Development Services

From Concept to Construction

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APPEAL SUMMARY

Status: Decision Rendered	
Appeal ID: 15807	**Project Address:** 375 NE Holladay St
Hearing Date: 9/13/17	**Appellant Name:** Terrance A. Gruenhagen
Case No.: B-003	**Appellant Phone:** 612-373-4656
Appeal Type: Building	**Plans Examiner/Inspector:** Jody Orrison
Project Type: commercial	**Stories:** 14 **Occupancy:** R-1 primary, A-3, A-2, B **Construction Type:** I-A
Building/Business Name:	**Fire Sprinklers:** Yes - fully sprinklered
Appeal Involves: Erection of a new structure	**LUR or Permit Application No.:** 16-279653-STR-01-MG
Plan Submitted Option: pdf [File 1] [File 2]	**Proposed use:** Commercial - hotel with event and meeting space

APPEAL INFORMATION SHEET

Appeal item 1

Code Section	Section 1009.9
Requires	In reference to the 2014 Oregon Structural Specialty Code - Chapter 10 Means of Egress Section 1009.9 - Stairway Construction - All stairways shall be built of materials consistent with the types permitted for the type of construction of the building, except that wood handrails shall be permitted for all types of construction. (Hotel is Type I-A Construction; noncombustible)
Proposed Design	This appeal is being submitted to address and respond to Item 13 from the Life Safety Checksheet received on January 13, 2017 on Permit Submission #1 for the Oregon Convention Center Hotel (aka - Hyatt Regency - Portland). Item 13 on that checksheet states "Please clarify how the CLT treads of Podium Stair E meets requirement for non-combustibility in Type IA construction". (Reference Drawing A7.8) Stair E as it is labeled on the plans is an open ornamental stair connecting the hotel lobby on the ground floor level with Level 2 prefunction and event spaces. It is proposed to be utilized as a means of egress stair in addition to all other stairways in the building. The design of this stair as proposed features a locally manufactured product - Cross Laminated Timber (CLT) - as mass timber treads and risers for the stair. CLT is currently being used an alternative to commonly used building materials like steel, masonry or concrete. It is an engineered wood panel typically consisting of three, five, or seven layers of dimension lumber oriented at right angles to one another and then glued to form structural panels with exceptional strength, dimensional stability, and rigidity. The CLT mass timber treads and risers are the only wood product being proposed for

Stair E other than the handrails. The structural stringer components of Stair E are proposed as steel.

Reason for alternative The alternative design for the use of CLT for the treads and risers on Stair E as a mass timber product is requested because:

CLT as an engineered mass timber product has inherent fire resistivity. Some of the most important testing of the fire resistivity of cross-laminated timber has been conducted in Canada. The National Research Council Canada conducted full scale fire resistance tests on cross-laminated timber and published their findings in 2012 (Refer to Volume 17, Number 4 dated December 2012 attached). According to the published results, a 3-ply panel of CLT (approx. 4.1" thick) with 1 layer of gypsum board protection subjected to a load of 2.4 kPa suffered an integrity failure after 86 minutes under the fire test conditions. An unprotected 5-ply panel of CLT subjected to a load of 11.8 kPa suffered an integrity failure after 96 minutes under the fire test conditions. The CLT riser thickness on Stair E is 5-1/2 inches. The riser will be constructed from 5-ply CLT. The design for Stair E includes a single layer of a Type 'X' gypsum board soffit which provides additional protection from the underside of the stair for the engineered CLT wood components (the premise being that a fire from below represents the greatest risk for failure on the stair). Type 'X' gypsum board panels have long been accepted by the International Code Council for enhanced fire resistive protection to a variety of substrates and structural members. A single layer of 5/8" Type 'X' gypsum panel would provide at least 30 minutes of additional protection time to the CLT. The area below Stair E will be protected by the fire sprinkler system. A wet sprinkler system will be installed below the stair to extinguish potential fires that could occur below the stair. Refer to drawing A?.8 attached to this appeal for the intended routing for the sprinkler lines. The heads would be fully recessed type and would be centered in the width of the stair at the gypsum board soffit.

Featuring mass timber CLT as a primary component of Stair E contributes to the aesthetic design of the hotel and also ties it to an important local industry (forest products) and sustainable resource.

