HARMONICS

The Engineering Explorations Newsletter

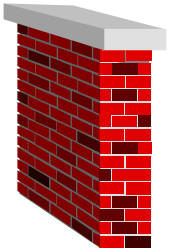
Volume 2, Issue 3
January 1999

WHAT IS CONSTRUCTION ENGINEERING?

Just about everything which can be engineered - from a tiny computer program to a huge airplane - can be constructed or built. But when engineers talk about construction engineering they are referring to particular kinds of construction and a particular kind of engineering. Construction engineers tend to focus on two main areas - buildings and infrastructure. But, construction engineers not only build things, they also design what they're going to build and plan how it is going to be built. In other words they manage a project from beginning to end. In many ways, construction engineers are a lot like hockey coaches, or orchestra conductors, or movie producers - they have to know everything that's going on and figure out how all the little pieces fit together to make a much bigger thing that works! Hockey coaches are trying to get a team that wins, orchestra conductors, beautiful music and movie producers, a film people want to see. Construction engineers are trying to build safe and useful structures for the benefit of society.

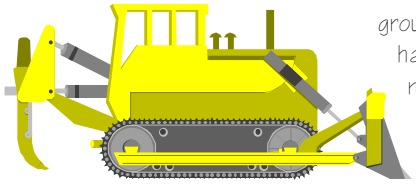
"Infra-" is a prefix which comes from Latin and means "below" or "under." So infrastructure refers to all the services which support a community; this includes roads, bridges, dams, airports, runways, sewer systems, electrical grids and pipelines.

During the planning and design stage of a project, construction engineers - together with architects, structural engineers and other professionals involved in the construction process - consider a whole bunch of things.



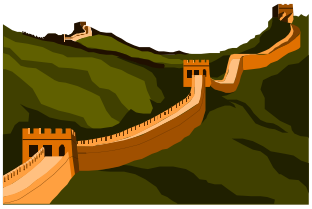
Materials: Construction engineers have to make sure that they have the right materials on site to do the job properly. Different construction materials - like wood, concrete, steel and bricks have very different strengths and properties (weight, durability etc.) so, certain materials can only be used for certain types of projects.

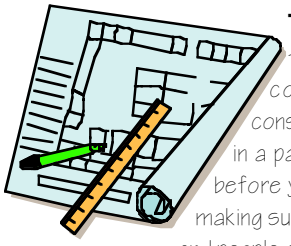
Equipment: Construction machines are just really big tools, and each tool does a different job in a construction project. Some dig, some crush rock, others - like steam rollers - are used to make sure the ground is level. Construction engineers have to know what each kind of machine can do (and cannot do) so that they can have the right equipment available to do the job.



People: As much as machines and materials are a necessary part of construction, more important are the people who are trained to use them. Construction engineers must make sure that they have project personnel who are qualified to get the job done.

The site: The place where something is built has a large impact on how it is constructed and even if it can be constructed. In general, construction engineers want to know as much about the site as they can before work begins. On land, this means testing the soil to find out what it can support, knowing about the possibilities of earthquakes etc. Some construction sites can present many challenges. What do you think the challenges of building under water are? How about in space?





Timing: Getting the timing right is the most important thing a construction engineer does. In a construction project, everything happens in a particular order; you have to have walls before you can put the windows in a house. So, making sure that the right materials, equipment and people are in place from the project's beginning through to the end is key.

The main job of a construction engineer is management and organization: knowing who and what is needed when and where, and how to get the job done in an efficient and safe way.

NATIVE ENGINEERS

A place to meet engineers from your community.

Name: Sidney Seymour
Nation: Bloodvein, Manitoba
Profession: Civil Engineer
School: University of Manitoba, Winnipeg
Degree: B. Eng., Civil Engineering
Job: Vice-President, Business Development, Ininew Project Management Ltd.
Favourite thing about job: Meeting people, travelling, working in Aboriginal communities.

The first time Sidney Seymour heard the word engineering, he was already into his second career. After high school, he had become an auto mechanic on the advice of his guidance counselor. With a growing family, he decided he needed a better job, so he went back to school to become a teacher. He was still studying at Brandon University and substituting in his hometown high school when a recruiter from the University of Manitoba Engineering Access Programme (ENGAP), came to town. "He explained what engineering was all about. It was all the courses I loved - math physics, chemistry. I ended up applying."

Finishing his degree took a little longer than usual, but Mr. Seymour persevered, "I went through some hard times, but I really liked engineering, so it wasn't hard to go back."

