Safety in MEP Services
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Lecture-24
A Case Study on Construction Safety

Hi, welcome everyone. I am Vidit Jaiswal, an architect by profession, graduated from School of Planning and Architecture, New Delhi in 2017. Today I am going to share some of my observations regarding quality and safety of the building with focus on MEP services installation in a building. MEP means mechanical, electrical and plumbing. So, now we will learn how design decisions of architects or designers about the integration of MEP services with the structure of the building can enhance the quality of the building.

And safety of the people involved in the construction phase and people occupying the building after construction phase, that is during operation and maintenance phase, so here it is.

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Integration of MEP services at initial design stage to ensure better building quality and safety.

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Need of services changed as advancement in technology happening day-by-day. A quick glance from past to present, humans started with the most basic form of shelter.

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The shelter evolved with increasing needs and progress in building materials.

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New materials thrived in the market.

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With the invention of breakthrough technologies in AEC architecture, engineering and construction, buildings expanded vertically and skyscrapers came into existence. In the 21st century, the basic purpose of a building remains the same, but the complexity has increased tremendously. The need for services in all types of buildings has greatly increased as a consequence of new approaches to working and living.

We cannot imagine life without these services and the comfort that they provide to us. They have become an inevitable need today.

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And now we have buildings with complex functions and services like malls, hotels, and hospitals.

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Or comfort, building operation economics, building lifecycle is now largely dependent on how effective these MEP services are planned in a building. Proper MEP services integration enhanced quality and safety of a building. Hence, a comfortable and safe environment can be achieved, imagine life without all these.

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Improper MEP services integration can lead us to experience this kind of situations during operation and maintenance of buildings. So, now you people have understood about the importance of MEP services in modern buildings and future construction. Now, there is need to talk about the key role plays involved in the design decisions about the integration of services with the structure at initial design phases.

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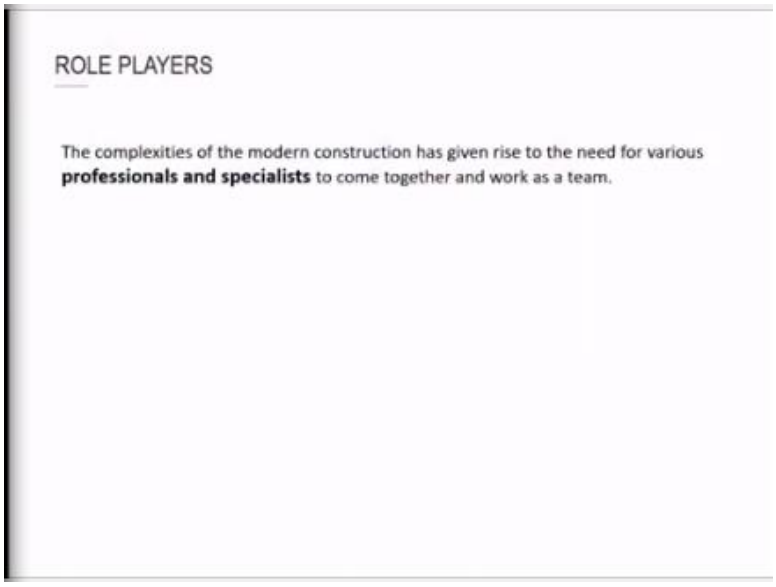

Role players, the complexities of the modern construction have given rise to the need for various professionals and specialist to come together and work as a team.

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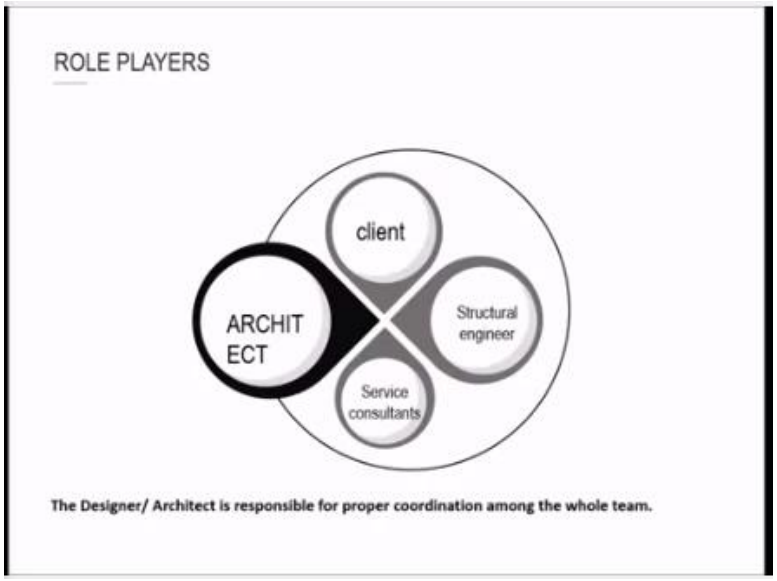

They include architects, structural engineer, service consultants, clients, that designer and architect is responsible for proper coordination among the whole team.

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What all should an architect consider and keep in mind while designing a building? The function of the spaces.

