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1 General

1.1 Introduction

This document defines the structural engineering requirements, which incorporate Owner's specific design requirements for Proposed Container House. Included herein is the design load as reference in determining the parametric values, the concept adopted for the framing systems, the bases upon which the design criteria is established, methods/procedures used for the analysisof the structures and computer programs pertaining to the project.

1.2 Structural Concepts

Check the adequacy of the existing Container Van to withstand the actions of Dead, Live, Wind Load and Seismic Load within the prescribed limits of deformation.

1.3 Codes, standards & references

2016 California Building Standards Code (CBC 2016)
International Building Code 2012 (IBC 2012)
American Society of Civil Engineers (ASCE 7-10)
United States Geological Survey (USGS)
American Concrete Institute (ACI 318)
American Institute of Steel Construction (AISC-ASD)

1.4 Design Loads

Loads are forces or other actions that result from the weight of all building materials, occupants and their possessions, environmental effects, differential movements, and restrained dimensional changes. Design loads and forces are those resulting from dead loads, live loads and environmental loads acting in the most critical combinations, using the appropriate load factors recommended by the applicable code. The basic load types and their corresponding magnitude are as follows:

1.4.1 Dead Loads

- Dead loads are gravity loads which include the weight of all materials incorporated into the building or other structure. Dead loads are permanent loads in which variations over time are rare or of small magnitude.

Self Weight

1.4.2 Live Loads

- Live loads are those loads produced by the use and occupancy of the building or other structure and do not include dead load, construction load or environmental load such as wind load, rain load, earthquake load or flood load.

Roof Live	300	PSF
Floor Live	50	PSF

1.4.3 Wind Loads

- The structure and every portion thereof shall be designed and constructed to resist the wind effects determined in accordance to the requirements of ASCE 07-10.

Basic Wind Speed, V, mph	180	Clients Value
Building Classification Category	II	ASCE Table 1.5-1
Exposure Category	D	Clients Value, ASCE Ch.26.7.3
Structure Type	Building	
Importance Factor, I	1	ASCE Table 1.5-2

1.4.4 Seismic Loads

-The purpose of the earthquake provisions is primarily to safeguard against major structural failures and loss of life, not to limit or maintain function.

- Structures and portions thereof shall, as a minimum be designed and constructed to resist the effects of seismic ground motions as provided in ASCE 7-10 and IBC 2012

- Spectral Response Accelator, S_s and S_1 were base on USGS as per ASCE 7-10 Notes Figure 22-17

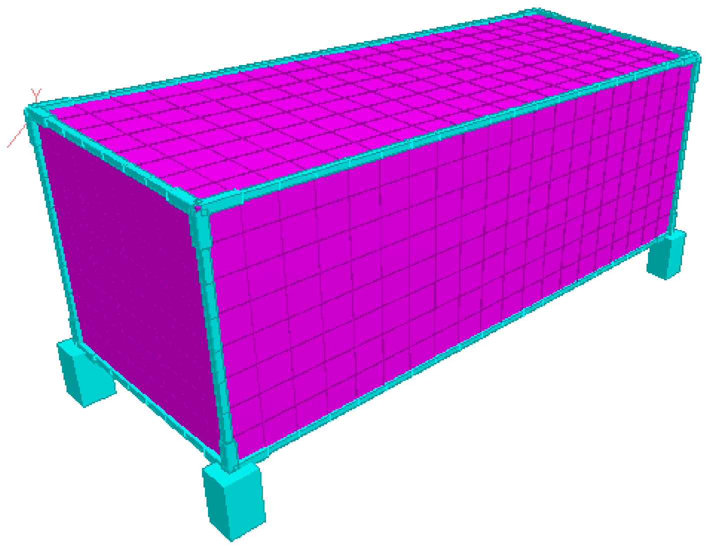
Zip Code	94116	San Francisco, California
Latitide	37.7438	USGS, STAAD Value
Lingitude	-122.486	USGS, STAAD Value
Spectral Resonse Accelarator, S_s	2.07135	USGS, STAAD Value
Spectral Resonse Accelarator, S_1	0.9797	USGS, STAAD Value
Period, TL	8	
Importance Factor, I	1	ASCE Table 1.5-2
Site Class	D	ASCE Ch.20.1
Site Coefficient, F_a	1	ASCE Table 11.4-1
Site Coefficient, F_v	1.5	ASCE Table 11.4-2
Response Modification Factor, Rx	8	ASCE Table 15.4-1
Response Modification Factor, Rz	8	ASCE Table 15.4-2

1.5 Analysis/Design Software

The following computer software were used for this project:

- STAAD Pro v8i SS6 - for structure modeling and structural analysis
- Microsoft Excel 2010 - for loading computations and calculation report documentation

2 Staad 3D Analysis Model



Job Information

	Engineer	Checked	Approved
Name:			
Date:	10-Feb-18		

Project ID	
Project Name	

Structure Type	SPACE FRAME

Number of Nodes	774	Highest Node	774
Number of Elements	148	Highest Beam	922
Number of Plates	768	Highest Plate	918

Number of Basic Load Cases	7
Number of Combination Load Cases	45

Included in this printout are data for:

Beams	1 to 12 36 56 102 170 190 208

Included in this printout are results for load cases:

Type	L/C	Name
Primary	1	EQX
Primary	2	EQZ
Primary	3	DEAD LOAD
Primary	4	ROOF LIVE
Primary	5	WIND_X
Primary	6	WIND_Z
Combination	7	GENERATED AISC GENERAL 1
Combination	8	GENERATED AISC GENERAL 2
Combination	9	GENERATED AISC GENERAL 3
Combination	10	GENERATED AISC GENERAL 4
Combination	11	GENERATED AISC GENERAL 5
Combination	12	GENERATED AISC GENERAL 6
Combination	13	GENERATED AISC GENERAL 7
Combination	14	GENERATED AISC GENERAL 8
Combination	15	GENERATED AISC GENERAL 9
Combination	16	GENERATED AISC GENERAL 10
Combination	17	GENERATED AISC GENERAL 11
Combination	18	GENERATED AISC GENERAL 12
Combination	19	GENERATED AISC GENERAL 13
Combination	20	GENERATED AISC GENERAL 14
Combination	21	GENERATED AISC GENERAL 15
Combination	22	GENERATED AISC GENERAL 16
Combination	23	GENERATED AISC GENERAL 17
Combination	24	GENERATED AISC GENERAL 18
Combination	25	GENERATED AISC GENERAL 19
Combination	26	GENERATED AISC GENERAL 20
Combination	27	GENERATED AISC GENERAL 21
Combination	28	GENERATED AISC GENERAL 22
Combination	29	GENERATED AISC GENERAL 23
Combination	30	GENERATED AISC GENERAL 24
Combination	31	GENERATED AISC GENERAL 25
Combination	32	GENERATED AISC GENERAL 26
Combination	33	GENERATED AISC GENERAL 27
Combination	34	GENERATED ACI TABLE1 1
Combination	35	GENERATED ACI TABLE1 2
Combination	36	GENERATED ACI TABLE1 3

Job Information Cont...

Type	L/C	Name
Combination	40	GENERATED ACI TABLE1 7
Combination	41	GENERATED ACI TABLE1 8
Combination	42	GENERATED ACI TABLE1 9
Combination	43	GENERATED ACI TABLE1 10
Combination	44	GENERATED ACI TABLE1 11
Combination	45	GENERATED ACI TABLE1 12
Combination	46	GENERATED ACI TABLE1 13
Combination	47	GENERATED ACI TABLE1 14
Combination	48	GENERATED ACI TABLE1 15
Combination	49	GENERATED ACI TABLE1 16
Combination	50	GENERATED ACI TABLE1 17
Combination	51	GENERATED ACI TABLE1 18

Beams

Beam	Node A	Node B	Length (ft)	Property	β (degrees)
1	2	9	1.000	3	0
2	1	231	1.000	3	0
3	4	442	1.000	3	0
4	2	391	1.000	3	0
5	2	11	1.000	3	0
6	1	233	1.000	3	0
7	6	441	1.000	3	0
8	6	175	1.000	3	0
9	8	498	1.000	3	0
10	5	378	1.000	3	0
11	3	196	1.000	2	0
12	4	48	1.000	3	0
36	26	28	1.000	2	0
56	46	4	1.000	3	0
102	90	111	1.000	2	0
170	155	6	1.000	3	0
190	174	8	1.000	3	0
208	183	184	1.000	2	0

Reference Load Cases

Number	Name	Type
R1	REF LOAD CASE 1	Dead

Primary Load Cases

Number	Name	Type
1	EQX	Seismic
2	EQZ	Seismic
3	DEAD LOAD	Dead
4	ROOF LIVE	Roof Live
5	WIND_X	Wind
6	WIND_Z	Wind

Combination Load Cases

Comb.	Combination L/C Name	Primary	Primary L/C Name	Factor
7	GENERATED AISC GENERAL 1	3	DEAD LOAD	1.00
8	GENERATED AISC GENERAL 2	3	DEAD LOAD	1.00
		4	ROOF LIVE	1.00
9	GENERATED AISC GENERAL 3	3	DEAD LOAD	1.00
		4	ROOF LIVE	0.75
10	GENERATED AISC GENERAL 4	3	DEAD LOAD	1.00
		5	WIND_X	1.00
11	GENERATED AISC GENERAL 5	3	DEAD LOAD	1.00
		6	WIND_Z	1.00
12	GENERATED AISC GENERAL 6	3	DEAD LOAD	1.00
		1	EQX	0.70
13	GENERATED AISC GENERAL 7	3	DEAD LOAD	1.00
		2	EQZ	0.70
14	GENERATED AISC GENERAL 8	3	DEAD LOAD	1.00
		1	EQX	-0.70
15	GENERATED AISC GENERAL 9	3	DEAD LOAD	1.00
		2	EQZ	-0.70
16	GENERATED AISC GENERAL 10	3	DEAD LOAD	1.00
		4	ROOF LIVE	0.75
		5	WIND_X	0.75
17	GENERATED AISC GENERAL 11	3	DEAD LOAD	1.00
		4	ROOF LIVE	0.75
		6	WIND_Z	0.75
18	GENERATED AISC GENERAL 12	3	DEAD LOAD	1.00
		5	WIND_X	0.75
19	GENERATED AISC GENERAL 13	3	DEAD LOAD	1.00
		6	WIND_Z	0.75
20	GENERATED AISC GENERAL 14	3	DEAD LOAD	1.00
		4	ROOF LIVE	0.75
		1	EQX	0.52
21	GENERATED AISC GENERAL 15	3	DEAD LOAD	1.00
		4	ROOF LIVE	0.75
		2	EQZ	0.52
22	GENERATED AISC GENERAL 16	3	DEAD LOAD	1.00
		1	EQX	0.52
23	GENERATED AISC GENERAL 17	3	DEAD LOAD	1.00
		2	EQZ	0.52
24	GENERATED AISC GENERAL 18	3	DEAD LOAD	1.00
		4	ROOF LIVE	0.75
		1	EQX	-0.52
25	GENERATED AISC GENERAL 19	3	DEAD LOAD	1.00
		4	ROOF LIVE	0.75
		2	EQZ	-0.52
26	GENERATED AISC GENERAL 20	3	DEAD LOAD	1.00
		1	EQX	-0.52
27	GENERATED AISC GENERAL 21	3	DEAD LOAD	1.00
		2	EQZ	-0.52
28	GENERATED AISC GENERAL 22	3	DEAD LOAD	0.60
		5	WIND_X	1.00
29	GENERATED AISC GENERAL 23	3	DEAD LOAD	0.60
		6	WIND_Z	1.00
30	GENERATED AISC GENERAL 24	3	DEAD LOAD	0.60
		1	EQX	0.70
31	GENERATED AISC GENERAL 25	3	DEAD LOAD	0.60
		2	EQZ	0.70
32	GENERATED AISC GENERAL 26	3	DEAD LOAD	0.60

Combination Load Cases Cont...

Comb.	Combination L/C Name	Primary	Primary L/C Name	Factor
		1	EQX	-0.70
33	GENERATED AISC GENERAL 27	3	DEAD LOAD	0.60
		2	EQZ	-0.70
34	GENERATED ACI TABLE1 1	3	DEAD LOAD	1.40
35	GENERATED ACI TABLE1 2	3	DEAD LOAD	1.20
		4	ROOF LIVE	0.50
36	GENERATED ACI TABLE1 3	3	DEAD LOAD	1.20
37	GENERATED ACI TABLE1 4	3	DEAD LOAD	1.20
		4	ROOF LIVE	1.60
38	GENERATED ACI TABLE1 5	3	DEAD LOAD	1.20
		4	ROOF LIVE	1.60
		5	WIND_X	0.80
39	GENERATED ACI TABLE1 6	3	DEAD LOAD	1.20
		4	ROOF LIVE	1.60
		6	WIND_Z	0.80
40	GENERATED ACI TABLE1 7	3	DEAD LOAD	1.20
		5	WIND_X	0.80
41	GENERATED ACI TABLE1 8	3	DEAD LOAD	1.20
		6	WIND_Z	0.80
42	GENERATED ACI TABLE1 9	3	DEAD LOAD	1.20
		4	ROOF LIVE	0.50
		5	WIND_X	1.60
43	GENERATED ACI TABLE1 10	3	DEAD LOAD	1.20
		4	ROOF LIVE	0.50
		6	WIND_Z	1.60
44	GENERATED ACI TABLE1 11	3	DEAD LOAD	1.20
		5	WIND_X	1.60
45	GENERATED ACI TABLE1 12	3	DEAD LOAD	1.20
		6	WIND_Z	1.60
46	GENERATED ACI TABLE1 13	3	DEAD LOAD	1.20
		1	EQX	1.00
47	GENERATED ACI TABLE1 14	3	DEAD LOAD	1.20
		2	EQZ	1.00
48	GENERATED ACI TABLE1 15	3	DEAD LOAD	0.90
		5	WIND_X	1.60
49	GENERATED ACI TABLE1 16	3	DEAD LOAD	0.90
		6	WIND_Z	1.60
50	GENERATED ACI TABLE1 17	3	DEAD LOAD	0.90
		1	EQX	1.00
51	GENERATED ACI TABLE1 18	3	DEAD LOAD	0.90
		2	EQZ	1.00

Wind Load Definition : Type 1

Intensity (N/mm^2)	Height (ft)
0.004	0.000
0.004	15.000

Exposure Factor	Range	Nodes / Height Range (ft)
0.850	Nodes	1 - 774

Wind Load Definition : Type 2

Intensity (N/mm^2)	Height (ft)
0.004	0.000
0.004	15.000

Exposure Factor	Range	Nodes / Height Range (ft)
0.850	Nodes	1 - 774

IBC Loading Definition

SDS	SD1	S1	Importance Factor	Rw X	Rw Z	Site Class	Ct	Period X (sec)	Period Z (sec)	Accidental Torsion
-	-	94.1E+3	1.000	8.000	8.000	4.000	-	-	-	No

Selfweight included

3 DEAD LOAD : Selfweight

Direction	Factor	Assigned Geometry
Y	-1.000	ALL

5 WIND X : Wind Loading

Direction	Type	Factor
X	1	1.000

6 WIND Z : Wind Loading

Direction	Type	Factor
Z	1	1.000

Materials

Mat	Name	E (kip/ft^2)	ν	Density (kip/in^3)	α (/°K)
1	STEEL	4.18E+6	0.300	0.000	6E -6
2	STAINLESSSTEEL	4.13E+6	0.300	0.000	18E -6
3	ALUMINUM	1.44E+6	0.330	0.000	23E -6
4	CONCRETE	454E+3	0.170	0.000	5E -6

