Mill Owners Association Building

Presented By:
Suril Gajera
Yangzao Li
Darrion Orpinel
Sahar Radwan
Neha Rampuria

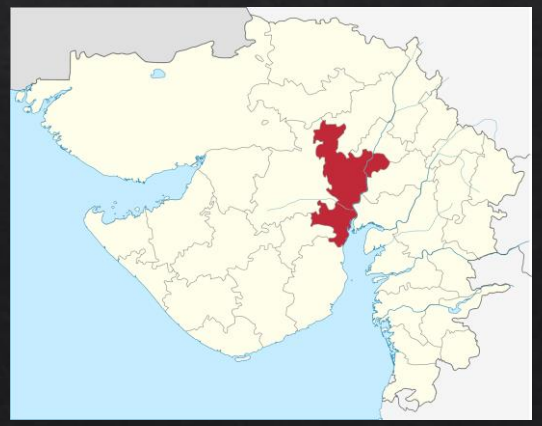
ARCH 631 - Fall 2019
Prof. Anne Nichols

Introduction

- Location - Ahmedabad, Gujarat, India
- Architect - Le Corbusier
- Client - Ahmedabad Mill Owners Association
- Timeline - 1954-1956
- Height ~ 58 ft
- Floors - 3

- Temperature - 55 F (min), upto 125 F(max)
- Climate - hot and semi-arid
- Annual Rainfall ~ 31 inches

Source - Maps of India webpage



Source - Wikipedia

Source - Google Maps

Site

- Elevation – 174ft.
- Soil Type – Sandy and Dry.
- Seismic Zone – 3.

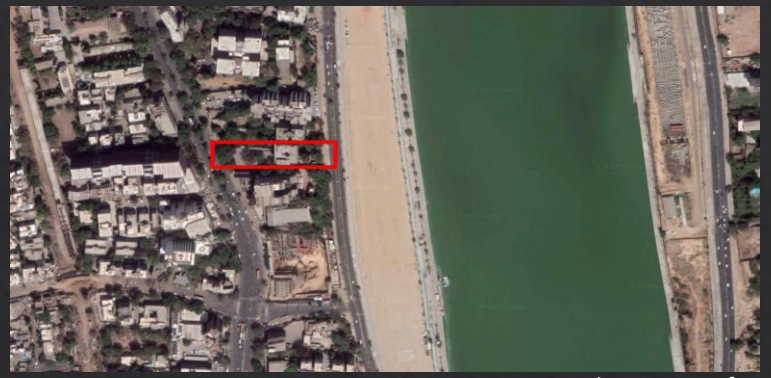


Figure 1. Bird Eye View of Site

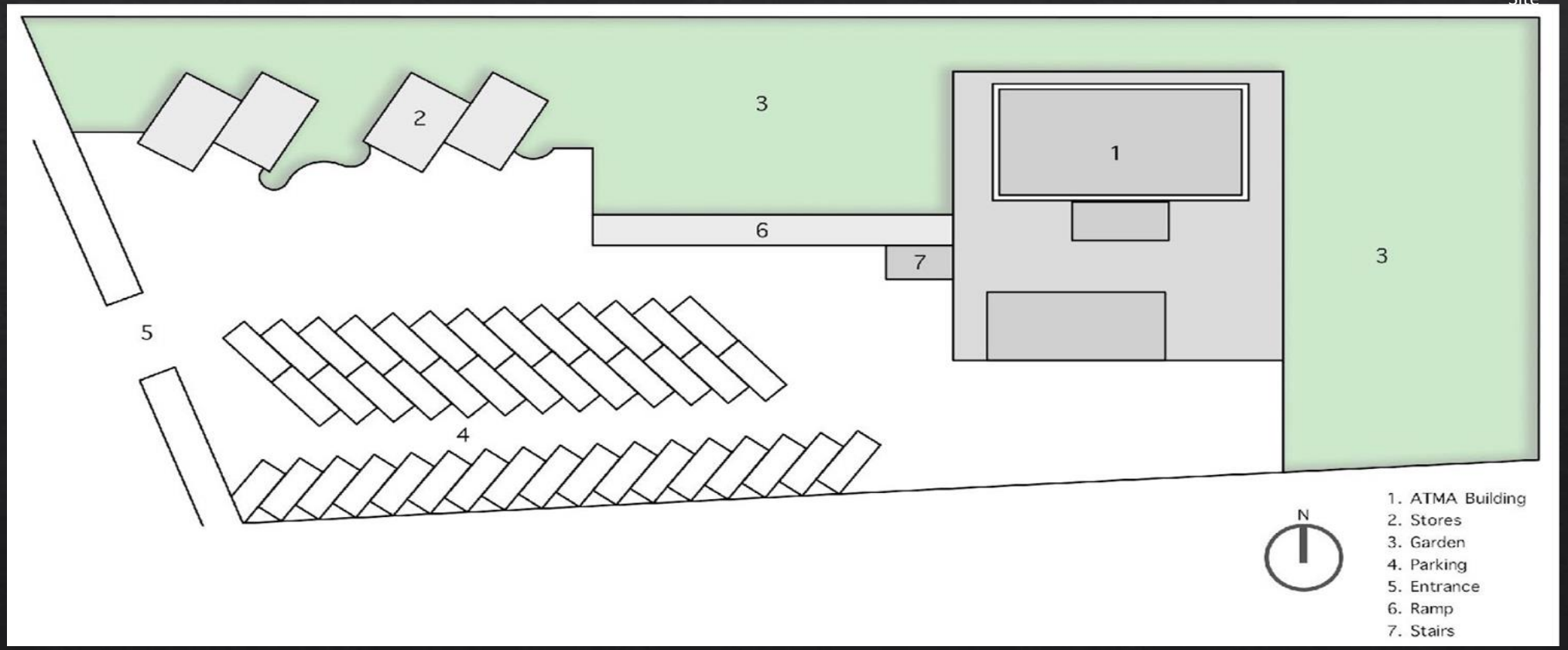


Figure 2. Site Plan.

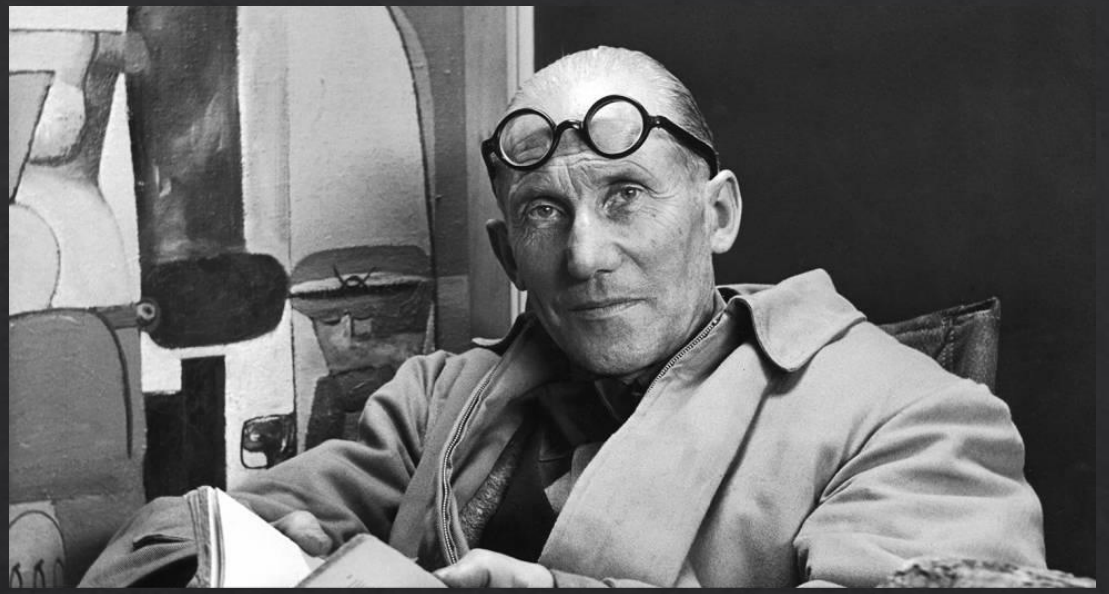
Background and Design Concept

Corbusier was invited to India by its first president to design the capital city of Chandigarh in 1951.

