# STRUCTURAL CONDITION ASSESSMENT
1210 Michigan Ave
Miami Beach, Florida

Prepared for

Bercow Radell Fernandez Larkin + Tapanes

December 5, 2024
H241960

PREPARED BY

www.yhengineering.com

99 NW 27 AVE, Miami, FL. 33125, (305) 969-9423, Fax (305) 969-9453

Youssef Hachem Consulting Engineering


Digitally signed by Youssef H Hachem
DN: CN=Youssef H Hachem,
dnQualifier=A01410D0000018C833CDD940012794F,
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STRUCTURAL CONDITION ASSESSMENT for
1210 Michigan Ave
Miami Beach, Florida

I. INTRODUCTION

**General**

Per the request of Bercow Radell Fernandez Larkin + Tapanes, we have conducted a visual structural condition assessment on the existing structure located at 1210 Michigan Ave in Miami Beach, Florida.

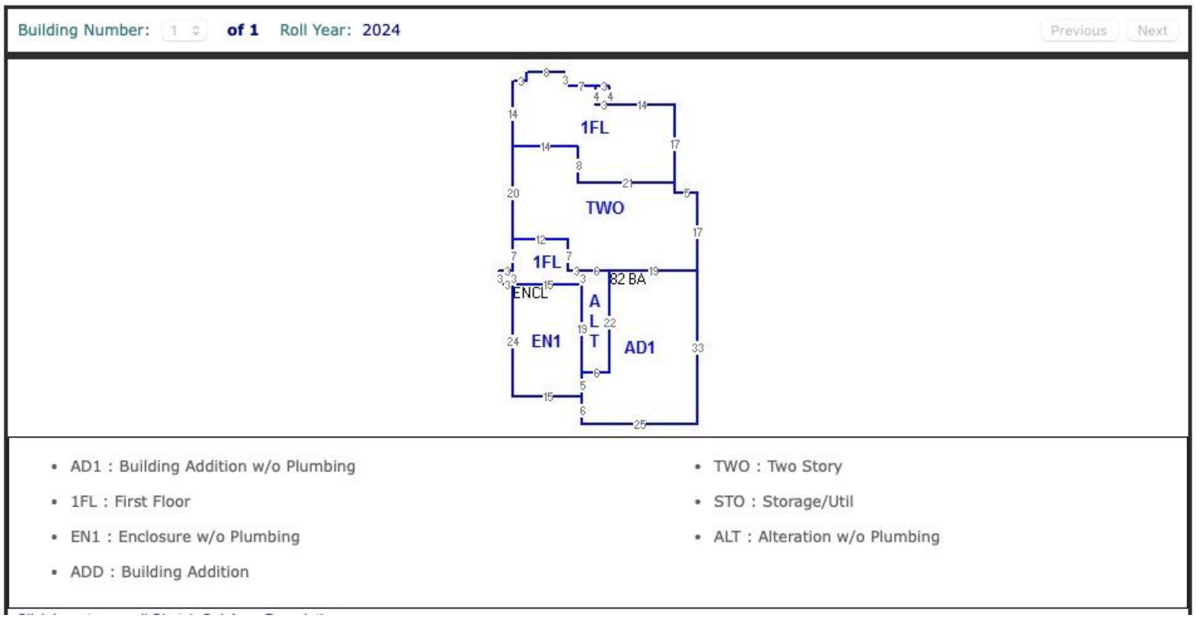

The purpose of the inspection is to assess the structural condition of the property.

**Structural System**

The Structure is a two story masonry building, that was built in three phases.

**BUILDING INFORMATION**

| Building Number | Sub Area | Year Built | Actual Sq.Ft. |
|---|---|---|---|
| 1 | 1 | 1940 | 2,759 |
| 1 | 2 | 1982 | 693 |
| 1 | 3 | 1995 | 21 |




The original building was built in 1940, with 2,759 square feet per Miami Dade Property Tax office. Subsequent additions were in 1982 and 1995.

The Building Structural System is as follows:

Original Construction

- First Floor:
  - Elevated wood floor framing, with wood planking supported by 2x12 wood joists at 24" o/c
  - Shallow foundations 10"x24" around the perimeter of the structure
  - Exterior unreinforced masonry bearing walls
  - Interior wood load bearing stud walls
- Second Floor:
  - Wood floor framing, with wood planking

- Exterior wood bearing walls
- Interior wood load bearing stud walls

- Roof:
  - Gabled roof with Slate

Additional Construction

- First Floor:
  - Part of elevated wood floor framing, with wood planking supported by 2x6 wood joists at 16” o/c, and slab on grade
  - Shallow foundations 10”x246” around the perimeter of the structure
  - Exterior unreinforced masonry bearing walls
  - Interior wood load bearing stud walls
- Roof:
  - Flat roof Pre-engineered Wood truss system 18” deep at 24” o/c.
  - Built up roofing waterproofing system

The components and cladding of the house, such as doors, windows and roof waterproofing are not addressed in this report.

## II. METHODOLOGY

This inspection was visual in nature from the exterior and interior of the building. Our office did not perform any destructive or non-destructive testing, however previous engineering reports were provided to this office and they are as follows (provided in Appendix C):

1- Calc Engineering report dated 9/16/24 for Concrete compressive strength
2- Calc Engineering report dated 9/7/24 for Structural Analysis and Calculations for Existing House Condition
3- Calc Engineering report dated 7/21/24 for Engineering Inspection Report

Currently, there are several locations in the building that has decayed wood framing which made a full inspection in parts of the building challenging. Every attempt was made to access all portions of the building to observe any signs of distress in the structural members of the building, which includes masonry, wood, and concrete. Distress signs are cracking, spalling, water damage, and termite damage.

## III. STRUCTURAL SYSTEMS

**Foundations:** The building is built on shallow foundations about 24” wide x 12” thick. The foundations support a concrete stem walls (interior and exterior). The interior stem walls support the interior wood stud walls and the exterior stem walls support the exterior masonry walls.

**Exterior Walls:** The exterior walls of the building are unreinforced masonry block with stucco.

**Interior Walls:** There are two types of interior walls, load bearing and non-load bearing. Both types are wood 2”x4” stud walls. The load bearing walls support the floor joists system extending from the exterior walls. These stud walls are in turn supported by the concrete stem walls and foundations.

**Floors:** For the original construction, the wood floor joists are 2”x12” spaced at 24” on center, and spanning from the exterior CMU wall over the interior load bearing wood stud walls. The joists system is supporting the wood decking wood which makes up the 1st and 2nd floor system. All wood joists are “Fire Cut” into the wood wall, meaning the wood joists are resting in openings in the wood wall and are not connected to the walls via strapping or any other mechanism.

As for the new construction the floor system is 2”x6” joists spanning between bearing walls.

**Roof**: Wood Rafter roof is on the original construction and flat pre-engineered rood flat trusses are on the addition.

IV. SITE OBSERVATIONS

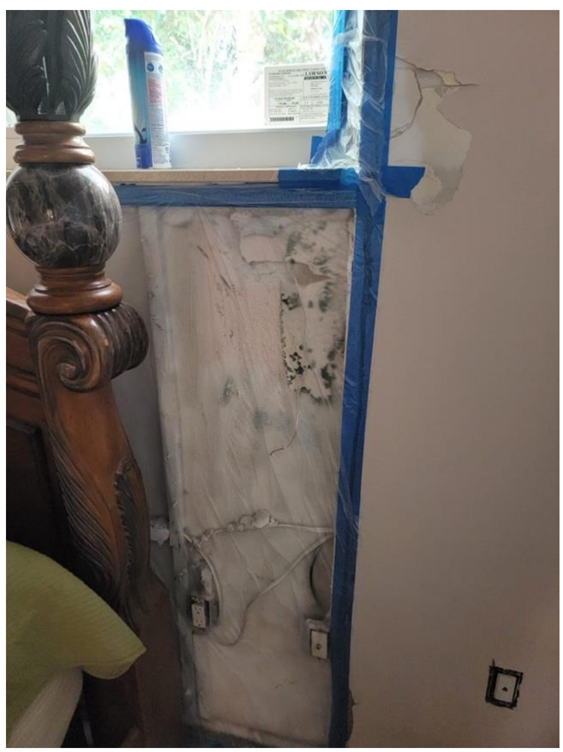
We have inspected the structure on several occasions, and our summary of the evaluation of the existing conditions of the structural components are as follows:

Wood members; The roof of the structure has failed in multiple locations, and the moisture intrusion had caused severe and extensive damage to all the wood members of the building (please see photos). There is moisture damage (rot) of wood, that has caused wood members to deflect, sag, and fail.

Roof Deflections and moisture intrusion

Roof Deflection and moisture intrusion

Moisture intrusion



Moisture intrusion

Moisture Intrusion

The foundations are severely deteriorated, and reinforcing rebars are corroded. The damage is accelerated by the fact that the house is affected by continuous flooding as the top of floor elevation is 5.68’ NGVD which is lower than FEMA flood elevation of 8.00’ NGVD.

The house first floor joists have been supported in a rudimentary fashion due to the floor sagging and settlement.

Floor Deflection and sagging

Damaged foundations

Damaged foundations

Previous repairs

Foundation Settlement

Wall Cracking Due to Settlement

Vertical members cracking

## V. STRUCTURAL EVALUATION

There are several factors to be considered in the structural evaluation of this building;

Initial Construction:

Building construction and standards of the 1940’s are considered deficient in today’s standards. This applies to this structure and other structures built in the 1940’s. This building under current building code is deemed deficient. The structure’s roof connections for wind uplift forces, and for wind lateral resistance are non-existent. Moreover, openings protection, and wood reinforcing is also non-existent. To develop this building, it has to undergo level III alteration of the Florida Building Code 2023 for existing structures. This means that the building has to be strengthened to comply with the current Florida Building Code. Which means that the roof connection tie downs have to be implemented to strengthen the roof, and lateral load structural systems have to be installed such as shearwalls. Wall openings such as doors and windows and the exterior wood walls have to reinforced. Hence, the foundations also have to be strengthened to resist such lateral loads.

Materials Status:

Site Conditions

Based on the visual observation in the field, all the wood members of the building such as the roof, floor joists on all floors, and interior stud walls are in poor and failing condition. There are no wood connectors present and wood members are not connected structurally.

The structural elements of the house including foundations, floor joists, floor beams, walls, stairs are compromised and vary in deterioration from 60%-80% and are no longer supporting their intended use, and cannot be depended on for safety and are in imminent danger of collapse.

Based on the Calcs reports, the results of the calculations reports show that the structure is unstable and is under-reinforced and does not sustain code required loads.

VI. LIFTING DUE TO FLOODING

The current house foundations are in poor condition, and cannot support the house based on the continuous water intrusion, and the lack of inappropriate support.

The Top of first floor elevation is at 5.42’ NGVD (see survey in appendix).
FEMA flood elevation is 8.00’ NGVD.


Hence to comply with flood elevations the house has to be lifted so the first floor slab elevation has to be raised to elevation 9.00’ NGVD.

The difference in elevation is 9.00’-5.42’ = 3.58’ of hydrostatic pressure that will be subjected on the ground floor slab, which is approximately 360 Punds per square foot. To avoid the stresses, we would raise the house. However, due to the concrete spalling and rebar corrosion,  we are not confident that the foundations will not fail during the lifting process.

## VII. RECOMMENDATIONS

Based on the site observations of the conditions of structural members of the building and level III alteration required by the Florida Building Code, the structural members of this building need to be replaced rather than repaired. Hence, in order to do so, these structural members need to be demolished.

The structure is in poor condition, leading to deficient structural conditions. The structural members which are mainly wood are deteriorated and moisture damaged and rotting. Most of the structural members cannot be replaced.

We are not confident that the replacement process will not damage the structure, even furthermore due to the connectivity between the members.

Structure does not comply with today's building code, and even when certain parts of it were built.

Based on the Calc reports (please see appendix), the structure is failing under code required loads, hence its not safe.

It is in imminent danger of collapse as it lacks any lateral support system, proper design and construction when portions of it were constructed, and current decay conditions of the structural member deem it unstable to support load conditions of the current permitted use.

APPENDIX A

PHOTOS

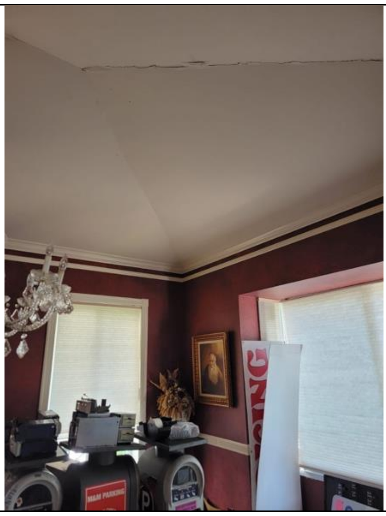
Overall view of structure

Overall view of structure

House elevation

Flat roof view

Flat roof view



Roof sagging and finish cracking

| | |
|---|---|
|  |  |
| Roof sagging and finish cracking | Floor sagging |

| | |
|---|---|
|  |  |
| Moisture intrusion | Wall settlement and finish cracking |

|  |  |
| --- | --- |
| Moisture intrusion | Concrete spalling and rebar corrosion |

| | |
|---|---|
|  |  |
| Floor sagging and previous repairs | Foundation cracking |

| | |
|---|---|
|  |  |
| Foundation cracking and spalling | Concrete spalling and rebar corrosion |

Appendix B
Calculations

# Concrete Compressive Testing

Regarding:
1210 Michigan Ave Miami Beach, FL 33139

Date: 9/16/2024

TO WHOM IT MAY CONCERN

CALC ENGINEERING performed an inspection and concrete compressive test at property located at 1210 Michigan Ave Miami Beach, FL 33139. CALC ENGINEERING performed concrete testing in concrete foundation and tie beam at the top level in exterior of the building. Five testing performed around exterior of the building facing east and west side of the property. Below is an average of the results of those areas. Testing performed using Digital Schmidt Hammer Concrete Ultrasonic Tester.

East side reading concrete compressive strength average 2670 psi
West side reading concrete compressive strength average 2667 psi

All five readings are less than 3000 psi as required by Florida Building Code,

Transmitted herewith is the inspection letter and testing and stating my professional opinion and if needed repair or replacement solution on existing work. Our recommendation in this letter is proper and applicable for the time of inspection, and not for future. It is our purpose to provide information on the condition of the structure on the day of the inspection, and not to provide discussions or recommendations concerning the future maintenance of the structure.
Thank you for asking Calc Engineering to perform this important inspection work for you.
If you have any questions after reviewing this report, please feel free to call me at my office with 305-898-9995. Please do not hesitate to contact me, if you have any question regarding this report.

Masood Hajali, PhD, PE
PE License number 82038
2000 NW 89 PL UNIT 102
DORAL FL 33172
Cell: 305 898-9995
masood@calceng.com

# 1210 MICHIGAN AVE

**1210 MICHIGAN AVE, MIAMI BEACH, FL 33139, USA**
FOR: Andrew Mirmelli

## Structural Analysis and Calculations for Existing House Condition

Calc Engineering
Calc Engineering LLC
2000 NW 89 PL UNIT 102 DORAL FL 33172
masood@calceng.com
Phone +1 (305) 898-9995
www.calceng.com

| | Date | Prepared by | Project Number: | Rev. |
|---|---|---|---|---|
| | 07-Sep-24 | SRS | S-24119 | 0 |
| Filepath: | | | | |

Calc Engineering LLC
2000 NW 89 PL UNIT 102 DORAL FL 33172
masood@calceng.com
Phone +1 (305) 898-9995
www.calceng.com

Reference

**Table of Contents:**

## Chapter 1: Design Criteria

### 1.1 Introduction

Scope of this calculation report is to provide preliminary assessment of an as-built residential structure. Project is located at "1210 Michigan Ave, Miami Beach, FL 33139, USA"

All calculations are with in reference to 8TH Edition of FBC-2023, and ASCE 7-22, ACI 318-19(22), TMS 402/602-16(22) based on the existing house components.

Refer below snips of mentioned structure.


This report examines the single-story flat and tile roofed area, due to its status as the most recent component of the structure.

Refer following pages for design loadings.

**Chapter 1: Design Criteria Cont'd...**

## 1.2 Design Loads

### A. Dead Load:

***Roof Load:***

| | |
|---|---|
| Roofing | 4.0psf |
| Insulation | 3.0psf |
| Self-Weight of Roof Deck | 3.0psf |
| Self-Weight of Wooden Framing | 4.0psf |
| MEP | 2.0psf |
| Misc. | 2.0psf |
| **Total** | **18.0psf** |

***Wall Load:***

| | |
|---|---|
| 8" CMU WALL | 81.0psf |
| Stucco Finish | 18.0psf |
| Total | **99.0psf** |

***(Refer Architectural Drawings)***

### B. Live Load:

***Roof Load:*** **20.0psf** ***(Table-1607.1,FBC-2023)***

## Chapter 1: Design Criteria Cont'd...

### C. Wind Load:

***Building Data:***

| | |
|---|---|
| Type of Roof : | Flat |
| Length of Building (L) : | 32 ft |
| Width of Building (B) : | 40 ft |
| Height of Building/Eaves (H) : | 9 ft |
| Parapet Height (h) : | 3 ft |

***General Wind Requirements:***

| | | |
|---|---|---|
| Basic Wind Speed ($V_b$) : | 170.00 mph | ***(Refer ASCE hazard tool report)*** |
| Risk Category : | II | |
| Wind Exposure Category : | D | |

***Design Wind Pressure (DD):***

**Pressure Along N-S Direction :**

| | |
|---|---|
| Windward pressure, P.mww : | **45.96 psf** |
| Leeward pressure, P.mlw : | **-10.82 psf** |

**Pressure Along E-W Direction :**

| | |
|---|---|
| Windward pressure, P.mww : | **45.96 psf** |
| Leeward pressure, P.mlw : | **-13.09 psf** |

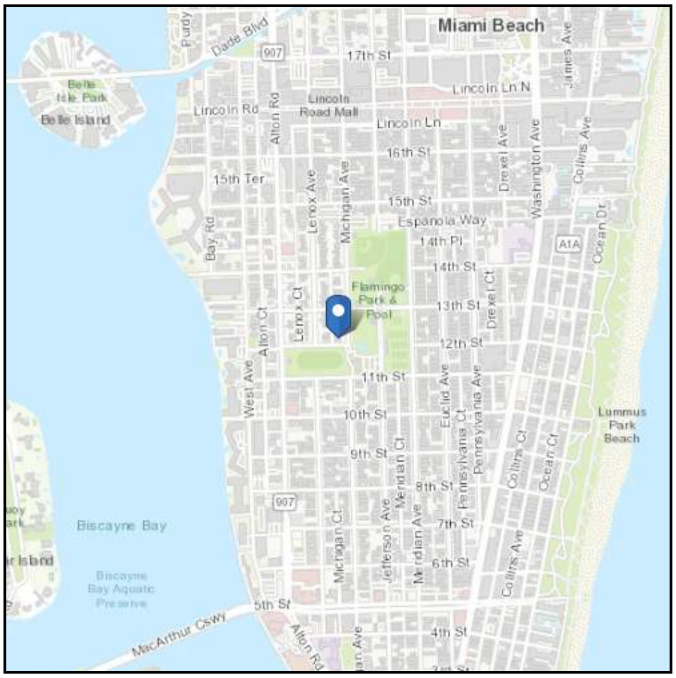
**Refer Attached Detailed Report of  Wind Pressure calculation*

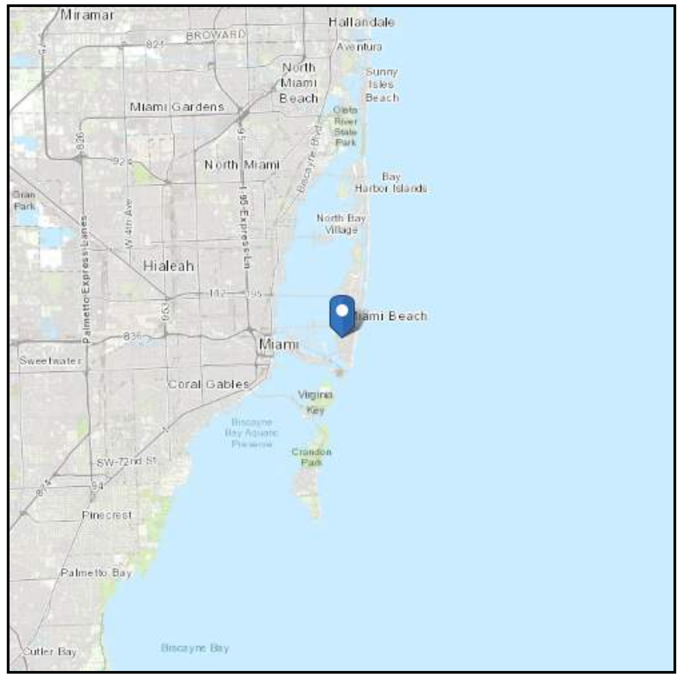
*Refer following pages for wind loading reports.*

# ASCE Hazards Report

**Address:**
1210 Michigan Ave
Miami Beach, Florida
33139

| | | | |
|---|---|---|---|
| **Standard:** | ASCE/SEI 7-22 | **Latitude:** | 25.783042 |
| **Risk Category:** | II | **Longitude:** | -80.138949 |
| **Soil Class:** | DE | **Elevation:** | 3.54531332539228 ft (NAVD 88) |




## Wind

**Results:**

| | |
|---|---|
| Wind Speed | 170 Vmph |
| 10-year MRI | 77 Vmph |
| 25-year MRI | 113 Vmph |
| 50-year MRI | 129 Vmph |
| 100-year MRI | 140 Vmph |
| 300-year MRI | 158 Vmph |
| 700-year MRI | 170 Vmph |
| 1,700-year MRI | 183 Vmph |
| 3,000-year MRI | 191 Vmph |
| 10,000-year MRI | 203 Vmph |
| 100,000-year MRI | 230 Vmph |
| 1,000,000-year MRI | 257 Vmph |

Data Source: ASCE/SEI 7-22, Fig. 26.5-1B and Figs. CC.2-1–CC.2-4, and Section 26.5.2

Date Accessed: Fri Sep 06 2024

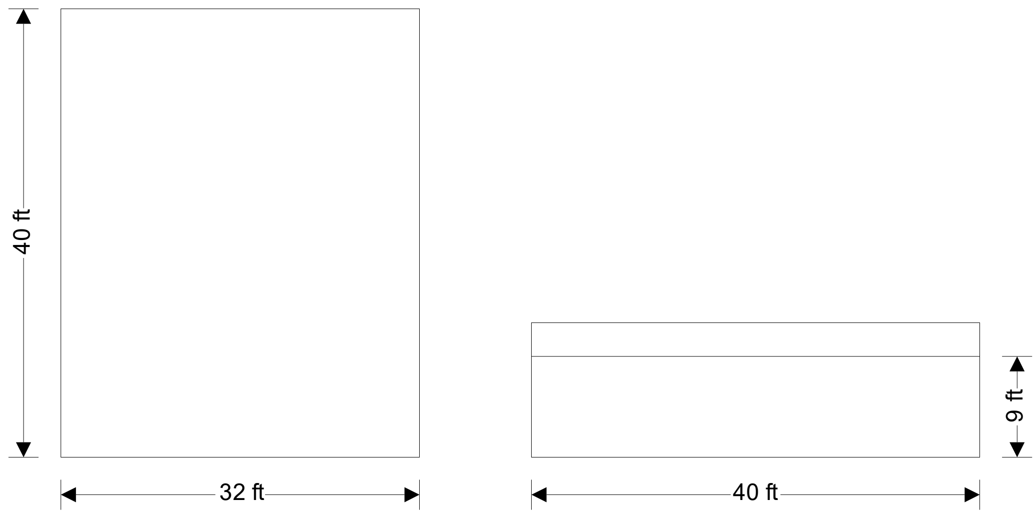
## Chapter 1: Design Criteria Cont'd...

**WIND LOADING**

**In accordance with ASCE7-22**

**Using the directional design method**

Tedds calculation version 2.1.16




Plan

Elevation

**Building data**

| | |
|---|---|
| Type of roof | Flat |
| Length of building | b = **32.00** ft |
| Width of building | d = **40.00** ft |
| Height to eaves | H = **9.00** ft |
| Height of parapet | $h_p$ = **3.00** ft |
| Mean height | h = **9.00** ft |

**General wind load requirements**

| | | |
|---|---|---|
| Basic wind speed | V = **170.0** mph | *Refer ASCE Hazard tool report* |
| Risk category | II | |
| Velocity pressure exponent coef (Table 26.6-1) | $K_d$ = **0.85** | |
| Ground elevation above sea level | $z_{gl}$ = **3** ft | |
| Ground elevation factor | $K_e = \exp(-0.0000362 \times z_{gl}/1ft)$ = **1.00** | |
| Exposure category (cl 26.7.3) | C | |
| Enclosure classification (cl.26.12) | Enclosed buildings | |
| Internal pressure coef +ve (Table 26.13-1) | $GC_{pi\_p}$ = **0.18** | |
| Internal pressure coef –ve (Table 26.13-1) | $GC_{pi\_n}$ = **-0.18** | |
| Gust effect factor | $G_f$ = **0.85** | |
| Minimum design wind loading (cl.27.1.5) | $p_{min\_r}$ = **8** lb/ft$^2$ | |

**Topography**

| | |
|---|---|
| Topography factor not significant | $K_{zt}$ = 1.0 |
| Velocity pressure equation | $q = 0.00256 \times K_z \times K_{zt} \times V^2 \times 1psf/mph^2$ |

## Chapter 1: Design Criteria Cont'd...

**Velocity pressures table**

| z (ft) | $K_z$ (Table 26.10-1) | $q_z$ (psf) |
|---|---|---|
| 9.00 | 0.85 | 62.88 |
| 12.00 | 0.85 | 62.88 |

**Peak velocity pressure for internal pressure**

Peak velocity pressure – internal (as roof press.) $q_i$ = **62.88** psf

**Parapet pressures and forces**

Velocity pressure at top of parapet $q_p$ = **62.88** psf

Combined net pressure coefficient, leeward $GC_{pnl}$ = **-1.0**

Combined net parapet pressure, leeward $p_{pl} = K_d \times q_p \times GC_{pnl}$ = **-53.45** psf

Combined net pressure coefficient, windward $GC_{pnw}$ = **1.5**

Combined net parapet pressure, windward $p_{pw} = K_d \times q_p \times GC_{pnw}$ = **80.17** psf

Wind direction 0 deg:

Leeward parapet force $F_{w,wpl\_0} = p_{pl} \times h_p \times b$ = **-5.1** kips

Windward parapet force $F_{w,wpw\_0} = p_{pw} \times h_p \times b$ = **7.7** kips

Wind direction 90 deg:

Leeward parapet force $F_{w,wpl\_90} = p_{pl} \times h_p \times d$ = **-6.4** kips

Windward parapet force $F_{w,wpw\_90} = p_{pw} \times h_p \times d$ = **9.6** kips

**Pressures and forces**

Net pressure $p = K_d \times q \times G_f \times C_{pe} - K_d \times q_i \times GC_{pi}$

Net force $F_w = p \times A_{ref}$

**Roof load case 1 - Wind 0, $GC_{pi}$ 0.18, $-c_{pe}$**

| Zone | Ref. height (ft) | Ext pressure coefficient $c_{pe}$ | Peak velocity pressure $q_p$ (psf) | Net pressure p (psf) | Area $A_{ref}$ ($ft^2$) | Net force $F_w$ (kips) |
|---|---|---|---|---|---|---|
| A (-ve) | 9.00 | -0.90 | 62.88 | -50.51 | 144.00 | -7.27 |
| B (-ve) | 9.00 | -0.90 | 62.88 | -50.51 | 144.00 | -7.27 |
| C (-ve) | 9.00 | -0.50 | 62.88 | -32.34 | 288.00 | -9.31 |
| D (-ve) | 9.00 | -0.30 | 62.88 | -23.25 | 704.00 | -16.37 |

Total vertical net force $F_{w,v}$ = **-40.23** kips

Total horizontal net force $F_{w,h}$ = **0.00** kips

**Walls load case 1 - Wind 0, $GC_{pi}$ 0.18, $-c_{pe}$**

| Zone | Ref. height (ft) | Ext pressure coefficient $c_{pe}$ | Peak velocity pressure $q_p$ (psf) | Net pressure p (psf) | Area $A_{ref}$ ($ft^2$) | Net force $F_w$ (kips) |
|---|---|---|---|---|---|---|
| A | 9.00 | 0.80 | 62.88 | 26.72 | 288.00 | 7.70 |
| B | 9.00 | -0.45 | 62.88 | -30.06 | 288.00 | -8.66 |
| C | 9.00 | -0.70 | 62.88 | -41.42 | 360.00 | -14.91 |
| D | 9.00 | -0.70 | 62.88 | -41.42 | 360.00 | -14.91 |

**Overall loading**

Projected vertical plan area of wall $A_{vert\_w\_0} = b \times (H + h_p)$ = **384.00** $ft^2$

## Chapter 1: Design Criteria Cont'd...

Projected vertical area of roof — $A_{vert\_r\_0}$ = **0.00** ft$^2$

Minimum overall horizontal loading — $F_{w,total\_min} = p_{min\_w} \times A_{vert\_w\_0} + p_{min\_r} \times A_{vert\_r\_0}$ = **6.14** kips

Leeward net force — $F_l = F_{w,wB} + F_{w,wpl\_0}$ = **-13.8** kips

Windward net force — $F_w = F_{w,wA} + F_{w,wpw\_0}$ = **15.4** kips

Overall horizontal loading — $F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total\_min})$ = **29.2** kips

