

How Everything man-made has a construction Construction Influences Your Life

By Pam Hunter

N

ext time you are outside, take a look around. All of the buildings that we work, live and play in were built by construction industry professionals. They

also built the factories that make our cars, the refineries that produce the gas to fuel them and the roads and bridges we drive on. Ditto for airports, train stations, cell-phone towers, powerplants and schools. There is very little in our world that is not affected in some way by construction.

Construction is the second-largest industry in the nation, employing about 7 million workers. It contributes about 5% of all domestic U.S. economic activity and accounts for nearly 10% of all businesses—mostly small, privately owned firms.

Construction has been a part of people's lives since they first crawled out of caves many thousands of years ago. They needed shelters and structures to shield themselves from the elements and slowly developed the tools and the techniques to build what was needed.

The industry has grown and changed tremendously over time. Today, construction is not just about bricks and mortar and hammers and nails. Contractors use high-tech tools and machinery to build highly sophisticated facilities such as hospitals, indus-



trial plants or research laboratories.

The construction industry can build big, like the Empire State Building or Hoover Dam. It also can build small, like a house in your neighborhood. But large or small, construction projects make a difference in the lives of people around them.

New Ball Game

Take, for example, the new sports arena for the Charlotte Bobcats in Charlotte, N.C. The 780,000-sq-ft arena, completed this fall, is home to the NBA's Charlotte Bobcats and the WNBA's Charlotte Sting. But buildings like this offer more. People can see basketball games in the arena—it seats more than 20,000—but it also offers a stage large enough for





tion connection

stadiums



offices

Starting Over

We don't realize how much construction touches our lives until a monster like **Hurricane Katrina** destroys everything in its path.

The storm wrecked 275,000 homes on the Gulf Coast. Whole towns suddenly were thrust under water and a way of life ended. Not only were homes and businesses destroyed, but also facilities for drinking water, wastewater, power and communications. Nothing worked.

Cleanup, planning and rebuilding has started, but it will take years to restore the region to a level that people would consider "normal."

acts such as Cold Play, Tim McGraw, local high school basketball games and ice-skating performances.

Such projects can transform entire neighborhoods. San Diego's PETCO Park, home to the Padres, has generated a construction boom in a neighborhood that previously had deteriorating buildings, warehouses, empty parking lots and little else. It now is full of life, with new restaurants, nightclubs, theaters and condominiums. Similar activity is taking place in other neighborhoods across the nation.

Even works of art are constructed. The new World War II Memorial in Washington, D.C., is visited each year by thousands of veterans and tourists from around the world to learn about the war,

remember the sacrifices and reflect on the consequences.

And where there are such projects, there is a need for bright, talented people to fill the jobs at architecture and engineering firms and construction companies. The future is bright. Government statistics show that construction is the only goods-producing industry that can expect to see employment growth in coming years.

To be able to walk through your town, city or state and be able to say, "I built that," is a rewarding and even awe-inspiring experience. So the next time you take a walk, look around. Without much effort, you will see the results of a lot of hard work, dedication and inspiration from the construction industry.



Per

The construction industry

The fect Time

By
Housley
Carr

needs workers and it pays well. **To Start**

You've picked the perfect time to think about a career in construction.

You know those moments—a dive into a pool, the swing of a bat, a win in a heated Xbox or PlayStation

match—when it all comes together? That's what's happening now in the construction industry.

Just look around your neighborhood, along the highway, or downtown. There is a lot of construction work going on. And not just new houses, but new shopping centers, office buildings, and stadiums. Not to mention all the new roadwork, the new sewage treatment plants, and the airport terminal expansions.

On top of that, the hurricanes of 2005, especially Katrina, caused billions of dollars in damage, and require tens of thousands of reconstruction and new-construction projects.

All of that work is demanding a lot of workers. Architects and engineers to design what's being built. Project managers to oversee the construction. Laborers and skilled craftsmen—carpenters, electricians and plumbers—to do the actual building. Overall, the U.S. Department of Labor estimates that one million new jobs will be added to the construction industry by 2012.

Luckily for you, this country's building boom is happening at a time when there is a real shortage of construction workers. And just like you pay more for a hot concert ticket, construction companies pay



more to find the scarce workers they need.

The need for new workers is so great that the construction industry itself is working with high schools, community colleges and four-year colleges to encourage students to consider careers in construction, and is providing them with training and summer-work opportunities.

High school and college graduates entering the construction industry “can earn very good money,” says Dr. Richard Judy, chief executive officer at Workforce Associates Inc., Indianapolis, which

Construction is searching for young workers to help it build the structures needed to keep America growing and strong.

Check Out Your Pay

Average annual salaries for construction professional staff

Architect	\$70,280
Landscape architect	\$81,990
Architectural/civil drafter	\$45,290
Construction manager	\$78,290
Cost estimator	\$60,690
Engineering manager	\$90,890
Civil engineer	\$63,560
Civil engineering technician	\$45,990
Electrical engineer	\$79,680
Health and safety engineer	\$59,010
Mechanical engineer	\$71,110
Mechanical drafter	\$48,720
Environmental engineering technician	\$45,980
Purchasing manager	\$79,730
Purchasing agent	\$56,360
Surveyor	\$53,410
Surveying technician	\$30,830

Average annual salaries for skilled crafts

Boilermaker	\$49,220
Brickmason	\$46,530
Carpenter	\$38,730
Concrete finisher	\$35,820
Drywall installer	\$34,010
Electrician	\$41,760
Equipment operator	\$42,210
Crane operator	\$39,660
Glazier	\$36,940
Painter	\$33,320
Plumber	\$47,190
Rebar worker	\$39,610
Steel worker	\$40,960

WAGES, SALARIES VARY BY REGION
SOURCE: U.S. DEPT. OF LABOR BUREAU OF LABOR STATISTICS

helps states develop programs to attract workers to construction.

A significant portion of the skilled construction workforce is in their 40s and 50s and will be retiring over the next few years, he says. But there are nowhere near enough younger workers to replace them.

“There’s a misconception among a lot of younger people that construction jobs are hard and dirty, and that they don’t offer a lot in terms of career advancement. But that is not the case,” says Judy. There are a wide range of opportunities available in the construction industry, both for high school graduates who want to go directly into the workforce and learn a trade, and those who want to go on to college.

Judy looks at the big picture. People closer to the action agree with them, though. “We are really in a bidding war” for good workers, says Karen Hall, director of human resources at Flintco, a company that builds sports facilities, prisons and schools.

“The opportunities for jobs are unlimited,” Hall says. “There are all kinds of positions that are available. And not just running a jackhammer, but for all kinds of skilled and professional jobs.”

Hall says that to grab the best college students graduating from construction-related programs, Flintco targets a few students early on, usually in their junior year. Many companies “may even pay [the student’s] tuition the last year or two” to help ensure the student joins them after graduation, she says.

College graduates joining Flintco typically would start out as either an assistant superintendent or an assistant



“Every construction job is like a big puzzle.”

—Betsy Tondreau

project engineer. A new hire might make \$42,000 to \$45,000 the first year.

The sky’s the limit from that point on. Knud Hermansen, a professor at the University of Maine’s Construction Management Technology program, said that the CMT program not only surveys its graduating seniors about the jobs

they take, but about how their careers are progressing five and 10 years after they graduate. For the program’s most recent graduating class, students received an average of about three job offers and an average starting salary of just over \$42,000. “They stick with construction, and have a very high level of career satisfaction,” he says.

