STRUCTURAL CALCULATIONS FOR

GATES

AT

DANA POINT MARINA

Building&Safety: Roshanak Amirazizi **3/14/2023**

Revision: 3

Permits: BNR21-0604.R3

County of Orange - OC Public Works
OC Development Services
APPROVED

This set of plans and specifications must be kept on the job at all times. It is unlawful to make any changes or alterations to these plans without written permission from OC Public Works, OC Development Services of Orange County. The stamping of these plan specifications SHALL NOT be held to permit or be an approval of the violation of any provisions of any County Ordinance or State law.

Hadi Tabatabaee
BUILDING OFFICIAL

3

REGISTERED PROFESSIONAL ENGINEER
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No. 82413
CIVIL
STATE OF CALIFORNIA

January 31, 2023

Prepared By:

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GRANTHAM ENGINEERING
Civil • Mechanical •Marine

BELLINGHAM MARINE INDUSTRIES, INC.

☒ NO EXCEPTIONS TAKEN

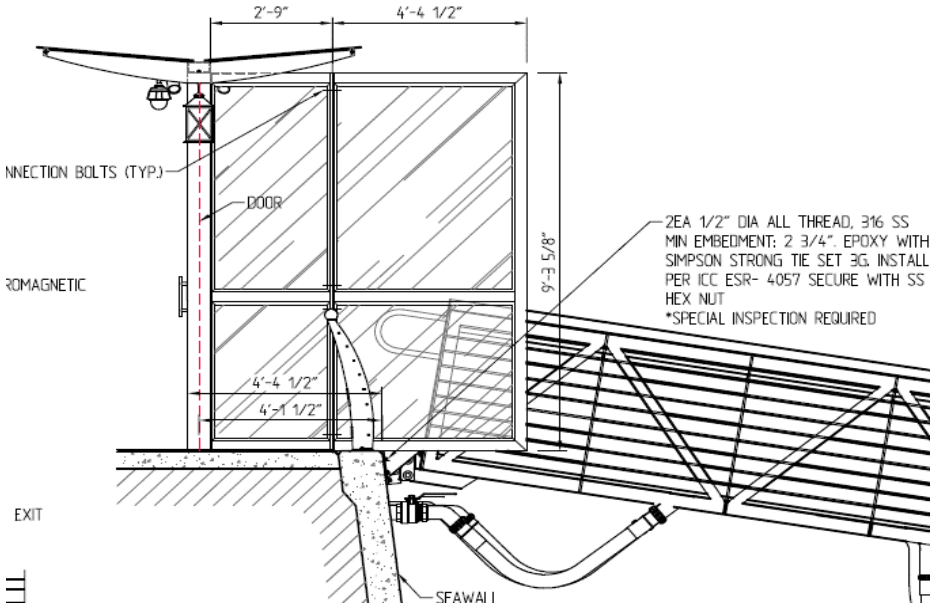
☐ REVISE AND RESUBMIT (RAR)

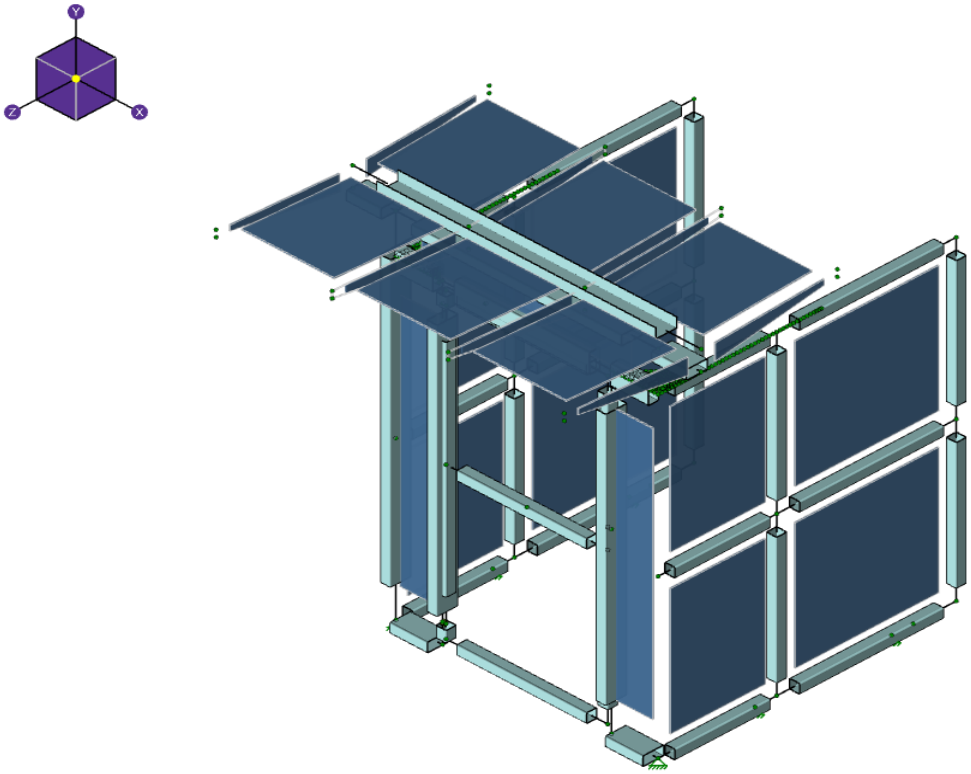
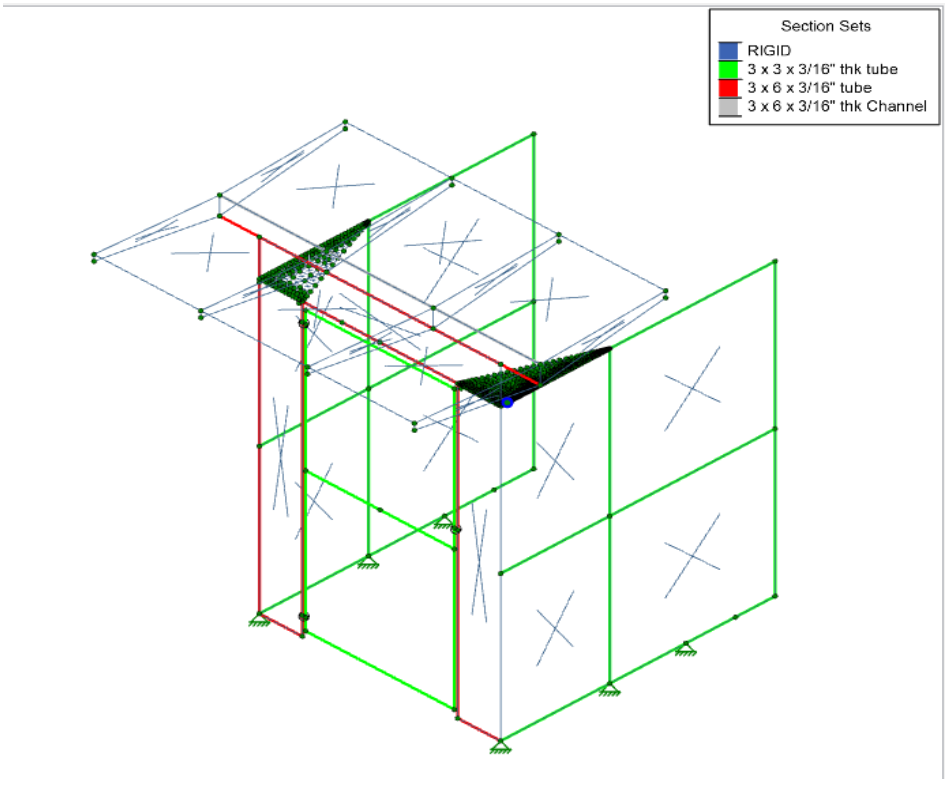
☐ OTHER: _____

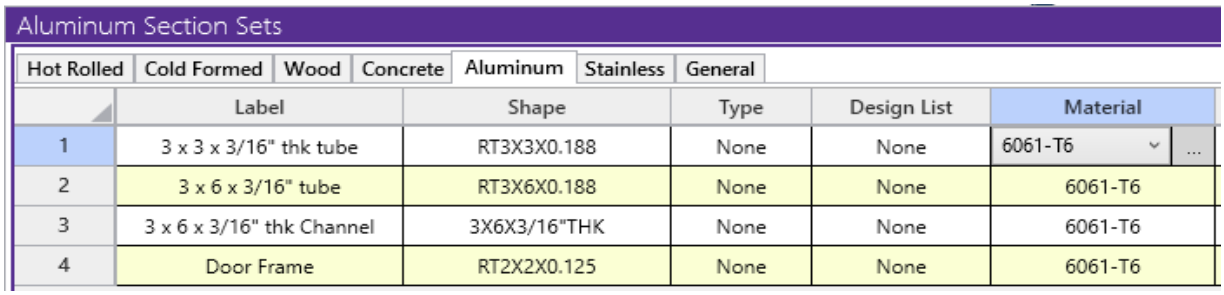
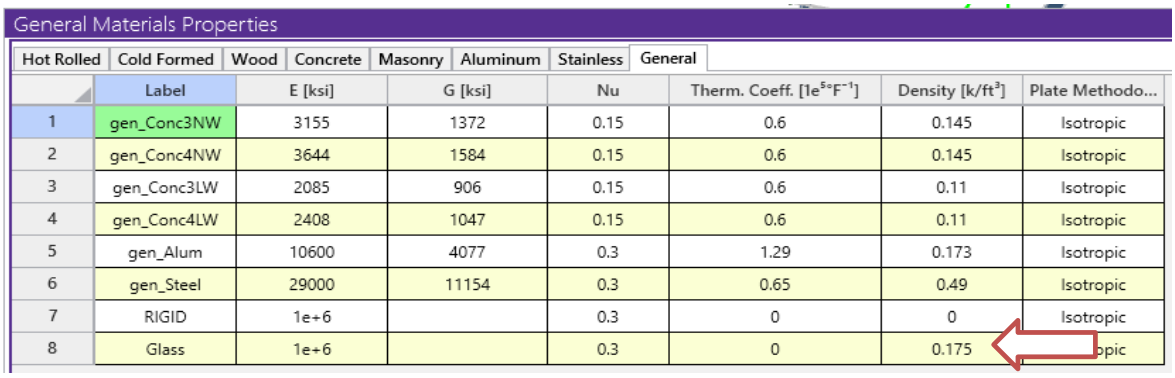
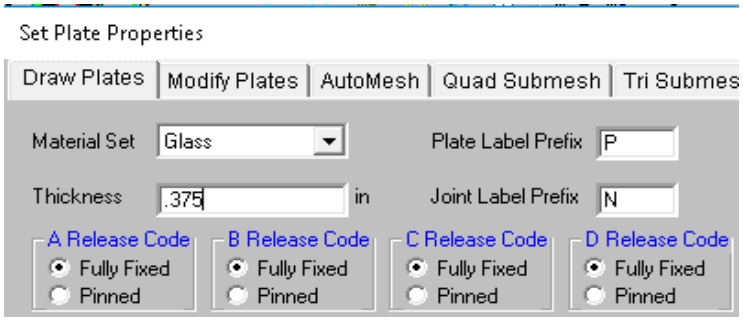
REVIEW IS ONLY FOR GENERAL CONFORMANCE WITH THE DESIGN CONCEPT OF THE PROJECT AND GENERAL COMPLIANCE WITH THE INFORMATION GIVEN IN THE CONTRACT DOCUMENTS. ANY ACTION SHOWN IS SUBJECT TO THE REQUIREMENTS OF THE PLANS AND SPECIFICATIONS. CONTRACTOR IS RESPONSIBLE FOR DIMENSIONS WHICH SHALL BE CONFIRMED AND CORRELATED AT THE JOB SITE; ENGINEERING; FABRICATION PROCESSES AND TECHNIQUES OF CONSTRUCTION; COORDINATION OF THEIR WORK WITH THAT OF ALL OTHER TRADES AND THE SATISFACTORY PERFORMANCE OF THEIR WORK.

