

Engineers

What do they do?

How are they involved in designing a city?



Types of Engineers

- Aerospace
- Biomechanical
- Chemical
- Civil
- Electrical
- Mechanical
- Robotics
- Nanoscience and Nanotechnology



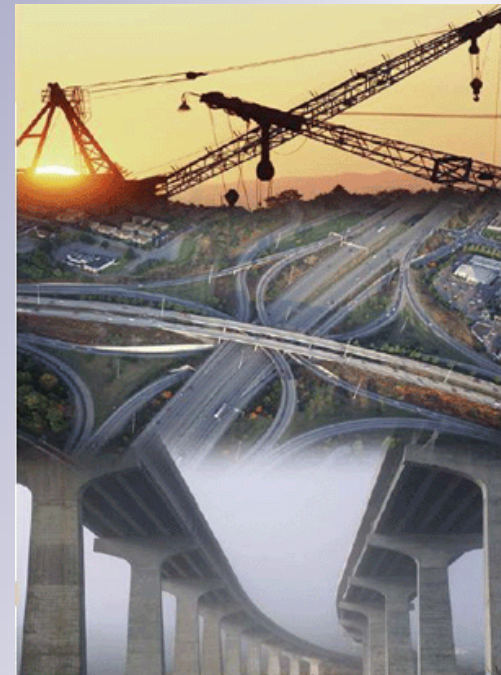
Civil Engineers

- Design
 - Buildings
 - Bridges
 - Airports
 - Highways
 - Railroads
 - Schools
 - Houses
 - Other structures and facilities



Branches of Civil Engineering

- Geotechnical Engineering
- Structural Engineering
- Traffic Engineering
- Marine and Coastal Engineering
- Civil/Highway Engineering
- Construction Inspection
- Transportation Planner
- Environmental Engineering
- Project Management
- Scheduling
- Site Engineering
- Cost Estimating



Geotechnical Engineer

- Design underground structures and structures affected by the soil or rock condition
 - Deep and shallow foundation systems
 - Pavement
 - Retaining structures
 - Tunnels
- Investigate soil conditions
- Determine soil properties through field investigations and laboratory testing
- Needed to build things like
 - Subways
 - Bridges
 - Buildings



Structural Engineer

- Use building codes to determine the loads acting on a structure
- Design structural members to insure that a structure is strong enough to carry the loads imposed on the structure and efficient enough to be cost effective
 - Steel
 - Concrete
 - Timber
 - Masonry
- Structural engineers are involved in almost every project
 - Bridges
 - Skyscrapers
 - Airports
 - Houses



Traffic Engineer

- Determine the impact a new structure or facility will have on the traffic
- Analyzes the impact an increased number of vehicles will have on a community
- Determines if increased traffic warrants the addition of extra traffic signals
- Decide what signs and markings are required on the roadway in order for people to find their way safely and efficiently



Marine and Coastal Engineer

- Design of water based structures
 - Piers
 - Wharfs
 - Marinas
 - Breakwaters
 - Fendering systems
 - Bulkheads
 - Offshore oil platforms
- Determine the effects of construction on
 - Stream flow
 - Sand deposits
 - Erosion
- Anything built on the water, the shoreline or the ocean is designed by a Marine/Coastal Engineer



Civil/Highway Engineer

- 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 to keep the roadway free of water by adjusting the pitch of the pavement and allowing the roadway to drain
 - Manholes
 - Catch-basins



Site Engineer

- Adjusts the site in order to make it suitable for construction
- Selects the desired elevation of the site
- Designs an appropriate grading of the site
 - Level area for the structure
 - Proper drainage of the site
 - To make the site more visually appealing.
- Having a well planned site makes construction easier and prevents future maintenance problems



Transportation Planner

- Plans transportation systems
 - Where would be the best streets to have a bus line?
 - Which locations would be most convenient for the bus stops?
- Can the existing system be improved?
 - Change the routes
 - Change stop locations
 - Express buses
 - Add bus lanes on the roads
- Makes transportation systems more efficient
 - Subways systems
 - High Occupancy Vehicle (HOV)



Environmental Engineer

- Determine the best strategies for maintaining or rehabilitating an environmental habitat
 - Will a project disrupt an existing environmental system?
 - 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
 - Develop strategies for environmental clean up: turning contaminated properties into properties that can once again be used productively



Cost Estimator

- Determine an estimated price of a project
- Allows the client to budget the appropriate amount of money for the project
- Opportunity to look for alternate construction methods that may save money and make a project more cost effective
- Important because often projects are funding by local, state and federal government agencies (your tax dollars)
- Help save taxpayers money and get the correct amount of money for the project allocated in the government's budget

