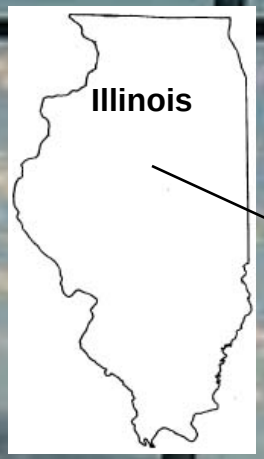
IPRO 335

Flying into a New Generation of Design

Objective

- **Develop a regional airport in Bloomington, Illinois**



Tasks

Architectural
Kimberly Lao
Chun Hang Lau

Acoustics and Lighting
Tiffany Lomax

HVAC
Jong Yoon Lee

Structural
Vladimir Kovacevic
Daniel Salabaj
Michael Heatwole
Gary Wang

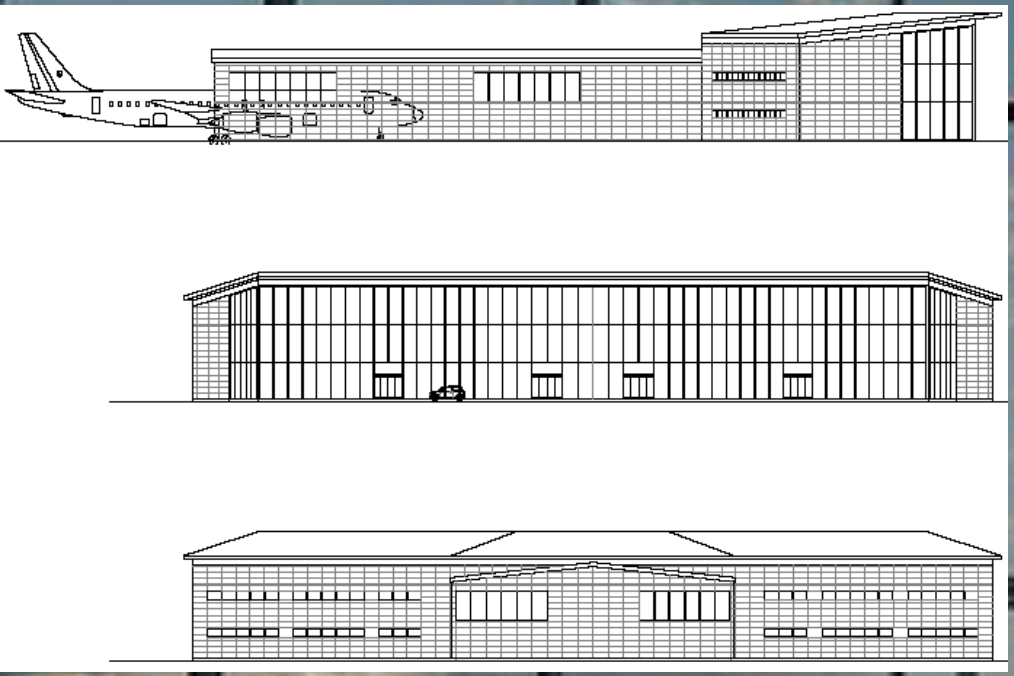
Runway
Jung Il Seo
Edwin Vargas

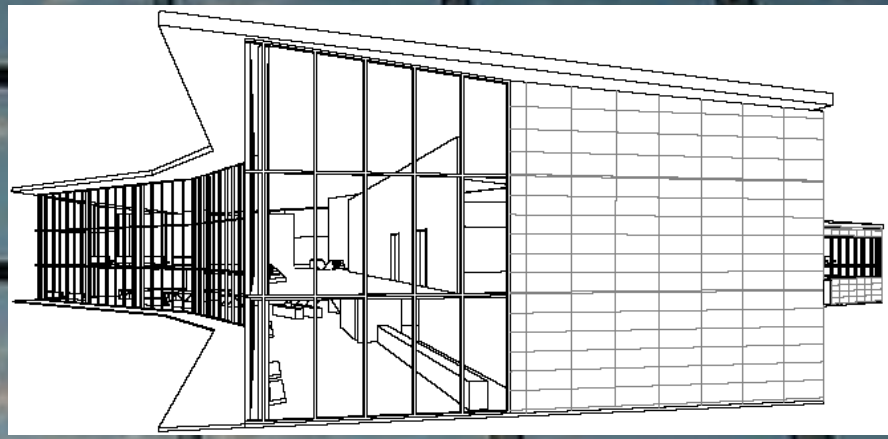
Faculty Advisors:
Ralph Muehleisen

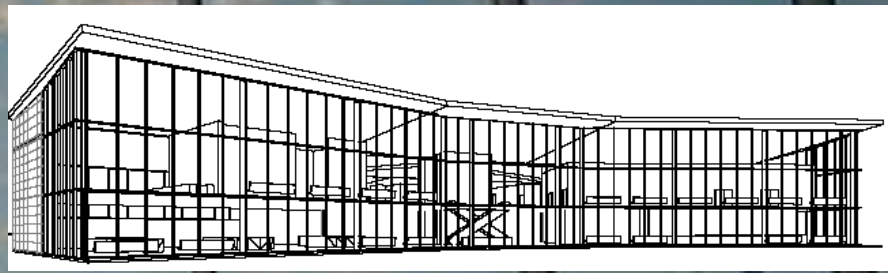
Eduardo DeSantiago

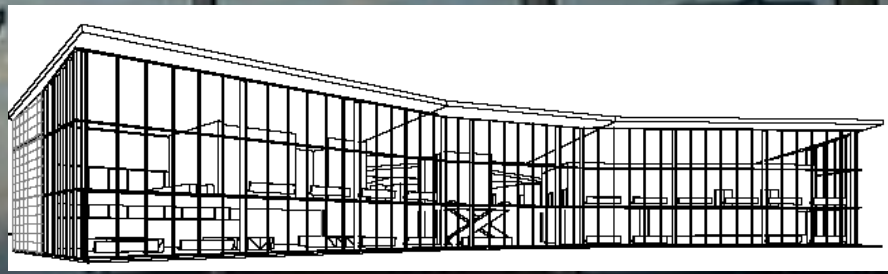
A r c h i t e c t u r e

Exterior Views