Section Properties

Prop	Section	Area (in^2)	I_{yy} (in^4)	I_{zz} (in^4)	J (in^4)	Material
2	HSST2.5X2.5X0.125	1.070	0.998	0.998	1.572	STEEL
3	HSST3.5X3.5X0.188	2.240	4.050	4.050	6.402	STEEL
4	Rect 0.30x0.30	144.000	1.73E+3	1.73E+3	2.92E+3	CONCRETE

Plate Thickness

Prop	Node A (ft)	Node B (ft)	Node C (ft)	Node D (ft)	Material
1	0.021	0.021	0.021	0.021	STEEL

Steel Design (Track 2) Beam 1 Check 1

```
|--------------------------------------------------------------------------|
|                                                    Y        PROPERTIES   |
|*************                                       |        IN INCH UNIT |
|           *  |=============================|                ------------ |
|MEMBER   1  *  |  AISC SECTIONS               |                AX =   2.24 |
|           *  | ST  HSST3.5X3.5X0.188       |            --Z  AY =   0.98 |
|DESIGN CODE *  |                             |                AZ =   0.98 |
| AISC-1989  *  ===============================                SY =   2.31 |
|           *                                                  SZ =   2.31 |
|           *  |<---LENGTH (FT)=    1.00 --->|                RY =   1.34 |
|*************                                                 RZ =   1.34 |
|                                                                          |
|                 1.0 (KIP-FEET)                                           |
|PARAMETER        |L28                                         STRESSES    |
|IN KIP  INCH     |   L28                                      IN KIP  INCH |
|---------------  +       L28                                  -------------|
| KL/R-Y=   8.92  |           L28                              FA  =  21.60 |
| KL/R-Z=   8.92  +               L28                          fa  =   0.90 |
| UNL   =  12.00  |                                            FCZ =  23.76 |
| CB    =   1.00  +                                            FTZ =  23.76 |
| CMY   =   0.85  |                   L28                  L24 FCY =  23.76 |
| CMZ   =   0.85  +                       L28     L8  L8       FTY =  23.76 |
| FYLD  =  36.00  |                           L16              fbz =   5.10 |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|    fby =   0.29 |
| DFF   =   0.00   0.1                                         Fey =1874.98 |
| dff=      0.00              ABSOLUTE MZ ENVELOPE             Fez =1874.98 |
|                                (WITH LOAD NO.)               FV  =  14.40 |
|                                                              fv  =   1.24 |
|                                                                          |
|                      MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)               |
|                      -------------------------                           |
|                                                                          |
|                AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z     |
|                                                                          |
|      VALUE      -2.0         1.2        0.2         0.1         1.0      |
|   LOCATION       0.0         1.0        0.0         1.0         0.0      |
|    LOADING        28          28         11          11          28      |
|                                                                          |
|**************************************************************************|
|*                                                                        *|
|*                         DESIGN SUMMARY  (KIP-FEET)                     *|
|*                         --------------                                 *|
|*                                                                        *|
|*       RESULT/     CRITICAL COND/     RATIO/         LOADING/           *|
|         FX              MY             MZ          LOCATION              |
|        =======================================================           |
|          PASS        AISC- H2-1     2.686E-01          28                |
|          2.02 T         -0.06       -0.98             0.00               |
|*                                                                        *|
|**************************************************************************|
|                                                                          |
|--------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 2 Check 1

```
|---------------------------------------------------------------------------|
|                                                     Y        PROPERTIES    |
|*************                                       |        IN INCH UNIT  |
|            *  |=============================|               ------------  |
|MEMBER   2  *  |  AISC SECTIONS              |               AX =   2.24   |
|            *  | ST  HSST3.5X3.5X0.188       |           --Z AY =   0.98   |
|DESIGN CODE *  |                             |               AZ =   0.98   |
| AISC-1989  *  ===============================               SY =   2.31   |
|            *                                                SZ =   2.31   |
|            *  |<---LENGTH (FT)=    1.00 --->|               RY =   1.34   |
|*************                                                RZ =   1.34   |
|                                                                           |
|                 1.0 (KIP-FEET)                                            |
|PARAMETER        |L28                                        STRESSES      |
|IN KIP  INCH     |   L28                                     IN KIP  INCH  |
|---------------  +       L28                                 -------------|
| KL/R-Y=   8.92  |           L28                               FA  =  21.60 |
| KL/R-Z=   8.92  +               L28                           fa  =   0.93 |
| UNL   =  12.00  |                                             FCZ =  23.76 |
| CB    =   1.00  +                                         L24 FTZ =  23.76 |
| CMY   =   0.85  |                   L28                       FCY =  23.76 |
| CMZ   =   0.85  +                       L28     L8  L8        FTY =  23.76 |
| FYLD  =  36.00  |                           L16               fbz =   5.21 |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|     fby =   0.29 |
| DFF   =   0.00   0.1                                          Fey =1874.98 |
| dff=      0.00              ABSOLUTE MZ ENVELOPE              Fez =1874.98 |
|                                (WITH LOAD NO.)               FV  =  14.40 |
|                                                              fv  =   1.27 |
|                                                                           |
|                       MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)               |
|                       -------------------------                           |
|                                                                           |
|                AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z      |
|                                                                           |
|      VALUE      -2.1         1.2        0.2         0.1         1.0       |
|   LOCATION       0.0         1.0        0.0         1.0         0.0       |
|    LOADING        28          28         17          17          28       |
|                                                                           |
|***************************************************************************|
|*                                                                         *|
|*                          DESIGN SUMMARY  (KIP-FEET)                     *|
|*                          --------------                                 *|
|*                                                                         *|
|*       RESULT/     CRITICAL COND/     RATIO/        LOADING/             *|
|         FX             MY             MZ           LOCATION              |
|        ======================================================            |
|          PASS        AISC- H2-1     2.750E-01          28                 |
|          2.09 T         0.06        -1.01            0.00                 |
|*                                                                         *|
|***************************************************************************|
|                                                                           |
|---------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 3 Check 1

```
|-----------------------------------------------------------------------------|
|                                                    Y        PROPERTIES      |
|*************                                       |        IN INCH UNIT    |
|           *  |=============================|                ------------    |
|MEMBER   3  *  | AISC SECTIONS               |                AX =   2.24    |
|           *  | ST  HSST3.5X3.5X0.188       |          --Z  AY =   0.98    |
|DESIGN CODE *  |                             |                AZ =   0.98    |
| AISC-1989  *  ===============================                SY =   2.31    |
|           *                                               SZ =   2.31    |
|           *  |<---LENGTH (FT)=    1.00 --->|                RY =   1.34    |
|*************                                              RZ =   1.34    |
|                                                                             |
|                 3.0 (KIP-FEET)                                              |
|PARAMETER       |L11                                       STRESSES         |
|IN KIP  INCH    |   L11                                    IN KIP  INCH     |
|--------------- +       L11                                -------------|
| KL/R-Y=   8.92 |           L29                            FA  =  21.21 |
| KL/R-Z=   8.92 +               L29                        fa  =   2.64 |
| UNL   =  12.00 |                                          FCZ =  23.76 |
| CB    =   1.00 +                   L29                    FTZ =  23.76 |
| CMY   =   0.85 |                       L29            L11 FCY =  23.76 |
| CMZ   =   0.85 +                               L17 L17    FTY =  23.76 |
| FYLD  =  36.00 |                           L8             fbz =  15.77 |
| NSF   =   1.00 +---+---+---+---+---+---+---+---+---+---|  fby =   0.85 |
| DFF   =   0.00 -0.0                                       Fey =1874.98 |
| dff=      0.00             ABSOLUTE MZ ENVELOPE           Fez =1874.98 |
|                              (WITH LOAD NO.)               FV  =  14.40 |
|                                                           fv  =   4.03 |
|                                                                             |
|                    MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)                    |
|                    -------------------------                                |
|                                                                             |
|              AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z          |
|                                                                             |
|      VALUE       5.9        4.0        0.1         0.2         3.0          |
|   LOCATION       0.0        0.0        0.0         0.0         0.0          |
|    LOADING        29         11         29          29          11          |
|                                                                             |
|*****************************************************************************|
|*                                                                           *|
|*                        DESIGN SUMMARY  (KIP-FEET)                         *|
|*                        --------------                                     *|
|*                                                                           *|
|*       RESULT/     CRITICAL COND/     RATIO/        LOADING/               *|
|         FX            MY             MZ          LOCATION                  |
|        ======================================================               |
|          PASS       AISC- H1-3     8.244E-01          29                    |
|          5.92 C         0.16         3.04            0.00                   |
|*                                                                           *|
|*****************************************************************************|
|                                                                             |
|-----------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 4 Check 1

```
|-----------------------------------------------------------------------------|
|                                                     Y        PROPERTIES      |
|*************                                       |        IN INCH UNIT    |
|           *  |=============================|                ------------    |
|MEMBER   4  *  | AISC SECTIONS                 |                AX =   2.24    |
|           *  | ST  HSST3.5X3.5X0.188         |           --Z  AY =   0.98    |
|DESIGN CODE *  |                               |                AZ =   0.98    |
| AISC-1989  *  ===============================                SY =   2.31    |
|           *                                                  SZ =   2.31    |
|           *  |<---LENGTH (FT)=    1.00 --->|                RY =   1.34    |
|*************                                                RZ =   1.34    |
|                                                                             |
|                  2.4 (KIP-FEET)                                             |
|PARAMETER        |L11                                        STRESSES        |
|IN KIP  INCH     |   L11                                     IN KIP  INCH    |
|---------------  +       L11                                 -------------|
| KL/R-Y=   8.92  |           L11                             FA  =  21.21    |
| KL/R-Z=   8.92  +               L11                         fa  =   2.07    |
| UNL   =  12.00  |                                           FCZ =  23.76    |
| CB    =   1.00  +                   L29                     FTZ =  23.76    |
| CMY   =   0.85  |                       L29             L17 FCY =  23.76    |
| CMZ   =   0.85  +                               L17 L17     FTY =  23.76    |
| FYLD  =  36.00  |                           L8              fbz =  12.65    |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|   fby =   0.59    |
| DFF   =   0.00   0.0                                        Fey =1874.98    |
| dff=      0.00              ABSOLUTE MZ ENVELOPE            Fez =1874.98    |
|                                (WITH LOAD NO.)             FV  =  14.40    |
|                                                             fv  =   3.27    |
|                                                                             |
|                       MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)                 |
|                       -------------------------                             |
|                                                                             |
|                 AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z       |
|                                                                             |
|      VALUE        4.6         3.2        0.1         0.1         2.4        |
|   LOCATION        0.0         0.0        0.0         0.0         0.0        |
|    LOADING         11          11         10          29          11        |
|                                                                             |
|*****************************************************************************|
|*                                                                           *|
|*                         DESIGN SUMMARY  (KIP-FEET)                        *|
|*                         --------------                                    *|
|*                                                                           *|
|*       RESULT/     CRITICAL COND/     RATIO/         LOADING/              *|
|         FX            MY             MZ           LOCATION                 |
|        =====================================================                |
|          PASS        AISC- H1-3     6.548E-01          11                   |
|          4.64 C        -0.11         2.44            0.00                   |
|*                                                                           *|
|*****************************************************************************|
|                                                                             |
|-----------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 5 Check 1

```
|--------------------------------------------------------------------------|
|                                                    Y        PROPERTIES   |
|*************                                       |        IN INCH UNIT |
|           *  |=============================|                ------------ |
|MEMBER   5  *  |  AISC SECTIONS              |                AX =   2.24  |
|           *  | ST  HSST3.5X3.5X0.188       |           --Z  AY =   0.98  |
|DESIGN CODE *  |                             |                AZ =   0.98  |
| AISC-1989  *  ===============================                SY =   2.31  |
|           *                                                 SZ =   2.31  |
|           *  |<---LENGTH (FT)=    1.00 --->|                RY =   1.34  |
|*************                                               RZ =   1.34  |
|                                                                          |
|                 1.0 (KIP-FEET)                                           |
|PARAMETER        |L28                                       STRESSES     |
|IN KIP  INCH     |   L28                                    IN KIP  INCH |
|---------------  +       L28                                -------------|
| KL/R-Y=   8.92  |           L28                            FA  =  21.60 |
| KL/R-Z=   8.92  +               L28                        fa  =   0.38 |
| UNL   =  12.00  |                                          FCZ =  23.76 |
| CB    =   1.00  +                   L28                    FTZ =  23.76 |
| CMY   =   0.85  |                       L28            L28 FCY =  23.76 |
| CMZ   =   0.85  +                                  L28     FTY =  23.76 |
| FYLD  =  36.00  |                           L10 L24        fbz =   0.88 |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|  fby =  11.37 |
| DFF   =   0.00  -0.0                                       Fey =1874.98 |
| dff=      0.00              ABSOLUTE MZ ENVELOPE           Fez =1874.98 |
|                                (WITH LOAD NO.)             FV  =  14.40 |
|                                                            fv  =   2.79 |
|                                                                          |
|                      MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)               |
|                      -------------------------                           |
|                                                                          |
|                AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z     |
|                                                                          |
|      VALUE       5.7         1.2        2.7         2.2         1.0      |
|   LOCATION       0.0         0.0        0.0         0.0         0.0      |
|    LOADING         8          28         29          29          28      |
|                                                                          |
|**************************************************************************|
|*                                                                        *|
|*                         DESIGN SUMMARY  (KIP-FEET)                     *|
|*                         --------------                                 *|
|*                                                                        *|
|*       RESULT/     CRITICAL COND/     RATIO/        LOADING/            *|
|         FX             MY             MZ          LOCATION              |
|        ======================================================            |
|          PASS        AISC- H2-1      5.333E-01         29                |
|          0.86 T         -2.19         0.17            0.00               |
|*                                                                        *|
|**************************************************************************|
|                                                                          |
|--------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 6 Check 1

