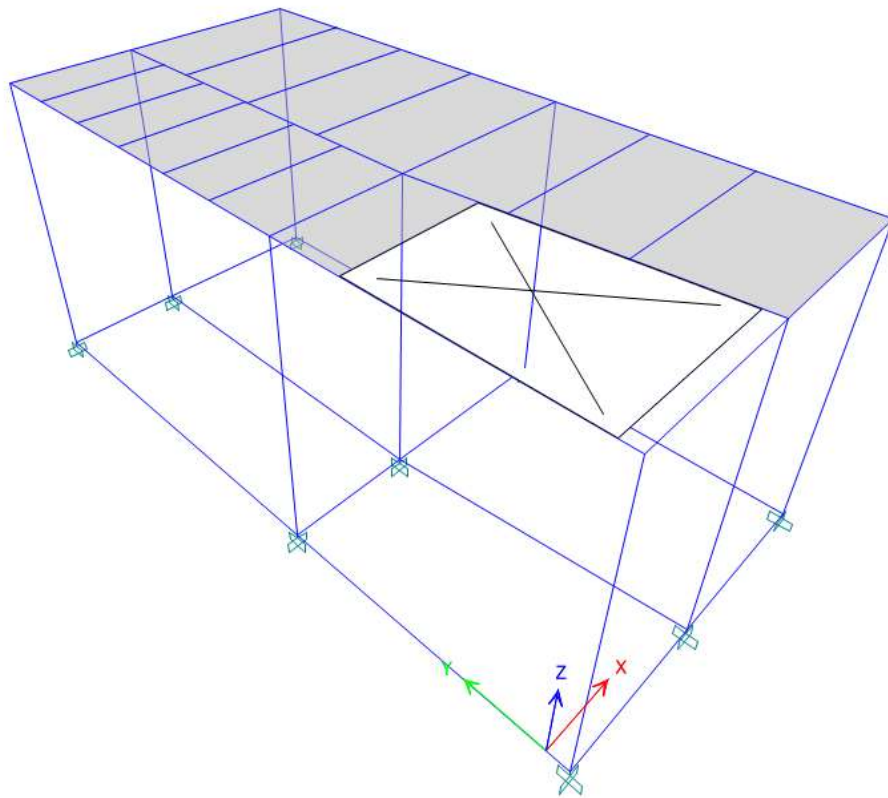




AS BUILT MS STEEL DECK DESIGN REP

Model File: deck1, Revision 0
7/7/2025

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1 Structure Data

This chapter provides model geometry information, including items such as story levels, point coordinates, and element connectivity.

1.1 Story Data

Table 1.1 - Story Definitions

Tower	Name	Height ft	Master Story	Similar To	Splice Story	Color
T1	Story1	20	Yes	None	No	Cyan

1.2 Grid Data

Table 1.2 - Grid Definitions - General

Tower	Name	Type	Ux ft	Uy ft	Rz deg	Story Range	Bubble Size in	Color
T1	G1	Cartesian	0	0	0	Default	60	Gray6

1.3 Point Coordinates

Table 1.3 - Point Bays

Label	Is Auto Point	X ft	Y ft	DZBelow ft
1	No	21.1458	17.6417	0
2	No	21.1458	30.2667	0
4	No	21.1458	24.1417	0
5	No	21.1458	-1.3583	0
7	No	21.1458	36.5167	0
8	No	8.4167	22.1833	0
9	No	21.1458	5.2667	0
10	No	21.1458	11.4125	0
14	No	8.4167	42.85	0
15	No	8.4167	38.85	0
16	No	8.4167	36.5167	0
17	No	8.4167	30.2667	0
18	No	8.4167	34.6833	0
19	No	8.4167	30.4333	0
20	No	8.4167	26.1	0
21	No	8.4167	24.1417	0
34	No	0	42.85	0
37	No	21.1458	42.85	0
38	No	0	17.6417	0
39	No	8.4167	17.6417	0
41	No	0	-1.3583	0
44	No	10.26	-1.3583	0
49	No	0	38.85	0
51	No	0	34.6833	0
53	No	0	30.4333	0
55	No	0	26.1	0

Table 1.3 - Point Bays (continued)

Label	Is Auto Point	X ft	Y ft	DZBelow ft
57	No	0	22.1833	0
59	No	0	13.0583	0
60	No	0	-0.3583	0
72	No	9.021	11.4125	0
73	No	9.6173	5.2667	0
74	No	8.8613	13.0583	0
75	No	10.163	-0.3583	0

1.4 Line Connectivity**Table 1.4 - Column Bays**

Label	PointBayI	PointBayJ	IEndStory
C1	14	14	Below
C2	1	1	Below
C3	5	5	Below
C14	34	34	Below
C17	37	37	Below
C18	38	38	Below
C19	39	39	Below
C21	41	41	Below
C22	44	44	Below

Table 1.5 - Beam Bays

Label	PointBayI	PointBayJ
B1	1	37
B2	39	1
B4	17	2
B5	21	4
B6	5	1
B7	44	5
B8	73	9
B9	72	10
B10	39	14
B11	34	14
B12	14	37
B13	16	7
B14	49	15
B16	57	8
B17	51	18
B18	53	19
B19	55	20
B26	38	34
B27	38	39
B32	41	38
B36	41	44

Table 1.5 - Beam Bays (continued)

Label	PointBayI	PointBayJ
B38	39	44
B53	59	74
B54	60	75

1.5 Area Connectivity**Table 1.6 - Floor Bays**

Label	NumPoints	PointNumber	PointBay
F1	4	1	38
F1		2	39
F1		3	14
F1		4	34
F2	4	1	39
F2		2	1
F2		3	37
F2		4	14
F5	4	1	5
F5		2	1
F5		3	39
F5		4	44
F6	4	1	74
F6		2	39
F6		3	38
F6		4	59

Table 1.7 - Null Area Bays

Label	NumPoints	PointNumber	PointBay	PointStory
A1	4	1	59	Same
A1		2	74	Same
A1		3	75	Same
A1		4	60	Same

2 Properties

This chapter provides property information for materials, frame sections, shell sections, and links.

2.1 Materials

Table 2.1 - Material Properties - General

Material	Type	SymType	Grade	Color	Notes
5000Psi	Concrete	Isotropic	f'c 5000 psi	Magenta	
A416Gr270	Tendon	Uniaxial	Grade 270	Gray8Dark	
A615Gr60	Rebar	Uniaxial	Grade 60	Yellow	
Q355	Steel	Isotropic	Q355	Yellow	

Table 2.2 - Material Properties - Steel Data

Material	Fy lb/in2	Fu lb/in2	Fye lb/in2	Fue lb/in2	SSCurveOpt	SSHysType	SHard in/in	SMax in/in	SRup in/in	FinalSlope
Q355	51488.39	68167.73	55114.34	75419.62	Simple	Kinematic	0.015	0.11	0.17	-0.1

Table 2.3 - Material Properties - Concrete Data

Material	Fc lb/in2	LtWtConc	IsUserFr	SSCurveOpt	SSHysType	SFc in/in	SCap in/in	FinalSlope	FAngle deg	DAngle deg
5000Psi	5000	No	No	Mander	Concrete	0.002481	0.005	-0.1	0	0

Table 2.4 - Material Properties - Rebar Data

Material	Fy lb/in2	Fu lb/in2	Fye lb/in2	Fue lb/in2	SSCurveOpt	SSHysType	SHard in/in	SCap in/in	FinalSlope
A615Gr60	60000	90000	66000	99000	Simple	Kinematic	0.01	0.09	-0.1

Table 2.5 - Material Properties - Tendon Data

Material	Fy lb/in2	Fu lb/in2	SSCurveOpt	SSHysType	FinalSlope
A416Gr270	245100	270000	270 ksi	Kinematic	-0.1

2.2 Frame Sections

Table 2.6 - Frame Section Property Definitions - Summary (Part 1 of 3)

Name	Material	Shape	Color	Area in2	J in4	I33 in4	I22 in4	I23 in4	As2 in2	As3 in2
HSS COMPOSITE	Q355	SD Section	Green	23.56	301.04	183.41	183.41	0	15.64	15.64
HSS203.2X203.2X15.9	Q355	Steel Tube	Green	16.43	245.06	146.07	146.07	0	9.31	9.31

Table 2.6 - Frame Section Property Definitions - Summary (Part 2 of 3)

Name	S33Pos in3	S33Neg in3	S22Pos in3	S22Neg in3	Z33 in3	Z22 in3	R33 in	R22 in	CG Offset 3 in	CG Offset 2 in	PNA Offset 3 in
HSS COMPOSITE	45.9	45.9	45.9	45.9	55.81	55.81	2.7903	2.7903	0	0	0
HSS203.2X203.2X15.9	36.55	36.55	36.55	36.55	44.73	44.73	2.9817	2.9817	0	0	0

Table 2.6 - Frame Section Property Definitions - Summary (Part 3 of 3)

Name	Area Modifier	As2 Modifier	As3 Modifier	J Modifier	I33 Modifier	I22 Modifier	Mass Modifier	Weight Modifier
HSS COMPOSITE	1	1	1	1	1	1	1	1
HSS203.2X203.2X15.9	1	1	1	1	1	1	1	1

Table 2.7 - Frame Section Property Definitions - Steel Tube (Part 1 of 3)

Name	Material	From File?	File Name	Section in File	Total Depth in	Total Width in	Flange Thickness in	Web Thickness in
HSS203.2X203.2X15.9	Q355	Yes	AISC16M	HSS203.2X203.2X15.9	7.9921	7.9921	0.5827	0.5827

Table 2.7 - Frame Section Property Definitions - Steel Tube (Part 2 of 3)

Name	Corner Radius in	Area Modifier	As2 Modifier	As3 Modifier	J Modifier	I22 Modifier	I33 Modifier	Mass Modifier	Weight Modifier
HSS203.2X203.2X15.9	0	1	1	1	1	1	1	1	1

Table 2.7 - Frame Section Property Definitions - Steel Tube (Part 3 of 3)

Name	Notes
HSS203.2X203.2X15.9	

Table 2.8 - Frame Section Property Definitions - Section Designer (Part 1 of 2)

Name	Base Material	Design Type	Concrete Column Designed?	Area Modifier	As2 Modifier	As3 Modifier	J Modifier	I22 Modifier	I33 Modifier
HSS COMPOSITE	Q355	Composite Column	Yes	1	1	1	1	1	1

Table 2.8 - Frame Section Property Definitions - Section Designer (Part 2 of 2)

Name	Mass Modifier	Weight Modifier	Color	Notes
HSS COMPOSITE	1	1	Green	

2.3 Shell Sections

Table 2.9 - Area Section Property Definitions - Summary

Name	Type	Element Type	Material	Total Thickness in	Deck Material	Deck Depth in
Deck1	Deck	Membrane	5000Psi	7	Q355	3

Table 2.10 - Deck Property Definitions (Part 1 of 3)

Name	Deck Type	Slab Material	Deck Material	Slab Depth in	Rib Depth in	Rib Width Top in	Rib Width Bottom in	Rib Spacing in	Deck Shear Thickness in	Deck Unit Weight lb/ft2	Shear Stud Diameter in
Deck1	Filled	5000Psi	Q355	4	3	7	5	12	0.035	2.3	0.75

Table 2.10 - Deck Property Definitions (Part 2 of 3)

Name	Shear Stud Height in	Shear Stud Tensile Strength lb/in2	f11 Modifier	f22 Modifier	f12 Modifier	m11 Modifier	m22 Modifier	m12 Modifier	v13 Modifier	v23 Modifier	Mass Modifier
Deck1	6	65000	1	1	1	1	1	1	1	1	1

Table 2.10 - Deck Property Definitions (Part 3 of 3)

Name	Color	Notes
Deck1	Yellow	

3 Assignments

This chapter provides a listing of the assignments applied to the model.

