

Larsen & Toubro Limited

Kudankulam Nuclear Power Project 5 & 6

Project Profile:

Larsen & Toubro Limited (L&T) is a technology, engineering, construction, and manufacturing company. It is one of the largest and most respected companies in India's private sector. More than seven decades of a strong, customer-focused approach have enabled it to attain and sustain leadership in all its major lines of business. We are constructing the 2 x 1000Mw Nuclear Power project, Unit# 5&6 located at Kudankulam, Tirunelveli, Tamilnadu. The project comprises the construction of reactor building, Reactor auxiliary building, Turbine building, Diesel generator building and other safety related structures.

Case Study : Building Information Modeling (BIM) for Safety - Utilizing BIM to visualize hazard zones prior to construction.

Challenge

Nuclear buildings are of critical nature having very frequent interfaces of the MEP and civil components. The civil structures are often constructed well in advance before the mechanical works start and these interfaces are often left with large openings on the floors and corridor without barricading. This creates a hazard in the site, in which any personnel on the site is at the risk of fall from height through these openings. The height from these openings is often more than 8m, thus making any fall to be fatal.

Till now, these openings can only be detected after the construction of that particular structure. Once it is constructed, the engineers and safety personnel shall check the site conditions and shall direct the team to provide engineering and administrative controls to make the area safe. This includes barricading and covering the openings, providing fire extinguishers, weekly floor opening inspection etc.

However, all these unsafe conditions can only be detected after the construction of a building, not before. Hence, this prevents the team from detecting safety hazards beforehand thus disabling them to plan for mitigating these risks. Also, during the construction phase of a building, not everybody is aware about the technical aspects and drawing of building, especially personnel of ancillary department like EHS, thus compelling them to rely on previous experience and site conditions only.

System to overcome this challenge

The L&T KKNPP site team used Building Information Modelling (BIM) Technology as a solution to this challenge and implemented BIM for safety at the site.

Building Information Modelling has been a trending topic in Construction Industry, which generally involves sharing of information through a single model having all relevant information fed into it. Building Information Modelling is a digital representation of physical and functional characteristics of

a facility creating a shared knowledge base for information that would be a dependable base for taking decisions during its life cycle, from earliest conception to demolition. Although BIM is extensively used in foreign projects, India has been lagging in it and specially it is seldom used in highly secure and sensitive Nuclear Power Projects. L&T KKNPP 5&6 team has taken up the challenge of adopting BIM in Nuclear Power plant and has created a benchmark for implementation towards safety of the site.

Implementing BIM & Virtual Reality

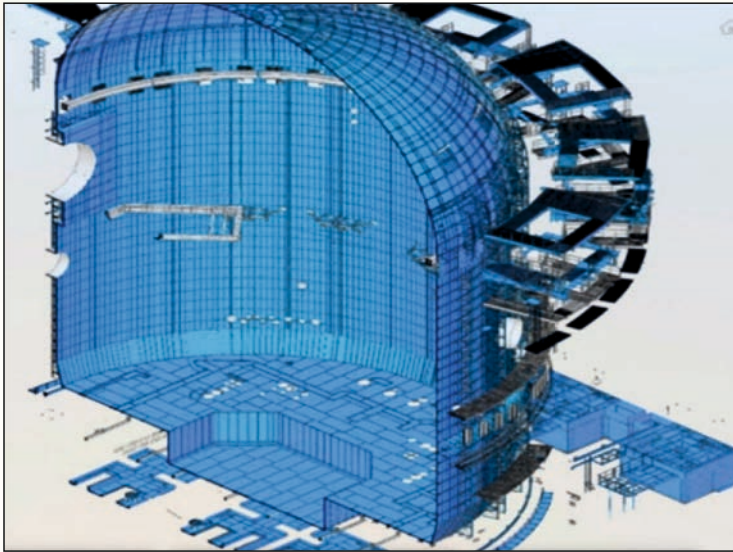
The BIM implementation in KKNPP5&6 involved 3D modelling of the critical nuclear structures. Revit Architecture was used for modelling, and it is broadcasted to site using BIM 360, a cloud based common data environment (CDE) web application. Finally, this model was rendered and visualized using Virtual Reality wherein any site personnel can take a fully immersive virtual walkthrough of the 3D model of the structure.