This is when he was commissioned by the mayor of Ahmedabad to do five projects in the city which reflects its futuristic vision.

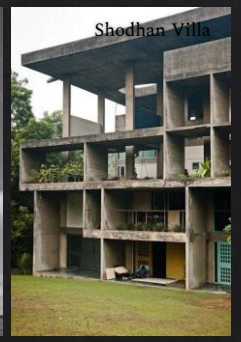
ATMA House was one of the first ones to get completed.

The building design majorly focused on the climate and culture of the people. Inspired by the local architecture and considering immediate context, various design principles were laid out.



Source - Foundation Le Corbusier

Source - www.researchgate.net

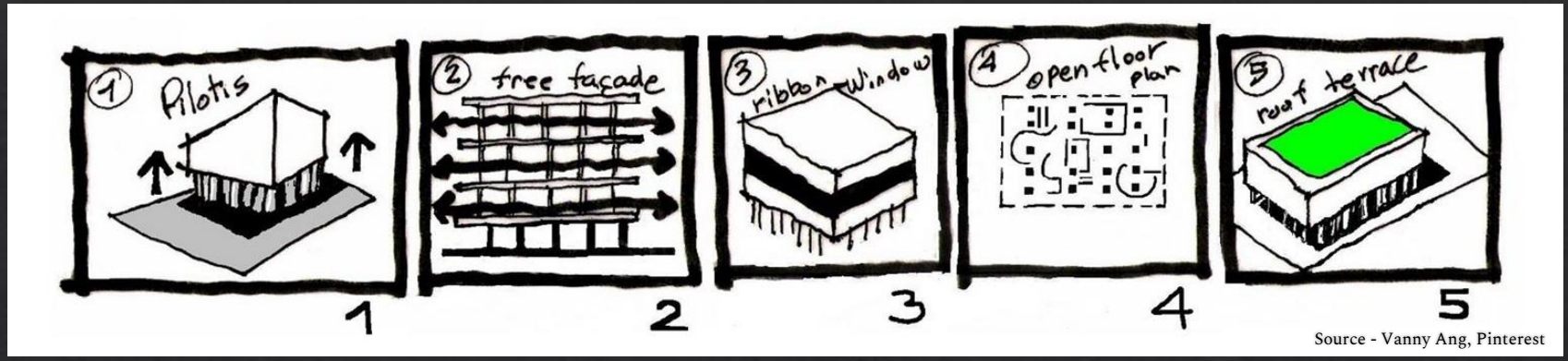


Archdaily

Archdaily

Five Points of Architecture

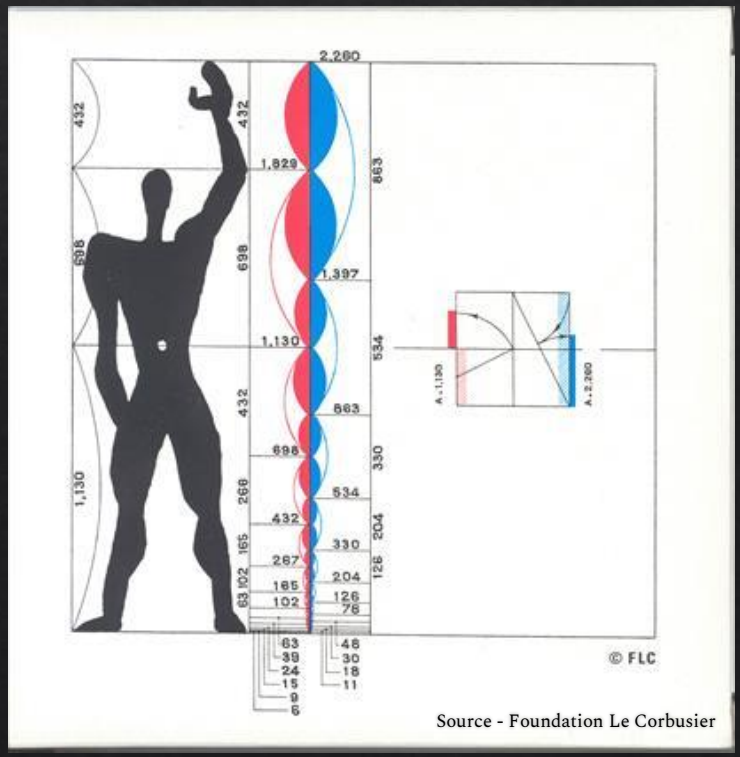
- Raised Structure
- A free facade
- Open Floor Plan
- Ribbon windows
- Rooftop Garden



Source - Vanny Ang, Pinterest

The Modular

Le Corbusier explicitly used the Modular to derive his scales and architectural proportions.



Source - Foundation Le Corbusier

Building Geometry

- Three Levels
- Elongated Entrance
- Rectangular Exterior
- Organic Interior Shapes

First Floor Plan

Figure 3.

Figure 4.

Figure 5.

Figure 6.

1. Entrance Foyer
2. Lobby
3. Exibition space
4. Auditorium
5. Elevator
6. Toilets
7. Sun Breakers
8. Stairs

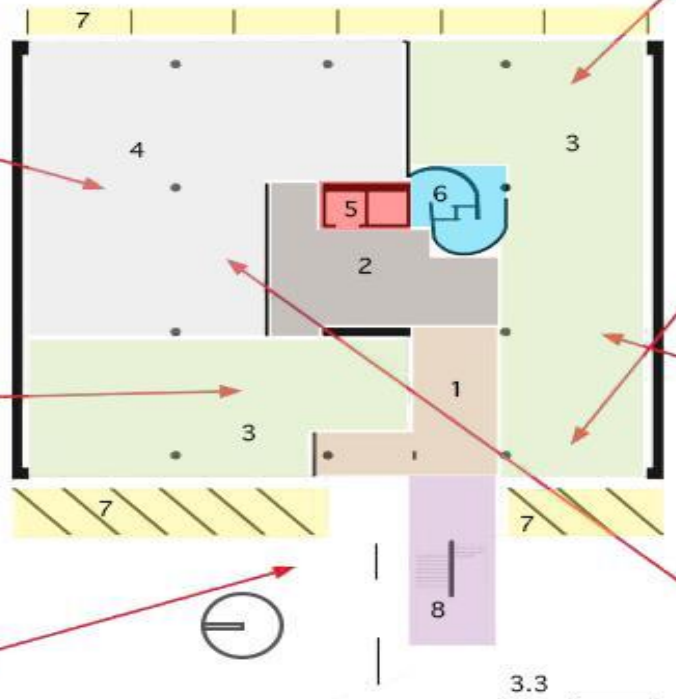


Figure 11.

Figure 7.

Figure 8.

Figure 9.

Figure 10.

Second Floor Plan

Figure 12.

Figure 13.

Figure 14.

Figure 15.