3.1 Frame Assignments

Table 3.1 - Frame Assignments - Summary

Story	Label	UniqueName	Design Type	Length ft	Analysis Section	Design Section	Max Station Spacing ft	Min Number Stations
Story1	C14	25	Column	20	HSS COMPOSITE	HSS COMPOSITE		3

Table 3.2 - Frame Assignments - Section Properties

Story	Label	UniqueName	Shape	Auto Select List	Section Property
Story1	C14	25	SD Section	N.A.	HSS COMPOSITE

4 Loads

This chapter provides loading information as applied to the model.

4.1 Load Patterns

Table 4.1 - Load Pattern Definitions

Name	Is Auto Load	Type	Self Weight Multiplier
~LLRF	Yes	Other	0
Dead	No	Dead	1
Live	No	Live	0

4.2 Load Cases

Table 4.2 - Load Case Definitions - Summary

Name	Type
Dead	Linear Static
Live	Linear Static
Modal	Modal - Eigen

Table 4.3 - Load Case Definitions - Linear Static

Name	Exclude Group	Mass Source	Stiffness Type	Load Type	Load Name	Load SF	Design Type	Notes
Dead	None	MsSrc1	P-Delta	Load	Dead	1	Program Determined	
Live	None	MsSrc1	P-Delta	Load	Live	1	Program Determined	

Table 4.4 - Modal Case Definitions - Eigen

Name	Exclude Group	Mass Source	Stiffness Type	Max Modes	Min Modes	Freq Shift cyc/sec	Cutoff Freq cyc/sec	Convergence Tol	Auto Shift?	Design Type	Notes
Modal	None	MsSrc1	P-Delta	12	1	0	0	0	Yes	Program Determined	

4.3 Load Combinations

Table 4.5 - Load Combination Definitions

Name	Type	Is Auto	Load Name	SF	Notes
DStID1	Linear Add	Yes	Dead	1	Dead [Deflections]
DStID2	Linear Add	Yes	Dead	1	Dead + Live [Deflections]
DStID2			Live	1	
DStIS1	Linear Add	Yes	Dead	1.4	Dead [Strength]
DStIS2	Linear Add	Yes	Dead	1.2	Dead + Live [Strength]
DStIS2			Live	1.6	

5 Analysis Results

This chapter provides analysis results.

5.1 Structure Results

Table 5.1 - Base Reactions

Output Case	Case Type	FX kip	FY kip	FZ kip	MX kip-ft	MY kip-ft	MZ kip-ft	X ft	Y ft	Z ft
Dead	LinStatic	0	0	104.315	2295.9741	-1135.2167	0	0	0	0
Live	LinStatic	0	0	76.435	2092.0878	-556.4547	2.295E-06	0	0	0
DStIS1	Combination	0	0	146.042	3214.3637	-1589.3034	0	0	0	0
DStIS2	Combination	0	0	247.475	6102.5093	-2252.5876	3.553E-06	0	0	0
DStID1	Combination	0	0	104.315	2295.9741	-1135.2167	0	0	0	0
DStID2	Combination	0	0	180.751	4388.0618	-1691.6714	2.196E-06	0	0	0

5.2 Line Results

Table 5.2 - Element Forces - Columns (Part 1 of 2)

Story	Column	Unique Name	Station ft	Output Case	Case Type	P kip	V2 kip	V3 kip	T kip-ft	M2 kip-ft	M3 kip-ft
Story1	C14	25	0	Dead	LinStatic	-7.633	-0.066	1.369	0.0219	8.08	-0.4619
Story1	C14	25	9.667	Dead	LinStatic	-6.595	-0.066	1.369	0.0219	-5.1569	0.1776
Story1	C14	25	19.334	Dead	LinStatic	-5.557	-0.066	1.369	0.0219	-18.3939	0.8171
Story1	C14	25	0	Live	LinStatic	-13.94	-0.099	2.73	0.1172	16.3485	-1.1397
Story1	C14	25	9.667	Live	LinStatic	-13.94	-0.099	2.73	0.1172	-10.0461	-0.1822
Story1	C14	25	19.334	Live	LinStatic	-13.94	-0.099	2.73	0.1172	-36.4407	0.7753
Story1	C14	25	0	DStIS1	Combination	-10.686	-0.093	1.917	0.0306	11.3121	-0.6467
Story1	C14	25	9.667	DStIS1	Combination	-9.233	-0.093	1.917	0.0306	-7.2197	0.2487
Story1	C14	25	19.334	DStIS1	Combination	-7.78	-0.093	1.917	0.0306	-25.7514	1.144
Story1	C14	25	0	DStIS2	Combination	-31.463	-0.238	6.012	0.2138	35.8536	-2.3777
Story1	C14	25	9.667	DStIS2	Combination	-30.218	-0.238	6.012	0.2138	-22.2621	-0.0784
Story1	C14	25	19.334	DStIS2	Combination	-28.973	-0.238	6.012	0.2138	-80.3779	2.221
Story1	C14	25	0	DStID1	Combination	-7.633	-0.066	1.369	0.0219	8.08	-0.4619
Story1	C14	25	9.667	DStID1	Combination	-6.595	-0.066	1.369	0.0219	-5.1569	0.1776
Story1	C14	25	19.334	DStID1	Combination	-5.557	-0.066	1.369	0.0219	-18.3939	0.8171
Story1	C14	25	0	DStID2	Combination	-21.572	-0.165	4.1	0.1391	24.4285	-1.6016
Story1	C14	25	9.667	DStID2	Combination	-20.535	-0.165	4.1	0.1391	-15.203	-0.0046
Story1	C14	25	19.334	DStID2	Combination	-19.497	-0.165	4.1	0.1391	-54.8346	1.5924

Table 5.2 - Element Forces - Columns (Part 2 of 2)

Story	Column	Unique Name	Station ft	Element	Elem Station ft	Location
Story1	C14	25	0	25	0	
Story1	C14	25	9.667	25	9.667	
Story1	C14	25	19.334	25	19.334	
Story1	C14	25	0	25	0	
Story1	C14	25	9.667	25	9.667	
Story1	C14	25	19.334	25	19.334	

Table 5.2 - Element Forces - Columns (Part 2 of 2, continued)

Story	Column	Unique Name	Station ft	Element	Elem Station ft	Location
Story1	C14	25	0	25	0	
Story1	C14	25	9.667	25	9.667	
Story1	C14	25	19.334	25	19.334	
Story1	C14	25	0	25	0	
Story1	C14	25	9.667	25	9.667	
Story1	C14	25	19.334	25	19.334	
Story1	C14	25	0	25	0	
Story1	C14	25	9.667	25	9.667	
Story1	C14	25	19.334	25	19.334	
Story1	C14	25	0	25	0	
Story1	C14	25	9.667	25	9.667	
Story1	C14	25	19.334	25	19.334	

5.3 Modal Results

Table 5.3 - Modal Periods And Frequencies

Case	Mode	Period sec	Frequency cyc/sec	CircFreq rad/sec	Eigenvalue rad2/sec2
Modal	1	0.612	1.635	10.2715	105.5028
Modal	2	0.564	1.773	11.1374	124.0422
Modal	3	0.412	2.424	15.2333	232.0544
Modal	4	0.022	46.191	290.2242	84230.074
Modal	5	0.012	82.612	519.0659	269429.4547
Modal	6	0.01	97.692	613.8182	376772.8201
Modal	7	0.01	101.079	635.0955	403346.355
Modal	8	0.008	120.365	756.2751	571952.0641
Modal	9	0.008	129.769	815.3599	664811.8406
Modal	10	0.008	131.145	824.0103	678992.9517
Modal	11	0.007	139.075	873.8344	763586.5548
Modal	12	0.006	155.35	976.0947	952760.9257

6 Design Data

This chapter provides design data and results.