Benefits

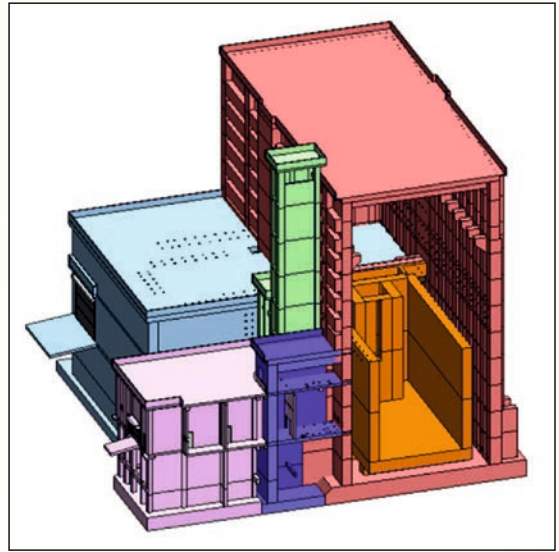
With the 3D model made prior to the construction, the site engineers, safety engineers as well as the client are getting to take a virtual walkthrough of the building with the help of the 3D model. They are also accessing the 3D model at site desktops through BIM 360 web applications. The benefits of the BIM system are as follows:

1. Early detection of hazardous openings on the upcoming floors and providing mitigation plans beforehand. Now, the safety engineers can quantify the hazards in the site and can estimate the count of barricades/ cover required for the site. The identified hazardous zones are specially highlighted and warned in daily pep talks and its mitigation actions like procuring barricading, installing sign boards are priorly taken up.
2. Positions of safety signs, firefighting equipment can be planed and modelled into main 3D model, thus enabling the engineers to know where to install the equipment site prior to the construction of the building, itself.
3. Through Immersive Virtual Reality walkthrough, engineers are enabled to understand the site condition virtually thus giving them the idea of the safety challenges like height and slope at they shall face at site prior to the construction itself.
4. Virtual Reality with the help of a rendering software called Twinmotion also enables the site to simulate night condition, which helps the team to plan for proper illumination at site, and procure lights accordingly.
5. Walkthroughs in both VR as well as in BIM 360 is exclusively beneficial for planning emergency evacuation plan and develop exit pathways.
6. BIM Model is extensively used to make new joinee, client meetings and dignitaries understand and acquainted with the whereabouts of the building in a quick and efficient manner. This has been an excellent way to demonstrate the L&T's capability to use cutting edge technology.

Gallery



Model of Reactor Building hermetic containment liner



3D Model of Extension Building (SFSE) of KKNPP to get the wholesome idea of the building.



Falling hazards detected prior to the construction of the structure itself through the 3D virtual reality walkthrough.



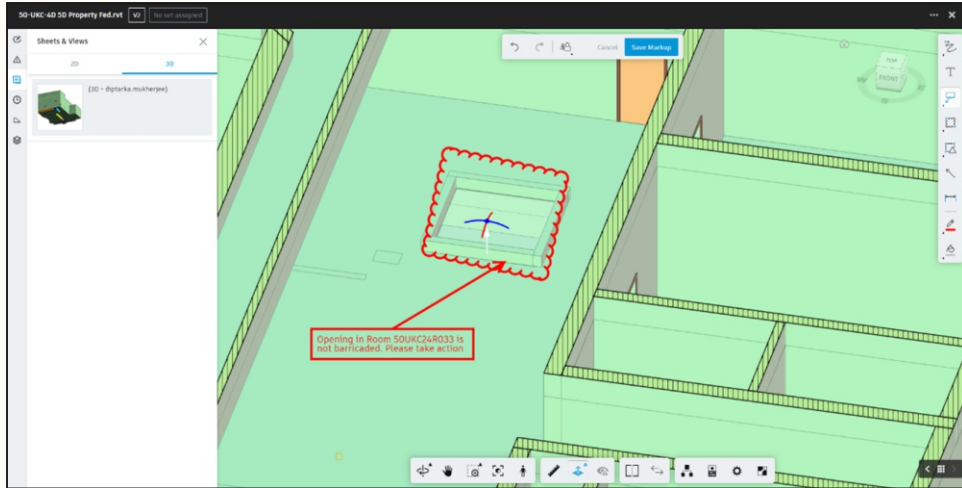
Checking hazards with the help of simulation.