1. Entrance Foyer
2. Lobby
3. Exibition space
4. Presentation Room
5. Elevator
6. Toilets
7. Sun Breakers
8. Stairs / Ramp
9. Office / Administration

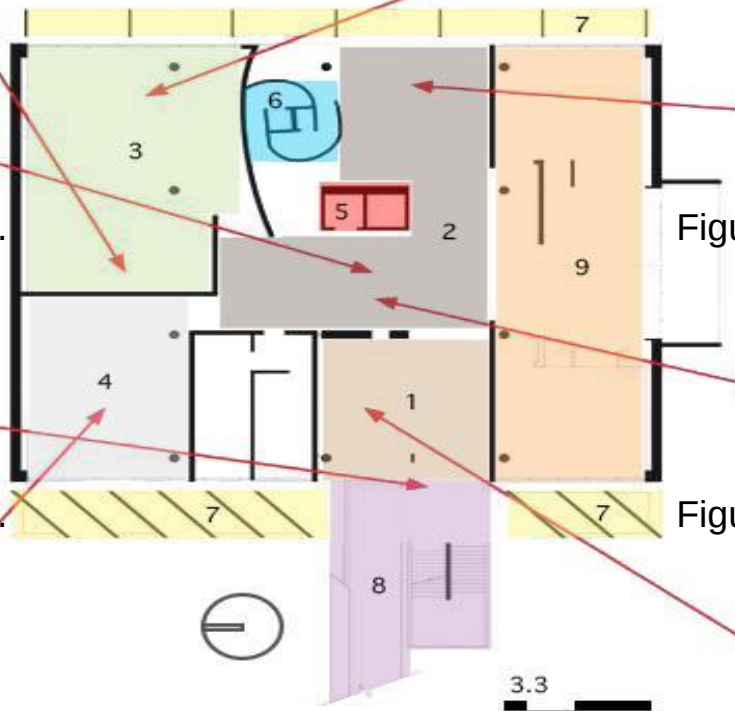


Figure 20.

Figure 16.

Figure 17.

Figure 18.

Figure 19.

Third Floor Plan

Figure 21.

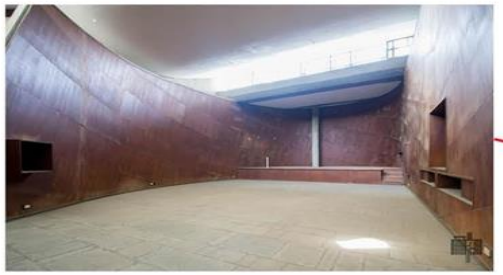
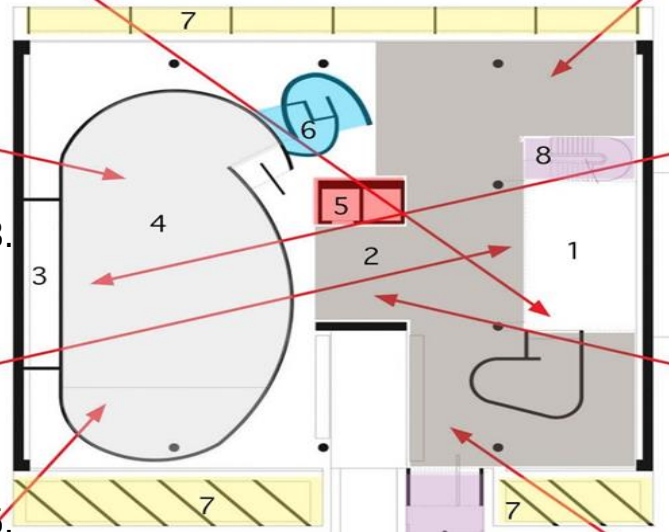


Figure 23.

Figure 25.

Figure 27.

1. Mezzanine Floor
2. Lobby
3. Storage
4. Auditorium
5. Elevator
6. Toilets
7. Sun Breakers
8. Stairs



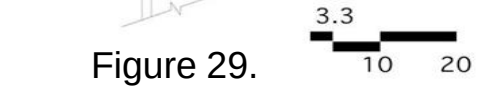


Figure 29.

Figure 22.

Figure 24.

Figure 26.

Figure 28.

Mezzanine Floor Plan

Figure 30.

Figure 31.

1. Mezzanine Floor
2. Lobby
3. Storage
4. Auditorium
5. Elevator
6. Toilets
7. Sun Breakers
8. Stairs

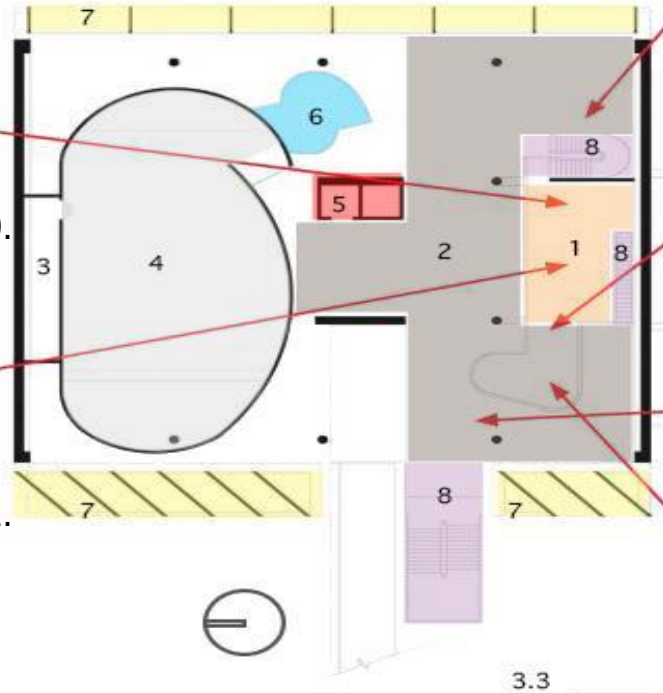


Figure 36 .

Figure 32.

Figure 33.

Figure 34.

Figure 35.

