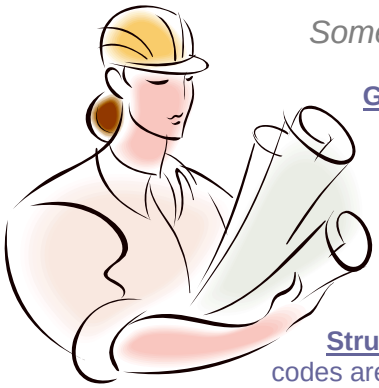
Engineers… what do they do?
How are they involved in designing a city?

Civil Engineers:

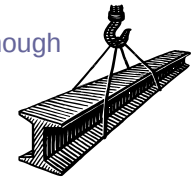
– design buildings, bridges, airports, highways, railroads, schools, houses and other structures and facilities.



Some Branches of Civil Engineering…

Geotechnical Engineering – Design of underground structures and structures affected by the soil or rock condition, such as deep and shallow foundation systems, pavement, retaining structures, tunnels, and other underground structures. Conduct investigation of soil condition and determination of soil properties through field investigations and laboratory testing. Geotechnical engineers are needed to build things like subways, bridges, buildings and other structures.

Structural Engineering – Ensure that all of the requirements of the various building codes are followed in determining the loads acting on the structure. Design structural members such as steel, concrete, timber or masonry to insure that a structure is strong enough to carry the loads imposed on the structure and efficient enough to be cost effective. Structural engineers are involved in almost every project…bridges, skyscrapers, airports, houses, etc…



Traffic Engineering – Determine the impact a new structure or facility will have on the traffic by analyzing the impact the increased number of vehicles will have on the community. Traffic Engineers determine if the increased traffic will warrant the addition of extra traffic signals to ensure the roadways will be efficient and safe for the drivers on the road. They also decide what signs and markings are required on the roadway in order for people to find their way safely and efficiently and helps them not to get lost.

Marine and Coastal Engineering – Design of water based structures… piers, wharfs, marinas, breakwaters, fendering systems, bulkheads, off-shore oil platforms, etc… Coastal Engineers determine the effects of construction on stream flow, sand deposits and erosion. Anything built on the water, the shoreline or the ocean is designed by a Marine/Coastal Engineer.

Civil/Highway Engineering – Design of new highways, expansion and improvement of existing highways, creating more and safer roads and highways, reducing traffic and increasing safety. Designing drainage structures, like manholes and catch-basins to keep the roadway free of water by adjusting the pitch of the pavement and allowing the roadway to drain.

Site Engineering – Adjusts the site in order to make it suitable for construction. The site engineer selects the desired elevation of the site and designs an appropriate grading of the site in order to have a level area to place your structure, for the site to drain properly, and to make the site more visually appealing. Having a well planned site makes construction easier and prevents future maintenance problems.

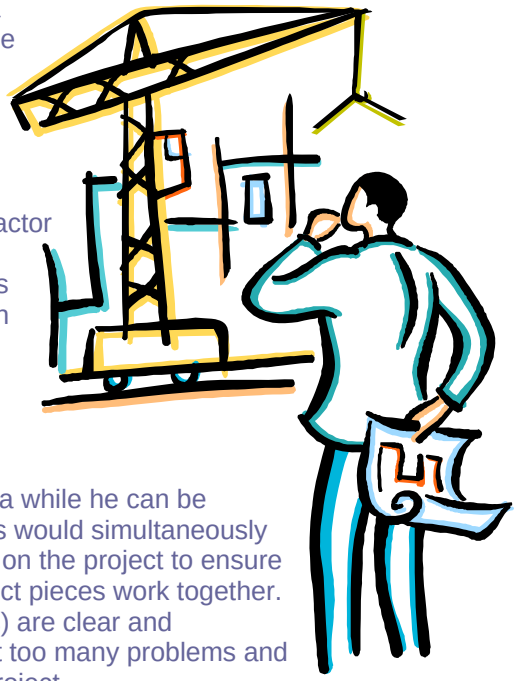
Civil Engineering (continued)….

Transportation Planner – Plans transportation systems. For example' where would be the best streets to have a bus line?' Which locations would be most convenient for the bus stops? Could the existing system be improved by changing the routes or changing the stop locations, making express buses or adding bus lanes on the roads? They also do the same for subways systems and High Occupancy Vehicle (HOV) Systems. This makes transportation systems more efficient and better able to help the community get where they need to go.

