City of Puyallup
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Building	Planning
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PRCNC20240601

City of Puyallup
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QUANTUM
CONSULTING ENGINEERS

April 12, 2024

STRUCTURAL CALCULATIONS
(Permit Submittal)

CENTERIS DATA CENTER
SWITCHGEAR RAIN SCREEN
& CONDUIT SUPPORT
1023 39th Avenue SE
Puyallup, WA 98374

Quantum Job Number: 23444.01

SCOTT H. TINKER
STATE OF WASHINGTON
36098
STRUCTURAL ENGINEER
PROFESSIONAL ENGINEER

Prepared for:
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Seattle, WA 98118

Prepared by:
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1511 Third Avenue, Suite 323
Seattle, WA 98101
TEL 206.957.3900
FAX 206.957.3901

Calculations required to be provided by the Permittee on site for all Inspections

Structural Design Criteria

Building Code: 2021 International Building Code
Building Department: City of Puyallup

Seismic Criteria

S_s:	1.26	I_e:	1.00
S_1:	0.43	Seismic Soil Site Class:	D
S_{ds}:	1.01	Seismic Design Category:	D
S_{d1}:	0.50	Cs:	0.29
R:	3.50	Steel Ordinary Moment Frames	

Wind Criteria

Wind Speed:	98
Risk Category:	II
Wind Exposure:	B
Kzt:	1

Geotechnical Criteria

Allowable Bearing Pressure	2,000 PSF
Minimum Footing Width	Continuous: 18” min., Isolated: 24” min.
Frost Depth	18” min.

Materials Criteria

Concrete (28 Day Strength):

Foundation/Slab on Grade	F'c= 3,000 PSI

Reinforcing Steel:

Grade 60	Fy= 60,000 PSI

Structural Steel:

Wide-Flange Sections: A-992	Fy= 50,000 PSI
Miscellaneous Sections: A-36	Fy= 36,000 PSI
Tube Sections: A-500	Fy= 46,000 PSI
Pipe Sections: A-53	Fy= 35,000 PSI
Welding	Fy= 70,000 PSI

Building Loads

Snow Load Roof 25 psf

Assembly Loads

Roof (Ecludes Steel Framing)		Comments
Roofing	2.0 psf	
Coverboard	2.3 psf	
3" Decking	2.1 psf	
Misc.	2.6 psf	
Total:	**9.0 psf**	SL=25 psf

Deflection Criteria

Roof		Seismic Drift	
Live Load:	**L/240**	EQ*Cd:	**0.025H**
Total Load:	**L/180**		

ATC Hazards by Location

Search Information

Address: 1015 39th Ave SE Puyallup, WA 98374

Coordinates: 47.1590004, -122.2794422

Elevation: 489 ft

Timestamp: 2023-12-01T15:14:56.409Z

Hazard Type: Seismic

Reference Document: ASCE7-16

Risk Category: III

Site Class: D-default

Basic Parameters

Name	Value	Description
S_S	1.257	MCE_R ground motion (period=0.2s)
S_1	0.433	MCE_R ground motion (period=1.0s)
S_{MS}	1.508	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	1.005	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.2	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.914	Coefficient of risk (0.2s)
CR_1	0.898	Coefficient of risk (1.0s)
PGA	0.5	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.6	Site modified peak ground acceleration
T_L	6	Long-period transition period (s)
SsRT	1.257	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.375	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.433	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.483	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.5	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

This is a beta release of the new ATC Hazards by Location website. Please contact us with feedback.

The ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

ATC Hazards by Location

Search Information

Address: 1015 39th Ave SE Puyallup, WA 98374

Coordinates: 47.1590004, -122.2794422

Elevation: 489 ft

Timestamp: 2023-12-01T15:13:57.333Z

Hazard Type: Wind

ASCE 7-16

MRI 10-Year	67 mph
MRI 25-Year	73 mph
MRI 50-Year	78 mph
MRI 100-Year	82 mph
Risk Category I	92 mph
Risk Category II	97 mph
Risk Category III	104 mph
Risk Category IV	108 mph

ASCE 7-10

MRI 10-Year	72 mph
MRI 25-Year	79 mph
MRI 50-Year	85 mph
MRI 100-Year	91 mph
Risk Category I	100 mph
Risk Category II	110 mph
Risk Category III-IV	115 mph

ASCE 7-05

ASCE 7-05 Wind Speed	85 mph

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

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Seismic Base Shear for the Equivalent Lateral Force Procedure

Per IBC 2021 & ASCE 7-16 Chapter 15.4

Structure: **Conduit Steel Frame**
Address: **1015 39th Ave SE Puyallup, WA 98374**
Latitude: **47.1590** Longitude: **-122.2794**

Structure Classification

Risk Category : **II** per ASCE Table 1.5-1

Seismic Force-Resisting System: **Steel Ordinary Moment Frames** per ASCE 15.7.14

R:	**3 1/2**	per ASCE Table 15.4-2
W_o:	**3**	per ASCE Table 15.4-2
C_d:	**3**	per ASCE Table 15.4-2
h_n (ft):	**20.00**	height above the base to the highest level of the structure

Site Ground Motion

S_1 (g-sec): **0.43** S_S (g-sec): **1.26**
Site Class: **D** **Assumed Value** per ASCE 11.4.3
ASCE 11.4.8 Exception 2 Used

F_v **1.87** F_a **1.20**
1.2 Min Value where SC D Assumed

S_{M1} (g-sec): **0.81** S_{MS} (g-sec): **1.51** per ASCE 11.4.4
S_{D1} (g-sec): **0.54** S_{DS} (g-sec): **1.01** per ASCE 11.4.5

SDC: **D** per ASCE 11.6
I_E: **1.00** per ASCE Table 1.5-2

Fundamental Period per ASCE 12.8.2

Period Method: **Approximate Fundamental Period**
Structure Type: **Steel Moment Frame**
T_L (sec): **6.00** ASCE Figures 22-14 through 22-17
T_S: 0.54

Ta (sec): 0.31 Ct * hnx per ASCE Eq. 12.8-7

T_{use} (sec): **0.31** - <= TL

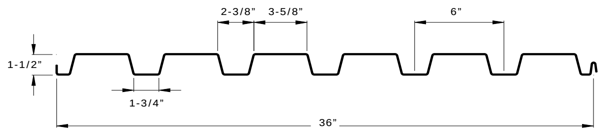
Equivalent Lateral Force Procedure Design Base Shear per ASCE 12.8

C_s:	0.287	$= S_{DS} / (R/I_E)$ per ASCE Eq. 12.8-2
$C_{s\text{-}max}$:	0.501	$= S_{D1} / (T_a{*}R/I_E)$ for $T <= T_L$ per ASCE Eq. 12.8-3
$C_{s\text{-}max}$:	--	$= S_{D1}{*}T_L / (T_a^2{*}R/I_E)$ for $T > T_L$ per ASCE Eq. 12.8-4
$C_{s\text{-}min}$:	0.044	per ASCE Eq. 15.4-1
$C_{s\text{-}min}$:	--	$= 0.8S_1 / (R/I_E)$ for S_1 => 0.6g per ASCE Eq. 15.4-2
$C_{s\text{-}use}$:	0.287	

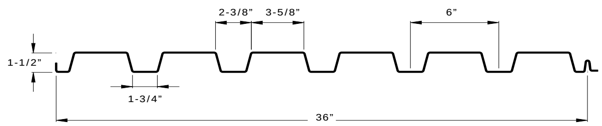
V : 0.287 W = $C_{S\text{-}use}$ * W per ASCE Eq. 12.8-1

2.1 DGB-36, B-36, BS-36 & BN-36

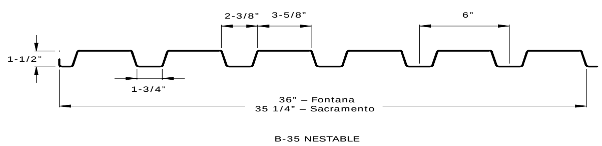
DGB-36 & B-36



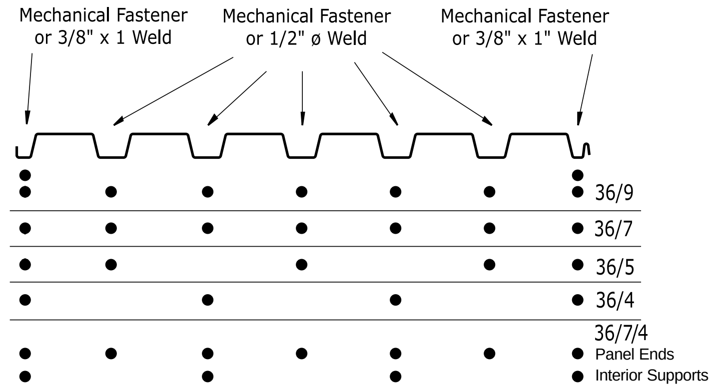
BS-36 Screwable Sidelap



BN-36 Nestable



Attachment Patterns



Note: Weld sizes are effective not visible. Refer to AISI S100 or AWS D1.3 for additional welding requirements.

Panel Properties

Gauge	Weight	Base Metal Thickness	Yield Strength	Tensile Strength	Gross Section Properties				
					Area	Moment of Inertia	Distance to N.A. from Bottom	Section Modulus (Min.)	Radius of Gyration
	w psf	t in	F_y ksi	F_u ksi	A_g in^2/ft	I_g in^4/ft	y_b in	S_g in^3/ft	r in
22	1.75	0.0299	50	65	0.514	0.200	0.94	0.213	0.625
21	1.93	0.0330	50	65	0.566	0.220	0.94	0.233	0.624
20	2.09	0.0359	50	65	0.615	0.240	0.94	0.053	0.623
19	2.43	0.0420	50	65	0.717	0.277	0.95	0.293	0.621
18	2.76	0.0478	50	65	0.814	0.313	0.95	0.330	0.619
16	3.44	0.0598	50	65	1.012	0.383	0.95	0.404	0.615

Gauge	Effective Section Properties at F_y for Bending Strength					Effective Section Properties at Service Load Load for Deflection			
	Area	Section Modulus (Min.)	Distance to N.A. from Bottom	Section Modulus (Min.)	Distance to N.A. from Bottom	Moment of Inertia	Moment of Inertia	Uniform Load Only $I_d = (2I_e+I_g)/3$	
	A_e+ in^2/ft	S_e+ in^3/ft	y_b in	S_e- in^3/ft	y_b in	I_e+ in^4/ft	I_e- in^4/ft	I+ in^4/ft	I- in^4/ft
22	0.179	0.175	0.74	0.187	0.98	0.157	0.197	0.171	0.198
21	0.207	0.202	0.77	0.213	0.97	0.197	0.220	0.204	0.220
20	0.235	0.228	0.77	0.236	0.96	0.197	0.237	0.211	0.238
19	0.296	0.271	0.81	0.287	0.95	0.263	0.277	0.268	0.277
18	0.351	0.311	0.84	0.329	0.94	0.287	0.313	0.296	0.313
16	0.330	0.392	0.89	0.404	0.95	0.377	0.383	0.379	0.383

Reactions at Supports (plf) Based on Web Crippling

Gage	Condition	Bearing Length of Webs							
		ASD, R/Ω				LRFD, ϕR			
		1"	1.5"	2"	3"	1"	1.5"	2"	3"
22	End	772	874	960	1105	1180	1337	1469	1691
	Interior	1229	1366	1482	1675	1828	2032	2204	2492
20	End	1081	1220	1336	1532	1655	1866	2045	2344
	Interior	1737	1922	2078	2339	2584	2859	3091	3479
18	End	1834	2053	2239	2550	2805	3142	3425	3901
	Interior	2984	3277	3525	3940	4439	4875	5243	5860
16	End	2771	3086	3351	3796	4240	4721	5127	5809
	Interior	4555	4975	5329	5923	6776	7401	7927	8810

Constants h = 1.32" r = 0.125" θ = 78.3°

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B PANELS

Inward Allowable (f_b/Ω) and Factored (Φf_b) Distributed Load (lbs/ft²)

Gauge	Span	Limit Condition	Panel Span (Support Spacing)								
			4' - 0"	5' - 0"	6' - 0"	7' - 0"	8' - 0"	9' - 0"	10' - 0"	11' - 0"	12' - 0"
22	Single Span	f_b / Ω	218	140	97	71	55	43	35	29	24
		Φf_b	328	210	146	107	82	65	52	43	36
		L/360	117	60	35	22	15	10	7	6	4
		L/240	175	90	52	33	22	15	11	8	6
		L/180	234	120	69	44	29	21	15	11	9
		L/120	351	179	104	65	44	31	22	17	13
	Double Span	f_b / Ω	234	149	104	76	58	46	37	31	26
		Φf_b	351	225	156	115	88	69	56	46	39
		L/360	281	144	83	53	35	25	18	14	10
		L/240	422	216	125	79	53	37	27	20	16
		L/180	563	288	167	105	70	49	36	27	21
		L/120	844	432	250	158	106	74	54	41	31
	Triple Span	f_b / Ω	292	187	130	95	73	58	47	39	32
		Φf_b	439	281	195	143	110	87	70	58	49
		L/360	220	113	65	41	28	19	14	11	8
		L/240	331	169	98	62	41	29	21	16	12
		L/180	441	226	131	82	55	39	28	21	16
		L/120	661	339	196	123	83	58	42	32	24
20	Single Span	f_b / Ω	285	182	127	93	71	56	46	38	32
		Φf_b	428	274	190	140	107	85	69	57	48
		L/360	144	74	43	27	18	13	9	7	5
		L/240	216	111	64	40	27	19	14	10	8
		L/180	288	148	85	54	36	25	18	14	11
		L/120	432	221	128	81	54	38	28	21	16
	Double Span	f_b / Ω	295	189	131	96	74	58	47	39	33
		Φf_b	443	284	197	145	111	88	71	59	49
		L/360	347	178	103	65	43	30	22	17	13
		L/240	521	267	154	97	65	46	33	25	19
		L/180	695	356	206	130	87	61	44	33	26
		L/120	1042	533	309	194	130	91	67	50	39
	Triple Span	f_b / Ω	369	236	164	120	92	73	59	49	41
		Φf_b	554	355	246	181	138	109	89	73	62
		L/360	272	139	81	51	34	24	17	13	10
		L/240	408	209	121	76	51	36	26	20	15
		L/180	544	279	161	102	68	48	35	26	20
		L/120	816	418	242	152	102	72	52	39	30
18	Single Span	f_b / Ω	388	248	172	127	97	77	62	51	43
		Φf_b	583	373	259	190	146	115	93	77	65
		L/360	202	103	60	38	25	18	13	10	7
		L/240	303	155	90	56	38	27	19	15	11
		L/180	404	207	120	75	50	35	26	19	15
		L/120	605	310	179	113	76	53	39	29	22
									66	54	46
									99	82	69
									31	23	18
									47	35	27
									62	47	36
									93	70	54
									82	68	57
									124	102	86
									24	18	14
									37	27	21
									49	37	28
									73	55	42
16									78	65	54
									118	97	82
									17	12	10
									25	19	14
									33	25	19
		L/120	776	397	230	145	97	68	50	37	29
	Double Span	f_b / Ω	504	323	224	165	126	100	81	67	56
		Φf_b	758	485	337	248	190	150	121	100	84
		L/360	623	319	185	116	78	55	40	30	23
		L/240	935	479	277	174	117	82	60	45	35
		L/180	1246	638	369	233	156	109	80	60	46
		L/120	1870	957	554	349	234	164	120	90	69
	Triple Span	f_b / Ω	631	404	280	206	158	125	101	83	70
		Φf_b	948	607	421	309	237	187	152	125	105
		L/360	488	250	145	91	61	43	31	23	18
		L/240	732	375	217	137	92	64	47	35	27
		L/180	976	500	289	182	122	86	62	47	36
		L/120	1465	750	434	273	183	129	94	70	54

DL = 5 psf

SL = 27.5 psf < 51 psf

WL = 0.6 (61.22 psf) = 24.6 psf

DL+SL = 30 psf < 92 psf & 68 psf

DL+0.75(SL+0.6WL) = 42.2 psf < 92 psf

Use 20 gauge deck

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2.2 DGB-36

Allowable Wind Uplift Loads

ASC STEEL DECK

DGB-36 — Support Fastener Pattern: 36 / 4

Allowable Wind Uplift Load (psf)