Hermansen says that it is not uncommon for CMT graduates to see their salaries double within seven to 10 years, and to be earning “six-figure” salaries by the time they are in their mid-30s.

Betsy Tondreau is a real-life example. She picked a construction major at the University of Arizona and was hired by Perini Corp., one of the nation’s largest general contractors, after graduating. Thirteen years later she is second in command on a \$450-million hotel/casino project in Las Vegas. “I love it. Every construction job is like a big puzzle. And you work with a great group of people to put it together,” Betsy says.

The bottom line is that work in the construction industry is interesting, the pay is good, and the job security is definitely there with a shot at management positions “where you aren’t necessarily tied to a desk,” says Marsha Freeland, head academic counselor at Purdue University’s College of Technology.

PHOTO: COURTESY OF PERINI CONSTRUCTION



There's something for everyone in the

Construction Industry



Job titles range so broadly they almost make it from A to Z



Acoustical Engineer + **Architect** (10) + Arbitrator + Attorney + Bricklayer + Building Products

Manufacturer + Business Developer + CAD Operator + **Carpenter** (11) + Cement Mason

+ **Civil Engineer** (15) + Code Writer + **Contractor** (12) + Concrete Subcontractor

+ Construction Manager + Cost Engineer + Detailer + Developer + Educator + Electrical Engineer

+ **Electrical Worker** (18) + Elevator Constructor + **Environmental Designer** (15)

+ Equipment Manager + Equipment Manufacturer + **Equipment Operator** (20) + **Estimator** (19)

+ Fabricator + Fire Protection Specialist + Geotechnical Engineer + Glaziers + Hydrogeologists + Industrial Hygienist

+ Insulation Worker + **Ironworker** (21) + Landscape Architect + **Landscape Contractor** (13) + Lineman

+ Lobbyist + **Marketing Specialist** (22) + Mason + Materials Manager + Materials Testing Consultant

+ Mechanic + Mechanical Engineer + Millwright + Operating Engineer + **Owner's Representative** (23)

+ Owner + Painter + Pipefitter + Planner + Plasterer + Plumber + Project Manager + Project Executive

+ Remediation Contractor + Roofer + Safety Official + Scheduler + Sheet Metal Worker

+ Software Developer + Specialty Contractor + Steel Erector + **Structural Engineer** (14)

+ Superintendent + Surveyor + Technology Officer + Truck Driver + Value Engineer + Writer

There are careers for all kinds in the construction industry, with more than 70 different job titles from acoustical engineer to truck driver. There is something for almost everyone from hands-on crafts (mason) to creative types (architect) to nature lovers (landscape contractor) to number crunchers (cost engineer) to high-tech (CAD operator). Some people think all construction jobs are dirty. You can get your boots muddy at a construction site for sure. But other industry jobs are as clean as a computer lab or as white collar as an owner's board room. Some people say there aren't many women or minorities in construction. The numbers are still low, but industry leaders know these groups make up the work force of the future. We will detail 14 popular career paths in construction on the following pages and answer some of the questions you may have about these careers. What do the people who have these jobs do? Why are these jobs important? How much money can you make? The stories should help you decide, "Is this job for me?"



ARCHITECT

What will I do?

Architects plan and design all kinds of buildings from houses and schools to airport terminals and skyscrapers. Many of the buildings where we shop, eat, work and worship were designed by architects. Architects work with owners to figure out the kinds of spaces needed for different activities in the building and how people using the building will move from one area to another. They select the materials that will be used

If you are good at art, math and science...

and work with engineers to figure out how strong the building has to be. Architects are responsible for making sure that buildings follow local safety codes.

What training will I need?

Architects should be good at art, math and science. High school students interested in a career in architecture should take courses in English, history, art, social studies, math, physics, and computer science. Good communication skills, creativity and the ability to work alone and with teams are also important. To be-

come an architect, you will need a professional degree in architecture, practical training and a license.

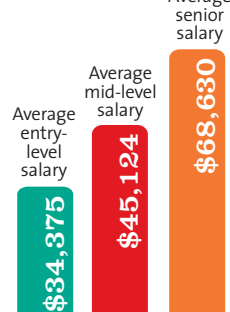
How can I get it?

You can complete a five-year Bachelor of Architecture program. Another option is an undergraduate nonprofessional degree plus a degree from a Master of Architecture program. Architectural students also need career-related experience in an architecture firm. Most start while they are still in school and learn computer-aided design and drafting technology. Architects have to complete a three-year internship, supervised by a licensed architect, before they can become licensed. Once licensed, they can manage projects, become associates in a firm or start their own firm.

What will I get paid?

The average salary of an architect in the U.S. is about \$56,000. The lowest 10 percent earned less than \$36,000 and the highest 10 percent earned more than \$92,000. Interns and entry-level workers should expect to earn about \$30,000.

Architect Salaries



Eric Corey Freed, 35

Owner and founder of OrganicArchitect, San Francisco, Calif.

Q&A

Q: What do you do at your job?

A: My firm designs single-family houses. It is what I enjoy the most, and what I am focused on for the next five years. This year we are starting to develop a community of green homes, a green prefabricated house for low-income people and a greening program for large hotel chains. I also teach other architects how to be green, and volunteer for non-profits.

Q: What do you mean by “green”?

A: Green buildings are both beautiful and environmentally friendly. They use energy efficiently. They don't pollute, and they use energy and materials from renewable sources.

Q: Why is architecture important?

A: Architecture goes beyond creating shelter. Architecture can help solve social problems (affordable housing), create a sense of community (shopping centers), tie us to our history (civic buildings) and even raise our spirits (cathedrals).

Q: Why do we need architects?

A: Architects are problem solvers. Right now they are working on the problem that buildings consume almost 40 percent of the energy used in the U.S. Architects with vision will help find solutions to issues like this facing us today.

CARPENTER

What will I do?

Everywhere there are examples of the work that carpenters do. Houses, schools, hospitals, and almost every type of building are built by carpenters. Carpenters work with many kinds of hand and power tools. They work with

Carpenters build houses, buildings and even highways.

wood to make frames for houses, decks, floors, cabinets, stairs and roofs, and they also work with drywall and other materials for interior and exterior finishing. They also build frames for pouring concrete. Carpenters work with their hands, but they must use their minds to read blueprints and calculate measurements and dimensions. Some are employed by construction firms, some are self-employed and others join trade unions.

What training do I need and how can I get it?

Carpenters have to learn how structures are built. From floors to roofs and everything

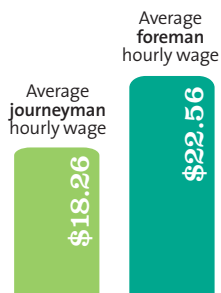
in between, carpenters must know how structures go together, what materials are used and which tools will get the job done. Many apprentice programs offer training in things like math, rigging, blueprint reading, working with reinforcing steel, fabrication and structural steel.

Carpenters are trained either through apprentice programs or by learning skills from mentors and co-workers. Some enroll in four-year apprenticeship programs where training takes place in classrooms and in the field on construction sites.

What will I get paid?

Wages for carpenters vary according to region, the company for which they work and their level of work experience. Most carpenters are paid by the hour, and the amount of money they earn goes up as they learn new skills and gain experience. An apprentice earns about half of the wage paid for three or four years of experience. Some are promoted to foreman or supervisor, positions that command higher wages.

