3E.2 Emergency Power Generating Buildings

Description of Emergency Power Generating Buildings

Two Emergency Power Generating Buildings (EPGB) are located adjacent to the NI Common Basemat and the Essential Service Water Buildings (ESWB) structures. Each EPGB is approximately 178 ft – 0 in long by 94 ft – 6 in wide. The height of the building, relative to the top of the mat foundation, varies from 51 ft – 6 inches in the diesel fuel storage tanks areas to 68 ft – 0 in at the remainder of the structure.

Cross sections and plan views associated with the typical EPGB are provided in Section 3.8.4, Figure 3.8-89, Figure 3.8-90, Figure 3.8-91, Figure 3.8-92, Figure 3.8-93, and Figure 3.8-94. A general description of the structure, including descriptions of functional equipment at each floor level, is provided in Section 3.8.4.1.4.

The lateral load resisting system primarily consists of exterior and interior reinforced concrete shear walls and a reinforced concrete mat foundation situated at grade. The basemat foundation, elevated concrete slabs, and steel framed platform levels consist of the structural elements described in Sections 3.8.4.1.4 and 3.8.5.1.2.

Upon evaluation of the EPGB, the following critical sections have been identified:

- Basemat Foundation (3E.2.1).
- Typical Wall at Column Line 11 (3E.2.2).
- Reinforced Concrete Slab and Composite Beams at Elevation 51 ft-6 in (3E.2.3).

Materials

Concrete for the EPGB excluding basemat shall have compressive strength f'_c = 5000 psi, modulus of elasticity, E= 4287 ksi, shear modulus, G = 1832 ksi, and Poisson's ratio is 0.17.

Reinforcing Steel – deformed steel bars conforming to ASTM A615 Grade 60 with minimum yield strength of F_y = 60 ksi, and minimum tensile strength F_u = 90 ksi. Minimum bar elongation is based on ASTM A615.

Structural Steel – conforms to the requirements specified in Table 3.8-8.

Floor Live and Dead Load Distribution

Dead loads include self weight of the structure, piping, cable tray, conduits and permanent equipment loads. Live loads include design live load. Design snow loads are provided in Section 3.8.4.3.1 and Table 2.1-1.

- Concrete self weight - based on concrete density of 150 pcf.

- Steel platform self weight at El. 33’-4” = 20 psf.
- Composite steel beam self weight on slab/roof at El. 51’-6” = 45 psf.
- Uniform area dead load for basemat = 100 psf.
- Uniform area dead load for slab at El. 51’-6” = 50 psf.
- Uniform area dead load for roof at El. 51’-6” = 70 psf.
- Uniform area dead load for roof at EL. 68’-0” = 20 psf.
- Uniform area live load for basemat = 100 psf.
- Steel platform at El. 33’-4” live load = 100 psf.

Equipment Loads

The weight of major equipment, combustion air ducts, and exhaust ducts is applied as point load throughout the building.

Equipment	Elevation (kips)	Weight
Engine/Generator skid	Basemat	3000
Combustion air filter	51’-6”	4.10 each
Combustion air silencers	51’-6”	4.00 each
Exhaust gas silencer	51’-6”	18.00
Air start equipment	Basemat	15.00
Fuel day tank	32’-0”	13.37
Lube oil make-up tank	Basemat	13.14
Jacket water expansion	16’-0”	1.815
Generator neutral grounding resistor	D/G skid	0.50
MCC’s	Basemat	12.00
I&C TCP control panels	Basemat	0.772 each
I&C TXS control panels	Basemat	0.822 each
HVAC control room chiller	Basemat	2.37
HVAC control room air handler	19’-3”	0.55
HVAC supply fan-small	51’-6”	1.862
HVAC supply fan-large	51’-6”	3.20
Intake and exhaust louvers	51’-6”	2.10 each

Foundation Stability

The EPGB is evaluated for stability against overturning, sliding, and floatation for the soil profiles used in establishing the certified plant design. Shear keys in the form of grade beams around the periphery of the building and in the middle of the building are used to enhance stability. The minimum factors of safety for the EPGB are listed in Table 3E.2-7. The calculated factors of safety against overturning, sliding and floatation satisfy the acceptance criteria.

The sliding and overturning factors are determined using load combination containing dead load (D), lateral earth pressure (H), SSE (E'), hydrostatic load (F), and buoyant force (F_b). It is conservatively assumed that (E') and (F_b) occur simultaneously. The floatation factor of safety is determined based on dead load (D) and buoyant force (F_b). For uniformity of site characteristics, the minimum static and dynamic bearing capacity of the foundation soil will be the same as the NI. The static and dynamic bearing pressure demands for the EPGB are listed in Table 3E.2-8.

Design Criteria

SSI analysis using MTR/SASSI is used to determine enveloping structural response accelerations for development of equivalent static SSE loads for the GT STRUDL FEM.

The use of GT STRUDL for the design of the critical sections is described in Sections 3.8.4.4.3 and Sections 3.8.5.4.3. Design forces and moments are extracted from GT STRUDL analyses for basemat foundation and superstructure component design.

All applicable loads used for the design of the critical sections located within the EPGBs are described in Sections 3.8.4.3.1 and 3.8.5.3; the applicable loading combinations are described in Sections 3.8.4.3.2 and 3.8.5.3. The design also accommodates the soil analysis cases shown in Table 3.7.1-8.

Reinforced concrete and structural steel components (including composite beams) are designed in accordance with the applicable codes, standards, and specifications described in Sections 3.8.4.2 and 3.8.5.2.

The planar reference system for the GT STRUDL finite element analysis output is provided in Figure 3E.2-1—Finite Element Planar Reference Frame Systems. The positive direction of the finite element bending moments M_{xx}, M_{yy} and M_{xy} and out-of plane shear forces V_{xx} and V_{yy} are shown in a) Plate Bending, included on Figure 3E.2-1. The positive direction of the finite element in-plane forces N_{xx}, N_{yy} and N_{xy} are the same as the positive orientation of the plane stresses S_{xx}, S_{yy} and S_{xy} shown in b) Plane Stress/Strain shown on Figure 3E.2-1.

3E.2.1 Basemat Foundation

This critical section presents the structural design of the reinforced concrete basemat required to support the EPGB. The EPGBs are composed of a 6 ft – 0 in thick reinforced concrete basemat foundation. The basemat foundation of the EPGB is a safety-related, Seismic Category I structure, as described in Sections 3.8.5.

Description of the Critical Section and Computer Model

The overall layout and dimensions of each EPGB basemat foundation are described in Section 3.8.5.1.2. EPGBs 1 and 2 and 3 and 4 are essentially identical; therefore, only one of the EPGBs is evaluated as a critical section.

As described in Section 3.8.5.4.3, GT STRUDL is used to create a FEM to analyze the EPGBs for the forces and moments applied to the EPGB basemat foundation. Figure 3E.2-2—EPGB Basemat Foundation – FEM shows a FEM plot of the basemat foundation layout. The elements shown in Figure 3E.2-2 are approximately 5 ft – 0 inches in length by 5 ft – 0 in wide by 6 ft – 0 in thick. The tapered areas of the mesh reflect an alignment of the mesh with the dimensions of the electrical rooms.

Applicable Loadings, Analysis and Design Methods

In addition to the loads described in Section 3.8.5.3, the GT STRUDL finite element analysis for the basemat foundation for the EPGB incorporates:

- Basemat flexibility through the use of the mat in the global GT STRUDL building model (transferring forces and moments resulting from superstructure deformation to the basemat).
- Buoyant forces associated with the normal ground water (Elevation -3 ft – 3 $^{9}/_{16}$ in) for structural design, and high water level (Elevation -1 ft – 0 in, or 5 ft – 0 in of hydrostatic head) for stability design.

Load combinations used to design the EPGB basemat foundation are described in Section 3.8.5.3. The soil analysis cases accommodated in this critical section are described in Table 3.7.1-8.

Results of Critical Section Design

The structural design for the critical section provides reinforcement to resist element forces and moments as described below.

Table 3E.2-1—Governing Forces and Moments for the EPGB Basemat Foundation shows the governing forces and moments for the design of the EPGB basemat foundation.

The typical reinforcement configuration is shown in Table 3E.2-3—Governing Forces and Moments for EPGB Typical Wall at Column Line 11 for Vertical Reinforcement (Shear Friction).

Section thicknesses and reinforcing quantities may be optimized based on subsequent analysis results.

3E.2.2 Typical Wall at Column Line 11

This critical section presents the structural design of the reinforced concrete typical wall along column line 11 required to support the EPGB shown in Figure 3.8-89. The typical wall along column line 11 in the EPGB is a safety-related, Seismic Category I structure, as described in Section 3.8.4.

Description of the Critical Section and Computer Model

The wall at column line 11 is selected as a typical critical section wall because it has two openings close to the EPGB basemat. The wall is 96 ft – 0 in long and 70 ft – 0 in tall and has four openings, which are shown in Figure 3E.2-4—EPGB Wall at Column Line 11 - GT STRUDL FEM.

As described in Section 3.8.4.4.3, GT STRUDL is used to create a FEM to analyze the EPGBs for the forces and moments applied to the EPGB typical wall along column line 11. The mesh of GT STRUDL elements is established at dimensions of approximately 4 ft – 0 in by 4 ft – 0 in with variations in aspect ratios to accommodate openings as shown in Figure 3E.2-4.