Environmental Engineering – Determines the best strategies for maintaining or rehabilitating an environmental habitat. For example, 'Will a project disrupt an existing environmental system? What can be done to adjust the project and minimize the impact on the environment? If the project must go forward, what mitigation (environmental improvements) can be done elsewhere to make up for what was lost in the project area? Environmental engineers also design, water treatment systems and develop strategies for environmental clean up; turning contaminated properties into properties that can once again be used productively.

Cost Estimating – Estimators use their knowledge of construction to determine an estimated price of a project. This allows the client to budget the appropriate amount of money for the project. And also gives an opportunity to look for alternate construction methods that may save money and make a project more cost effective. This is very important because often projects are funding by local, state and federal government agencies, in other words your tax dollars; cost estimators help save the taxpayers money and get the correct amount of money for the project allocated in the government's budget.

Scheduling – A Scheduler is an engineer who estimates and tracks the schedule of a project. In order to plan effectively, the owner of a project needs to know when his project will be finished. Also the contractor needs to know how to predict the construction schedule in order to know how much money the project will cost to build to he can bid an accurate price on the project. Schedule overruns will cost extra money to pay the workers and keep the equipment on site; this will cut into the contractor's profit. A good scheduler is needed to keep everything on track and make sure all of the materials are on site in time and all of the items that are on the critical path are finished on time. Items on the critical path are items that if they are not finished on time hold up all of the other work.



Construction Inspection – Inspectors are engineers that work for the Contractor or Design Firm whose task it is to watch the actual construction of the project as it progresses and confirm that everything is being built as intended. This is an important job because he or she often has the final say on the construction techniques used in the field. It is his or her responsibility to make sure everything is at built at the quality level required by the contract documents and to recognize when things do not match the plans and changes are required.

Project Management – After an engineer has worked in a specialty area for a while he can be promoted to act as a Project Manager. Projects have many type of engineers would simultaneously on the project. The Project Manager coordinates all of the engineers working on the project to ensure that all of the different engineers are working together to make all of the project pieces work together. Also, he will make sure the contract documents (blueprints and specifications) are clear and understandable, so the Contractor will be able to complete the design without too many problems and that the engineers will stay on schedule and on budget when designing the project.

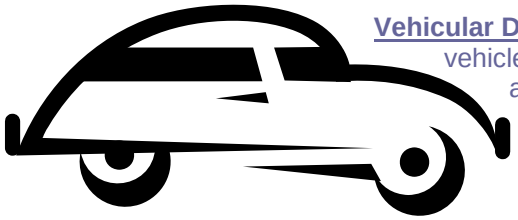
Other Fields of Engineering:

Mechanical Engineer – design mechanical systems…cars, boats, planes, motors, machinery, building mechanical systems; using statics, dynamics, continuum mechanics, multi-scale computational mechanics and other theories.

Some Branches of Mechanical Engineering…

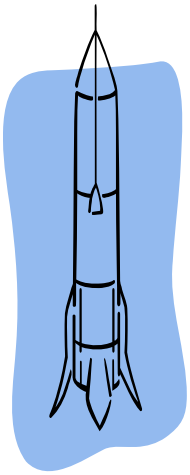
HVAC Engineering – Design of systems for buildings… heating, ventilating, and air conditioning systems (HVAC). HVAC Engineers determine the thermal conductivity of the structure (how much heat is lost through the walls, windows, doors, etc…) they use this to determine the size of systems used to heat or cool the structure. They also select the best type of systems to use based on the conditions of the structure. HVAC Engineers help to improve the comfort of the building occupants and improve the energy efficiency of a building; saving money and saving energy.

Production Design Engineering – Design of machinery and manufacturing equipment. Designing specialized equipment to achieve a certain task; such as conveyor systems, boxing and packing systems, cutting and trimming systems, labeling systems, etc… Imagine all of the small tasks required in an assembly line making a product. Each step in the assembly can be mechanized by the engineer to make an efficient system and an economic product.



Vehicular Design Engineer – Design of cars, SUVs, trucks, buses, trains and other vehicles. Their work makes vehicles more visually appealing, energy efficient, aerodynamic, cost efficient, stronger, safer, etc... Choose this career and you could be helping to designing the future line of 2020 cars, imagine the features that will be available in cars and other vehicles by 2020.