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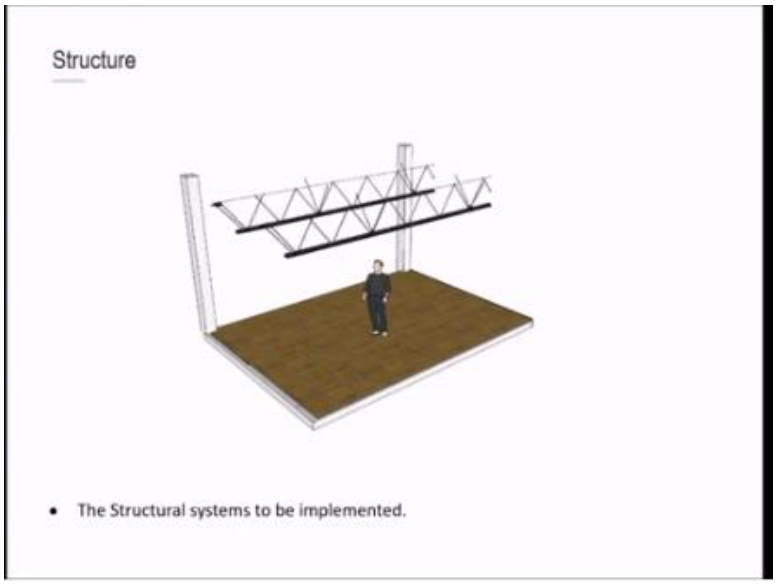

The structural systems to be implemented.

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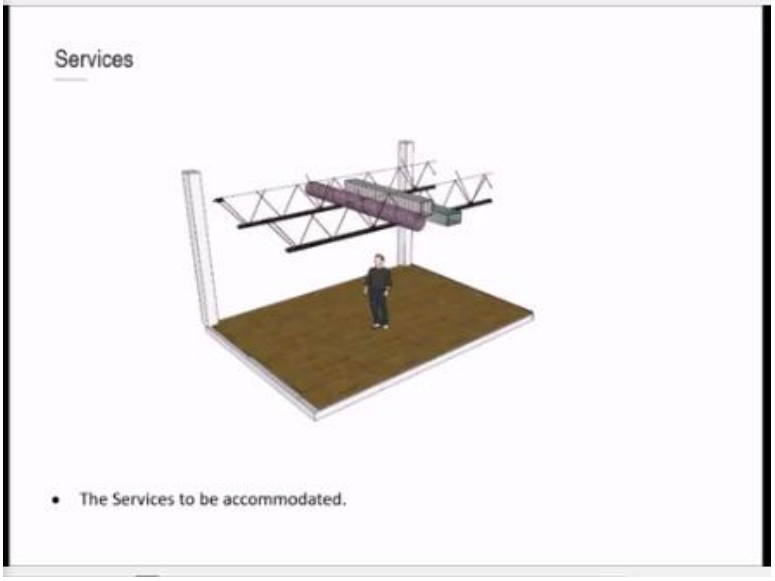

The services to be accommodated.

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The building envelope.

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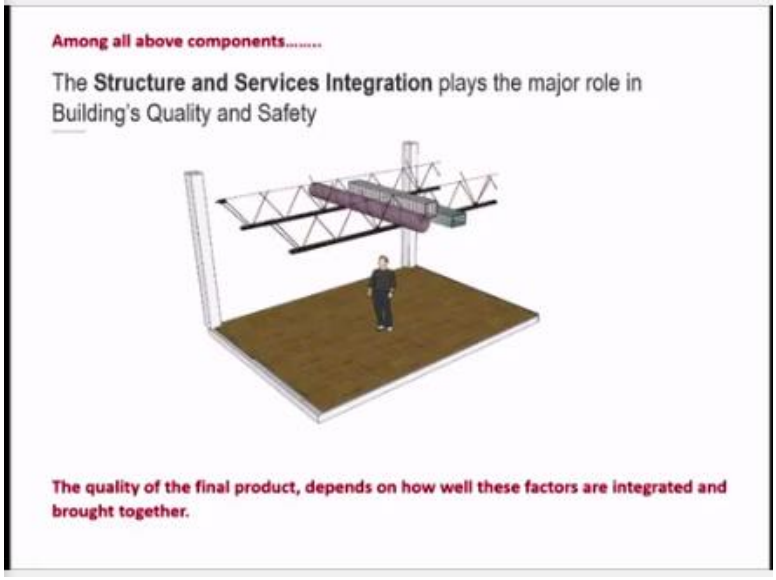

Among all of above components, the structure and services integration plays a major role in buildings quality and safety. The quality of the final product depends on how well these factors are integrated and brought together. After learning the key role plays involved, we will learn the concept behind the services integration and some ideal examples of services integration with the structure of the building.

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So, the methods of integration are.

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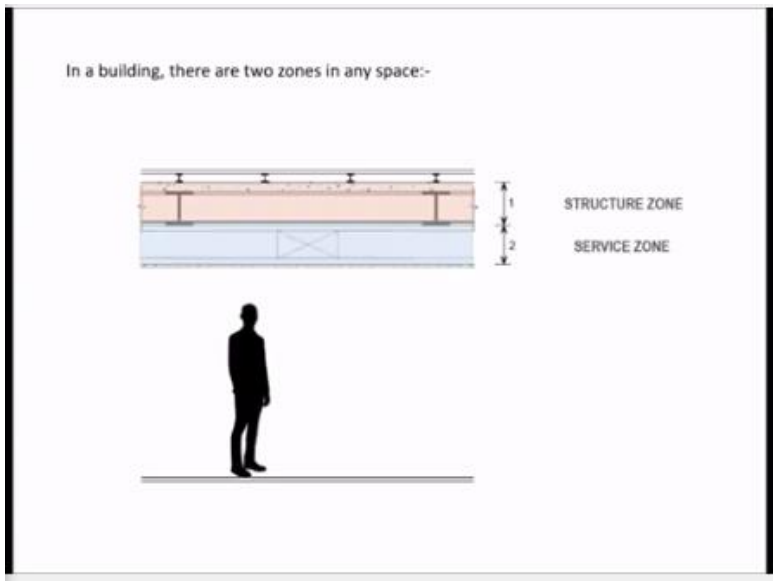

In a building, there are two zones in any space, first structure zone, second service zone.