6.1 Steel Frame Design

Table 6.1 - Steel Frame Design Preferences - AISC 360-22

Item	Value
Multi-Response Design	Step-by-Step - All
Frame Type	OMF
Seismic Design Category	D
Importance Factor	1
Design System Rho	1
Design System Sds	0.5
Design System R	8
Design System Omega0	3
Design System Cd	5.5
Design Provision	LRFD
Analysis Method	Direct Analysis
Second Order Method	General 2nd Order
Stiffness Reduction Method	Tau-b Fixed
Add Notional Load Case	No
Beta Factor	1.3
Beta Omega Factor	1.6
Phi (Bending)	0.9
Phi (Compression)	0.9
Phi (Tension-Yielding)	0.9
Phi (Tension-Fracture)	0.75
Phi (Shear)	0.9
Phi (Shear-Short Webbed Rolled I)	1
Phi (Torsion)	0.9
Ignore Seismic Code?	No
Ignore Special Seismic Load?	No
Doubler Plate Plug-Welded?	Yes
HSS Welding Type	ERW
Reduced HSS Thickness	No
Consider Deflection?	Yes
DL Ratio	120
SDL+LL Ratio	120
LL Ratio	360
Total Ratio	240
Total Camber Limit	240
Pattern Live Load Factor	0.75
D/C Ratio Limit	0.95
Maximum Iterations	1

Table 6.2 - Steel Frame Design Overwrites - AISC 360-22

Item	Value
Story	Story1
Label	C14
Unique Name	25
Design Type	Column
Design Section	Program Determined
Frame Type	Program Determined
Omega0	0
Connection Type	Program Determined
Relative Hinge Distance Sh/L Left	0
Yield Line Yc/h Parameter	0
Relative Hinge Distance Sh/L Right	0
BRB Beta Factor	0
BRB Beta*Omega Factor	0
Perform RBS Capacity Design	Program Determined
Check Deflection?	Program Determined
Deflection Type	Program Determined
DL Ratio	0
SDL+LL Ratio	0
LL Ratio	0
Total Ratio	0
Camber Ratio	0
Specified Camber in	0
Net Area Ratio	0
LLRF	0
Unbraced Length Ratio Major	0
Unbraced Length Ratio Minor	0
Unbraced Length Ratio (LTB)	0
Effective Length Factor 1 Major	0
Effective Length Factor 1 Minor	0
Effective Length Factor 2 Major	0
Effective Length Factor 2 Minor	0
Effective Length Factor (KLTB)	0
Moment Coefficient (Cm Major)	0
Moment Coefficient (Cm Minor)	0
Bending Coefficient (Cb)	0
Nonsway Moment Factor (B1 Major)	0
Nonsway Moment Factor (B1 Minor)	0
Sway Moment Factor (B2 Major)	0
Sway Moment Factor (B2 Minor)	0
Reduce HSS Thickness?	Program Determined
HSS Welding Type?	Program Determined
Yield stress, Fy lb/in2	0
Expected to specified Fy ratio, Ry	0
Compressive Capacity, Pnc kip	0
Tensile Capacity, Pnt kip	0
Major Bending Capacity, Mn3 kip-ft	0

Table 6.2 - Steel Frame Design Overwrites - AISC 360-22 (continued)

Item	Value
Minor Bending Capacity, Mn2 kip-ft	0
Major Shear Capacity, Vn2 kip	0
Minor Shear Capacity, Vn3 kip	0
D/C Ratio Limit	0

Table 6.3 - Steel Column Envelope - AISC 360-22

Story	Label	UniqueName	Section	Moment Interaction Check	PMM Combo	V22 Ratio	V33 Ratio	Section Class
Story1	C14	25	HSS COMPOSITE	$0.488 = 0.022 + 0.013 + 0.454$	DStIS2	0.001	0.014	Non-Compact

Table 6.4 - Steel Frame Design Summary - AISC 360-22 (Part 1 of 2)

UniqueName	Story	Label	Design Type	Design Section	Status	PMM Combo	PMM Ratio	P Ratio	M Major Ratio	M Minor Ratio
25	Story1	C14	Column	HSS COMPOSITE	No Message	DStIS2(C)	0.488	0.022	0.013	0.454

Table 6.4 - Steel Frame Design Summary - AISC 360-22 (Part 2 of 2)

UniqueName	V Major Combo	V Major Ratio	V Minor Combo	V Minor Ratio
25	DStIS2	0.001	DStIS2	0.014

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	232.0079	2.7903	83.147	200	83.147	300
Minor (2-2)	1	232.0079	2.7903	83.147	200	83.147	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	C14	25	HSS COMPOSITE	DStIS2	232.0079	Ordinary Moment Frame	Non-Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
240.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.006	0.008	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
23.56	301.04	183.41	183.41	15.64	15.64

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
45.9	45.9	55.81	55.81	2.7903	2.7903	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
232.0079	-28.973	2.221	-80.3779	-0.238	6.012	0.2138

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.967	1	1	1	1	0.226
Minor Bending	0.967	1	1	1	1	0.422

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.967	1	2.259

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r/2P_c) + (M_{r33}/M_{c33}) + (M_{r22}/M_{c22})
0.488 =	0.022 + 0.013 + 0.454

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
28.973	658.616	1091.586

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	2.221	177.2376	177.2376	177.2376
Minor Bending	80.3779	177.2376		

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.238	434.844	0.001
Minor Shear	6.012	434.844	0.014

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	C14	25	Ordinary Moment Frame	HSS COMPOSITE

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	240	0	2	0	DStID2	232.0079	OK
Super DL + Live Load	240	0	2	0	DStID2	232.0079	OK
Live Load	240	0	0.6667	0	DStID2	232.0079	OK
Total Load	240	0	1	0	DStID2	232.0079	OK
Total - Camber	240	0	1	0	DStID2	232.0079	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	232.0079	2.7903	83.147	200	83.147	300
Minor (2-2)	1	232.0079	2.7903	83.147	200	83.147	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	C1	32	HSS COMPOSITE	DStIS2	232.0079	Ordinary Moment Frame	Non-Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
240.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.012	0.014	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
23.56	301.04	183.41	183.41	15.64	15.64

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
45.9	45.9	55.81	55.81	2.7903	2.7903	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
232.0079	-34.155	1.9134	-79.8134	-0.214	5.985	0.2143

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.967	1	1	1	1	0.255
Minor Bending	0.967	1	1	1	1	0.42

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.967	1	2.245

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r/2P_c) + (M_{r33}/M_{c33}) + (M_{r22}/M_{c22})
0.487 =	0.026 + 0.011 + 0.45

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
34.155	658.616	1091.586

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	1.9134	177.2376	177.2376	177.2376
Minor Bending	79.8134	177.2376		

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.214	434.844	4.911E-04
Minor Shear	5.985	434.844	0.014

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	C1	32	Ordinary Moment Frame	HSS COMPOSITE

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	240	0	2	0	DStID2	232.0079	OK
Super DL + Live Load	240	0	2	0	DStID2	232.0079	OK
Live Load	240	0	0.6667	0	DStID2	232.0079	OK
Total Load	240	0	1	0	DStID2	232.0079	OK
Total - Camber	240	0	1	0	DStID2	232.0079	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	93.0079	2.9817	31.193	200	31.193	300
Minor (2-2)	1	93.0079	2.9817	31.193	200	31.193	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B11	33	HSS203.2X203.2X15.9	DS1S1	97.0039	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
101.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-2.957E-04	-5.024E-05	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
97.0039	0.09	-1.7884	0.0096	0.74	-0.002	2.0806

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.921	1	1	1	1	1
Minor Bending	0.921	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.921	1	1.941

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r/2P_c) + (M_{r33}/M_{c33}) + (M_{r22}/M_{c22})
0.01 =	5.893E-05 + 0.01 + 5.556E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.09	709.102	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	1.7884	172.7322	172.7322	172.7322
Minor Bending	0.0096	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
2.0806	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.74	202.316	0.004
Minor Shear	0.002	202.316	1.11E-05

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
0.449	DStIS2	0.74	DStIS1

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B11	33	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	101	0.004	0.8417	0.005	DStID2	3.9961	OK
Super DL + Live Load	101	0.008	0.8417	0.01	DStID2	3.9961	OK
Live Load	101	0.008	0.2806	0.029	DStID2	3.9961	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	101	0.004	0.4208	0.009	DStID1	3.9961	OK
Total - Camber	101	0.004	0.4208	0.009	DStID1	3.9961	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	232.0079	2.7903	83.147	200	83.147	300
Minor (2-2)	1	232.0079	2.7903	83.147	200	83.147	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	C17	34	HSS COMPOSITE	DStIS2	232.0079	Ordinary Moment Frame	Non-Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
240.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.008	0.01	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{v-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
23.56	301.04	183.41	183.41	15.64	15.64

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
45.9	45.9	55.81	55.81	2.7903	2.7903	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
232.0079	-14.373	-3.5678	-50.2824	0.219	3.684	0.2114

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.967	1	1	1	1	0.526
Minor Bending	0.967	1	1	1	1	0.433

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.967	1	1.901

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r/2P_c) + (M_{r33}/M_{c33}) + (M_{r22}/M_{c22})
0.315 =	0.011 + 0.02 + 0.284

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
14.373	658.616	1091.586

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	3.5678	177.2376	177.2376	177.2376
Minor Bending	50.2824	177.2376		

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.219	434.844	0.001
Minor Shear	3.684	434.844	0.008

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	C17	34	Ordinary Moment Frame	HSS COMPOSITE

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	240	0	2	0	DStID2	232.0079	OK
Super DL + Live Load	240	0	2	0	DStID2	232.0079	OK
Live Load	240	0	0.6667	0	DStID2	232.0079	OK
Total Load	240	0	1	0	DStID2	232.0079	OK
Total - Camber	240	0	1	0	DStID2	232.0079	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	144.7579	2.9817	48.549	200	48.549	300
Minor (2-2)	1	144.7579	2.9817	48.549	200	48.549	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B12	35	HSS203.2X203.2X15.9	DStIS2	148.7539	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
152.7500	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-8.665E-05	-3.566E-05	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
148.7539	0.163	6.0771	0.0041	-0.43	1.084E-04	-8.1273

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.948	1	1	1	1	1
Minor Bending	0.948	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.948	1	1.935

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r /2P_c) + (M_{r33} /M_{c33}) + (M_{r22} /M_{c22})
0.035 =	1.072E-04 + 0.035 + 2.35E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.163	640.888	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	6.0771	172.7322	172.7322	172.7322
Minor Bending	0.0041	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
-8.1273	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	1.239	202.316	0.006
Minor Shear	1.084E-04	202.316	0

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
1.239	DStIS2	0.43	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B12	35	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	152.75	0.0048	1.2729	0.004	DStID2	86.7148	OK
Super DL + Live Load	152.75	0.0098	1.2729	0.008	DStID2	107.3945	OK
Live Load	152.75	0.0098	0.4243	0.023	DStID2	107.3945	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	152.75	0.0083	0.6365	0.013	DStID2	86.7148	OK
Total - Camber	152.75	0.0083	0.6365	0.013	DStID2	86.7148	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	232.0079	2.7903	83.147	200	83.147	300
Minor (2-2)	1	232.0079	2.7903	83.147	200	83.147	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	C18	36	HSS COMPOSITE	DStIS2	232.0079	Ordinary Moment Frame	Non-Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
240.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.01	0.012	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
23.56	301.04	183.41	183.41	15.64	15.64

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
45.9	45.9	55.81	55.81	2.7903	2.7903	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
232.0079	-37.623	1.3569	64.4577	-0.116	-5.405	0.209

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.967	1	1	1	1	0.337
Minor Bending	0.967	1	1	1	1	0.351

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.967	1	2.204

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r/2P_c) + (M_{r33}/M_{c33}) + (M_{r22}/M_{c22})
0.4 =	0.029 + 0.008 + 0.364

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
37.623	658.616	1091.586

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	1.3569	177.2376	177.2376	177.2376
Minor Bending	64.4577	177.2376		