Applicable Loadings, Analysis and Design Methods

All applicable loads and loading combinations applied to the typical wall at column line 11 are described in Sections 3.8.4.3.1 and 3.8.4.3.2, respectively. The soil analysis cases shown in Table 3.7.1-6 are incorporated into the design of the typical wall at column line 11. For the analysis of this critical section, the soil analysis cases are enveloped.

Additional analyses are performed for the typical wall along column line 11, aside from the application of loads described in Section 3.8.4.3.1. These analyses include the following:

- Mesh sensitivity studies are performed on the wall segment to confirm that accurate results are obtained. As a result of the studies, the out-of-plane shear for the typical wall along column line 11 is increased by 20%; the out-of-plane bending moment is increased by 5%.

- Analytical calculations are generated for postulated tornado generated missiles, including automobile, and tornado differential pressures to demonstrate sufficient protection against tornado effects.

Section cuts are used to determine the forces and moments throughout the typical wall at column line 11. Section cut locations are determined through a review of enveloping distributions of forces and moments. The sign convention describing the nomenclature for horizontal and vertical cuts applicable to this critical section is shown in Figure 3E.2-5—EPGB Sign Convention for Horizontal and Vertical Cuts at Column Line 11; the section cut locations are shown in Figure 3E.2-6—Nomenclature for Section Cuts through EPGB Wall at Column Line 11.

Results of Critical Section Design

The structural design for the critical section provides reinforcement to resist element forces and moments as described below.

The governing out-of-plane and shear friction data are shown for horizontal and vertical reinforcement in Table 3E.2-2—Governing Forces and Moments for EPGB Typical Wall at Column Line 11 for Vertical Reinforcement (Local Cut), Table 3E.2-3—Governing Forces and Moments for EPGB Typical Wall at Column Line 11 for Vertical Reinforcement (Shear Friction), Table 3E.2-4—Governing Forces and Moments for EPGB Typical Wall at Column Line 11 for Horizontal Reinforcement (Local Cut), and Table 3E.2-5—Governing Forces and Moments for EPGB Typical Wall at Column Line 11 for Horizontal Reinforcement (In-Plane Shear), respectively. Figure 3E.2-7—FEM of Highly Stressed Areas of EPGB Wall at Column Line 11 shows a view of the GT STRUDL FEM with a shaded area indicating the location of highly stressed areas requiring additional vertical reinforcement and shear tie sets. The shaded area is approximately 4 ft – 0 in by 4 ft – 0 in.

The required reinforcement configuration for the typical wall along column line 11 is shown in Table 3E.2-6—Summary of Reinforcement for EPGB Wall along Column Line 11 and Figure 3E.2-8—Reinforcement Sketch for EPGB Wall at Column Line 11.

Section thicknesses and reinforcing quantities may be optimized based on subsequent analysis results.

3E.2.3 Reinforced Concrete Slab and Composite Beams at Elevation 51 ft – 6 in

This critical section presents the design of the reinforced concrete slab and composite beams at elevation 51 ft – 6 in. Elevation 51 ft – 6 in of the EPGB is a safety-related, Seismic Category I structure, as described in Section 3.8.4.

Description of the Critical Section and Computer Model

The critical section at elevation 51 ft – 6 in has a W40 composite beam at elevation 51 ft - 6 in, which spans 46 ft and supports a 2 ft – 0 in thick concrete missile barrier slab, and a 2 ft – 0 in thick missile barrier wall immediately above it. Additionally, this wall supports a portion of the nominally 2 ft – 0 in thick reinforced concrete slab at elevation 68 ft – 0 in.

Figure 3E.2-9—EPGB Slab at Elevation 51'-6", provides a plan view of elevation 51 ft – 6 in and indicates a section cut (B-B) through the composite beam and floor slab, and the wall above and roof slab that are adjacent to this critical section. The elevation view and the FEM of the critical section are shown in Figure 3E.2-10—Elevation View of EPGB Critical Section at Elevation 51'-6" and Figure 3E.2-11—FEM View of EPGB Elevation 51'-6".

As described in Section 3.8.4.4.3, GT STRUDL is used to create a FEM to analyze the EPGBs for the forces and moments applied to the EPGB reinforced concrete slab and composite beams at Elevation 51 ft – 6 in. Walls bridging elevations 51 ft – 6 in and 68 ft – 0 in are also included in the GT STRUDL FEM. The mesh of GT STRUDL elements is established at approximately 4 ft – 0 in by 4 ft – 0 in.

Applicable Loadings, Analysis and Design Methods

All applicable loads and loading combinations applied to elevation 51 ft – 6 in are described in Sections 3.8.4.3.1 and 3.8.4.3.2, respectively. The soil analysis cases shown in Table 3.7.1-6 are incorporated into the design of the critical section.

In-plane stiffness is accounted for directly in the overall GT STRUDL FEM. To accurately capture the stiffness of each composite beam, out-of-plane stiffness of the reinforced concrete slab at elevation 51 ft – 6 in has been adjusted in the Bechtel Code SASSI 2000 (v. 3.1).

All 2 ft – 0 in thick reinforced concrete slabs and walls are designed to withstand tornado missile barriers and tornado depressurization.

The reinforced concrete roof slab at elevation 68 ft – 0 in is primarily a one-way slab spanning between interior and exterior missile barrier walls. Therefore, the tornado missile barrier wall addressed here also functions as a bearing wall to carry loads to the composite beam at elevation 51 ft – 6 in.

The reinforced concrete slab and composite beam are designed in accordance with the applicable codes, standards, and specifications described in Section 3.8.4.2. The composite beam design also reflects staged construction of the non-composite and composite conditions and uses partial composite action to satisfy the maximum allowable three studs per flute.

Results of Critical Section Design

The structural design for the critical section provides reinforcement to resist element forces and moments as described below.

The wall, slab, and beam designs are determined to be the following (shown in Figure 3E.2-12—Design Sketch of EPGB Elevation 51'-6"):

- The Missile Barrier Wall requires #10 bars spaced at 8 in on center, running horizontally and vertically at each face.
- The elevation 51 ft – 6 in slab requires #10 bars spaced at 8 in on center, running both directions at each face.
- The composite beam is a W40 x 324 wide flange shape, with a bottom flange cover PL 1 x 18, 14 ft – 0 in long and centered along the beam's length. Partial composite action is obtained through the use of three, ¾ in diameter headed studs at each deck flute spaced 1 ft – 0 in on center. Galvanized decking, which is 3 in thick, is used as stay-in-place formwork.

Section thicknesses and reinforcing quantities may be optimized based on subsequent analysis results.

Table 3E.2-1—Governing Forces and Moments for the EPGB Basemat Foundation
Sheet 1 of 2

Location	GTStrudl Joint	Load Combination	AC	N_{xx} (k/ft)	N_{yy} (k/ft)	N_{xy} (k/ft)	M_{xx} (k-ft/ft)	M_{yy} (k-ft/ft)	M_{xy} (k-ft/ft)	V_{xx} (k/ft)	V_{yy} (k/ft)
General Zone 1 (Peak M_{xx})	**1309**	**DL+LL+EX+0.4EY +0.4EZ**	**2sn4u**	-18		31	**-608**		34		
	1310			-19		24	**-644**		-50		
	1311			-21		19	**-615**		-113		
General Zone 2 (Reduced Peak M_{xx})	**1274**	**DL+LL+EX+0.4EY +0.4EZ**	**2sn4u**	-11		61	**-302**		-69		
	1275			-16		43	**-401**		-43		
	1276			-18		26	**-390**		-34		
General Zone 1 (Peak M_{yy})	**1004**	**DL+LL-EX+0.4EY+0.4EZ**	**2sn4u**		-230	-10		**-1291**	-81		
	1021				-128	-20		**-906**	-51		
	1038				-85	-31		**-771**	-32		
General Zone 2 (Reduced Peak M_{yy})	**1072**	**DL+LL-EX+0.4EY+0.4EZ**	**2sn4u**		-41	-34		**-565**	-66		
	1089	**DL+LL-EX-0.4EY+0.4EZ**			-26	-20		**-521**	-18		
	1106				-20	-17		**-486**	-18		
Local to Internal Corners (X-Axis Peak M_{xy})	**1086**	**DL+LL-EX+0.4EY+0.4EZ**	**2sn4u**		-20	-92		76	**273**		
	1103	**DL+LL-EX-0.4EY+0.4EZ**			-13	-30		546	**264**		
	1120				-1	-18		412	**187**		
Local to Internal Corners (Y-Axis Peak M_{xy})	**1104**	**DL+LL-EX+0.4EY+0.4EZ**	**2sn4u**	6		-67	47		**185**		
	1103	**DL+LL-EX-0.4EY+0.4EZ**		-49		-30	94		**264**		
	1365	**DL+LL-0.4EX+0.4EY+EZ**		-16		-79	34		**172**		

Table 3E.2-1—Governing Forces and Moments for the EPGB Basemat Foundation
Sheet 2 of 2

