Development Services

From Concept to Construction

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More Contact Info (http://www.portlandoregon.gov//bds/article/519984)

APPEAL SUMMARY

Status: Mixed Decision. Items 1 and 5: Hold for Additional Information. Items 2, 3 and 4: Decision Rendered.

Appeal ID: 21898	**Project Address:** 1725 SW Salmon St
Hearing Date: 9/18/19	**Appellant Name:** Artur Grochowski
Case No.: B-012	**Appellant Phone:** 5034457362
Appeal Type: Building	**Plans Examiner/Inspector:** Brian McCall, Joe Thornton, Corey Stanley
Project Type: commercial	**Stories:** 8 **Occupancy:** R-2 **Construction Type:** III-A, I-A
Building/Business Name: 18S	**Fire Sprinklers:** Yes - Full NFPA 13
Appeal Involves: Erection of a new structure	**LUR or Permit Application No.:** 19-106743-CO
Plan Submitted Option: pdf [File 1] [File 2] [File 3] [File 4] [File 5] [File 6] [File 7] [File 8] [File 9]	**Proposed use:** Mixed use multi-family housing

APPEAL INFORMATION SHEET

Appeal item 1

Code Section	2014 OSSC 703.3, 704.3 704.10
Requires	704.3 requires individual encasement for primary structural frame. 704.10 requires that load-bearing structural members in exterior walls of type IIIA construction be provided with 2-hr fire protection. 703.3 addresses alternative methods for determining fire resistance. The section allows that the fire resistance of a building element, component or assembly be established by any of the following methods: Fire resistance designs documented in sources. Prescriptive designs of fire-resistance-rated building elements, components, or assemblies as prescribed in section 721. Calculations in accordance with Section 722. Engineering analysis based on a comparison of building element, component or assemblies designs having fire-resistance ratings as determined by the test procedures set forth in ASTM E119 or UL 263 Alternative protection methods as allowed by section 104.11.
Proposed Design	The building design is comprised of type IIIA wood construction over a type IA concrete podium and is protected by a full NFPA 13 sprinkler system. In limited areas in the IIIA construction steel structural members are utilized in and supporting 2-hr rated exterior walls. Per table 601 and section 704.10 these members require 2-hr fire protection. The fire protection is provided by intumescent fireproofing.

	For HSS and wide flange beams intumescent fireproofing is being used to meet the 2-hr protection requirements of 704.3 and 704.10. Listed assemblies for steel columns are being utilized to determine the intumescent coating thickness for beams. Refer to exhibit 1.A for project details of the conditions in question. Refer to exhibit 1.B for supporting documentation from the manufacturer showing application thicknesses to achieve 2-hr protection for corresponding steel member types. Refer to the attached tested assemblies for design 180-2 for wide flange columns and 180-3 for HSS columns.
Reason for alternative	Neither standard UL encasement assemblies, nor standard UL assemblies for intumescent fire protection are available for HSS and wide flange beams integrated into wood construction. As a conservative measure, the proposed design uses listed column assemblies for intumescent coating at these beams. Fire testing for columns assumes fire exposure on all sides, where testing for beams assumes some protection or heat sink provided by the floor assembly above. In terms of structural loading, columns are considered a worst-case situation for vulnerability to failure in a fire. As a result, the prescribed thickness of intumescent coating is greater for listed column designs than for beams. For the beams in question here, the documentation in exhibit 1.B establishes a conservative approach to equivalence to standard UL listed assemblies by utilizing column designs for beams. Using this approach, the proposed intumescent fireproofing design provides equivalent if not greater protection for the steel members.

Appeal item 2

Code Section	2014 OSSC 703.3, 704.3 704.10
Requires	704.3 requires individual encasement for primary structural frame. 704.10 requires that load-bearing structural members in exterior walls of type IIIA construction be provided with 2-hr fire protection. COP Guidance 19.02 – Calculated fire protection of wood columns, beams, and solid wood decking. (See exhibit 0.A)
Proposed Design	The building design is comprised of type IIIA wood construction over a type IA concrete podium and is protected by a full NFPA 13 sprinkler system. In limited areas in the IIIA construction wood posts are supporting 2-hr rated beams. Per table 601 and section 704.10 these members require 2-hr fire protection. The fire protection is provided by additional gypsum and an analysis as signed by the architect. This is per path 3 of Guidance 19-02. Please see exhibit 2.A for proposed detail and supporting analysis.
Reason for alternative	Standard UL encasement assemblies are only provided for steel columns. As no UL assemblies exist for wood columns, this appeal proposes using a calculated analysis per City of Portland guidance 19-02.

Appeal item 3

Code Section	2014 OSSC 703.3, 704.3 704.10
Requires	704.3 requires individual encasement for primary structural frame. 704.10 requires that load-bearing structural members in exterior walls of type IIIA construction be provided with 2-hr fire protection.

	COP Guidance 19.02 – Calculated fire protection of wood columns, beams, and solid wood decking. (See exhibit 0.A)
Proposed Design	Proposed Design: (Describe the alternate methods or materials of construction to be used or that exist. Be as specific as possible) The building design is comprised of type IIIA wood construction over a type IA concrete podium and is protected by a full NFPA 13 sprinkler system. As part of a building feature in the IIIA construction, a glulam beam is proposed supporting 2-hr rated construction. Per table 601 and section 704.10 this member requires 2-hr fire protection. The fire protection is provided by an analysis as signed by the architect. This is per path 3 of Guidance 19-02. Please see exhibit 0.B for beam location and exhibit 3.A for proposed detail and supporting analysis.
Reason for alternative	Standard UL encasement assemblies are only provided for steel columns. As no UL assemblies exist for glulam beams, this appeal proposes using a calculated analysis per City of Portland guidance 19-02.

Appeal item 4

Code Section	2014 OSSC 703.3, 704.3 704.10
Requires	704.3 requires individual encasement for primary structural frame. 704.10 requires that load-bearing structural members in exterior walls of type IIIA construction be provided with 2-hr fire protection. COP Guidance 19.02 – Calculated fire protection of wood columns, beams, and solid wood decking. (See exhibit 0.A)
Proposed Design	The building design is comprised of type IIIA wood construction over a type IA concrete podium and is protected by a full NFPA 13 sprinkler system. As part of a building feature in the IIIA construction, a glulam beam is proposed supporting 2-hr rated construction. Per table 601 and section 704.10 this member requires 2-hr fire protection. The fire protection is provided by an analysis as signed by the architect. This is per path 3 of Guidance 19-02. Please see exhibit 0.B for beam location and exhibit 4.A for proposed detail and supporting analysis.
Reason for alternative	Standard UL encasement assemblies are only provided for steel columns. As no UL assemblies exist for glulam beams, this appeal proposes using a calculated analysis per City of Portland guidance 19-02.

Appeal item 5

Code Section	2014 OSSC 703.3, 704.3 704.10
Requires	704.3 requires individual encasement for primary structural frame. 704.10 requires that load-bearing structural members in exterior walls of type IIIA construction be provided with 2-hr fire protection.
Proposed Design	The building design is comprised of type IIIA wood construction over a type IA concrete podium and is protected by a full NFPA 13 sprinkler system. As part of a building feature in the IIIA

	construction, a glulam beam connects to a 4x4 HSS and is proposed supporting 2-hr rated construction. Per table 601 and section 704.10 both elements and their connection requires 2-hr fire protection. The protection of the 4x4 HSS is described in item 1 of this appeal. The protection of the glulam beam is described in item 4 of this appeal. The required fire protection of the connection is provided per exhibit 5.A. Please see exhibit 0.B for connection location.
Reason for alternative	Standard UL encasement assemblies are not provided for connections of differing systems. As no UL assemblies exist for this condition, this appeal proposes using the protection provided by the structural members themselves to provide protection for the connection.

APPEAL DECISION

1. Alternate 2 hour fire rated beam assemblies: Hold for additional information.

2. Alternate 2 hour fire rated column assembly: Granted as proposed.

3. Alternate 2 hour glulam beam assembly: Granted provided char calculations are verified as part of plan review.

4. Alternate 2 hour glu-lam beam assembly: Granted provided char calculations are verified as part of plan review.

5. Alternate 2 hour fire rated glulam beam connection: Hold for additional information.

Appellant may contact Corey Stanley (971 291-8919) with questions.

The Administrative Appeal Board finds with the conditions noted, 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.

Bureau of Development Services FROM CONCEPT TO CONSTRUCTION

BUILDING OFFICIAL DETERMINATION

19-02: Calculated fire protection of wood columns, beams, and solid wood decking
2014 OSSC 703.3, 722.1 and 2018 NDS Technical Report No. 10

QUESTION: What options are available for determining the fire protection rating of wood columns, beams, and solid wood decking without requiring an approved appeal?

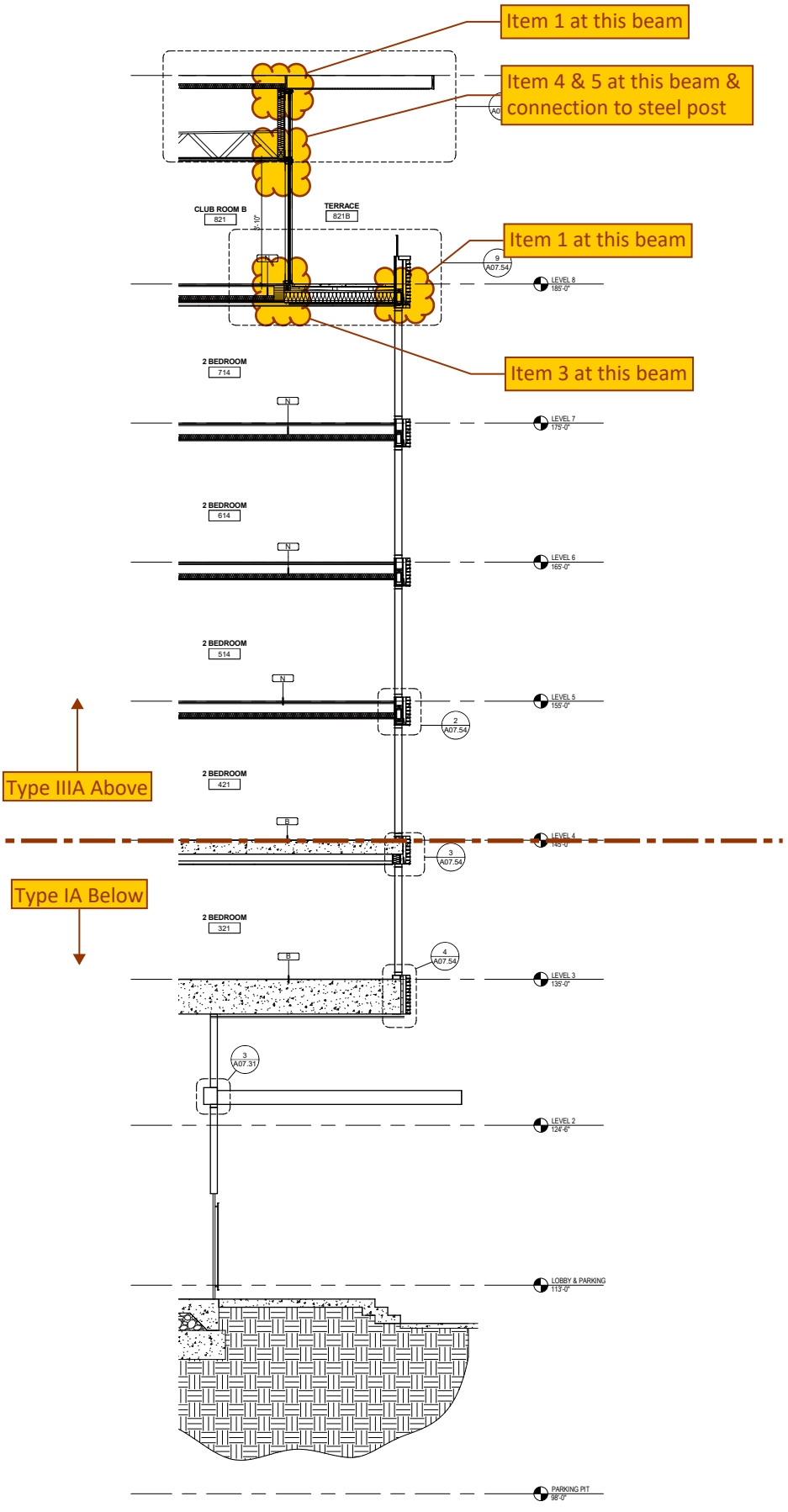
RESPONSE: These options are applicable to fully exposed, partially exposed, and concealed wood structural members in structures governed by the OSSC and ORSC.

