

SAMPLE DOCUMENT

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REQUEST FOR ALTERNATE MEANS OF PROTECTION

California State University
1234 College Street
College Town, California 90015

Date: January 16, 2022

Code Section: 2019 CBC Section 703.

Code Requirement: Section 703.1 requires that fire-resistive materials and assemblies be as described in Table 7-A, B or C of the code, or tested by a third party acceptable to the authority having jurisdiction.

Code Intent: To design construct fire-resistive systems, which have been tested, or otherwise shown to provide the required fire resistance.

Request: To allow the 1-hour and 2-hour columns and beams within this Type V – 1-hour building to be protected with a composite assembly consisting of wood, gypsum, and the steel member. These columns and beams are concealed within the 1- hour walls cavities. To allow the floor-ceiling assemblies and the supporting beams to be protected for 1-hour utilizing a composite assembly, consisting of wood and gypsum and the steel members. To allow the proposed wall assemblies to be considered 1- and 2- hour wall assemblies. The proposed assemblies are shown in Attachment A.

Justification: The beam and column assemblies are enclosed within 1- and 2- hour wall assemblies and are protected further by the addition of plywood sheeting and/or 2X or 4X wood nailers. These assemblies have been evaluated using computational models to evaluate their fire resistance. In accordance with UBC test standards, columns may be tested without load by measuring the temperature of the steel column for the duration of the test. The steel column must not exceed 1,200° F at any one point, or 1,000° F (538° C) at an average of 4 measuring points. The steel beams within the walls must not exceed 1,300° F at any one point or 1,100°F as an average. Fire resistance models were used to calculate the temperature of columns and the beams utilizing the standard ASTM E119 fire test curve assumed on both sides of the wall simultaneously. Two models were used to evaluate all typical conditions and show that the temperature at the steel is less than 538° C (1,000° F) for all of the 1- and 2-hour conditions, including interior and exterior, shear and non-shear walls. The interior assemblies were assumed to not include insulation within the wall cavity. Cavity insulation, according to SFPE Handbook, would increase the level of fire resistance of a wall assembly. These two models, SAFIR and FEHT show good correlation with each other and with other standard calculation procedures for columns. The beams in the walls represent the similar and less restrictive condition to the columns and were, therefore, not modeled. More information about the models and the results of the computations are attached as Appendix B.

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REQUEST FOR ALTERNATE METHOD OF DESIGN

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The floor-ceiling assemblies consist of a cementitious underlayment over a $\frac{3}{4}$ - inch plywood sub floor supported by steel beams ranging in size from W12 X 14 to W24 X117. The typical floor assembly includes W18 X 35 beams. The beam assembly includes a 2X or 4X nailer above the top flange and below the bottom flange. The assembly will be protected with two layers of 5/8 -inch Type X gypsum below. The system is similar to UL Design No. L524, which has achieved a 1-hour fire resistance rating with two layers of $\frac{1}{2}$ - inch (not Type X but regular gypsum). Type X gypsum is known to provide more fire resistance than non-Type X gypsum. UL Design L524 is similar in that it includes steel beams supporting a wood and cementitious floor, protected below by two layers of gypsum. In the UL L524 assembly, the gypsum is supported on steel channels. The proposed assembly includes wood nailers in lieu of the steel channels. The wood material will increase fire resistance of the assembly compared to light gage steel. The wood nailers are attached to the steel beams, with metal bolts welded to the beam. Gypsum will be attached to the wood nailers with screws and joints as described in Item 8 of the UL listed assembly. The joints will be staggered as described in UL L524. Please note the architectural drawing attached to this equivalency only includes one layer of gypsum. A second layer will be added.

The wall assemblies are similar to typical ICBO and UL listed and 1- and 2- hour wall assemblies, except that they include wood nailers and plywood. The fire resistance models show that these assemblies meet the wall criteria; a maximum temperature rise of 250° F (139° C) on the unexposed side.

Conclusion:

The proposed column, beam and floor-ceiling/beam assemblies provide the required 1- and 2-hour fire resistance. In the case of the columns and beams, the assemblies have been modeled with two different fire resistance models, which provide a similar result. The floor-ceiling assembly is similar to a UL listed floor-ceiling assembly, but with the provision of Type X gypsum instead of regular gypsum and the use of wood in lieu of light gage steel in certain locations within the assembly. The walls meet pass/failure criteria of the wall fire resistance test.

Prepared by:
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(Signature)
John Doe, Principal Architect _____ Date

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Bryan Jones, CSU Stanislaus _____ Date

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Approved by:

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Jack "CJ" Stinson _____ Date
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Brad Goodrich _____ Date
Chief, Fire and Life Safety Division
CAL FIRE – Office of the State Fire Marshal

For Daniel Berlant
Acting California State Fire Marshal

Attached Exhibits: