BSC

Design Calculation or Analysis Cover Sheet

Complete only applicable items.

1. QA: QA
2. Page 1

3. System	4. Document Identifier
Initial Handling Facility	51A-SYC-IH00-00400-000-00B

5. Title
Initial Handling Facility (IHF) Mass Properties

6. Group
Civil/Structural/Architectural

7. Document Status Designation
☐ Preliminary ☒ Committed ☐ Confirmed ☐ Cancelled / Superseded

8. Notes/Comments

a. Note for Revision:
This calculation revises calculation # 51A-SYC-IH00-00400-000, Rev. 00A. Rev. 00B is issued to clarify inconsistencies found in Section 6 (corrected the multipliers and carried the information over into the results)

Added pages 19(a), 20(a), 20(b), 23(a), 24(a), 25(a), 30(a), 31(a), 31(b), 34(a), 35(a), 36(a), 37(a), & 37(b). These pages are duplicates of their parent pages and were revised to clarify inconsistencies found in Section 6 as indicated by change bars.

Attachments	Total Number of Pages
ATTACHMENT A: IHF PLANS AND SECTIONS	6
ATTACHMENT B: IHF ELEVATIONS	10
ATTACHMENT C: IHF GROUND FLOOR PLAN AND FACILITY GRIDLINES	2
ATTACHMENT D: EMAILS AND INTEROFFICE MEMORANDUMS	14
ATTACHMENT E: CD – EXCEL FILES FOR IHF MASS PROPERTIES CALCULATION	1

RECORD OF REVISIONS

9. No.	10. Reason For Revision	11. Total # of Pgs.	12. Last Pg. #	13. Originator (Print/Sign/Date)	14. Checker (Print/Sign/Date)	15. EGS (Print/Sign/Date)	16. Approved/Accepted (Print/Sign/Date)
00A	Initial Issue	71	E-1 of Attach. E	Kuo-Chu Hsu 10/29/07 Toshio Doi (Attach. A & B) 10/29/07	Kirit Parikh 10/29/07	Salvador Macias 10/29/07	Raj Rajagopal 10/31/07
00B	This calculation is being revised as follows to address Condition Report (CR) #11888: Revision to the following pages, Pgs. 3, 5-11, 15, 24, 25, 38, D1, & E1 Updated Design Inputs, See block 8 above for further clarification.	85	E-1 of Attach. E	Dustin Croft [signature] 6/16/08	Tyson Day (Entire) [signature] 6/16/08 Carl Alexander (Entire) [signature] 6/16/08	Salvador Macias [signature] 6/16/08	Raj Rajagopal [signature] 6/16/08

DISCLAIMER

The calculations contained in this document were developed by Bechtel SAIC Company, LLC (BSC) and are intended solely for the use of BSC in its work for the Yucca Mountain Project.

CONTENTS

PAGE

ACRONYMS

BSC	Bechtel SAIC Company, LLC
HVAC	Heating, ventilation, and air-conditioning
IHF	Initial Handling Facility
ITS	Important to safety
TAD	Transportation, aging, and disposal
CTM	Canister transfer machine
IOM	Interoffice Memorandum
CG	Center of gravity
CG Xi	Distance to center of gravity of mass I in X-direction from Y-axis
CG Yi	Distance to center of gravity of mass I in Y-direction from X-axis
WP	Waste package
Wt.	Weight
Lbs	Pounds
Kips	1,000 Pounds
Psf	Pounds per square foot
Psi	Pounds per square inch
Ksf	Kips per square foot
Ksi	Kips per square inch

1. PURPOSE

The purpose of this calculation is to compute the mass properties of the Initial Handling Facility (IHF) structure. The basis of design for the IHF is defined in the 000-3DR-MGR0-00300-000, *Basis of Design for the TAD Canister-Based Repository Design Concept* (Ref. 2.2.3). The computed mass properties will then be used in the soil springs and damping calculation.

2. REFERENCES

2.1 PROJECT PROCEDURES/DIRECTIVES

2.1.1 BSC (Bechtel SAIC Company) 2008. EG-PRO-3DP-G04B-00037, Rev. 12, *Calculations and Analyses*. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080519.0005.

2.1.2 BSC (Bechtel SAIC Company) 2008. IT-PRO-0011, Rev. 009. *Software Management*. Las Vegas, Nevada: Bechtel SAIC Company. ACC: DOC.20080416.0010.

2.1.3 Not Used.

2.2 DESIGN INPUTS

2.2.1 BSC (Bechtel SAIC Company) 2007. *Project Design Criteria Document.* 000-3DR-MGR0-00100-000 Rev.007. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20071016.0005.

2.2.2 Clough, R.W. and Penzien, J. 1975. *Dynamics of Structures.* New York, New York: McGraw-Hill. ISBN: 0-07-011392-0. TIC: 254783.

2.2.3 BSC (Bechtel SAIC Company) 2008. *Basis of Design for the TAD Canister-Based Repository Design Concept.* 000-3DR-MGR0-00300-000-002. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20080229.0007.

2.2.4 BSC (Bechtel SAIC Company) 2007. *Seismic Analysis and Design Approach Document.* 000-30R-MGR0-02000-000-001. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20071220.0029.

2.2.5 BSC (Bechtel SAIC Company) 2007. *Initial Handling Facility General Arrangement Ground Floor Plan.* 51A-P10-IH00-00102-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20071226.0017.

2.2.6 BSC (Bechtel SAIC Company) 2007. *Initial Handling Facility General Arrangement Second Floor Plan.* 51A-P10-IH00-00103-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20071226.0018.

2.2.7 BSC (Bechtel SAIC Company) 2007. *Initial Handling Facility General Arrangement Sections A and B.* 51A-P10-IH00-00106-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20071226.0021.

2.2.8 BSC (Bechtel SAIC Company) 2007. *Initial Handling Facility General Arrangement Sections C, D and E.* 51A-P10-IH00-00107-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20071226.0022.

2.2.9 BSC (Bechtel SAIC Company) 2007. *Initial Handling Facility General Arrangement Sections F, G, H and J.* 51A-P10-IH00-00108-000-00C. Las Vegas, Nevada: Bechtel SAIC Company. ACC: ENG.20071226.0023.

2.2.10 BSC (Bechtel SAIC Company) 2007. *Mechanical Equipment Envelope*. Las Vegas, Nevada: Bechtel SAIC Company. Detailed titles and document numbers are listed below:

2.2.10.1 CRCF, IHF, RF and WHF Canister Transfer Machine Mechanical Equipment Envelope. 000-MJ0-HTC0-00201-000-00A. ACC: ENG.20061120.0011.
2.2.10.2 Initial Handling Facility CTM Maintenance Crane Mechanical Equipment Envelope. 51A-MJ0-HTC0-00101-000-00B. ACC: ENG.20071017.0008.
2.2.10.3 Initial Handling Facility Cask Preparation Crane Mechanical Equipment Envelope. 51A-MJ0-HM00-00401-000-00B. ACC: ENG.20071017.0006.
2.2.10.4 Initial Handling Facility Cask Preparation Platform Mechanical Equipment Envelope. 51A-MJ0-HMH0-00101-000-00C. ACC: ENG.20071126.0025.
2.2.10.5 Initial Handling Facility Cask Handling Crane Mechanical Equipment Envelope. 51A-MJ0-HM00-00101-000-00B. ACC: ENG.20071017.0005.
2.2.10.6 CRCF, RF, WHF and IHF Cask Handling Yoke Mechanical Equipment Envelope. 000-MJ0-HM00-00101-000-00A. ACC: ENG.20070305.0002.
2.2.10.7 Initial Handling Facility Cask Handling Yoke Stand Mechanical Equipment Envelope. 51A-MJ0-HM00-00501-000-00A. ACC: ENG.20070530.0039.
2.2.10.8 Initial Handling Facility WP Handling Crane Mechanical Equipment Envelope. 51A-MJ0-HMP0-00101-000-00C. ACC: ENG.20080301.0020.
2.2.10.9 Initial Handling Facility WP Closure Room Crane Mechanical Equipment Envelope. 51A-MJ0-HW00-00101-000-00B. ACC: ENG.20071017.0009.

2.2.11 INL (Idaho National Laboratory) 2007. *Drawing # 629110 – Yucca Mountain Waste Package Closure System, Initial Handling Facility WP Closure Room Remote Handling System, Mechanical Equipment Envelope.* 005128Q-0188-001, Rev. 001. Idaho Falls, Idaho: Idaho National laboratory. ACC: ENG.20070322.0008.

2.2.12 IOM # CCU.20070905.0011 (Reference information for IHF)/ With Emails

2.2.13 IOM # CCU.20071011.0006 (Reference information for IHF)/ With Emails

2.3 DESIGN CONSTRAINTS

None.

2.4 DESIGN OUTPUTS

Results of this calculation will be used as input in calculation 51A-SYC-IH00-00500-000 REV, *Initial Handling Facility (IHF) Soil Springs and Damping.*

3. ASSUMPTIONS

3.1 ASSUMPTIONS REQUIRING VERIFICATION

3.1.1 Structural Steel Framing Loads are assumed as follows.

Roofs at 60’, 64’-6” and 105’, Floors at Elev. 26’-9” and 37’-0”...………...….40 psf
Base slab at Elev. 0’: ………………………………………………………...10 psf

Rationale: Above loads are reasonable for heavy industrial steel structures. Actual structural steel weights will be used as the design matures in the detailed design phase of the project. This assumption is being tracked in CalcTrac.

This assumption is used on pages 13 – 14 and 21-25.

3.1.2 Equipment dead loads are assumed as 100 psf and 10 psf on the floor slabs and the roof slabs, respectively. Equipment dead loads include HVAC equipment and electrical equipment.

Rationale: The Initial Handling Facility is not an equipment intensive structure with the major equipment being the HVAC equipment and Electrical equipment. 100 psf is a reasonable assumption for this type of structure. It should be noted that actual equipment weights will be used as the design matures in the detailed design phase of the project. This assumption is being tracked in CalcTrac.

This assumption is used on pages 13 – 14 and 21-25.

3.1.3 Live load is assumed as 100 psf for concrete floor, 40 psf for concrete roof slab, and 20 psf for steel roof. 25% of these loads (that is 25 psf, 10 psf, and 5 psf, respectively) will be included for calculating the mass properties for use in the seismic analysis.

Rationale: Live loads of 100 psf for concrete floor, 40 psf for concrete roof, and 20 psf for steel roof are the standard engineering practice for heavy industrial buildings. Consideration of 25% of live load during seismic event is consistent with section 8.3.1 of Seismic Analysis and Design Approach Document (Ref. 2.2.4). This assumption is being tracked in CalcTrac.

This assumption is used on pages 13 – 14 and 21-25.

3.1.4 Roofing material dead load is assumed as 55 psf for roof at Elev. 60’-0”.

Rationale: This is a reasonable assumption that allows for a lightweight concrete fill material to be applied over the concrete slab with an average thickness of 6 inches as well as membrane roofing material. This assumption is being tracked in CalcTrac.

This assumption is used on page 14.

3.1.5 The Crane Masses are calculated based on the reference drawings as shown below:

Mechanical Equipment	**Mass (kips)** See ref. dwg for wt. of equipment	**Ref. Drawings (Ref. 2.2.10 and 2.2.11)**
CTM	800 + 140/4 = 835	000-MJ0-HTC0-00201-000
CTM Maintenance Crane	40 + 16 + 30/4 = 63.5, use 65	51A-MJ0-HTC0-00101-000
Cask Preparation Crane	80 + 22 + (60+20)/4 = 122, use 125	51A-MJ0-HM00-00401-000
Cask Preparation Platform	100	51A-MJ0-HMH0-00101-000
Cask Handling Crane Cask Handling Yoke Cask Handling Yoke Stand	(300 + 210 + 20 + 600/4) + 15 +11 = 706, use 710	51A-MJ0-HM00-00101-000 000-MJ0-HM00-00101-000 51A-MJ0-HM00-00501-000
WP Handling Crane	102 + 48 + 10 + 40/4 = 170	51A-MJ0-HMP0-00101-000
WP Closure Room Crane	30 + 16 + 30/4 = 53.5, use 55	51A-MJ0-HW00-00101-000
WP Closure Room Remote Handling System Crane	30 + 6/4 = 31.5, use 35	INL (Idaho National Lab.) Dwg-629110, Ref. 2.2.11

Rationale: The dead loads of cranes are calculated based on the listed reference drawings. However, the crane information taken from the sketches and notes of the reference drawings are adequate for Tier 1 analysis. 25% of the lifting capacity of the crane is treated as part of crane dead load for the mass calculation. Definitive information based on specified equipment will be used in the Tier 2 analysis and detailed design. Page A-3 of Attachment A shows the locations of the cranes. This assumption is being tracked in Calctrac.

This assumption is used on pages 14, 24, & 25.

3.1.6 The masses of moving cranes are assumed as concentrated masses acting at locations giving maximum eccentricity with respect to center of mass at that level.

Rationale: Using concentrated masses instead of uniformly distributed masses is appropriate for a preliminary analysis. This assumption is being tracked in CalcTrac.

This assumption is used on pages 13 – 14 and 21-25.

3.1.7 Steel roof (at Elev. 64'-6" and 105'-0") weight is assumed as 25 psf. Cladding self-weight is assumed as 25 psf.

Rationale: Above loads are reasonable for heavy industrial structures. Actual weights will be used as the design matures in the detailed design phase of the project. This assumption is being tracked in CalcTrac.

This assumption is used on pages 24 & 25.

3.1.8 Steel column and bracing weight is assumed as 500 lbs/ft and is also uniformly distributed on the area bounded by grid 4-10/A-M on both roofs (Elev. 64'-6" and 105'-0") and base mat (Elev. 0'-0"). The equivalent distributed weight is 65 psf based on the following calculation.

Rationale: Unit weight of 500 lbs/ft is a conservative assumption for steel column and bracing in the 186 ft. long by 160 ft. wide building. 500 lbs/ft x (105 ft. long /col. x 52 col. + 65 ft long /col. x 35 col.) / (2 x 186 ft L x 160 ft W) = 65 psf. Actual steel weights will be used as the design matures in the detailed design phase of the project. This assumption is being tracked in CalcTrac.

This assumption is used on pages 21, 24, & 25.

3.1.9 Assume the thickness of checkered plate at area confined by column lines 4-5 & F-M at elevation 26'-9" is 3/8", and the unit weight is 15 psf.

Rationale: Above loads are reasonable for heavy industry structures. Actual steel weights will be used as the design matures in the detailed design phase of the project. This assumption is being tracked in CalcTrac.

This assumption is used on page 22.

3.1.10 Assume buttresses are added to the structure bounded by column lines 1-3 and C-H.

Rationale: The buttresses will provide the necessary structural stability. The buttress design will be confirmed in detailed design. This assumption is being tracked in CalcTrac.

This assumption is used on page 15.

3.2 ASSUMPTIONS NOT REQUIRING VERIFICATION

3.2.1 Personnel types of door openings were not considered in the mass calculation.

Rationale: Most major concrete wall penetrations have a shield door, which is approximately equal to the weight of concrete removed to form the opening. Neglecting personnel types of door penetrations is conservative since a larger mass will result in a larger load to be carried by the concrete walls.

This assumption is used on pages 13-14 and 21-25.

3.2.2 The top of base mat is assumed to be at the same elevation (Elev. 0'-0").

Rationale: The part of mat at grid between column lines 1 and 2.7 and column lines C and H is raised 7' higher than the rest of the mat. This part of the mat is assumed to be at the same level (Elev. 0'-0") as the rest of the mat. This assumption has no impact on the base mat since the calculation of mass and mass moment of inertia is based on the actual base mat location of Elev. 7'-0".

This assumption is used on pages 13 – 14.

3.2.3 Assume there is uniform 4'-0" thick concrete slab at area confined by column lines 4-5 & E-F at Elev. 28'-1".

Rationale: There is a 4" thick steel plate over an opening located in the middle of slab. It is conservative to assume all of the area is 4' thick concrete slab.

This assumption is used on page 22.

4. METHODOLOGY

4.1 QUALITY ASSURANCE

This calculation was prepared in accordance with EG-PRO-3DP-G04B-00037, *Calculations and Analyses*, (Ref. 2.1.1). Section 3.1.2 of the *Basis of Design for the TAD Canister-Based Repository Design Concept* (Ref. 2.2.3) classifies the IHF structure as ITS. The approved version of this calculation is designated as QA: QA.

4.2 USE OF SOFTWARE

Excel 2003 and Word 2003, which are a part of the Microsoft Office 2003 suite of programs, were used in this calculation. Microsoft Office 2003 as used in this calculation is classified as Level 2 software usage as defined in IT-PRO-0011 (Ref. 2.1.2). Microsoft Office 2003 is listed on the current Software Report.

The software was executed on a PC system running the Microsoft Windows XP Professional operating system. Results were confirmed by visual inspection and by hand calculations. Word 2003 was used in the text preparation of this document; no calculation functions contained in word were used in this document.

4.3 4.3 CALCULATION METHODOLOGY

Attachments A and B were developed using Plant Design Drawings (References 2.2.5 to 2.2.9) and references 2.2.12 and 2.2.13. The IHF structure's data taken from plans shown in the attachments are used as the basis for computation of the mass properties.

The masses, centers of gravity of masses and mass moments of inertia of the structure, equipment, and 25% of applicable live loads are computed for the various diaphragm (floor/roof) elevations using basic principles of mechanics of materials.

CR 11888 discovered areas where the total loads were not included in the mass calculations. The revised mass and center of gravity have been incorporated in this calculation and compared in section 7.0.

5. LIST OF ATTACHMENTS

6. BODY OF CALCULATION

In this section of the calculation, the mass, center of mass and mass moments of inertia of the structure are computed. The input of the sizes and dimensions of the structure are based on Attachments A, B, C, and D.

The masses of the structure are lumped at the diaphragm (floor/roof) elevation of the structure.

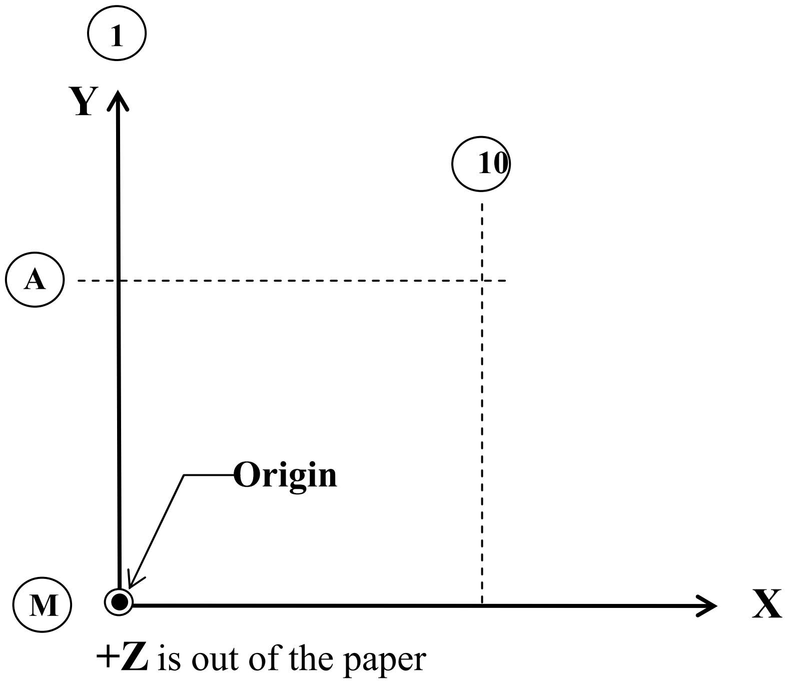
For the Initial Handing Facility, the diaphragm elevations are located at 0', 26'-9", 28'-1", 37', 60', 64'-6"and 105' (See Attachments A and B). Masses of the walls are lumped at the diaphragms by considering that half of the wall mass is tributary to the floor/roof at the bottom of the wall and half of the mass is tributary to the floor/roof at the top of the wall. This is the fundamental lumped mass technique adopted by engineers and popular structural software.

The IHF foundation has been separated into two independent parts. These two parts have been defined on Attachment page A-2 (Part 1 Structure is enclosed by column lines C-H /1-3 and Part 2 Structure is enclosed by column lines A-M/4-10). For the purpose of this calculation the philosophy of 2 parts has been used so subsequent evaluations for soil springs and foundation design are consistent.

The following spreadsheets, pages 13 to 37, are used to compute the mass, center of mass and mass moments of inertia for slabs and walls for each diaphragm elevation. Pages 13 to 20 are for Part 1 computations and from pages 21 to 37 are for Part 2 computations.

Concrete density is 150 pcf as per *Project Design Criteria Document,* (Ref. 2.2.1, Section 4.2.11.6.6).

The coordinate system used in computing the center of mass properties is shown below.


1
Y
10
A
Origin
M
X
+Z is out of the paper

Part 1 Structure

Elevation 0' **See Attachment A, Page A-2 and Attachment C, Page C-2**

Slab (Note 2)	**Width (W) (Xdim) (ft)**	**Length (L) (Ydim) (ft)**	**Thickness t (ft)**	**L*W*t*.15 Wt (kips)** (Note 3)	**CG Xi** (Note 1) **(ft)**	**CG Yi** (Note 1) **(ft)**	**Wt * CG Xi (ft-kips)**	**Wt * CG Yi (ft-kips)**	**Struc. Steel Framing Load (10 psf)** Note 4 **W1 (kips)**	**Equipment Dead Load (100 psf)** Note 4 **W2 (kips)**	**Floor Live Load (25psf)**Note 4 **W3 (kips)**	**Wi * CG Xi** (Note 5) **(ft-kips)**	**Wi * CG Yi** (Note 5) **(ft-kips)**	**Total Weight** W_{total}(Note 6) **(kips)**	W_{total} ***CG Xi (ft-kips)**	W_{total} *** CGYi (ft-kips)**
C-H/1-2.2	59.08	75	6	3988.12	22.54	116.5	89892.3	464616.3	19.50	195.0	48.7	5932.9	30664.7	4251.3	95825.2	495281.0
C-H/2.2-2.7	45.17	75	13	6605.63	74.66	116.5	493176.3	769555.9	14.91	149.1	37.26	15022.9	23441.9	6806.8	508199.2	792997.7
C-H/2.7-3	37.25	75	6	2514.38	115.88	116.5	291365.8	292924.7	12.29	122.9	30.73	19230.1	19333.0	2680.3	310595.9	312257.7
			Σ =	**13108.1**			**874434.4**	**1527096.9**	**46.7**	**467.0**	**116.7**	**40185.9**	**73439.6**	**13738.5**	**914620.3**	**1600536.4**

	xbar	**ybar**		
Centroid of Mass of Concrete =	**66.71**	**116.50**	**xbar =[Σ (Wt * CGXi)/32.2]/[Σ Wt/32.2]**	**ybar =[Σ (Wt * CGYi)/32.2]/[Σ Wt/32.2]**
Centroid of Added Masses =	**63.75**	**116.50**	**xbar =[Σ (Wi * CGXi)/32.2]/[Σ Wi/32.2]**	**ybar =[Σ (Wi * CGYi)/32.2]/[Σ Wi/32.2]**
Centroid of Total Masses =	**66.57**	**116.50**	**xbar = [Σ (W_{total} * CGXi)/32.2]/[Σ W_{total}/32.2]**	**ybar =[Σ (W_{total} * CGYi)/32.2]/[Σ W_{total}/32.2]**

Σ Wi = 630.4 kips

Notes:

1. For coordinate system definition see Section 6.0
2. Numbers and letters are in reference to the column grid lines for the building.
3. Wt = Weight of concrete slab. Unit weight of concrete = 0.15 kip/ft^3, Ref. 2.2.1
4. Loading Area = W ft x 33 ft
5. Wi = Weight of Added Masses = W1 + W2 + W3
6. W_{total} = Wt + W1 + W2 + W3 = Wt + Wi
7. See Assumptions 3.2.1 and 3.2.2.
8. Also see Assumptions 3.1.1 to 3.1.9 in this section of calculation.