1. Provide char calculation to confirm fire protection of wood beams, columns, and decking per 2018 NDS Technical Report No. 10 and shall include mass loss and structural calculations. Wood decking may require an additional smoke seal to be included as part of the evaluation.
2. Add layers of 5/8" Type X gyp board directly to the solid, laminated (e.g. glulam), or composite (e.g. 3 2x12's) beams and posts for 30 minutes of fire protection per layer up to 1-hour.
3. Provide an analysis of fire protection for up to 2 hours achieved by adding layers of gypsum combined with char calculation times following the methods in 2018 NDS Technical Report No. 10 signed by a licensed structural engineer, fire protection engineer, or architect.

Change History:

Effective Date	Significant Changes	Employee Name
3/29/2019	Implementation	Terry Whitehill

APPEAL EXHIBIT 0.B - OVERALL SECTION

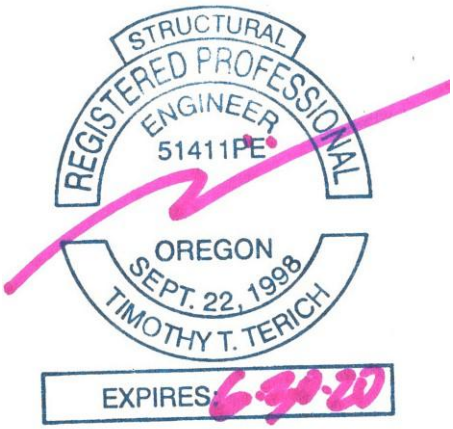


1 SECTION - SW CORNER
1/4" = 1'-0"

Supplementary Structural Calculations
For
18s

Portland, Oregon
Sera Architects

September 13, 2019
Job Number – 18-T066



FROELICH
ENGINEERS

*** * * LIMITATIONS * * ***

ENGINEERING DESIGN IS BASED UPON INFORMATION PROVIDED BY THE CLIENT, WHO IS SOLELY RESPONSIBLE FOR ACCURACY OF SAME. NO RESPONSIBILITY AND / OR LIABILITY IS ASSUMED BY, OR IS TO BE ASSIGNED TO THE ENGINEER FOR ITEMS BEYOND THAT SHOWN ON THESE SHEETS.

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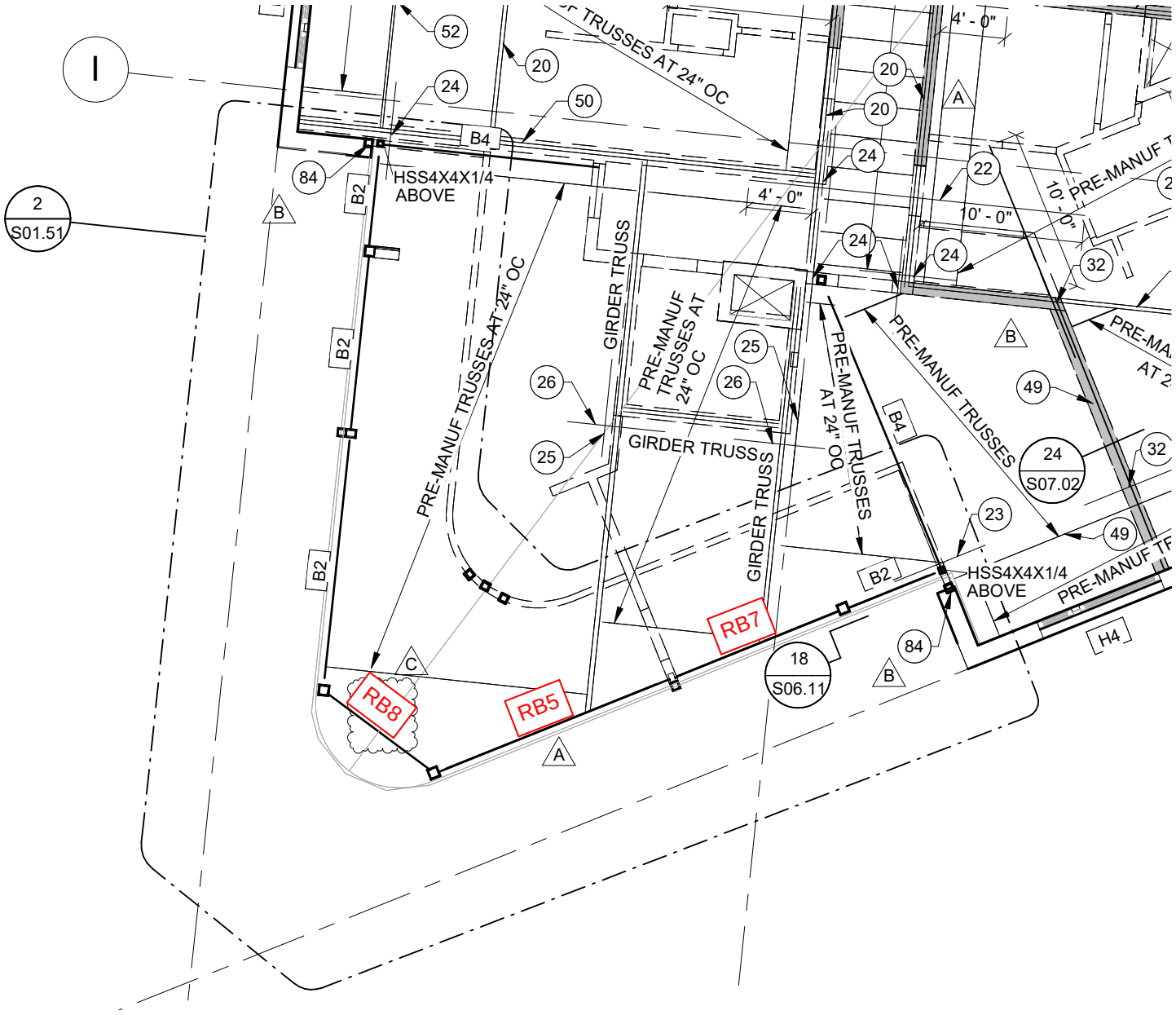
FROELICH
ENGINEERS

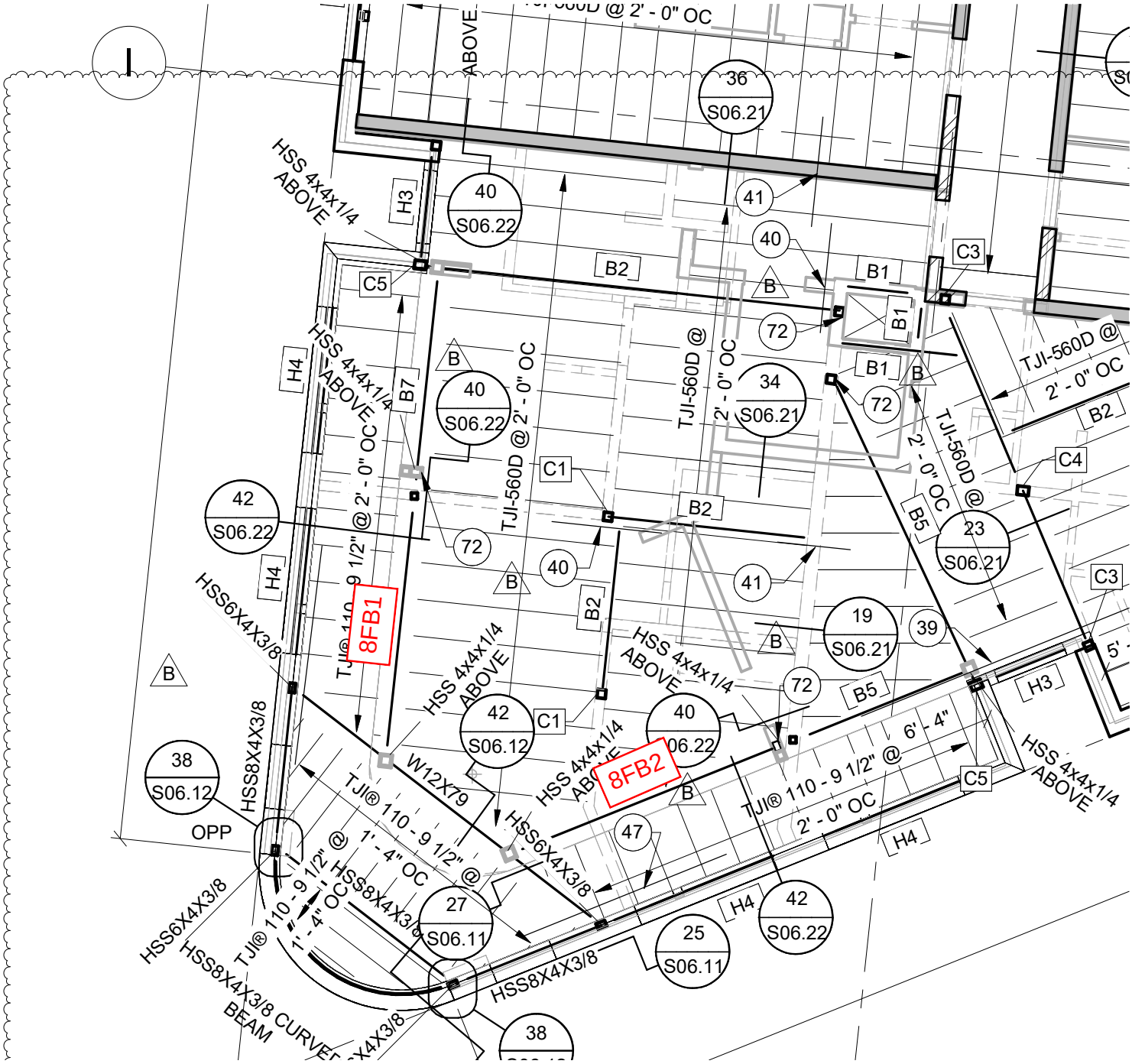
Scope of Work

Client: SERA
Project: 18S
Project Number: 18-T066
Date: September 13, 2019
By: SPD

Scope of Work:

Froelich Engineers, Inc. (FE) has provided supplementary structural calculations for the fire protection of the exterior glulam headers. These beams have been designed to char 1" on both side and will receive a minimum of (1) additional sacrificial lamination of 1 ½" tension lam under the beam.


I
2
S01.51
52
20
24
50
B4
84
B2
HSS4X4X1/4
ABOVE
B
PRE-MANUF TRUSSES AT 24" OC
GIRDER TRUSS
PRE-MANUF TRUSSES AT 24" OC
4' - 0"
10' - 0"
22
32
25
26
49
24
S07.02
23
RB7
RB8
RB5
C
A
18
S06.11
H4


8FB1
8FB2
W12X79
HSS8X4X3/8
HSS6X4X3/8
HSS 4x4x1/4 ABOVE
TJI® 110 - 9 1/2" @ 2' - 0" OC
TJI® 110 - 9 1/2" @ 1' - 4" OC
TJI-560D @ 2' - 0" OC
HSS8X4X3/8 CURVED BEAM
OPP
B1
B2
B5
C1
C3
C4
C5
H3
H4
B7
36 S06.21
40 S06.22
41
72
34 S06.21
23 S06.21
19 S06.21
39
42 S06.22
42 S06.12
38 S06.12
27 S06.11
25 S06.11
47

FROELICH ENGINEERS
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940 Kimbark St. Suite 3
Longmont, Colorado 80501
720-799-1001

CLIENT:

PROJECT:

NUMBER:

DATE:

BY:

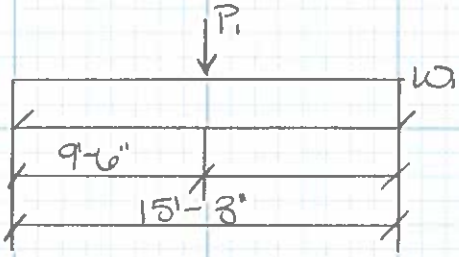
UPDATED EXTERIOR BEAM CALCULATIONS

RB5

SPAN = 15'-3"

P_1 = DL = 26931lb (GIRDER TRUSS)
LL = 5731lb
SL = 3919lb

W_1 DL = 20psf (10'-6")
SL = 25psf (10'-6")



∴ USE 10 3/4 X 13 1/2 GL
RAN AS 8 3/4 X 12 GL FOR CHAR RATING
SEE ATTACHED CALCS

RB7

SPAN = 10'-9"