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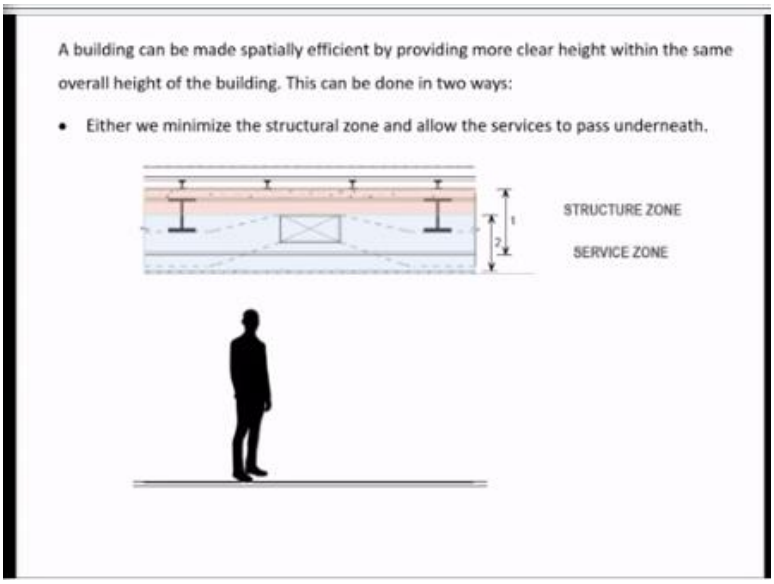

A building can be made spatially efficient by providing more clear height within the same overall height of the building. This can be done in two ways, either we minimize the structural zone and allow the services to pass underneath.

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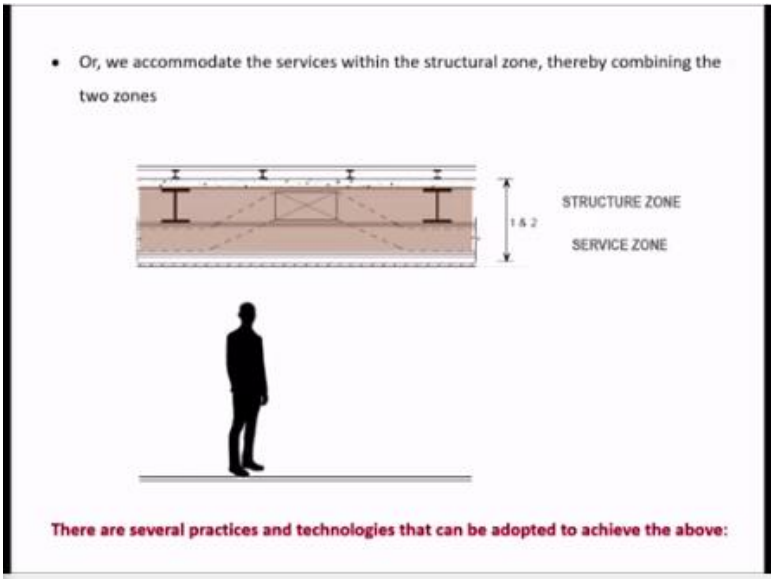

Or, we accommodate the services within the structural zone, thereby combining the 2 zones. There are several practices and technologies that can be adopted to achieve the above.

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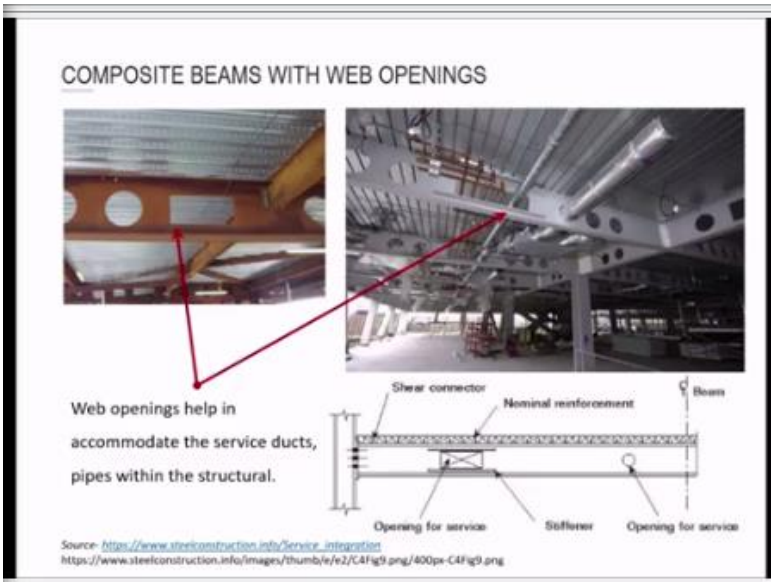

Composite beams with web openings. Web openings help in accommodate the service ducts and pipes within the structure.