Based on our design team's research, we are of the opinion that the use of CLT as a single component mass timber tread and riser for Stair E offers an equivalent performance level to that of an ornamental stair constructed of noncombustible materials. Although it is a wood product, it does not burn readily. It is further protected by a layer of 5/8" gypsum board soffit from any fire source below the stair. In addition, fire sprinklers are installed below the stair to extinguish any potential fire from that location. Stair E can reasonably be expected to provide a safe egress option for the occupants of the hotel in the same manner that a stair constructed entirely of noncombustible materials would. As such, we respectfully request your approval of the design approach via this appeal.

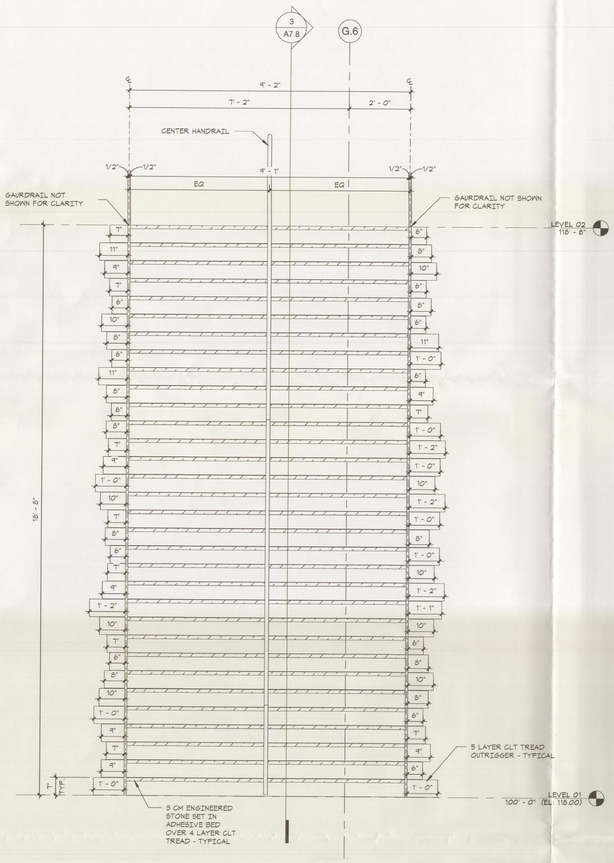
APPEAL DECISION

Use of cross laminated timber for Lobby stairway in Type 1A construction: Granted as proposed.
Note: Does not waive Code requirement for slip resistant walking surface.

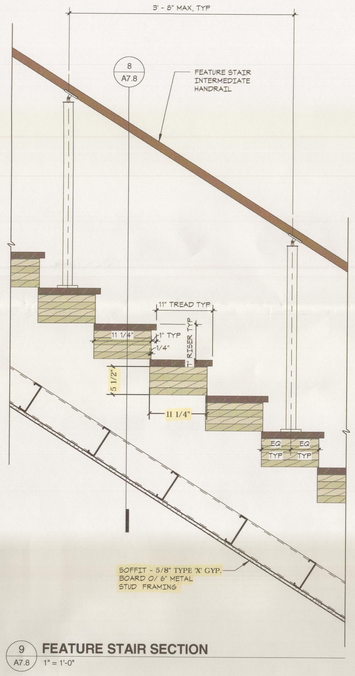
The Administrative Appeal Board finds that the information submitted by the appellant demonstrates that the approved modifications or alternate methods are consistent with the intent of the code; do not lessen health, safety, accessibility, life, fire safety or structural requirements; and that special conditions unique to this project make strict application of those code sections impractical.

Pursuant to City Code Chapter 24.10, you may appeal this decision to the Building Code Board of Appeal within 180 calendar days of the date this decision is published. For information on the appeals process and costs,

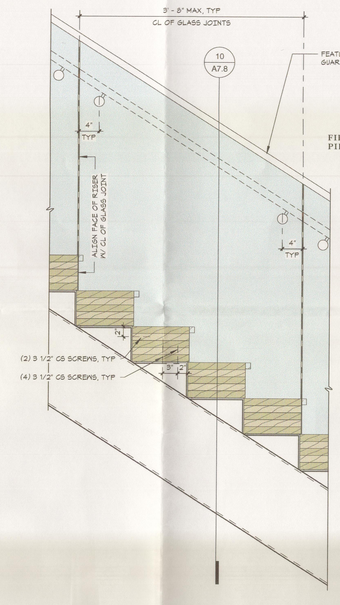
including forms, appeal fee, payment methods and fee waivers, go to www.portlandoregon.gov/bds/appealsinfo, call (503) 823-7300 or come in to the Development Services Center.