P_1: DL = 1458x1lb
LL = 2521lb
SL = 2686lb
WL = 558 lb

W_1: DL = 20psf (10'-6")
SL = 25psf (10'-6")

∴ USE 5 1/2 X 13 1/2 GL
RAN AS 3 1/2 x 11 7/8 GL FOR CHAR RATING
SEE ATTACHED CALCS

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720-799-1001

CLIENT:

PROJECT:

NUMBER:

DATE:

BY:

FB8

SPAN: 8'-6"

w_1 DL = 20psf (8ft - 0.75ft)
SL = 25psf (8ft - 0.75ft)

∴ USE 5 1/2 X 13 1/2 GL

RAN AS 3 1/2 x 11 7/8 GL FOR CHAR RATING
SEE ATTACHED CALCS

SFB1

SPAN: 14'-0"

w_1 DL = 29psf (8'-8")
LL = 100psf (8'-8")

∴ USE 8 3/4 X 13 1/2 GL

RAN AS 6 3/4 X 12 GL FOR CHAR RATING
SEE ATTACHED CALCS

SFB2

CASE 1

P_1 DL = 3660lb
SL = 602lb
WL = 2162lb

P_2 DL = 5373lb
SL = 7,200lb
WL = 2861b
LL = 4791b

w_1 DL = 29psf (8'-8")
LL = 100psf (8'-8")

∴ USE 10 3/4 X 13 1/2 GL

RAN AS 8 3/4 X 12 GL FOR CHAR RATING
SEE ATTACHED CALCS

CASE 2

P_1 DL = 3660lb
SL = 602lb
WL = 13,030lb

LOAD @ PARAPET LEVEL

P_2 DL = 5373lb
SL = 722lb
WL = 2861b
LL = 4791b

LOAD @ ROOF LEVEL

w_1 DL = 29 (8'-8")
LL = 100psf (8'-8")

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
	Sep. 14, 2019 08:04	RB5

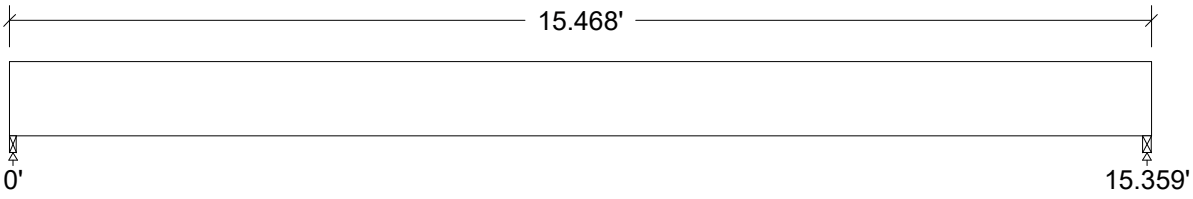
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Dead	Full Area				20.00(10.50')		psf
Load2	Snow	Full Area				25.00(10.50')		psf
Load3	Dead	Point		9.60		2693		lbs
Load4	Snow	Point		9.60		3919		lbs
Load5	Live	Point		9.60		573		lbs
Self-weight	Dead	Full UDL				24.2		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:			
Dead	2827		3485
Live	217		356
Snow	3511		4468
Factored:			
Total	6338		7953
Bearing:			
Capacity			
Beam	6592		8272
Support	6338		7953
Des ratio			
Beam	0.96		0.96
Support	1.00		1.00
Load comb	#4		#4
Length	1.16		1.45
Min req'd	1.16**		1.45**
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.00		1.00
Fcp sup	625		625

**Minimum bearing length governed by the required width of the supporting member.

Glulam-Bal., West Species, 24F-1.8E WS, 8-3/4"x12"

8 laminations, 8-3/4" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 15.47'; Clear span: 15.25'; volume = 11.3 cu.ft.
Lateral support: top= at supports, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 106	Fv' = 305	psi	fv/Fv' = 0.35
Bending(+)	fb = 2152	Fb' = 2699	psi	fb/Fb' = 0.80
Live Defl'n	0.35 = L/523	0.51 = L/360	in	0.69
Total Defl'n	0.62 = L/295	0.77 = L/240	in	0.81

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
	Sep. 13, 2019 16:29	RB7

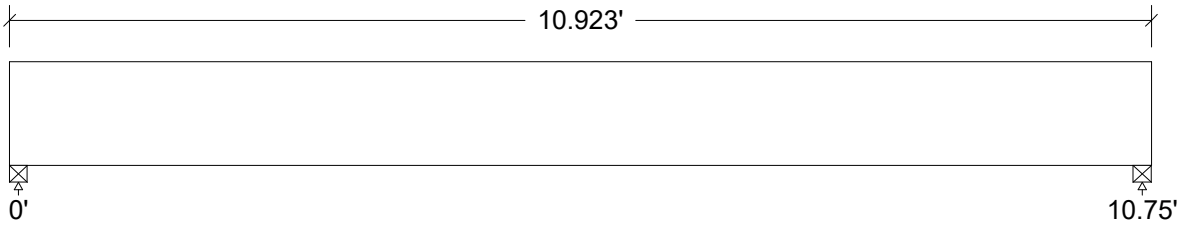
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Dead	Full Area				20.00(10.50')		psf
Load2	Snow	Full Area				25.00(10.50')		psf
Load3	Dead	Point		5.59		1488		lbs
Load4	Snow	Point		5.59		2686		lbs
Load5	Live	Point		5.59		252		lbs
Load6	Wind	Point		5.59		585		lbs
Self-weight	Dead	Full UDL				9.6		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:			
Dead	1925		1960
Live	123		129
Snow	2745		2808
Wind	286		299
Factored:			
Total	4670		4768
Bearing:			
Capacity			
Beam	4670		4768
Support	4972		5076
Des ratio			
Beam	1.00		1.00
Support	0.94		0.94
Load comb	#6		#6
Length	2.05		2.10
Min req'd	2.05		2.10
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

Glulam-Unbal., West Species, 24F-1.8E WS, 3-1/2"x11-7/8"

8 laminations, 3-1/2" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 10.92'; Clear span: 10.577'; volume = 3.2 cu.ft.
Lateral support: top= at supports, bottom= at supports;

This section FAILS the design check

WARNING: This section violates the following design criteria: Bending

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design	
Shear	fv = 152	Fv' = 305	psi	fv/Fv' = 0.50	
Bending(+)	fb = 2651	Fb' = 2567	psi	fb/Fb' = 1.03	okay
Live Defl'n	0.23 = L/570	0.36 = L/360	in	0.63	
Total Defl'n	0.45 = L/285	0.54 = L/240	in	0.84	

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	6
Fb'+	2400	1.15	1.00	1.00	0.930	1.000	1.00	1.00	1.00	1.00	-	6
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	6
Eminy'	0.85 million		1.00	1.00	-	-	-	-	1.00	-	-	6

CRITICAL LOAD COMBINATIONS:

Shear : LC #6 = D+S, V max = 4727, V design = 4208 lbs

Bending(+): LC #6 = D+S, M = 18171 lbs-ft

Deflection: LC #6 = D+S (live)

LC #6 = D+S (total)

D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake

All LC's are listed in the Analysis output

Load combinations: ASCE 7-10 / IBC 2015

CALCULATIONS:

Deflection: EI = 879e06 lb-in2

"Live" deflection = Deflection from all non-dead loads (live, wind, snow…)

Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.

Lateral stability(+): Lu = 10.75' Le = 20.50' RB = 15.4

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2015), the National Design Specification (NDS 2015), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2015 and manufactured in accordance with ANSI A190.1-2012
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
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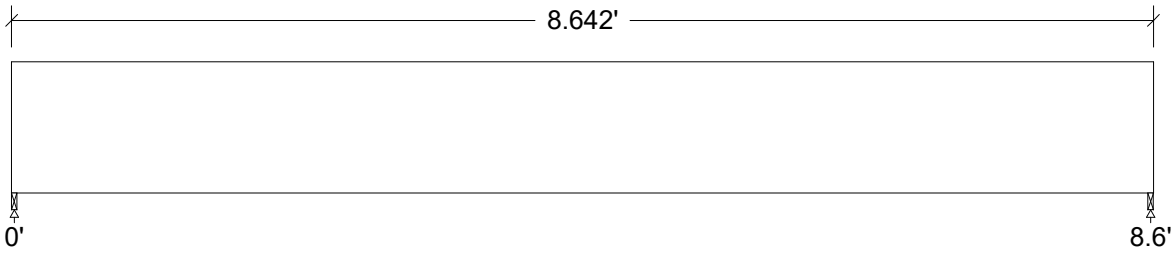
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Snow	Trapezoidal		0.02	8.52	200.0	18.8	plf
Load2	Dead	Trapezoidal		0.02	8.52	160.0	15.0	plf
Self-weight	Dead	Full UDL				9.6		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:			
Dead	519		307
Snow	597		333
Factored:			
Total	1116		640
Bearing:			
Capacity			
Beam	1137		1137
Support	1211		1211
Des ratio			
Beam	0.98		0.56
Support	0.92		0.53
Load comb	#2		#2
Length	0.50*		0.50*
Min req'd	0.50*		0.50*
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.11		1.11
Fcp sup	625		625

*Minimum bearing length setting used: 1/2" for end supports

Glulam-Unbal., West Species, 24F-1.8E WS, 3-1/2"x11-7/8"

8 laminations, 3-1/2" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 8.64'; Clear span: 8.558'; volume = 2.5 cu.ft.
Lateral support: top= at supports, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 28	Fv' = 305	psi	fv/Fv' = 0.09
Bending(+)	fb = 281	Fb' = 2624	psi	fb/Fb' = 0.11
Live Defl'n	0.02 = <L/999	0.29 = L/360	in	0.05
Total Defl'n	0.04 = <L/999	0.43 = L/240	in	0.08

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
	Sep. 14, 2019 08:08	8FB1

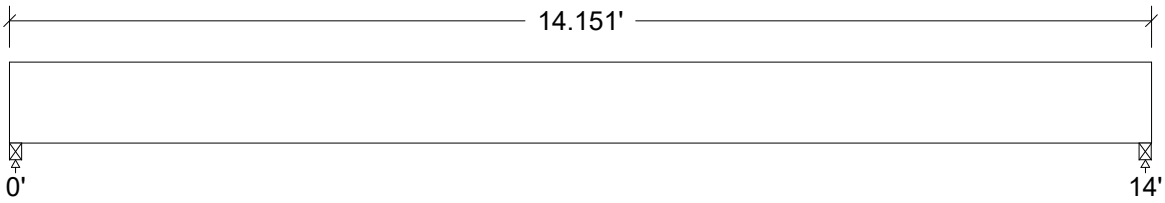
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Dead	Full Area				29.00(8.25')		psf
Load2	Live	Full Area				100.00(8.25')		psf
Self-weight	Dead	Full UDL				18.6		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:			
Dead	1823		1823
Live	5837		5837
Factored:			
Total	7661		7661
Bearing:			
Capacity			
Beam	7967		7967
Support	7661		7661
Des ratio			
Beam	0.96		0.96
Support	1.00		1.00
Load comb	#2		#2
Length	1.82		1.82
Min req'd	1.82**		1.82**
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.00		1.00
Fcp sup	625		625

**Minimum bearing length governed by the required width of the supporting member.

Glulam-Unbal., West Species, 24F-1.8E WS, 6-3/4"x12"

8 laminations, 6-3/4" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 14.15'; Clear span: 13.849'; volume = 8.0 cu.ft.
Lateral support: top= at supports, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv = 119	Fv' = 265	psi	fv/Fv' = 0.45
Bending(+)	fb = 1965	Fb' = 2372	psi	fb/Fb' = 0.83
Live Defl'n	0.41 = L/412	0.47 = L/360	in	0.87
Total Defl'n	0.60 = L/280	0.70 = L/240	in	0.86

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
	Sep. 14, 2019 08:11	8FB2 - Case 1

