

Safety in Construction
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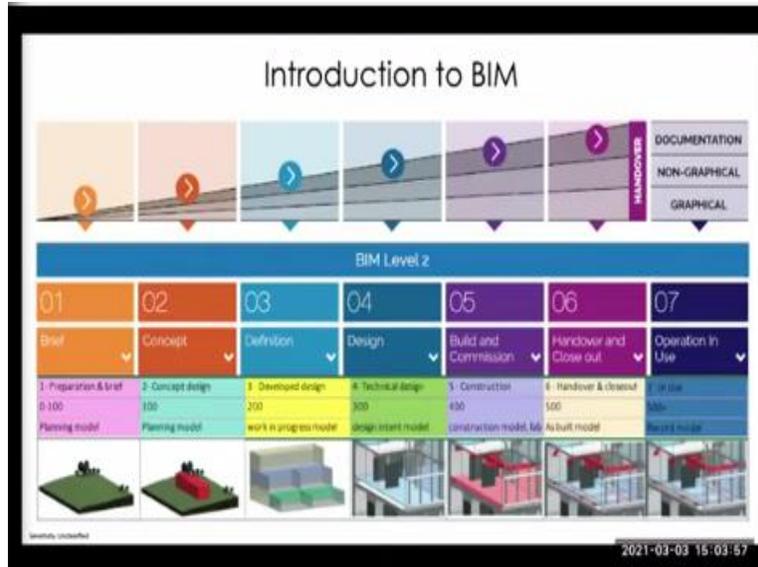
Lecture-26
BIM for Construction
A Case Study on Construction Safety

Dear audience, you are listening to Dr. Amarnath Chegu Badrinath who is currently serving as a head of BIM strategy at L & T Construction. I also serve as a president for India BIM association which is a national initiative that focus on digital transformation of Indian EPC sector. And here is my emails for your connect, I am usually available on WhatsApp for any communications or queries related to BIM, you are welcome to connect with me.

And today I am going to discuss with you on a topic called BIM for construction safety planning. I do believe that in today's session the audience would be probably the faculties or the students or the professionals also. So, you would have heard of BIM before and the benefits of what it can bring for the projects, it may be a building sector or in for smart cities. BIM has lot to do for the digitalization of the projects and it is also called as a digital data management for the projects.

So, BIM has key benefits for better construction safety planning which can help you provide lot of possible hazards on the site. So, today I will be giving a brief on what are these possible benefits BIM can bring in.

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Before getting into the safety planning, let us understand what is BIM. From this slide it is very clear from the starting of the slide, you have three items when we say about BIM model. BIM is nothing but building the information into the facility model. So, usually you have three categories of data one is graphical that is about how detailed is your objects and non-graphical which is all about parameters for each of the elements in the facility and documentation, any installations and fixtures and this kind of data.

So, usually these three categories of data keep on maturing from the stage one of the projects till the end of the project life cycle. And it is very much important to manage this data and to make sure that you get right set of stakeholders get the data as and when they need in the project life cycle. And looking into the image again there are different stages as you can see this is from the Royal Institute of British Architects life cycle phases.

Phase 1, it is all about the client and the consultant coordinations to look into the project requirements. And then comes a conceptual definition design where usually the design team is involved architectural structural MEP along in coordination with the project management consultant in the clients developing the BIM model. And then followed by you have a contractor and some subcontractor teams coming into the picture where build and commission happens and the handover of the facility happens.

Followed by you have operations and the client and the user team coming in for better utilization of the BIM model or a history BIM that has been developed for facility managements. Usually, we also speak about the level of detail of information that keep generated in each of the stages that you can see here. Now it is 0 to 100 in a brief stage that means you have only basic information on the site activity, site data captured which we also call it as a planning model.

Further concept designing it is a LOD 100 again where you are developing a conceptual model of your facility to finalize the orientation, massing and basic things. Based on this finalization further gets into LOD 200 detail where you have architectural and structural data getting built in which we call it as a work in progress model. Followed by you have a design intent model with LOD 300.

This is the kind of BIM model which is expected after the design phase to hand over to the construction team and followed by once the construction team start using this BIM model with LOD 300 to 350 which can be used for further fabrication of the building elements and also for installations. And it can also be used for time, cost planning and progress monitoring, safety, logistic planning etcetera.

Herein where the site changes whatever because whatever we plan may not be the same replica coming on to the site. Changes need to be updated back to the model that we call it as a as built model. During the handover of the facility, you may need to deliver the as built model, so that this can be utilized by the operation team for facility management integrations and here we call LOD 500+.

