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APPEAL	SUMMARY
	0010100

Status: Decision Rendered

Appeal ID: 16164	Project Address: 525 SE MLK Jr Blvd
Hearing Date: 11/22/17	Appellant Name: Alex Zelaya
Case No.: B-022	Appellant Phone: 503.227.1254
Appeal Type: Building	Plans Examiner/Inspector: John Cooley
Project Type: commercial	Stories: 6 Occupancy: A-2, A-3, S-2, B Construction Type: III-A
Building/Business Name: Eastside Office	Fire Sprinklers: Yes - Throughout, all floors
Appeal Involves: Erection of a new structure	LUR or Permit Application No.: 17-208587-CO
Plan Submitted Option: pdf[File 1][File 2][File 3][File 4][File 5][File 6][File 7][File 8][File 9][File10][File 11]	Proposed use: Office building with retail/restaurant uses at ground floor, single level below grade parking

APPEAL INFORMATION SHEET

Appeal item 1

Code Section	OSSC 2014 – Section 602.3
Requires	602.3 Type III. Type III construction is that type of construction in which the exterior walls are of noncombustible material 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	This project is a 6-story office building with Cross-laminated timber (CLT) panels as the floor framing. Per Table 601, floor framing is required to be 1-hour rated. The floor rating requirement is met by concrete topping over the floor framing. The floor framing is supported by glulam columns and beams. All columns are within the interior of the building and do not touch the exterior wall. The exterior wall is non-bearing and are 1-hour rated where noted on code plans (attached) per Table 602. The proposed floor framing uses the CLT panels to extend, carrying the load of the exterior, non-bearing walls on the East and West building edges. (Refer to attached typical detail 6/A-521 for typical condition).
	The condition where the CLT Panel floor framing intersects with the exterior wall, the concrete continues under the wall framing. A continuous steel ledger is designed to span from column to column and take all the load of the exterior wall during a fire event. Therefore, the loading of the exterior wall does not rely on the portion of the CLT panel that is in the exterior wall. In addition, where walls are required to be 1-hour rated, the CLT panel will be encapsulated with metal studs insulated with rockwool insulation, covered with one layer of gypsum wall board and sealed.
Reason for alternative	

https://www.portlandoregon.gov/bds/appeals/index.cfm?action=entry&appeal_id=16164





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	Per 602.3, combustible material is prohibited within the exterior walls. The Cross-laminated timber floor panels are wood and by code, viewed as a combustible material. This section allows the use of wood if it is Fire-retardant treated per section 2303.2, though the CLT panels are too large to be fire-retardant treated, and thus an alternate solution is required to protect the CLT panel in the wall assembly.
	We propose that the CLT floor panel is encapsulated by the 1-hour rated assembly required by the wall it is located in. The edge of the CLT panel in question will be covered by the rated wall and limit its exposure to fire, as the wall encapsulating it will be a rated assembly.
	Furthermore, the language stated in the 2015 IBC for Type IV Heavy Timber Buildings has a provision for Cross-laminated timber floors that is applicable to this project:
	"602.4.2 Cross-laminated timber in exterior walls Cross-laminated timber complying with Section 2303.1.4 shall be permitted within exterior wall assemblies with a 2-hour rating or less, provided the exterior surface of the cross-laminated timber is protected by one of the following:
	Fire-retardant-treated wood sheathing complying with Section 2303.2 and not less than 15/32 inch thick Gypsum board not less than ½ inch thick; or
	A noncombustible material" Using Item #3, the exterior surface of the edge of the CLT panel will be protected by a non- combustible material (steel framing and concrete) on the top, side and bottom, therefore protecting each edge of the panel within the exterior wall.
	This Appeal is similar in intent as to past granted appeals in Type III-A construction with wood in the exterior walls.
Appeal item 2	
Code Section	OSSC 2014 – Section 601, 711.3
Requires	Table 601. Type IIIA Construction. Floor construction and associated secondary members- Required to be 1-HR rated construction.
	711.3 Fire-Resistance rating. The fire-resistance rating of floor and roof assemblies shall not be less than that required by the building type of construction.
Proposed Design	703.3(3) Engineering analysis based on calculations in accordance with NDS guide and Section 722 of OSSC are utilized.
	 The proposed floor/ceiling assembly has been evaluated per OSSC chapter 7 in the attached engineering judgement letter (EJ #1) as one-hour fire-resistance. The proposed floor/ceiling assembly has been calculated utilizing the Component additive method from OSSC for a fire condition.
Reason for alternative	The proposed floor/ceiling assembly will provide fire resistance at least equal to the 1-hour fire- resistance. As analyzed per OSSC 703.3 by an Oregon Fire Protection Engineer and documented in the attached Engineering Judgement Letter, the assembly will meet fire resistance minimum requirements. Therefore, the proposed floor/ ceiling assembly will achieve the required minimum fire protection
	rating of 1 hour and we urge you to grant this appeal as submitted.