Carpenter Wages



Q: What do you do?

A: As a carpenter apprentice I'm learning all the basics of building. I do everything from hanging doors to working with sheet rock. I've learned how to build steps, which can be pretty complicated, and even how to build a domed roof. There is a lot math involved and a carpenter always has to do a lot of thinking.

Q: Why did you choose to be a carpenter?

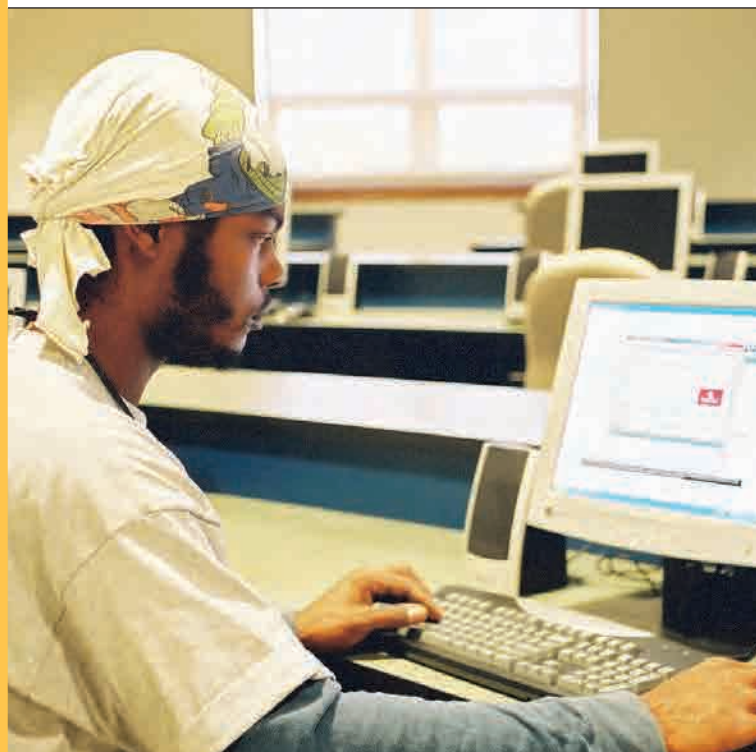
A: I like the fact that it's always different. There is always something new to learn. I've always liked working with my hands rather than sitting behind a desk. I was working as a cook in a restaurant before, and I like this much better.

Q: How are you getting your training?

A: I joined the carpenter's union and began attending the Carpenters and Joiners Apprentice Program. We go to school one day per week and the rest of the time we are out on jobs. I've been here about three and a half years. In that time I've worked with three or four different contractors a year, on all kinds of jobs. When I started all I knew about the craft was that carpenters use a hammer and a tape measure.

Q: What are your goals for the future?

A: After I become a journeyman, I plan to continue taking classes to keep upgrading my skills. I want to get as much training as I can. Ultimately, I want to start my own construction company.



CONTRACTOR

What will I do?

Contractors perform all kinds of jobs required to manage the construction of highways, bridges, tunnels, housing developments, commercial buildings and environmental cleanups. General contracting firms manage and coordinate

If you would like to translate drawings into reality...

the construction process from start to finish. Specialty contractors focus on one specific part of a project, such as the installing the electrical system, placing the concrete or building the steel frame. Contracting firms range from local companies with a handful of workers to global competitors with thousands of employees.

What training will I need and how will I get it?

Different contracting jobs require different kinds of training. Some high school graduates learn construction skills through craft apprenticeship programs that include classroom instruction and paid on-the-job training. They may move up to superintendent jobs and on to project manager jobs with a

contractor. Some start their own companies. Another way to enter the business is to attend a two-year or four-year college for a degree in construction management, engineering or construction science. During college, many students intern for contracting firms. After graduation, they often work as assistant project managers or assistant project engineers. Some contractors return to school after working for several years to earn a masters degree in construction management or a related field. Business training can be very useful.

What will I get paid?

The size and type of firm directly affect the salaries of contractors. Those with a four-year degree from a construction or engineering program can expect higher salaries earlier in their careers. According to U.S. Bureau of Labor Statistics, candidates with a construction-related bachelors degree make salaries averaging \$43,000 a year. Construction managers command annual salaries of about \$62,500. High-level managers make the most, and may earn \$80,000 or more a year. Owners and partners in contracting firms may earn \$100,000 or more.



Bodunde Omodele, 29

Skanska USA, Atlanta

Assistant Project Engineer

Q: How did you decide to become a contractor?

A: I knew about construction and engineering from family members in the industry. I graduated from high school in Nigeria and also attended a university there that offers construction management. I also got experience in the field working for a contractor. I graduated in 2000.

Q: How did you get your current job?

A: I applied for jobs in the U.S. to gain more experience and expand my horizons. But I had little success in my job search because construction is different here. To learn more, I enrolled in Southern Polytechnic State University in Atlanta and got a masters degree in construction management. Through the school, I got an internship at Skanska. After I graduated, the firm hired me.

Q: What do you do in your job?

A: I work with dozens of subcontractors, estimators, designers, material suppliers and the project owners to make sure the building is constructed on time and within budget. I have to think ahead, anticipate problems such as materials arriving late and find a solution to keep the project on track. It takes a lot of teamwork.

Q: Why do you like your job?

A: I love my job because you see a drawing on paper and then you bring it to reality.

Q&A

Ryan Letcher, 28

Midwest Wrecking Co., Oklahoma City, Okla.

Project manager and estimator

Q: How did you decide to become a demolition contractor?

A: My dad works in the industry as an independent insurance agent. He works with a lot of contractors, so I knew about the business. I enrolled in Texas Tech University to get a degree in civil engineering. One day, I read an article about a demolition company. I decided I wanted to tear down buildings instead of build them. So I changed my career course.

Q: What do you do in your job?

A: I work on a lot of different types of projects from small houses to 14-story buildings. I oversee projects so sometimes I drive from one job site to another, checking in with foremen and superintendents on progress. Other times I calculate proposals outlining the cost to tear down a structure.

Q: Why do you like your job?

A: I get to knock down buildings for a living. It's entirely different from building them. When you are building a house, there are drawings specifying the materials and mapping out the design. But when you tear down a building, the drawings don't always exist. The blueprints could be lost or destroyed. So it's a challenge to plan how to tear down a building without knowing all the pieces. I also get to meet a wide variety of people. I am never stuck in the office.



Q&A

Bill Sadler, 30

ValleyCrest, Orange County, Calif.

Project Manager

Q: Why do you like your job?

A: A love of nature, design and construction brought me to this position. I have opportunities to work on a variety of projects, from complex urban revitalization efforts to world class resorts to large master-planned communities. No day is ever like the one before, and this keeps me interested.

Q: How did you get your current job?

A: I graduated from California Polytechnic State University in 2000. My degree is in landscape architecture. After graduation, I worked for several general contractors and two landscape architecture firms prior to joining ValleyCrest.

Q: What do you do in your job?

A: I manage projects from start to finish. After a project is awarded, I create the budget and ensure that our labor and material costs are in line. Preparing and updating project schedules and labor production are also part of my job. Daily, I review the progress of my projects and visit sites. At the job sites, I work with the project superintendent and the customer.

