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APPEAL SUMMARY

Status: Decision Rendered

Appeal ID: 20744	**Project Address:** 4800 SE Woodstock Blvd
Hearing Date: 8/21/19	**Appellant Name:** Charles Kidwell
Case No.: B-001	**Appellant Phone:** 503.228.2840
Appeal Type: Building	**Plans Examiner/Inspector:** Corey Stanley
Project Type: commercial	**Stories:** 5 **Occupancy:** B, R-2, S-2 **Construction Type:** I-A, III-B
Building/Business Name: Modera Woodstock Apartments	**Fire Sprinklers:** Yes - Throughout
Appeal Involves: Erection of a new structure	**LUR or Permit Application No.:** 19-117964-EA
Plan Submitted Option: pdf [File 1] [File 2] [File 3] [File 4] [File 5] [File 6] [File 7]	**Proposed use:** Multi-Family Residential

APPEAL INFORMATION SHEET

Appeal item 1

Code Section	602.3 Type III Construction
Requires	Type III construction is that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. Fire-retardant-treated wood framing complying with Section 2303.2 shall be permitted within exterior wall assemblies of a 2-hour rating or less.
Proposed Design	The Design consists of a 5 Story Type IIIB Construction Residential building above a 1-level Type IA Construction 'Parking Garage Basement'. The building consists primarily of residential group R-2 apartments/live-work units with some Group B lobby & common area occupancies and Group M retail spaces on the ground floor. The building is fully protected by an NFPA 13 automatic sprinkler system, fire alarms and detection system. The proposed design is based on the 'Portland Code Guide - OSSC/6/#4' that allows Non - Fire Retardant Treated wood framing within exterior walls of R-2 occupancy buildings of Type III construction. The proposed design for this building meets the requirements for the Portland City Guide (OSSC/6/#4) except for the conditions #10 and #17. Note that fire apparatus aerial access for the full block building is available on the north and east frontages of the site (including the primary dominant street frontage on Woodstock Blvd.) Proposed Appeal Items:

· For condition #10: The proposed building would pass the allowable area calculations if a base area of 13,750 sf (an increase of 1,750 sf/floor from the Code Guide) was allowed. The proposed building total area is 153,377 sf. This will exceed the maximum building square footage under Item #10 of the Portland Code Guide - OSSC/6/#4. The Guide limits the Allowable Base Area to 12,000 sf/floor instead of the 16,000 sf/floor allowed in OSSC Table 503. This results in a maximum area of 44,693 sf/floor (when frontage and sprinkler increases are included) for a total building allowable area of 134,078 sf. The proposed building will meet the building maximum allowable area per floor at 33,101 sf/floor. Increase of the Allowable Base Area to 13,750 sf/floor would result in a maximum allowable building area of 153,630, which the proposed building will then also meet.
See attached Building Area Summary and Allowable Area Calculation Summary.
· For condition #17, details 6, 7 and 8 for sacrificial wood stud at window jambs and headers: Exterior walls will be protected with non-combustible mineral wool insulation (in lieu of the Fire Retardant Treated wood framing) as explained in the attached white paper by Code Unlimited.
The exterior bearing walls in the Type IIIB buildings are permitted to be fire-retardant-treated (FRT) wood per 602.3. The proposed design consists of exterior walls with untreated wood stud framing with Roxul ComfortBatt mineral wool insulation at 2.0 lbs/ft
3 friction fit between studs to fill the entire 6” nominal wall cavity. The attached white paper by Code Unlimited documents that this will exceed the performance of a traditional FRT wood wall.

Reason for alternative

As indicated in the Code Unlimited white paper, the use of FRT wood has several drawbacks, most notably that it:

reduces the structural strength of wood and requires more wood than a non-FRT wood wall, and the chemical used to provide the fire-retardant treatment has long term detrimental environmental impact.
Using conventional wood framing in conjunction with the proposed mineral wool insulation results in a more fire-resistant building that is also more environmentally friendly.
The White Paper established that ordinary lumber 2” X 6” exterior wall framing with mineral wool insulation friction-fit between studs will provide superior performance to an FRTW framed wall. The reason for requesting the Alternate Means & Method of construction is to provide relief from some additional requirements (Items #10 and #17 details 6, 7, and 8) imposed by the Code Guide when non-FRTW framing is provided. The attached white paper provides a fire analysis that supports the use of mineral wool insulation in the wall cavity of untreated wood stud framing as an alternate to FRT wood stud framing, which is an exterior wall material permitted by the OSSC section 602.3. The analysis
· compares untreated wood and FRT wood framed wall assemblies
· is based on published temperature data from full scale testing of multiple configurations of fire rated stud walls
· concludes that untreated wood framed walls with mineral wool insulation will outperform FRT wood framed walls without such insulation.

The proposed design is in compliance with all other provisions of the Portland Code Guide (except as noted above) including:
· Provision of aerial access.
· The building will be equipped with an approved automatic sprinkler system.
· The ceiling cavity will be constructed of non-combustible materials; or the spaces between the top chord of the trusses and the ceiling will be filled entirely with non-combustible insulation per NFPA 13, 8.15.1.2.7. (This satisfies the requirements that there are no combustible concealed attic spaces).
· Exit stairs are extended to the roof in a 2-hour enclosure.
· The roof slope is essentially flat with a slope of 3/8” per foot (less than 33% slope).
· Approved access is provided to the roof from all the stairways.
· Each roof hatch is a minimum of 36” x 96” and has a guardrail at the roof level.
· The building is equipped with standpipes and at least one standpipe will terminate on the roof.
This building, when constructed as outlined in the White Paper, will, from a fire resistance standpoint,
outperform a comparable building that has FRT wood in exterior walls as permitted by OSSC 602.3. With
these modifications, we believe a higher level of safety has clearly been provided for this project and we
urge you to approve this appeal.

Appeal item 2

Code Section	OSSC 716.5.3, Table 716.5
Requires	OSSC 716.5.3 Door assemblies in corridors and smoke barriers. Fire door assemblies required to have a minimum fire protection rating of 20 minutes where located in corridor walls or smoke-barrier walls having a fire-resistance rating in accordance with Table 716.5 shall be tested in accordance with NFPA 252 or UL 10C without the hose stream test.
Proposed Design	There is a Leasing Office and Fitness Room on the Ground Floor of the Woodstock Apt building. The Leasing Office and Fitness Room doors to the Lobby (Corridor) is required to have a rated opening of 20 minutes per Table 716.5. Non-rated glass doors (full glazing) are proposed. The proposed design is to provide a Fire Sprinkler Water Curtain at Leasing Office and Fitness Room door opening in lieu of the rated assembly. Additional Fire Marshal approved Sprinkler heads will be installed on each side of the doors. See attached Exhibit A1 for location information. The entire building is equipped with an NFPA 13 Automatic Fire Sprinkler System.
Reason for alternative	The entire building is equipped with an NFPA 13 Automatic Fire Sprinkler System. The proposed non-rated Leasing Office door will be protected by additional Fire Sprinkler heads installed on each side of to create a Water Curtain at the door opening. The proposed Fire Sprinkler Water Curtain will provide equal or better protection than the required 20-minute rated assembly.

Appeal item 3

Code Section	OSSC 2902 Minimum Plumbing Facilities
Requires	

2902.1 Minimum number of fixtures. Plumbing fixtures shall be provided for the type of occupancy or use of
space in relation to Table 2902.1 and in the minimum number shown in Table 2902.1. Types of occupancies not
shown in Table 2902.1 shall be considered individually by the building official and shall reflect the use of the
space being served by the fixtures. The number of occupants shall be determined by this code.
Exceptions:
Separate facilities shall not be required for dwelling units and sleeping units.
Separate facilities shall not be required in structures or tenant spaces with a
total occupant load, including both employees and customers, of 30 or less.
Separate facilities shall not be required in business occupancies with a total
occupant load, including both employees and customers, of 50 or less.
Separate facilities shall not be required in mercantile occupancies in which
the maximum occupant load is 100 or less.
Section 2902.3. Employee and public toilet facilities. Customers, patrons and visitors shall be provided with Public
toilet facilities in structures and tenant spaces intended for public utilization. The number of plumbing fixtures located
within the required toilet facilities shall be provided in accordance with Section 2902.1 for all users. Employees shall be
provided with toilet facilities in all occupancies. Employee toilet facilities shall either be separate or combined employee
and public toilet facilities.

Proposed Design

The design includes two (2) single occupant Toilet Rooms; one adjacent to the Lobby/Fitness Room on the Ground Level and one on the Fifth Floor serving the Club Room and Roof Deck that are both available for residents, visitors and building employees.
Access to the building including the Entrance Lobby is restricted by the security access control system, limited to residents of the apartment buildings and their guests as well as prospective renters and building management staff. Residents have access to toilets and lavatories facilities in the bathrooms of their apartment units.
The two unisex toilets provided as described above for tenants, visitors and employees in conjunction with the toilets available in apartment units will satisfy the need and meets the intent of the code.
See attached Exhibit 07 & Exhibit 09 which illustrate the distribution of the common Toilet Rooms.
The people who will use and occupy the Lobby, Fitness Room, Club Room and the Roof Deck area,
will be either residents or (visitors) guests of residents living in the apartment buildings. All of them have access to the two common Unisex Toilet Rooms and the toilet and lavatory facilities in the individual apartment units.
Residential plumbing & bathing facilities are provided as required, minimum one per dwelling unit. It is assumed the residents of the apartments will be able to use the toilet facilities in their own apartment,
therefore accessory residential areas such as the roof deck area, are not considered separate occupancies which would require public plumbing toilet facilities. Since the Clubroom and roof deck area
are only to be used by the occupants of the apartment building and their potential guests, this area would
not require additional public plumbing facilities.

Reason for alternative

a. The building entrance Lobby at the Ground Floor is primarily intended for use by the (tenants) residents of the apartment buildings and their guests as well as prospective renters meeting with Leasing Staff. The 'private' Clubroom and Lounge at the Ground Floor is intended only for use by the (tenants) residents of the apartment buildings and their guests.
b. The 'private' Roof Deck area is only intended for use by the (tenants) residents of the apartment buildings and their guests.
The two unisex toilets provided as described above for tenants, visitors and employees in conjunction with the toilets available in apartment units will satisfy the need and meets the intent of the code.
? Residents and Guests have access to the Unisex Toilet Room on the Ground Floor
? Residents and Guests have access to the Unisex Toilet Room on the Fifth-Floor level
? Residential plumbing & bathing facilities are provided as required in each apartment unit.
? Residential Accessory areas that have stair and elevator access, should not be considered separate occupancies which would require public plumbing facilities
? The Clubroom and Rooftop Deck is only to be used by the occupants of the apartment building and
their potential guests, this area would not require public plumbing facilities.
The reason for the alternate is because the Residential Accessory areas are intended only to be used by the residents and their guests who will have access to the restrooms in their own units and will be familiar with the building layout well enough to know there is an additional Unisex Toilet room on the Ground Floor adjacent to the Building Lobby and the Fifth Floor adjacent to the Clubroom and Roof Deck.
The two Unisex Toilet Room on the Ground Floor and Fifth Floors in conjunction with the toilet facilitiess provided in each apartment unit satisfy the spirit and intent of the code requirement for providing plumbing facilities.
No additional toilets are needed. No additional toilets should be required.

APPEAL DECISION

1. Combustible material within Type III exterior non-bearing walls: Denied. Proposal does not provide equivalent Life Safety protection.

2. Type 13 water curtain sprinkler protection at 2 non-fire rated openings in 1 hour fire rated corridor: Granted provided doors are on closers and sprinklers are spaced not more than 6 feet apart and placed a minimum of 6 inches and a maximum of 12 inches from the opening(s) and a maximum of 12 inches below the ceiling. Sprinklers are to be installed on the room side of the openings. A separate permit from the Fire Marshal's Office is required.

3. Reduction in minimum required plumbing fixtures in tenant only amenity spaces: Granted as proposed.
Appellant may contact John Butler (503 823-7339) with questions.

For the item granted, 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 90 calendar days of the date this decision is published. For information on the appeals process, go to www.portlandoregon.gov/bds/appealsinfo, call (503) 823-7300 or come in to the Development Services Center.

Modera Woodstock

CODE UNLIMITED, LLC

White Paper - Fire Analysis of Fire Retardant Treated Wood Alternate

Project Name: Modera Woodstock Apartments

Client: Mill Creek Residential Trust

Prepared by: Code Unlimited

Address: 12655 SW Center Street, Suite 350, Beaverton, OR 97005

Date: 8/9/2019

Table of Contents

1. OVERVIEW

1.1 Project Overview

The Modera Woodstock Apartments is a new project being constructed in Portland, OR. The project includes five (5) stories of Type IIIB construction over one (1) story of Type IA construction. The building is fully protected by automatic sprinklers, fire alarms and detection system.

Type IIIB construction requires that exterior walls be of noncombustible construction or of Fire-Retardant Treated Wood (FRTW) construction if the exterior wall can be 2 hour rated or less. The project proposes to use conventional wood studs without the Fire Retardant Treatment (FRT). There are structural and environmental benefits for this approach.

1.2 Executive Summary

Fire-retardant treated (FRT) wood framing is permitted by code within exterior Type III wall assemblies with a fire-resistance rating of 2 hours or less. This is based on the improved fire spread performance of treated wood compared to untreated wood of the same species. FRT of wood delays ignition and resists flame spread once it reaches ignition temperature. The proposed design of the exterior wall assembly uses compressed mineral wool insulation between non-treated wood framing members to provide equivalent protection to Fire Retardant Treated (FRT) wood wall assembly.

Code Unlimited has analyzed the issue of using non-FRT wood in place of FRT wood on multiple projects. This has been driven by many stakeholders within the Pacific Northwest region; local and state governments, universities and other research groups, manufacturers, real estate developers, and design and construction industry professionals. This white paper is the most current knowledge on this subject, based on rigorous analysis, review, and input from senior fire protection engineers and code experts.

The white paper will provide the following information to show that the use of non-treated wood in Type III exterior wall assemblies with compacted mineral wool insulation is equivalent to FRT wood allowed in Type III exterior walls:

- A detailed understanding of the code regulations that are driving the requirement for FRT in Type III exterior walls, with excerpts from the International Building Code (IBC) commentary to clarify intent where necessary.
- Code citations in the Oregon Structural Specialty Code (OSSC) and the IBC where the use of mineral wool delays ignition and inhibits flame migration.