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Appeal item 3	
Code Section	OSSC 2014 – Section 601, 711.3
Requires	Table 601. Type IIIA Construction. Roof construction and associated secondary members- Required to be 1-HR rated construction.
	711.3 Fire-Resistance rating. The fire-resistance rating of floor and roof assemblies shall not be less than that required by the building type of construction.
Proposed Design	703.3(3) Engineering analysis based on calculations in accordance with NDS guide and Section 722 of OSSC are utilized.
	The proposed roof assembly has been evaluated per OSSC chapter 7 in the attached engineering judgement letter (EJ #2) to provide one-hour fire-resistance.
	• The proposed roof assembly has been calculated utilizing the Component additive method per OSSC for a fire condition.
Reason for alternative	The proposed roof assembly will provide fire resistance at least equal to the 1-hour fire-resistance. As analyzed per OSSC 703.3 by an Oregon Fire Protection Engineer and documented in the attached Engineering Judgement Letter, the assembly will meet fire resistance minimum requirements.
	Therefore, the proposed roof assembly will achieve the required minimum fire protection rating of 1

APPEAL DECISION

1. Non-fire resistant treated CLT not fully within exterior wall: Granted as proposed.

2. Alternate 1 hour floor / ceiling assembly at mech., elec., plumb. chase with engineering analysis: Granted as proposed.

Note: Review of specified concrete type and char calculations will occur at time of plan review.

3. Alternate 1 hour roof / ceiling assembly at mech., elec., plumb. chase with engineering analysis: Granted as proposed.

Note: Review of specified concrete type and char calculations will occur at time of plan review.

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.



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ENGINEERING JUDGEMENT REPORT

1-HOUR CONCRETE FLOOR ASSEMBLY

Client Name: Hacker

Client Address: 733 SW Oak St #100, Portland, OR 97205

Date: 11/15/2017

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1 PROJECT OVERVIEW

This EastSide building is a 6-story office building in downtown Portland, Oregon. The building is of type III-A construction. Fire protection will be provided by automatic sprinklers and a fire alarm system. The floors are required to be 1-hour rated per OSSC Table 601.

Code Unlimited has been asked to evaluate the floor assembly for protection equivalent to a 1-hour per OSSC.

2 APPLICABLE CODES, STANDARDS, AND GUIDES

- 2014 Oregon Structural Specialty Code (OSSC)
- 2014 Oregon Fire Code (OFC)
- Chapter 16 of ANSI/AF&PA National Design Specification for Wood Construction (NDS)
- 2015 American Wood Council Technical Report No.10 (NDS TR-10)

3 APPROACH

- The proposed assembly has been analyzed in accordance with OSSC Chapter 7
- The protection of the proposed assembly has been compared to the requirements for OSSC Section 704
- Protection of the floor is analyzed by component additive method.

4 PROPOSED DESIGN

The floor assembly in the 6-story office building is composed of Cross-laminated timber panels as the floor framing for all upper levels. Per Table 601, floor framing is required to be 1-hour rated (Refer to Code Section 1/CS-101). The floor rating requirement is met by 3" of concrete topping over the floor framing, which is composed of 3-layer CLT panels spaced apart 2'-0" and spanned by ³/₄" plywood. The floor framing is supported by glulam columns and beams which are rated to 1-hour.

The typical floor assembly 6/A-500 (shown in Fig 1). CLT panels are spaced apart to allow for fire sprinkler and utility crossings over beams. This spacing creates a condition where the reinforced concrete slab is supported by a ³/₄" plywood, which is required to meet a 1-hour fire rating.



Figure 1: Proposed protection of concrete floor assembly

5 ASSEMBLY ANALYSIS

The concrete floor will be protected with 3/4" plywood on the bottom side for the 2 feet spanning between the CLT panels. Protection of the concrete assembly is summarized in Table 1 below.

ltem#	Protection Element	Note
Item #1	• 3" Concrete slab	Approximately 56 (interpolation from the data available in 2014 OSSC Table 722.2.2.1) see section 5.1 below
Item #2	• ³ ⁄ ₄ " Plywood flooring spanning between the CLT panels, beneath the concrete slab.	Approximately 20 minutes protection (NDS –see section 5.2)
	Total (60 mins. Minimum)	76 min (exceeds required)

Table 1: Summary of fire resistance

5.1 3" Concrete Slab Fire resistance

From the 2014 OSSC table 722.2.2.1, concrete slab of minimum 3.2 inches (thick) is required for 1 –hr fire resistance rating (see fig 2). By the linear interpolation method, 3 inch (thick) concrete slab will provide an approximate of 56 minutes fire resistance.

