Artificial Geographic Features, Construction Engineering, Building and Structures

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Chapter- 1

Construction Engineering

Construction engineering concerns the planning and management of the construction of structures such as highways, bridges, airports, railroads, buildings, dams, and reservoirs. Construction of such projects requires knowledge of engineering and management principles and business procedures, economics, and human behavior. Construction engineers engage in the design of temporary structures, quality assurance and quality control, building and site layout surveys, on site material testing, concrete mix design, cost estimating, planning and scheduling, safety engineering, materials procurement, and cost engineering and budgeting.

Career

The construction industry in the United States provides employment to millions with all types and levels of education. Construction contributes 14% of the United States Gross National Product. Construction engineering provides much of the design aspect used both in the construction office and in the field on project sites. To complete projects construction engineers rely on plans and specifications created by architects, engineers and other constructors. During most of the 20th century structures have been first designed then engineering staff ensure it is built to plans and specifications by testing and overseeing the construction. Prior to the 20th century and more commonly since the start of the 21st century structures are designed and built in combination allowing for site considerations and construction methods to influence the design process

Work activities

Construction engineers have a wide range of work areas. Typically, entry level construction engineers analyze topographical information. Construction engineers also have to use computer software to design hydraulic systems and structures while following construction codes. Keeping a workplace safe is key to having a successful construction company. It is the construction engineer's job to make sure that everything is conducted correctly. In addition to safety, the construction engineer has to make sure that the site stays clean and sanitary. They have to make sure that there are no impediments in the way of the structure's planned location and must move any that exist. Finally, more

seasoned construction engineers will assume the role of project management on a construction site and are involved heavily with the construction schedule and document control as well as budget and cost control. Their role on site is to provide construction information, including repairs, requests for information, change orders and payment applications.

Construction engineers should have strong understanding for math and science, but many other skills are required, including critical thinking, listening, learning, problem solving, monitoring and decision making. Construction engineers have to be able to think about all aspects of a problem and listen to other's ideas so that they can learn everything about a project before it begins. During project construction they must solve the problems that they encounter using math and science. Construction engineers must maintain project control of labor and equipment for safety, to ensure the project is on schedule and monitor quality control. When a problem occurs it is the construction engineer who will create and enact a solution.

Abilities

A construction engineer is really a combination of two different fields joined into one concentration. The engineer must be educated with the scientific background to be able to solve various problems and have the ability to be able to have the skills to design and calculate different project. On the other side of the engineer's education is the ability to be able to manage different types of people in the work force. Traditional educations only focus on either the engineering side of the equation or the management side of the equation, but the construction engineering field combines both sides of the equation together, to better educate people to become more well rounded employees.

Educational requirements

A typical construction engineering curriculum is a mixture of engineering mechanics, engineering design, construction management and general science and mathematics. This usually leads to a Bachelor of Science degree. The B.S. degree along with some construction experience is sufficient for most entry level construction engineering jobs. Graduate school may be an option for those who want to go further in depth of the construction and engineering subjects taught at the undergraduate level. In most cases construction engineering graduates look to either civil engineering, engineering management, or business administration as a possible graduate degree. For authority to approve any final designs of public projects (and most any project), a construction engineer must have a professional engineers (P.E.) license. To obtain a P.E. license the Fundamentals of Engineering exam and Principles and Practice in Engineering Exam must be passed and education and experience requirements met.

Job prospects

Job prospects for construction engineers generally have a strong cyclical variation. For example, starting in 2008 - continuing until at least 2011 - job prospects have been poor

due to the collapse of housing bubbles in many parts of the world. This sharply reduced demand for construction, and as a result, forced construction professionals towards infrastructure construction and therefore increased the competition faced by established and new construction engineers. This increased competition, and a core reduction in quantity demand is in parallel with a possible shift in the demand for construction engineers due to the automation of many engineering tasks, overall resulting in reduced prospects for construction engineers. In early 2010 the United States construction industry had a 27% unemployment rate, this is nearly three times higher than the 9.7% national average unemployment rate. The construction unemployment rate (including tradesmen) is comparable to the United States 1933 unemployment rate - the lowest point of the Great Depression - of 25% .

