# B. Architecture

# Structure and Architecture (AR6006)

# History of Structural Design in the post Industrial Period

# Lecture - 18

## Study of Architectural Form

### Form Continuum

Professor David Billington, he is a famous personality. He proposed that sculptural form, architectural form and structural form, these three are linked in a continuum. Sculptural, architectural and structural. These 3 are completely related in a continuum. All three of these forms are designed. Sculpture is designed, architecture is designed and structure is designed. They are all 3 Dimensional structures. Certainly because of these very strong similarity because they are all designed, they are all 3Dimensional structures, the dividing lines between these 3 maybe little more, little confusing maybe little blurred yet there are hallmarks defining each of this types or form that can be generally agreed upon. There are certain uniquely identifying factors. Let's take a look at architectural form.

### Architectural Form

Architectural form is dictated by architectural purposes, such as the practicalities of spatial organization and control of the flow of occupants. Architectural form also concerns with the sense of space a structure creates, its symbolism and its relationship to the setting. So what they identify here is architectural form is always dictated by architectural purpose. What exactly is an architectural purpose?

Architectural purpose can be of many types, the most common types are function. A place needs to perform a role because there is a series of activities that are supposed to happen in a space. So that particular space should be effective of use for that particular function to happen. Because

space is the host here. The host needs to allow the event to happen. Only then a host makes sense to us. So function is the primary architectural purpose. The secondary architectural purpose like what they explain is about symbolism, its aesthetics and relationship to the setting. Architecture if it doesn't have a relationship to the setting is useless because setting is very important for an architecture project otherwise it becomes irrelevant to the context. Setting could mean environmental setting, it could mean cultural setting, it could be historic setting, it could be an economical setting, it could be a political setting, and it could be a setting which is intangible forms. Symbolism, emotional setting. These are all different setting which the architecture has respond to. Let's look at other forms which the architecture concerns itself with. Architectural form can lean toward sculptural form as in the case where architectural elements are exaggerated or when forms reflect a non-efficient use of material just for the sake of emotional impact. Let's say I'm designing a building and I'm making certain element of the building very big or very small or exaggerated not because it has any structural reason or any architectural reason but simply for the sake of emotional impact. Simply for the sake of someone to say okay, this building looks beautiful, this building monstrous, this building looks nasty, this building looks subtle, just for people to use say an objective if I exaggerate a certain element into sculptural form.

Now architectural form has slightly exaggerated itself and become a sculpture. You sometimes wonder whether this is a highly form of sculpture or is it somewhere between sculpture and architecture. In a sense, the building is still technically useful. Technically the building has to house people, people have to move around, activities have to happen inside, and all those things have to happen. But architectural form is always at least somewhat functional. It is always 3Dimensional and typically it is client driven. It must satisfy the needs of the client and the occupants. Yet, it must also satisfy the artistic and creative goals of the architect. Finally, it needs to be safe since it ultimately will be used by people. Let's go on to structural form and see what structural form is about.

**Structural Form**

Structural form is dictated by structural needs just as architectural form is dictated by architectural needs. Structural form is dictated by structural needs primarily to support gravity and lateral loads and usually also the

need to provide a building envelope for shelter against the elements. Carefully designed structural form can exhibit the stark beauty of controlled strength, even to the point of excitement. Structure can define the visual impact of a building, as in the case of large exposed columns which give the appearance of strength and solidity, or the case of tall slender columns which can create an elegant logia effect. Clearly, structural elements can definitely give an impact. There are entire building that stand on one single column. There are buildings that even fall even after putting hundred columns. Structural form is dictated by structural needs. It has to support the building. It has to support the gravity. It has to support loads, lateral loads, wind loads, all kinds of loads. Also it needs to protect the inhabitants of the building against the elements. Again sometimes, the structure can also create beauty. Structure can also create sentiments in people. Structural form is mathematically based; it seeks the greatest efficiency, economy, elegance that the designer can create. It is not random, it is not generated by trial and error, it is not subjected to changes in taste or fashion, and it is not symbolic of some anthropomorphic idea. An architectural form that veers towards sculptural form as that whose dimensions and geometry are chosen, not because of limitations of material or worker skills. Often in spite of these very limitations they still do. Structure is made subservient to a design which finds its logic in the architect's particular aesthetic thought. Here, we have clearly defined the boundaries of structural form because it is mathematically formed, it is not random, it is not trial and error, it is not subjected to taste in fashion, it does not have any anthropomorphic idea, it does not concern with emotion. It is only considered efficiency, economy and elegance of the designer. Now if an architect has to veer the concept towards sculptural form make it interesting by exaggerating certain forms and changing the dimensions and geometry to his fancies. Inspite of all the differences in the way of people walking in everything, the structural form is made subservient to the design which finds its logic not in its primary use but also in the architect's particular aesthetic thought, the way in which architects chosen the aesthetic. So here the structural form becomes the subservient towards the architectural form.