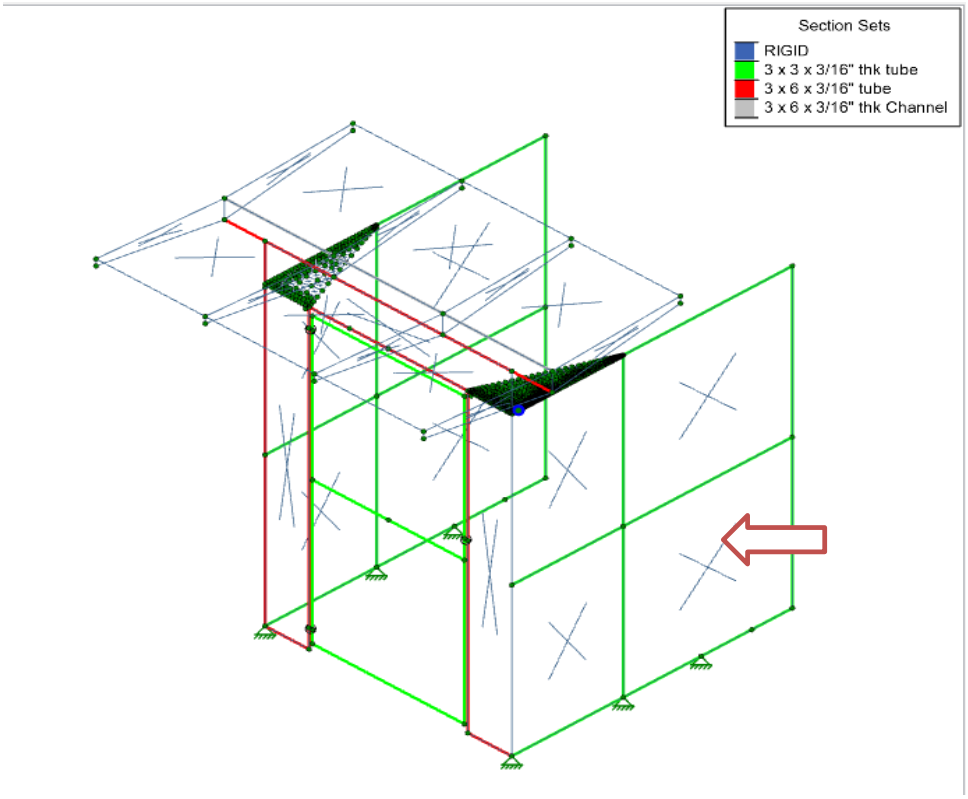
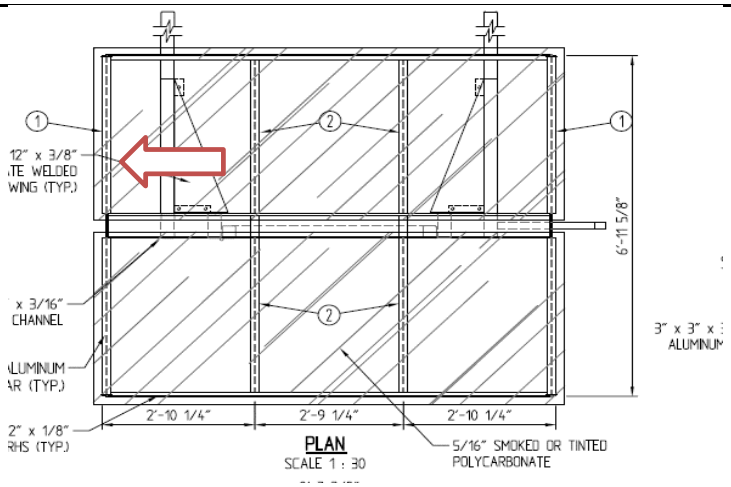
Craig Funston P.E., S.E.

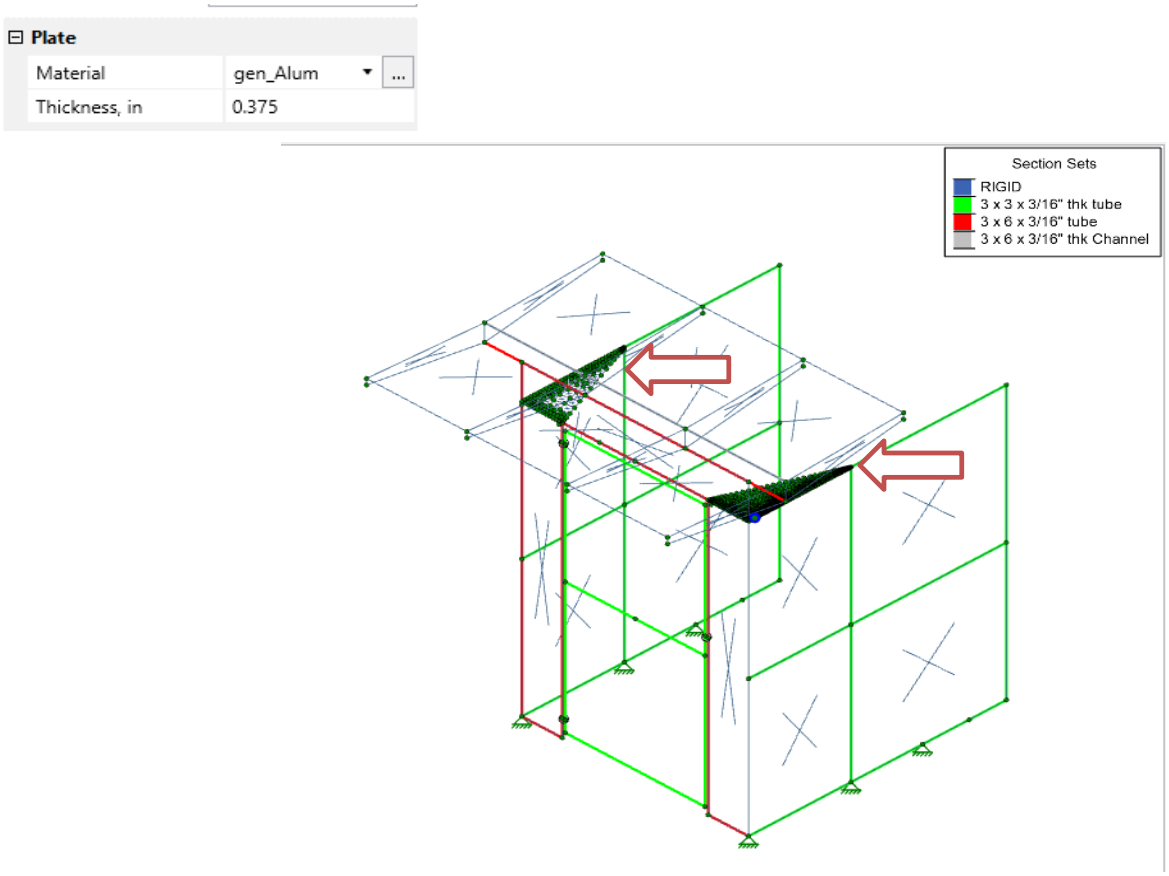
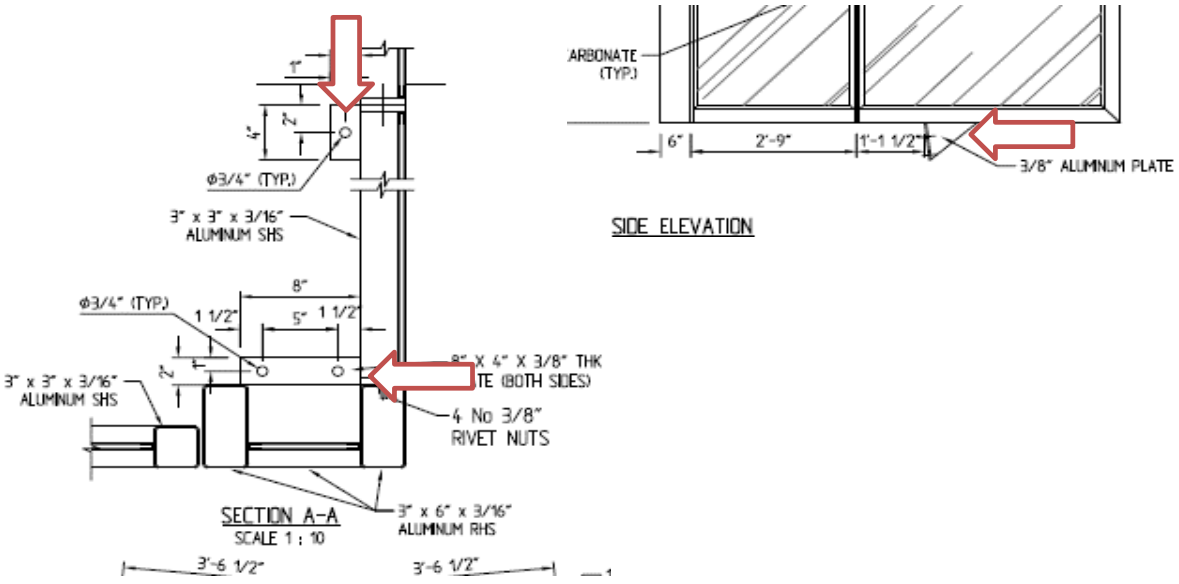
02/02/2023

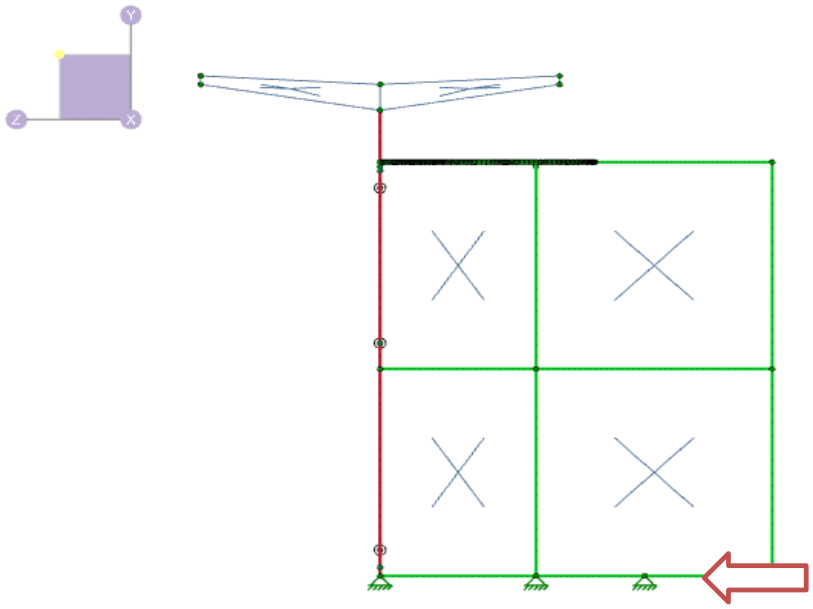
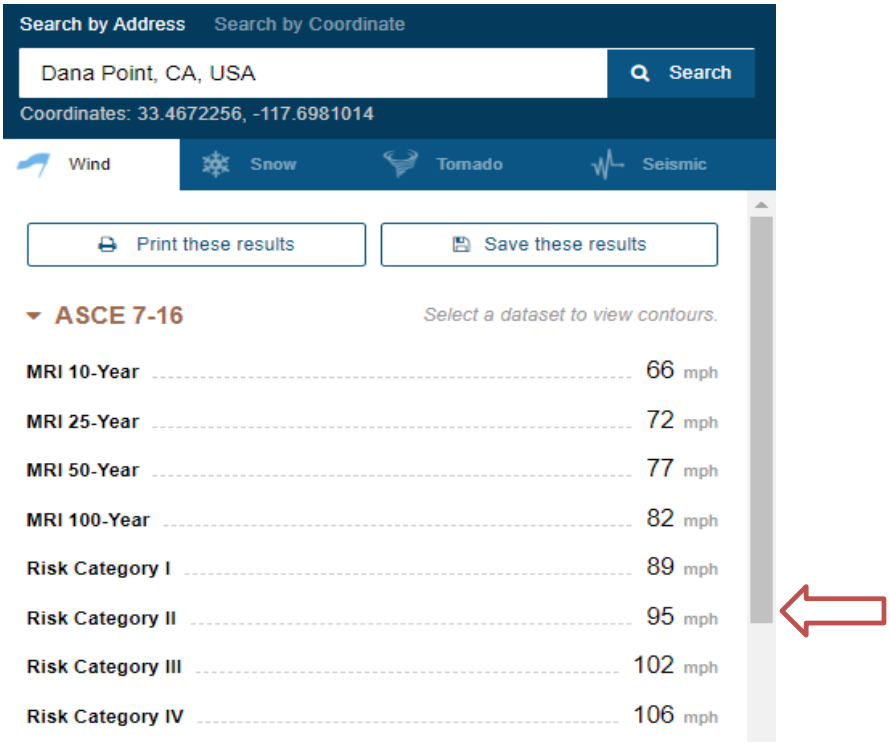
1	**Structural Calculations for Dana Point Gangway Gates**		
2	**Version 2**		
3	**Applicable Codes**		
4	ASCE 7-16 Minimum Design Loads for Building and other Structures		
5	California Layout and Design Marina Berthing Facilities 2005		
6	Aluminum Design Manual 2015 and 2020		
7	California Building Code 2019		
8	**Analytical Software**		
9	RISA 3D Version 20 (Structural)		
10	MECAWind PRO V2342 (Wind Loading)		
11	**Side View of Gate**		
12			
13	**Item**	**Value**	**Comments**
14	**Gate RISA Model**		