Many code provisions have evolved from traditional construction practices and then undergo rigorous analysis and/or testing to substantiate performance in those applications. This white paper follows that time tested path by including a rigorous performance analysis based on currently available test data in support of non-FRT wood in an exterior wall assembly of a Type III construction building.

Our analysis found that the fire performance of a non-FRT wood framed wall with mineral wool insulation is equal or superior to a FRT wood framed wall. Research from other authorities shows that this approach also reduces the potential for chemical exposure to the environment and to the occupants of these buildings compared to the current practice of using FRT wood.

1.3 Applicable Codes and Standards

Applicable Code or Standard
2014 Oregon Structural Specialty Code (OSSC)
2009 ASTM E-84 Test Methods for Surface Burning characteristics of Building Materials – American Society for Testing and Materials
2007 ASTM E-119 standard Test Methods for Fire Tests of Building Construction and Materials – American Society for Testing and Materials

1.4 Additional References

[1] 2007 Performance of a non-load-bearing steel stud gypsum board wall assembly: Experiments and modelling", Samuel L. Manzello, et al, Fire and Materials (Issue 31, pp 297-310)

[2] 2015 A Model for predicting heat transfer through insulated steel-stud wall assemblies exposed to fire, Sultan, M. A.; Alfawakhiri, F.; Bénichou, N., Fire and Materials - 2001 International Conference, San Francisco, January 22-24, 2001, pp. 495-506

[3] 2007 Analysis of Inter-laboratory Testing of Non-loadbearing Gypsum/Steel-Stud Wall Assemblies, William Grosshandler, Samuel L. Manzello, Alexander Maranghides - Building and Fire Research Laboratory, Tensei Mizukami - Center for Better Living

[4] 1977 Effect of fire-retardant treatments on performance properties of wood. In: Goldstein, I.S., ed. Wood technology: Chemical aspects. Proceedings, ACS symposium Series 43. Washington, DC: American Chemical Society.

[5] 1992 Charring Rate of Wood for ASTM E119 Exposure, Fire Technology Volume 28, Number 1, Robert H. White and Eric V. Nordheim

[6] 1977 National Board of Standards Technical Note 945: An Investigation of the Fire Environment in the ASTM E 84 Tunnel Test

[7] 2016 Calculating the Fire Resistance of Exposed Wood Members, Technical Report No 10, American Forest & Paper Association, Inc, American Wood Council, 1111 19th St., NW, Suite 800, Washington, DC 20036

[8] 2010 Wood Handbook, Wood as an Engineering Material, Chapter 17 Fire Safety, Robert H. White and Mark A. Dietenberger, Forest Product Laboratory, United States Department of Agriculture Forest Service, Madison Wisconsin

2. PROPOSED WALL ASSEMBLY

The proposed design is to provide a 2-hour exterior wall assembly that consists of untreated wood stud framing with one or two layers of 5/8" thick type X gypsum board on the interior and one layer of 5/8" type X gypsum sheathing or concrete masonry units on the exterior side of the wall (Non-Symmetric wall) for walls that are further than 10 feet from the property line. Rockwool insulation will be friction fit between studs to fill the entire 6-inch nominal wall cavity. The conclusions of this report are limited to the proposed Wall type shown in Figures 1-4 attached in Appendix A of this white paper.

3. ROCKWOOL USE PERMITTED IN CURRENT CODES

The 2014 OSSC Section 602.3 for Type III exterior wall construction permits the use of fire-retardant treated wood (FRTW) in lieu of non-combustible materials if wall is 2-hour rated or less.

Rockwool has been allowed as a means to retard or prevent the ignition of wood in concealed spaces in the following code sections:

1. OSSC 803.11.1.1 allows untreated wood to be used for furred walls or ceilings where non-combustible or fire rated construction is required when the cavity is filled with a Class A material like mineral wool.
2. OSSC 718.2.1(7) allows mineral wool batts to be used as fireblocking to cut off concealed draft openings.
3. OSSC 718.3.1 permits the use of mineral wool batts as an approved draft stopping material.
4. ORSC 316.5.3 permits the use of 1.5 inch thick mineral wool to satisfy the requirements for an ignition barrier.
5. NFPA 13 Section 8.15.1.2.17 allows untreated wood joist to be treated as FRT wood when the cavity is filled with mineral wool insulation.
6. OSSC 722.6 contains procedures by which the fire resistance ratings of wood assemblies are established by calculations.

   IBC Section 722.6 Commentary states:

   "Rockwool insulation provides additional protection to wood studs by shielding the studs from exposure to the furnace, thus delaying the time of collapse."

   OSSC table 722.6.2(5) allows glass fiber, or mineral wool, or cellulosic fill within stud cavity prescriptively to increase the fire resistance of a wall assembly by 15 minutes.

7. IBC Section 602.2 Commentary:

   "Fire Retardant-treated wood (FRTW), although combustible, is permitted in limited uses in building of Type I and Type II construction… it is not assumed to be fire-resistance rated, and generally does not afford any higher fire-resistance rating than untreated wood material."

4. PERFORMANCE BASED ANALYSIS AND VERIFICATION

Premise of Analysis

The list of prescriptive provisions in Section 3 establishes the code history of use of mineral wool insulation to improve the fire performance of wood wall and ceiling assemblies. These provisions are an outgrowth of tradition and historical construction practice. The values assigned to these are generic values, based on historical data. These are valuable in establishing precedence and intent of the code requirements. Our analysis is based on the full-scale test data documented in the research papers #1 and #2 listed in Section 1.4 in this white paper. The remaining references, #3, #4, #5, #6, #7 and #8, provide supporting evidence for the methodology used in this analysis as well as some other key metrics used in the analysis. The full-scale testing was performed with 4 inch metal stud wall assemblies, while the wall assemblies analyzed in this white paper are nominal 6 inch wood assemblies. Wood is a non-conductor of heat and a superior performer compared to metal within the context of this analysis. The test data includes wall assemblies with both fiber glass and mineral wool insulation within the stud cavity. Mineral wool out performs fiber glass insulation at higher temperatures in terms of sag and ability to retain protection of the framing members. Our analysis takes the conservative value when there are multiple data points available.

Building structural component fire performance is predicated on the type of fire exposure. Most commonly, fire from combustible building contents or furnishings expose the components, such as walls of structural frame, to heat from the fire, causing loss of structural integrity of the wall and its eventual collapse. The point at which the load-bearing components of a Type III wall (in this case, the wall studs) are exposed to heat from the fire, the building would have long since been evacuated and the space become untenable, as the temperature required to breach the gypsum board membrane would be beyond occupant survivability. In this case, the sole concern is for the preservation of structural stability, to protect emergency personnel, and reduce spread of fire to adjacent structures. The studs of the walls provide the necessary structural, load-bearing capability to support the exterior wall. Gypsum board or other sheathing is solely relied on to provide resistance to the fire exposure in order to protect the load-bearing members, its contribution to the structural strength of the wall is negligible. The Commentaries to section 722.6 of the IBC state “It is assumed that once the structural members fail, the entire assembly fails.”

OSSC section 602.3 defines Type III construction as “that type of construction in which the exterior walls are of noncombustible materials and the interior building elements are of any material permitted by this code. *Fire-retardant-treated wood* framing complying with Section 2303.2 shall be permitted within *exterior wall* assemblies of a 2-hour rating or less.”

Fire retardant treatment of wood does not prevent the wood from decomposing and charring under fire exposure. The rate of fire penetration through treated wood approximates the rate through untreated wood. Fire-retardant-treated wood used in walls can slightly improve fire endurance of these walls, but most of this improvement is associated with the reduction in surface flammability rather than any changes in charring rates.

Performance of FRT Wood

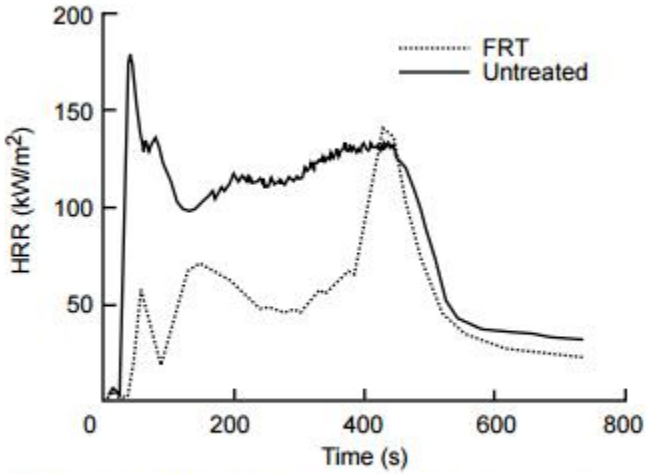


Figure 17–1. Heat release curves for untreated and FRT plywood exposed to 50-kW/m² radiance.

Fig.1. E84 Test Comparison (Wood Handbook Chapter 17)

Fire retardant treatment is a pressure applied surface treatment that slows ignition by interfering with heat transfer to the material and chemically interferes with combustion. It does so by converting combustible gases and tars to carbon char at temperatures below 550°F[4,8] and releases carbon dioxide and water vapor which dilutes the combustible gases. Above temperatures of 550°F, outgassing and pyrolysis effects of the FRT exceed the limits where the treatment inhibits ignition. Above 550°F, FRT heat release rate and burning rates become equivalent to untreated wood of the same species. Charts of the ASTM E84 (Standard Test Method for Surface Burning Characteristics of Building Materials) heat release rates (Fig. 1) show that at about 420 seconds (7 minutes), the heat release rate (HRR) for FRT wood and non-FRT wood are virtually identical, indicating that, after the fire retardant treatment has been exhausted, the non-FRT and FRT wood studs will provide the same level of protection of structural integrity for fire migration and for ignition. The amount of additional wood charred in non-FRT wood is .105” (less than 1/8”) than FRT wood.

Once the gypsum layers are compromised, the fire is free to attack the exposed studs. However, charring and consumption of the studs begins before failure of the gypsum membrane, as heat is conducted to the edge face of the studs and to the stud wall cavity by conduction through the gypsum board. In the stud wall cavity, the temperatures are already well over the auto ignition temperature of wood and the point at which FRTW becomes ineffective (550°F) by the time the two gypsum board layers have been compromised. Although the standard stud begins charring sooner than the FRTW stud, total time to fail for the standard stud is much longer due to the insulative effects of the mineral wool, slowing progressive char over the longer dimension (side) faces of the stud by preventing heat transfer to the stud cavity.

Above 550°F, FRTW studs behave similar to standard wood studs and charring continues until it fails in load. Char rates for softwoods such as used in framing lumber are at an average rate of 1.5 in/hr [6]. By calculating the heated perimeter of the wood studs for an uninsulated, code-accepted FRTW stud and a mineral-wool insulated standard stud, and using the average char rate, a time to failure of the two studs can be determined.

The effective heated perimeter of a 2" x 6" nominal FRTW stud is 12.5 inches at the point of its ignition. The effective heated perimeter of a mineral wool insulated stud is only 1.5 inches at the same point, although the point of ignition is approximately 7 minutes earlier due to the effects of FRT and the delay of ignition of the FRTW stud. As the studs are consumed by charring, the 3-sided attack[6] on the FRTW stud results in much more material loss due to charring and more rapid reduction in load-bearing capability. While there is some charring of the sides of the standard stud, especially nearest the exposed edge, the insulative properties of the mineral wool significantly slow charring and loss of material.

Code Basis of Engineered Design Performance

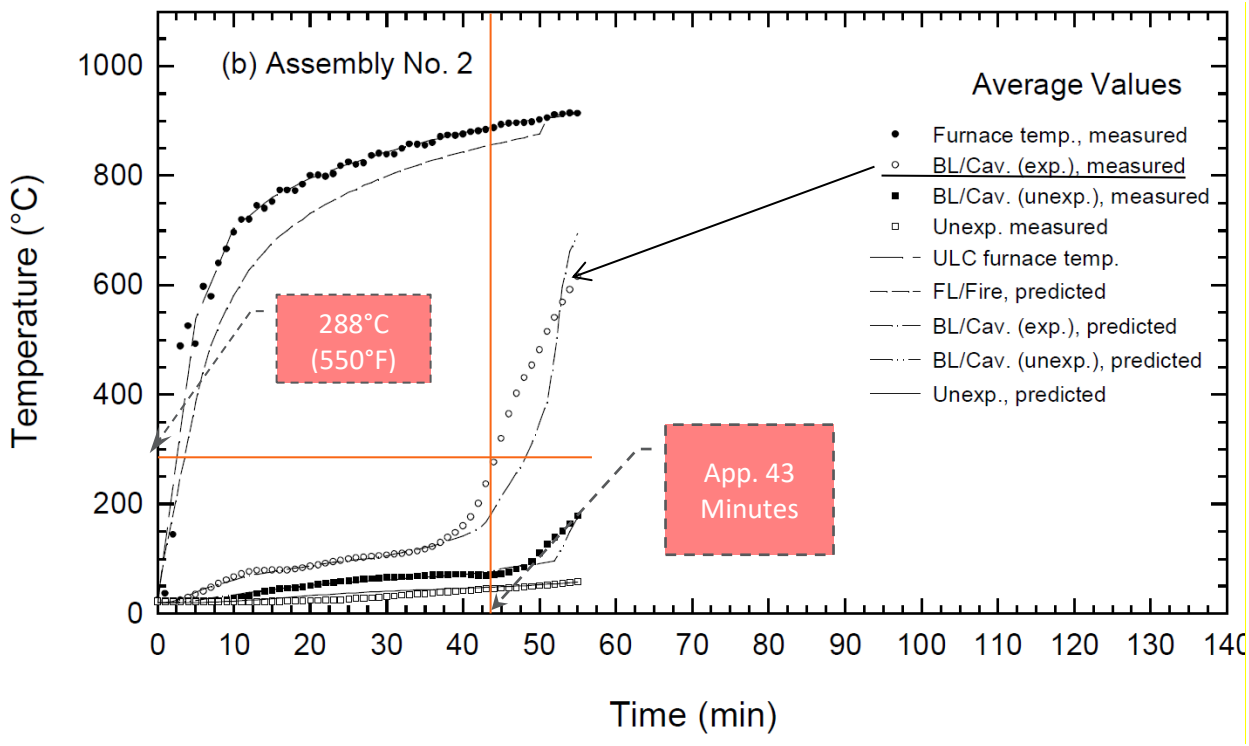
OSSC Table 722.6.2(2) states that the time assigned for contribution of the wood frame to fire resistance is 20 minutes. Within that time, the fire is assumed to consume sufficient of the stud framing to compromise its structural strength such that it fails under load. Thus it was assumed that, once the FRTW studs reach the point where the fire retardant treatment no longer interferes with charring, the stud will have 20 minutes of load-bearing capability before failure. This occurs with approximately 25% of the original stud cross-section remaining after charring. A similar failure point was used for analysis.