Location	GTStrudl Joint	Load Combination	AC	N_{xx} (k/ft)	N_{yy} (k/ft)	N_{xy} (k/ft)	M_{xx} (k-ft/ft)	M_{yy} (k-ft/ft)	M_{xy} (k-ft/ft)	V_{xx} (k/ft)	V_{yy} (k/ft)
Local to Roll-Up Doors (X-Axis Peak M_{xy})	**1014**	**DL+LL-0.4EX+EY-0.4EZ**	**5a**		-59	10		43	**376**		
	1031				-26	19		32	**334**		
	1048				-10	26		19	**243**		
Local to Roll-Up Doors (Y-Axis Peak M_{xy})	**1013**	**DL+LL-0.4EX+EY-0.4EZ**	**5a**	1		51	-45		**188**		
	1014			0		10	0		**376**		
	1015			-1		35	18		**223**		
Local to Internal Corners (Peak N_{xx})	**1256**	**DL+LL+0.4EX+0.4EY-EZ**	**2sn4u**	**266**			102		-84		
	1257			**99**			62		-17		
Local to Roll-Up Doors (Peak N_{yy})	**1003**	**DL+LL+0.4EX+0.4EY+EZ**	**2sn4u**		**193**			-644	-65		
	1020				**66**			-288	-69		
Local to Exterior Walls (Peak V_{xx})	**1019**	**DL+LL-EX+0.4EY+0.4EZ**	**2sn4u**	3		-19				**-103**	
	1020			-8		-11				**-80**	
Local to Exterior Walls (Peak V_{yy})	**1036**	**DL+LL-EX+0.4EY+0.4EZ**	**2sn4u**		-41	-43					**75**
	1053				-28	-60					**70**

*AC refers to soil analysis cases.

Table 3E.2-2—Governing Forces and Moments for EPGB Typical Wall at Column Line 11 for Vertical Reinforcement (Local Cut)

			Factored Load for Local Design						
Critical LC	Section cut	Cut length	Effects of Seismic	FX (k)	FY (k)	FZ (k)	MX (k-ft)	MY (k-ft)	MZ (k-ft)
D + L + 0.4EX + 0.4EY - EZ (D22S21)	H1	6 ft – 9 $^5/_8$ in	GLOBAL	-4	-521	505	2085	36	30
			LOCAL						
D + L + 0.4EX + 0.4EY + EZ (D18S17)	H2	5 ft – 2 $^3/_8$ in	GLOBAL	-10	-657	-352	-1531	15	74
			LOCAL						
D + L + 0.4EX + 0.4EY - EZ (D22S21)	H3	6 ft – 0 in	GLOBAL	-8.0	-968	424	1807	-24	62
			LOCAL						
D + L + 0.4EX + 0.4EY - EZ (D22S21)	H4	9 ft – 4 in	GLOBAL	-2	-308	947	3046	-31	31
			LOCAL						
D + L + EX + 0.4EY + 0.4EZ (D02S01)	H5	6 ft – 9 $^5/_8$ in	GLOBAL	-7	-75	-224	-587	8	-104
			LOCAL	-8	6	1	1	13	-159
D + L + EX - 0.4EY + 0.4EZ (D04S03)	H6	6 ft – 9 $^5/_8$ in	GLOBAL	-46	-16	179	-517	23	-287
			LOCAL	-26	-15	7	-28	71	-218
D + L + 0.4EX + 0.4EY - EZ (D22S21)	H7	5 ft – 2 $^3/_8$ in	GLOBAL	-4	-667	423	401	26	-1
			LOCAL						
D + L + EX + 0.4EY - 0.4EZ (D03S02)	H8	6 ft – 0 in	GLOBAL	-11	-176	123	230	-90	20
			LOCAL	-29	-4	2	3	-162	-1
D + L + 0.4EX + 0.4EY + EZ (D02S01)	H2-2	5 ft – 2 $^3/_8$ in	GLOBAL	-12	-309	-129	-388	82	61
			LOCAL	-14	-6	2	10	158	76
D + L + 0.4EX + 0.4EY - EZ (D03S02)	H3-2	6 ft – 0 in	GLOBAL	-15	-342	129	412	-88	88
			LOCAL	-25	-6	1	3	-173	131

Note:

1. Global effect of seismic addresses structural response while local effect of seismic addresses local flexibilities.

Table 3E.2-3—Governing Forces and Moments for EPGB Typical Wall at Column Line 11 for Vertical Reinforcement (Shear Friction)[1]

			Factored Load for Shear Friction Design						
Critical LC	Long Section Cut at (Local Cut)	Cut Length	Effects of Seismic	FX (k)	FY (k)	FZ (k)	MX (k-ft)	MY (k-ft)	MZ (k-ft)
D + L + 0.4EX + 0.4EY - EZ (D22S21)	HB at (H1)	12 ft – 0 in	GLOBAL	-12	33	806	6680	72	85
D + L + 0.4EX + 0.4EY + EZ (D18S17)	HB at (H2)	12 ft – 0 in	GLOBAL	-28	-331	-961	-6783	-27	171
D + L + 0.4EX + 0.4EY - EZ (D22S21)	HC at (H3)	40 ft – 0 in	GLOBAL	-49	219	3722	54171	262	368
D + L + 0.4EX + 0.4EY - EZ (D22S21)	HC at (H4)	40 ft – 0 in	GLOBAL	-49	219	3722	54171	262	368
D + L + EX - 0.4EY + 0.4EZ (D04S03)	HD at (H6)	96 ft – 0 in	GLOBAL	-378	-751	1546	-9078	-612	-2223

Note:

1. Required reinforcement is combined with required reinforcement on local cut.

Table 3E.2-4—Governing Forces and Moments for EPGB Typical Wall at Column Line 11 for Horizontal Reinforcement (Local Cut)

			Factored Load for Local Design						
Critical LC	**Section Cut**	**Cut Length**	**Effects of Seismic**	**FX (k)**	**FY (k)**	**FZ (k)**	**MX (k-ft)**	**MY (k-ft)**	**MZ (k-ft)**
D + L - EX - 0.4EY - 0.4EZ (D09S08)	V1	4 ft – 9 in	GLOBAL	34	-221	37	-525	-235	-27
			LOCAL	31	-7	6	-17	-289	-3
D + L + 0.4EX + 0.4EY + EZ (D18S17)	V2	5 ft – 6 in	GLOBAL	1	313	443	644	-47	10
			LOCAL						
D + L + 0.4EX + 0.4EY + EZ (D18S17)	V3	5 ft – 6 in	GLOBAL	-1	202	342	493	-17	-10
			LOCAL						
D + L + 0.4EX + 0.4EY + EZ (D18S17)	V4	4 ft – 9 in	GLOBAL	-12	487	-48	1126	99	12
			LOCAL						
D + L - EX - 0.4EY + 0.4EZ (D08S07)	V5	4 ft – 9 in	GLOBAL	38	-42	45	-106	-248	20
			LOCAL	25	-4	7	-10	-234	41
D + L + 0.4EX + 0.4EY - EZ (D18S17)	V6	4 ft – 9 in	GLOBAL	-6	347	-109	1161	31	37
			LOCAL						

Note:

1. Global effect of seismic addresses structural response while local effect of seismic addresses local flexibilities.

Table 3E.2-5—Governing Forces and Moments for EPGB Typical Wall at Column Line 11 for Horizontal Reinforcement (In-Plane Shear)[1]

			Factored Load for In-plane Shear Design						
Critical LC	Long section cut at (Local cut)	Cut length	Effects of Seismic	FX (k)	FY (k)	FZ (k)	MX (k-ft)	MY (k-ft)	MZ (k-ft)
D + L - EX - 0.4EY - 0.4EZ (D09S08)	HA at (V1)	96 ft – 0 in	GLOBAL	126	5625	2139	19391	68	524
D + L + 0.4EX + 0.4EY + EZ (D18S17)	HA at (V2)	96 ft – 0 in	GLOBAL	-48	371	-5347	-48479	-169	-201
D + L + 0.4EX + 0.4EY + EZ (D18S17)	HA at (V3)	96 ft – 0 in	GLOBAL	-48	371	-5347	-48479	-169	-201
D + L + 0.4EX + 0.4EY + EZ (D18S17)	HC at (V4)	40 ft – 0 in	GLOBAL	-49	219	-3722	-54171	-262	368
D + L - EX - 0.4EY + 0.4EZ (D08S07)	HA at (V5)	96 ft – 0 in	GLOBAL	126	5625	-2139	-19392	-68	524
D + L + 0.4EX + 0.4EY - EZ (D18S17)	HB at (V6)	12 ft – 0 in	GLOBAL	-28	-331	-961	-6783	-27	171

Note:

1. Required Reinforcement is combined with required reinforcement on local cut.

Table 3E.2-6—Summary of Reinforcement for EPGB Wall along Column Line 11

Vertical Reinforcement (Typical)	#10 at 8 inches on center
Horizontal Reinforcement (Typical)	#10 at 8 inches on center
Vertical Reinforcement *(Shaded Areas)	#10 at 8 inches on center with additional #8 at 8 inches on center
Shear Reinforcement *(Shaded Areas)	#4 Ties at 24 inches on center (Y) #4 spaced at 8 inches on center (Z)

*Shaded areas shown in Figure 3E.2-7.