**Sculptural Form**

Sculptural form, there may or may not be a client involved in sculptural form, there is typically no function associated with sculptural form except for certain kinetic sculptures where if the sculpture is to pour water, the design

has to pour water. The designer is free to make any and all decisions about the form, with virtually the only constraint being that the sculpture must stand on its own. Otherwise, the designer can make any change to the sculptures which he wants. That is the freedom in which the sculpture can work. An architect does not have this kind of freedom although some modern architects do but most of the architects don't have freedom of choosing whatever form because an architect's form has to perform necessarily whatever the function whereas in sculpture, there is typically no function.

## Role of Structure

Let's look at the role of structure, at first glance structure only provides stability to the building and it cannot be the creator of architectural space. Such an approach creates the border between structure and architecture.

In the past, due to the lack of coordination between structure and architecture, and due to the structural limitations, many buildings did not finish and in fact architecture had lost its identity and become a horizontal and vertical cover to the building structure. Because structure and architecture did not coordinate. What happened was, the structure was made and architecture was the cover, the horizontal cover and there is vertical cover to the building structure which was there and structure had all the elements of other things in the past. There is primarily because there is no coordination between architecture and structure. Sometimes also what happens in modern context, there is building which has beautiful architecture and the building cannot finish because it does not constraint or it does not coordinate itself with the structure. Both can happen. Also in cases of lack of coordination between structure and architecture after the implementation of the building, it would totally ruin quickly because of the absence of adequate strength and stability. In fact, the former executive architectural metaphor, not mathematical equations.

As the time passed, modern architectural thinking and the subsequent formation of a new architectural ideas such as high tech architecture, deconstructivism and folding, and new horizons appeared in the area and architectural space and structure were considered from a new point of view. The new point of view being architecture and structure are merely one and one needs to understand architecture and structure completely together so that he can look at the building in a proper manner. This created a new and

interesting point of view. There are two places in the past, one is where the buildings and architecture forms are skimmed and it just becomes the clothing material which the structure wears. In the other place where there is a beautiful piece of architecture and it completely ruins quickly because it does not have the strength and stability to stand. Between these two rises the new kind of thing which is the new point of view of these two ideas where the new idea which was created. Style such as high tech architecture, deconstructivism, they all looked at structure and architecture as integrated element and it changed the way we looked at buildings. Structure and architecture are two key components in shaping building formation according to these styles. Interaction and conflict between the two components and their balanced growth in the manufacturing processes and the development of construction technologies has led to the creation of a new generation of buildings with advanced technological structure.

**Structural Design**

Structural Design, the structural requirements imposed the form and formal logic has been praised and admired as a part of visual language. There are different types of structure where you can express structure as a design. Structural elements are selected and controlled primarily by visual standards. Then structure as a design is expressed. Then there is a neglected structure. Structure is ignored during the design of the building and will not be considered as part of the aesthetic programs. Then there is accepted structure. Structural requirements may considerably affect the form of the building even if the structure is not necessarily exposed. Then there is structure as productive forms. This option is the same as in part of a complex structural phenomenon in which structure also adds productive value to the design. Here is where, the structure and architecture there is a holy matrimony between them and here is where they start to become productive.

In this context, paying attention to the high tech architectural thinking which is another way of thinking about the structure as architecture is essential because we need to think of structure as architecture itself. Because the architects consider high tech as greatest achievement of the modernity and the most important factor in the development of the twentieth century. According to them, the extract and physical characteristics of each era has embodied in the architecture of that period. For example, Greek temples

with their perfect fit with the geometric regularities are the elaboration of the ancient Greeks perfectionist mentality. The Greeks were perfectionist. They try to create perfection in all the building they had produced. Similarly, modern buildings should represent the mental and technical essence of the present age of technology. Which means the present age of technology which is very important like the way the building stands, the structural elements, the HVAC elements, the fire elements, the way in which the building runs, the electronic lines, the electrical conduces. All these things are the thing which makes modern function work.