CONCRETE TYPE	FI	RE-RESIST	ANCE RA	TING (hou	rs)
CONCRETE TIPE	1	11/2	2	3	4
Siliceous	3.5	4.3	5	6.2	7
Carbonate	3.2	4	4.6	5.7	6.6
Sand-lightweight	2.7	3.3	3.8	4.6	5.4
Lightweight	2.5	3.1	3.6	4.4	5.1

Figure 2: Table 722.2.2.1, Minimum slab thickness

721.1(3)

3.2 inch = 60 minutes (1-hr) fire resistance.

 $3 \text{ inch} = \sim (60 \times 3) / 3.2$

3 inch = \sim 56 minutes fire resistance.

Therefore, the proposed 3 inch thick concrete slab on the east side of the 6 story building will provide approximately 56 minutes fire resistance.

5.2 ³/₄" Plywood

The fire resistance of wood is permitted by OSSC Section 722.1 to be calculated using Chapter 16 of ANSI/AF&PA *National Design Specification for Wood Construction (NDS).* The NDS specifies an effective char layer depth of 1.8" where 1-hour of fire resistance is required based on equation 16.2-1 shown in *Figure* 4. Table 16.2.1A of the NDS is reproduced below in **Figure** 4.



Figure 3: Equation 16.2-1 in the NDS

Table 16.2.1A	Effective Char Rates and Char Depths (for β_{n} = 1.5 in./hr.)		
Required Fire Endurance (hr.)	Effective Char Rate, β _{eff} (in./hr.)	Effective Char Depth, a _{char} (in.)	
1-Hour	1.8	1.8	
1 ¹ / ₂ -Hour	1.67	2.5	
2-Hour	1.58	3.2	

	Figure	4:	Table	16.2.1A	of	the	NDS
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NDS Calculation

Per Figure 3 and Figure 4, char rate calculation for ³/₄" plywood own below.

$$d_{char} = \beta_{eff} * t$$

 $\begin{array}{l} d_{char}- \mbox{ Char depth (in)} \\ \beta_{eff}- \mbox{ Effective char rate (in/hr)} \\ t- \mbox{ Exposure time (hr)} \end{array}$

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From the Fig 4, β_{eff} is considered as 1.8 (in/hr) and $\beta_{eff} = d_{char} / t$. As the thickness of plywood is $\frac{3}{4}$ ", the depth of char is assumed to be $\frac{3}{4}$ ".

$$\beta_{eff} = \frac{d_{char}}{t}$$

$$\frac{d_{char}}{t} = \frac{1.2 \ (\beta_n)}{t^{0.187}} \rightarrow (Eq \ 16.2 - 1)$$

$$\frac{\frac{3}{4}}{t} = \frac{1.8}{t^{0.187}}$$

$$t = 0.34 \ hr$$

$$t = 20 \ minutes.$$

From the NDS calculations, ³/₄" plywood provides approximately 20 minutes (0.34hr) fire endurance to the assembly.

6 CONCLUSION

We have evaluated the protection per 2014 OSSC Section 703.3 and 722. The 3" reinforced concrete slab is protected by CLT panels spaced 2 feet apart, the space between CLT is protected by a layer of 3/4" plywood. The Component Additive Method from OSSC 722 and NDS calculation confirms adequate protection through the protective materials.

As detailed above, the floor assembly protection achieves a minimum fire protection of 1-hour. By providing fire resistance on the lower side of the concrete slab, the proposed floor assembly will maintain a protection equivalent to the required 1-hour fire-resistance per 2014 OSSC Section 711.3.



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ENGINEERING JUDGEMENT REPORT

1-HOUR ROOF ASSEMBLY

Client Name: Hacker

Client Address: 733 SW Oak St #100, Portland, OR 97205

Date: 11/15/2017

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6	Conclusion	8

1 PROJECT OVERVIEW

This East site building is a 6-story office building in downtown Portland, Oregon. The building is of type III-A construction. Fire protection will be provided by automatic sprinklers and a fire alarm system. The roof construction is required to be 1-hour rated construction per OSSC Table 601.

Code Unlimited has been asked to evaluate the roof assembly for protection equivalent to a 1-hour per OSSC.

2 APPLICABLE CODES, STANDARDS, AND GUIDES

- 2014 Oregon Structural Specialty Code (OSSC)
- 2014 Oregon Fire Code (OFC)

3 APPROACH

- The proposed assembly has been analyzed in accordance with OSSC Chapter 7
- The protection of the proposed assembly has been compared to the requirements for OSSC Section 704
- Protection of the roof is analyzed by additive component and NDS char rate analysis method.