Part 1 Structure

Elevation 60' (Roof At 60'-0") **See Attachment A, Page A-3 & A-5.**

Slab (Note 2)	Width (Xdim) (ft)	Length (Ydim) (ft)	Thickness (ft)	Weight (Note 4 & 5) Wt (kips)	CG Xi (Note 1) (ft)	CG Yi (Note 1) (ft)	Wt * CG Xi (ft-kips)	Wt * CG Yi (ft-kips)	Struc. Steel Frame Load (40 psf) W1 (kips)	Crane Dead Load (Note 3) W2 (kips)	Roof Live Load (10 psf) W3 (kips)	Roofing Load (55 psf) W4 (kips)	Roof Equipment Dead Load (10 psf) W5 (kips)	Wi * CGXi (Note 6) (ft-kips)	Wi * CGYi (Note 6) (ft-kips)	Total Weight W_{total} (Note 7) (kips)	W_{total} * CGXi (ft-kips)	W_{total} * CGYi (ft-kips)
E-F/1-3	136.5	41	4	3481.0	66.25	116.5	230617.8	405539.2	223.9		56.0	307.8	56.0	42638.3	74979.1	4124.6	273256.1	480518.3
WP Handling Crane					16.625	116.5				170.0				2826.3	19805.0	170.0	2826.3	19805.0
			Σ =	**3481.0**			**230617.8**	**405539.2**	**223.9**	**170.0**	**56.0**	**307.8**	**56.0**	**45464.6**	**94784.1**	**4294.6**	**276082.4**	**500323.3**
					xbar	**ybar**												
		Centroid of Mass of Concrete =			**66.25**	**116.50**		**xbar =[Σ(Wt * CGXi)/32.2]/[Σ Wt/32.2]**			**ybar =[Σ(Wt * CGYi)/32.2]/[Σ Wt/32.2]**							
		Center of Added Mass =			**55.88**	**116.50**		**xbar =[Σ(Wi * CGXi)/32.2]/[Σ Wi/32.2]**			**ybar =[Σ(Wi * CGYi)/32.2]/[Σ Wi/32.2]**			**Σ Wi =**	**813.6**	**kips**		
		Centroid of Total Masses =			**64.29**	**116.50**		**xbar =[Σ(W_{total} * CGXi)/32.2]/[Σ W_{total}/32.2]**			**ybar =[Σ(W_{total} * CGYi)/32.2]/[Σ W_{total}/32.2]**							

Notes:

1. For coordinate system definition see Section 6.0
2. Numbers and letters are in reference to the column grid lines for the building
3. Crane Dead Load: See Section 3.1.5
4. Weight Computation: Slab weights are computed as follows Weight = (Length*Width*Thickness*((thickness*.15+.022)/thickness)
   the ((thickness*.15+.022)/thickness) term computes a weighted density that accounts for the weight of concrete in the metal decking valley of a three inch metal deck which weighs approximately 22 psf.
5. Wt = Weight of concrete slab. Unit weight of concrete = 0.15 kip/ft^3
6. Wi = Weight of Added Masses = W1 + W2 + W3 + W4 + W5
7. W_{total} = Wt + W1 + W2 + W3 + W4 + W5 = Wt + Wi

Part 1 Structure

Wall Elevations 0'/7' to 56' **See Attachment A Page A-2 and Attachment C Page C-2.**

WALL (Note 2)	start (Note 3) (ft)	end (Note 3) (ft)	Length =end-start L(ft)	Height H (ft)	Thickness T (ft)	Weight =L*H*T*0.15 (Note 6) W (kips)	CGx (Note 1) (ft)	CGy (Note 1) (ft)	W*CGx (ft-kips)	W*CGy (ft-kips)	
N/S WALLS:											
1	81	108	27.0	49.0	4.0	793.8	0.0	94.5	0.00	75014.1	
1	125	152	27.0	49.0	4.0	793.8	0.0	138.5	0.00	109941.3	
1	108	125	17.0	34.0	4.0	346.8	0.0	116.5	0.00	40402.2	
2	81	96	15.0	49.0	4.0	441.0	33.25	88.5	14663.3	39028.5	
2	137	152	15.0	49.0	4.0	441.0	33.25	144.5	14663.3	63724.5	
2.3	81	96	15.0	49.0	4.0	441.0	66.25	88.5	29216.3	39028.5	
2.3	137	152	15.0	49.0	4.0	441.0	66.25	144.5	29216.3	63724.5	
2.7	81	96	15.0	56.0	4.0	504.0	99.25	88.5	50022.0	44604.0	
2.7	137	152	15.0	56.0	4.0	504.0	99.25	144.5	50022.0	72828.0	
3	81	106	25.0	56.0	4.0	840.0	132.5	93.5	111300.0	78540.0	
3	127	152	25.0	56.0	4.0	840.0	132.5	138.5	111300.0	116340.0	
3	106	127	21.0	28.5	4.0	359.1	132.5	116.5	47580.8	41835.2	
E/W WALLS:											
E	2	130.5	128.5	49.0	4.0	3777.9	66.25	135	250285.875	510016.5	
F	2	130.5	128.5	49.0	4.0	3777.9	66.25	98	250285.875	370234.2	
					Total =	**14301.3**			**958555.5**	**1665261.5**	(Note 4)
					Total =	**7150.7**			**479277.8**	**832630.7**	(Note 5)
					XBAR =	**67.03**	**(ft)**	**XBAR =[Σ(W*CGx)/32.2]/[Σ W/32.2]**			
					YBAR =	**116.44**	**(ft)**	**YBAR =[Σ(W*CGy)/32.2]/[Σ W/32.2]**			

Notes:

1. For coordinate system definition see Section 6.0
2. Numbers and letters are in reference to the column grid lines for the building.
3. The start and end dimensions refer to the axis parallel with the wall. For example, the x-axis is parallel with the East/West walls (E/W). CGx would be calculated as the start plus half the length, and CGy would simply be the perpendicular distance from the wall to the origin. The opposite is true for the North/South wall (N/S).
4. Total wall lumped mass from Elevations 7' to 56'.
5. For wall lumped mass lumpped at foundation slab and roof, respectively.
6. Unit weight of concrete = 0.15 kips/ft^3

SUMMARY OF WEIGHTS AND CENTERS OF MASSES (PART 1 STRUCTURE)

Note : For coordinate system definition see Section 6.0

BASESLAB	Weight W (kips)	xbar (ft)	ybar (ft)	W*xbar (ft - kips)	W*ybar (ft - kips)	From Page #
BASE SLAB & ADDED MASSES @ 0'	13738.5	66.57	116.50	914620.3	1600536.4	13
WALLS 7' to 31.5' (1/2 WALLS)	7150.65	67.03	116.44	479277.8	832630.7	15
SUM	**20889.16**			**1393898.1**	**2433167.2**	

BASESLAB		
	XBAR =	66.73
	YBAR =	116.48
	WEIGHT	20889.16

XBAR =[Σ(W*xbar)/32.2]/[Σ(W)/32.2]
YBAR =[Σ(W*ybar)/32.2]/[Σ(W)/32.2]
WEIGHT = Σ(Weight)

60' ROOF	Weight W (kips)	xbar (ft)	ybar (ft)	W*xbar (ft - kips)	W*ybar (ft - kips)	From Page #
ROOF SLAB & ADDED MASSES @ 60'	4294.62	64.29	116.50	276082.4	500323.3	14
WALLS 31.5' to 56' (1/2 WALLS)	7150.65	67.03	116.44	479277.8	832630.7	15
SUM	**11445.27**			**755360.1**	**1332954.0**	

60' ROOF		
	XBAR =	66.00
	YBAR =	116.46
	WEIGHT	11445.27

XBAR =[Σ(W*xbar)/32.2]/[Σ(W)/32.2]
YBAR =[Σ(W*ybar)/32.2]/[Σ(W)/32.2]
WEIGHT = Σ(Weight)

SUMMARY OF MASSES & CENTERS OF MASSES (FOR PART 1 STRUCTURE)

For WEIGHT, XBAR and YBAR, see page 18

$g = 32.2\ ft/sec^2$

	WEIGHT (W) (kips)	MASS (W/g) (kip-sec^2/ft)	XBAR (ft)	YBAR (ft)
BASE SLAB @ 0' + 1/2 WALLS	20889.16	648.73	66.73	116.48
ROOF @ 60' + 1/2 WALLS	11445.27	355.44	66.00	116.46
TOTAL	32334.43	1004.17		

Note : For coordinate system definition see Section 6.0

Part 1 Structure

MASS MOMENTS OF INERTIA (for computing mass moment of inertia of a slab about its centroid see reference below)

BASESLAB @ 0' and 7' to 31.5' WALLS **CGx = 66.73** **CGy = 116.48** (From page 16)

Area Description	Length x Lx (ft)	Length y Ly (ft)	Weight (W) (kips)	CGxi (ft)	CGyi (ft)	Iox W*Ly^2/12g (kip-ft-sec^2)	mdy^2 W*(CGy-CGyi)^2/g (kip-ft-sec^2)	Ioy W*Lx^2/12g (kip-ft-sec^2)	mdx^2 W*(CGx-CGxi)^2/g (kip-ft-sec^2)
Baseslab @ 0'		(From page 13)							
C-H/1-2.2	59.08	75	4251.3	22.54	116.5	6.19E+04	5.34E-02	3.84E+04	2.58E+05
C-H/2.2-2.7	45.17	75	6806.8	74.66	116.5	9.91E+04	8.55E-02	3.59E+04	1.33E+04
C-H/2.7-3	37.25	75	2680.3	115.88	116.5	3.90E+04	3.37E-02	9.63E+03	2.01E+05
N/S Walls Elev. 7' to 31.5'		(Notes and data from page 15)							
1			396.9	0.0	94.5		5.95E+03		5.49E+04
1			396.9	0.0	138.5		5.98E+03		5.49E+04
1			173.4	0.0	116.5		2.18E-03		2.40E+04
2			220.5	33.25	88.5		5.36E+03		7.68E+03
2			220.5	33.25	144.5		5.38E+03		7.68E+03
2.3			220.5	66.25	88.5		5.36E+03		1.57E+00
2.3			220.5	66.25	144.5		5.38E+03		1.57E+00
2.7			252.0	99.25	88.5		6.13E+03		8.28E+03
2.7			252.0	99.25	144.5		6.14E+03		8.28E+03
3			420.0	132.5	93.5		6.89E+03		5.64E+04
3			420.0	132.5	138.5		6.32E+03		5.64E+04
3			179.6	132.5	116.5		2.25E-03		2.41E+04
E/W Walls Elev. 7' - 31.5'		(Notes and data from page 15)							
E			1888.95	66.25	135		2.01E+04		1.34E+01
F			1888.95	66.25	98		2.00E+04		1.34E+01
		Σ	20889.16			2.00E+05	9.90E+04	8.40E+04	7.75E+05

Mass Moment of Inertia about x-axis Ix = 2.99E+05 kip-ft-sec^2 (Iox + mdy^2)
Mass Moment of Inertia about y-axis Iy = 8.59E+05 kip-ft-sec^2 (Ioy + mdx^2)
Mass Moment of Inertia about z-axis Iz = Ix + Iy = 1.16E+06 kip-ft-sec^2

Mass Moment of Inertia of slab about its centroid from "Dynamics of Structures" by R. W. Clough and J. Penzien, 1975, Page 24 (Ref. 2.2.2).

Part 1 Structure

MASS MOMENTS OF INERTIA (for computing mass moment of inertia of a slab about its centroid see reference below)
ROOF @ 60' and 31.5' to 56' WALLS

CGx = 66.00 **CGy = 116.46** (From page 16)

Area Description	Length x Lx (ft)	Length y Ly (ft)	Weight (W) (kips)	CGxi (ft)	CGyi (ft)	Iox W*Ly^2/12g (kip-ft-sec^2)	mdy^2 W*(CGy-CGyi)^2/g (kip-ft-sec^2)	Ioy W*Lx^2/12g (kip-ft-sec^2)	mdx^2 W*(CGx-CGxi)^2/g (kip-ft-sec^2)
Roof Slab @ Elev. 60'			(From page 14)						
E-F/1-3	136.5	41	3481.02	66.25	116.50	1.514E+04	1.456E-01	1.679E+05	6.888E+00
WP Handling Crane			170.00	16.63	116.50		7.110E-03		1.287E+04
N/S Walls 31.5' to 56'			(Notes and datat from page 16)						
1			396.9	0.0	94.5		5.95E+03		5.37E+04
1			396.9	0.0	138.5		5.99E+03		5.37E+04
1			173.4	0.0	116.5		7.25E-03		2.35E+04
2			220.5	33.25	88.5		5.35E+03		7.34E+03
2			220.5	33.25	144.5		5.38E+03		7.34E+03
2.3			220.5	66.25	88.5		5.35E+03		4.36E-01
2.3			220.5	66.25	144.5		5.38E+03		4.36E-01
2.7			252.0	99.25	88.5		6.12E+03		8.65E+03
2.7			252.0	99.25	144.5		6.15E+03		8.65E+03
3			420.0	132.5	93.5		6.88E+03		5.77E+04
3			420.0	132.5	138.5		6.33E+03		5.77E+04
3			179.6	132.5	116.5		7.51E-03		2.47E+04
E/W Walls 31.5' to 56'			(From page 16)						
E			1888.95	66.25	135.00		2.02E+04		3.74E+00
F			1888.95	66.25	98.00		2.00E+04		3.74E+00
		Σ	10801.7			1.514E+04	9.90E+04	1.68E+05	3.16E+05

Mass Moment of Inertia about x-axis Ix =	1.142E+05	kip-ft-sec^2	(Iox + mdy^2)
Mass Moment of Inertia about y-axis Iy =	4.836E+05	kip-ft-sec^2	(Ioy + mdx^2)
Mass Moment of Inertia about z-axis Iz = Ix + Iy =	5.978E+05	kip-ft-sec^2	

Mass Moment of Inertia of slab about its centroid from "Dynamics of Structures" by R. W. Clough and J. Penzien, 1975, Page 24 (Ref. 2.2.2).

Part 1 Structure

MASS MOMENTS OF INERTIA (for computing mass moment of inertia of a slab about its centroid see reference below)
ROOF @ 60' and 31.5' to 56' WALLS

CGx = 66.00 **CGy = 116.46** (From page 16)

Area Description	Length x Lx (ft)	Length y Ly (ft)	Weight (W) (kips)	CGxi (ft)	CGyi (ft)	Iox W*Ly^2/12g (kip-ft-sec^2)	mdy^2 W*(CGy-CGyi)^2/g (kip-ft-sec^2)	Ioy W*Lx^2/12g (kip-ft-sec^2)	mdx^2 W*(CGx-CGxi)^2/g (kip-ft-sec^2)
Roof Slab @ Elev. 60'			(From page 14)						
E-F/1-3	136.5	41	4124.62	66.25	116.50	1.794E+04	1.725E-01	1.989E+05	8.162E+00
WP Handling Crane			170.00	16.63	116.50		7.110E-03		1.287E+04
N/S Walls 31.5' to 56'			(Notes and data from page 15)						
1			396.9	0.0	94.5		5.95E+03		5.37E+04
1			396.9	0.0	138.5		5.99E+03		5.37E+04
1			173.4	0.0	116.5		7.25E-03		2.35E+04
2			220.5	33.25	88.5		5.35E+03		7.34E+03
2			220.5	33.25	144.5		5.38E+03		7.34E+03
2.3			220.5	66.25	88.5		5.35E+03		4.36E-01
2.3			220.5	66.25	144.5		5.38E+03		4.36E-01
2.7			252.0	99.25	88.5		6.12E+03		8.65E+03
2.7			252.0	99.25	144.5		6.15E+03		8.65E+03
3			420.0	132.5	93.5		6.88E+03		5.77E+04
3			420.0	132.5	138.5		6.33E+03		5.77E+04
3			179.6	132.5	116.5		7.51E-03		2.47E+04
E/W Walls 31.5' to 56'			(From page 16)						
E			1888.95	66.25	135.00		2.02E+04		3.74E+00
F			1888.95	66.25	98.00		2.00E+04		3.74E+00
		Σ	11445.3			1.794E+04	9.90E+04	1.99E+05	3.16E+05

Mass Moment of Inertia about x-axis Ix =	1.170E+05	kip-ft-sec^2	($Iox + mdy^2$)
Mass Moment of Inertia about y-axis Iy =	5.146E+05	kip-ft-sec^2	($Ioy + mdx^2$)
Mass Moment of Inertia about z-axis Iz = Ix + Iy =	6.316E+05	kip-ft-sec^2	

Mass Moment of Inertia of slab about its centroid from "Dynamics of Structures" by R. W. Clough and J. Penzien, 1975, Page 24 (Ref. 2.2.2).

SUMMARY OF MASS MOMENT OF INERTIA ABOUT BASE SLAB ELEVATION (FOR PART 1 STRUCTURE)

	(1)	(2)	(3)	(4)	(5)	(1+5)	(2+5)	(1+2)
	Ix	Iy	mass (w/g)	h	mh^2	Ix + mh^2	Iy + mh^2	Iz
	(kip-ft-sec^2)	(kip-ft-sec^2)	(kip-sec^2/ft)	(ft)	(kip-ft-sec^2)	(kip-ft-sec^2)	(kip-ft-sec^2)	(kip-ft-sec^2)
			(From pg 17)		*			
BASE SLAB @ 0' + 1/2 WALLS	2.99E+05	8.59E+05	648.73	0.00	0.00E+00	2.99E+05	8.59E+05	1.16E+06
	(From pg 18)	(From pg 18)						(From pg 18)
ROOF @ 60' + 1/2 WALLS	1.14E+05	4.84E+05	355.44	60.00	1.28E+06	1.39E+06	1.76E+06	5.98E+05
	(From pg 19	(From pg 19)						
TOTAL			1004.17			1.69E+06	2.62E+06	1.76E+06

* Used parallel axis theorem to transform mass moment of inertia @ height "h" to base slab @ Elev. 0'-0"

SUMMARY OF MASS MOMENT OF INERTIA ABOUT BASE SLAB ELEVATION (FOR PART 1 STRUCTURE)

	(1)	(2)	(3)	(4)	(5)	(1+5)	(2+5)	(1+2)
	Ix	Iy	mass (w/g)	h	mh^2	Ix + mh^2	Iy + mh^2	Iz
	(kip-ft-sec^2)	(kip-ft-sec^2)	(kip-sec^2/ft)	(ft)	(kip-ft-sec^2)	(kip-ft-sec^2)	(kip-ft-sec^2)	(kip-ft-sec^2)
			(From pg 17)		*			
BASE SLAB @ 0' + 1/2 WALLS	2.99E+05	8.59E+05	648.73	0.00	0.00E+00	2.99E+05	8.59E+05	1.16E+06
	(From pg 18)	(From pg 18)						(From pg 18)
ROOF @ 60' + 1/2 WALLS	1.17E+05	5.15E+05	355.44	60.00	1.28E+06	1.40E+06	1.79E+06	6.32E+05
	(From pg 19 (a))	(From pg 19 (a))						
TOTAL			1004.17			1.70E+06	2.65E+06	1.79E+06

* Used parallel axis theorem to transform mass moment of inertia @ height "h" to base slab @ Elev. 0'-0"

PERCENT CHANGE OF MASS MOMENT OF INERTIA ABOUT BASE SLAB ELEVATION (PART 1 STRUCTURE)

	(1) Ix	(2) Iy	(3) mass (w/g)	(4) h	(5) mh^2	(1+5) Ix + mh^2	(2+5) Iy + mh^2	(1+2) Iz
BASE SLAB @ 0' + 1/2 WALLS	0%	0%	0%	0%	0%	0%	0%	0%
ROOF @ 60' + 1/2 WALLS	2.45%	6.42%	0%	0%	0.00%	0.20%	1.76%	5.66%
TOTAL			0%			0.17%	1.18%	1.93%

Part 2 Structure

Elevation 0' **See attachment A, Page A-2.**

Slab (Note 2)	Width (W) (Xdim) (ft)	Length (L) (Ydim) (ft)	Thickness t (ft)	L*W*t*.15 Wt (kips) (Note 5)	CG Xi (**1) (Note 1) (ft)	CG Yi (**1) (Note 1) (ft)	Wt * CG Xi (ft-kips)	Wt * CG Yi (ft-kips)	Struc. Steel Frame Load (75 psf)[Note 3] W1 (kips)	Equipment Dead Load (100 psf) W2 (kips)	Floor Live Load (25psf) W3 (kips)	Wi * CG Xi (Note 4) (ft-kips)	Wi * CG Yi (Note 4) (ft-kips)	Total Weight W_{total}(Note 6) (kips)	W_{total} *CG Xi (ft-kips)	W_{total} * CGYi (ft-kips)
A-M/3-10	170	196.5	6	30064.5	220	93.25	6614190.0	2803514.6	2505.4	3340.5	835.1	1469820.0	623003.3	36745.5	8084010.0	3426517.9
			Σ =	**30064.5**			**6614190.0**	**2803514.6**	**2505.4**	**3340.5**	**835.1**	**1469820.0**	**623003.3**	**36745.5**	**8084010.0**	**3426517.9**

	xbar	ybar					
Centroid of Mass of Concrete =	220.00	93.25	xbar =[Σ(Wt * CGXi)/32.2]/[Σ Wt/32.2]	ybar =[Σ(Wt * CGYi)/32.2]/[Σ Wt/32.2]			
Centroid of Added Masses =	220.00	93.25	xbar =[Σ(Wi * CGXi)/32.2]/[Σ Wi/32.2]	ybar =[Σ(Wi * CGYi)/32.2]/[Σ Wi/32.2]	Σ Wi =	6681.0	kips
Centroid of Total Masses =	220.00	93.25	xbar =[Σ(W_{total} * CGXi)/32.2]/[Σ W_{total}/32.2]	ybar =[Σ(W_{total} * CGYi)/32.2]/[Σ W_{total}/32.2]			

Notes:

1. For coordinate system definition see Section 6.0.
2. Numbers and letters are in reference to the column grid lines for the building.
3. W1 = 10 psf + 65 psf = 75 psf (See 3.1.1 and 3.1.8)
4. Wi = Weight of Added Masses = W1 + W2 + W3
5. Wt = Weight of Concrete Slab. Unit weight of concrete = 0.15 kip/ft^3
6. W_{total} = Wt + Wi
7. See Assumption 3.2.3.