So in high tech architecture, what people did was they turned them all inside out. Inside out was the other name that was given to high tech architecture. So they turned everything inside out in which you can actually see all the conduces, all the electrical HVAC lines on the naked ceiling because that was they believed in to be truthful to what you do. Greek temples were based on geometrical clarities because those people were perfectionist and our building should show off the technical essence of modern day technology because we are in that age. That is what the style represented. Here are a few lists of things that are very particular about the high tech architecture. They were optimistic about the progressive science and technology, representing technology as the extract and achievement of the new era. Representing building process, transparence, layering and displaying the movement of the building, representing the structure and components of the building facade and the plan, using simple bright colours, structure and construction as the design, applying light, tensile elements, separating the service provider parts from the parts that needs to be serviced, Roof design as the fifth façade. These are few elements which were incorporated in this kind of structure.

Let’s take a few examples in this particular typology. Santiago Calatrava designed the Elko city hall by recreating the human body in design the presence of structure as the base of the design itself. Norman Foster designed the HSBC back in Shanghai; we saw this example earlier in one of our lectures. Used techniques as a constant, all parts of the building are non-decorative and highly functional. Herzog and de-Meuron designed the Bird’s nest stadium in the China Beijing. They used the façade as the main structure designing the outer crust of the building itself. These are the famous examples of how structure can be cleverly used in the building the envelope within the building program itself to make very interesting designs.

It all depends on how wish to take it forward. Let's take a look on space and architecture. Space is the beginning and ending of architecture. Thus, the spatial definition, in our terms is a means criticizing and judging the effectiveness of the architecture. Space and vacuity are the key factor in architecture and they are considered natural because architecture is not just art and it is not just a picture of life or the life we or others have passed but it is an environment, a scene. According to the theory proposed by Marcus Vitruvius Pollio architecture based on combining three elements of performance, stability, beauty of architectural form and performance must meet these three elements and are necessarily they must coincide. The famous vitrivian trio says utilias, fermidas and vanastas. Utilias meaning utility or commodity, fermidas meaning firmness or the structural integrity, and vanastas is the venus the beauty. So commodity, firmness and delight are the famous vitrivian triad which is essential for any building to work.

Structure is the design of forms with different materials that provides various load bearings and horizontal parts on the roof thus understanding of the structure as well as the architect demands elegance, taste, art and creativity. Structures are architected before being calculated. The geometry of the structure has to provide the aesthetic. Nowadays the structure of the building is presented in architectural designs and sometimes the architecture is born out of structure. Like the crystal palace or the Eiffel tower. In both cases, the architectural spaces are created by structural element. Human specific environment is created when it is created by human made structure because human beings move and that determines our reaction to it. From the perspective of structuralism the architecture space created through interaction of human beings with the environment is kept at a technical or artificial totality. The components of an architectural space interacts between human, form and environment. In this system structure protects the form of the elements and the total system and it is main factor of defining the space, scope, or body that the architectural space is willing to define. The human space architecture components are form and environment. Therefore it is important that the spatial constructions be interactive with human.

If the building does not consider human characteristics and pays attention to other criteria, it will face human reactions and will become rendered useless. Any building that you design should have human characteristics because when you created a building you have created a space and this space is used predominantly 90% of the cases by humans, very rarely by just furniture

and other things and very rarely by other animal races but predominantly 95% of architecture is used by humans and if we don't belong there, we would certainly react to it and the building will be rendered useless if the reaction is not positive. The architectural space and identity depends on the structure and the function of structure and geometry are the factors of space design and thus the interaction of space and structure is necessary in creating human space. They say that architectural space is relatively depends on structure and function. For structure, geometry and space is the major factor so thus there needs to a common ground between these factors. From then structure becomes the centre of attention, sometime it is neglected during the process. But it must be confirmed that the best structure is the one that is accepted and synchronized by architecture. There are cases in the world where structure itself becomes the centre of attention like Eiffel tower. Sometimes structure is completely neglected in the process of building just like those buildings are keep falling, we hear about the news every now and then. But the best products are achieved when you combine structure and architecture. The best of structure and best of architecture should come together to give you the best of the building.