Special Features

Curvilinear Roof

Source : Bruno Vanbesien

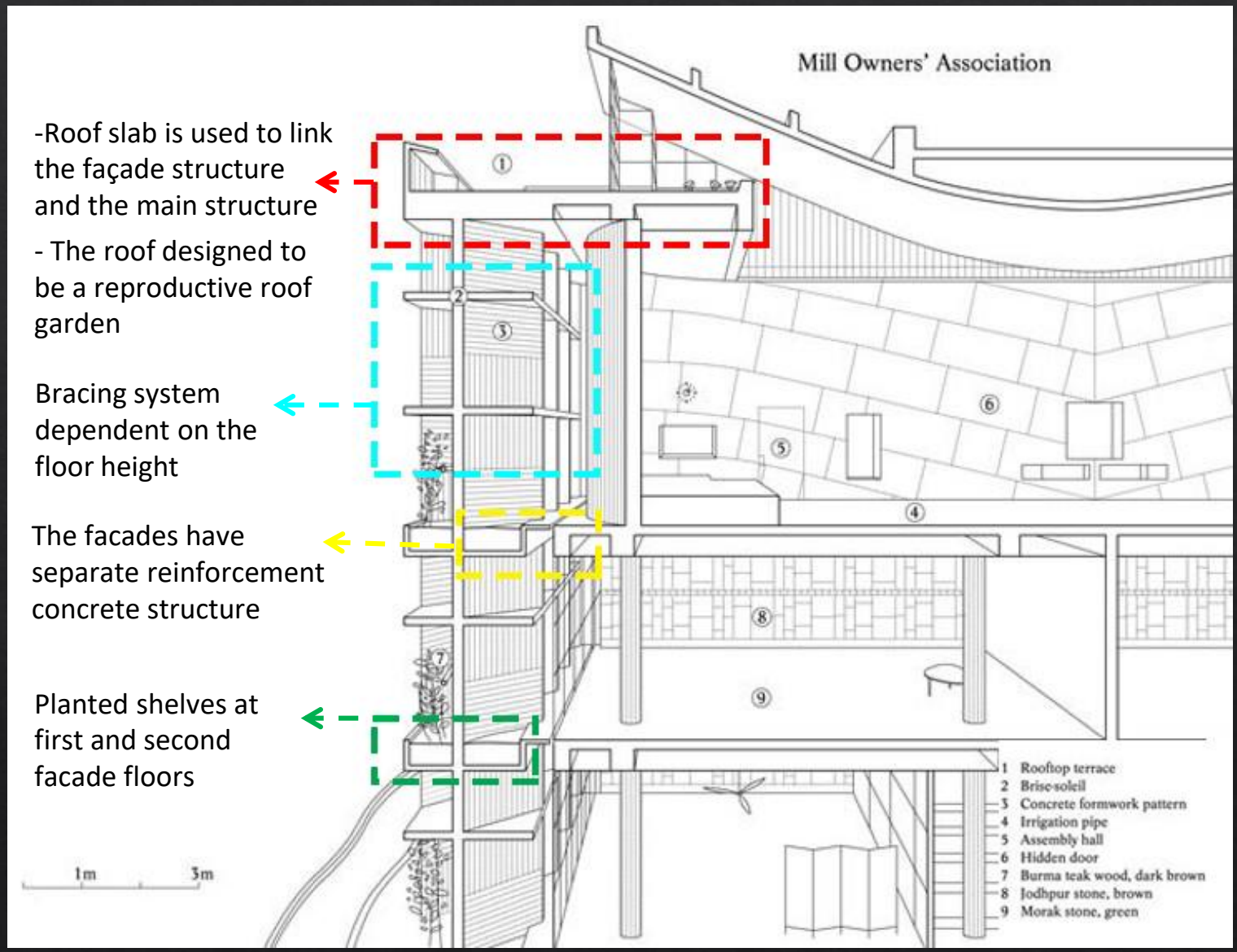
-Roof slab is used to link the façade structure and the main structure

- The roof designed to be a reproductive roof garden

Bracing system dependent on the floor height

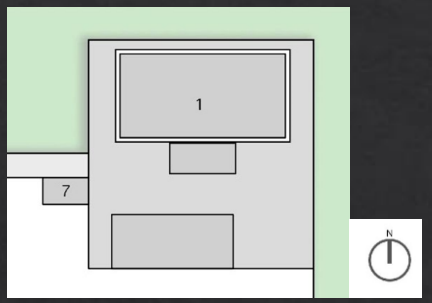
The facades have separate reinforcement concrete structure

Planted shelves at first and second facade floors



Alvaro, Pinterest

Brise Soleil / Sun Breakers



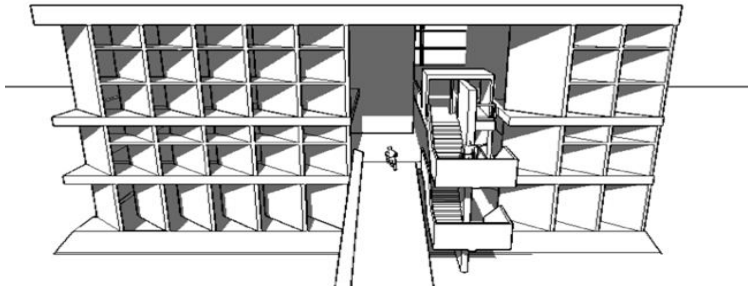


Figure 37. January, Sun Breaker at 12:30 pm.

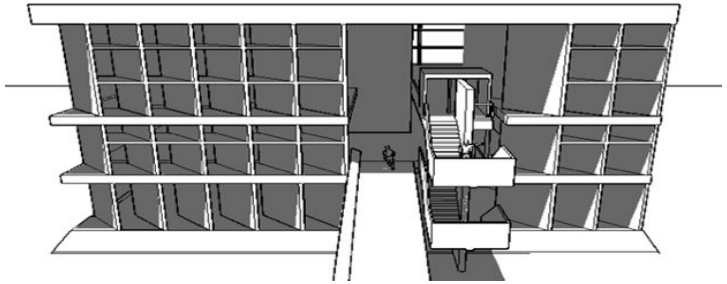


Figure 39. July, Sun Breaker at 12:30 pm.

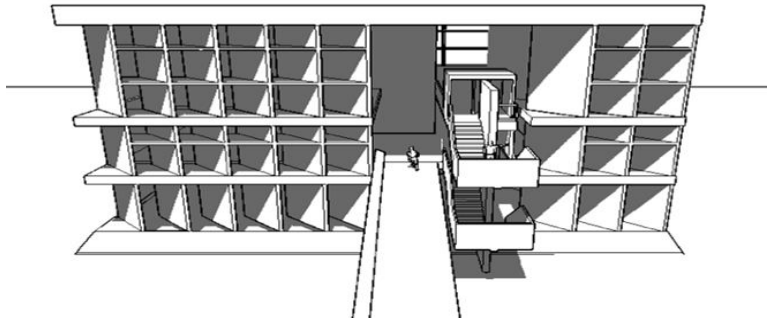


Figure 38. April, Sun Breaker at 12:30 pm.

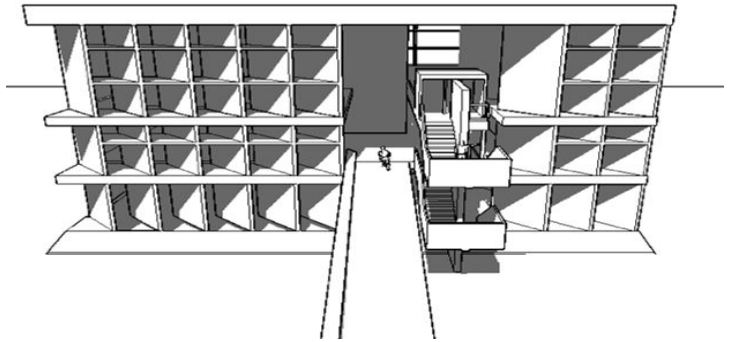


Figure 40. October, Sun Breaker at 12:30 pm.

Foundation

Because the soil in this area is dry sandy soil which has limited load bearing capacity, it is speculated that the strip foundation was used in the design.

In the strip foundation, the foundation beam has a large shear, bending and punching shear resistance, which is suitable for the situation that the load of the column is large, and the bearing capacity of the soil layer is low.