Gauge	Fastener	Support Thickness	Fastener Capacity [lbs]	Span	4	5	6	7	8	9	10	11	12
					Span (ft.-in.)								
22	#12-14 ITW Buildex TEKS	16ga	165	Single Span	55	44	37	31	28	24	22	20	18
	#12-24 ITW Buildex TEKS	≥ 3/16"	280		93	75	62	53	47	41	37	31	26
	Hilti X-ENP-19 L15	≥ 1/4"	660		220	150	104	76	58	46	37	31	26
	Hilti X-HSN 24	1/8" - 3/8"	435		145	116	97	76	58	46	37	31	26
	1/2" Eff. Arc Spot Weld	≥ 1/8"	787		234	150	104	76	58	46	37	31	26
	Simpson XL Screws	≥ 1/8"	385		128	103	86	73	58	46	37	31	26
	#12-14 ITW Buildex TEKS	16ga	165	Double Span	55	44	37	31	28	24	22	20	18
	#12-24 ITW Buildex TEKS	≥ 3/16"	280		93	75	62	53	47	41	37	31	26
	Hilti X-ENP-19 L15	≥ 1/4"	660		220	150	104	76	58	46	37	31	26
	Hilti X-HSN 24	1/8" - 3/8"	435		145	116	97	76	58	46	37	31	26
	1/2" Eff. Arc Spot Weld	≥ 1/8"	787		234	150	104	76	58	46	37	31	26
	Simpson XL Screws	≥ 1/8"	385		128	103	86	73	58	46	37	31	26
	#12-14 ITW Buildex TEKS	16ga	165	Triple Span	55	44	37	31	28	24	22	20	18
	#12-24 ITW Buildex TEKS	≥ 3/16"	280		93	75	62	53	47	41	37	34	31
	Hilti X-ENP-19 L15	≥ 1/4"	660		220	176	130	95	73	58	47	39	32
	Hilti X-HSN 24	1/8" - 3/8"	435		145	116	97	83	73	58	47	39	32
	1/2" Eff. Arc Spot Weld	≥ 1/8"	787		262	187	130	95	73	58	47	39	32
	Simpson XL Screws	≥ 1/8"	385		128	103	86	73	64	57	47	39	32

DGB-36 — Support Fastener Pattern: 36 / 4

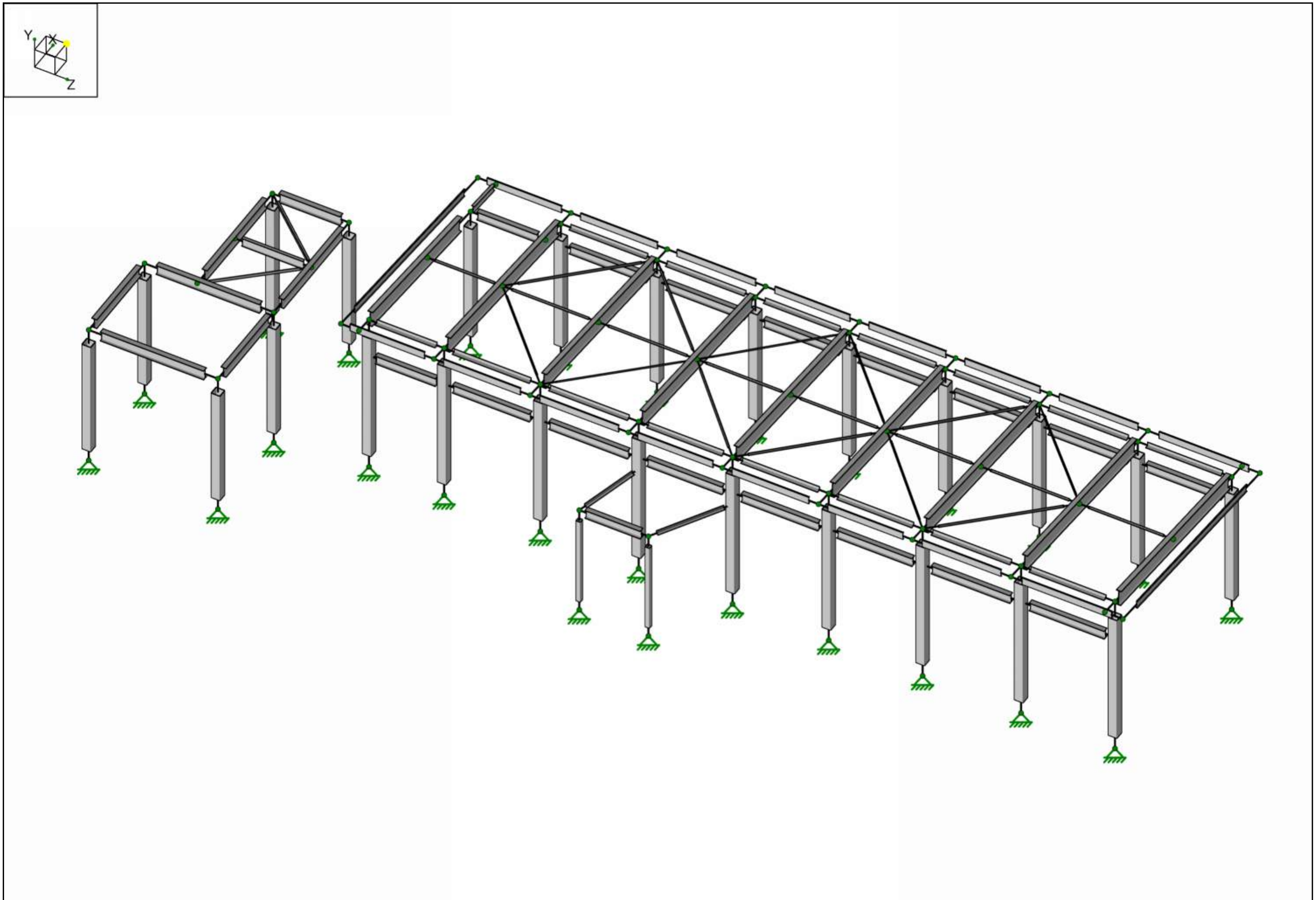
WL = 0.6 (-43.33 psf)
WL = -26.0 psf < 64 psf
20 gauge deck OK

Wind Uplift Load (psf)

Gauge				Span	4	5	6	7	8	9	10	11	12
					Span (ft.-in.)								
20	#12-14 ITW Buildex TEKS	16ga	165	Single Span	55	44	37	31	28	24	22	20	18
	#12-24 ITW Buildex TEKS	≥ 3/16"	336		112	90	75	64	56	50	45	39	33
	Hilti X-ENP-19 L15	≥ 1/4"	705		235	188	131	96	74	58	47	39	33
	Hilti X-HSN 24	1/8" - 3/8"	435		145	116	97	83	73	58	47	39	33
	1/2" Eff. Arc Spot Weld	≥ 1/8"	953		295	189	131	96	74	58	47	39	33
	Simpson XL Screws	≥ 1/8"	385		128	103	86	73	64	57	47	39	33
	#12-14 ITW Buildex TEKS	16ga	165	Double Span	55	44	37	31	28	24	22	20	18
	#12-24 ITW Buildex TEKS	≥ 3/16"	336		112	90	75	64	56	50	45	39	33
	Hilti X-ENP-19 L15	≥ 1/4"	705		235	188	131	96	74	58	47	39	33
	Hilti X-HSN 24	1/8" - 3/8"	435		145	116	97	83	73	58	47	39	33
	1/2" Eff. Arc Spot Weld	≥ 1/8"	953		295	189	131	96	74	58	47	39	33
	Simpson XL Screws	≥ 1/8"	385		128	103	86	73	64	57	47	39	33
	#12-14 ITW Buildex TEKS	16ga	165	Triple Span	55	44	37	31	28	24	22	20	18
	#12-24 ITW Buildex TEKS	≥ 3/16"	336		112	90	75	64	56	50	45	41	37
	Hilti X-ENP-19 L15	≥ 1/4"	705		235	188	157	120	92	73	59	49	41
	Hilti X-HSN 24	1/8" - 3/8"	435		145	116	97	83	73	64	58	49	41
	1/2" Eff. Arc Spot Weld	≥ 1/8"	953		318	236	164	120	92	73	59	49	41
	Simpson XL Screws	≥ 1/8"	385		128	103	86	73	64	57	51	47	41

Notes:

1) Deck uplift table evaluates for the allowable bending stress of the panel and the allowable fastener capacity.
2) Overall fastener capacities based on a minimum of: Fastener tensile capacity, Fastener pullout from substrate, and Deck pullover from fastener head.
3) ITW Buildex TEKS fastener capacities per ICC-ES ESR1976 compliance report utilizing a min. substrate Fu=45ksi.
4) Simpson XL fastener capacities per IAPMO-UES ER326 compliance report utilizing a min. substrate Fu=50ksi.
5) Hilti X-HSN 24 and X-ENP-19 pin capacities per ICC-ES ESR-2197 compliance report utilizing a min substrate Fu=58ksi.
6) Spot weld tensile capacities evaluated per AISI S100, Sec.J2.2.3 with a minimum effective weld diameter of 1/2”.
7) Shaded values represent conditions where panel capacity governs vs. fastener capacity.



Quantum Consulting Engineers	Switchgear Rain Screen / Conduit Support		
TVM		Apr 08, 2024 at 05:39 AM	
23444.01		24-04-01 - Rain Screen + Conduit Fram…	

Quantum Consulting Engineers

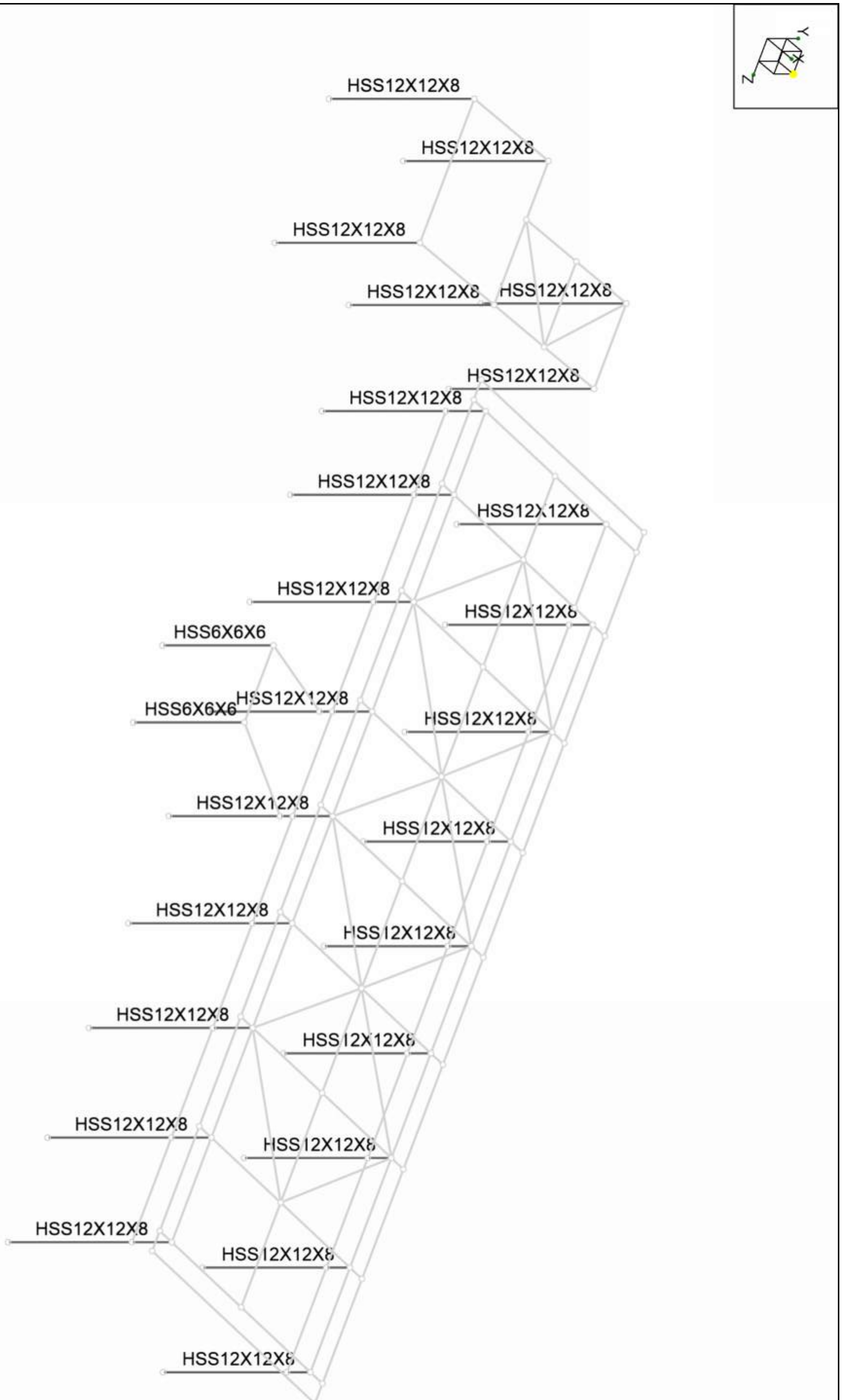
TVM

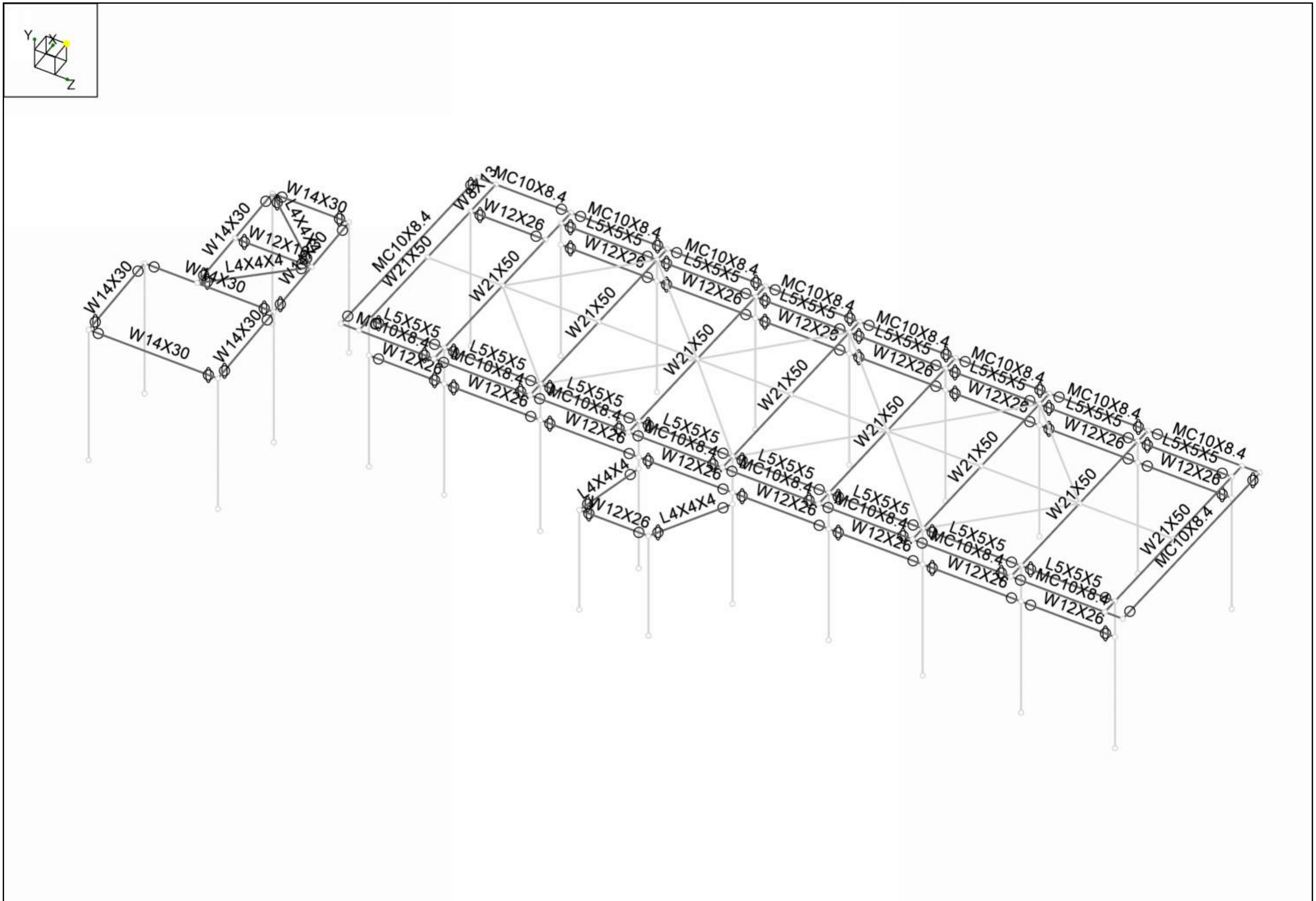
23444.01

Switchgear Rain Screen / Conduit Support

Apr 08, 2024 at 05:41 AM

24-04-01 - Rain Screen + Conduit Fram...