```
|--------------------------------------------------------------------------|
|                                                    Y        PROPERTIES   |
|*************                                       |        IN INCH UNIT |
|           *  |=============================|                ------------ |
|MEMBER   6  *  |  AISC SECTIONS              |                AX =   2.24  |
|           *  | ST  HSST3.5X3.5X0.188       |            --Z  AY =   0.98  |
|DESIGN CODE *  |                             |                AZ =   0.98  |
| AISC-1989  *  ===============================                SY =   2.31  |
|           *                                                SZ =   2.31  |
|           *  |<---LENGTH (FT)=    1.00 --->|                RY =   1.34  |
|*************                                                RZ =   1.34  |
|                                                                          |
|                 1.0 (KIP-FEET)                                           |
|PARAMETER        |L28                                        STRESSES     |
|IN KIP  INCH     |   L28                                     IN KIP  INCH |
|---------------  +       L28                                 -------------|
| KL/R-Y=   8.92  |           L28                             FA  =  21.21 |
| KL/R-Z=   8.92  +               L28                         fa  =   1.52 |
| UNL   =  12.00  |                   L28                     FCZ =  23.76 |
| CB    =   1.00  +                       L28                 FTZ =  23.76 |
| CMY   =   0.85  |                           L28         L28 FCY =  23.76 |
| CMZ   =   0.85  +                               L28         FTY =  23.76 |
| FYLD  =  36.00  |                           L10 L24         fbz =   0.83 |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|   fby =  11.70 |
| DFF   =   0.00  -0.0                                        Fey =1874.98 |
| dff=      0.00             ABSOLUTE MZ ENVELOPE             Fez =1874.98 |
|                              (WITH LOAD NO.)                FV  =  14.40 |
|                                                             fv  =   2.86 |
|                                                                          |
|                     MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)                |
|                     -------------------------                            |
|                                                                          |
|                AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z     |
|                                                                          |
|      VALUE       6.1         1.3        2.8         2.3         1.0      |
|   LOCATION       0.0         0.0        0.0         0.0         0.0      |
|    LOADING        17          28         11          11          28      |
|                                                                          |
|**************************************************************************|
|*                                                                        *|
|*                         DESIGN SUMMARY  (KIP-FEET)                     *|
|*                         --------------                                 *|
|*                                                                        *|
|*       RESULT/     CRITICAL COND/     RATIO/         LOADING/           *|
|         FX              MY             MZ          LOCATION             |
|        =====================================================             |
|          PASS        AISC- H1-3     5.989E-01          11                |
|          3.40 C         -2.26       -0.16            0.00                |
|*                                                                        *|
|**************************************************************************|
|                                                                          |
|--------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 7 Check 1

```
|-----------------------------------------------------------------------------|
|                                                     Y        PROPERTIES     |
|*************                                        |        IN INCH UNIT   |
|            *  |=============================|                ------------   |
|MEMBER   7  *  |  AISC SECTIONS              |                AX =   2.24    |
|            *  | ST  HSST3.5X3.5X0.188       |            --Z AY =   0.98    |
|DESIGN CODE *  |                             |                AZ =   0.98    |
| AISC-1989  *  ===============================                SY =   2.31    |
|            *                                                 SZ =   2.31    |
|            *  |<---LENGTH (FT)=    1.00 --->|                RY =   1.34    |
|*************                                                 RZ =   1.34    |
|                                                                             |
|                  2.3 (KIP-FEET)                                             |
|PARAMETER        |L8                                          STRESSES       |
|IN KIP  INCH     |   L8                                       IN KIP  INCH   |
|---------------  +       L8                                   -------------|
| KL/R-Y=   8.92  |           L8                               FA  =  21.21   |
| KL/R-Z=   8.92  +               L8                           fa  =   1.62   |
| UNL   =  12.00  |                                            FCZ =  23.76   |
| CB    =   1.00  +                   L8                       FTZ =  23.76   |
| CMY   =   0.85  |                       L8              L8   FCY =  23.76   |
| CMZ   =   0.85  +                                   L8       FTY =  23.76   |
| FYLD  =  36.00  |                           L8  L8           fbz =  12.18   |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|    fby =   1.20   |
| DFF   =   0.00  -0.1                                         Fey =1874.98   |
| dff=      0.00              ABSOLUTE MZ ENVELOPE             Fez =1874.98   |
|                                (WITH LOAD NO.)                FV  =  14.40   |
|                                                               fv  =   2.98   |
|                                                                             |
|                      MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)                  |
|                      -------------------------                              |
|                                                                             |
|                AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z        |
|                                                                             |
|      VALUE       3.6          2.9        0.3         0.2         2.3        |
|   LOCATION       0.0          1.0        0.0         0.0         0.0        |
|    LOADING         8            8          8           8           8        |
|                                                                             |
|*****************************************************************************|
|*                                                                           *|
|*                          DESIGN SUMMARY  (KIP-FEET)                       *|
|*                          --------------                                   *|
|*                                                                           *|
|*       RESULT/     CRITICAL COND/     RATIO/         LOADING/              *|
|         FX            MY             MZ            LOCATION                 |
|        ======================================================               |
|          PASS        AISC- H1-3     6.397E-01           8                   |
|          3.63 C        -0.23        -2.35             0.00                  |
|*                                                                           *|
|*****************************************************************************|
|                                                                             |
|-----------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 8 Check 1

```
|-----------------------------------------------------------------------------|
|                                                      Y        PROPERTIES    |
|*************                                         |        IN INCH UNIT  |
|           *  |=============================|                  ------------  |
|MEMBER   8  *  |  AISC SECTIONS              |                 AX =   2.24   |
|           *  | ST  HSST3.5X3.5X0.188       |             --Z  AY =   0.98   |
|DESIGN CODE *  |                             |                 AZ =   0.98   |
| AISC-1989  *  ===============================                 SY =   2.31   |
|           *                                                  SZ =   2.31   |
|           *  |<---LENGTH (FT)=    1.00 --->|                 RY =   1.34   |
|*************                                                  RZ =   1.34   |
|                                                                             |
|                  0.9 (KIP-FEET)                                             |
|PARAMETER        |L8                                           STRESSES      |
|IN KIP  INCH     |   L8                                        IN KIP  INCH  |
|---------------  +       L8                                    -------------|
| KL/R-Y=   8.92  |           L8                                FA  =  21.21  |
| KL/R-Z=   8.92  +               L8                            fa  =   0.56  |
| UNL   =  12.00  |                   L8                        FCZ =  23.76  |
| CB    =   1.00  +                       L8                    FTZ =  23.76  |
| CMY   =   0.85  |                                       L8    FCY =  23.76  |
| CMZ   =   0.85  +                           L8      L8        FTY =  23.76  |
| FYLD  =  36.00  |                               L8            fbz =   4.47  |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|    fby =   0.18  |
| DFF   =   0.00  -0.0                                          Fey =1874.98  |
| dff=      0.00               ABSOLUTE MZ ENVELOPE             Fez =1874.98  |
|                                 (WITH LOAD NO.)               FV  =  14.40  |
|                                                               fv  =   1.04  |
|                                                                             |
|                      MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)                  |
|                      -------------------------                              |
|                                                                             |
|                AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z        |
|                                                                             |
|      VALUE       1.3         1.0        0.0         0.0         0.9         |
|   LOCATION       0.0         1.0        0.0         0.0         0.0         |
|    LOADING         8           8         14           8           8         |
|                                                                             |
|*****************************************************************************|
|*                                                                           *|
|*                         DESIGN SUMMARY  (KIP-FEET)                        *|
|*                         --------------                                    *|
|*                                                                           *|
|*       RESULT/     CRITICAL COND/     RATIO/         LOADING/              *|
|         FX             MY              MZ          LOCATION                  |
|        =====================================================                |
|          PASS       AISC- H1-3      2.220E-01           8                    |
|          1.25 C        -0.03        -0.86             0.00                   |
|*                                                                           *|
|*****************************************************************************|
|                                                                             |
|-----------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 9 Check 1

```
|--------------------------------------------------------------------------|
|                                                    Y        PROPERTIES   |
|*************                                       |        IN INCH UNIT |
|           *  |=============================|               ------------ |
|MEMBER   9  *  |  AISC SECTIONS               |               AX =   2.24  |
|           *  | ST  HSST3.5X3.5X0.188        |            --Z  AY =   0.98  |
|DESIGN CODE *  |                              |               AZ =   0.98  |
| AISC-1989  *  ===============================               SY =   2.31  |
|           *                                                 SZ =   2.31  |
|           *  |<---LENGTH (FT)=    1.00 --->|               RY =   1.34  |
|*************                                               RZ =   1.34  |
|                                                                          |
|                  2.3 (KIP-FEET)                                          |
|PARAMETER        |L8                                        STRESSES     |
|IN KIP  INCH     |   L8                                     IN KIP  INCH |
|---------------  +       L8                                 -------------|
| KL/R-Y=   8.92  |           L8                             FA  =  21.21 |
| KL/R-Z=   8.92  +               L8                         fa  =   1.62 |
| UNL   =  12.00  |                                          FCZ =  23.76 |
| CB    =   1.00  +                   L8                     FTZ =  23.76 |
| CMY   =   0.85  |                       L8              L8 FCY =  23.76 |
| CMZ   =   0.85  +                                   L8     FTY =  23.76 |
| FYLD  =  36.00  |                           L8  L8         fbz =  12.18 |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|  fby =   1.21 |
| DFF   =   0.00  -0.1                                       Fey =1874.98 |
| dff=      0.00             ABSOLUTE MZ ENVELOPE            Fez =1874.98 |
|                               (WITH LOAD NO.)               FV  =  14.40 |
|                                                            fv  =   2.98 |
|                                                                          |
|                      MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)               |
|                      -------------------------                           |
|                                                                          |
|                AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z     |
|                                                                          |
|      VALUE       3.6         2.9        0.3         0.2         2.3      |
|   LOCATION       0.0         1.0        0.0         0.0         0.0      |
|    LOADING         8           8          8           8           8      |
|                                                                          |
|**************************************************************************|
|*                                                                        *|
|*                         DESIGN SUMMARY  (KIP-FEET)                     *|
|*                         --------------                                 *|
|*                                                                        *|
|*       RESULT/     CRITICAL COND/     RATIO/         LOADING/           *|
|         FX            MY             MZ           LOCATION              |
|        ======================================================           |
|          PASS       AISC- H1-3     6.398E-01           8                |
|          3.63 C         0.23       -2.35             0.00               |
|*                                                                        *|
|**************************************************************************|
|                                                                          |
|--------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 10 Check 1

```
|--------------------------------------------------------------------------|
|                                                     Y        PROPERTIES   |
|*************                                       |        IN INCH UNIT |
|           *  |=============================|                ------------ |
|MEMBER  10  *  |  AISC SECTIONS               |                AX =   2.24  |
|           *  | ST  HSST3.5X3.5X0.188       |            --Z AY =   0.98  |
|DESIGN CODE *  |                             |                AZ =   0.98  |
| AISC-1989  *  ===============================                SY =   2.31  |
|           *                                                 SZ =   2.31  |
|           *  |<---LENGTH (FT)=    1.00 --->|                RY =   1.34  |
|*************                                                RZ =   1.34  |
|                                                                          |
|                  0.9 (KIP-FEET)                                          |
|PARAMETER        |L8                                         STRESSES     |
|IN KIP  INCH     |   L8                                      IN KIP  INCH |
|---------------  +       L8                                  -------------|
| KL/R-Y=   8.92  |           L8                              FA  =  21.21 |
| KL/R-Z=   8.92  +               L8                          fa  =   0.56 |
| UNL   =  12.00  |                   L8                      FCZ =  23.76 |
| CB    =   1.00  +                       L8                  FTZ =  23.76 |
| CMY   =   0.85  |                                       L8  FCY =  23.76 |
| CMZ   =   0.85  +                           L8      L8      FTY =  23.76 |
| FYLD  =  36.00  |                               L8          fbz =   4.47 |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|   fby =   0.17 |
| DFF   =   0.00  -0.0                                        Fey =1874.98 |
| dff=      0.00             ABSOLUTE MZ ENVELOPE             Fez =1874.98 |
|                               (WITH LOAD NO.)               FV  =  14.40 |
|                                                             fv  =   1.04 |
|                                                                          |
|                     MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)                |
|                     -------------------------                            |
|                                                                          |
|               AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z      |
|                                                                          |
|      VALUE       1.2         1.0        0.0         0.0         0.9      |
|    LOCATION      0.0         1.0        0.0         0.0         0.0      |
|     LOADING        8           8         14           8           8      |
|                                                                          |
|**************************************************************************|
|*                                                                        *|
|*                         DESIGN SUMMARY  (KIP-FEET)                     *|
|*                         --------------                                 *|
|*                                                                        *|
|*       RESULT/     CRITICAL COND/     RATIO/         LOADING/           *|
|         FX             MY             MZ           LOCATION             |
|        ======================================================           |
|          PASS        AISC- H1-3     2.216E-01           8               |
|          1.25 C          0.03       -0.86             0.00              |
|*                                                                        *|
|**************************************************************************|
|                                                                          |
|--------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 11 Check 1

```
|--------------------------------------------------------------------------|
|                                                  Y        PROPERTIES     |
|*************                                     |        IN INCH UNIT   |
|            *  |=============================|              ------------ |
|MEMBER  11  *  |  AISC SECTIONS              |              AX =   1.07   |
|            *  | ST  HSST2.5X2.5X0.125       |          --Z  AY =   0.47   |
|DESIGN CODE *  |                             |              AZ =   0.47   |
| AISC-1989  *  ===============================              SY =   0.80   |
|            *                                               SZ =   0.80   |
|            *  |<---LENGTH (FT)=    1.00 --->|              RY =   0.97   |
|*************                                               RZ =   0.97   |
|                                                                          |
|                 0.4 (KIP-FEET)                                           |
|PARAMETER        |L10                                       STRESSES     |
|IN KIP  INCH     |   L10                                    IN KIP  INCH |
|---------------  +                                          -------------|
| KL/R-Y=  12.43  |       L10                                FA  =  21.03 |
| KL/R-Z=  12.43  +           L10                            fa  =   1.67 |
| UNL   =  12.00  |               L10                      L16 FCZ =  23.76 |
| CB    =   1.00  +                                  L16     FTZ =  23.76 |
| CMY   =   0.85  |                                          FCY =  23.76 |
| CMZ   =   0.85  +                   L10         L16        FTY =  23.76 |
| FYLD  =  36.00  |                       L28 L16            fbz =   0.83 |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|  fby =  14.60 |
| DFF   =   0.00   0.0                                       Fey = 967.24 |
| dff=      0.00              ABSOLUTE MZ ENVELOPE           Fez = 967.24 |
|                                (WITH LOAD NO.)              FV  =  14.40 |
|                                                            fv  =   3.02 |
|                                                                          |
|                     MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)                |
|                     -------------------------                            |
|                                                                          |
|               AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z      |
|                                                                          |
|      VALUE       4.0         0.6        1.4         1.0         0.4      |
|   LOCATION       0.0         0.0        0.0         0.0         0.0      |
|    LOADING         8          10         29          29          10      |
|                                                                          |
|**************************************************************************|
|*                                                                        *|
|*                         DESIGN SUMMARY  (KIP-FEET)                     *|
|*                         --------------                                 *|
|*                                                                        *|
|*       RESULT/     CRITICAL COND/     RATIO/         LOADING/            *|
|         FX              MY             MZ          LOCATION              |
|        =======================================================           |
|          PASS       AISC- H1-3      7.288E-01          11                |
|          1.79 C        -0.97        -0.06             0.00                |
|*                                                                        *|
|**************************************************************************|
|                                                                          |
|--------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 12 Check 1