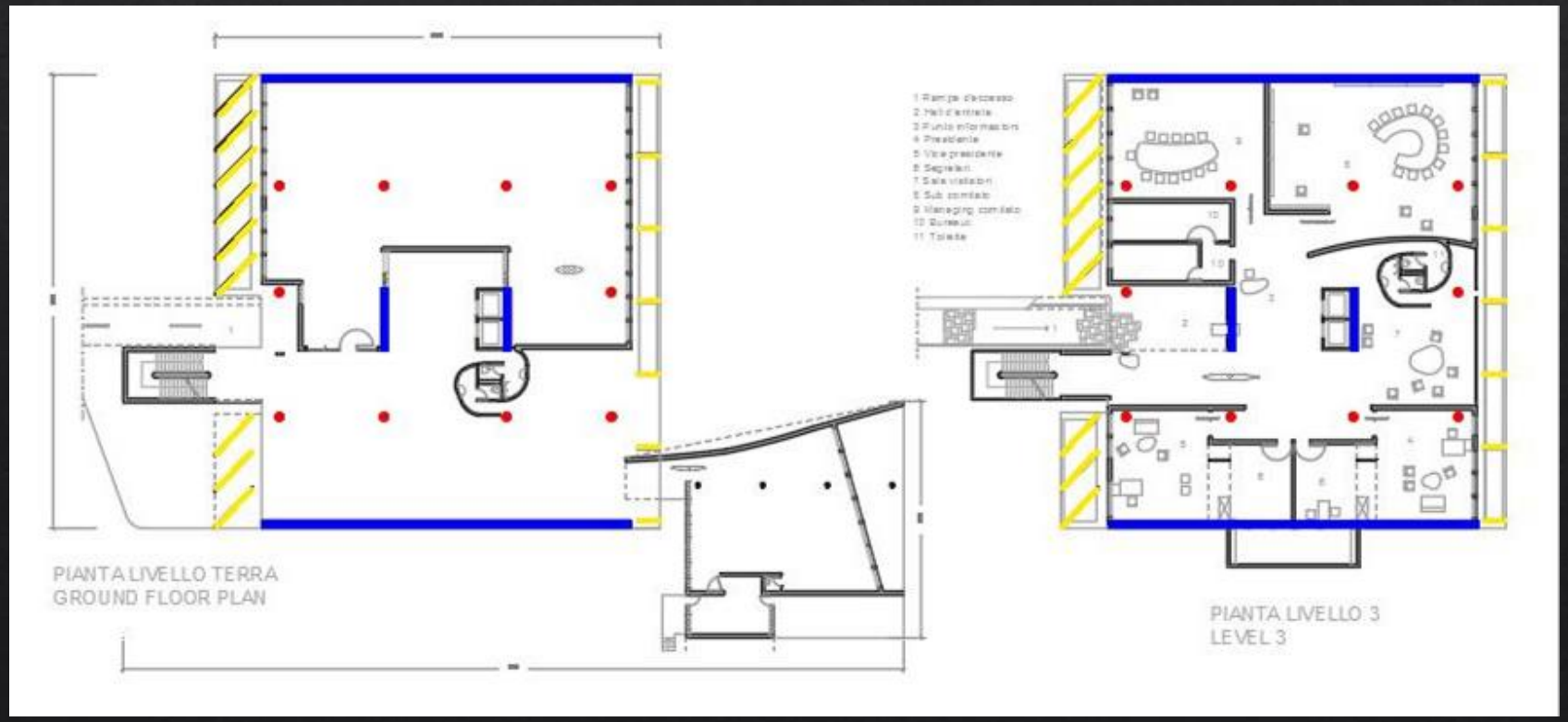
An example of strip foundation

An example of isolated footing

Structural Systems

This building has a rigid frame - shearing walls structural system, there are 4 primary shearing walls and 16 secondary shearing walls (bearing only self weight). The grid span is 24ft*24ft.

There is no column at the end span and middle span, so shearing walls were used to act as columns.



- Columns
- Primary shearing walls
- Secondary shearing walls (bearing only self weight)

Structural Systems

Beam (Single - way)

Primary shearing walls

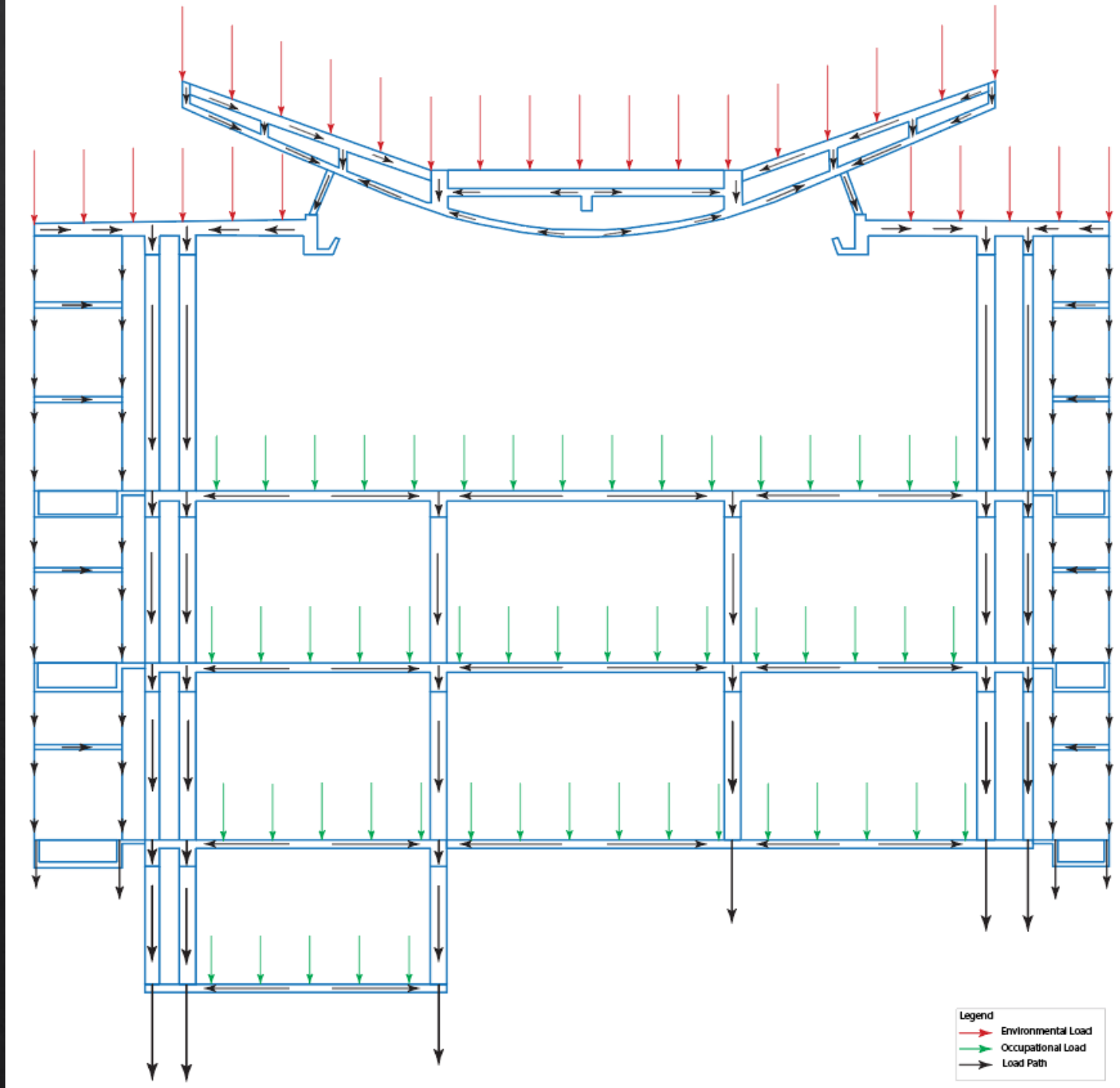
Secondary shearing walls

Column

This is a one-way beam frame structure, and the rigid floor plates can be regarded as “beams” in the other direction.