**Roof load case 2 - Wind 0, GC$_{pi}$ -0.18, -0c$_{pe}$**

| Zone | Ref. height (ft) | Ext pressure coefficient $c_{pe}$ | Peak velocity pressure $q_p$ (psf) | Net pressure p (psf) | Area $A_{ref}$ (ft$^2$) | Net force $F_w$ (kips) |
|---|---|---|---|---|---|---|
| A (+ve) | 9.00 | -0.18 | 62.88 | 1.44 | 144.00 | 0.21 |
| B (+ve) | 9.00 | -0.18 | 62.88 | 1.44 | 144.00 | 0.21 |
| C (+ve) | 9.00 | -0.18 | 62.88 | 1.44 | 288.00 | 0.42 |
| D (+ve) | 9.00 | -0.18 | 62.88 | 1.44 | 704.00 | 1.02 |

Total vertical net force — $F_{w,v}$ = **1.85** kips

Total horizontal net force — $F_{w,h}$ = **0.00** kips

**Walls load case 2 - Wind 0, GC$_{pi}$ -0.18, -0c$_{pe}$**

| Zone | Ref. height (ft) | Ext pressure coefficient $c_{pe}$ | Peak velocity pressure $q_p$ (psf) | Net pressure p (psf) | Area $A_{ref}$ (ft$^2$) | Net force $F_w$ (kips) |
|---|---|---|---|---|---|---|
| A | 9.00 | 0.80 | 62.88 | 45.96 | 288.00 | 13.24 |
| B | 9.00 | -0.45 | 62.88 | -10.82 | 288.00 | -3.12 |
| C | 9.00 | -0.70 | 62.88 | -22.18 | 360.00 | -7.99 |
| D | 9.00 | -0.70 | 62.88 | -22.18 | 360.00 | -7.99 |

**Overall loading**

Projected vertical plan area of wall — $A_{vert\_w\_0} = b \times (H + h_p)$ = **384.00** ft$^2$

Projected vertical area of roof — $A_{vert\_r\_0}$ = **0.00** ft$^2$

Minimum overall horizontal loading — $F_{w,total\_min} = p_{min\_w} \times A_{vert\_w\_0} + p_{min\_r} \times A_{vert\_r\_0}$ = **6.14** kips

Leeward net force — $F_l = F_{w,wB} + F_{w,wpl\_0}$ = **-8.2** kips

Windward net force — $F_w = F_{w,wA} + F_{w,wpw\_0}$ = **20.9** kips

Overall horizontal loading — $F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total\_min})$ = **29.2** kips

**Roof load case 3 - Wind 90, GC$_{pi}$ 0.18, -c$_{pe}$**

| Zone | Ref. height (ft) | Ext pressure coefficient $c_{pe}$ | Peak velocity pressure $q_p$ (psf) | Net pressure p (psf) | Area $A_{ref}$ (ft$^2$) | Net force $F_w$ (kips) |
|---|---|---|---|---|---|---|
| A (-ve) | 9.00 | -0.90 | 62.88 | -50.51 | 180.00 | -9.09 |
| B (-ve) | 9.00 | -0.90 | 62.88 | -50.51 | 180.00 | -9.09 |
| C (-ve) | 9.00 | -0.50 | 62.88 | -32.34 | 360.00 | -11.64 |
| D (-ve) | 9.00 | -0.30 | 62.88 | -23.25 | 560.00 | -13.02 |

Total vertical net force — $F_{w,v}$ = **-42.84** kips

Total horizontal net force — $F_{w,h}$ = **0.00** kips

## Chapter 1: Design Criteria Cont'd...

**Walls load case 3 - Wind 90, $GC_{pi}$ 0.18, $-c_{pe}$**

| Zone | Ref. height (ft) | Ext pressure coefficient $c_{pe}$ | Peak velocity pressure $q_p$ (psf) | Net pressure p (psf) | Area $A_{ref}$ ($ft^2$) | Net force $F_w$ (kips) |
|---|---|---|---|---|---|---|
| A | 9.00 | 0.80 | 62.88 | 26.72 | 360.00 | 9.62 |
| B | 9.00 | -0.50 | 62.88 | -32.34 | 360.00 | -11.64 |
| C | 9.00 | -0.70 | 62.88 | -41.42 | 288.00 | -11.93 |
| D | 9.00 | -0.70 | 62.88 | -41.42 | 288.00 | -11.93 |

**Overall loading**

Projected vertical plan area of wall $A_{vert\_w\_90} = d \times (H + h_p) = \mathbf{480.00}\ ft^2$

Projected vertical area of roof $A_{vert\_r\_90} = \mathbf{0.00}\ ft^2$

Minimum overall horizontal loading $F_{w,total\_min} = p_{min\_w} \times A_{vert\_w\_90} + p_{min\_r} \times A_{vert\_r\_90} = \mathbf{7.68}$ kips

Leeward net force $F_l = F_{w,wB} + F_{w,wpl\_90} = \mathbf{-18.1}$ kips

Windward net force $F_w = F_{w,wA} + F_{w,wpw\_90} = \mathbf{19.2}$ kips

Overall horizontal loading $F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total\_min}) = \mathbf{37.3}$ kips

**Roof load case 4 - Wind 90, $GC_{pi}$ -0.18, $+c_{pe}$**

| Zone | Ref. height (ft) | Ext pressure coefficient $c_{pe}$ | Peak velocity pressure $q_p$ (psf) | Net pressure p (psf) | Area $A_{ref}$ ($ft^2$) | Net force $F_w$ (kips) |
|---|---|---|---|---|---|---|
| A (+ve) | 9.00 | -0.18 | 62.88 | 1.44 | 180.00 | 0.26 |
| B (+ve) | 9.00 | -0.18 | 62.88 | 1.44 | 180.00 | 0.26 |
| C (+ve) | 9.00 | -0.18 | 62.88 | 1.44 | 360.00 | 0.52 |
| D (+ve) | 9.00 | -0.18 | 62.88 | 1.44 | 560.00 | 0.81 |

Total vertical net force $F_{w,v} = \mathbf{1.85}$ kips

Total horizontal net force $F_{w,h} = \mathbf{0.00}$ kips

**Walls load case 4 - Wind 90, $GC_{pi}$ -0.18, $+c_{pe}$**

| Zone | Ref. height (ft) | Ext pressure coefficient $c_{pe}$ | Peak velocity pressure $q_p$ (psf) | Net pressure p (psf) | Area $A_{ref}$ ($ft^2$) | Net force $F_w$ (kips) |
|---|---|---|---|---|---|---|
| A | 9.00 | 0.80 | 62.88 | 45.96 | 360.00 | 16.55 |
| B | 9.00 | -0.50 | 62.88 | -13.09 | 360.00 | -4.71 |
| C | 9.00 | -0.70 | 62.88 | -22.18 | 288.00 | -6.39 |
| D | 9.00 | -0.70 | 62.88 | -22.18 | 288.00 | -6.39 |

**Overall loading**

Projected vertical plan area of wall $A_{vert\_w\_90} = d \times (H + h_p) = \mathbf{480.00}\ ft^2$

Projected vertical area of roof $A_{vert\_r\_90} = \mathbf{0.00}\ ft^2$

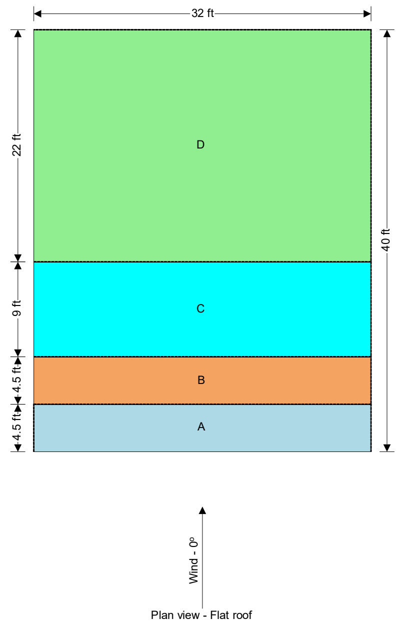
Minimum overall horizontal loading $F_{w,total\_min} = p_{min\_w} \times A_{vert\_w\_90} + p_{min\_r} \times A_{vert\_r\_90} = \mathbf{7.68}$ kips

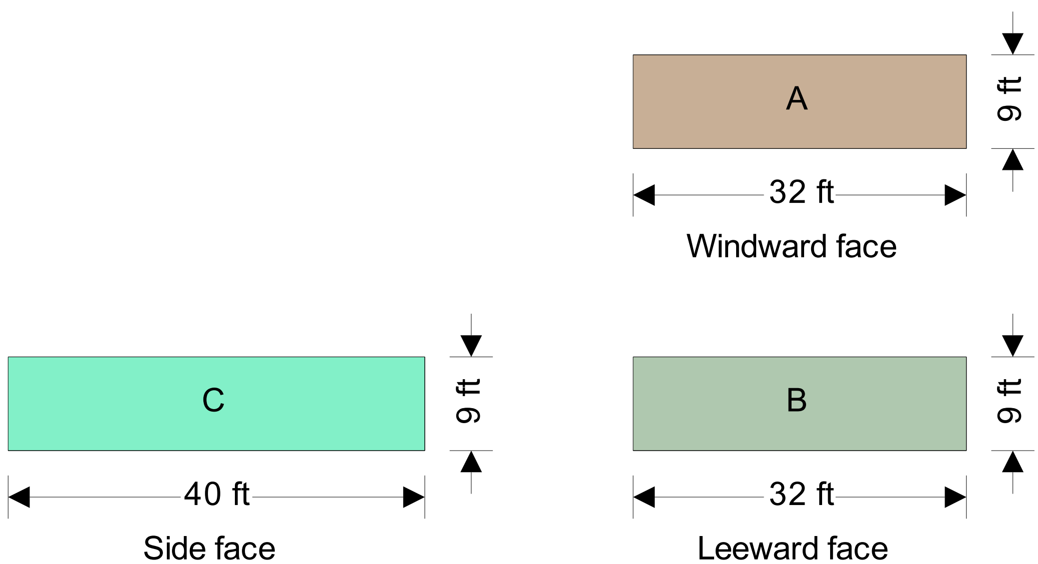
Leeward net force $F_l = F_{w,wB} + F_{w,wpl\_90} = \mathbf{-11.1}$ kips

Windward net force $F_w = F_{w,wA} + F_{w,wpw\_90} = \mathbf{26.2}$ kips

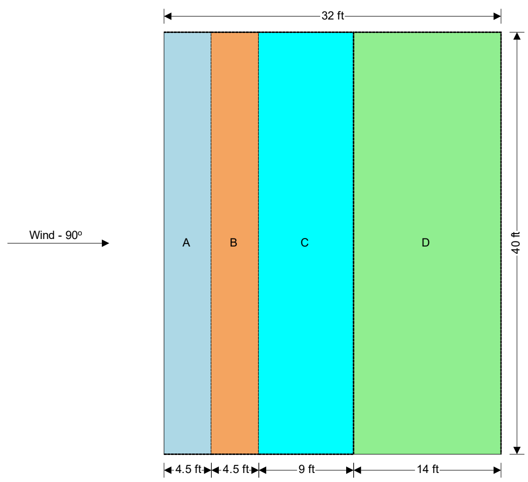
Overall horizontal loading $F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total\_min}) = \mathbf{37.3}$ kips

## Chapter 1: Design Criteria Cont'd...

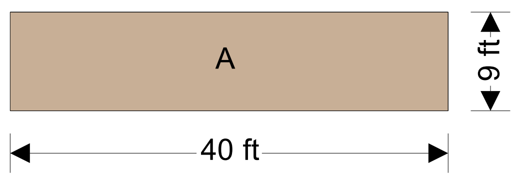


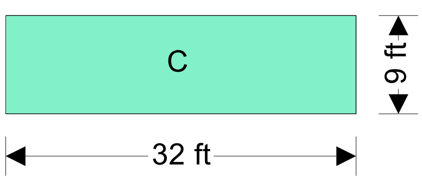
## Chapter 1: Design Criteria Cont'd...



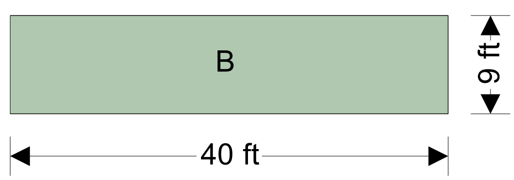

Plan view - Flat roof




Windward face




Side face




Leeward face

# Seismic

**Site Soil Class:** DE

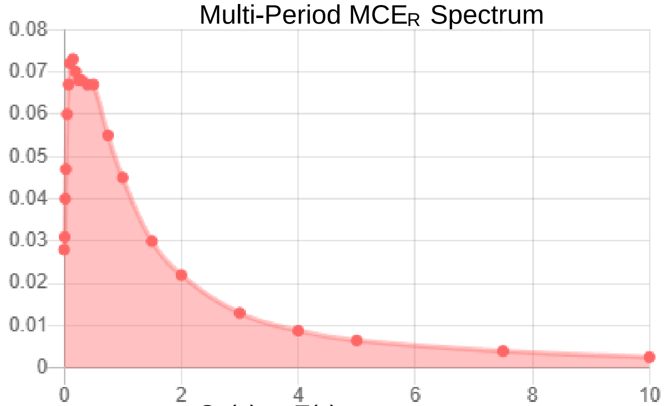
**Results:**

| | | | |
|---|---|---|---|
| $PGA_M$ : | 0.024 | $T_L$ : | 8 |
| $S_{MS}$ : | 0.063 | $S_S$ : | 0.048 |
| $S_{M1}$ : | 0.045 | $S_1$ : | 0.021 |
| $S_{DS}$ : | 0.042 | $V_{S30}$ : | 185 |
| $S_{D1}$ : | 0.03 | | |

**Seismic Design Category: A**

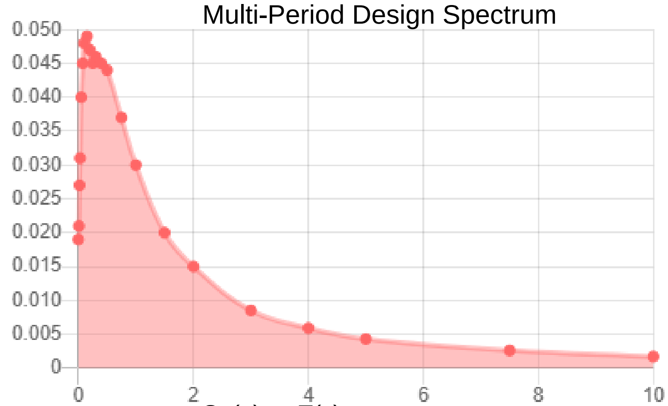
*Due to lower seismicity in this region, Wind force will act as governing lateral design force.*

Multi-Period $MCE_R$ Spectrum



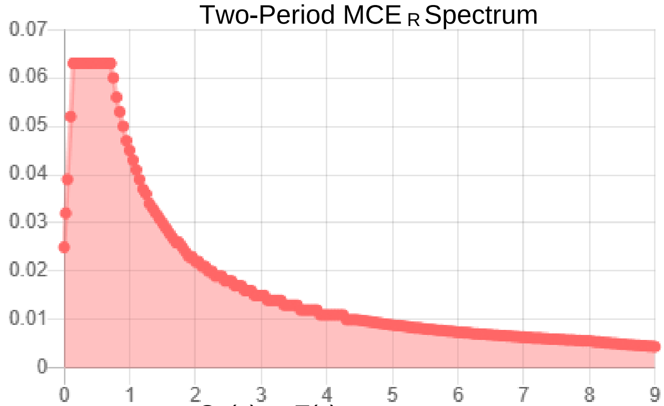

$S_a$(g) vs T(s)

Multi-Period Design Spectrum



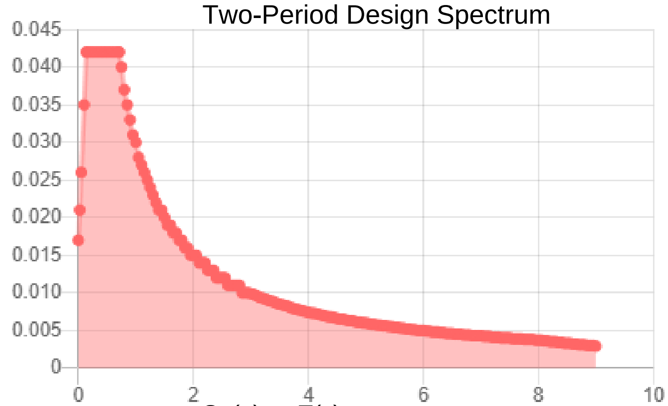

$S_a$(g) vs T(s)

Two-Period $MCE_R$ Spectrum




$S_a$(g) vs T(s)

Two-Period Design Spectrum




$S_a$(g) vs T(s)

$MCE_R$ Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

Design Vertical Response Spectrum

Vertical ground motion data has not yet been made available by USGS.

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# Snow

**Results:**

| | |
|---|---|
| Ground Snow Load, $p_g$ : | 3 lb/ft$^2$ |
| 20-year MRI Value: | 1 lb/ft^2 |
| Winter Wind Parameter: | 0.45 |
| Mapped Elevation: | 1.1 ft |
| Data Source: | ASCE/SEI 7-22, Figures 7.6-1 and 7.6-2 A-D |
| Date Accessed: | Fri Sep 06 2024 |

Values provided are ground snow loads. In areas designated "case study required," extreme local variations in ground snow loads preclude mapping at this scale. Site-specific case studies are required to establish ground snow loads at elevations not covered.

Snow load values are mapped to a 0.5 mile resolution. This resolution can create a mismatch between the mapped elevation and the site-specific elevation in topographically complex areas. Engineers should consult the local authority having jurisdiction in locations where the reported ‘elevation’ and ‘mapped elevation’ differ significantly from each other.

Ground Snow Loads for IRC only, $p_{g(asd)}$ : 2.1 lb/ft$^2$

**Chapter 1: Design Criteria Cont'd...**

## 1.3 Wind Load Calculation

Wind Force in N-S Direction = [{(45.96+10.82)*4.5*32}+(7.7+5.1)] = 20.9 kips
(0° as reference to calculation report)

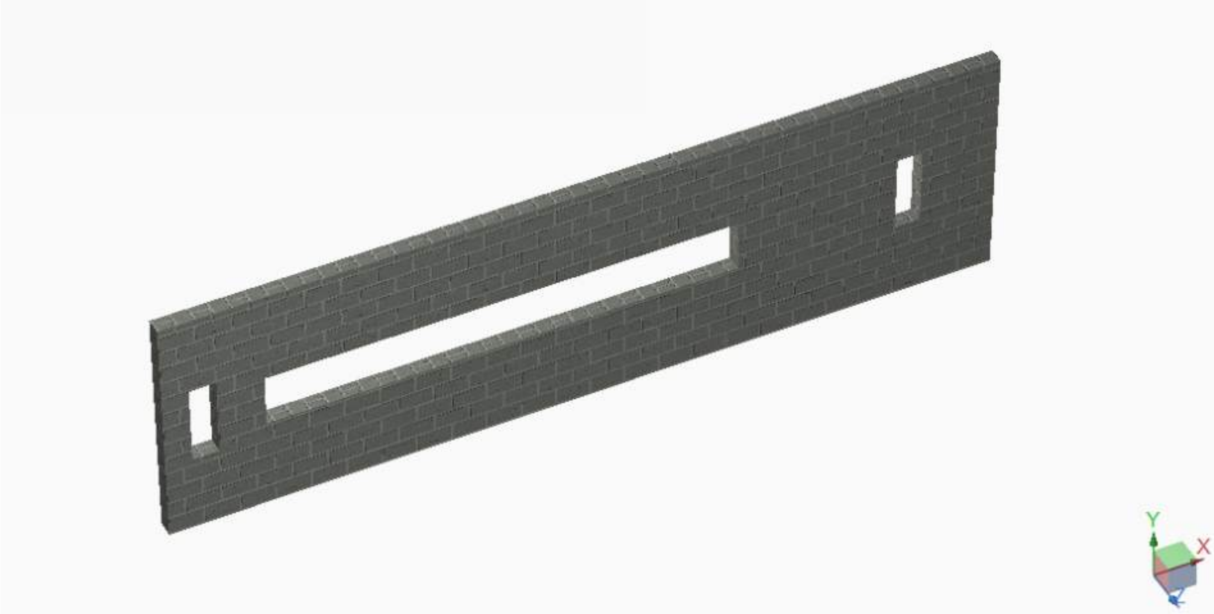

Wind Force in E-W Direction = [{(45.96+13.09)*4.5*40}+(9.6+6.4)] = 26.6 kips
(90° as reference to calculation report)

**Chapter 2: Analytical Model**

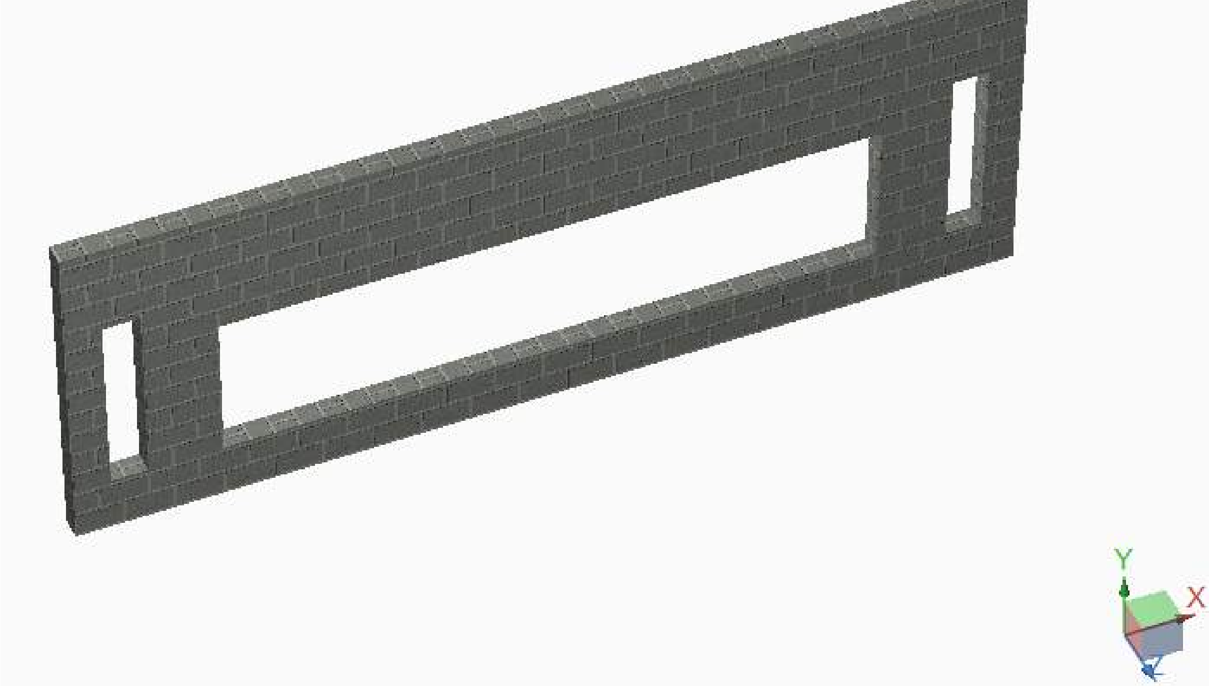
## 2.1 Model Information

In order to analyze the behavior of wind-facing walls under varying loads, two analytical models have been formulated.

South Wall




West Wall

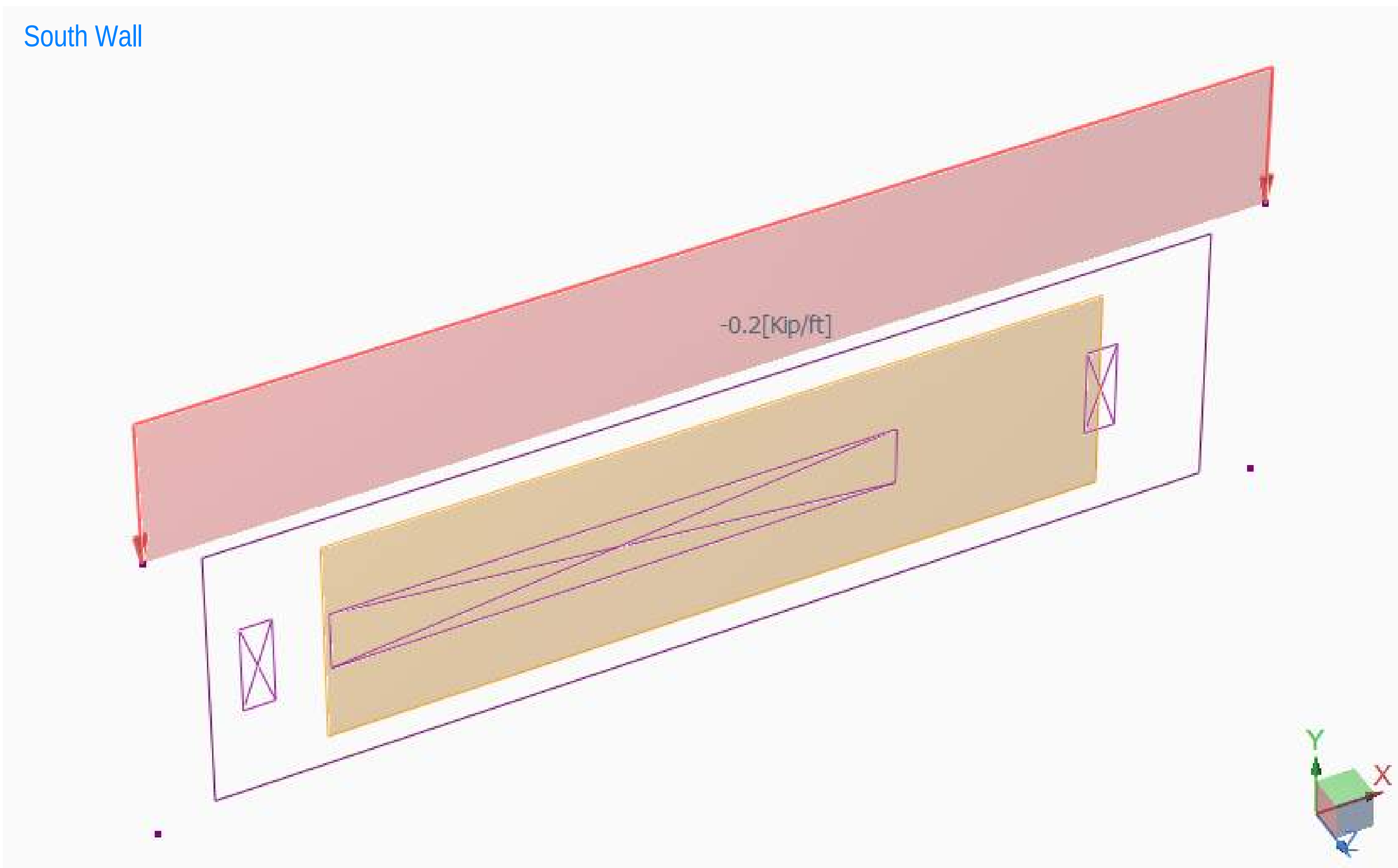


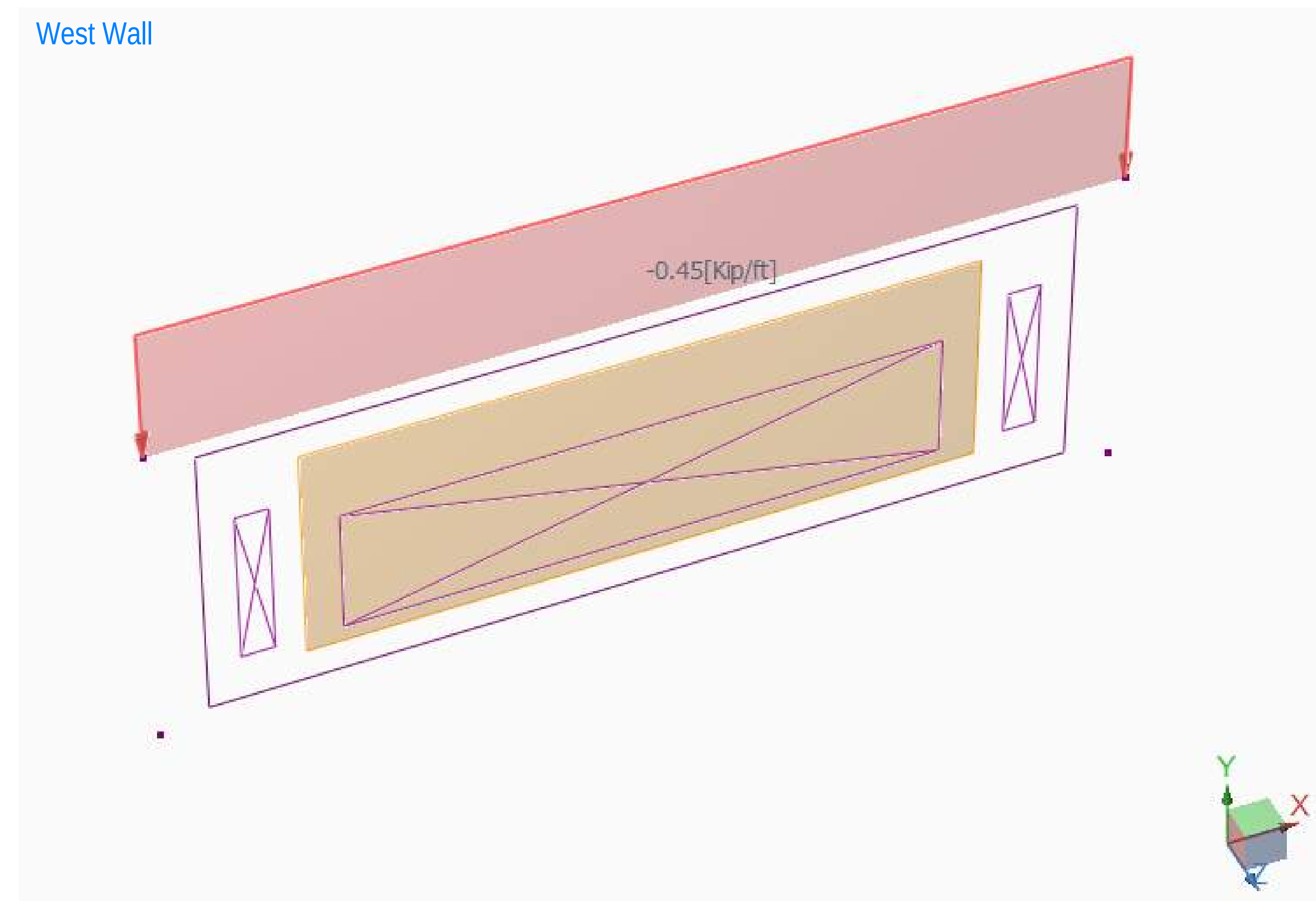

Appendix-A contains references pertaining to the empirical 8" CMU wall

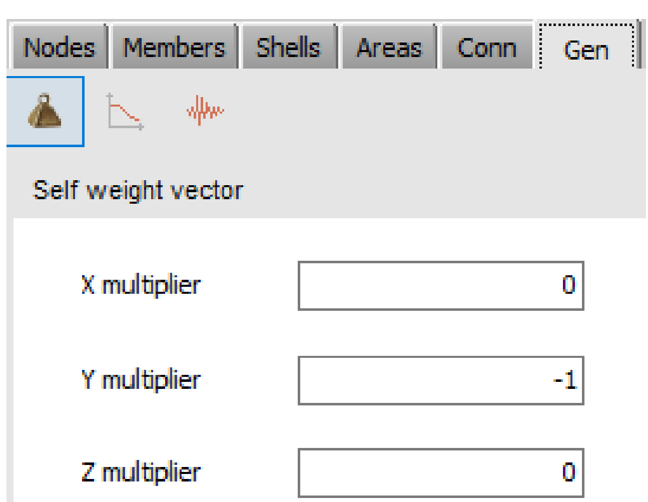
**Chapter 2: Analytical Model Cont'd...**