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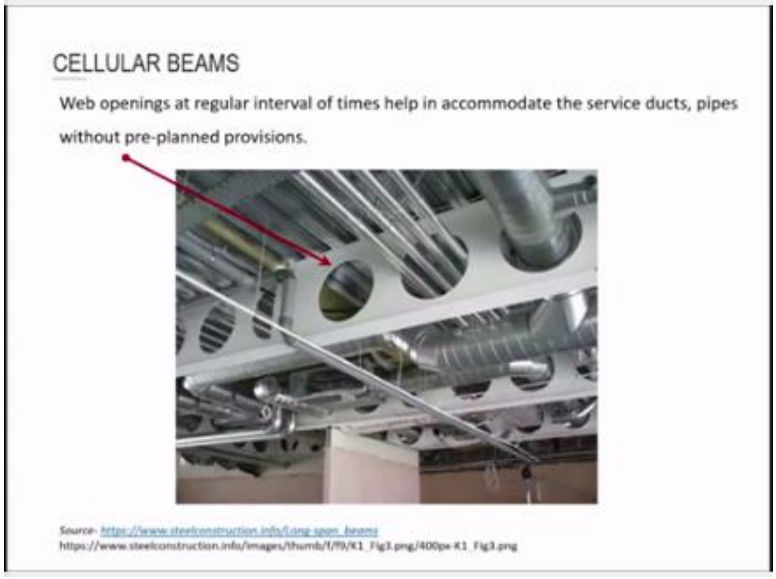

Cellular beams, web openings at regular intervals of times help in accommodate the service ducts, pipes without pre-planned provisions.

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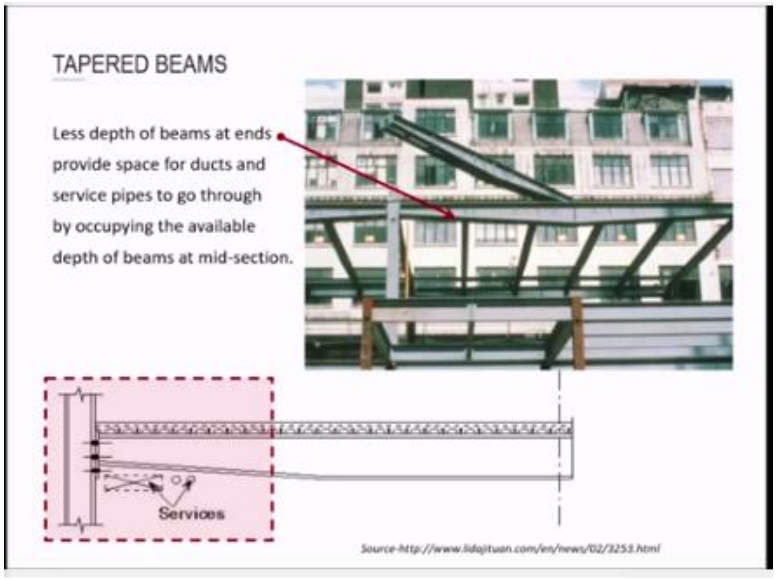

Tapered beams, less depth of beams at ends provide space for ducts and services pipes to go through by occupying the available depth of beams at mid section.

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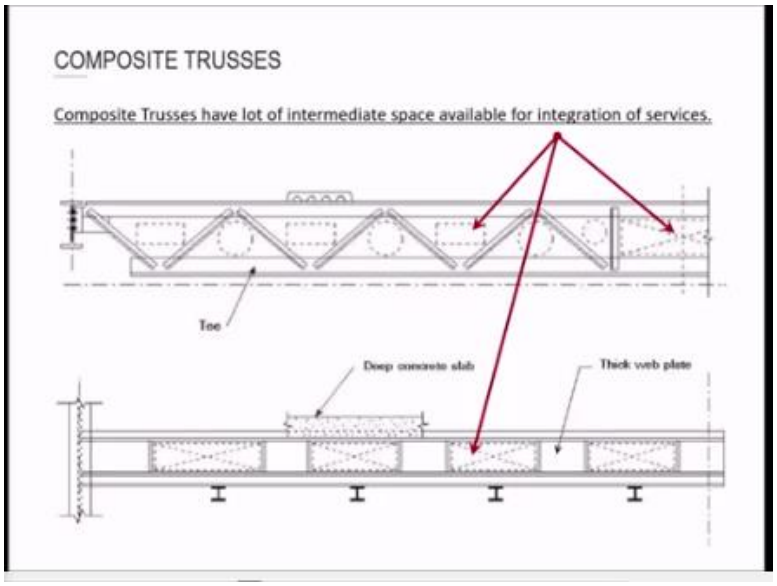

Composite trusses, composite trusses have lots of intermediate spaces available for integration of services through them.

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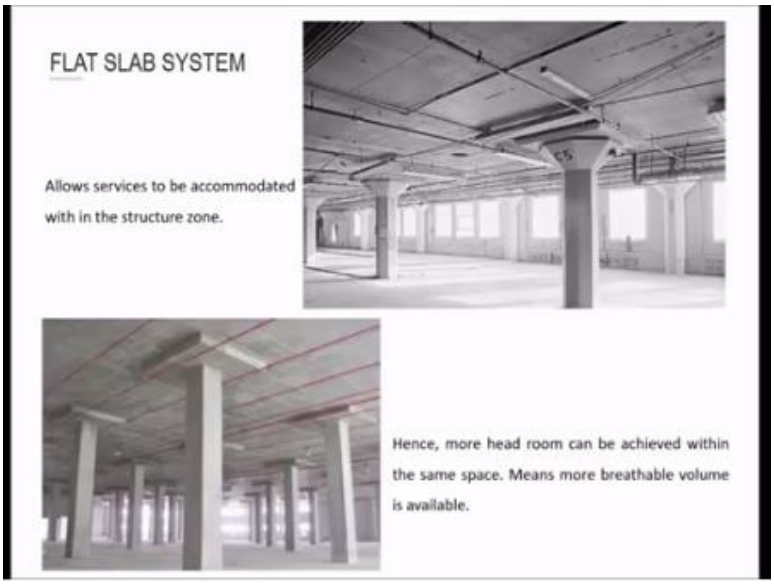

Flat slab system, allows services to be accommodated within the structure zone. Hence more head room can be achieved within the same space, means more breathable volume is available.