```
|--------------------------------------------------------------------------|
|                                                   Y        PROPERTIES    |
|*************                                      |        IN INCH UNIT  |
|            *  |=============================|              ------------  |
|MEMBER  12  *  |  AISC SECTIONS              |              AX =   2.24   |
|            *  | ST  HSST3.5X3.5X0.188       |          --Z AY =   0.98   |
|DESIGN CODE *  |                             |              AZ =   0.98   |
| AISC-1989  *  ===============================              SY =   2.31   |
|            *                                               SZ =   2.31   |
|            *  |<---LENGTH (FT)=    1.00 --->|              RY =   1.34   |
|*************                                               RZ =   1.34   |
|                                                                          |
|                 1.0 (KIP-FEET)                                           |
|PARAMETER        |L10                                       STRESSES      |
|IN KIP  INCH     |   L10                                    IN KIP  INCH  |
|---------------  +       L10                                -------------|
| KL/R-Y=   8.92  |           L10                            FA  =  21.60  |
| KL/R-Z=   8.92  +               L10                        fa  =   0.68  |
| UNL   =  12.00  |                                          FCZ =  23.76  |
| CB    =   1.00  +                   L10                    FTZ =  23.76  |
| CMY   =   0.85  |                       L10            L10 FCY =  23.76  |
| CMZ   =   0.85  +                                   L16    FTY =  23.76  |
| FYLD  =  36.00  |                           L28 L16        fbz =   0.00  |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|  fby =  14.44  |
| DFF   =   0.00  -0.0                                       Fey =1874.98  |
| dff=      0.00              ABSOLUTE MZ ENVELOPE           Fez =1874.98  |
|                                (WITH LOAD NO.)              FV  =  14.40  |
|                                                             fv  =   3.54  |
|                                                                          |
|                      MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)               |
|                      -------------------------                           |
|                                                                          |
|                AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z     |
|                                                                          |
|      VALUE       5.7         1.3        3.5         2.8         1.0      |
|   LOCATION       0.0         0.0        0.0         0.0         0.0      |
|    LOADING         8          10         29          29          10      |
|                                                                          |
|**************************************************************************|
|*                                                                        *|
|*                          DESIGN SUMMARY  (KIP-FEET)                    *|
|*                          --------------                                *|
|*                                                                        *|
|*       RESULT/     CRITICAL COND/     RATIO/         LOADING/           *|
|         FX              MY             MZ          LOCATION             |
|        ======================================================           |
|          PASS       AISC- H2-1     6.393E-01          29                 |
|          1.52 T         -2.78        0.00            0.00                |
|*                                                                        *|
|**************************************************************************|
|                                                                          |
|--------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 36 Check 1

```
|--------------------------------------------------------------------------|
|                                                    Y        PROPERTIES   |
|*************                                       |        IN INCH UNIT |
|           *  |=============================|                ------------ |
|MEMBER  36  *  |  AISC SECTIONS              |                AX =   1.07  |
|           *  | ST  HSST2.5X2.5X0.125       |            --Z  AY =   0.47  |
|DESIGN CODE *  |                             |                AZ =   0.47  |
| AISC-1989  *  ===============================                SY =   0.80  |
|           *                                                 SZ =   0.80  |
|           *  |<---LENGTH (FT)=    1.00 --->|                RY =   0.97  |
|*************                                                RZ =   0.97  |
|                                                                          |
|                 0.0 (KIP-FEET)                                           |
|PARAMETER        |L16L16                                     STRESSES     |
|IN KIP  INCH     |       L16 L8  L8  L8                      IN KIP  INCH |
|---------------  +                      L8                   -------------|
| KL/R-Y=  12.43  |                                           FA  =  21.60 |
| KL/R-Z=  12.43  +                          L8               fa  =   0.59 |
| UNL   =  12.00  |                              L8           FCZ =  23.76 |
| CB    =   1.00  +                                           FTZ =  23.76 |
| CMY   =   0.85  |                                  L8       FCY =  23.76 |
| CMZ   =   0.85  +                                           FTY =  23.76 |
| FYLD  =  36.00  |                                      L8   fbz =   0.04 |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|   fby =   0.00 |
| DFF   =   0.00   0.0                                        Fey = 967.24 |
| dff=      0.00             ABSOLUTE MZ ENVELOPE             Fez = 967.24 |
|                              (WITH LOAD NO.)                FV  =  14.40 |
|                                                             fv  =   0.00 |
|                                                                          |
|                     MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)                |
|                     -------------------------                            |
|                                                                          |
|               AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z      |
|                                                                          |
|      VALUE      -0.6         0.0        0.0         0.0         0.0      |
|   LOCATION       0.0         1.0        0.0         0.0         0.0      |
|    LOADING         8          10         10          10          16      |
|                                                                          |
|**************************************************************************|
|*                                                                        *|
|*                         DESIGN SUMMARY  (KIP-FEET)                     *|
|*                         --------------                                 *|
|*                                                                        *|
|*       RESULT/     CRITICAL COND/     RATIO/         LOADING/           *|
|         FX            MY              MZ           LOCATION             |
|        ======================================================           |
|          PASS       AISC- H2-1     2.880E-02           8                |
|          0.63 T         0.00       -0.00              0.33              |
|*                                                                        *|
|**************************************************************************|
|                                                                          |
|--------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 56 Check 1

```
|--------------------------------------------------------------------------|
|                                                    Y        PROPERTIES    |
|*************                                       |        IN INCH UNIT |
|            *  |=============================|               ------------ |
|MEMBER  56  *  | AISC SECTIONS               |               AX =   2.24  |
|            *  | ST  HSST3.5X3.5X0.188       |           --Z AY =   0.98  |
|DESIGN CODE *  |                             |               AZ =   0.98  |
| AISC-1989  *  ===============================               SY =   2.31  |
|            *                                                SZ =   2.31  |
|            *  |<---LENGTH (FT)=    1.00 --->|               RY =   1.34  |
|*************                                                RZ =   1.34  |
|                                                                          |
|                 1.3 (KIP-FEET)                                           |
|PARAMETER        |                                       L16 STRESSES     |
|IN KIP  INCH     |                                   L16     IN KIP  INCH |
|---------------  +                               L16         -------------|
| KL/R-Y=   8.92  |                                           FA  =  21.21 |
| KL/R-Z=   8.92  +                           L16             fa  =   0.99 |
| UNL   =  12.00  |                       L16                 FCZ =  23.76 |
| CB    =   1.00  +L16                                        FTZ =  23.76 |
| CMY   =   0.85  |   L16             L10                     FCY =  23.76 |
| CMZ   =   0.85  +       L16     L10                         FTY =  23.76 |
| FYLD  =  36.00  |           L8                              fbz =   6.19 |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|   fby =   0.43 |
| DFF   =   0.00   0.1                                        Fey =1874.98 |
| dff=      0.00              ABSOLUTE MZ ENVELOPE            Fez =1874.98 |
|                                (WITH LOAD NO.)               FV  =  14.40 |
|                                                             fv  =   1.61 |
|                                                                          |
|                      MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)               |
|                      -------------------------                           |
|                                                                          |
|                AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z     |
|                                                                          |
|      VALUE       2.2         1.8        0.2         0.2         1.3      |
|   LOCATION       0.0         1.0        0.0         0.0         1.0      |
|    LOADING        10          16         11          11          16      |
|                                                                          |
|**************************************************************************|
|*                                                                        *|
|*                         DESIGN SUMMARY  (KIP-FEET)                     *|
|*                         --------------                                 *|
|*                                                                        *|
|*       RESULT/     CRITICAL COND/     RATIO/         LOADING/           *|
|         FX             MY             MZ           LOCATION             |
|        ======================================================            |
|          PASS        AISC- H1-3     3.254E-01          10                |
|          2.22 C         0.08          1.19            1.00               |
|*                                                                        *|
|**************************************************************************|
|                                                                          |
|--------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 102 Check 1

```
|--------------------------------------------------------------------------|
|                                                     Y        PROPERTIES   |
|*************                                        |        IN INCH UNIT |
|          *  |=============================|                  ------------ |
|MEMBER 102  *  |  AISC SECTIONS               |                 AX =   1.07  |
|          *  | ST  HSST2.5X2.5X0.125       |              --Z  AY =   0.47  |
|DESIGN CODE *  |                             |                 AZ =   0.47  |
| AISC-1989  *  ===============================                 SY =   0.80  |
|          *                                                   SZ =   0.80  |
|          *  |<---LENGTH (FT)=    1.00 --->|                  RY =   0.97  |
|*************                                                 RZ =   0.97  |
|                                                                          |
|                 0.0 (KIP-FEET)                                           |
|PARAMETER        |L28                                        STRESSES     |
|IN KIP  INCH     |                                           IN KIP  INCH |
|---------------  +   L28                                     -------------|
| KL/R-Y=  12.43  |       L28                             L28 FA  =  21.03 |
| KL/R-Z=  12.43  +                                   L28     fa  =   0.75 |
| UNL   =  12.00  |           L28                 L24         FCZ =  23.76 |
| CB    =   1.00  +               L28                         FTZ =  23.76 |
| CMY   =   0.85  |                           L24             FCY =  23.76 |
| CMZ   =   0.85  +                       L8                  FTY =  23.76 |
| FYLD  =  36.00  |                   L16                       fbz =   0.06 |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|   fby =   0.21 |
| DFF   =   0.00   0.0                                        Fey = 967.24 |
| dff=      0.00              ABSOLUTE MZ ENVELOPE            Fez = 967.24 |
|                                (WITH LOAD NO.)              FV  =  14.40 |
|                                                             fv  =   0.05 |
|                                                                          |
|                      MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)               |
|                      -------------------------                           |
|                                                                          |
|                AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z     |
|                                                                          |
|      VALUE       0.8         0.0        0.0         0.0         0.0      |
|   LOCATION       0.0         0.0        0.0         0.0         0.0      |
|    LOADING         8          28         29          29          28      |
|                                                                          |
|**************************************************************************|
|*                                                                        *|
|*                          DESIGN SUMMARY  (KIP-FEET)                    *|
|*                          --------------                                *|
|*                                                                        *|
|*       RESULT/     CRITICAL COND/     RATIO/         LOADING/           *|
|         FX              MY             MZ          LOCATION             |
|        ======================================================           |
|          PASS        AISC- H1-3     4.698E-02          17               |
|          0.80 C         -0.01         0.00           0.00               |
|*                                                                        *|
|**************************************************************************|
|                                                                          |
|--------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 170 Check 1

```
|--------------------------------------------------------------------------|
|                                                     Y        PROPERTIES   |
|*************                                       |        IN INCH UNIT |
|            *  |=============================|               ------------ |
|MEMBER 170  *  |  AISC SECTIONS              |               AX =   2.24  |
|            *  | ST  HSST3.5X3.5X0.188       |           --Z  AY =   0.98  |
|DESIGN CODE *  |                             |               AZ =   0.98  |
| AISC-1989  *  ===============================               SY =   2.31  |
|            *                                                SZ =   2.31  |
|            *  |<---LENGTH (FT)=    1.00 --->|               RY =   1.34  |
|*************                                                RZ =   1.34  |
|                                                                          |
|                 1.0 (KIP-FEET)                                           |
|PARAMETER        |                                       L8  STRESSES    |
|IN KIP  INCH     |                                   L8      IN KIP  INCH |
|---------------  +                               L8          -------------|
| KL/R-Y=   8.92  |                           L8              FA  =  21.60 |
| KL/R-Z=   8.92  +                       L8                  fa  =   2.21 |
| UNL   =  12.00  |                                           FCZ =  23.76 |
| CB    =   1.00  +                   L8                      FTZ =  23.76 |
| CMY   =   0.85  |L8             L8                          FCY =  23.76 |
| CMZ   =   0.85  +   L8                                      FTY =  23.76 |
| FYLD  =  36.00  |       L8  L8                              fbz =   5.36 |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|   fby =  12.39 |
| DFF   =   0.00  -0.0                                        Fey =1874.98 |
| dff=      0.00              ABSOLUTE MZ ENVELOPE            Fez =1874.98 |
|                                (WITH LOAD NO.)              FV  =  14.40 |
|                                                             fv  =   3.05 |
|                                                                          |
|                     MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)                |
|                     -------------------------                            |
|                                                                          |
|               AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z      |
|                                                                          |
|      VALUE      -5.0        1.3        3.0         2.4         1.0       |
|   LOCATION       1.0        0.0        0.0         1.0         1.0       |
|    LOADING         8          8          8           8           8       |
|                                                                          |
|**************************************************************************|
|*                                                                        *|
|*                         DESIGN SUMMARY  (KIP-FEET)                     *|
|*                         --------------                                 *|
|*                                                                        *|
|*       RESULT/     CRITICAL COND/     RATIO/         LOADING/           *|
|         FX             MY             MZ           LOCATION             |
|        ======================================================           |
|          PASS       AISC- H2-1     8.496E-01           8                |
|          4.95 T        -2.39        1.03            1.00                |
|*                                                                        *|
|**************************************************************************|
|                                                                          |
|--------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 190 Check 1

```
|--------------------------------------------------------------------------|
|                                                     Y        PROPERTIES   |
|*************                                        |        IN INCH UNIT |
|            *  |=============================|                ------------ |
|MEMBER 190  *  |  AISC SECTIONS              |                AX =   2.24  |
|            *  | ST  HSST3.5X3.5X0.188       |           --Z  AY =   0.98  |
|DESIGN CODE *  |                             |                AZ =   0.98  |
| AISC-1989  *  ===============================                SY =   2.31  |
|            *                                                 SZ =   2.31  |
|            *  |<---LENGTH (FT)=    1.00 --->|                RY =   1.34  |
|*************                                                 RZ =   1.34  |
|                                                                           |
|                 1.0 (KIP-FEET)                                            |
|PARAMETER        |                                      L8  STRESSES      |
|IN KIP  INCH     |                                  L8      IN KIP  INCH  |
|---------------  +                              L8          --------------|
| KL/R-Y=   8.92  |                          L8              FA  =  21.60  |
| KL/R-Z=   8.92  +                      L8                  fa  =   2.21  |
| UNL   =  12.00  |                                          FCZ =  23.76  |
| CB    =   1.00  +                  L8                      FTZ =  23.76  |
| CMY   =   0.85  |L8            L8                          FCY =  23.76  |
| CMZ   =   0.85  +   L8                                     FTY =  23.76  |
| FYLD  =  36.00  |       L8  L8                             fbz =   5.36  |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|  fby =  12.40  |
| DFF   =   0.00  -0.0                                       Fey =1874.98  |
| dff=      0.00              ABSOLUTE MZ ENVELOPE           Fez =1874.98  |
|                                (WITH LOAD NO.)            FV  =  14.40  |
|                                                            fv  =   3.05  |
|                                                                           |
|                      MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)                |
|                      -------------------------                            |
|                                                                           |
|                AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z      |
|                                                                           |
|      VALUE      -4.9         1.3        3.0         2.4         1.0       |
|   LOCATION      1.0         0.0        0.0         1.0         1.0       |
|    LOADING        8           8          8           8           8        |
|                                                                           |
|***************************************************************************|
|*                                                                         *|
|*                          DESIGN SUMMARY  (KIP-FEET)                     *|
|*                          --------------                                 *|
|*                                                                         *|
|*       RESULT/     CRITICAL COND/     RATIO/        LOADING/             *|
|         FX            MY             MZ          LOCATION                |
|        =====================================================             |
|          PASS        AISC- H2-1     8.496E-01          8                 |
|          4.95 T         -2.39       -1.03            1.00                |
|*                                                                         *|
|***************************************************************************|
|                                                                           |
|---------------------------------------------------------------------------|
```