Aerospace Engineer – specialized branch of Mechanical Engineering. Aerospace Engineers design airplanes and spacecrafts to create the lightest, most efficient, aerodynamic aircrafts. She or he utilizes aerodynamics and lightweight materials to streamline vehicles. The goal of the aerospace engineer is to allow for fast and efficient passenger air travel and design the next generation of spacecraft for space exploration, rockets, missiles, etc…

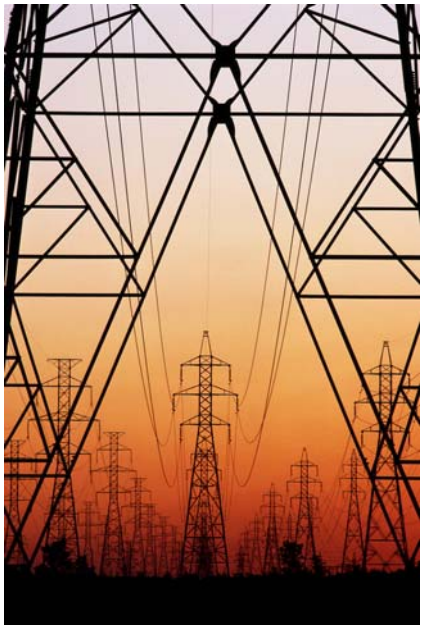


Biomechanical Engineer – specialized branch of Mechanical Engineering with a design focus on regenerative medicine, tissue engineering, biomedical computation, cellular and molecular systems, quantitative biology, and using machines and mechanical systems to make medical advances. In biomechanical engineering the fields of biology, engineering, and medicine are interrelated to develop new medical advances for example artificial hearts, artificial limbs and other organs, new medicines and other medical technologies.

Electrical Engineer – design electrical systems…electronics, building electrical systems, power generation, computers

Some Branches of Electrical Engineering…

Power Systems Engineering – Design of power systems… power plants, generators, electricity production. Types of plants might include fossil fuels (like coal, oil or natural gas), hydropower, wind power, solar power, nuclear, etc… Design and maintenance of the power grid of the city is one of the most important tasks an engineer might undertake, without power, the city comes to a standstill.

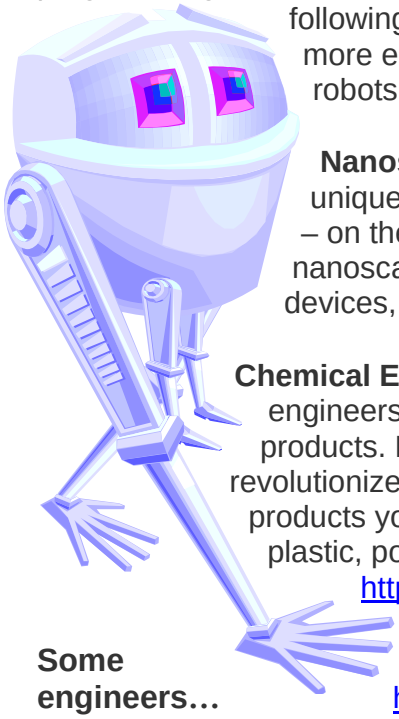


Electronics Engineering – Design of cell phones, radios, speakers, MP3 players, CD players, satellites, televisions, etc… Everyday electronics engineers are developing new products that will become the necessities of the next generations.

Electrical Systems Engineering – Design of electrical building systems, power distribution, electrical circuits, following building codes, lighting distribution and circuits. The Systems developed by systems engineers keep all of the buildings of the city powered and the building equipment running properly.

Computer Electronics Engineering – Design of computer components and equipment… hard drives, CD/DVDs, RAM, processors disk drives, digital peripherals such as cameras, printers, and other computer components in an effort make them, smaller, faster, more efficient, less expensive and develop advances that would make them more attractive to consumers.

Robotics Engineering – design robotic systems… cross of mechanical engineering, electrical engineering and computer programming. Robots need to be wired with electrical circuitry to moves mechanical systems, by following direction of a computer program. Robots are used by society more and more each day; many tasks that are done today by man will be performed by robots in the near future.



Nanoscience and Nanotechnology Engineering - Nanoscience is the study of unique behaviors and properties of materials that occur at extremely small scales – on the scale of atoms and molecules. Nanotechnology is the application of nanoscale science, engineering and technology used to make new materials and devices, including biological, medical and other applications.

Chemical Engineering – using chemistry to develop or improve materials; chemical engineers design the chemical processes that turn raw materials into valuable products. Biology, medicine, metallurgy, and power generation have all been revolutionized by engineers' ability to split the atom and isolate isotopes. Most of the products you use everyday have been developed by Chemical engineers… oil, gas, plastic, polymers, medicines, fabrics, What is a chemical engineer? http://www.pafko.com/history/h_whatis.html

Some engineers… predictions of future developments by the next generation of http://www.battelle.org/forecasts/technology2020.stm#5