## 2.2 Loadings

2.2.1 Dead Load



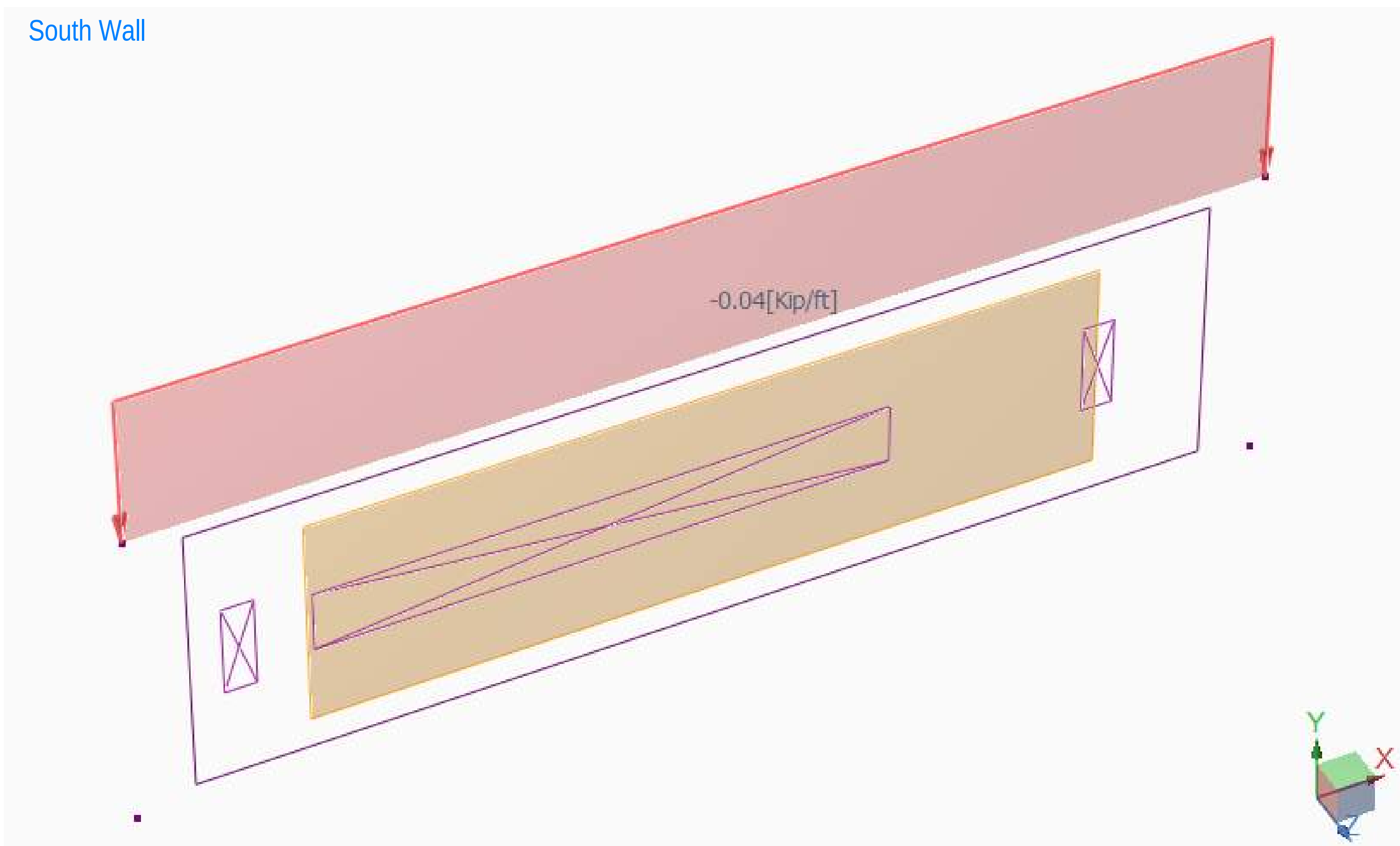



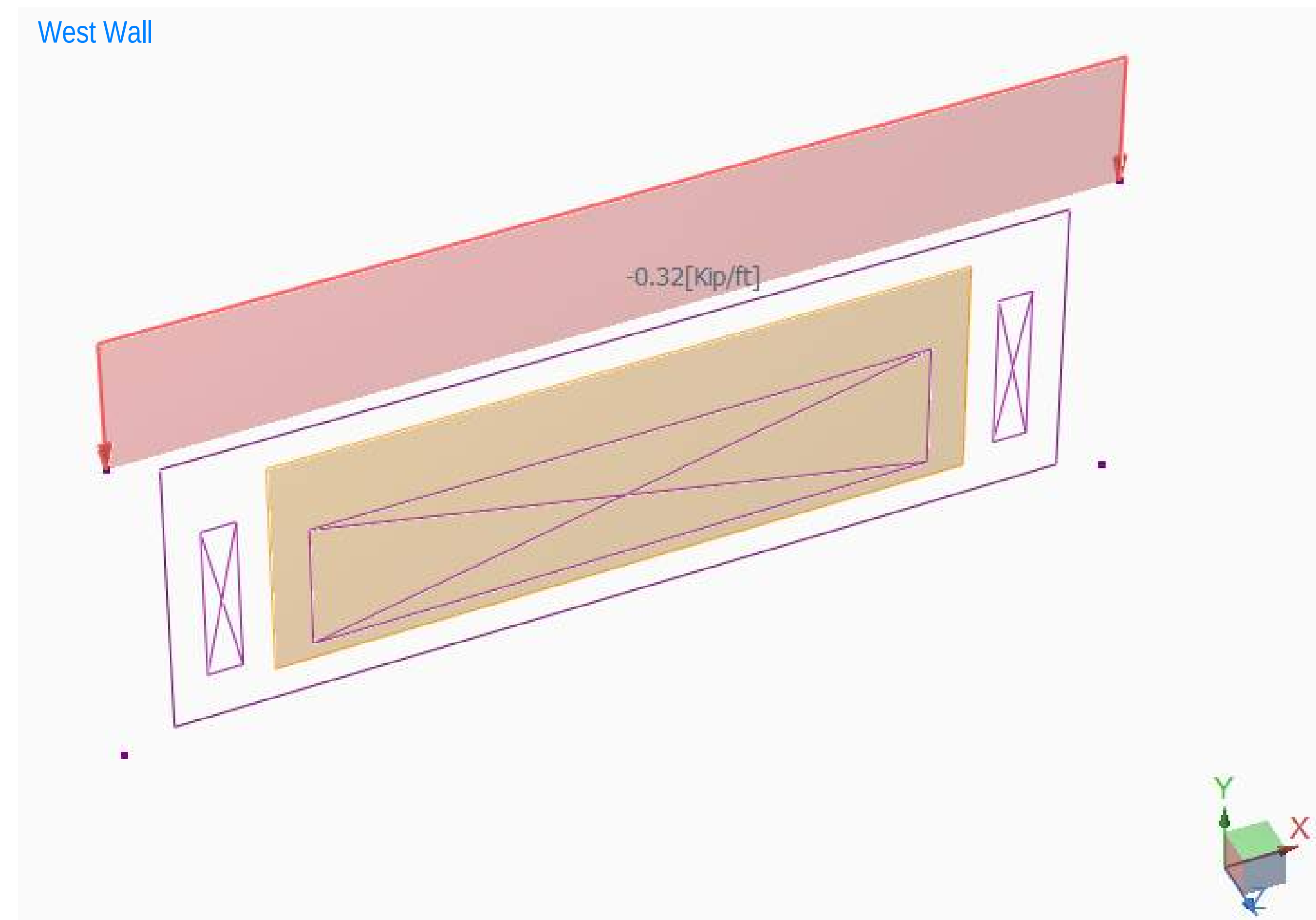



**Chapter 2: Analytical Model Cont'd...**

## 2.2 Loadings

### 2.2.2 Roof Live Load

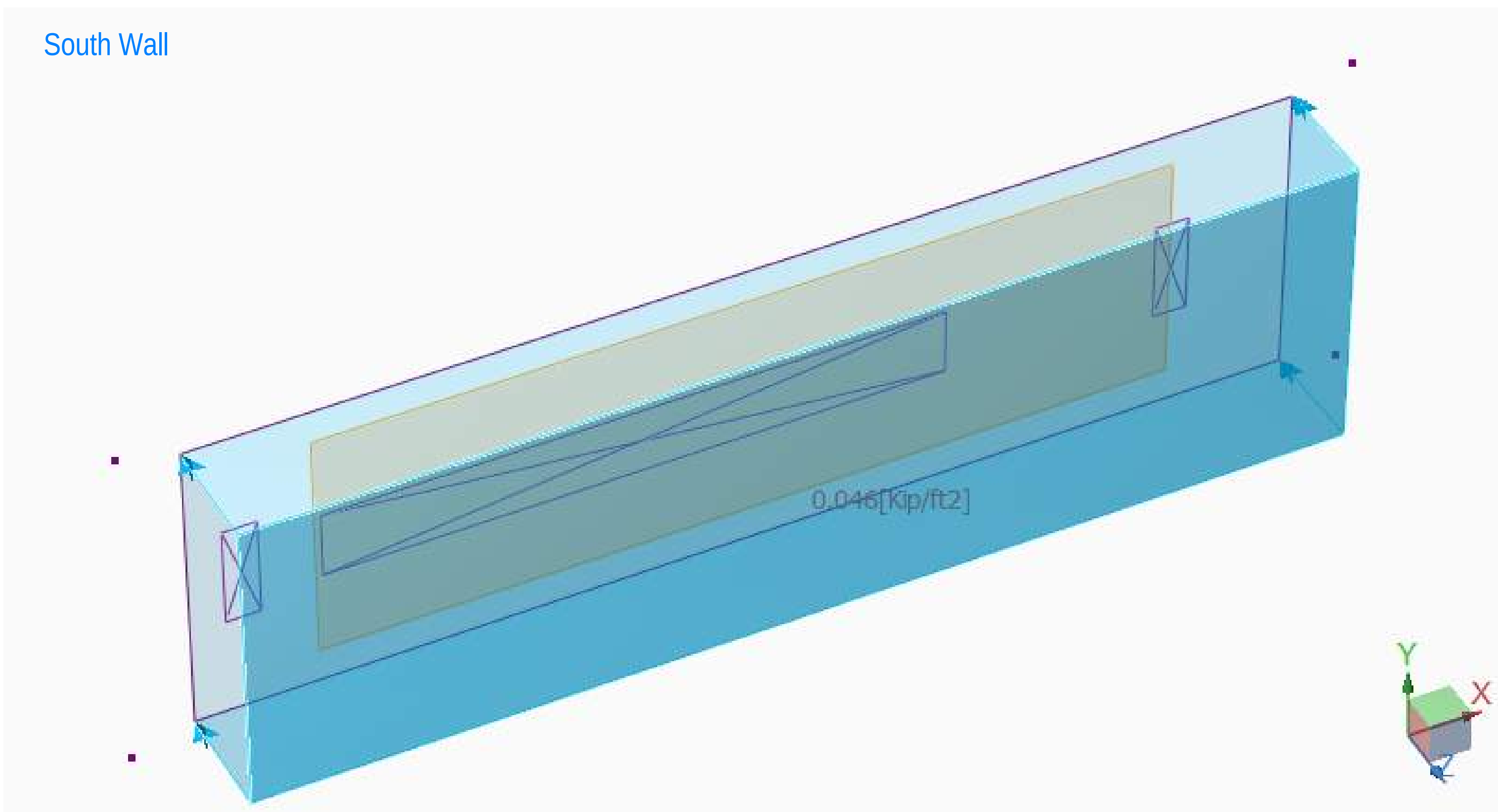


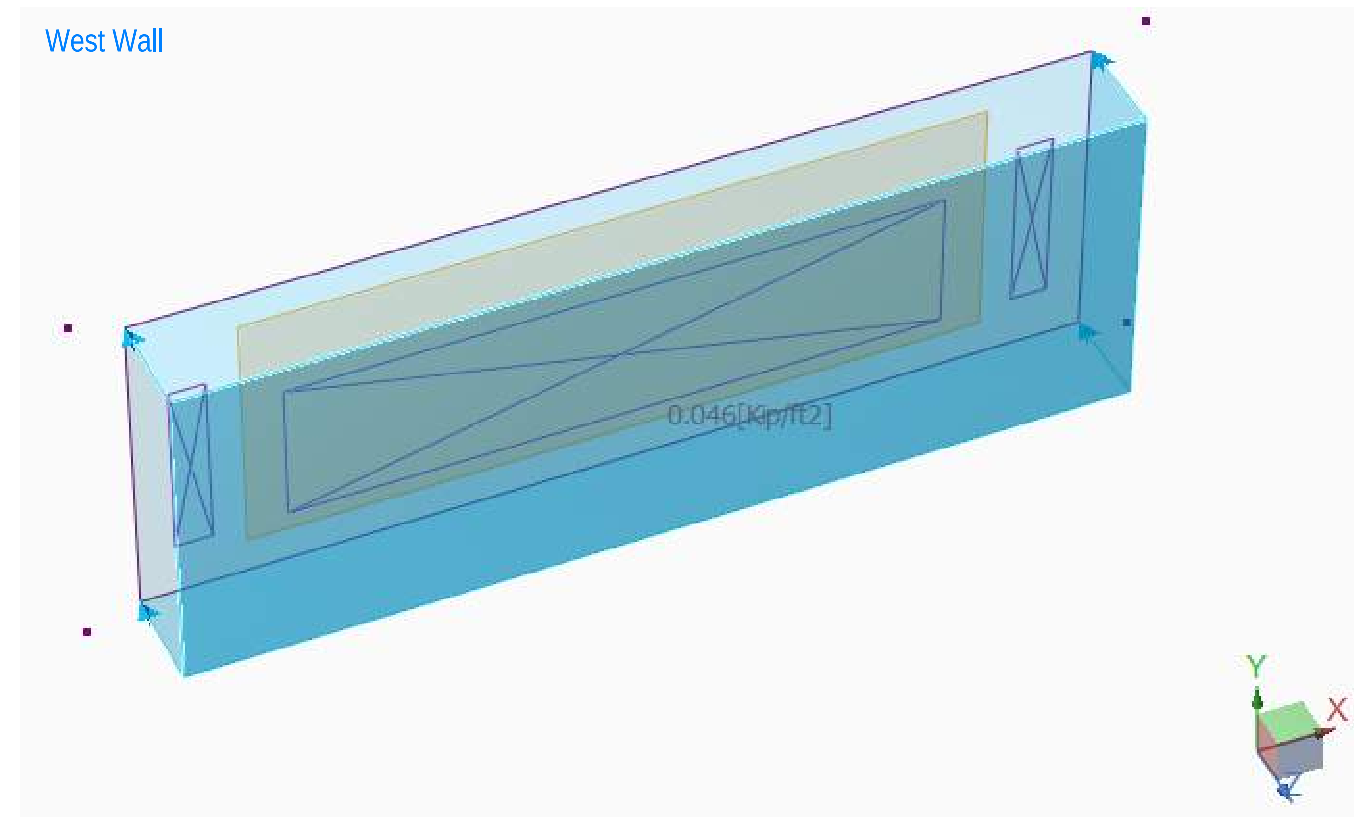



**Chapter 2: Analytical Model Cont'd...**

## 2.2 Loadings

2.2.3 Out-of-plane Wind Load

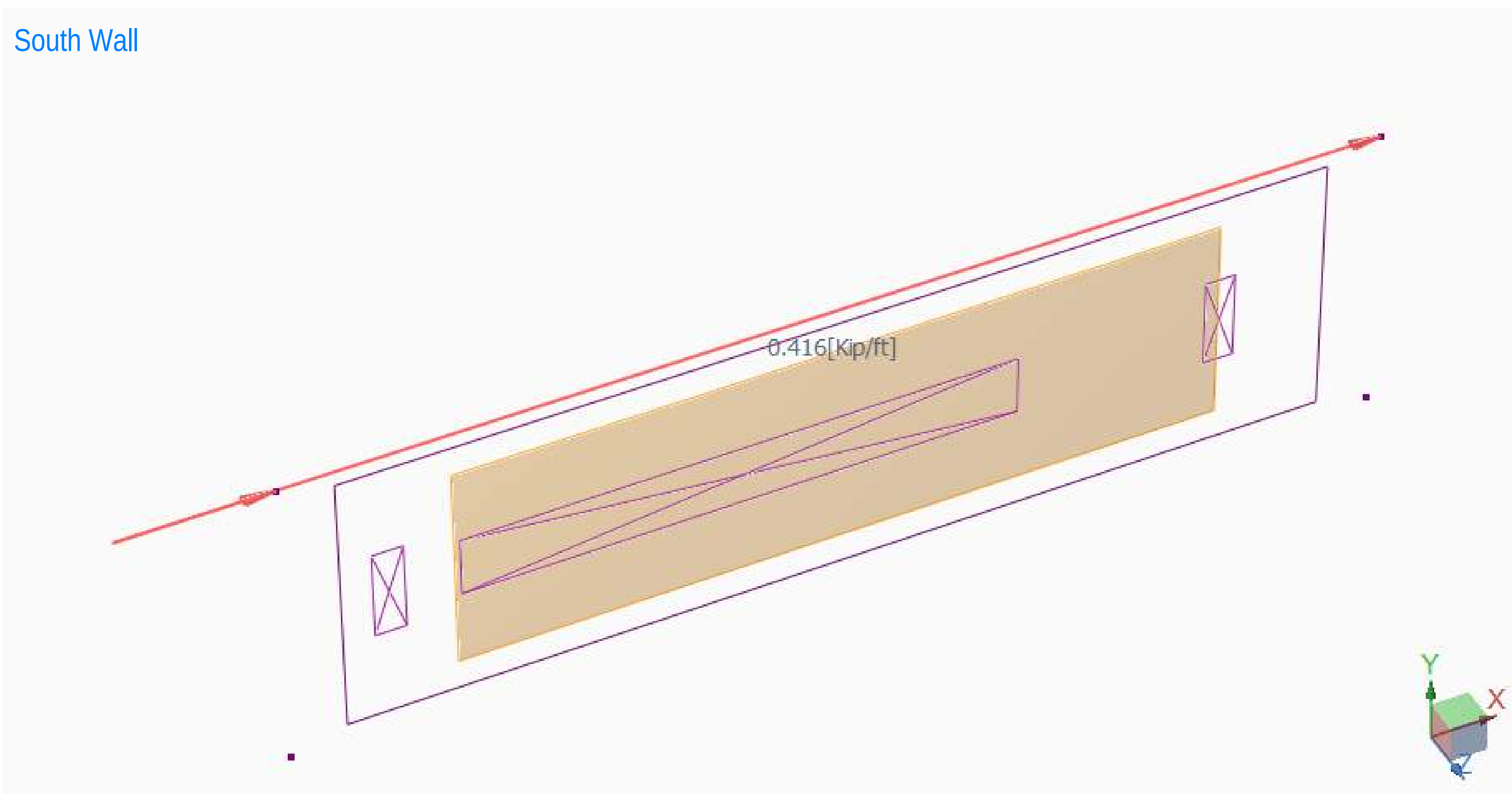


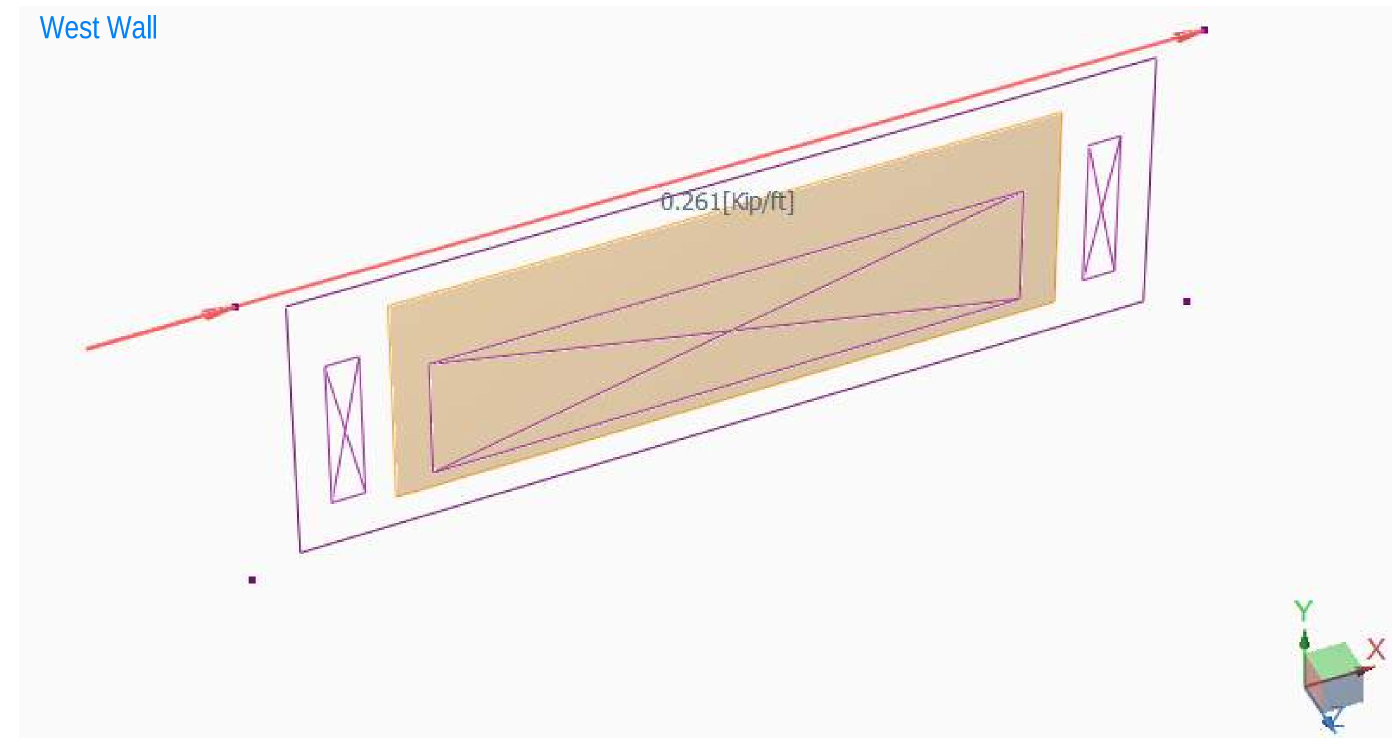



**Chapter 2: Analytical Model Cont'd...**

## 2.2 Loadings

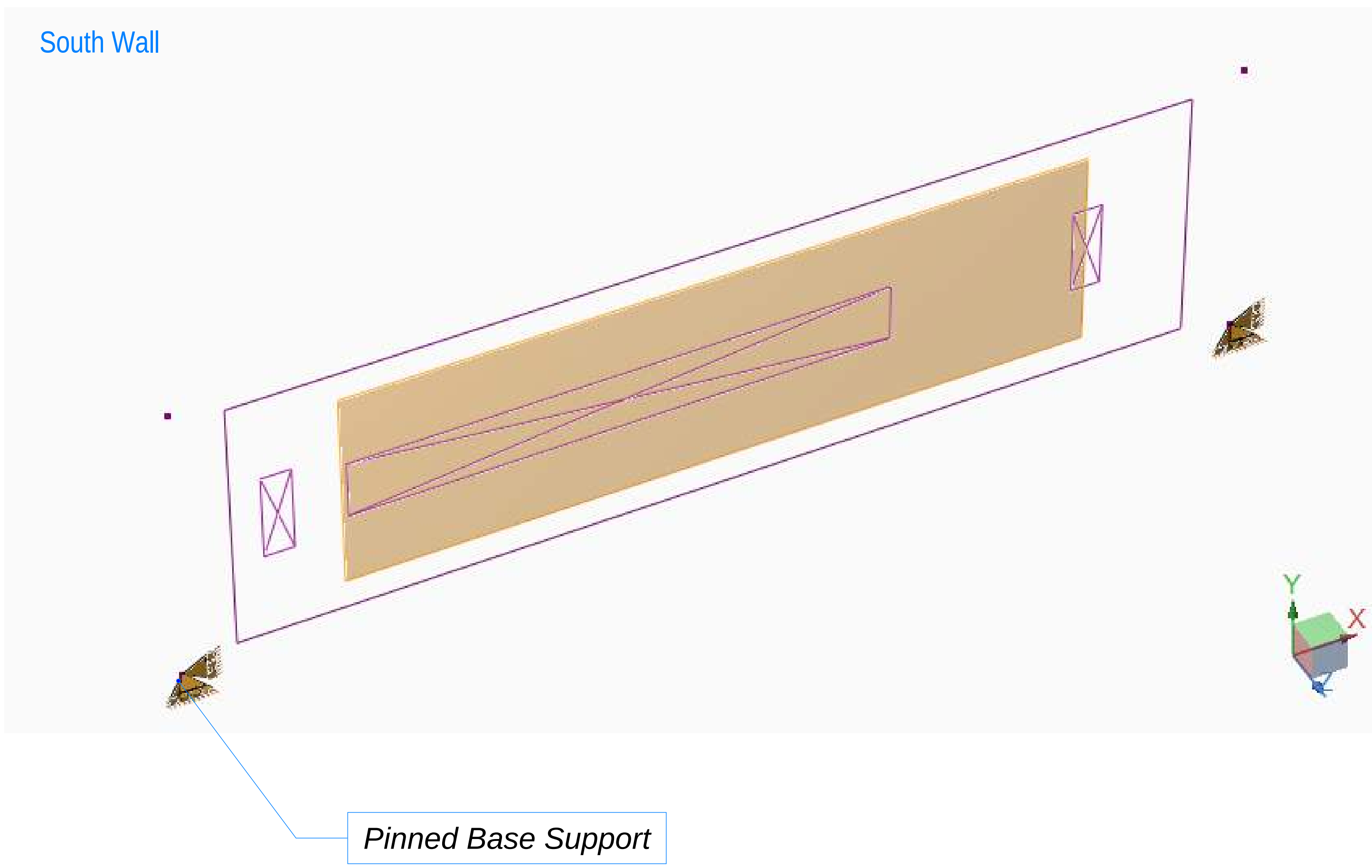
2.2.4 In-plane Wind Load

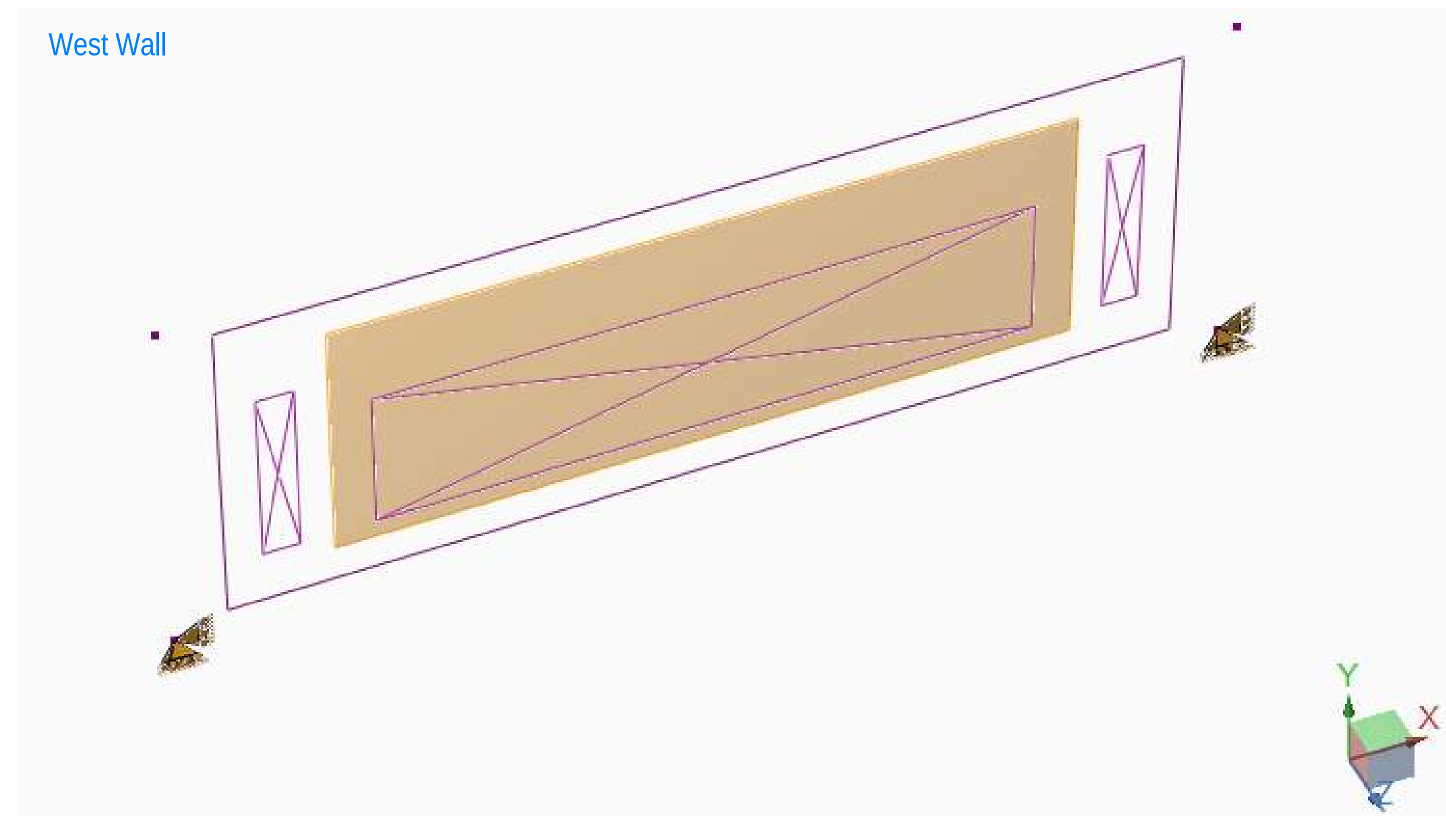


**Chapter 2: Analytical Model Cont'd...**

## 2.3 Support Conditions




Appendix-B contains design reports of the South & West Walls.