Steel Design (Track 2) Beam 208 Check 1

```
|--------------------------------------------------------------------------|
|                                                    Y        PROPERTIES    |
|*************                                       |        IN INCH UNIT  |
|           *  |=============================|                ------------  |
|MEMBER 208  *  |  AISC SECTIONS              |                AX =   1.07   |
|           *  | ST  HSST2.5X2.5X0.125       |           --Z  AY =   0.47   |
|DESIGN CODE *  |                             |                AZ =   0.47   |
| AISC-1989  *  ===============================                SY =   0.80   |
|           *                                                 SZ =   0.80   |
|           *  |<---LENGTH (FT)=    1.00 --->|                RY =   0.97   |
|*************                                                RZ =   0.97   |
|                                                                          |
|                  0.0 (KIP-FEET)                                          |
|PARAMETER        |L8                                        STRESSES      |
|IN KIP  INCH     |   L8  L8                                 IN KIP  INCH  |
|---------------  +           L8                             -------------|
| KL/R-Y=  12.43  |               L8                         FA  =  21.03  |
| KL/R-Z=  12.43  +                   L8                     fa  =   0.58  |
| UNL   =  12.00  |                       L8                 FCZ =  23.76  |
| CB    =   1.00  +                                          FTZ =  23.76  |
| CMY   =   0.85  |                           L8  L8         FCY =  23.76  |
| CMZ   =   0.85  +                                   L24    FTY =  23.76  |
| FYLD  =  36.00  |                                      L14 fbz =   0.10  |
| NSF   =   1.00  +---+---+---+---+---+---+---+---+---+---|  fby =   0.07  |
| DFF   =   0.00   0.0                                       Fey = 967.24  |
| dff=      0.00              ABSOLUTE MZ ENVELOPE           Fez = 967.24  |
|                                (WITH LOAD NO.)              FV  =  14.40  |
|                                                             fv  =   0.01  |
|                                                                          |
|                      MAX FORCE/ MOMENT SUMMARY  (KIP-FEET)               |
|                      -------------------------                           |
|                                                                          |
|                AXIAL      SHEAR-Y    SHEAR-Z    MOMENT-Y    MOMENT-Z     |
|                                                                          |
|      VALUE       0.6         0.0        0.0         0.0         0.0      |
|   LOCATION       0.0         1.0        0.0         0.0         0.0      |
|    LOADING         8           8          8           8           8      |
|                                                                          |
|**************************************************************************|
|*                                                                        *|
|*                          DESIGN SUMMARY  (KIP-FEET)                    *|
|*                          --------------                                *|
|*                                                                        *|
|*       RESULT/     CRITICAL COND/     RATIO/         LOADING/           *|
|         FX              MY             MZ           LOCATION            |
|        ======================================================           |
|          PASS        AISC- H1-3     3.423E-02           8               |
|          0.62 C         -0.00       -0.01             0.00              |
|*                                                                        *|
|**************************************************************************|
|                                                                          |
|--------------------------------------------------------------------------|
```

Utilization Ratio

Beam	Analysis Property	Design Property	Actual Ratio	Allowable Ratio	Ratio (Act./Allow.)	Clause	L/C	Ax (in^2)	Iz (in^4)	Iy (in^4)	Ix (in^4)
1	HSST3.5X3.	HSST3.5X3.	0.269	1.050	0.256	AISC- H2-1	28	2.240	4.050	4.050	6.560
2	HSST3.5X3.	HSST3.5X3.	0.275	1.050	0.262	AISC- H2-1	28	2.240	4.050	4.050	6.560
3	HSST3.5X3.	HSST3.5X3.	0.824	1.050	0.785	AISC- H1-3	29	2.240	4.050	4.050	6.560
4	HSST3.5X3.	HSST3.5X3.	0.655	1.050	0.624	AISC- H1-3	11	2.240	4.050	4.050	6.560
5	HSST3.5X3.	HSST3.5X3.	0.533	1.050	0.508	AISC- H2-1	29	2.240	4.050	4.050	6.560
6	HSST3.5X3.	HSST3.5X3.	0.599	1.050	0.570	AISC- H1-3	11	2.240	4.050	4.050	6.560
7	HSST3.5X3.	HSST3.5X3.	0.640	1.050	0.609	AISC- H1-3	8	2.240	4.050	4.050	6.560
8	HSST3.5X3.	HSST3.5X3.	0.222	1.050	0.211	AISC- H1-3	8	2.240	4.050	4.050	6.560
9	HSST3.5X3.	HSST3.5X3.	0.640	1.050	0.609	AISC- H1-3	8	2.240	4.050	4.050	6.560
10	HSST3.5X3.	HSST3.5X3.	0.222	1.050	0.211	AISC- H1-3	8	2.240	4.050	4.050	6.560
11	HSST2.5X2.	HSST2.5X2.	0.729	1.050	0.694	AISC- H1-3	11	1.070	0.998	0.998	1.610
12	HSST3.5X3.	HSST3.5X3.	0.639	1.050	0.609	AISC- H2-1	29	2.240	4.050	4.050	6.560
36	HSST2.5X2.	HSST2.5X2.	0.029	1.050	0.027	AISC- H2-1	8	1.070	0.998	0.998	1.610
56	HSST3.5X3.	HSST3.5X3.	0.325	1.050	0.310	AISC- H1-3	10	2.240	4.050	4.050	6.560
102	HSST2.5X2.	HSST2.5X2.	0.047	1.050	0.045	AISC- H1-3	17	1.070	0.998	0.998	1.610
170	HSST3.5X3.	HSST3.5X3.	0.850	1.050	0.809	AISC- H2-1	8	2.240	4.050	4.050	6.560
190	HSST3.5X3.	HSST3.5X3.	0.850	1.050	0.809	AISC- H2-1	8	2.240	4.050	4.050	6.560
208	HSST2.5X2.	HSST2.5X2.	0.034	1.050	0.033	AISC- H1-3	8	1.070	0.998	0.998	1.610

Appendix A - STAAD Input and Design Output

```
STAAD SPACE
INPUT FILE:\Container House\Staad\Container House.STD
START JOB INFORMATION
ENGINEER DATE 10-FEB-18
END JOB INFORMATION
INPUT WIDTH 79
UNIT FEET KIP
JOINT COORDINATES
1 0 0 0; 2 0 0 8; 3 20 0 0; 4 20 0 8; 5 0 8 0; 6 0 8 8; 7 20 8 0; 8 20 8 8
9 1 0 8; 10 1 1 8; 11 0 1 8; 12 2 0 8; 13 2 1 8; 14 3 0 8; 15 3 1 8; 16 4 0 8
17 4 1 8; 18 5 0 8; 19 5 1 8; 20 6 0 8; 21 6 1 8; 22 7 0 8; 23 7 1 8; 24 8 0 8
25 8 1 8; 26 9 0 8; 27 9 1 8; 28 10 0 8; 29 10 1 8; 30 11 0 8; 31 11 1 8
32 12 0 8; 33 12 1 8; 34 13 0 8; 35 13 1 8; 36 14 0 8; 37 14 1 8; 38 15 0 8
39 15 1 8; 40 16 0 8; 41 16 1 8; 42 17 0 8; 43 17 1 8; 44 18 0 8; 45 18 1 8
46 19 0 8; 47 19 1 8; 48 20 1 8; 49 1 2 8; 50 0 2 8; 51 2 2 8; 52 3 2 8
53 4 2 8; 54 5 2 8; 55 6 2 8; 56 7 2 8; 57 8 2 8; 58 9 2 8; 59 10 2 8
60 11 2 8; 61 12 2 8; 62 13 2 8; 63 14 2 8; 64 15 2 8; 65 16 2 8; 66 17 2 8
67 18 2 8; 68 19 2 8; 69 20 2 8; 70 1 3 8; 71 0 3 8; 72 2 3 8; 73 3 3 8
74 4 3 8; 75 5 3 8; 76 6 3 8; 77 7 3 8; 78 8 3 8; 79 9 3 8; 80 10 3 8
81 11 3 8; 82 12 3 8; 83 13 3 8; 84 14 3 8; 85 15 3 8; 86 16 3 8; 87 17 3 8
88 18 3 8; 89 19 3 8; 90 20 3 8; 91 1 4 8; 92 0 4 8; 93 2 4 8; 94 3 4 8
95 4 4 8; 96 5 4 8; 97 6 4 8; 98 7 4 8; 99 8 4 8; 100 9 4 8; 101 10 4 8
102 11 4 8; 103 12 4 8; 104 13 4 8; 105 14 4 8; 106 15 4 8; 107 16 4 8
108 17 4 8; 109 18 4 8; 110 19 4 8; 111 20 4 8; 112 1 5 8; 113 0 5 8
114 2 5 8; 115 3 5 8; 116 4 5 8; 117 5 5 8; 118 6 5 8; 119 7 5 8; 120 8 5 8
121 9 5 8; 122 10 5 8; 123 11 5 8; 124 12 5 8; 125 13 5 8; 126 14 5 8
127 15 5 8; 128 16 5 8; 129 17 5 8; 130 18 5 8; 131 19 5 8; 132 20 5 8
133 1 6 8; 134 0 6 8; 135 2 6 8; 136 3 6 8; 137 4 6 8; 138 5 6 8; 139 6 6 8
140 7 6 8; 141 8 6 8; 142 9 6 8; 143 10 6 8; 144 11 6 8; 145 12 6 8
146 13 6 8; 147 14 6 8; 148 15 6 8; 149 16 6 8; 150 17 6 8; 151 18 6 8
152 19 6 8; 153 20 6 8; 154 1 7 8; 155 0 7 8; 156 2 7 8; 157 3 7 8; 158 4 7 8
159 5 7 8; 160 6 7 8; 161 7 7 8; 162 8 7 8; 163 9 7 8; 164 10 7 8; 165 11 7 8
166 12 7 8; 167 13 7 8; 168 14 7 8; 169 15 7 8; 170 16 7 8; 171 17 7 8
172 18 7 8; 173 19 7 8; 174 20 7 8; 175 1 8 8; 176 2 8 8; 177 3 8 8; 178 4 8 8
179 5 8 8; 180 6 8 8; 181 7 8 8; 182 8 8 8; 183 9 8 8; 184 10 8 8; 185 11 8 8
186 12 8 8; 187 13 8 8; 188 14 8 8; 189 15 8 8; 190 16 8 8; 191 17 8 8
192 18 8 8; 193 19 8 8; 194 19 0 0; 195 19 1 0; 196 20 1 0; 197 18 0 0
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329. 717 598 599 618 617; 718 599 502 503 618; 719 436 600 619 435
330. 720 600 601 620 619; 721 601 602 621 620; 722 602 603 622 621
331. 723 603 604 623 622; 724 604 605 624 623; 725 605 606 625 624
332. 726 606 607 626 625; 727 607 608 627 626; 728 608 609 628 627
333. 729 609 610 629 628; 730 610 611 630 629; 731 611 612 631 630
334. 732 612 613 632 631; 733 613 614 633 632; 734 614 615 634 633
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735 615 616 635 634; 736 616 617 636 635; 737 617 618 637 636
738 618 503 504 637; 739 435 619 378 5; 740 619 620 377 378
741 620 621 376 377; 742 621 622 375 376; 743 622 623 374 375
744 623 624 373 374; 745 624 625 372 373; 746 625 626 371 372
747 626 627 370 371; 748 627 628 369 370; 749 628 629 368 369
750 629 630 367 368; 751 630 631 366 367; 752 631 632 365 366
753 632 633 364 365; 754 633 634 363 364; 755 634 635 362 363
756 635 636 361 362; 757 636 637 360 361; 758 637 504 7 360; 759 2 9 638 391
760 9 12 639 638; 761 12 14 640 639; 762 14 16 641 640; 763 16 18 642 641
764 18 20 643 642; 765 20 22 644 643; 766 22 24 645 644; 767 24 26 646 645
768 26 28 647 646; 769 28 30 648 647; 770 30 32 649 648; 771 32 34 650 649
772 34 36 651 650; 773 36 38 652 651; 774 38 40 653 652; 775 40 42 654 653
776 42 44 655 654; 777 44 46 656 655; 778 46 4 442 656; 779 391 638 657 389
780 638 639 658 657; 781 639 640 659 658; 782 640 641 660 659
783 641 642 661 660; 784 642 643 662 661; 785 643 644 663 662
786 644 645 664 663; 787 645 646 665 664; 788 646 647 666 665
789 647 648 667 666; 790 648 649 668 667; 791 649 650 669 668
792 650 651 670 669; 793 651 652 671 670; 794 652 653 672 671
795 653 654 673 672; 796 654 655 674 673; 797 655 656 675 674
798 656 442 444 675; 799 389 657 676 387; 800 657 658 677 676
801 658 659 678 677; 802 659 660 679 678; 803 660 661 680 679
804 661 662 681 680; 805 662 663 682 681; 806 663 664 683 682
807 664 665 684 683; 808 665 666 685 684; 809 666 667 686 685
810 667 668 687 686; 811 668 669 688 687; 812 669 670 689 688
813 670 671 690 689; 814 671 672 691 690; 815 672 673 692 691
816 673 674 693 692; 817 674 675 694 693; 818 675 444 446 694
819 387 676 695 385; 820 676 677 696 695; 821 677 678 697 696
822 678 679 698 697; 823 679 680 699 698; 824 680 681 700 699
825 681 682 701 700; 826 682 683 702 701; 827 683 684 703 702
828 684 685 704 703; 829 685 686 705 704; 830 686 687 706 705
831 687 688 707 706; 832 688 689 708 707; 833 689 690 709 708
834 690 691 710 709; 835 691 692 711 710; 836 692 693 712 711
837 693 694 713 712; 838 694 446 448 713; 839 385 695 714 383
840 695 696 715 714; 841 696 697 716 715; 842 697 698 717 716
843 698 699 718 717; 844 699 700 719 718; 845 700 701 720 719
846 701 702 721 720; 847 702 703 722 721; 848 703 704 723 722
849 704 705 724 723; 850 705 706 725 724; 851 706 707 726 725
852 707 708 727 726; 853 708 709 728 727; 854 709 710 729 728
855 710 711 730 729; 856 711 712 731 730; 857 712 713 732 731
858 713 448 450 732; 859 383 714 733 381; 860 714 715 734 733
```



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861 715 716 735 734; 862 716 717 736 735; 863 717 718 737 736
864 718 719 738 737; 865 719 720 739 738; 866 720 721 740 739
867 721 722 741 740; 868 722 723 742 741; 869 723 724 743 742
870 724 725 744 743; 871 725 726 745 744; 872 726 727 746 745
873 727 728 747 746; 874 728 729 748 747; 875 729 730 749 748
876 730 731 750 749; 877 731 732 751 750; 878 732 450 452 751
879 381 733 752 379; 880 733 734 753 752; 881 734 735 754 753
882 735 736 755 754; 883 736 737 756 755; 884 737 738 757 756
885 738 739 758 757; 886 739 740 759 758; 887 740 741 760 759
888 741 742 761 760; 889 742 743 762 761; 890 743 744 763 762
891 744 745 764 763; 892 745 746 765 764; 893 746 747 766 765
894 747 748 767 766; 895 748 749 768 767; 896 749 750 769 768
897 750 751 770 769; 898 751 452 454 770; 899 379 752 231 1
900 752 753 229 231; 901 753 754 227 229; 902 754 755 225 227
903 755 756 223 225; 904 756 757 221 223; 905 757 758 219 221
906 758 759 217 219; 907 759 760 215 217; 908 760 761 213 215
909 761 762 211 213; 910 762 763 209 211; 911 763 764 207 209
912 764 765 205 207; 913 765 766 203 205; 914 766 767 201 203
915 767 768 199 201; 916 768 769 197 199; 917 769 770 194 197
918 770 454 3 194
DEFINE PMEMBER
1 19 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 PMEMBER 1
2 268 266 264 262 260 258 256 254 252 250 248 246 244 242 240 238 236 234 -
231 PMEMBER 2
8 192 194 196 198 200 202 204 206 208 210 212 214 216 218 220 222 224 226 -
228 PMEMBER 3
10 440 438 436 434 432 430 428 426 424 422 420 418 416 414 412 410 408 406 -
404 PMEMBER 4
```