Quantum Consulting Engineers	Switchgear Rain Screen / Conduit Support	
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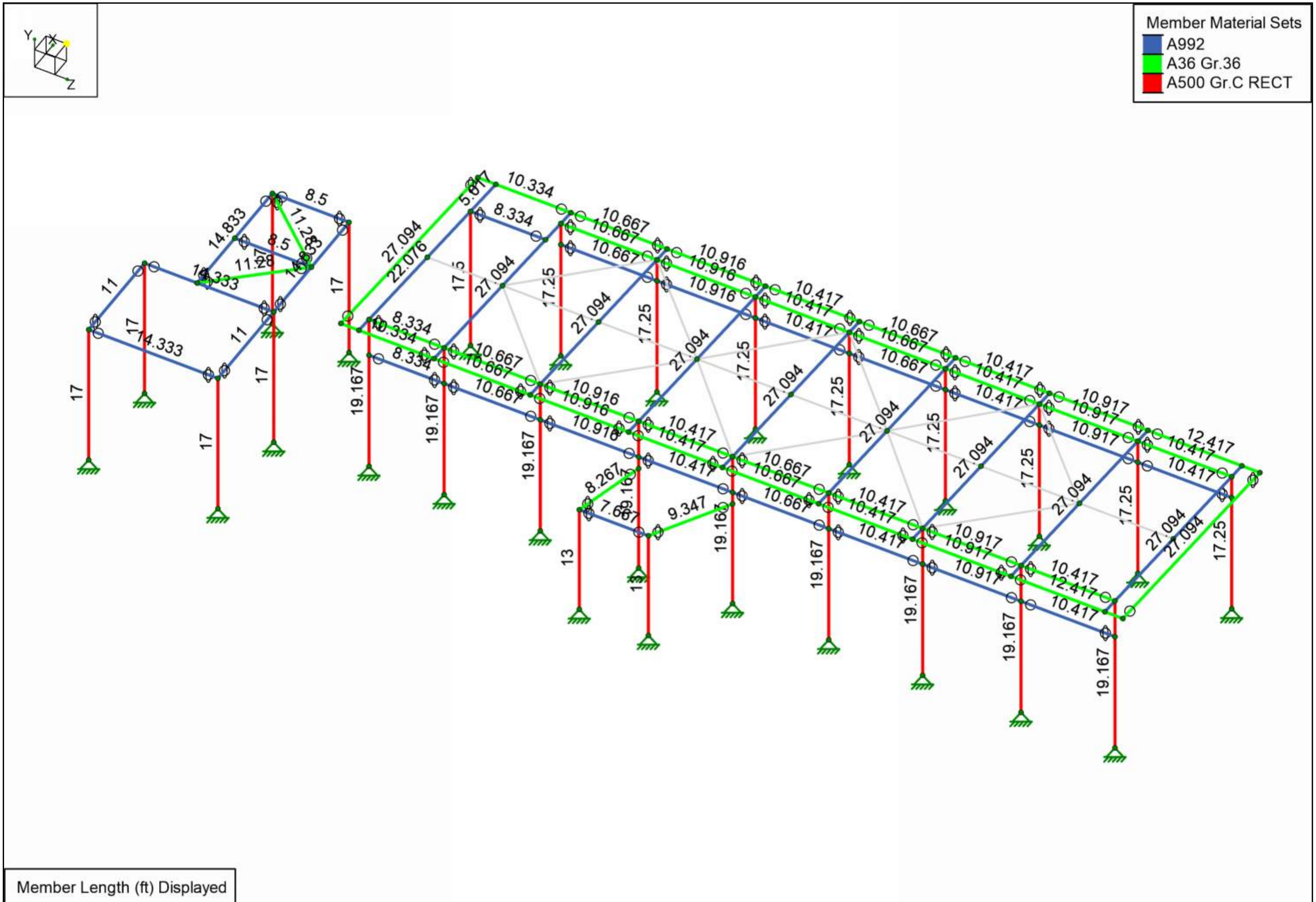
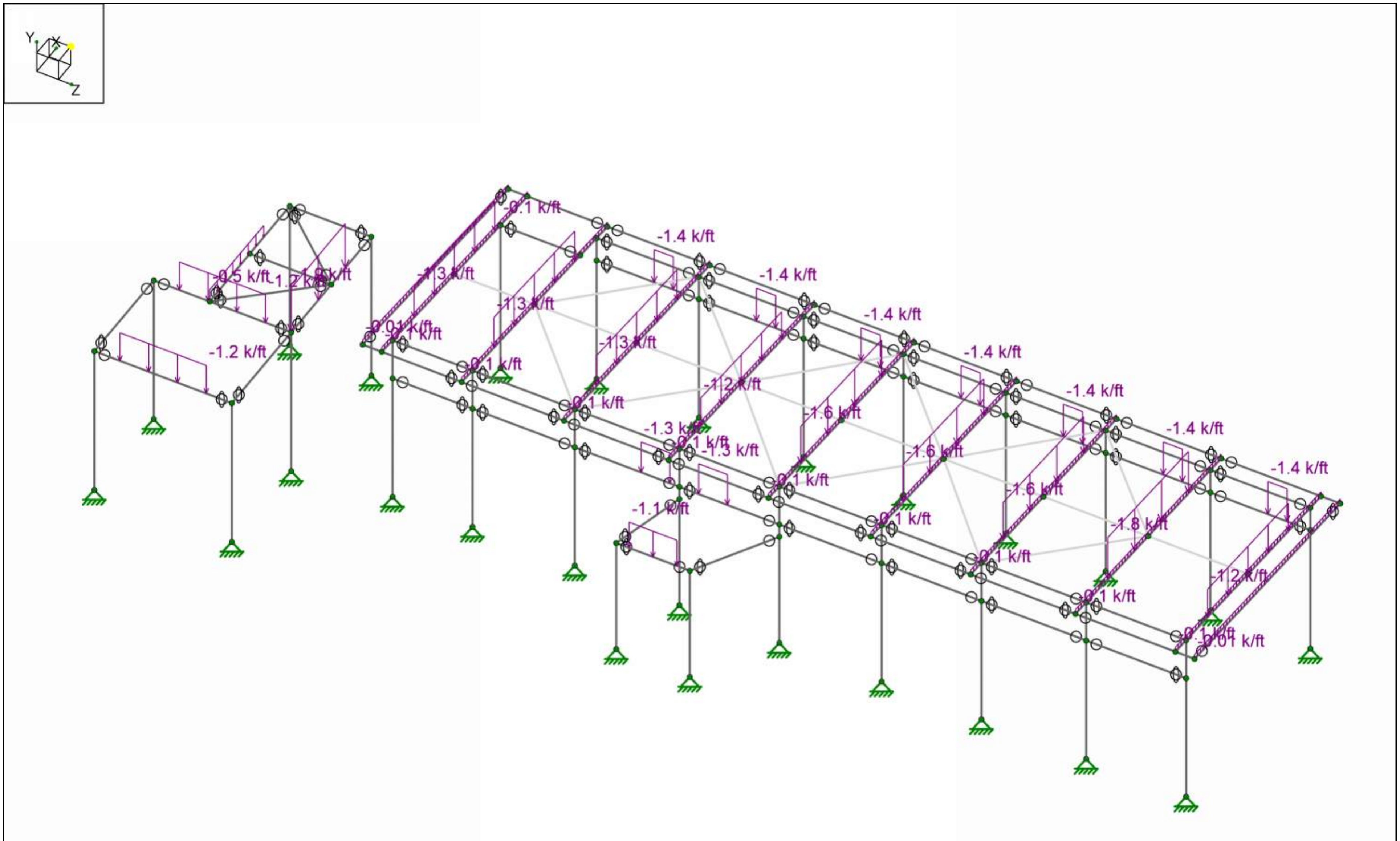
23444.01		24-04-01 - Rain Screen + Conduit Fram...

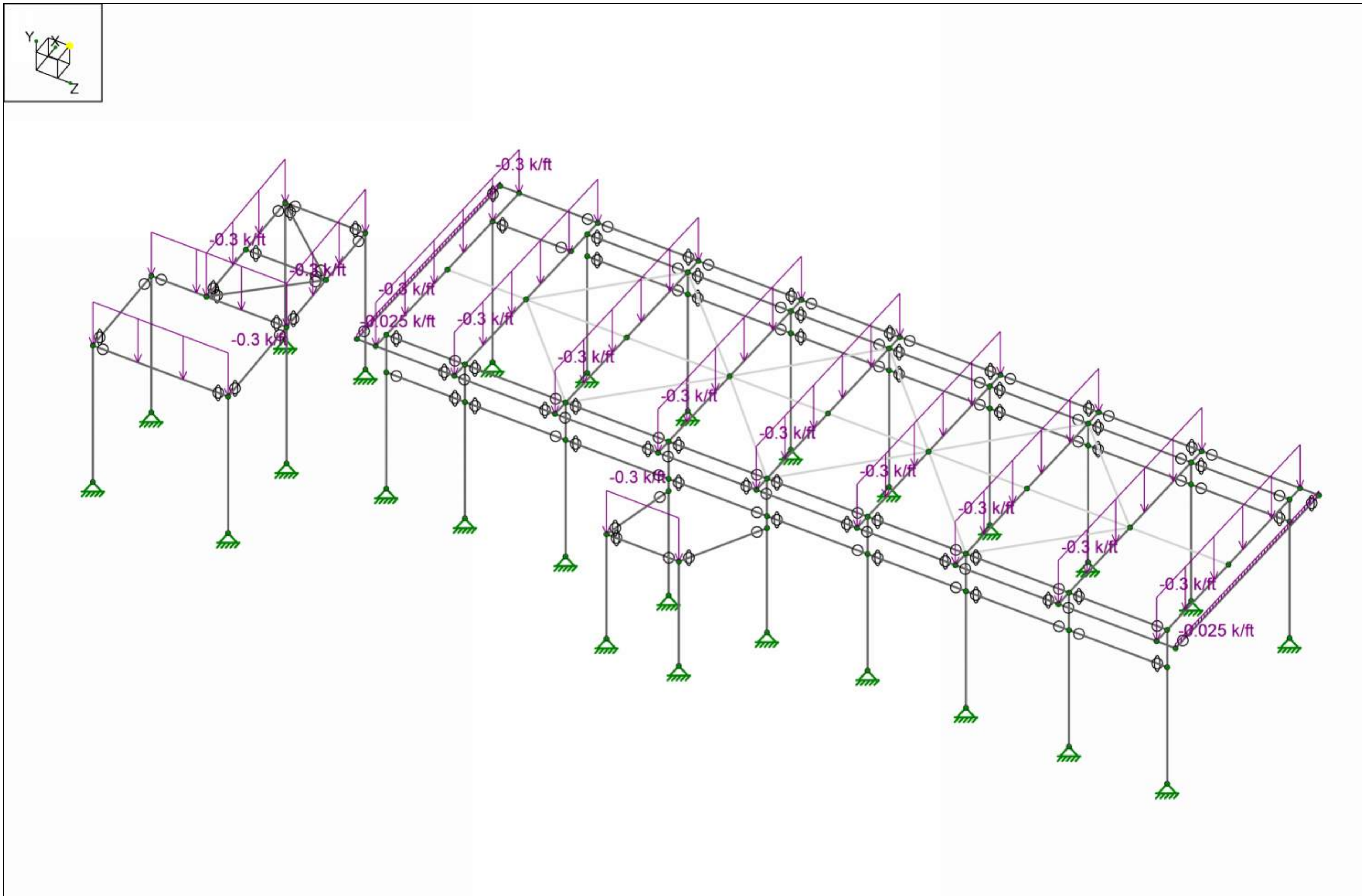


Quantum Consulting Engineers	Switchgear Rain Screen / Conduit Support	
TVM		Apr 08, 2024 at 05:44 AM
23444.01		24-04-01 - Rain Screen + Conduit Fram…



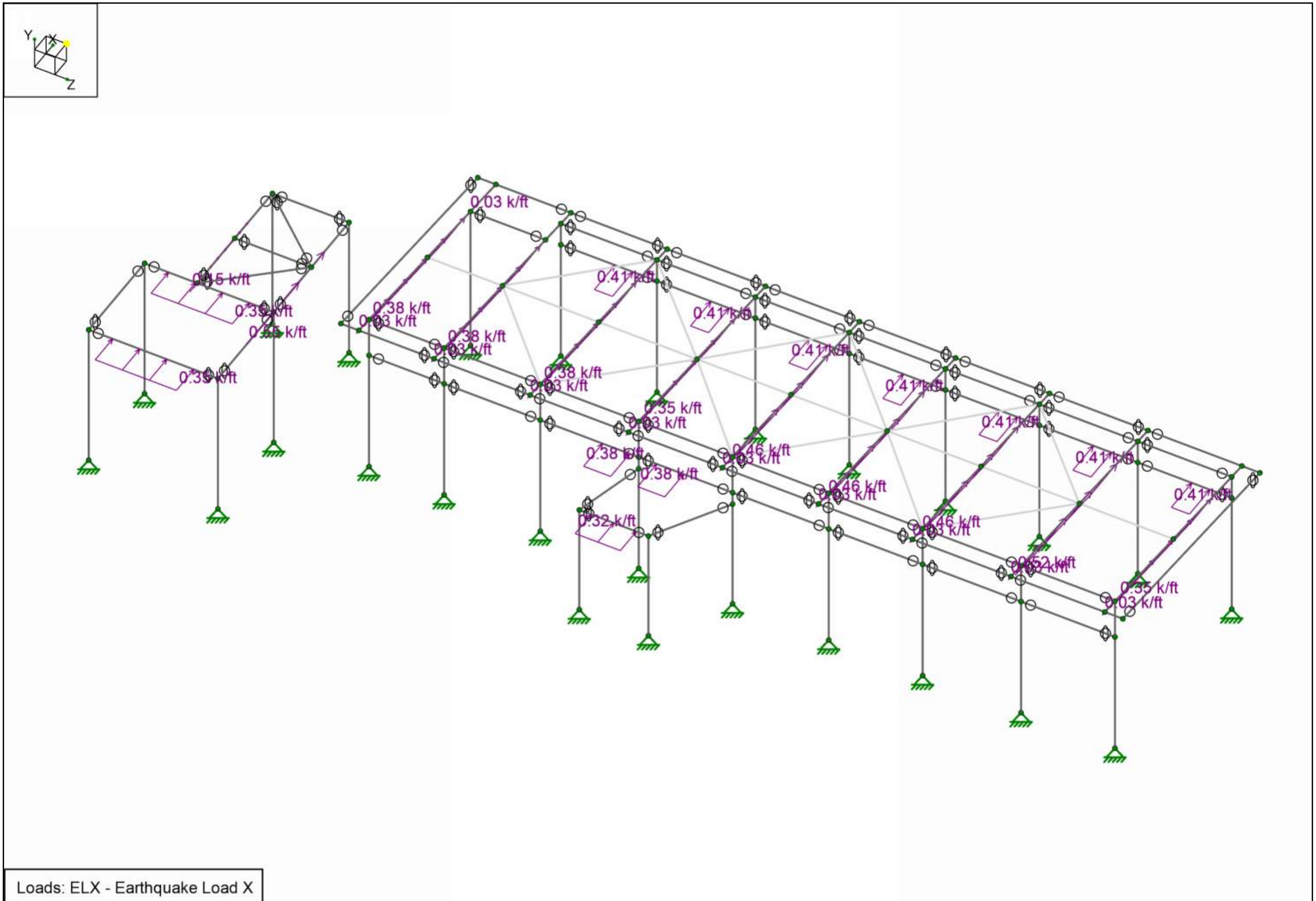
Loads: DL - Dead Load

Quantum Consulting Engineers	Switchgear Rain Screen / Conduit Support		
TVM		Apr 08, 2024 at 05:46 AM	
23444.01		24-04-01 - Rain Screen + Conduit Fram…	