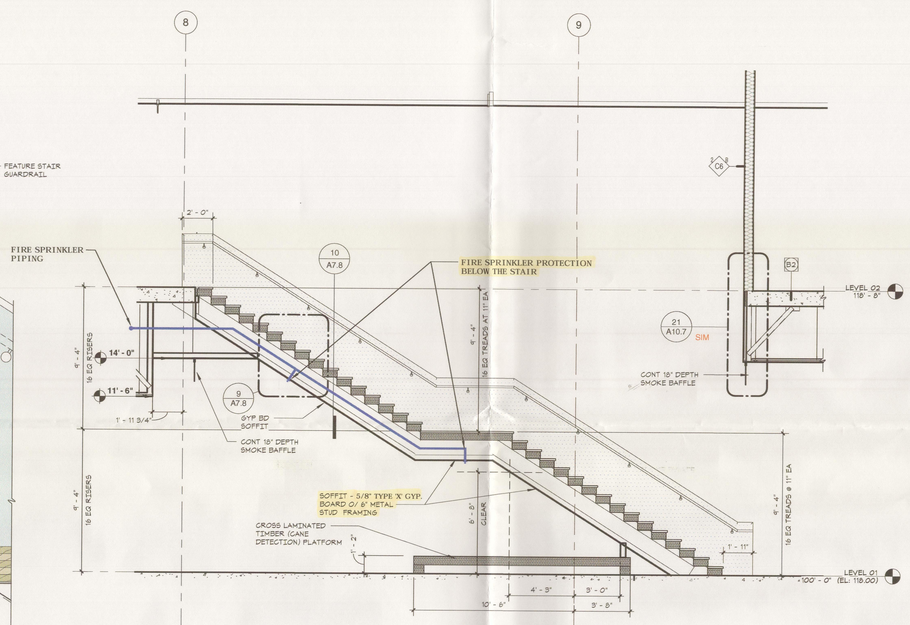
11 A7.8 **ENLARGED ELEVATION AT MONUMENTAL STAIR**
1/2" = 1'-0"



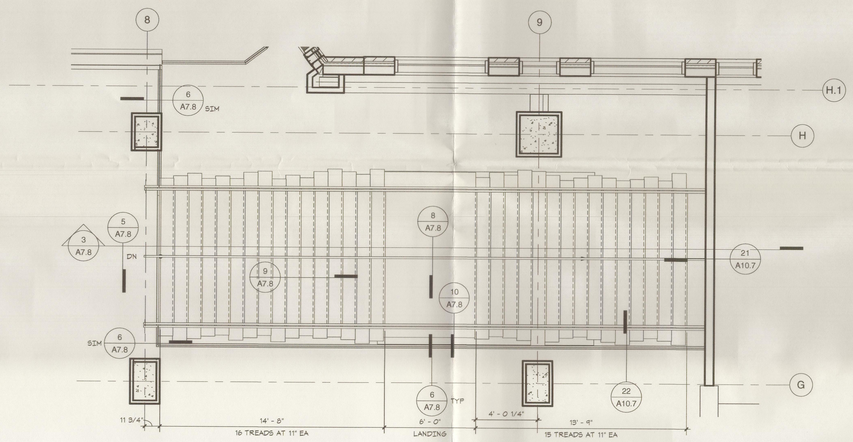
9 A7.8 **FEATURE STAIR SECTION**
1" = 1'-0"