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.116	434.844	2.675E-04
Minor Shear	5.405	434.844	0.012

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	C18	36	Ordinary Moment Frame	HSS COMPOSITE

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	240	0	2	0	DStID2	232.0079	OK
Super DL + Live Load	240	0	2	0	DStID2	232.0079	OK
Live Load	240	0	0.6667	0	DStID2	232.0079	OK
Total Load	240	0	1	0	DStID2	232.0079	OK
Total - Camber	240	0	1	0	DStID2	232.0079	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	294.5079	2.9817	98.772	200	98.772	300
Minor (2-2)	1	52	2.9817	17.44	200	17.44	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B26	37	HSS203.2X203.2X15.9	DSII S2	153.5	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
302.5000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.002	0.004	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
153.5	-1.819	125.2922	0.0051	0.732	0.003	-0.2788

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.974	1	1	1	1	1
Minor Bending	0.172	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.172	1	1.007

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r/2P_c) + (M_{r33}/M_{c33}) + (M_{r22}/M_{c22})
0.728 =	0.002 + 0.725 + 2.956E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
1.819	373.208	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	125.2922	172.7322	172.7322	172.7322
Minor Bending	0.0051	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
-0.2788	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	30.376	202.316	0.15
Minor Shear	0.008	202.316	3.917E-05

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
30.376	DStIS2	27.758	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B26	37	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	302.5	0.3906	2.5208	0.155	DStID2	153.5	OK
Super DL + Live Load	302.5	1.5442	2.5208	0.613	DStID2	153.5	OK
Live Load	302.5	1.5442	0.8403	1.838	DStID2	153.5	Not OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	302.5	1.9348	1.2604	1.535	DStID2	153.5	Not OK
Total - Camber	302.5	1.9348	1.2604	1.535	DStID2	153.5	Not OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	93.0079	2.9817	31.193	200	31.193	300
Minor (2-2)	1	93.0079	2.9817	31.193	200	31.193	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B27	38	HSS203.2X203.2X15.9	DS1S1	97.0039	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
101.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-8.975E-05	-1.525E-05	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
97.0039	0.017	-2.8856	-0.0021	0.957	0.001	0.1597

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.921	1	1	1	1	1
Minor Bending	0.921	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.921	1	2.292

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r /2P_c) + (M_{r33} /M_{c33}) + (M_{r22} /M_{c22})
0.017 =	1.139E-05 + 0.017 + 1.198E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.017	709.102	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	2.8856	172.7322	172.7322	172.7322
Minor Bending	0.0021	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0.1597	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.957	202.316	0.005
Minor Shear	0.001	202.316	0

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
0.35	DStIS1	0.957	DStIS1

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B27	38	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	101	0.0085	0.8417	0.01	DStID2	3.9961	OK
Super DL + Live Load	101	0.0014	0.8417	0.002	DStID2	97.0039	OK
Live Load	101	0.0014	0.2806	0.005	DStID2	97.0039	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	101	0.0113	0.4208	0.027	DStID2	3.9961	OK
Total - Camber	101	0.0113	0.4208	0.027	DStID2	3.9961	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	144.7579	2.9817	48.549	200	48.549	300
Minor (2-2)	1	144.7579	2.9817	48.549	200	48.549	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B2	39	HSS203.2X203.2X15.9	DSII S2	128.0742	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
152.7500	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-2.901E-05	-1.194E-05	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
128.0742	0.05	3.0485	0.002	-0.027	-0.001	6.0855

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.948	1	1	1	1	1
Minor Bending	0.948	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.948	1	1.312

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r /2P_c) + (M_{r33} /M_{c33}) + (M_{r22} /M_{c22})
0.018 =	3.299E-05 + 0.018 + 1.156E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.05	640.888	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	3.0485	172.7322	172.7322	172.7322
Minor Bending	0.002	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
6.0855	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.721	202.316	0.004
Minor Shear	0.001	202.316	6.656E-06

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
0.721	DStIS2	0.479	DStIS1

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B2	39	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	152.75	0.006	1.2729	0.005	DStID2	66.0352	OK
Super DL + Live Load	152.75	0.0077	1.2729	0.006	DStID2	148.7539	OK
Live Load	152.75	0.0077	0.4243	0.018	DStID2	148.7539	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	152.75	0.0111	0.6365	0.017	DStID2	86.7148	OK
Total - Camber	152.75	0.0111	0.6365	0.017	DStID2	86.7148	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	232.0079	2.7903	83.147	200	83.147	300
Minor (2-2)	1	232.0079	2.7903	83.147	200	83.147	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	C19	40	HSS COMPOSITE	DStIS2	232.0079	Ordinary Moment Frame	Non-Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
240.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.022	0.026	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{v-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
23.56	301.04	183.41	183.41	15.64	15.64

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
45.9	45.9	55.81	55.81	2.7903	2.7903	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
232.0079	-53.975	1.7005	57.1888	-0.143	-4.815	0.209

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.967	1	1	1	1	0.348
Minor Bending	0.967	1	1	1	1	0.349

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.967	1	2.199

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r/2P_c) + (M_{r33}/M_{c33}) + (M_{r22}/M_{c22})
0.373 =	0.041 + 0.01 + 0.323

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
53.975	658.616	1091.586

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	1.7005	177.2376	177.2376	177.2376
Minor Bending	57.1888	177.2376		

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.143	434.844	3.297E-04
Minor Shear	4.815	434.844	0.011

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	C19	40	Ordinary Moment Frame	HSS COMPOSITE

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	240	0	2	0	DStID2	232.0079	OK
Super DL + Live Load	240	0	2	0	DStID2	232.0079	OK
Live Load	240	0	0.6667	0	DStID2	232.0079	OK
Total Load	240	0	1	0	DStID2	232.0079	OK
Total - Camber	240	0	1	0	DStID2	232.0079	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	232.0079	2.7903	83.147	200	83.147	300
Minor (2-2)	1	232.0079	2.7903	83.147	200	83.147	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	C2	41	HSS COMPOSITE	DStIS2	232.0079	Ordinary Moment Frame	Non-Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
240.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.016	0.02	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
23.56	301.04	183.41	183.41	15.64	15.64

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
45.9	45.9	55.81	55.81	2.7903	2.7903	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
232.0079	-28.84	-3.9155	33.4124	0.299	-2.913	0.2114

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.967	1	1	1	1	0.409
Minor Bending	0.967	1	1	1	1	0.326

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.967	1	2.17

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r/2P_c) + (M_{r33}/M_{c33}) + (M_{r22}/M_{c22})
0.233 =	0.022 + 0.022 + 0.189

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
28.84	658.616	1091.586

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	3.9155	177.2376	177.2376	177.2376
Minor Bending	33.4124	177.2376		

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.299	434.844	0.001
Minor Shear	2.913	434.844	0.007

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	C2	41	Ordinary Moment Frame	HSS COMPOSITE

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	240	0	2	0	DStID2	232.0079	OK
Super DL + Live Load	240	0	2	0	DStID2	232.0079	OK
Live Load	240	0	0.6667	0	DStID2	232.0079	OK
Total Load	240	0	1	0	DStID2	232.0079	OK
Total - Camber	240	0	1	0	DStID2	232.0079	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	232.0079	2.7903	83.147	200	83.147	300
Minor (2-2)	1	232.0079	2.7903	83.147	200	83.147	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	C21	44	HSS COMPOSITE	DStIS2	0	Ordinary Moment Frame	Non-Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
240.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.003	0.004	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
23.56	301.04	183.41	183.41	15.64	15.64

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
45.9	45.9	55.81	55.81	2.7903	2.7903	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
0	-1.323	0.5157	-5.9716	0.019	-0.281	0.2012

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.967	1	1	1	1	0.715
Minor Bending	0.967	1	1	1	1	0.636

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.967	1	1.399

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r/2P_c) + (M_{r33}/M_{c33}) + (M_{r22}/M_{c22})
0.038 =	0.001 + 0.003 + 0.034

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
1.323	658.616	1091.586

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	0.5157	177.2376	177.2376	177.2376
Minor Bending	5.9716	177.2376		

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.031	434.844	7.186E-05
Minor Shear	0.355	434.844	0.001

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	C21	44	Ordinary Moment Frame	HSS COMPOSITE

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	240	0	2	0	DStID2	232.0079	OK
Super DL + Live Load	240	0	2	0	DStID2	232.0079	OK
Live Load	240	0	0.6667	0	DStID2	232.0079	OK
Total Load	240	0	1	0	DStID2	232.0079	OK
Total - Camber	240	0	1	0	DStID2	232.0079	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	220.0079	2.9817	73.786	200	73.786	300
Minor (2-2)	1	161	2.9817	53.996	200	53.996	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B32	46	HSS203.2X203.2X15.9	DSII S2	173	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
228.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
4.151E-04	3.946E-04	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
173	-0.29	-23.158	0.0316	2.637	-0.005	0.8975

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.965	1	1	1	1	1
Minor Bending	0.706	1	1	1	1	0.633

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.706	1	2.2

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r/2P_c) + (M_{r33}/M_{c33}) + (M_{r22}/M_{c22})
0.135 =	2.831E-04 + 0.134 + 1.83E-04

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.29	511.437	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	23.158	172.7322	172.7322	172.7322
Minor Bending	0.0316	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0.8975	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	6.562	202.316	0.032
Minor Shear	0.005	202.316	2.661E-05

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
1.297	DStIS2	6.562	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B32	46	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	228	0.0282	1.9	0.015	DStID2	173	OK
Super DL + Live Load	228	0.1159	1.9	0.061	DStID2	150	OK
Live Load	228	0.1159	0.6333	0.183	DStID2	150	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	228	0.1427	0.95	0.15	DStID2	150	OK
Total - Camber	228	0.1427	0.95	0.15	DStID2	150	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	232.0079	2.7903	83.147	200	83.147	300
Minor (2-2)	1	232.0079	2.7903	83.147	200	83.147	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	C22	47	HSS COMPOSITE	DStIS2	0	Ordinary Moment Frame	Non-Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
240.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.008	0.01	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
23.56	301.04	183.41	183.41	15.64	15.64

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
45.9	45.9	55.81	55.81	2.7903	2.7903	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
0	-9.899	1.0052	-10.1589	0.093	-0.952	0.211

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.967	1	1	1	1	0.288
Minor Bending	0.967	1	1	1	1	0.276

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.967	1	2.228

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r/2P_c) + (M_{r33}/M_{c33}) + (M_{r22}/M_{c22})
0.071 =	0.008 + 0.006 + 0.057