Table 3E.2-7—Minimum Factors of Safety for the Emergency Power Generating Building

Soil Case	Sliding			Overturning			Flotation	
	Required	Calculated X-DIR	Calculated Y-DIR	Required	Calculated X-DIR	Calculated Y-DIR	Required	Calculated
2sn4u	1.1	1.3	1.2	1.1	1.7	1.3	1.1	8.6
5a	1.1	1.2	1.1	1.1	1.5	1.6		
4u	1.1	1.1	1.1	1.1	1.7	1.2		
1n2u	1.1	1.4	1.6	1.1	1.9	1.6		
1n5a	1.1	1.2	1.1	1.1	1.6	1.4		
hf_c	1.1	1.6	1.1	1.1	2.7	2.5		
hf_s	1.1	2.6	2.9	1.1	3.1	2.9		

Notes:

1. hf_c is a high frequency profile with concrete.
2. hf_s is a high frequency profile with soil.
3. See Table 3.7.1-8 for more information.

Table 3E.2-8—Maximum Static and Dynamic Bearing Pressures for the Emergency Power Generating Building

Analysis Case	Static [ksf]		Dynamic [ksf]	
	Peak-Corner	Edge	Peak-Corner	Edge
1n2u	5.6	4.2	13.6	10.6
1n2u-cr	5.6	4.2	13.7	10.7
1n5a	5.3	4.0	22.0	11.2
1n5a-cr	5.3	4.0	20.0	10.0
2sn4u	5.5	3.9	17.2	14.2
2sn4u-cr	5.5	3.9	16.8	13.7
4u	5.6	4.2	19.6	11.2
4u-cr	5.6	4.2	18.8	12.3
5a	5.2	4.7	20.5	8.0
5a-cr	5.2	4.7	18.9	9.4
hf_c	5.2	4.0	16.0	7.8
hf_c-cr	5.2	4.0	12.6	7.7
hf_s	5.1	4.1	9.2	7.9
hf_s-cr	5.1	4.1	9.2	7.7
Maximum Bearing Pressure	5.6	4.7	22.0	14.2

Notes:

1. Analysis cases indicated with "-cr" represent the cracked case.
2. hf_c is a high frequency profile with concrete.
3. hf_s is a high frequency profile with soil.
4. See Table 3.7.1-8 for more information.

Table 3E.2-9—Emergency Power Generating Building Critical Sections

Section	Description of Critical Section
EPGB 1	Emergency Power Generating Building—Basemat Foundation at Elevation 0'–0"
EPGB 2	Emergency Power Generating Building—Shear Wall on Column Line 11
EPGB 3	Emergency Power Generating Building—Reinforced Concrete Slab and Composite Beams at Elevation 51'–6"
EPGB 4	Emergency Power Generating Building—Shear Wall on Column Line C
EPGB 5	Emergency Power Generating Building—Shear Wall on Column Line E