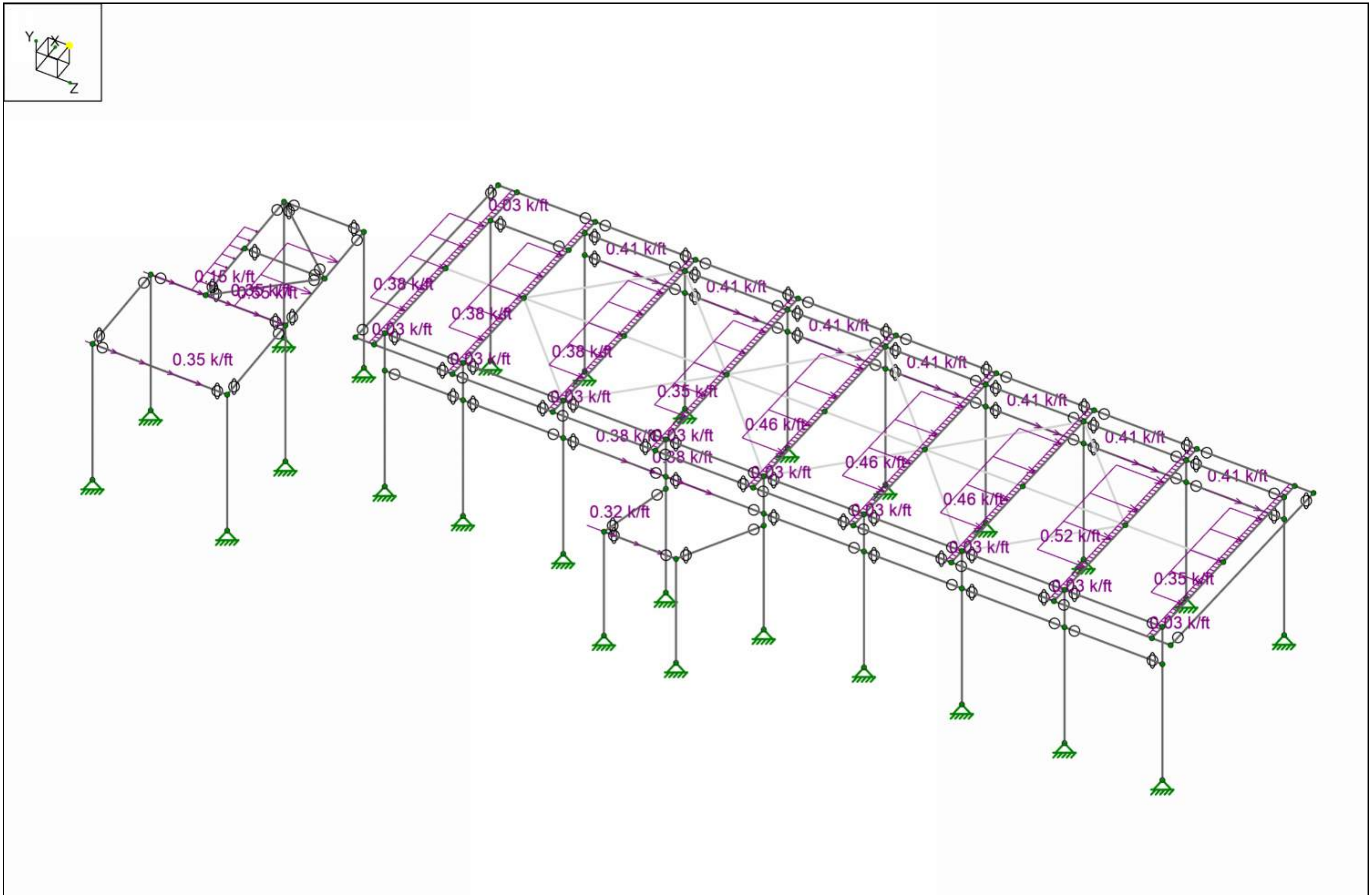


Loads: SL - Snow Load

Quantum Consulting Engineers		Switchgear Rain Screen / Conduit Support	
TVM			Apr 08, 2024 at 05:47 AM
23444.01			24-04-01 - Rain Screen + Conduit Fram…



Quantum Consulting Engineers	Switchgear Rain Screen / Conduit Support	
TVM		Apr 08, 2024 at 05:47 AM
23444.01		24-04-01 - Rain Screen + Conduit Fram…



Loads: ELZ - Earthquake Load Z

Quantum Consulting Engineers	Switchgear Rain Screen / Conduit Support	
TVM		Apr 08, 2024 at 05:47 AM
23444.01		24-04-01 - Rain Screen + Conduit Fram…

Basic Load Cases

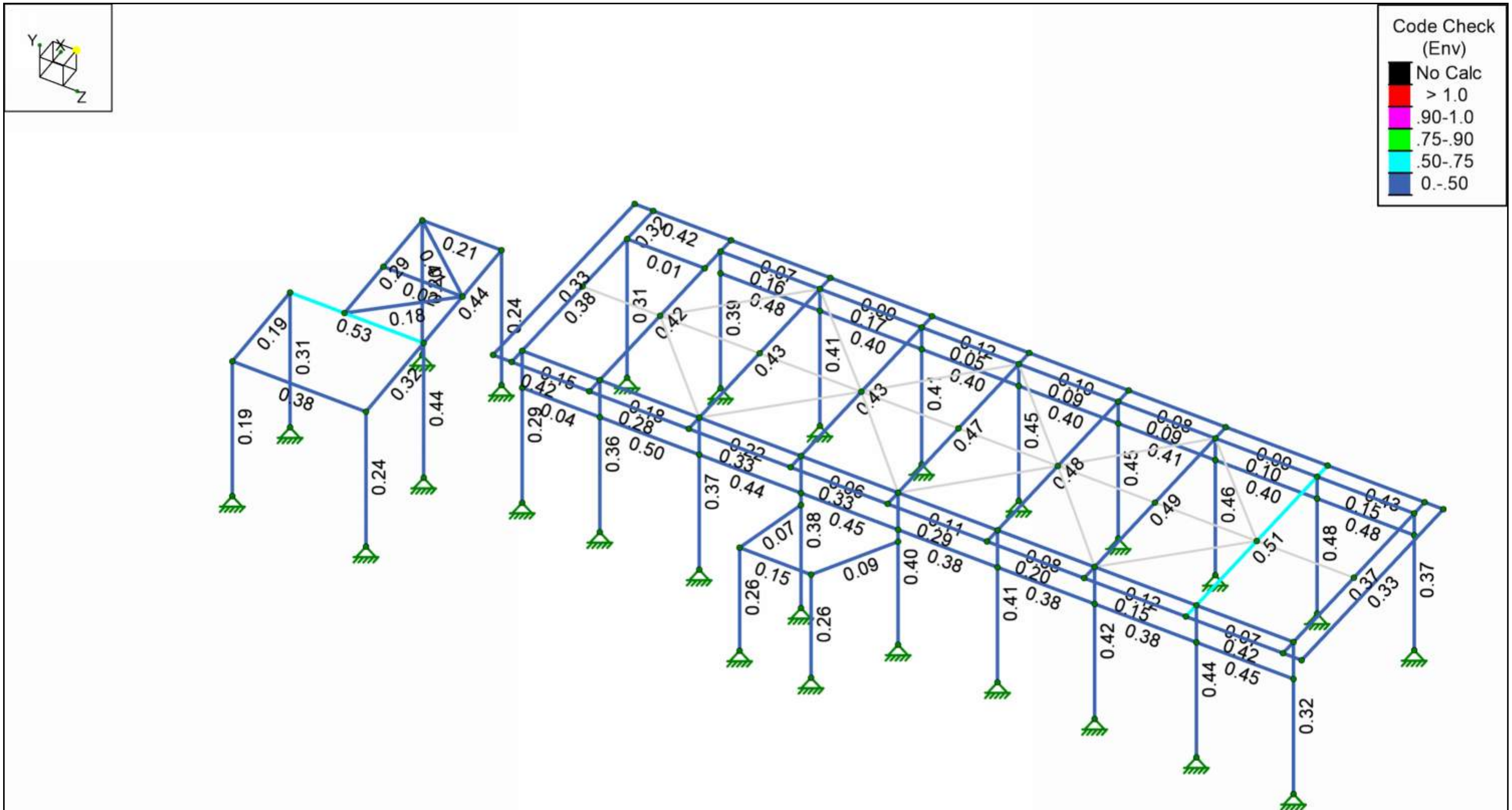
	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Distributed
1	Self Weight	DL - Dead Load		-1		
2	Snow	SL - Snow Load				12
3	EQX	ELX - Earthquake Load X	0.29			10
4	EQZ	ELZ - Earthquake Load Z			0.29	10
5	Roof DL	DL - Dead Load				12
6	Conduit	DL - Dead Load				23
7	EQX-Conduit	ELX - Earthquake Load X				23
8	EQZ-Conduit	ELZ - Earthquake Load Z				23
9	Snow-Conduit	SL - Snow Load				5

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	DEFLECTION												
2													
3	DL		Y	DL	1								
4	DL+SL		Y	DL	1	SL	1						
5	SL		Y	SL	1								
6	EQX*Cd		Y	ELX	3								
7	EXZ*Cd		Y	ELZ	3								
8	LRFD												
9	IBC 16-1	Yes	Y	DL	1.4								
10	IBC 16-3	Yes	Y	DL	1.2	SL	1.6						
11		Yes	Y	DL	1.2	SL	1.6	WL+X	0.5				
12		Yes	Y	DL	1.2	SL	1.6	WL-X	0.5				
13		Yes	Y	DL	1.2	SL	1.6	WL+Y	0.5				
14		Yes	Y	DL	1.2	SL	1.6	WL-Y	0.5				
15	IBC 16-4	Yes	Y	DL	1.2	WL+X	1						
16		Yes	Y	DL	1.2	WL-X	1						
17		Yes	Y	DL	1.2	WL+Y	1						
18		Yes	Y	DL	1.2	WL-Y	1						
19		Yes	Y	DL	1.2	WL+X	1	SL	0.5				
20		Yes	Y	DL	1.2	WL-X	1	SL	0.5				
21		Yes	Y	DL	1.2	WL+Y	1	SL	0.5				
22		Yes	Y	DL	1.2	WL-Y	1	SL	0.5				
23	IBC 16-6	Yes	Y	DL	0.9	WL+X	1						
24		Yes	Y	DL	0.9	WL-X	1						
25		Yes	Y	DL	0.9	WL+Y	1						
26		Yes	Y	DL	0.9	WL-Y	1						
27	IBC 16-5	Yes	Y	DL	1.2	SDS*DL	0.2	ELX	1	ELZ	0.3	SL	0.2
28		Yes	Y	DL	1.2	SDS*DL	0.2	ELZ	1	ELX	0.3	SL	0.2
29		Yes	Y	DL	1.2	SDS*DL	0.2	ELX	1	ELZ	-0.3	SL	0.2
30		Yes	Y	DL	1.2	SDS*DL	0.2	ELZ	1	ELX	-0.3	SL	0.2
31		Yes	Y	DL	1.2	SDS*DL	0.2	ELX	-1	ELZ	-0.3	SL	0.2
32		Yes	Y	DL	1.2	SDS*DL	0.2	ELZ	-1	ELX	-0.3	SL	0.2
33		Yes	Y	DL	1.2	SDS*DL	0.2	ELX	-1	ELZ	0.3	SL	0.2
34		Yes	Y	DL	1.2	SDS*DL	0.2	ELZ	-1	ELX	0.3	SL	0.2
35	IBC 16-7	Yes	Y	DL	0.9	SDS*DL	-0.2	ELX	1	ELZ	0.3		
36		Yes	Y	DL	0.9	SDS*DL	-0.2	ELZ	1	ELX	0.3		
37		Yes	Y	DL	0.9	SDS*DL	-0.2	ELX	1	ELZ	-0.3		
38		Yes	Y	DL	0.9	SDS*DL	-0.2	ELZ	1	ELX	-0.3		
39		Yes	Y	DL	0.9	SDS*DL	-0.2	ELX	-1	ELZ	-0.3		
40		Yes	Y	DL	0.9	SDS*DL	-0.2	ELZ	-1	ELX	-0.3		
41		Yes	Y	DL	0.9	SDS*DL	-0.2	ELX	-1	ELZ	0.3		
42		Yes	Y	DL	0.9	SDS*DL	-0.2	ELZ	-1	ELX	0.3		
43	LRFD (os)												
44	IBC 16-5 (os)		Y	DL	1.2	SDS*DL	0.2	ELX	2.5	ELZ	0.75	SL	0.2
45			Y	DL	1.2	SDS*DL	0.2	ELZ	2.5	ELX	0.75	SL	0.2
46			Y	DL	1.2	SDS*DL	0.2	ELX	2.5	ELZ	-0.75	SL	0.2
47			Y	DL	1.2	SDS*DL	0.2	ELZ	2.5	ELX	-0.75	SL	0.2
48			Y	DL	1.2	SDS*DL	0.2	ELX	-2.5	ELZ	-0.75	SL	0.2
49			Y	DL	1.2	SDS*DL	0.2	ELZ	-2.5	ELX	-0.75	SL	0.2
50			Y	DL	1.2	SDS*DL	0.2	ELX	-2.5	ELZ	0.75	SL	0.2
51			Y	DL	1.2	SDS*DL	0.2	ELZ	-2.5	ELX	0.75	SL	0.2
52	IBC 16-7 (os)		Y	DL	1	SDS*DL	-0.2	ELX	2.5	ELZ	0.75		
53			Y	DL	1	SDS*DL	-0.2	ELZ	2.5	ELX	0.75		
54			Y	DL	1	SDS*DL	-0.2	ELX	2.5	ELZ	-0.75		
55			Y	DL	1	SDS*DL	-0.2	ELZ	2.5	ELX	-0.75		
56			Y	DL	1	SDS*DL	-0.2	ELX	-2.5	ELZ	-0.75		
57			Y	DL	1	SDS*DL	-0.2	ELZ	-2.5	ELX	-0.75		

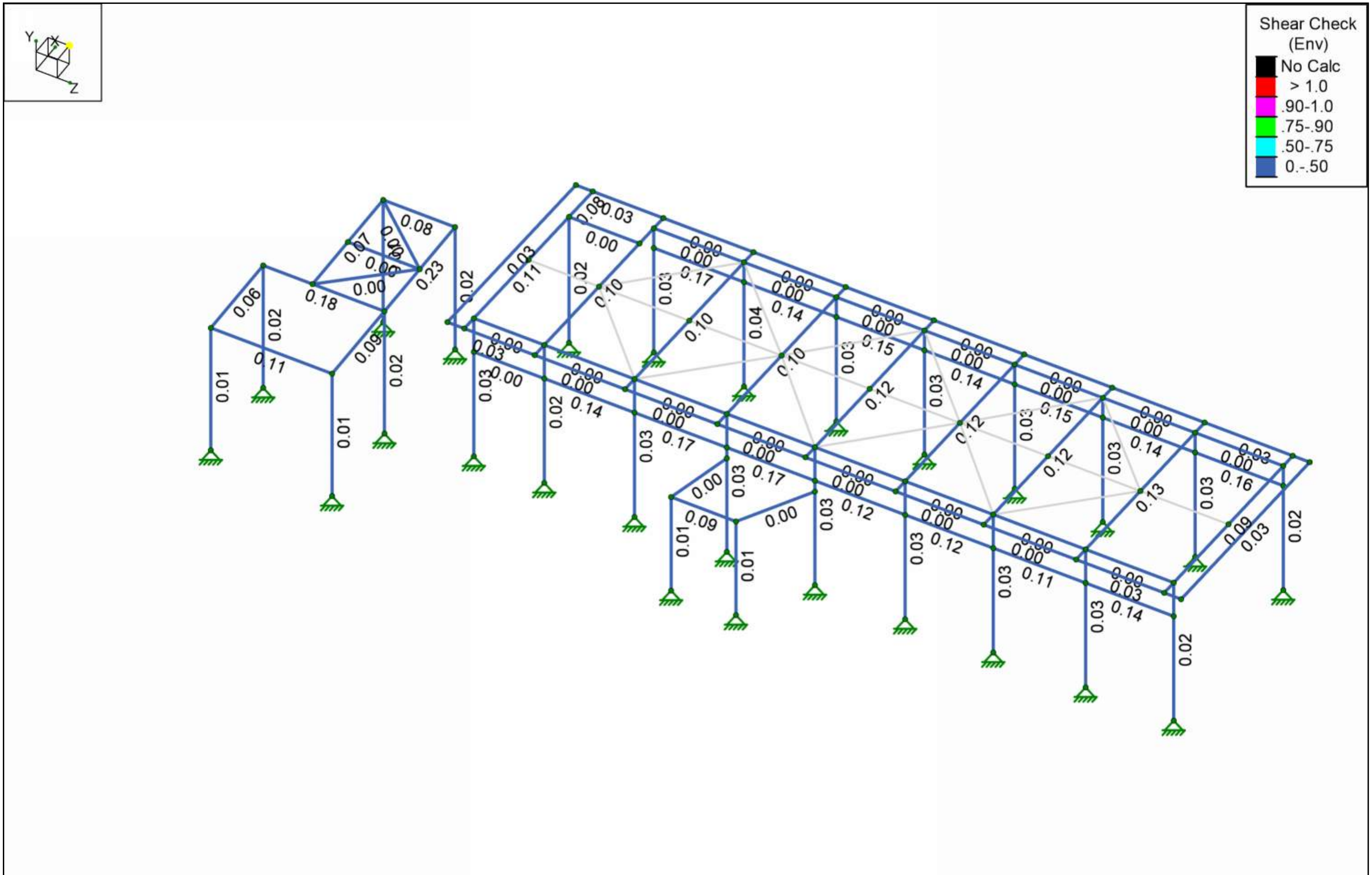
Load Combinations (Continued)

