119023.000 - Google Kirkland Urban - South

City of Kirkland
Post Revision
Reviewed by ASHaupt
02/10/2022

Google
Kirkland, Washington, US, 98033

To 1 reviewer

From

Jeremy Wentzel
jeremy.wentzel@bnbuilders.com

High Performance Concrete (Deferred)

Jan 3, 2022

Awaiting review - 0/1 reviews complete

Submittal no.	Version	Spec section	Due date
07 4247-005	1	074247	Jan 3, 2022

Included items

No items

Reviewers

0/1 complete

Reviewer	Review response	Date Reviewed
Alex Keifer (CollinsWoerman)	Awaiting review	-

REVIEWED AND NOTED FOR DESIGN INTENT ONLY DIMENSIONS & QUANTITIES NOT GUARANTEED ☐

REVIEWED FOR LOADS IMPOSED ON BASIC STRUCTURE ONLY ☒

NO EXCEPTIONS TAKEN ☒
NOTE MARKINGS ☐
COMMENTS ATTACHED ☐
REVISE AND RESUBMIT ☐
BY KG
DATE 01/03/2022
COUGHLIN PORTER LUNDEEN

☑ REVIEWED ☐ REJECTED
☐ FURNISH AS CORRECTED ☐ NOT REVIEWED
☐ REVISE AND RESUBMIT

Corrections or comments made on the shop drawings during this review do not relieve Contractor from compliance with requirements of the drawings and specifications. This check is only for review of the general conformance with the design concept of the project and general compliance with the information given in the Contract Documents. The Contractor is responsible for: Confirming and correlating all quantities and dimensions; selecting fabrication processes and techniques of construction; coordinating work with all other trades and performing all work in a safe and satisfactory manner.

CollinsWoerman
BY akeifer
DATE 1/4/2022

City of Kirkland
Post Revision
Reviewed by ASHaupt
02/10/2022

01/12/2021

Larson Engineering, Inc.
6380 E. Thomas Road, Suite 300
Scottsdale, AZ 85251-7084
480.212.4200
www.larsonengr.com

Ismael Madrigal-Martinez

Digitally signed by Ismael Madrigal-Martinez
Date: 2021.01.12 13:55:16-07'00'

Larson
www.larsonengr.com

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Design Criteria

Project Information:
Project: KUS20 Kirkland Urban South
Project Location: Kirkland, Washington
Project Number: 63200381.000

Load Criteria

1. Wind Load per ASCE 7-10:
   Mean Building Height: 136’
   Basic Wind Speed 115 mph
   Building Exposure “B”

Project Ultimate Loads	Project Allowable Loads
+33.53 psf/-33.53 psf (Typical)	+20.12 psf/-20.12 psf (Typical)
+33.53 psf/-61.48 psf (Corner)	+20.12 psf/-36.89 psf (Corner)

   Note: This wind load reflects a tributary area of ten square feet. See the load determination section of this book for a table of wind loads for various tributary areas. Wind Load Reductions apply based on effective tributary area.

2. Corner Width: 22’-0”

3. Seismic Criteria per ASCE 7-10: Seismic Group: III
   I_P= 1.0
   S_{DS}= 0.84
   S_{D1}= 0.425
   F_{BODY} = 2.90 psf
   $F_{CONNECTION}$ = 9.07 psf
   $F_{OVERSTRENGTH}$ = 13.61 psf
   $DL_{OVERSTRENGTH}$ = 9.85 psf
   $DL_{SEISMIC}$ = 8.05 psf

4. Structural calculations based on TAKTL drawings dated 12/23/2020.

Panel Wall System

1. Values utilized within the dead load calculations for UHPC panels are as follows:
   5/8” UHPC Panel: 7.2 psf

2. Aluminum extruded members shall be 6005A-T5.

Fasteners, Welds & Anchors

1. Fasteners specified as stainless steel shall be alloy groups 1, 2, OR 3 Condition CW. (Fu = 100 ksi minimum) as shown in the calculations.

2. Fasteners designated as Grade 5 shall meet the requirements of SAE-J429 material, (Fu = 120 ksi: Fy = 92 ksi).

3. All structural steel fasteners exposed to weathering will require proper coating to provide adequate corrosion protection for the intended service. This shall be the responsibility of others.

4. Fasteners are designed per "Metal Curtain Wall Fasteners", AAMA, TIR-A9-2014.

5. Fasteners into light gauge steel are designed per section E4 of the 2007 AISI "North American Specification for the Design of Cold-Formed Steel Structural Members".

6. Steel sub-framing provided by others for concealed-fastener panel system anchorage is assumed to be minimum 16 gauge Grade 33 steel. The size of this member is not determined in this package and is assumed to be structurally adequate.

7. Steel sub-framing provided by others for exposed-fastener panel system anchorage is assumed to be 16 gauge Grade 33 galvanized steel or better. The size of this member is not determined in this package and is assumed to be structurally adequate.

Disclaimers

1. This calculation package is for the final design and installed structural performance of the exterior system. Larson Engineering is not responsible for manufacturing, or the installation process.

2. The structural conditions analyzed in this calculation package represent the most critical conditions found by Larson Engineering in the shop drawings and/or other design documents. Similar conditions shown on the shop drawings and/or other design documents have been reviewed and are acceptable by comparison to the analyzed components.

3. The following calculation package represents Larson Engineering's interpretation of the design intent of the shop drawings and specifications. Larson Engineering is not responsible for verification of dimensions, material take-offs, installation and coordination with other building trades. If as built conditions differ from the conditions shown in this calculation package, TAKTL

must bring these differences to the attention of Larson Engineering so that the as built conditions can be structurally verified.

4. The structural engineer of record (EOR) shall verify that all surrounding structures to which framing is to be anchored are structurally sound and capable of supporting the weights and reactions of the panel system under maximum design loads.

Project Lead: Ashley Brawley

Quality Reviewer: Dustin Payne

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Elevations

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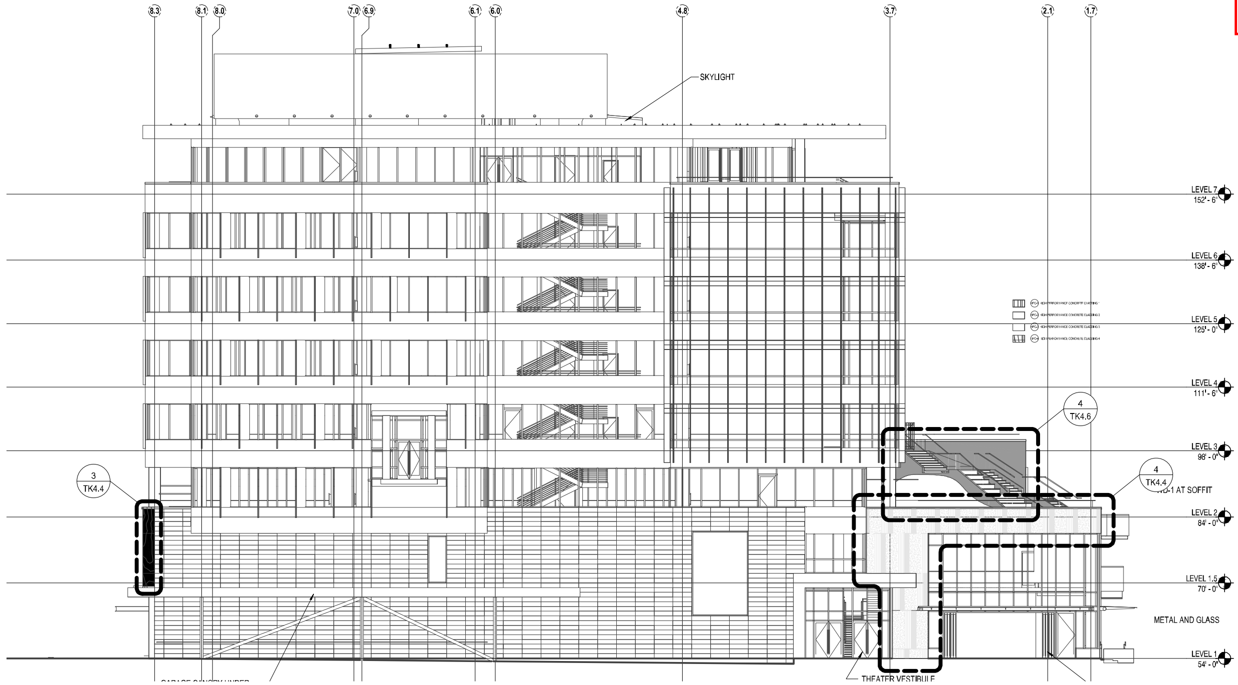
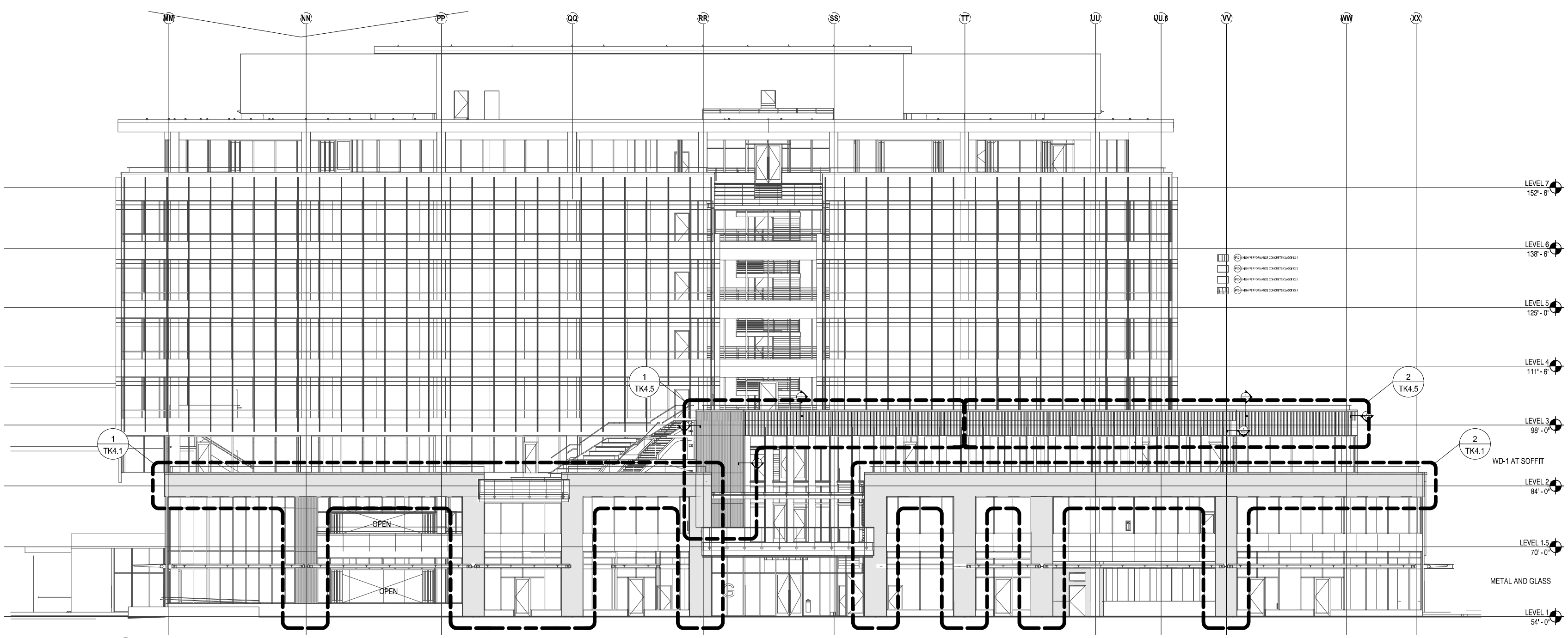


2 NORTH ELEVATION
SCALE: 3/32" = 1'-0" REF: 2/A4.1R



1 WEST ELEVATION
SCALE: 3/32" = 1'-0" REF: 1/A4.1R

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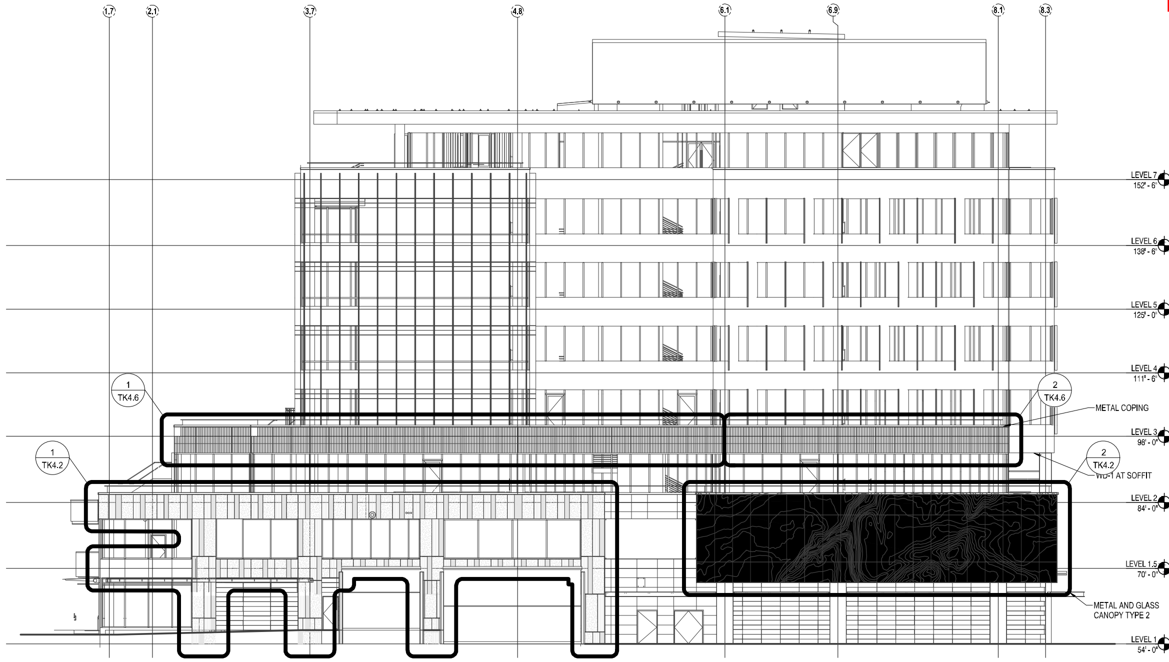
KEYPLAN

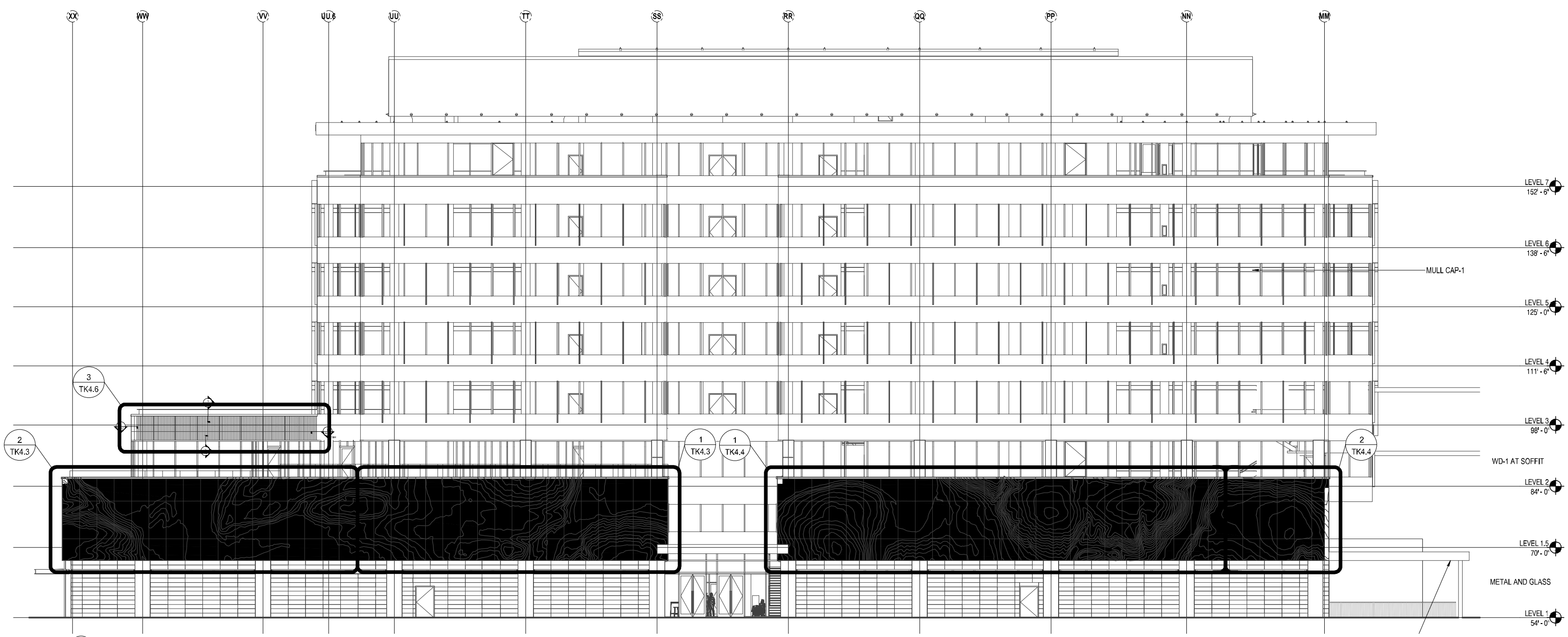
TAKTL PROJECT CODE: KUS20

DATE OF FIRST SUBMITTAL: 12.23.2020
DRAWN BY: BS
CHECKED BY: SS
TITLE: BUILDING ELEVATIONS

TK2.1



2 SOUTH ELEVATION
SCALE: 3/32" = 1'-0" REF: 2/A4.2R



1 EAST ELEVATION
SCALE: 3/32" = 1'-0" REF: 1/A4.2R

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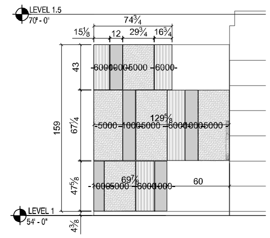
TITLE: BUILDING ELEVATIONS

TK2.2

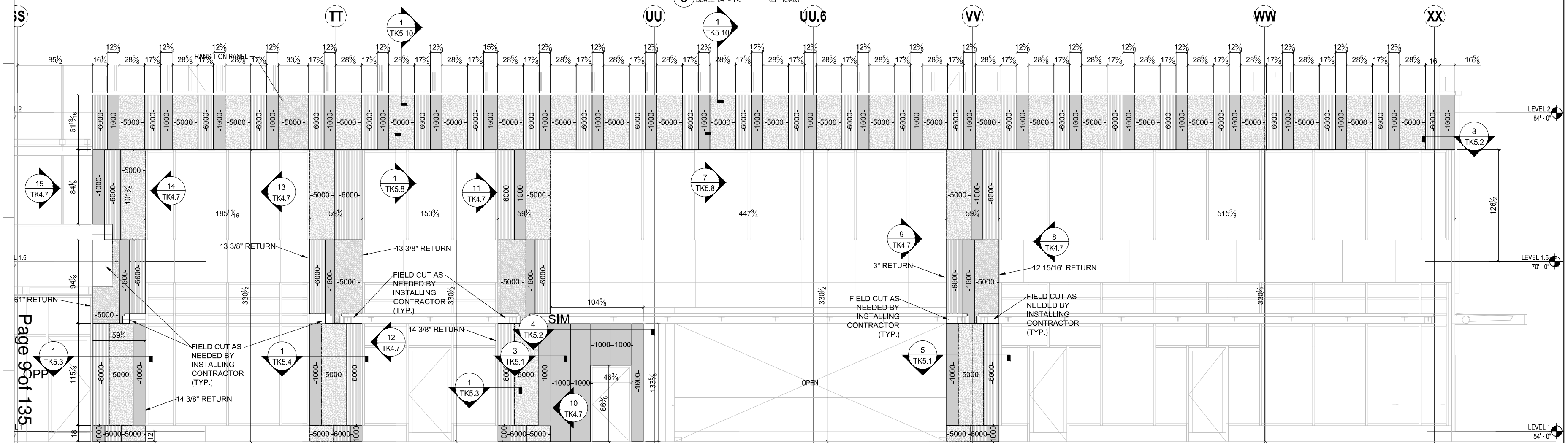
- ALL JOINTS ARE 3/8" U.N.O.
- DIMENSIONS ARE FROM PANEL EDGE TO PANEL EDGE
- HARDWARE LAYOUT TO BE PROVIDED UPON RECEIPT OF FINAL ENGINEERING
- PLEASE CONFIRM THAT FRAMING SYSTEM ACCOMMODATES FOR FLOOR DEFLECTION, ALLOWING PANELS TO CROSS THE FLOOR LINE.



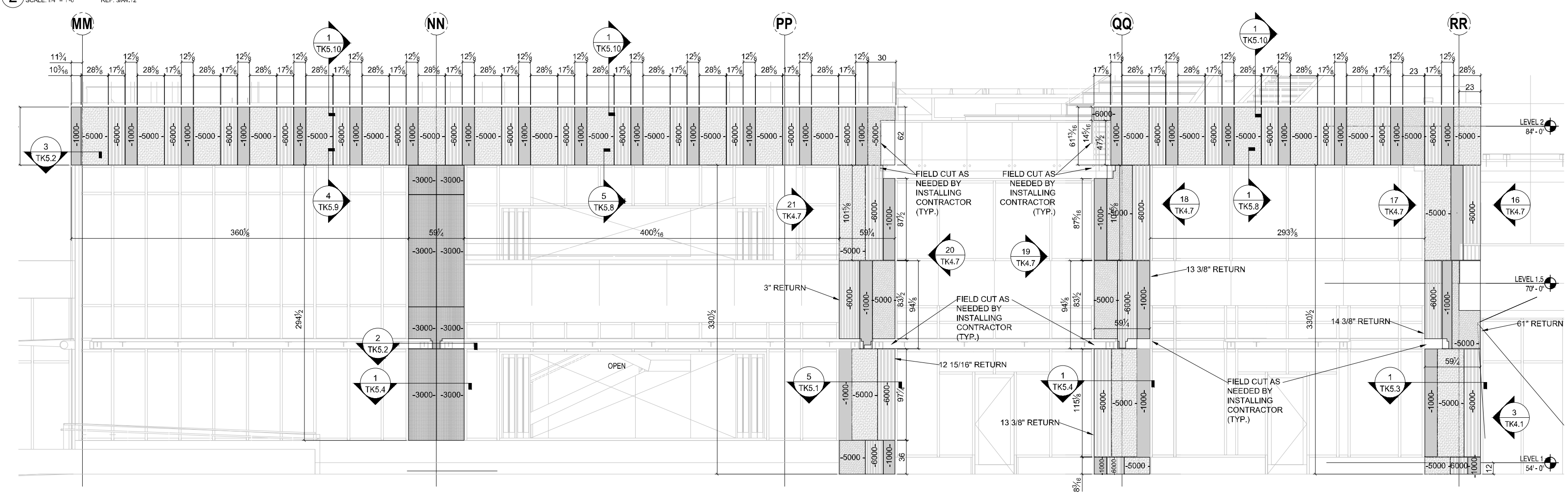
3 ELEVATION WEST LOBBY - NORTH
SCALE: 1/4" = 1'-0" REF: 10/A6.7

PANEL PATTERN LEGEND

THICKNESS: 5/8" THICK TEXTURE: STANDARD SMOOTH COLOR: BONE 78 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD	THICKNESS: 5/8" THICK TEXTURE: STANDARD SHADOWS COLOR: TITANIUM 63 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD	THICKNESS: 5/8" THICK TEXTURE: SMOOTH WITH CUSTOM SANDBLAST COLOR: DUNE 60 SEALER: TBD ANCHOR TYPE: EXPOSED FINISH TYPE: TBD
THICKNESS: 5/8" THICK TEXTURE: STANDARD ROUGH 2 COLOR: BONE 78 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD	THICKNESS: 5/8" THICK TEXTURE: STANDARD SHADOWS COLOR: GRAPHITE 40 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD	
THICKNESS: 5/8" THICK TEXTURE: STANDARD REEDS COLOR: BONE 78 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD	THICKNESS: 5/8" THICK TEXTURE: STANDARD SMOOTH COLOR: GRAPHITE 40 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD	



2 ELEVATION PARTIAL WEST
SCALE: 1/4" = 1'-0" REF: 3/A4.12



1 ELEVATION PARTIAL WEST
SCALE: 1/4" = 1'-0" REF: 1 & 2/A4.12

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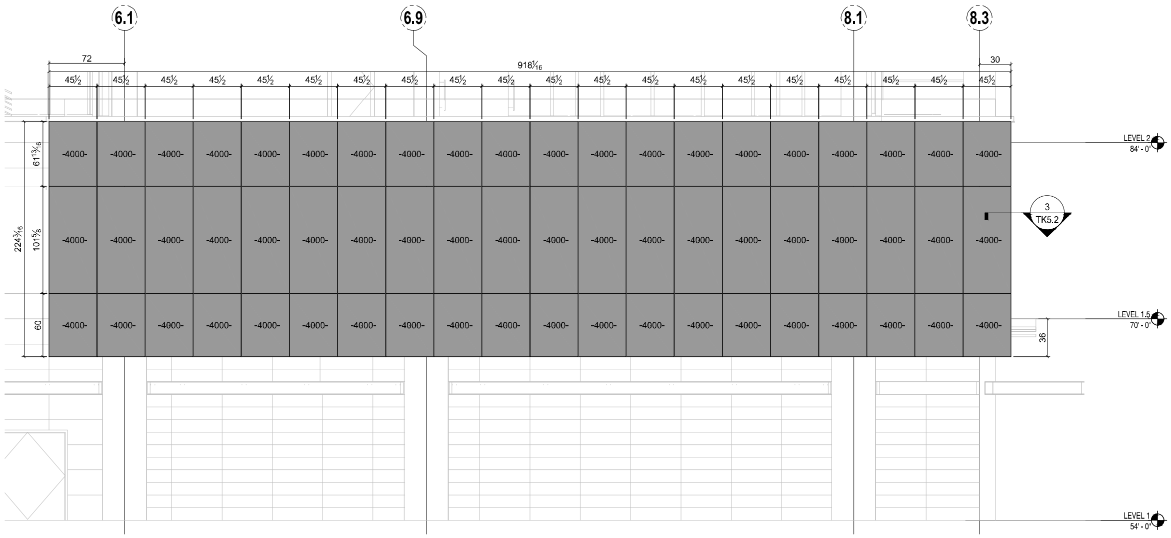
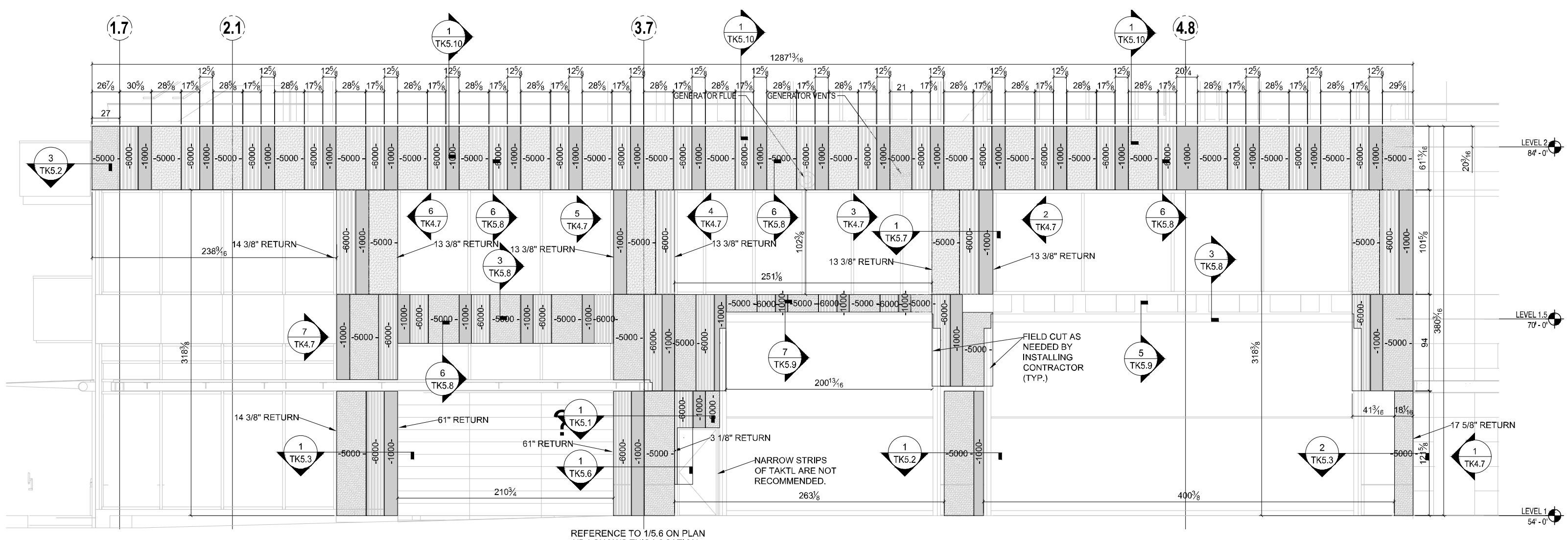
TK4.1

- ALL JOINTS ARE 3/8" U.N.O.
- DIMENSIONS ARE FROM PANEL EDGE TO PANEL EDGE
- HARDWARE LAYOUT TO BE PROVIDED UPON RECEIPT OF FINAL ENGINEERING
- PLEASE CONFIRM THAT FRAMING SYSTEM ACCOMMODATES FOR FLOOR DEFLECTION, ALLOWING PANELS TO CROSS THE FLOOR LINE.



2 ELEVATION PARTIAL SOUTH
SCALE: 1/4" = 1'-0" REF: 2/A4.13



1 ELEVATION PARTIAL SOUTH
SCALE: 1/4" = 1'-0" REF: 1/A4.13

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PANEL PATTERN LEGEND

1000	THICKNESS: 5/8" THICK TEXTURE: STANDARD SMOOTH COLOR: BONE 78 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD
5000	THICKNESS: 5/8" THICK TEXTURE: STANDARD ROUGH 2 COLOR: BONE 78 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD
6000	THICKNESS: 5/8" THICK TEXTURE: STANDARD REEDS COLOR: BONE 78 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD
2000	THICKNESS: 5/8" THICK TEXTURE: STANDARD SHADOWS COLOR: TITANIUM 63 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD
3000	THICKNESS: 5/8" THICK TEXTURE: STANDARD SHADOWS COLOR: GRAPHITE 40 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD
7000	THICKNESS: 5/8" THICK TEXTURE: STANDARD SMOOTH COLOR: GRAPHITE 40 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD
4000	THICKNESS: 5/8" THICK TEXTURE: SMOOTH WITH CUSTOM SANDBLAST COLOR: DUNE 60 SEALER: TBD ANCHOR TYPE: EXPOSED FINISH TYPE: TBD

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DATE OF FIRST SUBMITTAL: 12.23.2020
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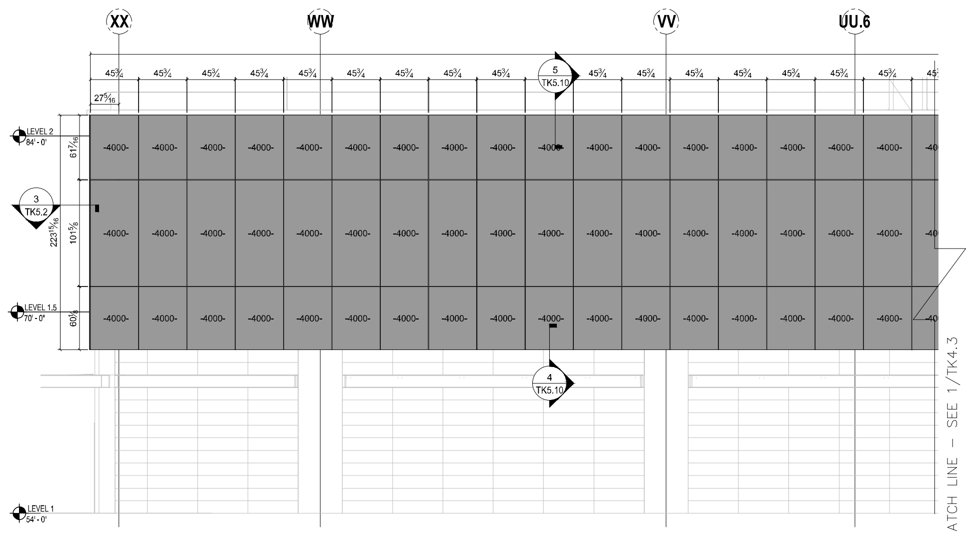
TITLE: ENLARGED ELEVATIONS

TK4.2

- ALL JOINTS ARE 3/8" U.N.O.
- DIMENSIONS ARE FROM PANEL EDGE TO PANEL EDGE
- HARDWARE LAYOUT TO BE PROVIDED UPON RECEIPT OF FINAL ENGINEERING
- PLEASE CONFIRM THAT FRAMING SYSTEM ACCOMMODATES FOR FLOOR DEFLECTION, ALLOWING PANELS TO CROSS THE FLOOR LINE.

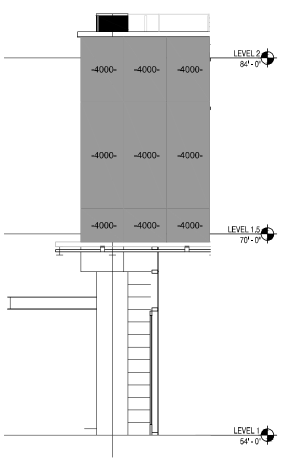
PANEL PATTERN LEGEND

Pattern	Thickness	Texture	Color	Sealer	Anchor Type	Finish Type
1000	5/8" THICK	STANDARD SMOOTH	BONE 78	TBD	CONCEALED	TBD
2000	5/8" THICK	STANDARD SHADOWS	TITANIUM 63	TBD	CONCEALED	TBD
4000	5/8" THICK	SMOOTH WITH CUSTOM SANDBLAST	DUNE 60	TBD	EXPOSED	TBD
5000	5/8" THICK	STANDARD ROUGH 2	BONE 78	TBD	CONCEALED	TBD
3000	5/8" THICK	STANDARD SHADOWS	GRAPHITE 40	TBD	CONCEALED	TBD
6000	5/8" THICK	STANDARD REEDS	BONE 78	TBD	CONCEALED	TBD
7000	5/8" THICK	STANDARD SMOOTH	GRAPHITE 40	TBD	CONCEALED	TBD

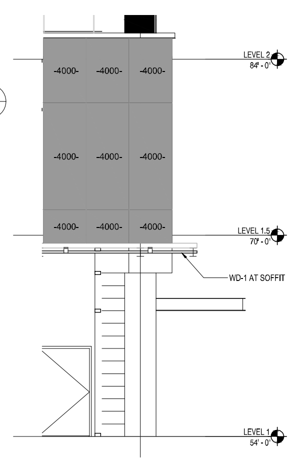


2 ELEVATION PARTIAL EAST
SCALE: 1/4" = 1'-0" REF: 1/A4.14

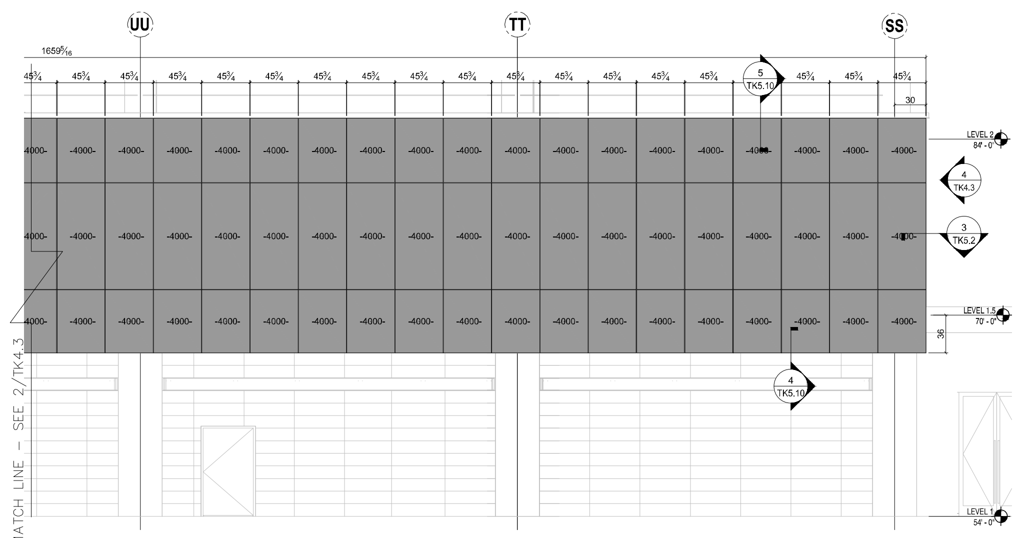
GRAPHIC INFORMATION AND LAYOUT PENDING.



4 ELEVATION EAST LOBBY, RIGHT
SCALE: 1/4" = 1'-0" REF: 4/A4.15



3 ELEVATION EAST LOBBY, RIGHT
SCALE: 1/4" = 1'-0" REF: 3/A4.15



1 ELEVATION PARTIAL EAST
SCALE: 1/4" = 1'-0" REF: 2/A4.14

GRAPHIC INFORMATION AND LAYOUT PENDING.

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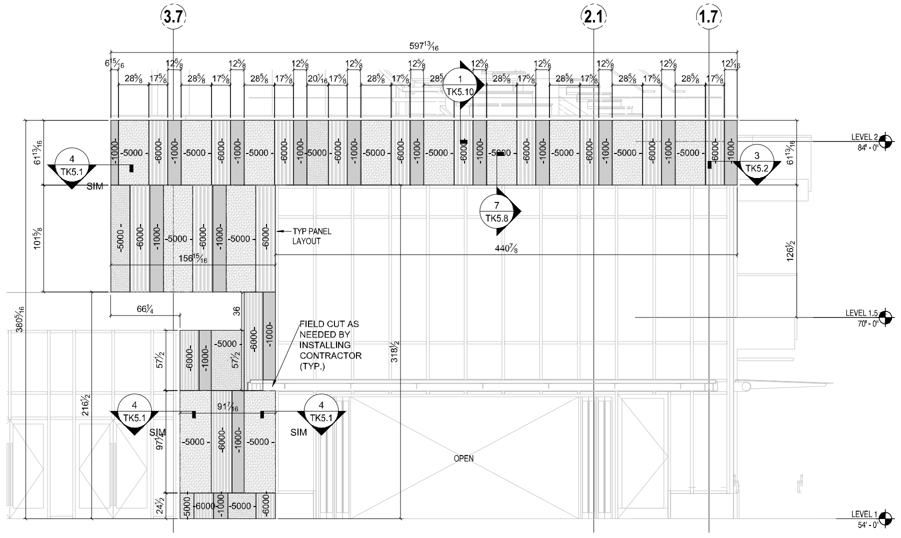
TITLE: ENLARGED ELEVATIONS

TK4.3

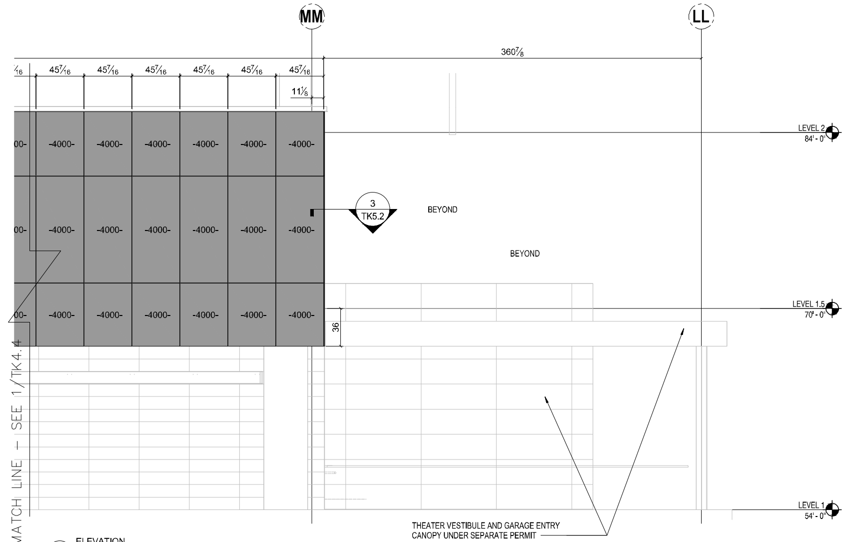
- ALL JOINTS ARE 3/8" U.N.O.
- DIMENSIONS ARE FROM PANEL EDGE TO PANEL EDGE
- HARDWARE LAYOUT TO BE PROVIDED UPON RECEIPT OF FINAL ENGINEERING
- PLEASE CONFIRM THAT FRAMING SYSTEM ACCOMMODATES FOR FLOOR DEFLECTION, ALLOWING PANELS TO CROSS THE FLOOR LINE.

PANEL PATTERN LEGEND

Panel	Thickness	Texture	Color	Sealer	Anchor Type	Finish Type
1000	5/8" THICK	STANDARD SMOOTH	BONE 78	TBD	CONCEALED	TBD
2000	5/8" THICK	STANDARD SHADOWS	TITANIUM 63	TBD	CONCEALED	TBD
4000	5/8" THICK	SMOOTH WITH CUSTOM SANDBLAST	DUNE 60	TBD	EXPOSED	TBD
5000	5/8" THICK	STANDARD ROUGH 2	BONE 78	TBD	CONCEALED	TBD
3000	5/8" THICK	STANDARD SHADOWS	GRAPHITE 40	TBD	CONCEALED	TBD
6000	5/8" THICK	STANDARD REEDS	BONE 78	TBD	CONCEALED	TBD
7000	5/8" THICK	STANDARD SMOOTH	GRAPHITE 40	TBD	CONCEALED	TBD

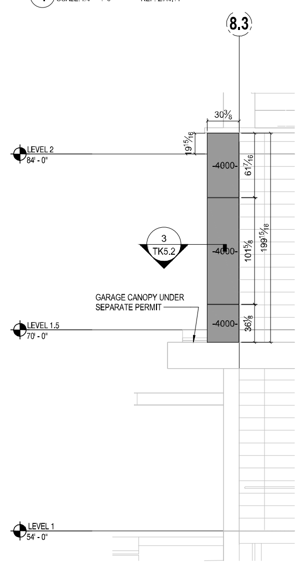


4 ELEVATION PARTIAL NORTH
SCALE: 1/4" = 1'-0" REF: 2/A4.11

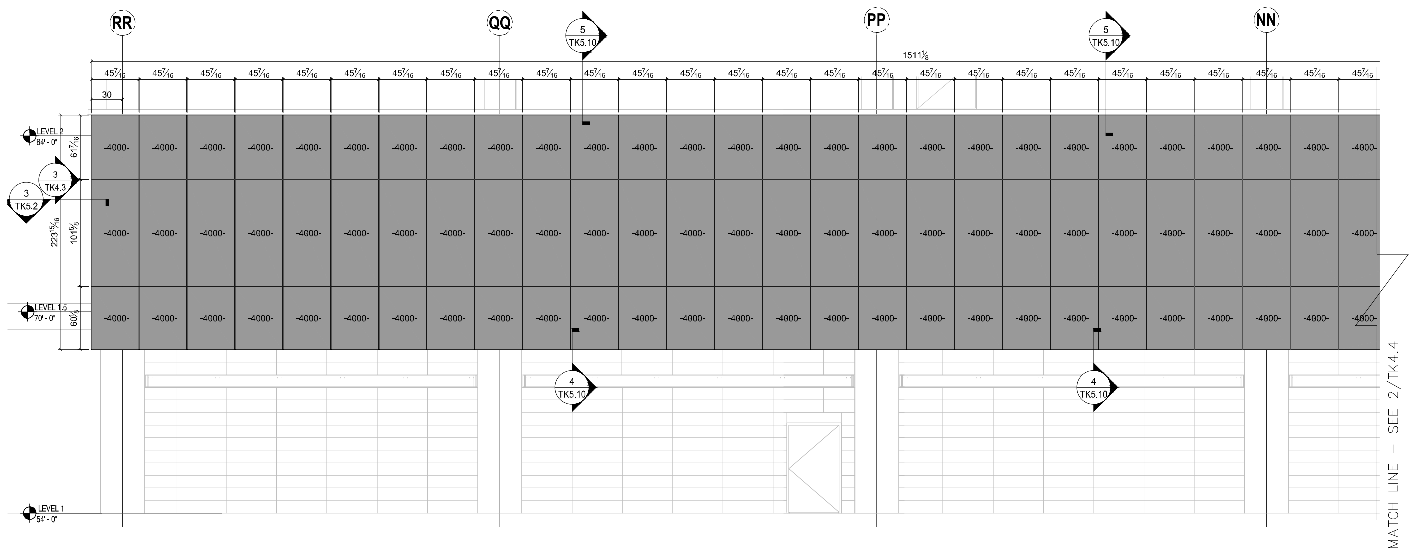


2 ELEVATION PARTIAL EAST
SCALE: 1/4" = 1'-0" REF: 3/A4.14

GRAPHIC INFORMATION AND LAYOUT PENDING.



3 ELEVATION PARTIAL NORTH
SCALE: 1/4" = 1'-0" REF: 1/A4.11



1 ELEVATION PARTIAL EAST
SCALE: 1/4" = 1'-0" REF: 2/A4.14

GRAPHIC INFORMATION AND LAYOUT PENDING.