Figure 3E.2-1—Finite Element Planar Reference Frame Systems

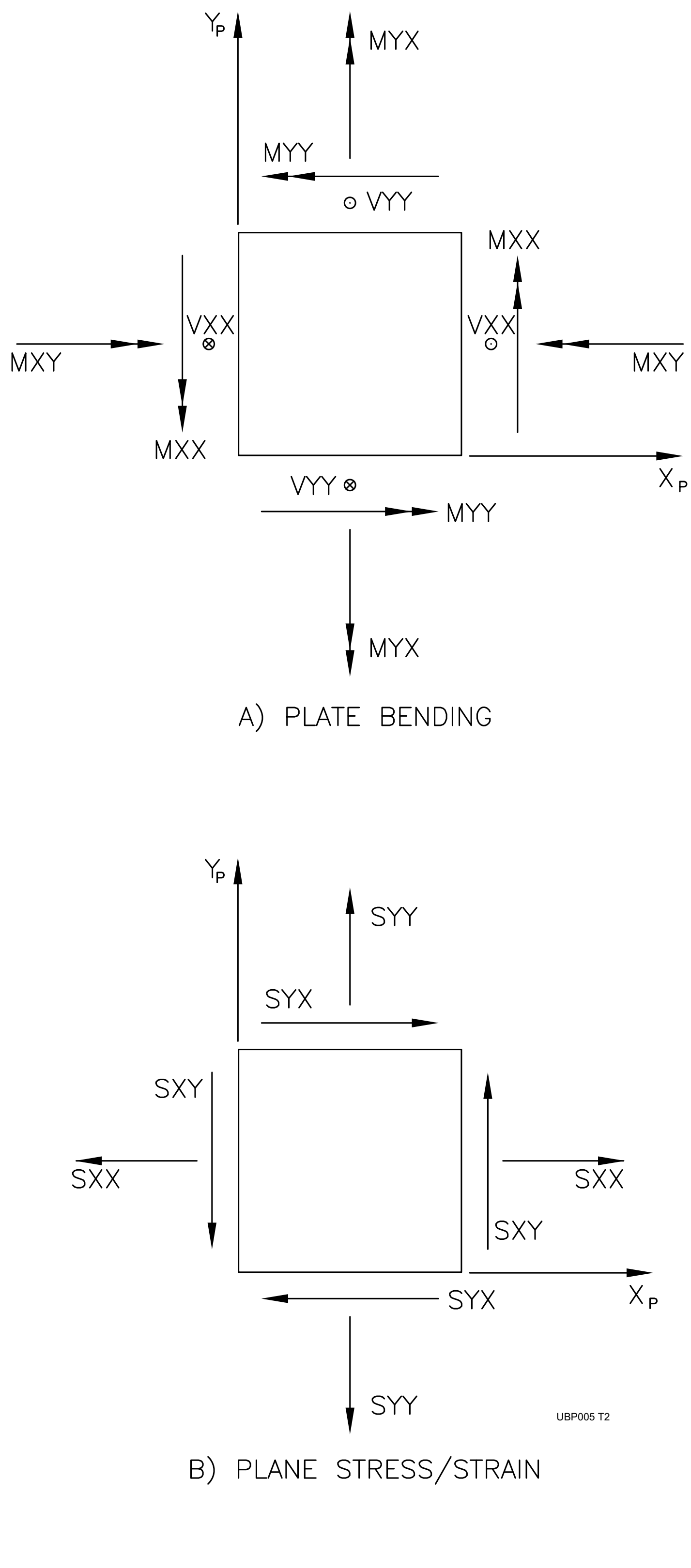

Figure 3E.2-2—EPGB Basemat Foundation – FEM

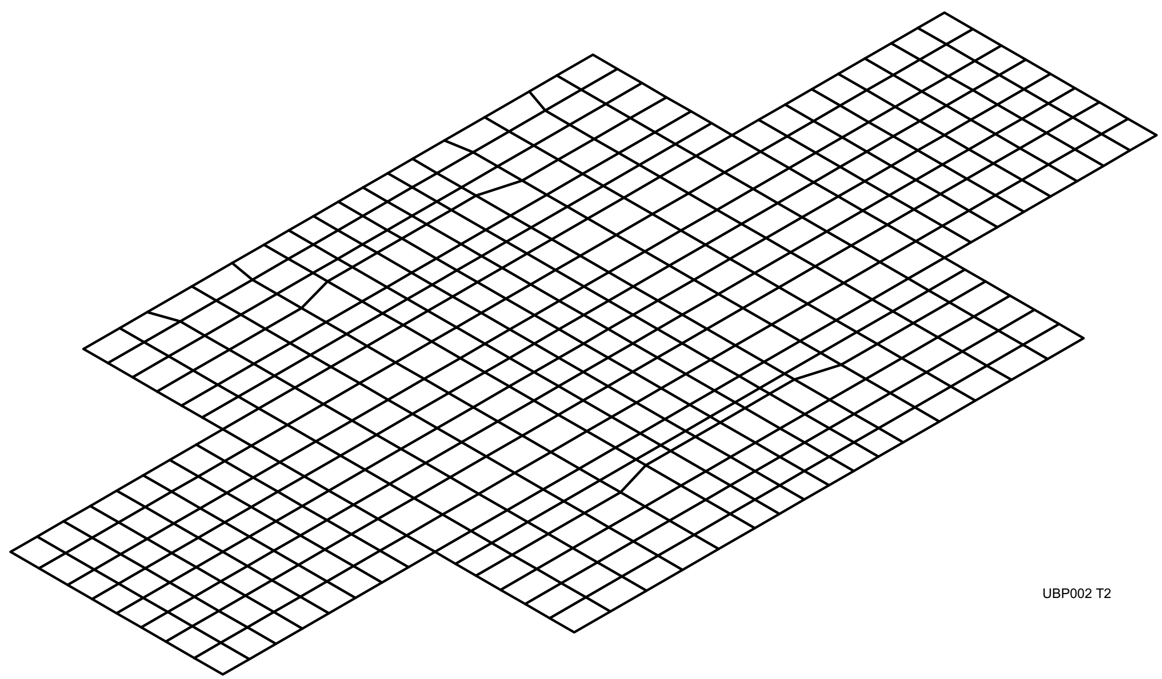

Figure 3E.2-3—Reinforcement Sketch for EPGB Basemat Foundation

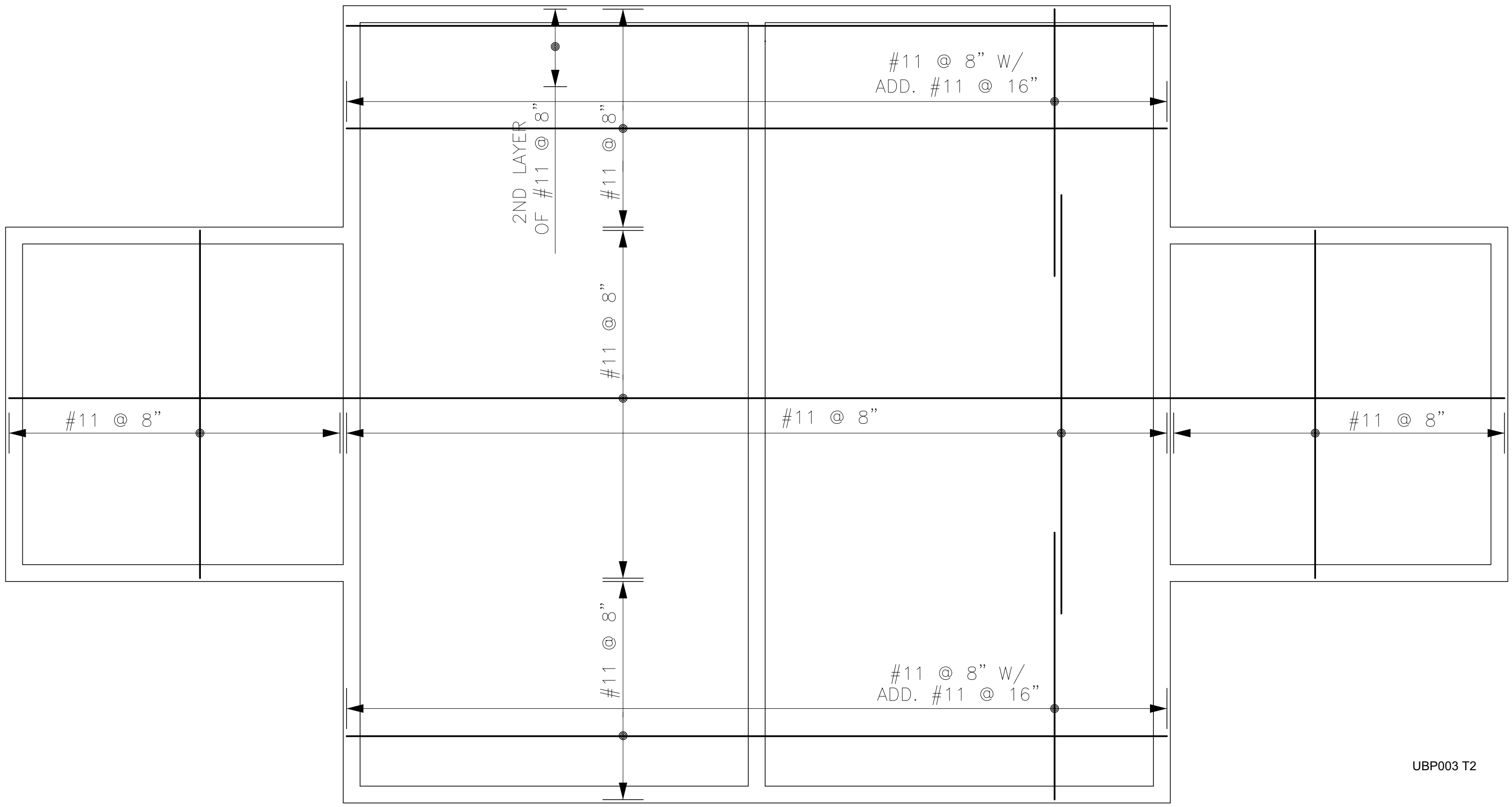

Figure 3E.2-4—EPGB Wall at Column Line 11 - GT STRUDL FEM

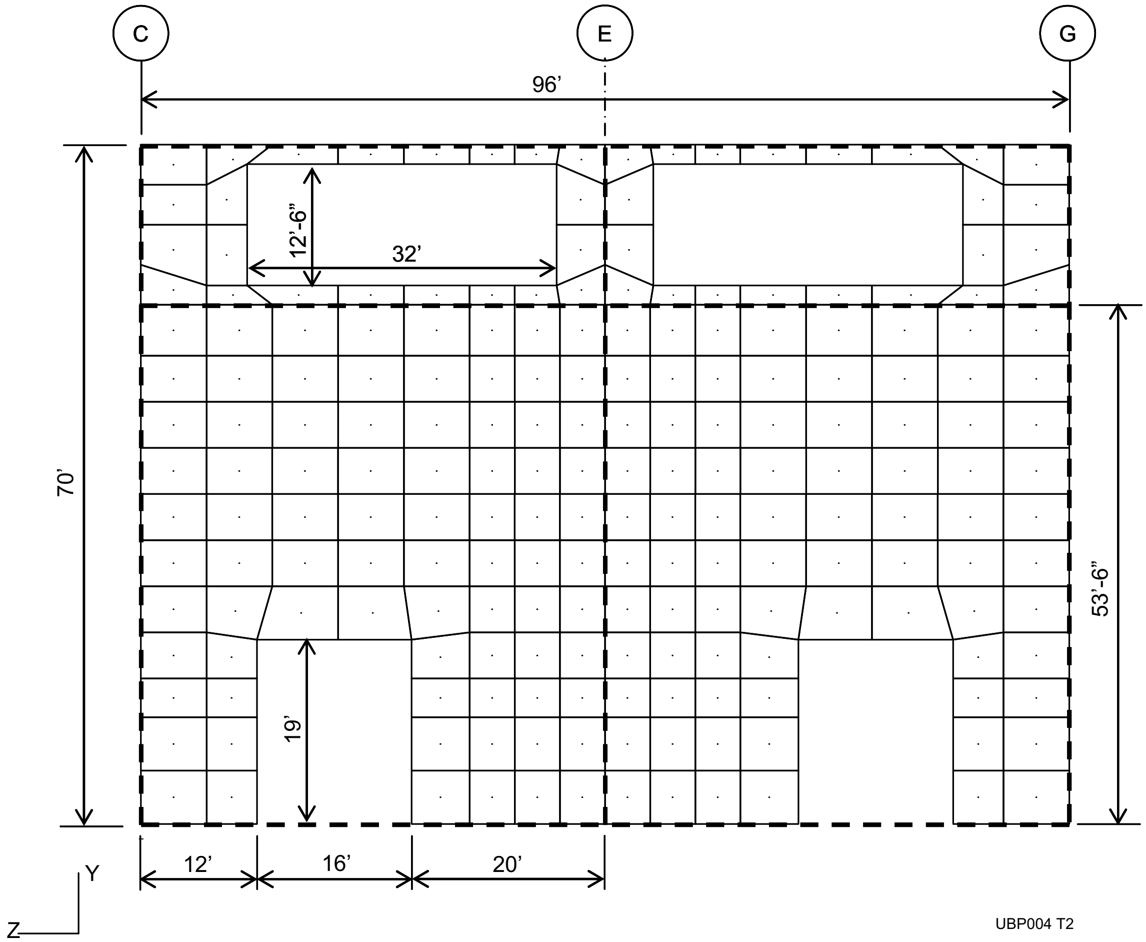

Figure 3E.2-5—EPGB Sign Convention for Horizontal and Vertical Cuts at Column Line 11