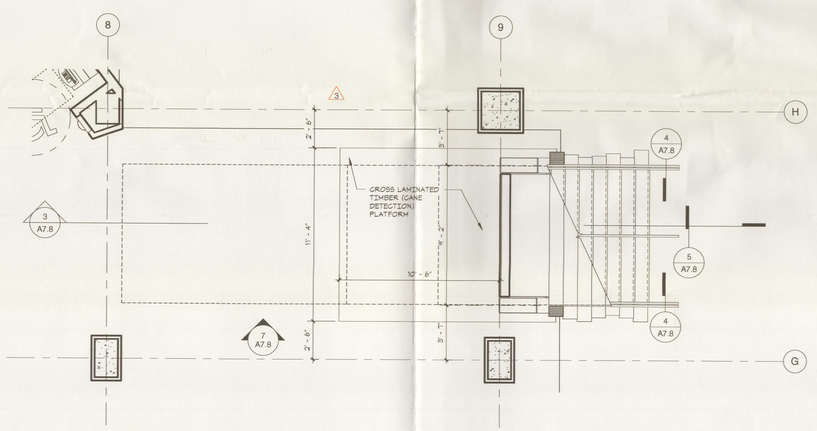
7 A7.8 **FEATURE STAIR ELEVATION**
1" = 1'-0"



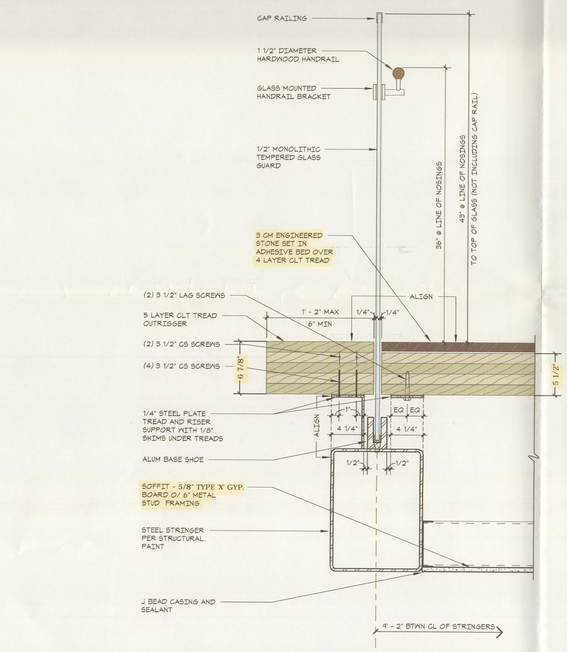
3 A7.8 **SECTION - PODIUM STAIR 'E'**
1/4" = 1'-0"



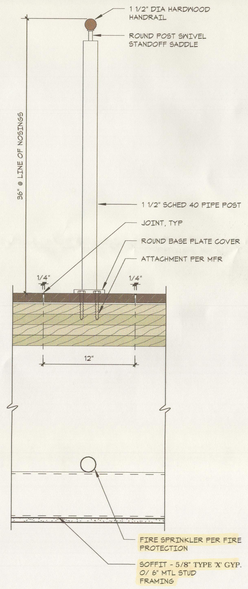
2 A7.8 **ENLARGED FLOOR PLAN - PODIUM STAIR 'E' - LEVEL 02**
1/4" = 1'-0"



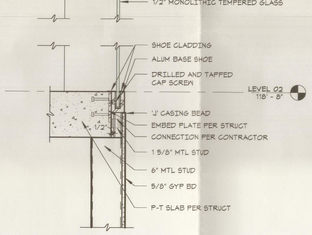
1 A7.8 **ENLARGED FLOOR PLAN - PODIUM STAIR 'E' - LEVEL 01**
1/4" = 1'-0"



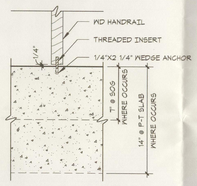
10 A7.8 **FEATURE STAIR GUARDRAIL**
1 1/2" = 1'-0"



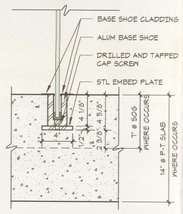
8 A7.8 **FEATURE STAIR INTERMEDIATE HANDRAIL**
1 1/2" = 1'-0"



6 A7.8 **EDGE OF P-T SLAB GUARDRAIL**
1" = 1'-0"



5 A7.8 **WD HANDRAIL SLAB TERMINATION**
1 1/2" = 1'-0"



4 A7.8 **FLUSH MOUNT GUARDRAIL**
1 1/2" = 1'-0"

Hyatt Regency Portland

Portland, Oregon

HYATT REGENCY®

Mortenson construction

esg

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REVISIONS

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PROJECT NUMBER

Author
DRAWN BY

Checker
CHECKED BY

Hyatt Regency Portland

PLANS / SECTIONS / DETAILS – PODIUM STAIR 'E'