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KEYPLAN

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TITLE: ENLARGED ELEVATIONS

TK4.4

- ALL JOINTS ARE 3/8" U.N.O.
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- HARDWARE LAYOUT TO BE PROVIDED UPON RECEIPT OF FINAL ENGINEERING
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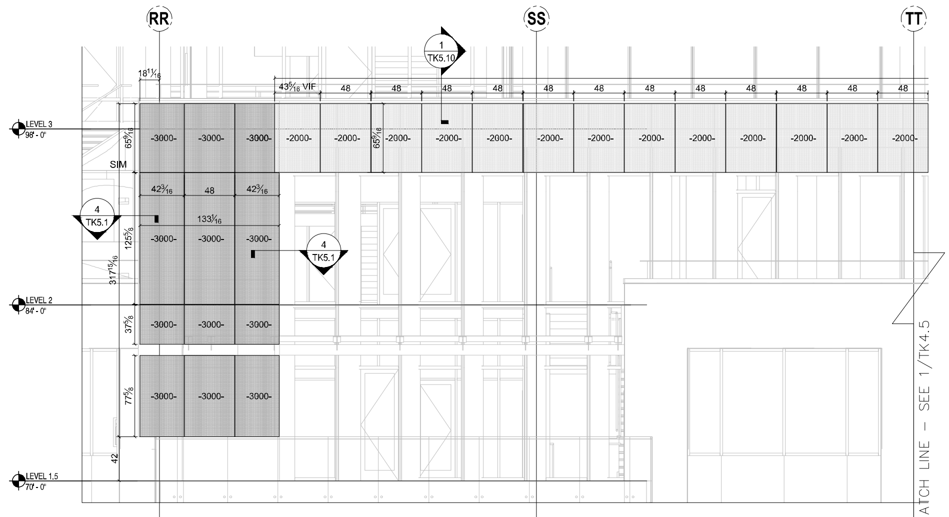
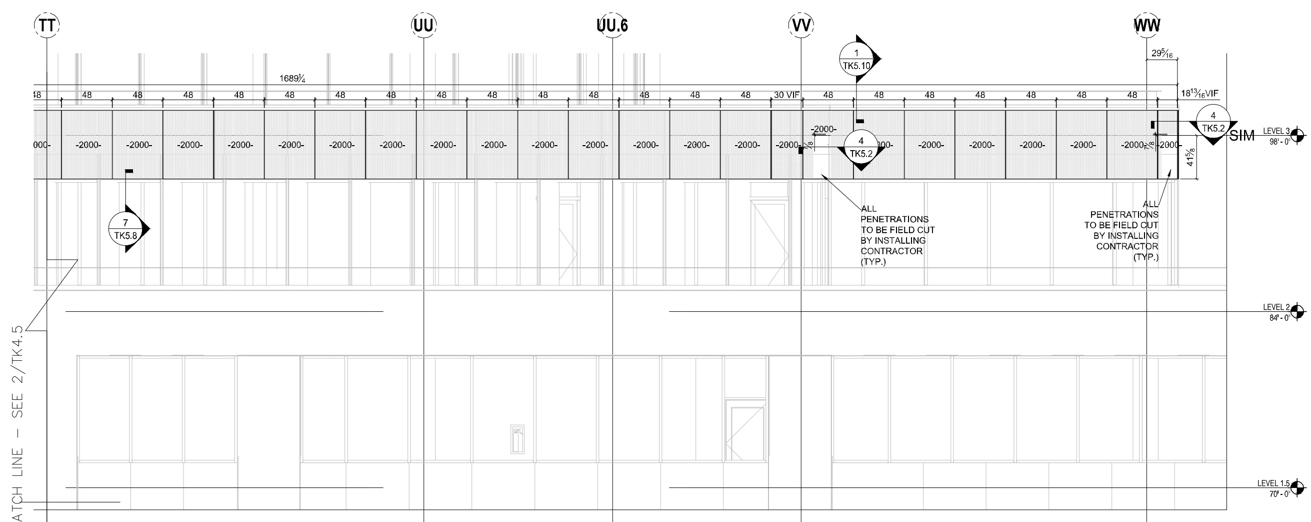
PANEL PATTERN LEGEND

PANEL	THICKNESS	TEXTURE	COLOR	SEALER	ANCHOR TYPE	FINISH TYPE
1000	5/8" THICK	STANDARD SMOOTH	BONE 78	TBD	CONCEALED	TBD
2000	5/8" THICK	STANDARD SHADOWS	TITANIUM 63	TBD	CONCEALED	TBD
4000	5/8" THICK	SMOOTH WITH CUSTOM SANDBLAST	DUNE 60	TBD	EXPOSED	TBD
5000	5/8" THICK	STANDARD ROUGH 2	BONE 78	TBD	CONCEALED	TBD
3000	5/8" THICK	STANDARD SHADOWS	GRAPHITE 40	TBD	CONCEALED	TBD
6000	5/8" THICK	STANDARD REEDS	BONE 78	TBD	CONCEALED	TBD
7000	5/8" THICK	STANDARD SMOOTH	GRAPHITE 40	TBD	CONCEALED	TBD



2 ELEVATION UPPER WEST, LEFT
SCALE: 1/4" = 1'-0" REF: 1/A4.1R



1 ELEVATION UPPER WEST, RIGHT
SCALE: 1/4" = 1'-0" REF: 1/A4.1R

Page 13 of 135

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PROJECT:
KIRKLAND URBAN SOUTH
200 PETER KIRK LANE
KIRKLAND, WA 98033

OWNER:
[OWNER NAME]
[OWNER ADDRESS LINE 1]
[OWNER ADDRESS LINE 2]
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ARCHITECT:
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REV.	DESCRIPTION	BY	DATE
0	FIRST SUBMITTAL		

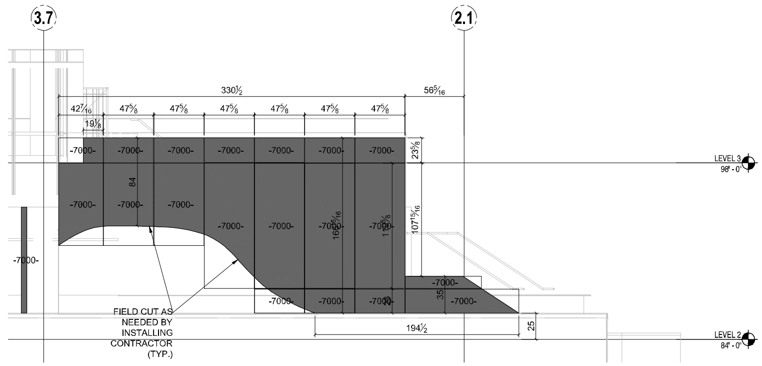
KEYPLAN

TAKTL PROJECT CODE: KUS20

DATE OF FIRST SUBMITTAL: 12.23.2020
DRAWN BY: BS
CHECKED BY: SS
TITLE: ENLARGED ELEVATIONS

TK4.5

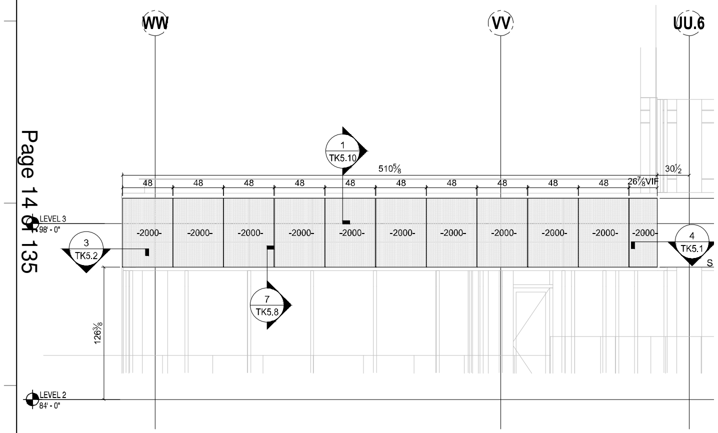
- ALL JOINTS ARE 3/8" U.N.O.
- DIMENSIONS ARE FROM PANEL EDGE TO PANEL EDGE
- HARDWARE LAYOUT TO BE PROVIDED UPON RECEIPT OF FINAL ENGINEERING
- PLEASE CONFIRM THAT FRAMING SYSTEM ACCOMMODATES FOR FLOOR DEFLECTION, ALLOWING PANELS TO CROSS THE FLOOR LINE.



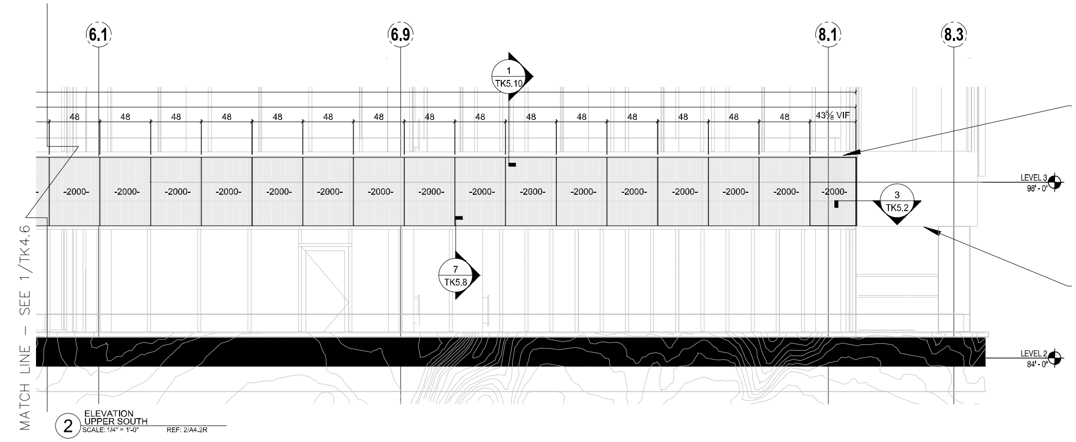
4 ELEVATION UPPER NORTH
SCALE: 1/4" = 1'-0" REF: 1/A4.1R

PANEL PATTERN LEGEND

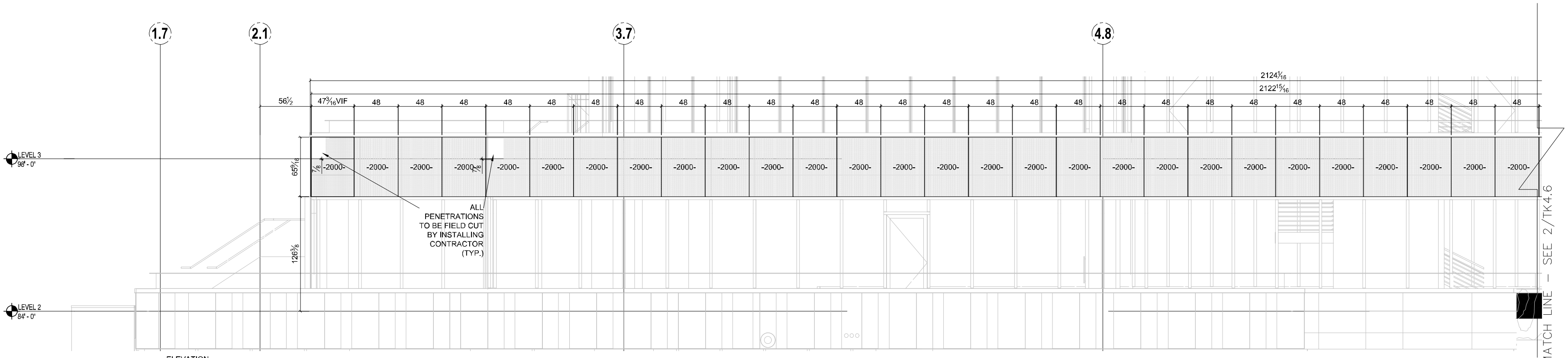
Panel	Thickness	Texture	Color	Sealer	Anchor Type	Finish Type
1000	5/8" THICK	STANDARD SMOOTH	BONE 78	TBD	CONCEALED	TBD
5000	5/8" THICK	STANDARD ROUGH 2	BONE 78	TBD	CONCEALED	TBD
6000	5/8" THICK	STANDARD REEDS	BONE 78	TBD	CONCEALED	TBD
2000	5/8" THICK	STANDARD SHADOWS	TITANIUM 63	TBD	CONCEALED	TBD
3000	5/8" THICK	STANDARD SHADOWS	GRAPHITE 40	TBD	CONCEALED	TBD
7000	5/8" THICK	STANDARD SMOOTH	GRAPHITE 40	TBD	CONCEALED	TBD
4000	5/8" THICK	SMOOTH WITH CUSTOM SANDBLAST	DUNE 60	TBD	EXPOSED	TBD



3 ELEVATION UPPER EAST
SCALE: 1/4" = 1'-0" REF: 1/A4.2R



2 ELEVATION UPPER SOUTH
SCALE: 1/4" = 1'-0" REF: 2/A4.2R



2 ELEVATION UPPER SOUTH
SCALE: 1/4" = 1'-0" REF: 2/A4.2R

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REV.	DESCRIPTION	BY	DATE
0	FIRST SUBMITTAL		

KEYPLAN

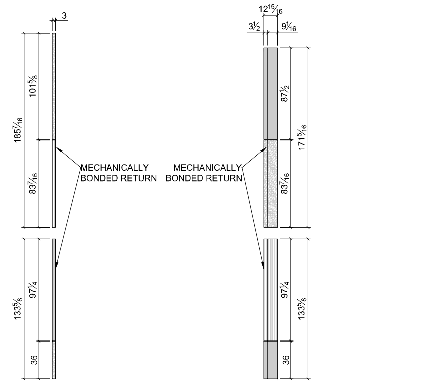
TAKTL PROJECT CODE: KUS20

DATE OF FIRST SUBMITTAL: 12.23.2020
DRAWN BY: BS
CHECKED BY: SS
TITLE: ENLARGED ELEVATIONS

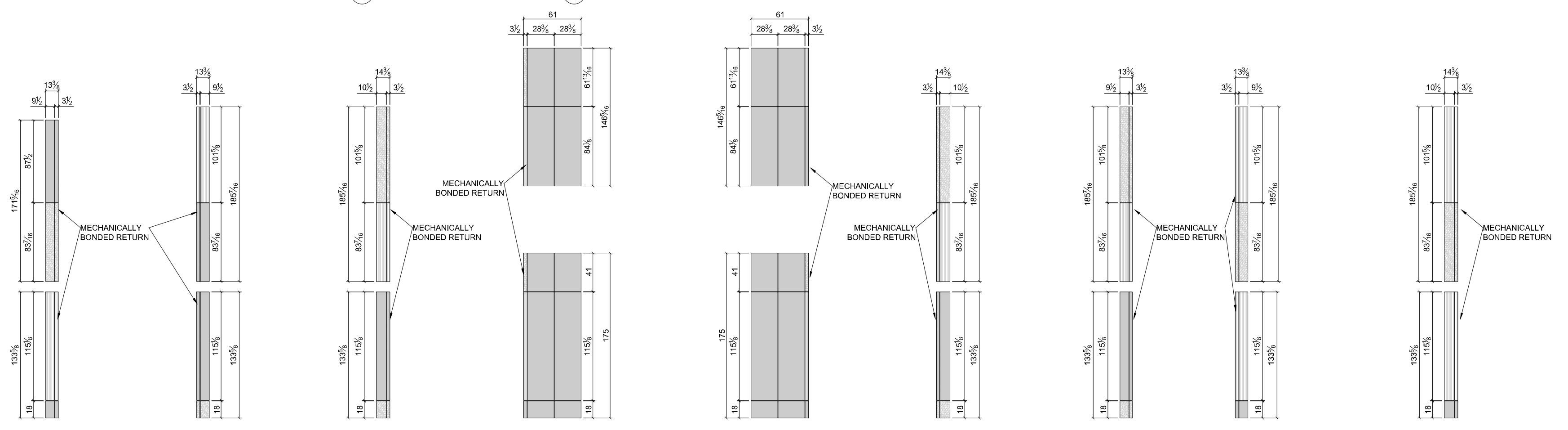
TK4.6

PANEL PATTERN LEGEND

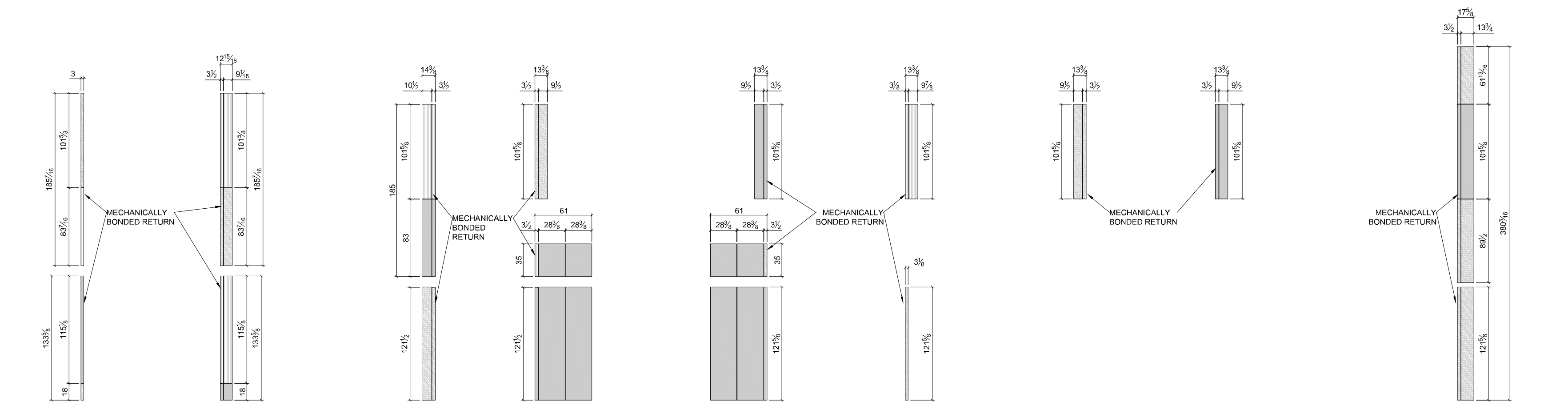
THICKNESS: 5/8" THICK TEXTURE: STANDARD SMOOTH COLOR: BONE 78 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD	THICKNESS: 5/8" THICK TEXTURE: STANDARD SHADOWS COLOR: TITANIUM 63 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD	THICKNESS: 5/8" THICK TEXTURE: SMOOTH WITH CUSTOM SANDBLAST COLOR: DUNE 60 SEALER: TBD ANCHOR TYPE: EXPOSED FINISH TYPE: TBD
THICKNESS: 5/8" THICK TEXTURE: STANDARD ROUGH 2 COLOR: BONE 78 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD	THICKNESS: 5/8" THICK TEXTURE: STANDARD SHADOWS COLOR: GRAPHITE 40 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD	
THICKNESS: 5/8" THICK TEXTURE: STANDARD REEDS COLOR: BONE 78 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD	THICKNESS: 5/8" THICK TEXTURE: STANDARD SMOOTH COLOR: GRAPHITE 40 SEALER: TBD ANCHOR TYPE: CONCEALED FINISH TYPE: TBD	



20 ELEVATION RETURN V SCALE: 1/4" = 1'-0" REF: NA
19 ELEVATION RETURN U SCALE: 1/4" = 1'-0" REF: NA



18 ELEVATION RETURN T SCALE: 1/4" = 1'-0" REF: NA
17 ELEVATION RETURN S SCALE: 1/4" = 1'-0" REF: NA
16 ELEVATION RETURN R SCALE: 1/4" = 1'-0" REF: NA
15 ELEVATION RETURN Q SCALE: 1/4" = 1'-0" REF: NA
14 ELEVATION RETURN P SCALE: 1/4" = 1'-0" REF: NA
13 ELEVATION RETURN N SCALE: 1/4" = 1'-0" REF: NA
12 ELEVATION RETURN M SCALE: 1/4" = 1'-0" REF: NA
11 ELEVATION RETURN L SCALE: 1/4" = 1'-0" REF: NA
10 ELEVATION RETURN K SCALE: 1/4" = 1'-0" REF: NA



9 ELEVATION RETURN J SCALE: 1/4" = 1'-0" REF: NA
8 ELEVATION RETURN H SCALE: 1/4" = 1'-0" REF: NA
7 ELEVATION RETURN G SCALE: 1/4" = 1'-0" REF: NA
6 ELEVATION RETURN F SCALE: 1/4" = 1'-0" REF: NA
5 ELEVATION RETURN E SCALE: 1/4" = 1'-0" REF: NA
4 ELEVATION RETURN D SCALE: 1/4" = 1'-0" REF: NA
3 ELEVATION RETURN C SCALE: 1/4" = 1'-0" REF: NA
2 ELEVATION RETURN B SCALE: 1/4" = 1'-0" REF: NA
1 ELEVATION RETURN A SCALE: 1/4" = 1'-0" REF: NA

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REV.	DESCRIPTION	BY	DATE
0	FIRST SUBMITTAL		

KEYPLAN

TAKTL PROJECT CODE: KUS20

DATE OF FIRST SUBMITTAL: 12.23.2020
DRAWN BY: BS
CHECKED BY: SS
TITLE: RETURN ELEVATIONS

TK4.7

Load Determination

Wind Loads Per ASCE 7-10 / IBC 2012

HIGH-RISE BUILDING (h>60FT)

Wind Load Design Parameters:

RISK := "III"	Risk Category	(ASCE 7-10 Table 1.5-1)
$V_{ult} := 115$ mph	Basic Wind Speed	(ASCE 7-10 Fig. 26.5-1B)
$K_d := 0.85$	Directionality Factor	(ASCE 7-10 Table 26.6-1)
EXP := "B"	Exposure Category	(ASCE 7-10 Section 26.7)
$K_{zt} := 1.0$	Topographic Factor	(ASCE 7-10 Section 26.11)
ENC := "Enclosed"	Enclosure Classification	(ASCE 7-10 Section 26.10)
$GC_{pi} = 0.18$	Internal Pressure Coefficient	(ASCE 7-10 Table 26.11-1)
$H := 136 \cdot ft$	Building Height	
$z = 136\ ft$	Height Above Ground Level	(ASCE 7-10 Table 30.3-1)
$\alpha = 7.0$	Terrain Exposure Constant	(ASCE 7-10 Table 26.9-1)
$z_g = 1200\ ft$	Terrain Exposure Constant	(ASCE 7-10 Table 26.9-1)
$K_z = 1.079$	Velocity Pressure Exposure Coefficient	(ASCE 7-10 Table 30.3-1)

External Pressure Coefficient

Tributary Area	Corner Zone (5)	Typical Zone (4)	Positive Zones (4) & (5)
$TA = \begin{bmatrix} 10 \\ 50 \\ 100 \end{bmatrix} ft^2$	$GC_{p5} = \begin{bmatrix} -1.800 \\ -1.572 \\ -1.400 \end{bmatrix}$	$GC_{p4} = \begin{bmatrix} -0.900 \\ -0.843 \\ -0.800 \end{bmatrix}$	$GC_{p+} = \begin{bmatrix} 0.900 \\ 0.815 \\ 0.750 \end{bmatrix}$

$W := 215 \cdot ft$ Least Horizontal Dimension

$a = 21.50\ ft$ Corner Zone Width (ASCE 7-10 Eq. 30.6-1)

Ultimate Wind Pressure (Wall)

$q_h := 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot (V_{ult})^2 \cdot psf$ $q_h = 31.05\ psf$ (ASCE 7-10 Eq. 30.3-1)

Tributary Area	Corner Zone (5)	Typical Zone (4)	Positive Zones (4) & (5)
$TA = \begin{bmatrix} 10 \\ 50 \\ 100 \end{bmatrix} ft^2$	$p_5 = \begin{bmatrix} -61.48 \\ -54.41 \\ -49.06 \end{bmatrix} psf$	$p_4 = \begin{bmatrix} -33.53 \\ -31.77 \\ -30.43 \end{bmatrix} psf$	$p_+ = \begin{bmatrix} 33.53 \\ 30.88 \\ 28.88 \end{bmatrix} psf$

Allowable Wind Pressure (Wall)

$q_{h\_ASD} := 0.6 \cdot q_h$ $q_{h\_ASD} = 18.63\ psf$

Tributary Area	Corner Zone (5)	Typical Zone (4)	Positive Zones (4) & (5)
$TA = \begin{bmatrix} 10 \\ 50 \\ 100 \end{bmatrix} ft^2$	$p_5 = \begin{bmatrix} -36.89 \\ -32.65 \\ -29.44 \end{bmatrix} psf$	$p_4 = \begin{bmatrix} -20.12 \\ -19.06 \\ -18.26 \end{bmatrix} psf$	$p_+ = \begin{bmatrix} 20.12 \\ 18.53 \\ 17.33 \end{bmatrix} psf$

Seismic Loads Per 2013 CBC/ASCE 7-10:

Risk Category: III

Design Category: D (From S0.0 of Structural Drawings)

$S_{DS} := 0.84$ (From S0.0 of Structural Drawings)

$S_{D1} := 0.425$ (From S0.0 of Structural Drawings)

0.50< SDS Seismic Design Category E. Reference ASCE 7-10 Table 11.6-1

0.2< SD1 Seismic Design Category D. Reference ASCE 7-10 Table 11.6-2

* Note that all architectural components in Seismic Design Categories A and B are exempt but the Seismic Design Category must be checked for both short and long period response.

* Assume that the curtain wall is an architectural component, use ASCE 7-10 Section 13.3

$W_p := 7.2 \cdot psf$ Component Weight

$I_p := 1.0$ Importance Factor (Component) (ASCE 7-10 13.1.3)

$z := 136 \cdot ft$ Height of Component

$h := 136 \cdot ft$ Average Roof Height of Structure

WALL ELEMENT AND BODY OF CONNECTION:

$a_p := 1.0$ ASCE 7-10 Table 13.5-1: Component Amplification Factor

$R_p := 2.5$ ASCE 7-10 Table 13.5-1: Component Response Modification Factor

$F_{p1} := 0.4 \cdot a_p \cdot S_{DS} \cdot W_p \cdot \frac{I_p}{R_p} \cdot \left(1 + 2 \cdot \frac{z}{h}\right) = 2.9\ psf$ (ASCE 7-10, Equation 13.3-1)

$F_{p2} := 1.6 \cdot S_{DS} \cdot I_p \cdot W_p = 9.68\ psf$ (ASCE 7-10, Equation 13.3-2) -- Maximum Fp

$F_{p3} := 0.3 \cdot S_{DS} \cdot I_p \cdot W_p = 1.81\ psf$ (ASCE 7-10, Equation 13.3-3) -- Minimum Fp

Seismic Load in Lateral Directions: $E_b := \min\left(F_{p2}, \max\left(F_{p1}, F_{p3}\right)\right) = 2.9\ psf$

Seismic Load in Dead Load Direction: $E_v := 0.2 \cdot S_{DS} \cdot W_p$ $E_v = 1.21\ psf$

Overstrengh Seismic Load in Lateral Direction: $E_c := 2.5 \cdot E_b$ $E_c = 7.26\ psf$

CONNECTION FORCES (FASTENERS & WELDS):

$a_p := 1.25$ ASCE 7-10 Table 13.5-1: Component Amplification Factor

$R_p := 1.0$ ASCE 7-10 Table 13.5-1: Component Response Modification Factor

$F_{p1} := 0.4 \cdot a_p \cdot S_{DS} \cdot W_p \cdot \frac{I_p}{R_p} \cdot \left(1 + 2 \cdot \frac{z}{h}\right) = 9.07\ psf$ (ASCE 7-10, Equation 13.3-1)

$F_{p2} := 1.6 \cdot S_{DS} \cdot I_p \cdot W_p = 9.68\ psf$ (ASCE 7-10, Equation 13.3-2) -- Maximum Fp

$F_{p3} := 0.3 \cdot S_{DS} \cdot I_p \cdot W_p = 1.81\ psf$ (ASCE 7-10, Equation 13.3-3) -- Minimum Fp

Seismic Load in Lateral Directions: $E := \min\left(F_{p2}, \max\left(F_{p1}, F_{p3}\right)\right) = 9.07\ psf$

Seismic Load in Dead Load Direction: $E_v := 0.2 \cdot S_{DS} \cdot W_p$ $E_v = 1.21\ psf$

Overstrengh Seismic Load in Lateral Direction: $E_c := 1.5 \cdot E$ $E_c = 13.61\ psf$

Seismic Loads Per 2013 CBC/ASCE 7-10:

BASIC COMBINATION FOR ALLOWABLE STRESS DESIGN ASCE 7-10:

$LC5_{DL} := (1.0 + 0.14 \cdot S_{DS}) \cdot W_p = 8.05\ psf$ $LC5_E := 0.70 \cdot E = 6.35\ psf$

$LC6B_{DL} := (1.0 + 0.105 \cdot S_{DS}) \cdot W_p = 7.84\ psf$ $LC6B_E := 0.525 \cdot E = 4.76\ psf$

$LC8_{DL} := (0.60 - 0.14 \cdot S_{DS}) \cdot W_p = 3.47\ psf$ $LC8_E := 0.70 \cdot E = 6.35\ psf$

BASIC COMBINATION FOR STRENGTH DESIGN WITH OVERSTRENGTH ASCE 7-10:

Overstrengh Seismic Load in Lateral Direction: $E_c := 1.5 \cdot E$ $E_c = 13.61\ psf$

$LC5_{DL} := (1.2 + 0.2 \cdot S_{DS}) \cdot W_p = 9.85\ psf$ $LC5_E := E_c = 13.61\ psf$

$LC7_{DL} := (0.9 - 0.2 \cdot S_{DS}) \cdot W_p = 5.27\ psf$ $LC7_E := E_c = 13.61\ psf$

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Panel Analysis

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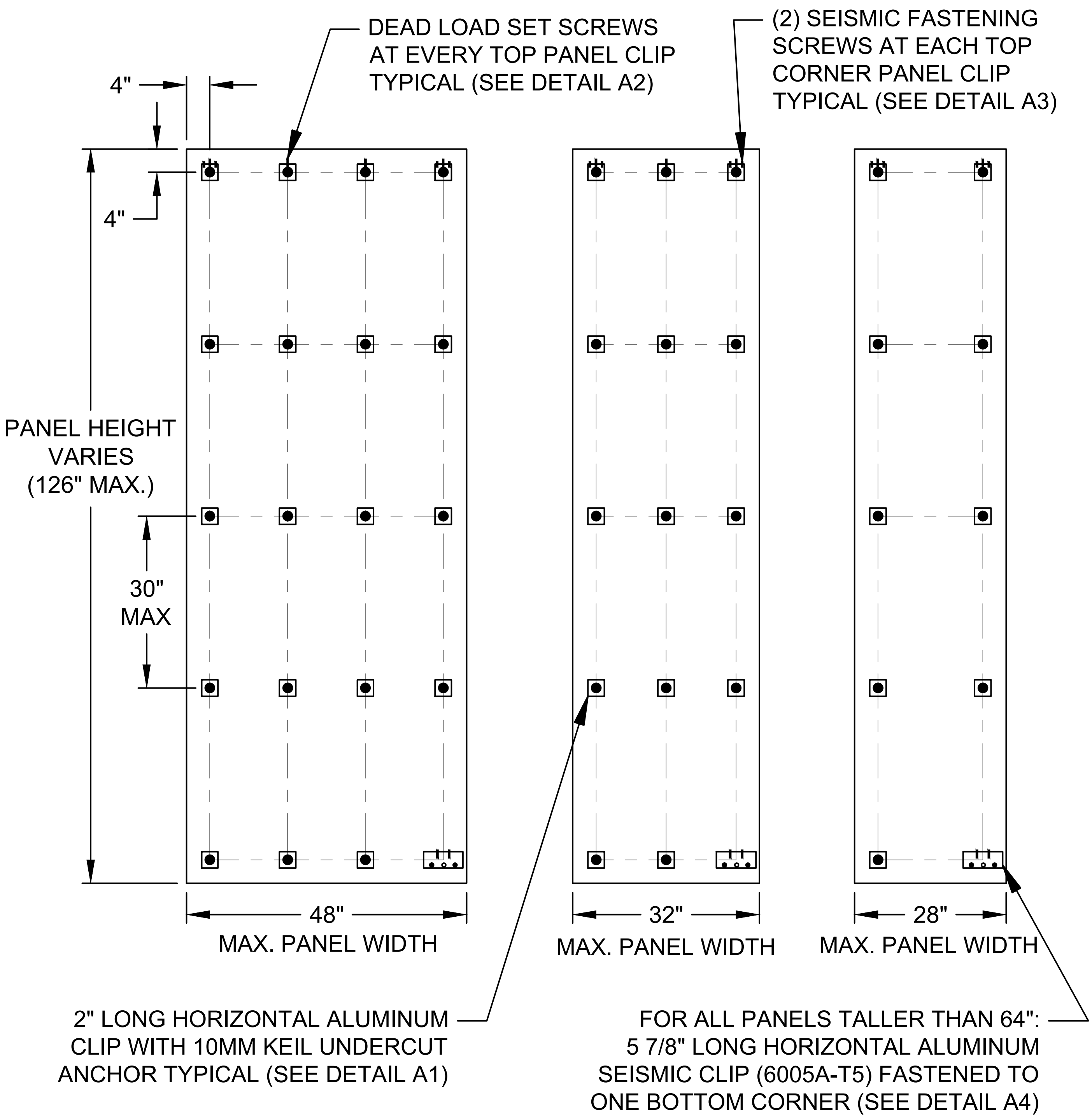
SUBJECT: KUS20 KIRKLAND URBAN SOUTH
CONCEALED–FASTENED PANEL DIAGRAM
CORNER ZONE 37 PSF ASD

SHEET NO. P0–1
PROJECT NO. 63200381.000
BY: AB DATE: 1/5/2021

CORNER ZONE:

37 PSF
CORNER ZONE WIDTH: 22'-0"

PANEL ANALYSIS BEGINS ON P1



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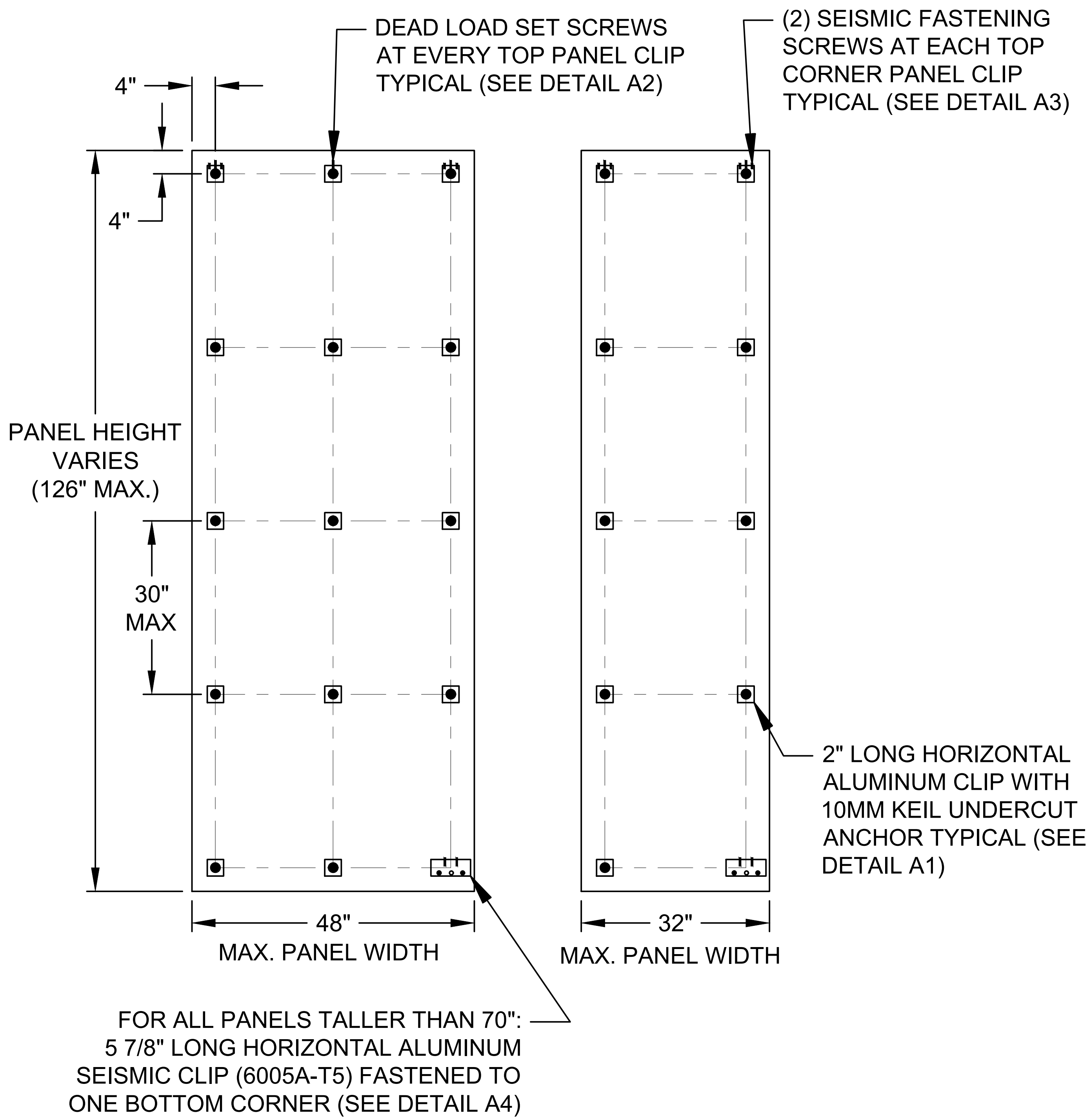
SUBJECT: KUS20 KIRKLAND URBAN SOUTH
CONCEALED–FASTENED PANEL DIAGRAM
TYPICAL ZONE 20 PSF ASD

SHEET NO. P0–2
PROJECT NO. 63200381.000
BY: AB DATE: 1/5/2021

TYPICAL ZONE:
20 PSF

PANEL ANALYSIS BEGINS ON P4



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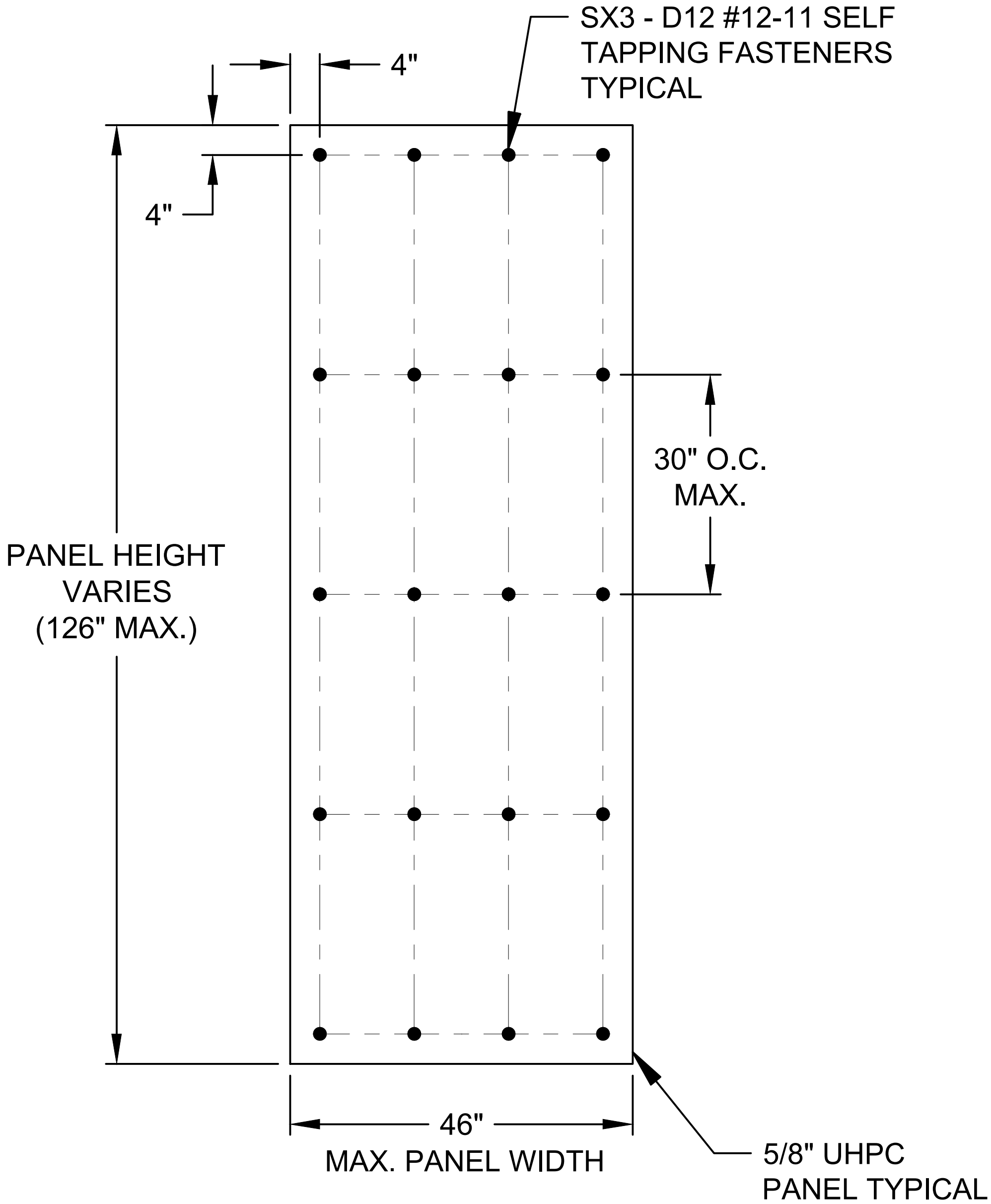
SUBJECT: KUS20 KIRKLAND URBAN SOUTH
FACE–FASTENED PANEL DIAGRAM
CORNER ZONE 37 PSF ASD

SHEET NO. P0–3
PROJECT NO. 63200381.000
BY: AB DATE: 1/5/2021

CORNER ZONE 37 PSF

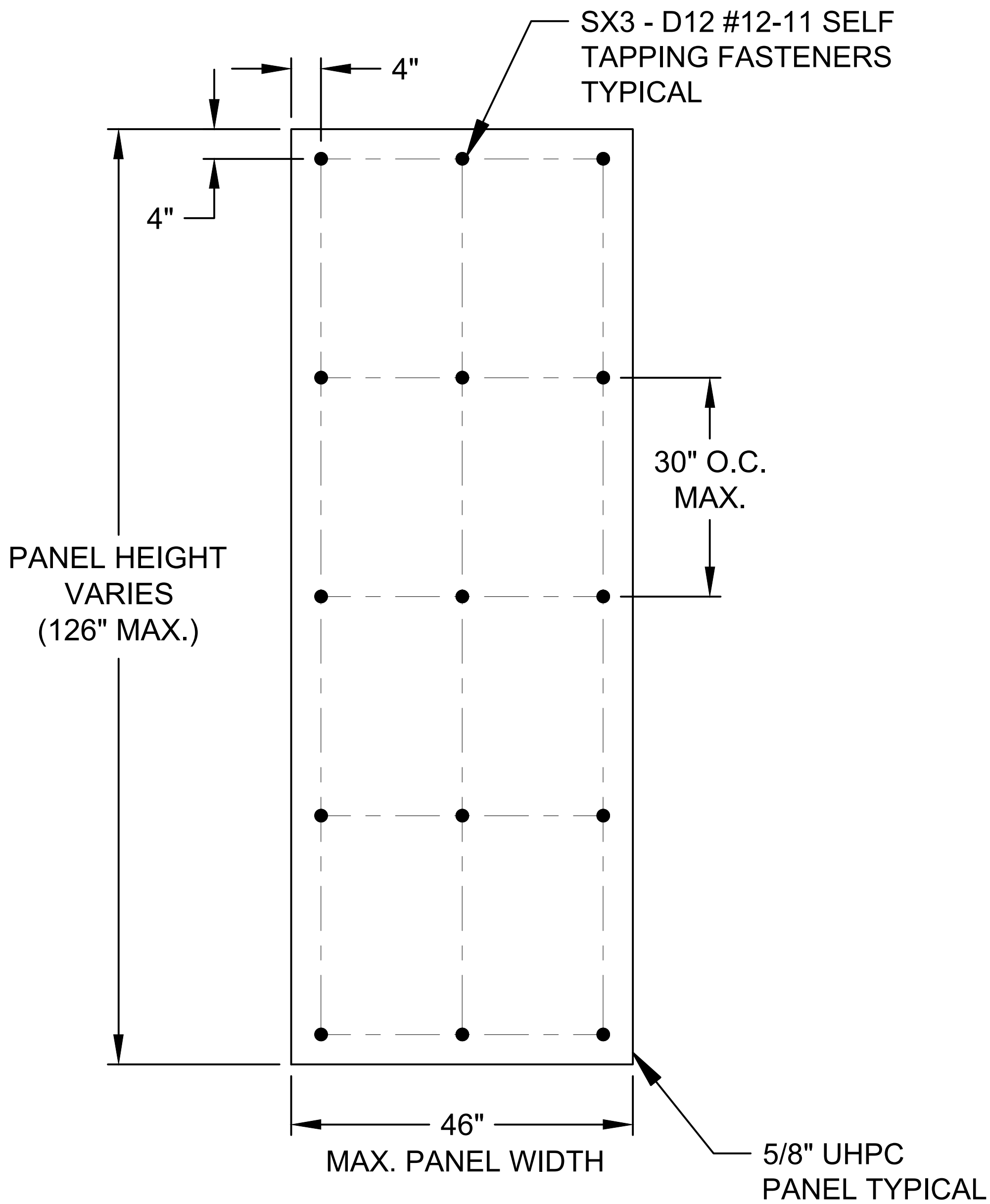
CORNER ZONE WIDTH: 22'-0"

PANEL ANALYSIS BEGINS ON P6



TYPICAL ZONE: 20 PSF

PANEL ANALYSIS BEGINS ON P7



5/8" PANEL ANALYSIS: (Typical Zone)

1. Panel RISA Analysis Summary:

Panel Size: 48" Wide

DESCRIPTION: 5/8" Concrete Panel
MATERIAL: High Performance Concrete

Properties:

$WL := 37 \cdot psf$	(Wind Pressure)
$t := 0.625 \cdot in$	(Nominal Panel Thickness)
$t_d := 0.575\ in$	(Design Panel Thickness - Includes panel tolerance)
$F_u := 3.190 \cdot ksi$	(Modulus of Rupture)
$\tau_u := 0.957 \cdot ksi$	(Shear Stress: 30% of Rupture)
$E := 3685 \cdot ksi$	(Elasticity)
$\rho := 137 \cdot \frac{lbf}{ft^3}$	(Density)
$\Omega := 3$	(Factor of Safety)

Deflection Summary:

$Fastener_{spacing} := 30 \cdot in$ (Fastener Spacing)

$\Delta_{WL\_allow} := min\left(\frac{Fastener_{spacing}}{360}\right)$ $\Delta_{MAX} := 0.0243 \cdot in$

$\Delta_{WL\_allow} = 0.083\ in$ > $\Delta_{MAX} = 0.024\ in$ **Check = "Deflection O.K."**

Bending Stress Summary:

$F_b := \frac{F_u}{\Omega}$ $fb := 0.62 \cdot ksi$

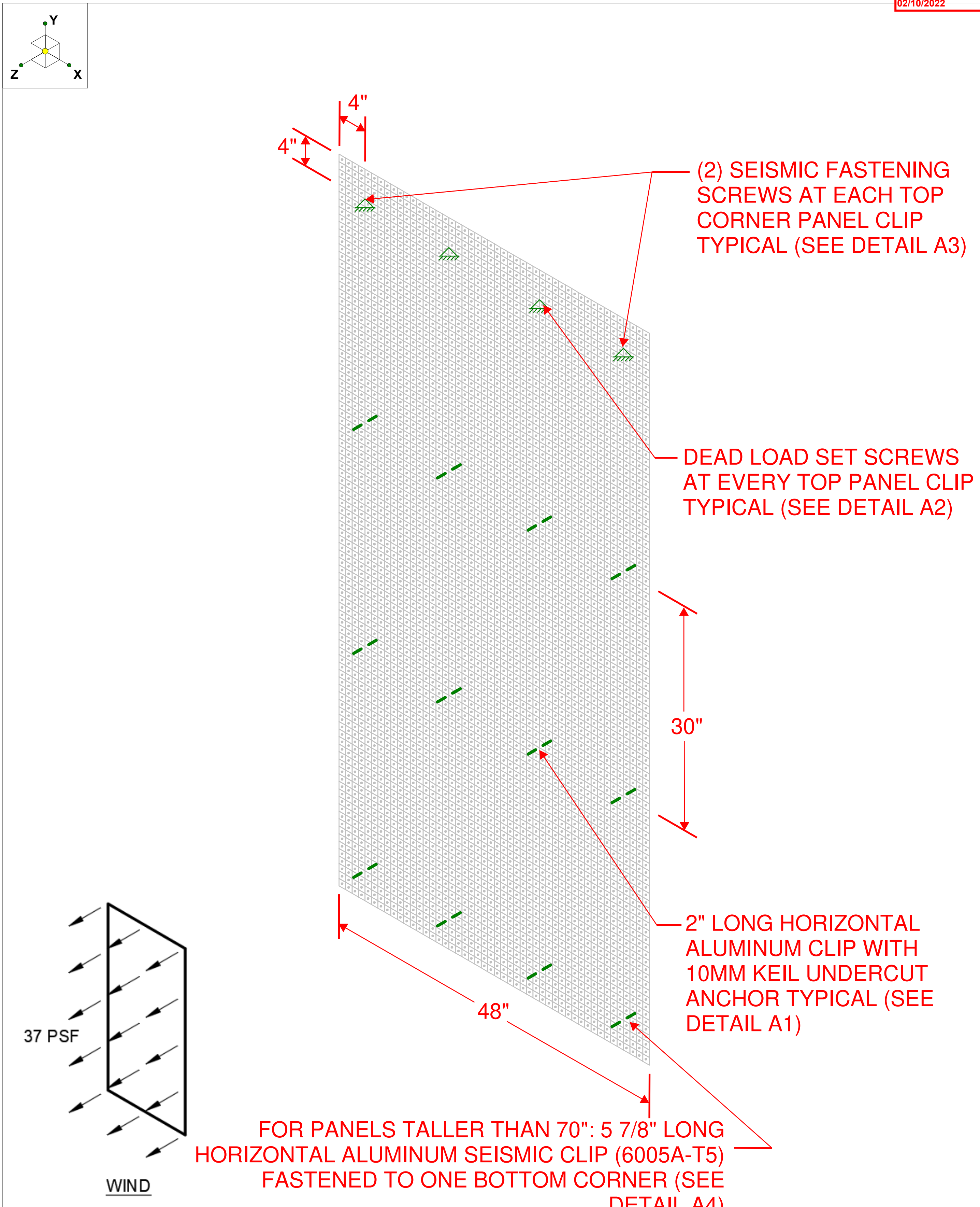
$F_b = 1.06\ ksi$ > $fb = 0.62\ ksi$ **Check = "Stress O.K."**

Shear Stress Summary:

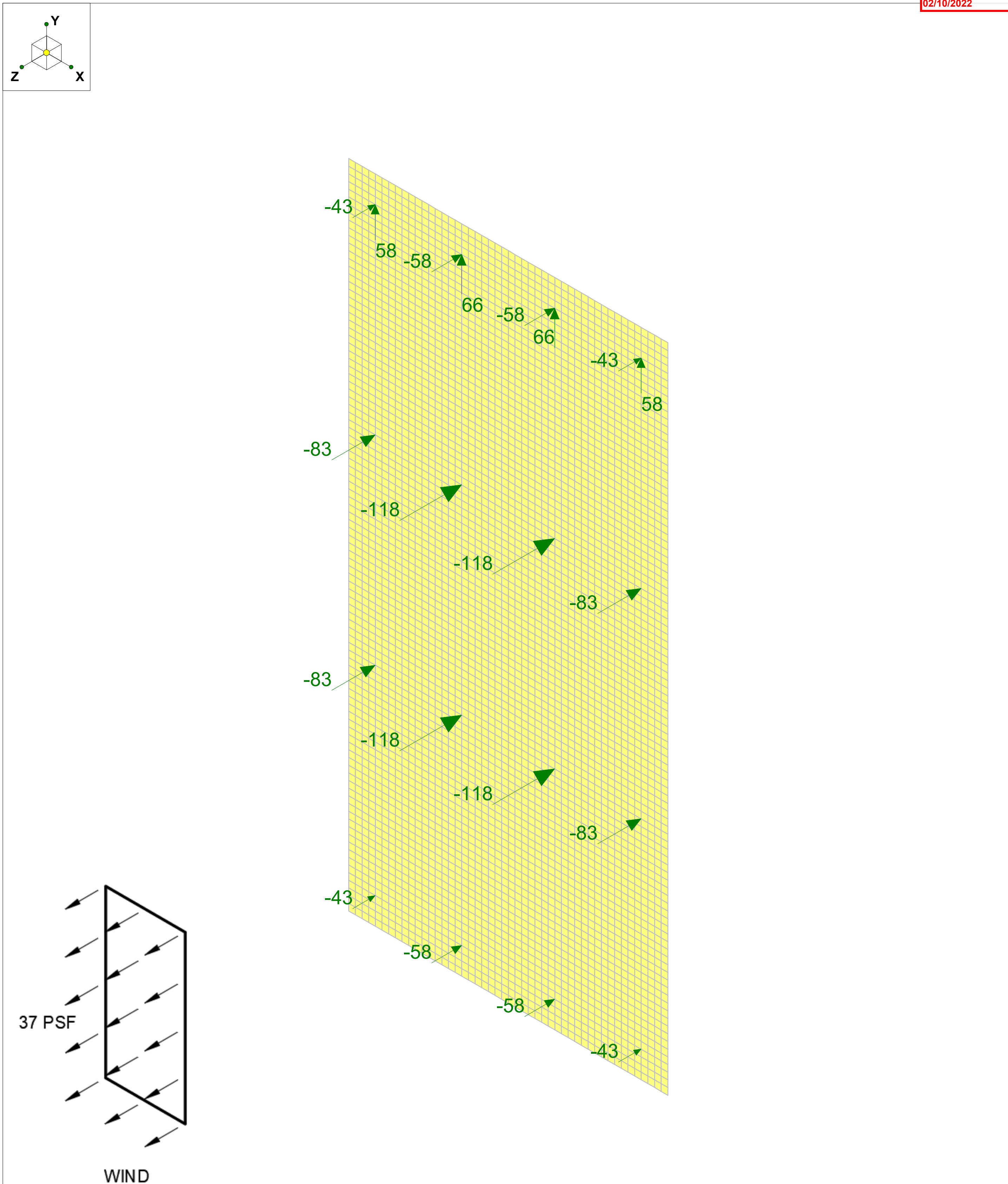
$F_\tau := \frac{\tau_u}{\Omega}$ $f\tau := 0.184 \cdot ksi$