## Chapter 3: Foundation Design

### F1 - SOUTH WALL FOOTING

**Footing analysis in accordance with ACI318-**

Tedds calculation version 3.3.08

**Pad footing details**

Length of footing $L_x$ = **32** ft

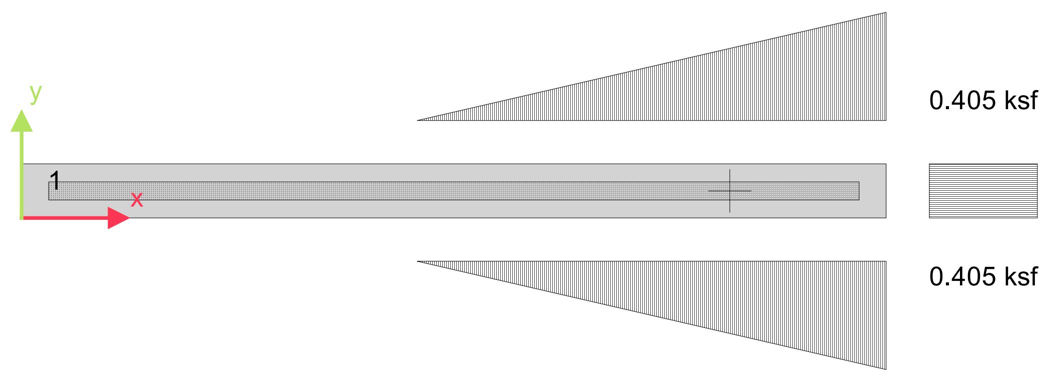
Width of footing $L_y$ = **2** ft

Footing area $A = L_x \times L_y$ = **64** $ft^2$

Depth of footing h = **10** in

Depth of soil over footing $h_{soil}$ = **8** in

Density of concrete $\gamma_{conc}$ = **150.0** $lb/ft^3$




**Column no.1 details**

Length of column $l_{x1}$ = **360.00** in

Width of column $l_{y1}$ = **8.00** in

position in x-axis $x_1$ = **192.00** in

position in y-axis $y_1$ = **12.00** in

**Soil properties**

Net allowable bearing pressure $q_{allow\_Net}$ = **2** ksf using a soil factor of safety, $FS_{soil}$, of 3

Density of soil $\gamma_{soil}$ = **120.0** $lb/ft^3$

Angle of internal friction $\phi_b$ = **30.0** deg

Design base friction angle $\delta_{bb}$ = **30.0** deg

Coefficient of base friction $\tan(\delta_{bb})$ = **0.577**

**Footing loads**

Self weight $F_{swt} = h \times \gamma_{conc}$ = **125** psf

Soil weight $F_{soil} = h_{soil} \times \gamma_{soil}$ = **80** psf

**Column no.1 loads**

Dead load in z $F_{Dz1}$ = **0.2** kips

Live roof load in z $F_{Lrz1}$ = **0.0** kips

Wind load moment in x $M_{Wx1}$ = **119.7** kip_ft

**Footing analysis for soil and stability**

## Chapter 3: Foundation Design Cont'd...

**Load combinations per ASCE 7-16**

1.0D (0.107)

1.0D + 1.0L (0.107)

1.0D + 1.0Lr (0.106)

1.0D + 1.0S (0.107)

1.0D + 1.0R (0.107)

1.0D + 0.75L + 0.75Lr (0.106)

1.0D + 0.75L + 0.75S (0.107)

1.0D + 0.75L + 0.75R (0.107)

1.0D + 0.6W (0.449)

1.0D + 0.75L + 0.75Lr + 0.45W (0.362)

1.0D + 0.75L + 0.75S + 0.45W (0.363)

1.0D + 0.75L + 0.75R + 0.45W (0.363)

0.6D + 0.6W (0.677)

**Combination 15 results: 0.6D + 0.6W**

**Forces on footing**

Force in z-axis — $F_{dz} = \gamma_D \times A \times (F_{swt} + F_{soil}) + \gamma_D \times (F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})$ = **7.0** kips

**Moments on footing**

Moment in x-axis, about x is 0 — $M_{dx} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_x / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times x_1) + \gamma_W \times (M_{Wx1})$ = **184.3** kip_ft

Moment in y-axis, about y is 0 — $M_{dy} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_y / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times y_1)$ = **7.0** kip_ft

**Uplift verification**

Vertical force — $F_{dz}$ = **7.032** kips

***PASS - Footing is not subject to uplift***

**Stability against overturning in x direction, moment about x is 0**

Overturning moment — $M_{OTx0} = \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times x_1)$ = **-13.44** kip_ft

Resisting moment — $M_{Rx0} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_x / 2) + \gamma_W \times (M_{Wx1})$ = **197.77** kip_ft

Factor of safety — $abs(M_{Rx0} / M_{OTx0})$ = **14.715**

***PASS - Overturning moment safety factor exceeds the minimum of 1.50***

**Stability against overturning in x direction, moment about x is $L_x$**

Overturning moment — $M_{OTxL} = \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times (x_1 - L_x)) + \gamma_W \times (M_{Wx1})$ = **85.26** kip_ft

Resisting moment — $M_{RxL} = -1 \times (\gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_x / 2))$ = **-125.95** kip_ft

Factor of safety — $abs(M_{RxL} / M_{OTxL})$ = **1.477**

***FAIL - Minimum overturning moment safety factor, 1.50, exceeds the actual safety factor***

**Stability against overturning in y direction, moment about y is 0**

Overturning moment — $M_{OTy0} = \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times y_1)$ = **-0.84** kip_ft

Resisting moment — $M_{Ry0} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_y / 2)$ = **7.87** kip_ft

Factor of safety — $abs(M_{Ry0} / M_{OTy0})$ = **9.371**

***PASS - Overturning moment safety factor exceeds the minimum of 1.50***

## Chapter 3: Foundation Design Cont'd...

**Stability against overturning in y direction, moment about y is $L_y$**

Overturning moment $M_{OTyL} = \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times (y_1 - L_y)) =$ **0.84** kip_ft

Resisting moment $M_{RyL} = -1 \times (\gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_y / 2)) =$ **-7.87** kip_ft

Factor of safety $abs(M_{RyL} / M_{OTyL}) =$ **9.371**

***PASS - Overturning moment safety factor exceeds the minimum of 1.50***

**Bearing resistance**

**Eccentricity of base reaction**

Eccentricity of base reaction in x-axis $e_{dx} = M_{dx} / F_{dz} - L_x / 2 =$ **122.56** in

Eccentricity of base reaction in y-axis $e_{dy} = M_{dy} / F_{dz} - L_y / 2 =$ **0** in

Length of bearing in x-axis $L'_{xd} = min(L_x, 3 \times (L_x / 2 - abs(e_{dx}))) =$ **208.321** in

**Pad base pressures**

$q_1 =$ **0** ksf

$q_2 =$ **0** ksf

$q_3 =$ **0.405** ksf

$q_4 =$ **0.405** ksf

Minimum base pressure $q_{min} = min(q_1,q_2,q_3,q_4) =$ **0** ksf

Maximum base pressure $q_{max} = max(q_1,q_2,q_3,q_4) =$ **0.405** ksf

**Allowable bearing capacity**

Allowable bearing capacity $q_{allow} = q_{allow\_Net} + ((h + h_{soil}) \times \gamma_{soil}) / FS_{soil} =$ **2.06** ksf

$q_{max} / q_{allow} =$ **0.197**

***PASS - Allowable bearing capacity exceeds design base pressure***

## Chapter 3: Foundation Design Cont'd...

### F2 - WEST WALL FOOTING

**Footing analysis in accordance with ACI318-**

Tedds calculation version 3.3.08

**Pad footing details**

Length of footing — $L_x$ = **26** ft

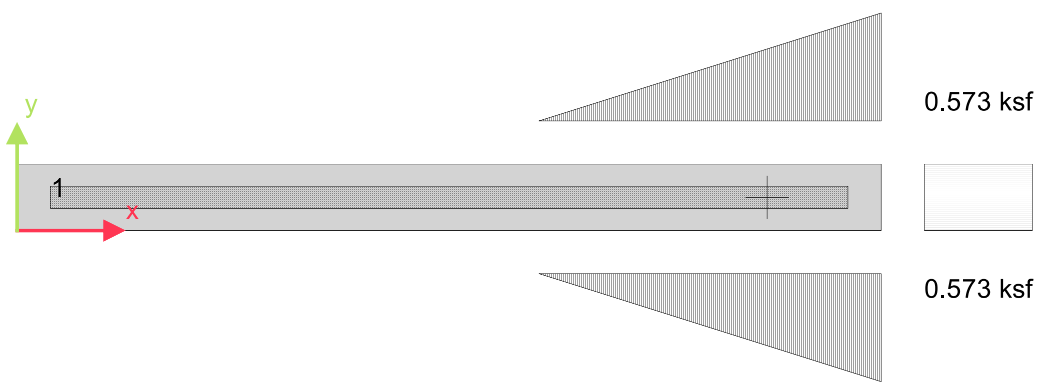
Width of footing — $L_y$ = **2** ft

Footing area — $A = L_x \times L_y$ = **52** ft$^2$

Depth of footing — h = **10** in

Depth of soil over footing — $h_{soil}$ = **8** in

Density of concrete — $\gamma_{conc}$ = **150.0** lb/ft$^3$




**Column no.1 details**

Length of column — $l_{x1}$ = **288.00** in

Width of column — $l_{y1}$ = **8.00** in

position in x-axis — $x_1$ = **156.00** in

position in y-axis — $y_1$ = **12.00** in

**Soil properties**

Net allowable bearing pressure — $q_{allow\_Net}$ = **2** ksf using a soil factor of safety, $FS_{soil}$, of 3

Density of soil — $\gamma_{soil}$ = **120.0** lb/ft$^3$

Angle of internal friction — $\phi_b$ = **30.0** deg

Design base friction angle — $\delta_{bb}$ = **30.0** deg

Coefficient of base friction — $\tan(\delta_{bb})$ = **0.577**

**Footing loads**

Self weight — $F_{swt} = h \times \gamma_{conc}$ = **125** psf

Soil weight — $F_{soil} = h_{soil} \times \gamma_{soil}$ = **80** psf

**Column no.1 loads**

Dead load in z — $F_{Dz1}$ = **0.5** kips

Live roof load in z — $F_{Lrz1}$ = **0.3** kips

Wind load moment in x — $M_{Wx1}$ = **94.1** kip_ft

**Footing analysis for soil and stability**

## Chapter 3: Foundation Design Cont'd...

**Load combinations per ASCE 7-16**

1.0D (0.092)
1.0D + 1.0L (0.092)
1.0D + 1.0Lr (0.095)
1.0D + 1.0S (0.092)
1.0D + 1.0R (0.092)
1.0D + 0.75L + 0.75Lr (0.094)
1.0D + 0.75L + 0.75S (0.092)
1.0D + 0.75L + 0.75R (0.092)
1.0D + 0.6W (0.485)
1.0D + 0.75L + 0.75Lr + 0.45W (0.375)
1.0D + 0.75L + 0.75S + 0.45W (0.383)
1.0D + 0.75L + 0.75R + 0.45W (0.383)
0.6D + 0.6W (INVALID)

**Combination 15 results: 0.6D + 0.6W**

**Forces on footing**

Force in z-axis — $F_{dz} = \gamma_D \times A \times (F_{swt} + F_{soil}) + \gamma_D \times (F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})$ = **5.9** kips

**Moments on footing**

Moment in x-axis, about x is 0 — $M_{dx} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_x / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times x_1) + \gamma_W \times (M_{Wx1})$ = **133.1** kip_ft

Moment in y-axis, about y is 0 — $M_{dy} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_y / 2) + \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times y_1)$ = **5.9** kip_ft

**Uplift verification**

Vertical force — $F_{dz}$ = **5.898** kips

***PASS - Footing is not subject to uplift***

**Stability against overturning in x direction, moment about x is 0**

Overturning moment — $M_{OTx0} = \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times x_1)$ = **-6.47** kip_ft

Resisting moment — $M_{Rx0} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_x / 2) + \gamma_W \times (M_{Wx1})$ = **139.58** kip_ft

Factor of safety — $abs(M_{Rx0} / M_{OTx0})$ = **21.560**

***PASS - Overturning moment safety factor exceeds the minimum of 1.50***

**Stability against overturning in x direction, moment about x is $L_x$**

Overturning moment — $M_{OTxL} = \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times (x_1 - L_x)) + \gamma_W \times (M_{Wx1})$ = **62.9** kip_ft

Resisting moment — $M_{RxL} = -1 \times (\gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_x / 2))$ = **-83.15** kip_ft

Factor of safety — $abs(M_{RxL} / M_{OTxL})$ = **1.322**

***FAIL - Minimum overturning moment safety factor, 1.50, exceeds the actual safety factor***

**Stability against overturning in y direction, moment about y is 0**

Overturning moment — $M_{OTy0} = \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times y_1)$ = **-0.5** kip_ft

Resisting moment — $M_{Ry0} = \gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_y / 2)$ = **6.4** kip_ft

Factor of safety — $abs(M_{Ry0} / M_{OTy0})$ = **12.843**

***PASS - Overturning moment safety factor exceeds the minimum of 1.50***

## Chapter 3: Foundation Design Cont'd...

**Stability against overturning in y direction, moment about y is $L_y$**

Overturning moment $M_{OTyL} = \gamma_D \times (((F_{Dz1} - l_{x1} \times l_{y1} \times h_{soil} \times \gamma_{soil})) \times (y_1 - L_y)) =$ **0.5** kip_ft

Resisting moment $M_{RyL} = -1 \times (\gamma_D \times (A \times (F_{swt} + F_{soil}) \times L_y / 2)) =$ **-6.4** kip_ft

Factor of safety $abs(M_{RyL} / M_{OTyL}) =$ **12.843**

***PASS - Overturning moment safety factor exceeds the minimum of 1.50***

**Bearing resistance**

**Eccentricity of base reaction**

Eccentricity of base reaction in x-axis $e_{dx} = M_{dx} / F_{dz} - L_x / 2 =$ **114.812** in

Eccentricity of base reaction in y-axis $e_{dy} = M_{dy} / F_{dz} - L_y / 2 =$ **0** in

Length of bearing in x-axis $L'_{xd} = min(L_x, 3 \times (L_x / 2 - abs(e_{dx}))) =$ **123.565** in

**Pad base pressures**

$q_1 =$ **0** ksf

$q_2 =$ **0** ksf

$q_3 =$ **0.573** ksf

$q_4 =$ **0.573** ksf

Minimum base pressure $q_{min} = min(q_1,q_2,q_3,q_4) =$ **0** ksf

Maximum base pressure $q_{max} = max(q_1,q_2,q_3,q_4) =$ **0.573** ksf

**Allowable bearing capacity**

Allowable bearing capacity $q_{allow} = q_{allow\_Net} + ((h + h_{soil}) \times \gamma_{soil}) / FS_{soil} =$ **2.06** ksf

$q_{max} / q_{allow} =$ **0.278**

***PASS - Allowable bearing capacity exceeds design base pressure***

***WARNING - Uplift occurs under a column. Concrete design is beyond scope.***

***WARNING - Uplift occurs under a column. Concrete design is beyond scope.***

# Appendix - A

## A.1 : Empirical CMU References

## A.1 : Empirical CMU References

*#1 Standard Building Code*
*https://archive.org/details/standardbuilding00unse*

*#2 Structural Details for Masonry Construction*
*https://archive.org/details/structuraldetail0000newm_a7g0/page/12/mode/2up*

*#3 Concrete Masonry Construction Details*
*https://archive.org/details/nationalconcretemasonryassociation/page/n5/mode/2up?q=mortar*

*#4 Facts About Concrete Masonry: With Construction Details And Suggested Specifications*
*https://archive.org/details/NationalCementMasonryAssocFactsAboutConcreteMason0001/page/n7/mode/2up?view=theater*

*#5 Concrete Masonry Manual*
*https://archive.org/details/ExpandedShaleClaySlateInstituteConcreteMasonryManu0001/page/n17/mode/2up*

# Appendix - B

B.1 : South Wall Design Reports

B.2 : West Wall Design Reports

# Design Results
# Masonry wall

## General Information

**Global status : N. G.**

| | | |
|---|---|---|
| Design code | : | TMS 402-16 ASD |

**Materials:**

| | | |
|---|---|---|
| Material | : | CMU 1.5-60 |
| Mortar type | : | Port/Mort - M/S |
| Grouting type | : | Full grouting |
| Masonry compression strength (F`m) | : | 1.5 [Kip/in2] |
| Steel tension strength (fy) | : | 60 [Kip/in2] |
| Steel allowable tension strength (Fs) | : | 32 [Kip/in2] |
| Steel elasticity modulus (Es) | : | 29000 [Kip/in2] |
| Masonry elasticity modulus (Em) | : | 1350 [Kip/in2] |
| Masonry unit weight | : | 0.135 [Kip/ft3] |

## Geometry

| | | |
|---|---|---|
| Total height | : | 9.00 [ft] |
| Total length | : | 32.00 [ft] |
| Foundation type | : | Continuous |
| Wall bottom restraint | : | Pinned |
| Column bottom restraint | : | Pinned |
| Rigidity elements | : | None |

**Number of stories: 1**

| Story | Story height [ft] | Wall thickness [in] | Effective unit weight [Kip/ft3] |
|---|---|---|---|
| 1 | 9.00 | 7.63 | 0.14 |

**Openings:**

| Reference | X Coordinate [ft] | Y Coordinate [ft] | Width [ft] | Height [ft] |
|---|---|---|---|---|
| Lower left | 10.25 | 3.50 | 18.00 | 2.00 |
| Lower left | 30.00 | 3.00 | 1.00 | 3.00 |
| Lower left | 3.00 | 3.00 | 1.00 | 3.00 |

## Load Conditions

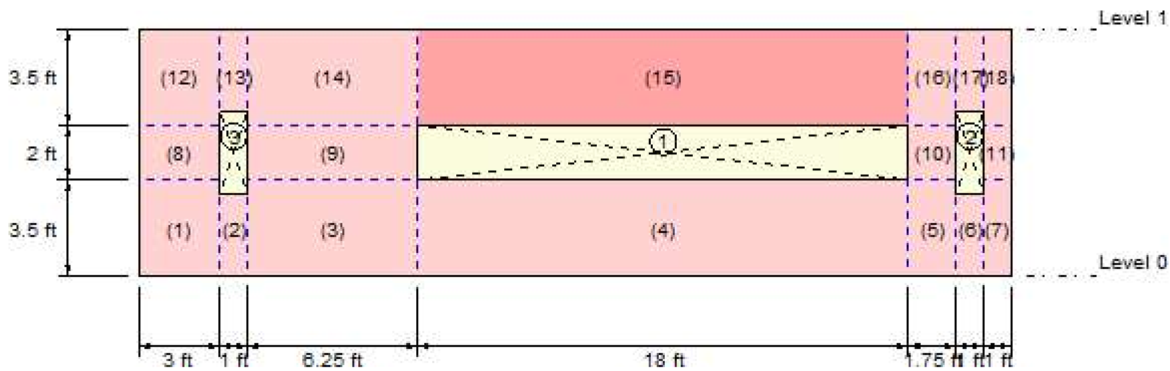
| ID | Comb. | Category | Description |
|---|---|---|---|
| DL | No | DL | Dead Load |
| LLR | No | LLR | Live Load Roof |
| WLz | No | WIND | Wind Load - Z |
| WLx | No | WIND | Wind load - X |
| D1 | Yes | | DL |
| D2 | Yes | | DL+LLR |
| D3 | Yes | | DL+0.75LLR |

| | | |
|---|---|---|
| D4 | Yes | DL+0.6WLz |
| D5 | Yes | DL+0.6WLx |
| D6 | Yes | DL+0.45WLz+0.75LLR |
| D7 | Yes | DL+0.45WLx+0.75LLR |
| D8 | Yes | 0.6DL+0.6WLz |
| D9 | Yes | 0.6DL+0.6WLx |
| S1 | Yes | DL |
| S2 | Yes | DL+LLR |
| S3 | Yes | DL+0.75LLR |
| S4 | Yes | DL+0.6WLz |
| S5 | Yes | DL+0.6WLx |
| S6 | Yes | DL+0.45WLz+0.75LLR |
| S7 | Yes | DL+0.45WLx+0.75LLR |
| S8 | Yes | 0.6DL+0.6WLz |
| S9 | Yes | 0.6DL+0.6WLx |

-----------------------------------------------------------------------------------------------------------------

# Bearing Wall Design

Status : N. G.
- Insufficient combined axial-flexural strength, TMS 402-16 ASD, 8.3.4.2.2, 8.3.4.1 (Segment 1)
- Insufficient shear strength, TMS 402-16 ASD, 8.2.6, 8.3.5 (Segment 2)




## *Geometry*

| Level | Segment | X Coordinate [ft] | Y Coordinate [ft] | Width [ft] | Height [ft] |
|---|---|---|---|---|---|
| 0 | 1 | 0.00 | 0.00 | 3.00 | 3.50 |
| | 2 | 3.00 | 0.00 | 1.00 | 3.50 |
| | 3 | 4.00 | 0.00 | 6.25 | 3.50 |
| | 4 | 10.25 | 0.00 | 18.00 | 3.50 |
| | 5 | 28.25 | 0.00 | 1.75 | 3.50 |
| | 6 | 30.00 | 0.00 | 1.00 | 3.50 |
| | 7 | 31.00 | 0.00 | 1.00 | 3.50 |
| | 8 | 0.00 | 3.50 | 3.00 | 2.00 |
| | 9 | 4.00 | 3.50 | 6.25 | 2.00 |
| | 10 | 28.25 | 3.50 | 1.75 | 2.00 |
| | 11 | 31.00 | 3.50 | 1.00 | 2.00 |
| | 12 | 0.00 | 5.50 | 3.00 | 3.50 |
| | 13 | 3.00 | 5.50 | 1.00 | 3.50 |
| | 14 | 4.00 | 5.50 | 6.25 | 3.50 |
| | 15 | 10.25 | 5.50 | 18.00 | 3.50 |
| | 16 | 28.25 | 5.50 | 1.75 | 3.50 |
| | 17 | 30.00 | 5.50 | 1.00 | 3.50 |
| | 18 | 31.00 | 5.50 | 1.00 | 3.50 |

-----------------------------------------------------------------------------------------------------------------

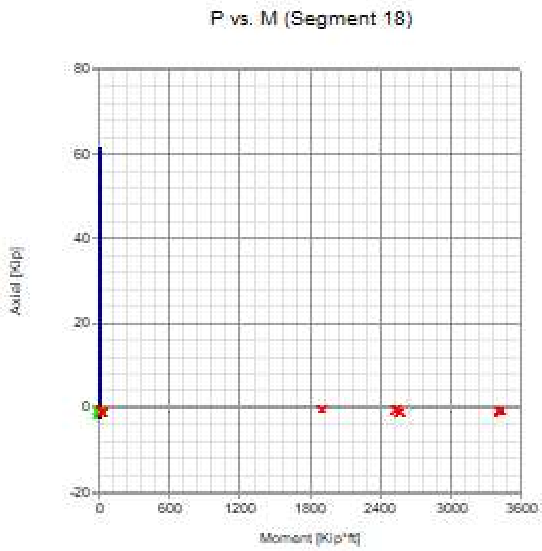
### *Vertical reinforcement*

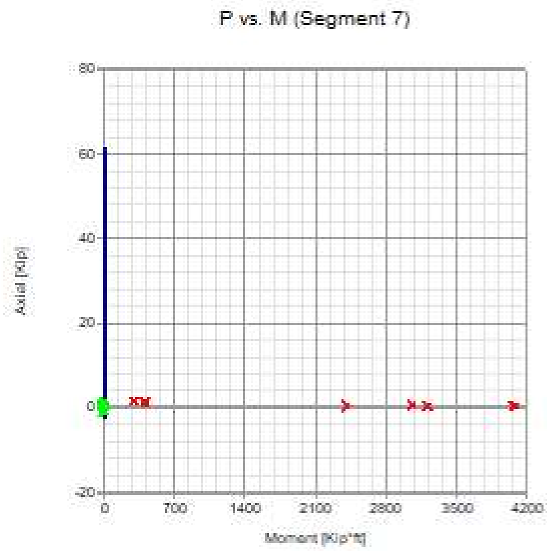
| Segment | Bars | Spacing [in] | Ld [in] |
|---|---|---|---|
| 1 | 2-#4 | 32.00 | 25.17 |
| 2 | 1-#4 | 32.00 | 25.17 |
| 3 | 3-#4 | 32.00 | 25.17 |
| 4 | 7-#4 | 32.00 | 25.17 |
| 5 | 1-#4 | 32.00 | 25.17 |
| 6 | 1-#4 | 32.00 | 25.17 |
| 7 | 1-#4 | 32.00 | 25.17 |
| 8 | 2-#4 | 32.00 | 25.17 |
| 9 | 3-#4 | 32.00 | 25.17 |
| 10 | 1-#4 | 32.00 | 25.17 |
| 11 | 1-#4 | 32.00 | 25.17 |
| 12 | 2-#4 | 32.00 | 25.17 |
| 13 | 1-#4 | 32.00 | 25.17 |
| 14 | 3-#4 | 32.00 | 25.17 |
| 15 | 7-#4 | 32.00 | 25.17 |
| 16 | 1-#4 | 32.00 | 25.17 |
| 17 | 1-#4 | 32.00 | 25.17 |
| 18 | 1-#4 | 32.00 | 25.17 |

### *Combined axial flexure*

| Segment | Condition | P [Kip] | M [Kip*ft] | Ma [Kip*ft] | Ratio |
|---|---|---|---|---|---|
| 1 | D8(Top) | 0.93 | -22.17 | 2.37 | 9.34 |
| 2 | D8(Max) | 0.32 | -4.12 | 0.79 | 5.19 |
| 3 | D8(Top) | 5.79 | -168.44 | 6.02 | 27.98 |
| 4 | D8(Max) | 3.69 | -6272.53 | 13.71 | NPC |
| 5 | D8(Max) | 2.35 | -3666.96 | 1.89 | NPC |
| 6 | D8(Max) | 1.14 | 3667.45 | 1.02 | NPC |
| 7 | D8(Max) | 0.36 | 4076.50 | 0.80 | NPC |
| 8 | D8(Bottom) | 0.93 | -22.03 | 2.37 | 9.28 |
| 9 | D8(Max) | 4.77 | -220.82 | 5.74 | 38.49 |
| 10 | D8(Bottom) | 3.84 | 1746.55 | 2.30 | NPC |
| 11 | D4(Top) | -0.43 | -2252.35 | 0.58 | NPC |
| 12 | D8(Bottom) | 0.54 | -16.84 | 2.26 | 7.44 |
| 13 | D8(Max) | 0.03 | -3.80 | 0.71 | 5.34 |
| 14 | D8(Max) | 3.19 | -170.34 | 5.30 | 32.17 |
| 15 | D8(Top) | 6.32 | -599.92 | 14.45 | 41.52 |
| 16 | D8(Bottom) | 2.68 | 1053.93 | 1.98 | NPC |
| 17 | D8(Max) | 0.28 | -3110.15 | 0.78 | NPC |
| 18 | D4(Max) | -1.06 | 3417.80 | 0.40 | NPC |