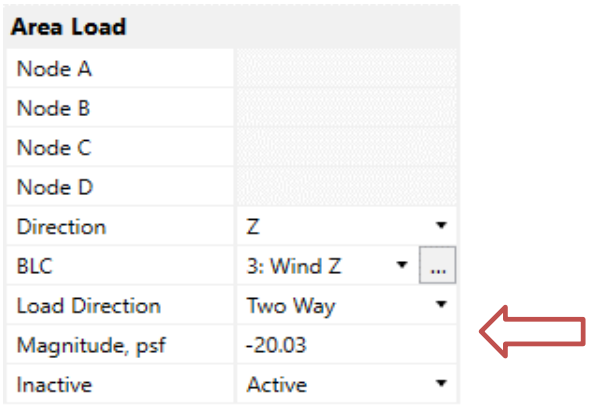
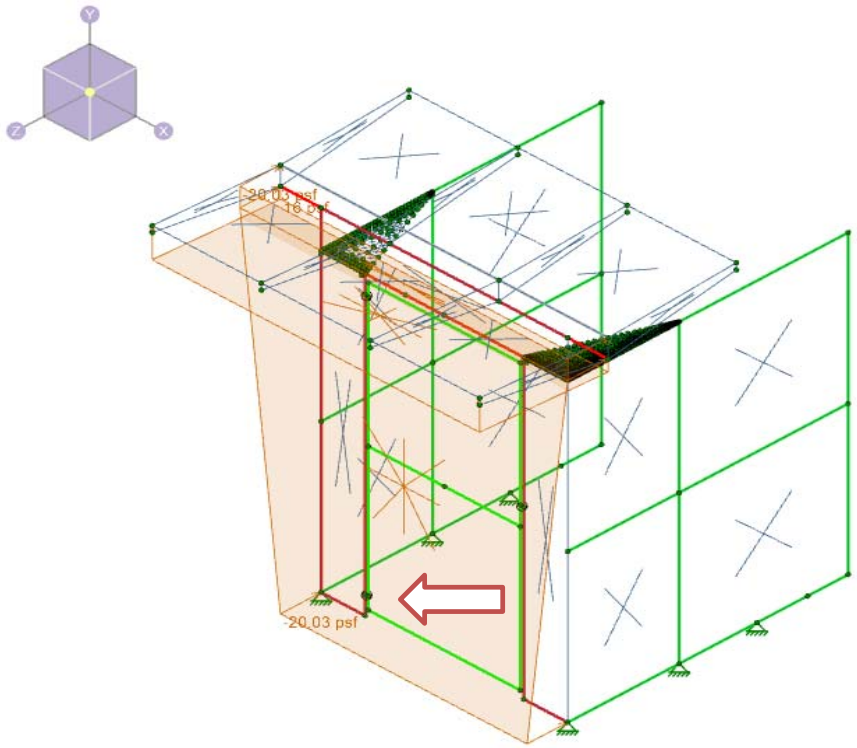
15	
16	 Section Sets RIGID 3 x 3 x 3/16" thk tube 3 x 6 x 3/16" tube 3 x 6 x 3/16" thk Channel

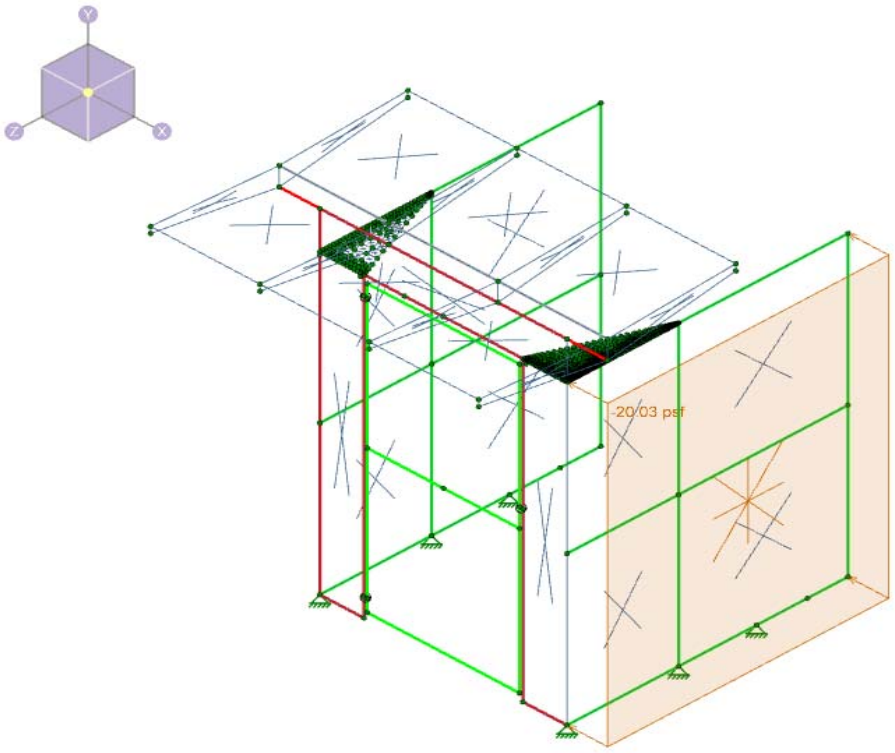
17	
18	The Section Sets define the major structural components of the Model match the parts list defined on the drawing
19	The polycarbonate panels are model as plates
20	
21	

22	
23	Add 3/8" Aluminum Gusset Plate at top of wing
24	

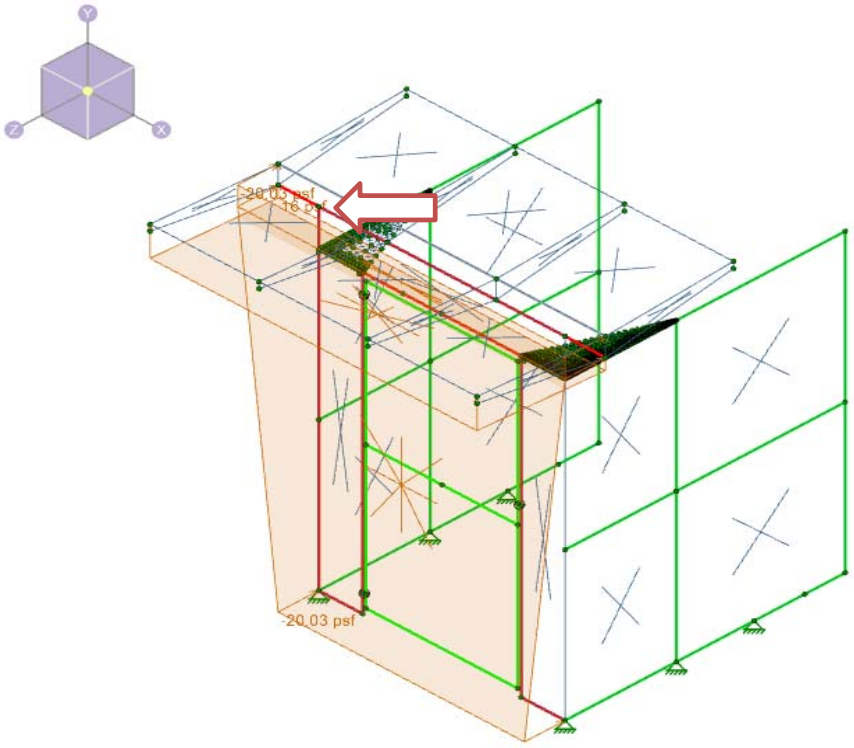
25	
26	Add restraints
27	

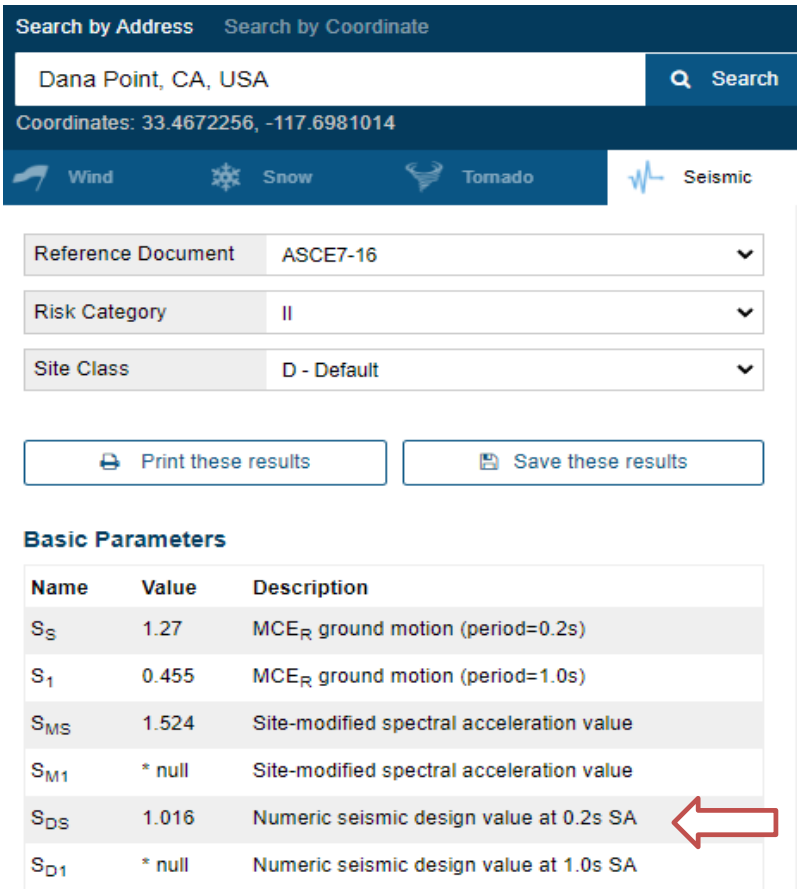
28			
29	**Loading the RISA Model**		
30	Wind Pressure, Qz (lbs/ft^2)	20.03	0.00256 x kz x kzt x Kd x Ws^2, Kz = .85, Kzt = 1.2, Kd =.75 Use in RISA analysis
31	Basic Wind Speed, V (mph)	95.00	See below
32			

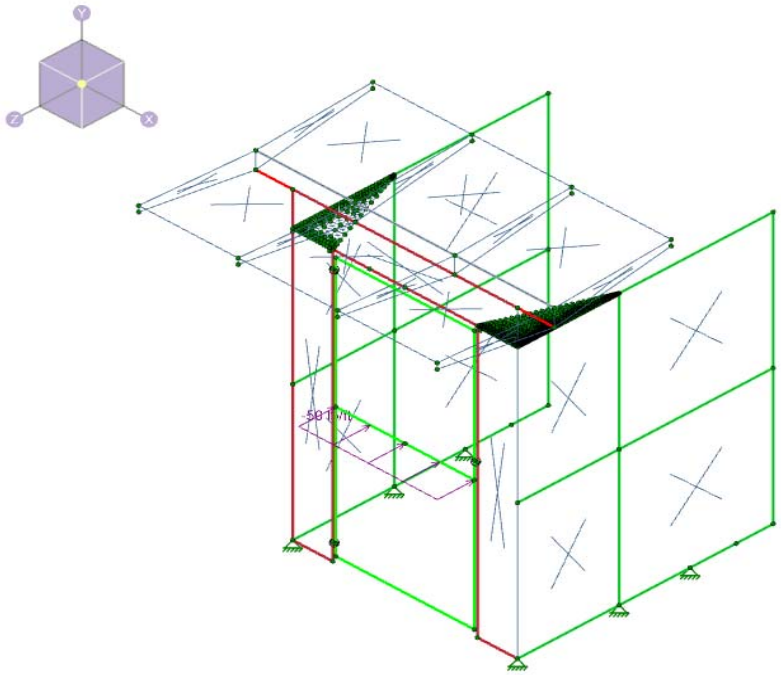
33	Wind Directionality factor, Kd	0.85	Section 26.6-1
34	Exposure Category	C	Section 26.7.3, If not Exposure B or D, use Exposure C.
35			
36	Wind Load in the Z-direction		
37			
38	Wind Load in the X-direction		

