Structure and Architecture
Lecture 1

Introduction to the Subject

A famous Architect, Jean Nouvel, once said "The best engineer a few decades ago was someone who could create the most beautiful beam or structure; today it's to do a structure you cannot see or understand how it's done. It disappears and you can talk only about color, symbols and light. It's an aesthetic of miracle."

Throughout history, story of mankind has been written and rewritten, through or over buildings. Famous buildings, not inspire us architects but the common man as well. Some buildings represent our spirit, while some represent sheer genius and the magnificence of the human mind. Some buildings face initial non acceptance from the crowd while some stand apart from the rest and are recognized for their true brilliance.

When we look at some buildings, it makes us wonder whether we really built that, while some buildings represent purity and ease of movement within the building, while other buildings make sure that everyone is aware about where and how the building is.

Some buildings make you even think, is this even real, how do people live in these boxes?

Some buildings make us feel so small in the presence of it.

While some make us think, nature is in our hands and that we can play with nature to our tunes.
Some buildings are appreciated since they depict how nature has been succumbed to create great architecture.

We think some buildings are famous because of an inherent flaw in the building. But they are actually famous, because of the architects who made them stand like the Leaning tower. Some buildings give us a feeling of exposure, like an industry is out there. While some give us the soul searching element. It makes us wonder as to what is there in us. It makes us wonder about our creator.

Some buildings are just a reminder that we can easily penetrate into the clouds and reach the skies. While some make us remember our animals.

There are other kind of buildings that are giant pieces of water art. While some, reflect our thoughts precisely. There are also those that, overpower us by mere size and proportions.

Our buildings have evolved from merely being a shelter against the sun, wind and rain. They have now become poetry and space; music and air. Behind all the poetry and music, there is a structural element , a beauty that holds everything precisely in its space. It is like a clockwork. Everything works because of the underlying principle. The principle is not always seen, but it is there. The principle that helps buildings endure the storms, the skies, the pressures of the earth, the natural disasters, wars, geomorphic changes, political changes etc. There are some buildings that have simply stood for a year and some that have stood strong for a decade or more. To withstand any of the aforesaid pressures is a miracle but to withstand all of these pressures, is true genius.

Gobekli Tepe

To begin we have get into the roots. We have to check what happen in the Pre-historic era. This is the site of Gobekli Tepe. It is present in Turkey, close to the Syrian border. It was recently excavated in 1996. The interesting thing about this find, is that; it is recently believed to be a ritual site known to man. It is about 13 millennia old, while known agriculture is only 9 or 10 millennia old. People began agriculture only when they settled down in a particular place, in clusters, before which, human simply lead a nomadic life. However, this site Gobekli Tepe changes the whole principle. Since we believe that, first cities cropped up and only then religions were formed, then the temples were created. However, thanks to this finding, people now have to contemplate on the fact that; temples were built , only then cities cropped up. That is marvel of the finding. Only 5 to 10 % of the finding has been excavated right now. So a lot more secrets are yet to be revealed.

There are huge T shaped columns, which have been dug, made, inserted into the bed rock. There is a cut-out that is made on the bed rock and this whole T shaped column is fitted into the socket, so that it is structurally stable. This stone has been standing there for 13 to 15 millennia right now.

After which early settlements were dug out and were found in Jericho, Mehrgarh and Ain Ghazal area. These settlements predecessor to the modern city, ancient cities started developing with this model. One of the earliest cities were, Jericho and Mehrgarh.

Later in the 6th millennium BC, the Chinese architecture made use of wood, timber and other things they could find and do with timber. To make use of timber was one of the difficult tasks to have accomplished back then. It was the ancient people who invented the ' Mortise and Tenon Joint'.

The Mortise and Tenon Joint makes use of a tenon which is a tongue like structure, which is being cut out from a piece of wood, which is further inserted into a hole or a small opening which is made into a piece. The left top is the tenon and the one right below is the Mortise (as seen in the fig below). The tenon fits itself into a Mortise. This joint is one of the basic most fascinating architecture that one could have ever found, how two pieces of wood can be joined to form a precursor in architecture, this concept birth to a lot of things in the future.

This site, from the Indus Valley civilization, from Mohenjodaro and Harappa, which was built in the 4th and 5th millennia. It was one of the well planned cities in the ancient civilization and in about 2600 BC, the pyramids of Egypt were formed. After which, Rajagriha was built. In about 1600 BC, the stonehenge began. In around 900 BC, the first Greek temple was constructed, this was built out of Timber. In 700 BC, the ancient city of Rome was built, it might be so in mythological books as well, however, it is said to have been built in 700 BC in reality as well. At about 500 BC, the city of Persepolis was started and the construction of Pataliputra as well.

What are Monolithic Structures?

These are basic structures cut out of rock. Rock cut architecture is another name for it.

These are structures that have been excavated out of a single homogeneous material. It was one piece of material, mostly rock/stone, back in those days. However, in today's context, monolithic structures can be the present buildings that have been made out of a single material like concrete.

Features of Monolithic Structures :

1. Top down approach, instead of traditional

2. Mega size can be achieved with relative ease

Advantages of Monolithic Structures :

1. No need to hunt and bring building material.

2. No need to worry about structural ability.

3. No complex calculations required.

4. Material inventory cost is less.

5. Stronger than regular construction because of homogeneity.

Trabeated Structures

Let's get on with Trabeated structures. Trabeated structures are very different from monolithic structures. This means that there are two vertical supports called the post and one horizontal support known as the lintel. There are present all throughout history, especially American history and Greece as well.

The above figures only depict that, across the globe, Trabeated structures were one the most easiest things to build since then and the most logical thing for architects to comply to. It developed uniformly across the globe, it exists all around the world.

Invention :

The invention of load transfer from one material to another was first made in this type of construction. What happens here, as depicted in the image below; is the lintel is distributed across the posts and is carried down to the posts. The load is being divided into the two posts. This was one of the finest inventions in architecture. It was simply the 'stepping stone' for latter architectural inventions that came along the way.

Features :

1. Build base : in order to build a big structure which acts as a support. Column base : this is built on top of the base, thereby causing the base to hold it together. Columns : These can b a single monolithic stone or can be individual building blocks; 4 or 5 elements stacked one on top of the other to form a column over the column base and then come the slabs; these are the lintels, which give a complete closure.

2. It was a great moment to architecture since it is from this that people gathered the idea that one piece is to put supported to another which in the end, is supported completely by the Earth by the end of the day.

Advantages :

1. Not restricted to the geographical location where material is available. Unlike monolithic structures, One can break down the pieces which he requires and transport it to the site of construction.

2. Not restricted to the size of stone available. While in Monolithic architecture, the size of the stone determines the size of the building. Mono means 1, litho means stone. It literally means,

being made of 'one big stone'. While in trabeated structure, you can add one stone on top of the other.

3. Monolithic architecture was a high form of sculpture, which required skilled artisans. While in trabeated structure architecture, you need people to move the huge rock, to chisel it, to erect the stone etc. It is more of a group effort, rather than having simply one or two people involved like the monolithic structure. It also depicts the amount of time it would take to construct a monolithic structure, while a trabeated would be more democratic since it is a group effort and a lot more faster as well.

4. Gave birth to complex structures like arches, vaults, domes, flying buttresses etc.