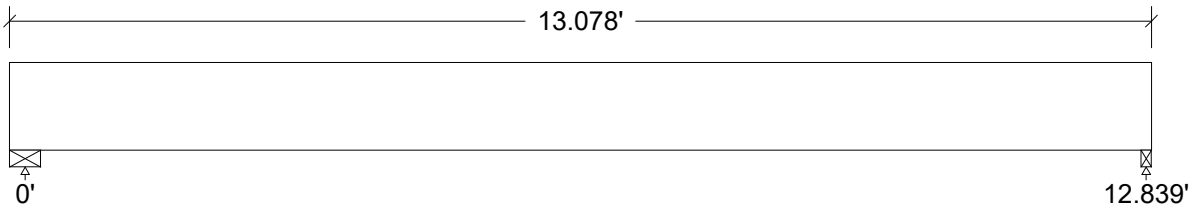
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Dead	Full Area				29.00(8.25')		psf
Load2	Live	Full Area				100.00(8.25')		psf
Load3	Dead	Point		1.25		3660		lbs
Load4	Dead	Point		1.25		5373		lbs
Load5	Live	Point		1.25		479		lbs
Load6	Snow	Point		1.25		6020		lbs
Load7	Snow	Point		1.25		7220		lbs
Load8	Wind	Point		1.25		-21620		lbs
Load9	Wind	Point		1.25		286		lbs
Self-weight	Dead	Full UDL				24.2		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:			
Dead	10014		2459
Live	5883		5385
Snow	12136		1104
Wind	-19554		-1779
Factored:			
Uplift	-5725		
Total	23528		7844
Bearing:			
Capacity			
Beam	24469		8158
Support	23528		7844
Des ratio			
Beam	0.96		0.96
Support	1.00		1.00
Load comb	#3		#2
Length	4.30		1.43
Min req'd	4.30**		1.43**
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.00		1.00
Fcp sup	625		625

**Minimum bearing length governed by the required width of the supporting member.

Glulam-Unbal., West Species, 24F-1.8E WS, 8-3/4"x12"

8 laminations, 8-3/4" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 13.08'; Clear span: 12.6'; volume = 9.5 cu.ft.
Lateral support: top= at supports, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv* = 292	Fv' = 305	psi	fv*/Fv' = 0.96
Bending(+)	fb = 1589	Fb' = 2386	psi	fb/Fb' = 0.67
Bending(-)	fb = 354	Fb' = 2307	psi	fb/Fb' = 0.15
Live Defl'n	0.25 = L/609	0.43 = L/360	in	0.59
Total Defl'n	0.47 = L/325	0.64 = L/240	in	0.74

*The effect of point loads within a distance d of the support has been included as per NDS 3.4.3.1

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	3
Fb'+	2400	1.00	1.00	1.00	0.994	0.996	1.00	1.00	1.00	1.00	-	2
Fb'-	1450	1.60	1.00	1.00	0.994	1.000	1.00	1.00	1.00	1.00	-	8
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	3
Eminy'	0.85 million		1.00	1.00	-	-	-	-	1.00	-	-	3

Only the lesser of CL and CV is applied, as per NDS 5.3.6

CRITICAL LOAD COMBINATIONS:

Shear : LC #3 = D+.75(L+S), V max = 23374, V design* = 20420 lbs

Bending(+): LC #2 = D+L, M = 27808 lbs-ft

Bending(-): LC #8 = .6D+.6W, M = 6187 lbs-ft

Deflection: LC #3 = D+.75(L+S) (live)

LC #3 = D+.75(L+S) (total)

D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake

All LC's are listed in the Analysis output

Load combinations: ASCE 7-10 / IBC 2015

CALCULATIONS:

Deflection: EI = 2268e06 lb-in2

"Live" deflection = Deflection from all non-dead loads (live, wind, snow…)

Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.

Lateral stability(+): Lu = 12.81' Le = 23.94' RB = 6.7; Lu based on full length

Lateral stability(-): Lu = 12.81' Le = 23.94' RB = 6.7; Lu based on full length

Design Notes:

1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2015), the National Design Specification (NDS 2015), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2015 and manufactured in accordance with ANSI A190.1-2012
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

WoodWorks® SOFTWARE FOR WOOD DESIGN	COMPANY	PROJECT
	Sep. 14, 2019 08:10	8FB2 - Case 2

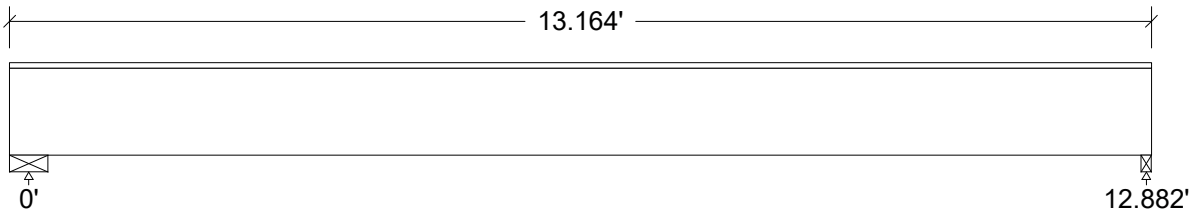
Design Check Calculation Sheet

WoodWorks Sizer 11.1

Loads:

Load	Type	Distribution	Pat-tern	Location [ft] Start	End	Magnitude Start	End	Unit
Load1	Dead	Full Area				29.00(8.25')		psf
Load2	Live	Full Area				100.00(8.25')		psf
Load3	Dead	Point		1.25		3660		lbs
Load4	Dead	Point		1.25		5373		lbs
Load5	Live	Point		1.25		479		lbs
Load6	Snow	Point		1.25		6020		lbs
Load7	Snow	Point		1.25		7220		lbs
Load8	Wind	Point		1.25		13030		lbs
Load9	Wind	Point		1.25		286		lbs
Self-weight	Dead	Full UDL				24.2		plf

Maximum Reactions (lbs), Bearing Capacities (lbs) and Bearing Lengths (in) :



Unfactored:			
Dead	10062		2432
Live	5938		5401
Snow	12184		1056
Wind	12254		1062
Factored:			
Total	29168		7833
Bearing:			
Capacity			
Beam	30334		8146
Support	29168		7833
Des ratio			
Beam	0.96		0.96
Support	1.00		1.00
Load comb	#4		#2
Length	5.33		1.43
Min req'd	5.33**		1.43**
Cb	1.00		1.00
Cb min	1.00		1.00
Cb support	1.00		1.00
Fcp sup	625		625

**Minimum bearing length governed by the required width of the supporting member.

Glulam-Unbal., West Species, 24F-1.8E WS, 8-3/4"x12"

8 laminations, 8-3/4" maximum width,
Supports: All - Timber-soft Beam, D.Fir-L No.2
Total length: 13.16'; Clear span: 12.6'; volume = 9.6 cu.ft.
Lateral support: top= full, bottom= at supports;

Analysis vs. Allowable Stress and Deflection using NDS 2015 :

Criterion	Analysis Value	Design Value	Unit	Analysis/Design
Shear	fv* = 271	Fv' = 305	psi	fv*/Fv' = 0.89
Bending(+)	fb = 1585	Fb' = 2389	psi	fb/Fb' = 0.66
Live Defl'n	0.30 = L/512	0.43 = L/360	in	0.70
Total Defl'n	0.52 = L/297	0.64 = L/240	in	0.81

*The effect of point loads within a distance d of the support has been included as per NDS 3.4.3.1

Additional Data:

FACTORS:	F/E(psi)	CD	CM	Ct	CL	CV	Cfu	Cr	Cfrt	Notes	Cn*Cvr	LC#
Fv'	265	1.15	1.00	1.00	-	-	-	-	1.00	1.00	1.00	3
Fb'+	2400	1.00	1.00	1.00	1.000	0.995	1.00	1.00	1.00	1.00	-	2
Fcp'	650	-	1.00	1.00	-	-	-	-	1.00	-	-	-
E'	1.8 million		1.00	1.00	-	-	-	-	1.00	-	-	4
Eminy'	0.85 million		1.00	1.00	-	-	-	-	1.00	-	-	4

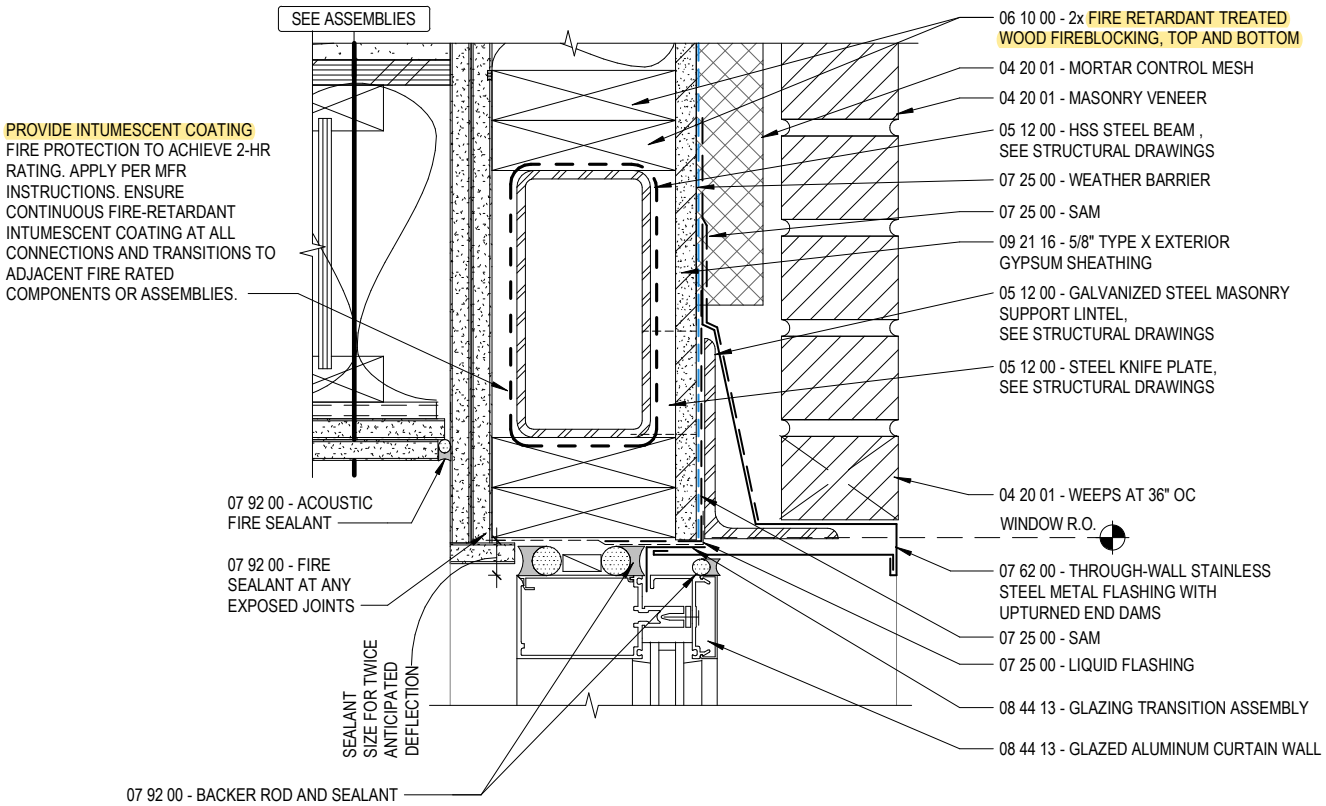
CRITICAL LOAD COMBINATIONS:
Shear : LC #3 = D+.75(L+S), V max = 23463, V design* = 18939 lbs
Bending(+): LC #2 = D+L, M = 27729 lbs-ft
Deflection: LC #4 = D+.75(L+S+.6W) (live)
LC #4 = D+.75(L+S+.6W) (total)
D=dead L=live S=snow W=wind I=impact Lr=roof live Lc=concentrated E=earthquake
All LC's are listed in the Analysis output
Load combinations: ASCE 7-10 / IBC 2015

CALCULATIONS:
Deflection: EI = 2268e06 lb-in2
"Live" deflection = Deflection from all non-dead loads (live, wind, snow…)
Total Deflection = 1.50(Dead Load Deflection) + Live Load Deflection.