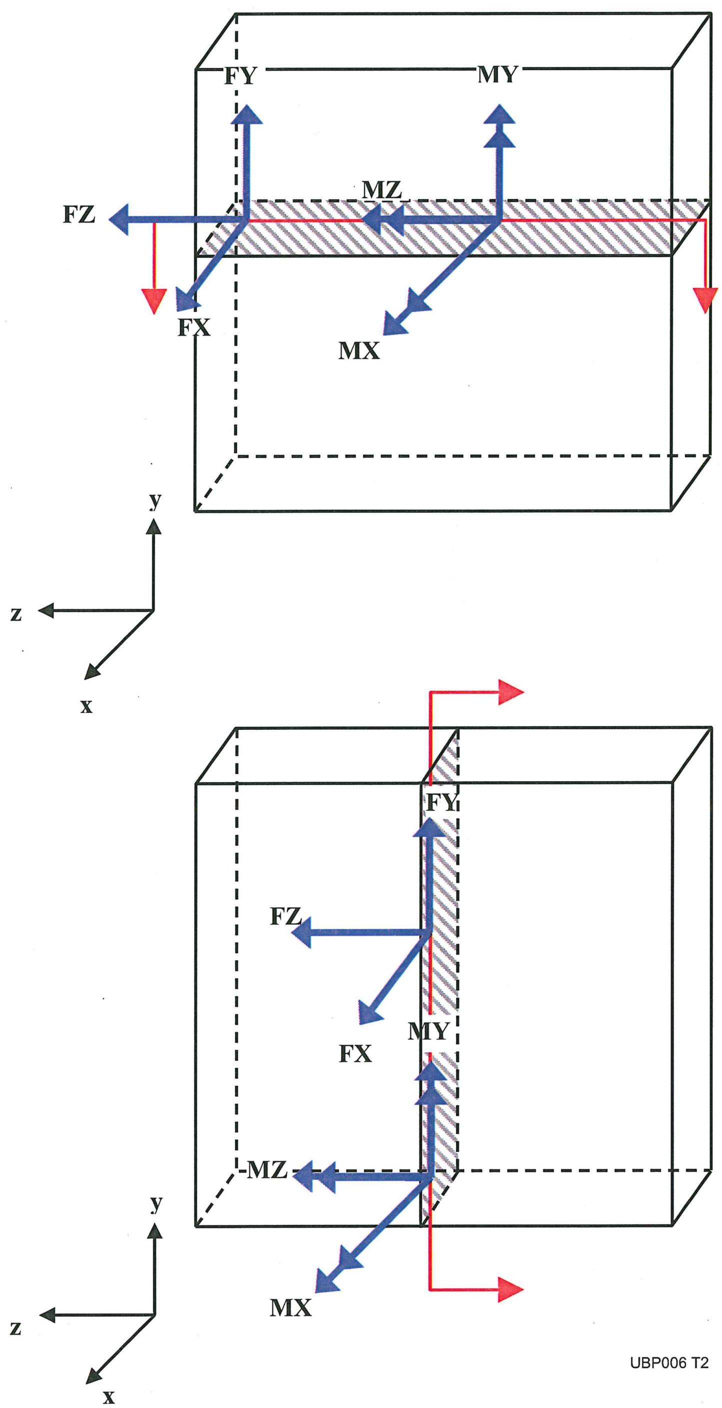

Figure 3E.2-6—Nomenclature for Section Cuts through EPGB Wall at Column Line 11

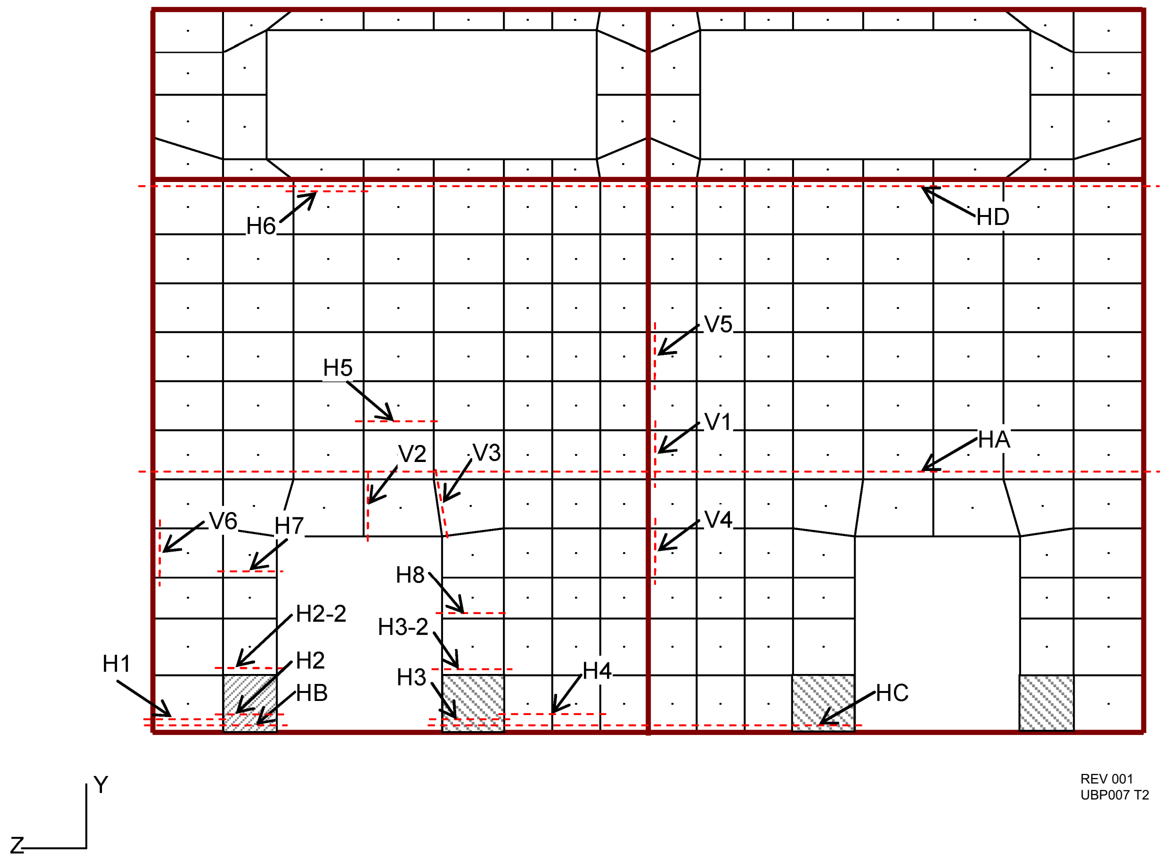

Figure 3E.2-7—FEM of Highly Stressed Areas of EPGB Wall at Column Line 11

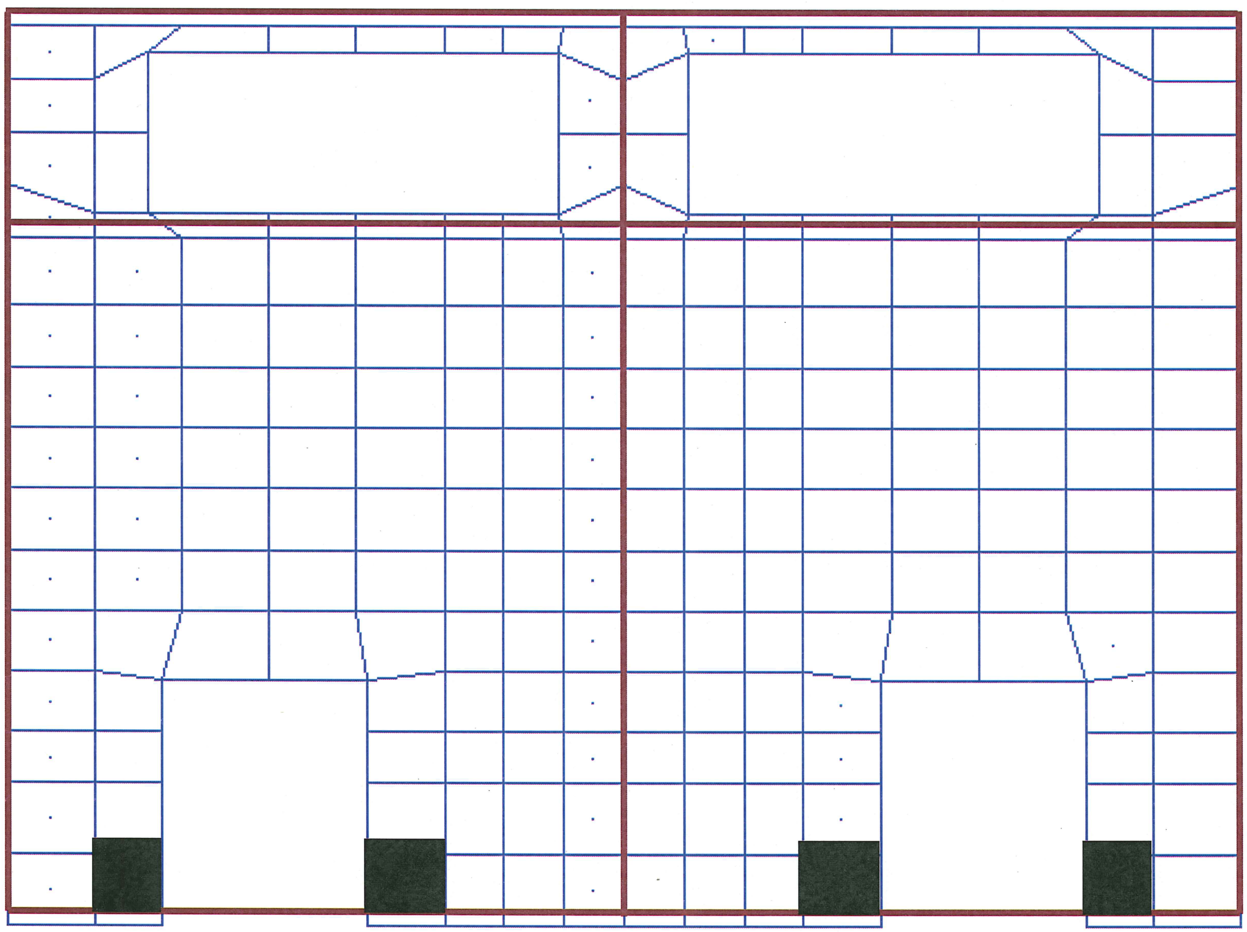

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Figure 3E.2-8—Reinforcement Sketch for EPGB Wall at Column Line 11