$F_\tau = 0.319\ ksi$ > $f\tau = 0.184\ ksi$ **Check = "Stress O.K."**

City of Kirkland
Post Revision
Reviewed by ASHaupt
02/10/2022

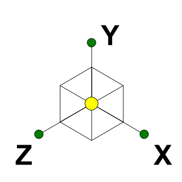


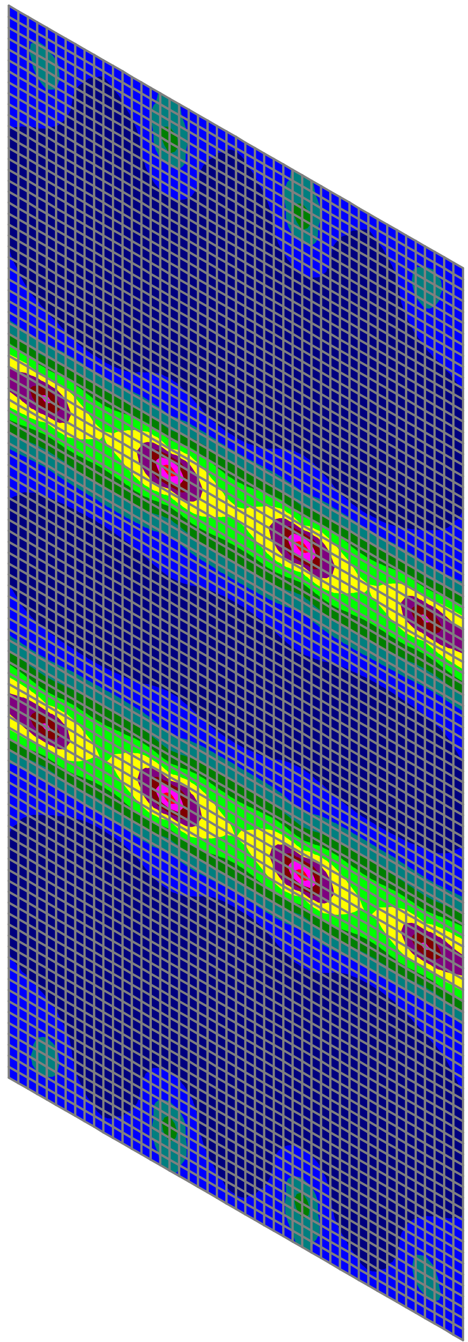
LARSON ENGINEERING	P1	48" WIDE PANEL (COR.)
AB	KUS20	Jan 5, 2021 at 2:01 PM
63200381.000	PANEL DIAGRAM	48IN WIDE PANEL.r3d

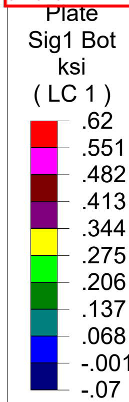


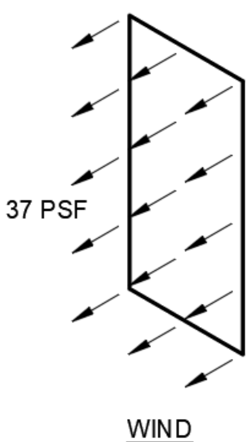
Results for LC 1, WL+DL
Reaction and Moment Units are lb and lb-ft

LARSON ENGINEERING	P1	48" WIDE PANEL (COR.)
AB	KUS20	Jan 5, 2021 at 2:03 PM
63200381.000	REACTIONS	48IN WIDE PANEL.r3d



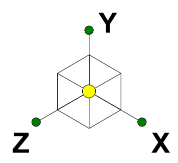


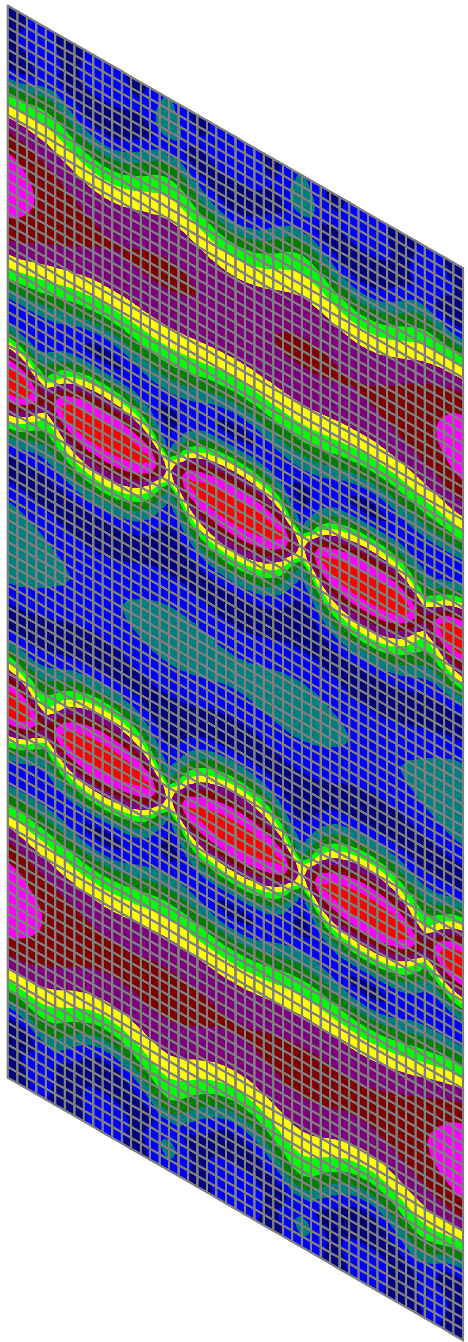


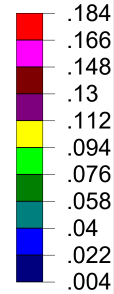


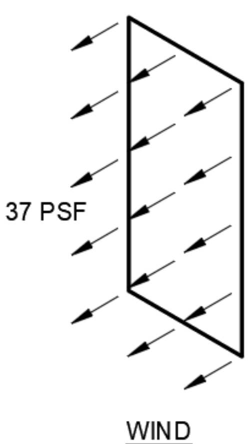
Results for LC 1, WL+DL

LARSON ENGINEERING	P1	48" WIDE PANEL (COR.)
AB	KUS20	Jan 5, 2021 at 2:06 PM
63200381.000	BENDING STRESS	48IN WIDE PANEL.r3d



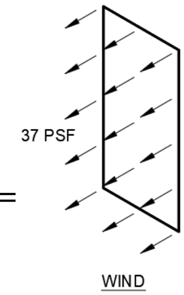






Results for LC 1, WL+DL

LARSON ENGINEERING	P1	48" WIDE PANEL (COR.)
AB	KUS20	Jan 5, 2021 at 2:05 PM
63200381.000	SHEAR STRESS	48IN WIDE PANEL.r3d



Joint Deflections (By Combination)

	LC	Joint Label	X [in]	Y [in]	Z [in]	X Rotation [rad]	Y Rotation [rad]	Z Rotation [rad]
1	1	N37	0	-.0001	.0243	1.3914e-04	2.0827e-04	0
2	1	N101	0	0	.0243	-1.3914e-04	2.0827e-04	0
3	1	N4835	0	0	.0243	-1.3914e-04	-2.0827e-04	0
4	1	N4771	0	-.0001	.0243	1.3914e-04	-2.0827e-04	0
5	1	N38	0	-.0001	.0243	-1.7698e-04	2.0109e-04	0
6	1	N100	0	0	.0243	1.7698e-04	2.0109e-04	0
7	1	N4834	0	0	.0243	1.7698e-04	-2.0109e-04	0
8	1	N4772	0	-.0001	.0243	-1.7698e-04	-2.0109e-04	0
9	1	N135	0	-.0001	.0241	1.4266e-04	1.6387e-04	0
10	1	N199	0	0	.0241	-1.4266e-04	1.6387e-04	0
11	1	N4737	0	0	.0241	-1.4266e-04	-1.6387e-04	0
12	1	N4673	0	-.0001	.0241	1.4266e-04	-1.6387e-04	0
13	1	N136	0	-.0001	.0241	-1.7038e-04	1.5751e-04	0
14	1	N198	0	0	.0241	1.7038e-04	1.5751e-04	0
15	1	N4736	0	0	.0241	1.7038e-04	-1.5751e-04	0
16	1	N4674	0	-.0001	.0241	-1.7038e-04	-1.5751e-04	0
17	1	N36	0	-.0001	.024	4.5825e-04	2.1101e-04	0
18	1	N102	0	0	.024	-4.5825e-04	2.1101e-04	0
19	1	N4836	0	0	.024	-4.5825e-04	-2.1101e-04	0
20	1	N4770	0	-.0001	.024	4.5825e-04	-2.1101e-04	0
21	1	N234	0	-.0001	.0239	1.4701e-04	1.263e-04	0
22	1	N298	0	0	.0239	-1.4701e-04	1.263e-04	0
23	1	N4638	0	0	.0239	-1.4701e-04	-1.263e-04	0
24	1	N4574	0	-.0001	.0239	1.4701e-04	-1.263e-04	0
25	1	N235	0	-.0001	.0239	-1.6224e-04	1.2081e-04	0
26	1	N297	0	0	.0239	1.6224e-04	1.2081e-04	0
27	1	N4637	0	0	.0239	1.6224e-04	-1.2081e-04	0
28	1	N4575	0	-.0001	.0239	-1.6224e-04	-1.2081e-04	0
29	1	N39	0	-.0001	.0239	-4.8543e-04	1.8943e-04	0
30	1	N99	0	0	.0239	4.8543e-04	1.8943e-04	0
31	1	N4833	0	0	.0239	4.8543e-04	-1.8943e-04	0
32	1	N4773	0	-.0001	.0239	-4.8543e-04	-1.8943e-04	0
33	1	N333	0	-.0001	.0238	1.5045e-04	9.5267e-05	0
34	1	N397	0	0	.0238	-1.5045e-04	9.5267e-05	0
35	1	N4539	0	0	.0238	-1.5045e-04	-9.5267e-05	0
36	1	N4475	0	-.0001	.0238	1.5045e-04	-9.5267e-05	0
37	1	N334	0	-.0001	.0238	-1.557e-04	9.0657e-05	0
38	1	N396	0	0	.0238	1.557e-04	9.0657e-05	0
39	1	N4538	0	0	.0238	1.557e-04	-9.0657e-05	0
40	1	N4476	0	-.0001	.0238	-1.557e-04	-9.0657e-05	0
41	1	N134	0	-.0001	.0238	4.5874e-04	1.6642e-04	0
42	1	N200	0	0	.0238	-4.5874e-04	1.6642e-04	0
43	1	N4738	0	0	.0238	-4.5874e-04	-1.6642e-04	0
44	1	N4672	0	-.0001	.0238	4.5874e-04	-1.6642e-04	0
45	1	N432	0	-.0001	.0238	-1.5012e-04	6.6226e-05	0
46	1	N492	0	0	.0238	1.5012e-04	6.6226e-05	0
47	1	N4440	0	0	.0238	1.5012e-04	-6.6226e-05	0
48	1	N4380	0	-.0001	.0238	-1.5012e-04	-6.6226e-05	0
49	1	N137	0	-.0001	.0238	-4.7574e-04	1.4732e-04	0
50	1	N197	0	0	.0238	4.7574e-04	1.4732e-04	0
51	1	N4735	0	0	.0238	4.7574e-04	-1.4732e-04	0
52	1	N4675	0	-.0001	.0238	-4.7574e-04	-1.4732e-04	0
53	1	N431	0	-.0001	.0238	1.5325e-04	6.9975e-05	0
54	1	N493	0	0	.0238	-1.5325e-04	6.9975e-05	0
55	1	N4441	0	0	.0238	-1.5325e-04	-6.9975e-05	0
56	1	N4379	0	-.0001	.0238	1.5325e-04	-6.9975e-05	0

5/8" PANEL ANALYSIS: (Typical Zone)

1. Panel RISA Analysis Summary:

Panel Size: 32" Wide

DESCRIPTION: 5/8" Concrete Panel
MATERIAL: High Performance Concrete

Properties:

$WL := 37 \cdot psf$	(Wind Pressure)
$t := 0.625 \cdot in$	(Nominal Panel Thickness)
$t_d := 0.575\ in$	(Design Panel Thickness - Includes panel tolerance)
$F_u := 3.190 \cdot ksi$	(Modulus of Rupture)
$\tau_u := 0.957 \cdot ksi$	(Shear Stress: 30% of Rupture)
$E := 3685 \cdot ksi$	(Elasticity)
$\rho := 137 \cdot \frac{lbf}{ft^3}$	(Density)
$\Omega := 3$	(Factor of Safety)

Deflection Summary:

$Fastener_{spacing} := 30 \cdot in$ (Fastener Spacing)

$\Delta_{WL\_allow} := min\left(\frac{Fastener_{spacing}}{360}\right)$ $\Delta_{MAX} := 0.0243 \cdot in$

$\Delta_{WL\_allow} = 0.083\ in$ > $\Delta_{MAX} = 0.024\ in$ **Check = "Deflection O.K."**

Bending Stress Summary:

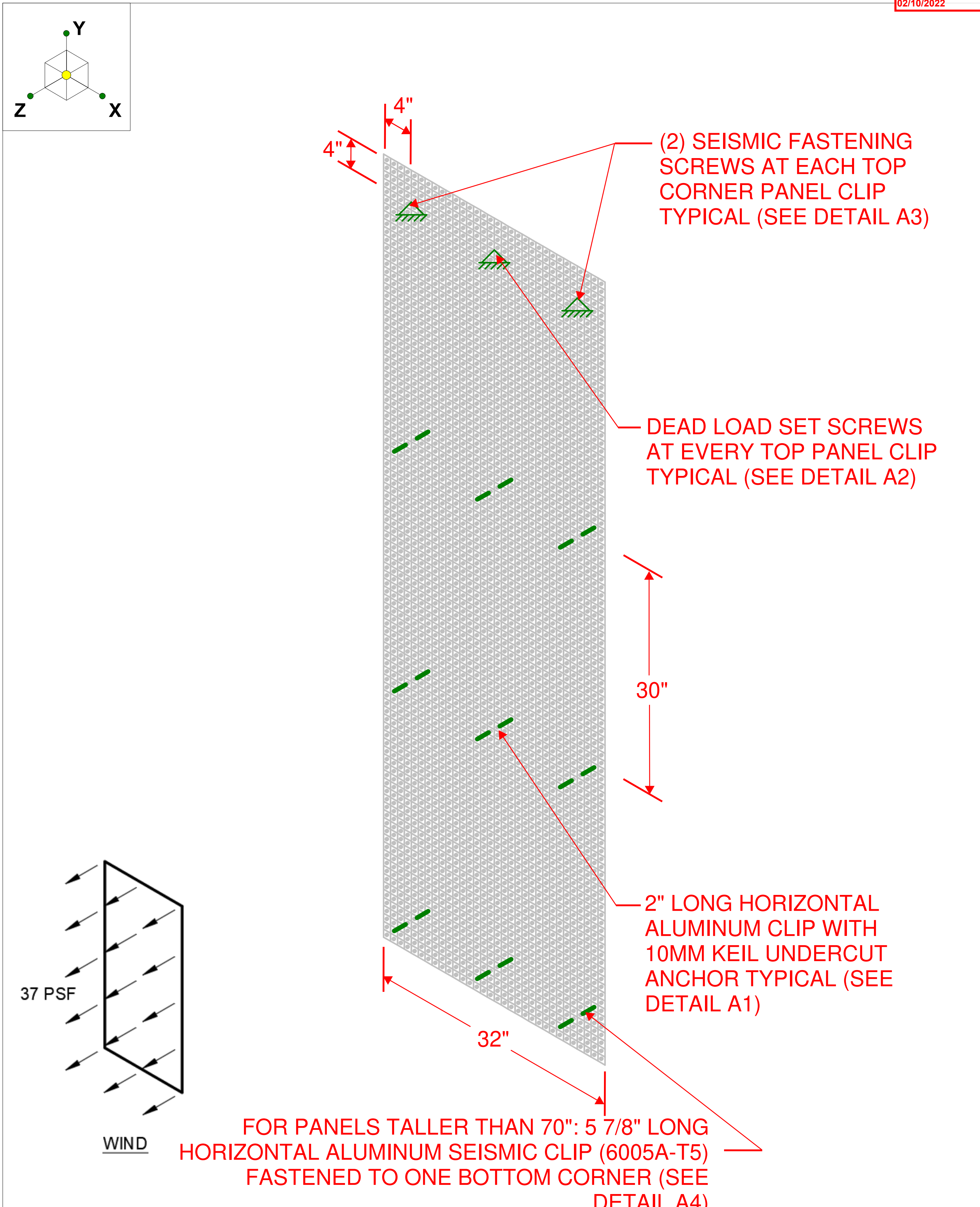
$F_b := \frac{F_u}{\Omega}$ $fb := 0.584 \cdot ksi$

$F_b = 1.06\ ksi$ > $fb = 0.584\ ksi$ **Check = "Stress O.K."**

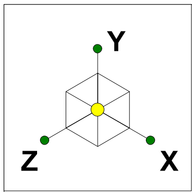
Shear Stress Summary:

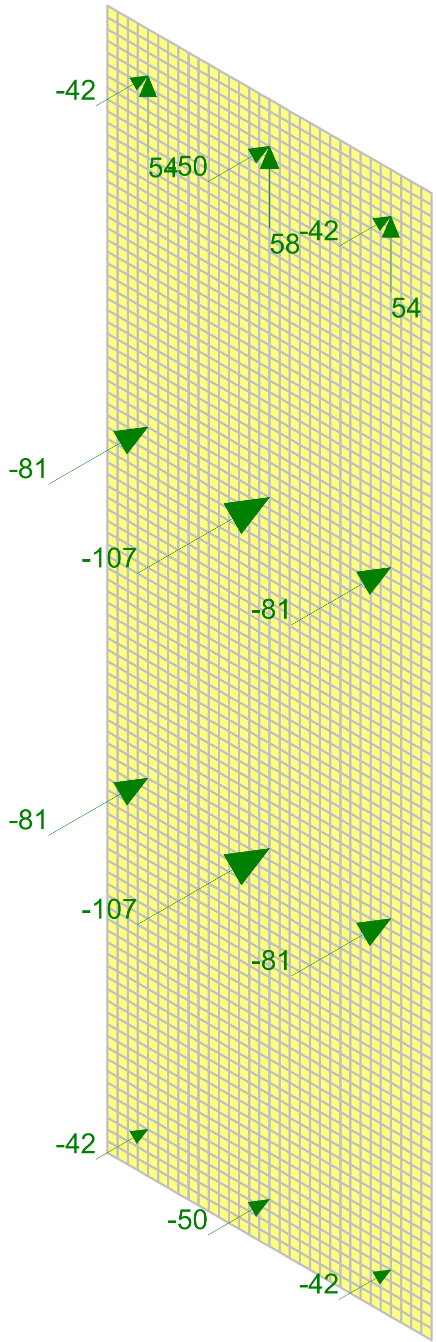
$F_\tau := \frac{\tau_u}{\Omega}$ $f\tau := 0.183 \cdot ksi$

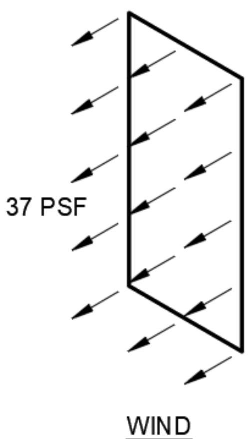
$F_\tau = 0.319\ ksi$ > $f\tau = 0.183\ ksi$ **Check = "Stress O.K."**



LARSON ENGINEERING	P2	32" WIDE PANEL (COR.)
AB	KUS20	Jan 5, 2021 at 4:28 PM
63200381.000	PANEL DIAGRAM	32IN WIDE PANEL (COR.).r3d

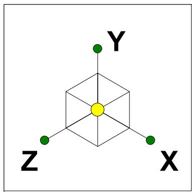


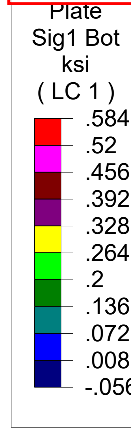


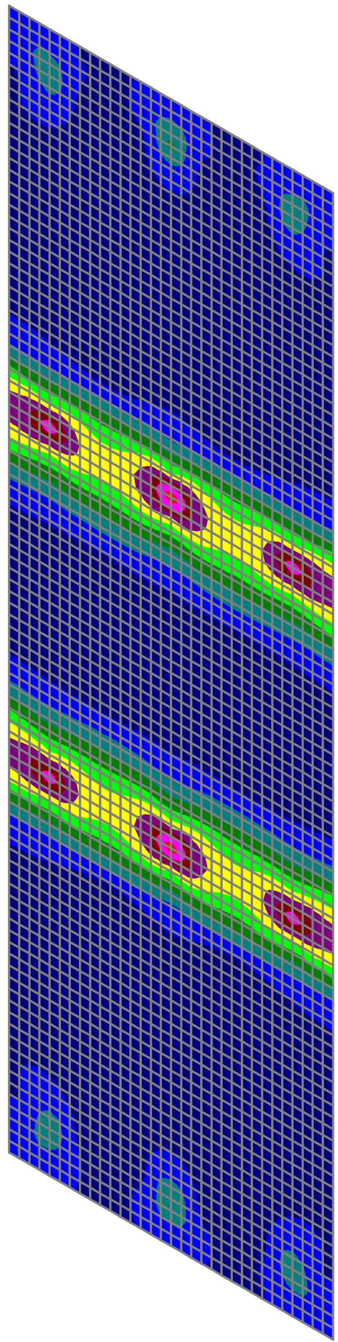


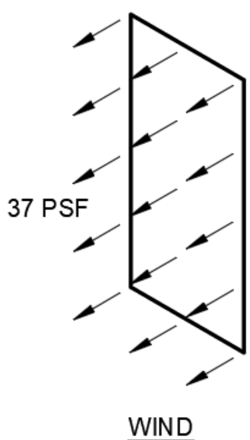
Results for LC 1, WL+DL
Reaction and Moment Units are lb and lb-ft

LARSON ENGINEERING	P2	32" WIDE PANEL (COR.)
AB	KUS20	Jan 5, 2021 at 4:30 PM
63200381.000	REACTIONS	32IN WIDE PANEL (COR.).r3d



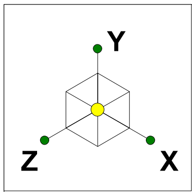


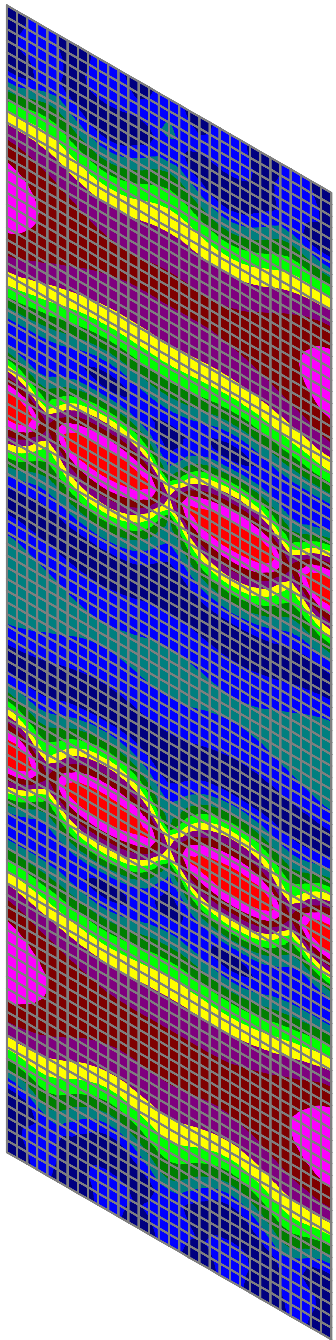


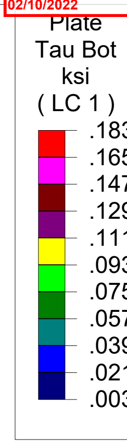


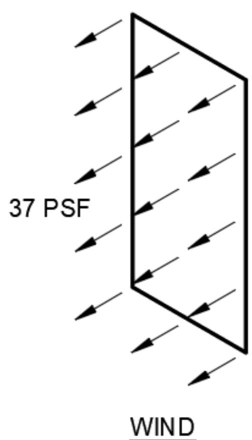
Results for LC 1, WL+DL

LARSON ENGINEERING	P2	32" WIDE PANEL (COR.)
AB	KUS20	Jan 5, 2021 at 4:29 PM
63200381.000	BENDING STRESS	32IN WIDE PANEL (COR.).r3d



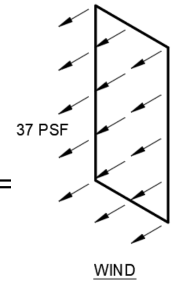






Results for LC 1, WL+DL

LARSON ENGINEERING	P2	32" WIDE PANEL (COR.)
AB	KUS20	Jan 5, 2021 at 4:29 PM
63200381.000	SHEAR STRESS	32IN WIDE PANEL (COR.).r3d



Joint Deflections (By Combination)

	LC	Joint Label	X [in]	Y [in]	Z [in]	X Rotation [rad]	Y Rotation [rad]	Z Rotation [rad]
1	1	N3187	0	-.0001	.0243	1.3843e-04	-2.4002e-04	0
2	1	N33	0	-.0001	.0243	1.3843e-04	2.4002e-04	0
3	1	N97	0	0	.0243	-1.3843e-04	2.4002e-04	0
4	1	N3251	0	0	.0243	-1.3843e-04	-2.4002e-04	0
5	1	N3188	0	-.0001	.0243	-1.7612e-04	-2.3348e-04	0
6	1	N34	0	-.0001	.0243	-1.7612e-04	2.3348e-04	0
7	1	N96	0	0	.0243	1.7612e-04	2.3348e-04	0
8	1	N3250	0	0	.0243	1.7612e-04	-2.3348e-04	0
9	1	N3089	0	-.0001	.0241	1.4155e-04	-1.9566e-04	0
10	1	N131	0	-.0001	.0241	1.4155e-04	1.9566e-04	0
11	1	N195	0	0	.0241	-1.4155e-04	1.9566e-04	0
12	1	N3153	0	0	.0241	-1.4155e-04	-1.9566e-04	0
13	1	N3090	0	-.0001	.0241	-1.7009e-04	-1.8994e-04	0
14	1	N132	0	-.0001	.0241	-1.7009e-04	1.8994e-04	0
15	1	N3152	0	0	.0241	1.7009e-04	-1.8994e-04	0
16	1	N194	0	0	.0241	1.7009e-04	1.8994e-04	0
17	1	N3186	0	-.0001	.024	4.5601e-04	-2.4235e-04	0
18	1	N32	0	-.0001	.024	4.5601e-04	2.4235e-04	0
19	1	N98	0	0	.024	-4.5601e-04	2.4235e-04	0
20	1	N3252	0	0	.024	-4.5601e-04	-2.4235e-04	0
21	1	N3189	0	-.0001	.024	-4.8293e-04	-2.227e-04	0
22	1	N35	0	-.0001	.024	-4.8293e-04	2.227e-04	0
23	1	N95	0	0	.024	4.8293e-04	2.227e-04	0
24	1	N3249	0	0	.024	4.8293e-04	-2.227e-04	0
25	1	N2990	0	-.0001	.0239	1.4536e-04	-1.5774e-04	0
26	1	N230	0	-.0001	.0239	1.4536e-04	1.5774e-04	0
27	1	N3054	0	0	.0239	-1.4536e-04	-1.5774e-04	0
28	1	N294	0	0	.0239	-1.4536e-04	1.5774e-04	0
29	1	N2991	0	-.0001	.0239	-1.6274e-04	-1.5287e-04	0
30	1	N231	0	-.0001	.0239	-1.6274e-04	1.5287e-04	0
31	1	N3053	0	0	.0239	1.6274e-04	-1.5287e-04	0
32	1	N293	0	0	.0239	1.6274e-04	1.5287e-04	0
33	1	N3088	0	-.0001	.0238	4.5627e-04	-1.9781e-04	0
34	1	N130	0	-.0001	.0238	4.5627e-04	1.9781e-04	0
35	1	N196	0	0	.0238	-4.5627e-04	1.9781e-04	0
36	1	N3154	0	0	.0238	-4.5627e-04	-1.9781e-04	0
37	1	N2891	0	-.0001	.0238	1.4832e-04	-1.2591e-04	0
38	1	N329	0	-.0001	.0238	1.4832e-04	1.2591e-04	0
39	1	N2955	0	0	.0238	-1.4832e-04	-1.2591e-04	0
40	1	N393	0	0	.0238	-1.4832e-04	1.2591e-04	0
41	1	N2892	0	-.0001	.0238	-1.5692e-04	-1.2189e-04	0
42	1	N330	0	-.0001	.0238	-1.5692e-04	1.2189e-04	0
43	1	N2954	0	0	.0238	1.5692e-04	-1.2189e-04	0
44	1	N392	0	0	.0238	1.5692e-04	1.2189e-04	0
45	1	N3091	0	-.0001	.0238	-4.7401e-04	-1.8063e-04	0
46	1	N133	0	-.0001	.0238	-4.7401e-04	1.8063e-04	0
47	1	N3151	0	0	.0238	4.7401e-04	-1.8063e-04	0
48	1	N193	0	0	.0238	4.7401e-04	1.8063e-04	0
49	1	N2795	0	-.0001	.0237	1.5066e-04	-9.9397e-05	0
50	1	N427	0	-.0001	.0237	1.5066e-04	9.9397e-05	0
51	1	N2857	0	0	.0237	-1.5066e-04	-9.9397e-05	0
52	1	N489	0	0	.0237	-1.5066e-04	9.9397e-05	0
53	1	N2796	0	-.0001	.0237	-1.5204e-04	-9.6203e-05	0
54	1	N428	0	-.0001	.0237	-1.5204e-04	9.6203e-05	0
55	1	N2856	0	0	.0237	1.5204e-04	-9.6203e-05	0
56	1	N488	0	0	.0237	1.5204e-04	9.6203e-05	0

5/8" PANEL ANALYSIS: (Corner Zone)

1. Panel RISA Analysis Summary:

Panel Size: 28" Wide

DESCRIPTION: 5/8" Concrete Panel
MATERIAL: High Performance Concrete

Properties:

$WL := 37 \cdot psf$ (Wind Pressure)

$t := 0.625 \cdot in$ (Nominal Panel Thickness)

$t_d := 0.575\ in$ (Design Panel Thickness - Includes panel tolerance)

$F_u := 3.190 \cdot ksi$ (Modulus of Rupture)

$\tau_u := 0.957 \cdot ksi$ (Shear Stress: 30% of Rupture)

$E := 3685 \cdot ksi$ (Elasticity)

$\rho := 137 \cdot \frac{lbf}{ft^3}$ (Density)

$\Omega := 3$ (Factor of Safety)

Deflection Summary:

$Fastener_{spacing} := 30 \cdot in$ (Fastener Spacing)

$\Delta_{WL\_allow} := min\left(\frac{Fastener_{spacing}}{360}\right)$ $\Delta_{MAX} := 0.0293 \cdot in$

$\Delta_{WL\_allow} = 0.083\ in$ > $\Delta_{MAX} = 0.029\ in$ **Check = "Deflection O.K."**

Bending Stress Summary:

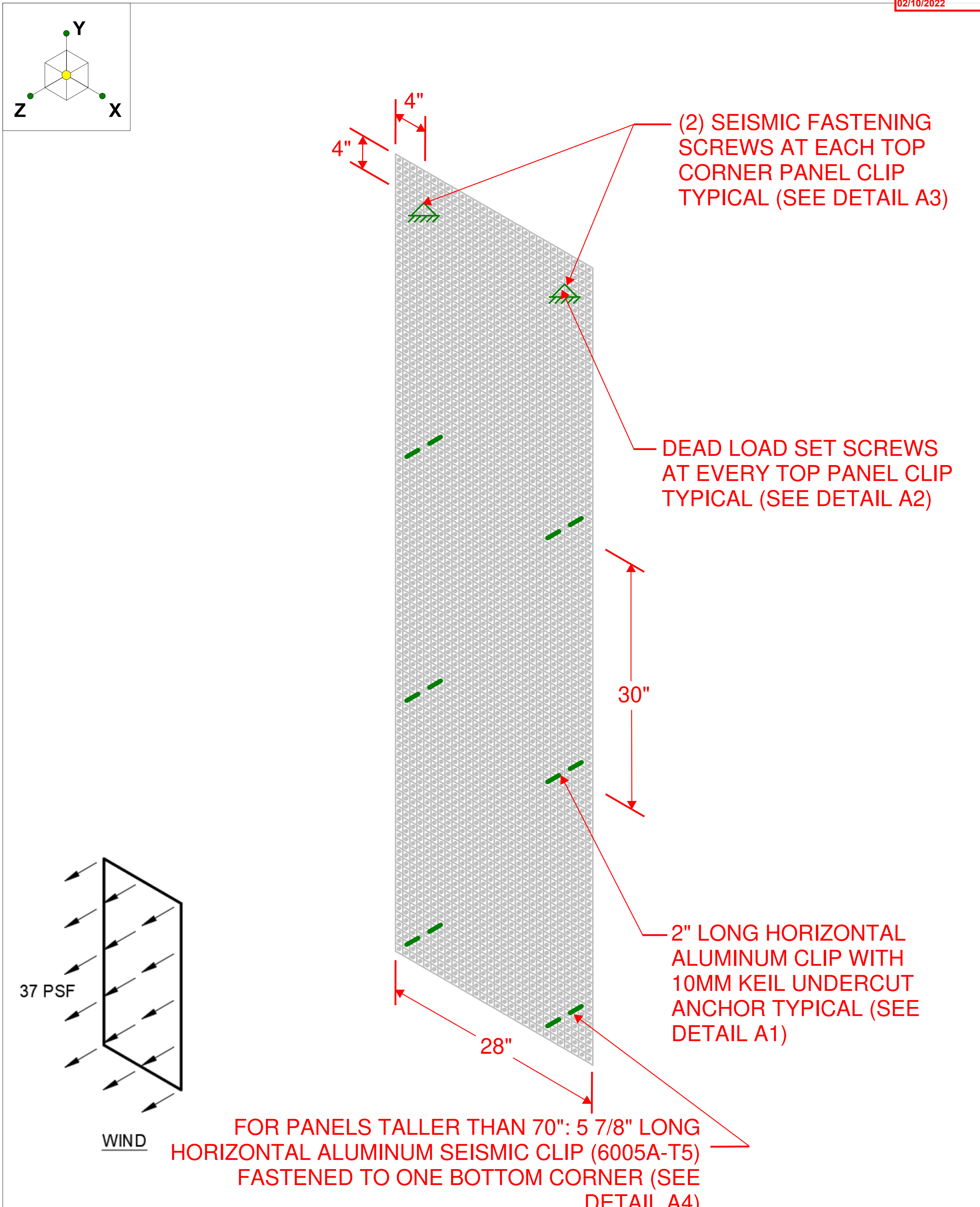
$F_b := \frac{F_u}{\Omega}$ $fb := 0.65 \cdot ksi$

$F_b = 1.06\ ksi$ > $fb = 0.65\ ksi$ **Check = "Stress O.K."**

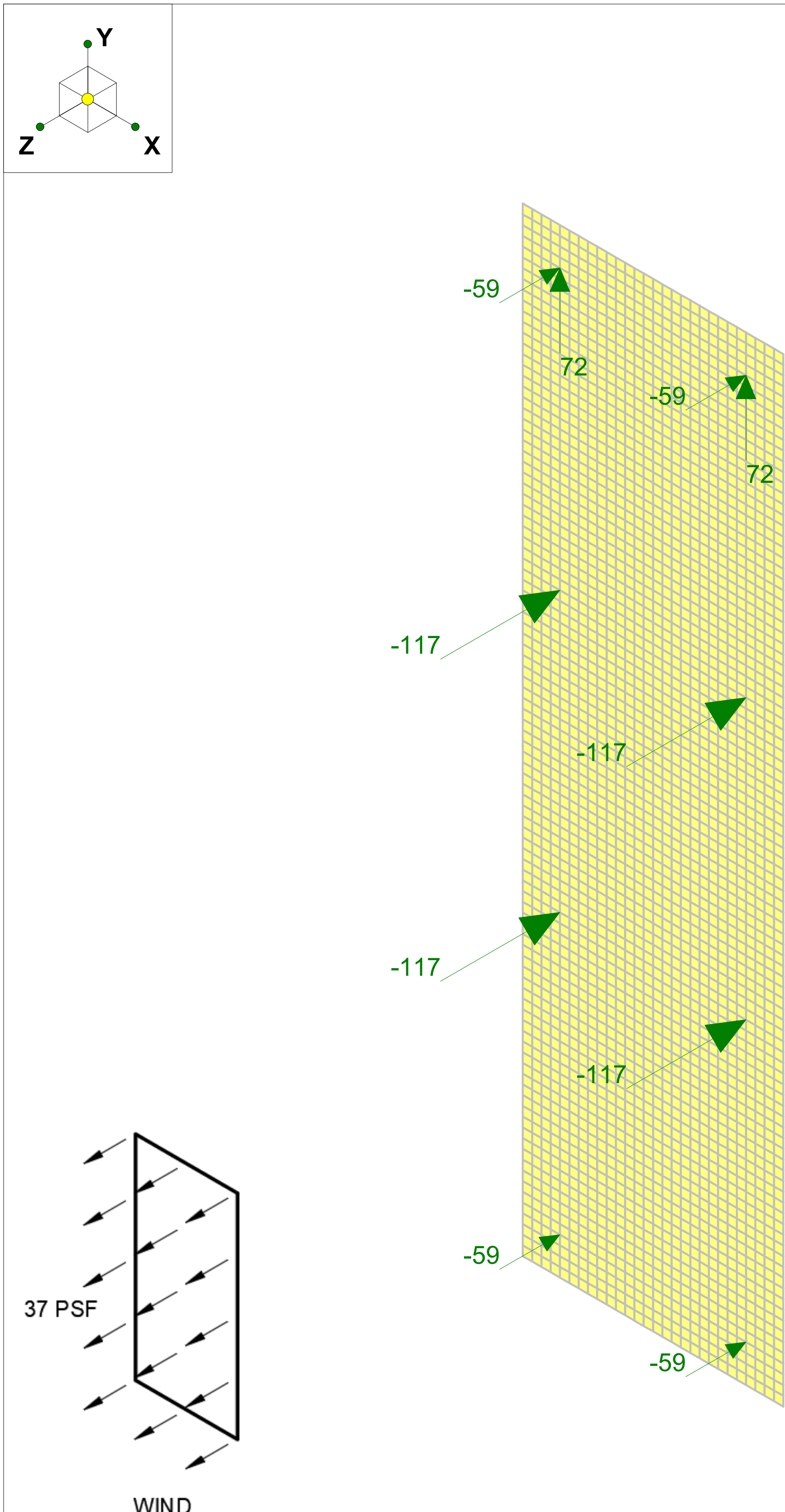
Shear Stress Summary:

$F_\tau := \frac{\tau_u}{\Omega}$ $f\tau := 0.225 \cdot ksi$

$F_\tau = 0.319\ ksi$ > $f\tau = 0.225\ ksi$ **Check = "Stress O.K."**

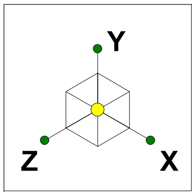


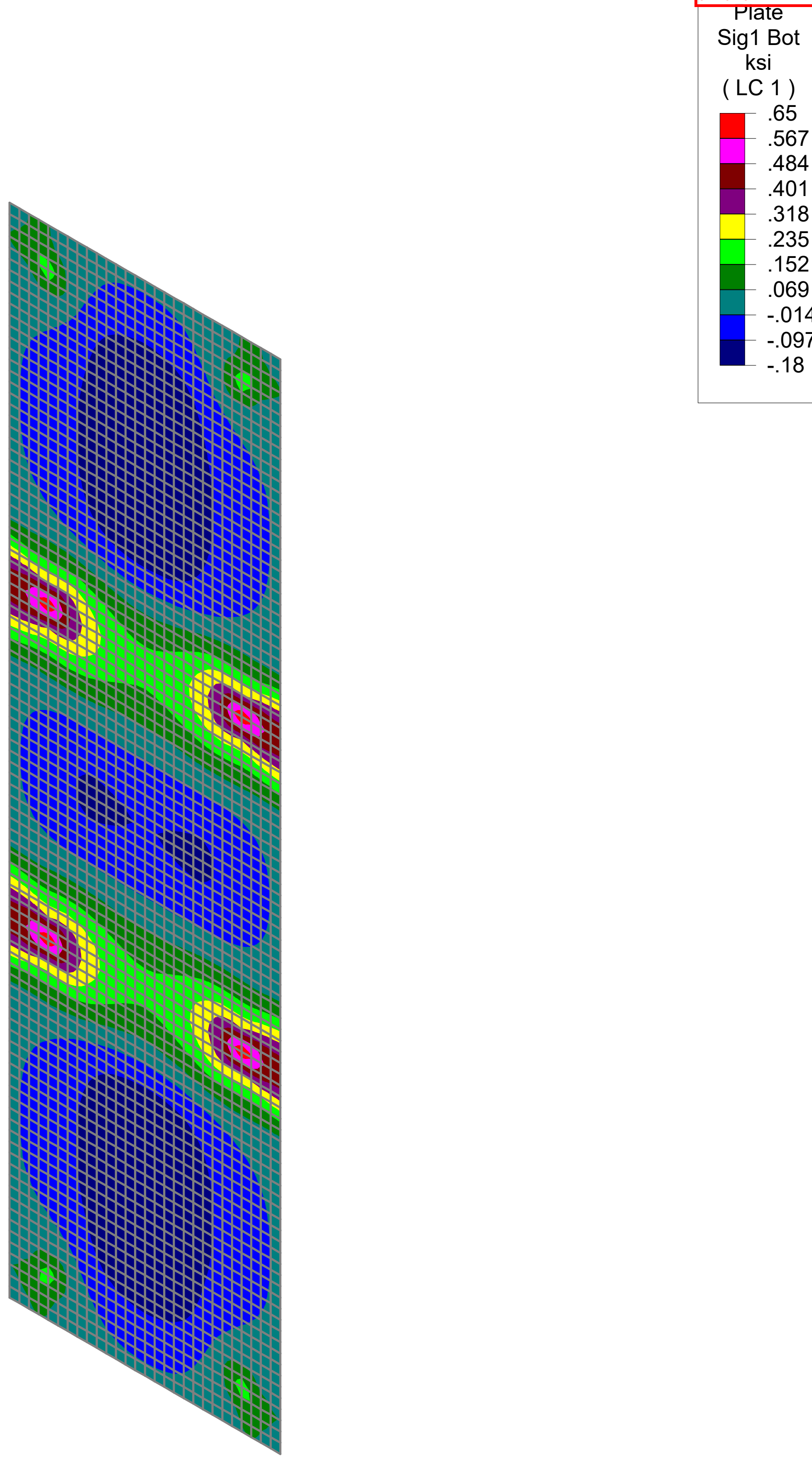
LARSON ENGINEERING	P3	28" WIDE PANEL (COR.)
AB	KUS20	Jan 6, 2021 at 9:44 AM
63200381.000	PANEL DIAGRAM	P3 WIDE PANEL (COR).r3d

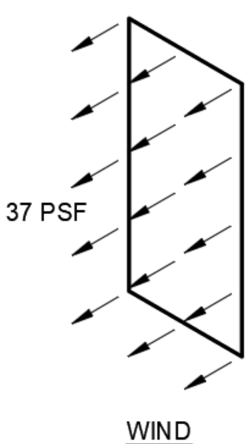


Results for LC 1, WL+DL
Reaction and Moment Units are lb and lb-ft

LARSON ENGINEERING	P3	28" WIDE PANEL (COR.)
AB	KUS20	Jan 6, 2021 at 9:46 AM
63200381.000	REACTIONS	P3 WIDE PANEL (COR).r3d







Results for LC 1, WL+DL

LARSON ENGINEERING	P3	28" WIDE PANEL (COR.)
AB	KUS20	Jan 6, 2021 at 9:47 AM
63200381.000	BENDING STRESS	P3 WIDE PANEL (COR).r3d

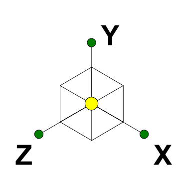
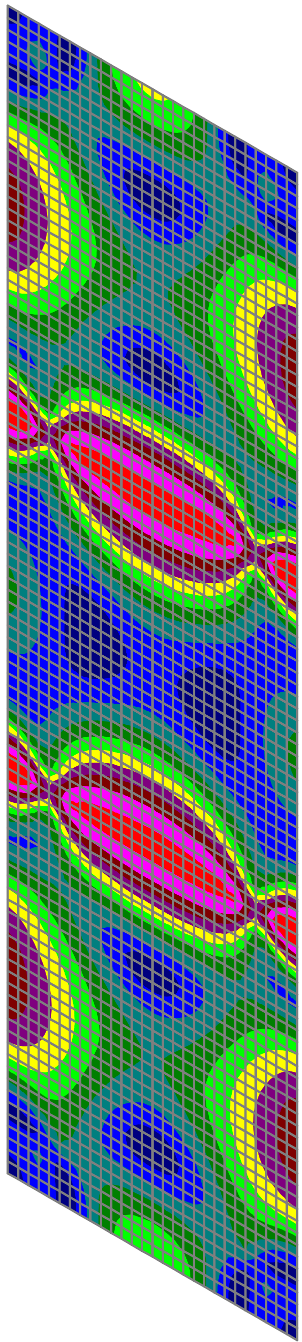
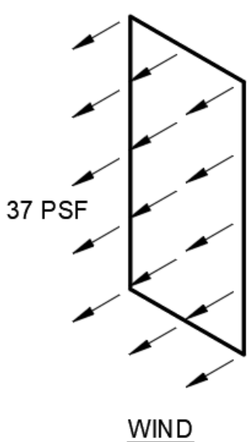


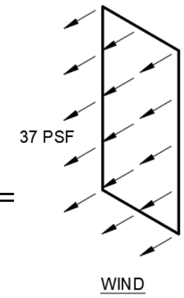
Plate
Tau Bot
ksi
(LC 1)
.225
.203
.181
.159
.137
.115
.093
.071
.049
.027
.005





Results for LC 1, WL+DL

LARSON ENGINEERING	P3	28" WIDE PANEL (COR.)
AB	KUS20	Jan 6, 2021 at 9:48 AM
63200381.000	SHEAR STRESS	P3 WIDE PANEL (COR).r3d



Joint Deflections (By Combination)