Contractor Salaries

Starting salaries with college degree

\$43,000

Managers

\$62,500

Owners and Partners

\$100,000

CHART SOURCE: U.S. BUREAU OF LABOR STATISTICS, 2004

ENGINEER

What will I do?

Engineers are problem solvers, inventors, and designers. Many things we use every day involve the work of engineers, including roads, buildings, running water and electricity. There are many different kinds of engineers, even in the construction industry. Civil engineers design highways, transit systems, dams and factories.

Environmental engineers protect and conserve our natural resources, and find solutions to problems like water and air pollution. Structural engineers design and inspect structures to make sure that they're well-made and won't collapse. There are other kind of engineers, as well.

Engineers are problem solvers and inventors...

Mechanical engineers design the heating and air-conditioning systems for buildings, electrical engineers design electric systems, and geotechnical engineers deal with underground conditions and structures. Engineers work in office buildings, labs or at construction sites. They help study the problems caused by natural disasters such as Hurricane Katrina

and help rebuild after them. Some travel the nation or the world for their jobs.

What training will I need?

During high school, it's a good idea to study math, science, English and writing. Engineers spend a great deal of time writing reports and consulting with other engineers, so communication skills are important.

How can I get it?

To become an engineer, you will need a bachelor's degree in engineering. The U.S. is known around the world for its engineering schools. There are many to choose from at colleges and universities. It is valuable to get an internship at an engineering or construction company to get practical experience.

What will I get paid?

Starting salaries for engineers are higher than for many other jobs. A recent survey found that engineers with bachelor's degrees and less than a year of experience earned more than \$43,000. Depending on experience and discipline, salaries range from \$40,000 to over \$100,000 a year.



Q&A

Maki Onodera, 26

Han-Padron and Associates, New York City

Structural Engineer/Diver

Q: What does a structural engineer do?

A: My work is a little unusual because I inspect marine structures, such as piers, ports and bridges. I go underwater to make sure these structures are safely built. I recommend repairs and make sure that necessary changes are made.

Q: What is a typical day for you?

A: I spend half my day in the office and half in the water.

Q: Why did you become an engineer?

A: I went to school in Thailand. Ever since high school I've been interested in construction and building. Everyday I saw new expressways and buildings being constructed, and it fascinated me. That's what is so great about engineering—you "get a tangible result. You can see your design actually get built.

Q: What are your goals?

A: I'd like to become a project manager. I'm interested in mass transit development. I think I'd like to work on the design side, designing instead of inspecting.

Engineer Salaries

Average entry-level salary

\$48,000

Average mid-level salary

\$80,000

Average senior-level salary

\$100,000

CHART SOURCE: NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Q&A

Davina Gonzales, 23

Stantec Engineering, Sacramento, Calif.

Environmental Designer

Q: What do you do?

A: I help keep the environment clean by minimizing the effects of construction projects on the environment. I help cities and builders treat their stormwater before it pollutes our natural resources.

Q: What's so great about engineering?

A: Engineering is a profession that carries as much prestige as a doctor. Doors will open because of your degree. There's a chance to make a lot of money in this job, but the work also is very rewarding.

Q: Why do you like your job?

A: It gives me the opportunity to sharpen skills in science, math and English. I also get involved with city planning and designing systems to keep the community's water clean. It's very hands-on.

Q: Where do you see yourself in five years?

A: After I get my professional engineer's license, I want a leadership role in management. I hope to work with all different types of people. I'm not cut out just for a technical job.



Henley (right) with Thai co-worker Sutip Sukdee at the water plant.

Q&A

Mark Henley, 39

Crisis Corps (part of the Peace Corps), Washington, D.C.

Civil Engineer

Q: What made you want to be an engineer?

A: When I was a kid, I would look up at tall buildings and be in awe. I was curious about how they were constructed. My dad told me about civil engineering.

Q: What have you done in the world as a civil engineer?

A: After I heard about the tsunami last December, I was very sad and concerned for the people of Thailand and other surrounding countries. I volunteered with the Crisis Corps, a branch of the Peace Corps, and traveled to Thailand and built a \$400,000 portable water treatment plant. I enjoyed getting to know Thai co-workers such as my friend Sutip Sukdee. Most Thais have nicknames. His nickname is Odt.

Q: What are the benefits of your job?

A: There is stable employment with good pay. I also have the chance to do something constructive and beneficial for society.

Q: What would happen if we didn't have civil engineers?

A: We would have no roads to drive on, no safe structures to live and work in, no clean water to drink, and no safe rivers to enjoy.



How It All Fits Together

There are more than 70 different careers in construction, from acoustical engineer to truck driver. Some jobs, like that of mason, require hands-on skill. Some, like that of architect, require creativity. Other professions, like estimator, require skill with numbers. A few of the most popular careers in construction are detailed here.

1 Architect
Many of the buildings where we shop, eat and work were designed by architects. They plan and design all kinds of buildings, from houses and schools to stadiums and skyscrapers.

2 Carpenter
Working with wood to make cabinets, decks and house frames, is the main activity of carpenters. But they also work with materials like drywall.

3 General Contractor
General contracting firms manage the construction process from start to finish. They oversee and hire other contractors who perform special tasks in connection with the construction of all kinds of structures, including roads, highways and buildings.

4 Demolition Contractor
Demolition contractors bring down older or unsafe structures. They must do this without damaging nearby buildings or endangering people.

5 Landscape Contractor
These contractors build with materials like plants, soil and water.

6 Structural Engineer
Structural engineers design and inspect structures to make sure that they're well-made and won't collapse. They must take into account all sorts of factors, like earthquakes and wind.



7 Environmental Engineer
These engineers protect and conserve our natural resources. They find ways to prevent pollution and solve environmental problems like the contamination of soil, water and air.

8 Civil Engineer
Civil engineers design large-scale infrastructure that moves people, goods, power and water. Some of the structures that civil engineers design

include highways, airports, other transit systems and dams.

9 Electrician
Installation of the cables and equipment that keeps electricity flowing is the responsibility of electricians. They work with switches and converters and sometimes with computerized systems.

10 Estimator
Estimators are responsible for



helping owners and contractors predict the cost of building or demolishing a project. They tally the cost of labor, and materials required. Estimating can be tricky because these costs can quickly change due to bad weather or shortages.

11 Heavy Equipment Operator

Equipment operators run and maintain the big machines on a construction site like cranes, backhoes and bulldozers.

12 Ironworker

Ironworkers bolt, weld and cut steel to build the skeletons that keep skyscrapers, bridges and stadiums standing. Some ironworkers also create ornamental metal work. Others assemble steel reinforcement for concrete structures.

13 Marketing

Public relations and marketing professionals help firms win commis-

sions for new projects. They prepare promotional materials, research business trends and identify potential clients.

14 Owner's Representative

The owner finances the project and makes decisions on how it will be designed and built. The project could be a movie theater, a highway, or an airport terminal. The owner works with architects, engineers and contractors.

ELECTRICAL WORKER

What will I do?

Electrical workers light up rooms wherever they go. They install the cables and equipment that keep electricity flowing across the country and into homes, schools and businesses. They work with electrical switches and converters and sometimes with complex, highly technical computerized systems. They wire houses as well as high-rise buildings and

ing equipment are some of the tools of the trade. Electrical workers learn how to test electrical systems, to identify problems and to replace wiring, equipment, and fixtures. Training in blueprint reading is necessary to determine location of wiring and equipment in structures.