OSSC Table 722.6.2(5) notes that "Additional Protection" can be provided to a wall for fire rating purposes by the addition of mineral wool insulation at a specified minimum density. The Commentaries for IBC section 722.6 note that "Mineral wool insulation provides additional protection to wood studs by shielding the studs from exposure to the furnace, thus delaying the time of collapse." Mineral wool does this by insulating the sides of the studs from direct heat and flame exposure and by interfering with flame spread by conduction, radiation and convection within the wall cavity. In this respect, the assembly is superior to FRTW with only fiberglass insulation, in that its ability to interfere with ignition is not compromised by high exposure temperatures. Mineral wool has a melting point of 2150°F and can withstand a 4 hour test per ASTM E119 time-temperature curve, where the fire temperature reaches a maximum temperature of 2000°F, well above the temperatures expected in a flashover fire condition.

Unlike a simple, 2-hour rated FRTW stud wall, mineral wool provides protection on the sides of the studs, ensuring the main route of burn-through to be in the longest dimension of the lumber (See Fig 4-6). In FRTW, fire attack, once the thermal membrane has been compromised, is on three sides of the stud and burn through of the stud is much more rapid. Use of mineral wool insulation is specified as it has greater refractory qualities, higher installed density and remains in place long after fiberglass insulation has melted away.

Clearly, there is an advantage to the use of mineral wool in the wall that an ordinary FRTW assembly does not match.

Rational Analysis



Legend

SL - Gypsum Board Single Layer BL - Gypsum Board Base Layer FL - Gypsum Board Face Layer
Std. - Stud Cav. - Cavity Exp. - Exposed Side Unexp. - Unexposed Side Fire - Directly exposed to furnace

Figure 2: Time vs temperature curve – Double Layer 5/8" Gypsum Board, Studs 16" O.C.[7]

Note: Line (open dots) for temperature at inner surface of base layer, exposed side. This is the temperature of stud cavity/edge of stud.

Derivation Calculation

Utilizing test data from reference document #7, (equation #10) and Fig. 2 above. The calculated stud surface temperature can be derived and graphed.

Eq. 10[7]

$$T_m^{j+1} = T_m^j + \frac{\Delta t}{(\rho_i c_i)_m^j (\Delta y)^2}\left\{\left[\frac{(k_i)_{m-1}^j + (k_i)_m^j}{2}\right](T_{m-1}^j - T_m^j) - \left[\frac{(k_i)_m^j + (k_i)_{m+1}^j}{2}\right](T_m^j - T_{m+1}^j)\right\}$$

The calculated time to autoignition temperature for several depth increments into the mineral wool insulation (long direction of stud) are displayed below. (See Fig. 2A)

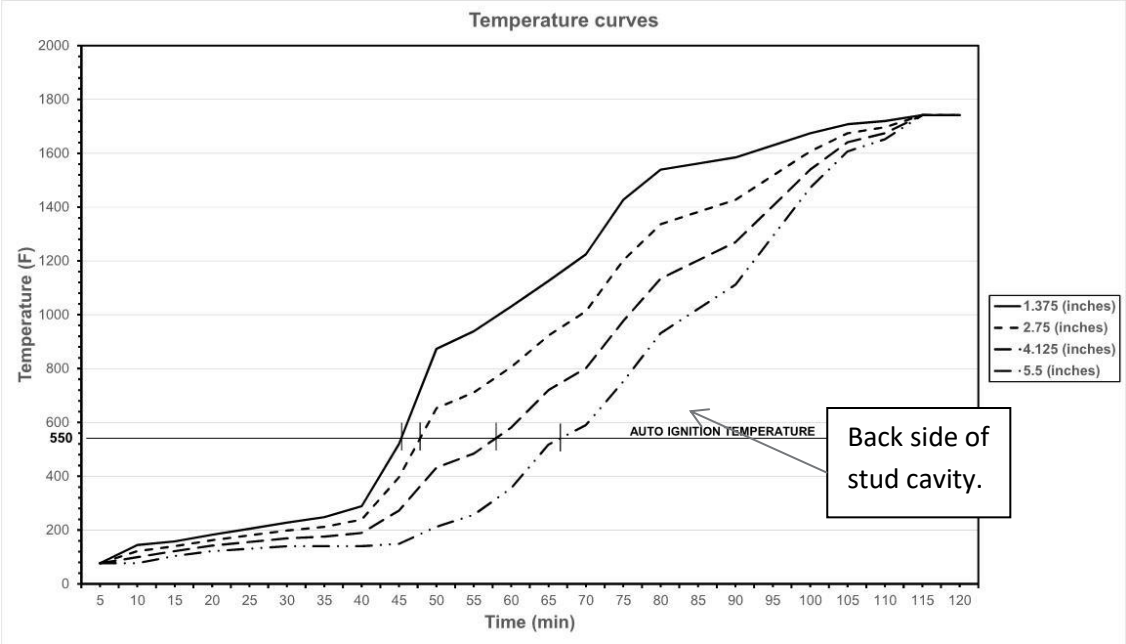


Figure 2A: Time vs Stud Surface Temperature curve – Calculated per Eq. 10.[7]

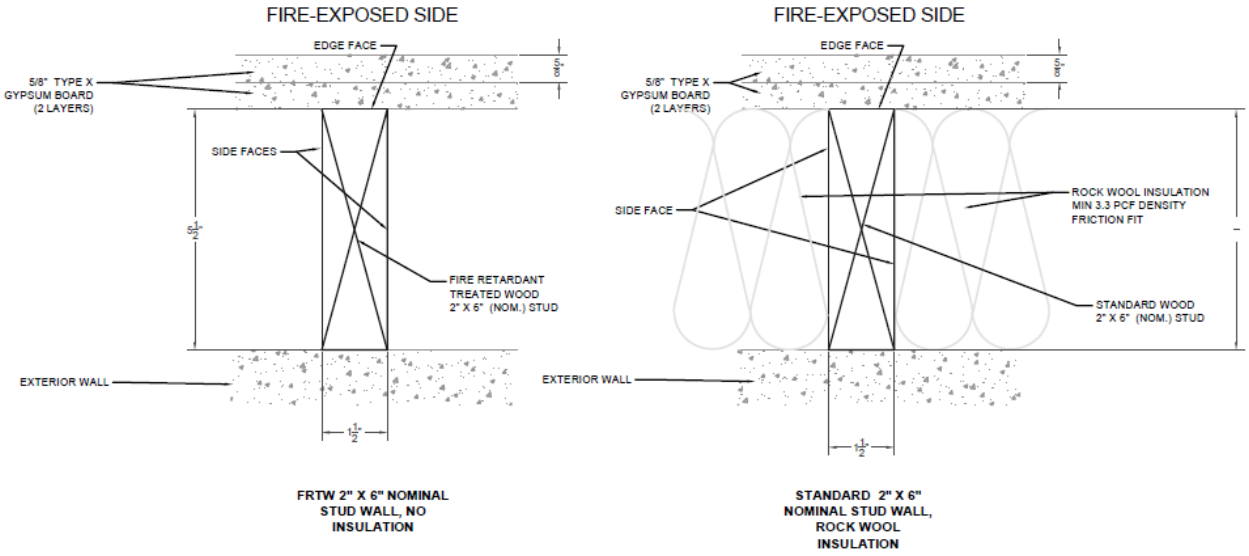


Figure 3: FRTW and Mineral Wool Stud Walls

Note: Figures 3-6 do not show composition of the exterior (non-fire exposed) side, as other constructions, allowed by code for non-fire exposed assemblies, may be used. All wall types shall be 2-hour rated as shown in Appendix A. In all cases addressed by this report, the Fire Separation Distance is greater than 10' and fire resistance rating may be calculated from the fire exposed side only in accordance with OSSC section 705.5.

5. FIRE RESISTANCE COMPARISON

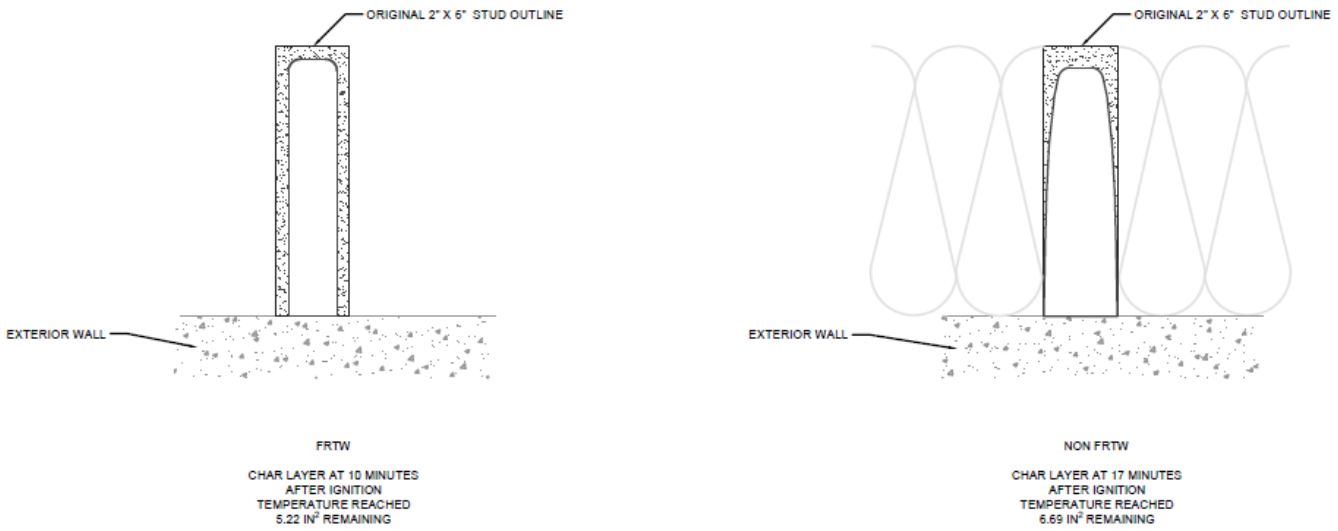


Fig 4: FRTW and non-FRTW Stud Wall at 60 Minutes After Fire Exposure of Gypsum Board Wall

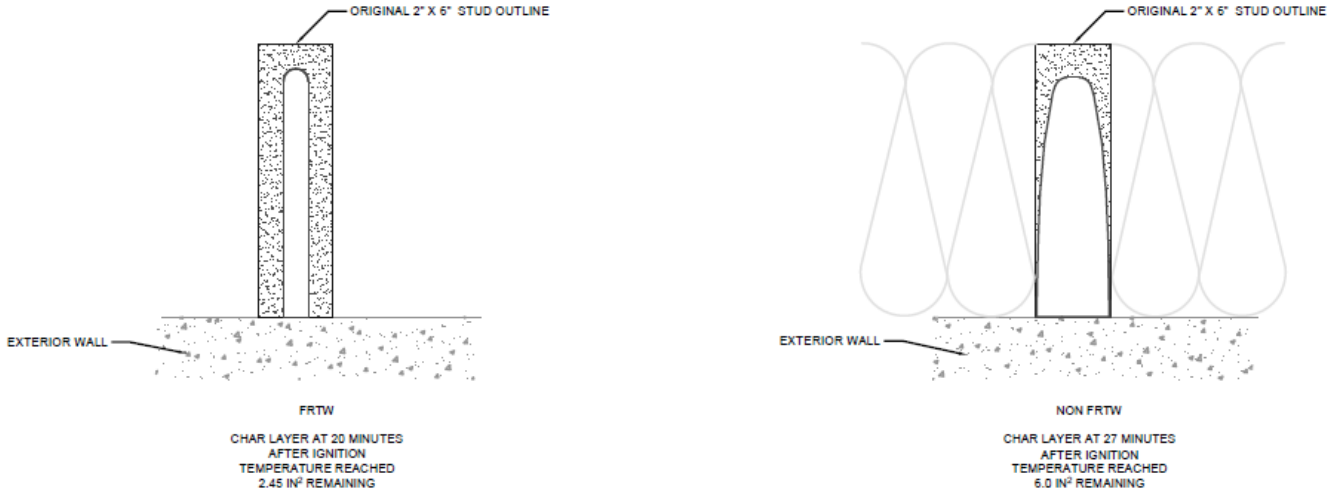


Figure 5: FRTW and Non-FRTW Stud Walls at 70 Minutes After Fire Exposure of Gypsum Board Wall Point of FRTW Wall Failure

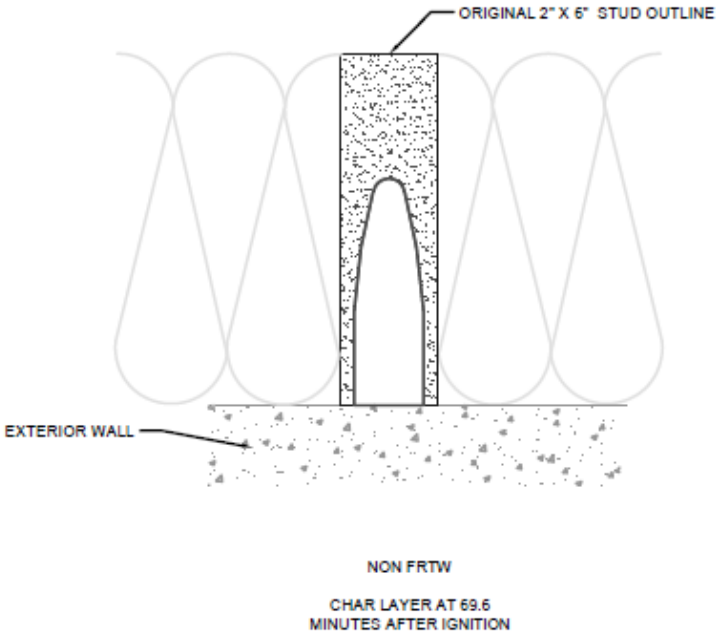


Figure 6: Non-FRTW Stud Wall at Failure at 112 Minutes – Reduced Cross Sectional Area Equivalent to FRTW at Failure

Charring and loss of load-supporting cross-section of the wood studs begins at approximately 43 minutes after exposure of the wall to fire, as heat conducts through the gypsum board and the temperature at the inside face of the gypsum board wall reaches the auto ignition temperature of wood. Ignition of the FRTW is delayed by approximately 7 minutes by the action of the fire retardant treatment. By approximately 50 minutes after exposure, both studs are experiencing charring.