So, any changes that happens during the facility maintenance that need to be updated into the model, so here we call it as a record model. So, whatever you hear in the market called it is straight win that is the thing model which is a replica of your physical asset. It is a virtual asset which is a replica of your physical asset that needs to be handed over during the handover phase of the project; we also call it as a soft landing of projects.

So, I believe you get a clarity on what is this BIM and to make sure this activities are going in flow. It is very much important to use of some BIM technologies, maybe some softwares are used for conceptual design, some for a detailed BIM model development, some softwares are used for coordination and for time planning, cost planning, safety, logistic, quality and also for different types of analysis like energy, lighting, wind, structural.

Followed by for site activities and construction management and also it can be used for facility maintenance, you have set of software that can be utilized for operations and better maintenance, that is where you have a smart facility management activity. In simple terms BIM is nothing but a data management which is getting generated across the phases of the project by different stakeholders and parties involved in the project.

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Looking into the BIM, the global initiatives there is lot of BIM related initiatives coming up in the global sector. And this is the courtesy goes for the building smart international. As you can see from the image more than 40 to 45 countries have this BIM related initiatives in the market already. That means most of the clients and the AEC sector participants have already realize the benefits of diffusing BIM in the projects.

And there are different, different levels of BIM diffusion in these areas; some clients have already mandated BIM for most of the projects, and some kind of private sector clients have

already realized it and they take it as a mandate. Some companies have realized the benefits of BIM and they make it as part of their journey for their organizations and up scaling the teams and so on.

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Coming into the construction field, I mean it is very important when you look into the construction field; you have a lot of material shiftings and equipment movements and travel paths and also the laborers and the site people moving here and there for site activities. It is very much important to make sure that safety precautions are taken; if not there will be a lot of hazard situations coming into picture. And that is the reason where you have a better safety plan that can be done with fame.

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Let me give you a brief on what are some samples of hazards that may happen on the site, if no proper measures are been taken. **(Video Starts: 07:47) (Video Ends: 08:53)**
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As you can see here there may be several types of hazards that may happen and it is very much important to do better safety planning. So, it is very much important to make sure we use such BIM solutions for safety planning which will also help to realize the possible hazard situations and avoid the risk. And make sure you have a safe construction sites and also for the operations. Here are some of the BIM softwares for construction safety plan; this has been from a reference of one research which our team has done before. And this you can see there are some softwares

which are very much supportive for the safety planning. For example, Fuzor, Synchro and there are also other solutions which can help to some level on safety planning.

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Let us understand what are the possible safety planning that can be done using this kind of solutions. And there are many other solutions but I am listing some of them for your reference. Number 1, real time monitoring and management of hazard sources such as safety signs, dangerous goods and large machinery at the construction site use. Second one like simulate the rescue scene and respond to the emergency management rescue plan or virtual safety, virtual reality devices can be used for safety training to give first-hand experience to construction workers. These days VR devices are not so expensive, it can be very well utilized for most of the construction site activities, no matter it is a small scale or a mid scale or a large-scale company project. Further it can be utilized for the fire exit risk assessment simulations.

You can also define the new rule sets in the softwares to identify the safety checks and also possible measures can be taken on those lines. You can make safety planning proactive, easy to communicate and engaging for the traders. The standardization of safety working environment which is most important. So, all these kinds of simulations can be performed by using this BIM solutions, it can bring you lot of benefits for site and operation phases.

And let me show you some of the videos which will give you a brief on how this BIM tools can be utilized for safety plan. **(Video Starts: 11:16)** There is one from the Fuzor, for example by using Fuzor software they have developed this VR safety training construction site. So, all this kind of site activities can be completely simulated using such software applications. You will get you will be able to virtualize the BIM models and your equipment and the site simulations on day-to-day activities what are the kind of scenarios and situations, everything can be simulated.

And possible measures should be taken on those lines. Here is a list that you can give for a site team which is going to enter the site team site. So, they will be given a checklist and a proper guidance on what are the possible measures to be taken before you enter into the site. So, here if you can see the hazard list, so based on the hazard checklist you will be able to make sure how many of these are followed and a proper guideline is given.

So, that there is lot of risk can be avoided on the site activities. The site worker is getting the glasses, helmets and his device which is PPE passed. And now the site person is entering into the site activity and there is an alert message coming in on the current situations. So, there is a barrier that is need to be fixed on the place and also giving on a fall hazard situation. These kinds of indicators will help a lot for the site team to realize on the possible safety measures to be taken on the site activities on a day to day.