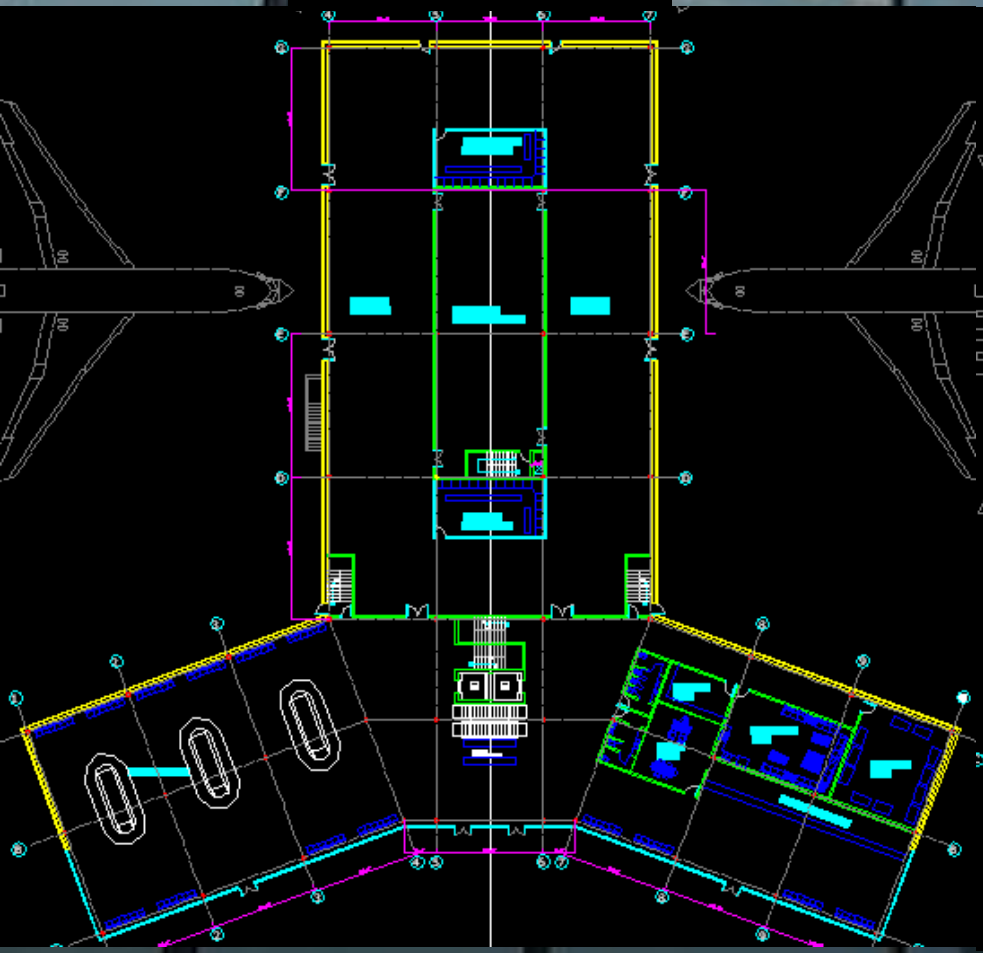




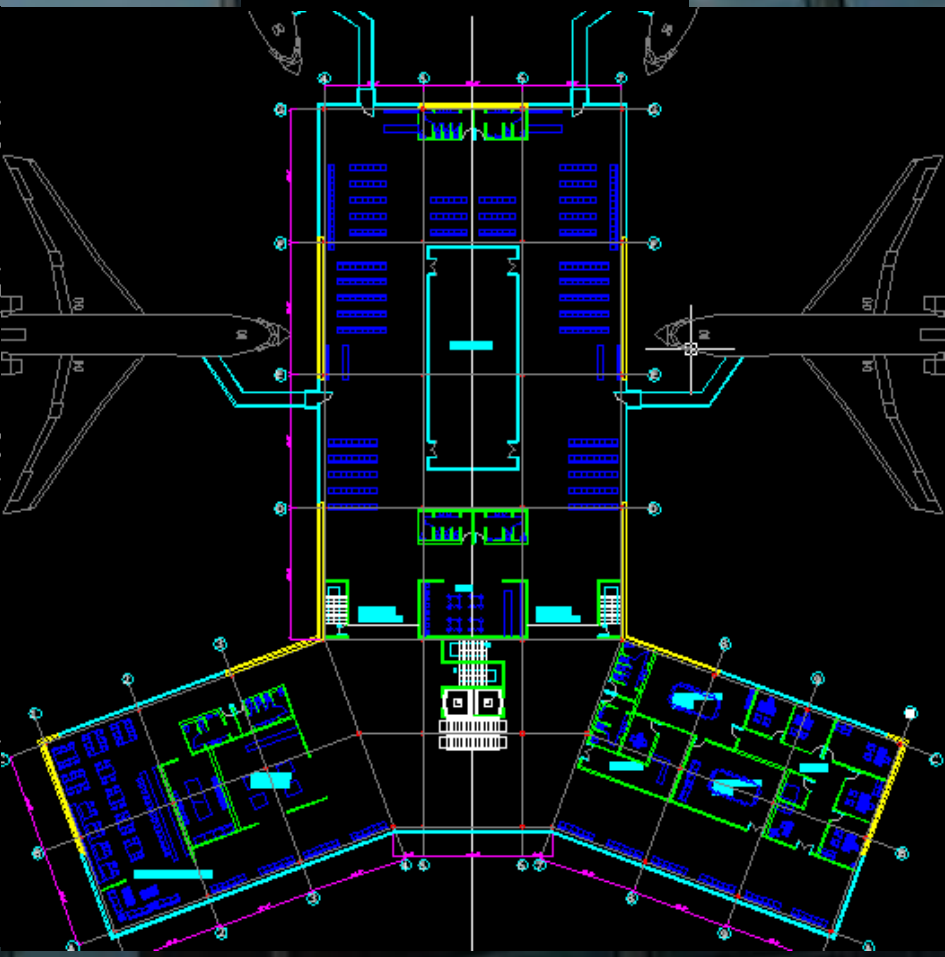
A r c h i t e c t u r e

Floor Plans

First Floor

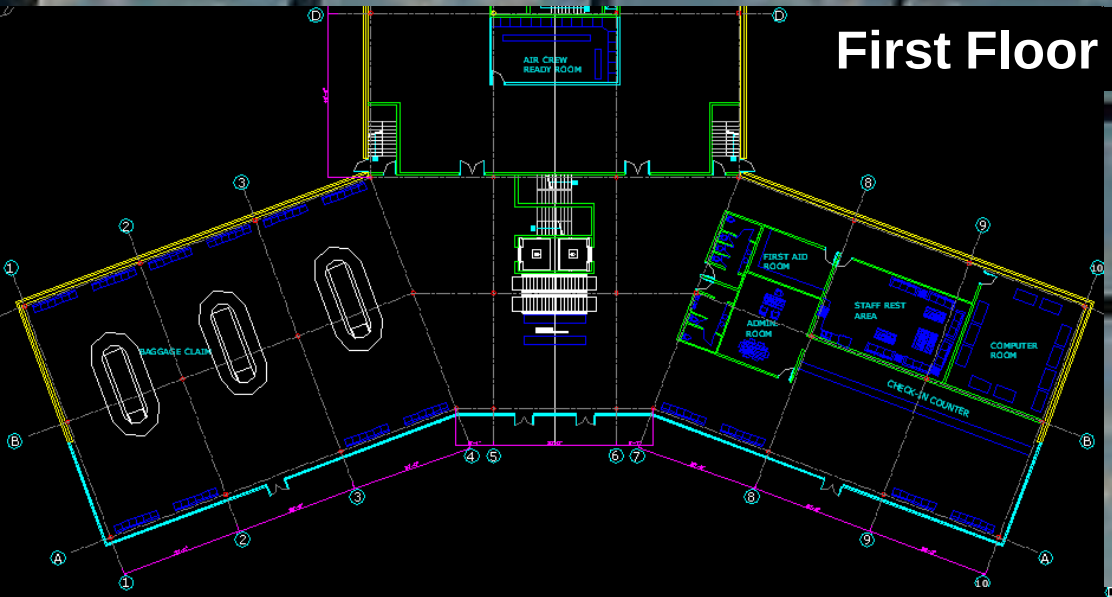


Second Floor

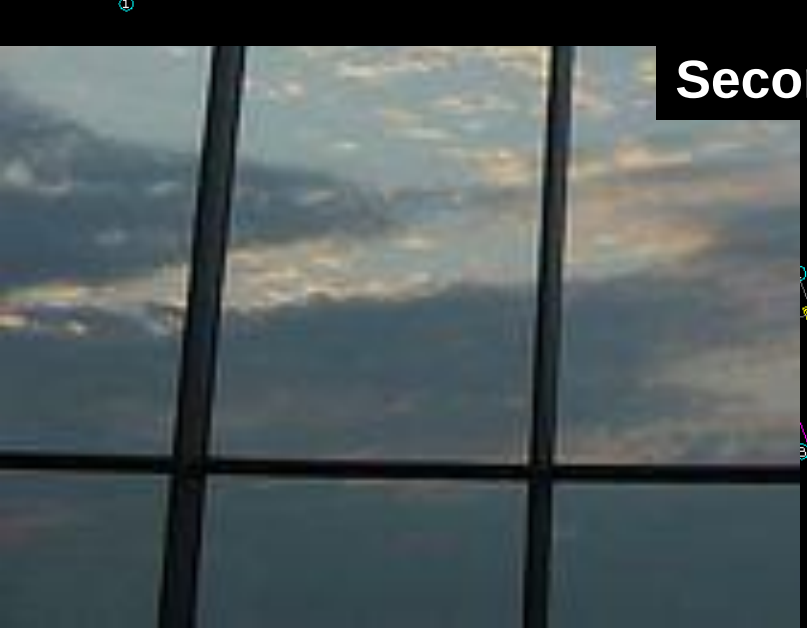


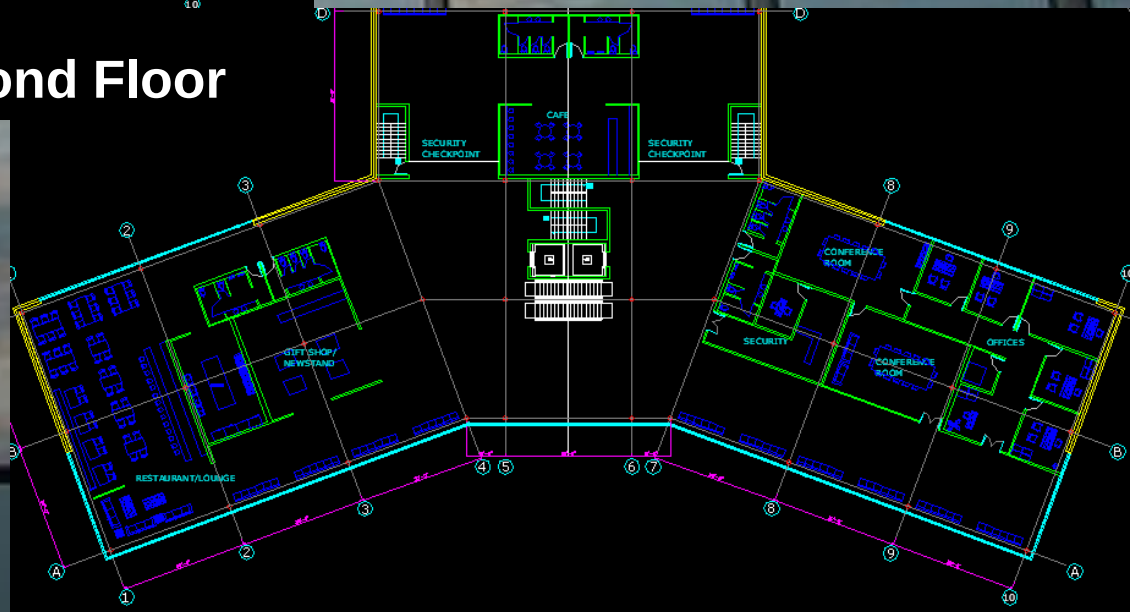
Architecture

First Floor