At 60 minutes after exposure, approximately 50% of the allowable cross-section of the FRTW stud has been consumed by charring. Somewhat less (27%) of the insulated non-FRTW stud has been consumed at the same point, due to the effects of mineral wool in limiting heat transfer to the wood.

At 70 minutes, the FRTW has lost sufficient cross section that it fails in load. At this point, approximately 25% of the original FRTW stud cross-section remains. However, only 39% of the insulated stud has been consumed.

At approximately 112 minutes, charring of the insulated non-FRTW stud reaches the point at which less than 25% of the original cross-section remains and the stud fails.

The table below provides a comparative analysis that clearly shows that standard wood framing with mineral wool insulation performs better than FRT wood framing under fire conditions.

Time Interval (minutes)	Description	FRTW Stud Reaction	Standard Stud with Mineral Wool Insulation Reaction
t = 0	Gypsum board face of wall is first exposed to flames/heat, interior of stud wall at ambient temperature	None	None
t = 43	Temperature at edge face of stud attached to gypsum board exceeds autoignition point of wood (500°F), stud cavity of FRTW exceeds autoignition point of wood (500°F) (See Fig. 2)	FRT of wood stud inhibits ignition of FRT studs	Charring begins on narrow edge of stud (1.5" wide)
t=50	Chemical and mechanical inhibition of ignition of FRT wood exhausted	Charring begins on narrow edge of stud (1.5" wide) and along both exposed long faces (5.5" wide each)	Charring along wide faces nearest to the gypsum board
t=60		Charring has consumed 50% of allowable	Charring has consumed approximately 27% of allowable
t =70		Char layer exceeds allowable, insufficient cross-section of stud available to support load, stud fails	Charring has consumed approximately 39% of allowable
t = 112.6			Char layer exceeds allowable, insufficient cross-section of stud available to support load, stud fails

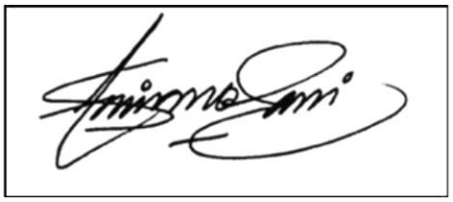
6. ADDITIONAL BENEFITS

1. Depending on the species, type of product (stud, joist, plywood, beam), and its application (wall, floor, roof), the strength originally associated with wood is reduced when treated with a fire retardant. Therefore, the FRTW manufacturer is required to provide strength adjustments based on the intended use of the wood. This reduction in strength must be factored in to the structural design of the building. The effective spans and bearing capacity of the lumber is reduced, so beams are over-sized and more lumber is used in the project than required with standard studs. Hence non-treated wood consumes less of the available resources and is structurally stronger than FRTW.

2. The process of pressure-impregnating chemicals into wood to achieve FRT lumber has a negative environmental impact, due to increased use of virgin chemicals and more waste chemicals that need to be treated before discharge into the sewer system. Additionally, there are health impact concerns to the occupants of the building from a long-term exposure to the chemicals used in pressure impregnation. Unlike the chemical FRT process, mineral wool is made from an inorganic fiber that does not have adverse impacts on the environment or individual health of occupants.
3. Due to the potential corrosion of steel, hot-dipped galvanized fasteners are required over standard zinc-plated type when using FRT wood. Mineral wool is made from inorganic fiber, it does not reduce the strength of the wood, and does not require hot dipped galvanized fasteners. Hence, it is a better alternative for the environment and overall structural design.

7. CONCLUSION

Mineral wool batt insulation friction fit between the 2x6 studs and filling the entire depth of the wall cavity will provide better protection than FRT wood framing as permitted by OSSC 2303.2 and 603.2. The architect is proposing to use comfort batt insulation by Roxul Company. The batt insulation will be 5.5 inches thick and will be friction fit within the stud cavity. This product is within the parameters of our analysis and the proposed wall assembly will exceed the performance of an FRT wood framed wall assembly. Code does not prohibit the use of better quality products than what is mandated. As this proposed assembly exceeds the base code criteria, it will satisfy the code requirements.

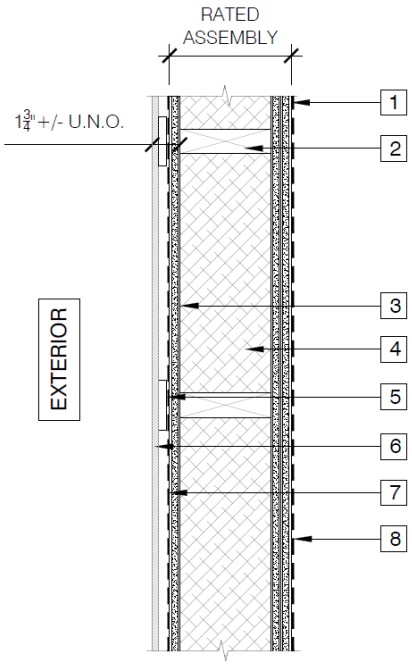


Samir Mokashi
Principal/Code Analyst
Code Unlimited

Vincent Collins
Fire Protection Engineer
Principal/Code Unlimited

Appendix A

Proposed Wall Section



ASSEMBLY LEGEND:

1 09 25 10, (2) LAYERS 5/8" TYPE X GYPSUM BOARD FOR FIRE-RESISTANT USE
2 06 11 00, 2x6 NON-FRT WOOD FRAMING, SIZE AND SPACING AS SCHEDULED PER STRUCTURAL
3 06 16 00, (1) LAYER 5/8" EXTERIOR GYPSUM SHEATHING
4 07 21 00, MINERAL WOOL INSULATION FIT TIGHT TO CAVITY, R-21, INS-2
5 07 46 00, NON-COMBUSTIBLE VERTICAL FURRING
6 07 46 00, NON-COMBUSTIBLE FIBER CEMENT SIDING
7 07 27 10, WEATHER RESISTANT BARRIER
8 09 90 00, INTERIOR FINISH PAINT OVER PRIMER - VAPOR RETARDER

WALL TYPE 10 - EXTERIOR WOOD FRAME WALL W/ FSD X≥10

LOCATION(S): LVLS 1-5, EXTERIOR LOAD BEARING WALL W/ NON-COMBUSTIBLE EXTERIOR WALL COVERING

MARK	STUD SIZE	FIRE		SOUND ATTENUATION	
		RATING	RATING SOURCE	STC RATING	RATING SOURCE
10	2x6	2-HR	CODE GUIDE*	NA	

* 2 HOUR RATED IN ACCORDANCE WITH CITY OF PORTLAND CODE GUIDE - TYPE III CONSTRUCTION - OSSC/6/#4.

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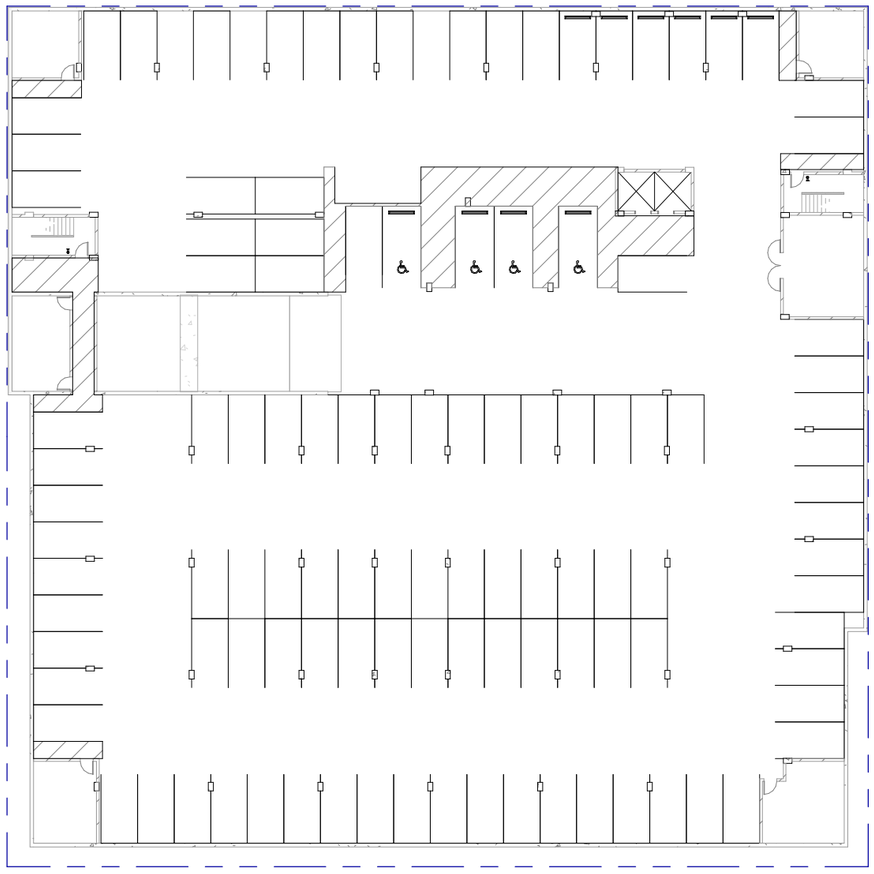
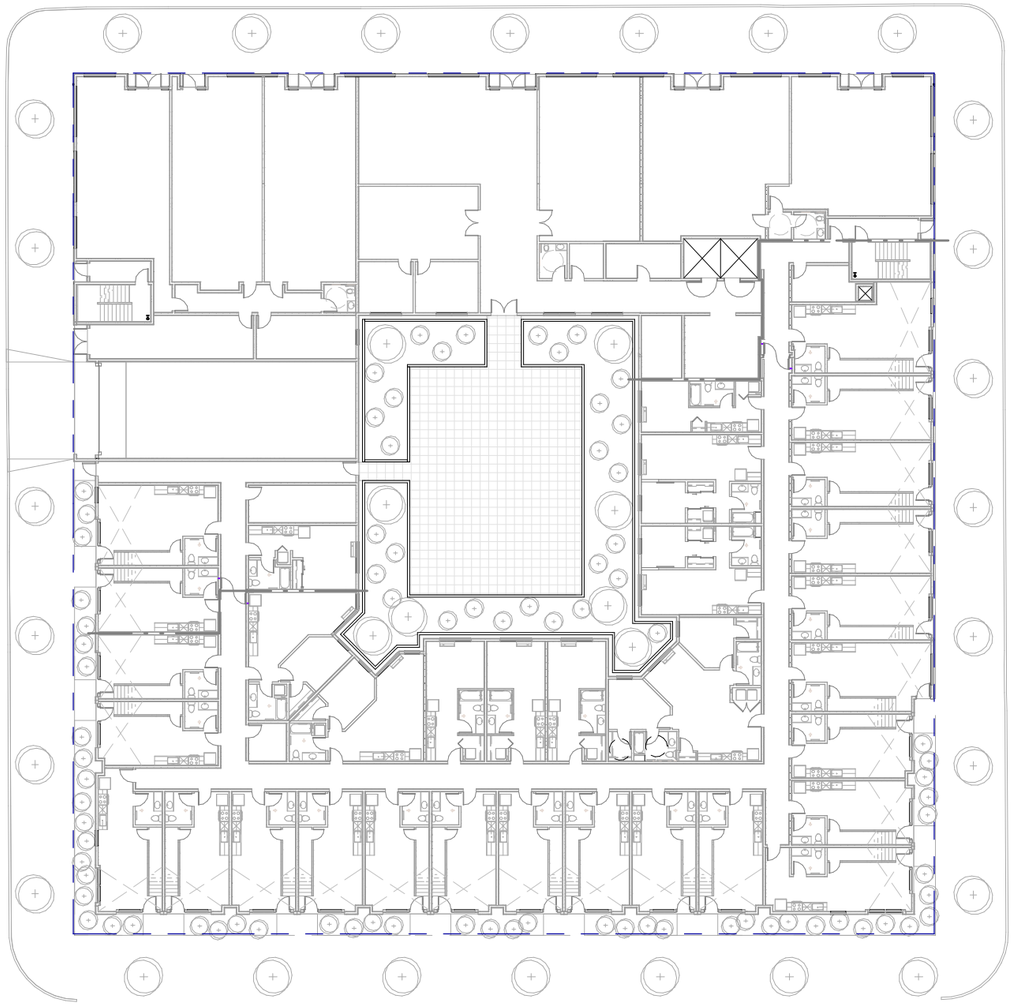
W10

Appendix A; Figure 1: Exterior Wall





1
01

FLOOR PLANS - LEVEL 0 PARKING

SCALE: 1/32" = 1'-0"

FLOOR PLAN LEVEL 1

SCALE: 1/32" = 1'-0"

0 8' 32' 64'