A7.8

Full-scale fire resistance tests on cross-laminated timber

Volume 17, Number 4, December 2012

Cross-laminated timber panels

Full-scale tests carried out by NRC Construction researchers have demonstrated that cross-laminated timber (CLT) assemblies can achieve good levels of fire resistance, even when unprotected under full loading conditions. The tests are part of a study recently launched by NRC in collaboration with FPInnovations to develop a methodology that will foster the design of fire-safe CLT or hybrid buildings in North America. The study will also facilitate the acceptance of future code provisions for the design of CLT panels with regard to fire resistance.

CLT is a relatively new building system in North American construction that is helping to define a new class of products known as massive timber. The wood industry in Canada is interested in using CLT panels in certain types of buildings, particularly those currently using non-combustible construction.

The panels are typically manufactured with three, five or seven plies that are glued together with the grain perpendicular to the previous layer.

Since CLT is a new product, there is a need to carry out research to fully understand its behaviour as a structural system in general, and in fire in particular.

As wood burns it forms a thick char layer, which acts as a low-density insulator that protects the wood underneath it from elevated temperatures. Understanding charring rates (a measure of the char depth over time) is fundamental to estimating the remaining thickness of full-strength wood, which in turn designers can use to calculate the residual strength of members for a given fire exposure. It is also important to understand the effect of other key factors on the performance of CLT in fire, such as the type of adhesive used between plies, the number of plies (thickness of the panel), the joint configuration, the protection methods used, and the type of fire exposure.

NRC wall furnace

Full-scale experiments

NRC researchers conducted eight full-scale experiments to obtain fire resistance ratings for a number of CLT panels and to obtain data on some of the other key factors. The panels were subjected to the standard ULC S101 fire exposure. The assemblies tested consisted of three wall tests and five floor tests. The tests were carried out in the NRC floor and wall furnaces.

Assemblies consisted of three or five CLT panels, which were constructed of No. 1, No. 2, No. 3 or MSR lumber boards, and came from different manufacturers from across Canada. Some of the CLT panels were fully exposed to fire (unprotected) while some were protected by Type X gypsum board. The configuration details of each test as well as the results are summarized in Table 1.

Table 1: Results from CLT fire resistance tests

Wall or Floor	# of Plies	Thickness (mm)	Gypsum Board Protection	Load	Charring from Data (mm/min)	Failure Mode	Fire Resistance (min)
Wall	3	114	2 x 12.7 mm	333 kN/m	0.41	Structural	106
Wall	5	175	Unprotected	333 kN/m	0.65	Structural	113
Wall	5	105	Unprotected	72 kN/m	0.80	Structural	57
Floor	3	114 approx. 4.5"	2 x 12.7 mm	2.7 kPa	-	No failure	77 [1] 1 hour 17 minutes
Floor	5	175 approx. 6.9"	Unprotected	11.8 kPa	0.64	Integrity	96 1 hour 36 minutes
Floor	3	105 approx. 4.1"	1 x 15.9 mm	2.4 kPa	0.60	Integrity	86 1 hour 26 minutes
Floor	5	175	1 x 15.9 mm	8.1 kPa	0.75	Integrity	124
Floor	7	245	Unprotected	14.6 kPa	0.65	Structural	178 2 hours 58 minutes

1 Test was stopped due to equipment safety concerns. Failure was not reached.

The tests demonstrated that CLT assemblies can achieve significant fire resistance that is close to three hours in some cases with even unprotected CLT under full loading conditions. The failure modes were a mix of integrity and structural failures.

NRC and FPInnovations researchers will use these test results to validate a generic fire resistance procedure developed by FPInnovations and currently published in the 2011 Edition of the Canadian CLT Handbook. The validation will consist of comparing the NRC test results to fire resistance values obtained by the generic method and then modifying the method to enhance its accuracy, if required.

The project was funded by the National Research Council of Canada and FPInnovations through the Natural Resources Canada Transformative Technology program.

For more information

Contact Noureddine Bénichou at noureddine.benichou@nrc-cnrc.gc.ca or 613-993-7229.