Part 2 Structure

Elevation 28'-1" **See attachment A, Page A-3.**

Slab (Note 2)	**Width (Xdim) (ft)**	**Length (Ydim) (ft)**	**Thickness** (Note 3) **(ft)**	**Weight** (Note 4) **Wt (kips)**	**CG Xi** (Note 1) **(ft)**	**CG Yi** (Note 1) **(ft)**	**Wt * CG Xi (ft-kips)**	**Wt * CG Yi (ft-kips)**	**Structural Steel Load (40 psf) W1 (kips)**	**Equipment Dead Load (100 psf) W2 (kips)**	**Floor Live Load (25 psf) W3 (kips)**	**Wi * CGXi** (Note 6) **(ft-kips)**	**Wi * CGYi** (Note 6) **(ft-kips)**	**Total Weight W_{total}** (Note 7) **(kips)**	**W_{total} * CGXi (ft-kips)**	**W_{total} * CGYi (ft-kips)**
C-E/4-5	42.25	12.08	2.33	189.9	157.0	143.04	29816.4	27165.6	20.42	51.05	12.76	13225.0	12049.2	274.15	43041.5	39214.8
C-E/5-6	25.75	12.08	1.00	53.5	191.0	143.04	10221.8	7655.2	12.45	31.11	7.78	9805.8	7343.6	104.86	20027.5	14998.8
B-C/4-6	68.0	30.0	1.00	350.9	169.0	164.0	59298.7	57544.3	81.60	204.0	51.0	56885.4	55202.4	687.48	116184.1	112746.7
B-B.47/6-10 (Note 8)	98.0	14.0	1.00	236.0	252.0	172.0	59468.0	40589.2	54.88	137.2	34.3	57047.8	38937.4	462.36	116515.7	79526.6
E-F/4-5	40.0	41.0	4.0	1020.1	155.0	116.5	158112.4	118839.3	65.60	164.0	41.0	41943.0	31524.9	1290.68	200055.4	150364.2
F-L/4-5	39.5	85.5	3/8"	50.66	157.0	51.0	7953.4	2583.6	135.09	337.7	84.4	87487.7	28419.6	607.91	95441.1	31003.2
			Σ =	**1901.0**			**324870.7**	**254377.2**	**370.0**	**925.1**	**231.3**	**266394.6**	**173477.1**	**3427.4**	**591265.3**	**427854.3**

	xbar	**ybar**		
Centroid of Mass of Slab =	**170.9**	**133.8**	**xbar =[Σ(Wt * CGXi)/32.2]/[Σ Wt/32.2]**	**ybar =[Σ(Wt * CGYi)/32.2]/[Σ Wt/32.2]**
Centroid of Added Mass =	**174.5**	**113.65**	**xbar =[Σ(Wi * CGXi)/32.2]/[Σ Wi/32.2]**	**ybar =[Σ(Wi * CGYi)/32.2]/[Σ Wi/32.2]**
Centroid of Total Masses =	**172.5**	**124.8**	**xbar =[Σ(W_{total} * CGXi)/32.2]/[Σ W_{total}/32.2]**	**ybar =[Σ(W_{total} * CGYi)/32.2]/[Σ W_{total}/32.2]**

Σ Wi = 1526.4 kips

Notes:

1. For coordinate system definition see Section 6.0

2. Numbers and letters are in reference to the column grid lines for the building

3. For weight computation at area D-H/4-5 (3/8" checker plate), See 3.1.9

4. Weight Computation: Slab weights are computed as follows Weight = (Length*Width*Thickness*((thickness*.15+.022)/thickness)
the ((thickness*.15+.022)/thickness) term computes a weighted density that accounts for the weight of concrete in the metal decking valley of a three inch metal deck which weighs approximately 22 psf.
(Future design may not require 3" metal deck. It is conservative to include 22 psf in the mass calculation)
Unit weight of 3/8" metal = (490/12)x(0.375) = 15 psf
Ignore the effect of opening for unit weight calculation for slab E-F/4-5 (See Assumption 3.2.4)
1' thick slab is located at Elev. 26'-9". Use Elev. 28'-0" in the calculation.

5. Wt = Weight of Concrete Slab. Unit weight of concrete = 0.15 kip/ft^3

6. Wi = Weight of added Masses = W1 + W2 + W3

7. W_{total} = Wt + Wi

8. See Attachment A, Sht. A-3 for location of column line B .47.

9. See Assumption 3.2.3.

Part 2 Structure - using original loads

Elevation 37' **See attachment A, Page A-3.**

Slab (Note 2)	**Width** **(Xdim)** **(ft)**	**Length** **(Ydim)** **(ft)**	**Thickness** **(ft)**	**Weight** (Note 3) **Wt (kips)**	**CG Xi** (Note 1) **(ft)**	**CG Yi** (Note 1) **(ft)**	**Wt * CG Xi** **(ft-kips)**	**Wt * CG Yi** **(ft-kips)**	**Struc. Steel Frame Load (40 psf) W1 (kips)**	**Equipment Dead Load (100 psf) W2 (kips)**	**Floor Live Load (25 psf) W3 (kips)**	**Wi * CGXi** (Note 5) **(ft-kips)**	**Wi * CGYi** (Note 5) **(ft-kips)**	**Total Weight** W_{total} (Note 6) **(kips)**	W_{total} *** CGXi (ft-kips)**	W_{total} *** CGYi (ft-kips)**
E-F/5-8	79	41	4	2014.7	214.5	116.5	432144.1	234707.7	129.56	32.39	80.98	52107.4	28300.8	2257.6	484251.6	263008.4
			Σ =	**2014.7**			**432144.1**	**234707.7**	**129.56**	**32.39**	**80.98**	**52107.4**	**28300.8**	**2257.6**	**484251.6**	**263008.4**

	xbar	**ybar**		
Centroid of Mass of Concrete =	**214.5**	**116.5**	**xbar =[Σ(Wt * CGXi)/32.2]/[Σ Wt/32.2]**	**ybar =[Σ(Wt * CGYi)/32.2]/[Σ Wt/32.2]**
Centroid of Added Masses =	**402.2**	**218.4**	**xbar =[Σ(Wi * CGXi)/32.2]/[Σ Wi/32.2]**	**ybar =[Σ(Wi * CGYi)/32.2]/[Σ Wi/32.2]**
Centroid of All Masses =	**214.5**	**116.5**	**xbar =[Σ(W_{total} * CGXi)/32.2]/[Σ W_{total}/32.2]**	**ybar =[Σ(W_{total} * CGYi)/32.2]/[Σ W_{total}/32.2]**

Σ Wi = 242.9 kips

Notes:

1. For coordinate system definition see Section 6.0
2. Numbers and letters are in reference to the column grid lines for the building

3. Weight Computation: Slab weights are computed as follows Weight = (Length*Width*Thickness*((thickness*.15+.022)/thickness)
the ((thickness*.15+.022)/thickness) term computes a weighted density that accounts for the weight of concrete in the metal decking valley of a three inch metal deck which weighs approximately 22 psf.
(Future design may not require 3" metal deck. It is conservative to include 22 psf in the mass calculation)

4. Wt = Weight of concrete slab. Unit weight of concrete = 0.15 kip/ft^3

5. Wi = Weight of added masses = W1 + W2 + W3

6. W_{total} = Wt + Wi

Part 2 Structure - using revised loads

Elevation 37' **See attachment A, Page A-3.**

Slab (Note 2)	**Width (Xdim) (ft)**	**Length (Ydim) (ft)**	**Thickness (ft)**	**Weight** (Note 3) **Wt (kips)**	**CG Xi** (Note 1) **(ft)**	**CG Yi** (Note 1) **(ft)**	**Wt * CG Xi (ft-kips)**	**Wt * CG Yi (ft-kips)**	**Struc. Steel Frame Load (40 psf) W1 (kips)**	**Equipment Dead Load (100 psf) W2 (kips)**	**Floor Live Load (25 psf) W3 (kips)**	**Wi * CGXi** (Note 5) **(ft-kips)**	**Wi * CGYi** (Note 5) **(ft-kips)**	**Total Weight** W_{total} (Note 6) **(kips)**	W_{total} *** CGXi (ft-kips)**	W_{total} *** CGYi (ft-kips)**
E-F/5-8	79	41	4	2014.7	214.5	116.5	432144.1	234707.7	129.56	323.90	80.98	114636.3	62261.7	2549.1	546780.4	296969.3
			Σ =	**2014.7**			**432144.1**	**234707.7**	**129.56**	**323.90**	**80.98**	**114636.3**	**62261.7**	**2549.1**	**546780.4**	**296969.3**

	xbar	**ybar**					
Centroid of Mass of Concrete =	**214.5**	**116.5**	**xbar =[Σ(Wt * CGXi)/32.2]/[Σ Wt/32.2]**	**ybar =[Σ(Wt * CGYi)/32.2]/[Σ Wt/32.2]**			
Centroid of Added Masses =	**214.5**	**116.5**	**xbar =[Σ(Wi * CGXi)/32.2]/[Σ Wi/32.2]**	**ybar =[Σ(Wi * CGYi)/32.2]/[Σ Wi/32.2]**	**Σ Wi =**	**534.4**	**kips**
Centroid of All Masses =	**214.5**	**116.5**	**xbar =[Σ(W_{total} * CGXi)/32.2]/[Σ W_{total}/32.2]**	**ybar =[Σ(W_{total} * CGYi)/32.2]/[Σ W_{total}/32.2]**			

Notes:

1. For coordinate system definition see Section 6.0

2. Numbers and letters are in reference to the column grid lines for the building

3. Weight Computation: Slab weights are computed as follows Weight = (Length*Width*Thickness*((thickness*.15+.022)/thickness)
the ((thickness*.15+.022)/thickness) term computes a weighted density that accounts for the weight of concrete in the metal decking valley of a three inch metal deck which weighs approximately 22 psf.
(Future design may not require 3" metal deck. It is conservative to include 22 psf in the mass calculation)

4. Wt = Weight of concrete slab. Unit weight of concrete = 0.15 kip/ft^3

5. Wi = Weight of added masses = W1 + W2 + W3

6. W_{total} = Wt + Wi

Part 2 Structure - using original loads

Elevation 64'-6" (Roof @ Elev. 64.5') **See attachment A, Page A-4.**

Slab (steel roof) (Note 2)	**Width** (Xdim) (ft)	**Length** (Ydim) (ft)	**Thickness of Steel Roof**	**Weight** (Note 4) **Wt (kips)**	**CG Xi** (Note 1) **(ft)**	**CG Yi** (Note 1) **(ft)**	**Wt * CG Xi** (ft-kips)	**Wt * CG Yi** (ft-kips)	**Struc. Steel Frame Load** (Note 7) **W1 (kips)**	**Crane Dead Load** (Note 3) **W2 (kips)**	**Roof Live Load (5 psf) W3 (kips)**	**Roofing Load (0 psf) W4 (kips)**	**Roof Equipment Dead Load (10 psf) W5 (kips)**	**Wi * CGXi** (Note 5) **(ft-kips)**	**Wi * CGYi** (Note 5) **(ft-kips)**	**Total Weight** W_{total} (Note 6) **(kips)**	W_{total} *** CGXi (ft-kips)**	W_{total} *** CGYi (ft-kips)**
A-M/4-5	37	181.5		268.62	157	83.5	42173.3	22429.8	436.5		33.58	0.0	67.16	84346.7	44859.5	805.9	126520.0	67289.3
WP Closure Room Crane					153.5	18.625				55.0				8442.5	1024.4	55.0	8442.5	1024.4
RHS Crane					153.5	18.625				35.0				5372.5	651.9	35.0	5372.5	651.9
			Σ =	**268.62**			**42173.3**	**22429.8**	**436.5**	**90.00**	**33.58**	**0.0**	**67.16**	**98161.7**	**46535.8**	**895.9**	**140335.0**	**68965.6**

	xbar	**ybar**			
Centroid of Mass of Steel Roof =	**157.0**	**83.50**	**xbar =[Σ(Wt * CGXi)/32.2]/[Σ Wt/32.2]**	**ybar =[Σ(Wt * CGYi)/32.2]/[Σ Wt/32.2]**	
Centroid of Added Masses =	**156.5**	**74.19**	**xbar =[Σ(Wi * CGXi)/32.2]/[Σ Wi/32.2]**	**ybar =[Σ(Wi * CGYi)/32.2]/[Σ Wi/32.2]**	**Σ Wi = 627.2 kips**
Centroid of Total Masses =	**156.6**	**76.98**	**xbar =[Σ(W_{total} * CGXi)/32.2]/[Σ W_{total}/32.2]**	**ybar =[Σ(W_{total} * CGYi)/32.2]/[Σ W_{total}/32.2]**	

Notes:

1. For coordinate system definition see Section 6.0.

2. Numbers and letters are in reference to the column grid lines for the building

3. Crane Dead Load: See Section 3.1.5

4. Unit weight of steel roof = 40 psf (See Sec. 3.1.1)
   Wt = (0.04)*Xdim*Ydim

5. Wi = Weight of added masses = W1 + W2 + W3 + W4 + W5

6. W_{total} = Wt + Wi

7. Weight of steel frame lumped to the roof = 65 psf (See Section 3.1.8)

Part 2 Structure - using revised loads

Elevation 64'-6" (Roof @ Elev. 64.5') **See attachment A, Page A-4.**

Slab (steel roof) (Note 2)	Width (Xdim) (ft)	Length (Ydim) (ft)	Thickness of Steel Roof	Weight (Note 4) Wt (kips)	CG Xi (Note 1) (ft)	CG Yi (Note 1) (ft)	Wt * CG Xi (ft-kips)	Wt * CG Yi (ft-kips)	Struc. Steel Frame Load (Note 7) W1 (kips)	Crane Dead Load (Note 3) W2 (kips)	Roof Live Load (5 psf) W3 (kips)	Roofing Load (0 psf) W4 (kips)	Roof Equipment Dead Load (10 psf) W5 (kips)	Wi * CGXi (Note 5) (ft-kips)	Wi * CGYi (Note 5) (ft-kips)	Total Weight W_{total} (Note 6) (kips)	W_{total} * CGXi (ft-kips)	W_{total} * CGYi (ft-kips)
A-M/4-5	37	181.5		436.51	157	83.5	68531.7	36448.4	436.5		33.58	0.0	67.16	84346.7	44859.5	973.7	152878.4	81307.9
WP Closure Room Crane					153.5	18.625				55.0				8442.5	1024.4	55.0	8442.5	1024.4
RHS Crane					153.5	18.625				35.0				5372.5	651.9	35.0	5372.5	651.9
			Σ =	**436.51**			**68531.7**	**36448.4**	**436.5**	**90.00**	**33.58**	**0.0**	**67.16**	**98161.7**	**46535.8**	**1063.7**	**166693.4**	**82984.2**

	xbar	ybar		
Centroid of Mass of Steel Roof =	**157.0**	**83.50**	**xbar =[Σ(Wt * CGXi)/32.2]/[Σ Wt/32.2]**	**ybar =[Σ(Wt * CGYi)/32.2]/[Σ Wt/32.2]**
Centroid of Added Masses =	**156.5**	**74.19**	**xbar =[Σ(Wi * CGXi)/32.2]/[Σ Wi/32.2]**	**ybar =[Σ(Wi * CGYi)/32.2]/[Σ Wi/32.2]**
Centroid of Total Masses =	**156.7**	**78.01**	**xbar =[Σ(W_{total} * CGXi)/32.2]/[Σ W_{total}/32.2]**	**ybar =[Σ(W_{total} * CGYi)/32.2]/[Σ W_{total}/32.2]**

Σ Wi = 627.2 kips

Notes:

1. For coordinate system definition see Section 6.0.
2. Numbers and letters are in reference to the column grid lines for the building
3. Crane Dead Load: See Section 3.1.5
4. Unit weight of steel roof = 40 psf (See Sec. 3.1.1) in addition to 25 psf (See Sec. 3.1.7)
   Wt = (0.04+0.025)*Xdim*Ydim
5. Wi = Weight of added masses = W1 + W2 + W3 + W4 + W5
6. W_{total} = Wt + Wi
7. Weight of steel frame lumped to the roof = 65 psf (See Section 3.1.8)

Part 2 Structure - using original loads

Elevation 105' (Roof @ Elev. 105') **See attachment A, Page A-4.**

Slab (steel roof) (Note 2)	**Width (Xdim) (ft)**	**Length (Ydim) (ft)**	**Thickness of Steel Roof**	**Weight** (Note 5 & 6) **Wt (kips)**	**CG Xi** (Note 1) **(ft)**	**CG Yi** (Note 1) **(ft)**	**Wt * CG Xi (ft-kips)**	**Wt * CG Yi (ft-kips)**	**Struc. Steel Frame Load** (Note 4) **W1 (kips)**	**Crane Dead Load** (Note 3) **W2 (kips)**	**Roof Live Load (5 psf) W3 (kips)**	**Roofing Load (0 psf) W4 (kips)**	**Roof Equipment Dead Load (10 psf) W5 (kips)**	**Wi * CGXi** (Note 7) **(ft-kips)**	**Wi * CGYi** (Note 7) **(ft-kips)**	**Total Weight** W_{total}(Note 8) **(kips)**	W_{total} *** CGXi (ft-kips)**	W_{total} *** CGYi (ft-kips)**
A-M/5-10	170.0	196.5		1336.2	238.5	83.5	318683.7	111572.7	2171.3		167.0	0.0	334.1	637367.4	223145.4	4008.6	956051.1	334718.1
Cask Handling Crane, Yoke and Yoke Stand					288.5	41.75				710.0				204835.0	29642.5	710.0	204835.0	29642.5
Cask Preparation Crane					288.5	41.75				125.0				36062.5	5218.8	125.0	36062.5	5218.8
Cask Preparation Platform					288.5	41.75				100.0				28850.0	4175.0	100.0	28850.0	4175.0
CTM Crane					288.5	161.5				835.0				240897.5	134852.5	835.0	240897.5	134852.5
CTM Maintenance Crane					288.5	161.5				65.0				18752.5	10497.5	65.0	18752.5	10497.5
			Σ =	**1336.2**			**318683.7**	**111572.7**	**2171.3**	**1835.0**	**167.0**	**0.0**	**334.1**	**1166764.9**	**407531.7**	**5843.6**	**1485448.6**	**519104.4**

	xbar	**ybar**		
Centroid of Mass of Steel Roof =	**238.5**	**83.50**	**xbar =[Σ(Wt * CGXi)/32.2]/[Σ Wt/32.2]**	**ybar =[Σ(Wt * CGYi)/32.2]/[Σ Wt/32.2]**
Centroid of Added Masses =	**258.9**	**90.41**	**xbar =[Σ(Wi * CGXi)/32.2]/[Σ Wi/32.2]**	**ybar =[Σ(Wi * CGYi)/32.2]/[Σ Wi/32.2]**
Centroid of Total Masses =	**254.2**	**88.83**	**xbar =[Σ(W_{total} * CGXi)/32.2]/[Σ $W_{total/32.2]}$**	**ybar =[Σ(W_{total} * CGYi)/32.2]/[Σ W_{total}/32.2]**

Σ Wi = 4507.4 kips

Notes:

1. For coordinate system definition see Section 6.0.
2. Numbers and letters are in reference to the column grid lines for the building
3. Crane Dead Load: (See Section 3.1.5)
4. Structural steel framing load = 65 psf (See Section 3.1.8)
5. Unit weight of steel roof = 40 psf (See Section 3.1.1)
6. Wt = Weight of steel roof =0.04 ksf*X dim*Ydim
7. Wi = Weight of added masses = W1 + W2 + W3 + W4 + W5
8. W_{total} = Wt + Wi

Part 2 Structure - using revised loads

Elevation 105' (Roof @ Elev. 105') **See attachment A, Page A-4.**

Slab (steel roof) (Note 2)	**Width (Xdim) (ft)**	**Length (Ydim) (ft)**	**Thickness of Steel Roof**	**Weight** (Note 5 & 6) **Wt (kips)**	**CG Xi** (Note 1) **(ft)**	**CG Yi** (Note 1) **(ft)**	**Wt * CG Xi (ft-kips)**	**Wt * CG Yi (ft-kips)**	**Struc. Steel Frame Load** (Note 4) **W1 (kips)**	**Crane Dead Load** (Note 3) **W2 (kips)**	**Roof Live Load (5 psf) W3 (kips)**	**Roofing Load (0 psf) W4 (kips)**	**Roof Equipment Dead Load (10 psf) W5 (kips)**	**Wi * CGXi** (Note 7) **(ft-kips)**	**Wi * CGYi** (Note 7) **(ft-kips)**	**Total Weight** W_{total}(Note 8) **(kips)**	W_{total} *** CGXi (ft-kips)**	W_{total} *** CGYi (ft-kips)**
A-M/5-10	170.0	196.5		2171.3	238.5	83.5	517861.0	181305.6	2171.3		167.0	0.0	334.1	637367.4	223145.4	4843.7	1155228.4	404451.0
Cask Handling Crane, Yoke and Yoke Stand					288.5	41.75				710.0				204835.0	29642.5	710.0	204835.0	29642.5
Cask Preparation Crane					288.5	41.75				125.0				36062.5	5218.8	125.0	36062.5	5218.8
Cask Preparation Platform					288.5	41.75				100.0				28850.0	4175.0	100.0	28850.0	4175.0
CTM Crane					288.5	161.5				835.0				240897.5	134852.5	835.0	240897.5	134852.5
CTM Maintenance Crane					288.5	161.5				65.0				18752.5	10497.5	65.0	18752.5	10497.5
			Σ =	**2171.3**			**517861.0**	**181305.6**	**2171.3**	**1835.0**	**167.0**	**0.0**	**334.1**	**1166764.9**	**407531.7**	**6678.7**	**1684625.9**	**588837.3**
					xbar	**ybar**												
			Centroid of Mass of Steel Roof =		**238.5**	**83.50**												
			Centroid of Added Masses =		**258.9**	**90.41**												
			Centroid of Total Masses =		**252.2**	**88.17**												

Centroid of Mass of Steel Roof: $xbar = [\Sigma(Wt * CGXi)/32.2]/[\Sigma Wt/32.2]$ $ybar = [\Sigma(Wt * CGYi)/32.2]/[\Sigma Wt/32.2]$

Centroid of Added Masses: $xbar = [\Sigma(Wi * CGXi)/32.2]/[\Sigma Wi/32.2]$ $ybar = [\Sigma(Wi * CGYi)/32.2]/[\Sigma Wi/32.2]$ **Σ Wi = 4507.4 kips**

Centroid of Total Masses: $xbar = [\Sigma(W_{total} * CGXi)/32.2]/[\Sigma W_{total/32.2}]$ $ybar = [\Sigma(W_{total} * CGYi)/32.2]/[\Sigma W_{total}/32.2]$

Notes:

1. For coordinate system definition see Section 6.0.
2. Numbers and letters are in reference to the column grid lines for the building
3. Crane Dead Load: (See Section 3.1.5)
4. Structural steel framing load = 65 psf (See Section 3.1.8)
5. Unit weight of steel roof = 40 psf + 25 psf (See Sections 3.1.1 & 3.1.7)
6. Wt = Weight of steel roof = (0.04 + 0.025) ksf*X dim*Ydim
7. Wi = Weight of added masses = W1 + W2 + W3 + W4 + W5
8. W_{total} = Wt + Wi

Part 2 Structure

Walls Elevations 0' to 24'-1" **See Attachment A Page A-2 and Attachment B Page B-5**