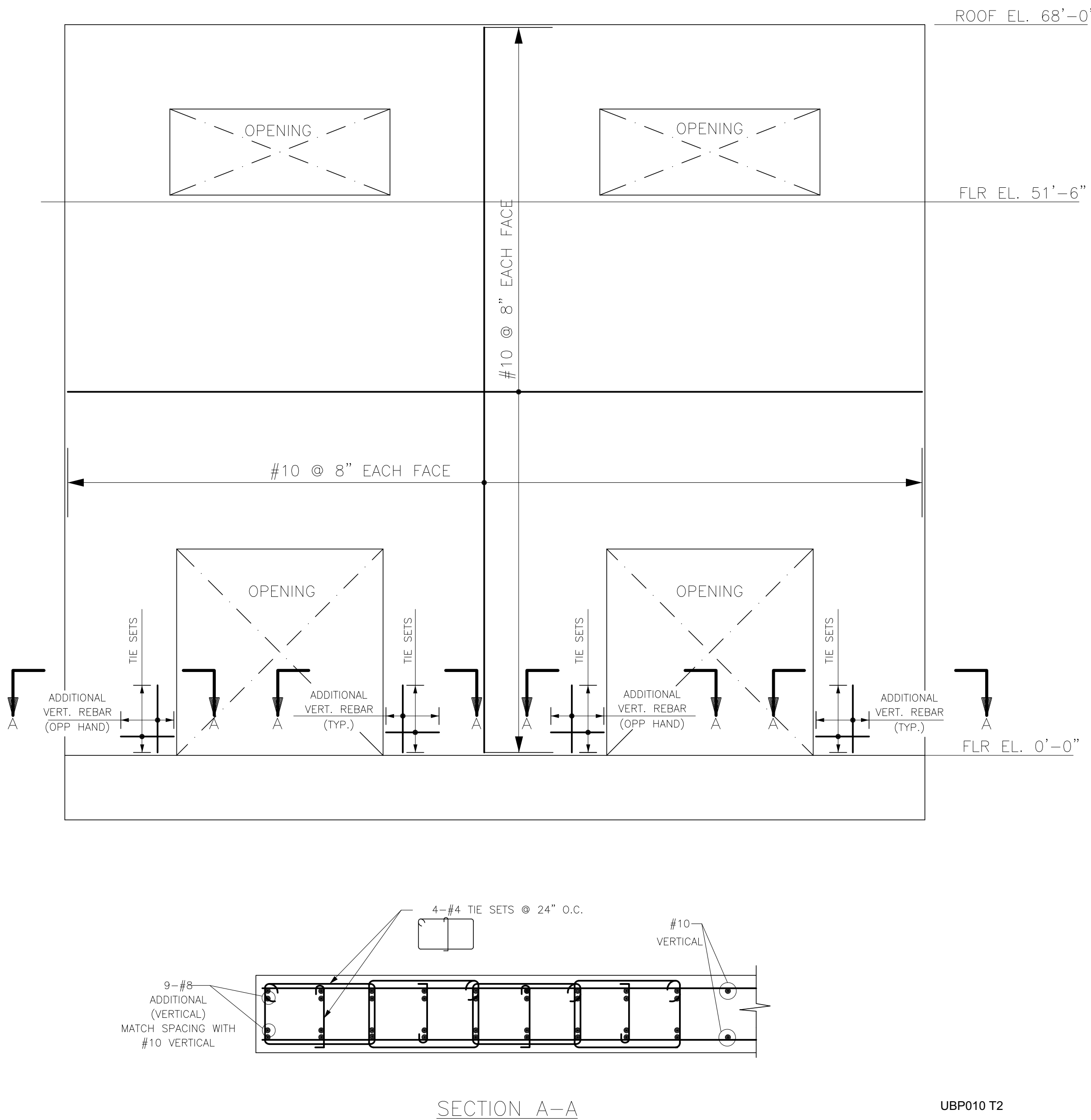


Figure 3E.2-9—EPGB Slab at Elevation 51'-6"

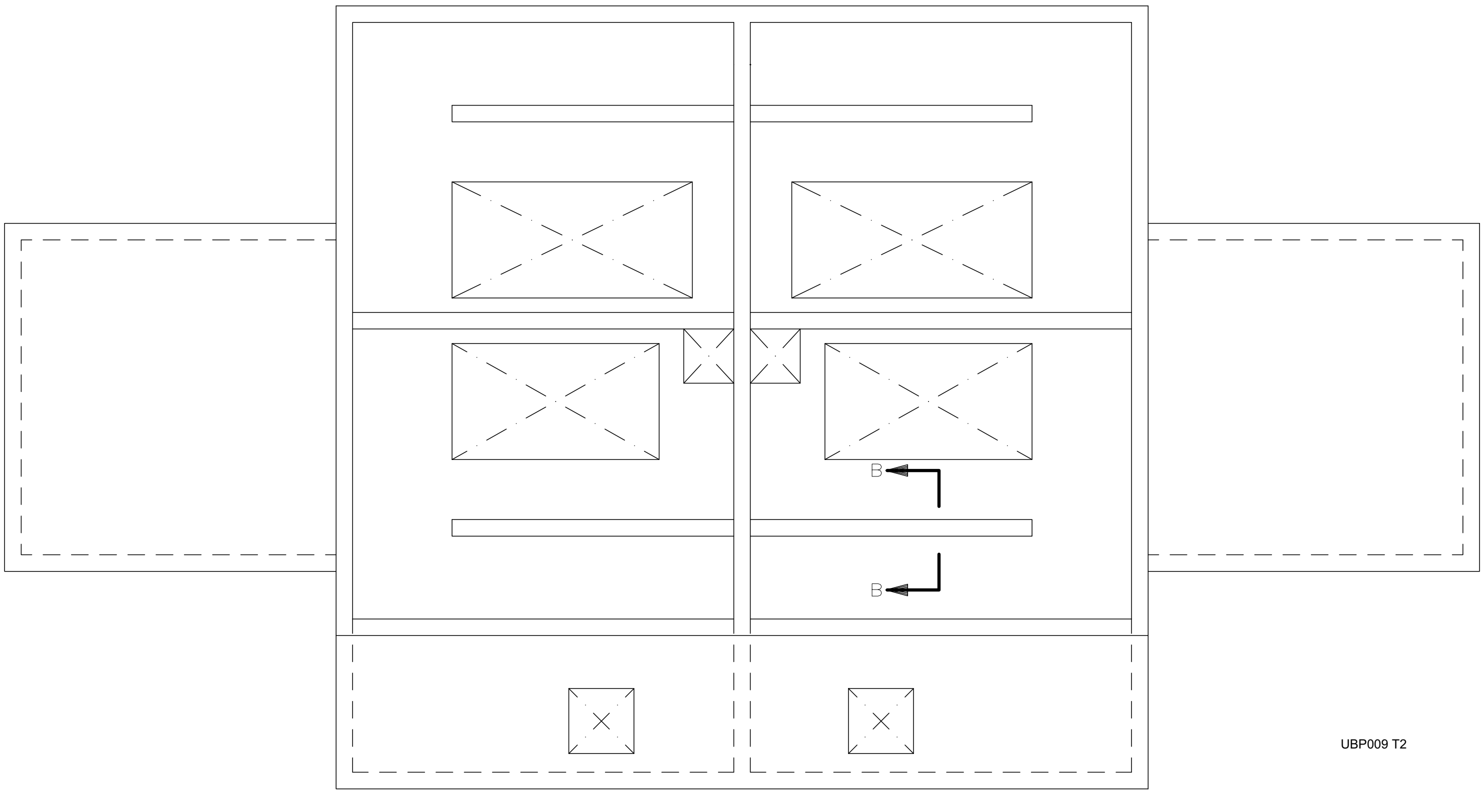


Figure 3E.2-10—Elevation View of EPGB Critical Section at Elevation 51'-6"