### *Interaction diagrams, P vs. M*




## *Axial compression*

| Segment | Condition | P [Kip] | Pa [Kip] | Ratio |
|---|---|---|---|---|
| 1 | D5(Bottom) | 4.34 | 90.30 | 0.05 |
| 2 | D5(Bottom) | 1.49 | 30.10 | 0.05 |
| 3 | D2(Top) | 10.35 | 188.12 | 0.05 |
| 4 | D2(Bottom) | 9.06 | 541.77 | 0.02 |
| 5 | D2(Top) | 6.49 | 52.67 | 0.12 |
| 6 | D6(Max) | 2.00 | 30.10 | 0.07 |
| 7 | D2(Bottom) | 1.60 | 30.10 | 0.05 |
| 8 | D5(Bottom) | 3.94 | 90.30 | 0.04 |
| 9 | D2(Bottom) | 10.46 | 188.12 | 0.06 |
| 10 | D2(Bottom) | 6.89 | 52.67 | 0.13 |
| 11 | D2(Bottom) | 0.43 | 30.10 | 0.01 |
| 12 | D5(Bottom) | 2.32 | 90.30 | 0.03 |
| 13 | D2(Top) | 0.10 | 30.10 | 0.00 |
| 14 | D2(Bottom) | 5.75 | 188.12 | 0.03 |
| 15 | D2(Top) | 11.70 | 541.77 | 0.02 |
| 16 | D7(Bottom) | 5.15 | 52.67 | 0.10 |
| 17 | D6(Max) | 0.50 | 30.10 | 0.02 |
| 18 | D1(Top) | -1.16 | 30.10 | 0.00 |

## *Axial tension*

| Segment | Condition | ft [Kip/in2] | Fs [Kip/in2] | Ratio |
|---|---|---|---|---|
| 1 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 2 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 3 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 4 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 5 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 6 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 7 | D9(Max) | 16.38 | 32.00 | 0.51 |
| 8 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 9 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 10 | D1(Top) | 0.00 | 32.00 | 0.00 |

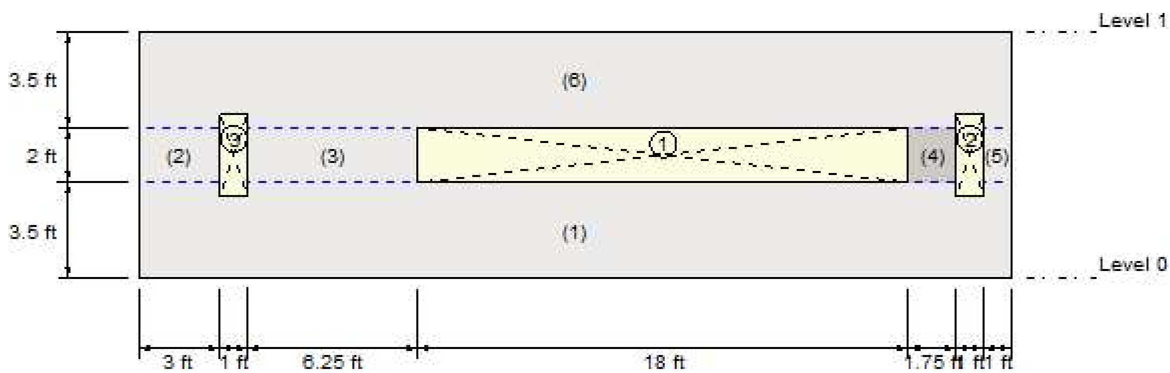
| | | | | | |
|---|---|---|---|---|---|
| 11 | D5(Top) | 15.81 | 32.00 | 0.49 | |
| 12 | D1(Top) | 0.00 | 32.00 | 0.00 | |
| 13 | D9(Max) | 0.97 | 32.00 | 0.03 | |
| 14 | D1(Top) | 0.00 | 32.00 | 0.00 | |
| 15 | D1(Top) | 0.00 | 32.00 | 0.00 | |
| 16 | D4(Top) | 1.78 | 32.00 | 0.06 | |
| 17 | D2(Max) | 10.22 | 32.00 | 0.32 | |
| 18 | D5(Max) | 19.81 | 32.00 | 0.62 | |

### *Shear*

| Segment | Condition | fv [Kip/in2] | Fv [Kip/in2] | Ratio | |
|---|---|---|---|---|---|
| 1 | D8(Bottom) | 0.038 | 0.056 | 0.68 | |
| 2 | D8(Max) | 0.217 | 0.057 | 3.81 | |
| 3 | D8(Bottom) | 0.128 | 0.081 | 1.58 | |
| 4 | D8(Max) | 12.356 | 0.046 | NPC | |
| 5 | D8(Max) | 222.859 | 0.074 | NPC | |
| 6 | D8(Max) | 167.150 | 0.058 | NPC | |
| 7 | D8(Top) | 287.142 | 0.066 | NPC | |
| 8 | D8(Top) | 0.028 | 0.045 | 0.63 | |
| 9 | D8(Top) | 0.277 | 0.047 | 5.95 | |
| 10 | D8(Max) | 29.669 | 0.056 | NPC | |
| 11 | D8(Bottom) | 254.701 | 0.066 | NPC | |
| 12 | D8(Top) | 0.027 | 0.044 | 0.61 | |
| 13 | D8(Max) | 0.150 | 0.048 | 3.12 | |
| 14 | D8(Max) | 0.308 | 0.046 | 6.65 | |
| 15 | D8(Bottom) | 0.618 | 0.046 | 13.57 | |
| 16 | D4(Top) | 3.308 | 0.044 | 75.92 | |
| 17 | D8(Max) | 77.704 | 0.045 | NPC | |
| 18 | D8(Max) | 324.802 | 0.065 | NPC | |

# Shear Wall Design

Status : OK




### *Geometry*

| Level | Segment | X Coordinate [ft] | Y Coordinate [ft] | Width [ft] | Height [ft] |
|---|---|---|---|---|---|
| 0 | 1 | 0.00 | 0.00 | 32.00 | 3.50 |
| | 2 | 0.00 | 3.50 | 3.00 | 2.00 |
| | 3 | 4.00 | 3.50 | 6.25 | 2.00 |
| | 4 | 28.25 | 3.50 | 1.75 | 2.00 |
| | 5 | 31.00 | 3.50 | 1.00 | 2.00 |
| | 6 | 0.00 | 5.50 | 32.00 | 3.50 |

## *Reinforcement*

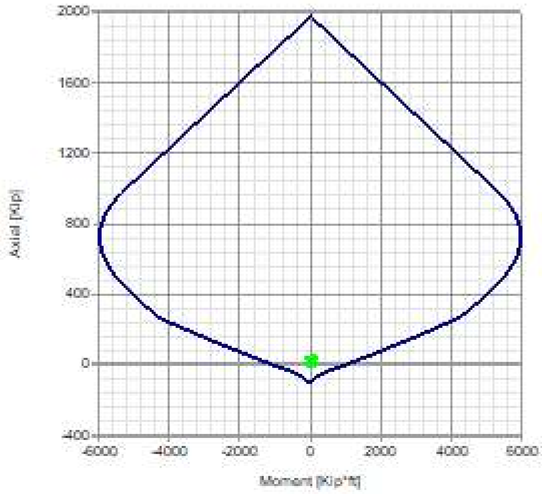
| | Vertical reinforcement | | | Horizontal reinforcement | | |
|---|---|---|---|---|---|---|
| Segment | Bars | Spacing [in] | Ld [in] | Bars | Spacing [in] | Ld [in] |
| 1 | 2-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 3-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 7-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| 2 | 2-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| 3 | 3-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| 4 | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| 5 | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| 6 | 2-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 3-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 7-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |

## *Combined axial flexure*

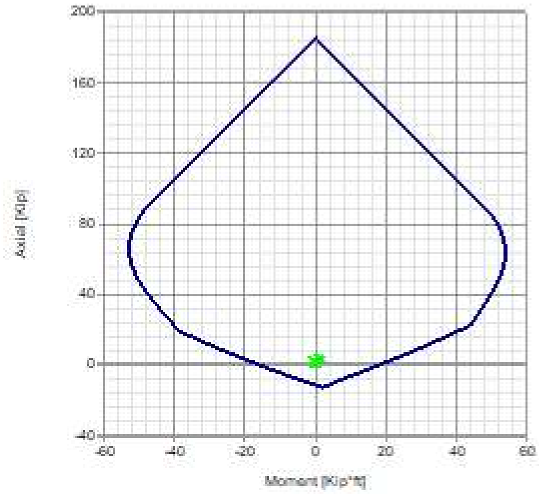
| Segment | Condition | P [Kip] | M [Kip*ft] | Ma [Kip*ft] | Ratio |
|---|---|---|---|---|---|
| 1 | D5(Max) | 22.27 | 106.99 | 1290.06 | 0.08 |
| 2 | D9(Max) | 3.13 | 1.34 | 22.05 | 0.06 |
| 3 | D2(Max) | 8.55 | -12.75 | 67.19 | 0.19 |
| 4 | D2(Top) | 5.57 | 2.21 | 4.81 | 0.46 |
| 5 | D7(Top) | -1.02 | 0.15 | 0.96 | 0.16 |
| 6 | D2(Max) | 3.34 | 59.92 | 1040.55 | 0.06 |

## *Interaction diagrams, P vs. M*

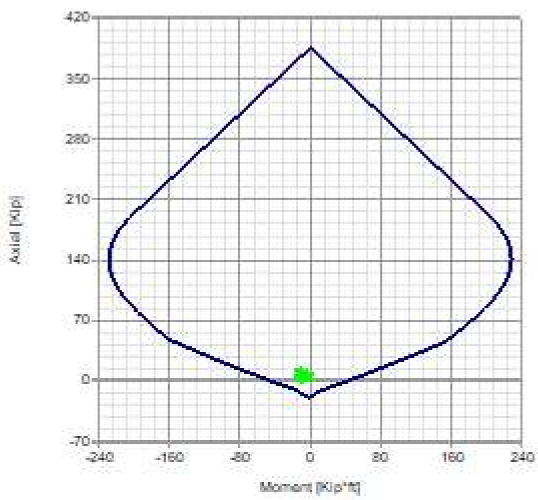
P vs. M (Segment 1)



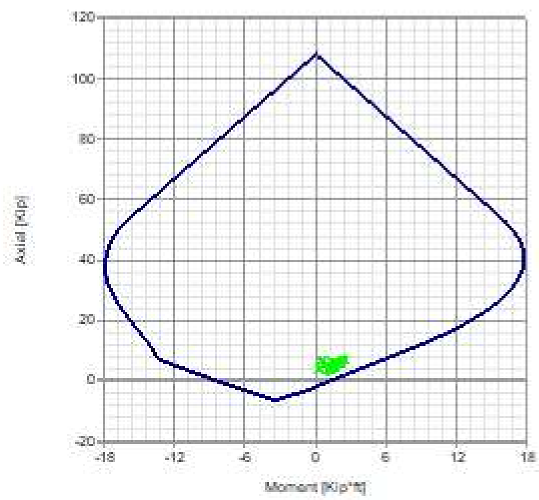

P vs. M (Segment 2)



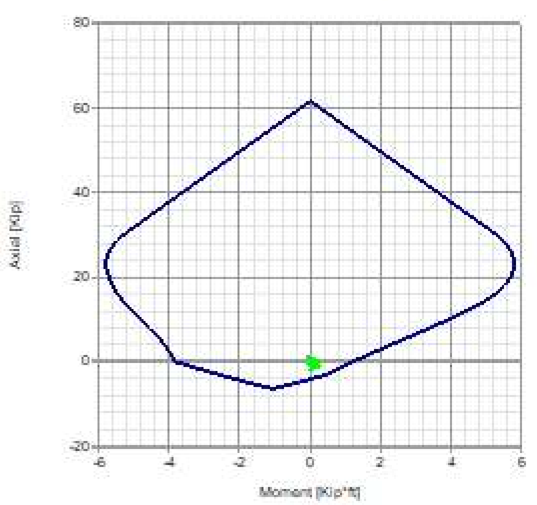

P vs. M (Segment 3)



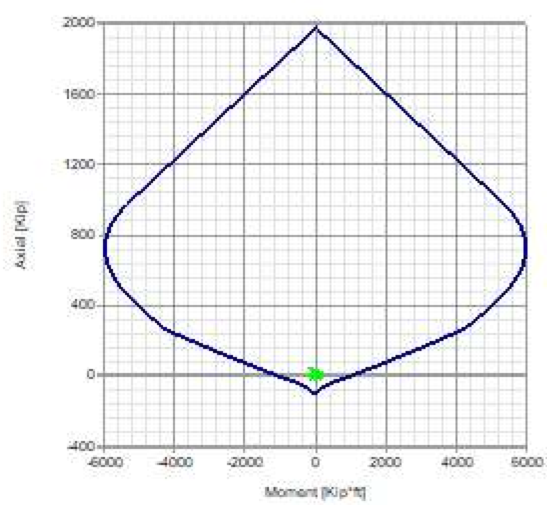

P vs. M (Segment 4)




P vs. M (Segment 5)




P vs. M (Segment 6)



### *Axial compression*

| Segment | Condition | P [Kip] | Pa [Kip] | Ratio |
|---|---|---|---|---|
| 1 | D2(Bottom) | 28.39 | 962.89 | 0.03 |
| 2 | D5(Bottom) | 3.94 | 90.24 | 0.04 |
| 3 | D2(Bottom) | 10.46 | 188.07 | 0.06 |
| 4 | D7(Max) | 7.17 | 52.65 | 0.14 |
| 5 | D2(Bottom) | 0.43 | 30.06 | 0.01 |
| 6 | D2(Bottom) | 22.66 | 962.89 | 0.02 |

### *Axial tension*

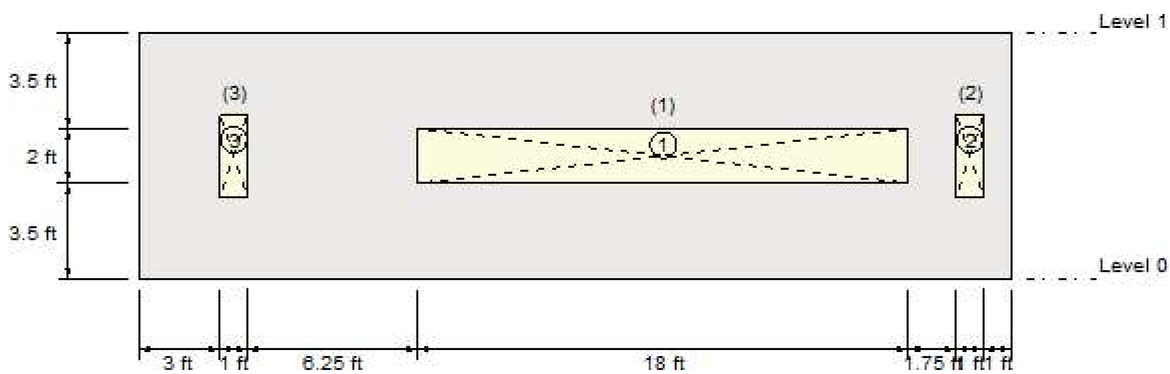
| Segment | Condition | ft [Kip/in2] | Fs [Kip/in2] | Ratio |
|---|---|---|---|---|
| 1 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 2 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 3 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 4 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 5 | D5(Top) | 5.93 | 32.00 | 0.19 |
| 6 | D1(Top) | 0.00 | 32.00 | 0.00 |

### *Shear*

| Segment | Condition | fv [Kip/in2] | Fv [Kip/in2] | Ratio |
|---|---|---|---|---|
| 1 | D5(Max) | 0.003 | 0.066 | 0.05 |
| 2 | D9(Max) | 0.004 | 0.063 | 0.06 |
| 3 | D5(Max) | 0.019 | 0.076 | 0.24 |
| 4 | D2(Max) | 0.016 | 0.068 | 0.24 |
| 5 | D2(Max) | 0.004 | 0.059 | 0.07 |
| 6 | D5(Top) | 0.003 | 0.076 | 0.05 |

## Lintel Design

Status : Warnings in design
- Insufficient clear spacing between bars, TMS 402-16 ASD, 6.1.3.1 (Lintel 1)
- Insufficient development length, TMS 402-16 ASD, 6.1.5.1 (Lintel 1)




### *Geometry*

| Lintel | X Coordinate [ft] | Y Coordinate [ft] | Length [ft] | Depth [in] |
|---|---|---|---|---|
| 1 | 10.25 | 3.50 | 18.00 | 26.00 |
| 2 | 30.00 | 3.00 | 1.00 | 26.00 |
| 3 | 3.00 | 3.00 | 1.00 | 26.00 |

## *Reinforcement*

| | Top long. reinforcement | | Bottom long. reinforcement | | Transverse reinforcement | | |
|---|---|---|---|---|---|---|---|
| Lintel | Bars | Extent [in] | Bars | Extent [in] | Bars | Spacing [in] | Ld [in] |
| 1 | 2-#7 | 7.00 | 2-#9 | 0.00 | #3 | 12.00 | 4.98 |
| 2 | 1-#4 | 0.00 | -- | 0.00 | -- | 0.00 | 0.00 |
| 3 | 2-#7 | 7.00 | 2-#9 | 0.00 | #3 | 12.00 | 4.98 |

## *Bending*

| Lintel | Condition | M [Kip*ft] | Ma [Kip*ft] | Ratio |
|---|---|---|---|---|
| 1 | D1(Top) | 17.90 | 62.71 | 0.29 |
| 2 | D2(Bottom) | -0.05 | 11.84 | 0.00 |
| 3 | D5(Bottom) | -0.01 | 62.08 | 0.00 |

## *Shear*

| Lintel | Condition | fv [Kip/in2] | Fv [Kip/in2] | Ratio |
|---|---|---|---|---|
| 1 | D2(Top) | 0.029 | 0.077 | 0.37 |
| 2 | D2(Bottom) | 0.003 | 0.044 | 0.08 |
| 3 | D9(Top) | 0.002 | 0.077 | 0.02 |

## *Deflection*

| Lintel | Condition | $\delta$s [in] | $\delta$max [in] | Ratio |
|---|---|---|---|---|
| 1 | S1(Top) | 0.08 | 0.36 | 0.22 |
| 2 | | 0.00 | 0.00 | 0.00 |
| 3 | | 0.00 | 0.00 | 0.00 |

# Notes

* P = Axial load
* Pa = Allowable compressive force due to axial load.
* M = Moment at the section under consideration.
* Ma = Wall allowable moment due to axial force or lintel pure flexure allowable moment
* fa = Calculated compressive stress due to axial load only
* fb = Calculated compressive stress due to axial flexure only
* ft = Calculated axial tension
* Fa = Allowable compressive stress due to axial load only

* Fb = Allowable compressive stress due to axial flexure only
* fv = Calculated shear stress
* Fs = Allowable tensile or compressive stress
* Fv = Allowable shear stress
* ld = Embedment length
* As = Effective cross sectional area of reinforcement
* δs = Calculated deflection
* δmax = Maximum allowable deflection

# Design Results
# Masonry wall

## General Information

**Global status :** N. G.

| | | |
|---|---|---|
| Design code | : | TMS 402-16 ASD |

**Materials:**

| | | |
|---|---|---|
| Material | : | CMU 1.5-60 |
| Mortar type | : | Port/Mort - M/S |
| Grouting type | : | Full grouting |
| Masonry compression strength (F`m) | : | 1.5 [Kip/in2] |
| Steel tension strength (fy) | : | 60 [Kip/in2] |
| Steel allowable tension strength (Fs) | : | 32 [Kip/in2] |
| Steel elasticity modulus (Es) | : | 29000 [Kip/in2] |
| Masonry elasticity modulus (Em) | : | 1350 [Kip/in2] |
| Masonry unit weight | : | 0.135 [Kip/ft3] |

## Geometry

| | | |
|---|---|---|
| Total height | : | 9.00 [ft] |
| Total length | : | 26.00 [ft] |
| Foundation type | : | Continuous |
| Wall bottom restraint | : | Pinned |
| Column bottom restraint | : | Pinned |
| Rigidity elements | : | None |

**Number of stories: 1**

| Story | Story height [ft] | Wall thickness [in] | Effective unit weight [Kip/ft3] |
|---|---|---|---|
| 1 | 9.00 | 7.63 | 0.14 |

**Openings:**

| Reference | X Coordinate [ft] | Y Coordinate [ft] | Width [ft] | Height [ft] |
|---|---|---|---|---|
| Lower left | 4.00 | 1.50 | 18.00 | 4.00 |
| Lower left | 24.00 | 1.50 | 1.00 | 5.00 |
| Lower left | 1.00 | 1.50 | 1.00 | 5.00 |

## Load Conditions

| ID | Comb. | Category | Description |
|---|---|---|---|
| DL | No | DL | Dead Load |
| LLR | No | LLR | Live Load Roof |
| WLz | No | WIND | Wind Load - Z |
| WLx | No | WIND | Wind load - X |
| D1 | Yes | | DL |
| D2 | Yes | | DL+LLR |
| D3 | Yes | | DL+0.75LLR |

| | | |
|---|---|---|
| D4 | Yes | DL+0.6WLz |
| D5 | Yes | DL+0.6WLx |
| D6 | Yes | DL+0.45WLz+0.75LLR |
| D7 | Yes | DL+0.45WLx+0.75LLR |
| D8 | Yes | 0.6DL+0.6WLz |
| D9 | Yes | 0.6DL+0.6WLx |
| S1 | Yes | DL |
| S2 | Yes | DL+LLR |
| S3 | Yes | DL+0.75LLR |
| S4 | Yes | DL+0.6WLz |
| S5 | Yes | DL+0.6WLx |
| S6 | Yes | DL+0.45WLz+0.75LLR |
| S7 | Yes | DL+0.45WLx+0.75LLR |
| S8 | Yes | 0.6DL+0.6WLz |
| S9 | Yes | 0.6DL+0.6WLx |

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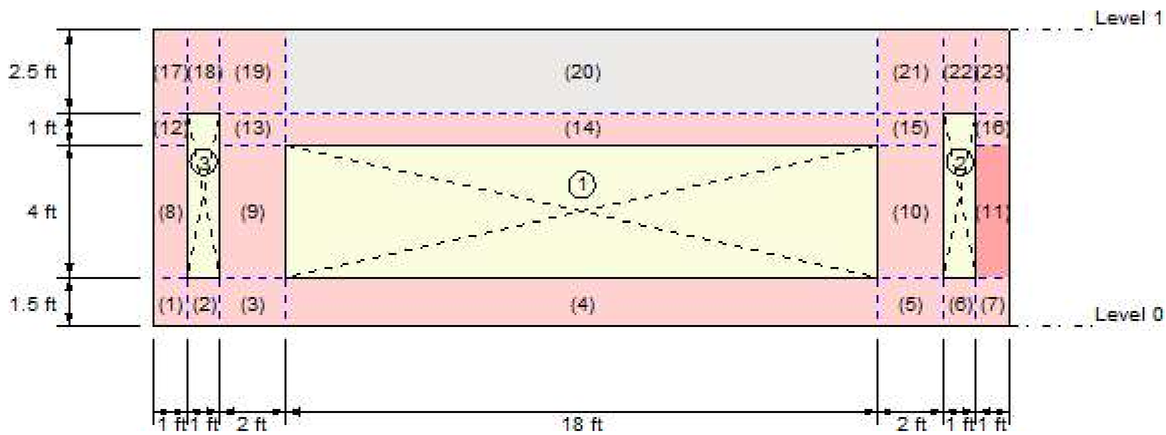
# Bearing Wall Design

Status : N. G.
- Insufficient combined axial-flexural strength, TMS 402-16 ASD, 8.3.4.2.2, 8.3.4.1 (Segment 1)
- Insufficient shear strength, TMS 402-16 ASD, 8.2.6, 8.3.5 (Segment 2)




## *Geometry*

| Level | Segment | X Coordinate [ft] | Y Coordinate [ft] | Width [ft] | Height [ft] |
|---|---|---|---|---|---|
| 0 | 1 | 0.00 | 0.00 | 1.00 | 1.50 |
| | 2 | 1.00 | 0.00 | 1.00 | 1.50 |
| | 3 | 2.00 | 0.00 | 2.00 | 1.50 |
| | 4 | 4.00 | 0.00 | 18.00 | 1.50 |
| | 5 | 22.00 | 0.00 | 2.00 | 1.50 |
| | 6 | 24.00 | 0.00 | 1.00 | 1.50 |
| | 7 | 25.00 | 0.00 | 1.00 | 1.50 |
| | 8 | 0.00 | 1.50 | 1.00 | 4.00 |
| | 9 | 2.00 | 1.50 | 2.00 | 4.00 |
| | 10 | 22.00 | 1.50 | 2.00 | 4.00 |
| | 11 | 25.00 | 1.50 | 1.00 | 4.00 |
| | 12 | 0.00 | 5.50 | 1.00 | 1.00 |
| | 13 | 2.00 | 5.50 | 2.00 | 1.00 |
| | 14 | 4.00 | 5.50 | 18.00 | 1.00 |
| | 15 | 22.00 | 5.50 | 2.00 | 1.00 |
| | 16 | 25.00 | 5.50 | 1.00 | 1.00 |
| | 17 | 0.00 | 6.50 | 1.00 | 2.50 |
| | 18 | 1.00 | 6.50 | 1.00 | 2.50 |
| | 19 | 2.00 | 6.50 | 2.00 | 2.50 |
| | 20 | 4.00 | 6.50 | 18.00 | 2.50 |

| | | | | |
|---|---|---|---|---|
| 21 | 22.00 | 6.50 | 2.00 | 2.50 |
| 22 | 24.00 | 6.50 | 1.00 | 2.50 |
| 23 | 25.00 | 6.50 | 1.00 | 2.50 |

### *Vertical reinforcement*

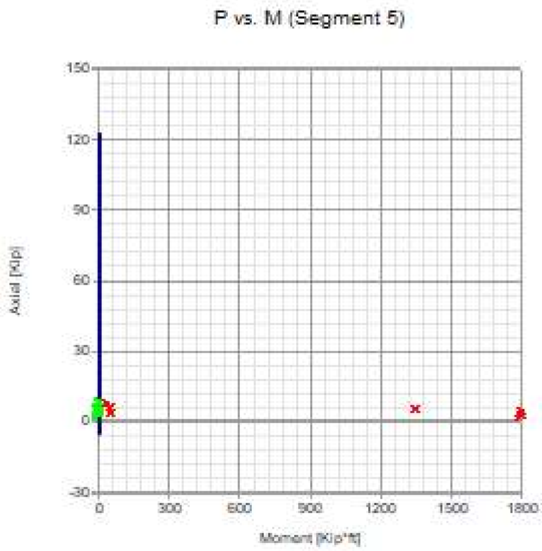
| Segment | Bars | Spacing [in] | Ld [in] |
|---|---|---|---|
| 1 | 1-#4 | 32.00 | 25.17 |
| 2 | 1-#4 | 32.00 | 25.17 |
| 3 | 1-#4 | 32.00 | 25.17 |
| 4 | 7-#4 | 32.00 | 25.17 |
| 5 | 1-#4 | 32.00 | 25.17 |
| 6 | 1-#4 | 32.00 | 25.17 |
| 7 | 1-#4 | 32.00 | 25.17 |
| 8 | 1-#4 | 32.00 | 25.17 |
| 9 | 1-#4 | 32.00 | 25.17 |
| 10 | 1-#4 | 32.00 | 25.17 |
| 11 | 1-#4 | 32.00 | 25.17 |
| 12 | 1-#4 | 32.00 | 25.17 |
| 13 | 1-#4 | 32.00 | 25.17 |
| 14 | 7-#4 | 32.00 | 25.17 |
| 15 | 1-#4 | 32.00 | 25.17 |
| 16 | 1-#4 | 32.00 | 25.17 |
| 17 | 1-#4 | 32.00 | 25.17 |
| 18 | 1-#4 | 32.00 | 25.17 |
| 19 | 1-#4 | 32.00 | 25.17 |
| 20 | 7-#4 | 32.00 | 25.17 |
| 21 | 1-#4 | 32.00 | 25.17 |
| 22 | 1-#4 | 32.00 | 25.17 |
| 23 | 1-#4 | 32.00 | 25.17 |