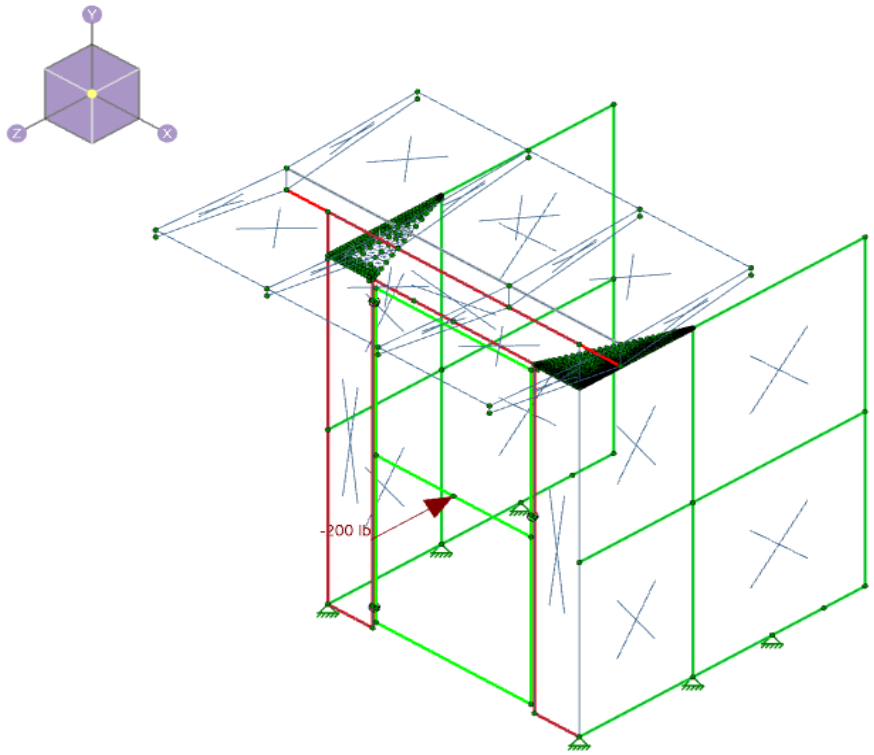
39	
40	**Wind Uplift Load**
41	Wind Uplift Load, Wu (psf) 16 See Below
42	**Wind Pressures for C&C on a Canopy per Ch 30 Part 7 and Sec 30.11** **Wind Pressures for C&C on Canopy per Ch 30 Part 7 & Fig 30.11-1A/B** **All wind pressures include a load factor of 1.0**

Description	Zone	Width ft	Span ft	Area ft	GCp Pos	GCp Neg	P Min psf	P Max psf
Zone Lower Surface	Lower Surface	9.000	26.000	234.000	0.600	-0.650	-16.00	16.00
Zone Upper Surface	Upper Surface	10.000	26.000	260.000	0.600	-0.700	-16.00	16.00

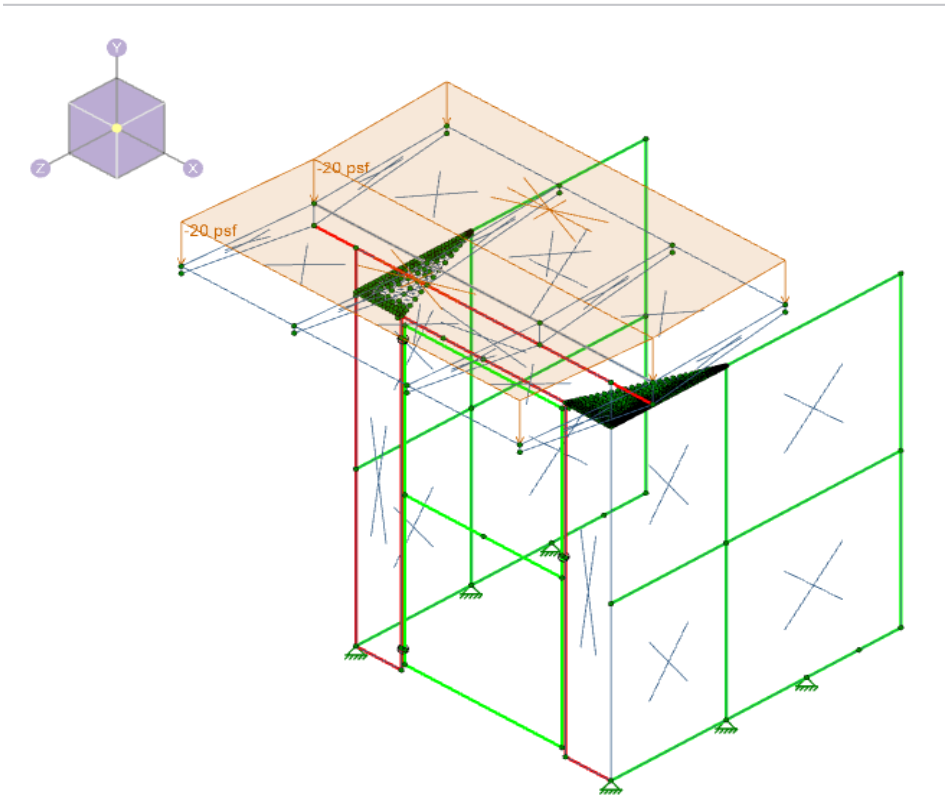
43			
44	**Equivalent Lateral Force Procedure for Seismic Loading**		
45	**Seismic Analysis**		
46	Risk Category	I	
47	Occupancy Category	II	Occupancy Category for this building, See Page 1-20 Seismic Design Review
48	Site Class	D	

49			
50	Sds	1.016	See above
51	Seismic Design Category (SDS)	D	
52	The Seismic Force Resisting System is based Table 12.2-1 Section C 2. Cantilever Column		
53	Response Modification Coefficient, R	1.25	See above
54	Seismic Importance Factor, I	1.00	Based on occupancy factor II page 1-30
55	Overstrength Factor, Of	2.00	See above
56	Redundancy, p	1.30	Does not have redundancy
57	Seismic Response Coefficient, Cs	1.06	Sds / (R / I) x p Per equation 12.8-2. Use in RISA for seismic loading. See basic load cases below.

58	Basic Load Cases BLC Description / Category / X Gravity / Y Gravity / Z Gravity 1 Self Weight / DL / / -1 / 2 Wind X / WLX / / / 3 Wind Z / WLZ / / / 4 Seismic X / ELX / 1.06 / / 5 Seismic Y / ELY / / / 6 Seismic Z / ELZ / / / 1.06 7 Uniform handrail load / OL1 / / /
59	Cs, ELX, and ELZ are added to RISA's Basic Load Cases so when the seismic loads are applied to the model, its applied proportionately based on weight and location of the equipment.
60	Uniform Handrail Load - 50 plf
61	
62	Concentrated Handrail Load - 200 lbs

63	
64	Roof Live Load: 20 psf

65



66 Define Basic Load Cases

67

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Nodal	Point	Distributed	Area(Member)
1	Self Weight	DL		-1					
2	Wind X	WLX							3
3	Wind Z	WLZ							3
4	Seismic X	ELX	1.06						
5	Roof Live Load	RLL							2
6	Seismic Z	ELZ			1.06				
7	Uniform handrail load	OL1						1	
8	Concentrated Load	OL2				1			

68 **Define Load Combinations**

69	Sds	1.016	See above
70	Dead Load Factor	1.403	1.2+0.2*Sds
71	Dead Load Factor	0.697	.9-0.2*Sds

72

Load Combinations

Combinations | Design

LC Generator | RSA Scaling Factor | Solve Curre

	Description	Solve	P-Delta	SRSS	BLC	Factor	BLC	Factor
1	Dead Load	☑	Y		DL	1		
2	Roof Load	☑	Y		DL	1.2	RLL	1.6
3	Concentrated handrail load	☑	Y		DL	1.2	OL2	1.6
4	handrail uniform load	☑	Y		DL	1.2	OL1	1.6
5	Wind Down X	☑	Y		DL	1.2	WLX	1
6	Wind Up X	☑	Y		DL	0.9	WLX	1
7	Wind Down Z	☑	Y		DL	1.2	WLZ	1
8	Wind Down -Z	☑	Y		DL	0.9	WLZ	-1
9	Wind Up Z	☑	Y		DL	0.9	WLZ	1
10	Wind Up -Z	☑	Y		DL	0.9	WLZ	-1
11	Seismic X Down	☑	Y		DL	1.403	ELX	1
12	Seismic X Up	☑	Y		DL	0.697	ELZ	1
13	Seismic Z Down	☑	Y		DL	1.403		1
14	Seismic Z Up	☑	Y		DL	0.697		1

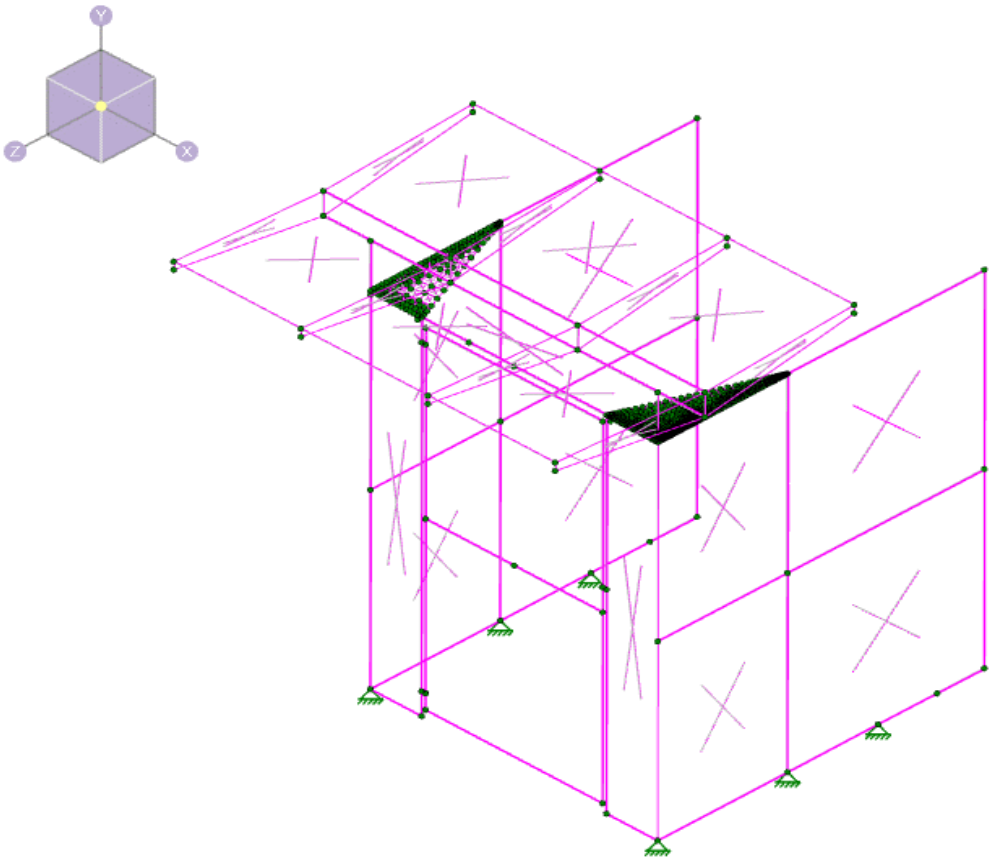
73 **Deflection Analysis**

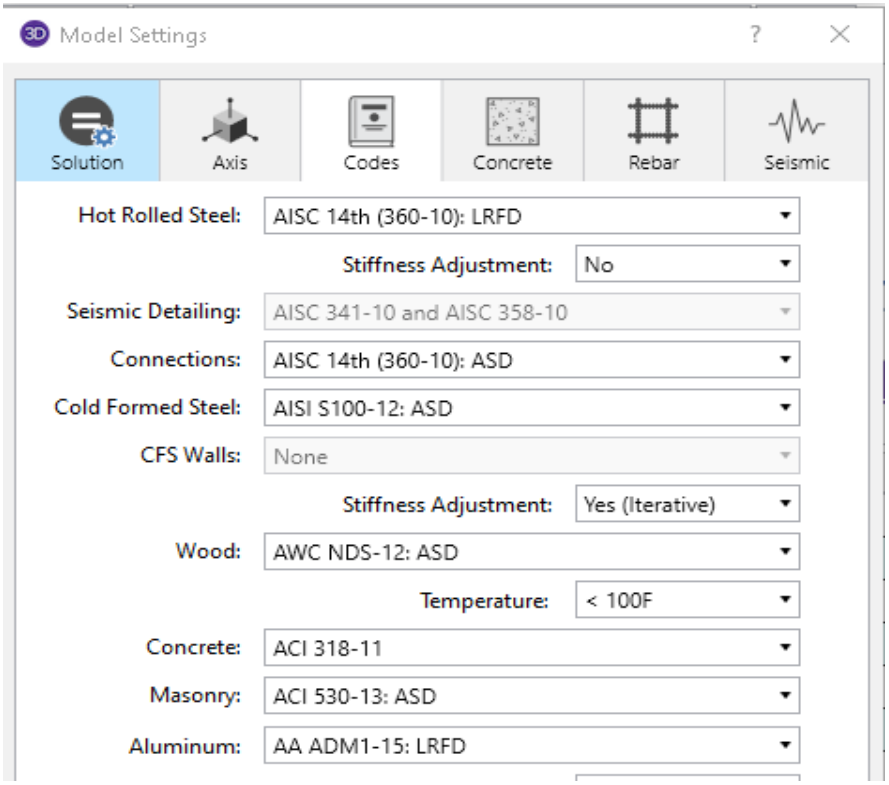
74 Run all the Load Combinations to determine the largest deflection