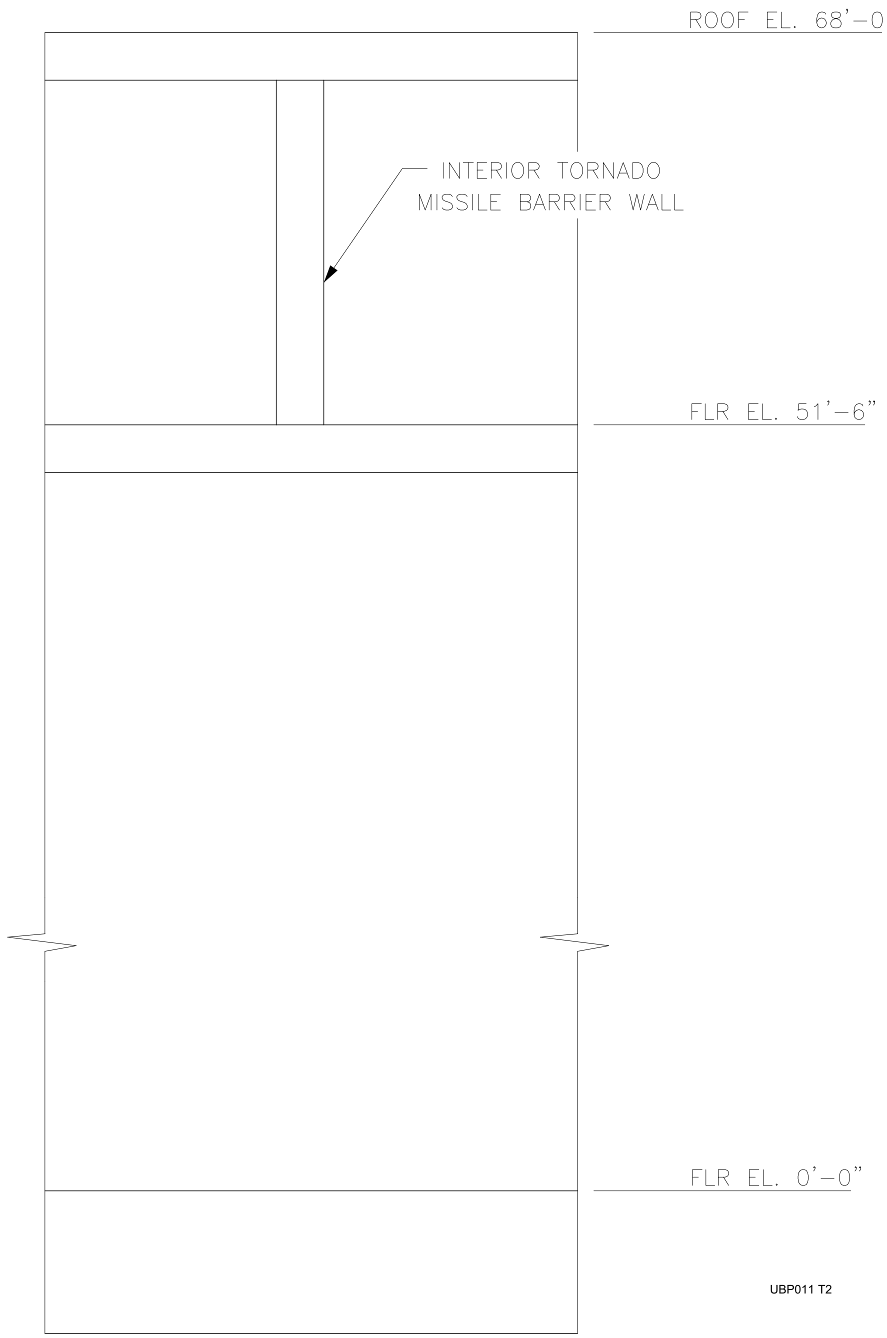


Figure 3E.2-11—FEM View of EPGB Elevation 51'-6"

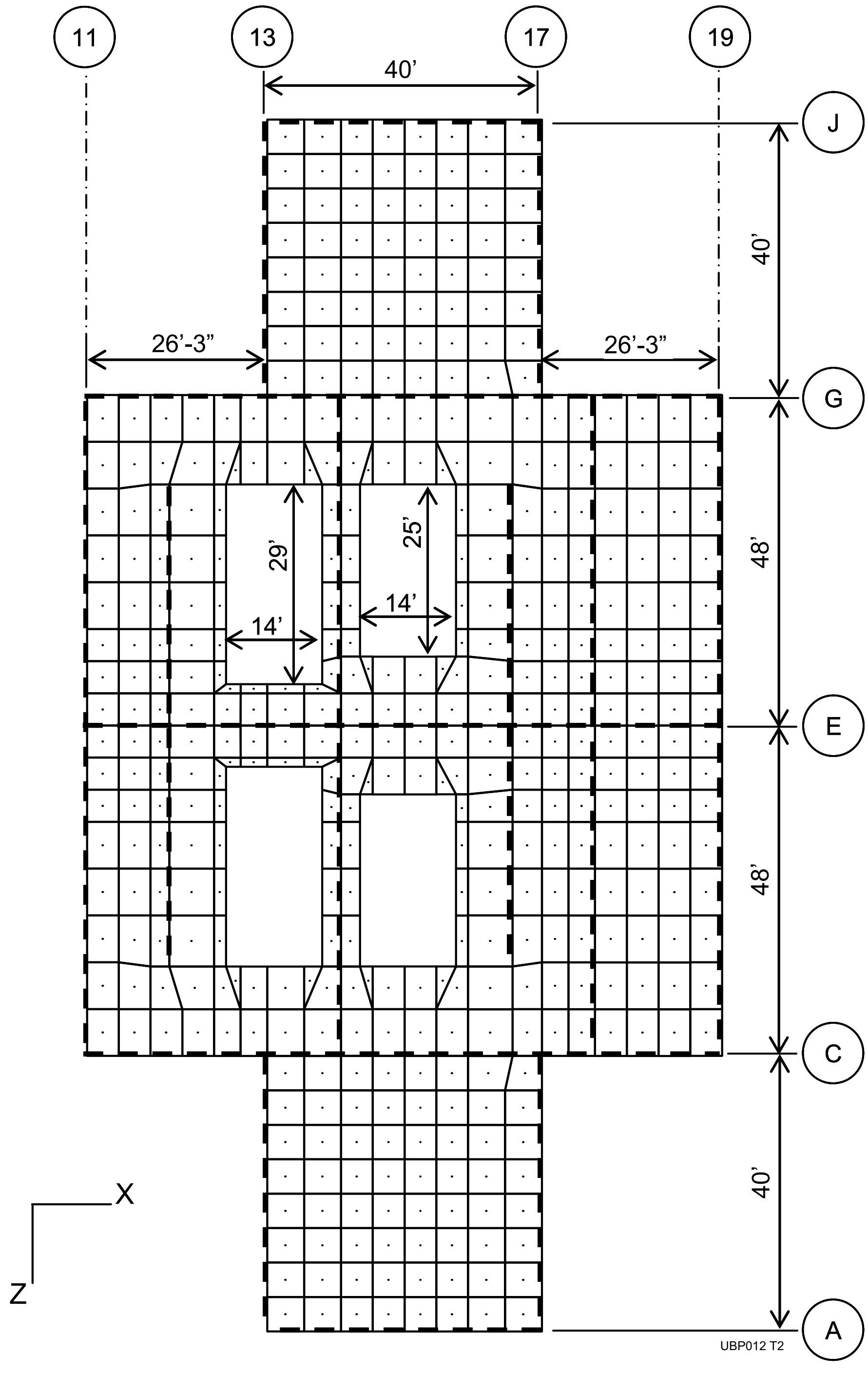
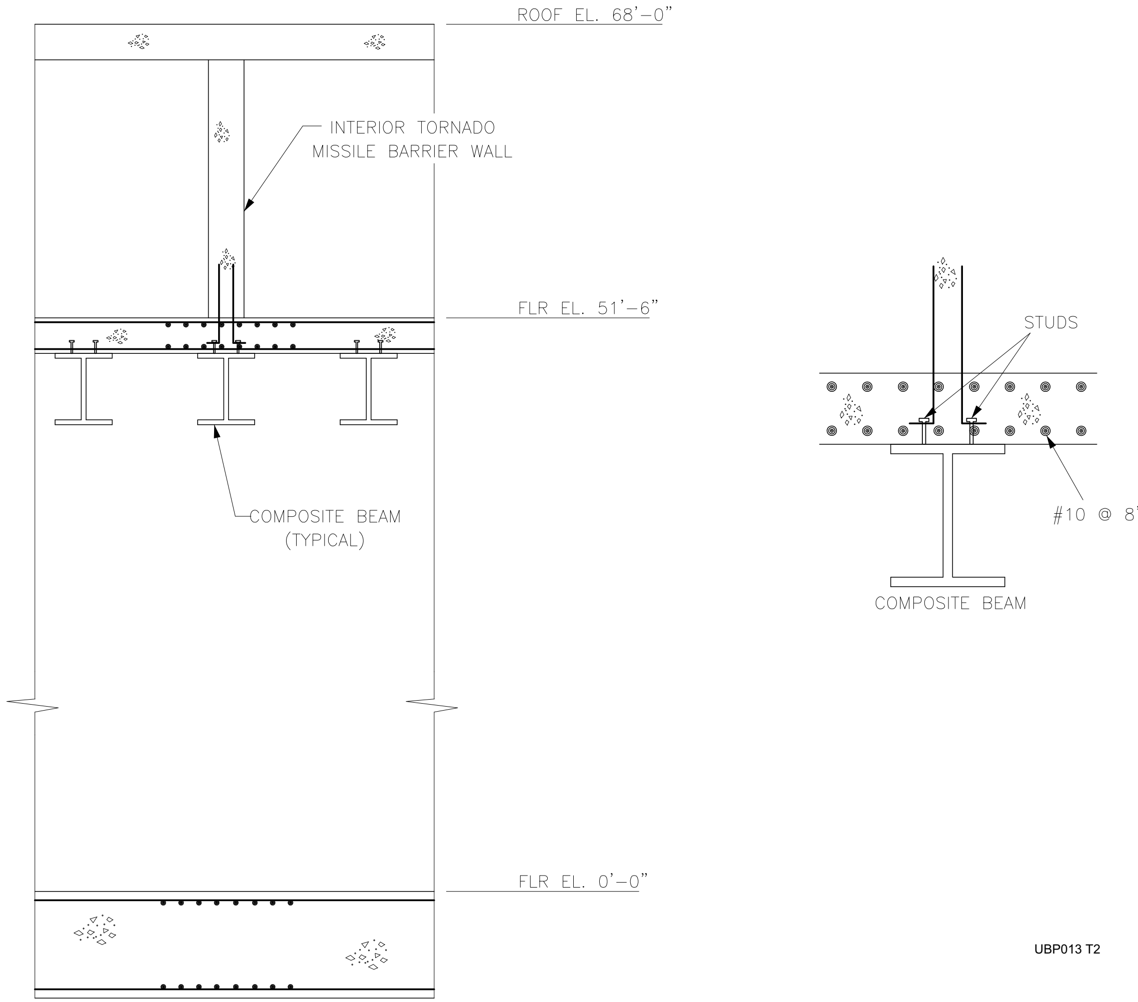


Figure 3E.2-12—Design Sketch of EPGB Elevation 51'-6"



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