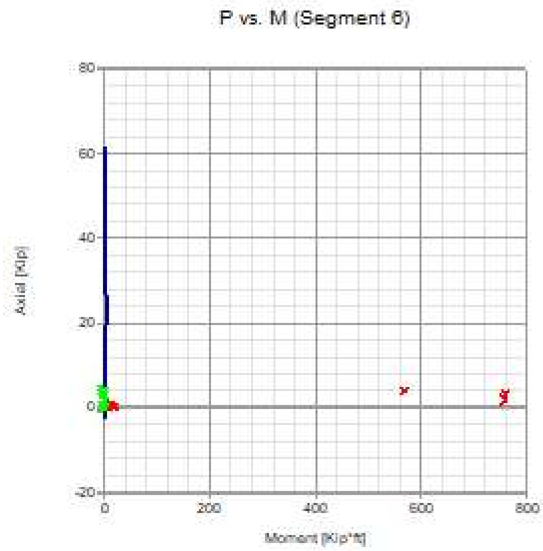
### *Combined axial flexure*

| Segment | Condition | P [Kip] | M [Kip*ft] | Ma [Kip*ft] | Ratio |
|---|---|---|---|---|---|
| 1 | D8(Max) | 0.05 | -3.99 | 0.72 | 5.56 |
| 2 | D8(Max) | 1.01 | -1.79 | 0.99 | 1.81 |
| 3 | D8(Max) | 4.06 | -4.69 | 2.53 | 1.85 |
| 4 | D8(Bottom) | 2.36 | 3066.20 | 13.34 | NPC |
| 5 | D8(Max) | 2.57 | -1796.90 | 2.13 | NPC |
| 6 | D8(Bottom) | 1.88 | -758.23 | 1.23 | NPC |
| 7 | D8(Max) | 1.72 | -387.09 | 1.18 | NPC |
| 8 | D4(Top) | -0.47 | -5.53 | 0.57 | 9.71 |
| 9 | D8(Max) | 5.02 | -24.79 | 2.77 | 8.94 |
| 10 | D8(Max) | 5.92 | 73.00 | 2.91 | 25.09 |
| 11 | D8(Max) | 0.19 | -65.19 | 0.76 | 85.94 |
| 12 | D4(Bottom) | -0.49 | -5.46 | 0.57 | 9.65 |
| 13 | D8(Bottom) | 4.72 | -23.35 | 2.71 | 8.61 |
| 14 | D8(Max) | 7.79 | -15.79 | 14.86 | 1.06 |
| 15 | D8(Max) | 5.57 | 42.28 | 2.86 | 14.80 |
| 16 | D4(Top) | -0.76 | 22.07 | 0.49 | 45.41 |
| 17 | D4(Bottom) | -0.64 | -4.54 | 0.52 | 8.70 |
| 18 | D8(Bottom) | 0.50 | -2.97 | 0.84 | 3.52 |
| 19 | D8(Max) | 2.07 | -10.44 | 1.99 | 5.26 |
| 20 | D4(Max) | -3.23 | 8.92 | 11.76 | 0.76 |
| 21 | D8(Max) | 1.74 | -15.84 | 1.90 | 8.36 |
| 22 | D4(Top) | -0.43 | -5.36 | 0.58 | 9.22 |

| | | | | | |
|---|---|---|---|---|---|
| 23 | D4(Max) | -0.80 | 22.07 | 0.48 | 46.30 |

### Interaction diagrams, P vs. M




### Axial compression

| Segment | Condition | P [Kip] | Pa [Kip] | Ratio |
|---|---|---|---|---|
| 1 | D7(Bottom) | 3.61 | 30.10 | 0.12 |
| 2 | D7(Bottom) | 4.00 | 30.10 | 0.13 |
| 3 | D2(Top) | 9.41 | 60.20 | 0.16 |
| 4 | D2(Bottom) | 4.77 | 541.77 | 0.01 |
| 5 | D2(Top) | 8.47 | 60.20 | 0.14 |
| 6 | D2(Bottom) | 4.35 | 30.10 | 0.14 |
| 7 | D2(Bottom) | 3.96 | 30.10 | 0.13 |
| 8 | D5(Bottom) | 1.62 | 30.10 | 0.05 |
| 9 | D2(Bottom) | 13.42 | 60.20 | 0.22 |
| 10 | D6(Max) | 12.87 | 60.20 | 0.21 |
| 11 | D2(Bottom) | 0.37 | 30.10 | 0.01 |
| 12 | D9(Bottom) | 0.44 | 30.10 | 0.01 |
| 13 | D2(Bottom) | 11.19 | 60.20 | 0.19 |
| 14 | D2(Bottom) | 43.86 | 541.77 | 0.08 |
| 15 | D2(Top) | 13.28 | 60.20 | 0.22 |
| 16 | D1(Top) | -0.76 | 30.10 | 0.00 |
| 17 | D9(Bottom) | 0.25 | 30.10 | 0.01 |
| 18 | D2(Bottom) | 1.23 | 30.10 | 0.04 |
| 19 | D2(Bottom) | 5.00 | 60.20 | 0.08 |
| 20 | D2(Bottom) | 16.07 | 541.77 | 0.03 |
| 21 | D2(Bottom) | 11.15 | 60.20 | 0.19 |
| 22 | D7(Bottom) | 0.84 | 30.10 | 0.03 |
| 23 | D1(Top) | -0.99 | 30.10 | 0.00 |

### Axial tension

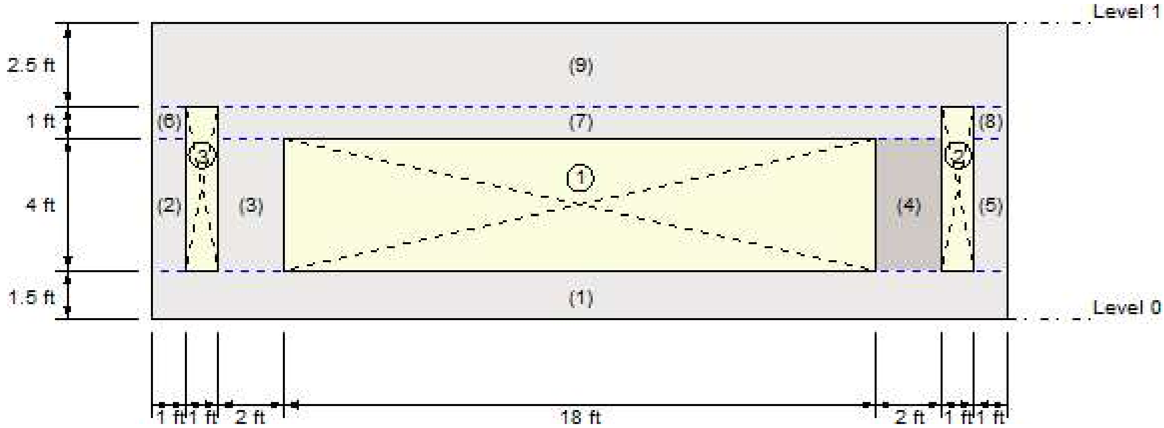
| Segment | Condition | ft [Kip/in2] | Fs [Kip/in2] | Ratio |
|---|---|---|---|---|
| 1 | D2(Max) | 17.62 | 32.00 | 0.55 |
| 2 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 3 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 4 | D2(Top) | 0.66 | 32.00 | 0.02 |
| 5 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 6 | D9(Max) | 1.00 | 32.00 | 0.03 |
| 7 | D9(Max) | 19.39 | 32.00 | 0.61 |
| 8 | D2(Top) | 8.42 | 32.00 | 0.26 |
| 9 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 10 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 11 | D9(Max) | 20.48 | 32.00 | 0.64 |
| 12 | D2(Top) | 11.07 | 32.00 | 0.35 |
| 13 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 14 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 15 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 16 | D7(Max) | 19.41 | 32.00 | 0.61 |
| 17 | D2(Max) | 24.89 | 32.00 | 0.78 |
| 18 | D7(Max) | 12.48 | 32.00 | 0.39 |
| 19 | D9(Top) | 4.06 | 32.00 | 0.13 |
| 20 | D1(Max) | 2.39 | 32.00 | 0.07 |
| 21 | D4(Top) | 1.57 | 32.00 | 0.05 |
| 22 | D7(Top) | 7.86 | 32.00 | 0.25 |
| 23 | D7(Max) | 30.46 | 32.00 | 0.95 |

## *Shear*

| Segment | Condition | fv [Kip/in2] | Fv [Kip/in2] | Ratio |
|---|---|---|---|---|
| 1 | D8(Top) | 0.021 | 0.044 | 0.48 |
| 2 | D8(Max) | 0.051 | 0.049 | 1.04 |
| 3 | D8(Max) | 0.099 | 0.061 | 1.63 |
| 4 | D8(Max) | 10.933 | 0.060 | NPC |
| 5 | D8(Bottom) | 29.249 | 0.051 | NPC |
| 6 | D8(Bottom) | 63.663 | 0.074 | NPC |
| 7 | D8(Max) | 57.614 | 0.079 | NPC |
| 8 | D8(Bottom) | 0.026 | 0.044 | 0.59 |
| 9 | D8(Max) | 0.100 | 0.057 | 1.75 |
| 10 | D8(Max) | 1.901 | 0.071 | 26.68 |
| 11 | D8(Max) | 1.160 | 0.045 | 25.98 |
| 12 | D4(Top) | 0.025 | 0.044 | 0.57 |
| 13 | D8(Top) | 0.097 | 0.050 | 1.95 |
| 14 | D8(Max) | 0.041 | 0.055 | 0.75 |
| 15 | D8(Top) | 0.720 | 0.059 | 12.26 |
| 16 | D4(Top) | 0.853 | 0.047 | 18.02 |
| 17 | D8(Bottom) | 0.024 | 0.044 | 0.55 |
| 18 | D8(Bottom) | 0.092 | 0.046 | 1.99 |
| 19 | D8(Bottom) | 0.093 | 0.049 | 1.90 |
| 20 | D8(Bottom) | 0.051 | 0.077 | 0.66 |
| 21 | D8(Bottom) | 0.303 | 0.056 | 5.39 |
| 22 | D8(Bottom) | 0.562 | 0.074 | 7.61 |
| 23 | D4(Max) | 0.796 | 0.045 | 17.62 |

# Shear Wall Design

Status : OK




## Geometry

| Level | Segment | X Coordinate [ft] | Y Coordinate [ft] | Width [ft] | Height [ft] |
|---|---|---|---|---|---|
| 0 | 1 | 0.00 | 0.00 | 26.00 | 1.50 |
| | 2 | 0.00 | 1.50 | 1.00 | 4.00 |
| | 3 | 2.00 | 1.50 | 2.00 | 4.00 |
| | 4 | 22.00 | 1.50 | 2.00 | 4.00 |
| | 5 | 25.00 | 1.50 | 1.00 | 4.00 |
| | 6 | 0.00 | 5.50 | 1.00 | 1.00 |
| | 7 | 2.00 | 5.50 | 22.00 | 1.00 |
| | 8 | 25.00 | 5.50 | 1.00 | 1.00 |
| | 9 | 0.00 | 6.50 | 26.00 | 2.50 |

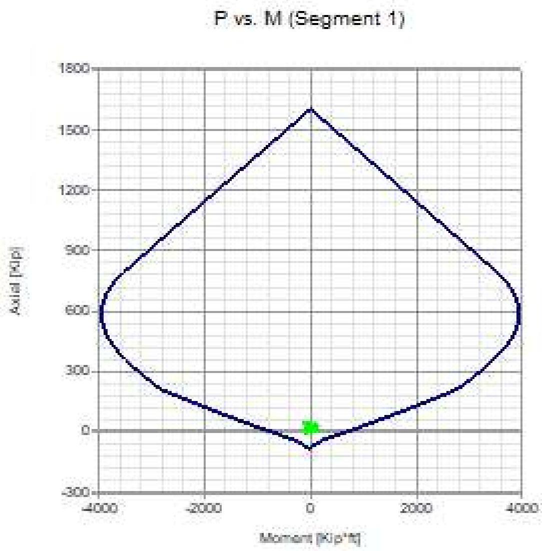
## Reinforcement

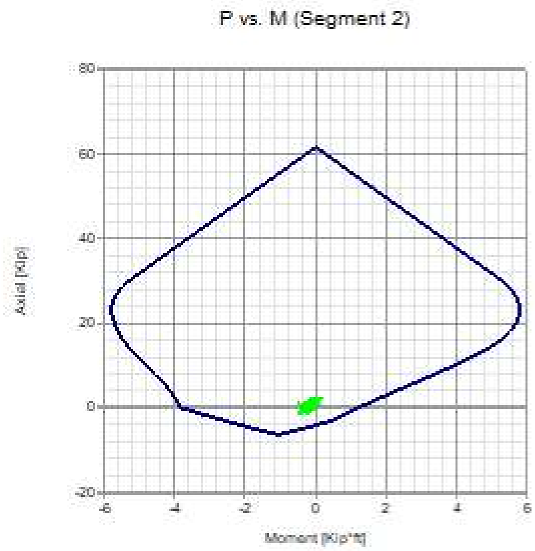
| Segment | Vertical reinforcement Bars | Vertical reinforcement Spacing [in] | Vertical reinforcement Ld [in] | Horizontal reinforcement Bars | Horizontal reinforcement Spacing [in] | Horizontal reinforcement Ld [in] |
|---|---|---|---|---|---|---|
| 1 | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 7-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| 2 | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| 3 | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| 4 | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| 5 | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| 6 | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| 7 | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 7-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| 8 | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| 9 | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 7-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |
| | 1-#4 | 32.00 | 25.17 | -- | 0.00 | 0.00 |

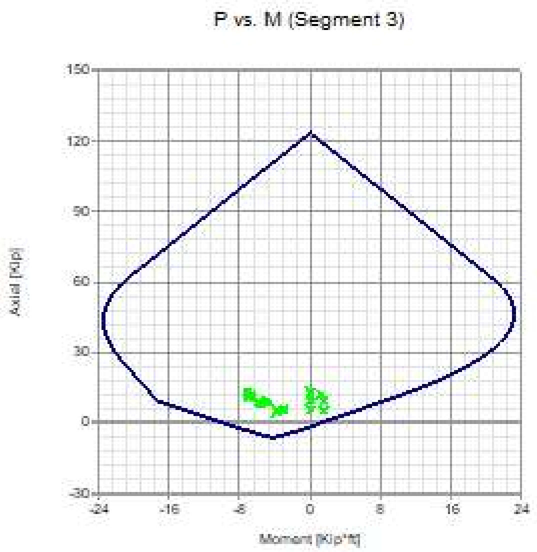
## *Combined axial flexure*

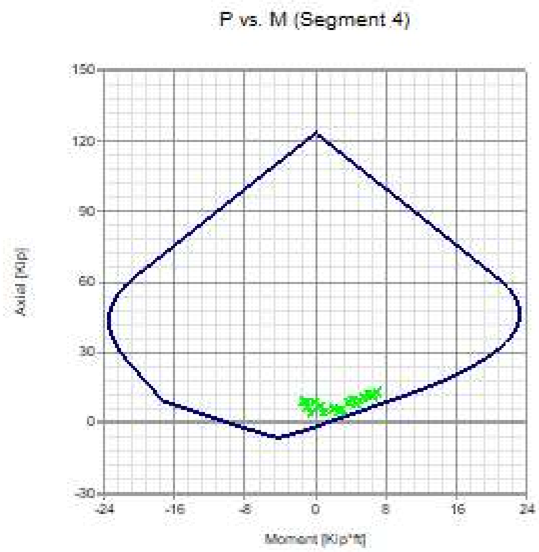
| Segment | Condition | P [Kip] | M [Kip*ft] | Ma [Kip*ft] | Ratio |
|---|---|---|---|---|---|
| 1 | D7(Max) | 24.09 | 91.97 | 933.72 | 0.10 |
| 2 | D2(Top) | -0.63 | -0.34 | 3.57 | 0.10 |
| 3 | D7(Top) | 10.51 | -7.05 | 17.70 | 0.40 |
| 4 | D2(Top) | 11.46 | 6.48 | 10.04 | 0.65 |
| 5 | D2(Top) | -0.76 | 0.41 | 1.02 | 0.41 |
| 6 | D2(Bottom) | -0.65 | -0.34 | 3.56 | 0.10 |
| 7 | D7(Max) | 43.05 | 99.79 | 772.22 | 0.13 |
| 8 | D2(Top) | -1.04 | 0.41 | 0.95 | 0.43 |
| 9 | D7(Max) | 22.48 | 138.21 | 916.74 | 0.15 |

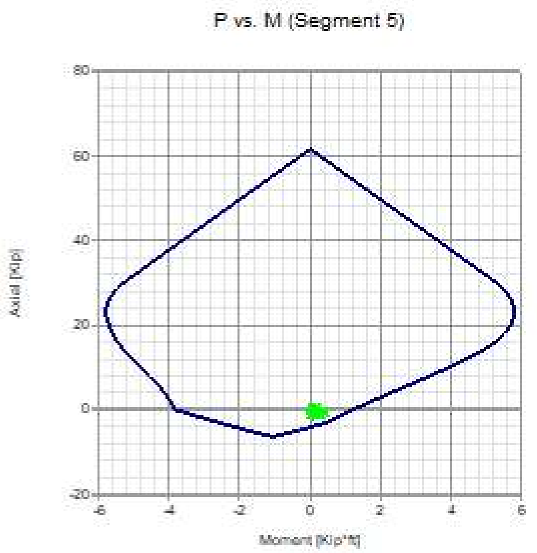
## *Interaction diagrams, P vs. M*

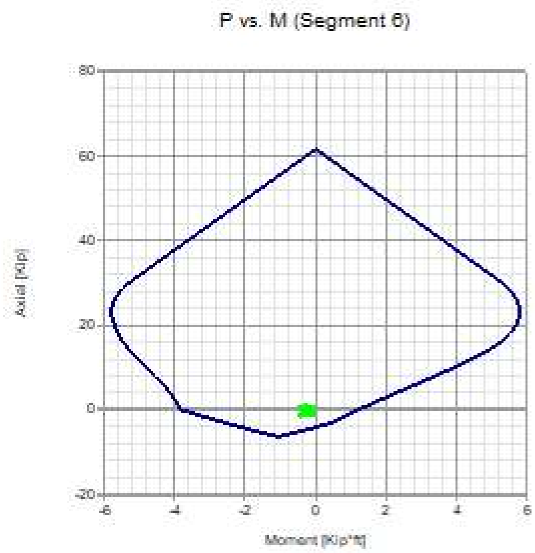

P vs. M (Segment 1)
Axial [Kip]
1800
1500
1200
900
600
300
0
-300
-4000
-2000
0
2000
4000
Moment [Kip*ft]

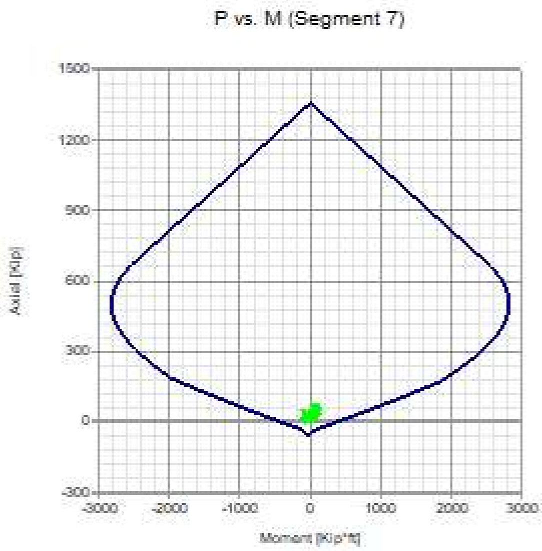

P vs. M (Segment 2)
Axial [Kip]
80
60
40
20
0
-20
-6
-4
-2
0
2
4
6
Moment [Kip*ft]

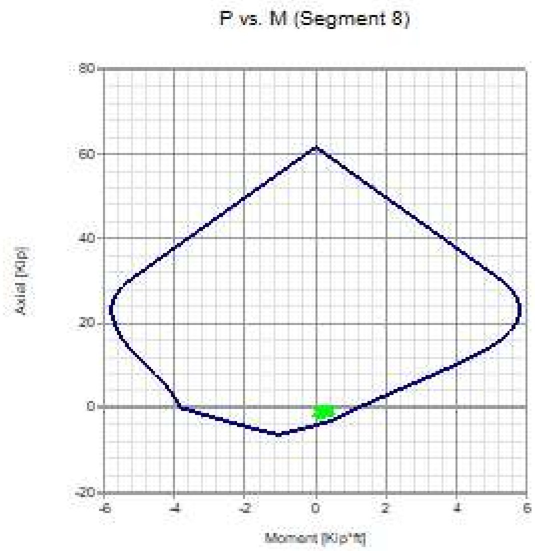

P vs. M (Segment 3)
Axial [Kip]
150
120
90
60
30
0
-30
-24
-16
-8
0
8
16
24
Moment [Kip*ft]

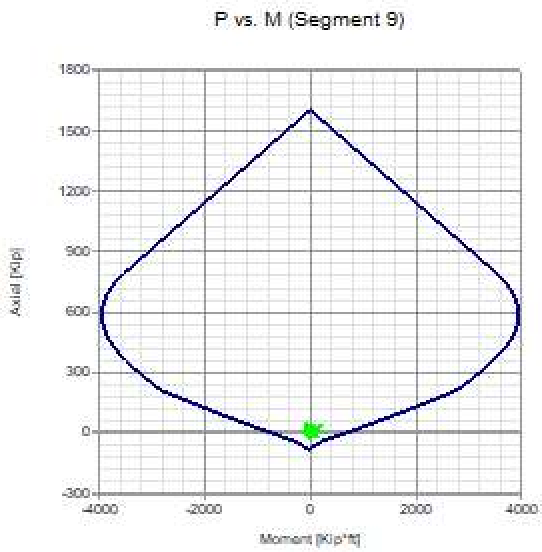

P vs. M (Segment 4)
Axial [Kip]
150
120
90
60
30
0
-30
-24
-16
-8
0
8
16
24
Moment [Kip*ft]


P vs. M (Segment 5)
Axial [Kip]
80
60
40
20
0
-20
-6
-4
-2
0
2
4
6
Moment [Kip*ft]


P vs. M (Segment 6)
Axial [Kip]
80
60
40
20
0
-20
-6
-4
-2
0
2
4
6
Moment [Kip*ft]




## *Axial compression*

| Segment | Condition | P [Kip] | Pa [Kip] | Ratio |
|---|---|---|---|---|
| 1 | D7(Bottom) | 32.83 | 782.35 | 0.04 |
| 2 | D5(Max) | 1.72 | 30.06 | 0.06 |
| 3 | D2(Max) | 13.55 | 60.18 | 0.23 |
| 4 | D2(Max) | 13.21 | 60.18 | 0.22 |
| 5 | D2(Max) | 0.55 | 30.06 | 0.02 |
| 6 | D9(Bottom) | 0.44 | 30.06 | 0.01 |
| 7 | D2(Bottom) | 65.71 | 662.12 | 0.10 |
| 8 | D1(Top) | -0.76 | 30.06 | 0.00 |
| 9 | D2(Bottom) | 32.23 | 782.35 | 0.04 |

## *Axial tension*

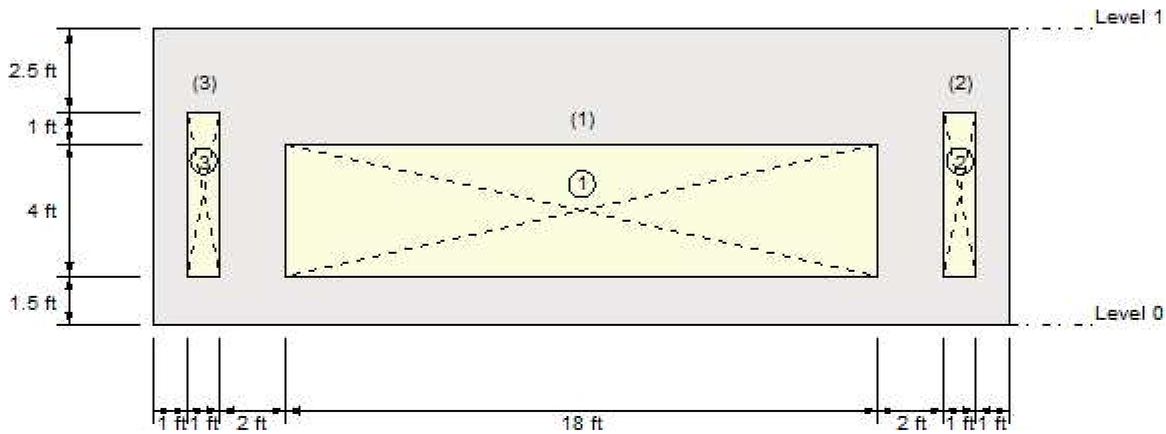
| Segment | Condition | ft [Kip/in2] | Fs [Kip/in2] | Ratio |
|---|---|---|---|---|
| 1 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 2 | D2(Top) | 3.16 | 32.00 | 0.10 |
| 3 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 4 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 5 | D9(Max) | 6.77 | 32.00 | 0.21 |
| 6 | D2(Top) | 4.15 | 32.00 | 0.13 |
| 7 | D1(Top) | 0.00 | 32.00 | 0.00 |
| 8 | D7(Top) | 7.28 | 32.00 | 0.23 |
| 9 | D1(Top) | 1.52 | 32.00 | 0.05 |

### *Shear*

| Segment | Condition | fv [Kip/in2] | Fv [Kip/in2] | Ratio |
|---|---|---|---|---|
| 1 | D5(Max) | 0.003 | 0.066 | 0.05 |
| 2 | D7(Max) | 0.015 | 0.078 | 0.19 |
| 3 | D7(Max) | 0.036 | 0.075 | 0.48 |
| 4 | D2(Max) | 0.034 | 0.077 | 0.45 |
| 5 | D2(Max) | 0.013 | 0.074 | 0.17 |
| 6 | D2(Max) | 0.004 | 0.044 | 0.09 |
| 7 | D5(Max) | 0.002 | 0.056 | 0.04 |
| 8 | D7(Max) | 0.003 | 0.044 | 0.07 |
| 9 | D7(Max) | 0.003 | 0.051 | 0.05 |

# Lintel Design

Status : Warnings in design
- Insufficient development length, TMS 402-16 ASD, 6.1.5.1 (Lintel 1)




### *Geometry*

| Lintel | X Coordinate [ft] | Y Coordinate [ft] | Length [ft] | Depth [in] |
|---|---|---|---|---|
| 1 | 4.00 | 1.50 | 18.00 | 26.00 |
| 2 | 24.00 | 1.50 | 1.00 | 26.00 |
| 3 | 1.00 | 1.50 | 1.00 | 26.00 |

### *Reinforcement*

| Lintel | Top long. reinforcement Bars | Top long. reinforcement Extent [in] | Bottom long. reinforcement Bars | Bottom long. reinforcement Extent [in] | Transverse reinforcement Bars | Transverse reinforcement Spacing [in] | Ld [in] |
|---|---|---|---|---|---|---|---|
| 1 | 2-#7 | 17.00 | 2-#9 | 0.00 | -- | 0.00 | 0.00 |
| 2 | 1-#4 | 0.00 | -- | 0.00 | -- | 0.00 | 0.00 |
| 3 | 1-#4 | 0.00 | -- | 0.00 | -- | 0.00 | 0.00 |

### *Bending*

| Lintel | Condition | M [Kip*ft] | Ma [Kip*ft] | Ratio |
|---|---|---|---|---|
| 1 | D2(Top) | 19.22 | 48.60 | 0.40 |
| 2 | D2(Bottom) | -0.05 | 11.84 | 0.00 |
| 3 | D7(Bottom) | -0.11 | 11.84 | 0.01 |

### *Shear*

| Lintel | Condition | fv [Kip/in2] | Fv [Kip/in2] | Ratio |
|---|---|---|---|---|
| 1 | D2(Top) | 0.039 | 0.044 | 0.90 |
| 2 | D7(Bottom) | 0.003 | 0.044 | 0.07 |
| 3 | D7(Top) | 0.005 | 0.044 | 0.12 |

### *Deflection*

| Lintel | Condition | $\delta$s [in] | $\delta$max [in] | Ratio |
|---|---|---|---|---|
| 1 | S2(Top) | 0.08 | 0.36 | 0.23 |
| 2 | | 0.00 | 0.00 | 0.00 |
| 3 | | 0.00 | 0.00 | 0.00 |

# Notes

* P = Axial load
* Pa = Allowable compressive force due to axial load.
* M = Moment at the section under consideration.
* Ma = Wall allowable moment due to axial force or lintel pure flexure allowable moment
* fa = Calculated compressive stress due to axial load only
* fb = Calculated compressive stress due to axial flexure only
* ft = Calculated axial tension
* Fa = Allowable compressive stress due to axial load only
* Fb = Allowable compressive stress due to axial flexure only
* fv = Calculated shear stress
* Fs = Allowable tensile or compressive stress
* Fv = Allowable shear stress
* ld = Embedment length
* As = Effective cross sectional area of reinforcement
* $\delta$s = Calculated deflection
* $\delta$max = Maximum allowable deflection

# Conclusion

## Conclusion

*The analysis and design of the structure, in accordance with the current building code, reveal that the structure is not structurally sound in reference to the latest Building Design code.*

*The analysis confirms that while the most recently constructed section is failing, the older sections of the structure are also at risk of failure, leading to overall instability and demanding immediate attention.*

# ENGINEERING INSPECTION REPORT

Subject Property: 1210 Michigan Ave Miami Beach, FL 33139

Prepared By: Masood Hajali, PE FL License: 82038
Date: 7/21/2024
Ref: Structural Condition Inspection

**TO WHOM IT MAY CONCERN**

Please be advised that our office at Calc Engineering has performed an Engineering Inspection of the single-family house located at 1210 Michigan Ave Miami Beach, FL 33139. The Property consists of a concrete shell single family structure located at Miami Beach FL. The inspection was done on 7/3/2024. The purpose of the field inspection was to visually evaluate any structural or building Issues. Calc Engineering confirms that the building is structurally unsafe due to all structural cracks and damages that was seen around the house. The inspection was done on the exterior and interior of the house.