Design Notes:

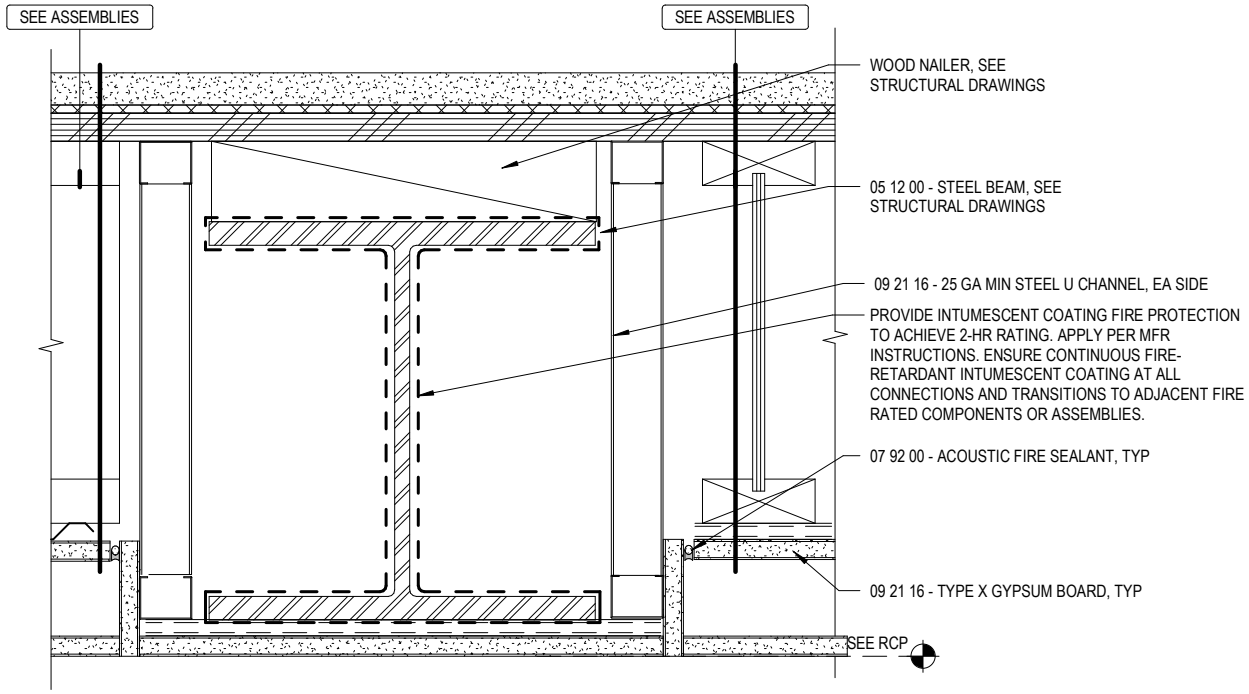
1. WoodWorks analysis and design are in accordance with the ICC International Building Code (IBC 2015), the National Design Specification (NDS 2015), and NDS Design Supplement.
2. Please verify that the default deflection limits are appropriate for your application.
3. Glulam design values are for materials conforming to ANSI 117-2015 and manufactured in accordance with ANSI A190.1-2012
4. GLULAM: bxd = actual breadth x actual depth.
5. Glulam Beams shall be laterally supported according to the provisions of NDS Clause 3.3.3.
6. GLULAM: bearing length based on smaller of Fcp(tension), Fcp(comp'n).

APPEAL EXHIBIT 1.A - INTUMESCENT FILM
18S - 19-106743-000-00-CO



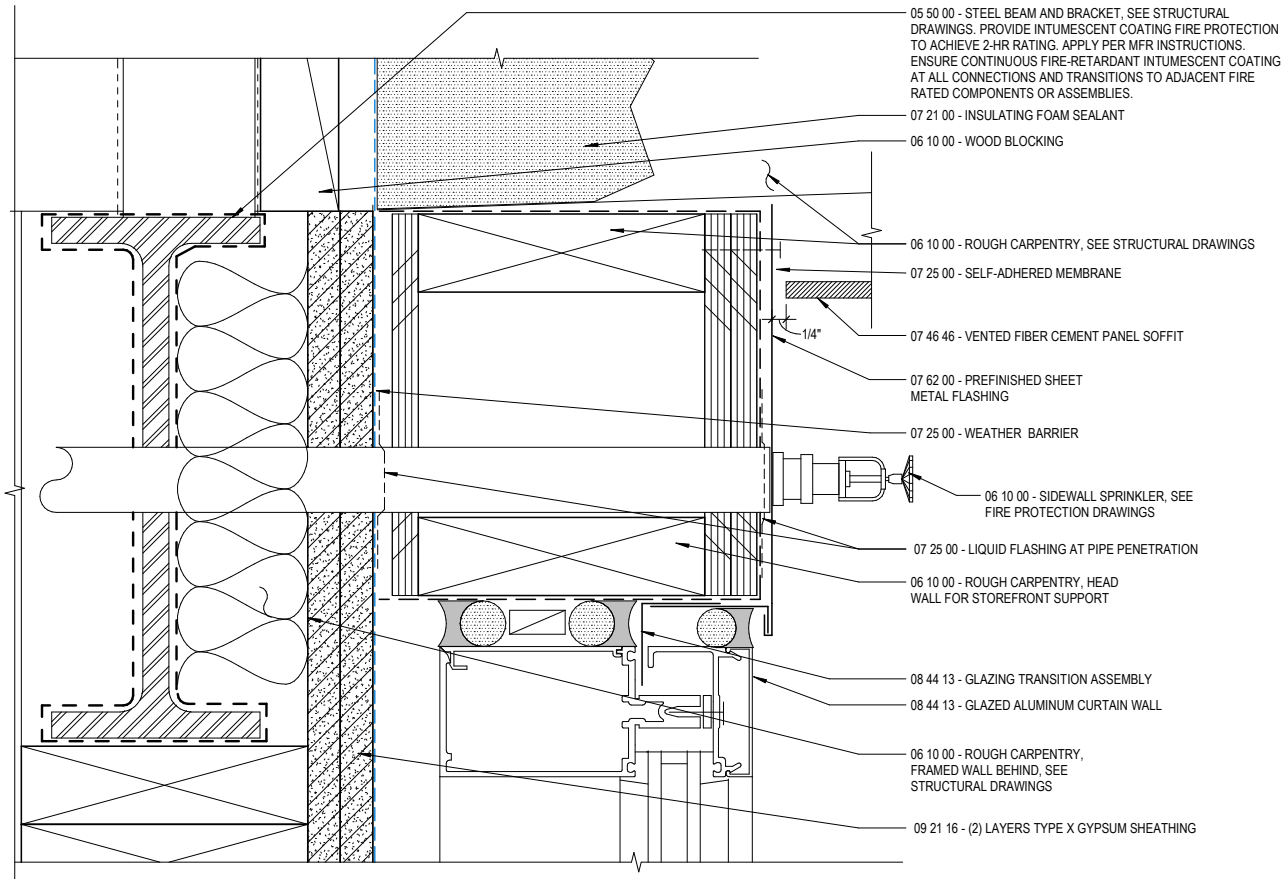
2 BRICK SUPPORT AT SW CORNER (WOOD)

NTS



8 2-HR STEEL BEAM PROTECTION

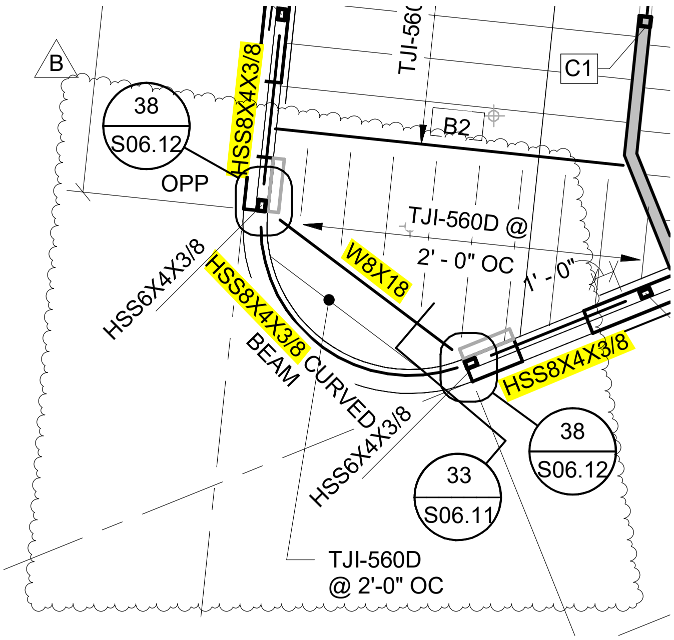
NTS



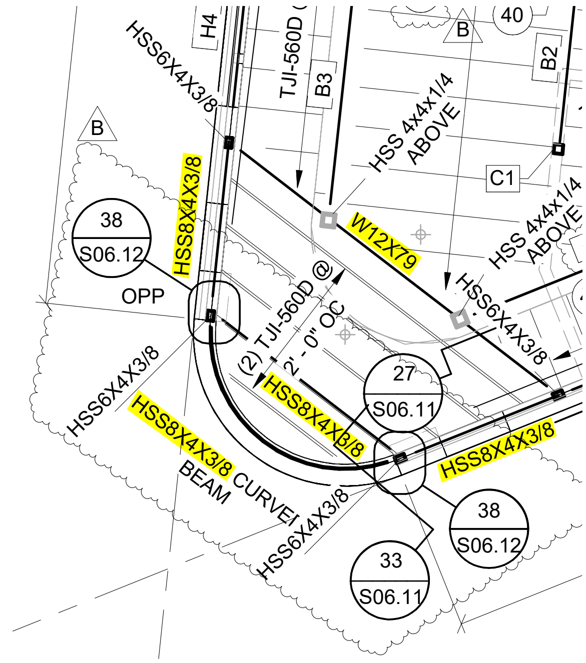
4 SPANDREL HEAD AT CLUB ROOM

NTS

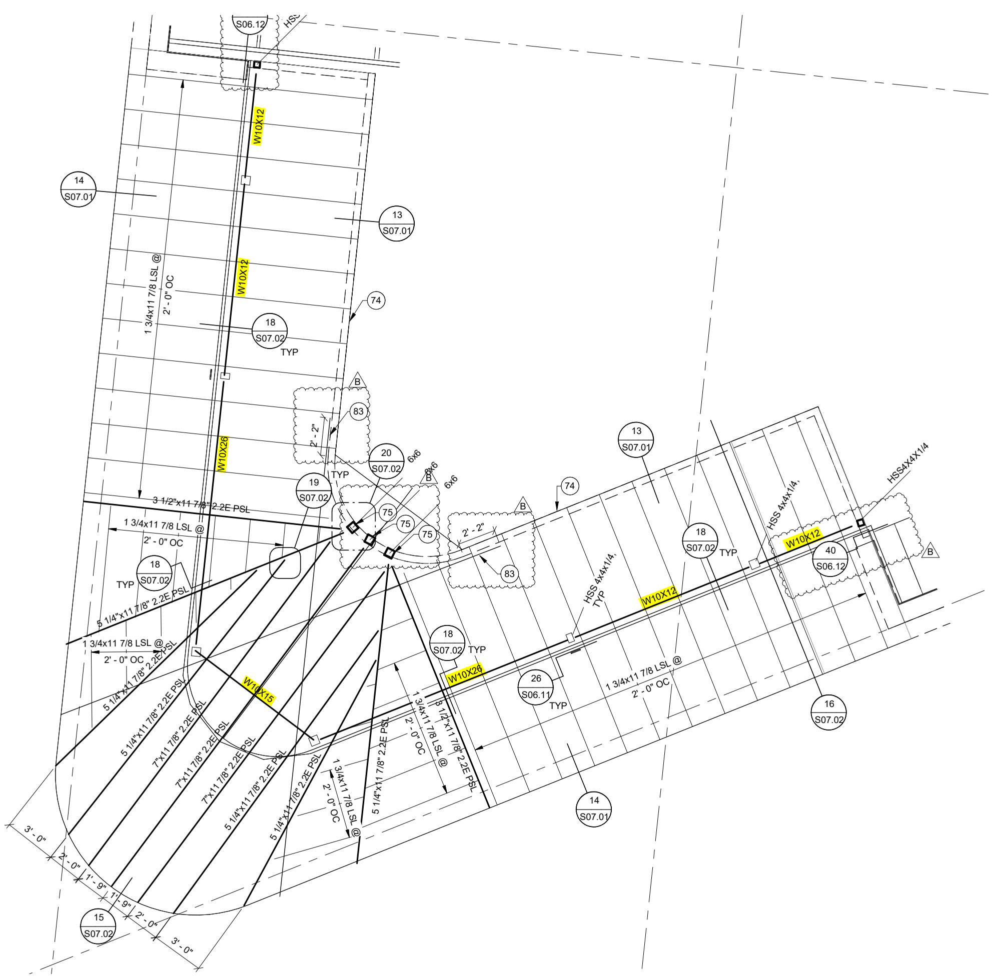
PARTIAL FRAMING PLANS



LEVEL 4-7



LEVEL 8



ROOF

APPEAL EXHIBIT 1.B - INTUMESCENT FILM
18S - 19-106743-000-00-CO

September 11, 2019

VIA E-Mail: andrewp@seradesign.com

Sera
338 NW 5th Ave.
Portland, OR 97209

Carboline Company
27821 Higuera
Mission Viejo, CA 92691, USA
TOLL FREE: 888/323-3473
949/458-2853
FAX: 949/458-9220