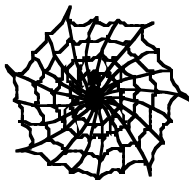
All his hard work has paid off. Mr. Seymour is now Vice-President of Ininew Project Management, a company which is 92.5% Aboriginal-owned. His job involves a lot of responsibilities including finding new clients, finances and managing projects. Right now he is overseeing the construction of a $5.59 million water treatment plant in God's Lake, Manitoba. This project is particularly satisfying for him because it meets a huge community need, "God's Lake was one of the communities earmarked by Health Canada because of its unsafe drinking water. I get to work in an Aboriginal community on a project which will affect and benefit the lives of people. It's the first time they're going to have safe, running water in their homes." The new water treatment plant should be big enough to serve the people of God's Lake for the next 20 years.

This kind of project is one of the reasons Mr. Seymour thinks it's paramount for young Aboriginal people to consider engineering and science as career choices. "We have to be able to design, construct and plan our own communities. People with engineering backgrounds give us the skill to do this type of job. But if our own people don't have these skills we have to rely on non-Aboriginal people who don't understand the communities."

He adds, "In high school you're never actually thinking about what you need, only what you can get by with. But education is the only way you're going to develop your potential and find your dreams."

The University of Manitoba is located in Winnipeg. It has 17 Faculties including Engineering, Nursing, Medicine, Law and Social Work. The University provides support to Aboriginal students pursuing their first degree through a number of access programmes in different Faculties. For more information contact the university at (204) 474-8880 or check out its web site http://www.umanitoba.ca.

NATURE'S ENGINEERS



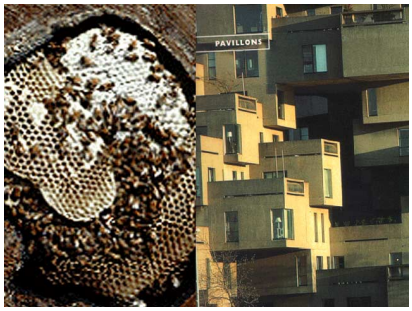
Some animals are natural construction engineers and build amazing things. Their construction methods are often so good that humans copy them!

A web is a spider's home. It's also its version of a trapline. Using a part of its body called spinnerets (most spiders have 6), a spider spins out liquid silk which quickly hardens into strong, sticky webbing. Building a web takes a lot of work. Some of them are damaged quickly by the thrashing of trapped bugs, so spiders are constantly repairing and reconstructing their webs. Take a look at the similarities between a spider's web and a hockey net!

The structures that ants build to live are called nests, but they're actually a lot more like cities! There are lots of different rooms called chambers in an ant's nest. Each chamber has a specific function. Some are used for storing food, others as garbage dumps, there are even special chambers like nurseries which are used for raising ant larvae. All of these chambers are connected by tunnels, which look a lot like highway interchanges.

Another city-builder is the prairie dog. Prairie dogs live in dry grasslands and are very small which makes them easy targets for predators, so they spend a lot of their time underground where it's both cooler and safer. Prairie dog towns, as they are called, can be huge - up to the size of a city block! Within each town there may be many families, each with its own burrow which is connected to others by tunnels. The towns have lots of entrances; when predators appear the prairie dogs can escape to safety quickly.

Bees construct hexagonal (6-sided) cells from beeswax to make their hives. The shape of the cell is very efficient, it makes the hive strong, but lightweight - an important consideration when 40,000 to 60,000 bees might be living there. The hexagon honeycomb is a shape which appears in other places in nature like in plant stems and the cornea in the human eye. Because of its high strength-to-weight ratio, the hexagon is used by designers in things like cardboard boxes.



http://pix.corbis.com/pix.asp?id=IH063197&key=prairie%20dog

Perhaps the most famous construction engineer in the animal world is the beaver. Beavers build dams, lodges, food stashes and even canals and logging trails. Their homes provide them with everything they need while keeping them incredibly safe from predators. Beavers build dams only in places where the water in shallow, in this way they make sure the water will be deep enough during the winter so that the entrance to the dam is not covered in ice. Where water is deeper, beavers build lodges which they cover in mud (except around the air intake near the top). When the cold weather begins the mud cements the outer twigs and wood of the lodge together so that no predators can get in. In order to get trees to their lodges or dams more easily, beavers often clear logging trails (routes which they clear of trees) or excavate canals. Canals can be 1.5m wide and 1m deep; sometimes beavers divert nearby streams through them to maintain the water level near their lodge or dam.

http://pix.corbis.com/pix.asp?id=IH071040

What other animals are construction engineers?