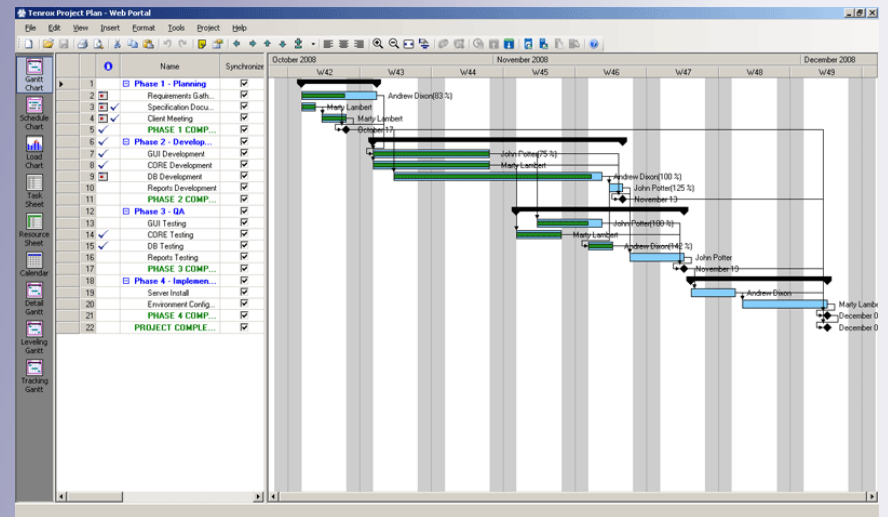
Office building, Dallas Park 2 Mark up 15.00 % Mark up Value 166,590.87

#	Description	Unit	Qty	Unit Rate	Sell. Total
1.00	Siteworks				2,916.00
2.00	Earthworks				177,518.60
3.00	Paving				42,488.69
4.00	Concrete				38,073.95
5.00	Formwork				15,729.01
6.00	Reinforcing				74,676.40
1.00	3/8" Diameter bars	Ton	1.10	840.00	809.60
2.00	1/2" Diameter bars	Ton	1.80	620.00	1,233.40
3.00	3/4" Diameter bars	Ton	2.20	630.00	1,593.90
4.00	1" Diameter bars	Ton	0.90	600.00	621.00
5.00	Allow for all necessary cover blocks.	Item	211.00	290.00	70,368.50
7.00	Brickwork				157,139.87
1.00	Half brick wall in foundations	ft2	211.00	15.60	3,785.34
	Half brick wall - Material	ft2		12.85	3,117.52
	Bricks, stock	1000	12.19	11.55	2,802.61
	Cement	100lb	30.80	0.88	212.49
	Sand, building	ft3	5.94	0.42	102.42
	Half brick wall, 500 b/day, 1BL, 2W	ft2		2.76	668.53
	Brick worker G1	Hr	38.76	1.65	401.12
	Bricklayer G1	Hr	19.38	1.10	267.41
2.00	One Brick wall in foundations	ft2	232.00	31.14	8,307.92

Total inc. Markup: 1,277,196.69
Total exc. Markup: 1,110,605.82

Scheduler

- Estimates and tracks the schedule of a project
- In order to plan effectively the owner of a project needs to know when the project will be finished
- Contractor needs know how much money the project will cost to build so 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
- Needed to
 - Cuts into the contractor's profit
- Needed to
 - Keep everything on track
 - Make sure all of the materials are on site in time
 - Make sure 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 Inspector

- Work for the Contractor or Design Firm
- Watch the actual construction of the project as it progresses and confirm that everything is being built as intended
- 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 built at the quality level required by the contract documents
 - Recognize when things do not match the plans and changes are required



Project Manager

- After an engineer has worked in a specialty area for a while he can be promoted to act as a Project Manager
- Coordinates all of the engineers working on a project to ensure that all of the different engineers are working together to make all of the project pieces work together
- Will make sure the contract documents (blueprints and specifications) are clear and understandable
 - Contractor will be able to complete the design without too many problems
 - Engineers will stay on schedule and on budget when designing the project



Mechanical Engineer

- Design mechanical systems using statics, dynamics, continuum mechanics, multi-scale computational mechanics and other theories
 - Cars
 - Boats
 - Planes
 - Motors
 - Machinery
 - Building mechanical systems
- Branches
 - HVAC Engineering
 - Production Design Engineering
 - Vehicular Design Engineering