Attention: Mr. Andrew Pulliam

Project: 18S Greystar
Portland, OR

Subject: Thermo-Lag E100
Exterior or Interior epoxy based thin-film intumescent fireproofing for structural steel

Dear Mr. Pulliam:
This is in follow up to our conversation regarding the dry film thicknesses for our Thermo-Lag E100. Following are our proposed thicknesses for Thermo-Lag E100 on the requested sizes of columns and beams supporting wood / floor assembly:

Fireproofing Schedule

Member	W/D	Hr. Rating	Mils Thick	mm Thick	Bases of method Intertek Design	Notes
Columns:						
HSS 6 x 6 x ¼	0.82	2	400	10.1	CC/IF 108-03	
HSS 6 x 4 x ¼	1.19	2	330	8.4	CC/IF 108-03	
HSS 4 x 4 x ¼	0.80	2	400	10.1	CC/IF 108-03	
Beams:						1
W 12 x 79	1.34	2	220	5.5	CC/IF 180-02	
W 10 x 26	0.71	2	310	8.0	CC/IF 180-02	
W 10 x 17	0.54	2	370	9.3	CC/IF 180-02	
W 10 x 15	0.48	2	390	9.9	CC/IF 180-02	
W 10 x 12	0.39	2	463	11.76	CC/IF 180-02	2
W 8 x 21	0.67	2	320	8.2	CC/IF 180-02	
MC 8 x 18.7	0.77	2	300	7.7	CC/IF 180-02	
HSS 8 x 4 x 3/8	1.44	2	290	7.3	CC/IF 108-03	
HSS 6 x 4 x 3/8	1.48	2	290	7.3	CC/IF 108-03	
HSS 12 x 8 x 5/16	1.29	2	310	8.0	CC/IF 108-03	
HSS 8 x 2 x 3/16	0.68	2	430	10.9	CC/IF 108-03	
HSS 4 x 2 x 3/16	0.72	2	420	10.7	CC/IF 108-03	
HSS 5 x 2 x 3/16	0.71	2	420	10.7	CC/IF 108-03	

Notes:

1. Column test designs were used on beams due to the lack of concrete fill above. The use of column test data for the beam protection requirements are conservative when used for beams because the ASTM E119 temperature limits are lower for columns (1000°F/1200°F) than for beams (1100°F/1300°F). Thermo-Lag E100 has demonstrated ability to perform on both columns and beams as indicated by the published designs.
2. The thickness was increased for this smaller member as an extension of our Intertek design CC/IF 180-02. This should be consistered considered conservative when taking into account item number one above

We realize above proposal would be subject to the authority having jurisdiction.

I trust this is the information you require. If you need any additional information and or have any questions what so ever, please do not hesitate to contact me.

Yours truly,

Ronald R. Carraway
Fireproofing Product Manager

Thermo-Lag® E100

PRODUCT DATA SHEET

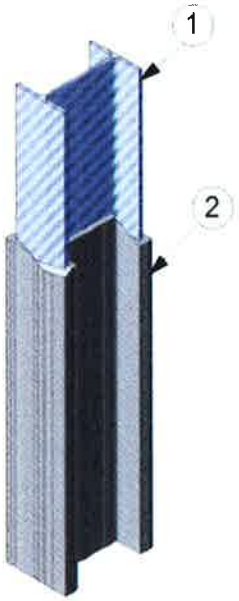
SELECTION & SPECIFICATION DATA

Generic Type	A two component, 100% solids epoxy intumescent fireproofing.
Description	An epoxy intumescent fireproofing for commercial and light industrial applications. It was specifically designed with an advanced formulation to provide 1-3 hour cellulosic fire protection for structural steel beams, I-section columns, tubular columns and pipes without the need for reinforcing mesh. It provides a fast curing, aesthetically pleasing fire protection solution and is rated for both exterior and interior applications.
Features	• Certified to UL 263 / ASTM E119 / NFPA 251 • Exterior and interior rated • High quality aesthetic finish • Does not require reinforcing mesh • Low thickness requirements • High build, fast recoat • Saves application time, lowering installation cost • Rugged durable material suitable for onsite or offsite applications • LEED compliant, low VOC • Low outgassing properties for clean room environments
Color	Grey
Finish	Slightly Textured
Primer	Must be applied over a compatible primer. If the steel has already been coated with an existing primer, refer to Carboline Technical Service for advice before applying. Contact Carboline Technical Service for a complete list of approved primers. Carboline approved primers must be sufficiently cured prior to application of Thermo-Lag E100. The general requirement for epoxy primers is a 24 hour cure. Material must be applied after 24 hours and not to exceed the approved primer's maximum recoat window.
Film Build	60-200 mils (1.5-5 mm)
Solids Content	By Volume 100%
Theoretical Coverage Rates	1604 ft² at 1 mil (149 m² at 25 microns)
VOC Values	**As Supplied** : 0.11 lb/gal (13 g/L)
Limitations	Not recommended for steelwork subject to long-term surface temperatures over 175°F (79°C) in normal use.
Topcoats	For interior conditioned space, topcoats are optional. For interior general purpose and exterior use, Carboline approved topcoats are required. Product must be applied to the specified DFT prior to applying a topcoat. The choice of topcoat will depend on project requirements. Contact Carboline Technical Service for a complete list of approved topcoats.

SUBSTRATES & SURFACE PREPARATION

General	Remove all oil or grease from the surface to be coated using Thinner 2 or Carboline Surface Cleaner 3.

Carboline Company
CC/IF 180-02
Column
Thermo-Lag E100, Thermo-Lag E100 S
ASTM E119-12a
CAN/ULC S101-07
Assembly Rating – See Table CC/IF 180-02



1. **SOLID STRUCTURAL STEEL COLUMN** - Use solid steel sections, I-shape or W-shape, having nominal Hp/A, W/D, or A/P section factors based on four sided exposure. Refer to Table CC/IF 180-02 for specific application thickness of intumescent fireproofing (Item 2A) based on nominal Hp/A, W/D, or A/P section factors.

2. **FIRE-RESISTIVE COATING** – Refer to Table CC/IF 180-02 for specific application thickness of fire resistive coating.

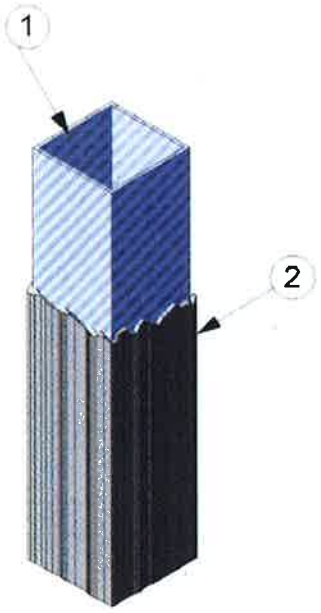
CERTIFIED MANUFACTURER: Carboline Company

CERTIFIED PRODUCT: Fire-resistive Coating

MODEL: Thermo-Lag E100, Thermo-Lag E100 S

Intumescent Fireproofing - Spray or paint in one or more coats according to manufacturer's instructions to required final thickness.

Carboline Company
CC/IF 180-03
Column
Thermo-Lag E100 and Thermo-Lag E100 S
ASTM E119-16
CAN/ULC S101-14
Assembly Rating – See Table CC/IF 180-03



1. **HOLLOW RECTANGULAR STRUCTURAL STEEL COLUMN** – Use hollow steel sections, rectangular-shape, having nominal Hp/A, W/D, or A/P section factors based on four sided exposure. Refer to Table CC/IF 180-03 for specific application thickness of intumescent mastic fireproofing (Item 2B) based on nominal Hp/A or W/D section factors. This table is applicable for circular-shape hollow steel sections as well.

2. **FIRE-RESISTIVE COATING –** Refer to Table CC/IF 180-03 for specific application thickness of fire resistive coating.

CERTIFIED MANUFACTURER: Carboline Company

CERTIFIED PRODUCT: Fire-resistive Coating

MODEL: Thermo-Lag E100 and Thermo-Lag E100 S

INTUMESCENT FIREPROOFING – Spray or paint in one or more coats according to manufacturer's instructions to required final thickness.

SUBSTRATES & SURFACE PREPARATION

Steel	The general requirement for steel preparation before the application of an approved primer should meet SSPC-SP6, with a 1.5-2.0 mil (37-50 micron) angular profile. Contact Carboline Technical Service for recommendations and specific primer requirements.
Galvanized Steel	The general requirement for steel preparation before priming should meet SSPC-SP7. 1.5-2.0 mil (37-50 micron) angular profile required. Prime with Carboline approved primer. Contact Carboline Technical Service for recommendations.
Non-Ferrous Metals	Contact Carboline Technical Service for recommendations.

PERFORMANCE DATA

Test Method	Results
ASTM D2240 Hardness	> 40 Shore D
ASTM D256 Impact Resistance	0.75 ft*lbs/in
ASTM D4541 Bond Strength	600-1200 psi (4.14-8.27 MPa)
ASTM D4541 Bond Strength	Typical Field Value 300 psi (2.07 MPa)
ASTM D695 Compressive Strength	> 2,330 psi (> 16.0 MPa)
ASTM D790 Flexural Strength	> 1,220 psi (> 8.4 MPa)
ASTM E84 Surface Burning	Class A

All values derived under controlled laboratory conditions unless otherwise noted.

MIXING & THINNING

Mixer	Use 1/2" electric or air driven drill with a slotted paddle mixer. Must be 300 rpm under load (minimum).
Mixing	**Plural Component Application:** For plural component applications, the part A and part B components must be pre-mixed separately before introduction into the plural equipment. **Trowel Application:** The product is supplied in 9 gallon (34.0 liter) kits. The product must be mixed in equal volumes of part A and part B. It is recommended to split each kit in half and mix 2.25 gallons (8.5 liters) of part A and 2.25 gallons (8.5 liters) of part B to achieve a maximum mixing volume of 4.5 gallons (17.0 liters). Add up to 1 quart (1 liter) of Carboline Plasite Thinner 19, Thinner 242E or Carboline approved equivalent to part B and mix until fully incorporated. Thinning is not required for this application and material should only be thinned as necessary to achieve the desired working time and consistency. Stage material by adding part B on top of part A. Mix staged material with slotted paddle mixing blade for approximately 2 minutes or until completely blended and consistent color is achieved. Once mixed, material should be immediately poured out of mass onto a clean table or flat working surface to extend the pot life. Mixed material left in the pail will begin to exotherm and diminish pot life. For small areas, equal volumes of part A and part B can be mixed as needed. Trowel application should commence immediately after mixing.
Thinning	**Plural Component Application:** Do not thin **Trowel Application:** Only thin as required with Plasite Thinner 19, Thinner 242E or Carboline approved equivalent – Maximum 1 quart (1 liter) per 4.5 gallon (17.0 liter) kit.
Ratio	1:1 (by volume)

MIXING & THINNING

Working Time	30-45 minutes @ 75°F (25°C) 15-20 minutes @ 100°F (38°C)

APPLICATION EQUIPMENT GUIDELINES

Listed below are general equipment guidelines for the application of this product. Job site conditions may require modifications to these guidelines to achieve the desired results.