Load Tracing

- Roof Distribution through anchors
- Through columns and Diaphragms
- Brise Soleil Carry little load



Visual Analysis

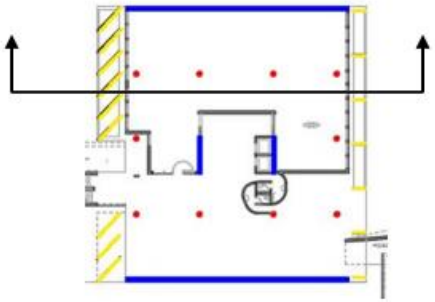
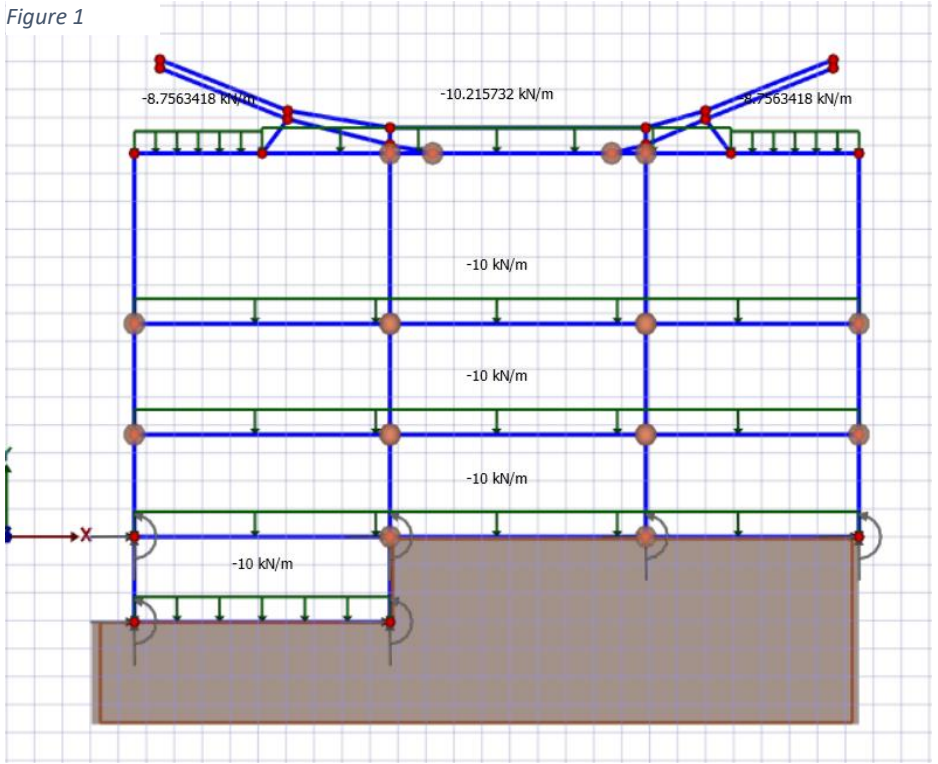
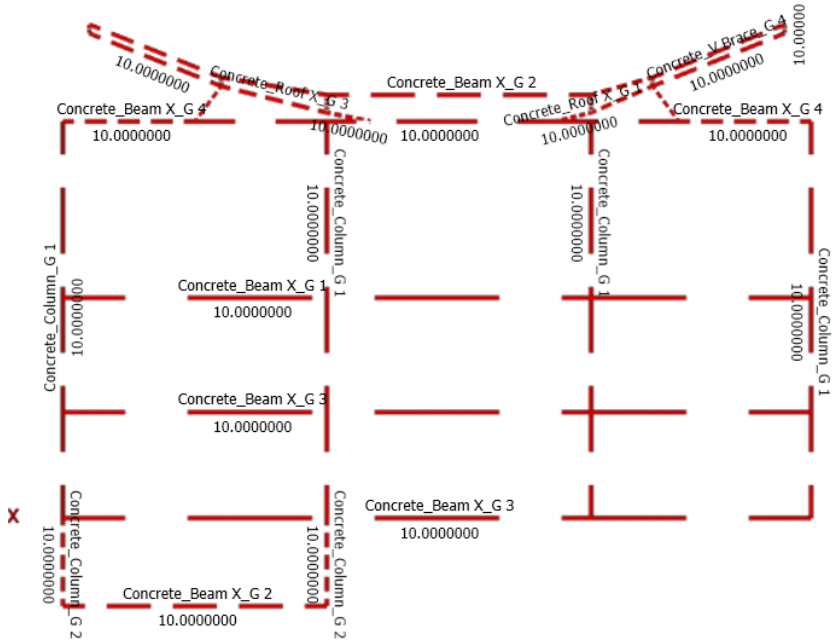
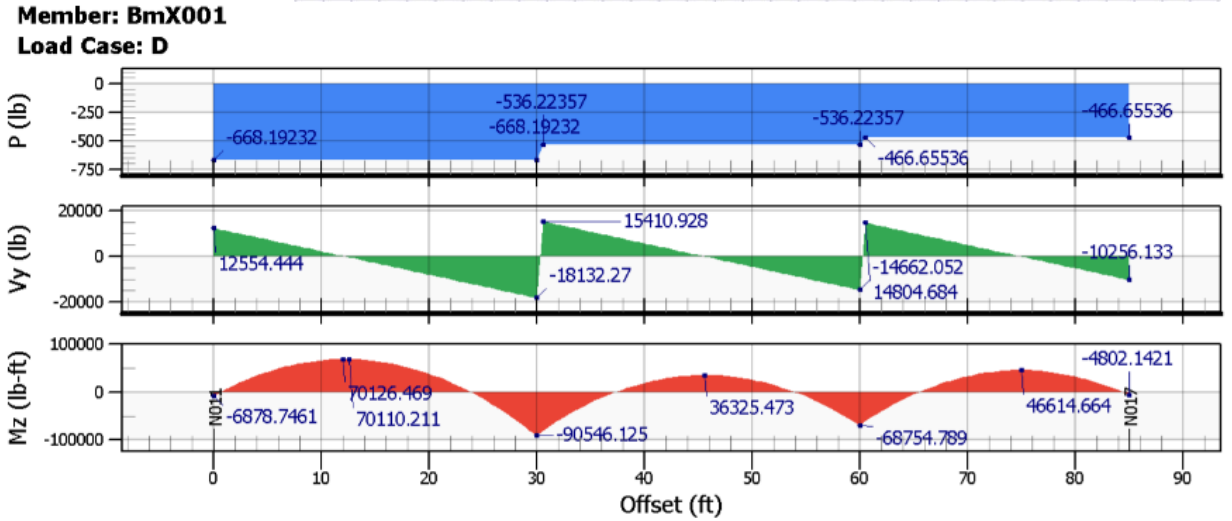


Figure 1



For the first section (figure 1), all the vertical members are circular columns, and the horizontal elements are the beams, in the graphs we selected one beam and one column to add its results for the moment shear and deflection as shown in the graphs below.





We've added fixed nodes at the ground base connection, the primary structural system consists of beams and columns grid, by applying the dead and live loads on it we got these results in the graphs below.

For the second section (figure 2), the middle three vertical members are the circular columns, the shear wall as the area in the middle, and the members at the edges are the bricks bearing walls, the nodes connections at intersections are pinned.