HVAC Engineer

- Design of heating, ventilating, and air conditioning systems (HVAC) for buildings
- Determine the thermal conductivity of the structure (how much heat is lost through the walls, windows, doors, etc...)
- Use thermal conductivity to determine the size of systems used to heat or cool the structure
- Select the best type of systems to use based on the conditions of the structure
- Help to improve the comfort of the building occupants and improve the energy efficiency of a building; saving money and saving energy



Production Design Engineer

- Design machinery and manufacturing equipment
- Design specialized equipment to achieve a certain task
 - Conveyor systems
 - Boxing and packing systems
 - Cutting and trimming systems
 - Labeling systems
- 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
 - Cars
 - SUVs
 - Trucks
 - Trains
 - Buses
- Make vehicles more
 - Visually appealing
 - Energy efficient
 - Aerodynamic
 - Cost efficient
 - Stronger
 - Safer
- Choose this career and you could be helping to designing the future line of 2020 cars



Aerospace Engineer

- Specialized branch of Mechanical Engineering
- Design airplanes and spacecrafts to create the lightest, most efficient, aerodynamic aircrafts
- Utilize aerodynamics and lightweight materials to streamline vehicles
- Goal is to allow for fast and efficient passenger air travel
- Design the next generations of
 - Spacecraft for space exploration
 - Rockets
 - Missiles



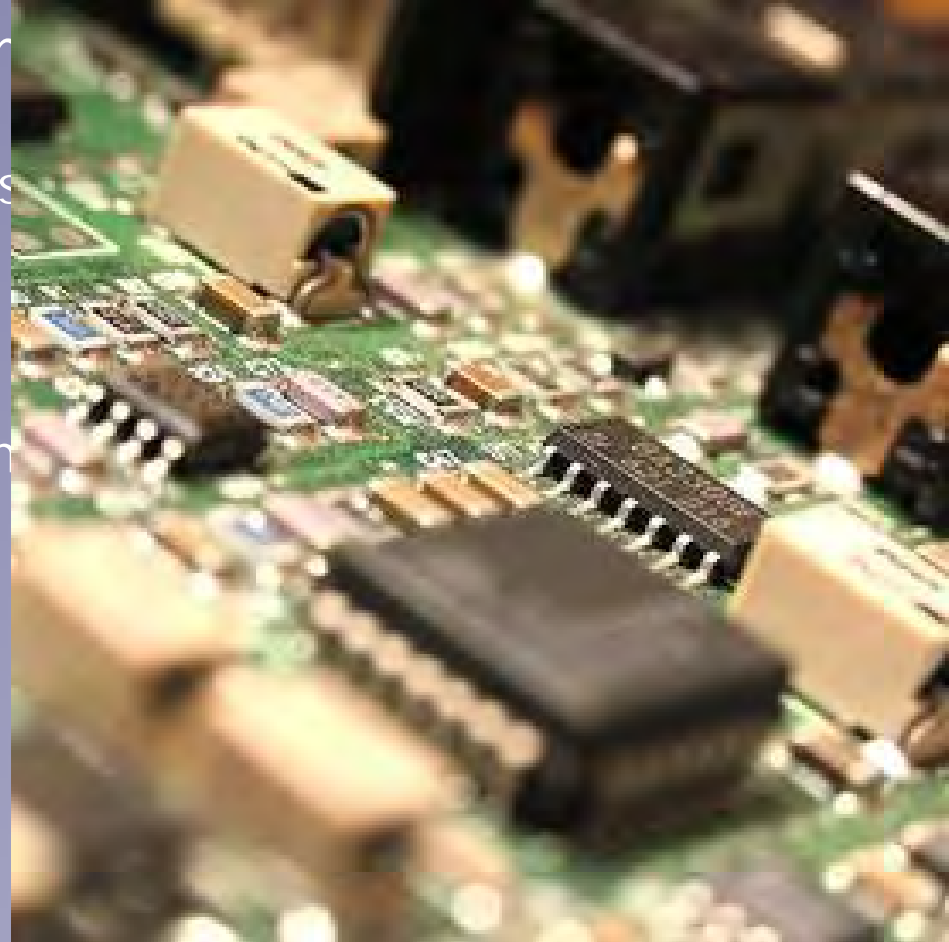
Biomechanical Engineer

- Specialized branch of Mechanical Engineering
- Focus on
 - Regenerative medicine
 - Tissue engineering
 - Biomedical computation
 - Cellular and molecular systems
 - Quantitative biology
 - Using machines and mechanical systems to make medical advances
- The fields of biology, engineering, and medicine are interrelated to develop new medical advances
 - Artificial hearts
 - Artificial limbs and other organs
 - New medicines and other medical technologies