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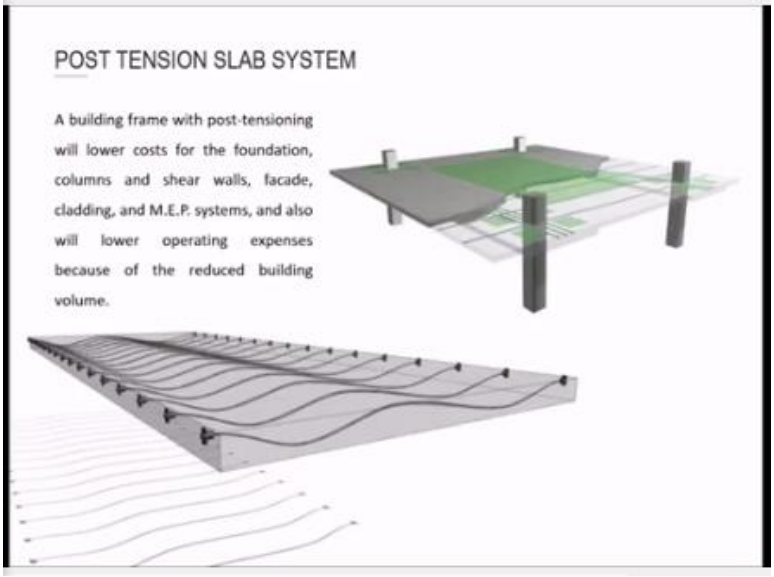

Post tensioned slab system: A building frame with post tensioning will lower costs for the foundation, columns and shear walls, façade, cladding and MEP systems. And also, will lower operating expenses because of the reduced building volume.

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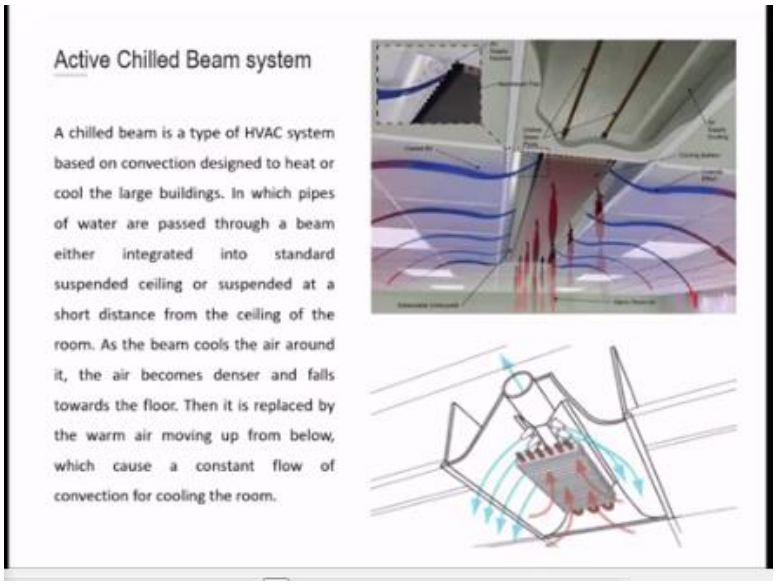

Active chilled beam system: A chilled beam is a type of HVAC system based on convection designed to heat or cool the large buildings. In which pipes of water are passed through a building either integrated into standard suspended ceiling or suspended at a short distance from the ceiling of the room. As the beam cools the air around it, the air becomes denser and falls towards the floor.

Then it is replaced by the warm air moving up from below, which causes a constant flow of convection for cooling the room.

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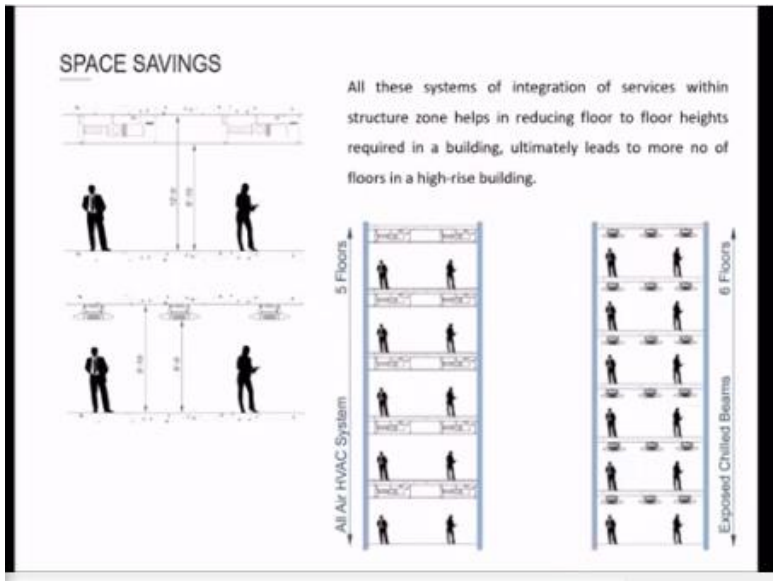

All the systems of integration of services within the structure zone helps in reducing floor to floor heights required in a building, ultimately leads to a greater number of floors in a high-rise building. Now we will see a case study of services integration with the building structure taken as a good example of pre thoughts given to integration of MEP services at initial design stages to ensure better building quality and safety of people.

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So, the case example is of Fortis hospital, Gurgaon.

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This is the front view of the Fortis hospital.

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Now talking about the complex buildings like hospitals and hotels, one very important structural component is service floors.