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
58			Y	DL	1	SDS*DL	-0.2	ELX	-2.5	ELZ	0.75		
59			Y	DL	1	SDS*DL	-0.2	ELZ	-2.5	ELX	0.75		
60	ASD												
61	IBC 16-12 (a)		Y	DL	1	WL+X	0.6						
62			Y	DL	1	WL-X	0.6						
63			Y	DL	1	WL+Y	0.6						
64			Y	DL	1	WL-Y	0.6						
65	IBC 16-13 (b)		Y	DL	1	WL+X	0.45	SL	0.75				
66			Y	DL	1	WL-X	0.45	SL	0.75				
67			Y	DL	1	WL+Y	0.45	SL	0.75				
68			Y	DL	1	WL-Y	0.45	SL	0.75				
69	IBC 16-15		Y	DL	0.6	WL+X	0.6						
70			Y	DL	0.6	WL-X	0.6						
71			Y	DL	0.6	WL+Y	0.6						
72			Y	DL	0.6	WL-Y	0.6						
73	IBC 16-12		Y	DL	1	SDS*DL	0.14	ELX	0.7	ELZ	0.21		
74			Y	DL	1	SDS*DL	0.14	ELZ	0.7	ELX	0.21		
75			Y	DL	1	SDS*DL	0.14	ELX	0.7	ELZ	-0.21		
76			Y	DL	1	SDS*DL	0.14	ELZ	0.7	ELX	-0.21		
77			Y	DL	1	SDS*DL	0.14	ELX	-0.7	ELZ	-0.21		
78			Y	DL	1	SDS*DL	0.14	ELZ	-0.7	ELX	-0.21		
79			Y	DL	1	SDS*DL	0.14	ELX	-0.7	ELZ	0.21		
80			Y	DL	1	SDS*DL	0.14	ELZ	-0.7	ELX	0.21		
81	IBC 16-14		Y	DL	1	SDS*DL	0.105	ELX	0.525	ELZ	0.158	SL	0.75
82			Y	DL	1	SDS*DL	0.105	ELZ	0.525	ELX	0.158	SL	0.75
83			Y	DL	1	SDS*DL	0.105	ELX	0.525	ELZ	-0.158	SL	0.75
84			Y	DL	1	SDS*DL	0.105	ELZ	0.525	ELX	-0.158	SL	0.75
85			Y	DL	1	SDS*DL	0.105	ELX	-0.525	ELZ	-0.158	SL	0.75
86			Y	DL	1	SDS*DL	0.105	ELZ	-0.525	ELX	-0.158	SL	0.75
87			Y	DL	1	SDS*DL	0.105	ELX	-0.525	ELZ	0.158	SL	0.75
88			Y	DL	1	SDS*DL	0.105	ELZ	-0.525	ELX	0.158	SL	0.75
89	IBC 16-16		Y	DL	0.6	SDS*DL	-0.14	ELX	0.7	ELZ	0.21		
90			Y	DL	0.6	SDS*DL	-0.14	ELZ	0.7	ELX	0.21		
91			Y	DL	0.6	SDS*DL	-0.14	ELX	0.7	ELZ	-0.21		
92			Y	DL	0.6	SDS*DL	-0.14	ELZ	0.7	ELX	-0.21		
93			Y	DL	0.6	SDS*DL	-0.14	ELX	-0.7	ELZ	-0.21		
94			Y	DL	0.6	SDS*DL	-0.14	ELZ	-0.7	ELX	-0.21		
95			Y	DL	0.6	SDS*DL	-0.14	ELX	-0.7	ELZ	0.21		
96			Y	DL	0.6	SDS*DL	-0.14	ELZ	-0.7	ELX	0.21		



Member Code Checks Displayed (Enveloped)
Envelope Only Solution

Quantum Consulting Engineers	Switchgear Rain Screen / Conduit Support	
TVM		Apr 08, 2024 at 05:51 AM
23444.01		24-04-01 - Rain Screen + Conduit Fram...



Member Shear Checks Displayed (Enveloped)
Envelope Only Solution

Quantum Consulting Engineers	Switchgear Rain Screen / Conduit Support	
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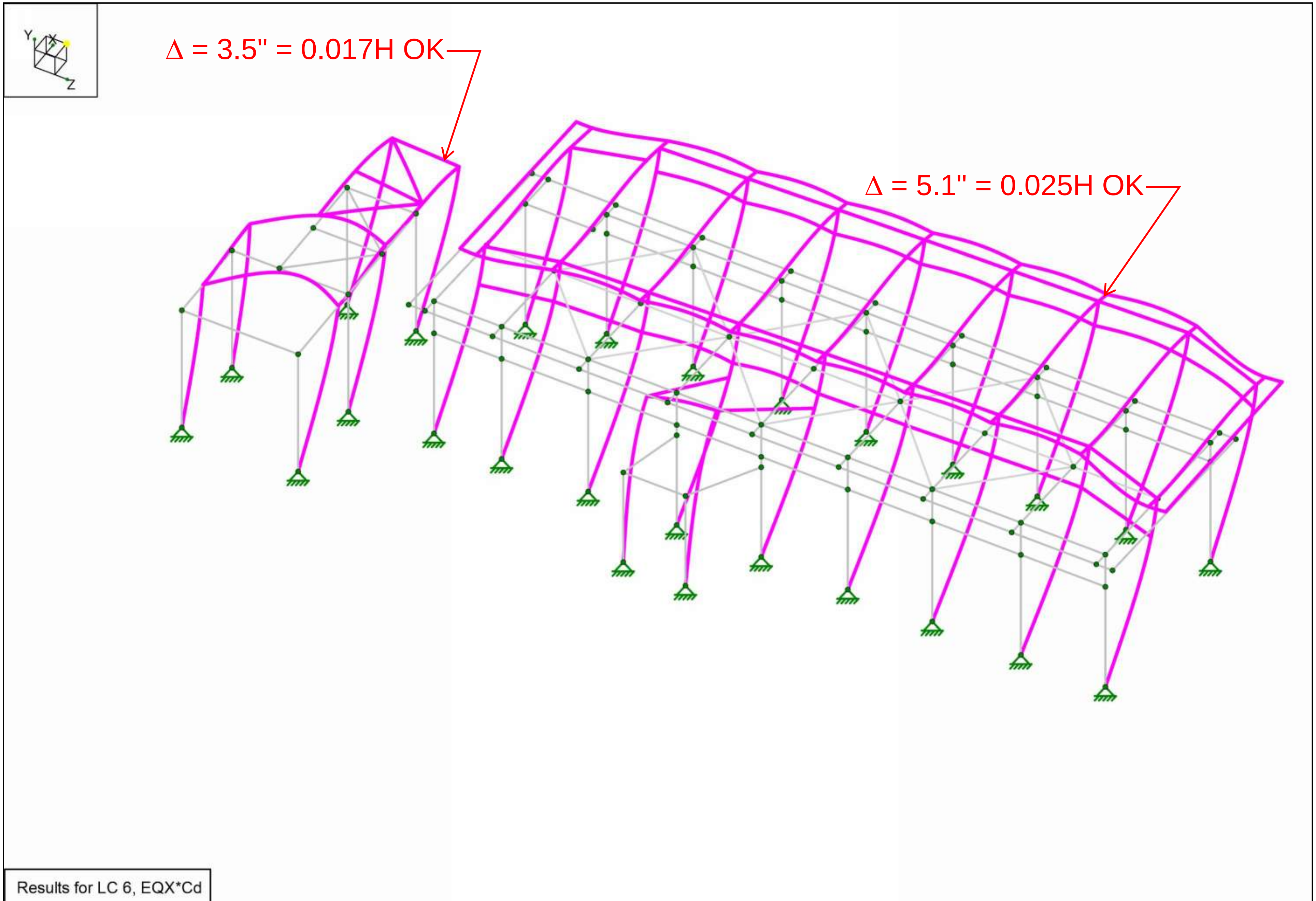
23444.01		24-04-01 - Rain Screen + Conduit Fram...



Quantum Consulting Engineers	Switchgear Rain Screen / Conduit Support	
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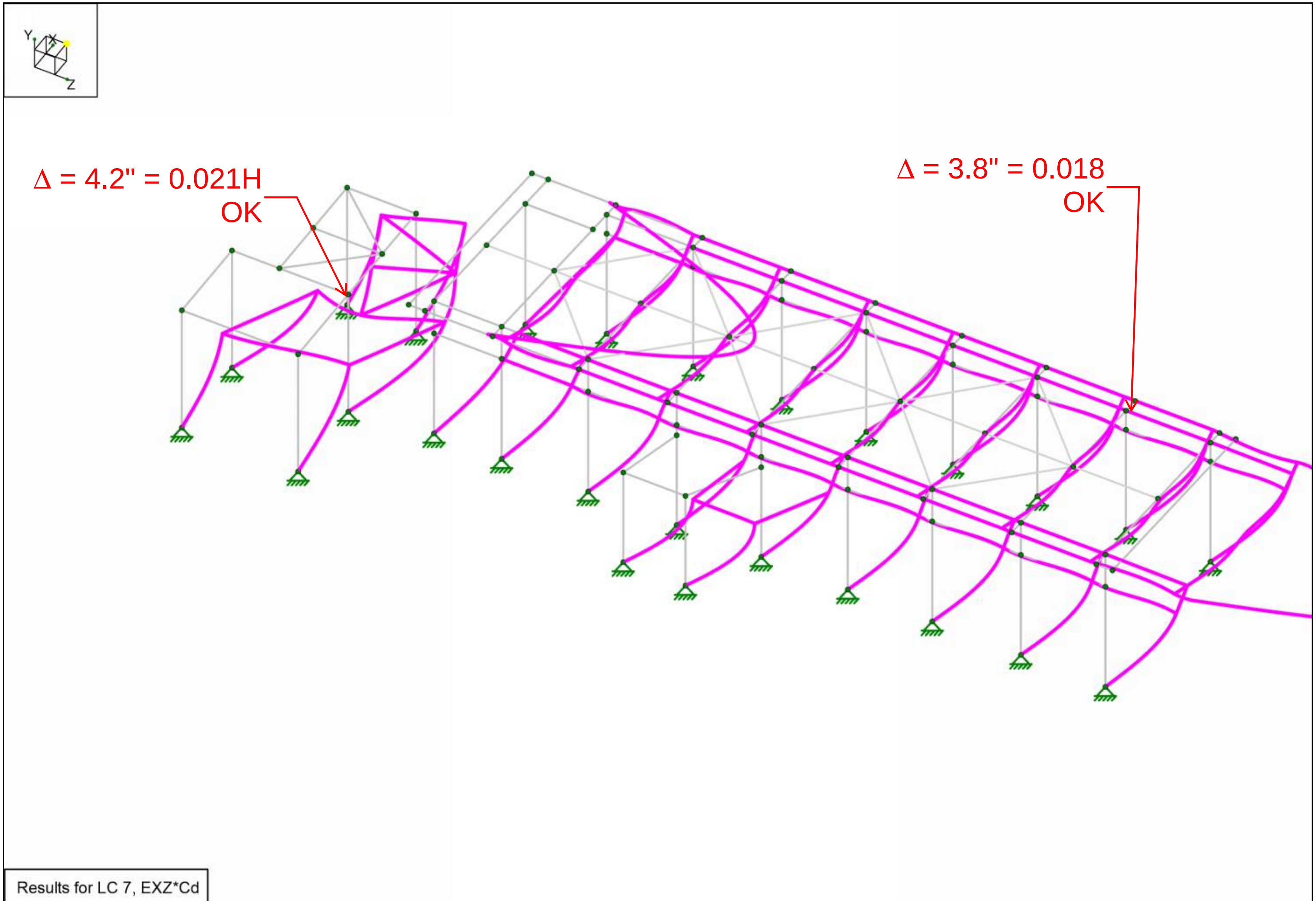
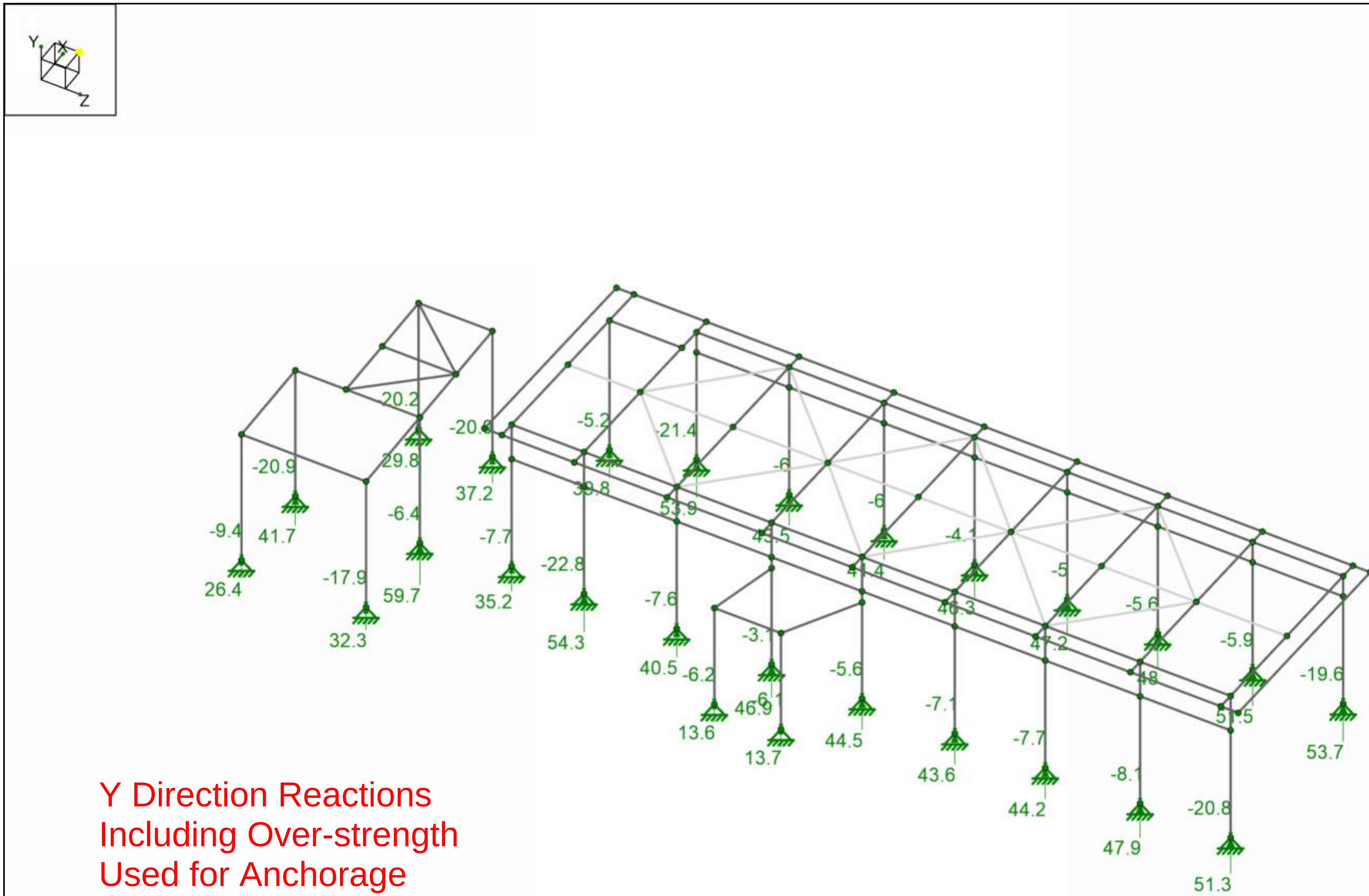