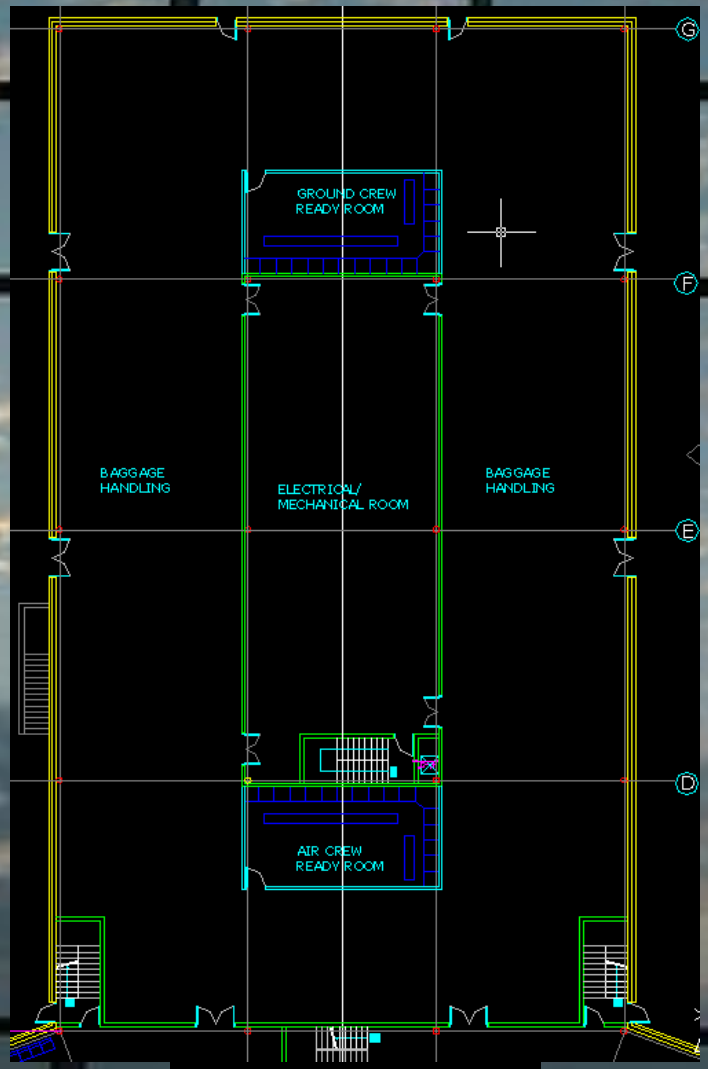


Second Floor

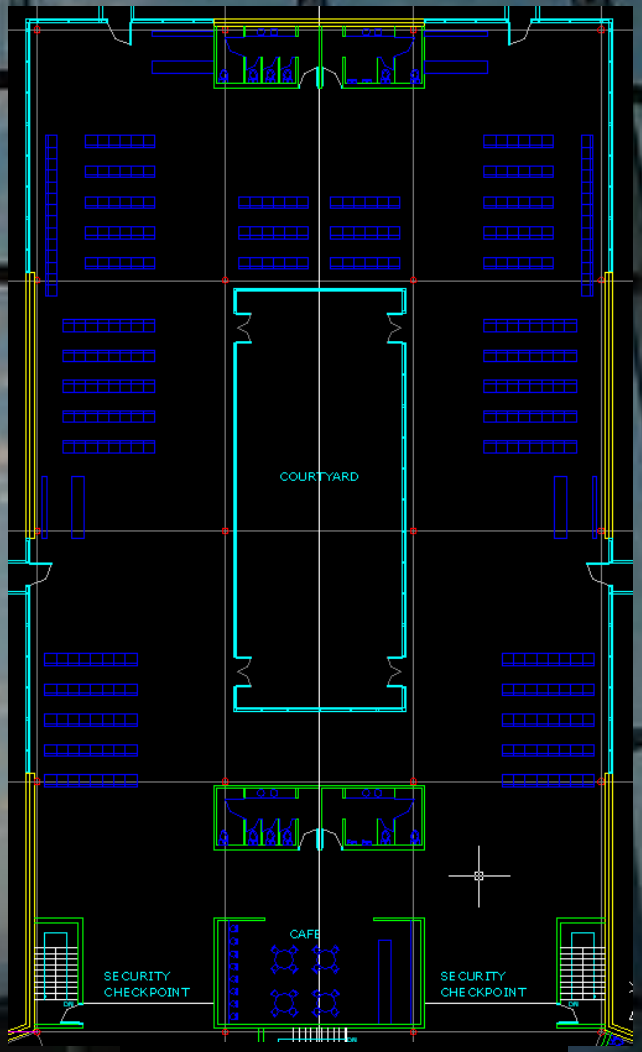




Architecture

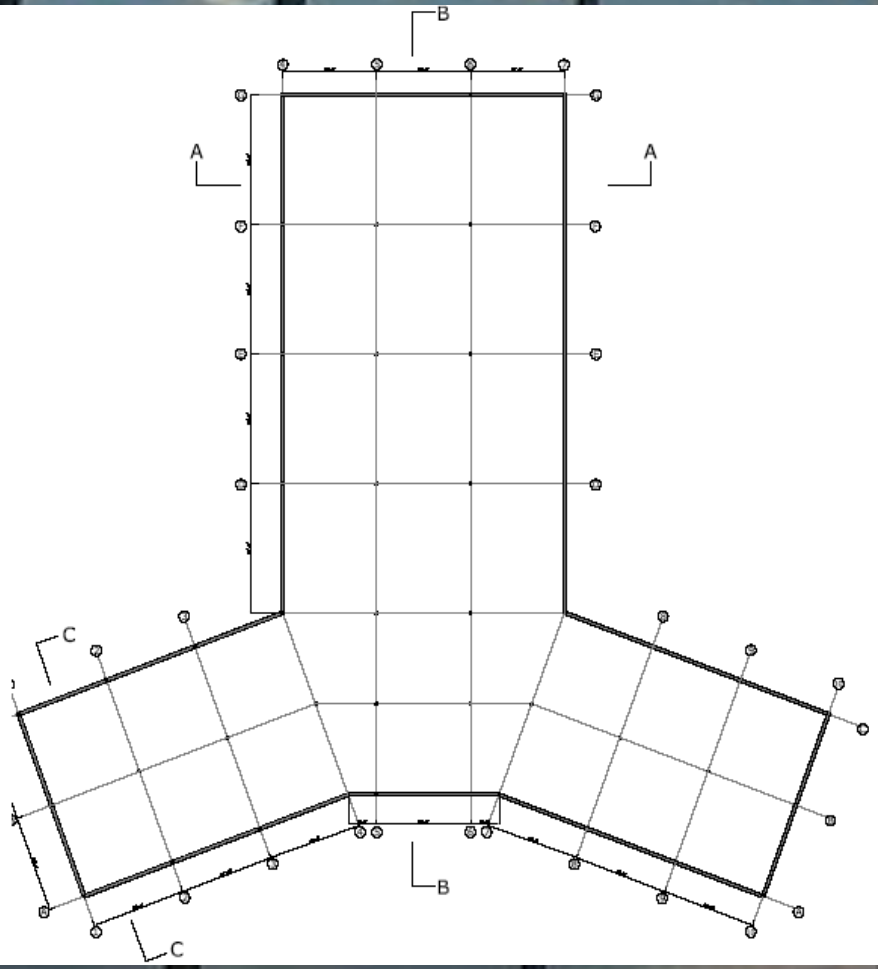


First Floor



Second Floor

S t r u c t u r a l

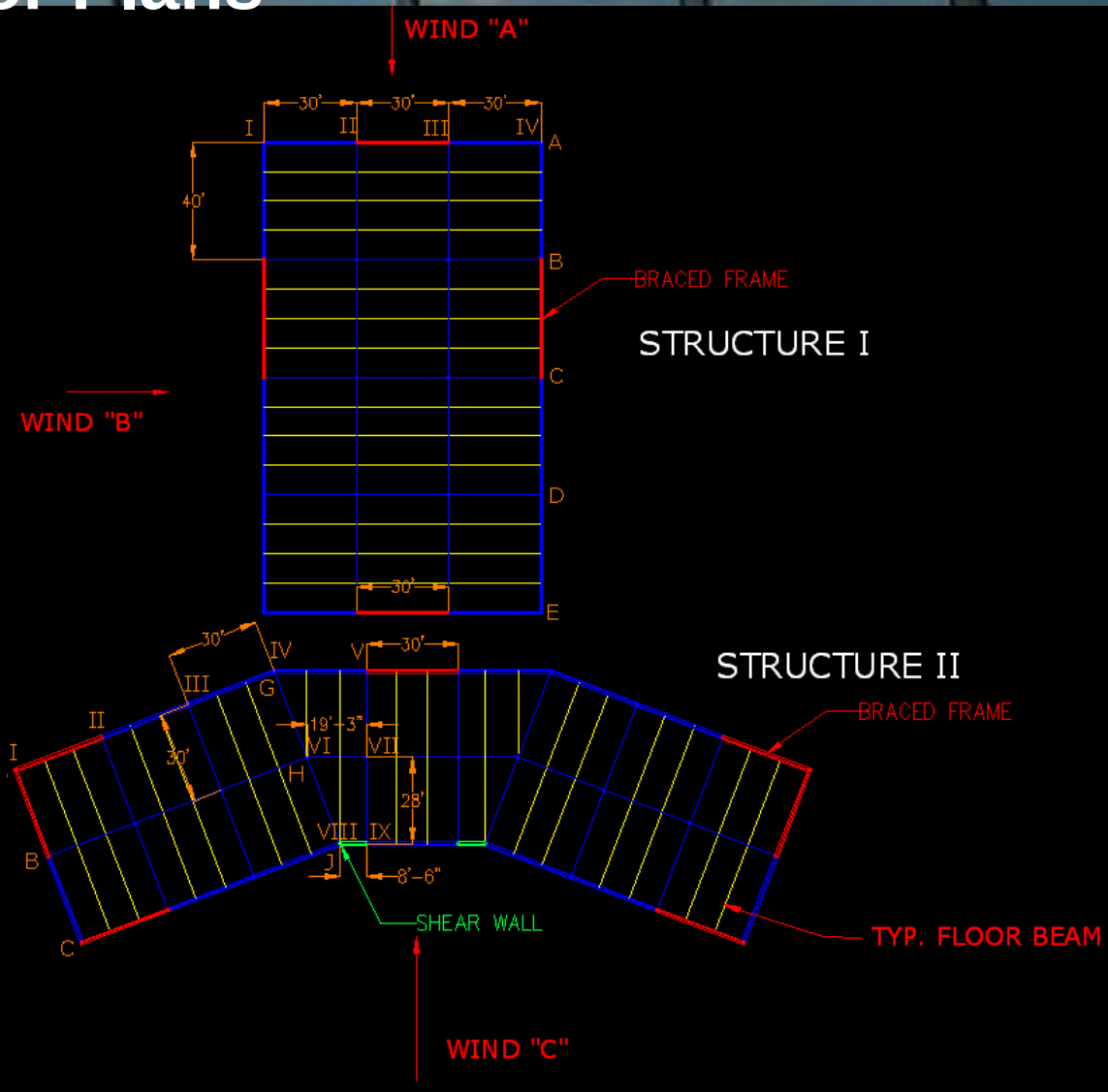


- **Wind is major lateral load**
- **Asymmetric shape of floor plan can lead to high torsional moments**
- **Stiff diaphragm needed to effectively transfer lateral loads to resisting frames**
- **Structural joint divides the building into 2 separate structures**
- **Relative lateral displacements of structures controlled by braced frames**
- **Composite floor beam gives higher stiffness to the diaphragm**