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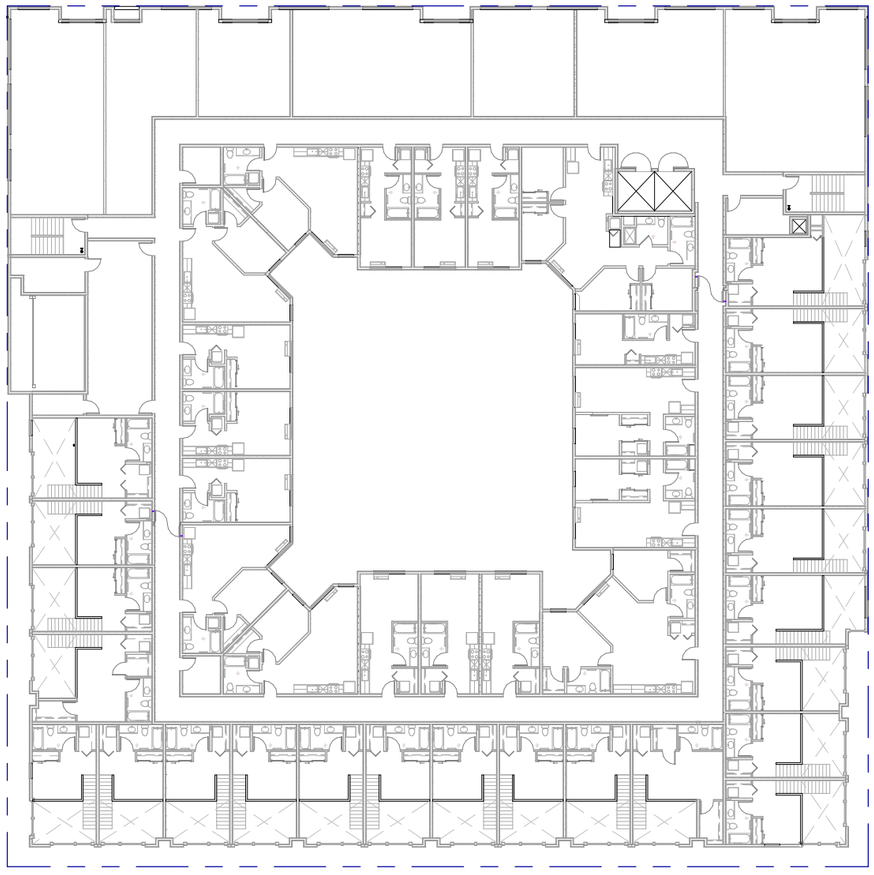
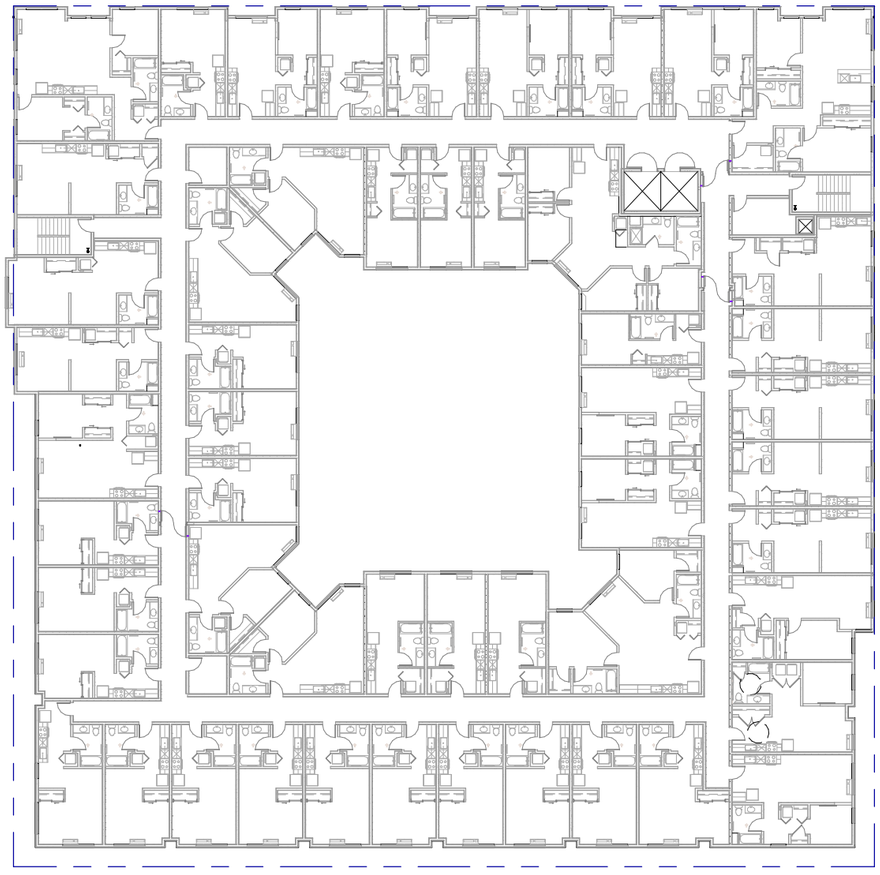
01





1
03

FLOOR PLANS - LEVEL 2 AND LEVEL 3-4

SCALE: 1/32" = 1'-0"

0 8' 32' 64'

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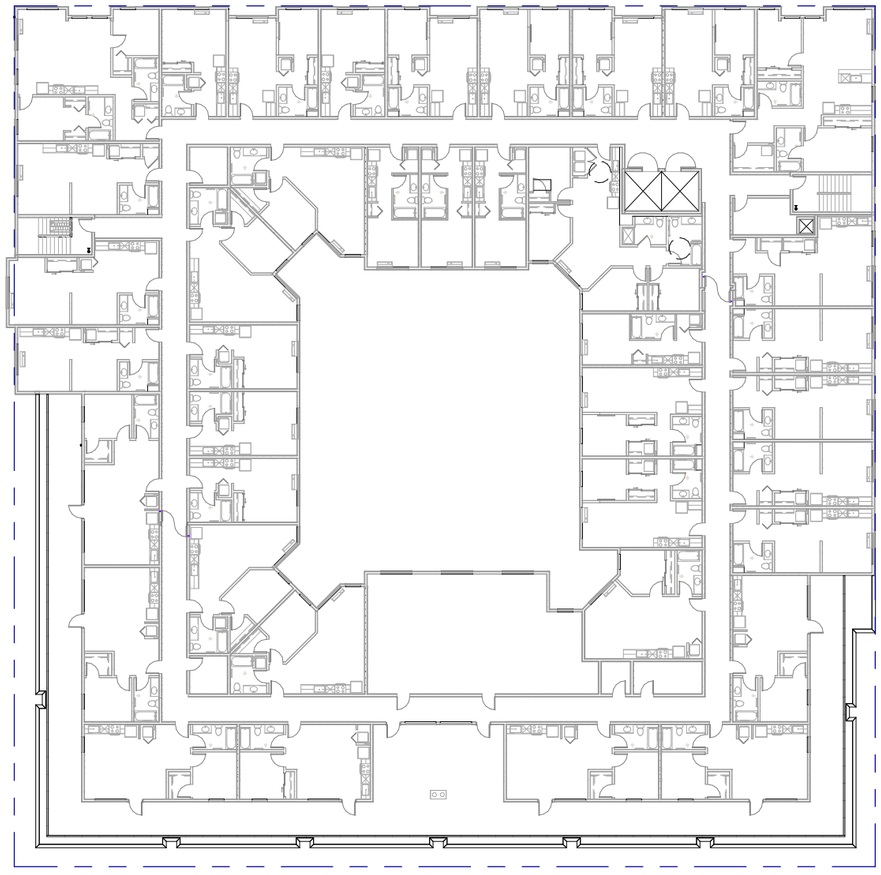
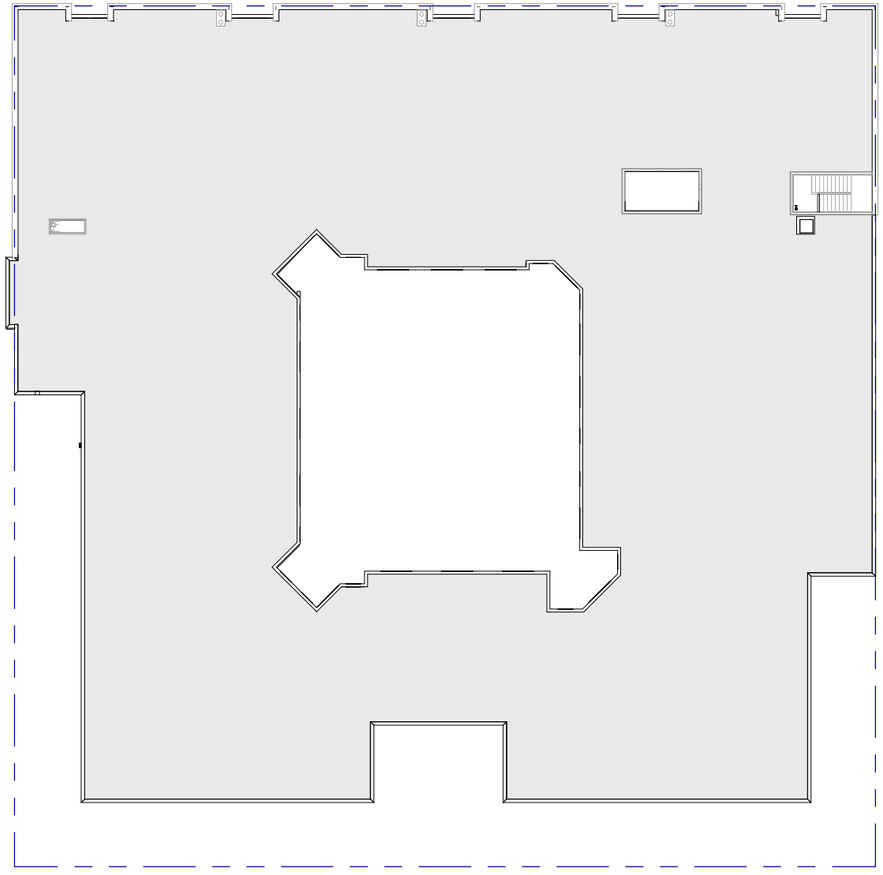
02





1
04

FLOOR PLANS - LEVEL 5 AND ROOF

SCALE: 1/32" = 1'-0"

0 8' 32' 64'

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1
05

BUILDING SECTION - WEST TO EAST

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Leeb Architects

PROJECT NAME	**Modera Woodstock**
TYPE	5-Story Wood Frame over 1 Story Basement
FOR	Mill Creek Residential
Project No.	A18-20
Date:	09 August 2019

All buildings w/ 'R' (Residential) Occupancies are required to have an Automatic Fire Sprinkler System throughout.

153,377

5 FLOORS / 70ft HGT

5	28,982	Level 6
4	33,101	Level 5
3	33,101	Level 4
2	26,413	Level 3
1	31,780	Level 2
P1	38,152	Level 1

Horizontal Assembly

3/5 STORY Residential (R2)
1 Level (IA), PODIUM BUILDING

ALLOWABLE BUILDING AREA (Type 3B Residential / Type 1A Podium)

Maximum Floor Area cannot exceed the Total Allowable Building Area without Area Separation Walls

Area Separation Wall Not Required

Combustable 1-Hour-rated Wood Construction permited

Occup. Group	Constr Type	A_t Basic AREA (Table 503)	Frontage Increase Factor	$A_t \times I_f$ Frontage Increase AREA	Sprinkler Increase	$A_t \times I_s$ Sprinkler Increase AREA	A_a ALLOWABLE AREA (SF) per FLOOR	Story Increase Factor	TOTAL ALLOWABLE BUILDING AREA (SF)
R-2	3-B								
R-2	3-B								
R-2	3-B								
R-2	3-B	16,000	72%	**11,590**	200%	**32,000**	**59,590**	3	**178,770**
R-2	3-B								
S2, R2	1-A	Unlimited							

1 Story, Type IA Podium Permitted by 2014 OSSC
Section 510 Special Provisions: Makes provisions for **special compartmentalization of a building** by using Horizontal Assemblies to create separations in conjuction with automatic sprinkler systems.

FRONTAGE INCREASE

F Building Frontage @ Public Way	P Perimeter of Entire Building	1st Adjust Factor	W Width of Public Way	2nd Adjust Factor	Total Frontage Area Increase
779.5	800	0.25	30.00	30	72%

PASSES

TOTAL PROPOSED BUILDING AREA (SF)	
Level 1	31,780
Level 2	26,413
Level 3	33,101
Level 4	33,101
Level 5	28,982
TOTAL	153,377

SUMMARY: Compartmentalized Building Areas (OSSC 506.1 & 506.4)

(Equation 5-1) $A_a = \{A_t + [A_f \times I_f] + [A_t \times I_s]\}$

Building Compartment	Occup. Group	Constr Type	At Basic AREA (Table 503)	Frontage Increase Factor	$A_t \times I_f$ Frontage Increase AREA	Sprinkler Increase	$A_t \times I_s$ Sprinkler Increase AREA	Aa ALLOWABLE AREA (SF) per FLOOR	Story Increase Factor	TOTAL ALLOWABLE BUILDING AREA (SF)
Building Area - 2	R-2	3-B	13,750	72%	**9,960**	200%	**27,500**	**51,210**	3	**153,630**

(Equation 5-2) $I_f = [F / P - 0.25] W / 30$

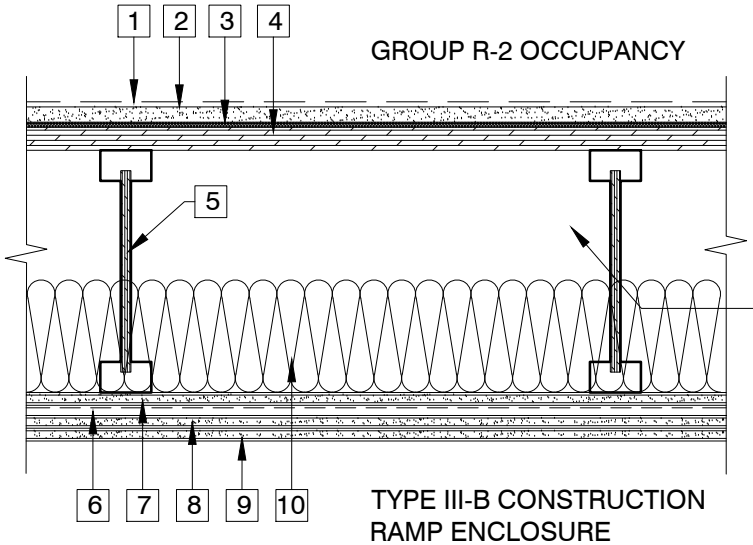
F Building Frontage @ Public Way	P Perimeter of Entire Building	1st Adjust Factor	W Width of Public Way	2nd Adjust Factor	Total Frontage Area Increase	PROPOSED Compartmentalized BUILDING AREA (SF)
779.5	800	0.25	30.00	30	72%	**153,377**

Building Frontage Increase

Building	North F	North P	East F	East P	South F	South P	West F	West P	Frontage Total (Ft)	Perimeter Total (Pt)	Weighted Width of Public Way (W)	Adjustment Factor (Af)	Frontage Increase (If) (Ft/Pt-.25)W/Af	OSSC Section
Building 2	199.5	200	195	200	190	200	195	200	779.5	800	30	30	0.72	506.2

Weighted Width of Public Way (W)

Building	North F	North W	East F	East W	South F	South W	West F	West W	Frontage Total (Ft)	Area of Public Way Total (At)	Weighted Width of Public Way (W)	OSSC Section
Building 2	200	30	195.5	30	190.5	30	195.5	30	781.5	23,445	30.00	506.2.1



GROUP R-2 OCCUPANCY

BUILDING IS FULLY SPRINKLERED PER NFPA 13, DRAFTSTOPPING IN FLOORS NOT REQUIRED PER OSSC 718.3.2, EXCEPTION 1.