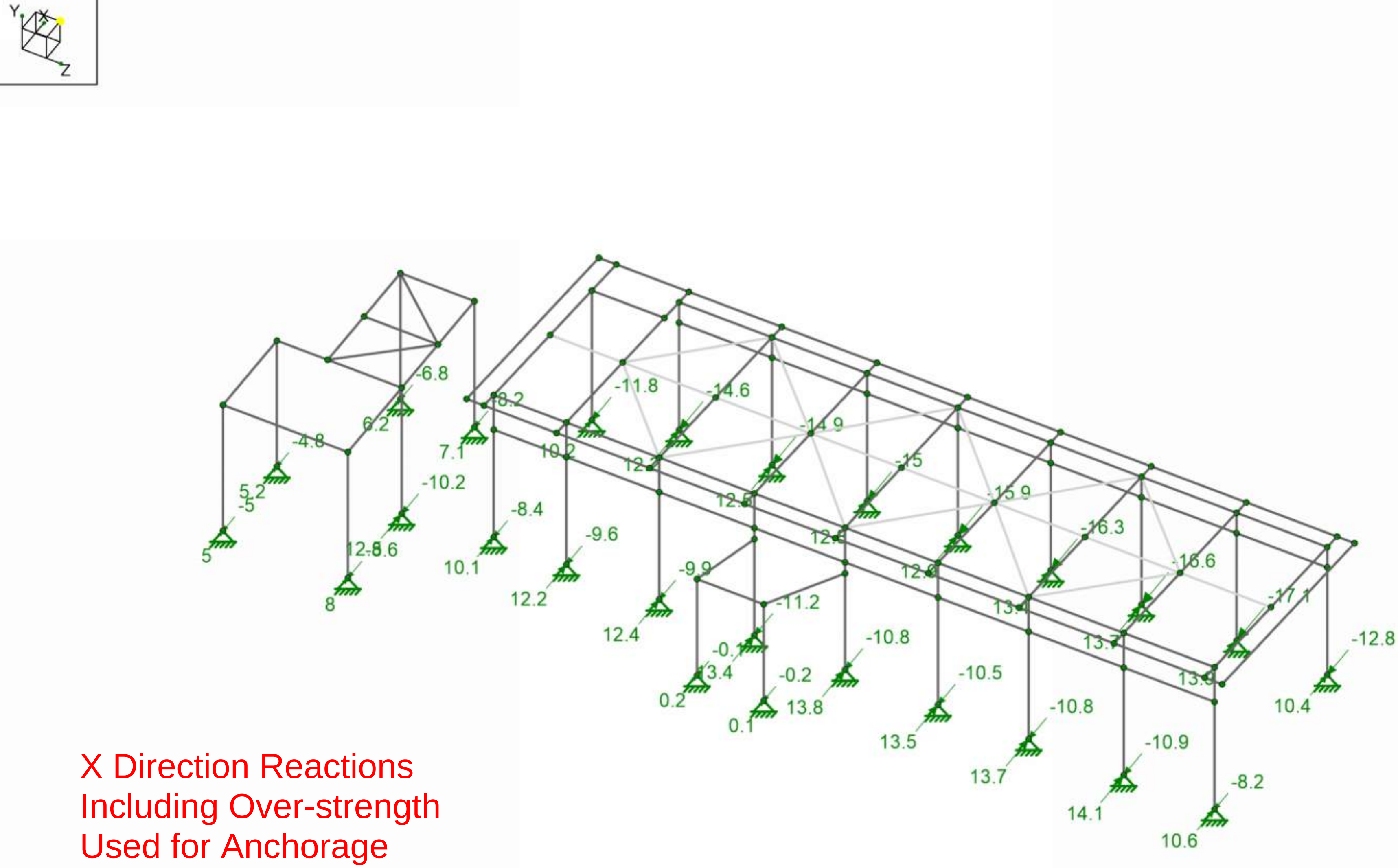
Quantum Consulting Engineers	Switchgear Rain Screen / Conduit Support	
TVM		Apr 08, 2024 at 05:57 AM
23444.01		24-04-01 - Rain Screen + Conduit Fram...



Y Direction Reactions
Including Over-strength
Used for Anchorage
Design

Envelope Only Solution
Y-direction Reaction Units are kips and kip-ft (Enveloped)

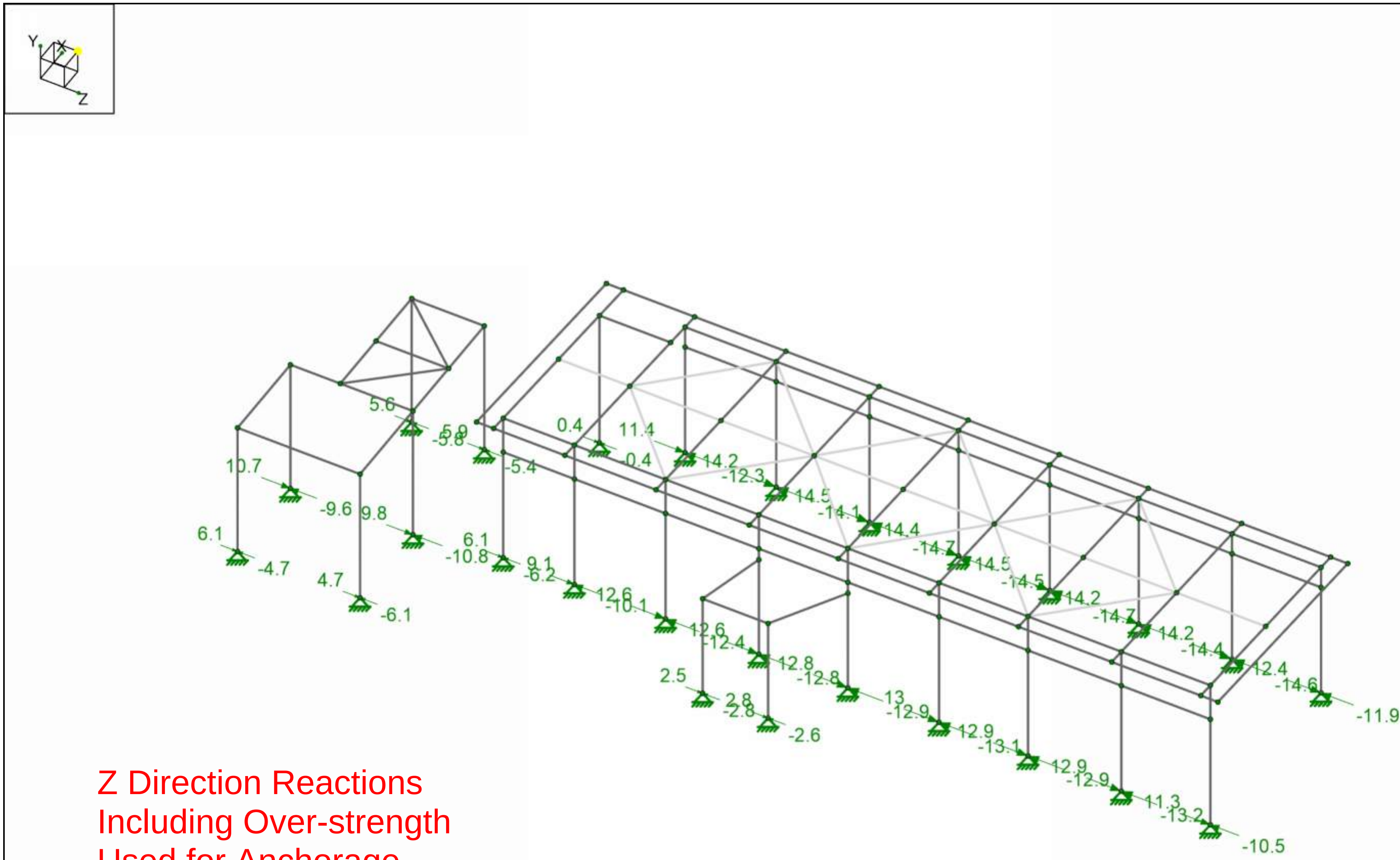
Quantum Consulting Engineers	Switchgear Rain Screen / Conduit Support	
TVM		Apr 08, 2024 at 06:04 AM
23444.01		24-04-01 - Rain Screen + Conduit Fram...



X Direction Reactions
Including Over-strength
Used for Anchorage
Design

Envelope Only Solution
X-direction Reaction Units are kips and kip-ft (Enveloped)

Quantum Consulting Engineers	Switchgear Rain Screen / Conduit Support	
TVM		Apr 08, 2024 at 06:06 AM
23444.01		24-04-01 - Rain Screen + Conduit Fram...



Z Direction Reactions
Including Over-strength
Used for Anchorage
Design

Envelope Only Solution
Z-direction Reaction Units are kips and kip-ft (Enveloped)

Quantum Consulting Engineers	Switchgear Rain Screen / Conduit Support	
TVM		Apr 08, 2024 at 06:07 AM
23444.01		24-04-01 - Rain Screen + Conduit Fram...

Bolted Flange Plate Moment Connection

AISC 360-16 & 341-16

Beams and Forces

Beam	Shape	Depth	Flange bf	Flange tf	Web tw	Fy	Moment Mu	Shear Vu	Axial Pu
1	W12x26	12.2 in	6.49 in	0.38 in	0.23 in	50 ksi	164.61 k-ft	29.44 k	26.28 k
2	W21x50	20.8 in	6.53 in	0.535 in	0.38 in	50 ksi	290.6 k-ft	43.95 k	17.13 k
3	W14x30	13.8 in	6.73 in	0.385 in	0.27 in	50 ksi	179.73 k-ft	31.9 k	9.84 k
4	W12x26	12.2 in	6.49 in	0.38 in	0.23 in	50 ksi	35.27 k-ft	13.08 k	2.36 k

Flanges Forces — **Use 7/8"Ø A325-N** — ϕRn = 24.3 k; Ø = 0.875 in

Beam	Moment T/C	Axial T/C	Combined T/C	# Bolts	
1	161.9 k	13.1 k	175.1 k	7.20	Use (4) rows (8) Bolts
2	167.7 k	8.6 k	176.2 k	7.25	
3	156.3 k	4.9 k	161.2 k	6.63	
4	34.7 k	1.2 k	35.9 k	1.48	Use (2) rows (4) Bolts

Flange Check — ϕ = 0.90; ϕ = 0.75; Fu = 65 ksi

Beam	Flange Area	Tension Yeild	Add'l t	Net Area	U	Rupture	Add'l t
1	2.47 sqin	111.0 k	0.22 in	2.09 sqin	0.85	86.447 k	0.53 in
2	3.49 sqin	157.2 k	0.06 in	2.96 sqin	0.85	122.59 k	0.23 in
3	2.59 sqin	116.6 k	0.15 in	2.21 sqin	0.85	91.413 k	0.29 in
4	2.47 sqin	111.0 k	0.00 in	2.09 sqin	1.85	188.15 k	0.00 in

Flange Plate — Width = 12 in

Beam	T_Min
1	0.66 in
2	0.66 in
3	0.55 in

SIMPSON Strong-Tie®

Anchor Designer™
Software
Version 3.0.7947.0

Company:	QCE	Date:	3/20/2024
Engineer:	TVM	Page:	1/6
Project:	Centeris		
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description: Thickened Edge Anchorage
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-19
Units: Imperial units

Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.875
Effective Embedment depth, h_{ef} (inch): 16.000
Code report: ICC-ES ESR-4057
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 18.00
c_{ac} (inch): 40.06
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 24.00
State: Cracked
Compressive strength, f'_c (psi): 3000
$\Psi_{c,V}$: 1.0
Reinforcement condition: A tension, A shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: No
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 18.00 x 18.00 x 0.25
Yield stress: 36000 psi

Profile type/size: HSS12X12X1/2

Recommended Anchor
Anchor Name: SET-3G - SET-3G w/ 7/8"Ø F1554 Gr. 36
Code Report: ICC-ES ESR-4057

SIMPSON Strong-Tie®

Anchor Designer™
Software
Version 3.0.7947.0

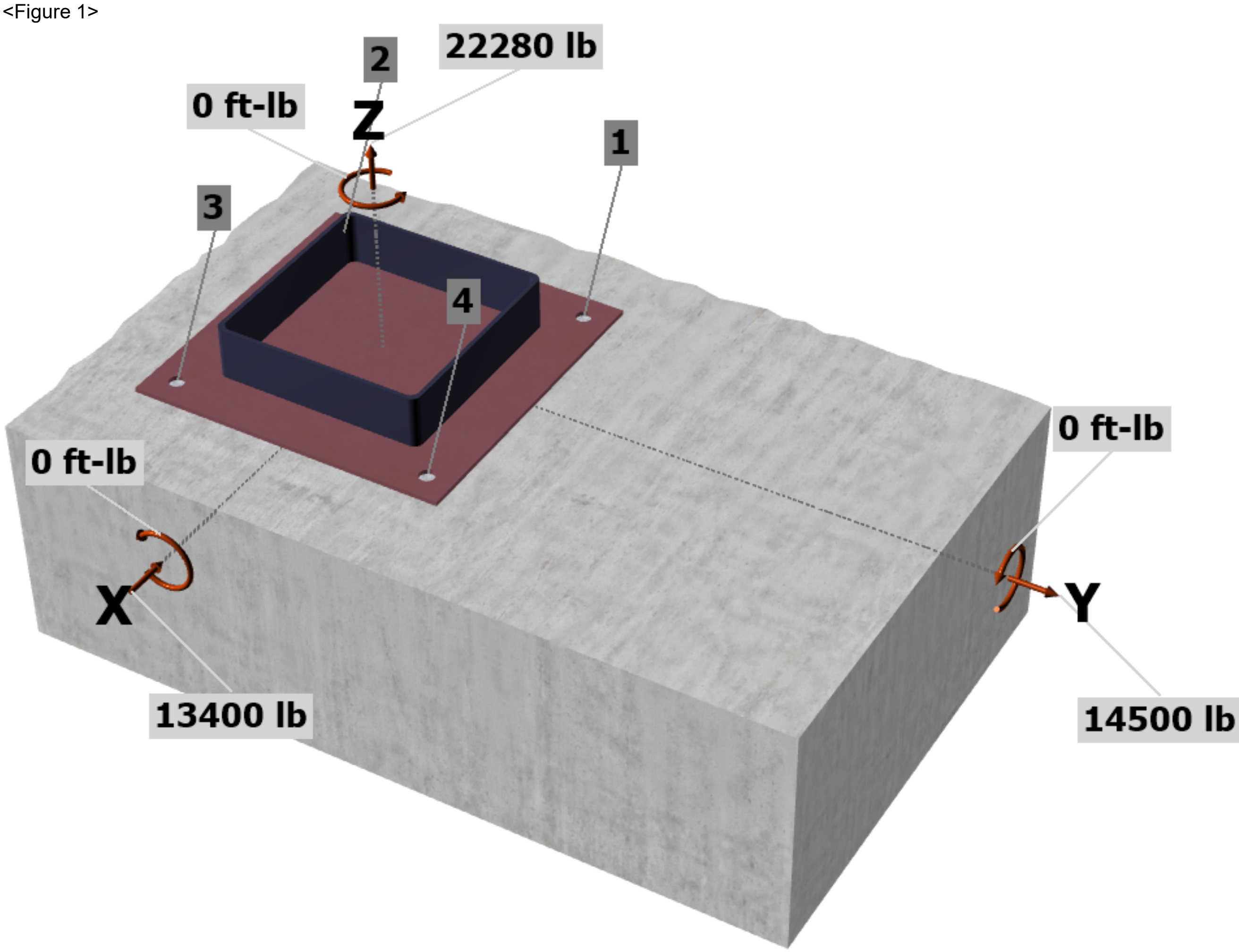
Company:	QCE	Date:	3/20/2024
Engineer:	TVM	Page:	2/6
Project:	Centeris		
Address:			
Phone:			
E-mail:			

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: No
Ductility section for tension: 17.2.3.4.3 (d) is satisfied
Ductility section for shear: 17.2.3.5.3 (c) is satisfied
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: 22280
V_{uax} [lb]: -13400
V_{uay} [lb]: 14500
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>