Many electrical workers are trained through three to five-year apprentice programs.

There are many apprentice programs available, some sponsored by electrical worker unions, or by other organizations.

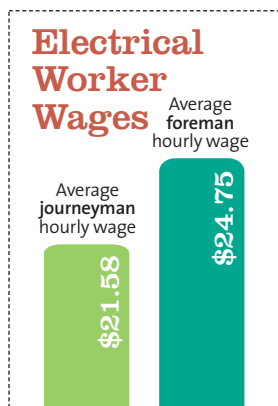
Upon graduation they become journeyman.

Electrical workers light up rooms wherever they go.

they repair and maintain electrical systems. Some do jobs involving fiber optics, sound and fire alarm systems and others work as linemen, installing and maintaining cables or high-tension lines.

What training do I need and how can I get it?

Electricians must train to use a variety of tools and equipment. Working with electricity can be dangerous so learning to work safely is important. Power tools, measuring devices and test-



prentice wages. Some journeymen make twice what they made as an apprentice. Experienced workers draw higher wages by being promoted to foreman or supervisor positions.

What will I get paid?

For most electrical workers, pay comes from an hourly wage. How much they earn depends on location, for whom they work and how many years they have been on the job. When starting out, electrical workers make ap-



Ricardo Rodriguez, 25

Orlando, Fla., Electrical Engineer Apprentice, Int'l Brotherhood of Electrical Workers Local #606

Q: What do you do?

A: My job changes all the time. Now, I'm working with a contractor putting fire alarms in the Pirates of the Caribbean ride at Disney World. We are wiring panels and going through the building to plan where to put conduit and then pulling cable in. Working with electricity can be dangerous, so part of my work is coordinating with other engineers on the job.

Q: Why did you choose to be an electrical worker?

A: I've always been a hands-on kind of person and that's the kind of job this is. I decided to do it because I had not found a career yet and this was something I knew I could do well and would like. If you like to dissect things, take them apart and put them back together, then you would like this job.

Q: How are you getting your training?

A: I have a friend who is a journeyman electrical engineer and he told me about the IBEW's National Joint Apprenticeship Training Committee. I've been in the apprenticeship program for four years now and I am close to finishing and becoming a journeyman. I've worked with several contractors on different jobs in that time. I learn a lot from the people I work with.

Q: What are your goals?

A: My goal now is be a journeyman and then find a contractor to work for. I'm looking to further my career eventually by becoming a foreman or a supervisor. Eventually I want to be a project manager.

PHOTO: GARY BOGDON

ESTIMATOR

What will I do?

As an estimator you'll be responsible for helping owners and contractors calculate the expense of building or demolishing a project by tallying the cost of labor, materials and equipment required. Project owners often use these estimates to help select a contracting firm. Estimating can be tricky because material shortages, bad weather and an increase in fuel costs can dramatically change a project's total cost.

If you like working with and analyzing data...

Estimators review preliminary building drawings and sometimes visit the proposed site to understand all the components of a project.

What training will I need and how can I get it?

Employers are increasingly looking for estimators with college degrees in building construction, construction management, construction

science, engineering or architecture. Skill in math is very important because estimating involves calculating costs and predicting future prices of materials. Young estimators also get much training on the job by working closely with veteran estimators. While in a college, many students participate in internship programs. Internships can provide additional training before graduation and help you determine if estimating is the right career choice.

What will I get paid?

Salaries of cost estimators vary widely by experience, education, employer and industry. Estimators start off earning about \$30,000 to \$40,000. Those with more experience earn about \$62,000. A senior estimator with a good track record predicting project costs can earn more than \$80,000 a year. College graduates with a bachelor's degree in construction management or construction science received job offers averaging \$42,229 a year, according to a 2003 salary survey by the National Association of Colleges and Employers.

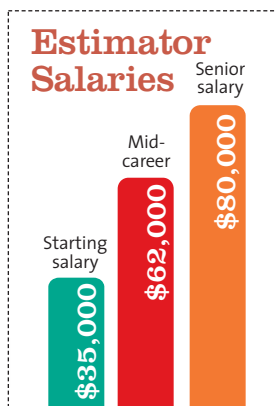


CHART SOURCE: U.S. BUREAU OF LABOR STATISTICS, 2004

Q: How did you decide to become an estimator?

A: My first job after college was for a small construction management company where I did lots of different tasks. I found estimating to be more challenging than other types of jobs. It involves communicating with owners, architects and subcontractors. And it gave me the opportunity to have the first look at many projects.

Q: How did you get your current job?

A: I graduated from the University of Colorado in Boulder in 2000. My degree is in architectural engineering. My mind was set on someday becoming a project manager. My first job required me to do a lot of estimating. I found it more fulfilling than my other tasks. After working at my first job for a while, a friend told me about my current job. And here I am.

Q: What do you do in your job?

A: Estimating entails a lot of communication and coordination with subcontractors and owners. I decide which subcontractors to use for each trade of the project. To do this I learn every aspect of the project. By knowing the ins and outs of the project I can help subcontractors with any questions. I am also responsible for knowing and researching approximate costs of all items for the project so that we can develop a budget.

Q: Why do you like your job?

A: I love the way it feels when my company is awarded a project and I know that my "number" is a good number. I also really like the adrenaline rush when my company is the low bidder in a hard bid selection process.



HEAVY EQUIPMENT OPERATOR

What will I do?

Whether they drive a machine that digs, pushes dirt, paves roads or lifts heavy objects, heavy equipment operators are in the driver's seat. Operators run machines such as cranes, pavers, bulldozers, excavators and many other kinds of equipment. They work on construction of highways, buildings, dams and airports. Operators manipulate cranes that hoist and deliver

tors learn to run several different kinds of machines.

Equipment operators can enroll in apprentice programs, where they learn through a combination of classroom study and on-the-job work. Many apprentice programs last from three to five years. Many operators begin as a helper for a heavy equipment company crew. After a few years, they are usually ready to get behind the controls.

Construction needs skilled equipment operators

materials and backhoes that dig into the earth. They are needed for all of construction's diverse jobs.

What training do I need and how can I get it?

Construction demands a great variety of equipment. Operators must learn to operate their machines and maintain and service them. Some equipment opera-

How much will I be paid?

Like many jobs in construction, equipment operators usually work for an hourly wage. The amount they are paid per hour is different from place to place, but they make more as they gain experience and get better at working their machines. An apprentice makes less than operators with several years experience. But after three or

fours years, or after graduating from an apprentice program, the wages increase. After mastering their operating skills and proving they can lead a job, some are promoted to foreman or supervisor.

Heavy Equipment Wages

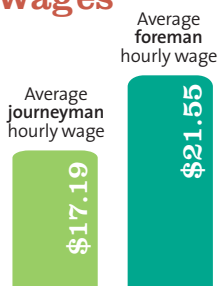


CHART SOURCE: U.S. DEPT. OF LABOR, OCCUPATIONAL EMPLOYMENT STATISTICS; PERSONNEL ADMINISTRATION SERVICES, INC.



David Keith, 22

Santee, CA, heavy equipment operator, Cass Construction Co.

Q&A

Q: What do you do?

A: I operate an excavator. This machine has a blade underneath that's used to scrape the ground. We are working on a project for a new business development, and it's my job to grade the ground down. I've also used the machine for digging trenches. I've worked as a grade checker, too, which is checking the ground for the right grade after it's been excavated.

