BIM Power: Fire Protection

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Over the past few years, many in the AEC industry have voiced the opinion that structural engineers need to take a more proactive involvement in passive fire protection for structural steel. After all, structural engineers routinely specify corrosion protection by indicating which steel members shall be galvanized. So why not specify thermal protection for structural steel members by indicating fire ratings and directly applied passive fire protection?

Ultimately, the decision to specify fire resistance and protection parameters in the structural documents will be made by the structural engineer of record on each project after weighing many factors. If the decision is made to indicate the fire rating and the directly applied fire protection, the power of Building Information Modeling (BIM) software can be used to easily and confidently incorporate this new responsibility into the structural drawings. Because of the parametric nature of BIM objects, custom parameters can be added to the BIM software's standard library of structural objects to calculate, schedule, and display the directly applied fire protection materials (*Figure 1*).

To begin, create a copy of the standard BIM structural framing object and create a numeric parameter named "Fire Rating". This parameter will hold the required hourly fire rating from the building code. Next, choose a specific design methodology on which to base the fire protection thickness calculations (e.g. UL X771 for pipe and HSS columns). Then, create a calculated length parameter named "Fire Protection Thickness" to automatically calculate the thickness of the directly applied fire protection (*Figure 2*). Finally, with the parameters for the additional object information in place, sketch an additional layer of material around the steel shape. Link the new material thickness dimensions to the "Fire Protection Thickness" parameter, and the new material type to the appropriate directly applied fire protection material definition in the BIM, and the fire protection graphics will automatically update when the fire rating or structural shape are changed.

For use in the directly applied fire protection thickness calculation, additional numeric parameters will usually be needed to calculate the W/D ratio for wide flange members and the area to perimeter ratio for pipes and HSS members. For floor and roof beams, lengthy logic calculations may be needed to ratio the required directly applied fire protection thickness based upon the minimum beam size implicit in the design methodology.

Now that the fire resistance and protection information is fully embedded in the object, the real power of BIM can be realized. The parameters can be used to schedule quantities of directly applied fire protection material to facilitate contractor takeoff. The "Fire Rating" parameter can be added to beam and column tags to indicate which members do and do not require fire protection, and the rating each member requires (*Figure 3*). By creating an additional material layer around the steel shape, the directly applied fire protection will be visible when the structural model is linked into the architectural model, and the increased size of the steel member will be properly used for clash detection.
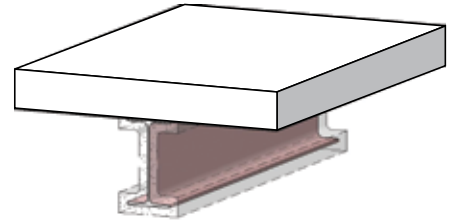
New processes, requirements, and responsibilities are always evolving in our industry, placing challenges on structural engineers. By utilizing the power of BIM, the structural engineer can easily and confidently adapt to the changes in our industry and provide added value to their client's. ▪

Figure 1: Axonometric view of beam and slab with fireproofing on beam.

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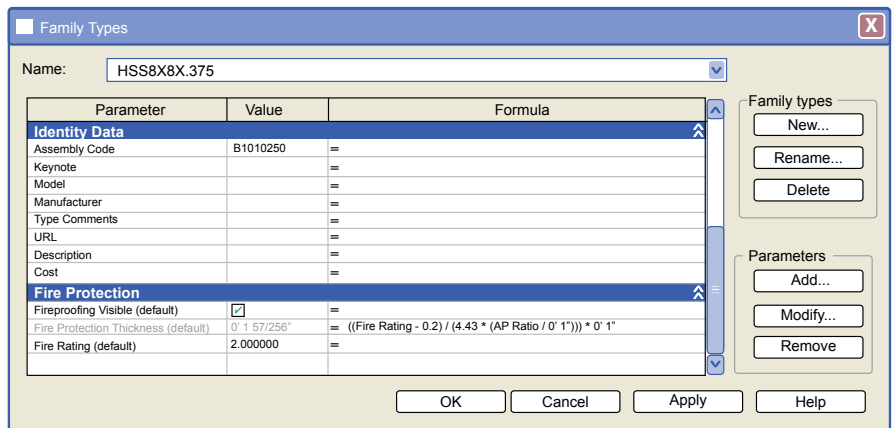
Figure 2: Column object parameter dialog box with UL X771 fireproofing thickness equation.

Figure 3: Steel column schedule with fire ratings.