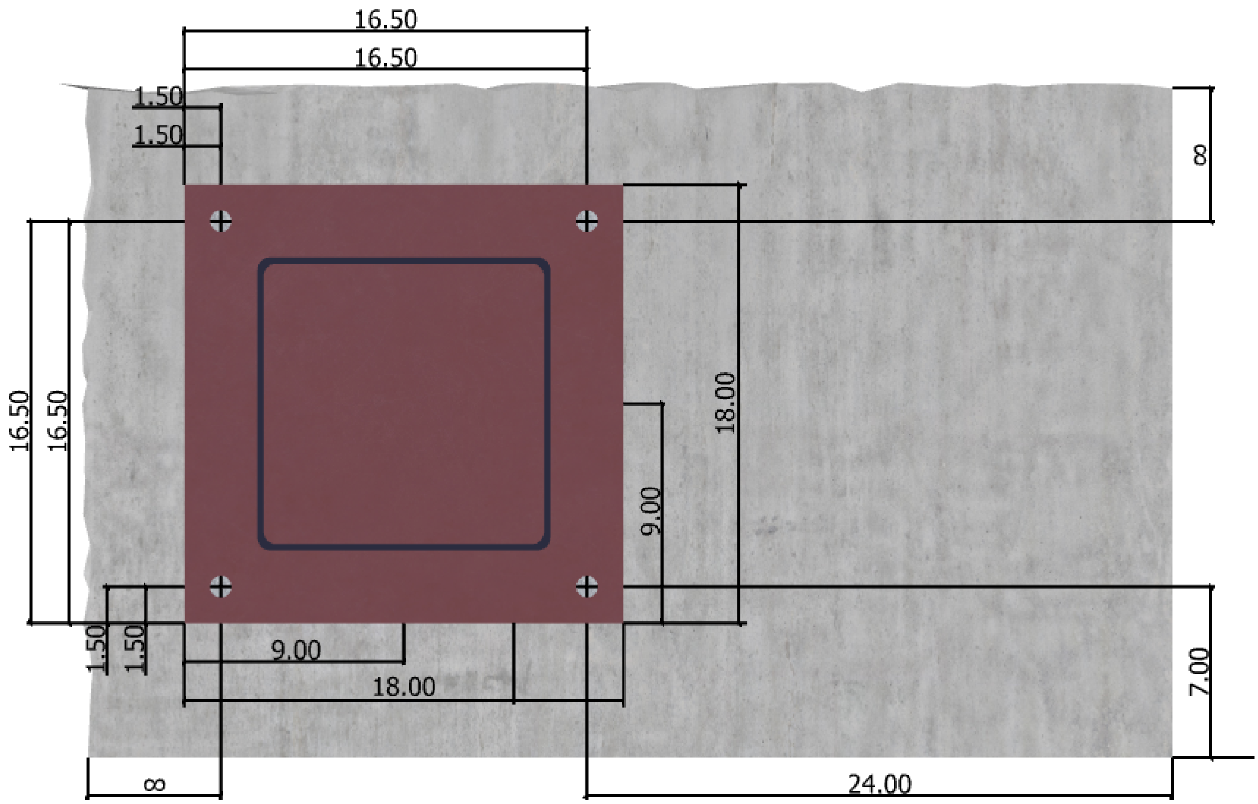


SIMPSON Strong-Tie®

Anchor Designer™
Software
Version 3.0.7947.0

Company:	QCE	Date:	3/20/2024
Engineer:	TVM	Page:	3/6
Project:	Centeris		
Address:			
Phone:			
E-mail:			

<Figure 2>

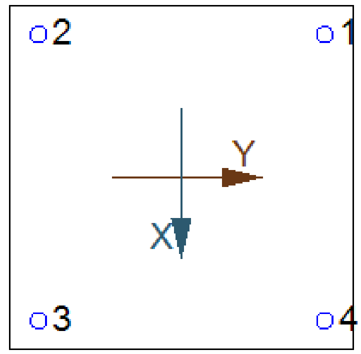


3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	5570.0	-3350.0	3625.0	4935.9
2	5570.0	-3350.0	3625.0	4935.9
3	5570.0	-3350.0	3625.0	4935.9
4	5570.0	-3350.0	3625.0	4935.9
Sum	22280.0	-13400.0	14500.0	19743.6

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 22280
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
26795	0.75	20096

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.4.2.2a)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	3000	16.000	59592

$0.75\phi N_{cbg} = 0.75\phi\,(A_{Nc} / A_{Nco})\,\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b$ (Sec. 17.3.1 & Eq. 17.4.2.1b)

A_{Nc} (in^2)	A_{Nco} (in^2)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	$0.75\phi N_{cbg}$ (lb)
2898.00	2304.00	7.00	1.000	0.788	1.00	1.000	59592	0.75	33203

6. Adhesive Strength of Anchor in Tension (Sec. 17.4.5)

$\tau_{k,cr} = \tau_{k,cr} f_{short\text{-}term} K_{sat} (f'_c / 2{,}500)^n \alpha_{N.seis}$

$\tau_{k,cr}$ (psi)	$f_{short\text{-}term}$	K_{sat}	$\alpha_{N.seis}$	f'_c (psi)	n	$\tau_{k,cr}$ (psi)
1265	1.00	1.00	1.00	3000	0.24	1322

$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef}$ (Eq. 17.4.5.2)

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	1322	0.88	16.000	58126

$0.75\phi N_{ag} = 0.75\phi\,(A_{Na} / A_{Na0})\,\Psi_{ec,Na}\Psi_{ed,Na}\Psi_{cp,Na}N_{ba}$ (Sec. 17.3.1 & Eq. 17.4.5.1b)

A_{Na} (in^2)	A_{Na0} (in^2)	c_{Na} (in)	$c_{a,min}$ (in)	$\Psi_{ec,Na}$	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	N_{ba}(lb)	ϕ	$0.75\phi N_{ag}$ (lb)
1294.16	547.63	11.70	7.00	1.000	0.879	1.000	58126	0.65	58894

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8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\alpha_{V,seis}$	$\phi_{grout}\alpha_{V,seis}\phi V_{sa}$ (lb)
16080	1.0	0.65	0.75	7839

9. Concrete Breakout Strength of Anchor in Shear (Sec. 17.5.2)

Shear perpendicular to edge in y-direction:

$V_{by} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. 17.5.2.2a & Eq. 17.5.2.2b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{by} (lb)
7.00	0.875	1.00	3000	39.00	120060

$\phi V_{cbgy} = \phi\ (A_{Vc} / A_{Vco})\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by}$ (Sec. 17.3.1 & Eq. 17.5.2.1b)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgy} (lb)
1932.00	6844.50	1.000	0.736	1.000	1.561	120060	0.75	29202

Shear parallel to edge in y-direction:

$V_{bx} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. 17.5.2.2a & Eq. 17.5.2.2b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{bx} (lb)
7.00	0.875	1.00	3000	24.00	57959

$\phi V_{cbgy} = \phi\ (2)(A_{Vc} / A_{Vco})\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{bx}$ (Sec. 17.3.1, 17.5.2.1(c) & Eq. 17.5.2.1b)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbgy} (lb)
1392.00	2592.00	1.000	1.000	1.000	1.225	57959	0.75	57182

Shear parallel to edge in x-direction:

$V_{by} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. 17.5.2.2a & Eq. 17.5.2.2b)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{by} (lb)
7.00	0.875	1.00	3000	7.00	9130

$\phi V_{cbgx} = \phi\ (2)(A_{Vc} / A_{Vco})\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{by}$ (Sec. 17.3.1, 17.5.2.1(c) & Eq. 17.5.2.1b)

A_{Vc} (in^2)	A_{Vco} (in^2)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{by} (lb)	ϕ	ϕV_{cbgx} (lb)
378.00	220.50	1.000	1.000	1.000	1.000	9130	0.75	23476

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$\phi V_{cpg} = \phi \min|k_{cp}N_{ag}\ ;\ k_{cp}N_{cbg}| = \phi \min|k_{cp}(A_{Na} / A_{Na0})\Psi_{ec,Na}\Psi_{ed,Na}\Psi_{cp,Na}N_{ba}\ ;\ k_{cp}(A_{Nc} / A_{Nco})\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b|$ (Sec. 17.3.1 & Eq. 17.5.3.1b)

k_{cp}	A_{Na} (in^2)	A_{Na0} (in^2)	$\Psi_{ed,Na}$	$\Psi_{ec,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	N_a (lb)
2.0	1294.16	547.63	0.879	1.000	1.000	58126	120808

A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	N_{cb} (lb)	ϕ
2898.00	2304.00	1.000	0.788	1.000	1.000	59592	59028	0.70

ϕV_{cpg} (lb)
82639

11. Results

Interaction of Tensile and Shear Forces (Sec. R17.6)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status
Steel	5570	20096	0.28	Pass

Concrete breakout	**22280**	**33203**	**0.67**	**Pass (Governs)**
Adhesive	22280	58894	0.38	Pass

Shear	Factored Load, V_{ua} (lb)	Design Strength, $øV_n$ (lb)	Ratio	Status
Steel	**4936**	**7839**	**0.63**	**Pass (Governs)**
T Concrete breakout y+	14500	29202	0.50	Pass
|| Concrete breakout y+	6700	57182	0.12	Pass
|| Concrete breakout x+	7250	23476	0.31	Pass
Concrete breakout, combined	-	-	0.33	Pass
Pryout	19744	82639	0.24	Pass

Interaction check	$(N_{ua}/\phi N_{ua})^{5/3}$	$(V_{ua}/\phi V_{ua})^{5/3}$	Combined Ratio	Permissible	Status
Sec. R17.6	0.51	0.46	97.7%	1.0	Pass

SET-3G w/ 7/8"Ø F1554 Gr. 36 with hef = 16.000 inch meets the selected design criteria.

12. Warnings

- Per designer input, ductility requirements for tension have been determined to be satisfied – designer to verify.

- Per designer input, ductility requirements for shear have been determined to be satisfied – designer to verify.

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

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1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description: Plinth Anchorage
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-19
Units: Imperial units

Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.875
Effective Embedment depth, h_{ef} (inch): 17.000
Code report: ICC-ES ESR-4057
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 19.00
c_{ac} (inch): 39.16
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 30.00
State: Cracked
Compressive strength, f'_c (psi): 3000
$\Psi_{c,V}$: 1.0
Reinforcement condition: A tension, A shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: Yes
Ignore concrete breakout in shear: Yes
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 18.00 x 18.00 x 0.25
Yield stress: 36000 psi

Profile type/size: HSS12X12X1/2

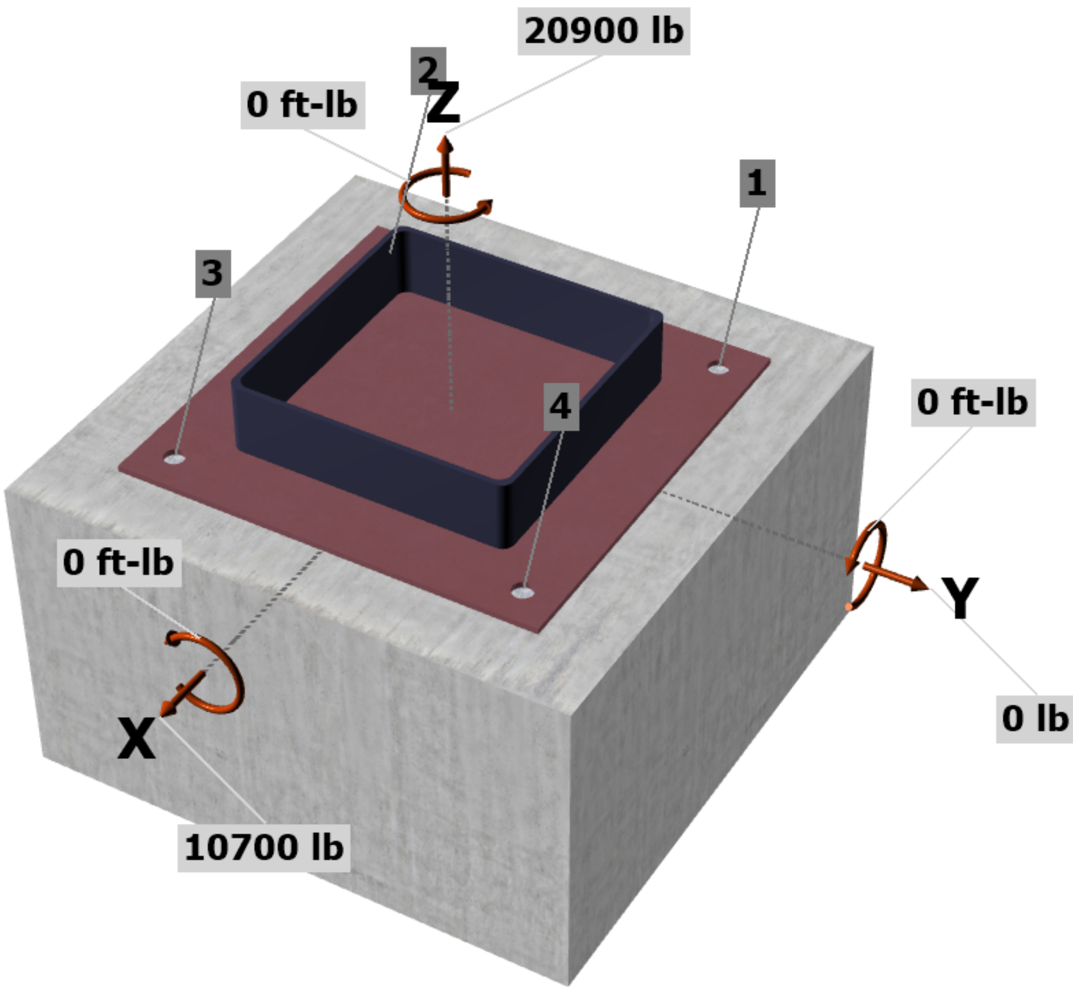
Recommended Anchor
Anchor Name: SET-3G - SET-3G w/ 7/8"Ø F1554 Gr. 36
Code Report: ICC-ES ESR-4057

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: No
Ductility section for tension: 17.2.3.4.3 (d) is satisfied
Ductility section for shear: 17.2.3.5.3 (c) is satisfied
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: 20900
V_{uax} [lb]: 10700
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



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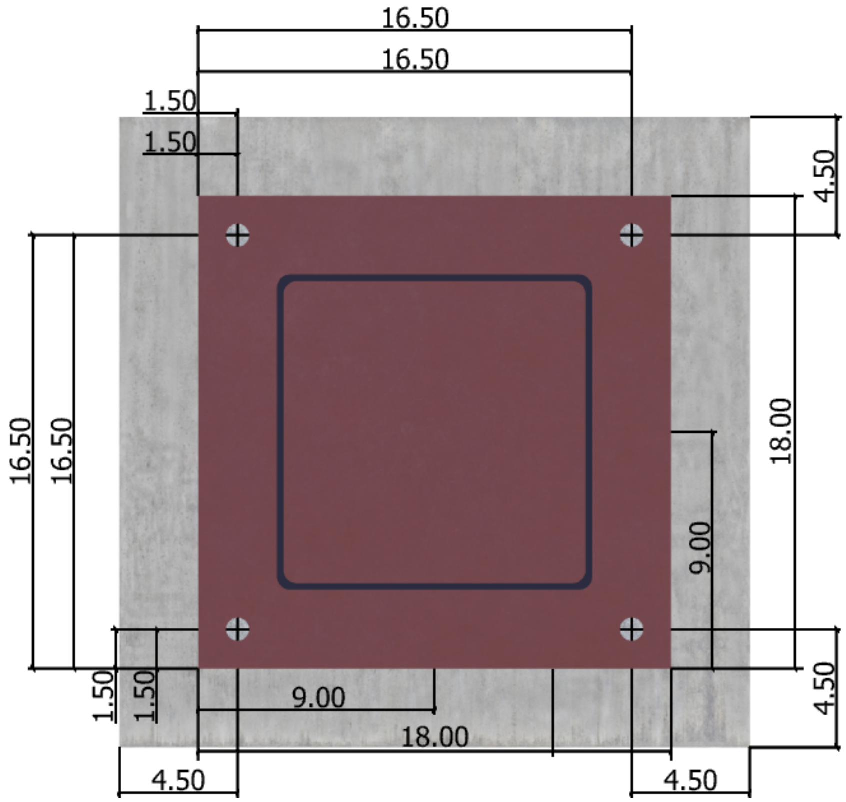
<Figure 2>



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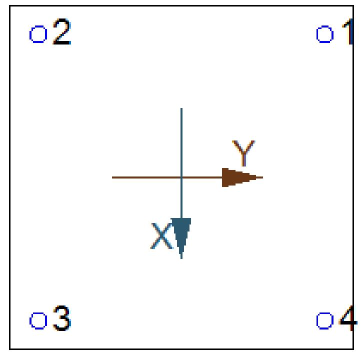
3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	5225.0	2675.0	0.0	2675.0
2	5225.0	2675.0	0.0	2675.0
3	5225.0	2675.0	0.0	2675.0
4	5225.0	2675.0	0.0	2675.0
Sum	20900.0	10700.0	0.0	10700.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 0
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
26795	0.75	20096

6. Adhesive Strength of Anchor in Tension (Sec. 17.4.5)

$\tau_{k,cr} = \tau_{k,cr} f_{short\text{-}term} K_{sat} (f'_c / 2{,}500)^n \alpha_{N.seis}$

$\tau_{k,cr}$ (psi)	$f_{short\text{-}term}$	K_{sat}	$\alpha_{N.seis}$	f'_c (psi)	n	$\tau_{k,cr}$ (psi)
1265	1.00	1.00	1.00	3000	0.24	1322

$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef}$ (Eq. 17.4.5.2)