Q: How are you getting your training?

A: I'm learning from my supervisors. They are teaching me how to grade and how to make the machine do what I want it to do. I started with this company as a laborer, but in a few months they taught me how to be a grade checker. It helped me understand what the machine does. I've learned everything on the jobsite.

Q: Why did you chose this as a career?

A: I was working in another field when the company went on strike. I needed to find a job. I knew that construction was something I'd like to do, so I applied and Cass hired me as a laborer. It's hard work, but the thing I like the best is that it's always different. I learn new things every day and before I can get bored with one job I'm on to the next.

Q: What are your goals for the future?

A: I want to move up to operating the bigger machines. My goal is to get as good as possible at my job. I'd like to be one of the best operators around.

IRON WORKER

What will I do?

When building with steel and metal, ironworkers are on top of it. And many times their work takes them to the top. The tops of skyscrapers, bridges, towers or stadiums, where they build the steel frames that keep those struc-

Ironworkers perform many metalworking tasks.

tures standing. They bolt and weld steel together. They signal crane operators to position the girders and then use a variety of tools to fasten them together. Many do ornamental metal work. Others specialize in using steel to reinforce concrete. Still others are experts at rigging, or assembling the hoists and lifts needed on many construction jobs.

What training do I need and how can I get it?

Learning about safety and the tools of the craft are the first things an ironworker learns. They learn which

tools are used to cut, weld, shape, hoist and fasten together steel. Welding is one of the main skills an iron worker needs. Ironworkers also have to learn the math needed to do calculations and measurements.

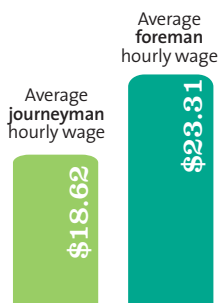
Many learn the craft through an apprentice training program. Training programs usually last three to five years and involve classroom work and on-the-job training. Those who attend an apprentice program graduate to become journeymen, which means they've mastered the basics of iron working. Some choose to learn on the job by hiring on with an iron working crew.

What will I be paid?

Like most jobs, the wage amount for a beginner is less than those who already have mastered the skills. Ironworkers usually are paid by the hour. After apprentices become journeymen, they can

earn twice what they earned as beginners. Pay increases may continue through promotions to positions of foremen or supervisors, jobs that are filled by experienced workers.

Ironworker Wages



Maggie Alberts, 21

Toledo, Ohio. Apprentice Ironworker, Int'l Association of Bridge, Structural, Ornamental and Reinforcing Iron Workers Local #55

Q: What do you do?

A: I just started the IABSORIW's apprentice program. I'm fresh out of safety training. But I'm a fast learner. I'm already out on jobs tying rebar. Right now we are on a job to build a Super Walmart. We will be putting the building's skeletal structure together. In my job as a rebar tier I have to measure out bars and tie them together. The rebar is used to reinforce concrete, so we put them where they need to be in the structure.

Q: Why did you chose to pursue iron working as a career?

A: When I had my first metal shop class in ninth grade I liked it and took metal shop all through high school. I knew I wanted to do welding or work with metal as a career. Being an ironworker, there are a lot of different jobs you can do working with metal. There is welding involved, and you can be a rigger, a connector, a rod tier or a lot of other things.

Q: What is your training like?

A: The apprentice program lasts four years. When you graduate you are called a journeyman. One day a week I'm in school and the rest of the time I go to jobsites and get instruction. It's hands-on training. We use math a lot to measure and for reading blueprints. Safety training is one of the first classes. Then you start learning to use all the different tools you need.

Q: What are your goals for the future?

A: My first goal is to work toward becoming a journeyman. I want to keep learning as much as I can about working with metal.



MARKETING

What will I do?

Marketing professionals help architects, engineers and contractors win assignments to work on projects. Responsibilities may include writing and designing proposals, press releases and other promotional materials such as brochures and newsletters. Marketing

If you enjoy writing, research and graphic design and have the ability to analyze information...

professionals sometimes organize special events and help colleagues prepare client presentations. They often research construction industry and business trends, develop strategies to help their firms enter new markets and help identify potential clients.

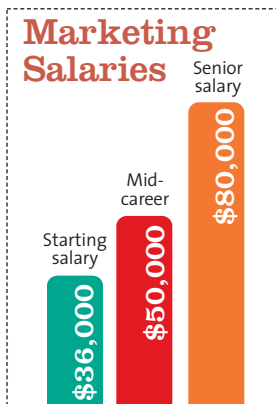
What training will I need and how will I get it?

Marketing professionals need a college

degree. Employers often look for candidates with degrees in communications, general business or those who specialize in a marketing program. A liberal arts degree with a major like English or art history will also provide the kinds of skills needed for success in this profession. People interested in a marketing career should have good writing and research skills and the ability to analyze and summarize information. Graphic design and computer skills will also help candidates win marketing jobs.

What will I get paid?

Salaries in this profession can vary widely depending on the candidate's prior experience, the size of the company doing the hiring, and the company's location. Recent college graduates entering the marketing profession can expect to earn between \$32,000 and \$40,000 per year. Managers can expect annual salaries between \$40,000 and \$60,000. Marketing directors can earn anywhere from \$60,000 to more than \$100,000 a year.



Q&A

Marisa Nedock, 25

Marketing Manager, Barton Malow Co., Detroit

Q: How did you decide to choose a career in marketing?

A: In high school and college I was heavily involved in music and journalism. Marketing seemed like the natural choice. I'm outgoing and creative and enjoyed performing. Now I can be creative through my writing, graphic design, publication layout, presentation and communication skills. I graduated in 2001 from Michigan State University. My degree is in organizational communications and public relations.

Q: How did you get your current job?

A: In college, I worked as a communications assistant for the Michigan Dept. of Management and Budget. My first job after graduation was for a small architecture and engineering firm as a marketing and public relations coordinator. Two years later, I went to work at a larger construction management firm. People I knew from the Society for Marketing Professional Services led me to my current job.

Q: What do you do in your job?

A: I prepare proposals and presentations to help my construction firm, Barton Malow, win new projects. I create brochures for ad campaigns and newsletters. I also manage a few marketing coordinators.

Q: Why do you like your job?

A: Working closely with architects, engineers and contractors is interesting because I work with other creative professionals. Every time I receive a request for proposal I'm excited to see what the client is building and how it will make a difference in the community. I have put together marketing materials for new facilities in my school district, my hometown and my university.

PHOTO: DONNA TEREK

OWNER'S REPRESENTATIVE

What will I do?

An owner's representative represents the interests of the individual, company or public agency that wants to build something. It could be a

If you like to organize the team, you might like this job.

house, a school, a movie theater, a highway, an airport terminal or any other kind of construction project. The owner finances the project and makes the decisions about how it is built. The owner's representative works with architects, engineers and contractors to carry out those decisions. The owner organizes the team, plans the project and finds the money for it. The owner's representative is a link between the company and the designers and builders.

What training will I need?

There are many ways to become an owner's representative. Some have a technical background in architecture or engineering.

Others have experience in construction management, business or law.

How can I get it?

Most people working for the owners of construction projects will have a degree from a four-year university. After graduation, they will work in the field for a few years to gain practical experience and an understanding of the business. If management interests you and you have knowledge of the construction business, then you can move up to an owner's representative position.