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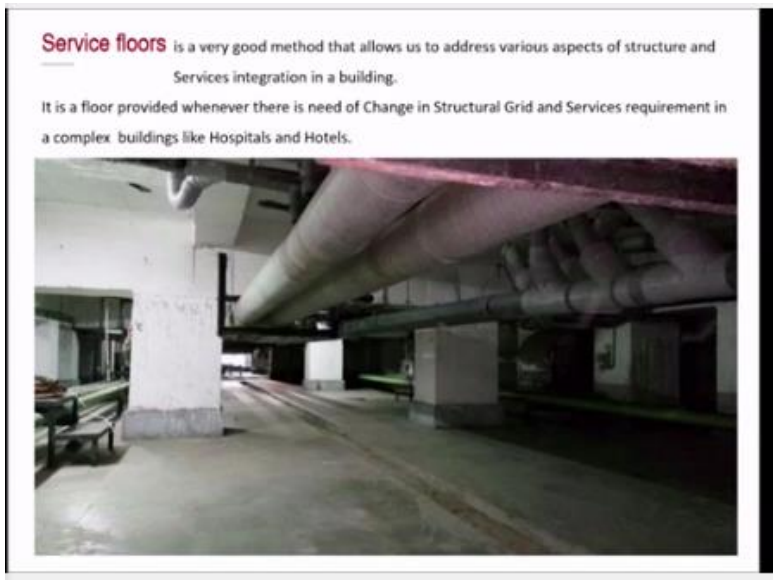

Service floors, is a very good method that allows us to address various aspects of structure and services integration in a building. It is a floor provided whenever there is a need of change in a structural grid and service requirements in a complex buildings like hospitals and hotels.

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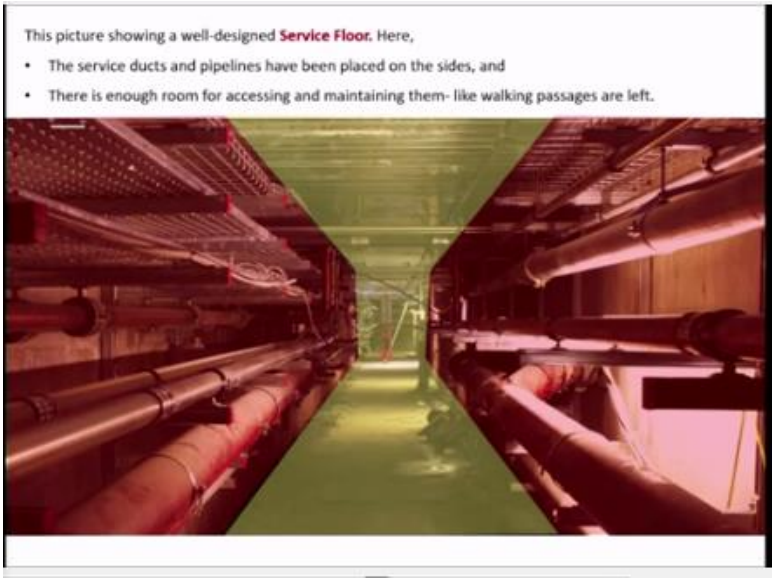

This picture showing a well-designed service floor. Here the service ducts and pipelines have been placed on the sides, and there is enough room for assessing and maintaining them, like walking passages are left.

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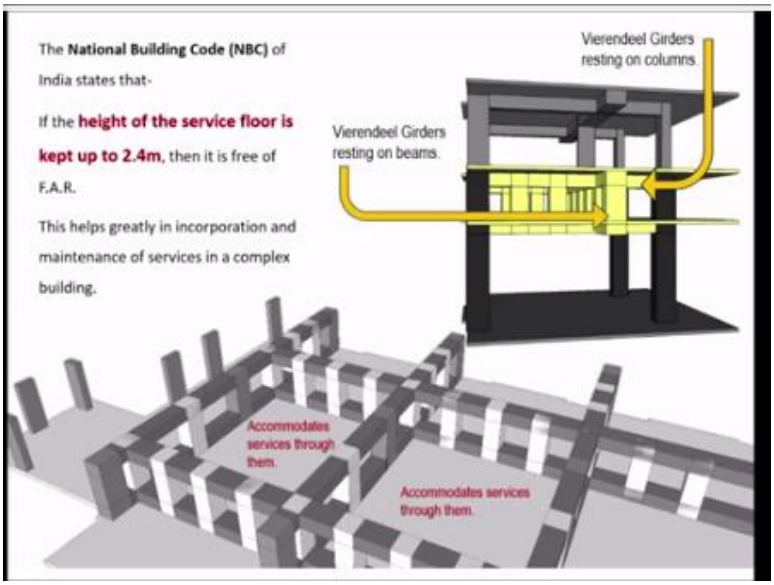

The National Building Code of India states that if the height of the service floor is kept up to 2.4 meter, then it is free of F.A.R floor area ratio. This helps greatly in the incorporation and maintenance of services in a complex building.

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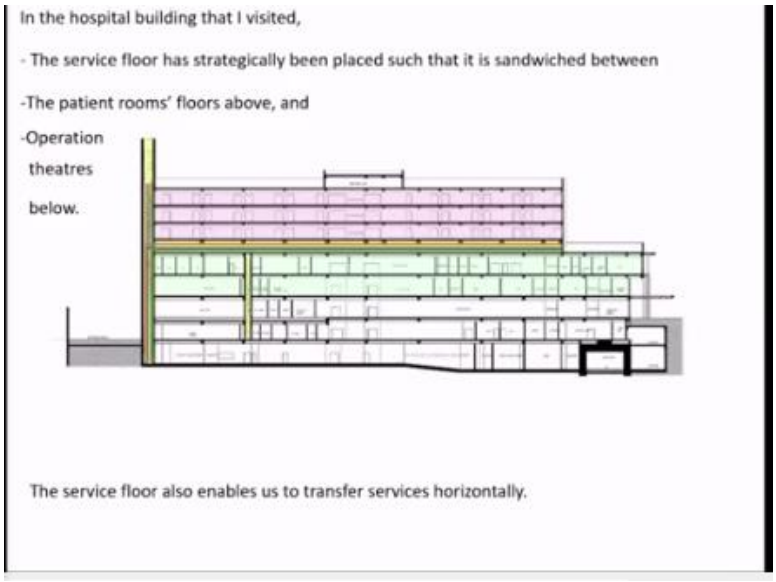

In a hospital building that I visited, the service floors had strategically been placed such that it is sandwiched between the patient's rooms floors above and operation theatres below. The service floors also enable us to transfer services horizontally and vertically.