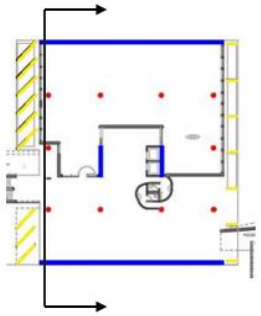
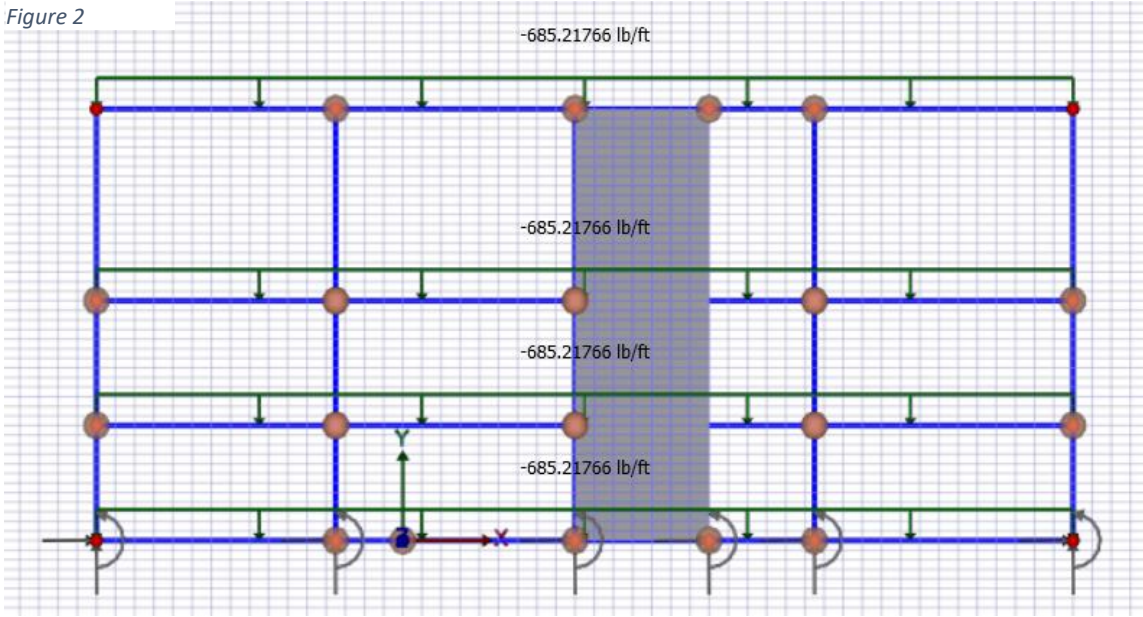
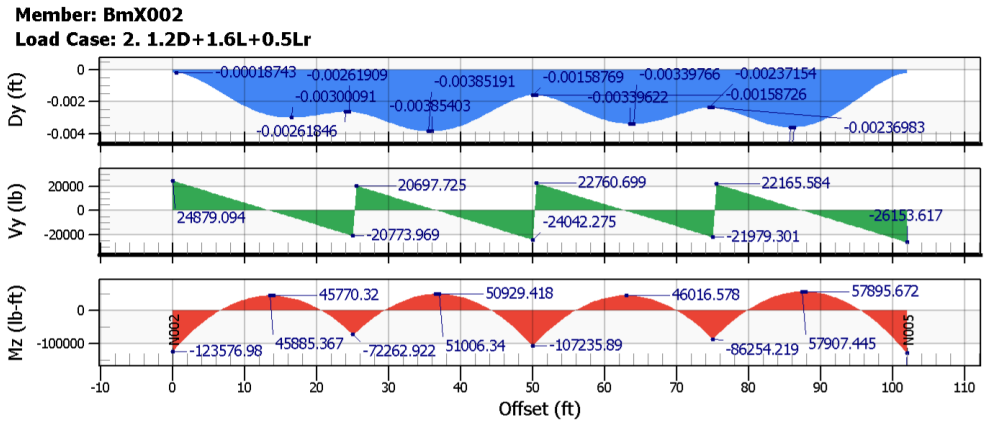
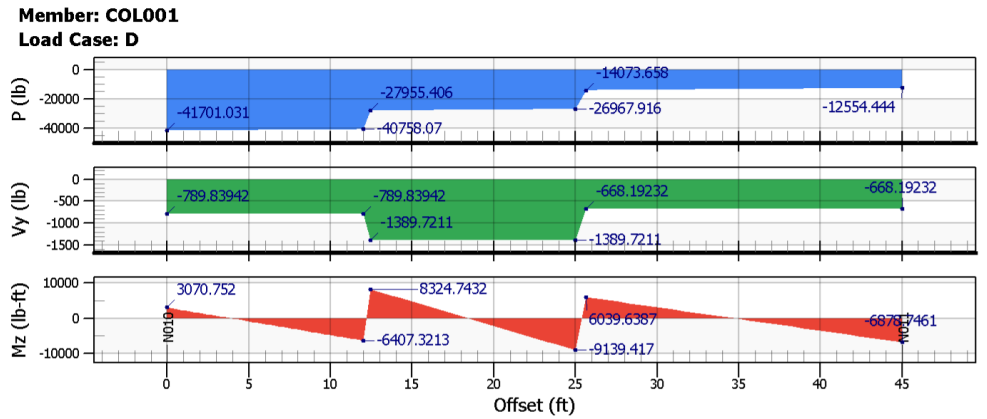
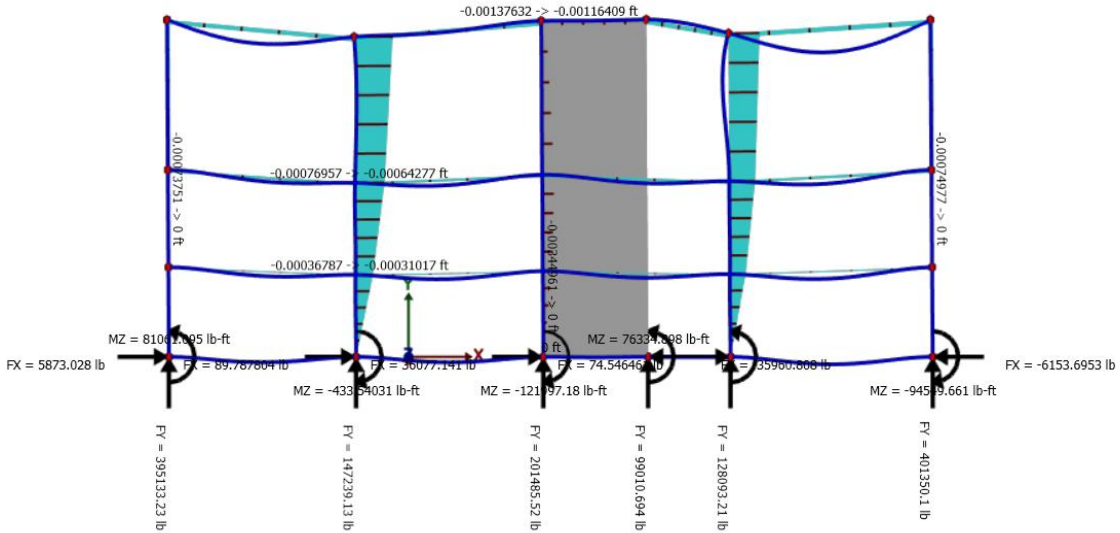