Sources: Environment Canada, Beaver - http://www.ec.gc.ca/cws-scf/hww-fap/beaver/beaver.html; Ants - http://www.dna.affrc.go.jp/htdocs/Ant.WWW/INTRODUCTION/Gakken79E/Page_20.html; Prairie Dogs - http://monhome.sw2.k12.wy.us/west/wildlife/prairiedog.html; Insects, Bees - http://starbuck.ced.appstate.edu/schools/Lenore/b/bees.html; *YESMag*, August 1998

COMMUNITY PROFILE

The Nisga'a Nation

The Nisga'a people of northwestern British Columbia have lived in the Nass River valley for more than 10,000 years. Traditionally, they lived off of the abundance of the land the Creator had given them: hunting, fishing, trapping and trading their goods with other villages and nations. When they made contact with Europeans, the Nisga'a numbered about 8,000 people and had several thriving communities. As in other areas of Turtle Island, smallpox and measles, European diseases for which the Nisga'a had no immune defenses, were devastating to their population; by 1900 only about 800 Nisga'a people remained. Despite the injustices of residential schools and bans on their traditional cultural practices like the Potlatch, this small group of people survived and grew. Today, there are 6,000 Nisga'a people around the world. About half still live in four villages near the Nass River.

Lately, the Nisga'a have been making international headlines; they have just negotiated the first modern-day treaty between an Aboriginal nation and the governments of Canada and British Columbia. It is the first treaty ever signed west of the Rocky Mountains and is a goal they have been working towards for more than 100 years!

The Nisga'a never gave up their title to the lands on which they traditionally lived. In 1887, Nisga'a Chiefs paddled into Victoria Harbour and went to the BC Parliament houses to demand recognition of their title and negotiation of treaties with the BC government. They were turned away by the province's premier. Three years later they created the Nisga'a Land Committee. Its job was to campaign for the reinstatement of territorial rights and self-government. Over the years, the Nisga'a tried several times to have the law recognize that they had never given up any title to the lands of the Nass River valley. It was only in 1973 that the Judges of the Supreme Court of Canada agreed with them, and that was when the federal government decided to start treaty negotiations with the Nisga'a people.

The Nisga'a Agreement, was initialed by everyone involved in the summer of 1998. In November 1998, the Nisga'a people held a referendum in which they voted overwhelmingly to accept the terms of the treaty. It now has to be approved by the provincial government in BC and the federal government in Ottawa.

Once it receives final approval, the treaty gives the Nisga'a people title to about 2000 square kilometers of land, including the natural resources on and below those lands. They will have the right to negotiate their own contracts, to make laws regarding culture, public works, traffic and transportation, land use, marriage, health and child welfare. The Nisga'a will also have their own police and court system, although they have agreed to abide by the laws of Canada and British Columbia and to pay taxes. Within the agreement, the Nisga'a have recognized that non-Native people living on Nisga'a land should have a voice in issues which affect them and so certain public bodies, like those to do with health, will have seats set aside for non-Natives.

Over the next 15 years, BC and Ottawa will transfer just over 190 million dollars to the Nisga'a as part of the treaty settlement. Much of this money will be used for education. Nisga'a Chief Joseph Gosnell has described the Agreement in this way,

"..clause by clause, the treaty emphasizes self-reliance, personal responsibility and modern education. It also encourages, for the first time, investment in Nisga'a lands and resources and allows us to pursue meaningful employment from the resources of our own territory for our own people. It gives us a fighting chance to establish legitimate economic independence, and to prossper in common with our non-Aboriginal neighbours in a new and proud Canada."

This article was written based on information found at the following web sites:

Chief Joseph Gosnell's European Speech, http://www.ntc.bc.ca/enrol.html

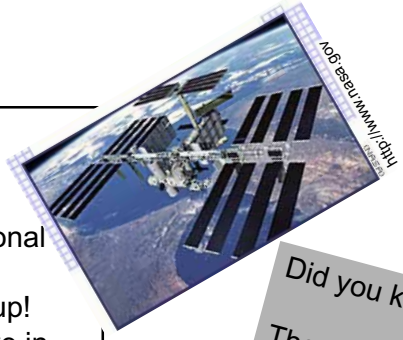
Chronology of events, http://www.aaf.gov.bc.ca/aaf/treaty/nisgaa/nrs/chrono.htm

A new journey - the Nisga'a treaty, http: www.aaf.gov.bc.ca/aaf/treaty /nisgaa/journeyvideo.htm

Who we are, http://www.ntc.bc.ca/who.html

FUN FACTS AND THINGS TO THINK ABOUT

The most amazing construction project... ever!



Construction has just begun on the International Space Station, the most challenging and ambitious construction project ever thought up!

- The Space Station will allow people to live in orbit for an extended period of time.
- The project will take at least 45 space flights over 5 years to complete.
- 16 countries are involved in the co-operative project including Canada.
- 3 Canadian astronauts will help in construction in space - Julie Payette, Marc Garneau and Chris Hadfield.
- Dr. Hadfield will be the first Canadian to make a space walk during a space shuttle mission planned for April 2000.
- A robot arm designed and made in Canada, similar to the one on the Space Shuttle, will be a permanent part of the space station. It will help in construction and during experiments once the station is complete.
- When complete the Space Station will be as large as two football fields and will be visible to the naked eye from Earth.