S t r u c t u r a l

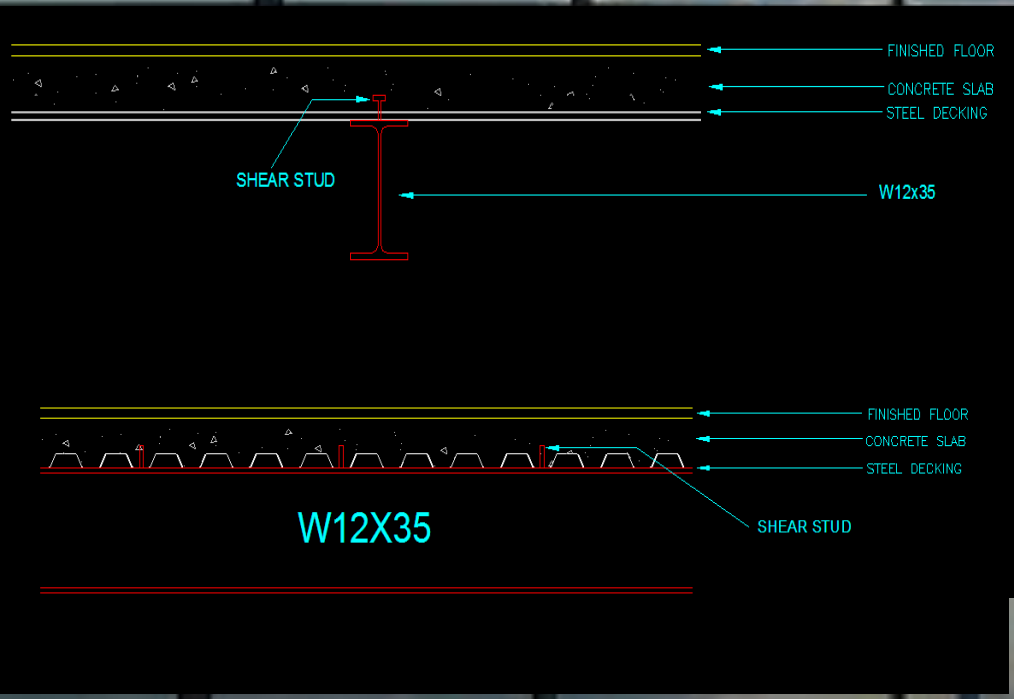
Floor Plans

- Divided structures have more symmetric shapes
- Most floor beams have equal spans and tributary areas
- Braced frames are unobtrusively positioned



S t r u c t u r a l

Composite Floor Beam

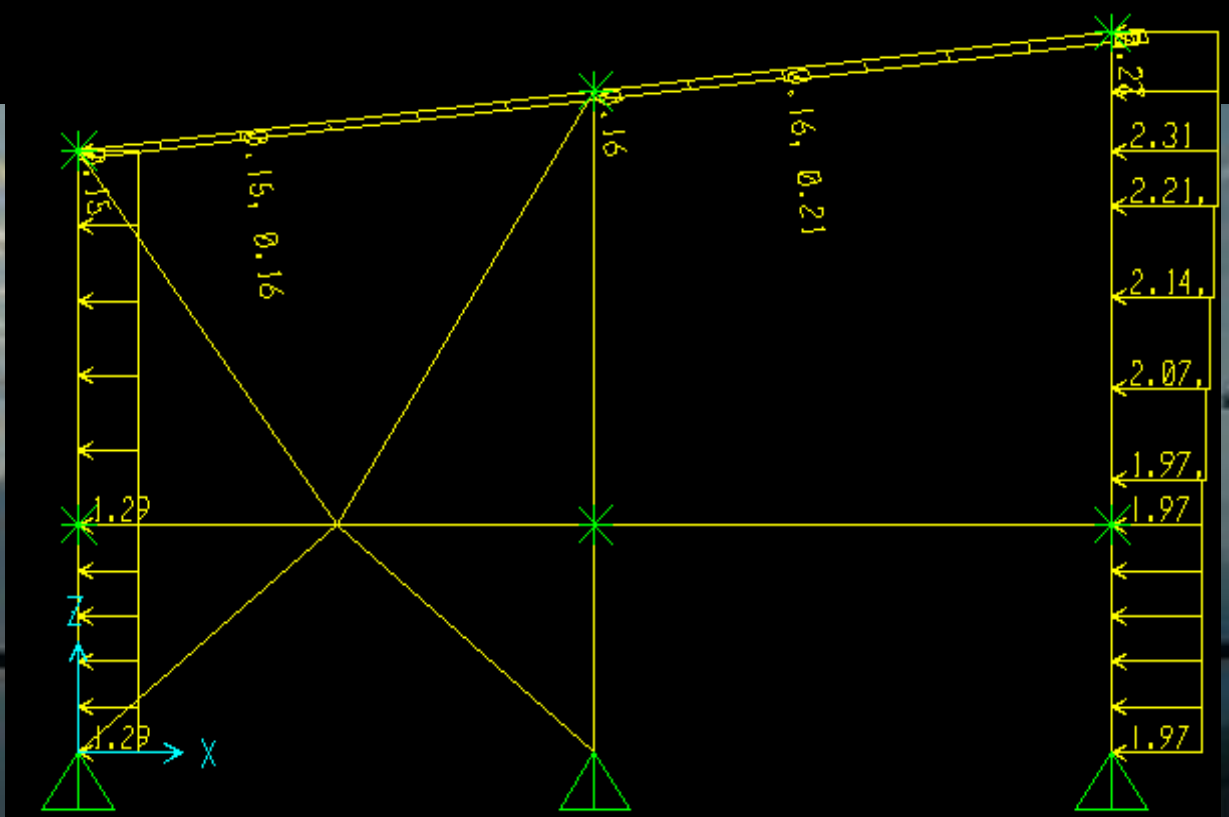


- W12 section was used to match girder dimensions
- Composite action of beam and concrete slab reduced the required size of steel beam from W14x82 to W12x35

S t r u c t u r a l

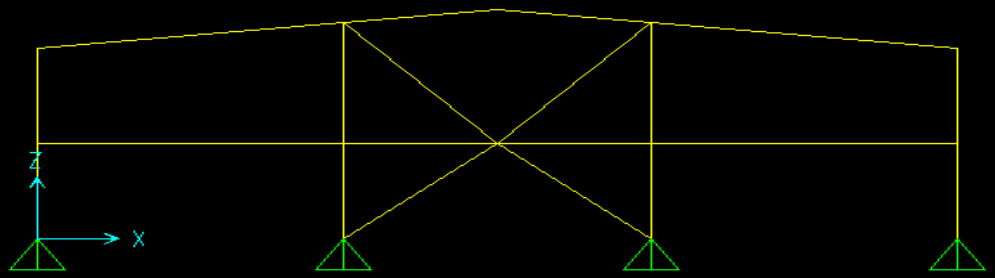
Wind Load

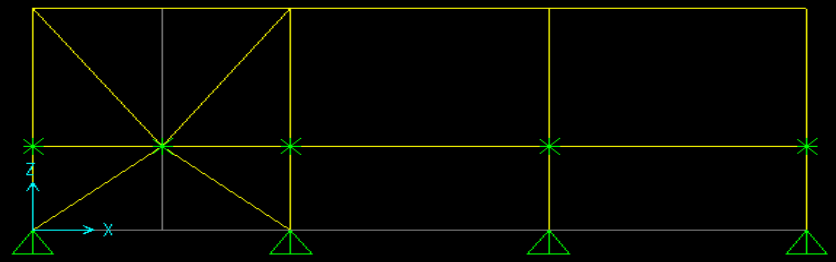
- **Wind tunnel test required by ASCE**
- **Building approximated by “T” shape and both structures evaluated independently, assuming no beneficial mutual interaction**