WALL (Note 2)	**start** (Note 3) **(ft)**	**end** (Note 3) **(ft)**	**Length =end-start L (ft)**	**Height H (ft)**	**Thickness T (ft)**	**Weight =L*H*T*0.15** (Note 6) **W (kips)**	**CGx (ft)**	**CGy (ft)**	**W*CGx ft-kips**	**W*CGy ft-kips**
N/S WALLS Elev. 0' to 12'-1/2" and 12'-1/2" to 24'-1" (Note 4)										
4/E-F	96.0	106.0	10.0	12.5	4	75.0	137.0	101.0	10275.0	7575.0
4/E-F	127.0	137.0	10.0	12.5	4	75.0	137.0	132.0	10275.0	9900.0
E/W WALLS Elev. 0' to 12'-1/2" and 12'-1/2" to 24'-1" (Note 4)										
E/ 4-5	139.0	175.0	36.0	12.5	4	270.0	157.0	135.0	42390.0	36450.0
F/ 4-5	139.0	175.0	36.0	12.5	4	270.0	157.0	98.0	42390.0	26460.0
					TOTAL =	**690.0**			**105330.0**	**80385.0**

XBAR = 152.65 (ft) **XBAR =[Σ(W*CGx)/32.2]/[Σ W/32.2**

YBAR = 116.50 (ft) **YBAR =[Σ(W*CGy)/32.2]/[Σ W/32.2**

Notes:

1. For coordinate system definition see Section 6.0.
2. Numbers and letters are in reference to the column grid lines for the building.
3. The start and end dimensions refer to the axis parallel with the wall. For example, the x-axis is parallel with the East/West walls (E/W). CGx would be calculated as the start plus half the length, and CGy would simply be the perpendicular distance from the wall to the origin. The opposite is true for the North/South wall (N/S).
4. The walls from Elev. 0' to 12'-1/2" and 12-1/2" to 24'-1" are identical. Therefore, these results are used for both 0' - 12'-1/2" and 12'-1/2" - 24'-1" on
5. Unit weight of concrete = 0.15 kip/ft^3
6. W = 0.15*L*H*T

Part 2 Structure

Walls Elevations 0' to 33' **See Attachment A Page A-2 and Attachment B Page B-6, B-7 and B-8**

WALL (Note 2)	**start (ft)** (Note 3)	**end (ft)** (Note 3)	**Length =end-start L (ft)**	**Height H (ft)**	**Thickness T (ft)**	**Weight =L*H*T*0.15** (Note 6) **W (kips)**	**CGx** (Note 1) **(ft)**	**CGy** (Note 1) **(ft)**	**W*CGx ft-kips**	**W*CGy ft-kips**
N/S WALLS Elev. 0' - 16.5' and 16.5' - 33' (Note 4)										
5/E-F	96.0	106.0	10.0	16.5	4	99.0	177.0	101.0	17523.0	9999.0
5/E-F	127.0	137.0	10.0	16.5	4	99.0	177.0	132.0	17523.0	13068.0
7/E-F	96.0	137.0	41.0	16.5	4	405.9	227.0	116.5	92139.3	47287.35
8/E-F	96.0	137.0	41.0	16.5	4	405.9	252.0	116.5	102286.8	47287.35
E/W WALLS Elev. 0' - 16.5' and 16.5' - 33' (Note 4)										
F/5-7	179.0	225.0	46.0	16.5	4	455.4	202.0	98.0	91990.8	44629.2
E/5-8	179.0	250.0	71.0	16.5	4	702.9	214.5	135.0	150772.1	94891.5

TOTAL = **2168.1** **472235** **257162.4**

XBAR = **217.81** **(ft)** **XBAR =[Σ(W*CGx)/32.2]/[Σ W/32.2**

YBAR = **118.61** **(ft)** **YBAR =[Σ(W*CGy)/32.2]/[Σ W/32.2**

Notes:

1. For coordinate system definition see Section 6.0.
2. Numbers and letters are in reference to the column grid lines for the building.
3. The start and end dimensions refer to the axis parallel with the wall. For example, the x-axis is parallel with the East/West walls (E/W). CGx would be calculated as the start plus half the length, and CGy would simply be the perpendicular distance from the wall to the origin. The opposite is true for the North/South wall (N/S).
4. The walls from elev. 0' to 16.5' and 16.5' to 33' are identical. Therefore, these results are used for both 0' - 16.5' and 16.5' - 33' on the summary sheets.
5. Unit weight of concrete = 0.15 kip/ft^3
6. W = 0.15*L*H*T

Part 2 Structure

Claddings Elevation 0' to 64.5' **See attachment A, Page A-2.**

CLADDING (Note 2)	**start** (Note 3) **(ft)**	**end** (Note 3) **(ft)**	**Length =end-start L(ft)**	**Height H (ft)**	**Weight 25psf** (Note 6) **W (kips)**	**CGx** (Note 1) **(ft)**	**CGy** (Note 1) **(ft)**	**W*CGx ft-kips**	**W*CGy ft-kips**
N/S CLADDING Elev. 0'-32.25' and 32.25'-64.5' (Note 4)									
4 /A - M	0	181.5	181.5	32.25	146.33	135.0	98.25	19755.14	14377.35
E/W CLADDING Elev. 0'-32.25' and 32.25'-64.5' (Note 4)									
A / 4-5	135.0	172.0	37.0	32.25	29.83	153.5	184.0	4579.10	5488.95
M / 4-5	135.0	172.0	37.0	32.25	29.83	153.5	2.5	4579.10	74.58
				TOTAL =	**206.00**			**28913.3**	**19940.9**
				XBAR =	**140.36**	**ft**	**XBAR =[Σ(W*CGx)/32.2]/[Σ W/32.2]**		
				YBAR =	**96.80**	**ft**	**YBAR =[Σ(W*CGy)/32.2]/[Σ W/32.2]**		

Notes:

1. For coordinate system definition see Section 6.0.
2. Numbers and letters are in reference to the column grid lines for the building.
3. The start and end dimensions refer to the axis parallel with the cladding. For example, the x-axis is parallel with the East/West cladding (E/W). CGx would be calculated as the start plus half the length, and CGy would simply be the perpendicular distance from the cladding to the origin. The opposite is true for the North/South cladding (N/S).
4. The claddings from Elev. 0' - 32.25' and 32.25' - 64.5' are identical. Therefore, these results are used for both 0' - 32.25' and 32.25' - 64.5' on the summary sheets. Assume the entire N/S surface is occupied by cladding.
5. Cladding self-weight = 25 psf (See Section 3.1.7)
6. W = 0.025*L*H

Part 2 Structure

Claddings Elevations 0' to 105' **See attachment A, Page A-2.**

CLADDING (Note 2)	**start** (Note 3) **(ft)**	**end** (Note 3) **(ft)**	**Length =end-start L(ft)**	**Height H (ft)**	**Weight 25psf** (Note 5) **W (kips)**	**CGx** (Note 1) **(ft)**	**CGy** (Note 1) **(ft)**	**W*CGx ft-kips**	**W*CGy ft-kips**	
N/S CLADDING Elev. 0'- 52.5' and 52.5'-105' (Note 4)										
5/A -M (Note 6)	0	196.5	196.5	40.5	198.96	172.0	93.25	34220.5	18552.7	
10/A-M (Note 6)	0	196.5	196.5	52.5	257.91	305.0	93.25	78661	24049.8	
E/W CLADDING Elev. 0'-52.5' and 52.5'-105' (Note 4)										
A/5-10	172	305	133	52.5	174.56	238.50	191.5	41633.2	33428.72	
M/5-10	172	305	133	52.5	174.56	238.50	-5.0	41633.2	-872.81	
				TOTAL =	**805.99**			**196148.2**	**75158.3**	**For lumped mass at Elev. 105'**
				TOTAL =	**607.03**			**161927.7**	**56605.7**	**For lumped mass at Elev. 0'**
				XBAR =	**243.36**	**ft**	**XBAR =[Σ(W*CGx)/32.2]/[Σ W/32.2]**			**For lumped mass at Elev. 105'**
				XBAR =	**266.75**	**ft**	**XBAR =[Σ(W*CGx)/32.2]/[Σ W/32.2]**			**For lumped mass at Elev. 0'**
				YBAR =	**93.25**	**ft**	**YBAR =[Σ(W*CGy)/32.2]/[Σ W/32.2]**			**For lumped mass at Elev. 105'**
				YBAR =	**93.25**	**ft**	**YBAR =[Σ(W*CGy)/32.2]/[Σ W/32.2]**			**For lumped mass at Elev. 0'**

Notes:

1. For coordinate system definition see Section 6.0.

2. Numbers and letters are in reference to the column grid lines for the building.

3. The start and end dimensions refer to the axis parallel with the cladding. For example, the x-axis is parallel with the East/West cladding (E/W). CGx would be calculated as the start plus half the length, and CGy would simply be the perpendicular distance from the cladding to the origin. The opposite is true for the North/South cladding (N/S).

4. The claddings from elev. 0' to 52.5' are identical. Therefore, these results are used for both 0' - 52.5' and 52.5' - 105' on the summary sheets. See Note 6 for cladding along col. line 5.

5. Cladding self-weight = 25 psf (See Section 3.1.7)
   W = 0.025*L*H

6. Cladding mass along col. line 5 from Elev. 64'-6" to 105'-0"is for lumpped mass at Elev. 105' only.
   Cladding mass along col. line 10 from Elev. 0' to 105'-0" is for lumpped mass at both Elev. 0' and 105'.

SUMMARY OF MASSES AND CENTERS OF MASSES (PART 2 STRUCTURE)
(Using original loads)

Note : For coordinate system definition see Section 6.0

BASESLAB	Weight W (kips)	xbar (ft)	ybar (ft)	W*xbar (ft - kips)	W*ybar (ft - kips)	From Page #
BASE SLAB & ADDED MASSES @ 0'	36745.5	220.00	93.25	8084010.0	3426517.9	21
WALLS 0-16.5'	2168.10	217.81	118.61	472235.0	257162.4	27
WALLS 0-12.04'	690.00	152.65	116.50	105330.0	80385.0	26
CLADDING 0-32.25'	206.00	140.36	96.80	28913.3	19940.9	28
CLADDING 0-52.5	607.03	266.75	93.25	161927.7	56605.7	29
SUM	**40416.63**			**8852416.0**	**3840611.8**	

	XBAR =	219.03
BASESLAB	YBAR =	95.03
	WEIGHT	40416.63

XBAR =[Σ(W*xbar)/32.2]/[Σ(W)/32.2]
YBAR =[Σ(W*ybar)/32.2]/[Σ(W)/32.2]
WEIGHT = Σ(Weight)

26'-9" & 28'-1" FLOOR SLABS (See Note below)	Weight W (kips)	xbar (ft)	ybar (ft)	W*xbar (ft - kips)	W*ybar (ft - kips)	From Page #
FLOOR SLAB & ADDED MASSES @ 28'-1"	3427.43	172.51	124.83	591265.3	427854.3	22
WALLS 12.04'-24.08'	690.00	152.65	116.50	105330.0	80385.0	26
SUM	**4117.43**			**696595.3**	**508239.3**	

	XBAR =	169.18
26'-9" FL SLAB	YBAR =	123.44
& 28'-1" FL SLAB	WEIGHT	4117.43

XBAR =[Σ(W*xbar)/32.2]/[Σ(W)/32.2]
YBAR =[Σ(W*ybar)/32.2]/[Σ(W)/32.2]
WEIGHT = Σ(Weight)

Note: Floor masses on Elev. 26'-9" are lumped into Elev. 28'-1"

37' FLOOR SLAB	Weight W (kips)	xbar (ft)	ybar (ft)	W*xbar (ft - kips)	W*ybar (ft - kips)	From Page #
FLOOR SLAB & ADDED MASSES @ 37'	2257.58	214.50	116.50	484251.6	263008.4	23
WALLS 16.5'-33'	2168.10	217.81	118.61	472235.0	257162.4	27
SUM	**4425.68**			**956486.5**	**520170.8**	

	XBAR =	216.12
37' FL. SLAB	YBAR =	117.53
	WEIGHT	4425.68

XBAR =[Σ(W*xbar)/32.2]/[Σ(W)/32.2]
YBAR =[Σ(W*ybar)/32.2]/[Σ(W)/32.2]
WEIGHT = Σ(Weight)

64'-6" ROOF	Weight W (kips)	xbar (ft)	ybar (ft)	W*xbar (ft - kips)	W*ybar (ft - kips)	From Page #
ROOF SLAB & ADDED MASSES @ 64'-6"	895.86	156.65	76.98	140335.0	68965.6	24
CLADDING 32.25'-64.5'	206.00	140.36	96.80	28913.3	19940.9	28
SUM	**1101.86**			**169248.4**	**88906.4**	

	XBAR =	153.60
64'-6" ROOF	YBAR =	80.69
	WEIGHT	1101.86

XBAR =[Σ(W*xbar)/32.2]/[Σ(W)/32.2]
YBAR =[Σ(W*ybar)/32.2]/[Σ(W)/32.2]
WEIGHT = Σ(Weight)

105' ROOF	Weight W (kips)	xbar (ft)	ybar (ft)	W*xbar (ft - kips)	W*ybar (ft - kips)	From Page #
ROOF SLAB & ADDED MASSES @ 105'	5843.60	254.20	88.83	1485448.6	519104.4	25
CLADDING 52.5'-105'	805.99	243.36	93.25	196148.2	75158.3	29
SUM	**6649.59**			**1681596.8**	**594262.7**	

	XBAR =	252.89
105' ROOF	YBAR =	89.37
	WEIGHT	6649.59

XBAR =[Σ(W*xbar)/32.2]/[Σ(W)/32.2]
YBAR =[Σ(W*ybar)/32.2]/[Σ(W)/32.2]
WEIGHT = Σ(Weight)

SUMMARY OF MASSES AND CENTERS OF MASSES (PART 2 STRUCTURE)
(Using revised loads)

Note : For coordinate system definition see Section 6.0

BASESLAB	**Weight W (kips)**	**xbar (ft)**	**ybar (ft)**	**W*xbar (ft - kips)**	**W*ybar (ft - kips)**	**From Page #**
BASE SLAB & ADDED MASSES @ 0'	36745.5	220.00	93.25	8084010.0	3426517.9	21
WALLS 0-16.5'	2168.10	217.81	118.61	472235.0	257162.4	27
WALLS 0-12.04'	690.00	152.65	116.50	105330.0	80385.0	26
CLADDING 0-32.25'	206.00	140.36	96.80	28913.3	19940.9	28
CLADDING 0-52.5	607.03	266.75	93.25	161927.7	56605.7	29
SUM	**40416.63**			**8852416.0**	**3840611.8**	

BASESLAB		
	XBAR =	**219.03**
	YBAR =	**95.03**
	WEIGHT	**40416.63**

XBAR =[Σ(W*xbar)/32.2]/[Σ(W)/32.2]
YBAR =[Σ(W*ybar)/32.2]/[Σ(W)/32.2]
WEIGHT = Σ(Weight)

26'-9" & 28'-1" FLOOR SLABS (See Note below)	**Weight W (kips)**	**xbar (ft)**	**ybar (ft)**	**W*xbar (ft - kips)**	**W*ybar (ft - kips)**	**From Page #**
FLOOR SLAB & ADDED MASSES @ 28'-1"	3427.43	172.51	124.83	591265.3	427854.3	22
WALLS 12.04'-24.08'	690.00	152.65	116.50	105330.0	80385.0	26
SUM	**4117.43**			**696595.3**	**508239.3**	

26'-9" FL SLAB & 28'-1" FL SLAB		
	XBAR =	**169.18**
	YBAR =	**123.44**
	WEIGHT	**4117.43**

XBAR =[Σ(W*xbar)/32.2]/[Σ(W)/32.2]
YBAR =[Σ(W*ybar)/32.2]/[Σ(W)/32.2]
WEIGHT = Σ(Weight)

Note: Floor masses on Elev. 26'-9" are lumped into Elev. 28'-1"

37' FLOOR SLAB	**Weight W (kips)**	**xbar (ft)**	**ybar (ft)**	**W*xbar (ft - kips)**	**W*ybar (ft - kips)**	**From Page #**
FLOOR SLAB & ADDED MASSES @ 37'	2549.09	214.50	116.50	546780.4	296969.3	23 (a)
WALLS 16.5'-33'	2168.10	217.81	118.61	472235.0	257162.4	27
SUM	**4717.19**			**1019015.4**	**554131.7**	

37' FL. SLAB		
	XBAR =	**216.02**
	YBAR =	**117.47**
	WEIGHT	**4717.19**

XBAR =[Σ(W*xbar)/32.2]/[Σ(W)/32.2]
YBAR =[Σ(W*ybar)/32.2]/[Σ(W)/32.2]
WEIGHT = Σ(Weight)

64'-6" ROOF	**Weight W (kips)**	**xbar (ft)**	**ybar (ft)**	**W*xbar (ft - kips)**	**W*ybar (ft - kips)**	**From Page #**
ROOF SLAB & ADDED MASSES @ 64'-6"	1063.75	156.70	78.01	166693.4	82984.2	24 (a)
CLADDING 32.25'-64.5'	206.00	140.36	96.80	28913.3	19940.9	28
SUM	**1269.74**			**195606.7**	**102925.0**	

64'-6" ROOF		
	XBAR =	**154.05**
	YBAR =	**81.06**
	WEIGHT	**1269.74**

XBAR =[Σ(W*xbar)/32.2]/[Σ(W)/32.2]
YBAR =[Σ(W*ybar)/32.2]/[Σ(W)/32.2]
WEIGHT = Σ(Weight)

105' ROOF	**Weight W (kips)**	**xbar (ft)**	**ybar (ft)**	**W*xbar (ft - kips)**	**W*ybar (ft - kips)**	**From Page #**
ROOF SLAB & ADDED MASSES @ 105'	6678.73	252.24	88.17	1684625.9	588837.3	25 (a)
CLADDING 52.5'-105'	805.99	243.36	93.25	196148.2	75158.3	29
SUM	**7484.71**			**1880774.1**	**663995.6**	

105' ROOF		
	XBAR =	**251.28**
	YBAR =	**88.71**
	WEIGHT	**7484.71**

XBAR =[Σ(W*xbar)/32.2]/[Σ(W)/32.2]
YBAR =[Σ(W*ybar)/32.2]/[Σ(W)/32.2]
WEIGHT = Σ(Weight)

SUMMARY OF MASSES & CENTERS OF MASSES (FOR PART 2 STRUCTURE)
(Using original loads)

For WEIGHT, XBAR and YBAR, see page 30

g = 32.2 ft/sec^2

	WEIGHT (W) (kips)	**MASS (W/g)** (kip-sec^2/ft)	**XBAR** (ft)	**YBAR** (ft)
BASE SLAB @ 0' + 1/2 WALLS	40416.63	1255.17	219.03	95.03
FLOOR SLABS @ 28'-1" + 1/2 WALLS	4117.43	127.87	169.18	123.44
FLOOR SLAB @ 37' +1/2 WALLS	4425.68	137.44	216.12	117.53
ROOF @ 64'-6"	1101.86	34.22	153.60	80.69
ROOF @ 105'	6649.59	206.51	252.89	89.37
TOTAL	56711.19	1761.22		

Note : For coordinate system definition see Section 6.0

SUMMARY OF MASSES & CENTERS OF MASSES (FOR PART 2 STRUCTURE)
(Using revised loads)

For WEIGHT, XBAR and YBAR, see page 30 (a)
$g = 32.2\ ft/sec^2$

	WEIGHT (W) (kips)	**MASS (W/g)** (kip-sec^2/ft)	**XBAR** (ft)	**YBAR** (ft)
BASE SLAB @ 0' + 1/2 WALLS	40416.63	1255.17	219.03	95.03
FLOOR SLABS @ 28'-1" + 1/2 WALLS	4117.43	127.87	169.18	123.44
FLOOR SLAB @ 37' +1/2 WALLS	4717.19	146.50	216.02	117.47
ROOF @ 64'-6"	1269.74	39.43	154.05	81.06
ROOF @ 105'	7484.71	232.44	251.28	88.71
TOTAL	58005.71	1801.42		

Note : For coordinate system definition see Section 6.0

SUMMARY OF PERCENT CHANGE OF MASSES & CENTERS OF MASSES (FOR PART 2 STRUCTURE)

	WEIGHT (W) (% CHANGE)	**MASS (W/g)** (% CHANGE)	**XBAR** (% CHANGE)	**YBAR** (% CHANGE)
BASE SLAB @ 0' + 1/2 WALLS	0.00%	0.00%	0.00%	0.00%
FLOOR SLABS @ 28'-1" + 1/2 WALLS	0.00%	0.00%	0.00%	0.00%
FLOOR SLAB @ 37' +1/2 WALLS	6.59%	6.59%	-0.05%	-0.05%
ROOF @ 64'-6"	15.24%	15.24%	0.29%	0.46%
ROOF @ 105'	12.56%	12.56%	-0.63%	-0.73%
TOTAL	2.28%	2.28%		

Part 2 Structure

MASS MOMENTS OF INERTIA (for computing mass moment of inertia of a slab about its centroid see reference below)

BASESLAB @ 0' + 1/2 WALLS **CGx = 219.03** **CGy = 95.03** (From page 30)

Area Description	Length x Lx (ft)	Length y Ly (ft)	Weight (W) (kips)	CGxi (ft)	CGyi (ft)	Iox W*Ly^2/12g (kip-ft-sec^2)	mdy^2 W*(CGy-CGyi)^2/g (kip-ft-sec^2)	Ioy W*Lx^2/12g (kip-ft-sec^2)	mdx^2 W*(CGx-CGxi)^2/g (kip-ft-sec^2)
Baseslab @ 0'		(From page 21)							
A-M/3-10	170	196.5	36745.5	220.0	93.25	3.67E+06	3.60E+03	2.75E+06	1.08E+03
N/S Walls 0' - 12.04'		(From page 26)							
4/E-F			75.00	137.0	101.0		8.31E+01		1.57E+04
4/E-F			75.00	137.0	132.0		3.18E+03		1.57E+04
E/W Walls 0' - 12.04'		(From page 26)							
E/ 4-5			270.00	157.0	135.0		1.34E+04		3.23E+04
F/ 4-5			270.00	157.0	98.0		7.42E+01		3.23E+04
N/S Walls 0' - 16.5'		(From page 27)							
5/E-F			99.00	177.0	101.0		1.10E+02		5.43E+03
5/E-F			99.00	177.0	132.0		4.20E+03		5.43E+03
7/E-F			405.9	227.0	116.5		5.81E+03		8.01E+02
8/E-F			405.9	252.0	116.5		5.81E+03		1.37E+04
E/W Walls 0' - 16.5'		(From page 27)							
F/5-7			455.4	202.0	98.0		1.25E+02		4.10E+03
E/5-8			702.9	214.5	135.0		3.49E+04		4.48E+02
N/S Cladding EL. 0-32.25'		(From page 28)							
4 /A - M			146.3	135.0	98.3		4.73E+01		3.21E+04
E/W Cladding EL. 0-32.25'		(From page 28)							
A / 4-5			29.83	153.5	184.0		7.33E+03		3.98E+03
M / 4-5			29.83	153.5	2.5		7.93E+03		3.98E+03
N/S Cladding EL. 0-52.5'		(From page 29)							
5/A -M (Note 6)			199.0	172.0	93.3		1.95E+01		1.37E+04
10/A-M (Note 6)			257.9	305.0	93.3		2.53E+01		5.92E+04
E/W Cladding EL. 0-52.5'		(From page 29)							
A/5-10			174.6	238.5	191.5		5.05E+04		2.06E+03
M/5-10			174.6	238.5	-5.0		5.42E+04		2.06E+03
		Σ	40615.58			3.67E+06	1.91E+05	2.75E+06	2.44E+05

Mass Moment of Inertia about x-axis Ix = 3.86E+06 kip-ft-sec^2 ($Iox + mdy^2$)
Mass Moment of Inertia about y-axis Iy = 2.99E+06 kip-ft-sec^2 ($Ioy + mdx^2$)
Mass Moment of Inertia about z-axis Iz = Ix + Iy = 6.86E+06 kip-ft-sec^2

Mass Moment of Inertia of slab about its centroid from "Dynamics of Structures" by R. W. Clough and J. Penzien, 1975, Page 24 (Ref. 2.2.2).