```
403. 4 455 453 451 449 447 445 443 PMEMBER 5
404. 7 518 516 514 512 510 508 506 PMEMBER 6
405. 3 521 523 525 527 529 531 533 PMEMBER 7
406. 9 584 586 588 590 592 594 596 PMEMBER 8
407. 6 270 292 314 336 358 380 402 PMEMBER 9
408. 5 20 60 82 104 126 148 170 PMEMBER 10
409. 12 58 80 102 124 146 168 190 PMEMBER 11
410. 11 232 272 294 316 338 360 382 PMEMBER 12
411. START GROUP DEFINITION
412. MEMBER
413. _EB 1 TO 10 12 56 170 190 228 382 402 404 443 506 596
414. _CC 919 TO 922
415. _SCB 11 19 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 58 60 80 -
416. 82 102 104 124 126 146 148 168 192 194 196 198 200 202 204 206 208 210 212 -
417. 214 216 218 220 222 224 226 231 232 234 236 238 240 242 244 246 248 250 252 -
418. 254 256 258 260 262 264 266 268 270 272 292 294 314 316 336 338 358 360 380 -
419. 406 408 410 412 414 416 418 420 422 424 426 428 430 432 434 436 438 440 445 -
420. 447 449 451 453 455 508 510 512 514 516 518 521 523 525 527 529 531 533 584 -
421. 586 588 590 592 594
422. END GROUP DEFINITION
423. ELEMENT PROPERTY
424. 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 TO 79 81 83 -
425. 84 TO 101 103 105 TO 123 125 127 TO 145 147 149 TO 167 169 171 TO 189 191 -
426. 193 195 197 199 201 203 205 207 209 211 213 215 217 219 221 223 225 227 229 -
427. 230 233 235 237 239 241 243 245 247 249 251 253 255 257 259 261 263 265 267 -
428. 269 271 273 TO 291 293 295 TO 313 315 317 TO 335 337 339 TO 357 359 -
429. 361 TO 379 381 383 TO 401 403 405 407 409 411 413 415 417 419 421 423 425 -
430. 427 429 431 433 435 437 439 441 442 444 446 448 450 452 454 456 TO 505 507 -
```



```
431. 509 511 513 515 517 519 520 522 524 526 528 530 532 534 TO 583 585 587 589 -
432. 591 593 595 597 TO 918 THICKNESS 0.021
433. DEFINE MATERIAL START
434. ISOTROPIC STEEL
435. E 4.176E+006
436. POISSON 0.3
437. DENSITY 0.489024
438. ALPHA 6E-006
439. DAMP 0.03
440. TYPE STEEL
441. STRENGTH FY 5184 FU 8352 RY 1.5 RT 1.2
442. ISOTROPIC CONCRETE
443. E 453600
444. POISSON 0.17
445. DENSITY 0.150336
446. ALPHA 5E-006
447. DAMP 0.05
448. TYPE CONCRETE
449. STRENGTH FCU 576
450. END DEFINE MATERIAL
451. MEMBER PROPERTY AMERICAN
452. _SCB TABLE ST HSST2.5X2.5X0.125
453. _EB TABLE ST HSST3.5X3.5X0.188
454. MEMBER PROPERTY AMERICAN
455. _CC PRIS YD 1 ZD 1
456. CONSTANTS
457. MATERIAL STEEL MEMB 1 TO 12 19 TO 918
458. MATERIAL CONCRETE MEMB 919 TO 922
459. SUPPORTS
460. 771 TO 774 PINNED
461. DEFINE IBC 2012
462. ZIP 94116 I 1 RX 8 RZ 8 SCLASS 4 TL 8 FA 1 FV 1.5

*****************************************************************************
* EQUIV. SEISMIC LOADS AS PER IBC 2012                                      *
* PARAMETERS CONSIDERED FOR SUBSEQUENT LOAD GENERATION                      *
*  SS =  2.071 S1 =  0.980 FA =  1.000 FV =  1.500                          *
*  SDS =  1.381 SD1 =  0.980                                                *
*****************************************************************************
```

```
463. SELFWEIGHT 1
464. ELEMENT WEIGHT
465. 759 TO 918 PRESSURE 0.05
466. DEFINE WIND LOAD

*** NOTE: If any floor diaphragm is present in the model Wind Load definition
          should be defined after Floor Diaphragm definition. Otherwise wind
          load generation may be unsuccessful during analysis.

467. TYPE 1 WIND 1
468. <! STAAD PRO GENERATED DATA DO NOT MODIFY !!!
469. ASCE-7-2010:PARAMS 180.000 MPH 0 3 1 0 0.000 FT 0.000 FT 0.000 FT 1 -
470. 1 8.000 FT 20.000 FT 8.000 FT 2.000 0.010 0 -
471. 0 0 0 0 1.030 1.000 1.000 0.850 0 -
472. 0 0 0 0.907 0.800 -0.550
```



```
473. !> END GENERATED DATA BLOCK
474. INT 0.0926768 0.0926768 HEIG  0  15
475. EXP 0.85 JOINT 1 TO 774
476. TYPE 2 WIND 2
477. <! STAAD PRO GENERATED DATA DO NOT MODIFY !!!
478. ASCE-7-2010:PARAMS 180.000 MPH 0 3 1 0 0.000 FT 0.000 FT 0.000 FT 1 -
479. 1 8.000 FT 20.000 FT 8.000 FT 2.000 0.010 0 -
480. 0 0 0 0 1.030 1.000 1.000 0.850 0 -
481. 0 0 0 0.907 0.800 -0.550
482. !> END GENERATED DATA BLOCK
483. INT 0.0926768 0.0926768 HEIG  0  15
484. EXP 0.85 JOINT 1 TO 774
485. DEFINE REFERENCE LOADS
486. LOAD R1 LOADTYPE DEAD  TITLE REF LOAD CASE 1
487. SELFWEIGHT Y -1
488. END DEFINE REFERENCE LOADS
489. LOAD 1 LOADTYPE SEISMIC  TITLE EQX
490. IBC LOAD X 1
491. PERFORM ANALYSIS


        P R O B L E M   S T A T I S T I C S
        -----------------------------------

  NUMBER OF JOINTS        774  NUMBER OF MEMBERS     148
  NUMBER OF PLATES        768  NUMBER OF SOLIDS        0
  NUMBER OF SURFACES        0  NUMBER OF SUPPORTS      4


        SOLVER USED IS THE IN-CORE ADVANCED MATH SOLVER

TOTAL      PRIMARY LOAD CASES =     1, TOTAL DEGREES OF FREEDOM =    4632
TOTAL LOAD COMBINATION  CASES =     0  SO FAR.
```



```
************************************************************
*  IBC 2012 SEISMIC LOAD ALONG X  :                        *
*     CT =  0.028 Cu =  1.400 x =  0.8000                  *
*  TIME PERIODS :                                          *
*     Ta =  0.177 T =  0.082 Tuser = 0.000                 *
*  TIME PERIOD USED (T) =  0.082                           *
*  Cs LIMITS : LOWER =  0.061 UPPER =  1.486               *
*  LOAD FACTOR          =  1.000                           *
*  DESIGN BASE SHEAR    =  1.000 X  0.173 X        17.70   *
*                       =         3.05  KIP                *
************************************************************
```

```
492. CHANGE
493. LOAD 2 LOADTYPE SEISMIC  TITLE EQZ
494. IBC LOAD Z 1
495. PERFORM ANALYSIS


************************************************************
*  IBC 2012 SEISMIC LOAD ALONG Z  :                        *
*     CT =  0.028 Cu =  1.400 x =  0.8000                  *
*  TIME PERIODS :                                          *
*     Ta =  0.177 T =  0.155 Tuser = 0.000                 *
*  TIME PERIOD USED (T) =  0.155                           *
*  Cs LIMITS : LOWER =  0.061 UPPER =  0.792               *
*  LOAD FACTOR          =  1.000                           *
*  DESIGN BASE SHEAR    =  1.000 X  0.173 X        17.70   *
*                       =         3.05  KIP                *
************************************************************


496. CHANGE
497. LOAD 3 LOADTYPE DEAD  TITLE DEAD LOAD
498. ELEMENT LOAD
499. 759 TO 918 PR GY -0.05
500. SELFWEIGHT Y -1
501. LOAD 4 LOADTYPE ROOF LIVE  TITLE ROOF LIVE
502. ELEMENT LOAD
503. 599 TO 758 PR GY -0.3
504. LOAD 5 LOADTYPE WIND  TITLE WIND_X
505. WIND LOAD X 1 TYPE 1 YR 0 8 ZR 0 8
   STAAD SPACE                                              -- PAGE NO.   12

506. LOAD 6 LOADTYPE WIND  TITLE WIND_Z
507. WIND LOAD Z 1 TYPE 2 YR 0 8 ZR 0 20
508. LOAD COMB 7 GENERATED AISC GENERAL 1
509. 3 1.0
510. LOAD COMB 8 GENERATED AISC GENERAL 2
511. 3 1.0 4 1.0
512. LOAD COMB 9 GENERATED AISC GENERAL 3
513. 3 1.0 4 0.75
514. LOAD COMB 10 GENERATED AISC GENERAL 4
515. 3 1.0 5 1.0
516. LOAD COMB 11 GENERATED AISC GENERAL 5
517. 3 1.0 6 1.0
518. LOAD COMB 12 GENERATED AISC GENERAL 6
519. 3 1.0 1 0.7
520. LOAD COMB 13 GENERATED AISC GENERAL 7
521. 3 1.0 2 0.7
522. LOAD COMB 14 GENERATED AISC GENERAL 8
523. 3 1.0 1 -0.7
524. LOAD COMB 15 GENERATED AISC GENERAL 9
525. 3 1.0 2 -0.7
526. LOAD COMB 16 GENERATED AISC GENERAL 10
527. 3 1.0 4 0.75 5 0.75
528. LOAD COMB 17 GENERATED AISC GENERAL 11
529. 3 1.0 4 0.75 6 0.75
530. LOAD COMB 18 GENERATED AISC GENERAL 12
531. 3 1.0 5 0.75
532. LOAD COMB 19 GENERATED AISC GENERAL 13
533. 3 1.0 6 0.75
534. LOAD COMB 20 GENERATED AISC GENERAL 14
535. 3 1.0 4 0.75 1 0.525
536. LOAD COMB 21 GENERATED AISC GENERAL 15
537. 3 1.0 4 0.75 2 0.525
538. LOAD COMB 22 GENERATED AISC GENERAL 16
```

```
539. 3 1.0 1 0.525
540. LOAD COMB 23 GENERATED AISC GENERAL 17
541. 3 1.0 2 0.525
542. LOAD COMB 24 GENERATED AISC GENERAL 18
543. 3 1.0 4 0.75 1 -0.525
544. LOAD COMB 25 GENERATED AISC GENERAL 19
545. 3 1.0 4 0.75 2 -0.525
546. LOAD COMB 26 GENERATED AISC GENERAL 20
547. 3 1.0 1 -0.525
548. LOAD COMB 27 GENERATED AISC GENERAL 21
549. 3 1.0 2 -0.525
550. LOAD COMB 28 GENERATED AISC GENERAL 22
551. 3 0.6 5 1.0
552. LOAD COMB 29 GENERATED AISC GENERAL 23
553. 3 0.6 6 1.0
554. LOAD COMB 30 GENERATED AISC GENERAL 24
555. 3 0.6 1 0.7
```



```
556. LOAD COMB 31 GENERATED AISC GENERAL 25
557. 3 0.6 2 0.7
558. LOAD COMB 32 GENERATED AISC GENERAL 26
559. 3 0.6 1 -0.7
560. LOAD COMB 33 GENERATED AISC GENERAL 27
561. 3 0.6 2 -0.7
562. LOAD COMB 34 GENERATED ACI TABLE1 1
563. 3 1.4
564. LOAD COMB 35 GENERATED ACI TABLE1 2
565. 3 1.2 4 0.5
566. LOAD COMB 36 GENERATED ACI TABLE1 3
567. 3 1.2
568. LOAD COMB 37 GENERATED ACI TABLE1 4
569. 3 1.2 4 1.6
570. LOAD COMB 38 GENERATED ACI TABLE1 5
571. 3 1.2 4 1.6 5 0.8
572. LOAD COMB 39 GENERATED ACI TABLE1 6
573. 3 1.2 4 1.6 6 0.8
574. LOAD COMB 40 GENERATED ACI TABLE1 7
575. 3 1.2 5 0.8
576. LOAD COMB 41 GENERATED ACI TABLE1 8
577. 3 1.2 6 0.8
578. LOAD COMB 42 GENERATED ACI TABLE1 9
579. 3 1.2 4 0.5 5 1.6
580. LOAD COMB 43 GENERATED ACI TABLE1 10
581. 3 1.2 4 0.5 6 1.6
582. LOAD COMB 44 GENERATED ACI TABLE1 11
583. 3 1.2 5 1.6
584. LOAD COMB 45 GENERATED ACI TABLE1 12
585. 3 1.2 6 1.6
586. LOAD COMB 46 GENERATED ACI TABLE1 13
587. 3 1.2 1 1.0
588. LOAD COMB 47 GENERATED ACI TABLE1 14
589. 3 1.2 2 1.0
590. LOAD COMB 48 GENERATED ACI TABLE1 15
591. 3 0.9 5 1.6
592. LOAD COMB 49 GENERATED ACI TABLE1 16
593. 3 0.9 6 1.6
594. LOAD COMB 50 GENERATED ACI TABLE1 17
595. 3 0.9 1 1.0
596. LOAD COMB 51 GENERATED ACI TABLE1 18
597. 3 0.9 2 1.0
598. PERFORM ANALYSIS


599. LOAD LIST 7 TO 33
600. PARAMETER 1
601. CODE AISC
602. TRACK 2 MEMB 1 TO 12 19 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 -
603. 54 56 58 60 80 82 102 104 124 126 146 148 168 170 190 192 194 196 198 200 -
604. 202 204 206 208 210 212 214 216 218 220 222 224 226 228 231 232 234 236 238 -
```

```
   605. 240 242 244 246 248 250 252 254 256 258 260 262 264 266 268 270 272 292 294 -
   606. 314 316 336 338 358 360 380 382 402 404 406 408 410 412 414 416 418 420 422 -
 ↑    STAAD SPACE                                              -- PAGE NO.   14

   607. 424 426 428 430 432 434 436 438 440 443 445 447 449 451 453 455 506 508 510 -
   608. 512 514 516 518 521 523 525 527 529 531 533 584 586 588 590 592 594 596
   609. RATIO 1.05 ALL
   610. CHECK CODE MEMB 1 TO 12 19 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 -
   611. 52 54 56 58 60 80 82 102 104 124 126 146 148 168 170 190 192 194 196 198 -
   612. 200 202 204 206 208 210 212 214 216 218 220 222 224 226 228 231 232 234 236 -
   613. 238 240 242 244 246 248 250 252 254 256 258 260 262 264 266 268 270 272 292 -
   614. 294 314 316 336 338 358 360 380 382 402 404 406 408 410 412 414 416 418 420 -
   615. 422 424 426 428 430 432 434 436 438 440 443 445 447 449 451 453 455 506 508 -
   616. 510 512 514 516 518 521 523 525 527 529 531 533 584 586 588 590 592 594 596

 ↑    STAAD SPACE                                              -- PAGE NO.  303

   617. LOAD LIST 34 TO 51
   618. START CONCRETE DESIGN
 ↑    STAAD SPACE                                              -- PAGE NO.  304

CONCRETE DESIGN
   619. CODE ACI
   620. TRACK 2 MEMB 919 TO 922
   621. DESIGN COLUMN 919 TO 922
 ↑    STAAD SPACE                                              -- PAGE NO.  305



        ACI 318-11   COLUMN  NO.   919   DESIGN RESULTS
        ===============================================


   FY - 60000  FC - 4000 PSI,  SQRE SIZE - 12.00 X 12.00 INCHES, TIED
           ONLY MINIMUM STEEL IS REQUIRED.
           AREA OF STEEL REQUIRED =   1.440  SQ. IN.