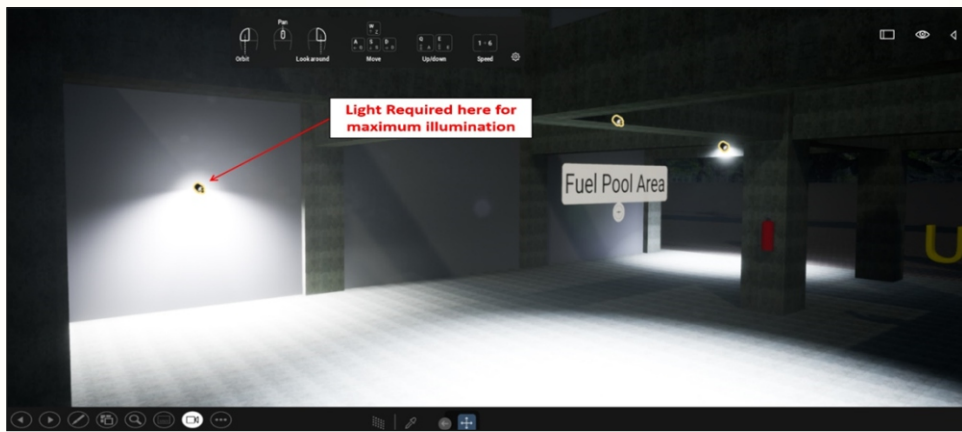
Ravi Kumar, designer from NPCIL taking reference from walkthrough in the fuel pool in the Virtual Reality



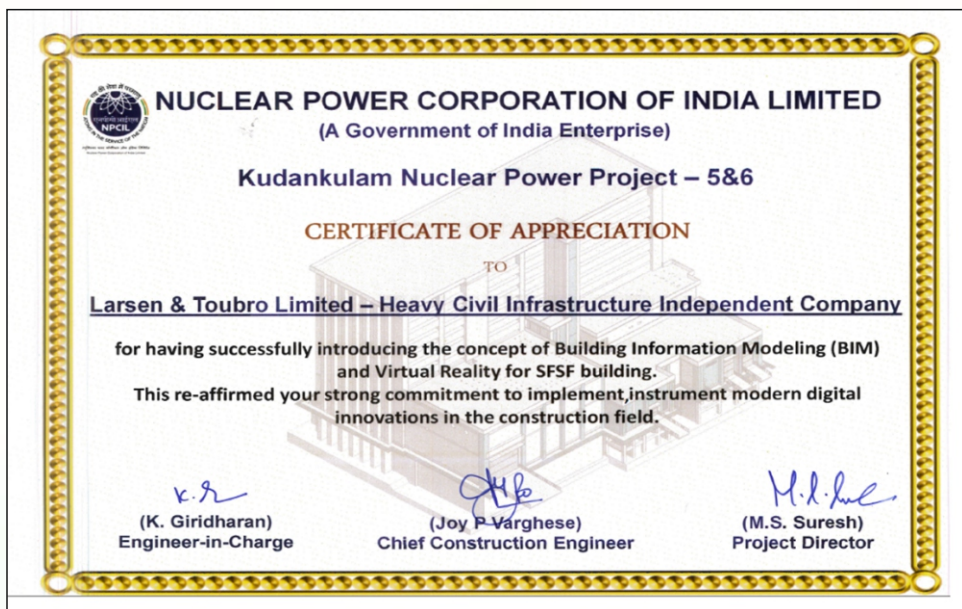
Mr Rishab (Sub-collector, Tirunelveli District) and his spouse having a look into the structure VR. The VR technology impressed the dignitaries who appreciated L&T's efforts towards digital.



Using BIM 360 Cloud Platform to communicate Safety hazards at site, and enabling them to take preventive actions.



Using Twinmotion - Illumination checking in a simulated model to estimate the location and number of lights required for night condition.



Certificate of Appreciation Received for implementation of BIM