Part 2 Structure

MASS MOMENTS OF INERTIA (for computing mass moment of inertia of a slab about its centroid see reference below)
FLOOR SLAB @ 28'-1"

CGx = 169.18 **CGy = 123.44** (From page 30)

Area Description	Length x Lx (ft)	Length y Ly (ft)	Weight (W) (kips)	CGxi (ft)	CGyi (ft)	Iox W*Ly^2/12g (kip-ft-sec^2)	mdy^2 W*(CGy-CGyi)^2/g (kip-ft-sec^2)	Ioy W*Lx^2/12g (kip-ft-sec^2)	mdx^2 W*(CGx-CGxi)^2/g (kip-ft-sec^2)
FLOOR Slab @ 28'-1"			(From page 22)						
C-E/4-5	42.3	12.1	274.1	157.0	143.0	1.04E+02	3.27E+03	1.27E+03	1.26E+03
C-E/5-6	25.8	12.1	104.9	191.0	143.0	3.96E+01	1.25E+03	1.80E+02	1.55E+03
B-C/4-6	68.0	30.0	687.5	169.0	164.0	1.60E+03	3.51E+04	8.23E+03	7.06E-01
.47/6-10 (Not	98.0	14.0	462.4	252.0	172.0	2.35E+02	3.39E+04	1.15E+04	9.85E+04
E-F/4-5	40.0	41.0	1290.7	155.0	116.5	5.61E+03	1.93E+03	5.34E+03	8.06E+03
F-L/4-5	39.5	85.5	607.9	157.0	51.0	1.15E+04	9.91E+04	2.45E+03	2.80E+03
N/S Walls 12.04' to 24.08'			(From page 26)						
4/E-F			75.0	137.0	101.0		1.17E+03		2.41E+03
4/E-F			75.0	137.0	132.0		1.71E+02		2.41E+03
E/W Walls 12.04' to 24.08'			(From page 26)						
E/ 4-5			270.0	157.0	135.0		1.12E+03		1.24E+03
F/ 4-5			270.0	157.0	98.0		5.43E+03		1.24E+03
		Σ	4117.4			1.91E+04	1.82E+05	2.90E+04	1.19E+05

Mass Moment of Inertia about x-axis Ix =	2.01E+05	kip-ft-sec^2	(Iox + mdy^2)
Mass Moment of Inertia about y-axis Iy =	1.48E+05	kip-ft-sec^2	(Ioy + mdx^2)
Mass Moment of Inertia about z-axis Iz = Ix + Iy =	3.50E+05	kip-ft-sec^2	

Mass Moment of Inertia of slab about its centroid from "Dynamics of Structures" by R. W. Clough and J. Penzien, 1975, Page 24 (Ref. 2.2.2).

Part 2 Structure

MASS MOMENTS OF INERTIA (for computing mass moment of inertia of a slab about its centroid see reference below)
FLOOR SLAB @37' + WALLS 16.5' - 33'
(Using original loads) **CGx = 216.12** **CGy = 117.53** (From page 30)

Area Description	Length x Lx (ft)	Length y Ly (ft)	Weight (W) (kips)	CGxi (ft)	CGyi (ft)	Iox W*Ly^2/12g (kip-ft-sec^2)	mdy^2 W*(CGy-CGyi)^2/g (kip-ft-sec^2)	Ioy W*Lx^2/12g (kip-ft-sec^2)	mdx^2 W*(CGx-CGxi)^2/g (kip-ft-sec^2)
Floor Slabs @ 37'		(From page 23)							
E-F/5-8	79	41	2257.6	214.5	116.5	9.82E+03	7.50E+01	3.65E+04	1.84E+02
N/S Walls 16.5' - 33'		(From page 27)							
5/E-F			99.0	177.0	101.0		8.41E+02		4.71E+03
5/E-F			99.0	177.0	132.0		6.43E+02		4.71E+03
7/E-F			405.9	227.0	116.5		1.35E+01		1.49E+03
8/E-F			405.9	252.0	116.5		1.35E+01		1.62E+04
E/W Walls 16.5' - 33'		(From page 27)							
F/5-7			455.4	202	98		5.40E+03		2.82E+03
E/5-8			702.9	214.5	135.0		6.66E+03		5.74E+01
		Σ	4425.68			9.82E+03	1.36E+04	3.65E+04	3.02E+04

Mass Moment of Inertia about x-axis Ix = 2.35E+04 kip-ft-sec^2 (Iox + mdy^2)
Mass Moment of Inertia about y-axis Iy = 6.67E+04 kip-ft-sec^2 (Ioy + mdx^2)
Mass Moment of Inertia about z-axis Iz = Ix + Iy = 9.01E+04 kip-ft-sec^2

Mass Moment of Inertia of slab about its centroid from "Dynamics of Structures" by R. W. Clough and J. Penzien, 1975, Page 24 (Ref. 2.2.2).

Part 2 Structure

MASS MOMENTS OF INERTIA (for computing mass moment of inertia of a slab about its centroid see reference below)
FLOOR SLAB @37' + WALLS 16.5' - 33'
(Using revised loads) **CGx = 216.02** **CGy = 117.47** (From page 30 (a))

Area Description	Length x Lx (ft)	Length y Ly (ft)	Weight (W) (kips)	CGxi (ft)	CGyi (ft)	Iox W*Ly^2/12g (kip-ft-sec^2)	mdy^2 W*(CGy-CGyi)^2/g (kip-ft-sec^2)	Ioy W*Lx^2/12g (kip-ft-sec^2)	mdx^2 W*(CGx-CGxi)^2/g (kip-ft-sec^2)
Floor Slabs @ 37'	(From page 23 (a))								
E-F/5-8	79	41	2549.1	214.5	116.5	1.11E+04	7.46E+01	4.12E+04	1.83E+02
N/S Walls 16.5' - 33'	(From page 27)								
5/E-F			99.0	177.0	101.0		8.34E+02		4.68E+03
5/E-F			99.0	177.0	132.0		6.49E+02		4.68E+03
7/E-F			405.9	227.0	116.5		1.19E+01		1.52E+03
8/E-F			405.9	252.0	116.5		1.19E+01		1.63E+04
E/W Walls 16.5' - 33'	(From page 27)								
F/5-7			455.4	202	98		5.36E+03		2.78E+03
E/5-8			702.9	214.5	135.0		6.71E+03		5.05E+01
		Σ	4717.19			1.11E+04	1.37E+04	4.12E+04	3.02E+04

Mass Moment of Inertia about x-axis Ix = 2.47E+04 kip-ft-sec^2 (Iox + mdy^2)
Mass Moment of Inertia about y-axis Iy = 7.14E+04 kip-ft-sec^2 (Ioy + mdx^2)
Mass Moment of Inertia about z-axis Iz = Ix + Iy = 9.61E+04 kip-ft-sec^2

Mass Moment of Inertia of slab about its centroid from "Dynamics of Structures" by R. W. Clough and J. Penzien, 1975, Page 24 (Ref. 2.2.2).

Part 2 Structure

MASS MOMENTS OF INERTIA (for computing mass moment of inertia of a slab about its centroid see reference below)
ROOF SLAB @ 64'-6"
(Using original loads) **CGx = 153.60** **CGy = 80.69** (From page 30)

Area Description	Length x Lx (ft)	Length y Ly (ft)	Weight (W) (kips)	CGxi (ft)	CGyi (ft)	Iox W*Ly^2/12g (kip-ft-sec^2)	mdy^2 W*(CGy-CGyi)^2/g (kip-ft-sec^2)	Ioy W*Lx^2/12g (kip-ft-sec^2)	mdx^2 W*(CGx-CGxi)^2/g (kip-ft-sec^2)
Roof Slab @ 64'-6"			(From page 24)						
A-M/4-5	37	181.5	805.9	157.0	83.5	6.87E+04	1.98E+02	2.86E+03	2.89E+02
WP Closure Room Crane			55.00	153.5	18.6		6.58E+03		1.81E-02
RHS Crane			35.00	153.5	18.6		4.19E+03		1.15E-02
N/S Cladding EL. 32.25'-64.5'			(From page 28)						
4 /A - M			146.33	135.0	98.3		1.40E+03		1.57E+03
E/W Cladding EL. 0-35.25'			(From page 28)						
A / 4-5			29.83	153.5	184.0		9.89E+03		9.80E-03
M / 4-5			29.83	153.5	2.5		5.66E+03		9.80E-03
		Σ	1101.86			6.87E+04	2.79E+04	2.86E+03	1.86E+03

Mass Moment of Inertia about x-axis Ix = 9.66E+04 kip-ft-sec^2 ($Iox + mdy^2$)
Mass Moment of Inertia about y-axis Iy = 4.72E+03 kip-ft-sec^2 ($Ioy + mdx^2$)
Mass Moment of Inertia about z-axis Iz = Ix + Iy = 1.01E+05 kip-ft-sec^2

Mass Moment of Inertia of slab about its centroid from "Dynamics of Structures" by R. W. Clough and J. Penzien, 1975, Page 24 (Ref. 2.2.2).

Part 2 Structure

MASS MOMENTS OF INERTIA (for computing mass moment of inertia of a slab about its centroid see reference below)
ROOF SLAB @ 64'-6"
(Using revised loads) **CGx = 154.05** **CGy = 81.06** (From page 30 (a))

Area Description	Length x Lx (ft)	Length y Ly (ft)	Weight (W) (kips)	CGxi (ft)	CGyi (ft)	Iox W*Ly^2/12g (kip-ft-sec^2)	mdy^2 W*(CGy-CGyi)^2/g (kip-ft-sec^2)	Ioy W*Lx^2/12g (kip-ft-sec^2)	mdx^2 W*(CGx-CGxi)^2/g (kip-ft-sec^2)
Roof Slab @ 64'-6"			(From page 24 (a))						
A-M/4-5	37	181.5	973.7	157.0	83.5	8.30E+04	1.80E+02	3.45E+03	2.63E+02
WP Closure Room Crane			55.00	153.5	18.6		6.66E+03		5.21E-01
RHS Crane			35.00	153.5	18.6		4.24E+03		3.31E-01
N/S Cladding EL. 32.25'-64.5'			(From page 28)						
4 /A - M			146.33	135.0	98.3		1.34E+03		1.65E+03
E/W Cladding EL. 0-35.25'			(From page 28)						
A / 4-5			29.83	153.5	184.0		9.82E+03		2.82E-01
M / 4-5			29.83	153.5	2.5		5.72E+03		2.82E-01
		Σ	1269.74			8.30E+04	2.80E+04	3.45E+03	1.91E+03

Mass Moment of Inertia about x-axis Ix = 1.11E+05 kip-ft-sec^2 (Iox + mdy^2)
Mass Moment of Inertia about y-axis Iy = 5.36E+03 kip-ft-sec^2 (Ioy + mdx^2)
Mass Moment of Inertia about z-axis Iz = Ix + Iy = 1.16E+05 kip-ft-sec^2

Mass Moment of Inertia of slab about its centroid from "Dynamics of Structures" by R. W. Clough and J. Penzien, 1975, Page 24 (Ref. 2.2.2).

Part 2 Structure

MASS MOMENTS OF INERTIA (for computing mass moment of inertia of a slab about its centroid see reference below)
ROOF SLAB @ Elev. 105'
(Using original loads) **CGx = 252.89** **CGy = 89.37** (From page 30)

Area Description	Length x Lx (ft)	Length y Ly (ft)	Weight (W) (kips)	CGxi (ft)	CGyi (ft)	Iox W*Ly^2/12g (kip-ft-sec^2)	mdy^2 W*(CGy-CGyi)^2/g (kip-ft-sec^2)	Ioy W*Lx^2/12g (kip-ft-sec^2)	mdx^2 W*(CGx-CGxi)^2/g (kip-ft-sec^2)
Roof Slab @ Elev. 105'			(From page 25)						
A-M/5-10	170	196.5	4008.6	238.5	83.5	4.01E+05	4.29E+03	3.00E+05	2.58E+04
Cask Handling Crane, Yoke and Yoke Stand			710.0	288.5	41.75		5.00E+04		2.80E+04
Cask Preparation Crane			125.0	288.5	41.75		8.80E+03		4.92E+03
Cask Preparation Platform			100.0	288.5	41.75		7.04E+03		3.94E+03
CTM Crane			835.0	288.5	161.5		1.35E+05		3.29E+04
CTM Maintenance Crane			65.0	288.5	161.5		1.05E+04		2.56E+03
N/S Cladding Elev. 52.5'-105'			(From page 29)						
5/A -M (Note 6)			199.0	172.0	93.3		9.31E+01		4.04E+04
10/A-M (Note 6)			257.9	305.0	93.3		1.21E+02		2.18E+04
E/W Cladding Elev. 52.5'-105'			(From page 29)						
A/5-10			174.6	238.5	191.5		5.65E+04		1.12E+03
M/5-10			174.6	238.5	-5.0		4.83E+04		1.12E+03
		Σ	6649.59			4.01E+05	3.21E+05	3.00E+05	1.62E+05

Mass Moment of Inertia about x-axis Ix = 7.21E+05 kip-ft-sec^2 ($Iox + mdy^2$)
Mass Moment of Inertia about y-axis Iy = 4.62E+05 kip-ft-sec^2 ($Ioy + mdx^2$)
Mass Moment of Inertia about z-axis Iz = Ix + Iy = 1.18E+06 kip-ft-sec^2

Mass Moment of Inertia of slab about its centroid from "Dynamics of Structures" by R. W. Clough and J. Penzien, 1975, Page 24 (Ref. 2.2.2).

Part 2 Structure

MASS MOMENTS OF INERTIA (for computing mass moment of inertia of a slab about its centroid see reference below)
ROOF SLAB @ Elev. 105'
(Using revised loads) **CGx = 251.28** **CGy = 88.71** (From page 30 (a))

Area Description	Length x Lx (ft)	Length y Ly (ft)	Weight (W) (kips)	CGxi (ft)	CGyi (ft)	Iox W*Ly^2/12g (kip-ft-sec^2)	mdy^2 W*(CGy-CGyi)^2/g (kip-ft-sec^2)	Ioy W*Lx^2/12g (kip-ft-sec^2)	mdx^2 W*(CGx-CGxi)^2/g (kip-ft-sec^2)
Roof Slab @ Elev. 105'			(From page 25 (a))						
A-M/5-10	170	196.5	4843.7	238.5	83.5	4.84E+05	4.09E+03	3.62E+05	2.46E+04
Cask Handling Crane, Yoke and Yoke Stand			710.0	288.5	41.75		4.86E+04		3.05E+04
Cask Preparation Crane			125.0	288.5	41.75		8.56E+03		5.38E+03
Cask Preparation Platform			100.0	288.5	41.75		6.85E+03		4.30E+03
CTM Crane			835.0	288.5	161.5		1.37E+05		3.59E+04
CTM Maintenance Crane			65.0	288.5	161.5		1.07E+04		2.80E+03
N/S Cladding Elev. 52.5'-105'			(From page 29)						
5/A -M (Note 6)			199.0	172.0	93.3		1.27E+02		3.88E+04
10/A-M (Note 6)			257.9	305.0	93.3		1.65E+02		2.31E+04
E/W Cladding Elev. 52.5'-105'			(From page 29)						
A/5-10			174.6	238.5	191.5		5.73E+04		8.86E+02
M/5-10			174.6	238.5	-5.0		4.76E+04		8.86E+02
		Σ	7484.71			4.84E+05	3.21E+05	3.62E+05	1.67E+05

Mass Moment of Inertia about x-axis Ix = 8.05E+05 kip-ft-sec^2 (Iox + mdy^2)
Mass Moment of Inertia about y-axis Iy = 5.30E+05 kip-ft-sec^2 (Ioy + mdx^2)
Mass Moment of Inertia about z-axis Iz = Ix + Iy = 1.33E+06 kip-ft-sec^2

Mass Moment of Inertia of slab about its centroid from "Dynamics of Structures" by R. W. Clough and J. Penzien, 1975, Page 24 (Ref. 2.2.2).

SUMMARY OF MASS MOMENT OF INERTIA ABOUT BASE SLAB ELEVATION (FOR PART 2 STRUCTURE
(Using original loads)

	(1) **Ix** (kip-ft-sec^2)	*(2)* **Iy** (kip-ft-sec^2)	*(3)* **Mass (m)** (kip-sec^2/ft) (From pg 31)	*(4)* **h** (ft)	*(5)* **mh^2** (kip-ft-sec^2) *	*(1+5)* **Ix + mh^2** (kip-ft-sec^2)	*(2+5)* **Iy + mh^2** (kip-ft-sec^2)	*(1+2)* **Iz** (kip-ft-sec^2)
Base Slab @ 0' +1/2 Walls	3.86E+06 (Page 32)	2.99E+06 (Page 32)	1255.17	0.00	0.00E+00	3.86E+06	2.99E+06	6.86E+06
Floor Slab @ 28'-1"+1/2 Walls	2.01E+05 (Page 33)	1.48E+05 (Page 33)	127.87	28.08	1.01E+05	3.02E+05	2.49E+05	3.50E+05
Floor Slab @ 37'+1/2 Walls	2.35E+04 (Page 34)	6.67E+04 (Page 34)	137.44	37.00	1.88E+05	2.12E+05	2.55E+05	9.01E+04
Roof @ 64'-6"	9.66E+04 (Page 35)	4.72E+03 (Page 35)	34.22	64.50	1.42E+05	2.39E+05	1.47E+05	1.01E+05
Roof @ 105'	7.21E+05 (Page 36)	4.62E+05 (Page 36)	206.51	105.00	2.28E+06	3.00E+06	2.74E+06	1.18E+06
Total			1761.22			7.61E+06	6.38E+06	8.58E+06

* Used parallel axis theorem to transform mass moment of inertia @ height "h" to base slab @ Elev. 0'-0"

SUMMARY OF MASS MOMENT OF INERTIA ABOUT BASE SLAB ELEVATION (FOR PART 2 STRUCTURE
(Using revised loads)

	(1) **Ix** (kip-ft-sec^2)	*(2)* **Iy** (kip-ft-sec^2)	*(3)* **Mass (m)** (kip-sec^2/ft) (From pg 31)	*(4)* **h** (ft)	*(5)* **mh^2** (kip-ft-sec^2) *	*(1+5)* **Ix + mh^2** (kip-ft-sec^2)	*(2+5)* **Iy + mh^2** (kip-ft-sec^2)	*(1+2)* **Iz** (kip-ft-sec^2)
Base Slab @ 0' +1/2 Walls	3.86E+06 (Page 32)	2.99E+06 (Page 32)	1255.17	0.00	0.00E+00	3.86E+06	2.99E+06	6.86E+06
Floor Slab @ 28'-1"+1/2 Walls	2.01E+05 (Page 33)	1.48E+05 (Page 33)	127.87	28.08	1.01E+05	3.02E+05	2.49E+05	3.50E+05
Floor Slab @ 37'+1/2 Walls	2.47E+04 (Page 34 (a))	7.14E+04 (Page 34 (a))	146.50	37.00	2.01E+05	2.25E+05	2.72E+05	9.61E+04
Roof @ 64'-6"	1.11E+05 (Page 35 (a))	5.36E+03 (Page 35 (a))	39.43	64.50	1.64E+05	2.75E+05	1.69E+05	1.16E+05
Roof @ 105'	8.05E+05 (Page 36 (a))	5.30E+05 (Page 36 (a))	232.44	105.00	2.56E+06	3.37E+06	3.09E+06	1.33E+06
Total			1801.42			8.03E+06	6.78E+06	8.75E+06

* Used parallel axis theorem to transform mass moment of inertia @ height "h" to base slab @ Elev. 0'-0"

SUMMARY OF PERCENT CHANGE OF MASS MOMENT OF INERTIA ABOUT BASE SLAB ELEVATION (PART 2 STRUCTURE)

	Ix (% CHANGE)	Iy (% CHANGE)	Mass (m) (% CHANGE)	mh^2 (% CHANGE)	Ix + mh^2 (% CHANGE)	Iy + mh^2 (% CHANGE)	Iz (% CHANGE)
Base Slab @ 0' +1/2 Walls	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Floor Slab @ 28'-1"+1/2 Walls	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Floor Slab @ 37'+1/2 Walls	5.44%	7.10%	6.59%	6.59%	6.46%	6.72%	6.67%
Roof @ 64'-6"	14.85%	13.72%	15.24%	15.24%	15.08%	15.19%	14.80%
Roof @ 105'	11.68%	14.54%	12.56%	12.56%	12.35%	12.89%	12.80%
Total			2.28%		5.51%	6.15%	2.01%

7. RESULTS AND CONCLUSIONS

7.1 RESULTS

The summary of the results from this calculation is as follows,

- Mass and centers of mass of each floor and roof level (See pages 17 & 31)
- Mass moments of inertia (See pages 20 & 37)

The results of this calculation show an increase in mass, for structure 2, on the order of 2.3% and an increase in the moments of inertia (Ix, Iy, & Iz) on the order of 2 to 6.2% (see page 37 (b), *Summary of Percent Change of Mass Moment of Inertia about Base Slab Elevation*). Structure 1 contains no change in mass; however, the change in its moments of inertia (Ix, Iy, & Iz) show an increase of approximately 0.2 to 1.9% (see page 20 (b), *Percent Change of Mass Moment of Inertia about Base Slab Elevation*). The results of this calculation are used in the 'Initial Handling Facility (IHF) Soil Springs and Damping' (51A-SYC-IH00-00500-000) calculation.