   BAR CONFIGURATION       REINF PCT.   LOAD   LOCATION   PHI
   ----------------------------------------------------------

     8 - NUMBER  4           1.111       34      END     0.650
   (PROVIDE EQUAL NUMBER OF BARS ON EACH FACE)
   TIE BAR NUMBER    4 SPACING   8.00 IN

       COLUMN INTERACTION: MOMENT ABOUT Z -AXIS (KIP-FT)

    --------------------------------------------------------
      P0        Pn max    P-bal.    M-bal.   e-bal.(inch)
     580.16    464.13    207.36     84.77    4.91
       M0       P-tens.   Des.Pn    Des.Mn     e/h
      39.08    -96.00      8.75      1.60    0.09164
    --------------------------------------------------------

       COLUMN INTERACTION: MOMENT ABOUT Y -AXIS (KIP-FT)

    --------------------------------------------------------
      P0        Pn max    P-bal.    M-bal.   e-bal.(inch)
     580.16    464.13    207.36     84.77    4.91
       M0       P-tens.   Des.Pn    Des.Mn     e/h
      39.08    -96.00      8.75      2.82    0.16101
    --------------------------------------------------------
                             Pn        Mn       Pn        Mn    (@ Z )
              |             428.43    54.43   214.21    84.42
         P0 |*              392.72    62.91   178.51    82.09
              | *           357.02    69.84   142.81    77.19
      Pn,max|__*            321.32    75.23   107.11    71.14
              |   *         285.62    79.28    71.40    62.97
      Pn    |    *          249.92    82.26    35.70    51.70
     NOMINAL|     *          Pn        Mn       Pn        Mn    (@ Y )
```

```
      AXIAL|       *       428.43    54.43   214.21    84.42
 COMPRESSION|       *      392.72    62.91   178.51    82.09
         Pb|-------*Mb     357.02    69.84   142.81    77.19
           |       *       321.32    75.23   107.11    71.14
___________|____*_______   285.62    79.28    71.40    62.97
           |  * M0   Mn,   249.92    82.26    35.70    51.70
           | *   BENDING
     P-tens|*     MOMENT
           |
    STAAD SPACE                                              -- PAGE NO.  306


       ACI 318-11   COLUMN  NO.   920   DESIGN RESULTS
       ===============================================

   FY - 60000  FC - 4000 PSI,  SQRE SIZE - 12.00 X 12.00 INCHES, TIED
           ONLY MINIMUM STEEL IS REQUIRED.
           AREA OF STEEL REQUIRED =   1.440  SQ. IN.

   BAR CONFIGURATION       REINF PCT.   LOAD   LOCATION   PHI
   ----------------------------------------------------------

     8 - NUMBER  4           1.111       34      END     0.650
   (PROVIDE EQUAL NUMBER OF BARS ON EACH FACE)
   TIE BAR NUMBER    4 SPACING   8.00 IN

       COLUMN INTERACTION: MOMENT ABOUT Z -AXIS (KIP-FT)

    --------------------------------------------------------
      P0        Pn max    P-bal.    M-bal.   e-bal.(inch)
     580.16    464.13    207.36     84.77    4.91
       M0       P-tens.   Des.Pn    Des.Mn     e/h
      39.08    -96.00      9.03      1.69    0.09362
    --------------------------------------------------------

       COLUMN INTERACTION: MOMENT ABOUT Y -AXIS (KIP-FT)

    --------------------------------------------------------
      P0        Pn max    P-bal.    M-bal.   e-bal.(inch)
     580.16    464.13    207.36     84.77    4.91
       M0       P-tens.   Des.Pn    Des.Mn     e/h
      39.08    -96.00      9.03      2.93    0.16245
    --------------------------------------------------------
                            Pn       Mn       Pn       Mn    (@ Z )
           |               428.43    54.43   214.21    84.42
        P0 |*              392.72    62.91   178.51    82.09
           | *             357.02    69.84   142.81    77.19
     Pn,max|__*            321.32    75.23   107.11    71.14
           |   *           285.62    79.28    71.40    62.97
     Pn    |    *          249.92    82.26    35.70    51.70
    NOMINAL|     *          Pn       Mn       Pn       Mn    (@ Y )
      AXIAL|      *        428.43    54.43   214.21    84.42
 COMPRESSION|       *      392.72    62.91   178.51    82.09
         Pb|-------*Mb     357.02    69.84   142.81    77.19
           |       *       321.32    75.23   107.11    71.14
___________|____*_______   285.62    79.28    71.40    62.97
           |  * M0   Mn,   249.92    82.26    35.70    51.70
           | *   BENDING
     P-tens|*     MOMENT
           |
    STAAD SPACE                                              -- PAGE NO.  307


       ACI 318-11   COLUMN  NO.   921   DESIGN RESULTS
       ===============================================
```

```

  FY - 60000  FC - 4000 PSI,  SQRE SIZE - 12.00 X 12.00 INCHES, TIED
          ONLY MINIMUM STEEL IS REQUIRED.
          AREA OF STEEL REQUIRED =   1.440  SQ. IN.

  BAR CONFIGURATION       REINF PCT.   LOAD   LOCATION   PHI
  ----------------------------------------------------------

    8 - NUMBER  4           1.111       34      END     0.650
  (PROVIDE EQUAL NUMBER OF BARS ON EACH FACE)
  TIE BAR NUMBER    4 SPACING   8.00 IN

      COLUMN INTERACTION: MOMENT ABOUT Z -AXIS (KIP-FT)

   --------------------------------------------------------
     P0        Pn max    P-bal.    M-bal.   e-bal.(inch)
    580.16    464.13    207.36     84.77    4.91
      M0       P-tens.   Des.Pn    Des.Mn     e/h
     39.08    -96.00      9.03      1.89    0.10479
   --------------------------------------------------------

      COLUMN INTERACTION: MOMENT ABOUT Y -AXIS (KIP-FT)

   --------------------------------------------------------
     P0        Pn max    P-bal.    M-bal.   e-bal.(inch)
    580.16    464.13    207.36     84.77    4.91
      M0       P-tens.   Des.Pn    Des.Mn     e/h
     39.08    -96.00      9.03      2.68    0.14867
   --------------------------------------------------------
                            Pn       Mn       Pn       Mn    (@ Z )
            |              428.43    54.43   214.21    84.42
        P0  |*             392.72    62.91   178.51    82.09
            | *            357.02    69.84   142.81    77.19
     Pn,max|__*            321.32    75.23   107.11    71.14
            |   *          285.62    79.28    71.40    62.97
     Pn     |    *         249.92    82.26    35.70    51.70
    NOMINAL|     *          Pn       Mn       Pn       Mn    (@ Y )
       AXIAL|      *       428.43    54.43   214.21    84.42
 COMPRESSION|       *      392.72    62.91   178.51    82.09
          Pb|-------*Mb    357.02    69.84   142.81    77.19
            |      *       321.32    75.23   107.11    71.14
 ___________|____*_______  285.62    79.28    71.40    62.97
            |  * M0   Mn,  249.92    82.26    35.70    51.70
            | *   BENDING
     P-tens|*      MOMENT
            |
    STAAD SPACE                                             -- PAGE NO.  308



        ACI 318-11   COLUMN  NO.   922   DESIGN RESULTS
        ==============================================

  FY - 60000  FC - 4000 PSI,  SQRE SIZE - 12.00 X 12.00 INCHES, TIED
          ONLY MINIMUM STEEL IS REQUIRED.
          AREA OF STEEL REQUIRED =   1.440  SQ. IN.

  BAR CONFIGURATION       REINF PCT.   LOAD   LOCATION   PHI
  ----------------------------------------------------------

    8 - NUMBER  4           1.111       34      END     0.650
  (PROVIDE EQUAL NUMBER OF BARS ON EACH FACE)
  TIE BAR NUMBER    4 SPACING   8.00 IN

      COLUMN INTERACTION: MOMENT ABOUT Z -AXIS (KIP-FT)

   --------------------------------------------------------
```

```
    P0        Pn max    P-bal.    M-bal.   e-bal.(inch)
   580.16    464.13    207.36     84.77    4.91
     M0       P-tens.   Des.Pn    Des.Mn     e/h
    39.08    -96.00      8.72      1.40    0.08035
  --------------------------------------------------------

     COLUMN INTERACTION: MOMENT ABOUT Y -AXIS (KIP-FT)

  --------------------------------------------------------
    P0        Pn max    P-bal.    M-bal.   e-bal.(inch)
   580.16    464.13    207.36     84.77    4.91
     M0       P-tens.   Des.Pn    Des.Mn     e/h
    39.08    -96.00      8.72      2.57    0.14720
  --------------------------------------------------------
                          Pn       Mn       Pn       Mn    (@ Z )
            |            428.43    54.43   214.21    84.42
        P0 |*            392.72    62.91   178.51    82.09
            | *          357.02    69.84   142.81    77.19
    Pn,max|__*           321.32    75.23   107.11    71.14
            |   *        285.62    79.28    71.40    62.97
    Pn      |    *       249.92    82.26    35.70    51.70
   NOMINAL|      *        Pn       Mn       Pn       Mn    (@ Y )
     AXIAL|       *      428.43    54.43   214.21    84.42
COMPRESSION|        *    392.72    62.91   178.51    82.09
        Pb|-------*Mb    357.02    69.84   142.81    77.19
           |       *     321.32    75.23   107.11    71.14
___________|____*_______ 285.62    79.28    71.40    62.97
           |  * M0   Mn, 249.92    82.26    35.70    51.70
           | *   BENDING
     P-tens|*      MOMENT
           |


  ********************END OF COLUMN DESIGN RESULTS********************


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  622. END CONCRETE DESIGN
  623. FINISH


            *********** END OF THE STAAD.Pro RUN ***********

              **** DATE= FEB 12,2018   TIME= 15: 9:35 ****

        ************************************************************
        *   For technical assistance on STAAD.Pro, please visit    *
        *   http://selectservices.bentley.com/en-US/               *
        *                                                          *
        *   Details about additional assistance from               *
        *   Bentley and Partners can be found at program menu      *
        *   Help->Technical Support                                *
        *                                                          *
        *      Copyright (c) 1997-2015 Bentley Systems, Inc.
        *                http://www.bentley.com                    *
        ************************************************************
```

Appendix B - Staad Technical Reference 5.31.2.16 IBC 2012 Seismic Load Definition

5.31.2.16 IBC 2012 Seismic Load Definition

The specifications of the seismic loading chapters of the International Code Council's IBC 2012 code and the ASCE 7-10 code for seismic analysis of a building using a static equivalent approach have been implemented as described in this section. Depending on the definition, equivalent lateral loads will be generated in the horizontal direction(s).

> This feature requires STAAD.Pro 2007 (Build 11) or higher. Refer to AD.2007-11.3.7 of the What's New section for additional information on using this feature.

The seismic load generator can be used to generate lateral loads in the X & Z directions for Y up or X & Y for Z up. Y up or Z up is the vertical axis and the direction of gravity loads (See the **SET Z UP** command in Section 5.5). All vertical coordinates of the floors above the base must be positive and the vertical axis must be perpendicular to the floors.

The rules described in section 1613 of the ICC IBC-2012 code (except 1613.5.5) have been implemented. This section directs the engineer to the ASCE 7-2010 code. The specific section numbers of ASCE 7— those which are implemented, and those which are not implemented—are shown in the table below.

Table 5-22: Sections of IBC 2012 implemented and omitted in the program

Implemented sections of IBC 2012 (ASCE 7-10)	Omitted sections of IBC 2012 (ASCE 7-10)
11.4	12.8.4.1
11.5	12.8.4.3 and onwards
12.8	

Steps used to calculate and distribute the base shear are as follows:

1. The Time Period of the structure is calculated based on section 12.8.2.1 of ASCE 7-10 (IBC 2012). This is reported in the output as Ta.
2. The period is also calculated in accordance with the Rayleigh method. This is reported in the output as T.
3. You may override the Rayleigh based period by specifying a value for PX or PZ (Items f7 and f8) depending on the direction of the IBC load.
4. The governing Time Period of the structure is then chosen between the above two periods, and the additional guidance provided in section 12.8.2 of ASCE 7-10 (IBC 2012). The resulting value is reported as "Time Period used" in the output file.
5. The Design Base Shear is calculated based on equation 12.8-1 of ASCE 7-10 (IBC 2012). It is then distributed at each floor using the rules of clause 12.83, equations 12.8-11, 12.8-12 and 12.8-13 of ASCE 7-10.
6. If the **ACCIDENTAL** option is specified, the program calculates the additional torsional moment. The lever arm for calculating the torsional moment is obtained as 5% of the building dimension at each floor level perpendicular to the direction of the IBC load (section 12.8.4.2 of ASCE 7-10 for IBC 2012). At each joint where a weight is located, the lateral seismic force acting at that joint is multiplied by this lever arm to obtain the torsional moment at that joint.
7. The amplification of accidental torsional moment, as described in Section 12.8.4.3 of the ASCE 7-10 code, is not implemented.
8. The story drift determination as explained in Section 12.8.6 of the ASCE 7-10 code is not implemented in STAAD.

Methodology

The design base shear is computed in accordance with the following equation (equation 12.8-1 of ASCE 7-10):

$V = C_s W$

The seismic response coefficient, C_s, is determined in accordance with the following equation (equation 12.8-2 of ASCE 7-10):

$C_s = S_{DS}/[R/I_E]$

For IBC 2012, C_s need not exceed the following limits defined in ASCE 7-10 (equations 12.8-3 and 12.8-4):

$C_s = S_{D1}/[T \cdot (R/I)]$ for $T \leq T_L$

$C_s = S_{D1} \cdot T_L/[T^2(R/I)]$ for $T > T_L$

However, C_s shall not be less than (equation 12.8-5 of ASCE 7-10):

$C_s = 0.044 \cdot S_{DS} \cdot I \geq 0.01$

In addition, per equation 12.8-6 of ASCE 7-10, for structures located where S_1 is equal to or greater than 0.6g, C_S shall not be less than

$C_s = 0.5 \cdot S_1/(R/I)$

For an explanation of the terms used in the above equations, please refer to the IBC 2012 and ASCE 7-10 codes.

General Format

There are two stages of command specification for generating lateral loads. This is the first stage and is activated through the **DEFINE IBC 2012 LOAD** command.