	LC	Joint Label	X [in]	Y [in]	Z [in]	X Rotation [rad]	Y Rotation [rad]	Z Rotation [rad]
1	1	N1473	0	0	.0293	6.1802e-05	0	0
2	1	N1411	0	-.0001	.0293	-6.1802e-05	0	0
3	1	N1374	0	0	.0292	6.2502e-05	-1.0694e-04	0
4	1	N1572	0	0	.0292	6.2502e-05	1.0694e-04	0
5	1	N1312	0	-.0001	.0292	-6.2502e-05	-1.0694e-04	0
6	1	N1510	0	-.0001	.0292	-6.2502e-05	1.0694e-04	0
7	1	N1474	0	0	.0292	-2.0131e-04	0	0
8	1	N1410	0	-.0001	.0292	2.0131e-04	0	0
9	1	N1375	0	0	.0292	-2.0134e-04	-1.0627e-04	0
10	1	N1573	0	0	.0292	-2.0134e-04	1.0627e-04	0
11	1	N1311	0	-.0001	.0292	2.0134e-04	-1.0627e-04	0
12	1	N1509	0	-.0001	.0292	2.0134e-04	1.0627e-04	0
13	1	N1472	0	0	.0291	3.1768e-04	0	0
14	1	N1412	0	-.0001	.0291	-3.1768e-04	0	0
15	1	N1275	0	0	.0291	6.459e-05	-2.1117e-04	0
16	1	N1671	0	0	.0291	6.459e-05	2.1117e-04	0
17	1	N1213	0	-.0001	.0291	-6.459e-05	-2.1117e-04	0
18	1	N1609	0	-.0001	.0291	-6.459e-05	2.1117e-04	0
19	1	N1373	0	0	.029	3.1912e-04	-1.0908e-04	0
20	1	N1571	0	0	.029	3.1912e-04	1.0908e-04	0
21	1	N1313	0	-.0001	.029	-3.1912e-04	-1.0908e-04	0
22	1	N1511	0	-.0001	.029	-3.1912e-04	1.0908e-04	0
23	1	N1276	0	0	.029	-2.0141e-04	-2.0983e-04	0
24	1	N1672	0	0	.029	-2.0141e-04	2.0983e-04	0
25	1	N1212	0	-.0001	.029	2.0141e-04	-2.0983e-04	0
26	1	N1608	0	-.0001	.029	2.0141e-04	2.0983e-04	0
27	1	N1475	0	0	.0289	-4.6704e-04	0	0
28	1	N1409	0	-.0001	.0289	4.6704e-04	0	0
29	1	N1274	0	0	.0289	3.2339e-04	-2.1539e-04	0
30	1	N1670	0	0	.0289	3.2339e-04	2.1539e-04	0
31	1	N1214	0	-.0001	.0289	-3.2339e-04	-2.1539e-04	0
32	1	N1610	0	-.0001	.0289	-3.2339e-04	2.1539e-04	0
33	1	N1376	0	0	.0288	-4.678e-04	-1.0707e-04	0
34	1	N1574	0	0	.0288	-4.678e-04	1.0707e-04	0
35	1	N1310	0	-.0001	.0288	4.678e-04	-1.0707e-04	0
36	1	N1508	0	-.0001	.0288	4.678e-04	1.0707e-04	0
37	1	N1176	0	0	.0288	6.8039e-05	-3.1011e-04	0
38	1	N1770	0	0	.0288	6.8039e-05	3.1011e-04	0
39	1	N1114	0	-.0001	.0288	-6.8039e-05	-3.1011e-04	0
40	1	N1708	0	-.0001	.0288	-6.8039e-05	3.1011e-04	0
41	1	N1177	0	0	.0287	-2.0147e-04	-3.0806e-04	0
42	1	N1771	0	0	.0287	-2.0147e-04	3.0806e-04	0
43	1	N1113	0	-.0001	.0287	2.0147e-04	-3.0806e-04	0
44	1	N1707	0	-.0001	.0287	2.0147e-04	3.0806e-04	0
45	1	N1277	0	0	.0287	-4.7004e-04	-2.1134e-04	0
46	1	N1673	0	0	.0287	-4.7004e-04	2.1134e-04	0
47	1	N1211	0	-.0001	.0287	4.7004e-04	-2.1134e-04	0
48	1	N1607	0	-.0001	.0287	4.7004e-04	2.1134e-04	0
49	1	N1471	0	0	.0286	5.6171e-04	0	0
50	1	N1413	0	-.0001	.0286	-5.6171e-04	0	0
51	1	N1175	0	0	.0286	3.3037e-04	-3.1631e-04	0
52	1	N1769	0	0	.0286	3.3037e-04	3.1631e-04	0
53	1	N1115	0	-.0001	.0286	-3.3037e-04	-3.1631e-04	0
54	1	N1709	0	-.0001	.0286	-3.3037e-04	3.1631e-04	0
55	1	N1372	0	0	.0286	5.639e-04	-1.127e-04	0
56	1	N1570	0	0	.0286	5.639e-04	1.127e-04	0

5/8" PANEL ANALYSIS: (Typical Zone)

1. Panel RISA Analysis Summary:

Panel Size: 48" Wide

DESCRIPTION: 5/8" Concrete Panel
MATERIAL: High Performance Concrete

Properties:

$WL := 37 \cdot psf$	(Wind Pressure)
$t := 0.625 \cdot in$	(Nominal Panel Thickness)
$t_d := 0.575\ in$	(Design Panel Thickness - Includes panel tolerance)
$F_u := 3.190 \cdot ksi$	(Modulus of Rupture)
$\tau_u := 0.957 \cdot ksi$	(Shear Stress: 30% of Rupture)
$E := 3685 \cdot ksi$	(Elasticity)
$\rho := 137 \cdot \frac{lbf}{ft^3}$	(Density)
$\Omega := 3$	(Factor of Safety)

Deflection Summary:

$Fastener_{spacing} := 30 \cdot in$ (Fastener Spacing)

$\Delta_{WL\_allow} := min\left(\frac{Fastener_{spacing}}{360}\right)$ $\Delta_{MAX} := 0.0144 \cdot in$

$\Delta_{WL\_allow} = 0.083\ in$ > $\Delta_{MAX} = 0.014\ in$ **Check = "Deflection O.K."**

Bending Stress Summary:

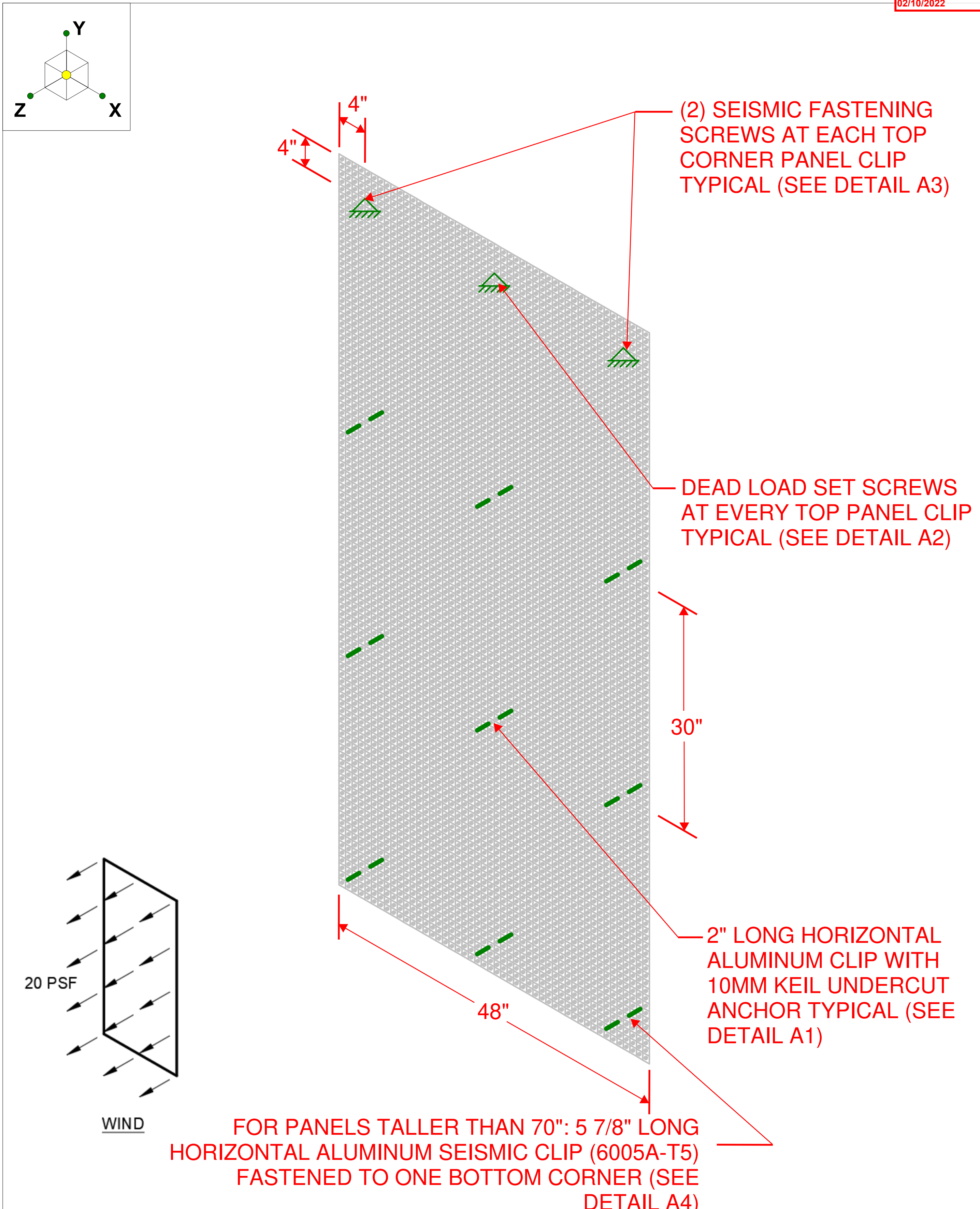
$F_b := \frac{F_u}{\Omega}$ $fb := 0.50 \cdot ksi$

$F_b = 1.06\ ksi$ > $fb = 0.5\ ksi$ **Check = "Stress O.K."**

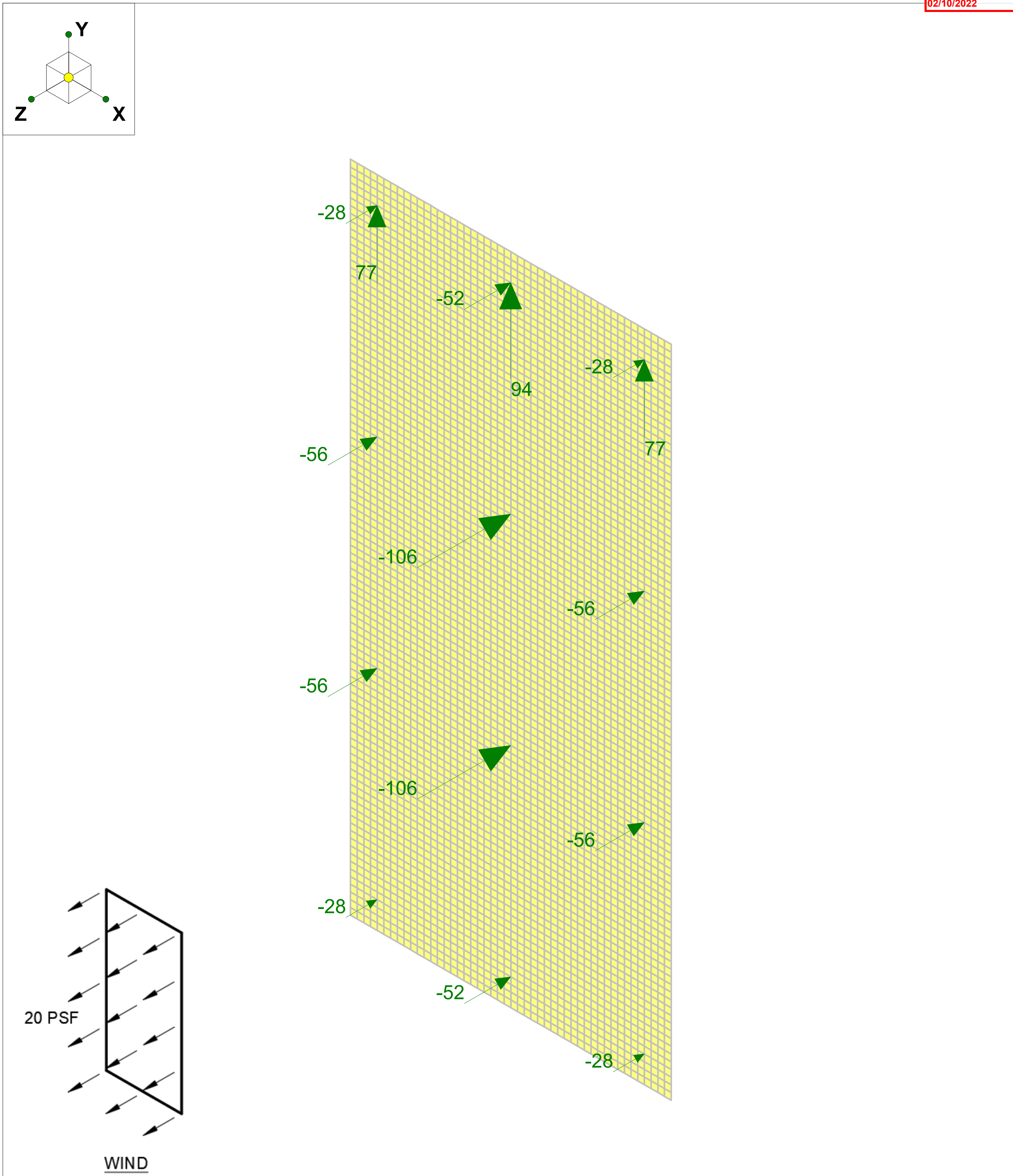
Shear Stress Summary:

$F_\tau := \frac{\tau_u}{\Omega}$ $f\tau := 0.117 \cdot ksi$

$F_\tau = 0.319\ ksi$ > $f\tau = 0.117\ ksi$ **Check = "Stress O.K."**

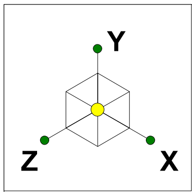


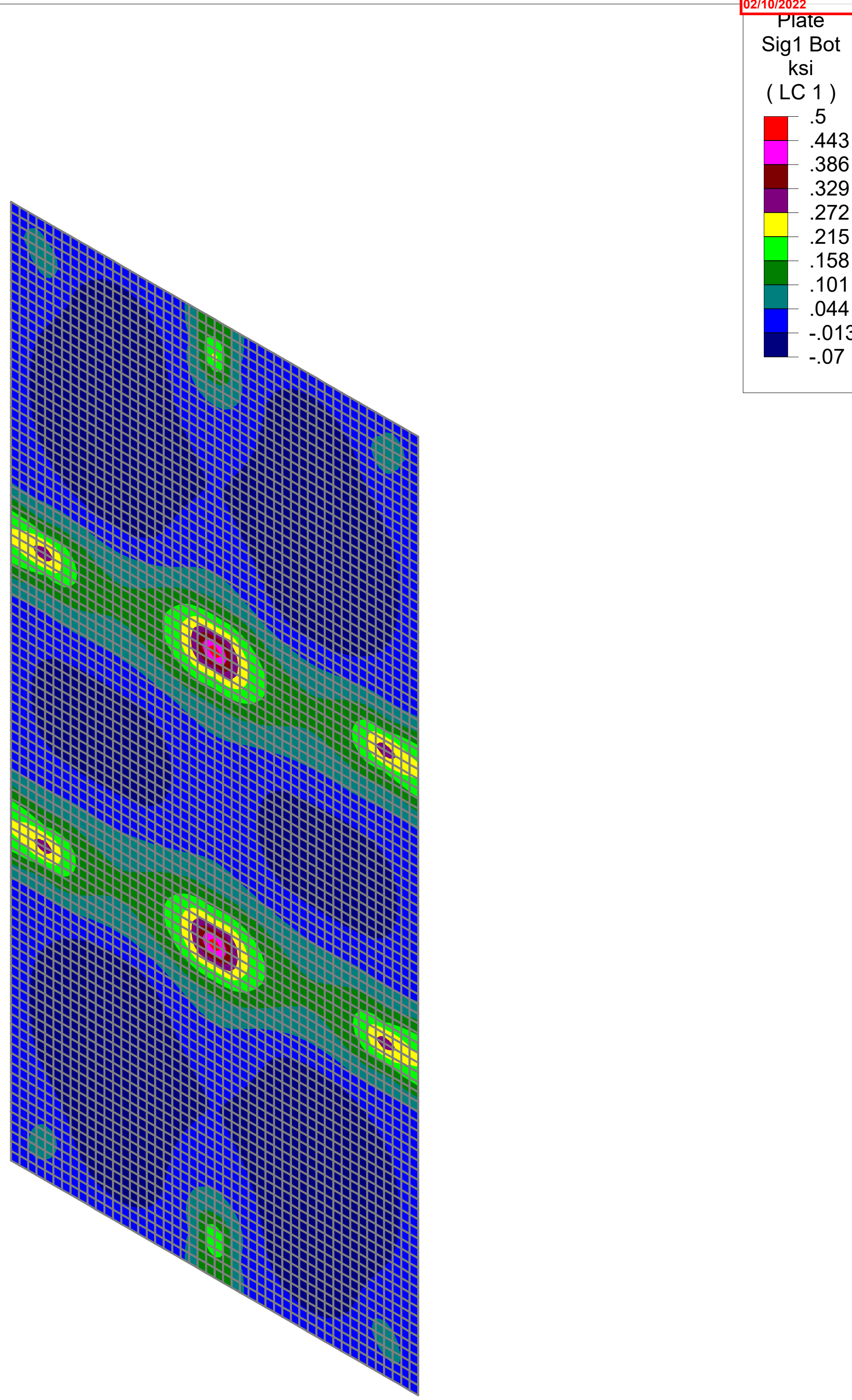
LARSON ENGINEERING	P4	48" WIDE PANEL (TYP.)
AB	KUS20	Jan 6, 2021 at 10:08 AM
63200381.000	PANEL DIAGRAM	48IN WIDE PANEL (TYP).r3d

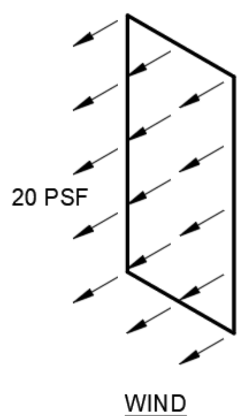


Results for LC 1, WL+DL
Reaction and Moment Units are lb and lb-ft

LARSON ENGINEERING	P4	48" WIDE PANEL (TYP.)
AB	KUS20	Jan 6, 2021 at 10:09 AM
63200381.000	REACTIONS	48IN WIDE PANEL (TYP).r3d

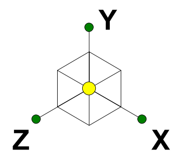


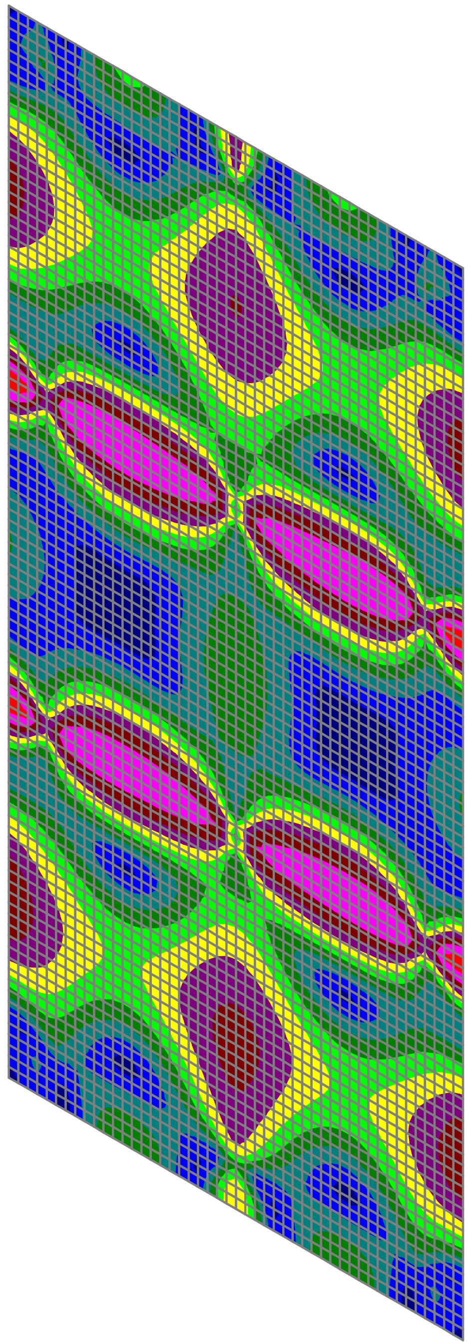


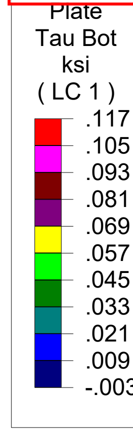


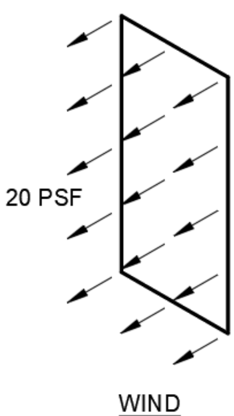
Results for LC 1, WL+DL

LARSON ENGINEERING	P4	48" WIDE PANEL (TYP.)
AB	KUS20	Jan 6, 2021 at 10:10 AM
63200381.000	BENDING STRESS	48IN WIDE PANEL (TYP).r3d



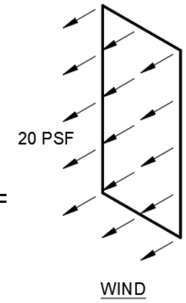






Results for LC 1, WL+DL

LARSON ENGINEERING	P4	48" WIDE PANEL (TYP.)
AB	KUS20	Jan 6, 2021 at 10:11 AM
63200381.000	SHEAR STRESS	48IN WIDE PANEL (TYP).r3d



Joint Deflections (By Combination)

	LC	Joint Label	X [in]	Y [in]	Z [in]	X Rotation [rad]	Y Rotation [rad]	Z Rotation [rad]
1	1	N1518	0	-.0001	.0144	-5.0013e-05	-1.7722e-06	0
2	1	N1580	0	0	.0144	5.0013e-05	-1.7722e-06	0
3	1	N3354	0	0	.0144	5.0013e-05	1.7722e-06	0
4	1	N3292	0	-.0001	.0144	-5.0013e-05	1.7722e-06	0
5	1	N1617	0	-.0001	.0144	-5.063e-05	1.6342e-05	0
6	1	N1679	0	0	.0144	5.063e-05	1.6342e-05	0
7	1	N3255	0	0	.0144	5.063e-05	-1.6342e-05	0
8	1	N3193	0	-.0001	.0144	-5.063e-05	-1.6342e-05	0
9	1	N1419	0	-.0001	.0144	-4.968e-05	-2.335e-05	0
10	1	N1481	0	0	.0144	4.968e-05	-2.335e-05	0
11	1	N3391	0	-.0001	.0144	-4.968e-05	2.335e-05	0
12	1	N3453	0	0	.0144	4.968e-05	2.335e-05	0
13	1	N1517	0	-.0001	.0144	1.0249e-04	-1.264e-06	0
14	1	N1581	0	0	.0144	-1.0249e-04	-1.264e-06	0
15	1	N3355	0	0	.0144	-1.0249e-04	1.264e-06	0
16	1	N3291	0	-.0001	.0144	1.0249e-04	1.264e-06	0
17	1	N1715	0	-.0001	.0144	-5.1448e-05	3.0158e-05	0
18	1	N1775	0	0	.0144	5.1448e-05	3.0158e-05	0
19	1	N3157	0	0	.0144	5.1448e-05	-3.0158e-05	0
20	1	N3097	0	-.0001	.0144	-5.1448e-05	-3.0158e-05	0
21	1	N1616	0	-.0001	.0144	1.0415e-04	1.6872e-05	0
22	1	N1680	0	0	.0144	-1.0415e-04	1.6872e-05	0
23	1	N3256	0	0	.0144	-1.0415e-04	-1.6872e-05	0
24	1	N3192	0	-.0001	.0144	1.0415e-04	-1.6872e-05	0
25	1	N1418	0	-.0001	.0144	1.0114e-04	-2.2834e-05	0
26	1	N1482	0	0	.0144	-1.0114e-04	-2.2834e-05	0
27	1	N3390	0	-.0001	.0144	1.0114e-04	2.2834e-05	0
28	1	N3454	0	0	.0144	-1.0114e-04	2.2834e-05	0
29	1	N1320	0	-.0001	.0144	-4.971e-05	-4.7366e-05	0
30	1	N1382	0	0	.0144	4.971e-05	-4.7366e-05	0
31	1	N3490	0	-.0001	.0144	-4.971e-05	4.7366e-05	0
32	1	N3552	0	0	.0144	4.971e-05	4.7366e-05	0
33	1	N1714	0	-.0001	.0144	1.0607e-04	3.0725e-05	0
34	1	N1776	0	0	.0144	-1.0607e-04	3.0725e-05	0
35	1	N3158	0	0	.0144	-1.0607e-04	-3.0725e-05	0
36	1	N3096	0	-.0001	.0144	1.0607e-04	-3.0725e-05	0
37	1	N1811	0	-.0001	.0143	-5.2377e-05	3.9101e-05	0
38	1	N1873	0	0	.0143	5.2377e-05	3.9101e-05	0
39	1	N3061	0	0	.0143	5.2377e-05	-3.9101e-05	0
40	1	N2999	0	-.0001	.0143	-5.2377e-05	-3.9101e-05	0
41	1	N1319	0	-.0001	.0143	1.0009e-04	-4.68e-05	0
42	1	N1383	0	0	.0143	-1.0009e-04	-4.68e-05	0
43	1	N3489	0	-.0001	.0143	1.0009e-04	4.68e-05	0
44	1	N3553	0	0	.0143	-1.0009e-04	4.68e-05	0
45	1	N1810	0	-.0001	.0143	1.0816e-04	3.97e-05	0
46	1	N1874	0	0	.0143	-1.0816e-04	3.97e-05	0
47	1	N3062	0	0	.0143	-1.0816e-04	-3.97e-05	0
48	1	N2998	0	-.0001	.0143	1.0816e-04	-3.97e-05	0
49	1	N1910	0	-.0001	.0143	-5.3329e-05	4.2908e-05	0
50	1	N1972	0	0	.0143	5.3329e-05	4.2908e-05	0
51	1	N2962	0	0	.0143	5.3329e-05	-4.2908e-05	0
52	1	N2900	0	-.0001	.0143	-5.3329e-05	-4.2908e-05	0
53	1	N1221	0	-.0001	.0143	-5.0166e-05	-7.268e-05	0
54	1	N1283	0	0	.0143	5.0166e-05	-7.268e-05	0
55	1	N3589	0	-.0001	.0143	-5.0166e-05	7.268e-05	0
56	1	N3651	0	0	.0143	5.0166e-05	7.268e-05	0

5/8" PANEL ANALYSIS: (Typical Zone)

1. Panel RISA Analysis Summary:

Panel Size: 32" Wide

DESCRIPTION: 5/8" Concrete Panel
MATERIAL: High Performance Concrete

Properties:

$WL := 20 \cdot psf$	(Wind Pressure)
$t := 0.625 \cdot in$	(Nominal Panel Thickness)
$t_d := 0.575\ in$	(Design Panel Thickness - Includes panel tolerance)
$F_u := 3.190 \cdot ksi$	(Modulus of Rupture)
$\tau_u := 0.957 \cdot ksi$	(Shear Stress: 30% of Rupture)
$E := 3685 \cdot ksi$	(Elasticity)
$\rho := 137 \cdot \frac{lbf}{ft^3}$	(Density)
$\Omega := 3$	(Factor of Safety)

Deflection Summary:

$Fastener_{spacing} := 30 \cdot in$ (Fastener Spacing)

$\Delta_{WL\_allow} := min\left(\frac{Fastener_{spacing}}{360}\right)$ $\Delta_{MAX} := 0.0377 \cdot in$

$\Delta_{WL\_allow} = 0.083\ in$ > $\Delta_{MAX} = 0.038\ in$ **Check = "Deflection O.K."**

Bending Stress Summary:

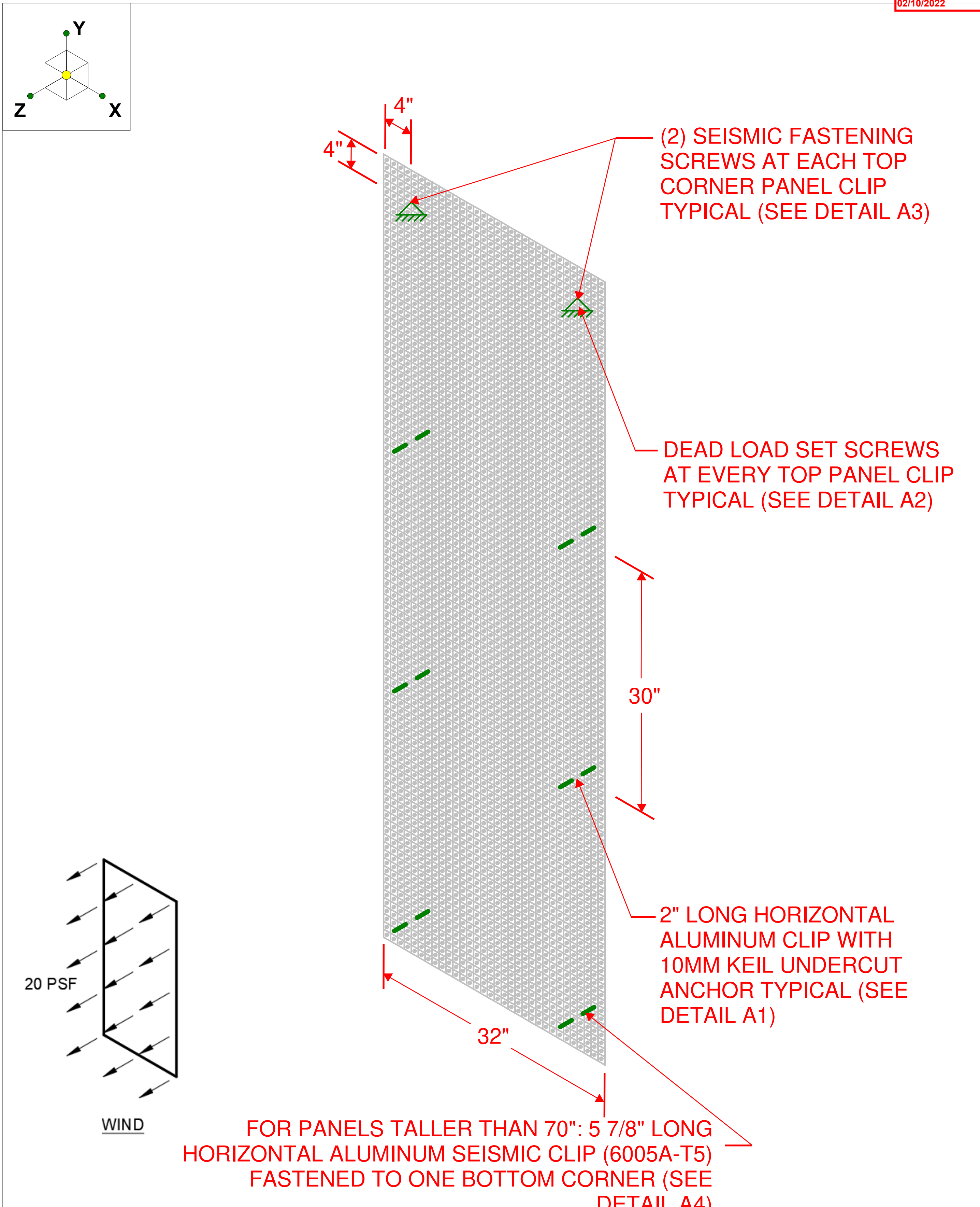
$F_b := \frac{F_u}{\Omega}$ $fb := 0.722 \cdot ksi$

$F_b = 1.06\ ksi$ > $fb = 0.722\ ksi$ **Check = "Stress O.K."**

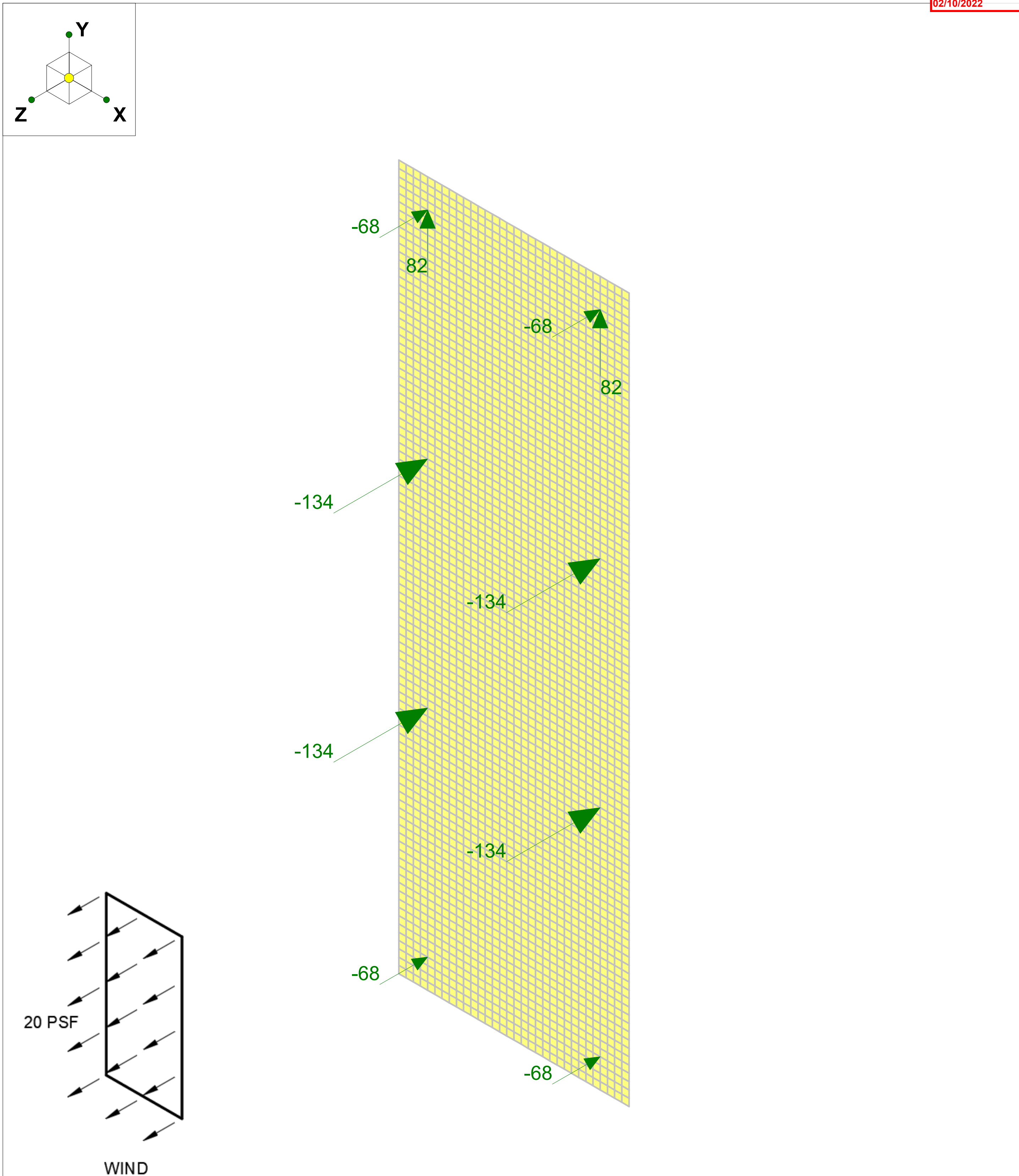
Shear Stress Summary:

$F_\tau := \frac{\tau_u}{\Omega}$ $f\tau := 0.252 \cdot ksi$

$F_\tau = 0.319\ ksi$ > $f\tau = 0.252\ ksi$ **Check = "Stress O.K."**

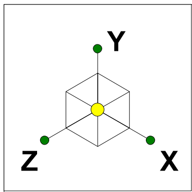


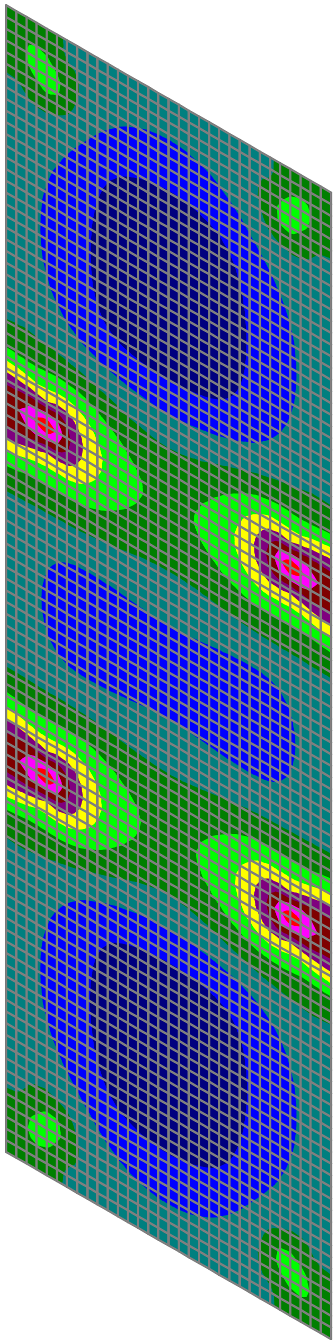
LARSON ENGINEERING	P5	32" WIDE PANEL (TYP.)
AB	KUS20	Jan 6, 2021 at 2:20 PM
63200381.000	PANEL DIAGRAM	P5 WIDE PANEL.r3d

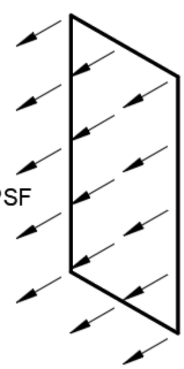


Results for LC 1, WL+DL
Reaction and Moment Units are lb and lb-ft

LARSON ENGINEERING	P5	32" WIDE PANEL (TYP.)
AB	KUS20	Jan 6, 2021 at 2:45 PM
63200381.000	REACTIONS	P5 WIDE PANEL.r3d

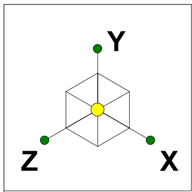


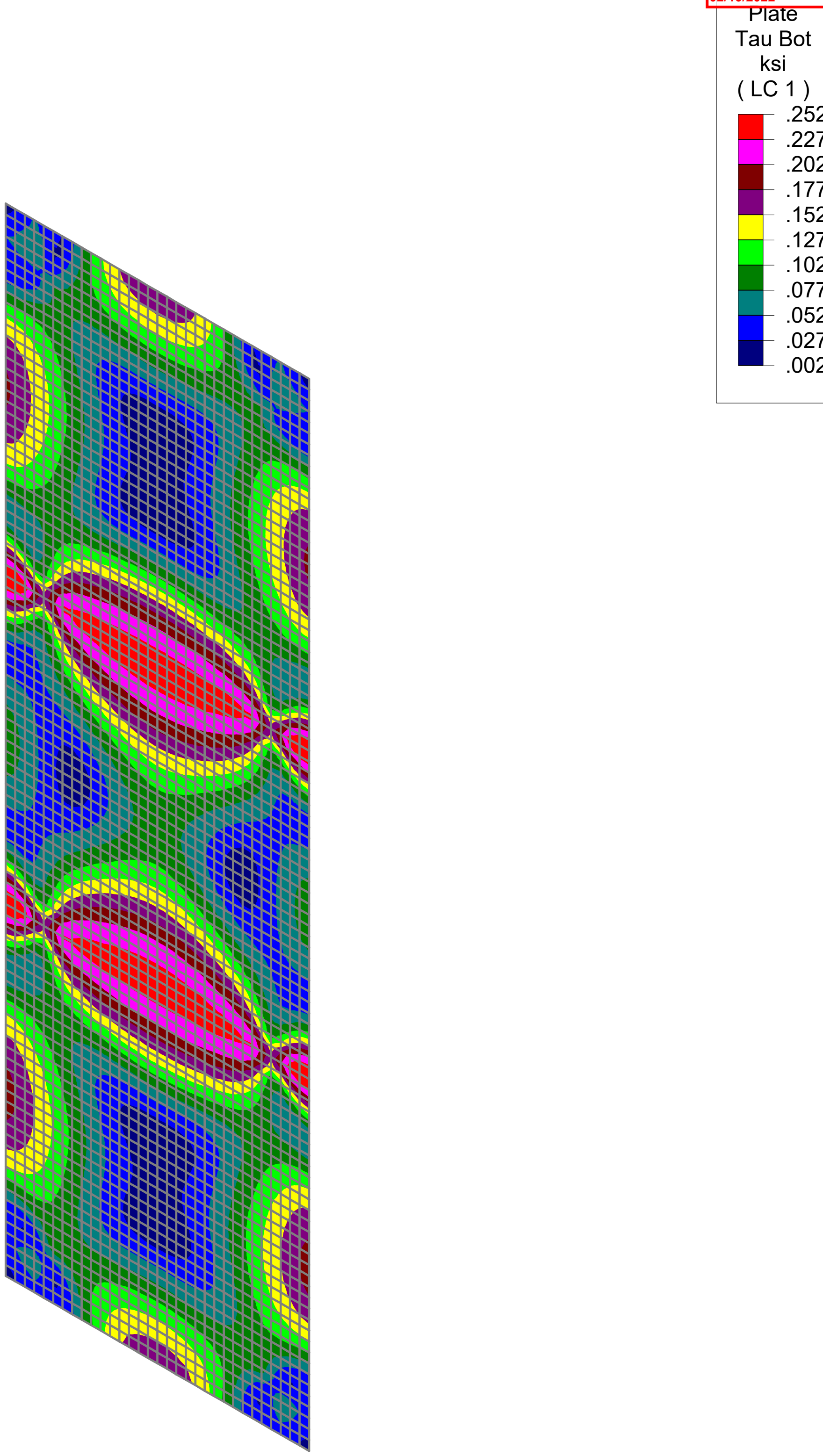


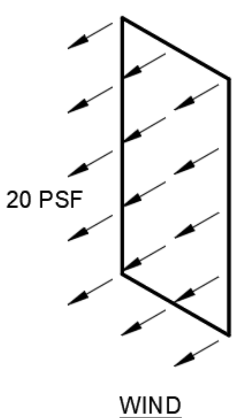


Results for LC 1, WL+DL

LARSON ENGINEERING	P5	32" WIDE PANEL (TYP.)
AB	KUS20	Jan 6, 2021 at 2:22 PM
63200381.000	BENDING STRESS	P5 WIDE PANEL.r3d

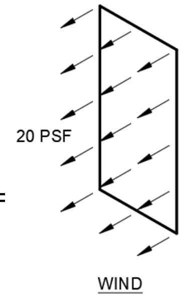






Results for LC 1, WL+DL

LARSON ENGINEERING	P5	32" WIDE PANEL (TYP.)
AB	KUS20	Jan 6, 2021 at 2:43 PM
63200381.000	SHEAR STRESS	P5 WIDE PANEL.r3d



Joint Deflections (By Combination)

	LC	Joint Label	X [in]	Y [in]	Z [in]	X Rotation [rad]	Y Rotation [rad]	Z Rotation [rad]
1	1	N1671	0	0	.0377	1.0412e-05	0	0
2	1	N1609	0	-.0002	.0377	-1.0412e-05	0	0
3	1	N1770	0	0	.0376	1.1273e-05	1.9987e-04	0
4	1	N1572	0	0	.0376	1.1273e-05	-1.9987e-04	0
5	1	N1510	0	-.0002	.0376	-1.1273e-05	-1.9987e-04	0
6	1	N1708	0	-.0002	.0376	-1.1273e-05	1.9987e-04	0
7	1	N1672	0	0	.0376	-2.3088e-04	0	0
8	1	N1608	0	-.0002	.0376	2.3088e-04	0	0
9	1	N1670	0	0	.0376	2.448e-04	0	0
10	1	N1610	0	-.0002	.0376	-2.448e-04	0	0
11	1	N1771	0	0	.0375	-2.3089e-04	1.9901e-04	0
12	1	N1573	0	0	.0375	-2.3089e-04	-1.9901e-04	0
13	1	N1707	0	-.0002	.0375	2.3089e-04	1.9901e-04	0
14	1	N1509	0	-.0002	.0375	2.3089e-04	-1.9901e-04	0
15	1	N1769	0	0	.0375	2.4654e-04	2.0247e-04	0
16	1	N1571	0	0	.0375	2.4654e-04	-2.0247e-04	0
17	1	N1511	0	-.0002	.0375	-2.4654e-04	-2.0247e-04	0
18	1	N1709	0	-.0002	.0375	-2.4654e-04	2.0247e-04	0
19	1	N1869	0	0	.0373	1.3841e-05	3.9625e-04	0
20	1	N1473	0	0	.0373	1.3841e-05	-3.9625e-04	0
21	1	N1411	0	-.0002	.0373	-1.3841e-05	-3.9625e-04	0
22	1	N1807	0	-.0002	.0373	-1.3841e-05	3.9625e-04	0
23	1	N1673	0	0	.0373	-4.7471e-04	0	0
24	1	N1607	0	-.0002	.0373	4.7471e-04	0	0
25	1	N1669	0	0	.0373	4.6792e-04	0	0
26	1	N1611	0	-.0002	.0373	-4.6792e-04	0	0
27	1	N1870	0	0	.0372	-2.309e-04	3.9455e-04	0
28	1	N1474	0	0	.0372	-2.309e-04	-3.9455e-04	0
29	1	N1806	0	-.0002	.0372	2.309e-04	3.9455e-04	0
30	1	N1410	0	-.0002	.0372	2.309e-04	-3.9455e-04	0
31	1	N1868	0	0	.0372	2.5171e-04	4.0139e-04	0
32	1	N1472	0	0	.0372	2.5171e-04	-4.0139e-04	0
33	1	N1412	0	-.0002	.0372	-2.5171e-04	-4.0139e-04	0
34	1	N1808	0	-.0002	.0372	-2.5171e-04	4.0139e-04	0
35	1	N1772	0	0	.0372	-4.7557e-04	1.9988e-04	0
36	1	N1574	0	0	.0372	-4.7557e-04	-1.9988e-04	0
37	1	N1706	0	-.0002	.0372	4.7557e-04	1.9988e-04	0
38	1	N1508	0	-.0002	.0372	4.7557e-04	-1.9988e-04	0
39	1	N1768	0	0	.0372	4.7054e-04	2.0682e-04	0
40	1	N1570	0	0	.0372	4.7054e-04	-2.0682e-04	0
41	1	N1512	0	-.0002	.0372	-4.7054e-04	-2.0682e-04	0
42	1	N1710	0	-.0002	.0372	-4.7054e-04	2.0682e-04	0
43	1	N1871	0	0	.0369	-4.7813e-04	3.9625e-04	0
44	1	N1805	0	-.0002	.0369	4.7813e-04	3.9625e-04	0
45	1	N1475	0	0	.0369	-4.7813e-04	-3.9625e-04	0
46	1	N1409	0	-.0002	.0369	4.7813e-04	-3.9625e-04	0
47	1	N1968	0	0	.0369	1.8068e-05	5.8576e-04	0
48	1	N1374	0	0	.0369	1.8068e-05	-5.8576e-04	0
49	1	N1312	0	-.0002	.0369	-1.8068e-05	-5.8576e-04	0
50	1	N1906	0	-.0002	.0369	-1.8068e-05	5.8576e-04	0
51	1	N1867	0	0	.0368	4.7832e-04	4.0999e-04	0
52	1	N1471	0	0	.0368	4.7832e-04	-4.0999e-04	0
53	1	N1413	0	-.0002	.0368	-4.7832e-04	-4.0999e-04	0
54	1	N1809	0	-.0002	.0368	-4.7832e-04	4.0999e-04	0
55	1	N1969	0	0	.0368	-2.3089e-04	5.8323e-04	0
56	1	N1905	0	-.0002	.0368	2.3089e-04	5.8323e-04	0

5/8" PANEL ANALYSIS: (Corner Zone)

1. Panel RISA Analysis Summary:

Panel Size: 46" Wide (Exposed Fastener)

DESCRIPTION: 5/8" Concrete Panel
MATERIAL: High Performance Concrete

Properties:

$WL := 37 \cdot psf$	(Wind Pressure)
$t := 0.625 \cdot in$	(Nominal Panel Thickness)
$t_d := 0.575\ in$	(Design Panel Thickness - Includes panel tolerance)
$F_u := 3.190 \cdot ksi$	(Modulus of Rupture)
$\tau_u := 0.957 \cdot ksi$	(Shear Stress: 30% of Rupture)
$E := 3685 \cdot ksi$	(Elasticity)
$\rho := 137 \cdot \frac{lbf}{ft^3}$	(Density)
$\Omega := 3$	(Factor of Safety)

Deflection Summary:

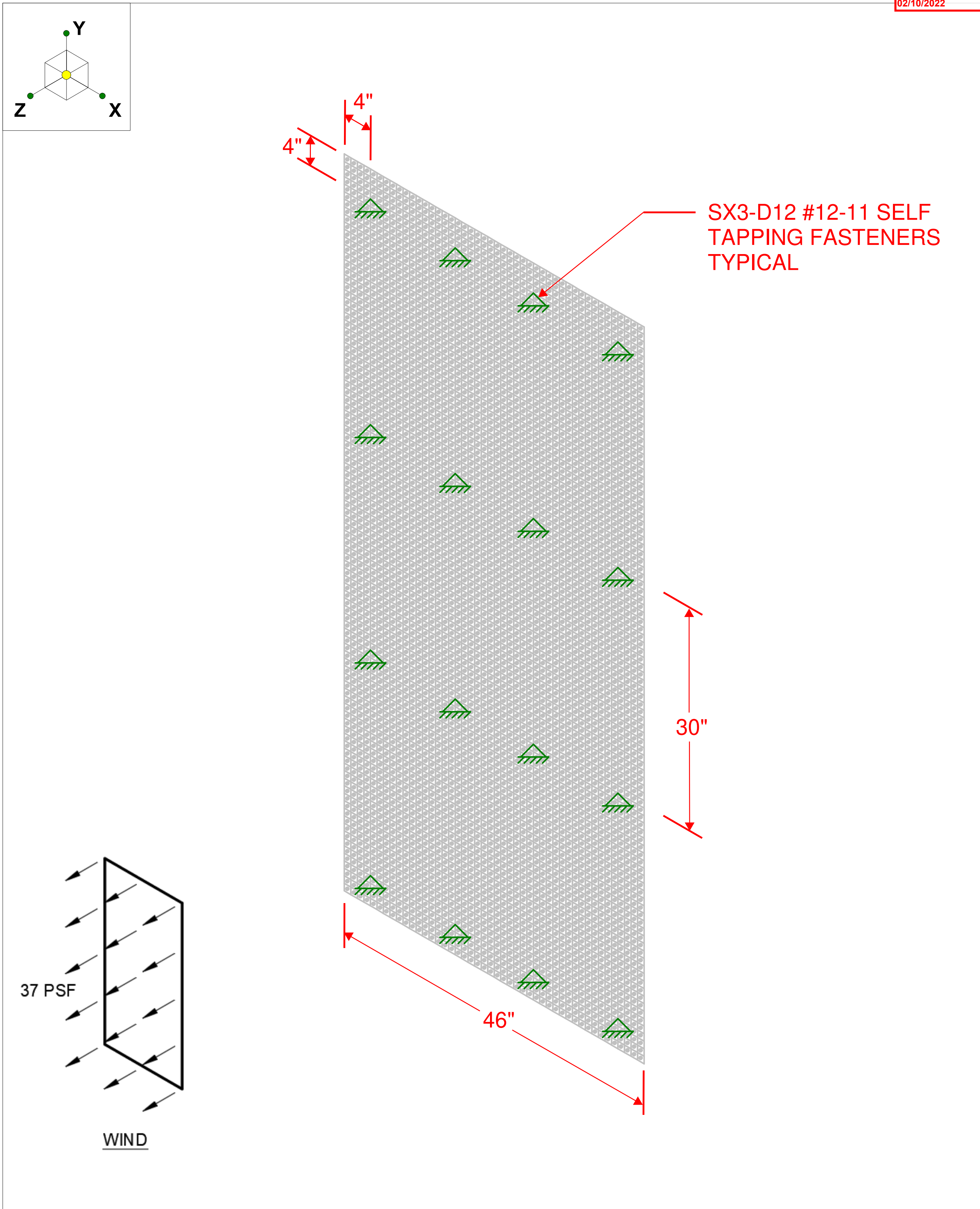
$Fastener_{spacing} := 30 \cdot in$		(Fastener Spacing)	
$\Delta_{WL\_allow} := min\left(\frac{Fastener_{spacing}}{360}\right)$		$\Delta_{MAX} := 0.0242 \cdot in$	
$\Delta_{WL\_allow} = 0.083\ in$	>	$\Delta_{MAX} = 0.024\ in$	**Check = "Deflection O.K."**

Bending Stress Summary:

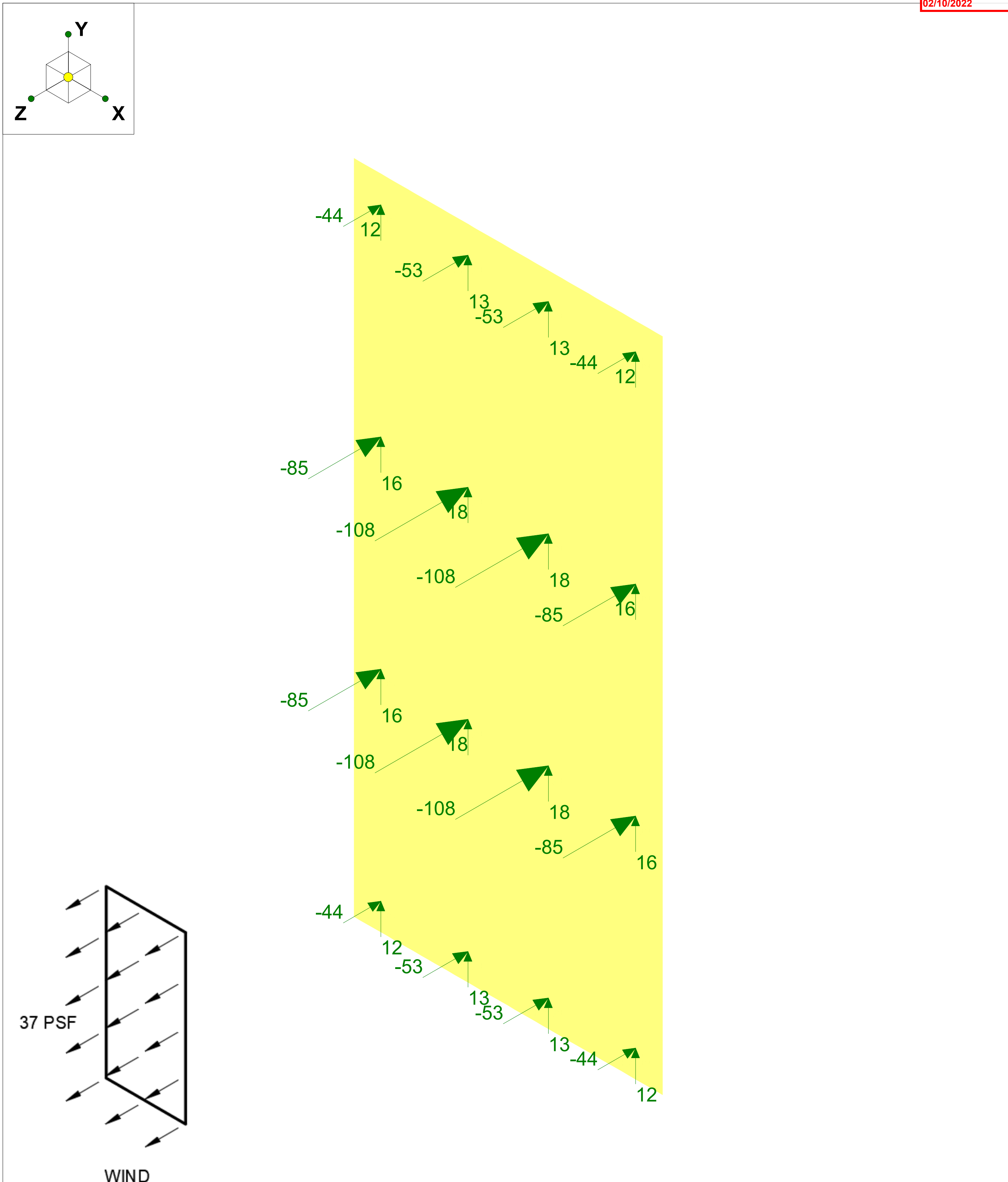
$F_b := \frac{F_u}{\Omega}$		$fb := 0.583 \cdot ksi$	
$F_b = 1.06\ ksi$	>	$fb = 0.583\ ksi$	**Check = "Stress O.K."**

Shear Stress Summary:

$F_\tau := \frac{\tau_u}{\Omega}$		$f\tau := 0.184 \cdot ksi$	
$F_\tau = 0.319\ ksi$	>	$f\tau = 0.184\ ksi$	**Check = "Stress O.K."**

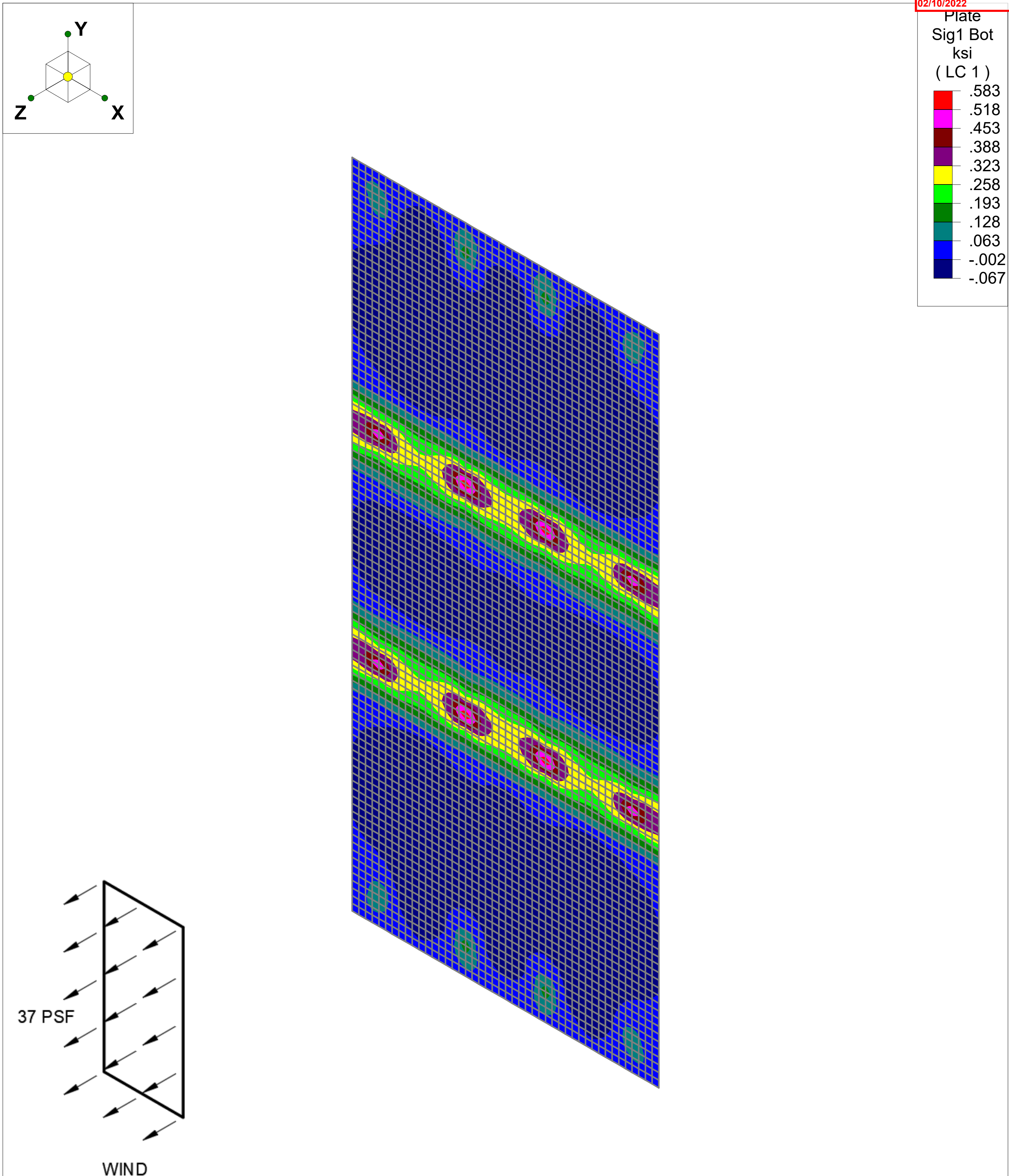


LARSON ENGINEERING	P6	46" WIDE PANEL (COR.)
AB	KUS20	Jan 7, 2021 at 1:18 PM
63200381.000	PANEL DIAGRAM	46IN WIDE (COR).r3d



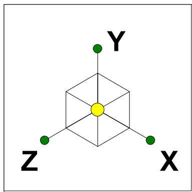
Results for LC 1, WL+DL
Reaction and Moment Units are lb and lb-ft

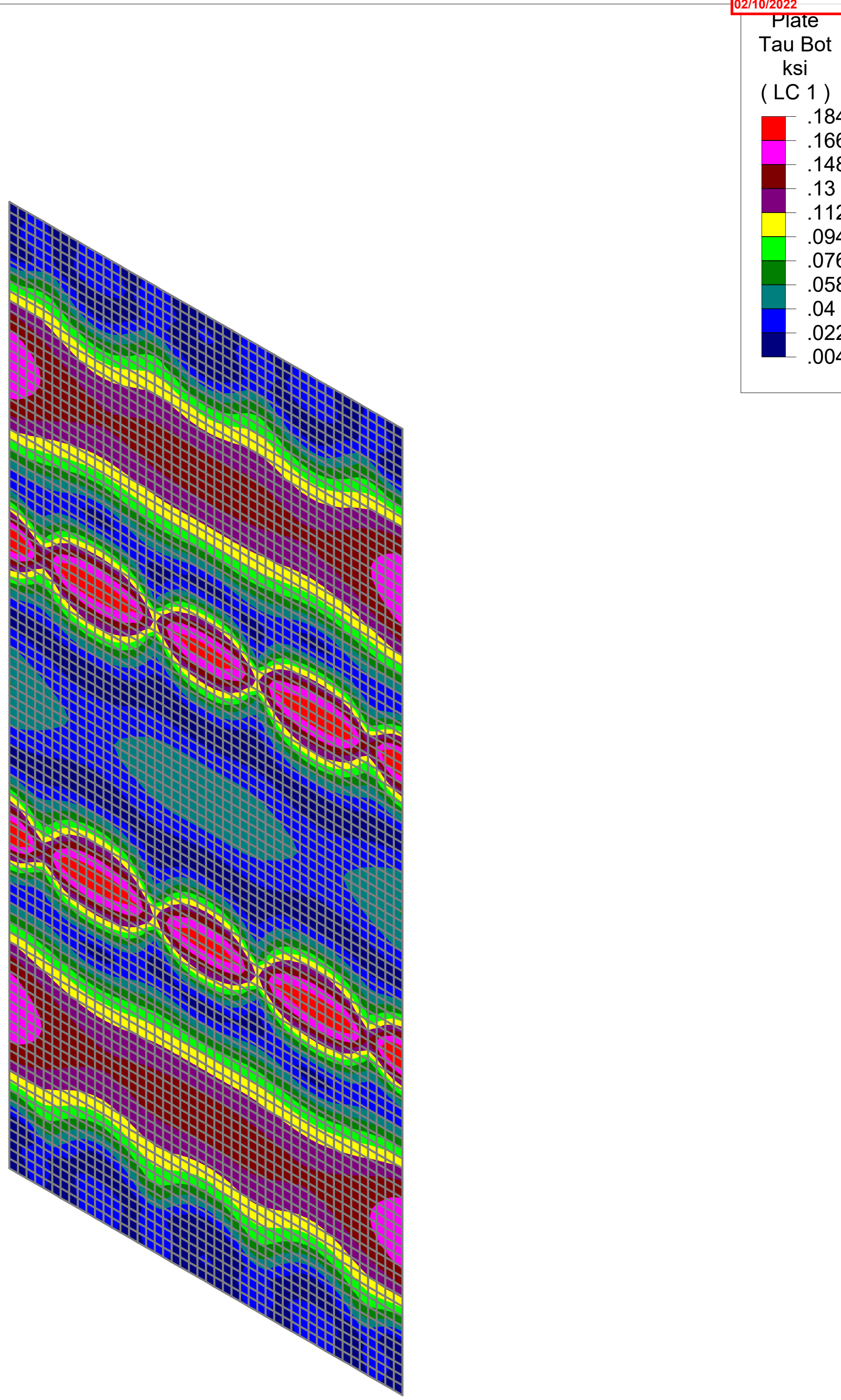
LARSON ENGINEERING	P6	46" WIDE PANEL (COR.)
AB	KUS20	Jan 7, 2021 at 1:14 PM
63200381.000	REACTIONS	46IN WIDE (COR).r3d

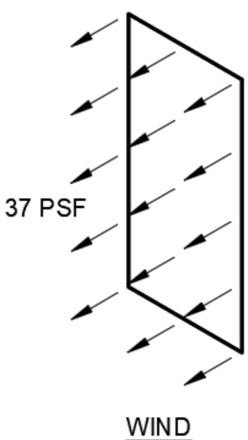


Results for LC 1, WL+DL

LARSON ENGINEERING	P6	46" WIDE PANEL (COR.)
AB	KUS20	Jan 7, 2021 at 1:16 PM
63200381.000	BENDING STRESS	46IN WIDE (COR).r3d

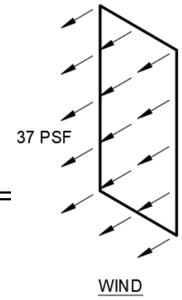






Results for LC 1, WL+DL

LARSON ENGINEERING	P6	46" WIDE PANEL (COR.)
AB	KUS20	Jan 7, 2021 at 1:17 PM
63200381.000	SHEAR STRESS	46IN WIDE (COR).r3d



Joint Deflections (By Combination)

	LC	Joint Label	X [in]	Y [in]	Z [in]	X Rotation [rad]	Y Rotation [rad]	Z Rotation [rad]
1	1	N4573	0	0	.0242	1.4165e-04	-2.0018e-04	0
2	1	N4637	0	0	.0242	-1.4165e-04	-2.0018e-04	0
3	1	N33	0	0	.0242	1.4165e-04	2.0018e-04	0
4	1	N97	0	0	.0242	-1.4165e-04	2.0018e-04	0
5	1	N4574	0	0	.0242	-1.7509e-04	-1.9326e-04	0
6	1	N4636	0	0	.0242	1.7509e-04	-1.9326e-04	0
7	1	N34	0	0	.0242	-1.7509e-04	1.9326e-04	0
8	1	N96	0	0	.0242	1.7509e-04	1.9326e-04	0
9	1	N4475	0	0	.0241	1.4489e-04	-1.5586e-04	0
10	1	N4539	0	0	.0241	-1.4489e-04	-1.5586e-04	0
11	1	N131	0	0	.0241	1.4489e-04	1.5586e-04	0
12	1	N195	0	0	.0241	-1.4489e-04	1.5586e-04	0
13	1	N4476	0	0	.0241	-1.6861e-04	-1.4976e-04	0
14	1	N4538	0	0	.0241	1.6861e-04	-1.4976e-04	0
15	1	N132	0	0	.0241	-1.6861e-04	1.4976e-04	0
16	1	N194	0	0	.0241	1.6861e-04	1.4976e-04	0
17	1	N4572	0	0	.0239	4.6134e-04	-2.0247e-04	0
18	1	N4638	0	0	.0239	-4.6134e-04	-2.0247e-04	0
19	1	N32	0	0	.0239	4.6134e-04	2.0247e-04	0
20	1	N98	0	0	.0239	-4.6134e-04	2.0247e-04	0
21	1	N4376	0	0	.0239	1.4885e-04	-1.1872e-04	0
22	1	N4440	0	0	.0239	-1.4885e-04	-1.1872e-04	0
23	1	N230	0	0	.0239	1.4885e-04	1.1872e-04	0
24	1	N294	0	0	.0239	-1.4885e-04	1.1872e-04	0
25	1	N4377	0	0	.0239	-1.6063e-04	-1.135e-04	0
26	1	N4439	0	0	.0239	1.6063e-04	-1.135e-04	0
27	1	N231	0	0	.0239	-1.6063e-04	1.135e-04	0
28	1	N293	0	0	.0239	1.6063e-04	1.135e-04	0
29	1	N4575	0	0	.0239	-4.8419e-04	-1.8166e-04	0
30	1	N4635	0	0	.0239	4.8419e-04	-1.8166e-04	0
31	1	N35	0	0	.0239	-4.8419e-04	1.8166e-04	0
32	1	N95	0	0	.0239	4.8419e-04	1.8166e-04	0
33	1	N4277	0	0	.0238	1.5191e-04	-8.8495e-05	0
34	1	N4341	0	0	.0238	-1.5191e-04	-8.8495e-05	0
35	1	N329	0	0	.0238	1.5191e-04	8.8495e-05	0
36	1	N393	0	0	.0238	-1.5191e-04	8.8495e-05	0
37	1	N4278	0	0	.0238	-1.5425e-04	-8.4166e-05	0
38	1	N4340	0	0	.0238	1.5425e-04	-8.4166e-05	0
39	1	N330	0	0	.0238	-1.5425e-04	8.4166e-05	0
40	1	N392	0	0	.0238	1.5425e-04	8.4166e-05	0
41	1	N4474	0	0	.0238	4.614e-04	-1.5795e-04	0
42	1	N4540	0	0	.0238	-4.614e-04	-1.5795e-04	0
43	1	N130	0	0	.0238	4.614e-04	1.5795e-04	0
44	1	N196	0	0	.0238	-4.614e-04	1.5795e-04	0
45	1	N4182	0	0	.0238	-1.4885e-04	-6.0957e-05	0
46	1	N4242	0	0	.0238	1.4885e-04	-6.0957e-05	0
47	1	N428	0	0	.0238	-1.4885e-04	6.0957e-05	0
48	1	N488	0	0	.0238	1.4885e-04	6.0957e-05	0
49	1	N4181	0	0	.0238	1.543e-04	-6.4403e-05	0
50	1	N4243	0	0	.0238	-1.543e-04	-6.4403e-05	0
51	1	N427	0	0	.0238	1.543e-04	6.4403e-05	0
52	1	N489	0	0	.0238	-1.543e-04	6.4403e-05	0
53	1	N4477	0	0	.0237	-4.7446e-04	-1.3961e-04	0
54	1	N4537	0	0	.0237	4.7446e-04	-1.3961e-04	0
55	1	N133	0	0	.0237	-4.7446e-04	1.3961e-04	0
56	1	N193	0	0	.0237	4.7446e-04	1.3961e-04	0

5/8" PANEL ANALYSIS: (Typical Zone)

1. Panel RISA Analysis Summary:

Panel Size: 46" Wide (Exposed Fastener)

DESCRIPTION: 5/8" Concrete Panel
MATERIAL: High Performance Concrete

Properties:

$WL := 20 \cdot psf$	(Wind Pressure)
$t := 0.625 \cdot in$	(Nominal Panel Thickness)
$t_d := 0.575\ in$	(Design Panel Thickness - Includes panel tolerance)
$F_u := 3.190 \cdot ksi$	(Modulus of Rupture)
$\tau_u := 0.957 \cdot ksi$	(Shear Stress: 30% of Rupture)
$E := 3685 \cdot ksi$	(Elasticity)
$\rho := 137 \cdot \frac{lbf}{ft^3}$	(Density)
$\Omega := 3$	(Factor of Safety)

Deflection Summary:

$Fastener_{spacing} := 30 \cdot in$ (Fastener Spacing)

$\Delta_{WL\_allow} := min\left(\frac{Fastener_{spacing}}{360}\right)$ $\Delta_{MAX} := 0.014 \cdot in$

$\Delta_{WL\_allow} = 0.083\ in$ > $\Delta_{MAX} = 0.014\ in$ **Check = "Deflection O.K."**

Bending Stress Summary:

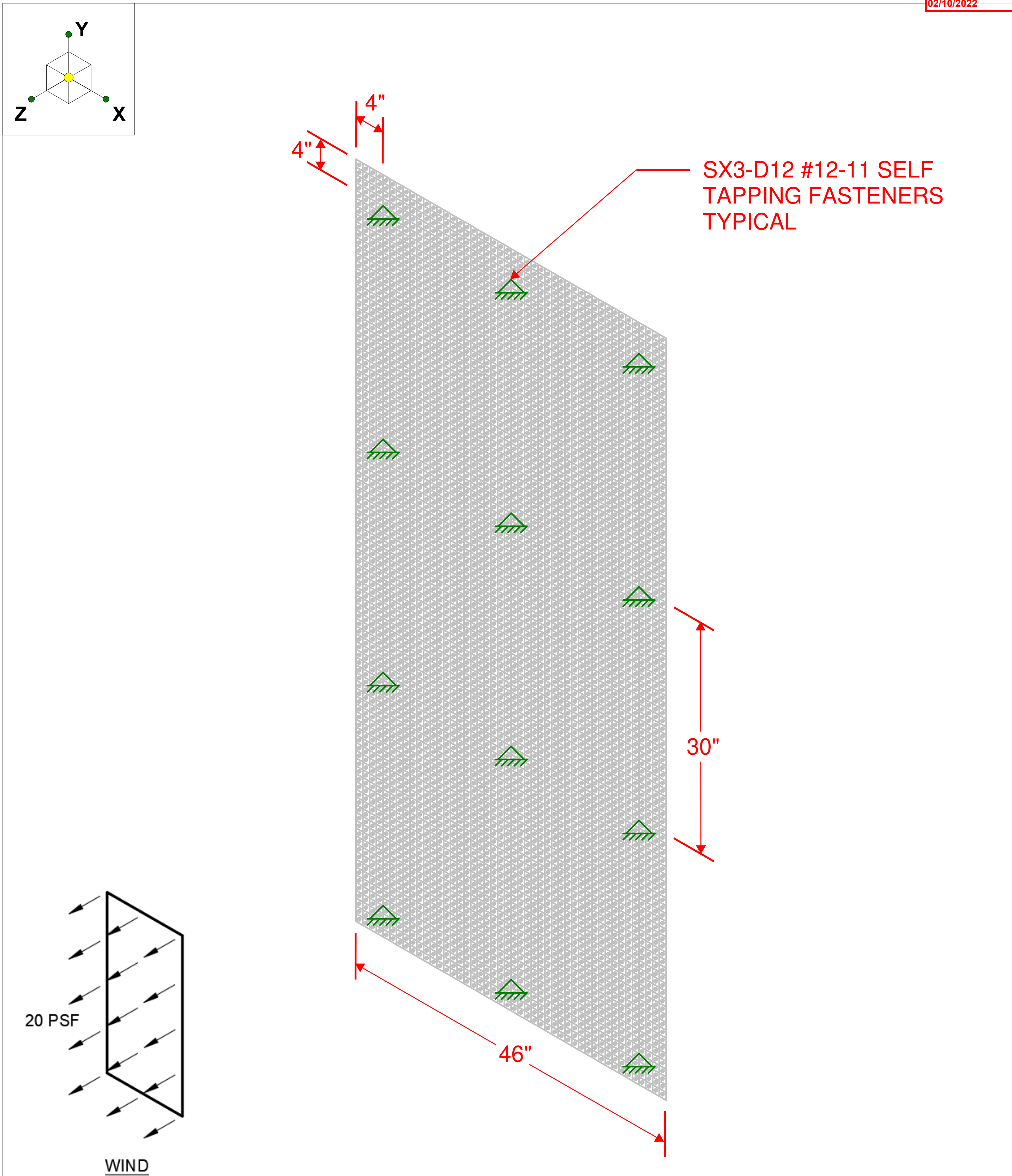
$F_b := \frac{F_u}{\Omega}$ $fb := 0.473 \cdot ksi$

$F_b = 1.06\ ksi$ > $fb = 0.473\ ksi$ **Check = "Stress O.K."**

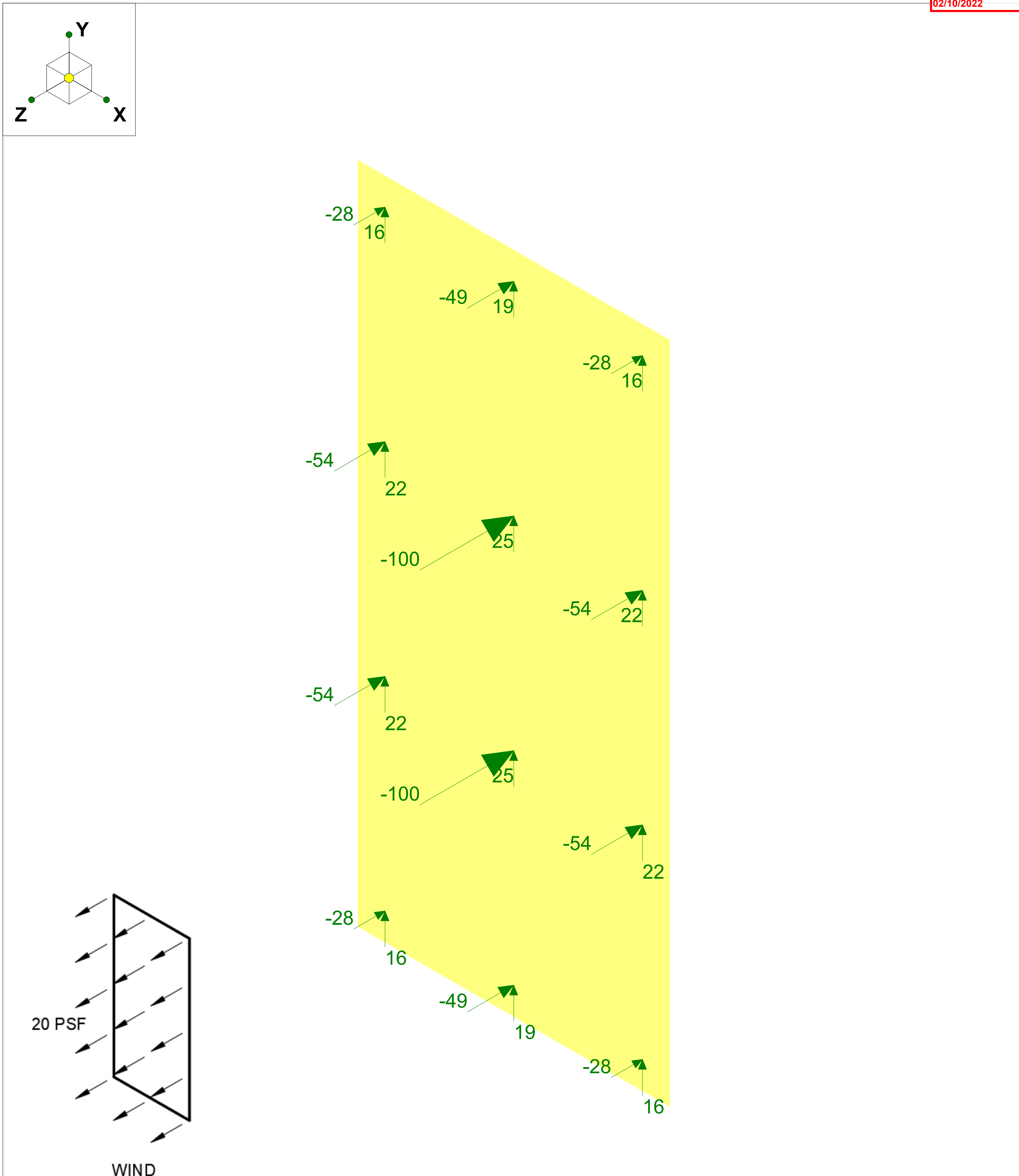
Shear Stress Summary:

$F_\tau := \frac{\tau_u}{\Omega}$ $f\tau := 0.11 \cdot ksi$

$F_\tau = 0.319\ ksi$ > $f\tau = 0.11\ ksi$ **Check = "Stress O.K."**

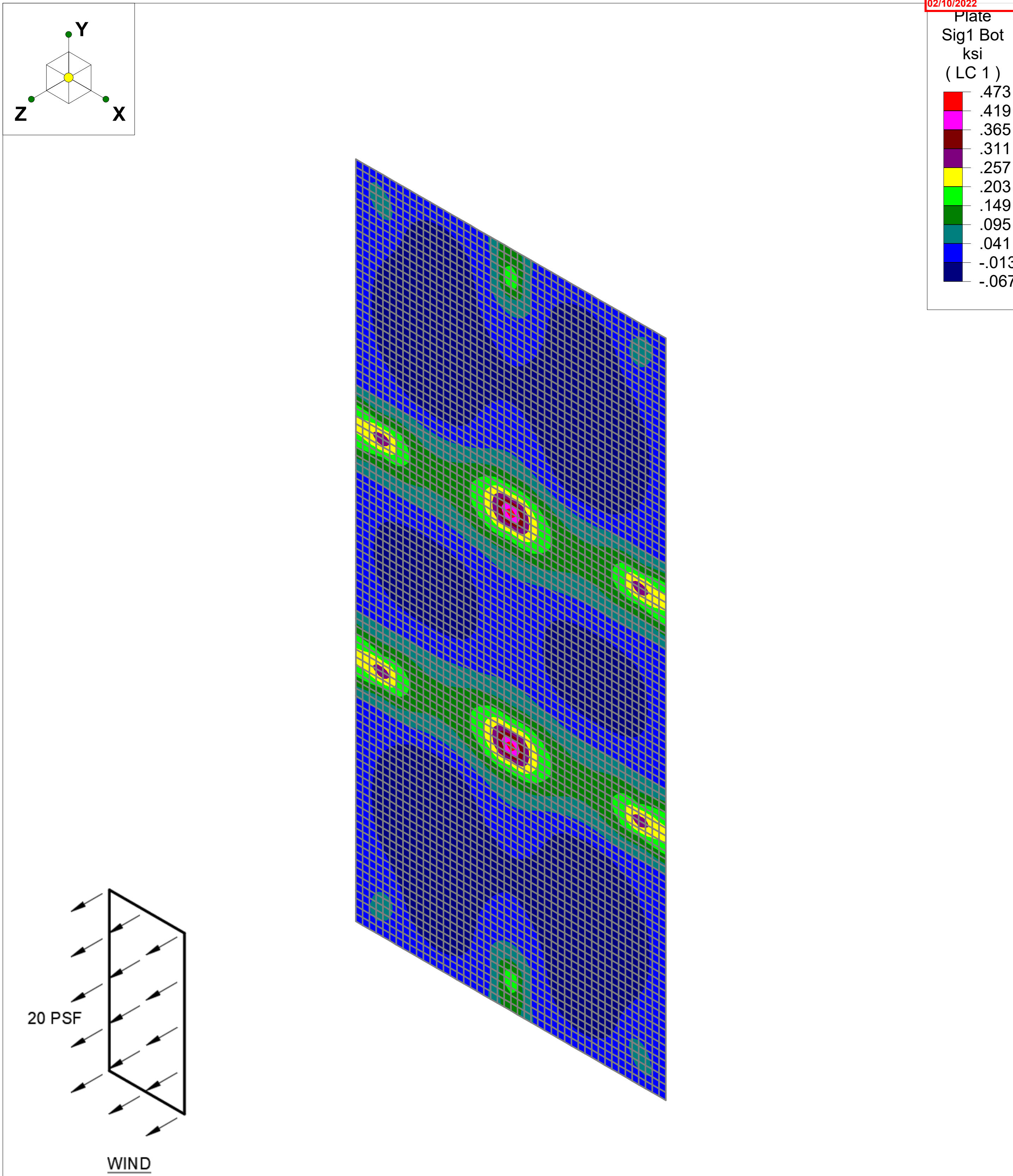


LARSON ENGINEERING	P7	46" WIDE PANEL (TYP.)
AB	KUS20	Jan 7, 2021 at 1:41 PM
63200381.000	PANEL DIAGRAM	46IN WIDE (TYP).r3d



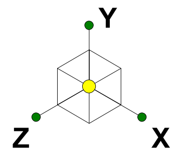
Results for LC 1, WL+DL
Reaction and Moment Units are lb and lb-ft

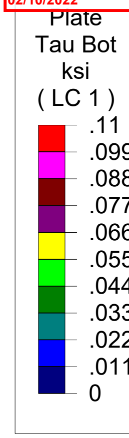
LARSON ENGINEERING	P7	46" WIDE PANEL (TYP.)
AB	KUS20	Jan 7, 2021 at 1:54 PM
63200381.000	REACTIONS	46IN WIDE (TYP).r3d

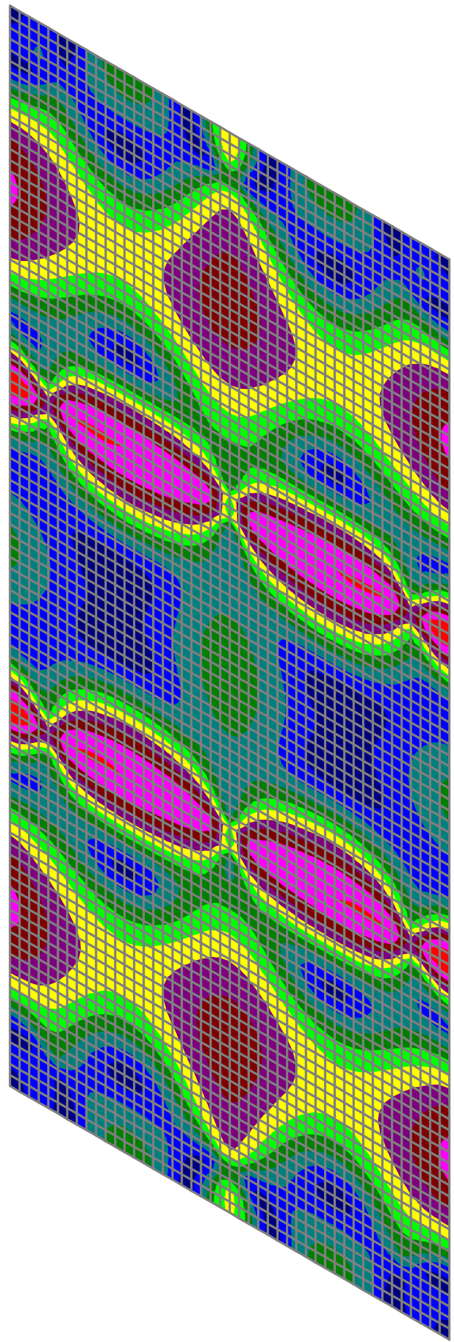


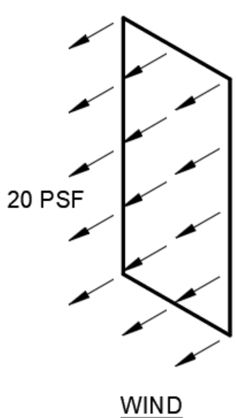
Results for LC 1, WL+DL

LARSON ENGINEERING	P7	46" WIDE PANEL (TYP.)
AB	KUS20	Jan 7, 2021 at 2:24 PM
63200381.000	BENDING STRESS	46IN WIDE (TYP).r3d



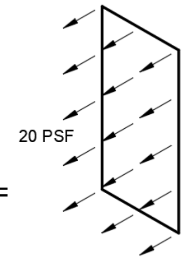






Results for LC 1, WL+DL

LARSON ENGINEERING	P7	46" WIDE PANEL (TYP.)
AB	KUS20	Jan 7, 2021 at 2:26 PM
63200381.000	SHEAR STRESS	46IN WIDE (TYP).r3d



City of Kirkland
Post Revision
Reviewed by ASHaupt
02/10/2022

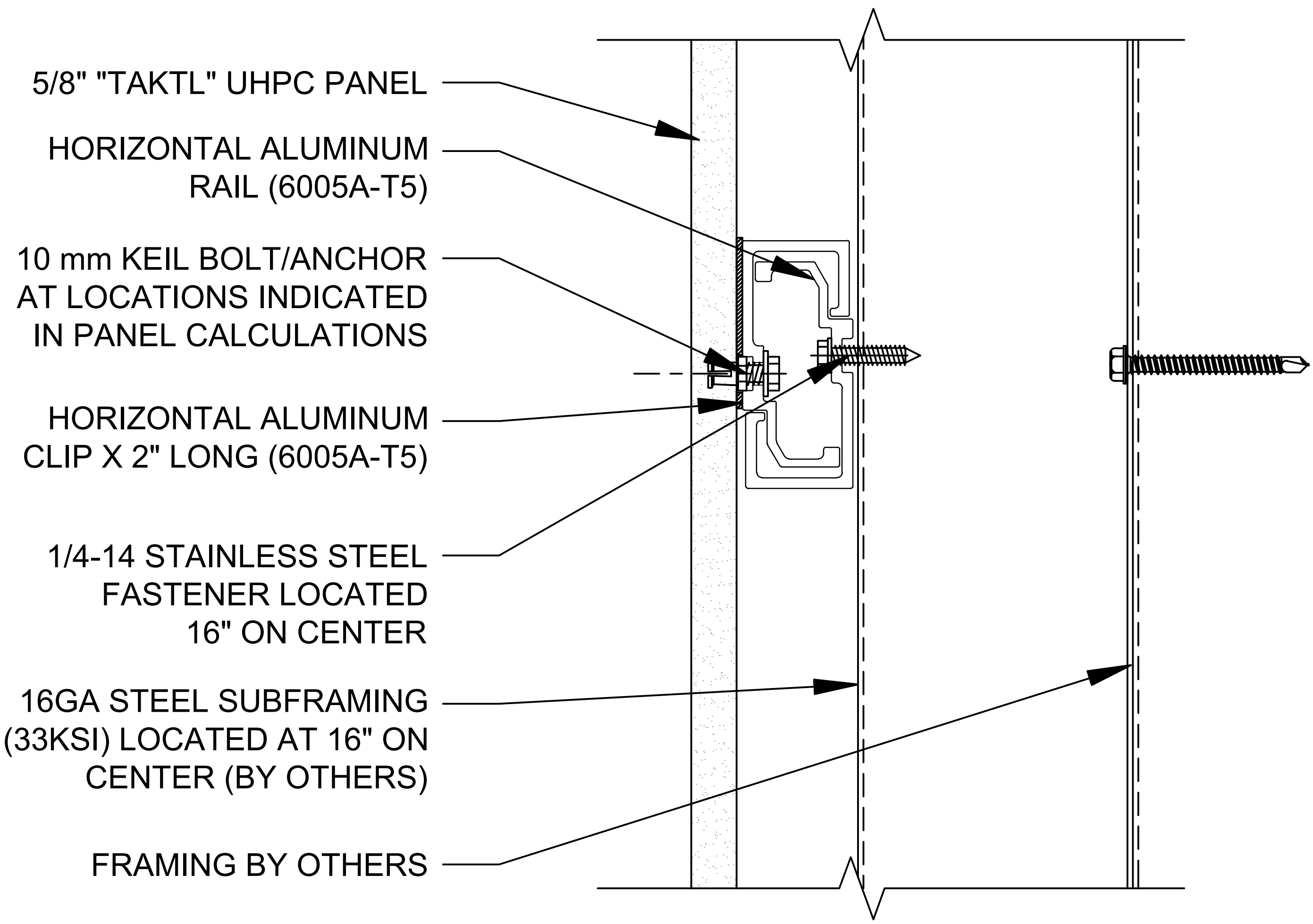
Joint Deflections (By Combination)

	LC	Joint Label	X [in]	Y [in]	Z [in]	X Rotation [rad]	Y Rotation [rad]	Z Rotation [rad]
1	1	N3094	0	0	.014	-5.4247e-05	-6.4016e-07	0
2	1	N1514	0	0	.014	-5.4247e-05	6.4016e-07	0
3	1	N1576	0	0	.014	5.4247e-05	6.4016e-07	0
4	1	N3156	0	0	.014	5.4247e-05	-6.4016e-07	0
5	1	N2995	0	0	.014	-5.4743e-05	-1.3437e-05	0
6	1	N1613	0	0	.014	-5.4743e-05	1.3437e-05	0
7	1	N1675	0	0	.014	5.4743e-05	1.3437e-05	0
8	1	N3057	0	0	.014	5.4743e-05	-1.3437e-05	0
9	1	N3193	0	0	.014	-5.3955e-05	1.5372e-05	0
10	1	N1415	0	0	.014	-5.3955e-05	-1.5372e-05	0
11	1	N1477	0	0	.014	5.3955e-05	-1.5372e-05	0
12	1	N3255	0	0	.014	5.3955e-05	1.5372e-05	0
13	1	N3093	0	0	.014	1.0058e-04	-1.2171e-06	0
14	1	N1513	0	0	.014	1.0058e-04	1.2171e-06	0
15	1	N1577	0	0	.014	-1.0058e-04	1.2171e-06	0
16	1	N3157	0	0	.014	-1.0058e-04	-1.2171e-06	0
17	1	N2896	0	0	.014	-5.5367e-05	-2.2421e-05	0
18	1	N1712	0	0	.014	-5.5367e-05	2.2421e-05	0
19	1	N1774	0	0	.014	5.5367e-05	2.2421e-05	0
20	1	N2958	0	0	.014	5.5367e-05	-2.2421e-05	0
21	1	N3192	0	0	.014	9.9147e-05	1.4812e-05	0
22	1	N1414	0	0	.014	9.9147e-05	-1.4812e-05	0
23	1	N1478	0	0	.014	-9.9147e-05	-1.4812e-05	0
24	1	N3256	0	0	.014	-9.9147e-05	1.4812e-05	0
25	1	N2994	0	0	.014	1.0226e-04	-1.4045e-05	0
26	1	N1612	0	0	.014	1.0226e-04	1.4045e-05	0
27	1	N1676	0	0	.014	-1.0226e-04	1.4045e-05	0
28	1	N3058	0	0	.014	-1.0226e-04	-1.4045e-05	0
29	1	N3292	0	0	.014	-5.3943e-05	3.3785e-05	0
30	1	N1316	0	0	.014	-5.3943e-05	-3.3785e-05	0
31	1	N1378	0	0	.014	5.3943e-05	-3.3785e-05	0
32	1	N3354	0	0	.014	5.3943e-05	3.3785e-05	0
33	1	N2895	0	0	.014	1.0412e-04	-2.3055e-05	0
34	1	N1711	0	0	.014	1.0412e-04	2.3055e-05	0
35	1	N1775	0	0	.014	-1.0412e-04	2.3055e-05	0
36	1	N2959	0	0	.014	-1.0412e-04	-2.3055e-05	0
37	1	N2797	0	0	.014	-5.6042e-05	-2.7268e-05	0
38	1	N1811	0	0	.014	-5.6042e-05	2.7268e-05	0
39	1	N1873	0	0	.014	5.6042e-05	2.7268e-05	0
40	1	N2859	0	0	.014	5.6042e-05	-2.7268e-05	0
41	1	N3291	0	0	.014	9.8002e-05	3.3211e-05	0
42	1	N1315	0	0	.014	9.8002e-05	-3.3211e-05	0
43	1	N1379	0	0	.014	-9.8002e-05	-3.3211e-05	0
44	1	N3355	0	0	.014	-9.8002e-05	3.3211e-05	0
45	1	N2796	0	0	.014	1.0607e-04	-2.7903e-05	0
46	1	N1810	0	0	.014	1.0607e-04	2.7903e-05	0
47	1	N1874	0	0	.014	-1.0607e-04	2.7903e-05	0
48	1	N2860	0	0	.014	-1.0607e-04	-2.7903e-05	0
49	1	N3391	0	0	.014	-5.4281e-05	5.3632e-05	0
50	1	N1217	0	0	.014	-5.4281e-05	-5.3632e-05	0
51	1	N1279	0	0	.014	5.4281e-05	-5.3632e-05	0
52	1	N3453	0	0	.014	5.4281e-05	5.3632e-05	0
53	1	N2698	0	0	.014	-5.6697e-05	-2.7966e-05	0
54	1	N1910	0	0	.014	-5.6697e-05	2.7966e-05	0
55	1	N1972	0	0	.014	5.6697e-05	2.7966e-05	0
56	1	N2760	0	0	.014	5.6697e-05	-2.7966e-05	0

Anchor Analysis

Larson
www.larsonengr.com

SUBJECT: KUS20 KIRKLAND URBAN SOUTH	SHEET NO. A1
DETAIL: WINDLOAD ANCHORAGE	PROJECT NO. 63200381.000
	BY: AB DATE: 1/5/2021

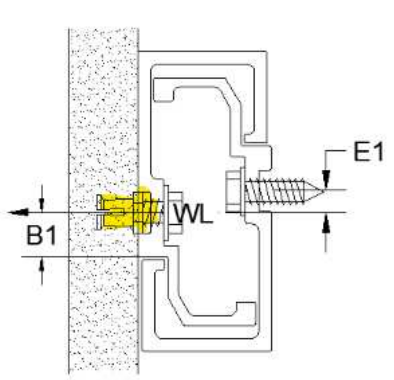


CONCRETE PANEL ANCHOR ANALYSIS:

Corner Zone Loading:

$WL := 134 \cdot lbf$ (Max. RISA reaction)

1. 10 mm Anchor Check at Panel Connection Point:



$E_1 := 0.2\ in$ $B_1 := 0.4\ in$

Panel Anchor Allowable Loads:

$\Omega := 4$ (Safety Factor)

$Tension_{ultimate} := 692 \cdot lbf$ (TAKTL Intertek) $Shear_{ultimate} := 1187 \cdot lbf$ (TAKTL Intertek)

$Tension_{allowable} := \frac{Tension_{ultimate}}{\Omega} = 173\ lbf$ $Shear_{allowable} := \frac{Shear_{ultimate}}{\Omega} = 297\ lbf$

Applied Loads wL Anchor:

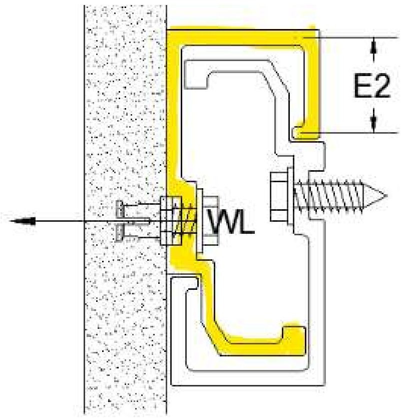
$\delta := 2$ (Double Curvature)

$$Tension := WL + \frac{WL \cdot E_1}{\delta \cdot B_1}$$

$Tension_{allowable} = 173\ lbf$ > $Tension = 168\ lbf$ **Check = "Keil Anchor O.K."**

CONCRETE PANEL ANCHOR ANALYSIS, Cont'd:

2. Aluminum Clip (6005A-T5) x 2" Long at Connection Point:



$Fu_{TAKTL} := 38 \cdot ksi$ $Fy_{TAKTL} := 31 \cdot ksi$

$length := 2 \cdot in$ $thickness := 0.1181 \cdot in$

$N_{Legs} := 2$ $E_2 := 0.71\ in$

$k := 1.25$

Local Bending Check:

$\Omega_F := 1.65$ (Safety factor for yielding) $\Omega_R := 1.95$ (Safety factor for rupture)

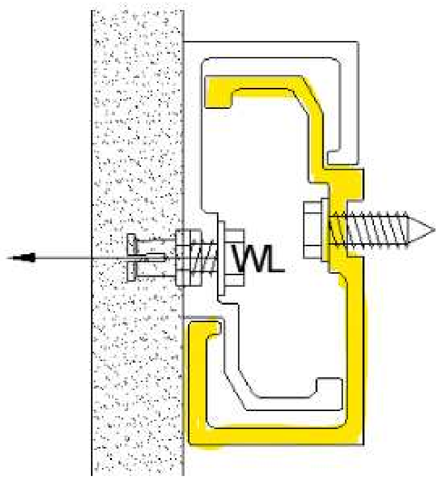
$M_y := \dfrac{WL \cdot E_2}{N_{Legs}}$ $M_y = 48\ lbf \cdot in$

$Z_y := \dfrac{length \cdot thickness^2}{4}$ $Z_y = 0.007\ in^3$

$F_{by} := min\left(\dfrac{Fy_{TAKTL}}{\Omega_F}, \dfrac{Fu_{TAKTL}}{k \cdot \Omega_R}\right)$ $f_{by} := \dfrac{M_y}{Z_y}$

$F_{by} = 15.6\ ksi$ > $f_{by} = 6.821\ ksi$ **Check = "Stress O.K."**

3. Aluminum Rail (6005A-T5):



$I_x := 0.473 \cdot in^4$ $S_x := 0.328 \cdot in^3$

$I_y := 0.106 \cdot in^4$ $S_y := 0.151 \cdot in^3$

$L := 16 \cdot in$ $L_b := 16 \cdot in$

$r_x := 0.864 \cdot in$ $r_y := 0.409 \cdot in$

$E := 10000 \cdot ksi$

CONCRETE PANEL ANCHOR ANALYSIS, Cont'd:

Allowable Stress (6005A-T5):

F.2.1: $S := \frac{L_b}{r_y} = 39$

$F_{b\_F.2.1} := \left(\begin{array}{l} \text{if } S \geq 79 \\ \quad 86996 \div S^2 \\ \text{if } S < 79 \\ \quad 23.9 - 0.124 \cdot S \end{array} \right) \cdot ksi = 19.049\ ksi$

$F_b := min(F_{b\_F.2.1}, 18.79 \cdot ksi) = 18.79\ ksi$

Gross Bending Check WL

$\gamma := 1$ (Load Concentration Factor)

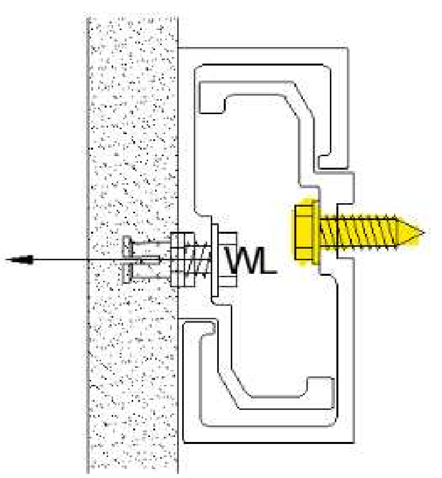
$M := \frac{\gamma\ WL \cdot L}{4}$ $f_{by} := \frac{M}{S_y}$

$F_b = 18.79\ ksi$ > $f_{by} = 3.55\ ksi$ Check = "Stress O.K."