TYPE III-B CONSTRUCTION
RAMP ENCLOSURE

ASSEMBLY LEGEND:

1 09 00 00, FINISH FLOOR COVERING. VARIES, SEE PLANS FOR MATERIAL AND LOCATIONS.
2 03 52 00, GYPSUM CEMENTITIOUS UNDERLAYMENT, 1-INCH THICK.
3 03 52 00, SOUND CONTROL MATTING.
4 06 16 00, WOOD STRUCTURAL PANEL FLOOR SHEATHING, FOR THICKNESS AND FASTENING SEE STRUCTURAL FRAMING PLANS.
5 06 17 40, WOOD WEB JOISTS, FOR SIZE AND SPACING SEE STRUCTURAL FRAMING PLANS.
6 09 25 10, CLARK DIETRICH RCSD INSTALLED PER MANUF RECOMMENDATIONS. APPLIED AT RIGHT ANGLE TO JOISTS AT 16 INCH CENTERS, 1/2-INCH, NO. 25 GAUGE, FASTEN TO EACH JOIST WITH 1-7/8" LONG TYPE S DRYWALL SCREWS.
7 09 25 10, BASE LAYER OF $\frac{5}{8}$" TYPE X GYPSUM BOARD APPLIED AT RIGHT ANGLE TO JOISTS, FASTENED WITH 1-5/8" LONG TYPE S DRYWALL SCREWS SPACED AT 8-INCH CENTERS.
8 09 25 10, SECOND LAYER OF $\frac{5}{8}$" TYPE X GYPSUM BOARD APPLIED AT RIGHT ANGLE TO RESILIENT CHANNEL AND FASTENED WITH 1 $\frac{1}{4}$" LONG TYPE S-12 DRYWALL SCREWS SPACED AT 8-INCH CENTERS. EDGE JOINTS OFFSET 24 INCHES FROM BASE LAYER EDGE JOINTS.
9 09 25 10, FACE LAYER OF $\frac{5}{8}$" TYPE X GYPSUM BOARD APPLIED AT RIGHT ANGLE TO JOISTS AND FASTENED WITH 1 $\frac{7}{8}$" LONG TYPE S-12 DRYWALL SCREWS SPACED AT 8-INCH CENTERS. EDGE JOINTS OFFSET MIN 16 INCHES FROM SECOND LAYER EDGE JOINTS.
10 09 52 10, ACOUSTIC INSULATION, 3-1/2 INCH THICKNESS.

TYPE F12, COMBUSTIBLE WOOD WEB JOIST FLOOR-CEILING				
MARK	FIRE		SOUND ATTENUATION	
	RATING	RATING SOURCE	STC RATING	RATING SOURCE
F12	2-HR	UL L538	62	RAL-OT03-05/06

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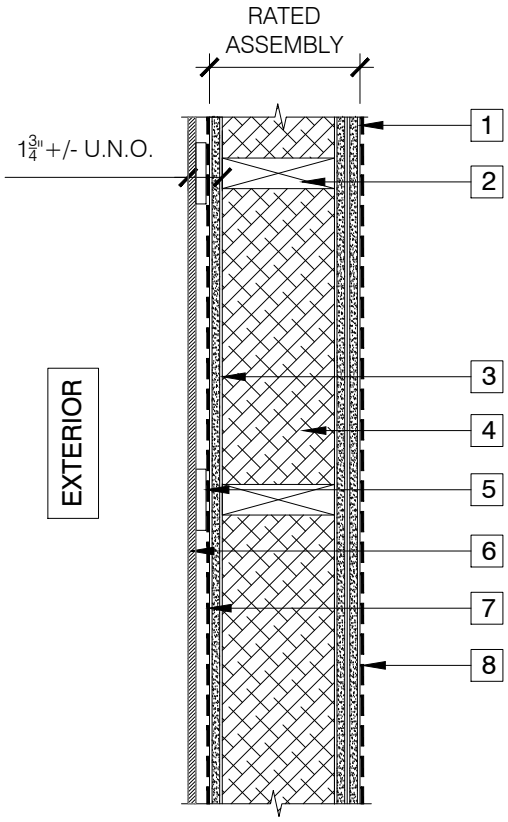
F12



ASSEMBLY LEGEND:

1 09 25 10, (2) LAYERS 5/8" TYPE X GYPSUM BOARD FOR FIRE-RESISTANT USE
2 06 11 00, 2x6 NON-FRT WOOD FRAMING, SIZE AND SPACING AS SCHEDULED PER STRUCTURAL
3 06 16 00, (1) LAYER 5/8" EXTERIOR GYPSUM SHEATHING
4 07 21 00, MINERAL WOOL INSULATION FIT TIGHT TO CAVITY, R-21, INS-2
5 07 46 00, NON-COMBUSTIBLE VERTICAL FURRING
6 07 46 00, NON-COMBUSTIBLE FIBER CEMENT SIDING
7 07 27 10, WEATHER RESISTANT BARRIER
8 09 90 00, INTERIOR FINISH PAINT OVER PRIMER - VAPOR RETARDER

WALL TYPE 10 - EXTERIOR WOOD FRAME WALL W/ FSD X≥10

LOCATION(S): LVLS 1-5, EXTERIOR LOAD BEARING WALL W/ NON-COMBUSTIBLE EXTERIOR WALL COVERING

MARK	STUD SIZE	FIRE		SOUND ATTENUATION	
		RATING	RATING SOURCE	STC RATING	RATING SOURCE
10	2x6	2-HR	CODE GUIDE*	NA	

* 2 HOUR RATED IN ACCORDANCE WITH CITY OF PORTLAND CODE GUIDE - TYPE III CONSTRUCTION - OSSC/6/#4.

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Thermal Batt Insulation

ROCKWOOL COMFORTBATT® is a semi-rigid stone wool batt insulation for exterior wood and steel stud applications in both new construction and renovations.

It features a unique flexible edge designed to compress as the batt is inserted then spring back, expanding the batt against the frame studs to give a complete fill. This flexibility ensures the expected R-value is achieved and maintained.

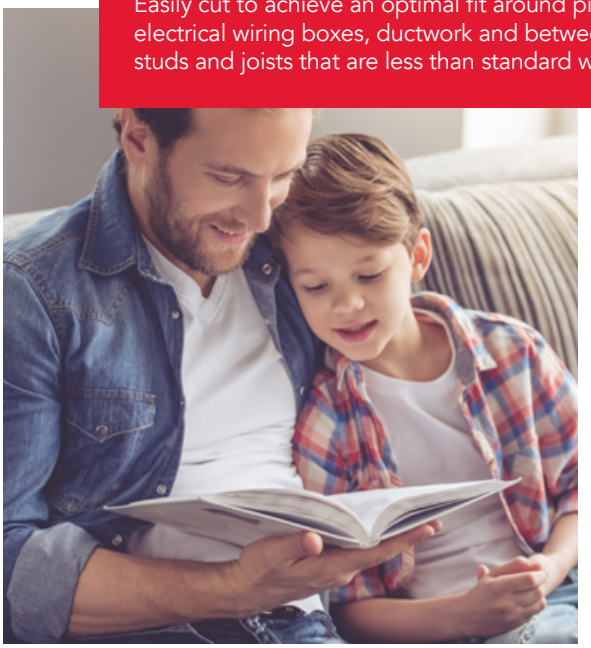
Non-combustible and fire resistant, COMFORTBATT® will not develop toxic smoke or promote flame spread, even when exposed directly to a fire. It also offers water and moisture resistance and excellent sound absorbency.

COMFORTBATT® is an effective way to improve a home's energy efficiency. It is GREENGUARD Gold Certified and contributes to a healthier indoor environment.

Learn more at rockwool.com

Easy Fit

Easily cut to achieve an optimal fit around pipes, electrical wiring boxes, ductwork and between studs and joists that are less than standard width.



ROCKWOOL™

COMFORTBATT®
Thermal Batt Insulation

Technical Data Sheet
Batt Insulation 07210*
Blanket Insulation 07 21 16**

ROCKWOOL COMFORTBATT® is a mineral wool batt insulation designed for thermal resistance in wood and steel framing.

	Performance		Test Standard
Compliance	Mineral Fiber Thermal Insulation for Buildings, Type 1 Compliant		ASTM C665
Reaction to Fire	Flame spread index = 0; Smoke developed index = 0 Determination of Non-combustibility of Building Materials - Non-combustible		ASTM E84 (UL 723) ASTM E136
Density	> 2 lbs/ft³ (>32 kg/m³)		ASTM C167
Thermal Resistance	Wood Stud R15 (RSI 2.64) – 3.5″ thick (89 mm) R23 (RSI 4.05) – 5.5″ thick (140 mm) R30 (RSI 5.28) – 7.25″ thick (184 mm)	Steel Stud R10 (RSI 1.76) – 2.5″ thick (64 mm) R15 (RSI 2.64) – 3.5″ thick (89 mm) R24 (RSI 4.23) – 6″ thick (152 mm)	ASTM C518
Dimensions	Wood Stud 16″ (406 mm) on center: 15.25″ x 47″ (387 mm x1194 mm) Wood Stud 24″ (610 mm) on center: 23″ x 47″ (584 mm x 1194 mm) Steel Stud 16″ (406 mm) on center: 16.25″ x 48″ (413 mm x 1219 mm) Steel Stud 24″ (610 mm) on center: 24.25″ x 48″ (616 mm x 1219 mm)		

Issued 01-01-18
Supersedes 08-23-17

NOTE: *Master Format 1995 Edition **Master Format 2004 Edition. As ROCKWOOL has no control over installation design and workmanship, accessory materials or application conditions, ROCKWOOL does not warranty the performance or results of any installation containing ROCKWOOL's products. ROCKWOOL's overall liability and the remedies available are limited by the general terms and conditions of sale. This warranty is in lieu of all other warranties and conditions expressed or implied, including the warranties of merchantability and fitness for a particular purpose.

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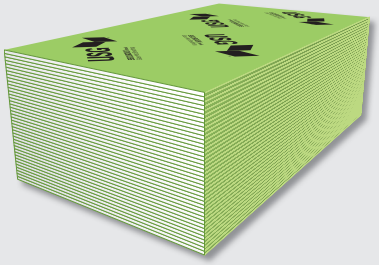
USG Building Envelope Solutions

USG SECUROCK® BRAND GLASS-MAT SHEATHING

REGULAR AND FIRECODE® X



NEW, IMPROVED FACER-MAT DESIGN

Quality, high-performance sheathing for warranted protection from the elements

- Improved coated fiberglass facer mat to maximize coverage of air/water barrier systems
- Treated gypsum core, combined with fiberglass face and back, offers exceptional water resistance
- Scores and snaps easily for quick installation
- For use in most exterior systems when properly detailed by exterior finish manufacturer
- Meets or exceeds the requirements of ASTM C1177

DESCRIPTION

USG Securock® Brand Glass-Mat Sheathing is a noncombustible, moisture- and mold-resistant panel designed for use under exterior claddings where conventional gypsum sheathing products have traditionally been used, such as brick veneer, properly detailed Exterior Insulation Finish Systems (EIFS), clapboard siding, panel siding, shingle siding, shake siding and conventional stucco.

ADVANTAGES

Mold-Resistant: High resistance to mold and mildew and scores a 10 (highest) when tested in accordance with ASTM D3273.

Resists Water: Glass-mat sheathing facer on both sides sheds water.

Quick, Dry Installation: Quick score and snap, no sawing or special tools, and rapid screw or nail attachment.

Exposure: Can be exposed to weather for up to 12 months after application.

Warranted Performance: USG Securock Glass-Mat Sheathing is guaranteed for five years against manufacturing defects and for 12 months of weather exposure.

LIMITATIONS

1. USG Securock Glass-Mat Sheathing shall not be used as a nail base for exterior cladding.
2. Specific requirements regarding framing spacing, fastener spacing and fastener specifics to provide required lateral wind-load resistance are the responsibility of the design professional. (Refer to technical data and specifications on the following pages.)
3. USG Securock Glass-Mat Sheathing offers resistance to weather but is not intended for constant exposure to water. Protect this and all similar materials from the eroding effects of cascading water. If extreme weather conditions are possible, the design professional should consider recommending that panel joints be treated or a weather-resistant barrier be installed.
4. Not recommended for lamination to masonry surfaces. Use furring strips or framing.
5. Maximum stud spacing is 24″ o.c.
6. USG Securock Glass-Mat Sheathing is not a finished surface.
7. USG Securock Glass-Mat Sheathing is not intended for tile applications.

PRODUCT DATA

Dimensions: 1/2″ or 5/8″ thick, 48″ wide, 8′, 9′ and 10′ long. Up to 12′ lengths available in 5/8″ thickness in some markets. Other sizes available on special order. Consult your USG sales office or representative for more information.