Calc Engineering confirms that the house has been involved with flood issue because of the current NGVD elevation in respect to the base flood elevation. The house has been damaged due to previous flood events. There are lot of areas in the house that have evidence of previous flood issue. Figures 4 and Figures 5 shows the change of color and evidence that how much water comes up during the heavy rain that causes change of color on exterior walls and on the wooden fence as well.

Existing house has structural cracks on the exterior concrete wall of the house and also has sign of termites and water damage on the wood part of the house including house wood joists and trusses. Calc Engineering confirms that the sub-floor is damaged and requires it to be completely replaced. Calc Engineering confirms that there is concrete spalling with exposed rebars inside the crawl space of the house. Calc Engineering also observed a lot of exterior walls with damaged and bumps on the stucco walls that shows structural damages on the exterior walls. With all the issues mentioned above, Calc Engineering believes that the house is not safe for occupation, and it requires demolition of the house and building a new under story structure house that complies with new flood elevation regulations.

Figures 48 to 52 is for interior of the house. There is clear evidence that the back of the home has been submerged extensively. At the highest point of the home, the rooms have been submerged approximately 18” as evidenced by the furniture staining as reflected in the attached pictures.

Our recommendation in this letter is proper and applicable for the time of inspection, and not for the future. It is our purpose to provide information on the condition of the structure on the day of the inspection, and not to provide discussions or recommendations concerning the future maintenance of the house. Thank you for asking Calc Engineering to perform this important inspection work for you.

Should you have any questions, or require additional information, please do not hesitate in contacting us.

Enclosures: (52) Photographs

**Masood Hajali, PhD, P.E.**

**Florida Reg.: 82038**

**CALC ENGINEERING**

**2000 NW 8th PL, Unit 102, Doral, FL 33172**

**Ph: 305-898-9995**

**CA 32566**

MASOOD HAJALI LICENSE No 82038 STATE OF FLORIDA PROFESSIONAL ENGINEER

This item has been digitally signed and sealed by MASOOD HAJALI, PE, on date above. Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

Digitally signed by MASOOD HAJALI
Date: 2024.07.26 08:31:15 -04'00'

Figure 1

Figure 2

Figure 3


Figure 4

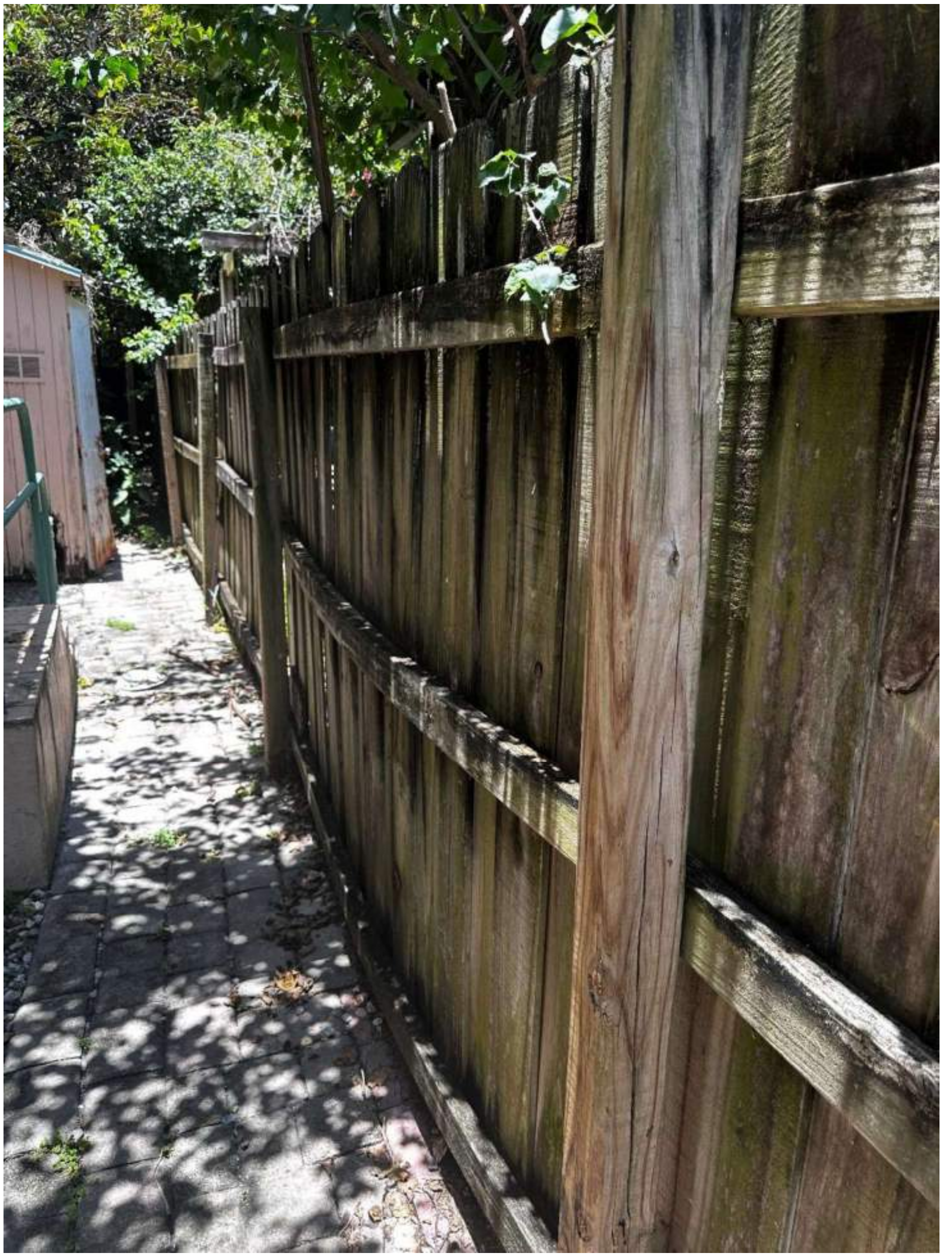


Figure 5

Figure 6

Figure 7

Figure 8

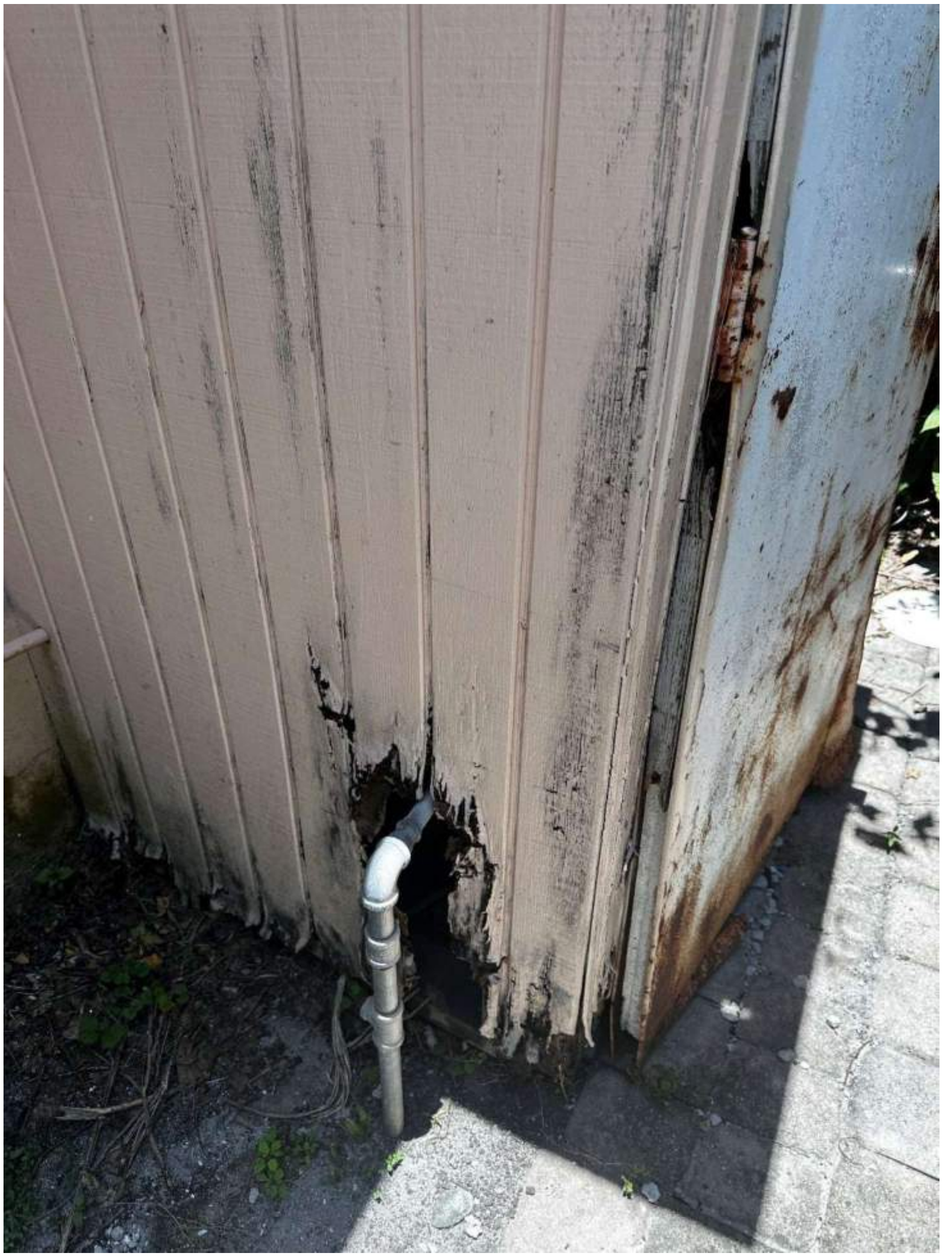


Figure 9

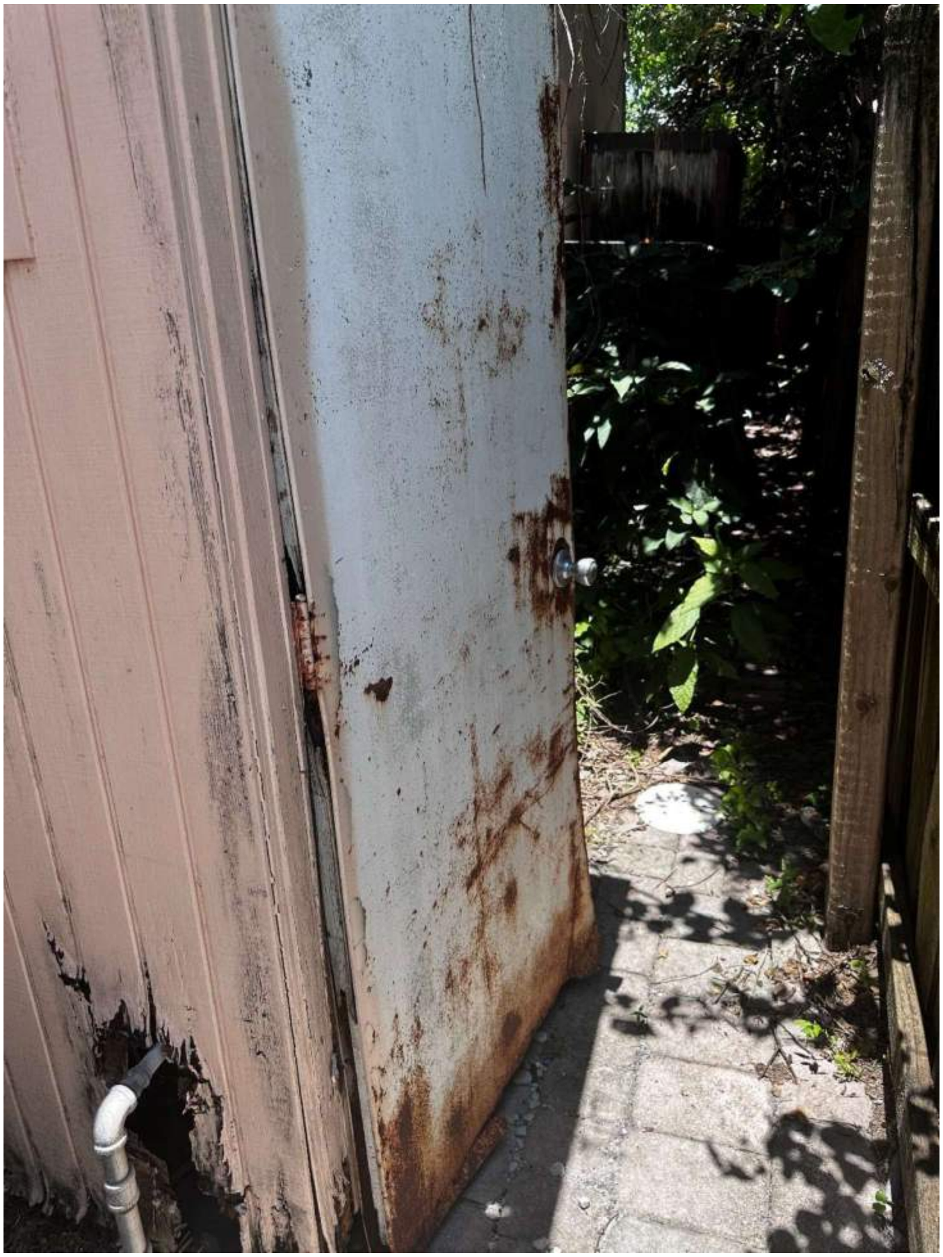


Figure 10

Figure 11

Figure 12

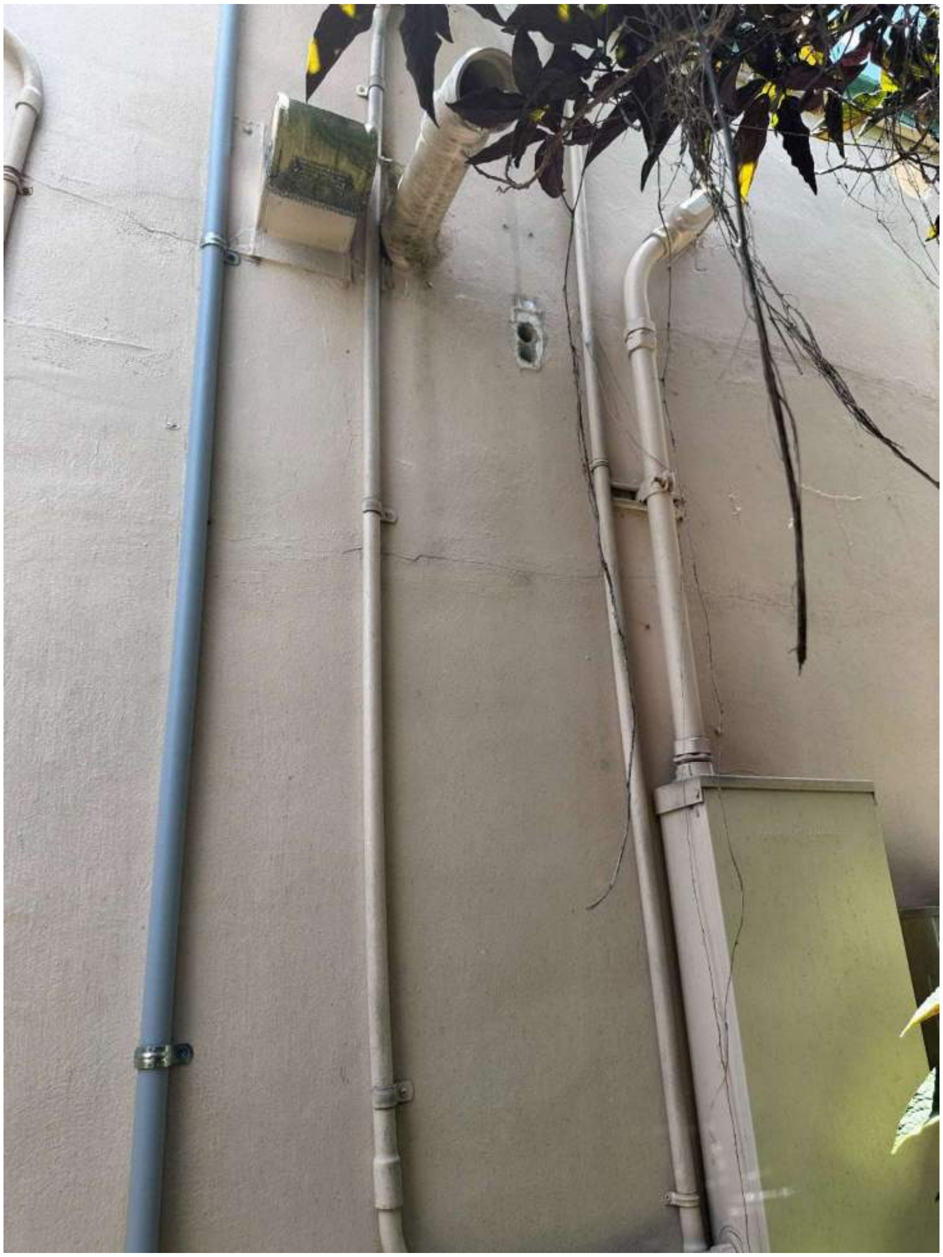


Figure 13

Figure 14

Figure 15

Figure 16

Figure 17

Company Email:
calcengineering@gmail.com

Office Cellphone:
786-409-2477
Personal Cellphone:
305-898-9995

Personal Email:
masood@calceng.com

Figure 18

Figure 19

Figure 20

Figure 21

Figure 22

Figure 23

Figure 24

Figure 25

Figure 26

Figure 27

Figure 28

Figure 29

Figure 30

Figure 31

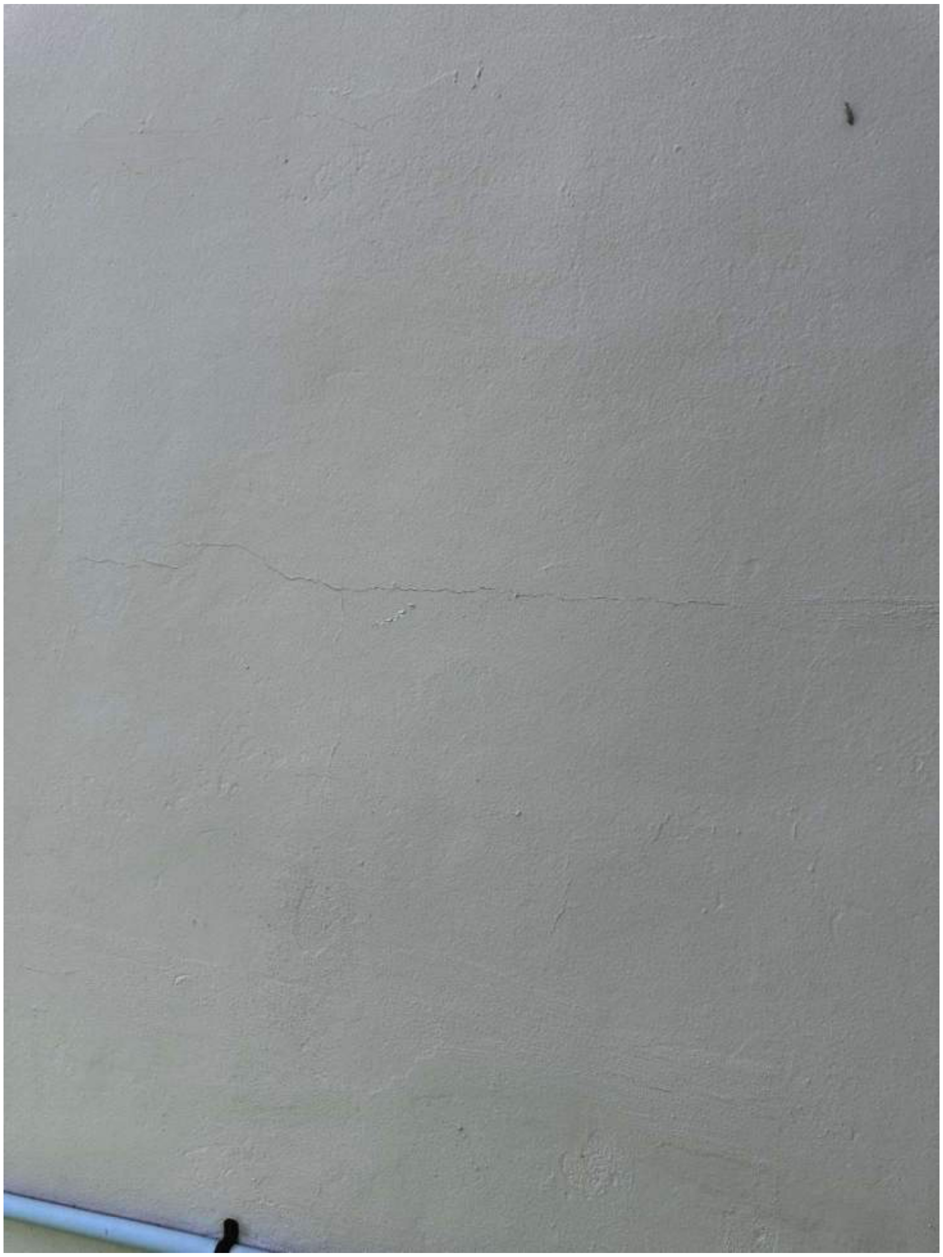


Figure 32

Figure 33

Figure 34

Figure 35

Figure 36

Figure 37

Figure 38

Figure 39

Figure 40

Company Email:
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Personal Cellphone:
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masood@calceng.com