Figure 2

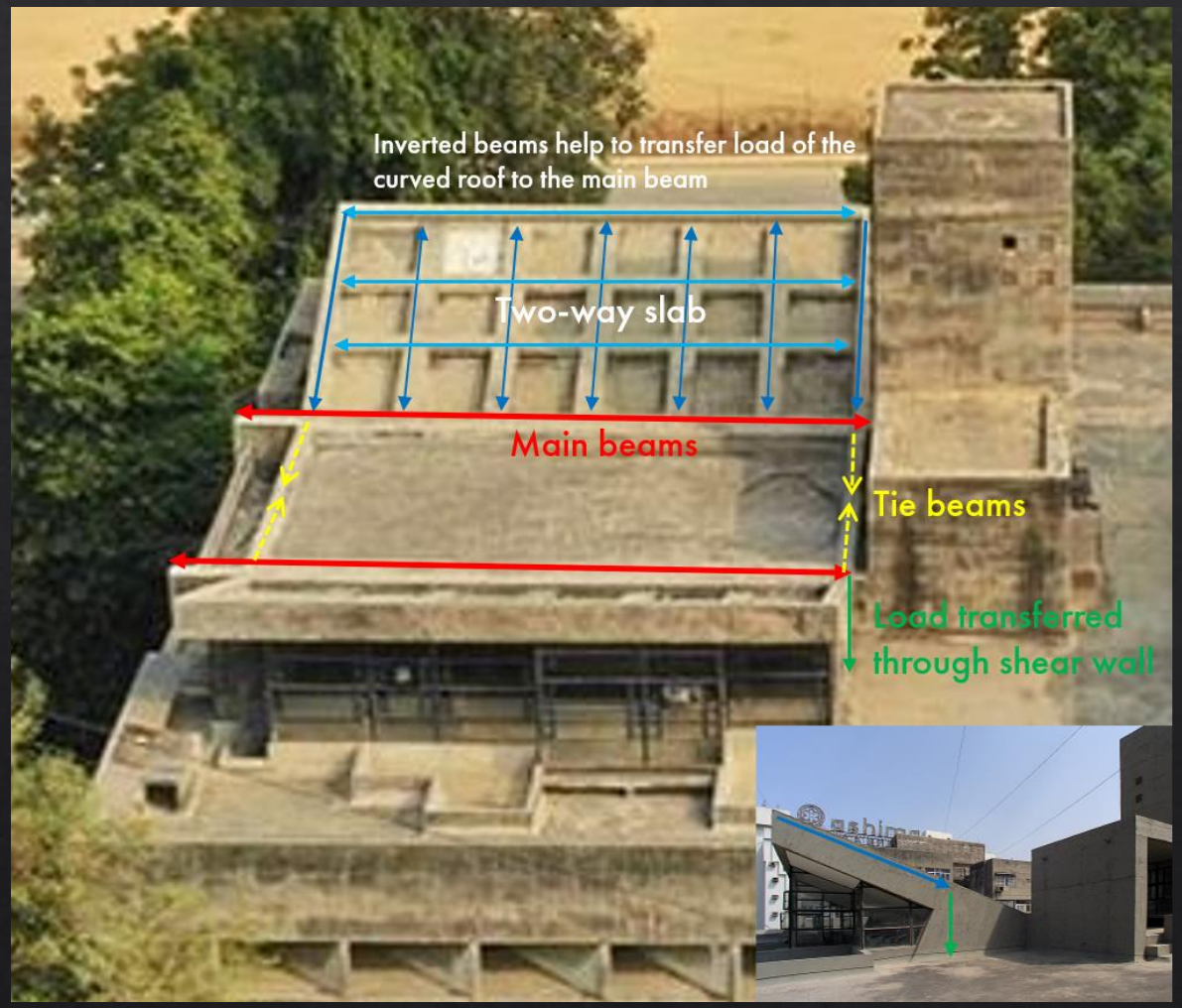


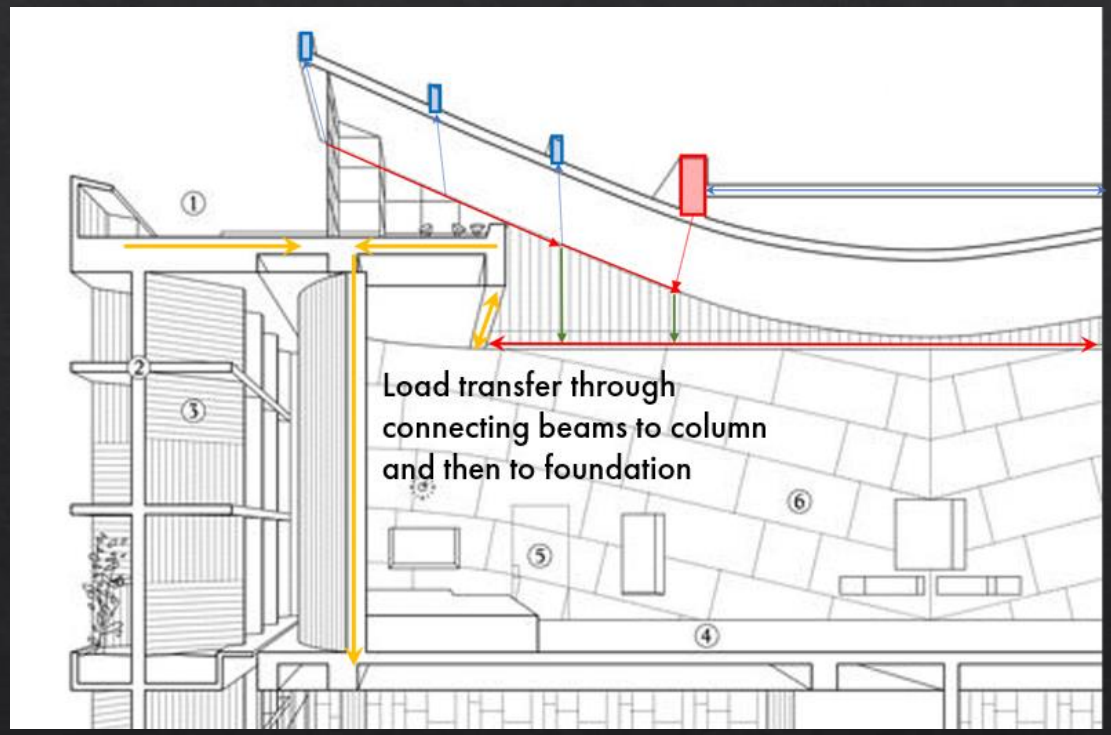






Load transfer in Roof





Figures above shows how the load of the curvilinear roof is getting transferred through the main beams to the foundations

Summary

This report is composed of a brief background of Mill Owner's Association, the city of Ahmedabad ,the Architect - Le Corbusier and how they came together to build this project. ATMA House has become an iconic structure in the history of Architecture in India. Not only it is a great example of an artistic design but received appreciation for its structural innovation. Special features like the Curvilinear roof and Brise Soleil, as descried in the report, were interesting learning in terms of its structural support system as well as its purpose. Furthermore, load tracing and analysis describes how each member behaves in this system and plays its role in transferring the load to the foundation.

Through this structure, the Architect and the engineer have redefined the idea of inside outside. The ceremonial ramp, perforated façade, curvilinear forms and ample open spaces harmonizes with it surrounding and stood out as a bold expression of modern aesthetic.

References

Figure 2, 11, 20, 36. by Author.
Figure 3-10; 12-19; 21-28; 30-35; from ATMA Wordpress Blog
Figure 37-40 from Google Sketchup Warehouse

- Ahmedabad's Textile Industry and its booming past (2017) - article at Voice by Kunjan Panchal
- Mill Owners Association Building Ahmedabad - Wikipedia
- #Archifocus: Le Corbusier building in India (2017) - article on Architect by Rima Alsammarae
- The Mill Owners Building of Le Corbusier - ATMA Webpage
- Mill Owners' Association Building / Le Corbusier - Archdaily
- Foundation Le Corbusier

Building Codes

For Load Calculations :

- Dead Load - IS 875 Part 1
- Live Load - IS 875 Part 2
- Wind Load - IS 875 Part 3
- Earthquake Load - IS 1893

For Design :

Concrete - IS 456, SP 16

- **IS Codes 875** - Indian Standard
  Code of Practice for Design Loads (other than earthquake) for buildings and Structures
- **IS 1893** - Indian Standard
  Criteria for Earthquake Resistant Design of Structures
- **SP-16** - Design Aids for Reinforced Concrete to IS: 456-1978

ATMA House, Ahmedabad

Presented By:
Suril Gajera, Yangzao Li, Darrion Orpinel, Sahar Radwan, Neha Rampuria