Weight: Approximately 2.0 lbs./sq. ft. for 1/2″ thickness, 2.7 lbs./sq. ft. for 5/8″ thickness.

Edge Configuration: Square edges.

Compliance With Standards: Meets or exceeds the physical property requirements of ASTM C1177. 5/8″ USG Securock Glass-Mat Sheathing is UL Classified as to fire resistance, surface-burning characteristics and core combustibility. ICC ES Evaluation Report ESR 3044.

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Fire Performance: USG Securock Glass-Mat Sheathing has a noncombustible core when tested in accordance with ASTM E136. Surface-burning characteristics—Flame spread 0, smoke developed 0, when tested in accordance with ASTM E84. Fire resistance—5/8″ panels meet the requirements of Type X as defined in ASTM C1396 and ASTM C1177 when tested in accordance with ASTM E119. UL Classified as to fire resistance. See Underwriters Laboratories Fire Resistance Directory for specific designs.

Tensile Bond: Exceeds 15 psi requirements for both cementitious and acrylic adhesives per ASTM C297.

Physical Properties Per ASTM C1177	1/2″ USG Securock® Brand Glass-Mat Sheathing	5/8″ USG Securock® Brand Glass-Mat Sheathing Firecode® X
Weight, nominal, lbs./sq. ft.	2.0	2.7
Linear expansion with moisture change, in/in %RH	6.25×10^{-6}	6.25×10^{-6}
Coefficient of thermal expansion, in/in/°F	8.5×10^{-6}	8.5×10^{-6}
Flexural strength, parallel, lbf.	>80	>100
Flexural strength, perpendicular, lbf.	>107	>147
R-Value, ft²•°F•hr/BTU	0.40	0.50
Combustibility	Noncombustible	Noncombustible
ASTM D3273 score	10/10	10/10
Permeance, perms	29	28
Surface burning characteristics (per ASTM E84 or CAN/ULC-S102): flame spread/smoke developed	0/0	0/0
Humidified deflection, inches	<2/8″	<1/8″
Bending radius (dry)*	9′	9′

*Due to the variability in environmental conditions of each installation, the framing and fastener spacing of curved walls should be reduced as the radius approaches the minimum allowed. At the minimum radius, it is recommended that fastener and frame spacing be 6″ o.c.

Allowable Uniform Wind Load (lbs./sq. ft.) for 1/2″-Thick Panels

Frame Spacing	12″			16″			24″		
Fastener Spacing	4	6	8	4	6	8	4	6	8
Allowable Pressure	75	46	34	51	34	26	26	19	16

Allowable Uniform Wind Load (lbs./sq. ft.) for 5/8″-Thick Panels

Frame Spacing	12″			16″			24″		
Fastener Spacing	4	6	8	4	6	8	4	6	8
Allowable Pressure	107	67	50	75	50	38	34	27	24

Notes: Applicable for both steel and wood framing. The values in this table are based on testing per ASTM E330 and represent the capacity of the sheathing to resist flexural failure or fastener pull-through with a 3.0 factor of safety. Capacities are based on a minimum fastener head diameter of 0.325″ (#6 bugle head screw). The withdrawal resistance of fasteners from framing is different on several factors, including but not limited to fastener type, fastener length and framing properties. The specification of fasteners is the responsibility of the Designer of Record. Manufacturer's recommendations are given below. These capacities assume continuous support of each stud flange over the full length of the sheathing panel. Allowable pressures are based on a maximum deflection limitation of L/360. Consult USG representative for higher deflection limitations. Allowable pressure values are for short-term wind loads. Framing design is independent of these values. The design capacities of assemblies constructed with pneumatically driven fasteners are beyond the scope of this submittal sheet.

Moisture and Mold Resistance: USG Securock Glass-Mat Sheathing resists moisture and mold and complies with ASTM C1177 for water resistance. In independent lab tests conducted on USG Securock Glass-Mat Sheathing at the time of manufacture per ASTM D3273, *Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber*, the panel score was 10.

This ASTM lab test may not accurately represent the mold performance of building materials in actual use. Given unsuitable project conditions during storage, installation or after completion, any building material can be overwhelmed by mold. To manage the growth of mold, the best and most cost-effective strategy is to protect building products from water exposure during storage and installation and after completion of the building. This can be accomplished by using good design and construction practices.

APPLICATION TO WOOD STUD WALLS FOR RACKING RESISTANCE

For resisting wind and seismic loads: 1/2″-thick (12.7 mm) USG Securock Glass-Mat Sheathing will provide an allowable racking resistance of 122 plf (1.8 kN/m) when sheathing is attached to wood framing spaced 16″ (406 mm) o.c. max. Application shall be by the use of nails: 11 gauge, 7/16″ (11 mm) diameter head, 1-1/2″ (38 mm) long, hot-dipped galvanized roofing nails, or #6 – 1-1/4″ (32 mm) long corrosion-resistant bugle head screws. 5/8″-thick (15.9 mm) USG Securock Glass-Mat Sheathing will provide an allowable racking resistance of 138 plf (2.0 kN/m) when sheathing is attached to wood framing spaced 24″ (610 mm) o.c. max. Application shall be by the use of nails: 11 gauge, 7/16″ (11 mm) diameter head, 1-3/4″ (44 mm) long, hot-dipped galvanized roofing nails, or #6 – 1-5/8″ (41 mm) long corrosion-resistant bugle head screws. The USG Securock Glass-Mat Sheathing panels shall be applied solidly to the wall framing with the long edges of the panels parallel to the framing with all edges backed by framing members. Design capacities are based on a maximum fastener spacing of 4″ (101 mm) o.c. around the perimeter of the sheathing panels and 8″ (203 mm) o.c. along the intermediate framing members. The maximum height-length ratio shall not exceed 1.5:1 to be considered a shear wall segment. Studs and plates shall be anchored to resist forces. Shear walls using USG Securock Glass-Mat Sheathing shall not be used to resist forces imposed by masonry or concrete walls. The design capacities of assemblies constructed with pneumatically driven fasteners are beyond the scope of this submittal sheet.

Note: Local code requirements may limit the racking resistance values to a prescribed load; be sure to check with the authority having jurisdiction for the correct limitations when designing the racking resistance.

INSTALLATION

USG Securock Glass-Mat Sheathing shall be installed in accordance with WB2451 USG Securock Glass-Mat Sheathing Installation Guide, GA-253 Application of Gypsum Sheathing, and ASTM C1280 Standard Specification for Application for Application of Gypsum Panel Products for Use as Sheathing. If extreme weather conditions are possible, the design professional should consider recommending that panel joints be treated or a weather-resistant barrier be installed.

SPECIFICATIONS

PART 1: GENERAL

1.1 Scope
Specify to meet project requirements.

1.2 Delivery and Storage of Materials
All materials shall be stored in an enclosed shelter providing protection from damage and exposure to the elements. Damaged or deteriorated materials shall be removed from the premises. Prior to installation, panels should be stacked flat (unless the contractor in charge of site safety directs otherwise to avoid point overloading of the structure or a tripping hazard) and reasonably protected from the elements.

Warning: Store all USG Securock Glass-Mat panels flat. Panels are heavy and can fall over, causing serious injury or death. Do not move unless authorized. Panels 12′ in length will ship in banded units. To ensure safety and performance of the product, use of a forklift truck with minimum 35″ span between the forks when moving the banded units is recommended. Keep the nylon bands on each lift until individual boards are moved.

PART 2: PRODUCTS

A. USG Securock Glass-Mat Sheathing—(1/2″) (5/8″) thick x 48″ wide x 8′-10′ long (up to 12′ for 5/8″ thickness) with square edges.

B. Nails—(1-1/2″) (1-3/4″), 11-gauge hot-dipped galvanized roofing nails, 7/16″ diameter head (minimum).

C. Screws—(1-1/4″) (1-5/8″) #6 bugle head corrosion-resistant fasteners. Where sheet-type weather-resistive barriers or self-adhering membranes are placed over the sheathing, corrosion resistance shall be equal to or greater than a hot-dipped galvanized coating of 1.5 ounces of zinc per square foot of surface area. Where liquid or fluid-applied air and water barriers are used, or where no sheet-type weather-resistive barrier is used over the sheathing, screws shall have a corrosion resistance of more than 800 hours per ASTM B117. Stainless steel fasteners shall be used in coastal or aggressive environments. Consult the building code for other requirements.

PART 3: EXECUTION

3.1 Walls— Sheathing

A. Apply weather-resistive or water barriers and flashing as required by and in accordance with the applicable local code requirements and the recommendations of the exterior cladding manufacturer, whichever is more stringent.

B. Maximum fastener spacing for vertical surfaces is 8″ o.c., unless limited by wind load restrictions or wood stud racking resistance requirements outlined in Product Data.

C. Maximum frame spacing is 24″ o.c.

D. Sheathing must be thoroughly dry prior to installing adhesively applied and self-adhered ice/water barriers and joint tape. Failure to do so will result in an insufficient bond to the sheathing.

E. Apply side labeled "USG Securock®" toward exterior. Fit ends and edges closely but not forced together.

F. Fasteners shall be driven flush with the panel surface, without countersinking or deep enough to break the glass mat, and into the framing.

G. Unless otherwise specified or required, USG Securock Glass-Mat Sheathing may be applied either perpendicular or parallel to wood or steel framing.

3.2 Soffits—Sheathing Application
The maximum frame spacing for soffits is 16″ o.c. when installed parallel to the joists and 24″ o.c. when installed perpendicular to the joists. Maximum fastener spacing for horizontal surface (soffits) is 8″ o.c.

3.3 Control Joints
Control joints shall be installed at building expansion joints. Location and design of these control joints shall be detailed by the design professional. Per the International Building Code®, the distance between control joints shall not be more than 30 feet.

3.4 Shear- or Fire-Rated Construction
Shear- or fire-rated construction may have additional execution requirements as specified in local codes or the UL Fire Resistance Directory.

3.5 Weather-Resistant Barriers
No weather-resistant barrier is required for exposure warranty but may be required by local codes or cladding system specifications.

3.6 Exterior Cladding Application
Consult exterior cladding manufacturer for installation instructions.

3.7 EIFS
EIFS, like all other cladding systems, is vulnerable to moisture that enters the cavity through wall penetrations, such as windows, doors, deck attachments and utility pipe chases, and at wall/roof intersections. For most residential and some commercial EIFS, manufacturers now specify a weather-resistive barrier for additional protection from moisture that penetrates the wall. In addition, manufacturers of windows, doors, flashing and sealants offer instruction on proper installation and maintenance of their products.

- EIMA (EIFS Industry Members Association), www.eima.com. This website has extensive information about proper installation of EIFS, sealants, flashing, proper attachment of EIFS to substrates, and inspection, maintenance and repair of EIFS claddings.
- ASTM E2112, *Standard Practice for Installation of Exterior Windows, Doors and Skylights*
- ASTM C1481, *Standard Guide for Use of Joint Sealants with EIFS*
- ASTM C1397, *Standard Practice for Application of Class PB EIFS*
- AWCI (Association of Wall and Ceiling Industry) offers EIFS Education and Certification Programs for EIFS applicators and also for building officials, inspectors and design professionals. Contractors whose personnel have successfully completed the AWCI EIFS training can be found on AWCI's EIF*Smart* Construction National Registry. See www.awci.org.

SUBMITTAL APPROVALS

Job Name	
Contractor	**Date**

PRODUCT INFORMATION
See usg.com for the most up-to-date product information.

WARNING
Dust can contain silica. Prolonged and repeated breathing of silica dust can cause lung damage and cancer. If cutting with a power tool, use a wet or vacuum saw to reduce the amount of dust generated. Dust can be corrosive to eyes, skin and respiratory tract. Contact can cause severe chemical burns. Wear eye, skin and respiratory protection. If eye contact occurs, flush immediately with water for 30 minutes. If ingested, call a physician.
Product safety information: 800 507-8899 or usg.com
Customer Service: 800 USG.4YOU (874-4968).
KEEP OUT OF REACH OF CHILDREN.

NOTE
Products described here may not be available in all geographic markets. Consult your USG Company sales office or representative for information.

NOTICE
We shall not be liable for incidental and consequential damages, directly or indirectly sustained, nor for any loss caused by application of these goods not in accordance with current printed instructions or for other than the intended use. Our liability is expressly limited to replacement of defective goods. Any claim shall be deemed waived unless made in writing to us within thirty (30) days from date it was or reasonably should have been discovered.

SAFETY FIRST!
Follow good safety/industrial hygiene practices during installation. Wear appropriate personal protective equipment. Read MSDS and literature before specification and installation.