Chapter- 2

Construction Structures and Infrastructures

Highway

A **highway** is a public road, especially a major road connecting two or more destinations. Any interconnected set of highways can be variously referred to as a "highway system", a "highway network", or a "highway transportation system". Each country has its own national highway system. Major highways are often named and numbered by the governments that typically develop and maintain them. Australia's Highway 1 is the longest national highway in the world at over 14,500 km (9,000 miles) and runs almost the entire way around the continent. The United States has the world's largest network of highways, including both the Interstate Highway System and the U.S. Highway System. At least one of these networks is present in every state and they interconnect most major cities. Some highways, like the Pan-American Highway or the European routes, span multiple countries. Some major highway routes include ferry services, such as U.S. Route 10, which crosses Lake Michigan.

Highway 401, the busiest highway in North America.

A German Autobahn in Lehrte.

The Makran Coastal Highway was an ancient road within Pakistan. Now it's a major road leading to the city of Gwadar

The SP-160, known as Rodovia dos Imigrantes, in southeastern Brazil.

Traditionally highways were used by people on foot or on horses. Later they also accommodated carriages, bicycles and eventually motor cars, facilitated by advancements in road construction. In the 1920s and 1930s many nations began investing heavily in progressively more modern highway systems to spur commerce and bolster national defense. Major modern highways that connect cities in populous developed and developing countries usually incorporate features intended to enhance the road's capacity, efficiency, and safety to various degrees. Such features include a reduction in the number of locations for user access, the use of dual carriageways with two or more lanes on each carriageway, and grade-separated junctions with other roads and modes of transport. These features are typically present on highways built as *motorways* (*freeways*).

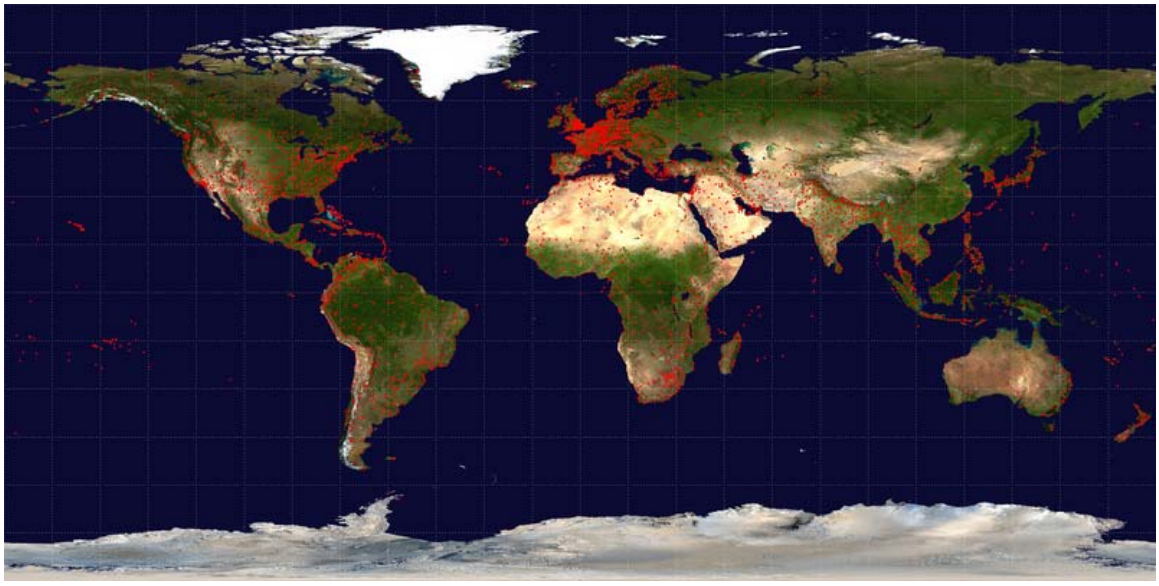
Bridge

The Akashi-Kaikyō Bridge in Japan, the world's longest suspension span.

The Si-o-se Pol bridge over Zayandeh River is the epitome of Safavid dynasty (1502–1722) bridge design. Esfahan, Iran

A bridge is a structure built to span physical obstacles such as a body of water, valley, or road, for the purpose of providing passage over the obstacle. Designs of bridges vary depending on the function of the bridge, the nature of the terrain where the bridge is constructed, the material used to make it and the funds available to build it.