General	Thermo-Lag E100 is applied by plural component application. Use only plural component equipment specifically designed for epoxy based PFP. Consult the manufacturers for specific information and models: **AirTech Spray Systems** **ECCO** **Spray Quip** **Spray Pump Services** **Graco** **WIWA**
Spray Gun	WIWA 500F PFP or equivalent Must have non-wetted spring assembly.
Gun Swivel	5,000 psi (34.4 MPa) 1/2" - 3/8" (12.7 mm - 9.5 mm)
Spray Tips	0.027-0.035" (Use heavy duty RAC non diffuser tips and housing)
Fan Size	6-10" (152-254 mm) depending on section being sprayed
Static Mixer	Standard Static 12 turn 3/4" (19 mm) I.D.
Material Hose	**Plural Component:** 100' (30.4 m) heated hose bundle with 3/4" (19 mm) I.D. minimum and 3/4" (19 mm) mixer manifold
Whip Hose	20' (6.1 m) of 1/2" (12.7 mm) I.D. minimum
Compressor	185 cfm @ 100 psi (6.9 kPa) minimum

APPLICATION PROCEDURES

General	**Plural Component Application:** Prior to introduction into the plural component equipment, the product must be preheated to 70-100°F (21-38°C). Perform at least two ratio checks per day and also after any equipment maintenance. Apply first coat at 60-200 mils (1.5-5 mm). Lighter coats will achieve a smoother finish for higher quality aesthetics. Allow material to gel for 15 minutes before backrolling (only if required). If backrolling, use solvent resistant mohair rollers. Use Carboline Plasite Thinner 19, Thinner 242E or approved equal as rolling solvent to mist down rollers to prevent them from sticking to the material. Allow material to cure for approximately 30 minutes (depending upon temperature) between coats. Continue building material at 60-200 mils (1.5-5 mm) per coat to specified thickness. **Trowel Application:** Prior to trowel application, the material must be preheated to a minimum of 70°F (21°C) to achieve a workable consistency. Once material is mixed, it must be poured out of mass onto a clean table or flat working surface to extend the pot life. The material can then be divided into workable amounts. Trowel apply first coat at 60-200 mils (1.5-5 mm). Allow material to gel for 15 minutes before

APPLICATION PROCEDURES

backrolling (only if required). If backrolling, use Carboline Plasite Thinner 19, Thinner 242E or approved equal as rolling solvent to mist down rollers to prevent them from sticking to the material. Allow material to set up sufficiently to support the next trowel applied coat. This will range between 1-4 hours between coats. Continue building material at 60-200 mils (1.5-5 mm) per coat to specified thickness.

Avoid using excessive solvent when backrolling as this can lead to solvent entrapment and lengthen the cure time of the material. Use solvent moistened rollers to back roll material after each subsequent coat to improve finish and level surface if required. Lighter coats will achieve a smoother finish. Contact Carboline Technical Service or refer to the product application manual for more detailed information.

Wet Film Thickness

Frequent thickness measurements with a wet film gauge are recommended during the application process to ensure uniform thickness.

Dry Film Thickness

For recommended methods of thickness determination and tolerances refer to: AWCI Technical Manual 12-B (Standard Practice for the Testing and Inspection of Field Applied Thin Film Intumescent Fire Resistive Materials) or SSPC-PA 2 (The Society for Protective Coatings Paint Application Standard No. 2).

APPLICATION CONDITIONS

Condition	Material	Surface	Ambient	Humidity
Minimum	70°F (21°C)	41°F (5°C)	41°F (5°C)	0%
Maximum	140°F (60°C)	125°F (52°C)	110°F (43°C)	85%

Air and substrate temperature must be at least 41°F (5°C) and rising. Steel surface temperature should be a minimum of 5°F (3°C) above the dew point. The maximum humidity is 85%. Material must be protected from direct rain until it has reached sufficient cure.

CURING SCHEDULE

Surface Temp.	Touch	Handle	Minimum Recoat Time	Maximum Recoat Time	Minimum Topcoat Time	Maximum Topcoat Time
50°F (10°C)	1 Hour	24 Hours	1 Hour	7 Days	24 Hours	7 Days
70°F (21°C)	30 Minutes	24 Hours	30 Minutes	7 Days	10 Hours	7 Days
95°F (35°C)	30 Minutes	24 Hours	30 Minutes	7 Days	10 Hours	7 Days

*Above cure times are based on 50% relative humidity. Curing times are dependent upon temperature, air movement and humidity. Lower temperatures will slow down the curing process and increase recoat intervals, higher temperatures will speed up the curing process and shorten the recoat intervals. The material can be heated to achieve a quicker recoating and curing schedule. For optimum curing, it is recommended to apply coats at 60-200 mils (1.5-5 mm) wet per coat. If maximum recoat or topcoat times are exceeded, the surface must be mechanically abraded and solvent wiped prior to applying additional coats. Consult Carboline Technical Service for specific details.

CLEANUP & SAFETY

Cleanup

Flush static mixer, whip hose, gun and tips with hot water or Carboline approved thinner immediately after each use (depending on pump set up). Use Carboline Plasite Thinner 19, Thinner 242E or approved equal for cleaning solvent. Break down static mixer, gun and tip assembly and hand clean.

CLEANUP & SAFETY

Safety	Read and follow all caution statements on this product data sheet and on the SDS for this product. Employ normal workmanlike safety precautions. Use adequate ventilation. Keep container closed when not in use.
Overspray	All adjacent and finished surfaces shall be protected from damage and overspray.
Ventilation	When used in enclosed areas, thorough air circulation must be used during and after application until the coating is cured. The ventilation system should be capable of preventing the solvent vapor concentration from reaching the lower explosion limit for the solvents used. User should test and monitor exposure levels to insure all personnel are below guidelines. If not sure or if not able to monitor levels, use MSHA/NIOSH approved respirator.

MAINTENANCE

General	For patches and repairs, the material can be applied by spray or trowel. Repair areas must be abraded back to a firm edge by sanding or scraping. Remove product from areas in need of repair back to solidly adhered material. Ensure that the primer system is still is tact as well. If not, the primer system shall be reinstated to its original specification. All edges can be left as butt joints at a 90 degree angle or beveled at a 45 degree angle. The topcoat should be abraded back by 1" (25.4 mm) from the repair area. All edges must be solvent cleaned and allowed to dry before commencing application. It is important that the patch area blends into the existing material to achieve a uniform appearance. The product shall then be troweled or spray applied to the appropriate thickness based on the project specification and fire test certification. Once the material has been allowed to sufficiently cure, the specified topcoat system shall be applied, based on the original specification, in strict accordance with Carboline's written instructions.

TESTING / CERTIFICATION / LISTING

Underwriters Laboratories, Inc.	This product has been tested in accordance with the UL Environmental Test Program and is listed and classified by UL for both exterior and interior use.
Intertek	This product has been tested in accordance with ASTM E-119 at Intertek Laboratories and is listed in the following designs: **Wide Flange Columns:** CC/IF 180-02 **HSS Columns:** CC/IF 180-03 **Restrained / Unrestrained Beams:** CC/IF 180-01
City of Los Angeles	Report: RR 25484

PACKAGING, HANDLING & STORAGE

Packaging	**Full Kits:** 9.0 gallons (34.0 liters) Part A: 4.5 gallons (17.0 liters) Part B: 4.5 gallons (17.0 liters)
Shelf Life	12 Months Shelf life when kept at recommended storage conditions and in original unopened containers.
Storage	Store indoors in a dry environment between 32-120°F (0-49°C). Can be stored down to 20°F (-7°C) for no longer than 30 days. 0-100% Relative Humidity

PACKAGING, HANDLING & STORAGE

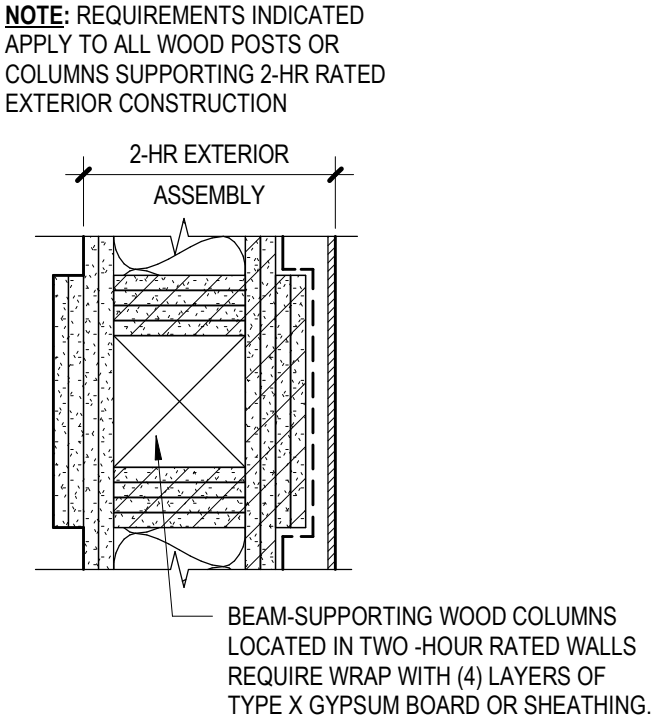
Shipping Weight (Approximate)	11 lb. per gallon (1.3 kg per liter)
Flash Point (Setaflash)	Part A: 185°F (85°C) Part B: >200°F (>93°C)

WARRANTY

To the best of our knowledge the technical data contained herein is true and accurate on the date of publication and is subject to change without prior notice. User must contact Carboline Company to verify correctness before specifying or ordering. No guarantee of accuracy is given or implied. We guarantee our products to conform to Carboline quality control. We assume no responsibility for coverage, performance, injuries or damages resulting from use. Carbolines sole obligation, if any, is to replace or refund the purchase price of the Carboline product(s) proven to be defective, at Carbolines option. Carboline shall not be liable for any loss or damage. NO OTHER WARRANTY OR GUARANTEE OF ANY KIND IS MADE BY CARBOLINE, EXPRESS OR IMPLIED, STATUTORY, BY OPERATION OF LAW, OR OTHERWISE, INCLUDING MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. All of the trademarks referenced above are the property of Carboline International Corporation unless otherwise indicated.

APPEAL EXHIBIT 2.A - TYPICAL 2HR COLUMN DRAWING

Several wood posts are proposed to support 2HR beams. The posts must meet a 2HR fire resistance and be independently encased.



APPEAL EXHIBIT 2.A - TYPICAL 2HR COLUMN ANALYSIS

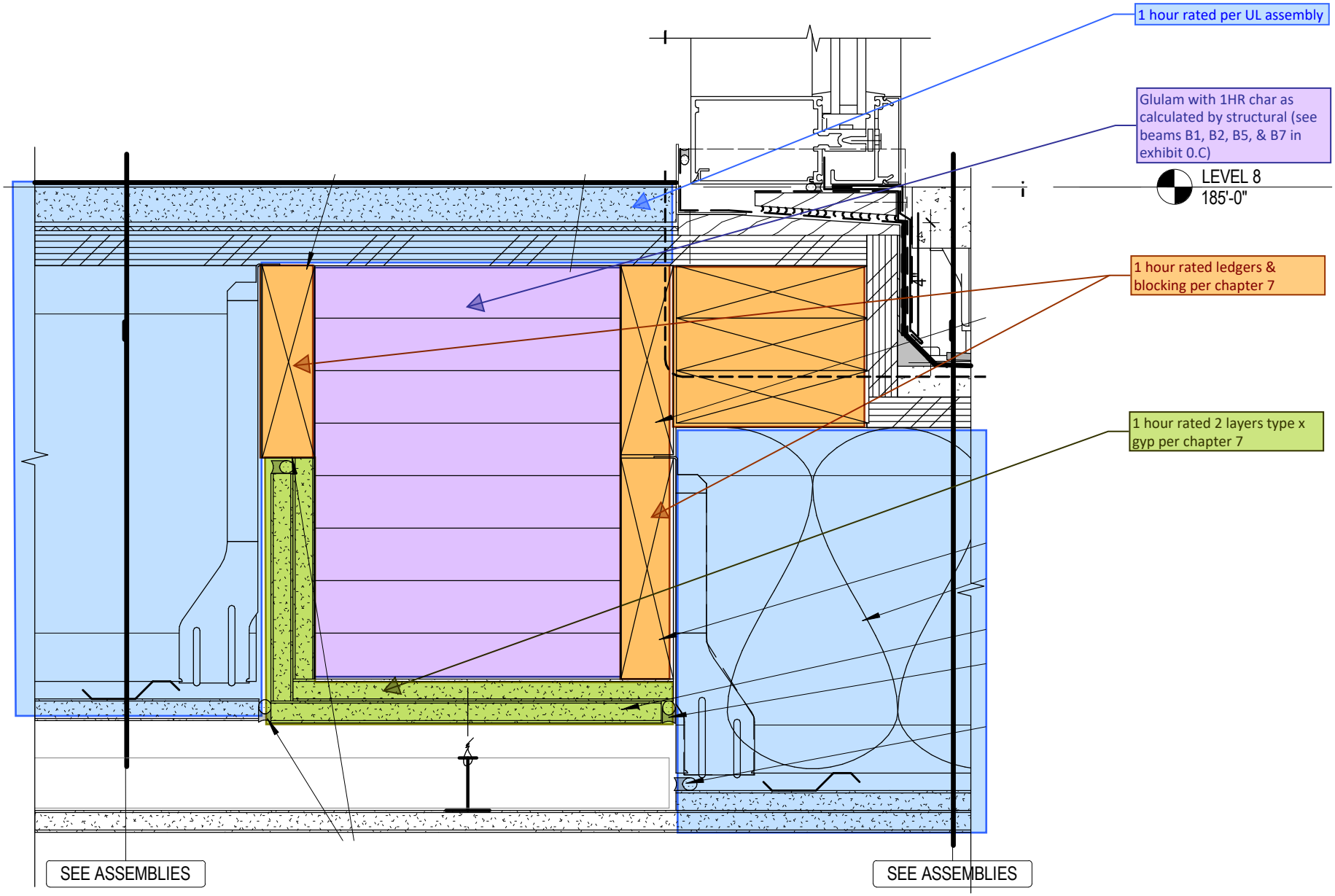
The required 2HR fire rating of the proposed columns is achieved through encompassing protection as follows:

- Four layers of 5/8" gypsum type X applied to beam provide 2HR of additional protection per Table 3.2a of 2018 NDS Tech Report No. 10.