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
9.899	658.616	1091.586

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	1.0052	177.2376	177.2376	177.2376
Minor Bending	10.1589	177.2376		

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.093	434.844	2.129E-04
Minor Shear	0.952	434.844	0.002

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	C22	47	Ordinary Moment Frame	HSS COMPOSITE

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	240	0	2	0	DStID2	232.0079	OK
Super DL + Live Load	240	0	2	0	DStID2	232.0079	OK
Live Load	240	0	0.6667	0	DStID2	232.0079	OK
Total Load	240	0	1	0	DStID2	232.0079	OK
Total - Camber	240	0	1	0	DStID2	232.0079	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	232.0079	2.7903	83.147	200	83.147	300
Minor (2-2)	1	232.0079	2.7903	83.147	200	83.147	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	C3	49	HSS COMPOSITE	DStIS2	232.0079	Ordinary Moment Frame	Non-Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
240.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.005	0.006	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
23.56	301.04	183.41	183.41	15.64	15.64

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
45.9	45.9	55.81	55.81	2.7903	2.7903	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
232.0079	-7.718	-0.6431	13.1488	0.081	-1.316	0.2101

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.967	1	1	1	1	0.324
Minor Bending	0.967	1	1	1	1	0.226

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.967	1	2.211

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r/2P_c) + (M_{r33}/M_{c33}) + (M_{r22}/M_{c22})
0.084 =	0.006 + 0.004 + 0.074

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
7.718	658.616	1091.586

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	0.6431	177.2376	177.2376	177.2376
Minor Bending	13.1488	177.2376		

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.081	434.844	1.873E-04
Minor Shear	1.316	434.844	0.003

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	C3	49	Ordinary Moment Frame	HSS COMPOSITE

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	240	0	2	0	DStID2	232.0079	OK
Super DL + Live Load	240	0	2	0	DStID2	232.0079	OK
Live Load	240	0	0.6667	0	DStID2	232.0079	OK
Total Load	240	0	1	0	DStID2	232.0079	OK
Total - Camber	240	0	1	0	DStID2	232.0079	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	115.1279	2.9817	38.611	200	38.611	300
Minor (2-2)	1	115.1279	2.9817	38.611	200	38.611	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B36	51	HSS203.2X203.2X15.9	DS1S2	119.1239	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
123.1200	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0	0	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
119.1239	0.107	-1.4318	0.015	0.6	-0.007	-3.1541

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.935	1	1	1	1	1
Minor Bending	0.935	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.935	1	1.76

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r /2P_c) + (M_{r33} /M_{c33}) + (M_{r22} /M_{c22})
0.008 =	7.056E-05 + 0.008 + 8.684E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.107	682.767	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	1.4318	172.7322	172.7322	172.7322
Minor Bending	0.015	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
-3.1541	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.6	202.316	0.003
Minor Shear	0.007	202.316	3.534E-05

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
0.223	DStIS1	0.6	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B36	51	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	123.12	0.0019	1.026	0.002	DStID2	50.0472	OK
Super DL + Live Load	123.12	0.0022	1.026	0.002	DStID2	3.9961	OK
Live Load	123.12	0.0022	0.342	0.006	DStID2	3.9961	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	123.12	0.0021	0.513	0.004	DStID2	50.0472	OK
Total - Camber	123.12	0.0021	0.513	0.004	DStID2	50.0472	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	122.6379	2.9817	41.13	200	41.13	300
Minor (2-2)	1	122.6379	2.9817	41.13	200	41.13	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B7	52	HSS203.2X203.2X15.9	DSII S2	126.6339	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
130.6300	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-2.12E-05	-6.261E-06	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
126.6339	0.048	-1.3792	0.0107	0.495	-0.002	-1.7834

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.939	1	1	1	1	1
Minor Bending	0.939	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.939	1	2.501

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r /2P_c) + (M_{r33} /M_{c33}) + (M_{r22} /M_{c22})
0.008 =	3.138E-05 + 0.008 + 6.221E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.048	672.819	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	1.3792	172.7322	172.7322	172.7322
Minor Bending	0.0107	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
-1.7834	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.495	202.316	0.002
Minor Shear	0.002	202.316	8.74E-06

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
0.439	DStIS1	0.495	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B7	52	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	130.63	0.0009	1.0886	0.001	DStID2	65.315	OK
Super DL + Live Load	130.63	0.0054	1.0886	0.005	DStID2	3.9961	OK
Live Load	130.63	0.0054	0.3629	0.015	DStID2	3.9961	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	130.63	0.0009	0.5443	0.002	DStID1	65.315	OK
Total - Camber	130.63	0.0009	0.5443	0.002	DStID1	65.315	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	221.0784	2.9817	74.145	200	74.145	300
Minor (2-2)	1	74.0963	2.9817	24.85	200	24.85	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B38	53	HSS203.2X203.2X15.9	DSII S2	3.9961	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
229.0705	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
1.644E-04	1.578E-04	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
3.9961	-0.254	-68.4828	-0.0062	-15.089	0.002	-0.8082

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.965	1	1	1	1	1
Minor Bending	0.323	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.323	1	1.642

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.397 =	2.497E-04 + 0.396 + 3.566E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.254	509.456	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	68.4828	172.7322	172.7322	172.7322
Minor Bending	0.0062	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
-0.8082	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	15.089	202.316	0.075
Minor Shear	0.002	202.316	9.65E-06

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
15.089	DStIS2	7.411	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B38	53	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	229.0705	0.0489	1.9089	0.026	DStID2	130.6732	OK
Super DL + Live Load	229.0705	0.1069	1.9089	0.056	DStID2	112.1491	OK
Live Load	229.0705	0.1069	0.6363	0.168	DStID2	112.1491	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	229.0705	0.1523	0.9545	0.16	DStID2	130.6732	OK
Total - Camber	229.0705	0.1523	0.9545	0.16	DStID2	130.6732	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	101	2.9817	33.873	200	33.873	300
Minor (2-2)	1	101	2.9817	33.873	200	33.873	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B17	55	HSS203.2X203.2X15.9	DSII S2	101	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
101.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-5.458E-05	-1.093E-05	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
101	0.148	8.2275	0.0102	-0.695	-0.002	-0.9747

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	1.545

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r /2P_c) + (M_{r33} /M_{c33}) + (M_{r22} /M_{c22})
0.048 =	9.729E-05 + 0.048 + 5.907E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.148	700.121	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	8.2275	172.7322	172.7322	172.7322
Minor Bending	0.0102	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
-0.9747	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	1.26	202.316	0.006
Minor Shear	0.002	202.316	1.187E-05

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
1.26	DStIS2	0.695	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B17	55	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	101	0.0849	0.8417	0.101	DStID2	101	OK
Super DL + Live Load	101	0.0069	0.8417	0.008	DStID2	60.6	OK
Live Load	101	0.0069	0.2806	0.025	DStID2	60.6	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	101	0.0849	0.4208	0.202	DStID1	101	OK
Total - Camber	101	0.0849	0.4208	0.202	DStID1	101	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	101	2.9817	33.873	200	33.873	300
Minor (2-2)	1	101	2.9817	33.873	200	33.873	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B18	56	HSS203.2X203.2X15.9	DS1IS2	101	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
101.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-5.8E-05	-1.162E-05	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
101	0.158	14.1015	0.0035	-1.503	-0.001	-0.2294

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	1.663

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r /2P_c) + (M_{r33} /M_{c33}) + (M_{r22} /M_{c22})
0.082 =	1.037E-04 + 0.082 + 2.038E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.158	700.121	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	14.1015	172.7322	172.7322	172.7322
Minor Bending	0.0035	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
-0.2294	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	2.068	202.316	0.01
Minor Shear	0.001	202.316	0

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
2.068	DStIS2	1.503	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B18	56	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	101	0.0957	0.8417	0.114	DStID2	101	OK
Super DL + Live Load	101	0.0112	0.8417	0.013	DStID2	60.6	OK
Live Load	101	0.0112	0.2806	0.04	DStID2	60.6	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	101	0.0957	0.4208	0.227	DStID1	101	OK
Total - Camber	101	0.0957	0.4208	0.227	DStID1	101	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	101	2.9817	33.873	200	33.873	300
Minor (2-2)	1	101	2.9817	33.873	200	33.873	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B19	57	HSS203.2X203.2X15.9	DS1IS2	101	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
101.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-4.583E-05	-9.182E-06	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
101	0.14	7.7103	-0.0014	-0.585	2.104E-04	0.569

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	1.489

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r /2P_c) + (M_{r33} /M_{c33}) + (M_{r22} /M_{c22})
0.045 =	9.22E-05 + 0.045 + 8.231E-06

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.14	700.121	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	7.7103	172.7322	172.7322	172.7322
Minor Bending	0.0014	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0.569	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	1.15	202.316	0.006
Minor Shear	2.104E-04	202.316	0

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
1.15	DStIS2	0.585	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B19	57	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	101	0.0782	0.8417	0.093	DStID2	101	OK
Super DL + Live Load	101	0.0068	0.8417	0.008	DStID2	60.6	OK
Live Load	101	0.0068	0.2806	0.024	DStID2	60.6	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	101	0.0782	0.4208	0.186	DStID1	101	OK
Total - Camber	101	0.0782	0.4208	0.186	DStID1	101	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	106.336	2.9817	35.663	200	35.663	300
Minor (2-2)	1	106.336	2.9817	35.663	200	35.663	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B53	59	HSS203.2X203.2X15.9	DSII S2	0	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
106.3360	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-7.425E-05	-1.649E-05	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
0	0.129	-3.9733	0.0072	-0.895	0.003	4.5988

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L _{ltb}	K _{ltb}	C _b
1	1	2.405

Demand/Capacity (D/C) Ratio

D/C Ratio =	$(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})$
0.023 =	8.444E-05 + 0.023 + 4.172E-05

Axial Force and Capacities

P _u Force (kip)	φP _{nc} Capacity (kip)	φP _{nt} Capacity (kip)
0.129	693.783	761.36

Moments and Capacities

	M _u Moment (kip-ft)	φM _n Capacity (kip-ft)	φM _n No LTB (kip-ft)	φM _n Cb=1 (kip-ft)
Major Bending	3.9733	172.7322	172.7322	172.7322
Minor Bending	0.0072	172.7322		

Torsion Moment and Capacities

T _u Moment (kip-ft)	T _n Capacity (kip-ft)	φT _n Capacity (kip-ft)
4.5988	162.7386	146.4647