$\Delta_{allowable} := \frac{L}{240}$ $\Delta := \frac{\gamma\ WL \cdot L^3}{48 \cdot E \cdot I_y}$

$\Delta_{allowable} = 0.067\ in$ > $\Delta = 0.011\ in$ Check = "Deflection O.K."

4. #1/4-14 Stainless Steel Fasteners Located 32" OC:



$F_{ufast} := 100000 \cdot psi$ $F_{yfast} := 65000 \cdot psi$

$Fu_{steel} := 45 \cdot ksi$ $Fy_{steel} := 33 \cdot ksi$

$Fu_{TAKTL} = 38\ ksi$ $Fy_{TAKTL} = 31\ ksi$

$t_{TAKTL} := 0.118 \cdot in$ $t_{steel} := 0.06 \cdot in$

$D_{fast} := 0.25 \cdot in$ $N_F := 1$

CONCRETE PANEL ANCHOR ANALYSIS, Cont'd:

Allowable Loads

$\Omega := 3$ (Safety Factor)

$\gamma = 1$ (Load Concentration Factor)

$Shear_{ns} := 517 \cdot lbf$ (AAMA TIR A9-14)

$Tension_{ns} := 896 \cdot lbf$ (AAMA TIR A9-14)

$$Bearing_{ns1} := \frac{4.2 \cdot \left(t_{steel}^{3} \cdot D_{fast}\right)^{0.5} \cdot Fu_{steel}}{\Omega} = 463\ lbf$$

$$Bearing_{ns2} := \frac{2 \cdot t_{TAKTL} \cdot D_{fast} \cdot Fu_{TAKTL}}{\Omega} = 747\ lbf$$

$$Bearing_{ns3} := \frac{2.7 \cdot t_{steel} \cdot D_{fast} \cdot Fu_{steel}}{\Omega} = 608\ lbf$$

$$Pullout_{ns} := \frac{0.85 \cdot D_{fast} \cdot t_{steel} \cdot Fu_{steel}}{\Omega} = 191\ lbf$$

$$Shear_{Allowable} := min\left(Shear_{ns}, Bearing_{ns1}, Bearing_{ns2}, Bearing_{ns3}\right) = 463\ lbf$$

$$Tension_{Allowable} := min\left(Tension_{ns}, Pullout_{ns}\right) = 191\ lbf$$

Applied Loads:

$\delta := 2$ (Double Curvature)

$$Tension_{bolt} := \frac{\gamma\ WL}{N_F} + \frac{\gamma \cdot WL \cdot E_1}{\delta \cdot B_1 \cdot N_F}$$

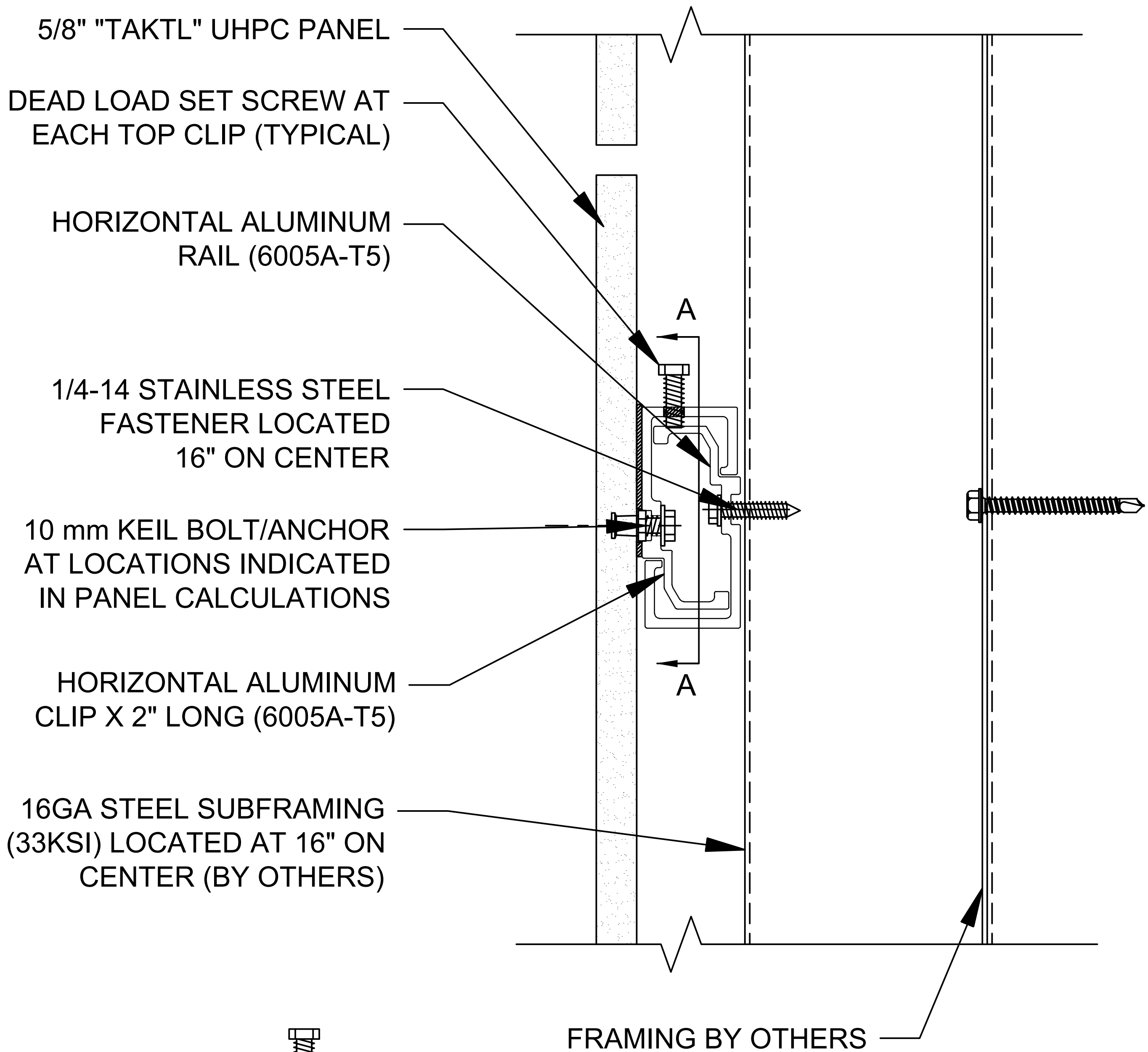
$Tension_{Allowable} = 191\ lbf$ > $Tension_{bolt} = 168\ lbf$

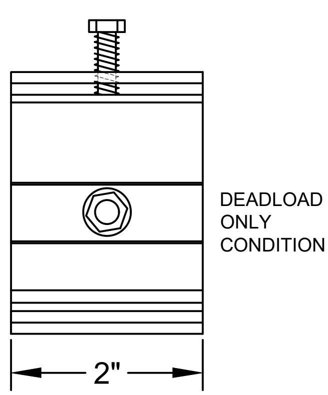
Check = **"Fastener O.K."**

Larson
www.larsonengr.com

SUBJECT: KUS20 KIRKLAND URBAN SOUTH
DETAIL: DEADLOAD ANCHORAGE

SHEET NO. A2
PROJECT NO. 63200381.000
BY: AB DATE: 1/5/2021





SECTION A-A

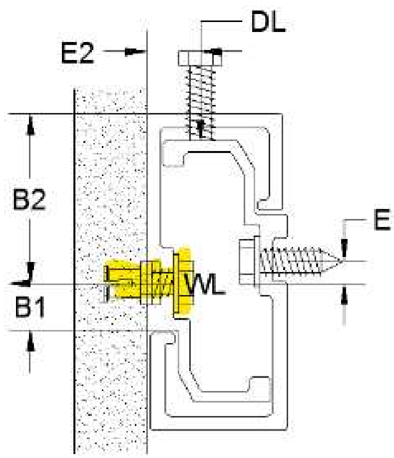
CONCRETE PANEL ANCHOR ANALYSIS (DL+WL):

$Panel_{height} := 126\ in$ $Panel_{trib} := 16\ in$ $Deadload := 7.2\ psf$ $DL := Panel_{height} \cdot Panel_{trib} \cdot Deadload$

Corner Zone Loading:

$WL := 68 \cdot lbf$ (Max. RISA Reaction) $DL = 100.8\ lbf$

1. 10 mm Anchor Check at Panel Connection Point:



$E_1 := 0.2\ in$ $B_1 := 0.4\ in$

$E_2 := 0.375\ in$ $B_2 := 1.4375\ in$

Panel Anchor Allowable Loads:

$\Omega := 4$ (Safety Factor)

$Tension_{ultimate} := 692 \cdot lbf$ (TAKTL Intertek) $Shear_{ultimate} := 1187 \cdot lbf$ (TAKTL Intertek)

$Tension_{allowable} := \frac{Tension_{ultimate}}{\Omega} = 173\ lbf$ $Shear_{allowable} := \frac{Shear_{ultimate}}{\Omega} = 297\ lbf$

Applied Loads DL Anchor:

$Tension := WL + \frac{DL \cdot E_2}{B_2} + \frac{WL \cdot E_1}{B_1}$ $Shear := DL$

$Tension_{allowable} = 173\ lbf$ > $Tension = 128\ lbf$

$Shear_{allowable} = 297\ lbf$ > $Shear = 100.8\ lbf$

Interaction:

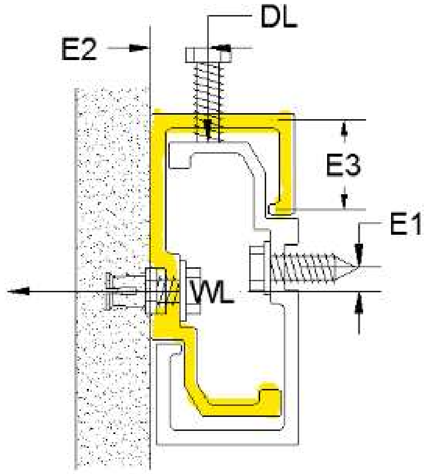
$$Interaction := \left(\frac{Shear}{Shear_{allowable}}\right)^{\frac{5}{3}} + \left(\frac{Tension}{Tension_{allowable}}\right)^{\frac{5}{3}}$$

$Interaction = 0.773$ < 1

Check = "Keil Anchor O.K."

CONCRETE PANEL ANCHOR ANALYSIS, Cont'd:

2. Aluminum Clip (6005A-T5) x 2" Long at Connection Point:



$Fu_{TAKTL} := 38 \cdot ksi$ $Fy_{TAKTL} := 31 \cdot ksi$

$length := 2 \cdot in$ $thickness := 0.1181 \cdot in$

$E_2 = 0.375\ in$ $E_3 := 0.71\ in$

$N_{Legs} := 2$ $k := 1.25$

Local Bending Check:

$\Omega_F := 1.65$ (Safety factor for yielding) $\Omega_R := 1.95$ (Safety factor for rupture)

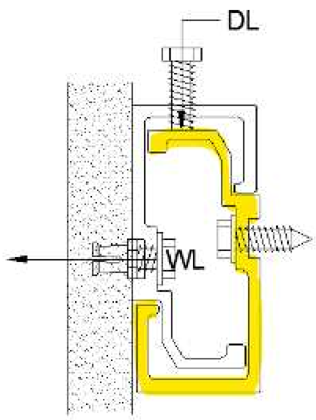
$M_y := \frac{WL \cdot E_3}{N_{Legs}} + DL \cdot E_2$ $M_y = 62\ lbf \cdot in$

$Z_y := \frac{length \cdot thickness^2}{4}$ $Z_y = 0.007\ in^3$

$F_{by} := min\left(\frac{Fy_{TAKTL}}{\Omega_F}, \frac{Fu_{TAKTL}}{k \cdot \Omega_R}\right)$ $f_{by} := \frac{M_y}{Z_y}$

$F_{by} = 15.6\ ksi$ > $f_{by} = 8.882\ ksi$ **Check = "Stress O.K."**

3. Aluminum Rail (6005A-T5):



$I_x := 0.473 \cdot in^4$ $S_x := 0.328 \cdot in^3$

$I_y := 0.106 \cdot in^4$ $S_y := 0.151 \cdot in^3$

$L := 16 \cdot in$ $L_b := 16 \cdot in$

$r_x := 0.864 \cdot in$ $r_y := 0.409 \cdot in$

$E := 10000 \cdot ksi$

CONCRETE PANEL ANCHOR ANALYSIS, Cont'd:

Allowable Stress (6005A-T5):

F.2.1: $S := \frac{L_b}{r_y} = 39$

$$F_{b\_F.2.1} := \left(\begin{array}{l} \text{if } S \geq 79 \\ \quad 86996 \div S^2 \\ \text{if } S < 79 \\ \quad 23.9 - 0.124 \cdot S \end{array} \right) \cdot ksi = 19.049\ ksi$$

$$F_b := min(F_{b\_F.2.1}, 18.79 \cdot ksi) = 18.79\ ksi$$

Gross Bending Check DL

$\gamma := 1$ (Load Concentration Factor)

$M := \frac{\gamma\ DL \cdot L}{4}$ $f_{bx} := \frac{M}{S_x}$

$F_b = 18.79\ ksi$ > $f_{bx} = 1.229\ ksi$

$\Delta_{allowable} := \frac{L}{240}$ $\Delta := \frac{\gamma\ DL \cdot L^3}{48 \cdot E \cdot I_x}$

$\Delta_{allowable} = 0.067\ in$ > $\Delta = 0.002\ in$ Check = "Deflection O.K."

Gross Bending Check WL

$M := \frac{\gamma\ WL \cdot L}{4}$ $f_{by} := \frac{M}{S_y}$

$F_b = 18.79\ ksi$ > $f_{by} = 1.8\ ksi$

$\Delta_{allowable} := \frac{L}{240}$ $\Delta := \frac{\gamma\ WL \cdot L^3}{48 \cdot E \cdot I_y}$

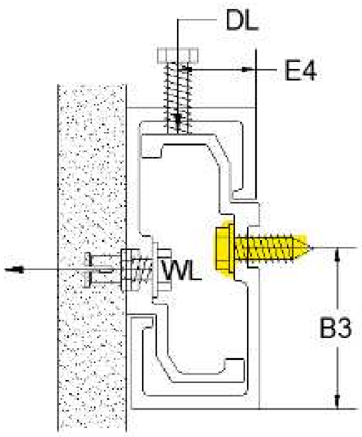
$\Delta_{allowable} = 0.067\ in$ > $\Delta = 0.005\ in$ Check = "Deflection O.K."

Stress Interaction Analysis:

$I := \frac{f_{bx}}{F_b} + \frac{f_{by}}{F_b} = 0.16$ < 1 Check = "Interaction O.K."

CONCRETE PANEL ANCHOR ANALYSIS, Cont'd:

4. #1/4-14 Stainless Steel Fastener Located 16" OC:



$F_{ufast} := 100000 \cdot psi$ $F_{yfast} := 65000 \cdot psi$

$Fu_{steel} := 45 \cdot ksi$ $Fy_{steel} := 33 \cdot ksi$

$Fu_{TAKTL} = 38\ ksi$ $Fy_{TAKTL} = 31\ ksi$

$t_{TAKTL} := 0.118 \cdot in$ $t_{steel} := 0.06 \cdot in$

$D_{fast} := 0.25 \cdot in$ $N_F := 1$

$E_4 := 0.7875\ in$ $B_3 := 1.4375 \cdot in$

Allowable Loads

$\Omega := 3$ (Safety Factor)

$\gamma = 1$ (Load Concentration Factor)

$Shear_{ns} := 517 \cdot lbf$ (AAMA TIR A9-14) $Tension_{ns} := 896 \cdot lbf$ (AAMA TIR A9-14)

$$Bearing_{ns1} := \frac{4.2 \cdot \left(t_{steel}^{\ 3} \cdot D_{fast}\right)^{0.5} \cdot Fu_{steel}}{\Omega} = 463\ lbf \qquad Bearing_{ns2} := \frac{2 \cdot t_{TAKTL} \cdot D_{fast} \cdot Fu_{TAKTL}}{\Omega} = 747\ lbf$$

$$Bearing_{ns3} := \frac{2.7 \cdot t_{steel} \cdot D_{fast} \cdot Fu_{steel}}{\Omega} = 608\ lbf \qquad Pullout_{ns} := \frac{0.85 \cdot D_{fast} \cdot t_{steel} \cdot Fu_{steel}}{\Omega} = 191\ lbf$$

$$Shear_{Allowable} := min\left(Shear_{ns}, Bearing_{ns1}, Bearing_{ns2}, Bearing_{ns3}\right) = 463\ lbf$$

$$Tension_{Allowable} := min\left(Tension_{ns}, Pullout_{ns}\right) = 191\ lbf$$

Applied Loads:

$$Tension_{bolt} := \frac{\gamma\ WL}{N_F} + \frac{\gamma\ DL \cdot E_4}{N_F \cdot B_3} = 123\ lbf \qquad Shear_{bolt} := DL = 101\ lbf$$

$Tension_{Allowable} = 191\ lbf$ > $Tension_{bolt} = 123\ lbf$

$Shear_{Allowable} = 463\ lbf$ > $Shear_{bolt} = 101\ lbf$

Interaction:

$$Interaction := \left(\frac{Shear_{bolt}}{Shear_{Allowable}}\right)^2 + \left(\frac{Tension_{bolt}}{Tension_{Allowable}}\right)^2$$

$Interaction = 0.46$ < 1 **Check = "Interaction O.K."**

Larson
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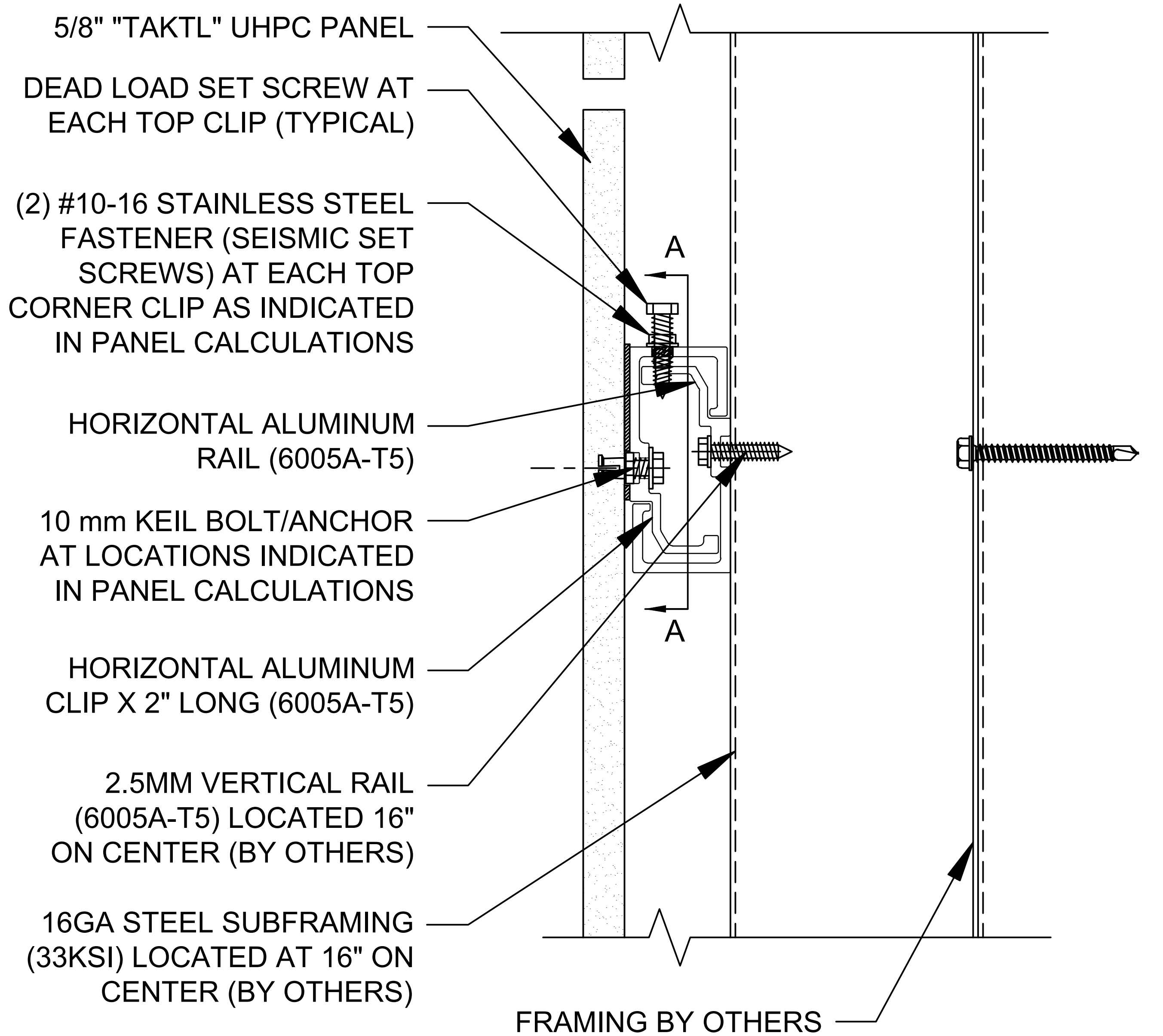
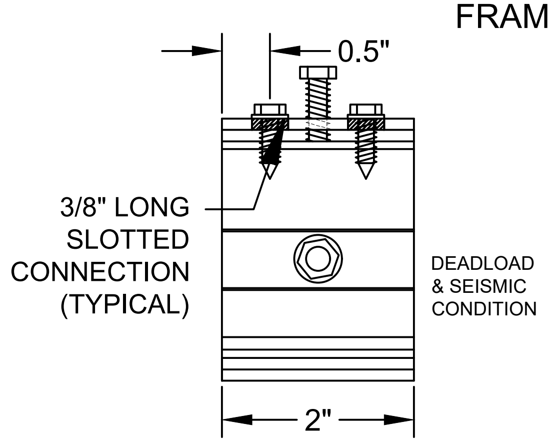
SUBJECT: KUS20 KIRKLAND URBAN SOUTH
DETAIL: SEISMIC ANCHORAGE (TOP)

SHEET NO. A3
PROJECT NO. 63200381.000
BY: AB DATE: 1/5/2021





SECTION A-A

CONCRETE PANEL ANCHOR ANALYSIS: (Seismic)

Project Loads (Corner Zone):

$WL := 37\ psf$ $DL := 8.05\ psf$

$S_{LB} := 2.90\ psf$ $S_{LC} := 9.07\ psf$

$S_O := 13.61\ psf$ $DL_O := 9.85\ psf$

Applied Loads:

$h := 70 \cdot in$ $w := 48 \cdot in$ $w_{dl\_corner} := 14\ in$

$Area_{Panel} := h \cdot w = 3360\ in^2$ $Area_{dl\_corner} := h \cdot w_{dl\_corner} = 980\ in^2$

$P_{DL} := DL \cdot Area_{Panel} = 188\ lbf$ (Total Vertical Dead Loading)

$P_{DL\_s} := DL \cdot Area_{dl\_corner} = 55\ lbf$ (Vertical Dead Load At Seismic Anchor)

$P_{body} := 0.7 \cdot S_{LB} \cdot Area_{Panel} = 47\ lbf$ (Seismic Loading for Body)

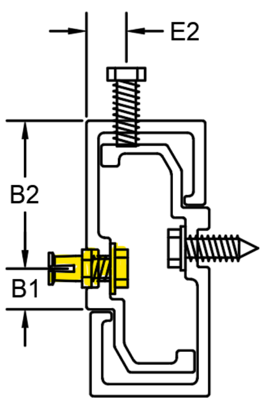
$P_{con} := 0.7\ S_{LC} \cdot Area_{Panel} = 148\ lbf$ (Seismic Loading for Connections)

$P_o := S_O \cdot Area_{Panel} = 318\ lbf$ (Seismic Overstrength Lateral Loading)

$P_{DL\_o} := DL_O \cdot Area_{Panel} = 230\ lbf$ (Seismic Overstrength Vertical Loading)

$P_{DL\_oc} := DL_O \cdot Area_{dl\_corner} = 67\ lbf$ (Seismic Overstrength Vertical Loading - Corner)

1. 10 mm Anchor Check at Panel Connection Point (Corner):



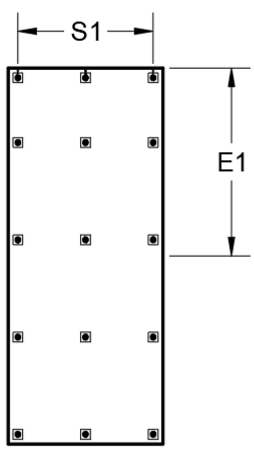
$E_1 = 35\ in$ $S_1 = 40\ in$

$E_2 := 0.375\ in$ $B_1 := 0.4\ in$

$B_2 := 1.47\ in$

$N_{C\_Seismic} := 2$ (Number of Seismic Clips)

$N_A := 1$ (Number of Anchors per Clip)



Concrete Capacities Per Testing: (LRFD)

$Tension_{ultimate} := 692 \cdot lbf$ (TAKTL Intertek) $Shear_{ultimate} := 1187 \cdot lbf$ (TAKTL Intertek)

$Tension_{design} := 0.75 \cdot Tension_{ultimate} = 519\ lbf$ $Shear_{design} := 0.75 \cdot Shear_{ultimate} = 890.25\ lbf$

$\phi_{ns} := 0.65$ (Strength Reduction Factor, Tension/Shear)

$\phi_s := 0.75$ (Strength Reduction Factor, Seismic)

$\phi N := \phi_{ns} \cdot \phi_s \cdot Tension_{design} = 253\ lbf$ (Tensile Design Strength)

$\phi V := \phi_{ns} \cdot \phi_s \cdot Shear_{design} = 434\ lbf$ (Shear Design Strength)

City of Kirkland
Post Revision
Reviewed by ASHaupt
02/10/2022

CONCRETE PANEL ANCHOR ANALYSIS: (Seismic)

Applied Loads DL Seismic Anchor:

$P_y := \frac{P_o \cdot E_1}{S_1}$ $P_y = 278\ lbf$

$Tension := \frac{P_y \cdot E_2}{N_A \cdot B_2} + \frac{P_{DL\_oc} \cdot E_2}{N_A \cdot B_2}$ $Shear := \sqrt{\left(\frac{P_y}{N_A} + \frac{P_{DL\_oc}}{N_A}\right)^2 + \left(\frac{P_o}{N_{C\_Seismic} \cdot N_A}\right)^2}$

$\phi N = 253\ lbf$ > $Tension = 88\ lbf$

$\phi V = 434\ lbf$ > $Shear = 380\ lbf$

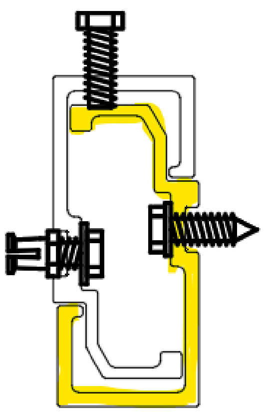
Interaction:

$Interaction := \left(\frac{Shear}{\phi V}\right)^{\frac{5}{3}} + \left(\frac{Tension}{\phi N}\right)^{\frac{5}{3}} = 0.972$

$Interaction = 0.972$ < 1

Check = "Panel Anchor O.K."

2. Aluminum Rail (6005A-T5):



$Fu := 38 \cdot ksi$ $Fy := 31 \cdot ksi$

$I_x := 0.473 \cdot in^4$ $S_x := 0.328 \cdot in^3$

$I_y := 0.106 \cdot in^4$ $S_y := 0.151 \cdot in^3$

$L := 32 \cdot in$ $L_b := 32 \cdot in$

$r_x := 0.864 \cdot in$ $r_y := 0.409 \cdot in$

$E := 10000 \cdot ksi$ $ka := 1.25$

$\Omega_y := 1.65$ (Safety Factor) $\Omega_R := 1.95$ (Safety Factor - Rupture)

Allowable Stress (6005A-T5):

Sec F.2.1: $S := \frac{L_b}{r_y} = 78$

$F_{b\_F.2.1} := \left| \begin{array}{l} \text{if } S \geq 79 \\ \quad \| 86996 \div S^2 \\ \text{if } S < 79 \\ \quad \| 23.9 - 0.124 \cdot S \end{array} \right| \cdot ksi$ $F_{b\_F.2.1} = 14.198\ ksi$

$F_b := min\left(F_{b\_F.2.1}, \frac{Fy}{\Omega_y}, \frac{Fu}{\Omega_R \cdot ka}\right) = 14.198\ ksi$

CONCRETE PANEL ANCHOR ANALYSIS, Cont'd:

Gross Bending Check DL

$P_y := \frac{P_{body} \cdot E_1}{S_1}$ $P_y = 41\ lbf$

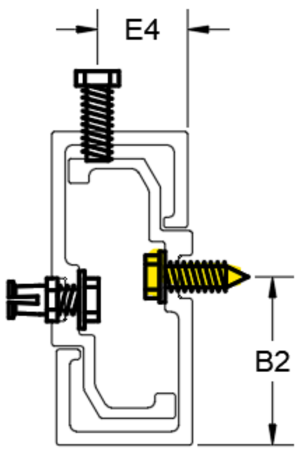
$M := \frac{(P_y + P_{DL\_s})\ L}{4}$ $M = 770\ lbf \cdot in$

$F_b = 14.2\ ksi$ $f_{bx} := \frac{M}{S_x}$

$F_b = 14.2\ ksi$ > $f_{bx} = 2.347\ ksi$ Check = "Stress O.K."

$\Delta_a := \frac{L}{240} = 0.133\ in$ > $\Delta := \frac{(P_y + P_{DL}) \cdot L^3}{48 \cdot E \cdot I_x} = 0.0331\ in$ Check = "Deflection O.K."

3. (2) #1/4-14 Stainless Steel Fastener CW Located at 16" O.C.:



$F_{ufast} := 100000 \cdot psi$ $F_{yfast} := 65000 \cdot psi$

$Fu_{steel} := 45 \cdot ksi$ $Fy_{steel} := 33 \cdot ksi$

$Fu_{aluminum} := 38 \cdot ksi$ $Fy_{aluminum} := 31 \cdot ksi$

$t_{alum} := 0.118 \cdot in$ $t_{steel} := 0.06 \cdot in$

$D := 0.25 \cdot in$ $N_F := 2$

$E_4 := 0.7875\ in$ $B_2 := 1.47 \cdot in$

Fastener Capacity Check: (ASD)

$\Omega := 3$ (Safety Factor)

$Shear_{ns} := 517 \cdot lbf$ (AAMA TIR A9-14) $Tension_{ns} := 896 \cdot lbf$ (AAMA TIR A9-14)

$Bearing_{ns1} := \frac{4.2 \cdot (t_{steel}^3 \cdot D)^{0.5} \cdot Fu_{steel}}{\Omega} = 463\ lbf$ $Bearing_{ns2} := \frac{2 \cdot t_{alum} \cdot D \cdot Fu_{aluminum}}{\Omega} = 747\ lbf$

$Bearing_{ns3} := \frac{2.7 \cdot t_{steel} \cdot D \cdot Fu_{steel}}{\Omega} = 608\ lbf$ $Pullout_{ns} := \frac{0.85 \cdot D \cdot t_{steel} \cdot Fu_{steel}}{\Omega} = 191\ lbf$

$Tension_{Allowable} := min(Tension_{ns}, Pullout_{ns}) = 191\ lbf$

$Shear_{Allowable} := min(Shear_{ns}, Bearing_{ns1}, Bearing_{ns2}, Bearing_{ns3}) = 463\ lbf$

CONCRETE PANEL ANCHOR ANALYSIS, Cont'd:

Applied Loads:

$P_y := \frac{P_{con} \cdot E_1}{S_1}$ $P_y = 130\ lbf$

$Tension_{bolt} := \frac{(P_y + P_{DL\_s}) \cdot E_4}{N_F \cdot B_2}$ $Shear_{bolt} := \frac{\sqrt{(P_y + P_{DL\_s})^2 + P_{con}^2}}{N_F}$

$Tension_{Allowable} = 191\ lbf$ > $Tension_{bolt} = 49\ lbf$

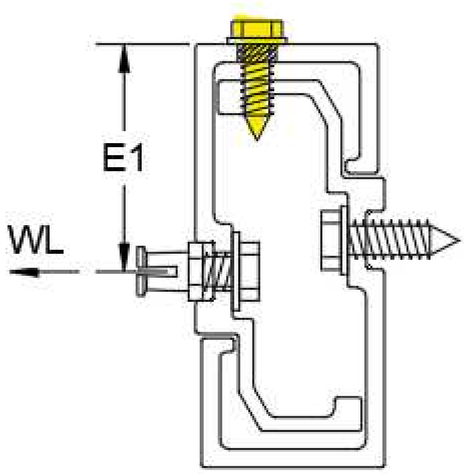
$Shear_{Allowable} = 463\ lbf$ > $Shear_{bolt} = 118\ lbf$

Interaction:

$$Interaction := \left(\frac{Shear_{bolt}}{Shear_{Allowable}}\right)^2 + \left(\frac{Tension_{bolt}}{Tension_{Allowable}}\right)^2$$

$Interaction = 0.132$ < 1 Check = "Fastener O.K."

4. (2) #10-16 Stainless Steel Fastener At Top Panel Corners:



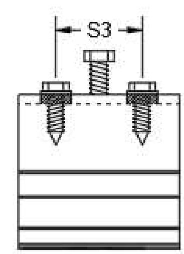
$F_{ufast} := 100000 \cdot psi$ $F_{yfast} := 65000 \cdot psi$ $n_{threads} := 16$

$Fu_{aluminum} := 38 \cdot ksi$ $Fy_{aluminum} := 31 \cdot ksi$

$t_{rail} := 0.0886 \cdot in$ $D := 0.19 \cdot in$

$E_1 := 1.46875 \cdot in$ $S_3 := 1.0 \cdot in$

$N_{C\_Seismic} := 2$ $N_{F\_Clip} := 2$



$K_s :=$ if $0.038\ in \le t_{rail} \le 0.080\ in$
  1.01
else if $0.080\ in \le t_{rail} \le \frac{2}{n_{threads}} \cdot in$
  1.20

Fastener Capacity Check: (ASD)

$\Omega := 3$ (Safety Factor)

$Tension_{ns} := 477 \cdot lbf$ (AAMA TIR A9-14)

$Shear_{ns} := 275 \cdot lbf$ (AAMA TIR A9-14)

$Pullout_{ns} := \frac{K_s \cdot D \cdot t_{rail} \cdot Fy_{aluminum}}{\Omega} = 208.742\ lbf$

$Bearing_{ns2} := \frac{2 \cdot t_{rail} \cdot D \cdot Fu_{aluminum}}{\Omega} = 426\ lbf$

$Shear_{Allowable} := min(Shear_{ns}, Bearing_{ns1}, Bearing_{ns2}) = 275\ lbf$

$Tension_{Allowable} := min(Tension_{ns}, Pullout_{ns}) = 209\ lbf$

CONCRETE PANEL ANCHOR ANALYSIS, Cont'd:

Applied Loads:

$P_{vertical} := P_y = 130\ lbf$

$Tension_{bolt} := \frac{P_{vertical}}{N_{F\_Clip}} + \frac{P_{con} \cdot E_1}{S_3 \cdot N_{C\_Seismic}} = 174\ lbf$

$Shear_{bolt} := \frac{P_{con}}{N_{F\_Clip} \cdot N_{C\_Seismic}} = 37\ lbf$

$Tension_{Allowable} = 209\ lbf$ > $Tension_{bolt} = 174\ lbf$

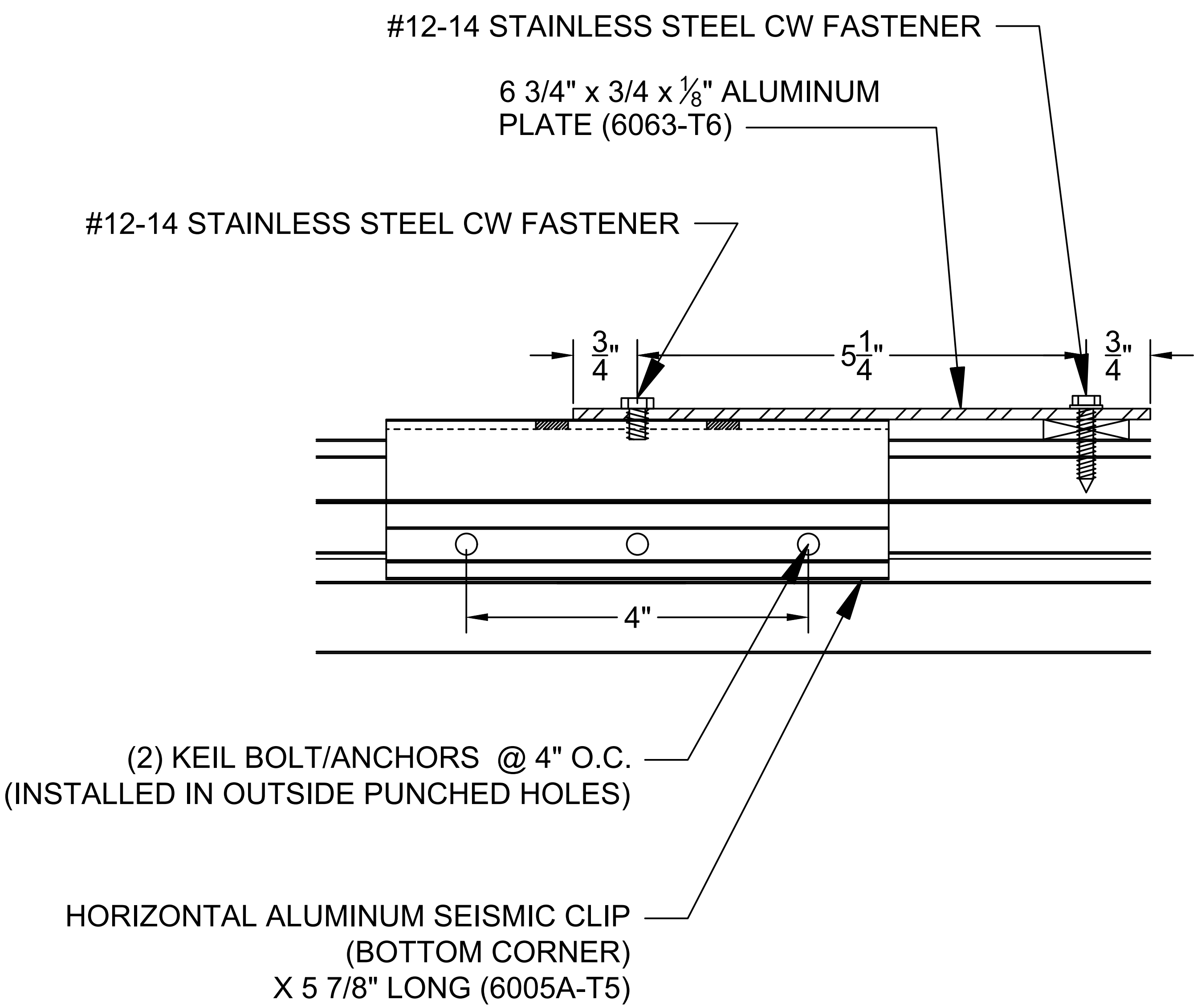
$Shear_{Allowable} = 275\ lbf$ > $Shear_{bolt} = 37\ lbf$

Interaction:

$$Interaction := \left(\frac{Shear_{bolt}}{Shear_{Allowable}}\right)^2 + \left(\frac{Tension_{bolt}}{Tension_{Allowable}}\right)^2$$

$Interaction = 0.7098$ < 1

Check = "Fastener O.K."



(1) SEISMIC CLIP LOCATED AT BOTTOM CORNER OF PANEL IN ADDITION TO THE (2) TYPICAL SEISMIC CLIPS LOCATED AT THE TOP CORNERS OF THE PANEL

LATERAL SEISMIC PANEL ANCHOR ANALYSIS:

Project Loads:

$WL := 37\ psf$

$DL_{Seismic} := 8.05\ psf$

$S_{LB} := 2.90\ psf$

$S_{LC} := 9.07\ psf$

$S_O := 13.61\ psf$

$DL_O := 9.85\ psf$

Applied Loads:

$h := 126 \cdot in$

$w := 48 \cdot in$

$Area_{Panel} := h \cdot w$

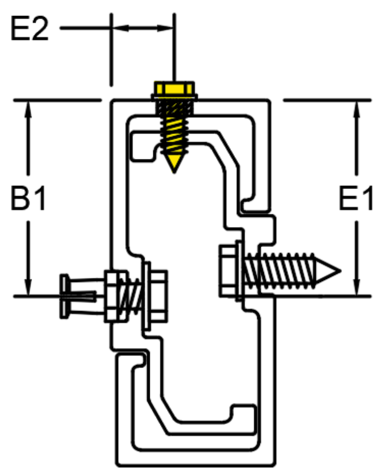
$Area_{Panel} = 6048\ in^2$

$P_{body} := \frac{0.7 \cdot S_{LB} \cdot Area_{Panel}}{2} = 43\ lbf$ (Seismic Loading for Body)

$P_{con} := \frac{0.7\ S_{LC} \cdot Area_{Panel}}{2} = 133\ lbf$ (Seismic Loading for Connections)

$P_o := \frac{S_O \cdot Area_{Panel}}{2} = 286\ lbf$ (Seismic Overstrength Loading for Connections)

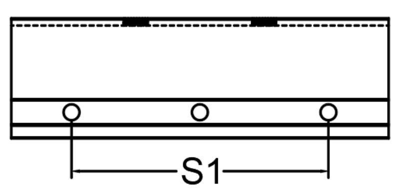
1. (2) 10 mm Anchor Check at Panel Connection Point:



$E_1 := 1.625\ in$

$S_1 := 4\ in$

$N_F := 2$ (Number of Anchors per Clip)



Concrete Capacities Per Testing: (LRFD)

$Tension_{ultimate} := 668 \cdot lbf$

$Shear_{ultimate} := 1060 \cdot lbf$

$\phi_{ns} := 0.55$ (Strength Reduction Factor, Tension/Shear)

$\phi_s := 0.75$ (Strength Reduction Factor, Seismic)

$\phi N := \phi_{ns} \cdot \phi_s \cdot Tension_{ultimate} = 276\ lbf$ (Tensile Design Strength)

$\phi V := \phi_{ns} \cdot \phi_s \cdot Shear_{ultimate} = 437\ lbf$ (Shear Design Strength)

CONCRETE PANEL ANCHOR ANALYSIS, Cont'd:

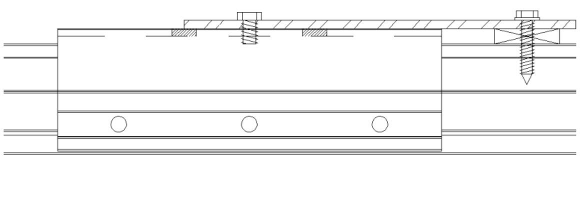
Applied Loads: (Lateral)

$$Shear := \sqrt{\left(\frac{P_o \cdot E_1}{S_1}\right)^2 + \left(\frac{P_o}{N_F}\right)^2}$$

$\phi V = 437\ lbf$ > $Shear = 184\ lbf$

Check = "Panel Anchor O.K."

2. 1/8" Aluminum Plates x 4 3/4" Long (6063-T6):



$Fu := 30 \cdot ksi$ $Fy := 25 \cdot ksi$

$t := 0.125 \cdot in$ $E := 10100 \cdot ksi$

$Length := 0.75 \cdot in$ (Clip length)

$L_b := 5.25 \cdot in$ $A_g := Length \cdot t = 0.094\ in^2$

$\Omega := 1.65$ (Safety Factor)

$$I_y := \frac{t^3 \cdot Length}{12} = 0.00012\ in^4 \qquad r_y := \sqrt{\frac{I_y}{A_g}} = 0.036\ in$$

Stresses in Anchor Clip:

[Compressive Stress]:

$$F_e := \frac{\pi^2 \cdot E}{\left(\frac{L_b}{r_y}\right)^2} \qquad F_e = 4.709\ ksi$$

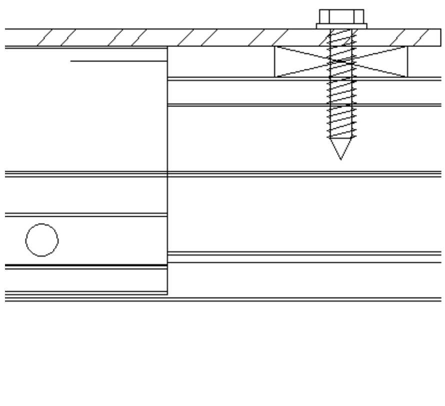
$$F_a := min\left(F_e, \frac{Fy}{\Omega}\right) \qquad f_a := \frac{P_{body}}{A_g}$$

$F_a = 4.7\ ksi$ > $f_a = 0.455\ ksi$

Check = "Stress O.K."