S t r u c t u r a l

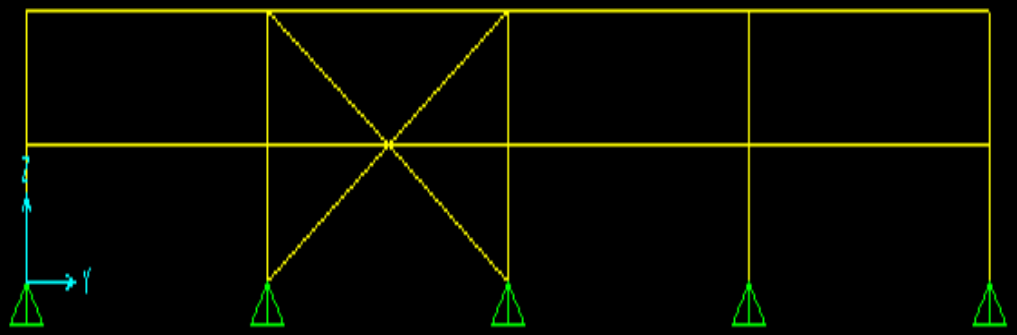
Braced Frames

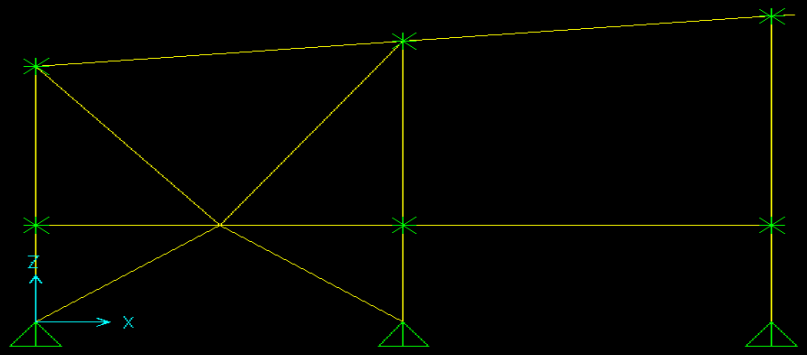




- **Braced frames were placed as far apart as possible to increase the effective lever and better distribute the torsional moments**

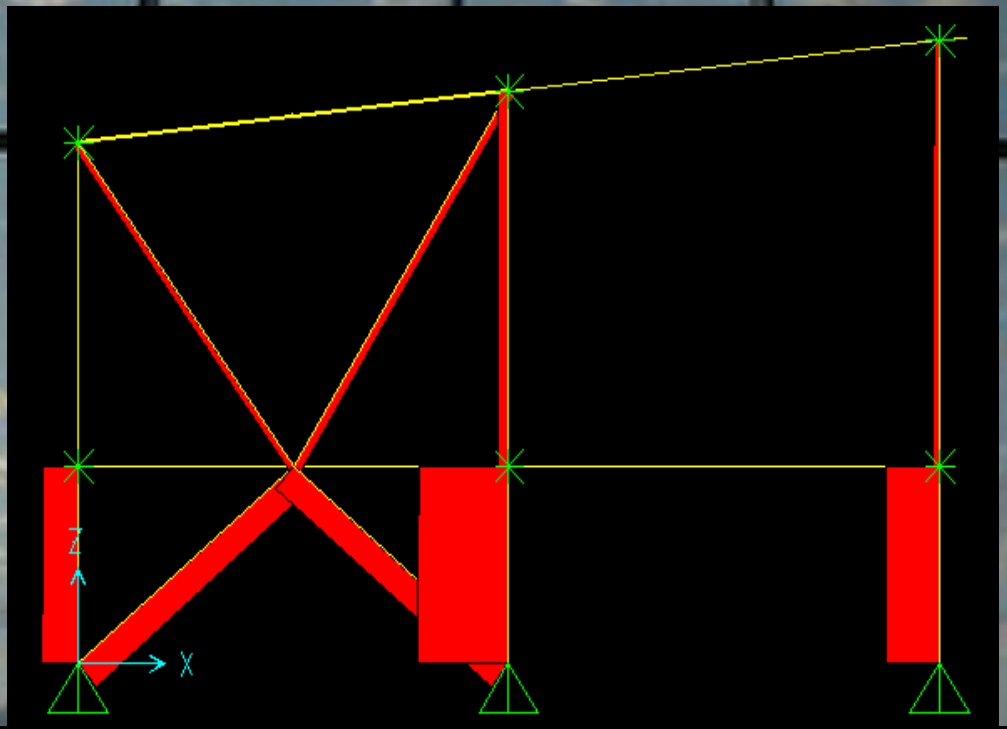
- **Braced frames were selected for lateral load resisting system in both directions to control the lateral sway and to reduce the cost**