Electrical Engineer

- Designs electrical systems
 - Electronics
 - Building electrical systems
 - Power generation
 - Computers
- Branches
 - Power Systems Engineering
 - Electronics Engineering
 - Electrical Systems Engineering
 - Computer Electronics Engineering



Power Systems Engineer

- Design power systems
 - Power plants
 - Generators
 - Electricity production
- Types of power plants
 - Fossil fuels (coal, oil or natural gas)
 - Hydropower
 - Wind power
 - Solar power
 - Nuclear
- Design and maintenance of the power grid of the city is one of the most important tasks
 - Without power, the city comes to a standstill



Electronics Engineer

- Design
 - Cell phones
 - Radios
 - Speakers
 - MP3 players
 - CD players
 - Satellites
 - televisions
- Everyday electronics engineers are developing new products that will become the necessities of the next generations



Electrical Systems Engineer

- Design
 - Electrical building systems
 - Power distribution
 - Electrical circuits
 - Lighting distribution
 - Circuits
- These systems keep all of the buildings of the city powered and the building equipment running properly



Computer Electronics Engineer

- Design of computer components and equipment
 - Hard drives
 - CD/DVDs
 - RAM
 - Processors disk drives
 - Digital peripherals
 - Cameras
 - Printers
 - Other computer components
- Makes them, smaller, faster, more efficient, less expensive
- Develop advances that make them more attractive to consumers



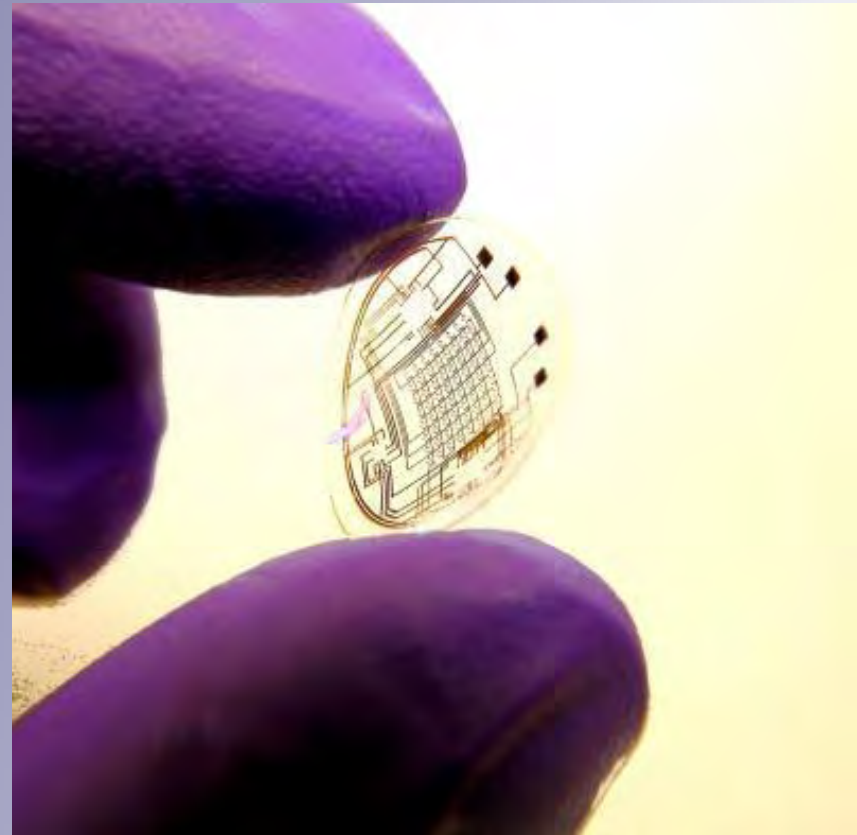
Robotics Engineer

- Design robotic systems
- Cross between
 - Mechanical engineering
 - Electrical engineering
 - Computer programming
- Robots need to be wired with electrical circuitry to move mechanical systems by following directions 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:** the study of unique behaviors and properties of materials that occur at extremely small scales – on the scale of atoms and molecules
- **Nanotechnology:** the application of nanoscale science, engineering and technology used to make new materials and devices, including biological, medical and other applications



Chemical Engineer

- Use chemistry to develop or improve materials
- 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