In: Fire Safety

Date modified: 2013-02-20

Gypsum Board Key Facts

EXPLORE GYPSUM

› GYPSUM THROUGH THE AGES
› WHAT IS GYPSUM?
› WHAT IS GYPSUM BOARD?
› MAKING GYPSUM BOARD
› OTHER USES OF GYPSUM
› WATCH THE MIRACLE MINERAL

Quick Links:

Advantages of Gypsum Board Construction

Gypsum board walls and ceilings have a number of outstanding advantages:

- Fire Resistive
- Sound Attenuating
- Durable
- Economical
- Versatile

Fire Resistive

Gypsum board is an excellent fire resistive material. It is the most commonly used interior finish where fire resistance classifications are required. Its noncombustible core contains chemically combined water which, under high heat, is slowly released as steam, effectively retarding heat transfer. Even after complete calcination, when all the water has been released, it continues to act as a heat insulating barrier. In addition, tests conducted in accordance with ASTM E 84 show that gypsum board has a low flame spread index and smoke density index. When installed in combination with other materials it serves to effectively protect building elements from fire for prescribed time periods.

The fire resistance of gypsum board can be described using three distinct terms: regular core, type 'X' core and improved type 'X' core. Regular core gypsum board is made of a noncombustible core material composed mainly of gypsum. Although it does not have the specially enhanced fire-resistive properties of type 'X', regular core gypsum board affords a degree of natural fire resistance.

For information about the use of gypsum board in fire-resistant construction systems consult GA-600, *Fire Resistance Design Manual*.

FIRE RESISTANCE DESIGN MANUAL

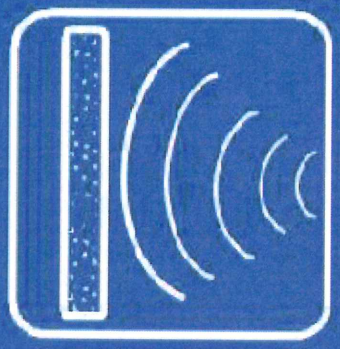
SOUND CONTROL

GYPSUM SYSTEMS

GYPSUM ASSOCIATION

19th Edition
GA-600-2009

JUNE 2009



SECTION II - REQUIREMENTS FOR FIRE PROTECTION

FIRE RESISTIVE PROPERTIES OF GYPSUM

Gypsum is approximately 21 percent by weight chemically combined water which greatly contributes to its effectiveness as a fire resistive barrier. When gypsum board or gypsum plaster is exposed to fire, the water is slowly released as steam, effectively retarding heat transmission (Figure 1). It can, in a sense, be compared to what happens when a blowtorch is turned on a block of ice. Although the ice is being melted, one can hold a hand on the opposite side without being burned. Even though the ice gets very thin it effectively blocks the transfer of the intense heat and one's hand would not be burned until the ice is melted.

When gypsum-protected wood or steel structural members are exposed to a fire, the chemically combined water (being released as steam) acts as a thermal barrier until this slow process, known as calcination, is completed. The temperature directly behind the plane of calcination is only slightly higher than that of boiling water (212°F), which is significantly lower than the temperature at which steel begins losing strength or wood ignites. Once calcination is complete, the in-place calcined gypsum continues to act as a barrier protecting the underlying structural members from direct exposure to flames.

TYPE X GYPSUM BOARD

ASTM C 1396 describes two types of gypsum board - regular and type X - each providing a different degree of fire resistance. Where fire-resistance rated systems are specified, type X gypsum board is typically required to achieve the rating. Type X gypsum board is defined in ASTM C 1396 as gypsum board that provides not less than one-hour fire resistance for boards 5/8 inch thick or not less than 3/4-hour fire-resistance rating for boards 1/2 inch thick, applied parallel with and on each side of load bearing 2x4 wood studs spaced 16 inches on center with 6d coated nails, 1 7/8 inch long, 0.095 inch diameter shank, 1/4 inch diameter heads, spaced 7 inches on center with gypsum board joints staggered 16 inches on each side of the partition and tested in accordance with the requirements of ASTM E 119.

In order to qualify for use in generic systems contained in this Manual, the Gypsum Association also requires that 1/2 inch type X gypsum board shall achieve a one-hour fire-resistance rating when applied to a floor-ceiling system as described by GA File No. FC 5410 on page 142.