4 PROPOSED DESIGN

The 6-story office building has Cross-laminated timber panels as the roof framing. Per Table 601, the roof framing is required to be 1-hour rated. The roof rating requirement is met by 3" of concrete topping over the roof framing, which is composed of 3-layer CLT panels spaced apart 2'-0" and spanned by $\frac{3}{4}$ " plywood (similar to floor assembly). The roof framing is supported by glulam columns and beams which are rated to 1-hour. The typical roof assembly 14/A-500 (shown in Fig 1).

This EJ review is limited to the MEP chase detailed below.



Figure 1: Proposed protection of roof assembly

5 ASSEMBLY ANALYSIS

The roof will be protected with $\frac{3}{4}$ " plywood on bottom side for the 2 feet spanning between the CLT panels. Protection of the roof assembly is summarized in Table 1 below.

ltem#	Protection Element	Notes
Item #1	• 3" Concrete Slab	Approximately 56 (interpolation from the data available in 2014 OSSC Table 722.2.2.1) see section 5.1 below
Item #2	 ¾" Plywood spanning between the CLT panels, beneath the concrete slab. 	Approximately 20 minutes protection (NDS –see section 5.2)
Total (60 mins. Minimum)		76 min (exceeds required)

Table 1: Summary of fire resistance

5.1 3" Concrete Slab Fire resistance

From the 2014 OSSC table 722.2.2.1, concrete slab of minimum 3.2 inches (thick) is required for 1 –hr fire resistance rating (see fig 2). By the linear interpolation method, 3 inch (thick) concrete slab will provide an approximate of 56 minutes fire resistance.

CONCRETE TYPE	FIRE-RESISTANCE RATING (hours)				
	1	11/2	2	3	4
Siliceous	3.5	4.3	5	6.2	7
Carbonate	3.2	4	4.6	5.7	6.6
Sand-lightweight	2.7	3.3	3.8	4.6	5.4
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Figure 2: Table 722.2.2.1, Minimum slab thickness

3.2 inch = 60 minutes (1-hr) fire resistance.

 $3 \text{ inch} = \sim (60 \times 3) / 3.2$

3 inch = \sim 56 minutes fire resistance.

Therefore, the proposed 3 inch thick concrete slab on the east side of the 6 story building will provide approximately 56 minutes fire resistance.

5.2 ³/₄" Plywood

The fire resistance of wood is permitted by OSSC Section 722.1 to be calculated using Chapter 16 of ANSI/AF&PA *National Design Specification for Wood Construction (NDS).* The NDS specifies an effective char layer depth of 1.8" where 1-hour of fire resistance is required based on equation 16.2-1 shown in *Figure* 4. Table 16.2.1A of the NDS is reproduced below in **Figure** 4.



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2-Hour	1.58	3.2		

Figure 4: Table 16.2.1A of the NDS

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 $d_{char} = \beta_{eff} * t$

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From the Fig 4, β_{eff} is considered as 1.8 (in/hr) and $\beta_{eff} = d_{char}/t$. As the thickness of plywood is $\frac{3}{4}$ ", the depth of char is assumed to be $\frac{3}{4}$ ".

$$\beta_{eff} = \frac{d_{char}}{t}$$

$$\frac{d_{char}}{t} = \frac{1.2 \ (\beta_n)}{t^{0.187}} \rightarrow (Eq \ 16.2 - 1)$$

$$\frac{\frac{3}{4}}{t} = \frac{1.8}{t^{0.187}}$$

$$t = 0.34 \ hr$$

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From the NDS calculations, ³/₄" plywood provides approximately 20 minutes (0.34hr) fire endurance to the assembly.

6 CONCLUSION

We have evaluated the protection per 2014 OSSC Section. 703.3 and 722. The 3" reinforced concrete slab is protected by CLT panels spaced 2 feet apart, the space between CLT is protected by a layer of 3/4" plywood. The component additive method from OSSC 722 and char rate analysis from NDS guide confirms adequate protection through the protective materials.

As detailed above, the roof assembly protection achieves a minimum fire protection of 1-hour. By providing fire layers of fire resistance, the proposed roof assembly will maintain a protection equivalent to the required 1-hour fire-resistance per 2014 OSSC Section 711.3.

12-31-17 Expires

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TYPICAL WALL ASSEMBLY (6/A-521) AT WEST AND EAST EDGE OF BUILDING SCALE: 1-1/2" = 1'-0"



TYPICAL FLOOR ASSEMBLY (6/A-500) SCALE: 1-1/2" = 1'-0"



TYPICAL ROOF ASSEMBLY (11/A-500) SCALE: 1-1/2" = 1'-0"