```
DEFINE IBC 2012 (ACCIDENTAL) LOAD
map-spec ibc12-spec
SELFWEIGHT
JOINT WEIGHT
joint-list WEIGHT w
…
```

See "UBC 1994 or 1985 Load Definition" for complete weight input definition.

Where:

```
map-spec = { ZIP f1 | LAT f2 LONG f3 | SS f4 S1 f5 }
ibc12-spec = { RX f6 RZ f7 I f8 TL f9 SCLASS f10 (CT f11) (PX f12) (PZ f13) (K f14) (FA f15) (FV f16) }
```

f_1 = The zip code of the site location to determine the latitude and longitude and consequently the Ss and S1 factors. (ASCE 7-10 Chapter 22).

f_2, f_3 = The latitude and longitude, respectively, of the site used with the longitude to determine the Ss and S1 factors. (ASCE 7-10 Chapter 22).

f_4 = The mapped MCE for 0.2s spectral response acceleration. (IBC 2012 Clause 1613.5.1, ASCE 7-10 Clause 11.4.1).

f_5 = The mapped MCE spectral response acceleration at a period of 1 second as determined in accordance with Section 11.4.1 ASCE7-10

f_6 = The response modification factor for lateral load along the X direction, (ASCE Table 12.2.1). This is the value used in "R" in the equations shown above for calculating C_S.

f_7 = The response modification factor for lateral load along the Z direction, (ASCE Table 12.2.1) This is the value used in "R" in the equations shown above for calculating C_S.

f_8 = Occupancy importance factor. (IBC 2012 Clause 1604.5, ASCE 7-10 Table 11.5-1)

f_9 = Long-Period transition period in seconds. (ASCE 7-10 Clause 11.4.5 and Chapter 22).

f_{10} = Site class. Enter 1 through 6 in place of A through F, see table below. (IBC 2012 clause 1613.3.2, ASCE 7-10 Section 20.3)

The Soil Profile Type parameter **SCLASS** can take on values from 1 to 6. These relate to the values shown in Site Class Definitions Table in the following manner:

Table 5-23: Values of IBC soil class (SCLASS) used in STAAD

IBC Class	SCLASS value
A	1
B	2
C	3
D	4
E	5
F	6

f_{11} = Optional CT value to calculate time period. (ASCE 7-10 Table 12.8-2).

f_{12} = Optional Period of structure (in sec) in X-direction to be used as fundamental period of the structure. If not entered the value is calculated from the code. (ASCE 7-10 Table 12.8-2).

f_{13} = Optional Period of structure (in sec) in Z-direction to be used as fundamental period of the structure. If not entered the value is calculated from the code. (ASCE 7-10 Table 12.8-2).

f_{14} = Exponent value, x, used in equation 12.8-7, ASCE 7. (ASCE 7-2005 table 12.8-2 page 129).

f_{15} = Optional Short-Period site coefficient at 0.2s. Value must be provided if **SCLASS** set to F (i.e., 6). (IBC 2012 Clause 1613.3.3, ASCE 7-10 Section 11.4.3).

f_{16} = Optional Long-Period site coefficient at 1.0s. Value must be provided if **SCLASS** set to F (i.e., 6). (IBC 2012 Clause 1613.3.3, ASCE 7-10 Section 11.4.3).

Appendix C - Staad Technical Reference 5.31.3 Definition of Wind load

5.31.3 Definition of Wind Load

This set of commands may be used to define some of the parameters for generation of wind loads on the structure. See **Section 5.32.12** for the definition of wind direction and the possible surfaces to be loaded. **Section 1.17.3** of this manual describes the two types of structures on which this load generation can be performed.

The wind load generator can be used to generate lateral loads in the horizontal—X and Z (or Y if Z up) —directions only.

✓ The graphical user interface can be used to automatically generate the appropriate intensity values via the **ASCE-7: Wind Load dialog**. **See "Persistence of Parameters used to Generate ASCE Wind Loads"**

General Format

```
DEFINE WIND LOAD
TYPE j ( optional_comment )
{ intensity-definition | code-parameters }
EXPOSURE e1 { JOINT joint-list | YRANGE f1 f2 | ZRANGE f1 f2 }
```

Repeat **EXPOSURE** command up to 98 times.

Where:

intensity-definition or *code-parameters* data is entered based on either custom or Russian code wind definitions. **See "Wind Intensity Definition"** or **See "Russian Wind Loads"**

j = wind load system type number (integer)

optional_comment = A text string comment or description used to help identify the wind load type.

$p_1, p_2, p_3 \ldots p_n$ = wind intensities (pressures) in force/area. Up to 100 different intensities can be defined in the input file per type.

$h_1, h_2, h_3 \ldots h_n$ = corresponding heights in global vertical direction, measured in terms of actual Y (or Z for Z UP) coordinates up to which the corresponding intensities occur.

$e_1, e_2 \ldots e_m$ = exposure factors. A value of 1.0 means that the wind force may be applied on the full influence area associated with the joint(s) if they are also exposed to the wind load direction. Limit: 99 factors.

joint-list = Joint list associated with Exposure Factor (joint numbers or **TO** or **BY**) or enter only a group name.

f_1 and f_2 = global coordinate values to specify Y (or Z if Z UP) vertical range for Exposure Factor. Use **YRANGE** when Y is Up and **ZRANGE** when Z is Up (See the **SET Z UP** command in **Section 5.5**).

If the command **EXPOSURE** is not specified or if a joint is not listed in an Exposure, the exposure factor for those joints is chosen as 1.0.

Wind Intensity Definition

For custom (including for ASCE 7) wind load definitions, the wind intensity at heights above ground are defined as follows:

intensity-definition = **INTENSITY** p_1 p_2 p_3 … p_n**HEIGHT** h_1 h_2 h_3 … h_n

These values are automatically generated for ASCE 7 wind loads when the ASCE-7: Wind Load dialog is used.

All intensities and heights are in current unit system. The heights specified are in terms of actual Y coordinate (or Z coordinates for Z UP) and not measured relative to the base of the structure. The first value of intensity (p_1) will be applied to any part of the structure for which the Y coordinate (or Z coordinate for Z UP) is equal to or less than h_1. The second intensity (p_2) will be applied to any part of the structure that has vertical coordinates between the first two heights (h_1 and h_2) and so on. Any part of the structure that has vertical coordinates greater than h_n will be loaded with intensity p_n.

Only exposed surfaces bounded by members (not by plates or solids) will be used. The joint influence areas are computed based on surface member selection data entered in section 5.32.12 and based on the wind direction for a load case. Only joints actually exposed to the wind and connected to members will be loaded. The individual bounded areas must be planar surfaces, to a close tolerance, or they will not be loaded.

Exposure factor (e) is the fraction of the influence area associated with the joint(s) on which the load may act if it is also exposed to the wind load. Total load on a particular joint is calculated as follows.

Joint load = (Exposure Factor) × (Influence Area) × (Wind Intensity)

The exposure factor may be specified by a joint-list or by giving a vertical range within which all joints will have the same exposure. If an exposure factor is not entered or not specified for a joint, then it defaults to 1.0 for those joints; in which case the entire influence area associated with the joint(s) will be considered.

For load generation on a closed type structure defined as a PLANE FRAME, influence area for each joint is calculated considering unit width perpendicular to the plane of the structure. You can accommodate the actual width by incorporating it in the Exposure Factor as follows.

Exposure Factor (User Specified) = (Fraction of influence area) × (influence width for joint)

Notes

a. All intensities, heights and ranges must be provided in the current unit system.

b. If necessary, the **INTENSITY** and **EXPOSURE** command lines can be continued on to additional lines by ending all but last line with a space and hyphen (-). Use up to 11 lines for a command.

Appendix D - Staad Technical Reference 2.4.1.1 Allowable per AISC code

2.4.1.1 Allowables per AISC Code

For steel design, STAAD compares the actual stresses with the allowable stresses as defined by the American Institute of Steel Construction (AISC) Code. The ninth edition of the AISC Code, as published in 1989, is used as the basis of this design (except for tension stress). Because of the size and complexity of the AISC codes, it would not be practical to describe every aspect of the steel design in this manual. Instead, a brief description of some of the major allowable stresses are described herein.

2.4.1.1.1 Tension Stress

Allowable tensile stress on the net section is calculated as;

$$F_t = 0.60\ F_y$$

2.4.1.1.2 Shear Stress

Allowable shear stress on the gross section,

$$F_v = 0.4\ F_y$$

2.4.1.1.3 Stress Due To Compression

Allowable compressive stress on the gross section of axially loaded compression members is calculated based on the formula E-1 in the AISC Code, when the largest effective slenderness ratio (Kl/r) is less than C_c. If Kl/r exceeds C_c, allowable compressive stress is decreased as per formula 1E2-2 of the Code.

$$C_c = \sqrt{\frac{2\pi^2 E}{F_y}}$$

2.4.1.1.4 Bending Stress

Allowable bending stress for tension and compression for a symmetrical member loaded in the plane of its minor axis, as given in Section 1.5.1.4 is:

$F_b = 0.66F_y$

If meeting the requirements of this section of:

a. $b_f/2t_f \leq 65/\sqrt{(F_y)}$
b. $b_f/t_f \leq 190/\sqrt{(F_y)}$
c. $d/t \leq 640(1 - 3.74\ (f_a/F_y))/\sqrt{(F_y)}$ when $(f_a/F_y) < 0.16$, or than $257/\sqrt{(F_y)}$ if $(f_a/F_y) > 0.16$
d. The laterally unsupported length shall not exceed $76.0\ b_f/F_y$ (except for pipes or tubes), nor $20{,}000/(d\ F_y/A_f)$
e. The diameter:thickness ratio of pipes shall not exceed $3{,}300/\sqrt{(F_y)}$

If for these symmetrical members, $b_f/2t_f$ exceeds $65/\sqrt{(F_y)}$, but is less than $95/\sqrt{(F_y)}$, $F_b = F_y(0.79 - 0.002(b_f/2t_f)\sqrt{(F_y)})$

For other symmetrical members which do not meet the above, Fb is calculated as the larger value computed as per AISC formulas F1-6 or F1-7 and F1-8 as applicable, but not more than 0.60Fy. An unstiffened member subject to axial compression or compression due to bending is considered fully effective when the width-thickness ratio is not greater than the following:

- $76.0/\sqrt{(F_y)}$, for single angles or double angles with separators
- $95.0/\sqrt{(F_y)}$, for double angles in contact
- $127.0/\sqrt{(F_y)}$, for stems of tees

When the actual width-thickness ratio exceeds these values, the allowable stress is governed by B5 of the AISC code.

Tension and compression for the double symmetric (I & H) sections with $b_f/2t_f$ less than $65/\sqrt{(F_y)}$ and bent about their minor axis, $F_b = 0.75\ F_y$. If $b_f/2t_f$ exceeds $65/\sqrt{(F_y)}$, but is less than $95/\sqrt{(F_y)}$, $F_b = F_y(1.075 - 0.005(b_f/2t_f)\sqrt{(F_y)})$.

For tubes, meeting the subparagraphs b and c of this Section, bent about the minor axis, $F_b = 0.66F_y$; failing the subparagraphs B and C but with a width:thickness ration less than $238/\sqrt{(F_y)}$, $F_b = 0.6F_y$.

2.4.1.1.5 Combined Compression and Bending

Members subjected to both axial compression and bending stresses are proportioned to satisfy AISC formula H1-1 and H1-2 when fa/Fa is greater than 0.15, otherwise formula H1-3 is used. It should be noted that during code checking or member selection, if fa/Fa exceeds unity, the program does not compute the second and third part of the formula H1-1, because this would result in a misleadingly liberal ratio. The value of the coefficient Cm is taken as 0.85 for sidesway and 0.6 - 0.4 (M1/M2), but not less than 0.4 for no sidesway.

Appendix E - Staad Technical Reference 3.7 Column Design

3.7 Column Design

Columns design in STAAD per the ACI code is performed for axial force and uniaxial as well as biaxial moments. All active loadings are checked to compute reinforcement. The loading which produces the largest amount of reinforcement is called the critical load. Column design is done for square, rectangular and circular sections. For rectangular and circular sections, reinforcement is always assumed to be equally distributed on all faces. This means that the total number of bars for these sections will always be a multiple of four (4). If the MMAG parameter is specified, the column moments are multiplied by the MMAG value to arrive at the ultimate moments on the column. Since the ACI code no longer requires any minimum eccentricity conditions to be satisfied, such checks are not made.

Method used

Bresler Load Contour Method

Known Values

Pu, Muy, Muz, B, D, Clear cover, Fc, Fy

Ultimate Strain for concrete : 0.003

Steps involved

1. Assume some reinforcement. Minimum reinforcement (1%) is a good amount to start with.
2. Find an approximate arrangement of bars for the assumed reinforcement.
3. Calculate PNMAX = 0.85 Po, where Po is the maximum axial load capacity of the section. Ensure that the actual nominal load on the column does not exceed PNMAX. If PNMAX is less than Pu/PHI, (PHI is the strength reduction factor) increase the reinforcement and repeat steps 2 and 3. If the reinforcement exceeds 8%, the column cannot be designed with its current dimensions.
4. For the assumed reinforcement, bar arrangement and axial load, find the uniaxial moment capacities of the column for the Y and the Z axes, independently. These values are referred to as MYCAP and MZCAP respectively.
5. Solve the interaction equation:

   $$\left(\frac{M_{ny}}{M_{ycap}}\right)^{a} + \left(\frac{M_{nz}}{M_{zcap}}\right)^{a} \leq 1.0$$

   Where a = 1.24

   If the column is subjected to a uniaxial moment, a is chosen as 1.0
6. If the Interaction equation is satisfied, find an arrangement with available bar sizes, find the uniaxial capacities and solve the interaction equation again. If the equation is satisfied now, the reinforcement details are written to the output file.
7. If the interaction equation is not satisfied, the assumed reinforcement is increased (ensuring that it is under 8%) and steps 2 to 6 are repeated.
8. The maximum spacing of reinforcement closest to the tension force, for purposes of crack control, is given by

   $$s = 15\left(40,000\frac{40,000}{f_s}\right) - 2.5cc \leq 12\left(\frac{40,000}{f_s}\right)$$

with f_s in psi and is permitted to be taken equal to (2/3) f_y, rather than 60 percent of f_y, as in ACI 318-02.

9. Section 10.9.3 has been modified to permit the use of spiral reinforcement with specified yield strength of up to 100,000 psi. For spirals with fyt greater than 60,000 psi, only mechanical or welded splices may be used.

Column Interaction

The column interaction values may be obtained by using the design parameter TRACK 1.0 or TRACK 2.0 for the column member. If a value of 2.0 is used for the TRACK parameter, 12 different Pn-Mn pairs, each representing a different point on the Pn-Mn curve are printed. Each of these points represents one of the several Pn-Mn combinations that this column is capable of carrying about the given axis, for the actual reinforcement that the column has been designed for. In the case of circular columns, the values are for any of the radial axes. The values printed for the TRACK 1.0 output are:

P0 = Maximum purely axial load carrying capacity of the column (zero moment).

Pnmax = Maximum allowable axial load on the column (Section 10.3.5 of ACI 318).

P-bal = Axial load capacity at balanced strain condition.

M-bal = Uniaxial moment capacity at balanced strain condition.

e-bal = M-bal / P-bal = Eccentricity at balanced strain condition.

M0 = Moment capacity at zero axial load.

P-tens = Maximum permissible tensile load on the column.

Des. Pn = Pu/PHI where PHI is the Strength Reduction Factor and Pu is the axial load for the critical load case.

Des. Mn = Mu*MMAG/PHI where PHI is the Strength Reduction Factor and Mu is the bending moment for the appropriate axis for the critical load case. For circular columns,

$$M_u = \sqrt{M_{uy}^2 + M_{uz}^2}$$

$$e/h = (M_n/P_n)/h$$

Where:

h is the length of the column.