Per the above, the required 2HR rating is provided by option 3 of COP Guidance 19-02: Calculated fire protection of wood columns, beams, and solid wood decking.

APPEAL EXHIBIT 3.A - TERRACE BEAM SECTION

A glulam beam has been designed at an exterior wall as shown in below. The beam must meet a 2HR fire resistance.



APPEAL EXHIBIT 3.A - TERRACE BEAM ANALYSIS

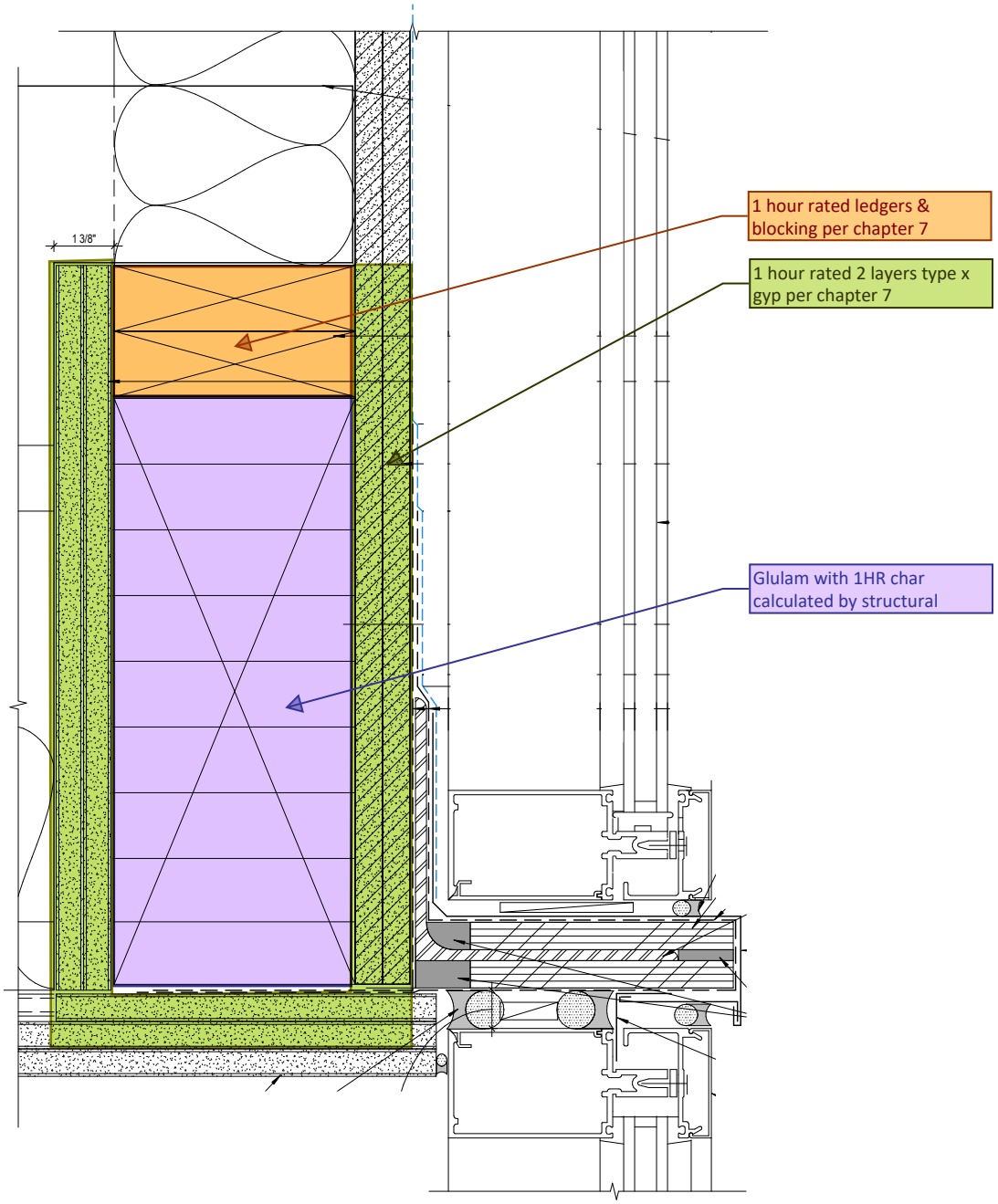
The required 2HR fire rating of the proposed beam is achieved through encompassing protection as follows:

- The beam has been designed with additional size by the structural engineer to allow for 1HR of additional char. Please see exhibit 0.C for calculations.
- Two layers of 5/8" gypsum type X applied to beam provide 1HR of additional protection per Table 3.2a of 2018 NDS Tech Report No. 10.
- 1-1/2" thick wood ledgers and fire blocking provide 1HR of additional protection per 3.81 of 2018 NDS Tech Report No. 10.
- The UL rated enclosing floor assembly further adds 1HR of protection.

Per the above, the required 2HR rating is provided by option 3 of COP Guidance 19-02: Calculated fire protection of wood columns, beams, and solid wood decking.

APPEAL EXHIBIT 4.A - SPANDREL BEAM SECTION

A glulam beam has been designed at an exterior wall as shown in below. The beam must meet a 2HR fire resistance.



APPEAL EXHIBIT 4.A - SPANDREL BEAM ANALYSIS

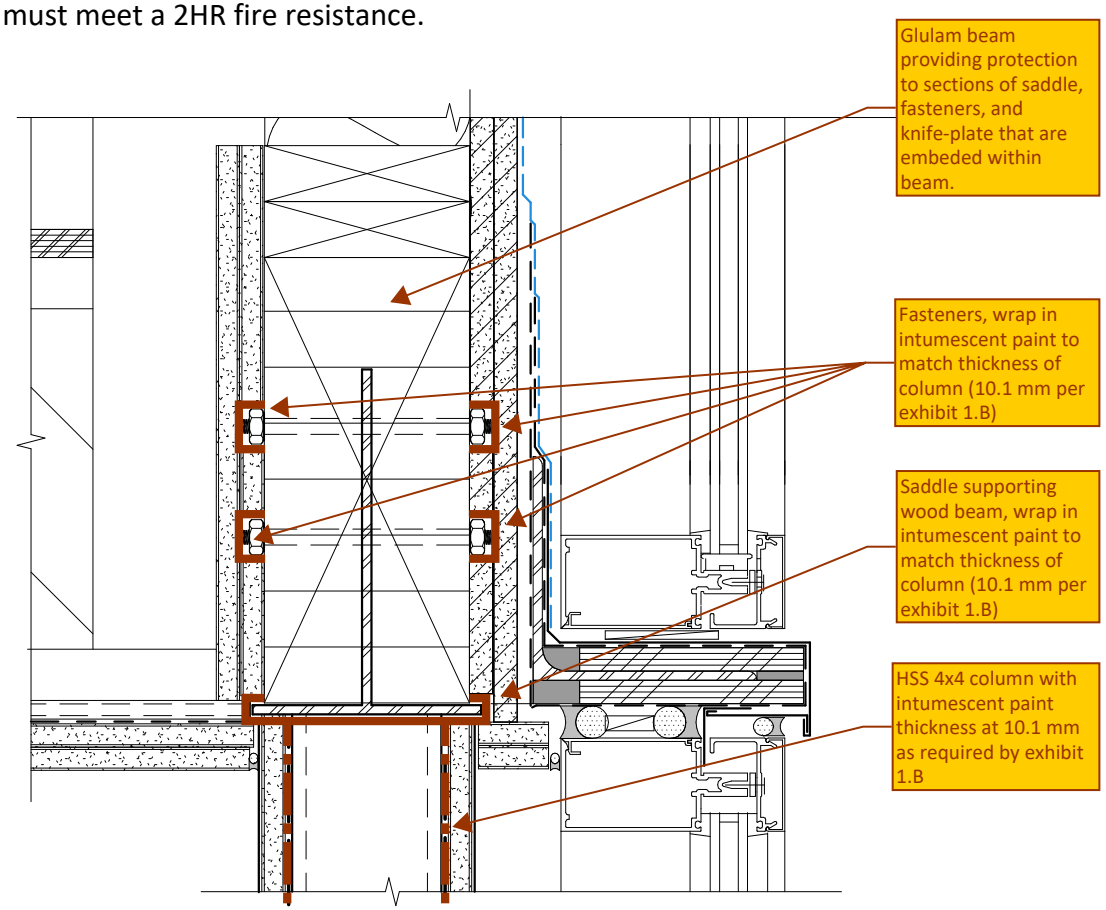
The required 2HR fire rating of the proposed beam is achieved through encompassing protection as follows:

- The beam has been designed with additional size by the structural engineer to allow for 1HR of additional char. Please see exhibit 0.C for calculations.
- Two layers of 5/8" gypsum type X applied to beam provide 1HR of additional protection per Table 3.2a of 2018 NDS Tech Report No. 10.
- 2 1-1/2" thick wood fire blocking provide 2HR of additional protection per 3.81 of 2018 NDS Tech Report No. 10.

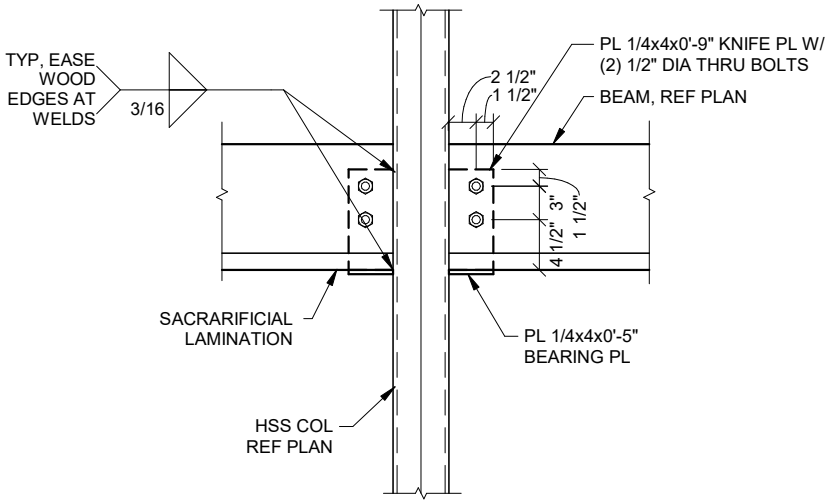
Per the above, the required 2HR rating is provided by option 3 of COP Guidance 19-02: Calculated fire protection of wood columns, beams, and solid wood decking.

APPEAL EXHIBIT 5.A - COLUMN/BEAM CONNECTION DETAILS

A glulam beam has been designed at an exterior wall and is supported by an intumescent-coated steel column as shown below. The beam connection must meet a 2HR fire resistance.



SECTION THROUGH SUPPORTED BEAM AND SADDLE



STRUCTURAL ELEVATION OF BEAM CONDITION

APPEAL EXHIBIT 5.A - COLUMN/BEAM CONNECTION ANALYSIS

The required 2HR fire rating of the proposed column/beam connection is achieved through encompassing protection as follows:

- The 4x4 HSS column has been designed to be 2HR rated by intumescent coating per item 1 of this appeal.
- The glulam beam has been designed to be 2HR rated by option 3 of COP Guidance 19-02 per item 3 of this appeal.
- The saddle, knifeplate, & connection hardware is protected via enclosure in the 2HR rated glulam beam.

  At portions where these items are exposed, the intumescent coating that is being utilized on the 4x4 HSS column is proposed to be extended onto the connection elements. The thickness of the coating is to be 10.1 mm, equivalent to that of the 4x4 HSS per exhibit 1.B.