Shear Design

	V _u Force (kip)	φV _n Capacity (kip)	Stress Ratio
Major Shear	0.895	202.316	0.004
Minor Shear	0.003	202.316	1.376E-05

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
0.895	DStIS2	0.3	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B53	59	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	106.336	0.0467	0.8861	0.053	DStID2	106.336	OK
Super DL + Live Load	106.336	0.0421	0.8861	0.048	DStID2	106.336	OK
Live Load	106.336	0.0421	0.2954	0.143	DStID2	106.336	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	106.336	0.0888	0.4431	0.2	DStID2	106.336	OK
Total - Camber	106.336	0.0888	0.4431	0.2	DStID2	106.336	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	121.9558	2.9817	40.901	200	40.901	300
Minor (2-2)	1	121.9558	2.9817	40.901	200	40.901	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B54	60	HSS203.2X203.2X15.9	DS1S1	81.3039	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
121.9558	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
9.823E-05	2.869E-05	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
81.3039	-0.03	0.8688	-0.0066	0.053	0.003	-2.3945

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	0.315

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	1.189

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.005 =	2.229E-05 + 0.005 + 3.839E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.03	673.742	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	0.8688	172.7322	172.7322	172.7322
Minor Bending	0.0066	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
-2.3945	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.478	202.316	0.002
Minor Shear	0.003	202.316	1.288E-05

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
0.478	DStIS1	0.318	DStIS1

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B54	60	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	121.9558	0.0024	1.0163	0.002	DStID2	60.9779	OK
Super DL + Live Load	121.9558	0.0009	1.0163	0.001	DStID2	0	OK
Live Load	121.9558	0.0009	0.3388	0.003	DStID2	0	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	121.9558	0.0024	0.5081	0.005	DStID1	60.9779	OK
Total - Camber	121.9558	0.0024	0.5081	0.005	DStID1	60.9779	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	152.75	2.9817	51.229	200	51.229	300
Minor (2-2)	1	152.75	2.9817	51.229	200	51.229	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B13	61	HSS203.2X203.2X15.9	DSII S2	0	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
152.7500	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-4.619E-05	-2.117E-05	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
0	0.061	13.0484	0.0035	0.999	0.001	-9.3379

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L _{ltb}	K _{ltb}	C _b
1	1	1.95

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r /2P_c) + (M_{r33} /M_{c33}) + (M_{r22} /M_{c22})
0.076 =	3.993E-05 + 0.076 + 2.037E-05

Axial Force and Capacities

P _u Force (kip)	φP _{nc} Capacity (kip)	φP _{nt} Capacity (kip)
0.061	628.484	761.36

Moments and Capacities

	M _u Moment (kip-ft)	φM _n Capacity (kip-ft)	φM _n No LTB (kip-ft)	φM _n Cb=1 (kip-ft)
Major Bending	13.0484	172.7322	172.7322	172.7322
Minor Bending	0.0035	172.7322		

Torsion Moment and Capacities

T _u Moment (kip-ft)	T _n Capacity (kip-ft)	φT _n Capacity (kip-ft)
-9.3379	162.7386	146.4647

Shear Design

	V _u Force (kip)	φV _n Capacity (kip)	Stress Ratio
Major Shear	1.853	202.316	0.009
Minor Shear	0.001	202.316	0

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
0.999	DStIS2	1.853	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B13	61	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	152.75	0.0152	1.2729	0.012	DStID2	65.4643	OK
Super DL + Live Load	152.75	0.0102	1.2729	0.008	DStID2	65.4643	OK
Live Load	152.75	0.0102	0.4243	0.024	DStID2	65.4643	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	152.75	0.0458	0.6365	0.072	DStID2	0	OK
Total - Camber	152.75	0.0458	0.6365	0.072	DStID2	0	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	152.75	2.9817	51.229	200	51.229	300
Minor (2-2)	1	152.75	2.9817	51.229	200	51.229	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B4	62	HSS203.2X203.2X15.9	DSII S2	0	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
152.7500	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-6.399E-05	-2.932E-05	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{v-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
0	0.106	21.9227	-0.001	2.088	-8.322E-05	0.2671

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	2.079

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r /2P_c) + (M_{r33} /M_{c33}) + (M_{r22} /M_{c22})
0.127 =	6.958E-05 + 0.127 + 5.659E-06

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.106	628.484	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	21.9227	172.7322	172.7322	172.7322
Minor Bending	0.001	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0.2671	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	2.942	202.316	0.015
Minor Shear	8.322E-05	202.316	0

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
2.088	DStIS2	2.942	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B4	62	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	152.75	0.0771	1.2729	0.061	DStID2	21.8214	OK
Super DL + Live Load	152.75	0.4639	1.2729	0.364	DStID2	0	OK
Live Load	152.75	0.4639	0.4243	1.093	DStID2	0	Not OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	152.75	0.5397	0.6365	0.848	DStID2	0	OK
Total - Camber	152.75	0.5397	0.6365	0.848	DStID2	0	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	152.75	2.9817	51.229	200	51.229	300
Minor (2-2)	1	152.75	2.9817	51.229	200	51.229	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B5	63	HSS203.2X203.2X15.9	DSII S2	0	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
152.7500	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-4.489E-05	-2.057E-05	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
0	0.068	12.4815	-0.0023	0.939	-0.001	9.4338

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L _{ltb}	K _{ltb}	C _b
1	1	1.941

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r /2P_c) + (M_{r33} /M_{c33}) + (M_{r22} /M_{c22})
0.072 =	4.482E-05 + 0.072 + 1.354E-05

Axial Force and Capacities

P _u Force (kip)	φP _{nc} Capacity (kip)	φP _{nt} Capacity (kip)
0.068	628.484	761.36

Moments and Capacities

	M _u Moment (kip-ft)	φM _n Capacity (kip-ft)	φM _n No LTB (kip-ft)	φM _n Cb=1 (kip-ft)
Major Bending	12.4815	172.7322	172.7322	172.7322
Minor Bending	0.0023	172.7322		

Torsion Moment and Capacities

T _u Moment (kip-ft)	T _n Capacity (kip-ft)	φT _n Capacity (kip-ft)
9.4338	162.7386	146.4647

Shear Design

	V _u Force (kip)	φV _n Capacity (kip)	Stress Ratio
Major Shear	1.793	202.316	0.009
Minor Shear	0.001	202.316	0

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
0.939	DStIS2	1.793	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B5	63	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	152.75	0.0147	1.2729	0.012	DStID2	65.4643	OK
Super DL + Live Load	152.75	0.0096	1.2729	0.008	DStID2	65.4643	OK
Live Load	152.75	0.0096	0.4243	0.023	DStID2	65.4643	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	152.75	0.0443	0.6365	0.07	DStID2	0	OK
Total - Camber	152.75	0.0443	0.6365	0.07	DStID2	0	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	138.3429	2.9817	46.397	200	46.397	300
Minor (2-2)	1	138.3429	2.9817	46.397	200	46.397	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B8	65	HSS203.2X203.2X15.9	DStIS2	92.2286	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
138.3429	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-3.207E-05	-1.205E-05	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
92.2286	0.027	1.523	-0.0025	-0.05	-1.667E-05	-1.4281

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	1.261

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r /2P_c) + (M_{r33} /M_{c33}) + (M_{r22} /M_{c22})
0.009 =	1.749E-05 + 0.009 + 1.434E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.027	650.528	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	1.523	172.7322	172.7322	172.7322
Minor Bending	0.0025	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
-1.4281	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.565	202.316	0.003
Minor Shear	1.667E-05	202.316	0

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
0.565	DStIS2	0.384	DStIS1

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B8	65	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	138.3429	0.0042	1.1529	0.004	DStID2	69.1714	OK
Super DL + Live Load	138.3429	0.0016	1.1529	0.001	DStID2	138.3429	OK
Live Load	138.3429	0.0016	0.3843	0.004	DStID2	138.3429	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	138.3429	0.0056	0.5764	0.01	DStID2	69.1714	OK
Total - Camber	138.3429	0.0056	0.5764	0.01	DStID2	69.1714	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	101	2.9817	33.873	200	33.873	300
Minor (2-2)	1	101	2.9817	33.873	200	33.873	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B14	16	HSS203.2X203.2X15.9	DStIS2	101	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
101.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-5.875E-05	-1.177E-05	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{v-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
101	0.172	5.5864	0.0109	-0.508	-0.002	-0.3104

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	1.686

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r /2P_c) + (M_{r33} /M_{c33}) + (M_{r22} /M_{c22})
0.033 =	1.13E-04 + 0.032 + 6.314E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.172	700.121	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	5.5864	172.7322	172.7322	172.7322
Minor Bending	0.0109	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
-0.3104	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	1.073	202.316	0.005
Minor Shear	0.002	202.316	7.822E-06

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
1.073	DStIS2	0.508	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B14	16	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	101	0.0029	0.8417	0.003	DStID2	60.6	OK
Super DL + Live Load	101	0.0084	0.8417	0.01	DStID2	101	OK
Live Load	101	0.0084	0.2806	0.03	DStID2	101	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	101	0.0151	0.4208	0.036	DStID2	101	OK
Total - Camber	101	0.0151	0.4208	0.036	DStID2	101	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	145.4979	2.9817	48.797	200	48.797	300
Minor (2-2)	1	145.4979	2.9817	48.797	200	48.797	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B9	13	HSS203.2X203.2X15.9	DStIS2	124.7125	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
145.4979	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-6.599E-05	-2.744E-05	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
124.7125	0.091	2.885	0.0033	0.039	2.544E-04	0.706

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K ₁	K ₂	B ₁	B ₂	C _m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L _{ltb}	K _{ltb}	C _b
1	1	1.219

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r /2P_c) + (M_{r33} /M_{c33}) + (M_{r22} /M_{c22})
0.017 =	5.996E-05 + 0.017 + 1.936E-05

Axial Force and Capacities

P _u Force (kip)	φP _{nc} Capacity (kip)	φP _{nt} Capacity (kip)
0.091	639.758	761.36

Moments and Capacities

	M _u Moment (kip-ft)	φM _n Capacity (kip-ft)	φM _n No LTB (kip-ft)	φM _n Cb=1 (kip-ft)
Major Bending	2.885	172.7322	172.7322	172.7322
Minor Bending	0.0033	172.7322		

Torsion Moment and Capacities

T _u Moment (kip-ft)	T _n Capacity (kip-ft)	φT _n Capacity (kip-ft)
0.706	162.7386	146.4647