CONCRETE PANEL ANCHOR ANALYSIS, Cont'd:

3. #12-14 Stainless Steel Fastener Attaching Strap to Rail:



$F_{ufast} := 100000 \cdot psi$ $F_{yfast} := 65000 \cdot psi$

$Fu_{rail} := 38 \cdot ksi$ $Fy_{rail} := 31 \cdot ksi$

$Fu_{plate} := 30 \cdot ksi$ $Fy_{plate} := 25 \cdot ksi$

$t_1 := 0.125 \cdot in$ $t_2 := 0.118 \cdot in$

$D := 0.216 \cdot in$ $N_F := 1$

Fastener Capacity Check: (ASD)

$Shear_{ns} := 373 \cdot lbf$ $Tension_{ns} := 645 \cdot lbf$

$Bearing_{ns1} := \frac{2 \cdot t_1 \cdot D \cdot Fu_{plate}}{3} = 540\ lbf$ $Bearing_{ns2} := \frac{2 \cdot t_2 \cdot D \cdot Fu_{rail}}{3} = 646\ lbf$

$Pullout_{ns} := 315 \cdot lbf$

$Shear_{Allowable} := min(Shear_{ns}, Bearing_{ns1}, Bearing_{ns2}) = 373\ lbf$

$Tension_{Allowable} := min(Tension_{ns}, Pullout_{ns}) = 315\ lbf$

Applied Loads:

$Shear_{bolt} := \frac{P_{con}}{N_F} = 133\ lbf$

$Shear_{Allowable} = 373\ lbf$ > $Shear_{bolt} = 133\ lbf$ **Check = "Fastener O.K."**

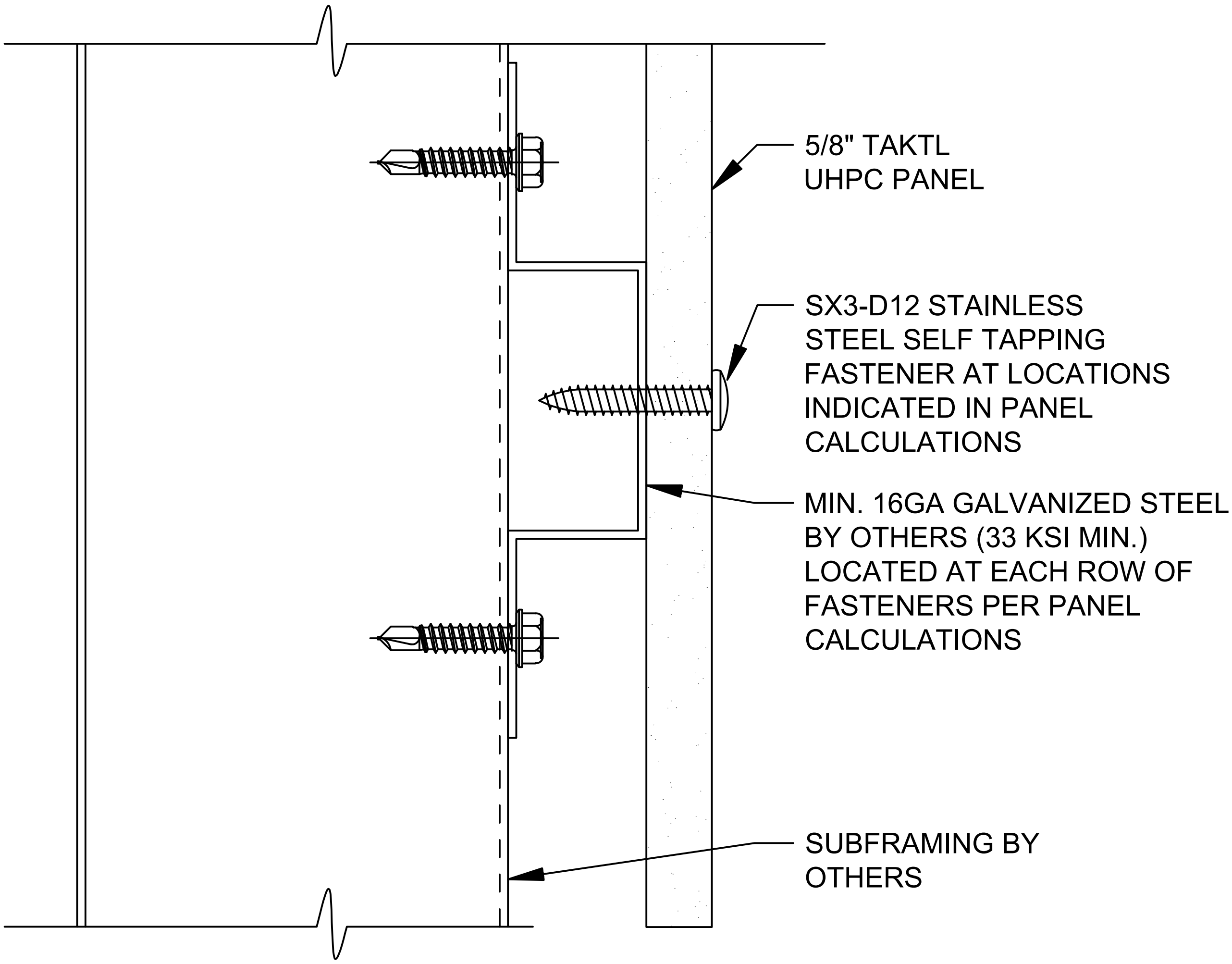
Fastener Bending Stress:

$Eccentricity := 0.1875 \cdot in$

$Moment := \frac{Shear_{bolt} \cdot Eccentricity}{2} = 12\ lbf \cdot in$ $S_x := \frac{\pi \cdot D^3}{32} = 0.001\ in^3$

$F_b := 0.75 \cdot F_{yfast}$ $f_b := \frac{Moment}{S_x}$

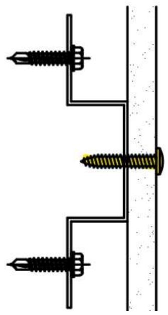
$F_b = 48.75\ ksi$ > $f_b = 12.63\ ksi$ **Check = "Stress O.K."**


5/8" TAKTL
UHPC PANEL
SX3-D12 STAINLESS
STEEL SELF TAPPING
FASTENER AT LOCATIONS
INDICATED IN PANEL
CALCULATIONS
MIN. 16GA GALVANIZED STEEL
BY OTHERS (33 KSI MIN.)
LOCATED AT EACH ROW OF
FASTENERS PER PANEL
CALCULATIONS
SUBFRAMING BY
OTHERS

CONCRETE PANEL ANCHOR ANALYSIS:

$Windload := 37\ psf$ $Deadload := 8\ psf$ $R_{WL} := 108\ lbf$ $R_{DL} := 18\ lbf$ (RISA)

1. SX3 - D12 #12-11 Self Tapping Fastener:



$F_{ufast} := 100000 \cdot psi$ $F_{yfast} := 65000 \cdot psi$

$Fu_{steel} := 45 \cdot ksi$ $Fy_{steel} := 33 \cdot ksi$

$t_{steel} := 0.06 \cdot in$ $D_{fast} := 0.2160 \cdot in$

Concrete Allowable Strength

$\Omega := 4$ (Safety Factor)

$Tension_{ultimate} := 820 \cdot lbf$ (TAKTL Intertek) $Shear_{ultimate} := 2032 \cdot lbf$ (TAKTL Intertek)

$Tension_{allowable} := \frac{Tension_{ultimate}}{\Omega} = 205\ lbf$ $Shear_{allowable} := \frac{Shear_{ultimate}}{\Omega} = 508\ lbf$

Fastener Allowable Strength

$\Omega := 3$ (Safety Factor)

$Shear_{ns} := \frac{1620 \cdot lbf}{\Omega} = 540\ lbf$ (SFS Intec) $Tension_{ns} := \frac{1900 \cdot lbf}{\Omega} = 633.333\ lbf$ (SFS Intec)

$Bearing_{ns1} := \frac{4.2 \cdot \left(t_{steel}^{3} \cdot D_{fast}\right)^{0.5} \cdot Fu_{steel}}{\Omega} = 430\ lbf$ $Bearing_{ns2} := \frac{2.7 \cdot t_{steel} \cdot D_{fast} \cdot Fu_{steel}}{\Omega} = 525\ lbf$

$Pullout_{ns} := \frac{0.85 \cdot D_{fast} \cdot t_{steel} \cdot Fu_{steel}}{\Omega} = 165\ lbf$ $Pullout_{tested} := \frac{554\ lbf}{\Omega} = 185\ lbf$ (SFS Intec)

$Shear_{Allowable} := min\left(Shear_{allowable}, Shear_{ns}, Bearing_{ns1}, Bearing_{ns2}\right) = 430\ lbf$

$Tension_{Allowable} := min\left(Tension_{allowable}, Tension_{ns}, Pullout_{ns}\right) = 165\ lbf$

Applied Loads:

$Tension_{bolt} := R_{WL}$ $Shear_{bolt} := R_{DL}$

$Tension_{Allowable} = 165\ lbf$ > $Tension_{bolt} = 108\ lbf$

$Shear_{Allowable} = 430\ lbf$ > $Shear_{bolt} = 18\ lbf$

Interaction:

$$Interaction := \left(\frac{Shear_{bolt}}{Shear_{Allowable}}\right)^2 + \left(\frac{Tension_{bolt}}{Tension_{Allowable}}\right)^2$$

$Interaction = 0.429$ < 1

Check = "Fastener O.K."

CONCRETE PANEL ANCHOR ANALYSIS: (Seismic)

2. SX3 - D12 #12-11 Self Tapping Fastener:

$Windload = 37\ psf$ $Deadload = 8\ psf$ $R_{WL} = 108\ lbf$ $R_{DL} = 18\ lbf$ (RISA)

$R_O := 13.61\ psf$

Concrete Capacities Per Testing: (LRFD)

$Tension_{ultimate} := 820 \cdot lbf$ $Shear_{ultimate} := 2032 \cdot lbf$ (TAKTL Intertek)

$\phi_{ns} := 0.55$ (Strength Reduction Factor, Tension/Shear)

$\phi_s := 0.75$ (Strength Reduction Factor, Seismic)

$\phi N := \phi_{ns} \cdot \phi_s \cdot Tension_{ultimate} = 338\ lbf$ (Tensile Design Strength)

$\phi V := \phi_{ns} \cdot \phi_s \cdot Shear_{ultimate} = 838\ lbf$ (Shear Design Strength)

Applied Loads:

$Tension := \frac{R_{WL} \cdot R_O}{Windload} = 39.726\ lbf$ $Shear := 1.2 \cdot R_{DL} = 21.6\ lbf$

$\phi N = 338\ lbf$ > $Tension = 40\ lbf$

$\phi V = 838\ lbf$ > $Shear = 21.6\ lbf$

Interaction:

$$Interaction := \left(\frac{Shear}{\phi V}\right)^{\frac{5}{3}} + \left(\frac{Tension}{\phi N}\right)^{\frac{5}{3}} = 0.03$$

$Interaction = 0.03$ < 1 **Check = "Panel Anchor O.K."**

Appendix A

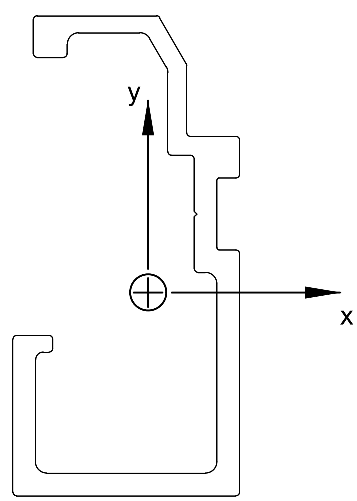
Section Properties

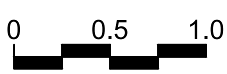
Larson Engineering Inc
6380 E. Thomas Road, Suite 300
Scottsdale, Arizona 85251-7084
Phone: (480) 212-4200

Section Number Aluminum Rail (6005A-T5)

Area	0.634	in^2	Material	Aluminum	
Perimeter	10.947	in	Weight	0.74 lbs/ft	
Centroid			Total size		
X	0.705	in	x	1.181	in
Y	1.059	in	y	2.500	in

Inertias			Section Moduli						Radius of Gyration		
IX	0.473	in^4	Sx (top)	0.328	in^3	Sy (left)	0.151	in^3	rx	0.864	in
IY	0.106	in^4	Sx (bottom)	0.446	in^3	Sy (right)	0.223	in^3	ry	0.409	in





Larson
www.larsonengr.com

Appendix B

Technical Information

Extruded Aluminum Alloy 6005A

sapa:

Sapa Extrusions North America

Alloy 6005A is a versatile alloy that can be used for various structural and architectural applications in the commercial transportation, automotive, industrial, electrical, machinery and equipment industries. Alloy 6005A can be used to produce standard and custom shape extrusions that are solid (open) or hollow in design.

As a medium strength aluminum alloy, 6005A-T61 temper has mechanical property levels similar to 6061-T6, 6005-T5, and 6105-T5. Alloy 6005A has improved toughness characteristics compared to 6005 and 6105 and the chemical composition of 6005A provides improved extrudability compared to 6061 alloy. 6005A should not be confused with 6005 due to a difference in manganese and chromium content. 6005A-T1, -T5, -T61 tempers are included in ASTM B 221, ASTM B 241, and ASTM B 429 specifications.

6005A provides good corrosion resistance and finishing characteristics for anodizing or paint (caution: direct contact with dissimilar metals can cause galvanic corrosion). Alloy 6005A can be welded or brazed using various commercial methods. Consult the Material Safety Data Sheet (MSDS) for proper safety and handling precautions when using 6005A alloy.

Typical applications for alloy 6005A include:

- **Truck, trailer, automotive, bus, and rail components**
- **Marine applications**
- **Platforms, ladders, structures**
- **Building and construction applications**

6005A Temper Designations and Definitions

Standard Tempers	Standard Temper Definitions*
T1	Cooled from an elevated temperature shaping process and naturally aged. (See Note A.)
T5	Cooled from an elevated temperature shaping process & artificially aged. (See Note A.)
T6, T61	Solution heat-treated and artificially aged. (See Note B.)

* For further details of definitions, see Aluminum Association's Aluminum Standards and Data manual and Tempers for Aluminum and Aluminum Alloy Products.
Note A: Applies to products that are not cold worked after cooling from an elevated temperature shaping process, or in which the effect of cold work in flattening or straightening may not be recognized in mechanical properties.
Note B: Applies to products that are not cold worked after solution heat treatment, or in which the effect of cold work in flattening or straightening may not be recognized in mechanical properties.

Chemical Composition   Melting Temperature Range: 1110-1200 °F   Density: 0.098 lb./in.^{3}

Alloy	Si	Fe	Cu	Mn*	Mg	Cr*	Zn	Ti	Others	
									Each	Total
6005A	0.50-0.9	0.35	0.30	0.50	0.40-0.7	0.30	0.20	0.10	0.05	0.15

Chemical composition in weight percent maximum unless shown as a range or minimum.
Average Coefficient of Thermal Expansion (68° to 212°F) = 13.1 x 10-6 (in./in.°F)

Aluminum = Remainder
*** 0.12 to 0.50 total Mn + Cr**

6005A Extruded Mechanical and Physical Property Limits[1*]

Alloy	Standard Tempers	Wall Thickness[2] Inches (min.)	Tensile Strength (ksi)		Elongation[3] % (min.)	Typical Thermal Conductivity, @77°F, BTU-in./ft.²hr.°F (W/m-K@25°C)	Typical Electrical Conductivity, @68°F, % IACS
			Ultimate (min.)	Yield - 0.2% offset (min.)			
6005A	-T1	Up thru 0.249	25.0	14.5	15	1220 (176)	47
	-T5	Up thru 0.249	38.0	31.0	7	1340 (193)	50
		.250 - 0.999	38.0	31.0	9	1340 (193)	50
	-T61	Up thru .0.249	38.0	35.0	8	1310 (188)	49
		0.250 - 1.000	38.0	35.0	10	1310 (188)	49
	(open profiles)						
	-T6	Up thru .197	39.2	32.6	8	NA	NA
		.198 - .394	37.7	31.2	8		
		.395 - .984	36.3	29.0	8		
	(hollow profiles)						
	-T6	Up thru .197	37.0	31.2	8	NA	NA
		.198 - .591	36.3	29.0	8		
6061	-T6	up thru .249	38.0	35.0	8	1160 (167)	43
		.250 & above	38.0	35.0	10		
6005	-T5	up thru .124	38.0	35.0	8	1310 (188)	50
		.125 - 1.000	38.0	35.0	10		

1. Minimum property levels unless shown as a range or indicated as a maximum (max.)
2. The thickness of the cross section from which the tension test specimen is taken determines the applicable mechanical properties.
3. For materials of such dimensions that a standard test specimen cannot be taken, or for shapes thinner than .062", the test for elongation is not required. Elongation percent is minimum in 2" or 4 times specimen diameter.

* Mechanical property values for 6005A -T1, -T5, -T61 tempers per Aluminum Association. Values for 6005A-T6 temper per EN755-2 specification.

Comparative Characteristics of Related Alloys / Tempers[1]

Alloy	Temper	Formability (D C B A)	Machinability (D C B A)	General Corrosion Resistance (D C B A)	Weldability (D C B A)	Brazeability (D C B A)	Anodizing Response (D C B A)
6005A	-T1	B	C	B	A	A	B
	-T5	B	C	B	A	A	A
	-T6	C	C	B	A	A	A
	-T61	C	C	B	A	A	A
6061	-T6	C	C	B	A	A	A
6005	-T5			B	A	A	A
6063	-T6	C	C	A	A	A	A

1. Rating: A=Excellent B=Good C=Fair D=Poor

Sapa Extrusions North America
9600 W. Bryn Mawr Avenue
Rosemont, IL 60018
Phone: 877-710-Sapa (877-710-7272)
Email: NorthAmerican.sales@sapagroup.com
www.sapagroup.com/NA

Shaping the future

Architectural Testing

PERFORMANCE TEST REPORT

Rendered to:

TAKTL

PRODUCTS: 10mm and 13mm Keil Undercut Anchors
Embedded in TAKTL Fiber-Reinforced Concrete Façade Panels

Report No.: **F9897.01-106-31**
Report Date: **07/18/16**
Test Record Retention Date: **06/21/20**

130 Derry Court
York, PA 17406
www.archtest.com • www.intertek.com/building
p. 717.764.7700
f. 717.764.4129

Intertek | Architectural Testing

PERFORMANCE TEST REPORT

Rendered to:

TAKTL
230 Braddock Avenue RIDC Keystone Commons-Portal 9
Turtle Creek, Pennsylvania 15145

Report No.: F9897.01-106-31
Test Start Date: 06/20/16
Test Completion Date: 06/21/16
Report Date: 07/18/16
Test Record Retention Date: 06/21/20

Products: Keil Undercut Anchors Embedded in TAKTL fiber-reinforced concrete façade panel: 10 mm anchors embedded in 1/2" concrete; 13 mm anchors embedded in 5/8" concrete.

Project Summary: Architectural Testing, Inc., an Intertek company ("Intertek-ATI"), was contracted by TAKTL to evaluate the tensile and shear load capacities of anchors embedded in fiber-reinforced concrete façade panels. The product description, test procedures, and test results are reported herein. The average test results are displayed below.

Average Test Results

Product Type	Orientation	Maximum Load (lb_f)
10mm Keil Undercut Anchor	Tension	692
	Shear	1,187
13 mm Keil Undercut Anchor	Tension	903
	Shear	1,434

Test Method: The test specimens were evaluated in accordance with the following method.

ASTM E488/E488M-15, *Standard Test Method for Strength of Anchors in Concrete Elements*

Product Descriptions: The test specimens were submitted to Intertek-ATI by TAKTL and consisted of 16 nominally six-inch square by 0.5-inch thick panels with embedded 10mm Keil undercut anchors (Block A) and 16 nominally six-inch square by 0.625-inch thick panels with embedded 13mm Keil undercut anchors (Block B). The material was tested as received. Refer to the product description photos in Appendix A.

Test Procedures and Test Results: The testing procedures and results obtained from testing are reported as follows. All conditioning of test specimens and test conditions were at standard laboratory conditions unless otherwise reported. Refer to the test related photos in Appendix A and datasheets in Appendix B.

Tensile Anchor Load

The tensile load capacity of the anchors embedded in precast concrete was determined utilizing an Instron Model 3369 Universal Test Machine (ICN: 005740) with a 10 kN load cell (ICN: 005965) operating at a crosshead speed of 0.04 in/min. Each specimen was secured horizontally to the test stage, and a tensile load was applied to the embedded anchor with a fastener holding fixture until a mode of failure was observed. The tensile test results are displayed in the tables below.

10mm Keil Anchor (Block A) Tensile Test Results

Specimen ID	Peak Load (lb_f)	Displacement (in)	Failure Mode
A-1	662	0.050	Concrete Pulled Out
A-2	668	0.044	Concrete Pulled Out
A-3	699	0.044	Concrete Pulled Out
A-7	655	0.044	Concrete Pulled Out
A-15	775	0.043	Concrete Pulled Out
Average	**692**	**0.045**	
Standard Deviation	49.7	0.0	

13 mm Keil Anchor (Block B) Tensile Test Results

Specimen ID	Peak Load (lb_f)	Displacement (in)	Failure Mode
B-7	946	0.041	Concrete Pulled Out
B-8	984	0.044	Concrete Pulled Out
B-9	899	0.038	Concrete Pulled Out
B-13	883	0.027	Concrete Pulled Out
B-15	845	0.043	Concrete Pulled Out
B-16	859	0.044	Anchor Withdrew
Average	**903**	**0.040**	
Standard Deviation	53.0	0.01	

Test Procedures and Test Results: (Continued)

Shear Anchor Load

The shear load capacity of the anchors embedded in precast concrete was determined utilizing an Instron Model 3369 Universal Test Machine (ICN: 005740) with a 10 kN load cell (ICN: 005965) operating at a crosshead speed of 0.04 in/min. Each specimen was secured vertically to the test stage, and a shear load was applied to the embedded anchor with a fastener pulling plate until a mode of failure was observed. The shear test results are displayed in the tables below.

10 mm Keil Anchor (Block A) Shear Test Results

Specimen ID	Peak Load (lb_f)	Displacement (in)	Failure Mode
A-12	1,214	0.092	Concrete Pulled Out
A-14	1,179	0.127	Concrete Pulled Out
A-16	1,233	0.106	Concrete Pulled Out
A-17	1,179	0.113	Concrete Pulled Out
A-18	1,021	0.086	Concrete Pulled Out
A-20	1,296	0.106	Concrete Pulled Out
Average	**1,187**	**0.105**	
Standard Deviation	92.07	0.01	

13 mm Keil Anchor (Block B) Shear Test Results

Specimen ID	Peak Load (lb_f)	Displacement (in)	Failure Mode
B-1	1,525	0.127	Concrete Pulled Out
B-2	1,343	0.130	Concrete Pulled Out
B-3	1,369	0.169	Anchor Withdrew
B-4	1,469	0.158	Concrete Pulled Out
B-6	1,554	0.155	Anchor Withdrew
B-12	1,345	0.122	Anchor Withdrew
Average	**1,434**	**0.144**	
Standard Deviation	94.11	0.02	

Intertek-ATI will service this report for the entire test record retention period. Test records that are retained such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation will be retained by Intertek-ATI for the entire test record retention period.

Results obtained are tested values and were secured using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimens tested. This report may not be reproduced, except in full, without the written approval of Intertek-ATI.

For INTERTEK-ATI:

Digitally Signed by: Joshua Kennedy

Joshua A Kennedy
Technician III
Components / Materials Testing

Digitally Signed by: Joseph M. Brickner

Joseph M. Brickner
Laboratory Supervisor
Components / Materials Testing

JAK:jmb/kf

Attachments (pages) This report is complete only when all attachments listed are included.

- Appendix A - Photographs (8)
- Appendix B - Datasheets (4)

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	07/18/16	N/A	Original report issue

APPENDIX A

Photographs

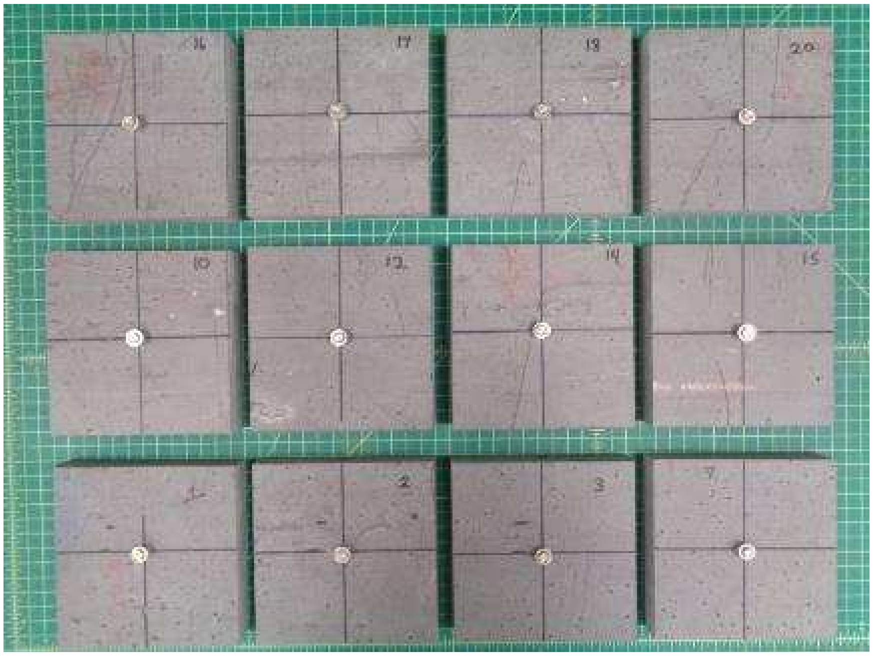


Photo No. 1
10 mm Keil Anchor (Block A) Material As-Received

Photo No. 2
13 mm Keil Anchor (Block B) Material As-Received

Photo No. 3
Typical Block A Specimen Face Detail

Photo No. 4
Typical Block B Specimen Face Detail

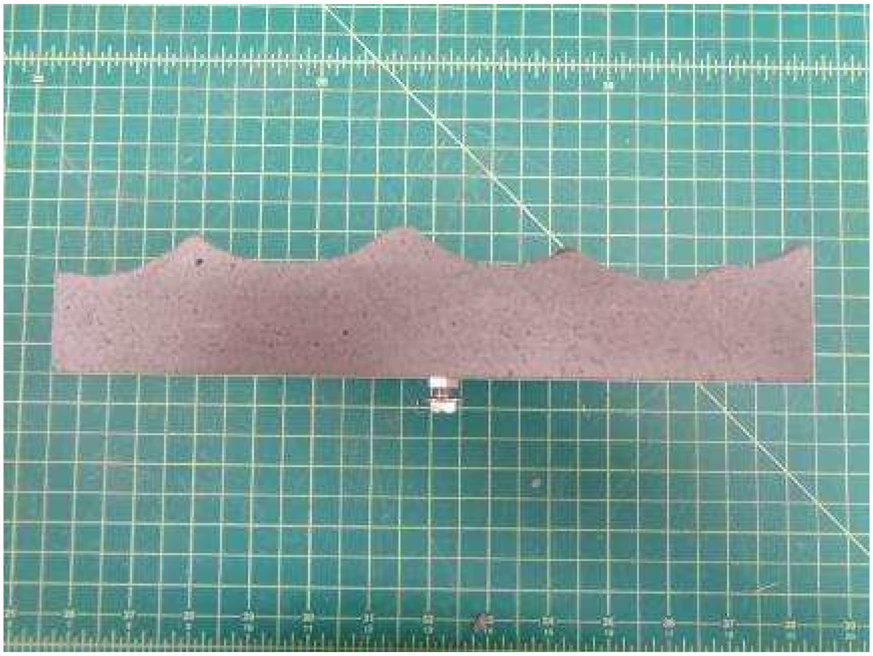


Photo No. 5
Typical Block B Specimen Side Detail

Photo No. 6
Typical Tensile Test Setup Detail

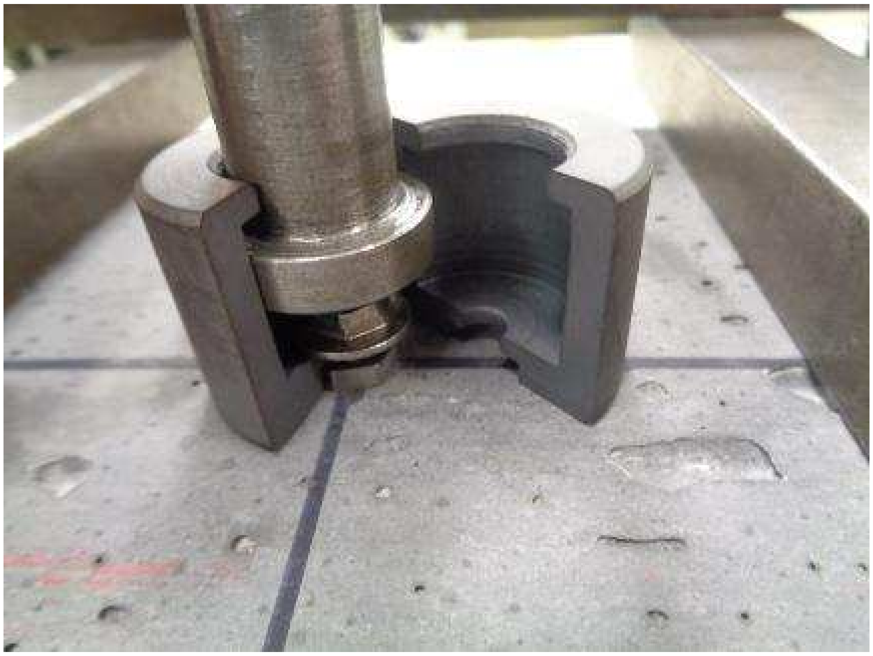


Photo No. 7
Typical Tensile Fixture Setup Detail

Photo No. 8
Typical Tensile Test In-Progress Detail

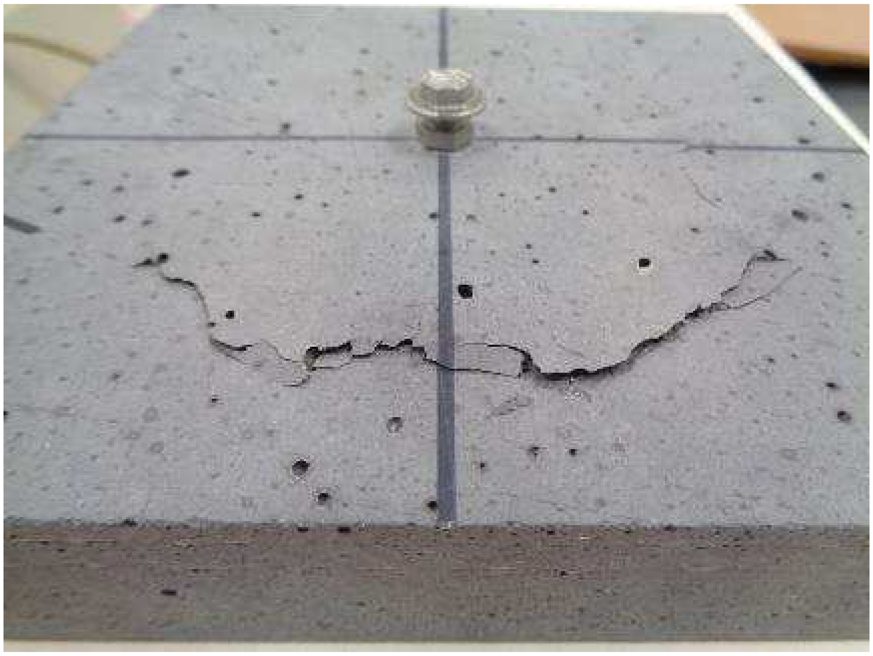


Photo No. 9
Typical Block A Tensile Concrete Pullout Failure Mode Detail

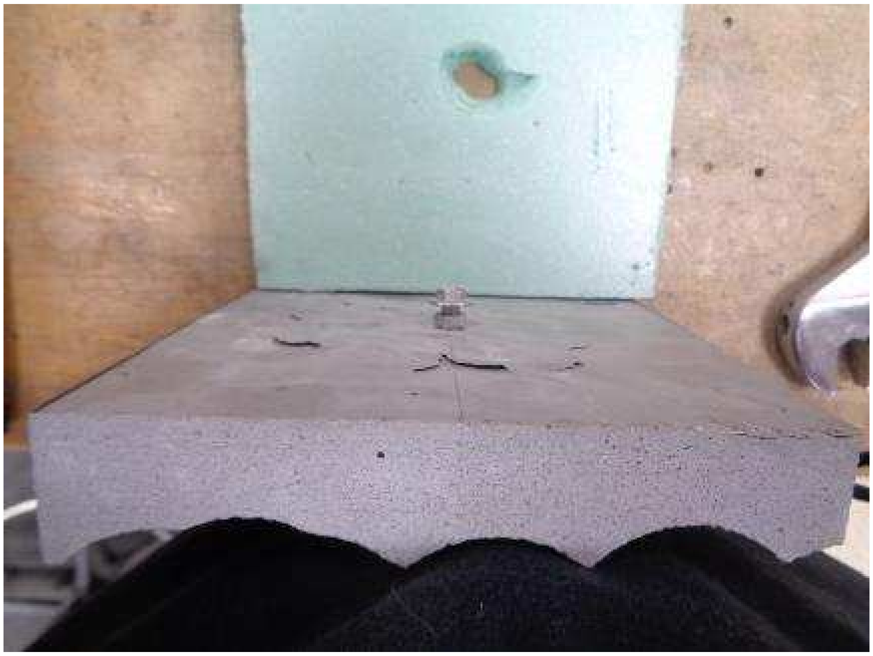


Photo No. 10
Typical Block B Tensile Concrete Pullout Failure Mode Detail

Photo No. 11
Typical Tensile Anchor Withdrawal Failure Mode Detail

Photo No. 12
Typical Shear Test Setup Detail

Photo No. 13
Typical Shear Test In-Progress Detail

Photo No. 14
Typical Shear Concrete Pullout Failure Mode Detail

Photo No. 15
Typical Shear Anchor Withdrawal Failure Mode Detail

APPENDIX B

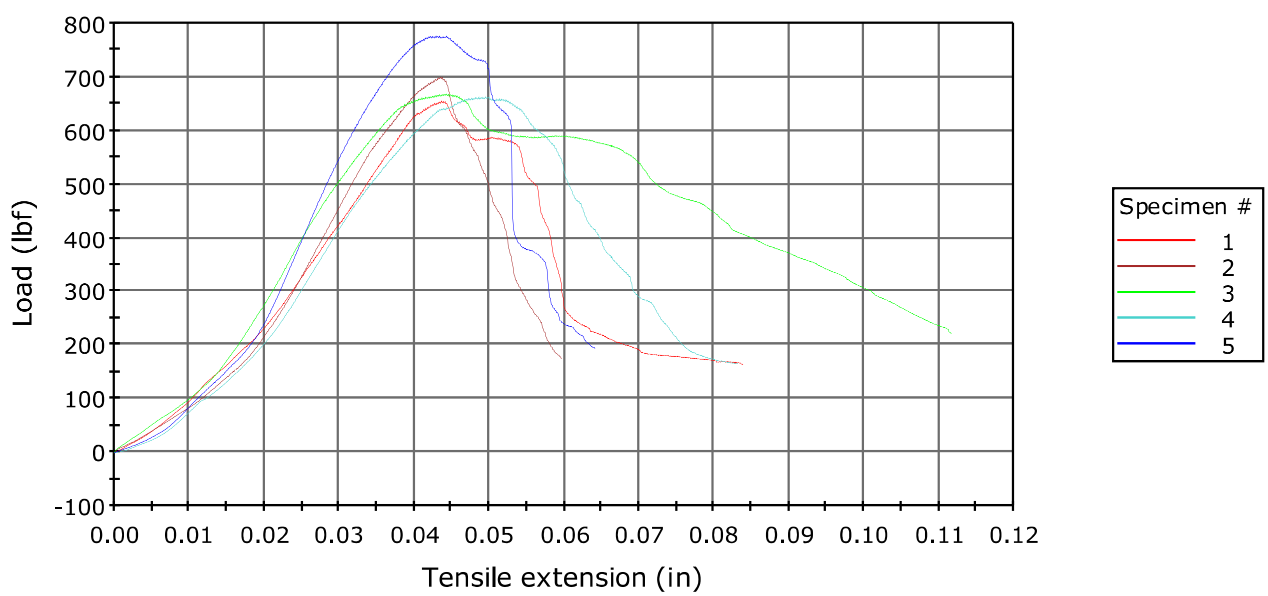
Datasheets

Intertek | Architectural Testing

ASTM E488-15, Strength of Anchors in Concrete
Last Updated by: Josh K. 06/20/16

ATI Job #	F9897.01-106-31
Client Name	TAKTL
Sample Description	Fastener in Concrete (Tension)
User	Josh K.
Test Speed	0.04 in/min
Depth	0.400 in
Diameter	0.28200 in
Lab Conditions	70.2ºF / 46.4% R.H.
Load Test Frame / ICN	INSTRON 3369 / 005740
Load Cell / ICN	10kN / 005965

Specimens 1 to 5

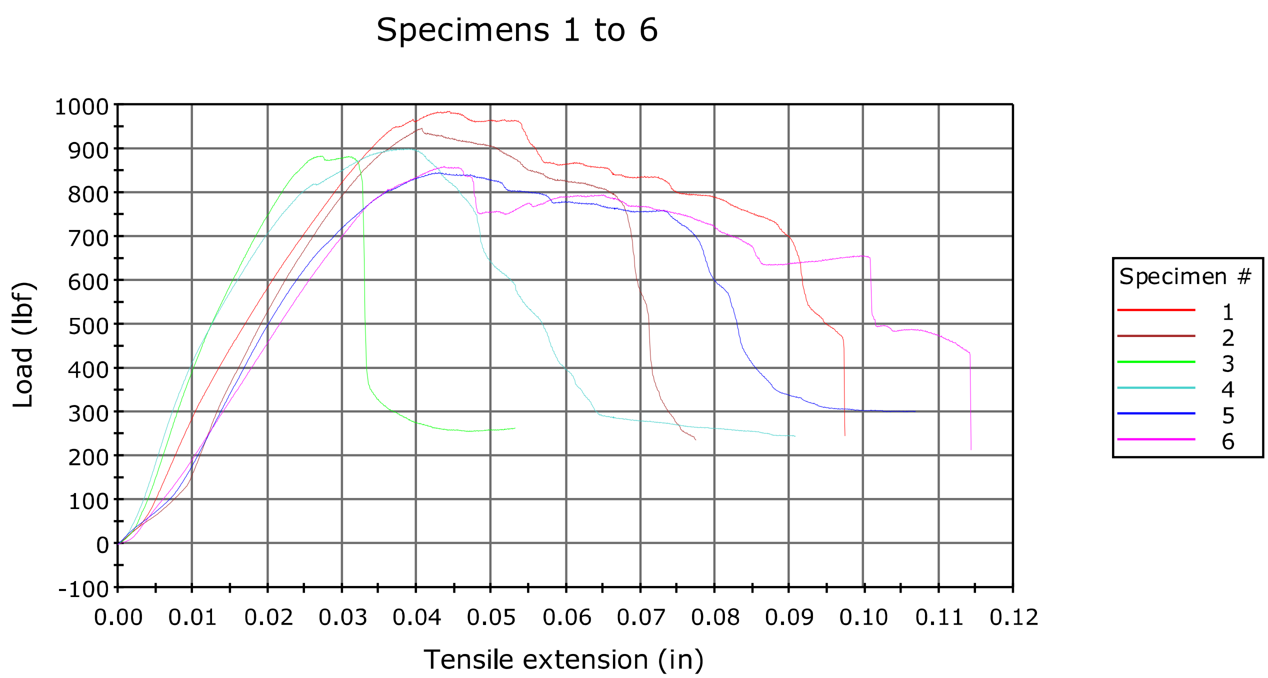


	Specimen ID	Maximum Load (lbf)	Tensile extension at Maximum Load (in)	Comment	Time at Maximum Load (min)	Start Date	End Date
1	A-7	654.6	0.0437	Concrete Pullout	0.87	6/20/2016 3:41 PM	6/20/2016 3:43 PM
2	A-3	699.2	0.0436	Concrete Pullout	1.09	6/20/2016 3:50 PM	6/20/2016 3:51 PM
3	A-2	667.5	0.0444	Concrete Pullout	1.11	6/20/2016 5:11 PM	6/20/2016 5:14 PM
4	A-1	662.3	0.0496	Concrete Pullout	1.24	6/20/2016 5:19 PM	6/20/2016 5:21 PM
5	A-15	775.3	0.0434	Concrete Pullout	1.09	6/20/2016 5:24 PM	6/20/2016 5:26 PM
Mean		691.8	0.0449		1.08		
Standard Deviation		49.70	0.00		0.13		

Intertek | Architectural Testing

ASTM E488-15, Strength of Anchors in Concrete
Last Updated by: Josh K. 06/20/16

ATI Job #	F9897.01-106-31
Client Name	TAKTL
Sample Description	Fastener in Concrete (Tension)
User	Josh K.
Test Speed	0.04 in/min
Depth	0.400 in
Diameter	0.28200 in
Lab Conditions	70.2ºF / 50.0% R.H.
Load Test Frame / ICN	INSTRON 3369 / 005740
Load Cell / ICN	10kN / 005965



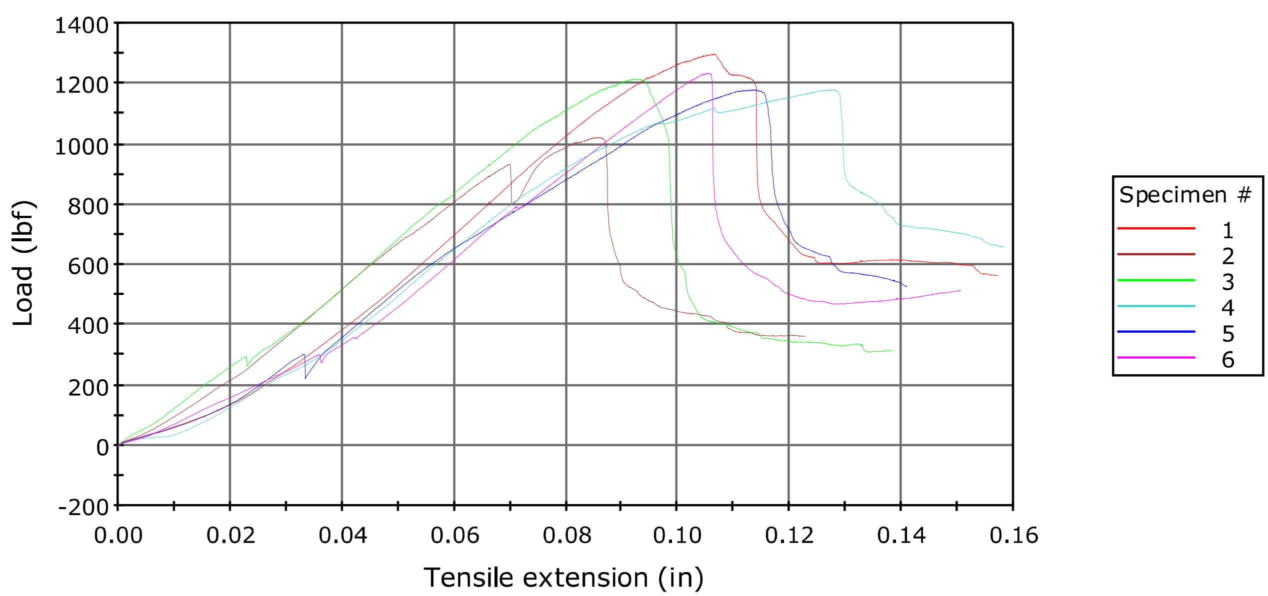
	Specimen ID	Maximum Load (lbf)	Tensile extension (in)	Failure Mode	Time at Maximum Load (min)	Start Date	End Date
1	B-8	984.0	0.0442	Concrete Pullout	1.1	6/21/2016 7:14 AM	6/21/2016 7:16 AM
2	B-7	945.7	0.0408	Concrete Pullout	1.0	6/21/2016 7:24 AM	6/21/2016 7:26 AM
3	B-13	883.3	0.0274	Concrete Pullout	0.7	6/21/2016 7:34 AM	6/21/2016 7:36 AM
4	B-9	899.4	0.0384	Concrete Pullout	1.0	6/21/2016 7:40 AM	6/21/2016 7:43 AM
5	B-15	845.1	0.0430	Concrete Pullout	1.1	6/21/2016 7:47 AM	6/21/2016 7:50 AM
6	B-16	859.1	0.0437	Anchor Withdrew	1.1	6/21/2016 7:55 AM	6/21/2016 7:58 AM
Mean		902.7	0.0396		1.0		
Standard Deviation		53.04	0.01		0.16		

Intertek | Architectural Testing

ASTM E488-15, Strength of Anchors in Concrete
Last Updated by: Josh K. 06/20/16

ATI Job #	F9897.01-106-31
Client Name	TAKTL
Sample Description	Fastener in Concrete (Shear)
User	Josh K.
Test Speed	0.04 in/min
Depth	0.400 in
Diameter	0.28200 in
Lab Conditions	69.9ºF / 49.9% R.H.
Load Test Frame / ICN	INSTRON 3369 / 005740
Load Cell / ICN	10kN / 005965

Specimens 1 to 6

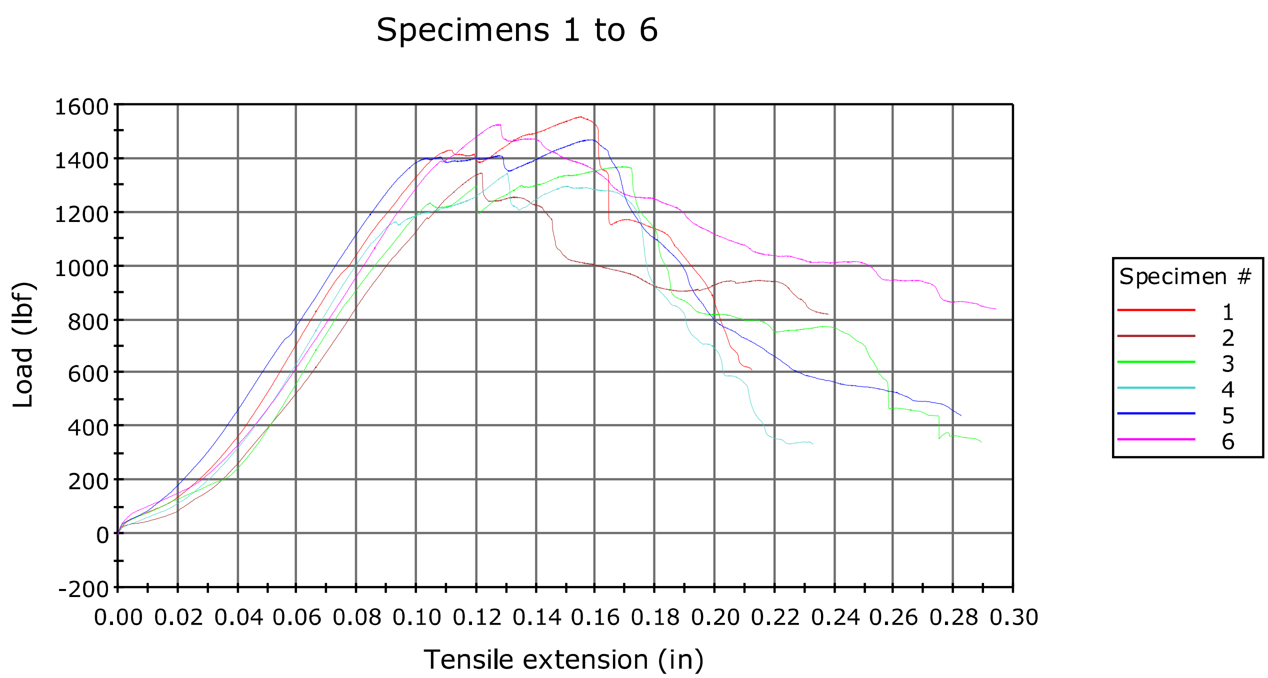


	Specimen ID	Maximum Load (lbf)	Tensile extension at Maximum Load (in)	Time at Maximum Load (min)	Failure Mode	Start Date	End Date
1	A-20	1296.3	0.10643	2.7	Concrete Pullout	6/21/2016 8:58 AM	6/21/2016 9:02 AM
2	A-18	1021.4	0.08570	2.1	Concrete Pullout	6/21/2016 9:09 AM	6/21/2016 9:13 AM
3	A-12	1214.0	0.09222	2.3	Concrete Pullout	6/21/2016 9:19 AM	6/21/2016 9:22 AM
4	A-14	1179.4	0.12742	3.2	Concrete Pullout	6/21/2016 9:26 AM	6/21/2016 9:30 AM
5	A-17	1179.0	0.11343	2.8	Concrete Pullout	6/21/2016 9:36 AM	6/21/2016 9:39 AM
6	A-16	1233.4	0.10569	2.6	Concrete Pullout	6/21/2016 9:43 AM	6/21/2016 9:47 AM
Mean		1187.2	0.10515	2.6			
Standard Deviation		92.07	0.01	0.37			

Intertek | Architectural Testing

ASTM E488-15, Strength of Anchors in Concrete
Last Updated by: Josh K. 06/20/16

ATI Job #	F9897.01-106-31
Client Name	TAKTL
Sample Description	Fastener in Concrete (Shear)
User	Josh K.
Test Speed	0.04 in/min
Depth	0.400 in
Diameter	0.28200 in
Lab Conditions	69.9ºF / 49.0% R.H.
Load Test Frame / ICN	INSTRON 3369 / 005740
Load Cell / ICN	10kN / 005965



	Specimen ID	Maximum Load (lbf)	Tensile extension at Maximum Load (in)	Time at Maximum Load (min)	Failure Mode	Start Date	End Date
1	B-6	1553.9	0.15489	3.9	Anchor Withdrew	6/21/2016 10:00 AM	6/21/2016 10:06 AM
2	B-12	1344.6	0.12175	3.0	Anchor Withdrew	6/21/2016 10:13 AM	6/21/2016 10:19 AM
3	B-3	1369.0	0.16889	4.2	Anchor Withdrew	6/21/2016 10:25 AM	6/21/2016 10:32 AM
4	B-2	1343.1	0.13041	3.3	Concrete Pullout	6/21/2016 10:38 AM	6/21/2016 10:44 AM
5	B-4	1468.7	0.15789	3.9	Concrete Pullout	6/21/2016 10:49 AM	6/21/2016 10:56 AM
6	B-1	1524.7	0.12722	3.2	Concrete Pullout	6/21/2016 11:01 AM	6/21/2016 11:08 AM
Mean		1434.0	0.14351	3.6			
Standard Deviation		94.11	0.02	0.49			

TAKTL

ULTRA HIGH PERFORMANCE CONCRETE

TAKTLHARDWARE Concealed Anchor Panel Attachment

Product Description:

- Extruded aluminum inter-locking clips and rails for concealed attachment of panel products.
- Custom clip widths are available for special load design criteria (panel weights > 500lbs) or very high windloads.
- Rails are available in 12ft, 16ft, and 20ft lengths. Allow overage for drops when ordering.
- Clips are attached to the back of the panel with undercut anchors, studs, or screws depending upon the panel type.
- Clips and rails accommodate seismic or regular building movement, while providing the means for direct fixing where necessary.
- Clips and rails are made from recycled content (may contribute to LEED certification for materials and resources).
- Made in the USA

Manufacturer + Distributor:

TAKTL LLC
230 Braddock Avenue,
Keystone Commons Portal 9
Turtle Creek, PA 15145
412-486-1600 | www.TAKTL-LLC.com

Installation Features:

- Clip extrusion profile is designed specifically for undercut anchors so that anchors mechanically engage the panel without transferring internal stress.
- Extrusions feature a channel to lock undercut anchors while driving the setting bolt and register the anchor depth for safe, accurate and reliable clip attachment.
- Registration groves for self-drilling fasteners are integral to the clip and rail extrusions.
- Chamfered edges provide ease of panel installation.
- Panels are able to be removed individually (with open joints not less than 1/2in).
- Each clip has an integral closed-cell neoprene pad to separate the metal from cement-based materials and assist in proper anchor setting.