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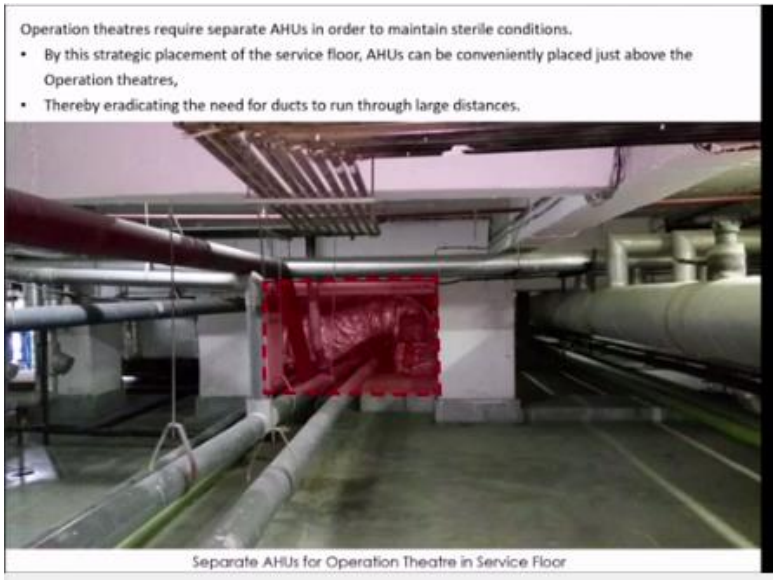

Operation theatres require separate AHUs in order to maintain sterile conditions. By this strategic placement of the service floor, AHUs can be conveniently placed just above the operation theatres, thereby eradicating the need for ducts to run through large distances.

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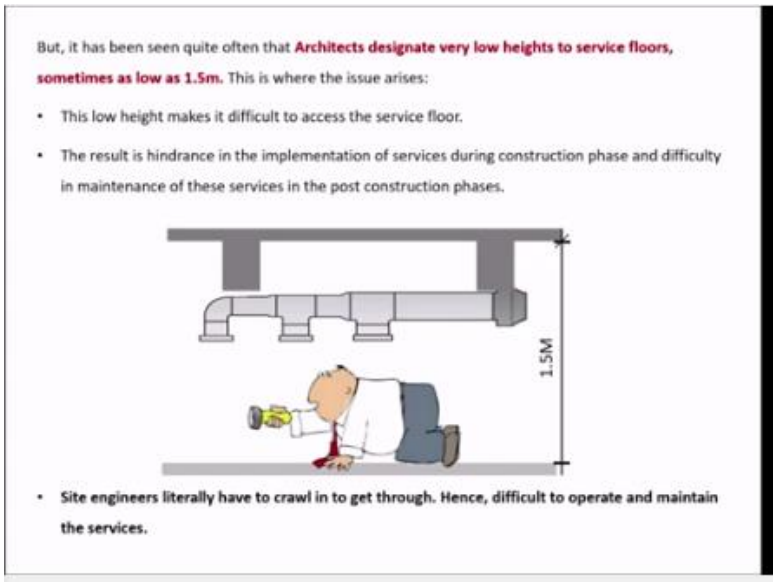

But it has been seen quite often that architects designate very low heights to service floors, sometimes as low as 1.5 meter. This is where the issue arises. This low height makes it difficult to access the service floor. The result is hindrance in the implementation of services during construction phase and difficulty in maintenance of these services in the post construction phases. Site engineers literally have to crawl in to get through as difficult to operate and maintain the service floors.

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Service floor pics showing pre-thoughts are given to the service integration, hence very less clashes between the services.

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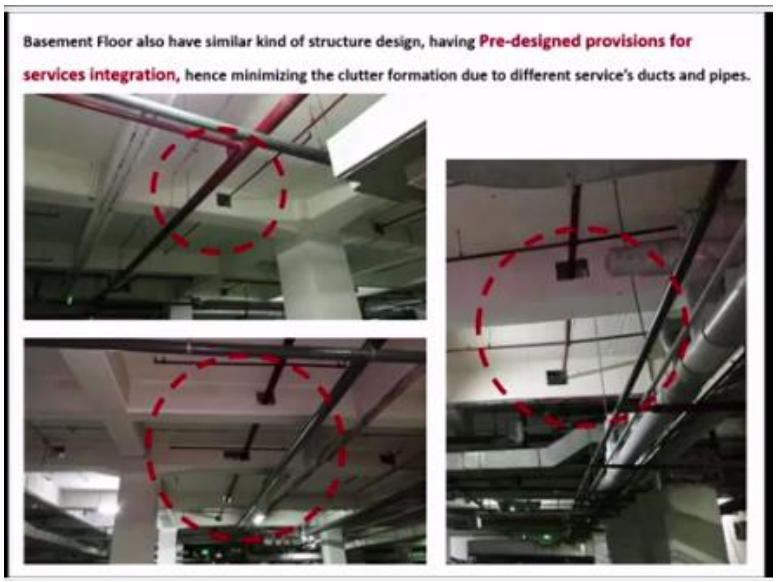

Basement floors also have similar kind of structure design having pre designed provisions for services integration, hence minimizing the clutter formation due to different service ducts in pipes.