75

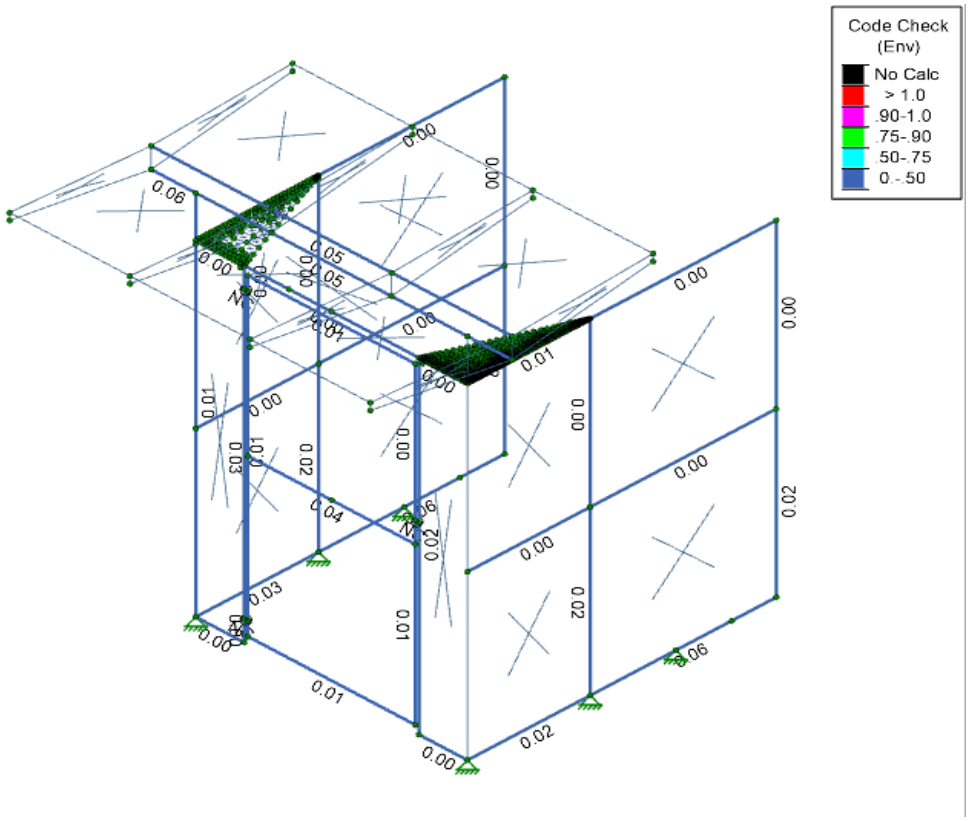
Envelope Node Displacements

	Node Label		X [in]	LC	Y [in]	LC	Z [in]	LC
1	N55	max	0.056	9	0.182	8	0.876	12
2		min	-0.002	5	-1.801	11	-0.601	7
3	N61	max	0.056	9	0.182	8	0.876	12
4		min	-0.002	5	-1.801	11	-0.602	7
5	N64	max	0.103	9	1.798	12	0.876	12

76			
77	Max Allowable Deflection, Dam (in)	1.333	10 ft height x 12 /180 for Cantilever Systems.
78	Max Deflection, Dm (in)	0.876	See above
79	**Safety Factor**	**1.52**	**Dam/Dm >1 OK**
80	**Verify Code Compliance**		

81	
82	**Strength Analysis**
83	Run the all Load Combinations

84



85

Envelope AA ADM1-15: LRFD - Building Aluminum Code Checks

Hot Rolled Steel | Cold Formed Steel | Wood | Concrete Beams | Concrete Columns | Aluminum | Stair

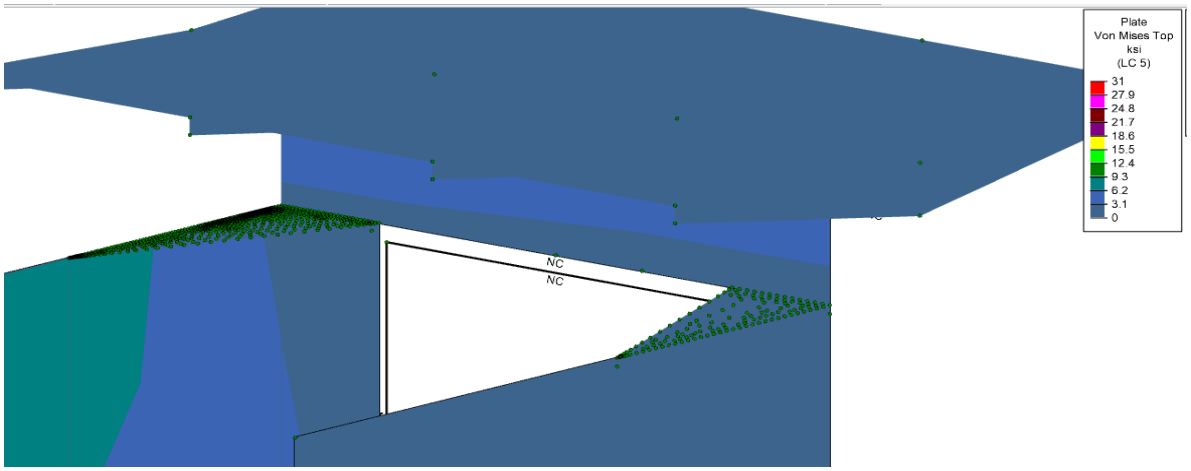
	Member	Shape	Code Check	Loc[in]	LC	Shear Check	Loc[in]
1	M31	RT3X6X0.188	0.06		2	0.039	0
2	M30	RT3X6X0.188	0.06	0	2	0.039	0
3	M32	3X6X3/16"THK	0.05	64.667	2	0.013	64.667
4	M33	RT3X6X0.188	0.044	0	2	0.021	0

86

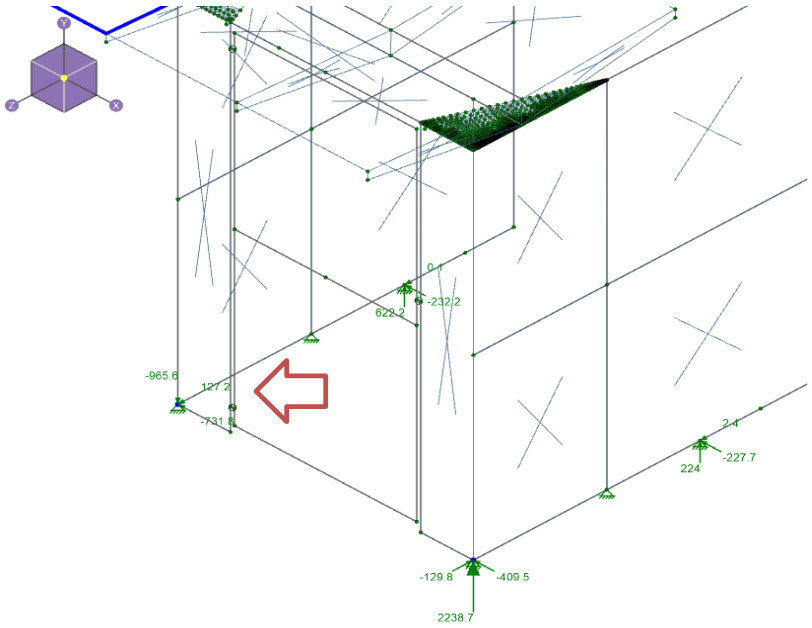
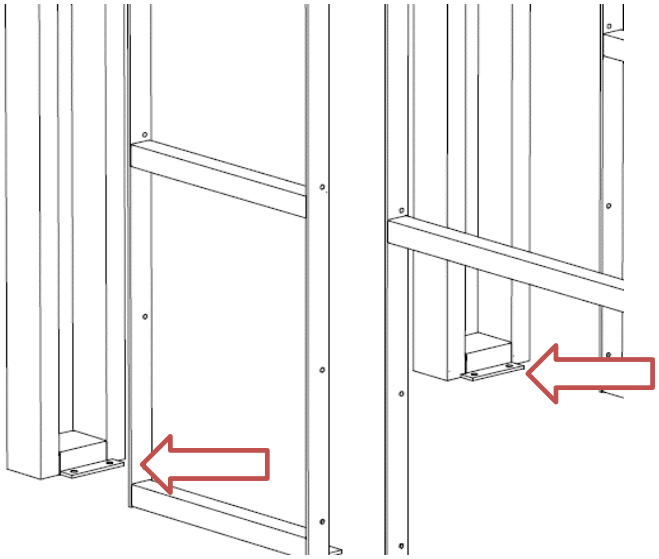
The code check values are the UC Max and Shear UC shown on the bridge. The colors represent a factored ratio of actual to allowable load for LFRD based on the provisions of the Aluminum Design Manual 2015. Ratios greater than 1 are shown in RED; therefore, any member in RED is not acceptable.

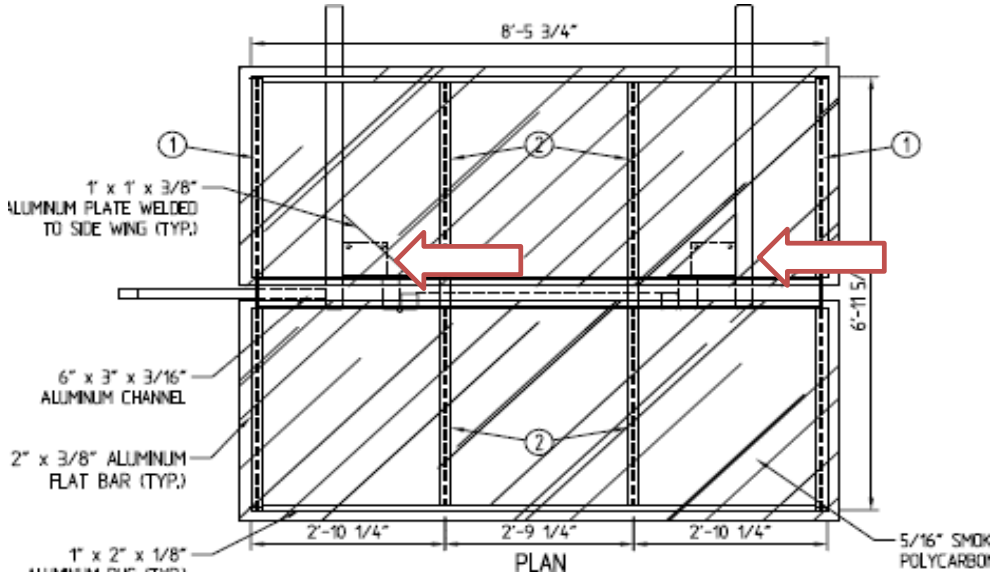
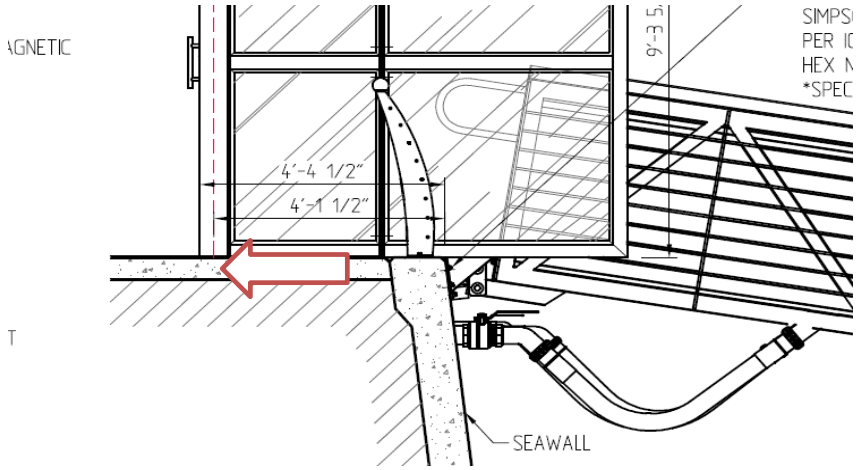
87