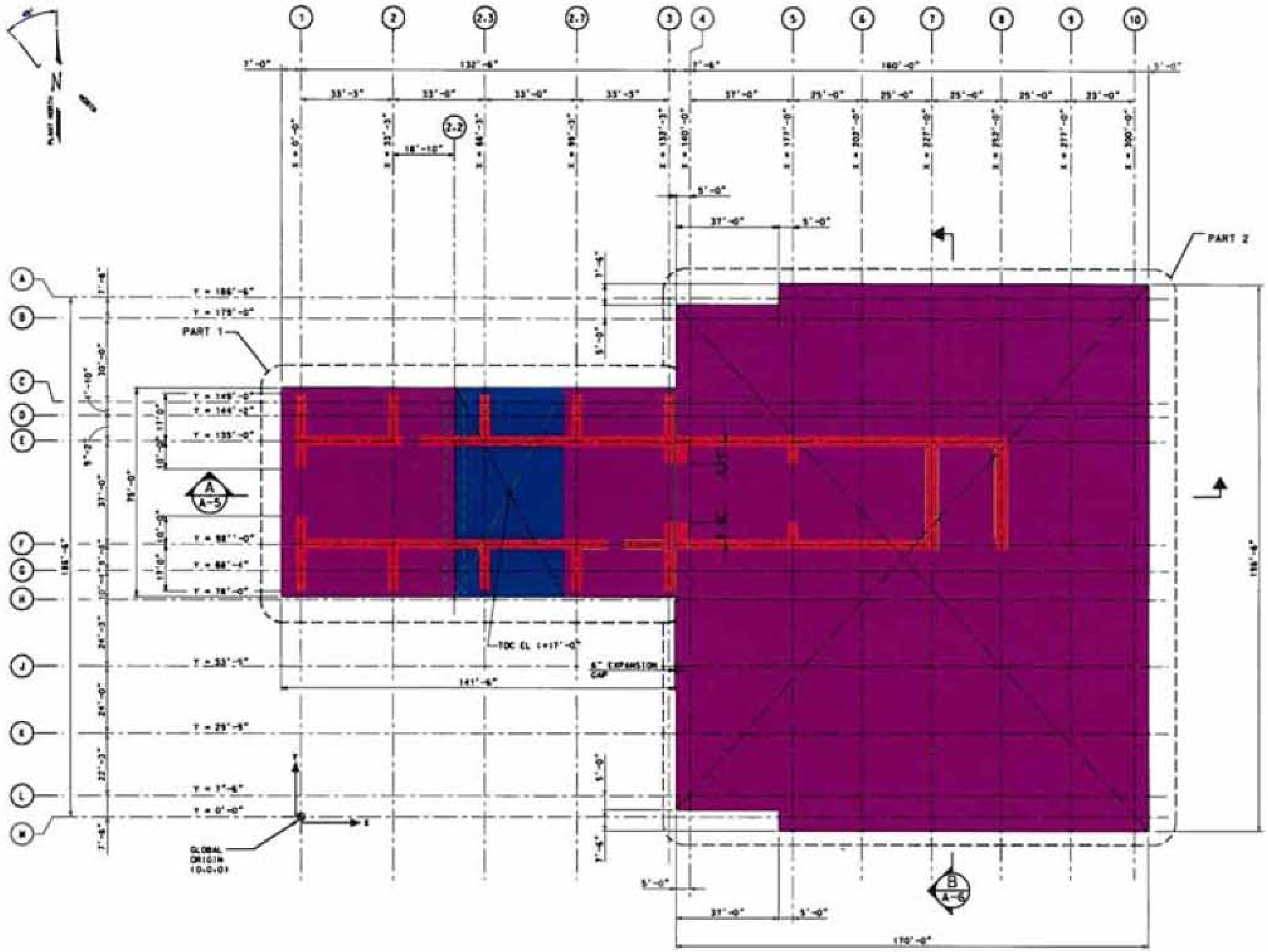
7.2 CONCLUSIONS

The results of the calculation are adequate for use in the structural calculations being performed as part of the Tier 1 seismic analysis. A more refined finite element analysis will be generated for Tier 2 seismic analysis.

The increase of mass moments of inertia identified in Section 7.1 has negligible impact to the overall results and conclusion of this calculation. Therefore, the mass moment of inertia identified on pages 20 and 37 are acceptable for use.

ATTACHMENT A

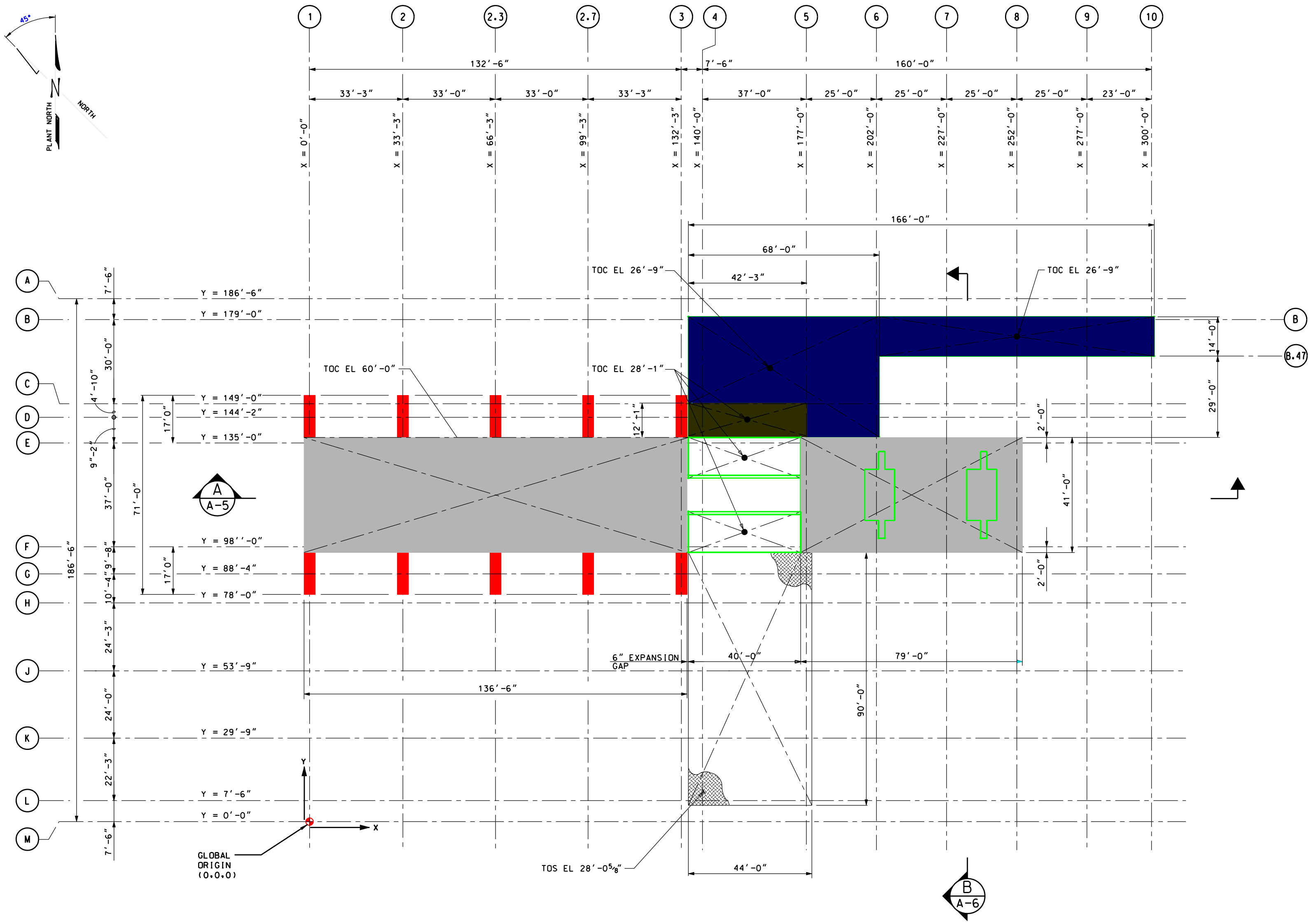
IHF PLANS AND SECTIONS



LEGEND:

- 13'-0" BASE SLAB
- 6'-0" BASE SLAB
- 4'-0" WALL

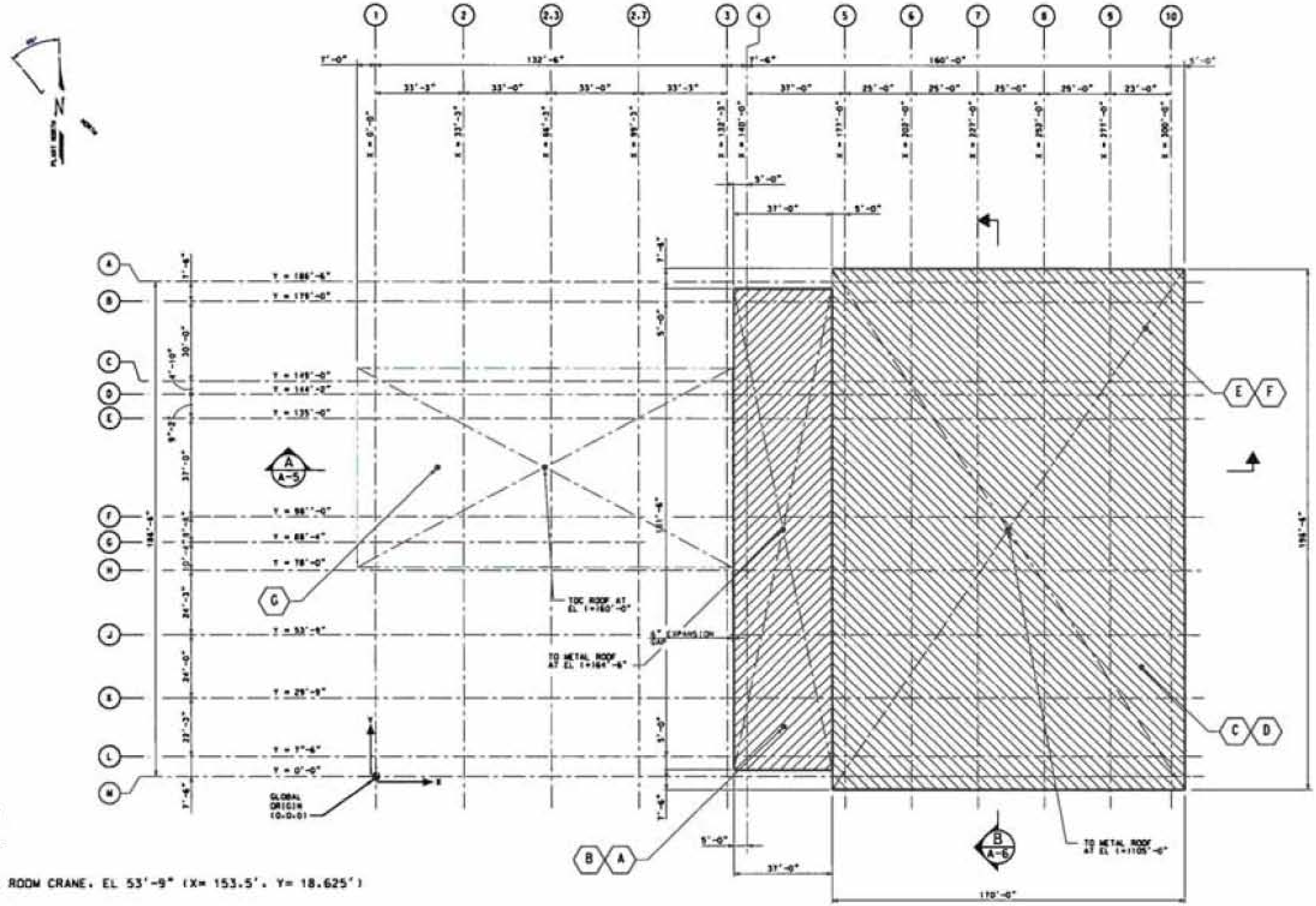
GROUND FLOOR PLAN AT TOC EL 0'-0" TYP UNO



LEGEND:

- 1'-0" FLOOR SLAB
- 2'-4" FLOOR SLAB
- 4'-0" FLOOR SLAB
- 4'-0" WALL
- CHECKERED PLATE

ROOF CONCRETE FORMING PLAN AT TOC EL 37'-0" TYP UNO



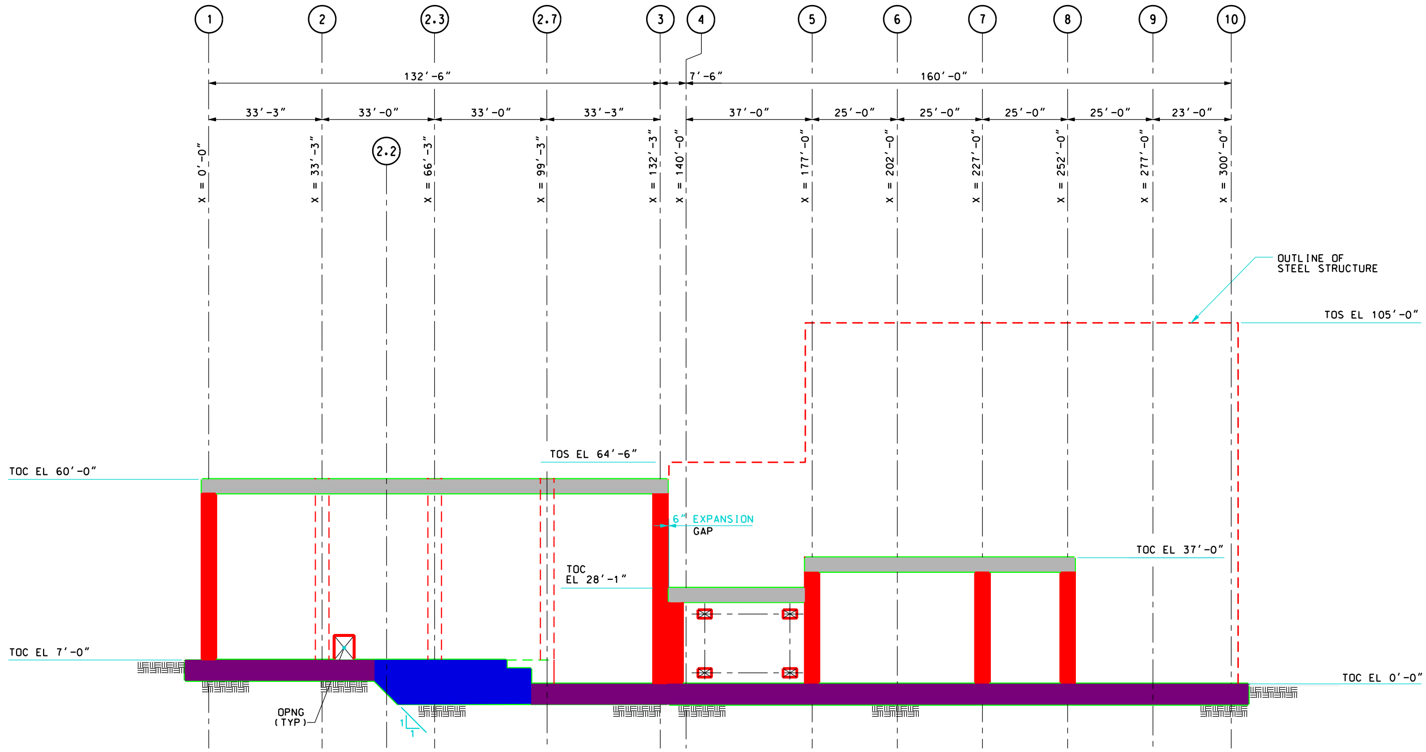
LEGEND:

METAL ROOF

METAL ROOF

- (A) WP CLOSURE ROOM CRANE, EL 53'-9" (X= 153.5', Y= 18.625')
- (B) REMOTE HANDLING SYSTEM CRANE, EL 44'-1" (X= 153.5', Y= 18.625')
- (C) CASK HANDLING CRANE, EL 65'-0" (X= 288.5', Y= 41.75')
- (D) CASK PREPARATION CRANE, EL 87'-9" (X= 288.5', Y= 41.75')
- (E) CTM CRANE, EL 65'-0" (X= 288.5', Y= 161.5')
- (F) CTM MAINTENANCE CRANE, EL 87'-9" (X= 288.5', Y= 161.5')
- (G) WP HANDLING CRANE, EL 37'-0" (X= 16.625', Y= 116.5')

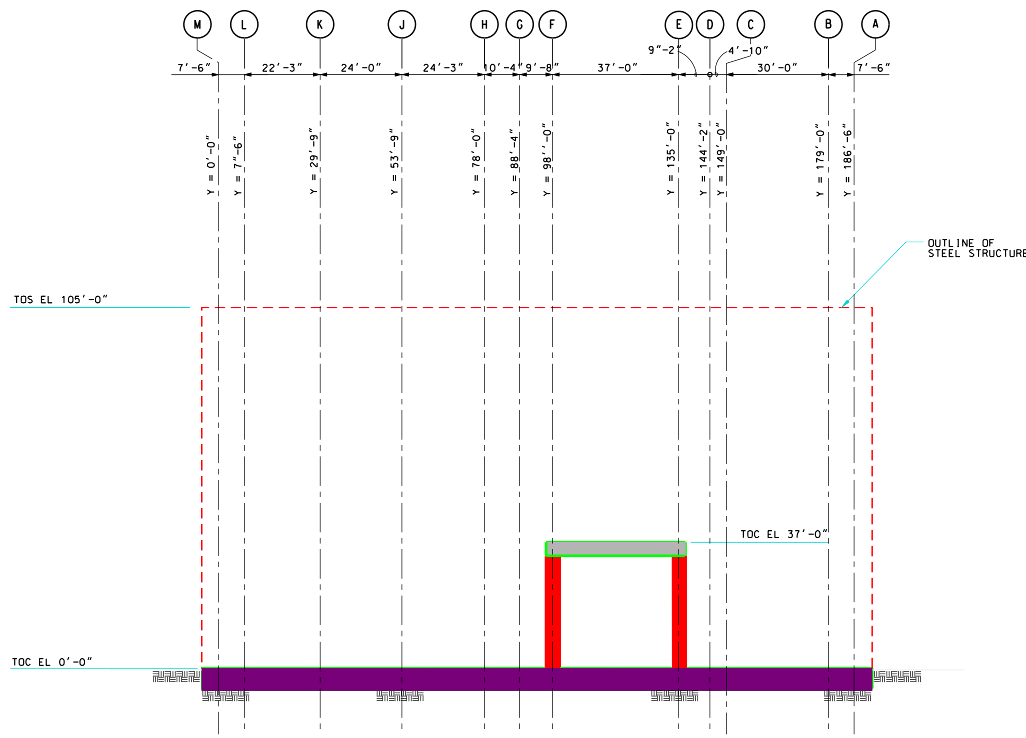
ROOF PLAN AT TOC EL (+)105'-0" TYP UNO



SECTION A
A-2, A-3, A-4

LEGEND:

(blue)	13'-0" BASE SLAB
(purple)	6'-0" BASE SLAB
(gray)	4'-0" FLOOR SLAB
(red)	4'-0" WALL



SECTION B
A-2, A-3, A-4

LEGEND:

6'-0" BASE SLAB

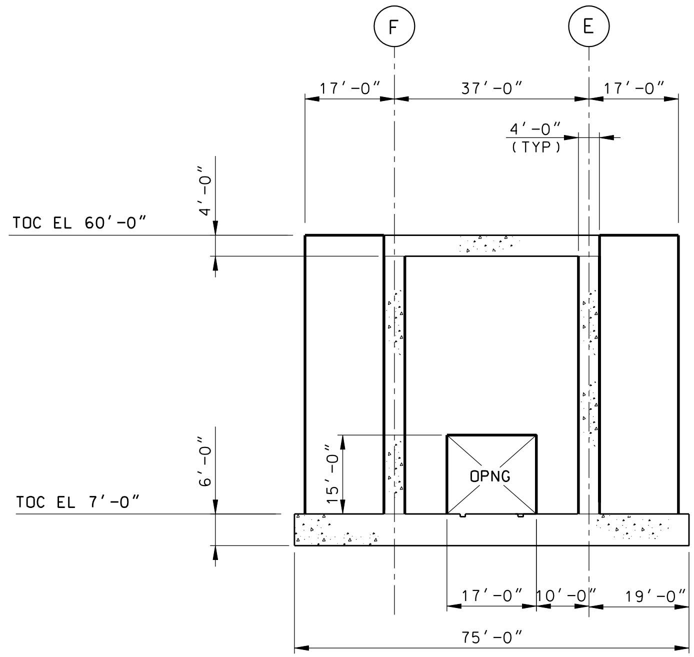
4'-0" FLOOR SLAB

4'-0" WALL

ATTACHMENT B

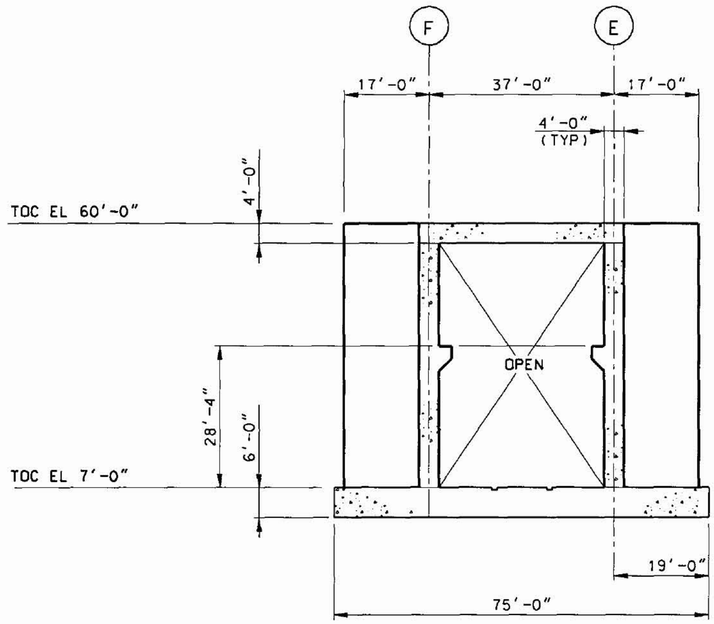
IHF ELEVATIONS

NOTE: ALL DIMENSIONS ARE +/- SIX INCHES

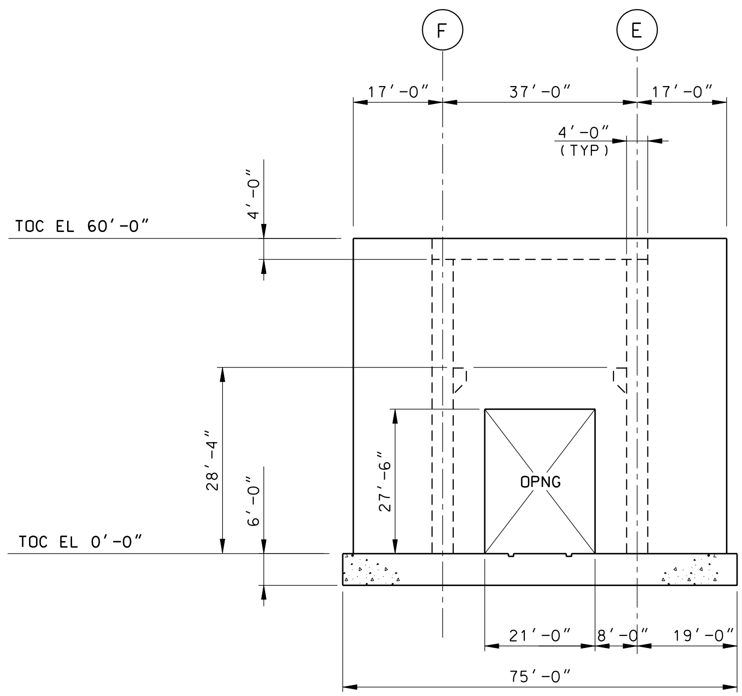


ELEVATION ALONG COL "1"
(LOOKING WEST)