What will I earn?

Salaries for owner's representatives vary depending on the owner and the nature of the work. On the low end, someone working for a non-profit group that builds affordable housing, for example, might earn between \$40,000 to \$70,000 a year. Salaries at

private corporations on the other hand could be between \$70,000 to \$120,000. Public agencies, like a state highway department, would be in between.

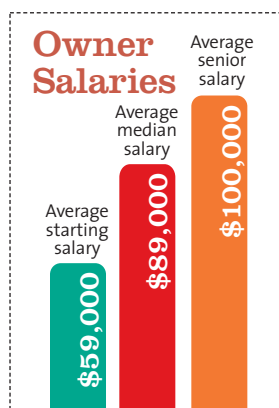


CHART SOURCE: ZWEIG WHITE INFORMATION SERVICES LLC

Q: What is the Corps of Engineers?

A: The Corps is a federal government agency. Its mission is to provide engineering services to the nation. These include designing and managing the construction of buildings, waterways and other civil works projects. We also build military facilities for the Army, the Air Force, and other defense and federal agencies. The Corps has 34,600 civilian and 650 military employees.

Q: What do you do for the Corps?

A: The Corps also helps in times of emergency. I make plans about what to do in case of an emergency and carry them out when something happens. Right now, I am part of the team coordinating the Corps' work rebuilding after Hurricane Katrina.

Q: How did you get where you are today?

A: I am a licensed professional engineer with a bachelors degree in civil engineering. The Corps also sends me to training classes and has given me assignments that develop my skills.

Q: What's most interesting about your job?

A: I get to travel and see parts of the world that I would never see otherwise. I have developed friendships with interesting people who live all over the world, and there are many opportunities for advancement. To me, the Corps of Engineers is like a large extended family.





Jumping into the

Computer gaming skills translate into construction jobs
By Kathleen McFall

Future of Construction

W

hen Jack Padgett first grabbed the controls of an earthmoving machine at the start of his career in construction, he never thought that one day the big machine would be able to tell him where he needed to dig. But that is exactly what happens today.

Now Jack controls a 93-ton excavator with a pair of joysticks from a comfortable seat in an air-conditioned cab. A small computer screen with a lifelike picture of the job site shows where his machine is all the time, and it tells him where and how much to dig. On one day recently it helped him shape the ground for a new NASCAR racetrack he was helping to build in Iowa.

“The old machines had handles and levers, but that is definitely not the case anymore,” says Mark Casso, president of the Construction Industry Roundtable, an organization helping construction companies find ways to build faster, better and cheaper. “Now, it is more like a jet cockpit,” he says.

Technology has changed construction, but even bigger changes are ahead.

PHOTOS: COURTESY OF CATERPILLAR INC.

Computers, sensors and joy-stick controls give today's operators of construction equipment the power to make big jobs go fast.

Until recently, builders had a hard time finding ways to use computers in their work. Architects and engineers have used computers for a long time. So have specialists who have very cool software to do things like figure out how air currents will move in new buildings. Others suggest changes to building designs to help music sound great in concert halls. In the end, after all the calculations, designers have traditionally handed the builders rolls of paper plans when the time came for construction.

That is now changing as more and more builders get tools—like Jack Padgett's excavator—that can work with computerized plans.

Constructing houses, big buildings, highways and bridges is like putting together huge, fantastic puzzles. And leading contractors are now finding that building from plans, created as 3-D models on computers, can help them build complicated structures faster, more safely and with fewer errors. The models show them exactly where to put things so the thousands of parts involved go together well.

Digital plans also help builders plan the process of construction—what gets built first, and what follows next. And they help contractors buy their materials so everything they need gets to the job site in the right order at just the right time.

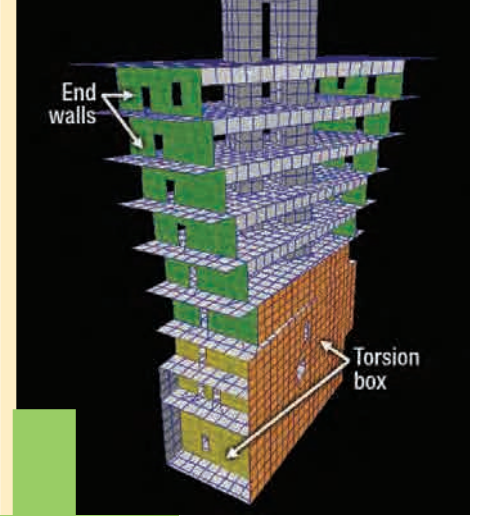
Taking digital plans to job sites also lets contractors use them to aim lasers and show workers exactly where to put walls and drill holes and place equipment. Because electronic plans can be extremely accurate, they are even used to make larger and larger chunks of structures in factories, rather than on the job sites, so big components can be trucked in and snapped into place.

Other interesting technology is hitting job sites as well. Construction is starting to use lots of electronic sensors. It uses them, for instance, to make work sites safer by warning equipment operators when they are too close to power lines or when people are standing near. Builders also are putting sensors inside beams and walls to make sure they stay strong. After the work is finished, built-in sensors can warn people if something needs attention, like fixing leaks or even hidden earthquake damage.

The men and women who take care of construction equipment are going high-tech, too. Equipment makers are building cranes and earth movers and trucks with satellite trackers and transmitters for sending data about machine performance to maintenance crews. They can tell if a part is about to go bad or needs attention. Technology is helping managers keep machines working by letting them fix them before they break, rather than after they stop working. Managers are also using video game-style tools to train operators.

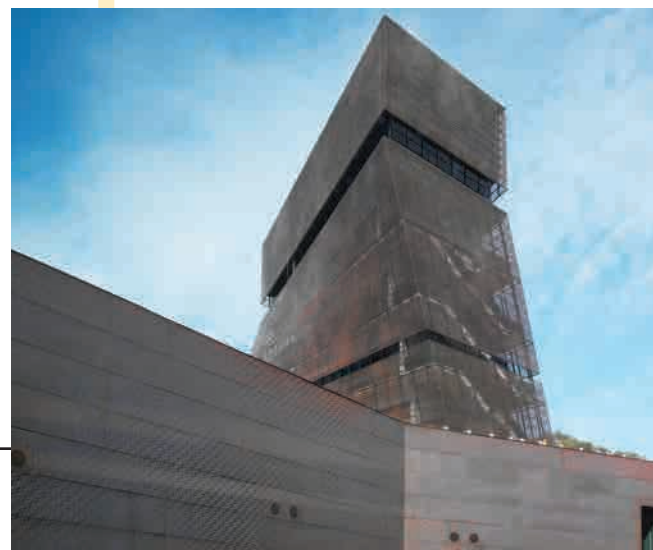
Construction companies use smart communications tools, too. Every project takes a big team, and the many players often need to send lots of messages and data about projects to their partners, even in remote parts of the world.

The flow of new technology going into construction has already helped the industry work so much better that leading companies are eager to hire young people who are comfortable with computers—and even video games—to help improve their operations. On job sites, and in offices and research labs around the world, sharp and inventive people are driving construction's technology revolution. Being part of it is fun, rewarding, and—quite simply—amazing.