Check Gusset Plates Stresses

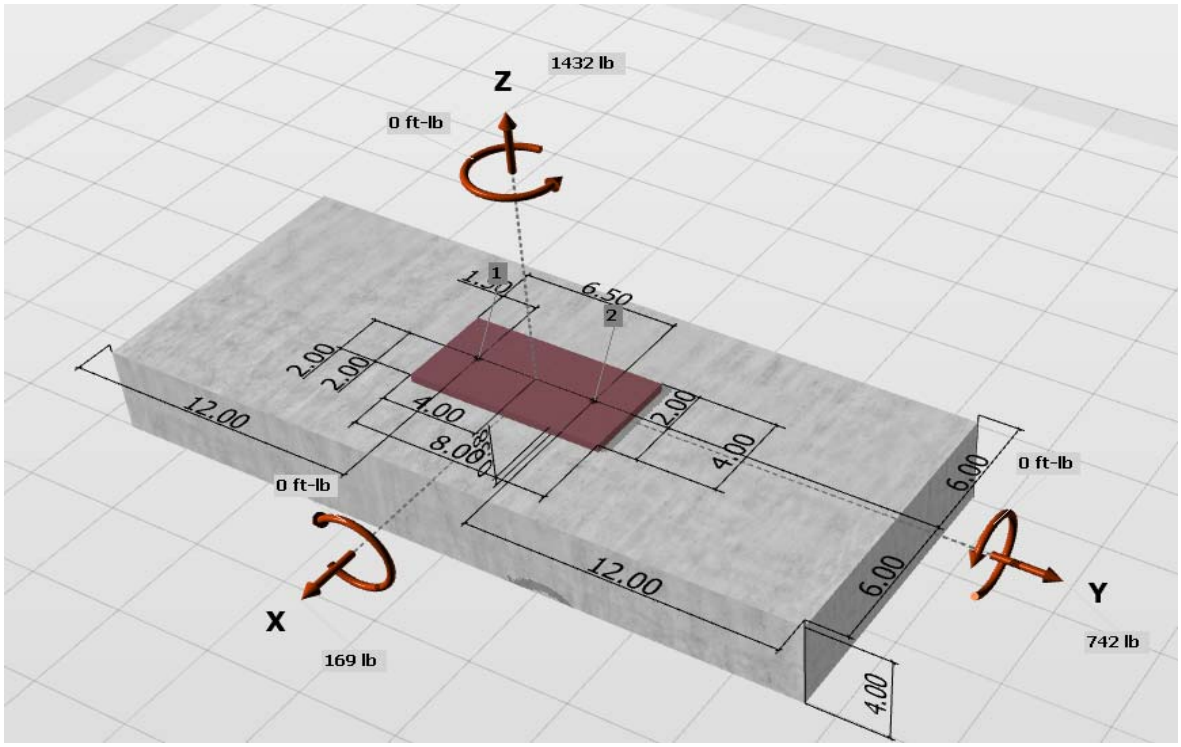
88			
89	Max Stress of Member, Fm (psi)	6,200	See above
90	Yield Stress of Material, Fy (psi)	28,500.00	See below. 38,000 x 0.75.
91	**Design of Aluminum Structure** **Design of member in Tension** **Strength reduction factor and safety factor** **LRFD design:** Strength reduction factors-building type structures $\phi = 0.75$ for tensile rupture $\phi = 0.75$ for tensile yielding		
92	**Safety Factor**	**4.60**	**Fy/Fm > 1 OK**
93	**Door Panel Base Anchors**		
94	**Run all load combinations**		
95	Envelope Node Reactions		

	Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC
1	N6	max	108.642	6	2238.748	11	659.199	9
2		min	-409.545	11	-566.13	6	-777.224	13
3	N1	max	407.134	5	1590.071	13	693.793	9
4		min	-731.789	11	-965.586	11	.126	13

96			
97			
98	Node Reactions (By Combination) LC | Node Label | X [lb] | Y [lb] | Z [lb] 1 | 11 | N6 | -409.545 | 2238.748 | -129.757 2 | 11 | N1 | -731.789 | -965.586 | 127.188		
99	Shear Load in the Z Direction, Vz. (lbs)	129	See above
100	Tensile Load, Y (lbs)	965	See above

101	Shear Load in the X Direction, Vx. (lbs)	731	See above
102	N of bolts, N	2	
103			
104	Use Simpson Strong Tie Software to define the Anchors		
105	The Sea Wall is defined below: a 12" wide by 12" deep reinforced concrete head		
106			

107



108

Input Data

Design method: ACI 318-14
Anchor: SET-3G w/ 1/2"Ø A193 Gr. B8/B8M (304/316SS)
Effective Embedment depth: 2.750 inch
Concrete: Normal-weight
State: Cracked
Compressive strength: 3000 psi
Seismic design: Yes

Resulting Anchor Forces

#	Tension [lb]	Shear [lb]
1	483	371
2	483	371

Governing tension ratio: 38.9% (Pass)

	Ratio	N_{ua} [lb]	ΦN_n [lb]
Steel strength	7.9%	483	6071
Concrete breakout	29.0%	965	3325
Adhesive	38.9%	965	2480

Governing shear ratio: 42.1% (Pass)

	Ratio	V_{ua} [lb]	ΦV_n [lb]
Steel strength	14.7%	371	2525
T Concrete breakout y+	41.9%	731	1743
T Concrete breakout x+	3.9%	129	3341
|| Concrete breakout x-	10.9%	731	6682
|| Concrete breakout y+	1.8%	64	3486
Concrete breakout, combined	42.1%	-	-
Concrete pryout	8.8%	742	8418

Interaction ratio: 44.4% (Pass)

	Ratio	$(N_{ua}/\Phi N_n)^{5/3}$	$(V_{ua}/\Phi V_n)^{5/3}$
Sec. R17.6	44.4%	0.21	0.24

SET-3G w/ 1/2"Ø A193 Gr. B8/B8M (304/316SS) with hef = 2.750 inch meets the

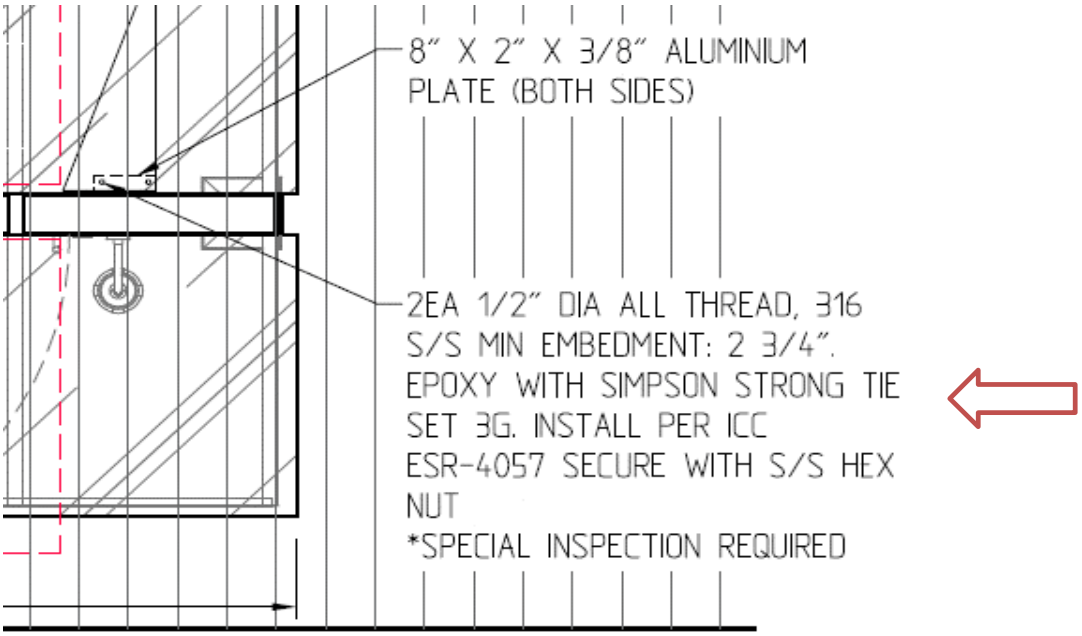
Anchor Information:
Anchor type: Bonded anchor
Material: A193 Grade B8/B8M (304/316SS)
Diameter (inch): 0.500
Effective Embedment depth, h_{ef} (inch): 2.750
Code report: ICC-ES ESR-4057
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 4.00
c_{ac} (inch): 6.15
C_{min} (inch): 1.75
S_{min} (inch): 2.50

Recommended Anchor
Anchor Name: SET-3G - SET-3G w/ 1/2"Ø A193 Gr. B8/B8M (304/316SS)
Code Report: ICC-ES ESR-4057

Compre
$\Psi_{c,V}$: 1.
Reinfor
Supple
Reinfor
Ignore
Ignore
Hole cc
Inspecti
Temper
Ignore
Build-u