Shear Design

	V _u Force (kip)	φV _n Capacity (kip)	Stress Ratio
Major Shear	0.658	202.316	0.003
Minor Shear	2.544E-04	202.316	0

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
0.658	DStIS2	0.549	DStIS1

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B9	13	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	145.4979	0.008	1.2125	0.007	DStID2	62.3563	OK
Super DL + Live Load	145.4979	0.0042	1.2125	0.003	DStID2	145.4979	OK
Live Load	145.4979	0.0042	0.4042	0.01	DStID2	145.4979	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	145.4979	0.0121	0.6062	0.02	DStID2	83.1417	OK
Total - Camber	145.4979	0.0121	0.6062	0.02	DStID2	83.1417	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	294.5079	2.9817	98.772	200	98.772	300
Minor (2-2)	1	75	2.9817	25.153	200	25.153	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B1	14	HSS203.2X203.2X15.9	DStIS2	3.9961	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
302.5000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0.001	0.001	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
3.9961	-0.817	-74.5899	0.0126	-17.15	0.003	-10.1685

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.974	1	1	1	1	1
Minor Bending	0.248	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.248	1	1.029

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r/2P_c) + (M_{r33}/M_{c33}) + (M_{r22}/M_{c22})
0.433 =	0.001 + 0.432 + 7.268E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.817	373.208	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	74.5899	172.7322	172.7322	172.7322
Minor Bending	0.0126	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
-10.1685	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	17.15	202.316	0.085
Minor Shear	0.003	202.316	1.709E-05

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
17.15	DStIS2	14.401	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B1	14	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	302.5	0.4103	2.5208	0.163	DStID2	151.5	OK
Super DL + Live Load	302.5	0.6454	2.5208	0.256	DStID2	151.5	OK
Live Load	302.5	0.6454	0.8403	0.768	DStID2	151.5	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	302.5	1.0556	1.2604	0.838	DStID2	151.5	OK
Total - Camber	302.5	1.0556	1.2604	0.838	DStID2	151.5	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	220.0079	2.9817	73.786	200	73.786	300
Minor (2-2)	1	75.5039	2.9817	25.322	200	25.322	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B6	18	HSS203.2X203.2X15.9	DStIS2	224.0039	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
228.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
2.86E-04	2.718E-04	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
224.0039	-0.273	-47.4091	-0.0056	10.884	3.779E-04	-3.0876

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.965	1	1	1	1	1
Minor Bending	0.331	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.331	1	1.246

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.275 =	2.668E-04 + 0.274 + 3.258E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.273	511.437	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	47.4091	172.7322	172.7322	172.7322
Minor Bending	0.0056	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
-3.0876	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	10.884	202.316	0.054
Minor Shear	3.779E-04	202.316	0

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
6.869	DStIS2	10.884	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B6	18	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	228	0.0603	1.9	0.032	DStID2	97.9375	OK
Super DL + Live Load	228	0.09	1.9	0.047	DStID2	116.375	OK
Live Load	228	0.09	0.6333	0.142	DStID2	116.375	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	228	0.1482	0.95	0.156	DStID2	97.9375	OK
Total - Camber	228	0.1482	0.95	0.156	DStID2	97.9375	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	101	2.9817	33.873	200	33.873	300
Minor (2-2)	1	101	2.9817	33.873	200	33.873	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B16	19	HSS203.2X203.2X15.9	DS1S2	101	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
101.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
-6.571E-05	-1.316E-05	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
101	0.167	4.6291	-0.0093	-0.253	0.002	0.4577

Axial Force & Biaxial Moment Design Factors (H1.2,H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	1.439

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r /2P_c) + (M_{r33} /M_{c33}) + (M_{r22} /M_{c22})
0.027 =	1.096E-04 + 0.027 + 5.371E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.167	700.121	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	4.6291	172.7322	172.7322	172.7322
Minor Bending	0.0093	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0.4577	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.817	202.316	0.004
Minor Shear	0.002	202.316	1.019E-05

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
0.817	DStIS2	0.258	DStIS1

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B16	19	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	101	0.0027	0.8417	0.003	DStID2	60.6	OK
Super DL + Live Load	101	0.0108	0.8417	0.013	DStID2	101	OK
Live Load	101	0.0108	0.2806	0.039	DStID2	101	OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	101	0.007	0.4208	0.017	DStID2	60.6	OK
Total - Camber	101	0.007	0.4208	0.017	DStID2	60.6	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	294.5079	2.9817	98.772	200	98.772	300
Minor (2-2)	1	51	2.9817	17.104	200	17.104	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Story1	B10	20	HSS203.2X203.2X15.9	DS1IS2	3.9961	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
302.5000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
4.292E-04	0.001	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
3.9961	-0.993	-124.9027	-0.0114	-35.749	-0.001	-4.2938

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	0.974	1	1	1	1	1
Minor Bending	0.169	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
0.169	1	1.01

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.724 =	0.001 + 0.723 + 6.588E-05

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0.993	373.208	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	124.9027	172.7322	172.7322	172.7322
Minor Bending	0.0114	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
-4.2938	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	35.749	202.316	0.177
Minor Shear	0.001	202.316	6.111E-06

End Reaction Major Shear Forces

Left End Reaction (kip)	Load Combo	Right End Reaction (kip)	Load Combo
35.749	DStIS2	31.763	DStIS2

Element Details

Level	Element	Unique Name	Element Type	Section
Story1	B10	20	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	302.5	0.4574	2.5208	0.181	DStID2	153.5	OK
Super DL + Live Load	302.5	1.4643	2.5208	0.581	DStID2	151.5	OK
Live Load	302.5	1.4643	0.8403	1.743	DStID2	151.5	Not OK

DEFLECTION DESIGN (continued)

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Total Load	302.5	1.9212	1.2604	1.524	DStID2	153.5	Not OK
Total - Camber	302.5	1.9212	1.2604	1.524	DStID2	153.5	Not OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	101	2.9817	33.873	200	33.873	300
Minor (2-2)	1	101	2.9817	33.873	200	33.873	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Base	B11	1	HSS203.2X203.2X15.9	DS1S1	0	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
101.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0	0	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
0	0	-0.4622	0	-0.33	0	0

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	2.637

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.003 =	0 + 0.003 + 0

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0	700.121	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	0.4622	172.7322	172.7322	172.7322
Minor Bending	0	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.33	202.316	0.002
Minor Shear	0	202.316	0

Element Details

Level	Element	Unique Name	Element Type	Section
Base	B11	1	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	101	0.0002	0.8417	2.641E-04	DStID2	60.6	OK
Super DL + Live Load	101	0	0.8417	0	DStID2	101	OK
Live Load	101	0	0.2806	0	DStID2	101	OK
Total Load	101	0.0002	0.4208	0.001	DStID2	60.6	OK
Total - Camber	101	0.0002	0.4208	0.001	DStID2	60.6	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	152.75	2.9817	51.229	200	51.229	300
Minor (2-2)	1	152.75	2.9817	51.229	200	51.229	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Base	B12	2	HSS203.2X203.2X15.9	DS1S1	152.75	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
152.7500	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0	0	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
152.75	0	-1.0572	0	0.498	0	0

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	2.505

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.006 =	0 + 0.006 + 0

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0	628.484	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	1.0572	172.7322	172.7322	172.7322
Minor Bending	0	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.498	202.316	0.002
Minor Shear	0	202.316	0

Element Details

Level	Element	Unique Name	Element Type	Section
Base	B12	2	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	152.75	0.0013	1.2729	0.001	DStID2	65.4643	OK
Super DL + Live Load	152.75	0	1.2729	0	DStID2	152.75	OK
Live Load	152.75	0	0.4243	0	DStID2	152.75	OK
Total Load	152.75	0.0013	0.6365	0.002	DStID2	65.4643	OK
Total - Camber	152.75	0.0013	0.6365	0.002	DStID2	65.4643	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	302.5	2.9817	101.452	200	101.452	300
Minor (2-2)	1	302.5	2.9817	101.452	200	101.452	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Base	B1	3	HSS203.2X203.2X15.9	DS1S1	0	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
302.5000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0	0	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
0	0	-4.1463	0	-0.987	0	0

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	2.416

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.024 =	0 + 0.024 + 0

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0	358.853	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	4.1463	172.7322	172.7322	172.7322
Minor Bending	0	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.987	202.316	0.005
Minor Shear	0	202.316	0

Element Details

Level	Element	Unique Name	Element Type	Section
Base	B1	3	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	302.5	0.0225	2.5208	0.009	DStID2	162.8846	OK
Super DL + Live Load	302.5	0	2.5208	0	DStID2	302.5	OK
Live Load	302.5	0	0.8403	0	DStID2	302.5	OK
Total Load	302.5	0.0225	1.2604	0.018	DStID2	162.8846	OK
Total - Camber	302.5	0.0225	1.2604	0.018	DStID2	162.8846	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	228	2.9817	76.466	200	76.466	300
Minor (2-2)	1	228	2.9817	76.466	200	76.466	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Base	B6	4	HSS203.2X203.2X15.9	DS1S1	0	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
228.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0	0	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
0	0	-2.3555	0	-0.744	0	0

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	2.422

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.014 =	0 + 0.014 + 0

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0	496.603	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	2.3555	172.7322	172.7322	172.7322
Minor Bending	0	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.744	202.316	0.004
Minor Shear	0	202.316	0

Element Details

Level	Element	Unique Name	Element Type	Section
Base	B6	4	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	228	0.0072	1.9	0.004	DStID2	114	OK
Super DL + Live Load	228	0	1.9	0	DStID2	228	OK
Live Load	228	0	0.6333	0	DStID2	228	OK
Total Load	228	0.0072	0.95	0.008	DStID2	114	OK
Total - Camber	228	0.0072	0.95	0.008	DStID2	114	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	130.63	2.9817	43.81	200	43.81	300
Minor (2-2)	1	130.63	2.9817	43.81	200	43.81	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Base	B7	5	HSS203.2X203.2X15.9	DS1S1	130.63	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
130.6300	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0	0	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
130.63	0	-0.7732	0	0.426	0	0

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	2.5

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.004 =	0 + 0.004 + 0

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0	661.716	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	0.7732	172.7322	172.7322	172.7322
Minor Bending	0	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.426	202.316	0.002
Minor Shear	0	202.316	0