Where 3/4 inch or 1 inch gypsum board is described as "type X" in proprietary systems contained in this Manual, consult the manufacturer to determine what specific products are required.

PERFORMANCE OF GYPSUM PLASTER

Job performance of gypsum plaster systems can be affected by several factors such as: extreme weather conditions, poor or no ventilation, thermal shock, unusual framing or frame loading, etc. Precautions shall be taken to prevent these and other adverse conditions.

Mix ratios such as 1:2 gypsum-perlite, -vermiculite, or -sand are used to describe a mixture consisting of 100 pounds of gypsum plaster to 2 cubic feet of

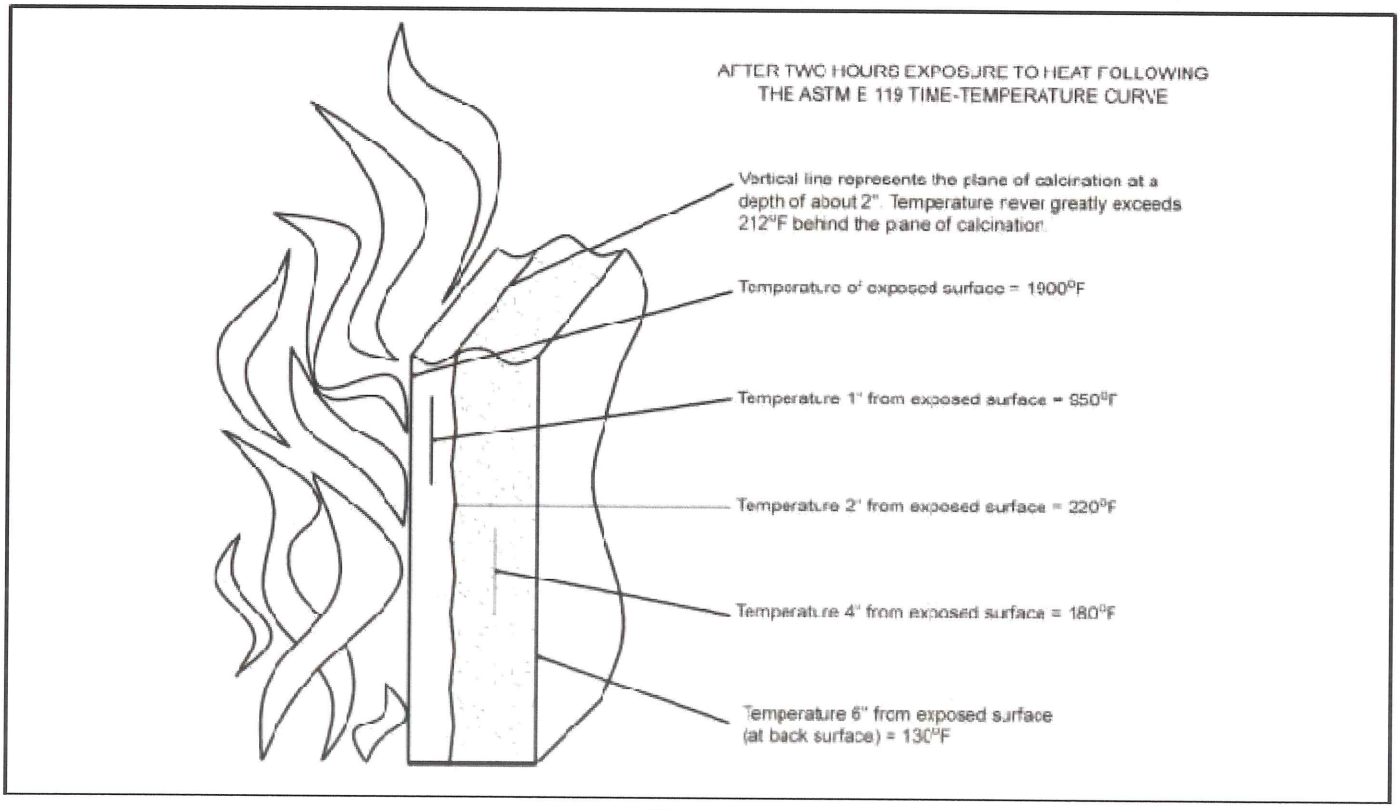


Figure 1
How Gypsum Retards Heat Transmission