So, now he has fixed the safety barrier also, so here is a fire extinguisher which need to be taken and to avoid that the fire. And he is now entering into the construction and his there is an indicator on the moving equipments. This mainly will give you a better immersive environment for the actual site activities and then the possible measures can be taken. So, here you get a caution on the moving equipment.

So, this kind of sessions can be done on day-to-day basis for the kind of situations on the site and trainings can be given for their site team. And here is another video for you to understand the fall hazards. This again will give you a clarity on what are the kind of safety precautions and barricades and things need to be fixed during the site activities. Here you can see there is an opening and if that has not been properly realized there is a fall hazard coming in.

So, what to be done? So, you need to have the precaution trap fixed there, safety precaution needs to be taken there, so it is fixing that. So, this kind of indicators will help a lot to understand what are the possible hazards on the site and also take the possible measures and give the right instruction for the site safety team to fix those kinds of situations. And here again there is a hidden hazard nearby and there is a fall situation that can happen.

So, then the safety precaution needs to be taken, so there is a barricade that can be fixed along the side on these lines to avoid that fall hazards. Here is another video for you to give an idea on how these VR devices are used for safety training again for the high rise fall hazards. Now we are entering into the construction site and as you can see there is a high-rise structure and a lot of barricades which need to be done on the sites.

This kind of simulation can be performed before the site activities happen and possible questions can be taken. And there is a dangerous zone here; this is mainly for fall hazard safety training. So, what has to be done? So, there is a rope that can be tied for the person who is working on that site, so that it can avoid that kind of hazards. And during those trainings it gives a danger zone alerts which will help for planning the safety precautions on these lines.

So, there is a safety netting which is important to be put across this site on these high levels. So, the safety nets can be taken and installed on the site, so that the possible hazards can be avoided. Here is another video for you to understand how BIM can benefit or the trainings can benefit for operation phase if there is a kind of fire situations. So, this is for fire safety training wherein there is a kind of fire attacks on during usage of the facility, what are the kind of precautions to be taken?

So, you should be the users should be aware of the fire extinguishers and fire equipment that are available in that facility. And it will give you the step-by-step guidelines on how to tackle such situations. This is step 1, identify the type of fire and then step two alert everyone on the fire by pressing the fire alarm, step 3 is for pick up the phone to call for the emergency and police department.

And the step 4 which is gives you a clarity on shutdown of the circuit breaker followed by using these extinguishers. Again, which extinguisher we should need to be selected and then using that extinguisher for clearing that fire, which is a step 6 to put out the fire alright. So, these are the possible simulations that can be performed by using BIM models. **(Video Ends: 19:08)**

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Here are some lists which I like to discuss the kind of safety planning with BIM. Create safety training with your BIM model. So, using the BIM model which has been delivered by the design team, you can do the site activities using software like Fuzor and Synchro. And do the possible simulations on the possible safety precautions and measures to be taken and alert the safety team on the site to activate that.

Next, create interactive activities for safety training, export video for safety training and demonstrations, have a safety checking with height clearance and edge detections and many other safety planning options are available.

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Coming into the BIM jobs in the market, there are three categories of job roles, one is a technical, second is managerial, third is a strategic job. When we say about technical jobs when we say BIM there is roughly 15 to 20 softwares across the lifecycle of the project you need to use. Some softwares are used for planning the projects and some for developing the BIM model, some for coordination and clash detections, time planning, cost planning, safety planning, quality control, logistic planning.

Different types of analysis like energy, wind, lighting, structural and it can also be used for facility maintenance. So, if you are capable of any of these software solutions then you fall into the technical job role. This may be softwares coming from software vendors like Autodesk or Bentley or Trimble or Dassault or Nemechek or Graphisoft. There are roughly 25 to 30 software vendors in the market providing this kind of BIM solutions.

Second is manage your job rules, here is where you are very much aligned with understanding the BIM workflows and able to manage the team and the deliverables during the design construction and operation phases. Usually, you play a role of a design or a construction or a facility or a project manager or a coordinator role followed by a strategic job role. This is more on leading the organization and it is team or a project and it is team towards the digital transformation journey.

Understanding the kind of digital transformation happening in the global sector, and aligning the company activities and the team towards their efforts towards the same lines. Planning out the quarterly plans and initiatives and supporting and handholding the companies on day-to-day journey on these lines. It is more of a strategic leadership jobs usually it is for a it will be strategy coordinator or a manager or a strategy head or a digital director kind of job roles.

But these are the kind of possible job roles on BIM; it is not that BIM software is only the one which you need to learn to get into the BIM. So, different, different areas and new job roles are coming into the market. So, thank you for listening to me for this session and again I sharing my connects here, you are welcome to connect with me for any queries. Thank you so much.