Figure 41

Figure 42

Figure 43

Figure 44

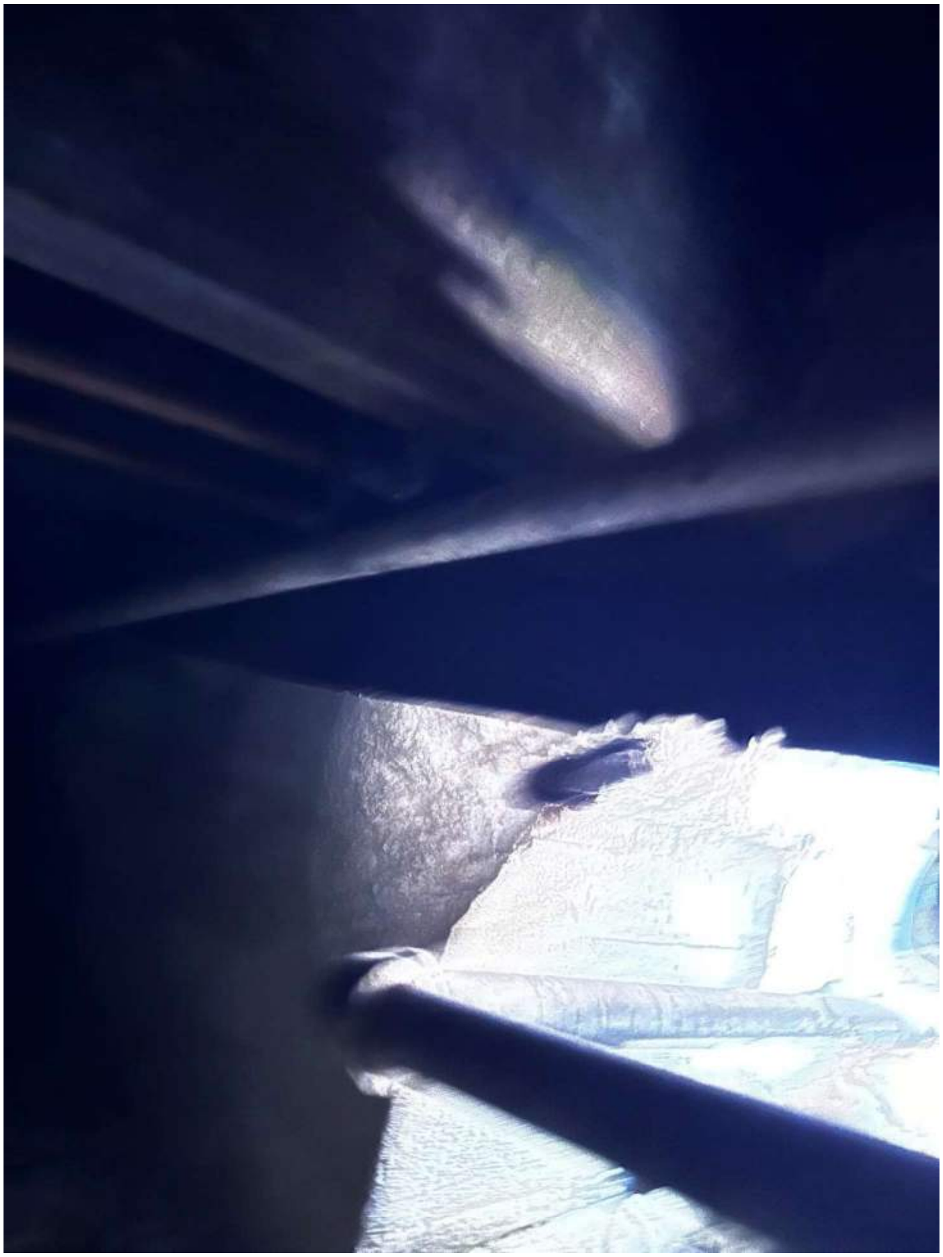

Figure 45

Figure 46

Figure 47

Figure 48

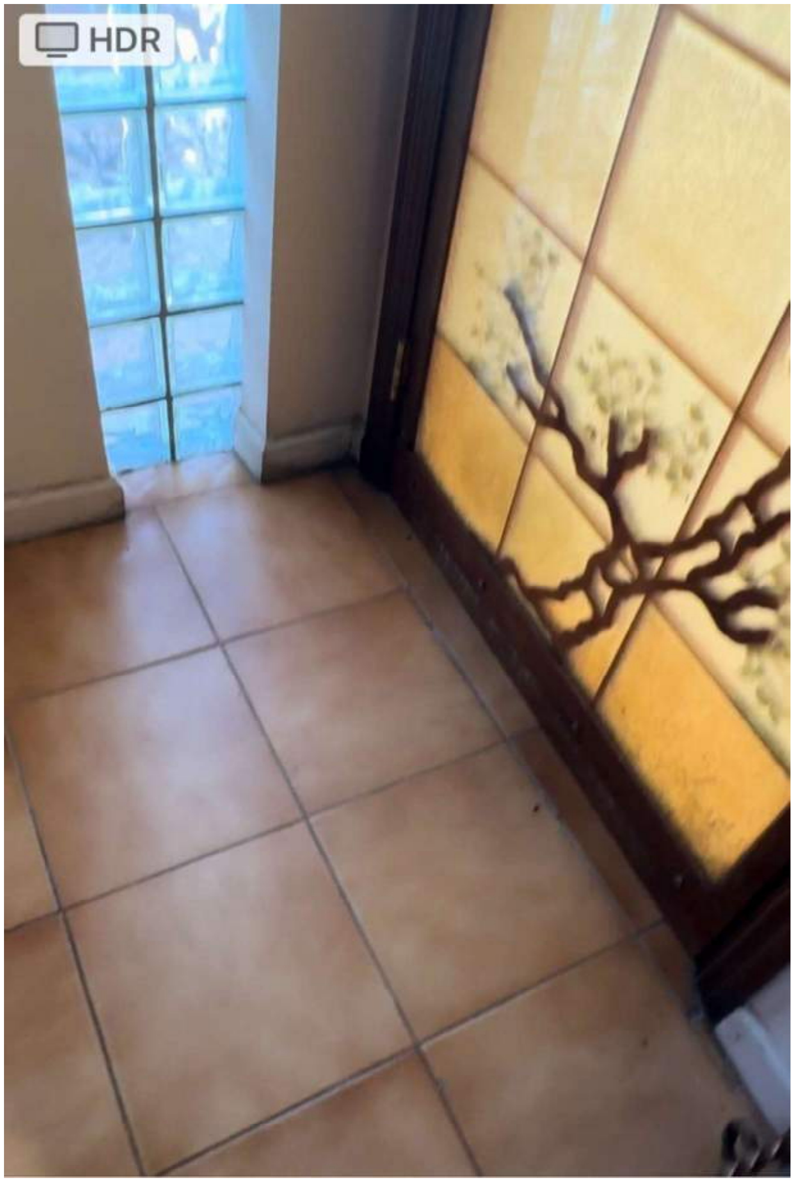


Figure 49

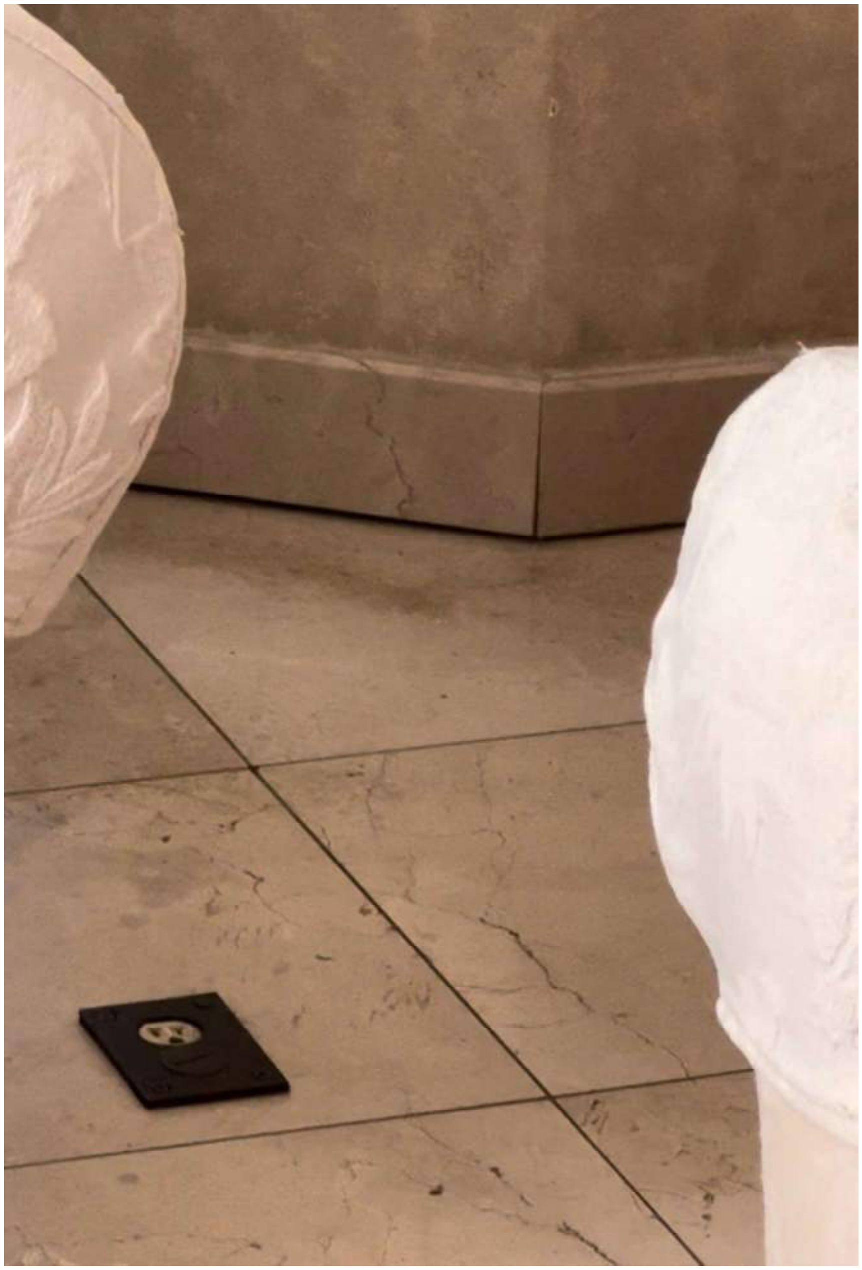

Figure 50

Figure 51

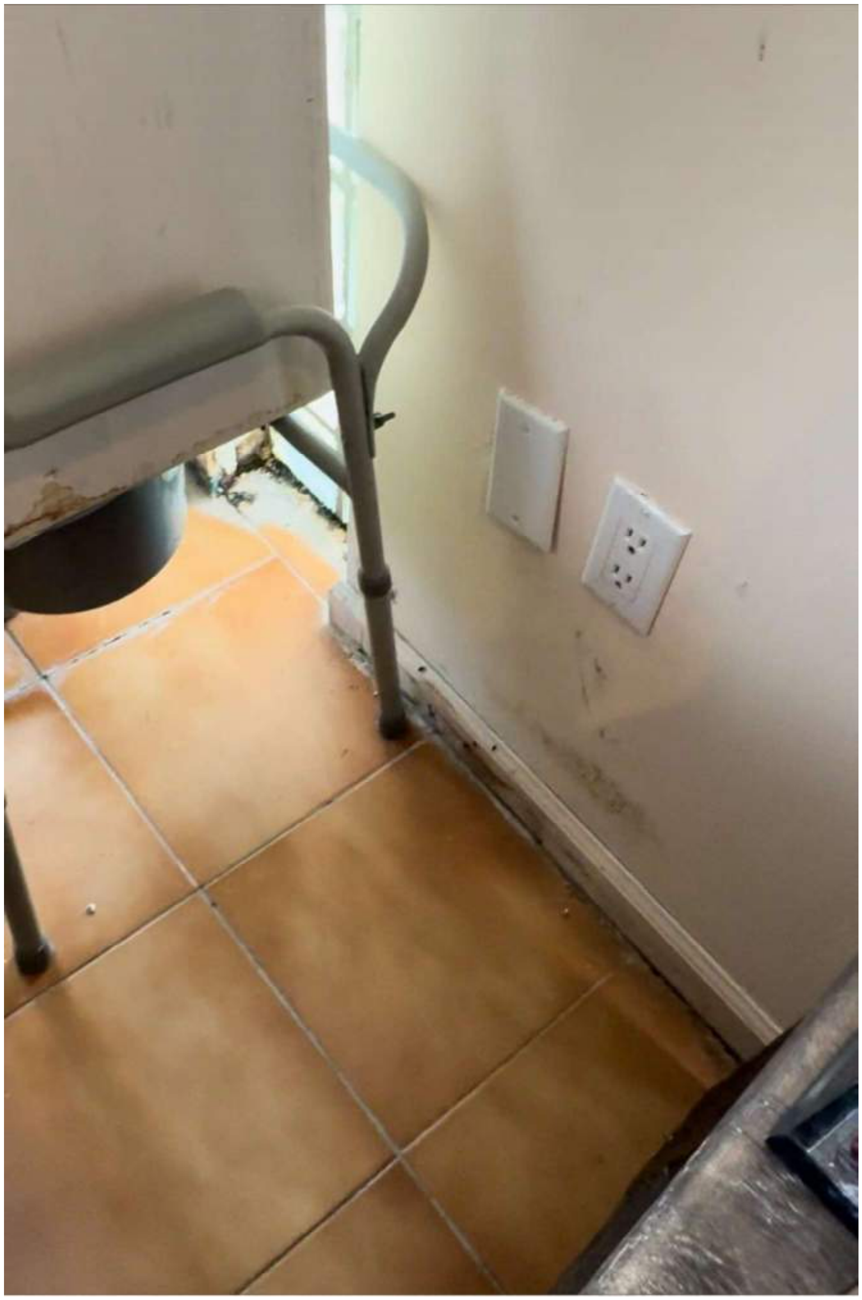

Figure 52

**CALC ENGINEERING LLC**
**2000 NW 89 PL UNIT 102 DORAL FL 33172**
**WWW.CALCENG.COM**

# SUBSURFACE EXPLORATION REPORT AND ENGINEERING RECOMMENDATION PROPOSED FOR 1210 Michigan Ave, Miami Beach, FL 33139

To: Mr. Andrew Mirmelli

Gentlemen:

We transmit our soil investigation and geotechnical report on the completed subsurface soil exploration for your current condition structure as requested and authorized by you. The scope of the study is required to evaluate the subsurface conditions and provide information about the soil layers and type of the soils up to 20 feet depth into ground. Since the house has no piles under the existing exterior walls, soil investigation was performed to determine if piles needed or not based on the existing soil condition.

The data and recommendations presented in this report are based on information obtained from one (1) Standard Penetration Test (SPT).

We thank you for allowing us to serve you. Please do not hesitate to contact our office with any questions regarding this report.

Yours truly,

***CALC ENGINEERING LLC***
***WWW.CALCENG.COM***
***2000 NW 89 PL UNIT 102***
***DORAL FL 33172***

**CALC ENGINEERING LLC**
**2000 NW 89 PL UNIT 102 DORAL FL 33172**
**WWW.CALCENG.COM**

**Scope and Purpose:**

The purposes of performing this exploration were to evaluate the general subsurface conditions and the groundwater level variations due to climatic changes within the proposed building area and provide recommendations for its foundation support.

**Site Location and Site Description:**

The site for the proposed facility is located at 1210 Michigan Ave, Miami Beach, FL 33139 for Andrew Mirmelli residents. The subsurface exploration was performed on 8/22/2024. Soil boring test was performed up to 20 feet underground. This investigation was conducted to analyze the existing subsurface soil condition and specify the water table level. A detailed exploration and subsequent analysis undertaken are discussed and included in this report.

**Field Exploration Program:**

The field exploration program performed one Standard Penetration test (SPT) boring. The SPT borings were performed within the proposed area of the building. The borings were advanced to a depth of 20 feet below the actual ground surface using the methodology outlined in ASTM D-1586. Split-spoon soil samples recovered during the performance of the borings were visually classified in the Field. The groundwater level at my boring locations was measured upon completion of the drilling.

**Procedure Method**

The penetration testing and soil sampling are accomplished simultaneously using procedures according to ASTM D-1586, the Standard Penetration Test (S.P.T.). A 2-inch O.D by 1.4-inch I.D. split-spoon samplers is driven with a 140 pounds hammer falling 30 inches. The number of hammer blows required to drive was counted.

The sampler is recorded on the Soil Standard Penetration Test Result on the borehole logs. Where possible, the sampler is driven 24 inches, with the hammer blows being recorded for each of four 6-inch intervals. The "Penetration Resistance" or "N" value is the sum of the blows recorded for the second and third six-inch intervals. The geotechnical Engineer widely accepts this value as an indication of the relative density and strength of the soil being sampled. Following Table shows N value for different soil types.

**SOIL AND ROCK CLASSIFICATION CRITERIA**

**SAND/SILT**

| N-VALUE (bpf) | RELATIVE DENSITY |
|---|---|
| 0 – 4 | Very Loose |
| 5 – 10 | Loose |
| 11 – 29 | Medium |
| 30 – 49 | Dense |
| >50 | Very dense |
| 100 | Refusal |

**CLAY/SILTY CLAY**

| N-VALUE (bpf) | UNCONFINED COMP. STRENGTH (tsf) | CONSISTENCY |
|---|---|---|
| <2 | <0.25 | v. Soft |
| 2 – 4 | 0.25 – 0.50 | Soft |
| 5 – 8 | 0.50 – 1.00 | Medium |
| 9 – 15 | 1.00 – 2.00 | Stiff |
| 16 – 30 | 2.00 – 4.00 | v. Stiff |
| >30 | >4.00 | Hard |

**ROCK**

| N-VALUE (bpf) | RELATIVE HARDNESS | ROCK CHARACTERISTICS |
|---|---|---|
| $N \geq 100$ | Hard to v. hard | Local rock formations vary in hardness from soft to very hard within short vertical and horizontal distances and often contain vertical solution holes of 3 to 36 inch diameter to varying depths and horizontal solution features. Rock may be brittle to split spoon impact, but more resistant to excavation. |
| $25 \leq N \leq 100$ | Medium hard to hard | |
| $5 \leq N \leq 25$ | Soft to medium hard | |

**PARTICLE SIZE**

| | |
|---|---|
| Boulder | >12 in. |
| Cobble | 3 to 12 in. |
| Gravel | 4.76 mm to 3 in. |
| Sand | 0.074 mm to 4.76 mm |
| Silt | 0.005 mm to 0.074 mm |
| Clay | <0.005 mm |

**DESCRIPTION MODIFIERS**

| | |
|---|---|
| 0 – 5% | Slight trace |
| 6 – 10% | Trace |
| 11 – 20% | Little |
| 21 – 35% | Some |
| >35% | And |

## Groundwater Monitoring:

The groundwater level was measured in the boreholes after the downhole water level stabilization. The water levels measured at the testing time were average 5’ below the ground surface. Groundwater levels may vary throughout the year primarily due to seasonal rainfall. These levels may be modified at any time a hurricane hits the area and groundwater level may top the ground surface level.

The boring logs information shows that most of the areas up to 20 feet is sand and silt which is a very weak soil for structure above; these soft layers of low "N" values are running to a Depth of 20' from the ground level elevation. N values of SPT tests are very low values up to 20 feet, see page 5 and 6 from the soil test results. Any future construction has to be on pile. Even existing structure has to be on helical or auger cast piles.

**Conclusion:**

The above findings are based on our soil standard penetration data and information obtained at the test location. Therefore, uniformity of soil strata in the immediate vicinity may be assumed. However, it is not guaranteed, and this office assumes no responsibility for areas other than those where the sub-soil investigation was made and reported herein.

Layers of soil determined in the soil boring log. Water table is 5 feet as specified in the report. Any future construction has to be on pile. There are soft sand layers up to a depth of 20 feet. Even existing condition of the house with no pile is not safe condition because of the weak layers of the soils found under the house.

# CALC ENGINEERING LLC
## 2000 NW 89 PL UNIT 102 DORAL FL 33172
## WWW.CALCENG.COM

# BORING LOG REPORT

BORING #1

**SOIL BORING LOG**

| | | | |
|---|---|---|---|
| **CLIENT** | | **Order No** | 2 |
| **ADDRESS** | 1210 Michigan Ave Miami Beach, FL 33139 | **Report No.** | 1 |
| **PROJECT** | | **Boring No.** | B2 |
| **ADDRESS** | 1210 Michigan Ave Miami Beach, FL 33139 | **Date** | 8/22/2024 |
| **LOCATION** | | **Driller/Helper** | Tim |

| Sample No. | DESCRIPTION OF MATERIALS | Depth (feet) | Hammer blows on sampler | | "N" | "N" Curve |
|---|---|---|---|---|---|---|
| | Soil Boring from 0' to 30' | | | | | |
| 1 | DARK GRAY SAND | 0'-2' | 4 | 5 | 10 | |
| | | | 5 | 6 | | |
| 2 | DARK GRAY SAND WITH ROCK PIECES | 2'-4' | 6 | 6 | 12 | |
| | | | 6 | 7 | | |
| 3 | BEACH SAND | 4'-8' | 7 | 7 | 14 | |
| | | | 7 | 6 | | |
| 4 | | | 1 | 2 | 3 | |
| | | | 1 | 2 | | |
| 5 | BEACH SAND | 8'-10' | 1 | 1 | 3 | |
| | | | 2 | 1 | | |
| 6 | GRAY SILT WITH BEACH SAND | 10'-20' | 2 | 2 | 6 | |
| | | | 4 | 2 | | |
| 7 | | | 9 | 3 | 13 | |
| | | | 10 | 8 | | |
| 8 | | | 11 | 1 | 13 | |
| | | | 12 | 11 | | |
| 9 | | | 12 | 13 | 28 | |
| | | | 15 | 14 | | |
| 10 | | | 19 | 16 | 37 | |
| | | | 21 | 17 | | |
| | **End of boring @ 20'-0"** | | | | | |

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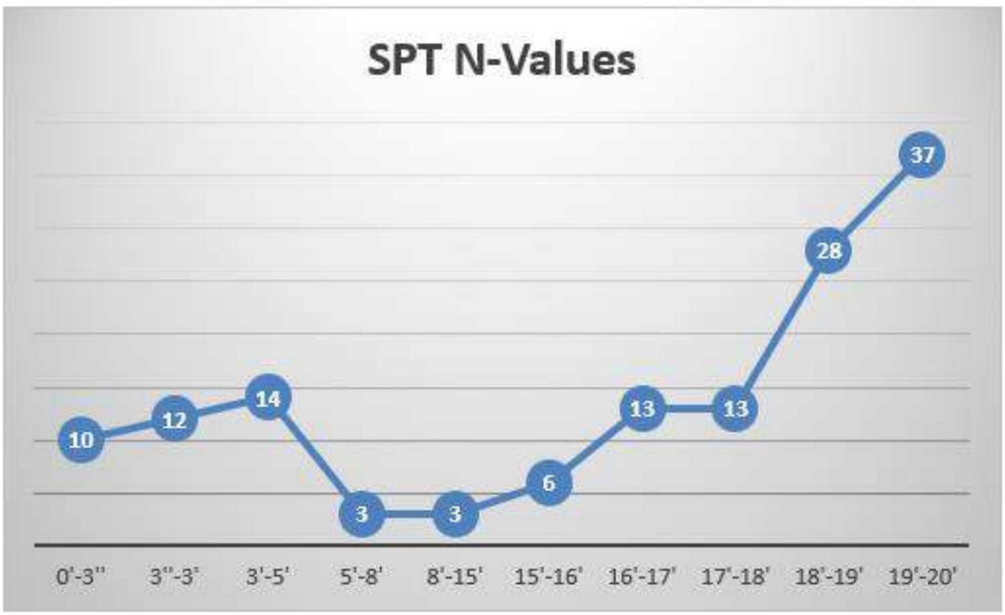
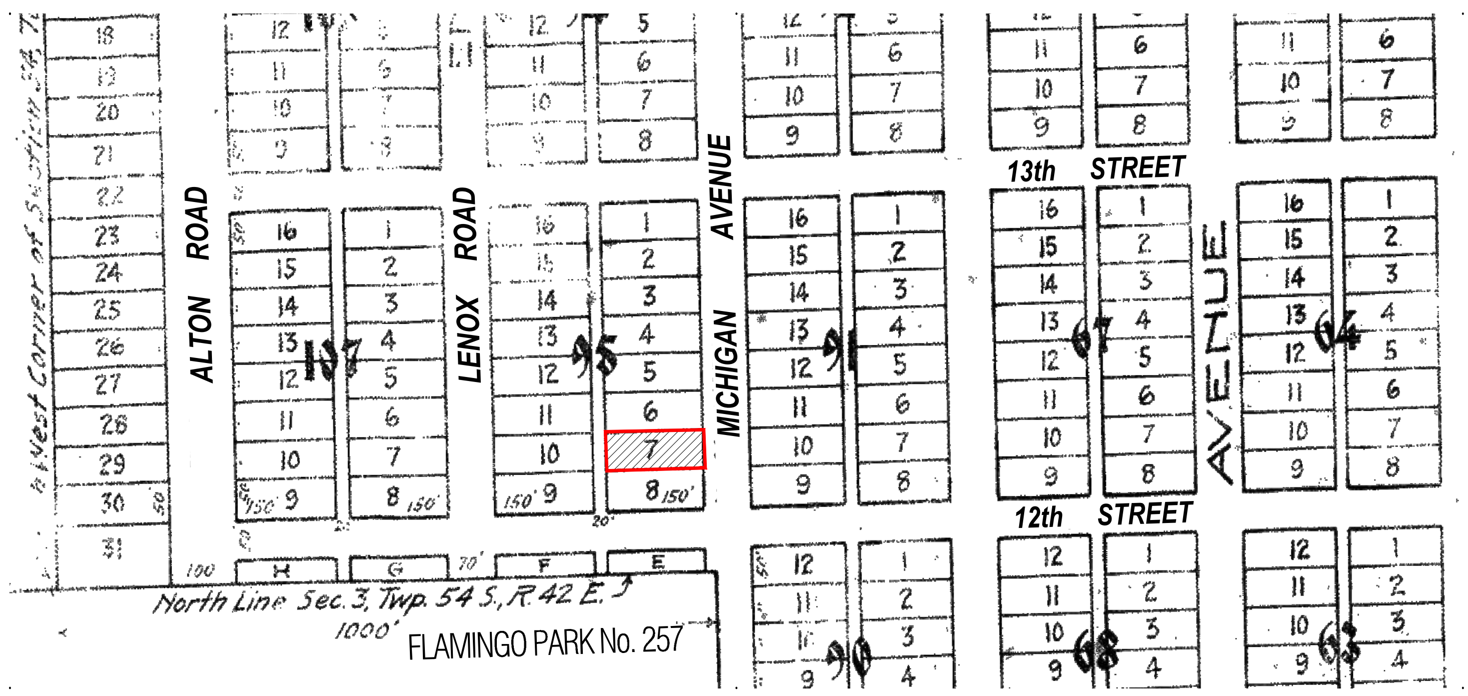
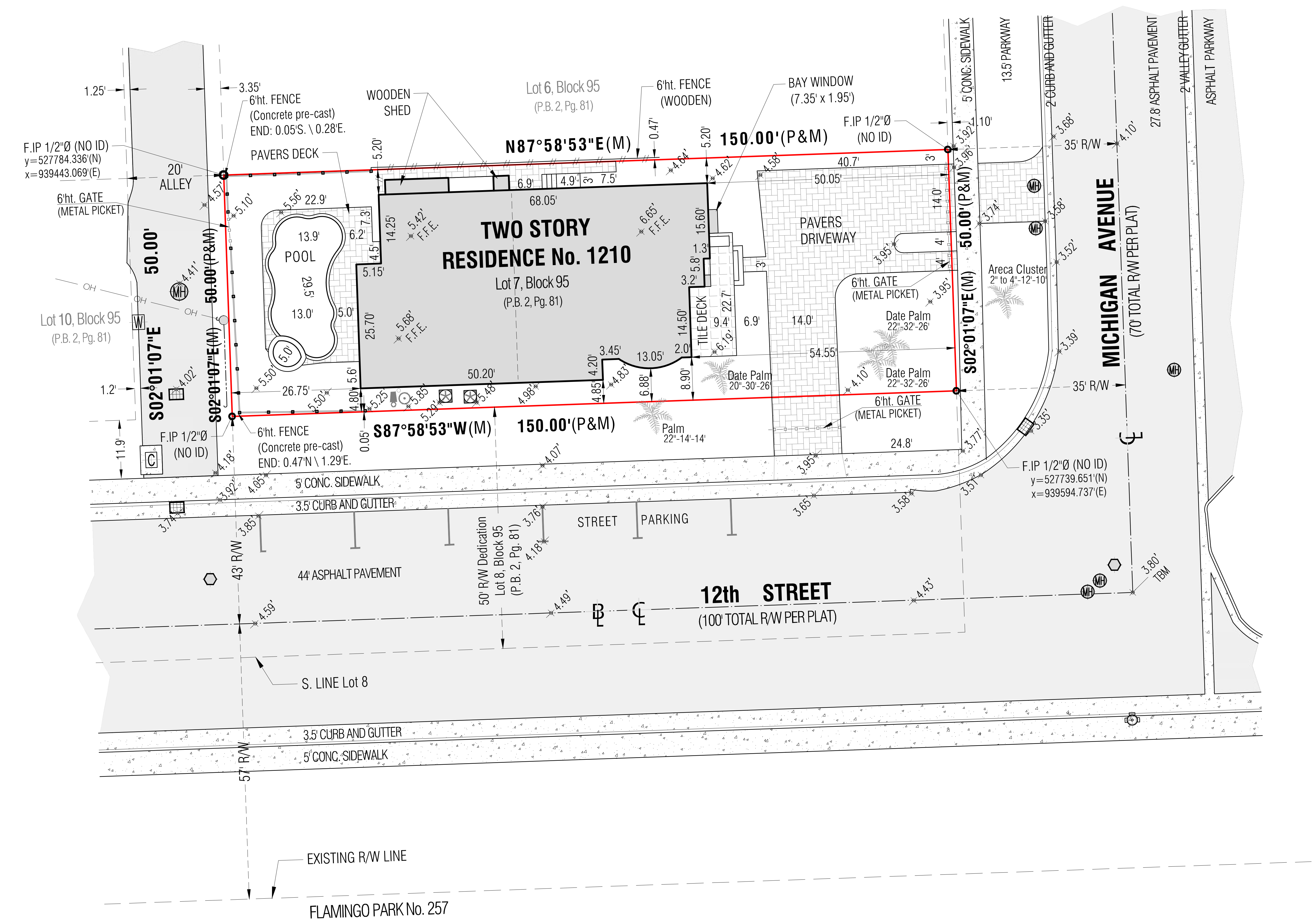



---------------------------------------------------------------
As a mutual protection to clients, the public, and ourselves, all reports are submitted as the confidential property of clients, and authorization for publication of statements, conclusions, or extracts from or regarding our reports
is reserved pending our written approval.

## LOCATION SKETCH:
SCALE: N.T.S.




# MAP OF BOUNDARY SURVEY:
SCALE 1" : 20'




GRAPHIC SCALE 1" : 20' (IN FEET)

## SURVEYOR'S REPORT :

**1. MAP OF BOUNDARY SURVEY FOR:**
1210 MICHIGAN AVENUE, MIAMI BEACH, FLORIDA 33139

**2. LEGAL DESCRIPTION :**
Lot 7, Block 95 of "OCEAN BEACH ADD. No. 3"; according to the Plat Thereof as Recorded in Plat Book 2 at Page 81 of the Public Record of Miami Dade County, Florida.

**3. SOURCES OF DATA (HORIZONTAL CONTROL):**
The North Arrow and Bearings as shown hereon are based of bearings value S02°01'07"E, along the center line of Michigan Avenue; according to Plat Book 2, Page 81 of the Public Records of Miami Dade County, Florida.

**4. SOURCES OF DATA (VERTICAL CONTROL):**

| FLOOD INFORMATION BASED ON THE FLOOD INSURANCE RATE MAP OF THE FEDERAL EMERGENT MANAGEMENT AGENCY. (NGVD29) | | | | | | |
|---|---|---|---|---|---|---|
| F.I.R.M. date | Flood Zone | Base elevation | Community | Panel No. | Suffix | BM Used |
| 09-11-2014 | AE | 8.0' | 120651 | 0317 | L | V 310 ELEV. 4.57 NGVD29 |

**5. ACCURACY :** The accuracy obtained by measurement and calculation of closed geometric figures was found to exceed this requirement.

**6. LIMITATIONS :**
■ This survey was performed for the sole and exclusive benefit of the parties to whom it was certified. ■ Likewise, any reuse of this survey for any purpose other than which was originally intended, without the written permission of the undersigned surveyor, will be done so at the risk of the reusing party and without any liability to the undersigned surveyor. ■ Since no other information other than what is cited in the Sources of Data were furnished, the Client is hereby advised that there may be legal restrictions on the Subject Property that are not shown on the Survey Map or contained within this Report that may be found in the Public Records of County, or the records of any other public and private entities as their jurisdictions may appear. ■ Land shown hereon were not abstracted for easements and/or right-of-way of record except as shown on the Record Plat if any. ■ The Surveyor makes no representation as to ownership or possession of the Subject Property by any entities or individual who may appear of public record. ■ This survey may be subject to dedications, limitations, restrictions,reservations, encumbrances or easements of record the same that may not be noted or depicted hereon. ■ No improvements were located, other than those shown. ■ This survey does not purport to show ownership of walls and/ or fences along property lines. ■ Unless otherwise noted, this firm has not attempted to locate underground footings and/or foundations. ■ The elevations (if any) were measured to an expected vertical positional accuracy of 1/10 foot for natural ground surfaces and 1/100 foot for hardscape surfaces, including pavement, curbs, sidewalks and other manmade structures. ■ Wall ties are to the face of the same. ■ Fence ties are from the nearest face of the same to the property line. ■ Public Records have not been researched by the surveyor to determine the accuracy of these descriptions nor have adjoining properties been researched to determine overlaps and hiatus. ■ The survey depicted here is not covered by professional liability insurance. ■ **Notice**: Sunshine State One Call of Florida, Inc. must be contacted at least 48 hours in advance of any construction, excavation or demolition activity within, upon, abutting or adjacent to the Subject Property. Pursuant to Chapter 556.101-111 of the Fl. Statutes.

## ABBREVIATIONS AND LEGEND:

A =arc
ADJ =adjacent
A.E. =anchor easement
BBQ =barbecue
BOB =basis of bearings
BM =bench mark
BC =block corner
CME =canal maintenance easement.
C =calculated
Ch =chord
CBS =concrete block structure
Ø =diameter
D =central angle
DH =drill hole
DME =drainage maintenance easement
° =degrees
E =east
F.IP =found iron pipe no id
F.IR =found iron rebar no id
F.N&D=found nail and disc
F.F.E.=finish floor elevation
HT =high (height)
L.F.E.=lowest floor elevation
LME =lake maintenance easement
LS =land surveyor
M =measured distance
N A =not applicable
N&D =nail & disc
NAVD=national american vertical datum
NGVD=national geodetic vertical datum
N =north
NTS =not to scale
OH =overhang
O/S =offset
ORB =official record book
P =plat
P.B. =plat book
P.C. =point of curvature
PG =page
PCP =permanent control point
P/L =property line
POB =point of beginning
POC =point of commencement
PRM =permanent reference monument
PT =point of tangency
R =radius
R/R =railroad
R/W =right-of-way
Sec =section
S =south
T =tangent
U.E. =utility easement
W =west

air conditioner
a/c split
catch basin
clean out
communication box
electric register
electric meter
electric panel
emergency generator
X.XX' _elevation NGVD29
(X.XX')_elevation NAVD88
fire hydrant
FPL box
gas meter
propane gas tank
manhole (unknown)
pool equipment
pool water heater
concrete power pole
wood power pole
light pole
storm flow
valve
water back flow
water meter
well & electric pump
board fence
CBS wall / fence
chain link fence
pre-cast fence
picket fence
wooden fence
base line
center line
monument line
overhead utility line
covered / rofed
building/adjacent
asphalt
concrete
rock
pavers
tile
vegetation
water
wooden

**CERTIFY TO :** *SHARON MIRMELLI.*

NOTICE: Not valid without the signature and original raised seal of a Florida Licensed Surveyor and Mapper. Additions or deletions to Survey Maps and Reports by other than the signing party are prohibited without the written consent of the signing party.

SURVEYOR'S CERTIFICATE : I hereby certify: That this "Boundary and Topographic Survey" and Report resulting therefor was performed under my direction and is true and correct to the best of my knowledge and belief and further, that said "Boundary and Topographic Survey" meets the intent of the applicable provisions of the "Standards of Practice for Land Surveying in the State of Florida", pursuant to Section 5J-17.050 through 5J-17.052 of the Florida Administrative Code and it's implementing law, chapter 472.027 of the Florida Statutes.

By: ______________________.
**Miguel J. Garay**
Professional Surveyor and Mapper
No. 6594 State of Florida


8801 NW 176th Street Miami Lakes, Fl. 33018
P. 305_362_7926 P. 305_305_4143
M. madelin @surveyinflorida.com


Date: 04-22-2024
Job No.24-12843F
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**PRISMA LAND SURVEYORS LLC**
SURVEYOR AND MAPPERS LB. 8036
**north central and south florida**