NOTE: ALL DIMENSIONS ARE +/- SIX INCHES

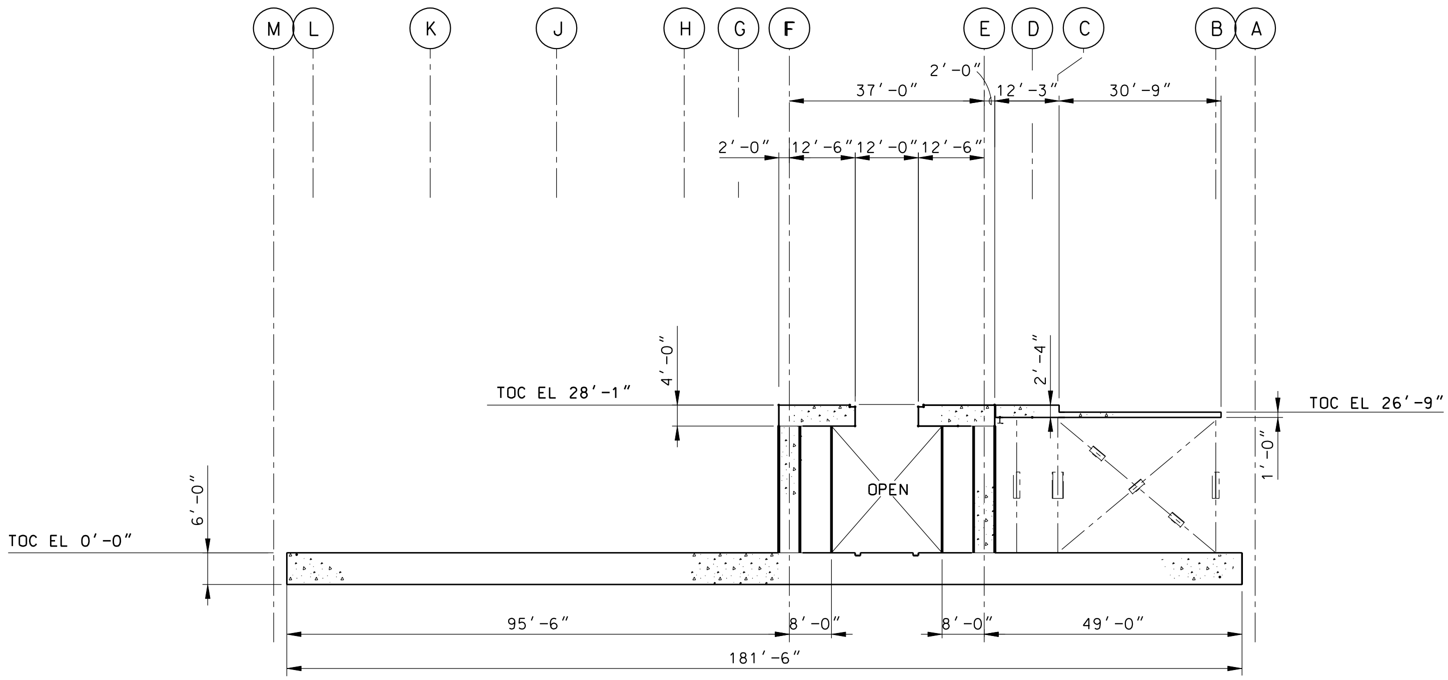


ELEVATION ALONG COL "2"
(LOOKING WEST)

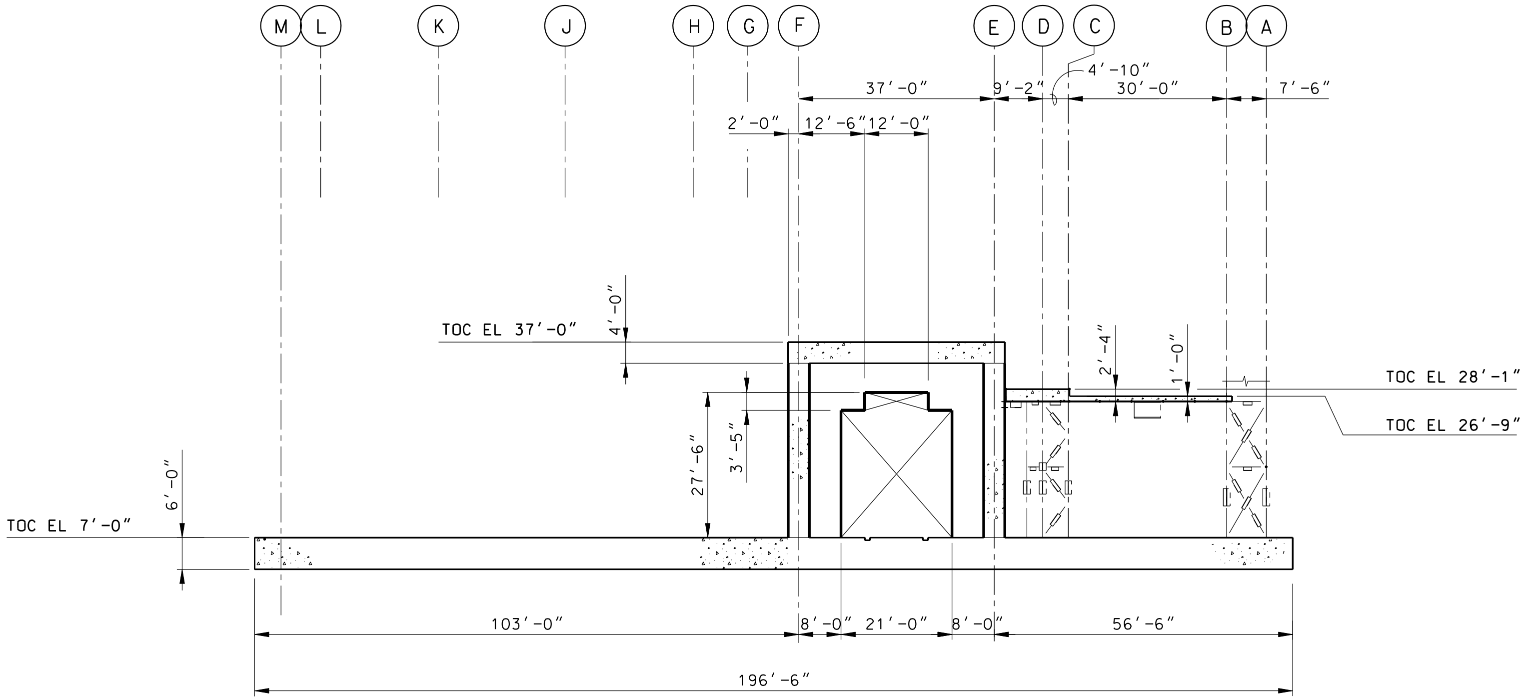


ELEVATION ALONG COL "3"
(LOOKING WEST)

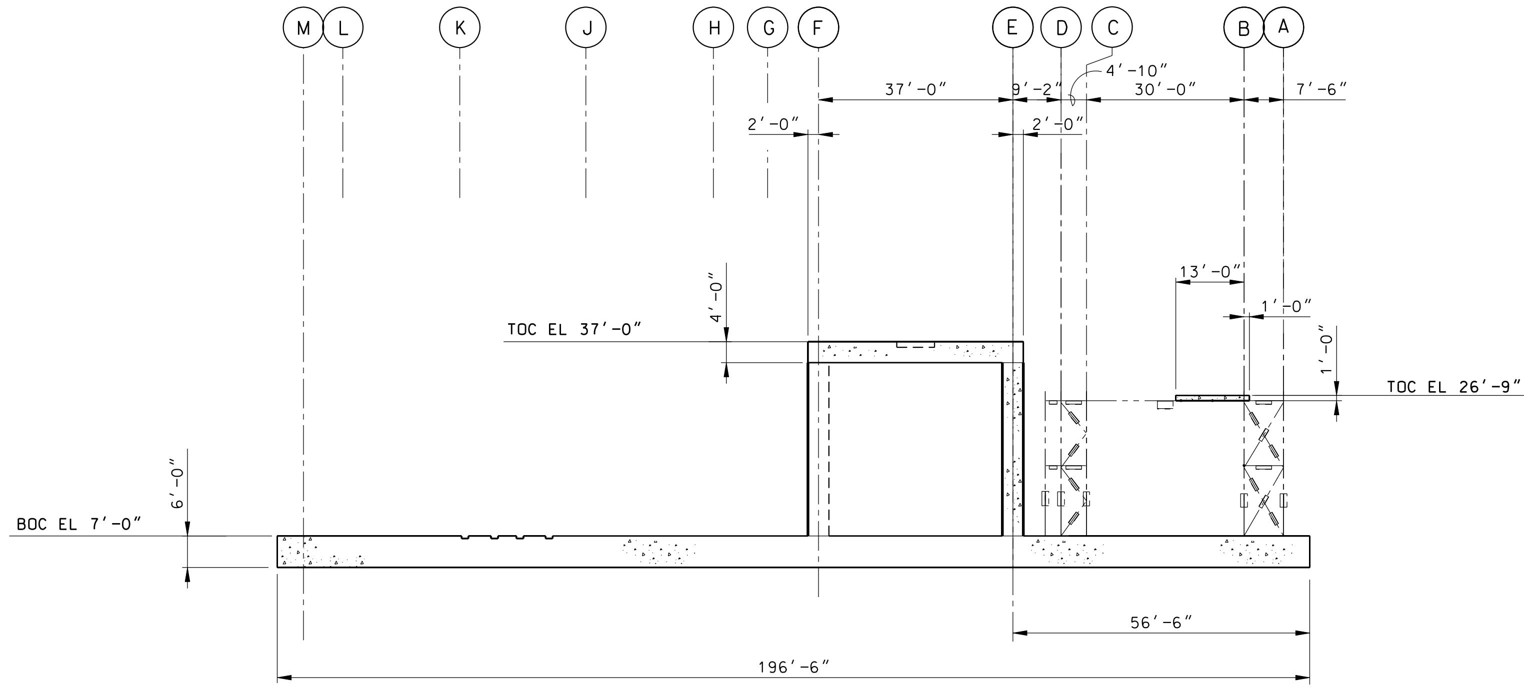
NOTE: ALL DIMENSIONS ARE +/- SIX INCHES



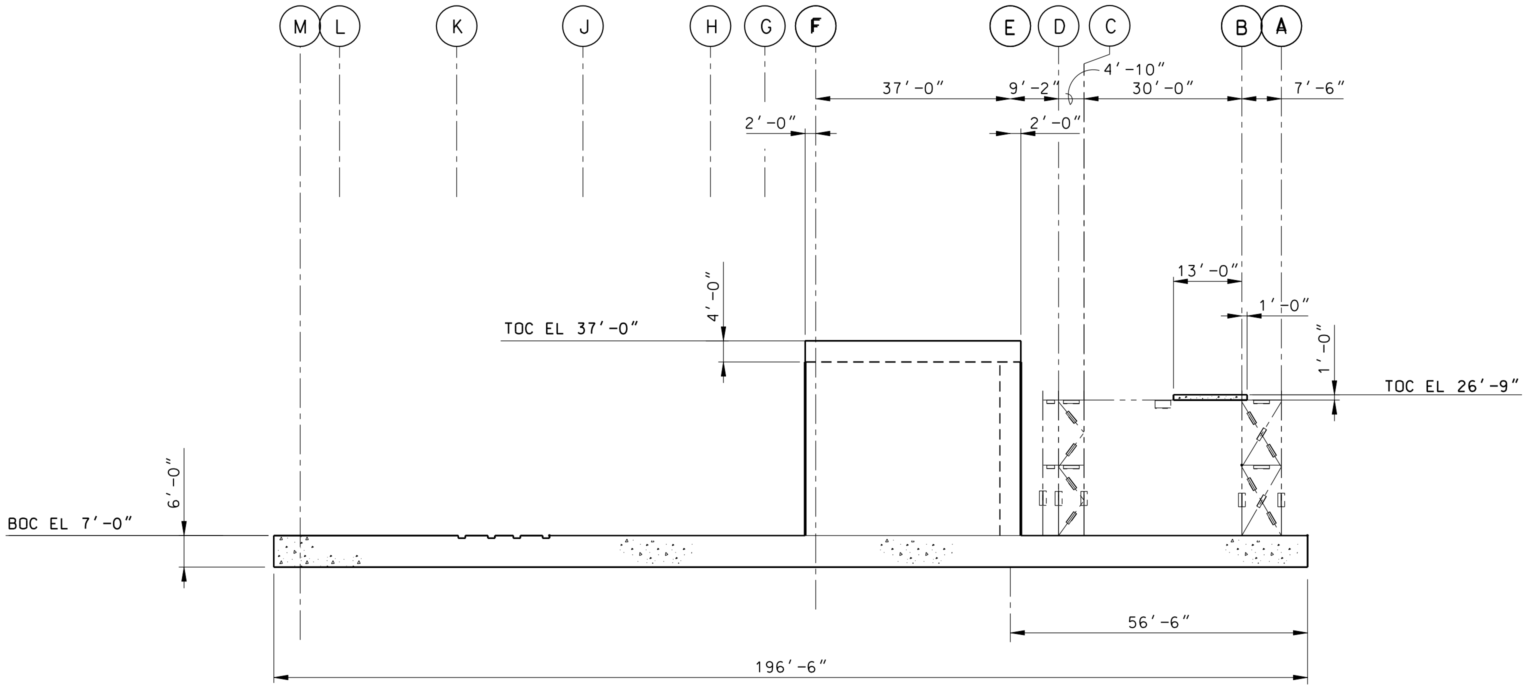
ELEVATION ALONG COL "4"
(LOOKING WEST)



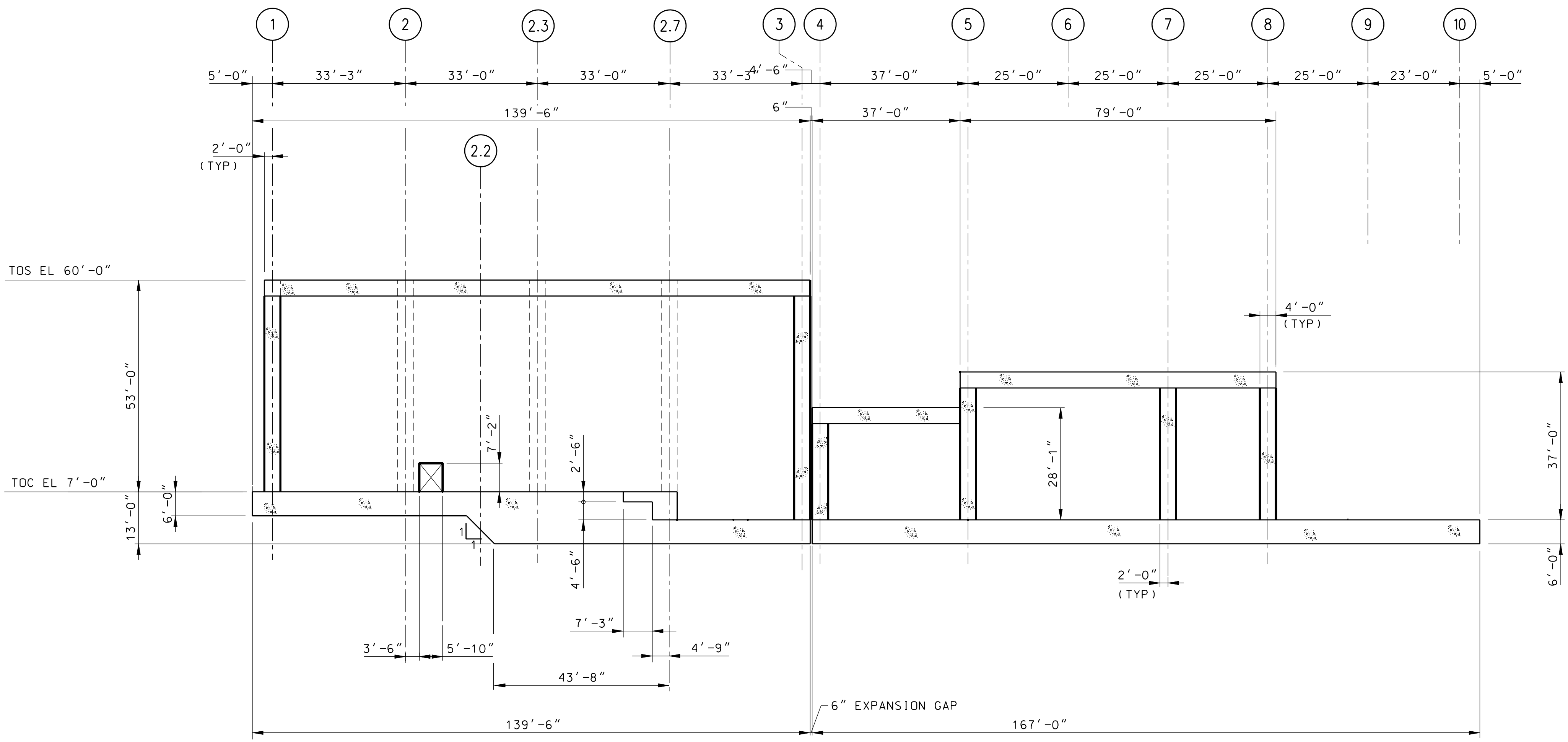
ELEVATION ALONG COL "5"
(LOOKING WEST)



ELEVATION ALONG COL "7"
(LOOKING WEST)

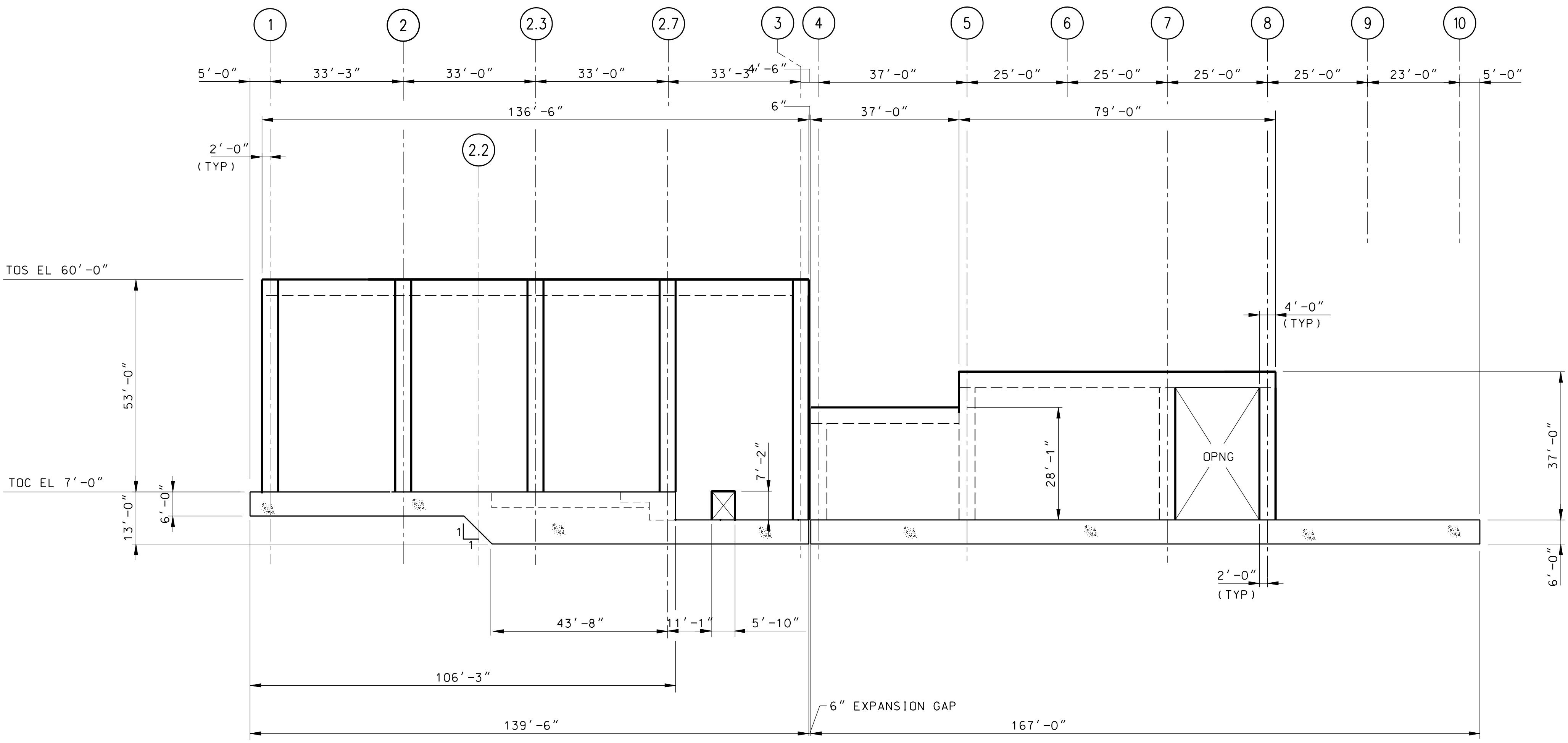


ELEVATION ALONG COL "8"
(LOOKING WEST)



ELEVATION ALONG COL "E"
(LOOKING NORTH)

NOTE: ALL DIMENSIONS ARE +/- SIX INCHES



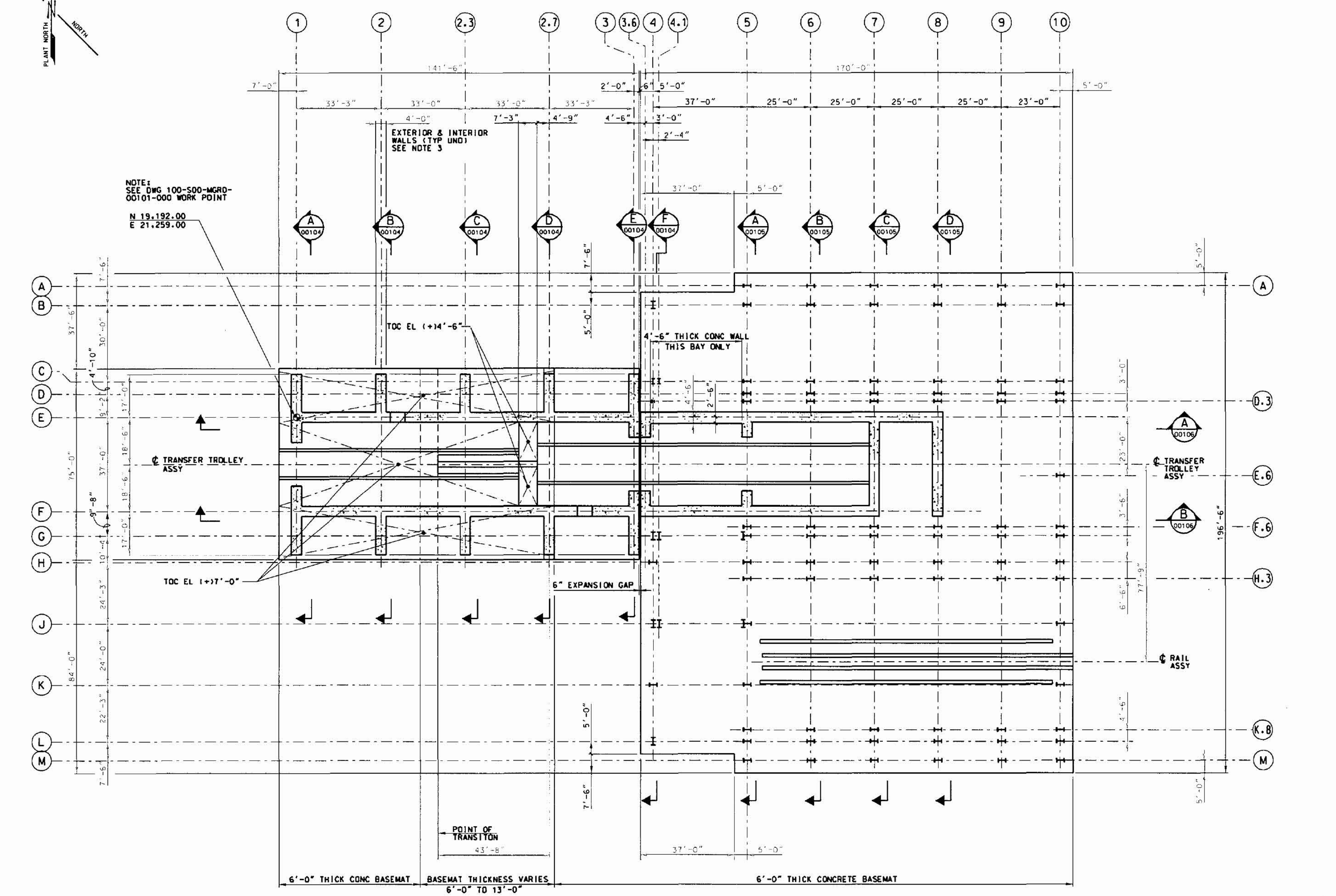
ELEVATION ALONG COL "F"
(LOOKING SOUTH)