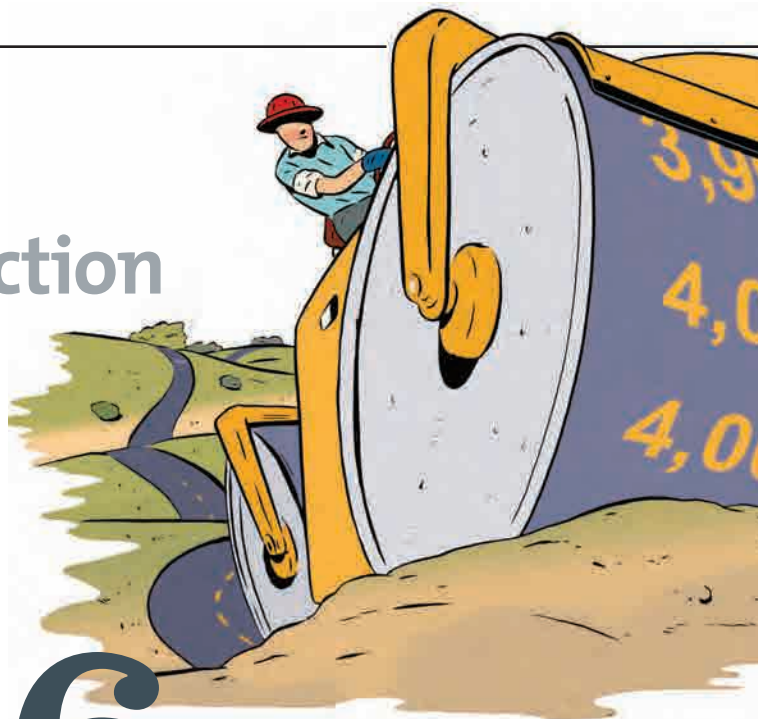
3 steps to reality

Architect's computer model, top, takes shape in concrete and steel and becomes the fantastic new San Francisco Art Museum in the end.



Fun Facts

about construction



1. What president was also an architect?

Answer: Thomas Jefferson was an accomplished architect, despite being self-taught. His major works include Monticello (his home), the Virginia State Capitol and the University of Virginia. His buildings helped initiate the ensuing American fashion for Federal style architecture.

2. What movie star worked as a carpenter before he became an actor?

Answer: Harrison Ford (Indiana Jones).



3. Which building is larger in volume, the Pentagon or the 110-story Sears Tower?

Answer: The Pentagon, with 77 million cubic feet, is larger. The Sears Tower contains 61 million cubic feet.

5. Which two former TV network anchormen's fathers were construction workers?

Answer: NBC anchor Tom Brokaw and CBS anchor Dan Rather. Brokaw's father, Anthony "Red" Brokaw, worked for the U.S. Army Corps of Engineers on the Fort Randall Dam on the Missouri River in South Dakota, and later on the Gavins Point Dam near Yankton. Rather's father, Irvin "Rags" Rather, was a pipeliner who dug ditches for laying pipes in the Texas oil fields.

6. How many miles of paved roads are there in the U.S., and how many bridges?



9. How big is the largest dump truck in the world?

Answer: The Caterpillar 797B, which can carry a load of 380 tons. It has a 3,370-horsepower engine, and is 47 feet 8 inches long, 32 feet wide, and 24 feet 11 inches high. Its tires are 13 feet 6 inches in diameter. It costs \$5.7 million. It is used in surface mines to haul ore and rock.

7. What project is nicknamed "T-REX"?

Answer: Colorado's Transportation Expansion Project, involving road and rail improvements to Denver's southeast corridor, scheduled for completion in 2006.

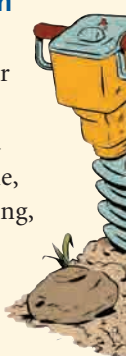


8. How many housing units were built in the U.S. in 2004?

Answer: 1.84 million units of housing.

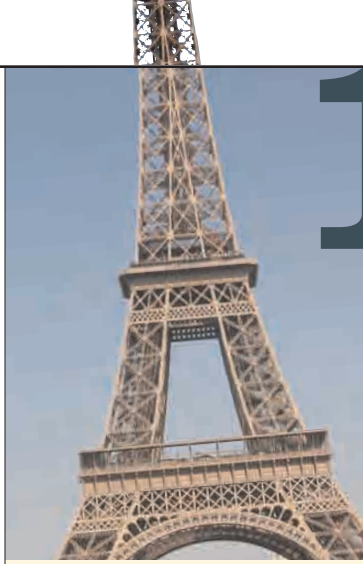
10. What percentage of construction and demolition materials are recycled in the U.S.?

Answer: 25 percent





Answer: 4 million miles of paved roads, including 45,000 miles of interstate freeway and 600,000 bridges.



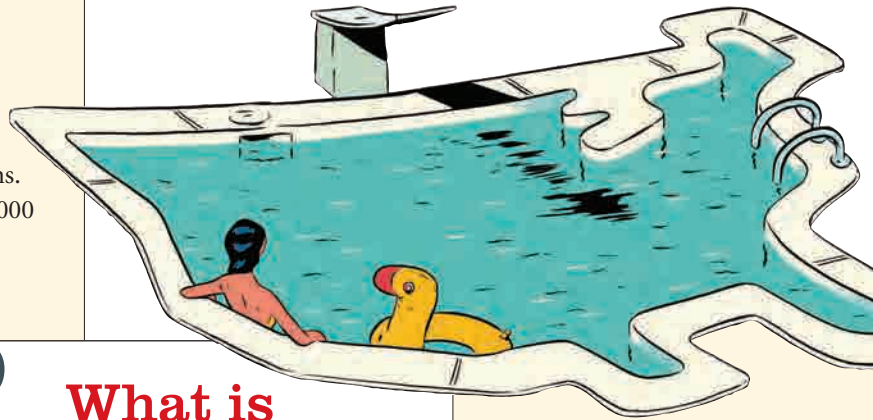
12. How long does it take to paint the Eiffel Tower?

Answer: 15 months, by a team of 25 painters, using only brushes. The paint weighs 60 tons. The surface area is 239,000 square yards/200,000 square meters.

15.

How many home swimming pools were built in the U.S. in 2003, and how large is the residential swimming pool market?

Answer: 165,000 home pools were built in 2003, at a cost of \$8 billion.



13.

What is a mole?

Answer: A self-propelled tunneling machine. Some bore tunnels to diameters over 30 feet.

14. Which bridge built in 98 A.D. is still in use?

Answer: The Alcantara Bridge, in Spain, built by Roman engineer Gaius Julius Lacer. It has six arches made of granite blocks without cement. It is 600 feet long, rising to 175 feet above the river. Broken in the Middle Ages and damaged in a later war, it was repaired each time.



16. Which is the longest suspension bridge in the world?

Answer: The Akashi-Kaikyo Bridge in Japan. It's main span is 6,532 feet.

17. What is the total length of the U.S. Interstate Highway System, and when did construction on it begin?

Answer: The system totaled 46,677 miles as of 2003. Ground was first broken on Aug. 13, 1956, on Interstate 70, in St. Charles County, Missouri. Dwight D. Eisenhower was President.

11. What was the first school in the U.S. to teach the principles of engineering and their application?

Answer: The U.S. Military Academy at West Point, N.Y., founded in 1802

18.

What is the tallest building in the world?

Answer: The Taipei 101, an office building in Taiwan. It is 1,671 feet/509 meters tall, and opened on December 31, 2004.