Element Details

Level	Element	Unique Name	Element Type	Section
Base	B7	5	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	130.63	0.0007	1.0886	0.001	DStID2	65.315	OK
Super DL + Live Load	130.63	0	1.0886	0	DStID2	130.63	OK
Live Load	130.63	0	0.3629	0	DStID2	130.63	OK
Total Load	130.63	0.0007	0.5443	0.001	DStID2	65.315	OK
Total - Camber	130.63	0.0007	0.5443	0.001	DStID2	65.315	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	123.12	2.9817	41.292	200	41.292	300
Minor (2-2)	1	123.12	2.9817	41.292	200	41.292	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Base	B36	6	HSS203.2X203.2X15.9	DS1S1	123.12	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
123.1200	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0	0	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
123.12	0	-0.6869	0	0.402	0	0

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	2.5

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.004 =	0 + 0.004 + 0

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0	672.164	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	0.6869	172.7322	172.7322	172.7322
Minor Bending	0	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.402	202.316	0.002
Minor Shear	0	202.316	0

Element Details

Level	Element	Unique Name	Element Type	Section
Base	B36	6	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	123.12	0.0006	1.026	0.001	DStID2	61.56	OK
Super DL + Live Load	123.12	0	1.026	0	DStID2	123.12	OK
Live Load	123.12	0	0.342	0	DStID2	123.12	OK
Total Load	123.12	0.0006	0.513	0.001	DStID2	61.56	OK
Total - Camber	123.12	0.0006	0.513	0.001	DStID2	61.56	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	228	2.9817	76.466	200	76.466	300
Minor (2-2)	1	228	2.9817	76.466	200	76.466	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Base	B32	7	HSS203.2X203.2X15.9	DS1S1	0	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
228.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0	0	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
0	0	-2.3555	0	-0.744	0	0

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	2.422

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.014 =	0 + 0.014 + 0

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0	496.603	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	2.3555	172.7322	172.7322	172.7322
Minor Bending	0	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.744	202.316	0.004
Minor Shear	0	202.316	0

Element Details

Level	Element	Unique Name	Element Type	Section
Base	B32	7	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	228	0.0072	1.9	0.004	DStID2	114	OK
Super DL + Live Load	228	0	1.9	0	DStID2	228	OK
Live Load	228	0	0.6333	0	DStID2	228	OK
Total Load	228	0.0072	0.95	0.008	DStID2	114	OK
Total - Camber	228	0.0072	0.95	0.008	DStID2	114	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	302.5	2.9817	101.452	200	101.452	300
Minor (2-2)	1	302.5	2.9817	101.452	200	101.452	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Base	B26	8	HSS203.2X203.2X15.9	DS1S1	0	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
302.5000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0	0	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
0	0	-4.1463	0	-0.987	0	0

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	2.416

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.024 =	0 + 0.024 + 0

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0	358.853	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	4.1463	172.7322	172.7322	172.7322
Minor Bending	0	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.987	202.316	0.005
Minor Shear	0	202.316	0

Element Details

Level	Element	Unique Name	Element Type	Section
Base	B26	8	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	302.5	0.0225	2.5208	0.009	DStID2	162.8846	OK
Super DL + Live Load	302.5	0	2.5208	0	DStID2	302.5	OK
Live Load	302.5	0	0.8403	0	DStID2	302.5	OK
Total Load	302.5	0.0225	1.2604	0.018	DStID2	162.8846	OK
Total - Camber	302.5	0.0225	1.2604	0.018	DStID2	162.8846	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	101	2.9817	33.873	200	33.873	300
Minor (2-2)	1	101	2.9817	33.873	200	33.873	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Base	B27	9	HSS203.2X203.2X15.9	DS1S1	0	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
101.0000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0	0	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{v-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
0	0	-0.4622	0	-0.33	0	0

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	2.637

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.003 =	0 + 0.003 + 0

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0	700.121	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	0.4622	172.7322	172.7322	172.7322
Minor Bending	0	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.33	202.316	0.002
Minor Shear	0	202.316	0

Element Details

Level	Element	Unique Name	Element Type	Section
Base	B27	9	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	101	0.0002	0.8417	2.641E-04	DStID2	60.6	OK
Super DL + Live Load	101	0	0.8417	0	DStID2	101	OK
Live Load	101	0	0.2806	0	DStID2	101	OK
Total Load	101	0.0002	0.4208	0.001	DStID2	60.6	OK
Total - Camber	101	0.0002	0.4208	0.001	DStID2	60.6	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	152.75	2.9817	51.229	200	51.229	300
Minor (2-2)	1	152.75	2.9817	51.229	200	51.229	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Base	B2	10	HSS203.2X203.2X15.9	DS1S1	0	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
152.7500	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0	0	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_v	ϕ_{v-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
0	0	-1.0572	0	-0.498	0	0

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	2.505

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.006 =	0 + 0.006 + 0

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0	628.484	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	1.0572	172.7322	172.7322	172.7322
Minor Bending	0	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.498	202.316	0.002
Minor Shear	0	202.316	0

Element Details

Level	Element	Unique Name	Element Type	Section
Base	B2	10	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	152.75	0.0013	1.2729	0.001	DStID2	87.2857	OK
Super DL + Live Load	152.75	0	1.2729	0	DStID2	152.75	OK
Live Load	152.75	0	0.4243	0	DStID2	152.75	OK
Total Load	152.75	0.0013	0.6365	0.002	DStID2	87.2857	OK
Total - Camber	152.75	0.0013	0.6365	0.002	DStID2	87.2857	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	229.0705	2.9817	76.825	200	76.825	300
Minor (2-2)	1	229.0705	2.9817	76.825	200	76.825	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Base	B38	12	HSS203.2X203.2X15.9	DS1S1	229.0705	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
229.0705	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0	0	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
229.0705	0	-2.3776	0	0.747	0	0

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	2.422

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.014 =	0 + 0.014 + 0

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0	494.61	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	2.3776	172.7322	172.7322	172.7322
Minor Bending	0	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.747	202.316	0.004
Minor Shear	0	202.316	0

Element Details

Level	Element	Unique Name	Element Type	Section
Base	B38	12	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	229.0705	0.0074	1.9089	0.004	DStID2	114.5353	OK
Super DL + Live Load	229.0705	0	1.9089	0	DStID2	229.0705	OK
Live Load	229.0705	0	0.6363	0	DStID2	229.0705	OK
Total Load	229.0705	0.0074	0.9545	0.008	DStID2	114.5353	OK
Total - Camber	229.0705	0.0074	0.9545	0.008	DStID2	114.5353	OK

ETABS Steel Frame Design

AISC 360-22 Steel Section Check (Envelope Details)

Slenderness Check

Buckling Mode	K Factor	L Length (in)	r (in)	KL/r	KL/r Limit	L/r	L/r Limit
Major (3-3)	1	302.5	2.9817	101.452	200	101.452	300
Minor (2-2)	1	302.5	2.9817	101.452	200	101.452	300

Element Details

Level	Element	Unique Name	Section	Combo	Location	Frame Type	Classification
Base	B10	15	HSS203.2X203.2X15.9	DSIS1	0	Ordinary Moment Frame	Compact

LLRF and Demand/Capacity Ratio

L (in)	LLRF	Stress Ratio Limit
302.5000	1	0.95

Analysis and Design Parameters

Provision	Analysis	2nd Order	Reduction
LRFD	Direct Analysis	General 2nd Order	Tau-b Fixed

Stiffness Reduction Factors

$\alpha P_r / P_y$	$\alpha P_r / P_e$	τ_b	EA factor	EI factor
0	0	1	0.8	0.8

Design Code Parameters

ϕ_b	ϕ_b	ϕ_{TY}	ϕ_{TF}	ϕ_V	ϕ_{V-RI}	ϕ_{VT}
0.9	0.9	0.9	0.75	0.9	1	1

Section Properties

A (in ²)	J (in ⁴)	I ₃₃ (in ⁴)	I ₂₂ (in ⁴)	A _{v3} (in ²)	A _{v2} (in ²)
16.43	245.06	146.07	146.07	7.28	7.28

Design Properties

S ₃₃ (in ³)	S ₂₂ (in ³)	Z ₃₃ (in ³)	Z ₂₂ (in ³)	r ₃₃ (in)	r ₂₂ (in)	C _w (in ⁶)
36.55	36.55	44.73	44.73	2.9817	2.9817	Not required

Material Properties

E (lb/in ²)	f _y (lb/in ²)	R _y	C _{pr}	α
29877771.39	51488.39	1.07	1.4	NA

Stress Check forces and Moments

Location (in)	P _u (kip)	M _{u33} (kip-ft)	M _{u22} (kip-ft)	V _{u2} (kip)	V _{u3} (kip)	T _u (kip-ft)
0	0	-4.1463	0	-0.987	0	0

Axial Force & Biaxial Moment Design Factors (H1-1b)

	L Factor	K₁	K₂	B₁	B₂	C_m
Major Bending	1	1	1	1	1	1
Minor Bending	1	1	1	1	1	1

Parameters for Lateral Torsion Buckling

L_{ltb}	K_{ltb}	C_b
1	1	2.416

Demand/Capacity (D/C) Ratio

D/C Ratio =	(P_r / 2P_c) + (M_{r33} / M_{c33}) + (M_{r22} / M_{c22})
0.024 =	0 + 0.024 + 0

Axial Force and Capacities

P_u Force (kip)	φP_{nc} Capacity (kip)	φP_{nt} Capacity (kip)
0	358.853	761.36

Moments and Capacities

	M_u Moment (kip-ft)	φM_n Capacity (kip-ft)	φM_n No LTB (kip-ft)	φM_n Cb=1 (kip-ft)
Major Bending	4.1463	172.7322	172.7322	172.7322
Minor Bending	0	172.7322		

Torsion Moment and Capacities

T_u Moment (kip-ft)	T_n Capacity (kip-ft)	φT_n Capacity (kip-ft)
0	162.7386	146.4647

Shear Design

	V_u Force (kip)	φV_n Capacity (kip)	Stress Ratio
Major Shear	0.987	202.316	0.005
Minor Shear	0	202.316	0

Element Details

Level	Element	Unique Name	Element Type	Section
Base	B10	15	Ordinary Moment Frame	HSS203.2X203.2X15.9

DEFLECTION DESIGN

Deflection Type	L in	Deflection Value in	Deflection Limit in	Deflection Ratio	Load Combo	Station Location in	Check Status
Dead Load	302.5	0.0225	2.5208	0.009	DStID2	162.8846	OK
Super DL + Live Load	302.5	0	2.5208	0	DStID2	302.5	OK
Live Load	302.5	0	0.8403	0	DStID2	302.5	OK
Total Load	302.5	0.0225	1.2604	0.018	DStID2	162.8846	OK
Total - Camber	302.5	0.0225	1.2604	0.018	DStID2	162.8846	OK