800 USG.4YOU
800 (874-4968)
usg.com

Manufactured by
United States Gypsum Company
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Chicago, IL 60661

WB2452/rev. 6-15

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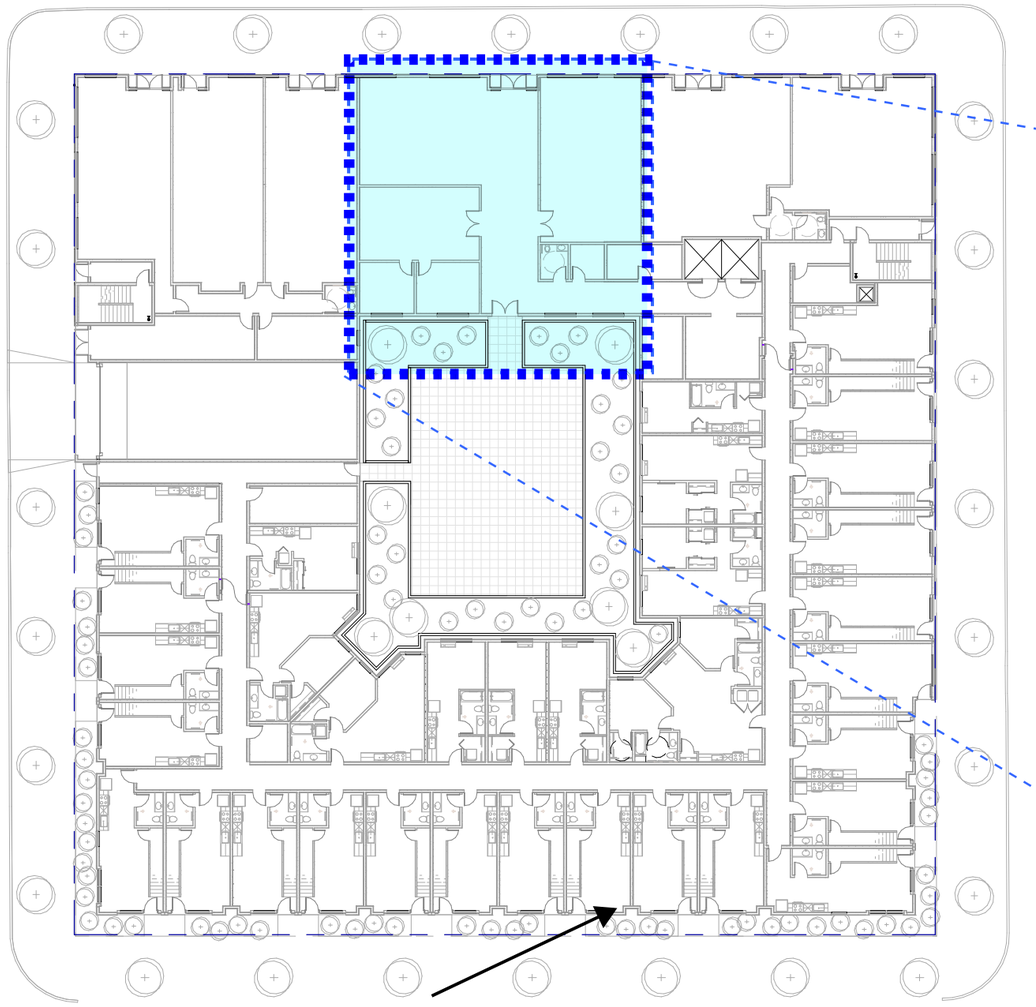

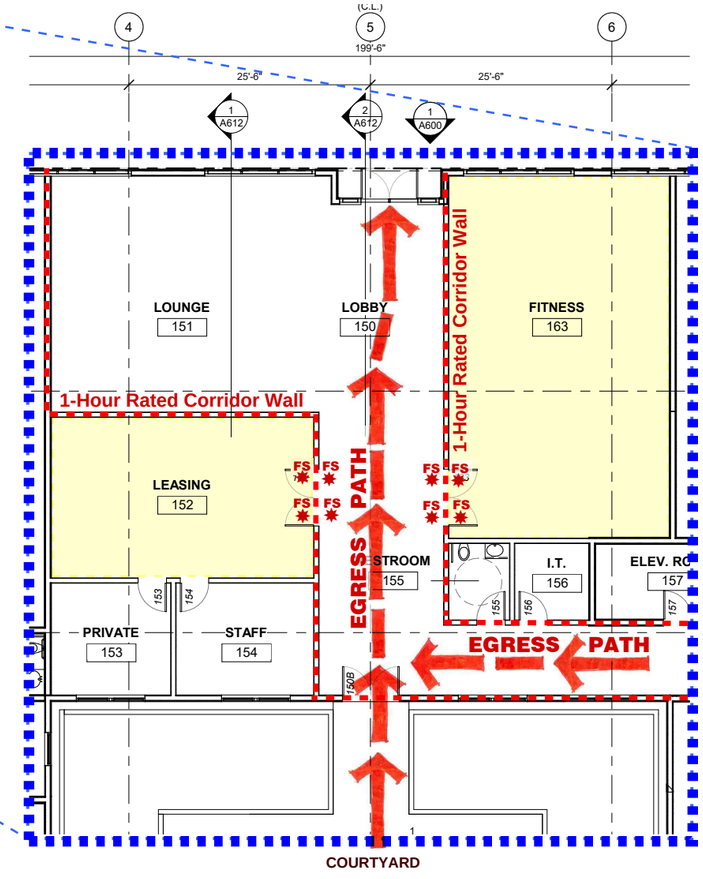

1/06 **FLOOR PLANS - LEVEL 1**

SCALE: 1/32" = 1'-0"

0 32' 64'

2/06 **ENLARGED PLAN - LEVEL 1**

SCALE: 1/16" = 1'-0"

0 16' 32'

Leeb Architects
308 SW 1st Ave, # 200 Portland, Or 97204
Phone: 503.228.2840 Fax: 503.228.2907
leebarc.com

MODERA WOODSTOCK

CODE APPEAL
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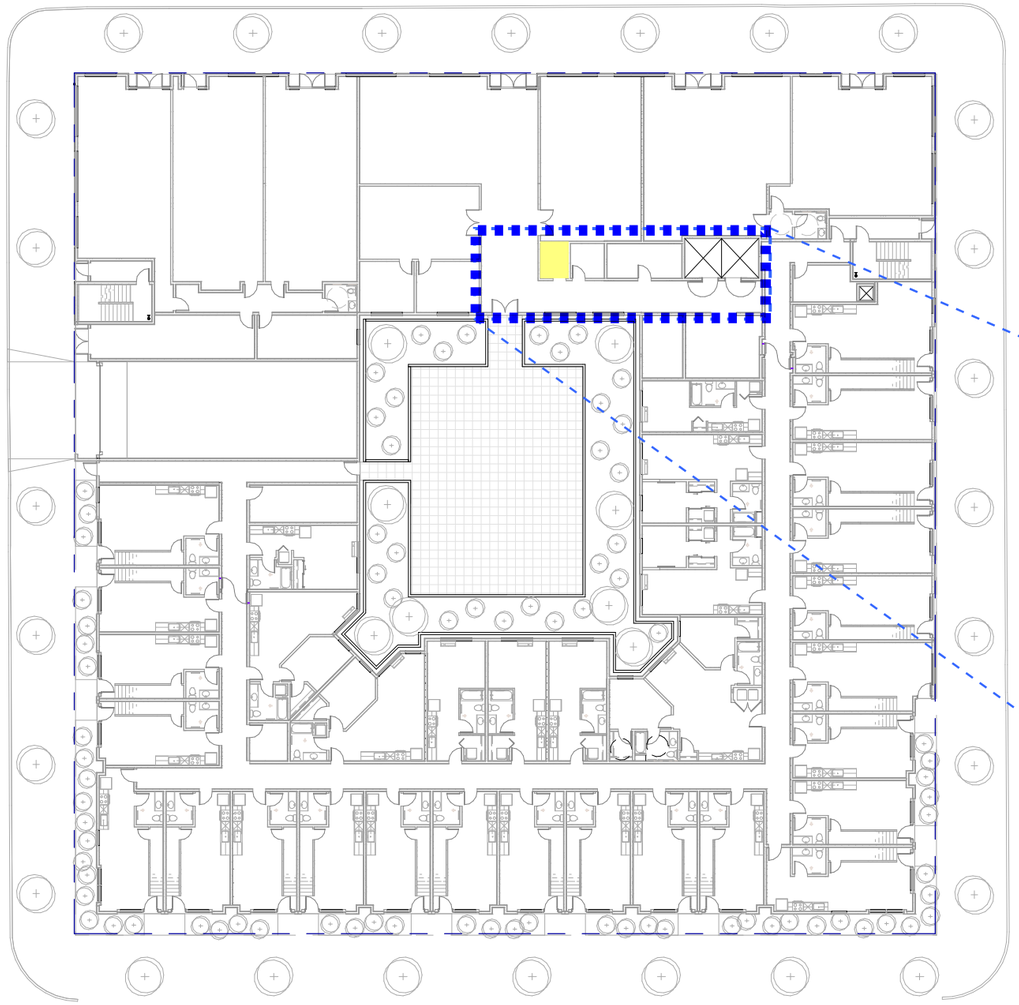

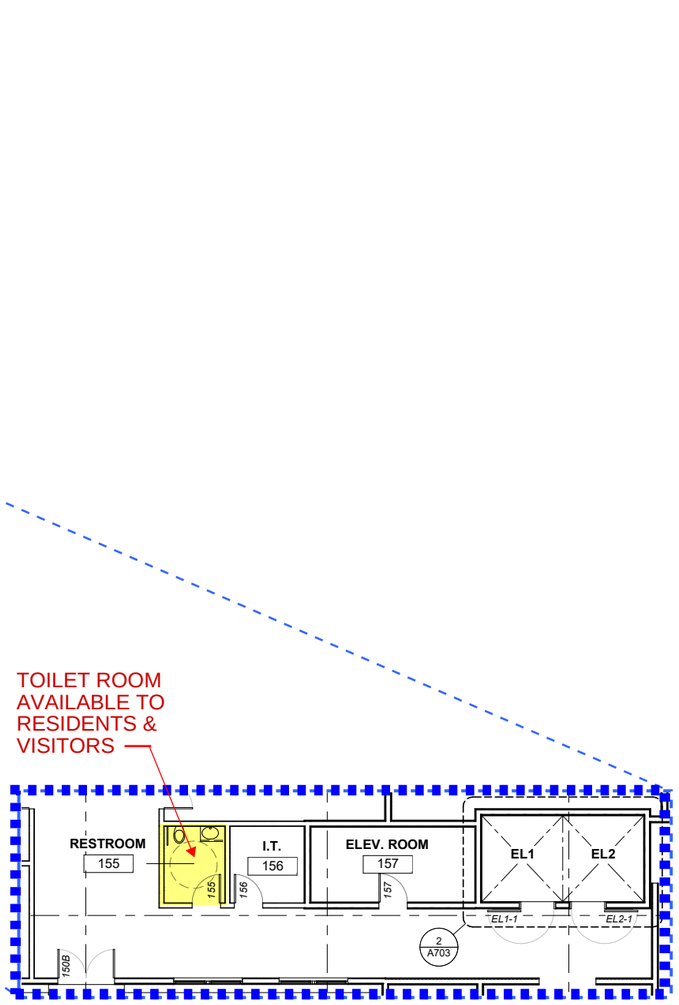

1/07 **FLOOR PLANS - LEVEL 1**

SCALE: 1/32" = 1'-0"

0 32' 64'

2/07 **ENLARGED PLAN - LEVEL 1**

SCALE: 1/16" = 1'-0"

0 16' 32'

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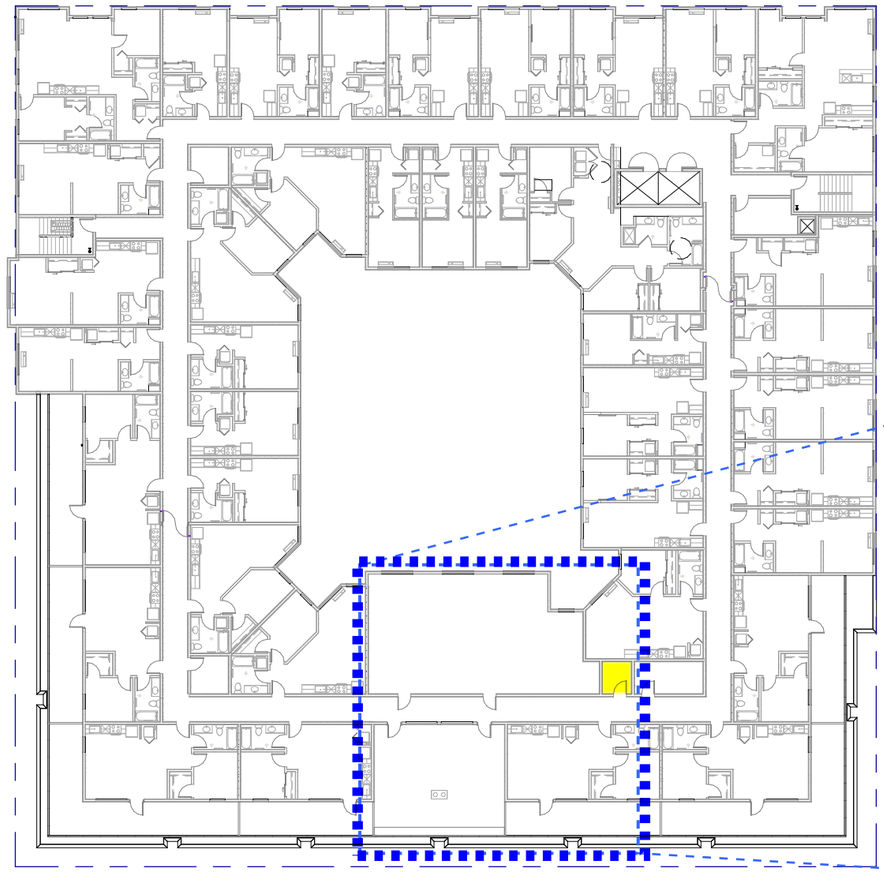

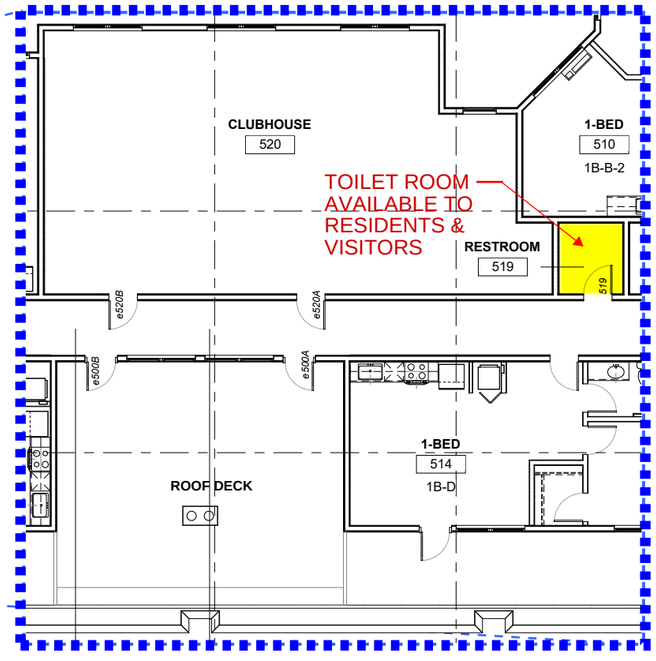

1/09 **FLOOR PLANS - LEVEL 5**

SCALE: 1/32" = 1'-0"

0 32' 64'

2/09 **ENLARGED PLAN - LEVEL 5**

SCALE: 1/16" = 1'-0"

0 16' 32'

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