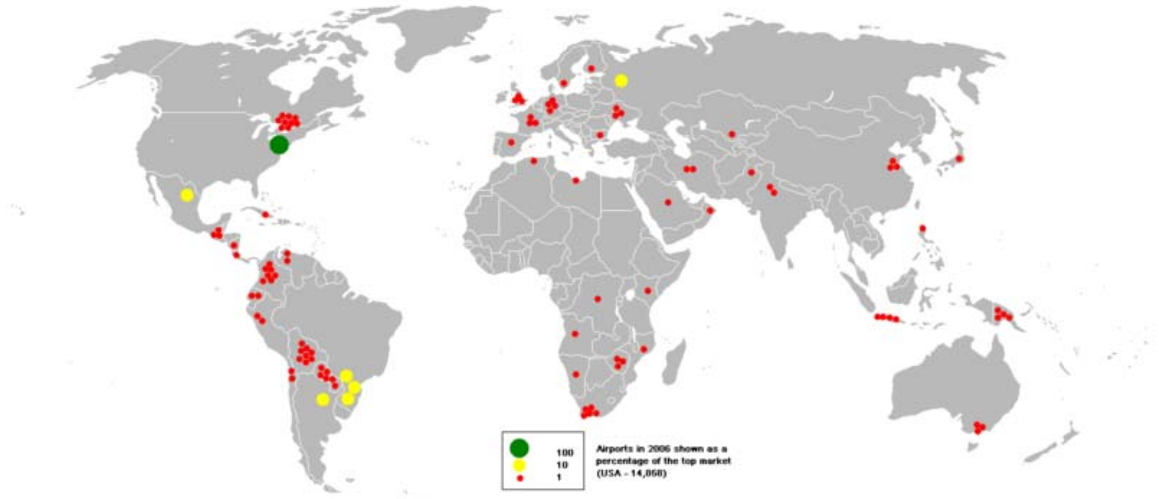
Airport



Airport distribution in 2008

Airport sign

Airport Traffic sign



Airports in 2006

An **airport** is a location where aircraft such as fixed-wing aircraft, helicopters, and blimps takeoff and land. Aircraft may be stored or maintained at an airport. An airport consists of at least one surface such as a runway for a plane to takeoff and land, a helipad, or water for takeoffs and landings, and often includes buildings such as control towers, hangars and terminal buildings.

Larger airports may have fixed base operator services, seaplane docks and ramps, air traffic control, passenger facilities such as restaurants and lounges, and emergency services. A military airport is known as an airbase or air station. The terms ***aerodrome***, ***airdrome***, ***airfield***, and ***airstrip*** may also be used to refer to airports, and the terms *heliport*, *seaplane base*, and *STOLport* refer to airports dedicated exclusively to helicopters, seaplanes, or short take-off and landing aircraft.

In colloquial use, the terms *airport* and aerodrome are often interchanged. However, in general, the term *airport* may imply or confer a certain stature upon the aviation facility that an aerodrome proper may not have achieved. In some jurisdictions, *airport* is a legal term of art reserved exclusively for those aerodromes certified or licensed as *airports* by the relevant governing organization (e.g. the U.S. Federal Aviation Administration (FAA), or Transport Canada) after meeting specified certification criteria or regulatory requirements. That is to say, in the purest sense, all airports are aerodromes, but not all aerodromes are airports. Other jurisdictions define an airport as one that is furnished with the customs offices expected of a port of entry, though the more general term for such aerodromes is *airport of entry*. In jurisdictions where there is no legal distinction between aerodrome and airport, the terms are often used according to the users' or managers' preference.

Rail transport

Rail transport is the means of conveyance of passengers and goods by way of wheeled vehicles running on rail tracks. In contrast to road transport, where vehicles merely run on a prepared surface, rail vehicles are also directionally guided by the tracks they run on. Track usually consists of steel rails installed on sleepers/ties and ballast, on which the rolling stock, usually fitted with metal wheels, moves. However, other variations are also possible, such as slab track where the rails are fastened to a concrete foundation resting on a prepared subsurface.

Rolling stock in railway transportation systems generally has lower frictional resistance when compared with highway vehicles, and the passenger and freight cars (carriages and wagons) can be coupled into longer trains. The operation is carried out by a railway company, providing transport between train stations or freight customer facilities. Power is provided by locomotives which either draw electrical power from a railway electrification system or produce their own power, usually by diesel engines. Most tracks are accompanied by a signalling system. Railways are a safe land transportation system when compared to other forms of transportation. Railway transportation is capable of high levels of passenger and cargo utilization and energy efficiency, but is often less