Did you know?

The Native peoples of the southwestern United States were outstanding construction engineers! Using the local adobe soil they built multi-storey, multi-family "apartment" complexes called Pueblos.

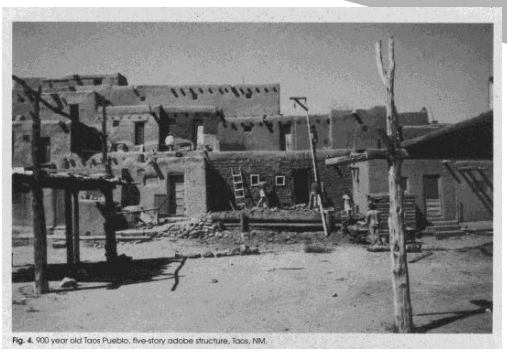


Fig. 4. 900 year old Taos Pueblo, five-story adobe structure, Taos, NM.

The Universe is full of magical things, patiently waiting for our wits to grow sharper.
- Eden Philpotts

WHAT COULD YOU DO AS A CONSTRUCTION ENGINEER?

Construction and construction engineers often play a large role in communities which are growing and developing, and Aboriginal communities in Canada are growing very fast. Within many of these communities there are huge construction needs - both building (homes, business, schools, hospitals and clinics) and infrastructure. As a construction engineer, you could not only oversee and manage projects, but you could also help to plan and design them so that they both answer the community's needs and respect the community's traditions; streets and sewer systems could be planned to reflect the local landscape; buildings could be designed and placed to reflect the traditional structure of the village. Training in construction engineering also gives you lots of skills which can be applied to other areas of community development. You could help with long-term economic planning, negotiate contracts with suppliers and contractors from outside the community and you could share your knowledge with other people in the community by becoming involved in adult education.

The Longhouse

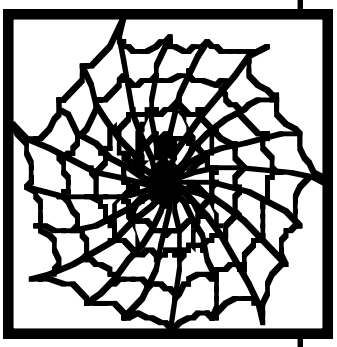
Today's construction methods often involve large machines and lots of construction specialists, but people have been building and constructing in innovative ways for thousands of years. Aboriginal people in the Americas developed a number of different construction practices for houses, towns and entire cities.

The traditional homes of the Iroquois people in and around southern Quebec and Ontario were longhouses. These structures were much longer than they were wide (sometimes they were more than 60 metres long). An extended family lived in each longhouse. The buildings were constructed from a framework of narrow tree trunks or long branches which were usually cut in the spring so the wood would be flexible. These were lashed together and covered with elm bark. At each end of the building there was a door. In the roof there were a number of holes. Every family group in the building had a fire pit, the holes were positioned over the fire pits so smoke could escape from the building. Other pits were dug into the floor of the longhouse for food storage. Enough food was stored to get the families through the winter.

Longhouses were very durable and lasted for about 20 years. That was about the same amount of time that nearby soil could be farmed before it lost its nutrients, so Iroquois villages were moved about every 20 years (although sometimes more often for defensive purposes).

Puzzles and Games

Spiders Web



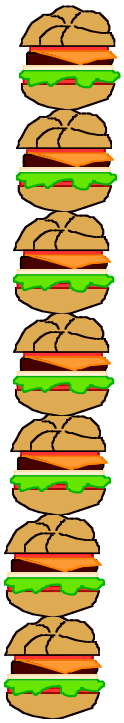
A spider spins a web in a window frame. Each day, it spins an area equal to the amount already completed. It takes 30 days to cover the entire window frame. How long would it take two spiders to cover the entire window frame?

Source: Discover learning
http://www.bc.sympatico.ca/learning/students/brainstrain/spider.question.html

Source: http://pix.corbis.com/pix.asp?id=SP012910

That's a whole lotta beef!

How many Big Macs would it take to reach the top of the CN Tower? A Big Mac is about 8cm high; the CN Tower is 553m high!



All About Us

The Native Access to Engineering Program at Concordia University is a joint project of the Faculty of Engineering and Computer Science and l'Ordre des ingénieurs du Québec. It has been running since 1993 with the goal of introducing young Aboriginal people and their teachers to engineering and its connection to economic development. The project's ultimate goal is to increase the representation of Aboriginal peoples among the ranks of professional engineers in Canada.

You can reach us at

Native Access to Engineering
Engineering and Computer Science
Concordia University
1455 de Maisonneuve West, LB 1001
Montreal, Quebec H3G 1M8
Tel: (514) 848-7847
Fax: (514) 848-4509
Email: Native-Access@encs.concordia.ca