ATTACHMENT C

IHF GROUND FLOOR PLAN AND FACILITY GRIDLINES

ATTACHMENT C

IHF GROUND FLOOR PLAN & FACILITY GRIDLINES



GROUND FLOOR CONCRETE FORMING PLAN AT TOC EL 0'-0", TYP UNO

NOTE: IHF EL (+)7'-0" = SITE EL 3678.0 FT

ATTACHMENT D

EMAILS AND INTEROFFICE MEMORANDUMS

Email From:	Salvador Macias
Date:	10/11/2007
To:	IHF Group Engineers
Subject:	Fw: IHF Gridline Coordinate System – Correspondence Log # 1010071991
Page number:	D-2, D-3, D-4, and D-5
Interoffice Memorandum From:	David W. Tooker
Interoffice Memorandum No:	1010071991; CCU.20071011.0006
Date:	10/10/2007
To:	Distribution
Re:	IHF Gridline Coordinate System
Page Number:	D-6 and D-7
Email From:	Salvador Macias
Date:	10/12/2007
To:	IHF Group Engineers
Subject:	Fw: Reference Information for IHF Include New Coordinates, Rail to Rail Dimensions, and New Control Point Information
Page number:	D-8, D-9, D-10, and D-11
Interoffice Memorandum From:	David W. Tooker
Interoffice Memorandum No:	0904071711; CCU.20070905.0011
Date:	09/05/2007
To:	Distribution
Re:	Reference Information for IHF Include New Coordinates, Rail-to-Rail Dimensions, and New Control Point Information
Page Number:	D-12, D-13, and D-14

ATTACHMENT D

DOCUMENT ID:
51A-SYC-IH00-00400-000-00B

Salvador Macias
10/11/2007 01:44 PM

To: Jason Paredes/YM/RWDOE@CRWMS, Charles Lew/YM/RWDOE@CRWMS, Luis Alires/YM/RWDOE@CRWMS, Ray Chou/YM/RWDOE@CRWMS, Hsien-Hsiu Ko/YM/RWDOE@CRWMS, Kuo-Chu Hsu/YM/RWDOE@CRWMS, Elmer Acaac/YM/RWDOE@CRWMS, Alan Ketin/YM/RWDOE@CRWMS, Kiritkumar Parikh/YM/RWDOE@CRWMS, Chyi-Ching Lu/YM/RWDOE@CRWMS, Ken McEwan/YM/RWDOE@CRWMS
cc: Thomas Frankert/YM/RWDOE@CRWMS
Subject: Fw: IHF GRIDLINE COORDINATE SYSTEM - CORRESPONDENCE LOG #1010071991

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

All,

This IOM is a DESIGN INPUT for our calculations: Mass Properties, Soil Springs, Steel calculations, Concrete calculations, etc....... Please ensure to reference this IOM into each of our structural calcualtions.

CALCULATIONS AND ANALYSES
EG-PRO-3DP-G04B-00037, REVISION 9

7. Engineering sketches (EG-PRO-3DP-G04B-00046, *Engineering Drawings*) and studies may be used as design input in preliminary calculations and in committed calculations provided the calculations are not used for procurement, fabrication or construction purposes. Sketches shall be replaced by appropriate drawings in confirmed calculations and committed calculations that are used for procurement, fabrication or construction. The results of engineering studies (EG-PRO-3DP-G04B-00016, *Engineering Studies*) shall be confirmed and replaced by engineering calculations or technical reports prior to using as input in confirmed calculations.

8. When using data from an email or IOM as design input to a calculation or analysis, the originator (as well as the checker and approver) must verify that the data is appropriate for use in the calculation. IOMs are tracked through the correspondence control unit (CCU). The originator shall request the RPM Document Control to log the IOM from CCU into InfoWorks and then establish a link to the IOM. Email should be attached to the calculation with a statement in the body of the calculation as to how (and/or why) the information in the email is being used.

I have attached a copy of "Part of the Calculation and Analyses Procedure, Section 3.2.2. - Section F (Design Inputs), Paragraph 8" for your convenience & to ensure all originators follow the same process.

Thanks,
Sal Macias

ATTACHMENT D

-------------------- Forwarded by Salvador Macias/YM/RWDOE on 10/11/2007 01:26 PM --------------------

BSC Correspondence Control Unit 10/11/2007 01:12 PM

Work Safe America

Sent by: Linda Mantor

To: Thomas Frankert/YM/RWDOE@CRWMS, Lisa Green/YM/RWDOE@CRWMS, Tracy Johnson/YM/RWDOE@CRWMS, Norman Kahler/YM/RWDOE@CRWMS, Maurice LaFountain/YM/RWDOE@CRWMS, Salvador Macias/YM/RWDOE@CRWMS, Arsenio Mendiola/YM/RWDOE@CRWMS, Steve Ployhar/YM/RWDOE@CRWMS, Charles Sauer/YM/RWDOE@CRWMS, Robert Slovic/YM/RWDOE@CRWMS, Frank Trapanese/YM/RWDOE@CRWMS
cc: David Tooker/YM/RWDOE@CRWMS, Leticia Catino/YM/RWDOE@CRWMS, CMS Coordinator@CRWMS
Subject: IHF GRIDLINE COORDINATE SYSTEM - CORRESPONDENCE LOG #1010071991

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

BSC Correspondence Control scans the **interoffice memorandum**, enters it into the Correspondence Control System (a Lotus Notes database) and forwards the memorandum to individuals electronically. The interoffice memorandum attached in the doclink above is for your review and disposition.

If you are on copy for the correspondence attached in the doclink above, it is provided for your information only.

Should you experience difficulty with the doclink, access the Correspondence Control System in Lotus Notes and sort by Log Number to locate correspondence log #1010071991.

Please call Linda Mantor at (702) 821-7301 if you have any questions.

Thank you.

ATTACHMENT D

DOCUMENT ID: 51A-SYC-IH00-00400-000-00B

Correspondence Data Entry Form

Log No: 1010071991

Signed Date	10/10/2007
Subject: IHF GRIDLINE COORDINATE SYSTEM	

○ Outgoing Correspondence
● Interoffice Memorandum
○ Incoming Correspondence

Attached File	1010071991.pdf Enclosure: 1010071991_enc.pdf	CO/TD L No.	
To Name	Distribution	**To Org**	BSC/Repository Project Management
cc	Leticia Catino/YM/RWDOE, CMS Coordinator	**bcc**	
From Name	David Tooker/YM/RWDOE	**From Org**	BSC/Repository Project Management
Author	Neils Sorensen/YM/RWDOE	**Concurrence**	David Tooker/YM/RWDOE
Related Correspondence		**Classification**	QA: N/A (Not LSN Relevant)
From/Creator View Only	○ Y ● N	**Commitment**	○ Y ● N
Status	Signed	**Status Date**	10/11/2007
Comments	Transmitted 10/11/2007 @ 1:12 pm.		
Record Accession	CCU.20071011.0	**Creator of Log**	Leticia Catino

ATTACHMENT D

Number	006	Entry	
Open ATS Database	Open RISWeb		

ATTACHMENT D

~~CCU.20071011.0006~~
FOR REF: KQ 10-19-07

OCT 1 0 2007

DOCUMENT ID:
51A-SYC-1H00-00400-000-00B

BECHTEL SAIC COMPANY, LLC

Interoffice Memorandum

QA: N/A

To:	Distribution	**No.:**	1010071991
From:	David W. Tooker	**Date:**	Oct. 10, 2007
Re:	IHF Gridline Coordinate System	**CC:**	

The purpose of this interoffice memorandum (IOM) is to provide a suitable reference / basis for the facility gridline layout of the Initial Handling Facility (IHF). This IOM will serve as a suitable reference to support the issuance of various IHF drawings. Use of the information contained in this IOM will ensure that work is aligned with the Plant Design equipment model and the Central Support Area Frameworks model.

The following sketch contains the current IHF ground floor plan and facility gridlines, and should be used as input to documents regarding the IHF layout. This sketch has been determined not be Official Use Only.

If you have any questions or require clarification, please call me at (702) 821-7580.

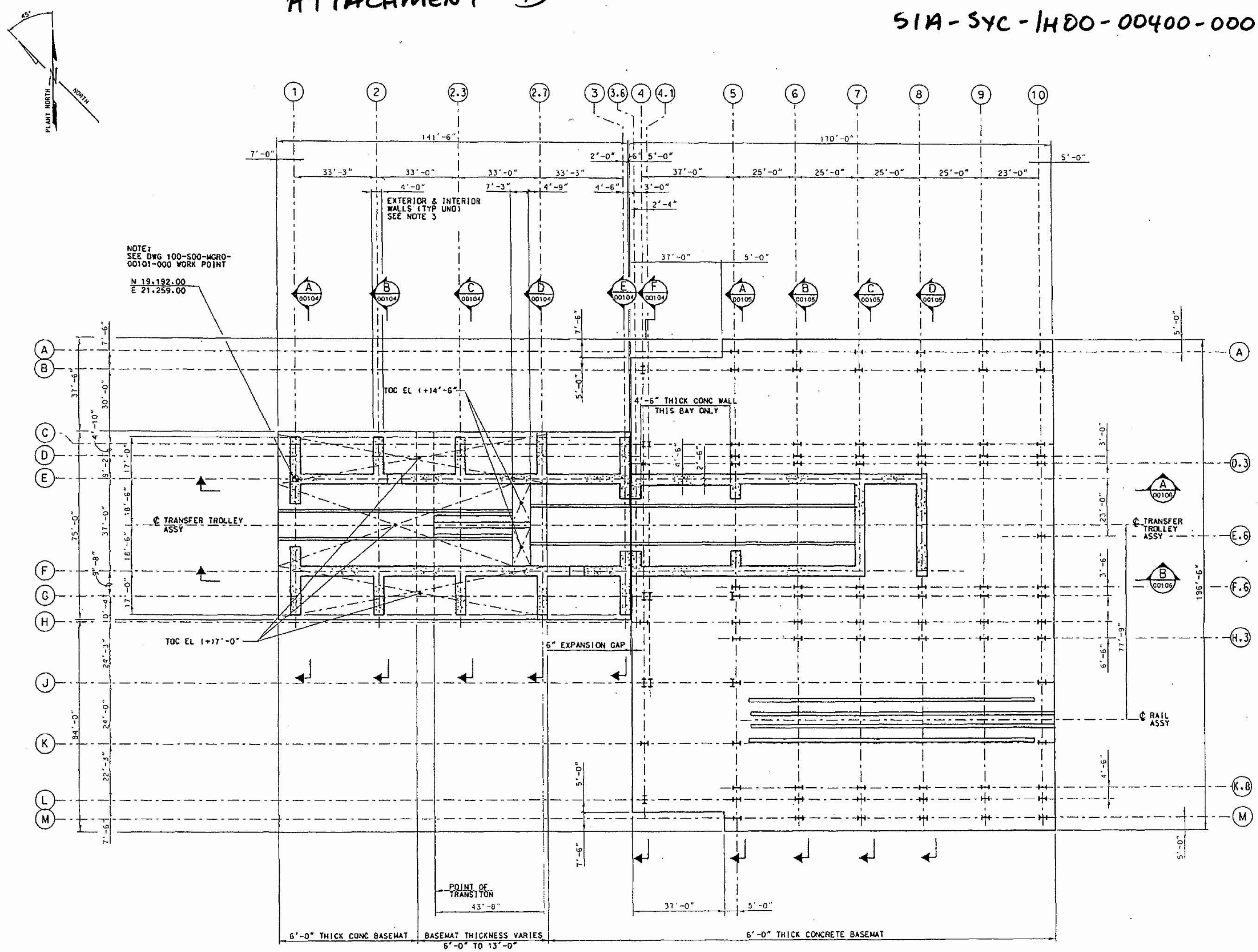
Enclosure:
IHF Layout Design Drawing

Distribution:
Thomas Frankert, BSC, Las Vegas, NV
Lisa V. Green, BSC, Las Vegas, NV
Tracy L. Johnson, BSC, Las Vegas, NV
Norman Kahler, BSC, Las Vegas, NV
Maurice A. LaFountain, BSC, Las Vegas, NV
Salvador C. Macias, BSC, Las Vegas, NV
Arsenio M. Mendiola, BSC, Las Vegas, NV
Steve J. Ployhar, BSC, Las Vegas, NV
Charles L. Sauer, BSC, Las Vegas, NV
Robert C. Slovic, BSC, Las Vegas, NV
Frank X. Trapanese, BSC, Las Vegas, NV

RECEIVED BY BSC CC
DATE: 10/11/2007

ATTACHMENT D

DOCUMENT ID:
51A-SYC-1H00-00400-000-00B



PAGE D-7

GROUND FLOOR CONCRETE FORMING PLAN AT TOC EL 0'-0", TYP UNO

NOTE: IHF EL (+17'-0" = SITE EL 3678.0 FT

Attachment D

Document ID: 51A-SYC-1H00-00400-000-00B

Salvador Macias
10/12/2007 10:29 AM

To: Jason Paredes/YM/RWDOE@CRWMS, Charles Lew/YM/RWDOE@CRWMS, Luis Alires/YM/RWDOE@CRWMS, Ray Chou/YM/RWDOE@CRWMS, Hsien-Hsiu Ko/YM/RWDOE@CRWMS, Kuo-Chu Hsu/YM/RWDOE@CRWMS, Elmer Acaac/YM/RWDOE@CRWMS, Alan Ketin/YM/RWDOE@CRWMS, Kiritkumar Parikh/YM/RWDOE@CRWMS, Chyi-Ching Lu/YM/RWDOE@CRWMS, Ken McEwan/YM/RWDOE@CRWMS
cc: Thomas Frankert/YM/RWDOE@CRWMS
Subject: Fw: REFERENCE INFORMATION FOR IHF INCLUDE NEW COORDINATES, RAIL TO RAIL DIMENSIONS, AND NEW CONTROL POINT INFORMATION

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

All,

Here is a copy of the 2nd IOM to be used as a DESIGN INPUT for our calculations: Mass Properties, Soil Springs, Steel calculations, Concrete calculations, etc.......Please ensure to reference this IOM into each of our structural calculations.

Thanks,
Sal Macias

----------------------- Forwarded by Salvador Macias/YM/RWDOE on 10/12/2007 10:29 AM -----------------------

BSC Correspondence Control Unit 09/05/2007 03:22 PM

[redacted]

Sent by: Linda Mantor

To: Thomas Frankert/YM/RWDOE@CRWMS, Lisa Green/YM/RWDOE@CRWMS, Tracy Johnson/YM/RWDOE@CRWMS, Norman Kahler/YM/RWDOE@CRWMS, Maurice LaFountain/YM/RWDOE@CRWMS, Salvador Macias/YM/RWDOE@CRWMS, Arsenio Mendiola/YM/RWDOE@CRWMS, Steve Ployhar/YM/RWDOE@CRWMS, Charles Sauer/YM/RWDOE@CRWMS, Robert Slovic/YM/RWDOE@CRWMS, Frank Trapanese/YM/RWDOE@CRWMS
cc: David Tooker/YM/RWDOE@CRWMS, Leticia Catino/YM/RWDOE@CRWMS, Ernest Stemley/YM/RWDOE@CRWMS, CMS Coordinator@CRWMS
Subject: REFERENCE INFORMATION FOR IHF INCLUDE NEW COORDINATES, RAIL TO RAIL DIMENSIONS, AND NEW CONTROL POINT INFORMATION
CORRESPONDENCE LOG #0904071711

LSN: Not Relevant - Not Privileged
User Filed as: Excl/AdminMgmt-14-4/QA:N/A

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If you are on copy for the correspondence attached in the doclink above, it is provided for your information only.

Should you experience difficulty with the doclink, access the Correspondence Control System in Lotus Notes and sort by Log Number to locate correspondence log #0904071711.

Please call Linda Mantor at (702) 821-7301 if you have any questions.

Thank you.

Document ID:
SIA-SYC-IH00-00400-000-00B

ATTACHMENT D

Correspondence Data Entry Form

Log No. 0904071711	

Signed Date	09/05/2007
Subject: REFERENCE INFORMATION FOR IHF INCLUDE NEW COORDINATES, RAIL TO RAIL DIMENSIONS, AND NEW CONTROL POINT INFORMATION	

- ○ Outgoing Correspondence
- ● Interoffice Memorandum
- ○ Incoming Correspondence

Attached File	0904071711.pdf Enclosure: 0904071711_enc.pdf	**CO/TDL No.**	
To Name	Distribution	**To Org**	BSC/Repository Project Management
cc	Leticia Catino/YM/RWDOE, Ernest Stemley/YM/RWDOE, CMS Coordinator	**bcc**	
From Name	David Tooker/YM/RWDOE	**From Org**	BSC/Repository Project Management
Author	David Tooker/YM/RWDOE	**Concurrence**	
Related Correspondence		**Classification**	QA: N/A (LSN Relevant)
From/Creator View Only	○ Y ● N	**Commitment**	○ Y ● N
Status	Signed	**Status Date**	09/05/2007

Document ID:

Attachment D

51A-SYC-/H00-00400-000-00B

Comments	Transmitted 09/05/2007 @ 3:22 pm.		
Record Accession Number	CCU.20070905.0011	**Creator of Log Entry**	Leticia Catino
Open ATS Database	Open RISWeb		

ATTACHMENT D

SEP 0 5 2007

DOCUMENT ID:

51A-SYC-IH00-00400-000-00B

~~CCU.20070905.0011~~

FOR Ref:- KP 10-19-07

BECHTEL SAIC COMPANY, LLC

Interoffice Memorandum

QA: N/A

To:	Distribution	**No.:**	0904071711
From:	David W. Tooker DWTooker	**Date:**	Sept. 05, 2007
Re:	Reference Information for IHF Include New Coordinates, Rail-to-Rail Dimensions, and New Control Point Information	**CC:**	

The purpose of this interoffice memorandum (IOM) is to provide a suitable reference / basis for selected layout features of the Initial Handling Facility (i.e., the new (IHF) coordinate grid line identification, new rail centerline-to-centerline dimensions for all of the IHF cranes, and the revised control point information – working point coordinates and elevation of the IHF Building). This IOM will serve as a suitable reference to support preparation and issuance of selected IHF drawings (i.e., the IHF General Arrangement (GA) drawings Revision 00B, and revisions to various mechanical equipment envelope (MEE) drawings until such time that the civil structural drawings and other reference drawings are issued. Use of the information contained within this IOM and enclosure will ensure that all disciplines are aligned with one another and with the Plant Design equipment model and Central Support Area (CSA) Frameworks model.

The information contained in the CSA discipline prepared sketches represents the current up-to-date positions / locations of the steel columns and the up-to-date definition of the coordinate grid lines for the IHF. The CSA sketch of the IHF Ground Floor Plan is located on the L:\\ Drive at the following location: **L:\\ STRU \ LA \ 51A(IHF) ** and the file name is **51ABD0IH0000101.DGN**. The IHF coordinate grid numbering was changed to reflect the addition of structural steel columns and the re-location of several rows of structural steel columns in the facility. The new IHF steel and relocated IHF steel column location changes were made to improve the structural / seismic response of the facility to high seismic conditions that have been imposed on the design of the facility. These necessitated changes for the layout changes and the coordinate grid system for this facility.

Enclosure 1 represents the current up-to-date definition of the crane rail centerline-to-centerline spacing for each of the major cranes in the IHF. The crane rail centerline-to-centerline information contained in enclosure 1 shall be used by all engineering disciplines for the IHF and is consistent with the dimensions that were used in the CSA Frameworks model for the IHF.

The control point information for the IHF is as presented below and on Drawing Number 100-C00-MGR0-00501-000, Revision 00C:

RECEIVED BY BSC CC
DATE: 09/05/2007

SEP 05 2007

ATTACHMENT D

DOCUMENT ID:

51A-SYC-IH0D-00400-000-00B

Control Point (E/1)

Plant N Coordinate 19,192.0, Plant E Coordinate 21,259.0, and Elevation 3678.00

Please consider this as direction to proceed on the basis of the information contained in this IOM and in enclosure 1 for completion of the near-term IHF calculations and associated IHF drawings (i.e., GA drawings and Mechanical Handling MEE drawings). In the future, the CSA structural discipline IHF calculations and concrete and steel drawings will be issued that will utilize the new IHF coordinate system and the crane rail centerline-to-centerline dimensions as presented above.

If you have any questions or require clarification, please call me at (702) 821-7580.

Enclosure:
Tabulation of IHF Cranes Rail
Centerline-to-Centerline Dimensions

Distribution:
Thomas Frankert, BSC, Las Vegas, NV
Lisa V. Green, BSC, Las Vegas, NV
Tracy L. Johnson, BSC, Las Vegas, NV
Norman Kahler, BSC, Las Vegas, NV
Maurice A. LaFountian, BSC, Las Vegas, NV
Salvador C. Macias, BSC, Las Vegas, NV
Arsenio M. Mendiola, BSC, Las Vegas, NV
Steve J. Ployhar, BSC, Las Vegas, NV
Charles L. Sauer, BSC, Las Vegas, NV
Robert C. Slovic, BSC, Las Vegas, NV
Frank X. Trapanese, BSC, Las Vegas, NV

ATTACHMENT D

DOCUMENT ID:

51A-SYC-IH00-00400-000-00B

September 04, 2007 IOM from
D. Tooker to Distribution
Enclosure 1, Sheet 1 of 1

TABULATION OF INITIAL HANDLING FACILITY (IHF) CRANES RAIL CENTERLINE-TO-CENTERLINE DIMENSIONS

IHF CRANE NAME	CRANE RAIL-CENTERLINE-TO-RAIL-CENTERLINE DIMENSION
IHF Canister Transfer Machine (CTM) rail-to-rail dimension	= 49'-4"
IHF CTM Maintenance rail-to-rail dimension	= 51'-4"
IHF Cask Handling Crane rail to rail dimension	= 59'-6"
IHF Cask Preparation Crane rail to rail dimension	= 65'-6"
IHF Waste Package Closure System (WPCS) Remote Handling System (RHS) rail to rail dimension	= 28'-4"
IHF Waste Package Closure Room Crane rail to rail dimension	= 28'-4"

ATTACHMENT E

CD – EXCEL FILES FOR IHF MASS PROPERTIES CALCULATION

Mass Properties data on CD:

- 1st part of IHF_Mass Prop.xls
- 2nd part of IHF_Mass Prop.xls