Base P
Length

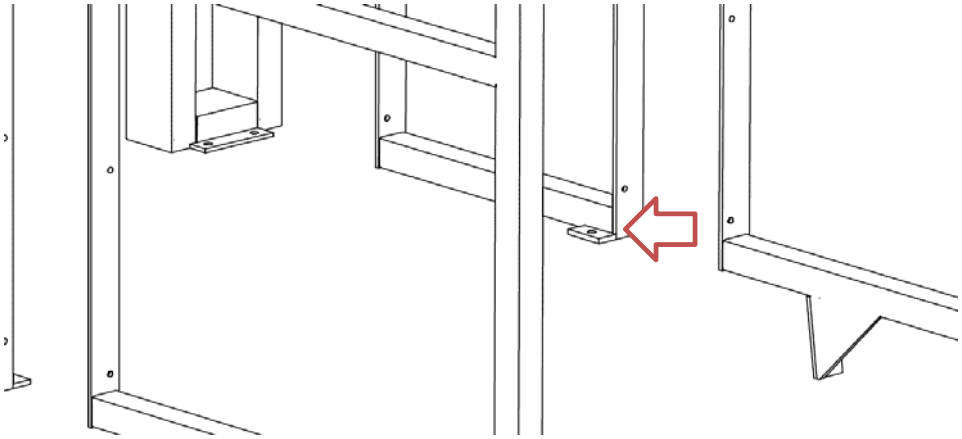
109



110 Check Anchor Plate Yielding

111 **Side Panel Base Anchors**

112

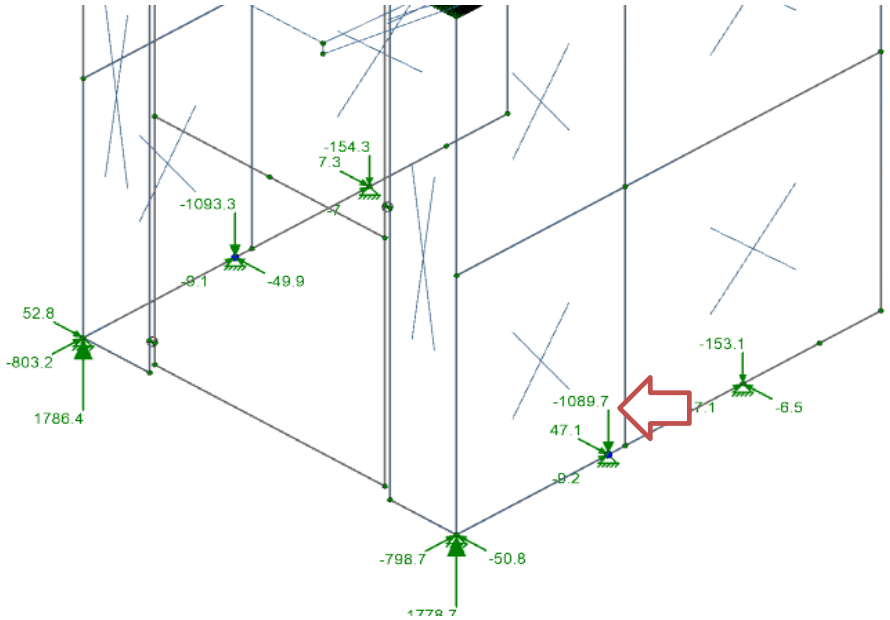


113 **Run all load combinations**

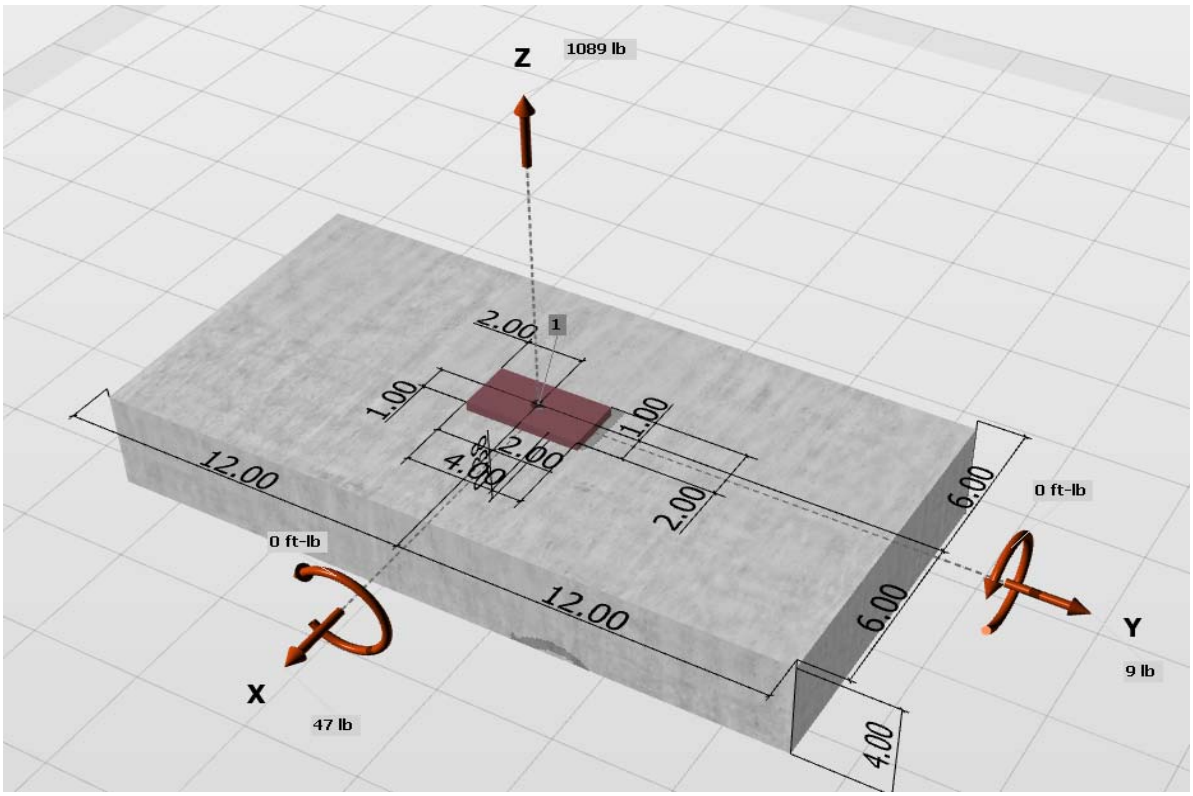
114

Envelope Node Reactions

	Node Label		X [lb]	LC	Y [lb]	LC	Z [lb]	LC
1	N1018	max	213.083	9	1584.045	7	5.185	2
2		min	-213.127	8	-1093.332	12	-9.054	12
3	N1017	max	290.68	5	1662.369	7	5.163	2
4		min	-189.97	9	-1089.744	12	.215	12

115				
116	Node Reactions (By Combination) LC | Node Label | X [lb] | Y [lb] | Z [lb] 1 | 12 | N1018 | -49.909 | -1093.332 | -9.054 2 | 12 | N1017 | 47.11 | -1089.744 | -9.215			
117	Shear Load in the Z Direction, Vz. (lbs)	9.2	See above	
118	Tensile Load, Y (lbs)	1089	See above	
119	Shear Load in the X Direction, Vx. (lbs)	47	See above	
120	N of bolts, N	1		
121	Use Simpson Strong Tie Software to define the Anchors			
122	The Sea Wall is defined below: a 12" wide by 12" deep reinforced concrete head			

123



124

Input Data
Design method: ACI 318-14
Anchor: SET-3G w/ 1/2"Ø F593 CW (304/316SS)
Effective Embedment depth: 2.750 inch
Concrete: Normal-weight
State: Cracked
Compressive strength: 3000 psi
Seismic design: Yes

Resulting Anchor Forces

#	Tension [lb]	Shear [lb]
1	1089	48

Governing tension ratio: 59.8% (Pass)

	Ratio	N_{ua} [lb]	ΦN_n [lb]
Steel strength	10.2%	1089	10650
Concrete breakout	52.6%	1089	2070
Adhesive	59.8%	1089	1821

Governing shear ratio: 1.9% (Pass)

	Ratio	V_{ua} [lb]	ΦV_n [lb]
Steel strength	1.1%	48	4430
T Concrete breakout y+	0.5%	9	1743
T Concrete breakout x+	1.8%	47	2615
|| Concrete breakout x-	0.2%	9	5230
|| Concrete breakout y+	1.3%	47	3486
Concrete breakout, combined	1.9%	-	-
Concrete pryout	0.8%	48	5945

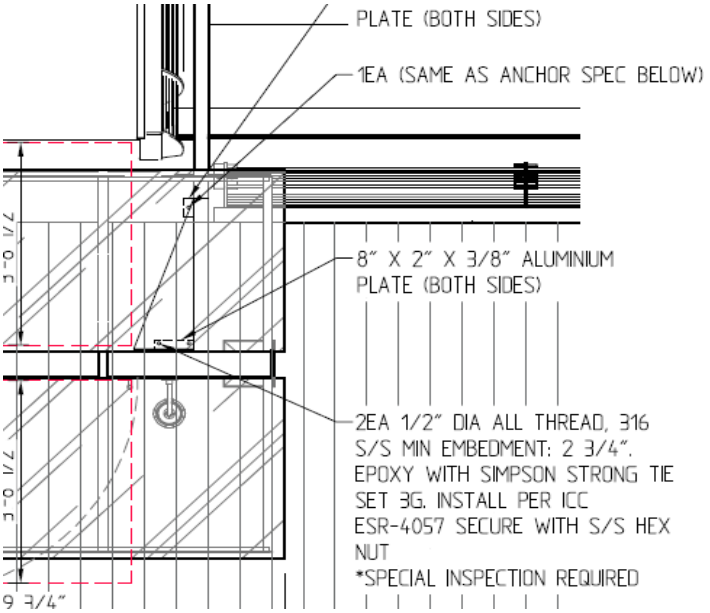
Interaction ratio: 59.8% (Pass)

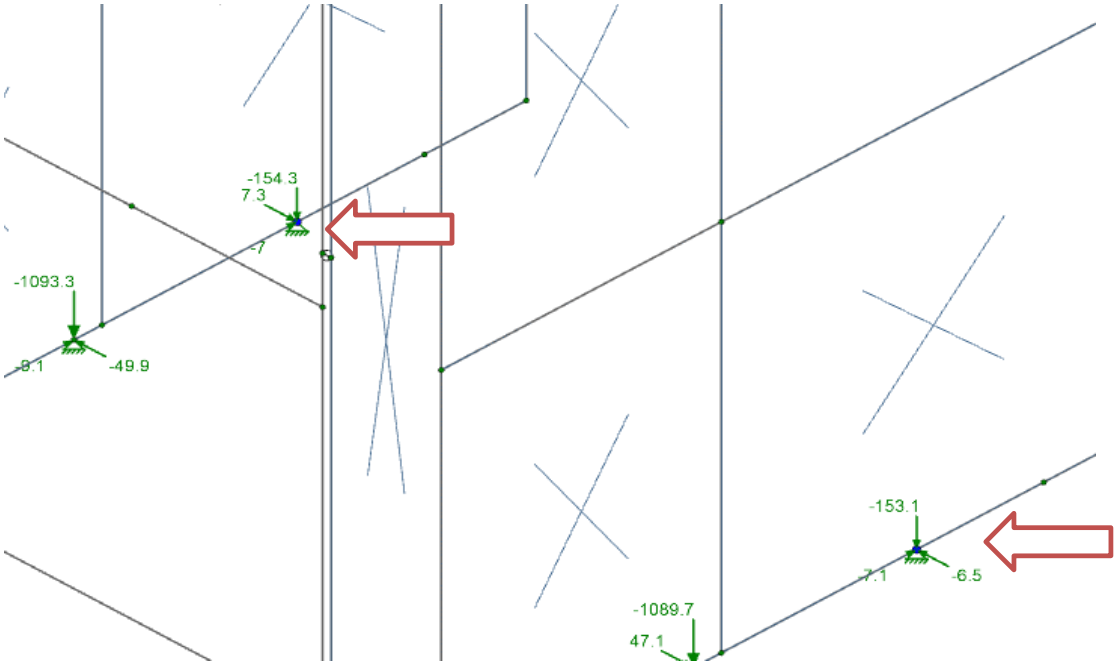
	Ratio	$N_{ua}/\Phi N_n$	$V_{ua}/\Phi V_n$
Sec. 17.6.1	59.8%	0.60	-

SET-3G w/ 1/2"Ø F593 CW (304/316SS) with hef = 2.750 inch meets the selected design criteria.

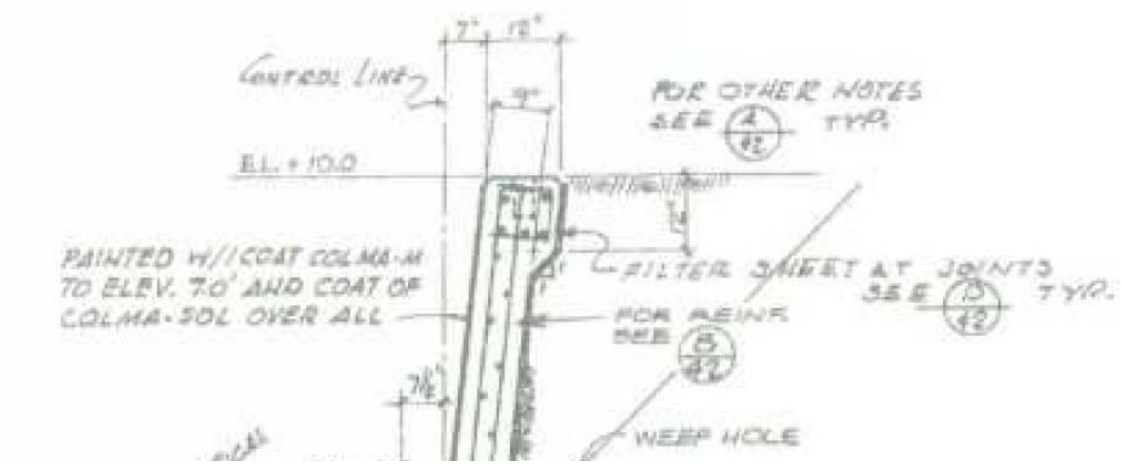
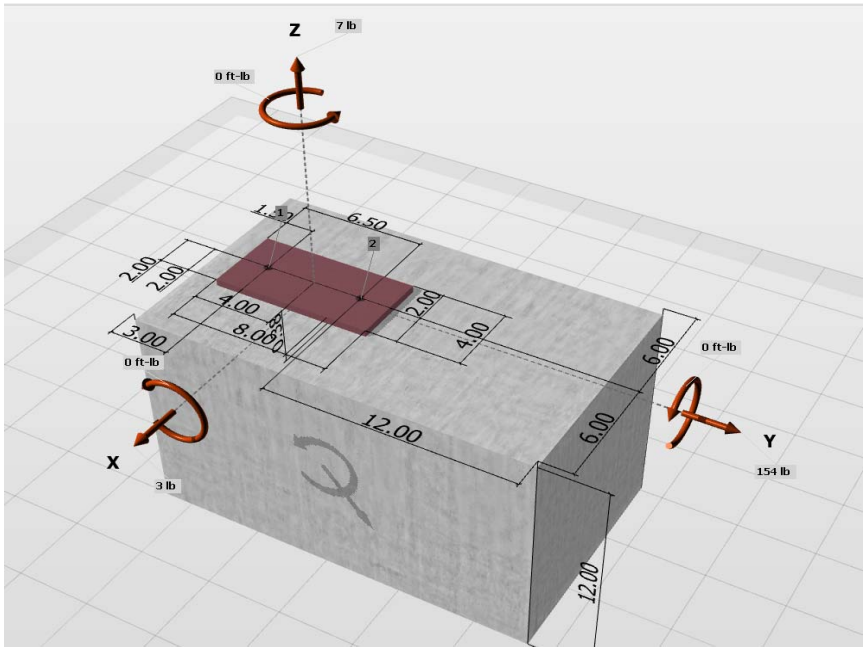
Anchor Information:
Anchor type: Bonded anchor
Material: F593 304/316SS
Diameter (inch): 0.500
Effective Embedment depth, h_{ef} (inch): 2.750
Code report: ICC-ES ESR-4057
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 4.00
c_{ac} (inch): 6.15
C_{min} (inch): 1.75
S_{min} (inch): 2.50