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	1322	0.88	17.000	61759

$0.75\phi N_{ag} = 0.75\phi\,(A_{Na} / A_{Na0})\,\Psi_{ec,Na}\Psi_{ed,Na}\Psi_{cp,Na}N_{ba}$ (Sec. 17.3.1 & Eq. 17.4.5.1b)

A_{Na} (in^2)	A_{Na0} (in^2)	c_{Na} (in)	$c_{a,min}$ (in)	$\Psi_{ec,Na}$	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	N_{ba}(lb)	ϕ	$0.75\phi N_{ag}$ (lb)
576.00	547.63	11.70	4.50	1.000	0.815	1.000	61759	0.65	25821

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8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\alpha_{V,seis}$	$\phi_{grout}\alpha_{V,seis}\phi V_{sa}$ (lb)
16080	1.0	0.65	0.75	7839

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$\phi V_{cpg} = \phi \min|k_{cp}N_{ag} ; k_{cp}N_{cbg}| = \phi \min|k_{cp}(A_{Na} / A_{Na0}) \Psi_{ec,Na} \Psi_{ed,Na} \Psi_{cp,Na} N_{ba} ; k_{cp}(A_{Nc} / A_{Nco}) \Psi_{ec,N} \Psi_{ed,N} \Psi_{c,N} \Psi_{cp,N} N_b|$ (Sec. 17.3.1 & Eq. 17.5.3.1b)

k_{cp}	A_{Na} (in^2)	A_{Na0} (in^2)	$\Psi_{ed,Na}$	$\Psi_{ec,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	N_a (lb)
2.0	576.00	547.63	0.815	1.000	1.000	61759	52966

A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	N_{cb} (lb)	ϕ
576.00	225.00	1.000	0.880	1.000	1.000	10410	23452	0.70

ϕV_{cpg} (lb)
32833

11. Results

Interaction of Tensile and Shear Forces (Sec. R17.6)

Tension	Factored Load, N_{ua} (lb)	Design Strength, ϕN_n (lb)	Ratio	Status
Steel	5225	20096	0.26	Pass
Adhesive	**20900**	**25821**	**0.81**	**Pass (Governs)**

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	**2675**	**7839**	**0.34**	**Pass (Governs)**
Pryout	10700	32833	0.33	Pass

Interaction check	$(N_{ua}/\phi N_{ua})^{5/3}$	$(V_{ua}/\phi V_{ua})^{5/3}$	Combined Ratio	Permissible	Status
Sec. R17.6	0.70	0.17	87.0%	1.0	Pass

SET-3G w/ 7/8"Ø F1554 Gr. 36 with hef = 17.000 inch meets the selected design criteria.

12. Warnings

- Concrete breakout strength in tension has not been evaluated against applied tension load(s) per designer option. Refer to ACI 318 Section 17.3.2.1 for conditions where calculations of the concrete breakout strength may not be required.

- Concrete breakout strength in shear has not been evaluated against applied shear load(s) per designer option. Refer to ACI 318 Section 17.3.2.1 for conditions where calculations of the concrete breakout strength may not be required.

- Per designer input, ductility requirements for tension have been determined to be satisfied – designer to verify.

- Per designer input, ductility requirements for shear have been determined to be satisfied – designer to verify.

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

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1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description: Footing Anchorage
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-19
Units: Imperial units

Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.875
Effective Embedment depth, h_{ef} (inch): 5.000
Code report: ICC-ES ESR-4057
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 7.00
c_{ac} (inch): 6.87
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 18.00
State: Cracked
Compressive strength, f'_c (psi): 3000
$\Psi_{c,V}$: 1.0
Reinforcement condition: A tension, A shear
Supplemental reinforcement: Not applicable
Reinforcement provided at corners: No
Ignore concrete breakout in tension: No
Ignore concrete breakout in shear: Yes
Hole condition: Dry concrete
Inspection: Continuous
Temperature range, Short/Long: 150/110°F
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 18.00 x 18.00 x 0.25
Yield stress: 36000 psi

Profile type/size: HSS12X12X1/2

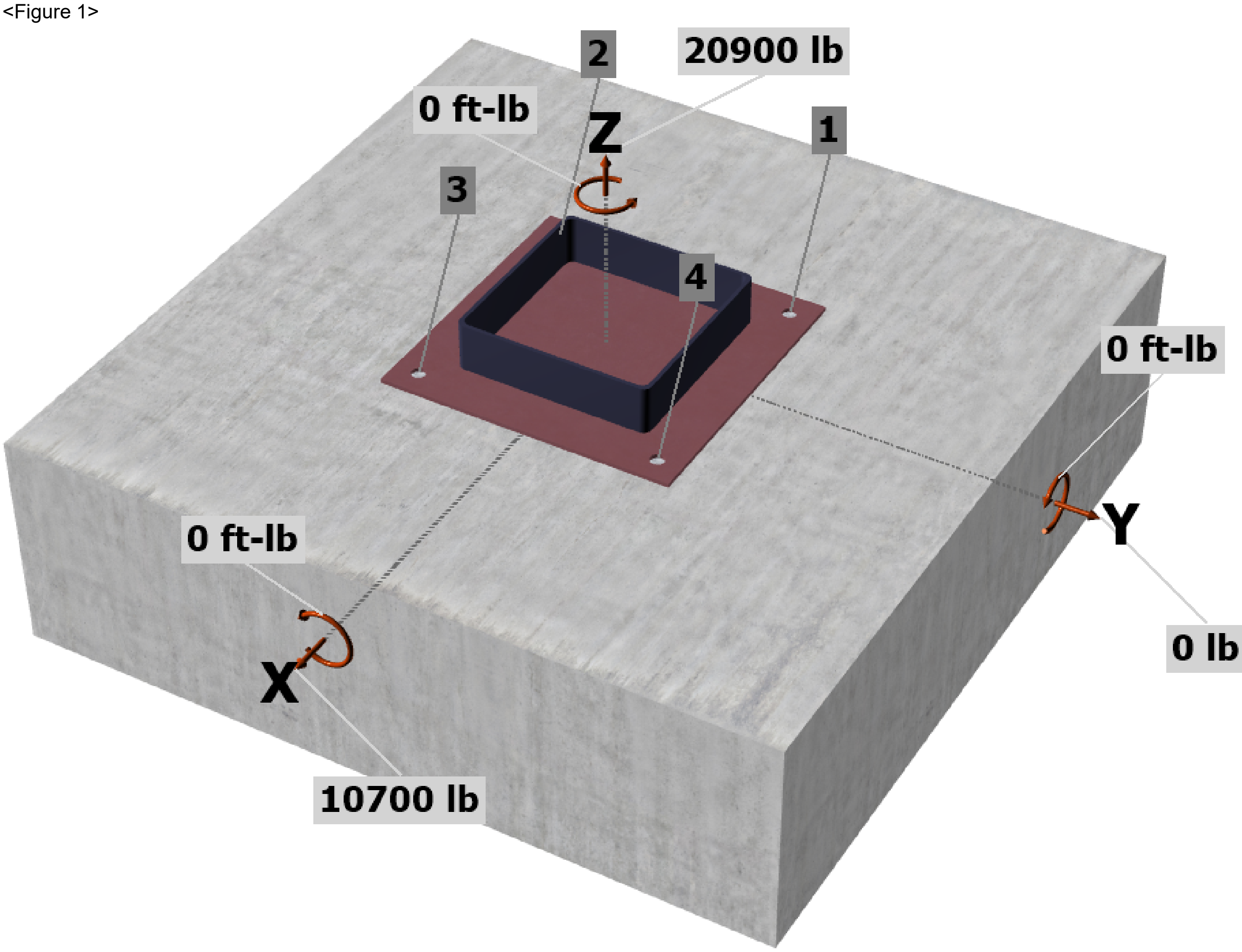
Recommended Anchor
Anchor Name: SET-3G - SET-3G w/ 7/8"Ø F1554 Gr. 36
Code Report: ICC-ES ESR-4057

Load and Geometry
Load factor source: ACI 318 Section 5.3
Load combination: not set
Seismic design: Yes
Anchors subjected to sustained tension: No
Ductility section for tension: 17.2.3.4.3 (d) is satisfied
Ductility section for shear: 17.2.3.5.3 (c) is satisfied
Ω_0 factor: not set
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

Strength level loads:

N_{ua} [lb]: 20900
V_{uax} [lb]: 10700
V_{uay} [lb]: 0
M_{ux} [ft-lb]: 0
M_{uy} [ft-lb]: 0
M_{uz} [ft-lb]: 0

<Figure 1>



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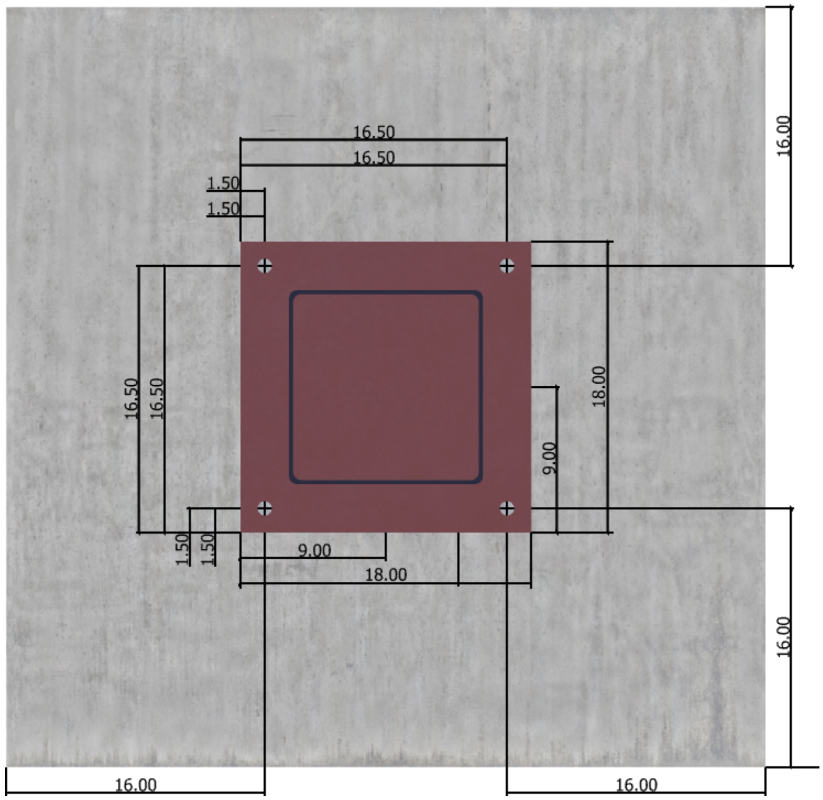
<Figure 2>



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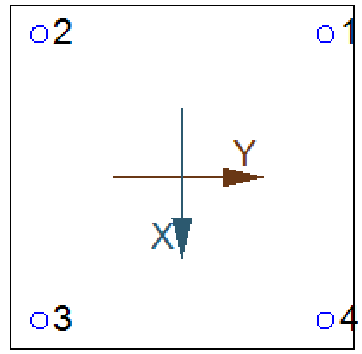
E-mail:			

3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	5225.0	2675.0	0.0	2675.0
2	5225.0	2675.0	0.0	2675.0
3	5225.0	2675.0	0.0	2675.0
4	5225.0	2675.0	0.0	2675.0
Sum	20900.0	10700.0	0.0	10700.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 20900
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



4. Steel Strength of Anchor in Tension (Sec. 17.4.1)

N_{sa} (lb)	ϕ	ϕN_{sa} (lb)
26795	0.75	20096

5. Concrete Breakout Strength of Anchor in Tension (Sec. 17.4.2)

$N_b = k_c \lambda_a \sqrt{f'_c} h_{ef}^{1.5}$ (Eq. 17.4.2.2a)

k_c	λ_a	f'_c (psi)	h_{ef} (in)	N_b (lb)
17.0	1.00	3000	5.000	10410

$0.75\phi N_{cbg} = 0.75\phi\,(A_{Nc}/A_{Nco})\,\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b$ (Sec. 17.3.1 & Eq. 17.4.2.1b)

A_{Nc} (in^2)	A_{Nco} (in^2)	$c_{a,min}$ (in)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	ϕ	$0.75\phi N_{cbg}$ (lb)
900.00	225.00	16.00	1.000	1.000	1.00	1.000	10410	0.75	23423

6. Adhesive Strength of Anchor in Tension (Sec. 17.4.5)

$\tau_{k,cr} = \tau_{k,cr} f_{short\text{-}term} K_{sat} (f'_c / 2{,}500)^n \alpha_{N.seis}$

$\tau_{k,cr}$ (psi)	$f_{short\text{-}term}$	K_{sat}	$\alpha_{N.seis}$	f'_c (psi)	n	$\tau_{k,cr}$ (psi)
1265	1.00	1.00	1.00	3000	0.24	1322

$N_{ba} = \lambda_a \tau_{cr} \pi d_a h_{ef}$ (Eq. 17.4.5.2)

λ_a	τ_{cr} (psi)	d_a (in)	h_{ef} (in)	N_{ba} (lb)
1.00	1322	0.88	5.000	18164

$0.75\phi N_{ag} = 0.75\phi\,(A_{Na}/A_{Na0})\,\Psi_{ec,Na}\Psi_{ed,Na}\Psi_{cp,Na}N_{ba}$ (Sec. 17.3.1 & Eq. 17.4.5.1b)

A_{Na} (in^2)	A_{Na0} (in^2)	c_{Na} (in)	$c_{a,min}$ (in)	$\Psi_{ec,Na}$	$\Psi_{ed,Na}$	$\Psi_{cp,Na}$	N_{ba}(lb)	ϕ	$0.75\phi N_{ag}$ (lb)
1474.68	547.63	11.70	16.00	1.000	1.000	1.000	18164	0.65	23845

8. Steel Strength of Anchor in Shear (Sec. 17.5.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\alpha_{V,seis}$	$\phi_{grout}\alpha_{V,seis}\phi V_{sa}$ (lb)
16080	1.0	0.65	0.75	7839

10. Concrete Pryout Strength of Anchor in Shear (Sec. 17.5.3)

$\phi V_{cpg} = \phi \min|k_{cp}N_{ag}\ ;\ k_{cp}N_{cbg}| = \phi \min|k_{cp}(A_{Na}/A_{Na0})\Psi_{ec,Na}\Psi_{ed,Na}\Psi_{cp,Na}N_{ba}\ ;\ k_{cp}(A_{Nc}/A_{Nco})\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b|$ (Sec. 17.3.1 & Eq. 17.5.3.1b)

k_{cp}	A_{Na} (in^2)	A_{Na0} (in^2)	$\Psi_{ed,Na}$	$\Psi_{ec,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	N_a (lb)
2.0	1474.68	547.63	1.000	1.000	1.000	18164	48914

A_{Nc} (in^2)	A_{Nco} (in^2)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	N_{cb} (lb)	ϕ
900.00	225.00	1.000	1.000	1.000	1.000	10410	41641	0.70

ϕV_{cpg} (lb)
58298

11. Results

Interaction of Tensile and Shear Forces (Sec. R17.6)

Tension	Factored Load, N_{ua} (lb)	Design Strength, $øN_n$ (lb)	Ratio	Status
Steel	5225	20096	0.26	Pass
Concrete breakout	**20900**	**23423**	**0.89**	**Pass (Governs)**
Adhesive	20900	23845	0.88	Pass

Shear	Factored Load, V_{ua} (lb)	Design Strength, $øV_n$ (lb)	Ratio	Status
Steel	**2675**	**7839**	**0.34**	**Pass (Governs)**
Pryout	10700	58298	0.18	Pass

Interaction check	$(N_{ua}/\phi N_{ua})^{5/3}$	$(V_{ua}/\phi V_{ua})^{5/3}$	Combined Ratio	Permissible	Status
Sec. R17.6	0.83	0.17	99.4%	1.0	Pass

SET-3G w/ 7/8"Ø F1554 Gr. 36 with hef = 5.000 inch meets the selected design criteria.

SIMPSON Strong-Tie®

Anchor Designer™
Software
Version 3.0.7947.0

Company:	QCE	Date:	3/20/2024
Engineer:	TVM	Page:	6/6
Project:	Centeris		
Address:			
Phone:			
E-mail:			

12. Warnings

- Concrete breakout strength in shear has not been evaluated against applied shear load(s) per designer option. Refer to ACI 318 Section 17.3.2.1 for conditions where calculations of the concrete breakout strength may not be required.

- Per designer input, ductility requirements for tension have been determined to be satisfied – designer to verify.

- Per designer input, ductility requirements for shear have been determined to be satisfied – designer to verify.

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer’s product literature for hole cleaning and installation instructions.