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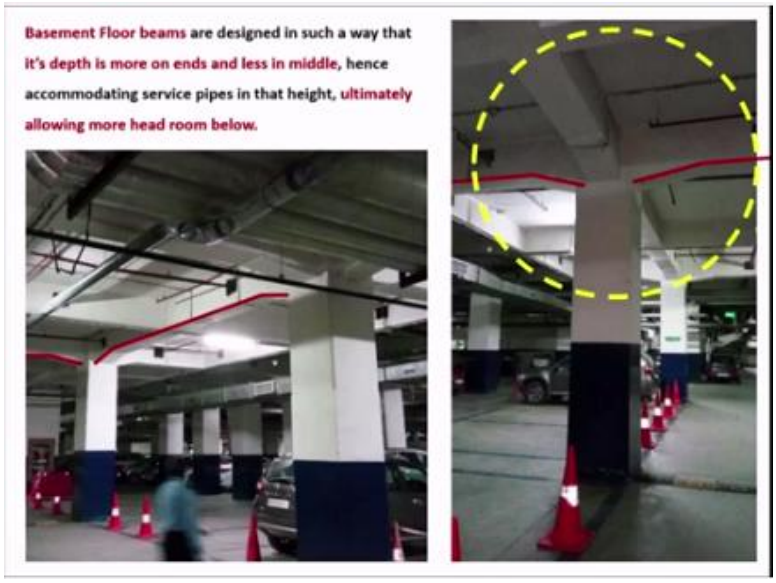

Basement floor beams are designed in such a way that it is depth is more on ends and less in middle. Hence accommodating service pipes in that height, ultimately allowing more headroom below.

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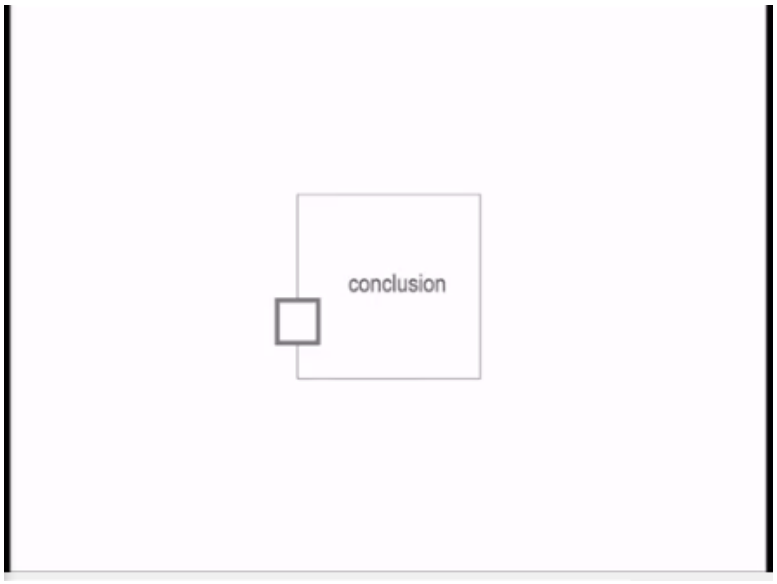

So, the conclusion is.

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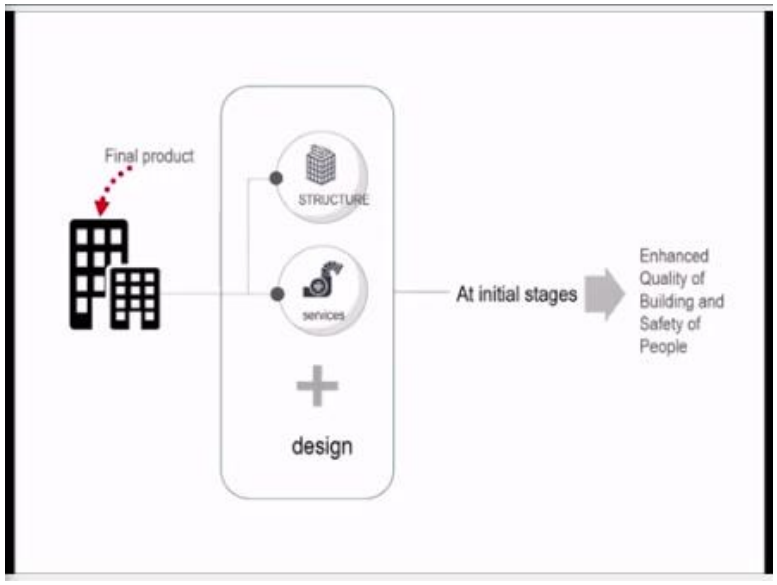

Building with structure and services combined and design stage at initial stages. The final product will have enhanced quality of building and safety of people.

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So, the final product is efficient, comfortable, cost effective, easy to maintain and flexible.

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Ultimately, it gives happy end users. So, this presentation is about that there is need of proper indication of building services with the structure of the building to have a neat and effective execution of services. As the right execution of services affects the building lifecycle from conception stages to post conception phase that is operation and maintenance phase of the building also.

Means, if any services have difficulty in its execution phase, at construction time due to the issues from design decisions. Then it will surely be a problem in future operation and

maintenance of the building also, that is in the post construction phase also. Hence, it gives a degraded building quality and safety of people in a building. So, it is recommended that pre-thought should be given to the integration of MEP services with the building structure at initial design stages to ensure better building quality and safety of people. Thank you.