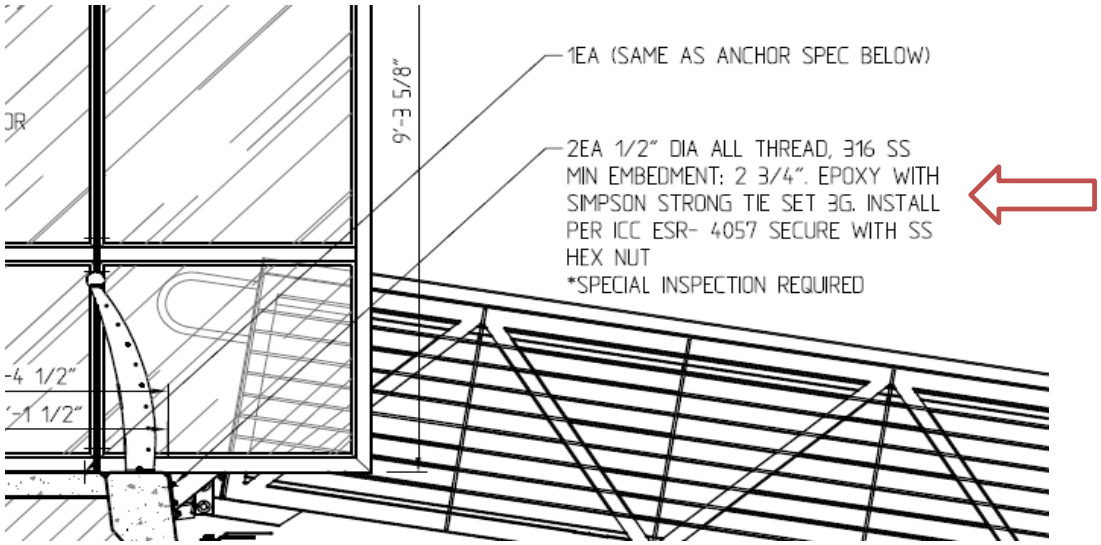
Recommended Anchor
Anchor Name: SET-3G - SET-3G w/ 1/2"Ø F593 CW (304/316SS)
Code Report: ICC-ES ESR-4057

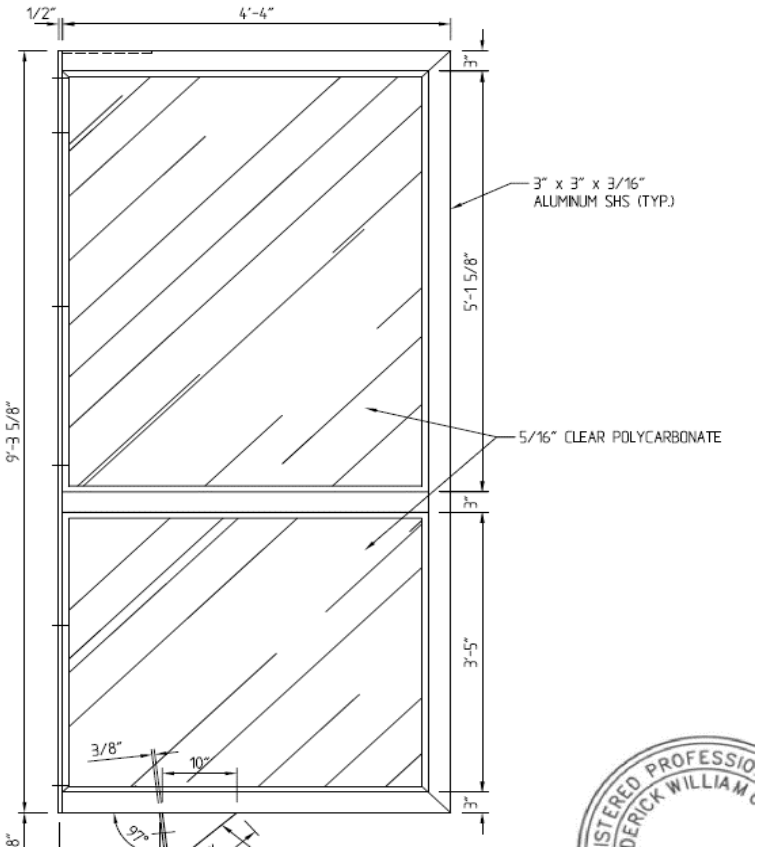
125	
126	**Side Base Anchors**
127	Run the all Load Combinations
128	Envelope Node Reactions Node Label / X [lb] / LC / Y [lb] / LC / Z [lb] / LC 1 N1474 max 33.362 10 224.1 7 1.659 2 2 min -152.3 11 -154.333 12 13 3 N1475 max 422.683 6 231.108 7 1.921 11 4 min -154.165 11 -153.074 12 -7.078 13
129	Find the largest Shear load is in the Y direction. Run LC12 only to get the loads on the anchor points

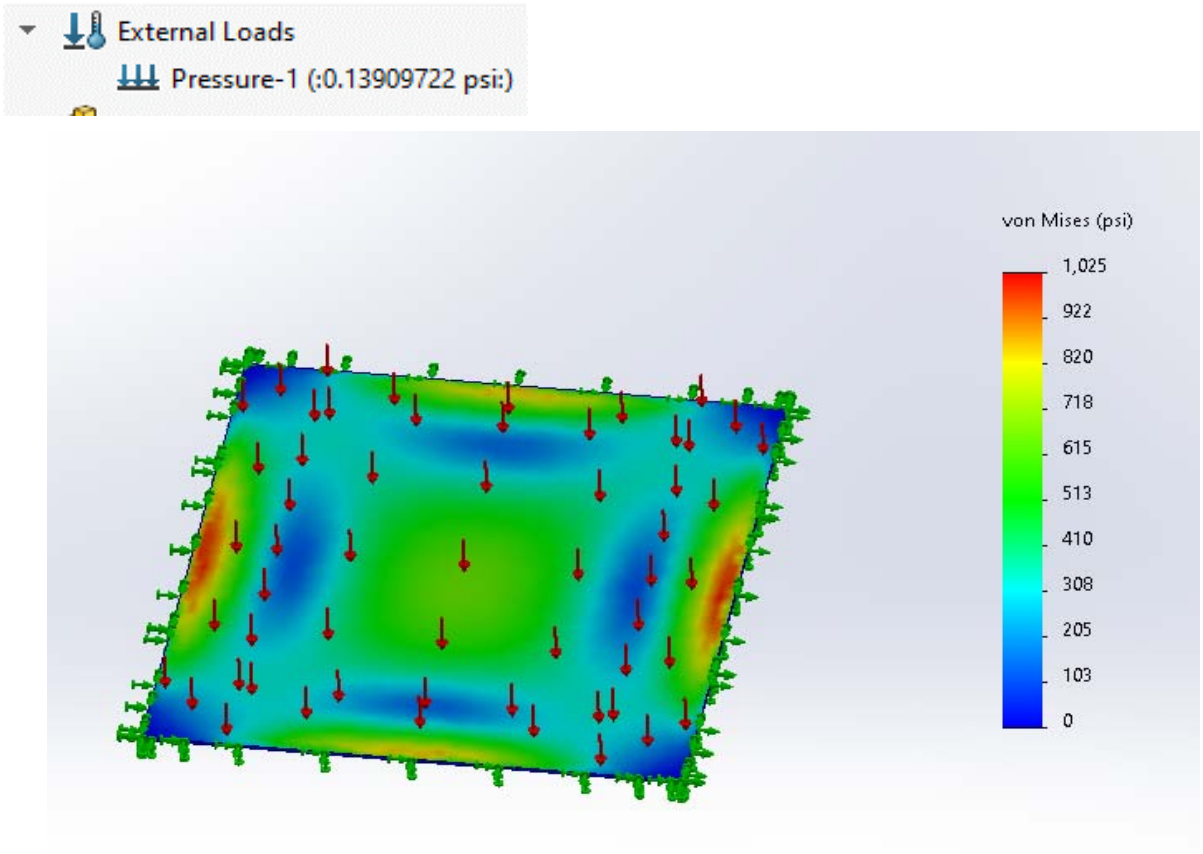
130	
131	Node Reactions (By Combination) LC | Node Label | X [lb] | Y [lb] | Z [lb] 1 | 12 | N1474 | 7.33 | -154.333 | -7.013 2 | 12 | N1475 | -6.533 | -153.074 | -7.061

132	Shear Load in the Z Direction, Vz. (lbs)	7	See above
133	Shear Load, Y (lbs)	154	See above
134	Shear Load in the X Direction, Vx. (lbs)	7	See above
135	N of bolts, N	2	
136	Use Simpson Strong Tie Software to analyze the Anchors		
137	The Sea Wall is defined below: a 12" wide by 12" deep reinforced concrete head		

138	 CONTROL LINE FOR OTHER NOTES SEE 4/42 TYP. EL. +10.0 PAINTED W// COAT COLMA-M TO ELEV. 7.0' AND COAT OF COLMA-SOL OVER ALL FILTER SHEET AT JOINTS SEE 15/42 TYP. FOR REINF. SEE 8/42 WEEP HOLE
139	 Z 7 lb 0 ft-lb 1.50 6.50 2.00 2.00 4.00 8.00 3.00 2.00 4.00 6.00 0 ft-lb 0 ft-lb 12.00 6.00 X Y 3 lb 154 lb 12.00

140	**Input Data** Design method: ACI 318-14 Anchor: SET-3G w/ 1/2"Ø A193 Gr. B8/B8M (304/316SS) Effective Embedment depth: 2.750 inch Concrete: Normal-weight State: Cracked Compressive strength: 3000 psi Seismic design: Yes  **Resulting Anchor Forces** \# / Tension [lb] / Shear [lb] 1 / 4 / 77 2 / 4 / 77 **Governing tension ratio: 0.4% (Pass)** Ratio / N_{ua} [lb] / ΦN_n [lb] Steel strength 0.1% 4 6071 Concrete breakout 0.3% 7 2793 Adhesive 0.4% 7 1698 **Governing shear ratio: 6.0% (Pass)** Ratio / V_{ua} [lb] / ΦV_n [lb] Steel strength 3.1% 77 2525 T Concrete breakout y+ 6.0% 154 2566 T Concrete breakout x+ 0.1% 3 2964 || Concrete breakout x+ 2.1% 154 7409 || Concrete breakout y- 0.1% 1 2773 Concrete breakout, combined 6.0% - - Concrete pryout 2.7% 154 5765 **Interaction ratio: 6.0% (Pass)** Ratio / $N_{ua}/\Phi N_n$ / $V_{ua}/\Phi V_n$ Sec. 17.6.2 6.0% - 0.06 **SET-3G w/ 1/2"Ø A193 Gr. B8/B8M (304/316SS) with hef = 2.750 inch meets the selected design criteria.** **Anchor Information:** Anchor type: Bonded anchor Material: F593 304/316SS Diameter (inch): 0.500 Effective Embedment depth, h_{ef} (inch): 2.750 Code report: ICC-ES ESR-4057 Anchor category: - Anchor ductility: Yes h_{min} (inch): 4.00 c_{ac} (inch): 6.15 C_{min} (inch): 1.75 S_{min} (inch): 2.50 **Recommended Anchor** Anchor Name: SET-3G - SET-3G w/ 1/2"Ø F593 CW (304/316SS) Code Report: ICC-ES ESR-4057 
141	
142	**Verify Polycarbonate Plate will meet the loads.**
143	Check Wing Walls (straight wind loads)

144			
145	Use solidworks simulation to determine the max stress on the material.		
146	Roof Uplift Load, RLL (psf)	16	See above
147	Wing Wall Wind Load, Wm (psf)	20.03	See above
148	Max wind load, Wm (psi)	0.14	Wm is controlling both in magnitude and has a larger span between supports. Wm / 144

149			
150	Max stress of polycarbonate, Fm (psi)	1,095.00	See above
151	Yield Stress of Material, Fy (psi)	6,705.00	See below. 8940 x 0.75.
152	TUFFAK® GP sheets with thicknesses ranging between 0.030 to 0.060-inch-thick (0.76 to 1.5 mm) for wall and ceiling applications comply with the interior finish requirements of IBC Section 803.1. Select TUFFAK® GP, **MECHANICAL** Tensile Strength, Ultimate — ASTM D 638 — psi — 9,500 Tensile Strength, Yield — ASTM D 638 — psi — 9,000 Tensile Modulus — ASTM D 638 — psi — 340,000		
153	Safety Factor	6.12	Fy / Fm > 1 OK
154	End of Analysis		