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HOW THE A/E CAN INFLUENCE SAFETY

The Power of 3D Modeling

Safety is a topic that is usually brought up during the start of construction and oftentimes at owner meetings, toolbox talks, and other contractor-led meetings. Architects usually attend these meetings during construction administration but rarely get involved or have much to offer to the safety conversations. But how can the architect influence safety on a project? In the architectural and engineering (A/E) industry, we usually attribute safety to the design of safe buildings through building codes, national standards, and good design practices, but architects and engineers have more to contribute.

Early Decision-Making

All the items listed are of utmost importance to the architect or engineer, but how can we ensure that the buildings are operationally safe to the users? By using 3D modeling, we can fly through the project early in the design development stage and illustrate to building managers, maintenance personnel, and owners the locations and placement of critical equipment that will require regular maintenance. This review during the design process is critical not only for the coordination between disciplines, but also for the visual review of objects that could pose a hazard during construction and/or occupancy.

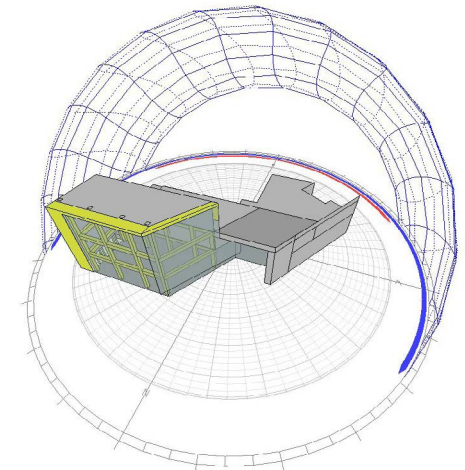
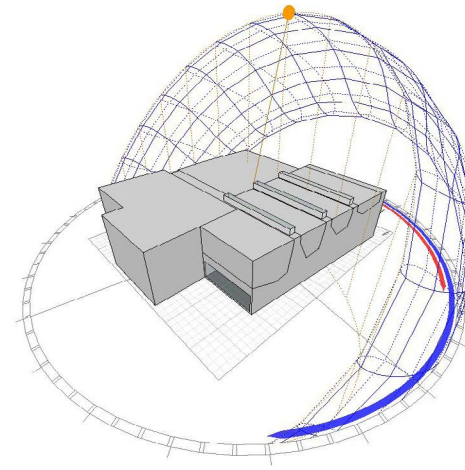
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In the placement of rooftop equipment, for example, a 3D BIM model can be used during the design to indicate where the removable panels and controls are located so it is clear that the distances from the edge of the roof are being met for safe operation. Shut-off valves, point-of-use controls and operations can be placed closer to a clear working service to avoid having to use other means for access. By modeling equipment and piping on the roof, tripping hazards can be avoided or crossover means can be designed to traverse potential hazards. Frequently used items such

as ladders, stairs, platforms, and elevated surfaces can be illustrated so that all parties involved in building operations can provide input on the size and locations to ensure that the functionality is appropriate for the task.

The Footprint

Other areas where the architect and engineer can influence safety is both inside and outside of the building footprint. Exterior drive aisles, pedestrian walkways, exit paths, truck entry and exits can all be modeled with simulations to illustrate frequency of use and avoid potentially dangerous intersections. Early in the design, it can be determined if barriers should be placed to separate vehicles and pedestrians or if redirection and signage will be necessary.



Inside of the building, pedestrian simulations can be modeled to avoid similar dangers. Buildings that have machinery or equipment active within can be modeled and potentially simulated to aid in the layout of pedestrian aisles, means of egress, and simply to avoid dangerous interactions between humans and machines.

Scenario Modeling

In public-facing buildings such as schools, community buildings, airports, cultural facilities, and other occupancies, defensible design practices can be modeled and scenarios simulated to aid in a practical design that security experts can review and comment on during the design phase. The review can be as simple as modeling exterior and interior illumination levels both to avoid potential hiding locations to more complex simulations requiring experts in blast mitigation and other security consultants.

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In a more analytical way, architects and designers have been using simulations in the design of buildings to study how the structure will respond to natural disasters such as high winds, earthquakes, and most recently floods and hurricanes. This data can be shared and illustrated as a basis of design to accommodate building codes, but may also generate discussion of additional ways to make the building safer. The more data and understanding that the architect, engineer, owner, and contractor has on this building design contributes to a safer building.

Manufacturing and warehouse projects where employees are exposed to active machinery, moving vehicles, elevation changes, and other process hazards can and should be reviewed by the architect, owner, and process engineering team. Per OSHA statistics, injuries within the manufacturing and warehouse occupations have been consistently trending down over the past 10 years; however, they still account for a high majority of workforce injuries. Routine work tasks within these types of occupancies can be reviewed within a 3D model to

study worker ergonomics and machine-to-human interactions. It can also aid in the addition of protection screens, identification of hazardous zones, and the design of physical barriers with the goal of making the workplace safer.

Research and development and laboratory projects can also benefit from a safety review during the design of the building within a 3D model. Buildings where the primary function of the testing and research consists of destructive means and laboratories of all types including analytical, biological, medical, incubator, production, and research usually contain some level of hazard that needs to be mitigated and can benefit from a safety review from the users who know and understand the process and dangers.

Collaboration

Finally, the architecture and engineering disciplines can help the construction community build safer buildings. We will not instruct or direct means and methods of construction, as the builders and contractors are still the most knowledgeable and most responsible for this work. But in the early stages of construction, the 3D model can be used to verify construction sequencing and can be used by builders in a similar fashion used during design to avoid potential construction-related hazards.

In summary, the 3D model can be a powerful tool to properly communicate across all the parties involved in the development of a project. Beyond helping to aid the design team in the development of a safer project, it is an important tool to avoid potential costly changes during construction.

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