Primary Uses:

TAKTLHARDWARE is primarily used for exterior applications in back ventilated facade wall assemblies (rainscreen), with or without continuous exterior insulation. It is compatible with a wide range of sub-frame products and can be incorporated into assemblies and unitized curtain wall fabrications with horizontal and continuous rail orientation attached to a sub-frame/sub-girt system for:

- Close-cladding (without sub-girts) for concealed fixing with equal success for both interior finishes and exterior cladding
- Ceiling and soffit conditions
- Sloped roof applications with appropriate detailing and support system engineering
- Large and heavy panels

Limitations:

Use of **TAKTL**HARDWARE components, must be designed to comply with project performance requirements and design criteria as determined by a calculations report prepared, signed, and sealed by a qualified professional engineer. We strongly recommend single-source design and engineering of the cladding system even if multiple manufacturers are providing facade system components. Facade system engineering should include:

- On-center spacing of clips and rails
- Anchor, clip, and rail layout coordinated with the design and detailing of the entire wall assembly (sub-girts, sub-girt brackets, and wall substrate) using wind-load, seismic load, and structural performance criteria per the ASCE
- Allowance for thermal expansion of framing, floor deflections and building expansion in the design and sizing of connections and joints.

NOTE: Care must be taken to avoid direct contact between dissimilar metals.

TAKTL
ULTRA HIGH PERFORMANCE CONCRETE

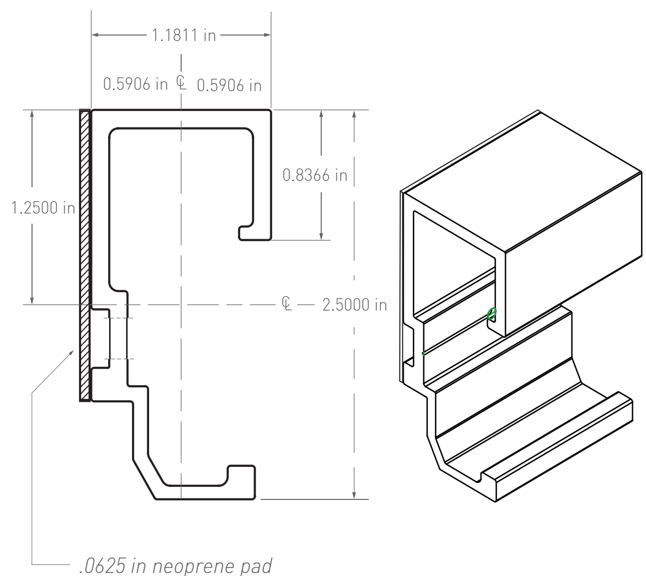
TAKTLHARDWARE **Concealed Anchor Panel Attachment**

MATERIAL + MECHANICAL PROPERTIES

Clips + Rails Aluminum Alloy Description:

- 6005A-T5 aluminum alloy is tempered for use in structural and architectural applications in the commercial transportation, automotive, industrial, machinery and equipment industries.
- 6005A with T5 temper has excellent weld-ability and braze-ability using a variety of methods.
- Tempers meet the ASTM B 221, ASTM B 241, and ASTM B 429 specifications.
- Alloy is suitable for marine environments with "good" corrosion resistance.
- Paint finish is .08 mil high solid paint electrostatic (wet applied per AAMA 2603).
- Recycled Content: 40% pre-consumer recycled aluminum and 35% post -consumer recycled aluminum content. LEED Certification Documentation available upon request.

Average Coefficient of Thermal Expansion (68º to 212ºF)	13.1 x 10^{6} (in/in ºF)	
Min Tensile Strength	38ksi	
Tensile Strength Yield - 0.2% offset	31ksi	
Typical Thermal Conductivity @77°F, BTU-in/ft 2hr °F (W/m-K@25ºC)	1340 (193)	
Average Thickness	0.118in (3.00mm)	
Area	0.633in² (408mm²)	
Weight	0.760lbs/ft (1.13kg/m)	
Section Moduli	Sx(top): 0.342in³	Sx(left): 0.138in³
	Sx(bottom): 0.449in³	Sx(right): 0.223in³
Moment of Inertia	IX 0.485in⁴ , IY 0.101in⁴	
Radius of Gyration	rx: 0.884in , ry: 0.402in	
Max Span	32in under max uniform load	

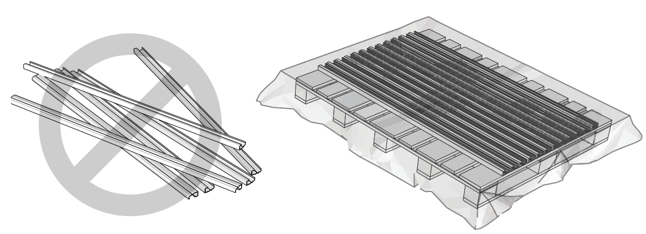


Anchors + Fasteners Stainless Steel Description:

- Undercut anchors and mated bolts are high-corrosion resistant – 316 Grade austenitic stainless steel.
- Adjustment bolts and fasteners are 304 Grade austenitic stainless steel.

HANDLING

- Check the shipping manifest for accuracy upon delivery. Notify TAKTL of any discrepancies with quantities or damaged product.
- Do not stack extrusions directly on the ground. Store bundled on a pallet that is flat to avoid damage.
- Store all materials dry, free of dirt, and covered until needed for installation.
- Provide protective padding when staging panels with clips installed to avoid surface damage to panels.

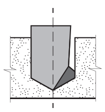
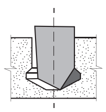
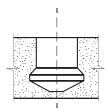
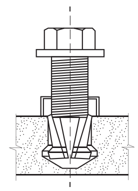
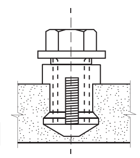


TAKTL®

ULTRA HIGH PERFORMANCE CONCRETE

TAKTLHARDWARE Concealed Anchor Panel Attachment

INSTALLATION INSTRUCTIONS + DETAILS

[1]  [2]  [3]  [4]  [5] 

About KEIL Anchor Drilling:

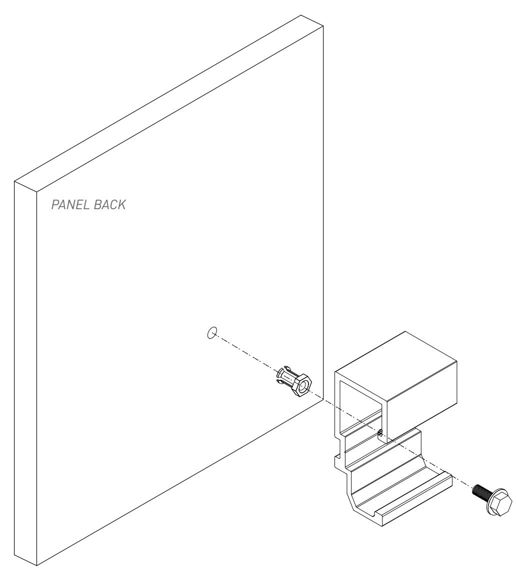
- TAKTL factory-drills panels with undercut holes for KEIL Anchors exclusively.
- The undercut hole is produced in one step (cylindrical drilling **[1]** and undercutting **[2]**).
- Prescribed installation of the undercut facade anchor is possible only if a precisely undercut hole exists **[3]**.
- The hole geometry is regularly monitored with the KEIL gauge matching the insertion depth of the anchor.

About KEIL Anchor Installation:

- The undercut anchor consists of an anchor sleeve and its hex screw.
- Hole, anchor sleeve and screw length have to be matched to the hole depth required and to the panel bracket chosen. Matching components are required for proper, safe, and quick installation.
- The anchor sleeve, which is compressed in the lower end, is placed in the hole together with the specified panel bracket **[4]**.
- The screw is screwed in while exerting slight pressure on the panel bracket (to fix the anchor)**[5]**.
- The locking mechanism of the screw cuts into the panel bracket to secure it. Thus, the panel bracket forms a rigid unit with the KEIL facade anchor.

Instructions | Installing Clips to Panels:

1. Confirm panel part number with shop drawings and anchor layout.
2. Check hole depth and confirm hole is clear of debris (2mm tolerance on depth checker). NOTE: A variation in depth of holes is allowable. Pullout strength for anchor holes drilled slightly deeper than KEIL's specification meets or exceeds the pullout strengths for TAKTL UHPC certified testing.
3. Insert the undercut anchor and place clip over it. Compress the clip to engage the anchor head with the clip channel so that the anchor cannot spin when the bolt is driven in. Using a cordless nut driver or ratchet wrench, tighten the bolt until it is set tight to the clip.
4. Check that the clip can rotate. This will confirm that the undercut anchor is installed properly and that the anchor is seated as intended (via mechanical connection, rather than expansion or friction connection).
5. Identify the top of the panel and install adjustment bolts set to 1/8in below the inner face of the rail wall.



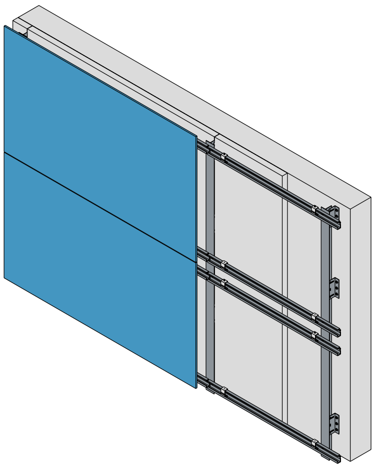
NOTE: Proper coordination of the clip thickness, anchor depth and bolt length is required for a safe and structurally sound connection. Only anchors, bolts, and clips supplied by TAKTL shall be used.

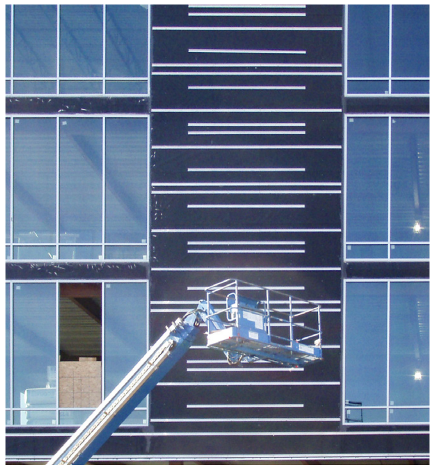
TAKTL®

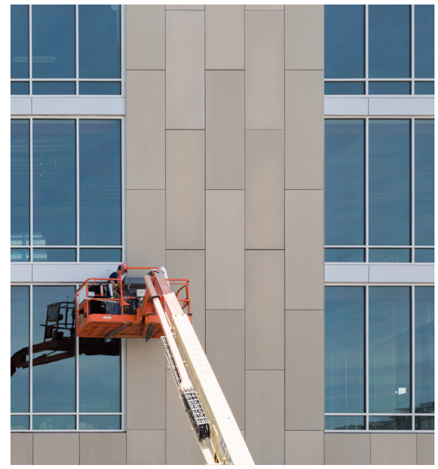
ULTRA HIGH PERFORMANCE CONCRETE

TAKTLHARDWARE Concealed Anchor Panel Attachment

INSTALLATION INSTRUCTIONS + DETAILS







Instructions | Installing Rails to Sub-Frame:

1. Cut extrusions in the field with TCG non-chip, grind-proof saw blade with carbide teeth count 72-100 (10in diameter) or other recommended non-ferrous metal cutting methods.
2. Set elevations of rail datum/work points and locate rail positions per the approved shop drawings.
3. Note the offset of panel clip anchor location relative to the rail and layout rails accordingly (5/16in).
4. Install rails level, plumb, and true to the finished plane of the facade.
5. Fasten the rail to the sub-girts or back-up wall with self-drilling stainless steel screws (spacing, size, and thread of screws per the stamped engineer's calculations).
6. Allow space between joining rails' sections for expansion of aluminum (Example: ±1/4in per 10ft, therefore minimum 1/2in gap between two 10ft rails).
7. Do not bridge rails with fixed connections to back-up wall across building expansion joint or seismic joints. Consult engineer and TAKTL for rail placement and panel layout details.

NOTE: When cutting extrusions, wear protective clothing and eye protection. File cut edges so they are free of burs and sharp edges.

RECOMMENDATION: Touch up cut edges of extrusions with spray paint near corners where extrusions may be visible after panel installation.

Instructions | Installing Panels to Rails:

1. Set panels into position and ensure all clips are engaged with their respective rails.
2. Lower panels until the clips and rails interlock.
3. Adjust the panel position to achieve the specified joint dimension. Use shims to set a consistent joint width and level the panel.
4. Adjust bolts on the top row clips so that all are tight and in contact with the rail.
5. Once the adjustment bolts have been set, do not attempt to move the panel without backing off the adjustment bolts and lifting the panel to re-position.
6. For cladding with special design criteria, direct fastening of the clip to the rail may be required. The expansion and contraction of the rail must be allowed for, independent of the panel. Fasten a screw through the top of the clip on one end of the panel and a z-clip as a hold-down to the opposite end. Consult engineer and TAKTL for such requirements.

NOTE: See page 5 for installation examples.

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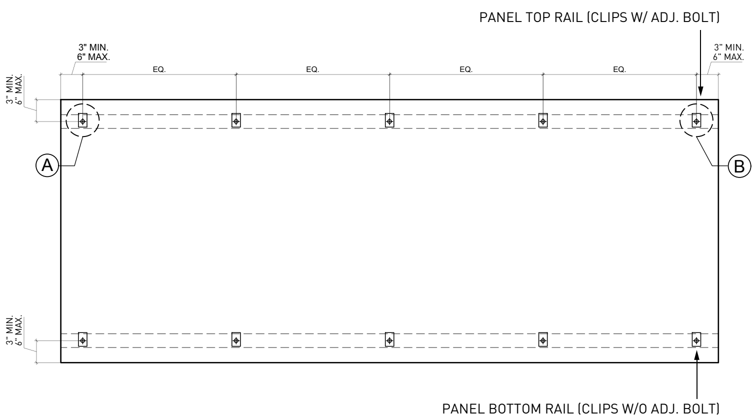
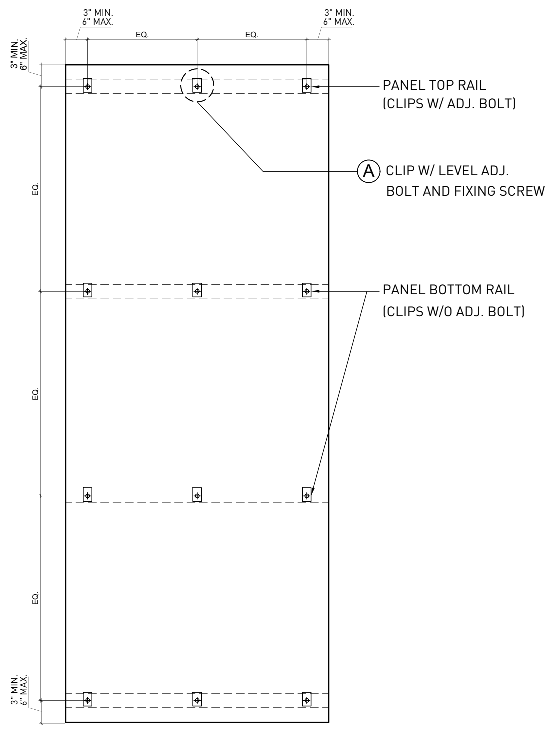
TAKTLHARDWARE Concealed Anchor Panel Attachment

Horizontally Oriented Panel (Example*)



*Anchor spacing and direct fastening of clips to rails or hold-down clips are determined through evaluation of specific design criteria and engineering calculations.

Vertically Oriented Panel (Example*)



(A) Fixing Screw Example*

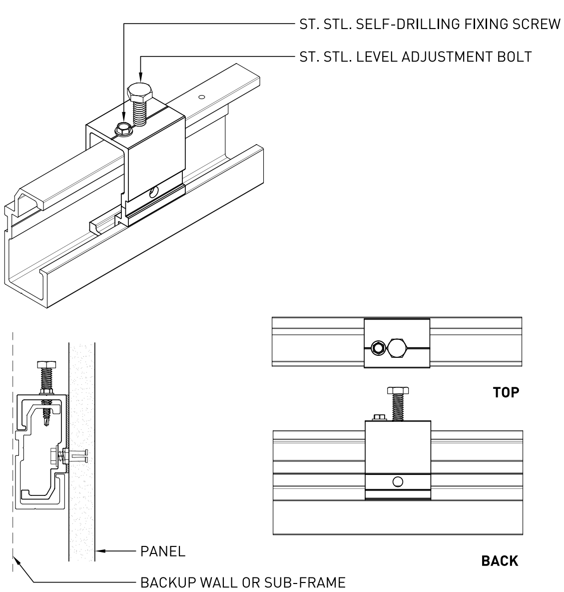


Fig. 1 | See A in drawing above

(B) 2-Clip Hold-down Example*

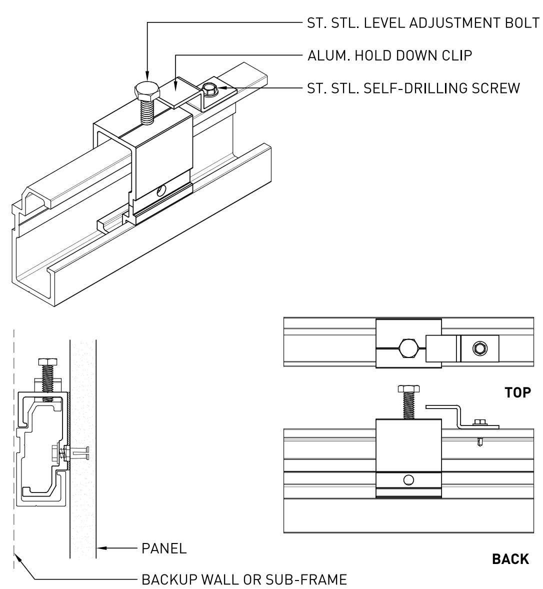


Fig. 2 | See B in drawing above

STAINLESS STEEL - Alloy Groups 1, 2 and 3, Condition CW (UNC Treads)															
Nominal Fastener Diameter & Threads per Inch	D Nominal Thread Diameter (in)	A(S) Tensile Stress Area (in2)	A(R) Thread Root Area (in2)	Allow able Tension (lbs)	Allow able Shear		Allow able Bearing (lbs)			Minimum Material Thickness (lbs) to Equal Tensile Capacity of Fastener (in)			Maximum Tensile Load (lbs) for Available 3/8" Plate Thickness		
					Single (lbs)	Double (lbs)	1/8" Steel A36	1/8" Aluminum 6063-T5	1/8" Aluminum 6063-T6	A36	6063-T5	6063-T6	3/8" Steel A36	3/8" Aluminum 6063-T5	3/8" Aluminum 6063-T6
#6-32	0.1380	0.0091	0.0078	303	150	300	900	253	345	0.1335	0.2538	0.1943	303	303	303
#8-32	0.1640	0.0140	0.0124	467	239	477	1,070	301	410	0.1733	0.3356	0.2466	467	467	467
#10-24	0.1900	0.0175	0.0151	584	292	583	1,240	348	475	0.1872	0.3410	0.2501	584	584	584
#12-24	0.2160	0.0242	0.0214	805	411	822	1,409	396	540	0.2269	> 3/8"	0.3016	805	734	805
1/4-20	0.2500	0.0318	0.0280	1,061	538	1,076	1,631	458	625	0.2534	> 3/8"	0.3373	1,061	865	1,061
5/16-18	0.3125	0.0524	0.0469	2,097	1,083	2,166	2,039	573	781	0.2867	> 3/8"	> 3/8"	2,097	1,303	1,776
3/8-16	0.3750	0.0775	0.0699	3,100	1,614	3,228	2,447	688	938	0.3181	> 3/8"	> 3/8"	3,100	1,572	2,144
7/16-14	0.4375	0.1063	0.0961	4,252	2,220	4,440	2,855	802	1,094	0.3442	> 3/8"	> 3/8"	4,252	1,873	2,554
1/2-13	0.5000	0.1419	0.1292	5,676	2,984	5,968	3,263	917	1,250	> 3/8"	> 3/8"	> 3/8"	5,642	2,140	2,918
9/16-12	0.5625	0.1819	0.1664	7,278	3,842	7,685	3,670	1,031	1,406	> 3/8"	> 3/8"	> 3/8"	6,444	2,444	3,333
5/8-11	0.6250	0.2260	0.2071	9,040	4,782	9,564	4,078	1,146	1,563	> 3/8"	> 3/8"	> 3/8"	7,148	2,711	3,697
3/4-10	0.7500	0.3345	0.3091	11,372	6,022	12,045	4,894	1,375	1,875	> 3/8"	> 3/8"	> 3/8"	8,612	3,266	4,454
7/8-9	0.8750	0.4617	0.4285	15,583	8,351	16,701	5,709	1,604	2,188	> 3/8"	> 3/8"	> 3/8"	10,158	3,853	5,254
1-8	1.0000	0.6057	0.5630	20,444	10,970	21,940	6,525	1,833	2,500	> 3/8"	> 3/8"	> 3/8"	11,696	4,437	6,050

STAINLESS STEEL - Alloy Groups 1, 2 and 3, Condition CW (Spaced Threads)															
Nominal Fastener Diameter & Threads per Inch	D Nominal Thread Diameter (in)	K Basic Minor Diameter (in)	A(R) Thread Root Area (in2)	Allow able Tension (lbs)	Allow able Shear		Allow able Bearing (lbs)			Minimum Material Thickness (lbs) to Equal Tensile Capacity of Fastener (in)			Maximum Tensile Load (lbs) for Available 3/8" Plate Thickness		
					Single (lbs)	Double (lbs)	1/8" Steel A36	1/8" Aluminum 6063-T5	1/8" Aluminum 6063-T6	A36	6063-T5	6063-T6	3/8" Steel A36	3/8" Aluminum 6063-T5	3/8" Aluminum 6063-T6
#6-20	0.1380	0.0990	0.0077	257	148	296	900	253	345	0.1191	0.1695	0.1378	257	257	257
#8-18	0.1640	0.1160	0.0106	352	203	407	1,070	301	410	0.1437	0.1930	0.1567	352	352	352
#10-16	0.1900	0.1350	0.0143	477	275	551	1,240	348	475	0.1528	0.2225	0.1805	477	477	477
#12-14	0.2160	0.1570	0.0194	645	373	745	1,409	396	540	0.1820	0.2610	0.2115	645	645	645
1/4-14	0.2500	0.1850	0.0269	896	517	1,035	1,631	458	625	0.2181	0.2994	0.2379	896	896	896
5/16-12	0.3125	0.2360	0.0437	1,750	1,010	2,020	2,039	573	781	0.2839	> 3/8"	0.2990	1,750	1,681	1,750
3/8-12	0.3750	0.2990	0.0702	2,809	1,622	3,243	2,447	688	938	> 3/8"	> 3/8"	> 3/8"	2,773	2,017	2,751

Group 1,2,3-Cond. CW	≤ 5/8" Dia.	≥ 3/4" Dia.	For Diameters < 3/4"	Effective Area (UNC Threads)	Effective Area (Spaced Threads)
F_U (Min. Ultimate Tensile Strength)	100,000 psi	85,000 psi	$F_T = F_U/SF$	$A(R) = \pi\ (D-1.2269/N)^2 / 4$	$A(R) = \pi K^2/4$
F_T (Allow. Tensile Stress, D≤1/4")	33,333 psi	N/A psi	Allow able Tension = $F_T[A(S)]$	$A(S) = \pi\ (D-0.9743/N)^2 / 4$	$A(S) = \pi K^2/4$
F_T (Allow. Tensile Stress, D> 1/4")	40,000 psi	33,750 psi	F_V = Fu / (SF x sq rt (3))		
F_V (Allowable Shear Strass; D≤1/4")	19,245 psi	N/A psi	Allowable Single Shear $=F_V[A(R)]$		
F_V (Allowable Shear Strass; D>1/4")	23,094 psi	19,486 psi			

NOTE 11:

1. Values are taken from AISC, ASTM, IFI, SAE and AA documents. K values for spaced threads are taken as the minimum values in IFI Fastener Handbook, 6th Ed. 2. Safety Factor used for fasteners with diameters 1/4" or less is 3.0, Safety Factor used for fasteners with diameters 5/16" or greater is 2.5.

3. Fasteners with diameters of 3/4" and greater are fabricated from different material than fasteners less than 3/4" in diameter.

4. For diameters of 3/4" and greater, F_y=45,00 psi. For these, tensile and shear yields govern the allowable tension and shear values (i.e., 0.75 F_y<F_u/SF

SFS intec

SFS intec, Inc. Wyomissing, PA

LABORATORY TEST REPORT

Date: 5/14/2014 **No:** 5104.14
Test: Pull-out **By:** K. Reinheimer

SCOPE:

Test pull-out SX3 - D12 into 18 gauge per customer request.

TEST MATERIAL:

SX3/40-D12-5,5x55 (#12 x 2-1/8")
18 gauge test strip, 50 ksi min

EQUIPMENT:

Dillon Model DTM tensile test machine.
Dillon 2000 Lb load cell.
DeWalt DW 284 2000 rpm max Screw Gun.

TEST METHOD:

Pull-out:

Per T-0750

TEST DATA:

Table 1: Pull-out Results (lbs)

Trial	SX3 - D12
1	651.78
2	545.64
3	525.21
4	499.51
5	564.62
6	542.84
7	552.32

Average	554.56
Std Dev	47.72

CONCLUSION:

The minimum recommended thickness the SX3-D12 fastener is recommended to be used into is 16 ga steel. The 18 ga steel was tested per the request of the customer for review of the pull-out strength. The use of the SX3-D12 fastener into metal thinner then 16 ga steel would increase the risk of fasteners unwinding in the steel. SFS intec would recommend the use of an SSO-D15 rivet for attachment into 18 ga steel due to this increase in unwinding of a threaded fastener.

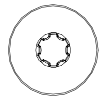
The values expressed herein are ultimate strength values, which were the result of laboratory testing. Appropriate safety factors should always be utilized in design and other possible failure modes should also be considered.

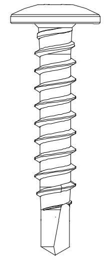
SX3 #12-11 TORX® Drive 304 Austentic Stainless Steel Self-drilling BiMetal Fastener

APPLICATION
METAL TO METAL

SX3 (304) austentic stainless steel fastener with carbon steel drill point

Drive	T-25 TORX®
Head Dia.	.482 - .462".
Thread Major Dia.	.220 - .212"
Thread Minor Dia.	.165 - .157"
Drill Capacity	.118 - .060"
Nom. Tensile	1900 lbs
Nom. Shear	1620 lbs
Min. Torsional	80 lb·in





APPLICATION: Metal to Metal

POTENTIAL STRENGTH IN APPLICATION (POUNDS ULTIMATE)

PULL OUT STRENGTH (LBS) IN 55 KSI YIELD SHEET STEEL

12ga (.105"): 1715
14ga (.075"): 1032
16ga (.060"): 696

AVAILABLE SIZES (Lengths) and SFS Part Number

SX3/15-D12-5,5 x 30	12 x 1-3/16"
SX3/40-D12-5,5 x 55	12 x 2-1/8"

LENGTH SELECTION

Fastener length selection should provide for a minimum of 3 fully developed threads through the metal substrate

INSTALLATION AND APPLICATION CONSIDERATIONS

Install fasteners with 0-2000 RPM screw driver equipped with depth sensing nose piece.

04/14

SFS intec
800-234-4533

Architectural Testing

PERFORMANCE TEST REPORT

Rendered to:

TAKTL

PRODUCT: UHPC Anchor Assembly System

Report No.: G9376.02-106-31
Report Date: 03/31/17
Test Record Retention Date: 03/20/21

PERFORMANCE TEST REPORT

Rendered to:

TAKTL
230 Braddock Avenue RIDC Keystone Commons-Portal 9
Turtle Creek, Pennsylvania 15145

Report No.: G9376.02-106-31
Test Start Date: 03/17/17
Test Completion Date: 03/20/17
Report Date: 03/31/17
Test Record Retention Date: 03/20/21

Products: UHPC Anchor Assembly System

Project Summary: Architectural Testing, Inc., an Intertek company ("Intertek-ATI"), was contracted by Taktl to evaluate one anchor assembly system (2 in. long SFS SX3 #12-14 Stainless steel screw into 16 gauge steel channel) loaded in both tension and shear through sections of their ultra-high performance concrete (UHPC) panel product. The product description, test procedures, and test results are reported herein.

Summary of Test Results: Results are summarized in the following table:

AISI S905 Anchorage Evaluation Results Summary

Fastener Load Orientation	Number of Test Replicates	Mean Ultimate Failure Load (lb_f)	Typical Failure Mode
Tensile	8	820.1	Pull-out
Shear	8	2,032.8	Fastener Shear

Test Methods: The test specimens were evaluated in general accordance with AISI S905-08, *Test Methods for Mechanically Fastened Cold-Formed Steel Connections.*

Product Description: The test specimens were submitted to Intertek-ATI by TAKTL and consisted of assembled anchor installation mockups each consisting of a 2 in. long SFS SX3 #12-14 Stainless steel screw installed through a 5/16 in. diameter predrilled hole in a UHPC panel section (nominal 6 in. square x 5/8 in. thickness, counter bored for recessed screw head) and into a 16 gauge steel (50 ksi) 7/8” furring / hat channel test substrate. The test materials were tested as received.

Test Procedures and Test Results: The testing procedures and results obtained from testing are reported as follows. All conditioning of test specimens and test conditions were at standard laboratory conditions unless otherwise reported. Refer to the test related photos in Appendix A.

Fastener Tensile (Withdrawal) Loading Evaluation

The fastener withdrawal loading evaluation was conducted in general accordance with the procedures detailed in AISI S905. As specified in Section 8.1.2, the fastener diameter and substrate thickness were measured for each specimen mockup with a digital micrometer (ICN: 65884) and a 6 in. x 0.001 in. digital caliper (ICN: 65688) respectively prior to testing.

The specimen mockups were restricted horizontally, with the exterior face oriented downwards, on the test stage of a SATEC 50 UD Universal Testing Machine (ICN: Y002011) and, as per Section 9.1.3, tensile load was applied at a constant crosshead movement rate of 0.10 in. per minute to the 16 gauge steel channel through an appropriate steel restriction fixture until failure was observed. Ultimate load and failure mode (per Section 8.3.1 classification) were documented for each individual specimen and averaged for the test series.

Fastener Tensile (Withdrawal) Loading Evaluation

No.	Measurements (in)			Failure Load (lb_f)	Failure Mode
	Fastener Diameter	Channel Thickness	UHPC Panel		
1	0.1580	0.0580	0.654	859.9	b. Pull-out (Channel)
2	0.1580	0.0572	0.667	858.6	b. Pull-out (Channel)
3	0.1580	0.0573	0.653	734.0	b. Pull-out (UHPC Plug Withdrawal)
4	0.1575	0.0578	0.610	870.8	b. Pull-out (UHPC Plug Withdrawal)
5	0.1585	0.0583	0.675	852.4	b. Pull-out (Channel)
6	0.1580	0.0582	0.618	817.8	b. Pull-out (Channel)
7	0.1580	0.0575	0.665	830.5	b. Pull-out (Channel)
8	0.1585	0.0574	0.674	736.7	b. Pull-out (Channel)
Tensile Series Mean				**820.1**	**b. Pull-out (Channel)**

Test Procedures and Test Results: (Continued)

Fastener Shear Loading Evaluation

The fastener shear loading evaluation was conducted in general accordance with the procedures detailed in AISI S905. As specified in Section 8.1.2, the fastener diameter and substrate thickness were measured for each specimen mockup with a digital micrometer (ICN: 65884) and a 6 in. x 0.001 in. digital caliper (ICN: 65688) respectively prior to testing.

The specimen mockups were restricted upright to the test stage of a SATEC 50 UD Universal Testing Machine (ICN: Y002011) by an appropriate steel restriction fixture affixed to the 16 gauge steel channel portion of the mockup assembly and, as per Section 9.1.3, compressive load was applied at a constant crosshead movement rate of 0.10 in. per minute to the UHPC panel section until failure was observed. Ultimate load, Extension at 40% ultimate load (as per Section 9.2.1) and failure mode (per Section 9.2.2 [Figure 11] classification) were documented for each individual specimen and averaged for the test series.

Fastener Shear Loading Evaluation

No.	Measurements (in)			Failure Load (lb_f)	Extension at 40% Ultimate Load (in)	Failure Mode
	Fastener Diameter	Channel Thickness	UHPC Panel			
1	0.1580	0.0579	0.616	1,742.9	0.312	Type IV - Fastener Shear
2	0.1580	0.0575	0.653	2,322.5	0.606	Type V - Tilt and pull-out
3	0.1585	0.0576	0.622	2,159.3	0.565	Type IV - Fastener Shear
4	0.1575	0.0581	0.607	1,814.2	0.293	Type IV - Fastener Shear
5	0.1575	0.0588	0.609	1,986.9	0.578	Type IV - Fastener Shear
6	0.1580	0.0576	0.633	2,235.4	0.486	Type IV - Fastener Shear
7	0.1585	0.0573	0.639	1,798.1	0.389	Type IV - Fastener Shear
8	0.1575	0.0579	0.621	2,203.2	0.553	Type IV - Fastener Shear
Shear Series Mean				**2,032.8**	**0.473**	**Type IV - Fastener Shear**

Intertek-ATI will service this report for the entire test record retention period. Test records that are retained such as detailed drawings, datasheets, representative samples of test specimens, or other pertinent project documentation will be retained by Intertek-ATI for the entire test record retention period.

Results obtained are tested values and were secured using the designated test methods. This report does not constitute certification of this product nor an opinion or endorsement by this laboratory. It is the exclusive property of the client so named herein and relates only to the specimens tested. This report may not be reproduced, except in full, without the written approval of Intertek-ATI.

For INTERTEK-ATI:

Digitally Signed by: Scott Scallorn

Scott D. Scallorn
Project Engineer
Components / Materials Testing

Digitally Signed by: Joseph A. Reed

Joseph A. Reed, P.E.
Senior Director

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
JOSEPH A. REED
ENGINEER
No. PE-044401-E

2017.03.31 10:12:37 -04'00'

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Attachments (pages)   This report is complete only when all attachments listed are included.
Appendix A - Photographs (4)

Revision Log

Rev. #	Date	Page(s)	Revision(s)
0	03/31/17	N/A	Original report issue

APPENDIX A

Photographs

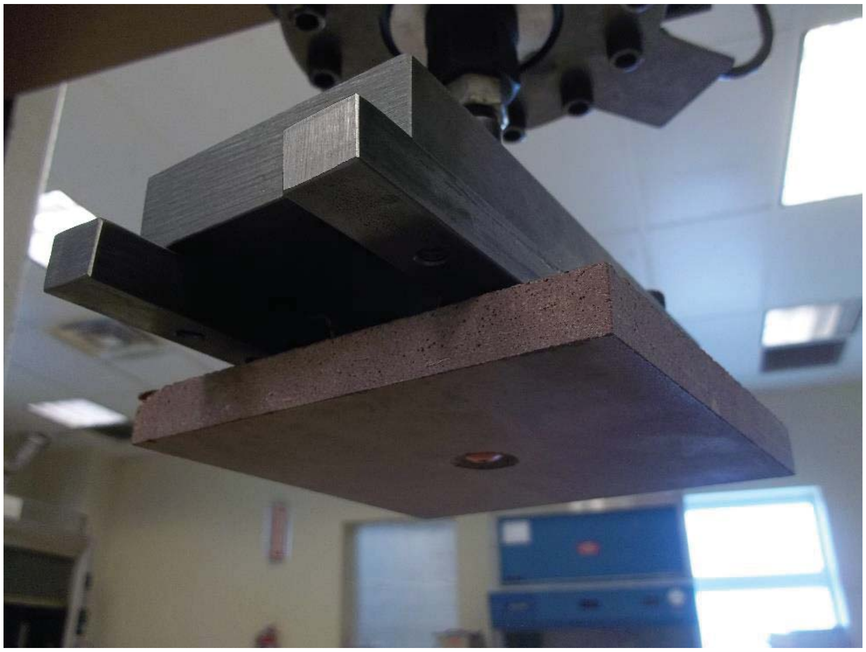

Photo No. 1
Typical Pretest Condition Anchor Mockup Counter Bored Face/Recessed Fastener Detail

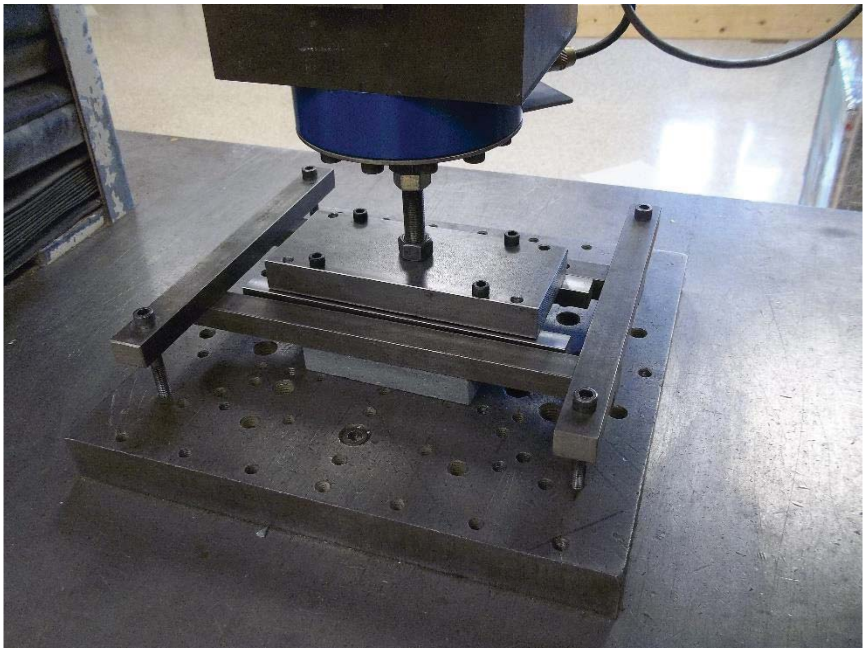

Photo No. 2
AISI S905 Fastener Evaluation - Tensile Load Evaluation Setup

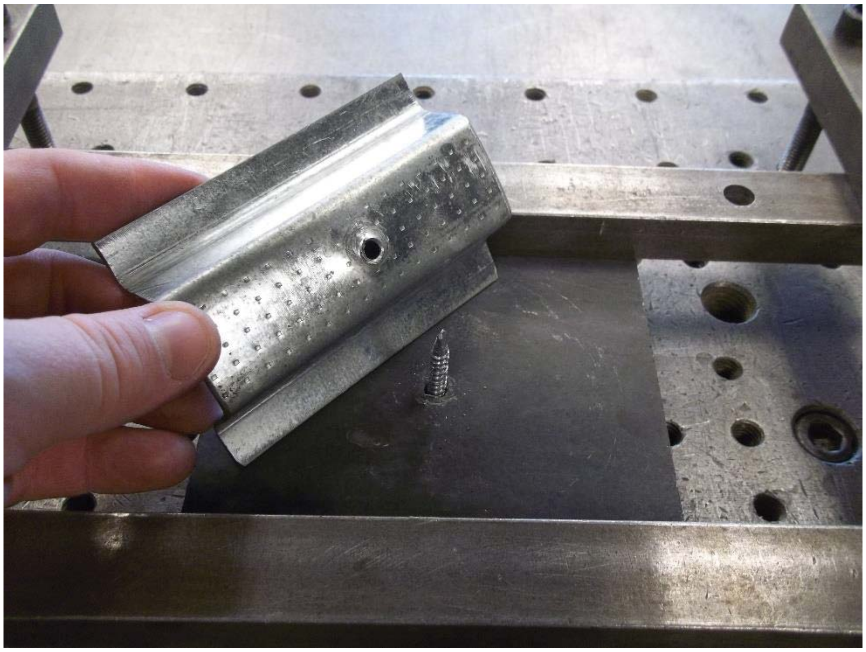

Photo No. 3
AISI S905 Fastener Evaluation - Representative Tensile Specimen Pull-Out Failure Mode

Photo No. 4
Representative Tensile Specimen UHPC Plug Withdrawal Failure Failure Mode

Photo No. 5
AISI S905 Fastener Evaluation - Shear Load Evaluation Setup

Photo No. 6
AISI S905 Fastener Evaluation – Depiction of Representative Shear Load Specimen Failure

Photo No. 7
Representative Shear Specimen Fastener Shear Failure Mode Detail

Photo No. 8
Shear Specimen Fastener Tile and Pull-Out Failure Mode Detail

Certified Test Results (US) TAKTL® panels are tested according to the methods for ASTM C1185 without sealer or coating. The products have been certified to meet the standards of ASTM C1186. All test results exceed the requirements for classification of Type A, Grade IV (highest grade). ASTM C 1186 is the International Building Code referenced standard for exterior fiber cement panels (1405.16).

Except as noted, the following results reflect testing completed by Architectural Testing, Inc. (York, PA) on 0.5" panels cast at the TATKL production plant in Pittsburgh, PA and selected at random by ATI during certification. CAN/ULC S114-05 testing was conducted by Intertek (Coquitlam, BC).

Please contact our Technical Support team for project-specific consultation on Certified Test Results and Recommended Design Values.

Quality Management + Certification TAKTL's Quality Management System monitors parameters such as product dimensions, physical properties, flexural strength, anchor pullout strength, color and curing conditions, and provides full traceability for each panel back to raw materials. Under the independent quality certification program, ATI conducts unannounced audits of TAKTL operations at least four times annually, verifying procedures, reviewing QMS records, and selecting panels at random for laboratory testing and verification. TAKTL employs a full-time Quality Administrator, who monitors procedures, testing, training and reporting.

Reference TAKTL Doc. Q2-1 for complete quality and acceptance criteria.

ASTM C 1186 CERTIFICATION - GRADE IV		3RD PARTY TESTING CERTIFIED RESULTS (US)	RECOMMENDED DESIGN VALUES (US)	CERTIFICATION REQUIREMENT DETAILS
ASTM C 1185-08	Tolerance - Length	0.00 in	0.25 in	1/4 inch maximum variation from nominal dimension
ASTM C 1185-08	Tolerance - Width	0.00 in	0.25 in	1/4 inch maximum variation from nominal dimension
ASTM C 1185-08	Tolerance - Thickness within Sheets	3.65 %	≤ 15 %	≤ 15% variation between extreme measure of max measured value
ASTM C 1185-08	Tolerance - Thickness between Sheets	0.022 in	≤ 0.05 in	≤ 0.05 inch variation between sheets
ASTM C 1185-08	Tolerance - Squareness (Diagonal)	0.00 in	≤ 0.03 in/ft	Length variation ≤ 1/32/in/ft of sheet length
ASTM C 1185-08	Tolerance - Squareness (Width Edge)	0.00 in	≤ 0.03 in/ft	Variation between opposite edges of sheet ≤ 1/32/in/ft
ASTM C 1185-08	Tolerance - Squareness (Length Edge)	0.00 in	≤ 0.03 in/ft	Variation between opposite edges of sheet ≤ 1/32/in/ft
ASTM C 1185-08	Tolerance - Straightness (Length)	0.00 in	0.03 in/ft	Edge dimensions within 1/32/in/ft of length
ASTM C 1185-08	Toloerance - Straightness (Width)	0.00 in	0.03 in/ft	Edge dimensions within 1/32/in/ft of width
ASTM C 1185-08	Density	137.1 lb/ft³		Reporting Requirement Only
ASTM C 1185-08	Modulus of Elasticity - Equilibrium	3,685,222 psi		Reporting Requirement Only
ASTM C 1185-08	Modulus of Rupture - Equilibrium	6,895 psi	≥ 3,190 psi	Flexural strength must be ≥ 3190 psi
ASTM C 1185-08	Modulus of Rupture - Wet	6,176 psi	> 2,610 psi	Flexural Strength >2,610 psi and >50% of Equilibrium Flexural Strength
ASTM C 1185-08	Freeze/Thaw - Flexural Strength Retention	97.3 %	≥ 80 %	No visible cracks and ≥ 80% strength retention
ASTM C 1185-08	Heat/Rain Exposure - Rainscreen Assy	No Defects	No Defects	No visible cracks/structural alteration of the sheets and frame assembly
ASTM C 1185-08	Moisture Content	0.9 %		Reporting Requirement Only
ASTM C 1185-08	Moisture Movement	0.00 %		Reporting Requirement Only
ASTM C 1185-08	Water Absorption	3.9 %		Reporting Requirement Only
ASTM C 1185-08	Penetration & Water Droplet Formation	0/0		Moisture penetration permitted, but no droplet formation
FIRE TESTING / SURFACE BURN CHARACTERISTICS		**RESULTS (US)**		**CERTIFICATION REQUIREMENT DETAILS**
ASTM E 84-09	Flame Spread Index	0 (Class A)		Class A: Flame spread 0-25 / ASTM C 1186: Flame spread 0
ASTM E 84-09	Smoke Development Index	5 (Class A)		Class A: Development 0-450 / ASTM C 1186: Development ≤ 5
ASTM E 136-09	Combustibility	Non Combustible (6.9% loss,< 0°C)		Max loss of mass during the test ≤ 50%; Surface and interior temp rise ≤ 30°C above furnace temp; No flaming after first 30 seconds
CAN/ULC S114-05	Combustibility	Non Combustible (6.6% loss,< 0°C)		Max loss of mass during the test ≤ 20%; Temp rise of specimens ≤ 36°C. No flaming of any of the specimens during the last 14.5 minutes
ANCHOR STRENGTH - KEIL UNDERCUT ANCHORS		**RESULTS (US)**	**RECOMMENDED DESIGN VALUES (US)**	**PANEL AND ANCHOR DETAILS**
ASTM E 488-10/E 488M-10	Anchor Shear Strength	1,135.4 lbf	850 lbf	8.5mm anchors
ASTM E 488-10/E 488M-10	Anchor Tensile Strength (Pullout)	537.5 lbf	400 lbf	8.5mm anchors
ASTM E 488-10/E 488M-10	Anchor Shear Strength	1,187 lbf	890 lbf	10mm anchors
ASTM E 488-10/E 488M-10	Anchor Tensile Strength (Pullout)	692 lbf	520 lbf	10mm anchors
ASTM E 488-10/E 488M-10	Anchor Shear Strength	1,493.5 lbf	1,120 lbf	11.5mm anchors
ASTM E 488-10/E 488M-10	Anchor Tensile Strength (Pullout)	760.9 lbf	550 lbf	11.5mm anchors
ASTM E 488-10/E 488M-10	Anchor Shear Strength	1,434 lbf	1,075 lbf	13mm anchors
ASTM E 488-10/E 488M-10	Anchor Tensile Strength (Pullout)	903 lbf	675 lbf	13mm anchors
ASTM E 488-10/E 488M-10	Anchor Shear Strength	1,691.7 lbf	1,265 lbf	14.5mm anchors
ASTM E 488-10/E 488M-10	Anchor Tensile Strength (Pullout)	807.4 lbf	605 lbf	14.5mm anchors
ASTM E 488-10/C 666M-03	Anchor Shear Strength - Freeze/Thaw	117.3 %		8.5mm anchors
ASTM E 488-10/C 666M-03	Anchor Tensile Strength - Freeze/Thaw	111.0 %		8.5mm anchors
ACCELERATED WEATHER TESTING / COLOR CHANGE		**RESULTS (US)**		
ASTM G-155-05a/D2244-09a	ColorSeal/T (2000 hrs)	1.69 ΔE		
ASTM G-155-05a/D2244-09a	MicroSeal/T (500 hrs)	0.37 ΔE		