operations research. Other courses should include manufacturing engineering, facilities design, simulation, and production planning.

Graduate programs are geared mainly for those who plan to do advanced analytical analysis, research, consulting, teaching, or other industrial engineering specialties. Because of rapid technology changes, engineers typically continue their education throughout their career.

Engineering programs last from four to six years. Those that require five or six years may award a master's degree. Or they may offer a cooperative plan of study and work experience with a nearby industry. These cooperative education students get paid while working and gain valuable experience.

High school students should plan to attend college. To prepare for college, they should take courses in mathematics (algebra, geometry, and trigonometry), chemistry, physics, English, and social science.

Licensing and Professional Societies

All states and the District of Columbia require engineers whose work may affect life, health, or property, or who offer their services to the public to be registered or licensed by the state. To obtain registration, engineers must pass the Fundamentals of Engineering examination, get at least four years of engineering experience, then pass the professional practices examination in industrial engineering.

Many industrial engineers find joining a professional organization valuable to their careers. Membership and networking with colleagues help them to keep abreast of important trends and developments in industrial engineering.

Most industrial engineers are members of the Institute of Industrial Engineers, which serves the needs and interests of industrial engineers. It offers a resume referral service, has links to job banks, and offers publications and continuing education seminars on industrial engineering.

Personal Qualifications

Industrial engineers should have a skill for detail and the ability to work as members of a team. Industrial engineers should have an inquiring mind, be creative and organized planners, and enjoy working with people.

Good communications skills are vital. To work closely

with all kinds of people, industrial engineers must be tactful in what they say and how they say it. They must also be willing to stand up for their recommendations even when management is unresponsive.

Occupations can be adapted for workers with disabilities. Persons should contact their school or employment counselors, their state office of vocational rehabilitation, or their state department of labor to explore fully their individual needs and requirements as well as the requirements of the occupation.

Where Employed

There are approximately 198,000 industrial engineers employed throughout industry and commerce. About 65 percent of them work in manufacturing industries. The principal employers are manufacturers of aircraft, computers, electronics, semiconductor devices, communications equipment, motor vehicles and heavy machinery, electronic components and accessories, apparel, recreational equipment, and other consumer products.

Industrial engineers also work in nonmanufacturing or service industries. They are employed by banks and finance organizations; colleges and universities; state and federal governments; health care organizations; and retail, transportation, logistics, distribution, and utilities companies. Many industrial engineers serve as consultants for engineering and management consulting firms, which help manufacturers evaluate and allocate their resources.

Employment Outlook

The future of industrial engineers has expanded to a worldwide scope. There are opportunities in nearly every region in the United States as well as in many countries overseas. Many industrial engineers will work abroad during their careers.

According to the Bureau of Labor Statistics, overall employment of industrial engineers is expected to grow more slowly than the average for all occupations through the year 2010. However, their services are in demand in the manufacturing sector as firms seek to reduce costs and increase productivity. There is also an increased demand within the financial services sector, as more emphasis is put on information technology. Each year many industrial engineers will replace those who transfer to other jobs or retire.

Entry Methods

Graduates of accredited industrial engineering schools can ask for help from the placement office of their college. Letters of inquiry and resumes directed to the personnel directors of organizations can lead to employment. Engineering journals and web sites are other sources of information.

Once hired, new engineers must quickly become expert not only in company operations but also in the specific

problems and challenges the company faces. Many newly hired industrial engineers take an actual operations assignment for a few months to learn firsthand company methods, products, and markets. Following this assignment, they usually work under an experienced industrial engineer doing tasks such as collecting data, putting it into usable form, analyzing it, doing initial design, and writing reports.

Advancement

Industrial engineers with experience, knowledge, and education will advance to more responsible work and higher pay. Many move into management positions. Others become consultants, or they may set up their own consulting firm.

Some engineers earn a graduate degree in industrial engineering or business administration to qualify for advancement. Others get a law degree and become patent attorneys with a knowledge of both manufacturing processes and law. Industrial engineering education and experience is a solid background for advancement in many kinds of work. Many top executives in industry have an industrial engineering background.

For Further Research

Institute of Industrial Engineers, 3577 Parkway Lane, Suite 200, Norcross, GA 30092. Visit their Website: <http://www.iienet.org>

Accredited University IE Programs. Single copy free.

Student IE. Single copy free.

IIE Solutions. Monthly. Subscription \$60.00, single issue \$7.00. Magazine on industrial engineering, facilities design, systems integration, production control, and material handling management.

Peter Li, 1100 Superior Avenue, Cleveland, OH 44114.

Industry Week.

Semimonthly. Subscription \$60.00, single issue \$5.00. Magazine with articles to help industrial executives sharpen management skills and increase their effectiveness.

Acknowledgments

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