S t r u c t u r a l

Sizing of the Members

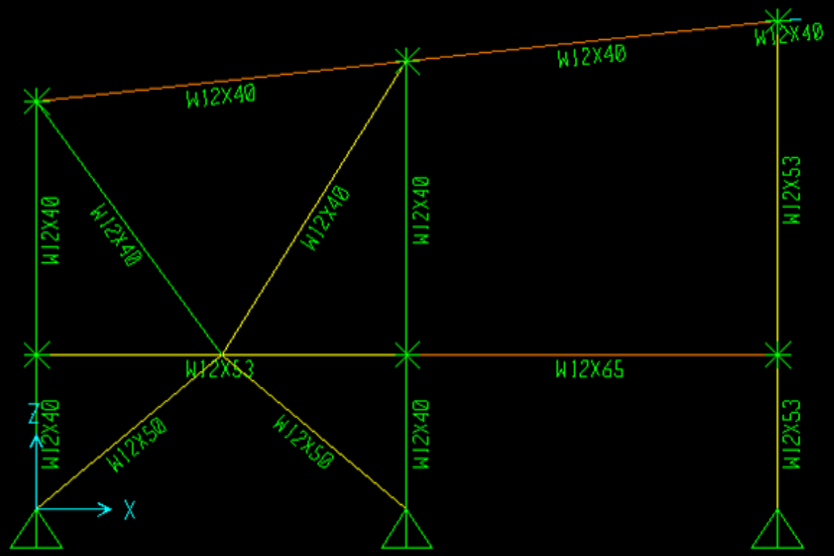


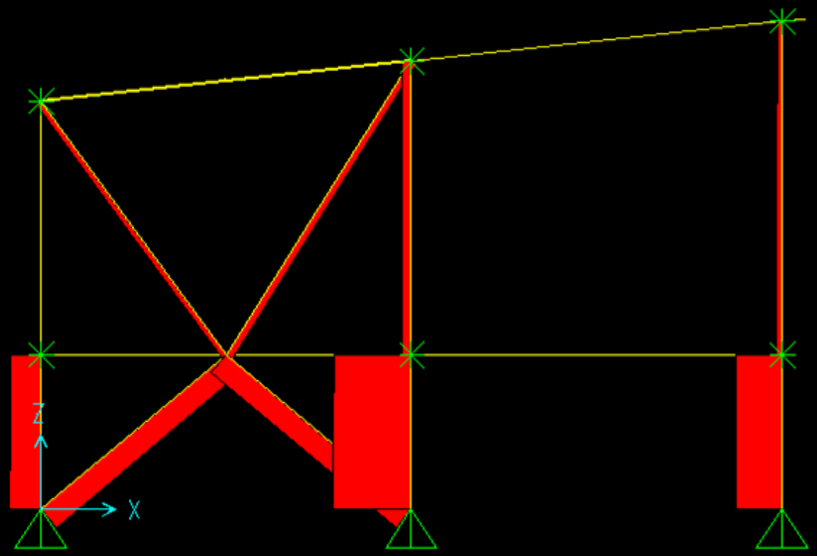
- Extensive structural analysis was performed to determine the minimum required sections for each member
- W12 and W14 shapes almost exclusively used

S t r u c t u r a l

Final member sizes

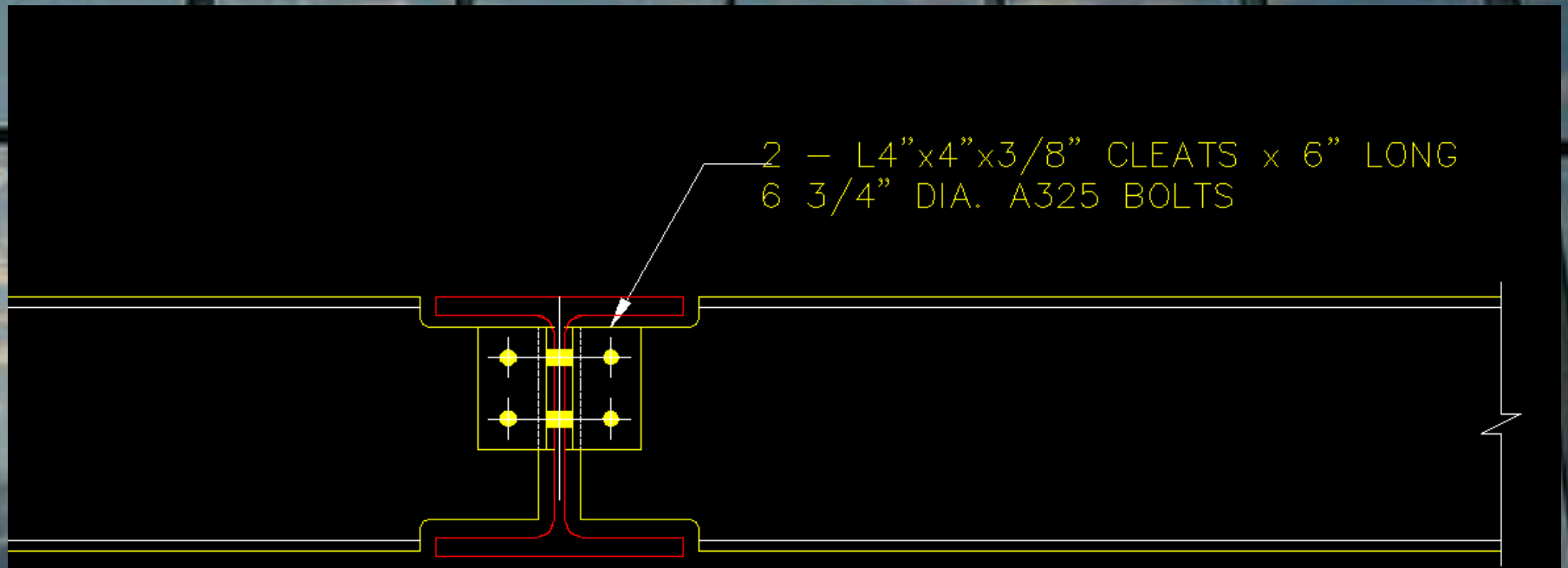
- **To facilitate the construction, certain members were over-designed and the supporting structural members check for final design**





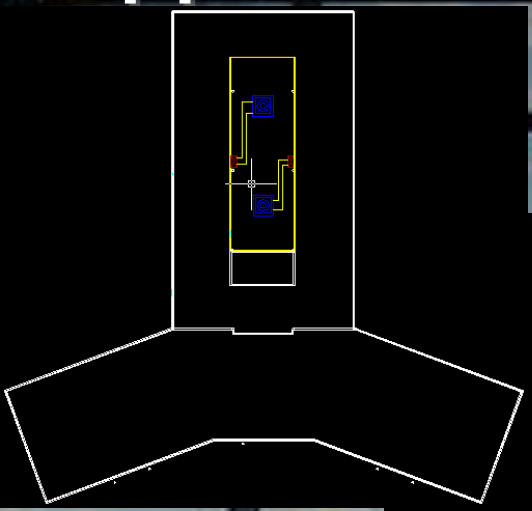
S t r u c t u r a l

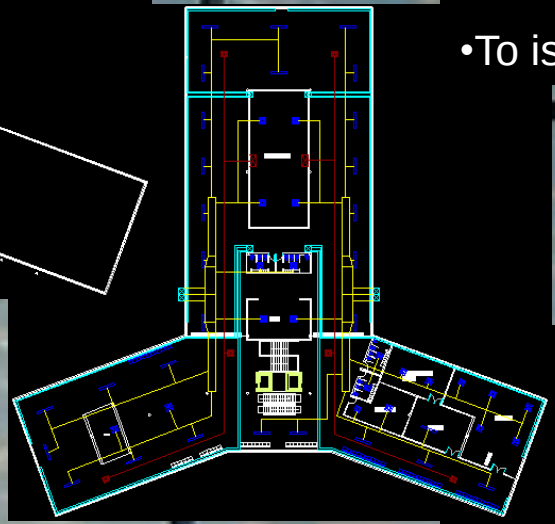
Connections

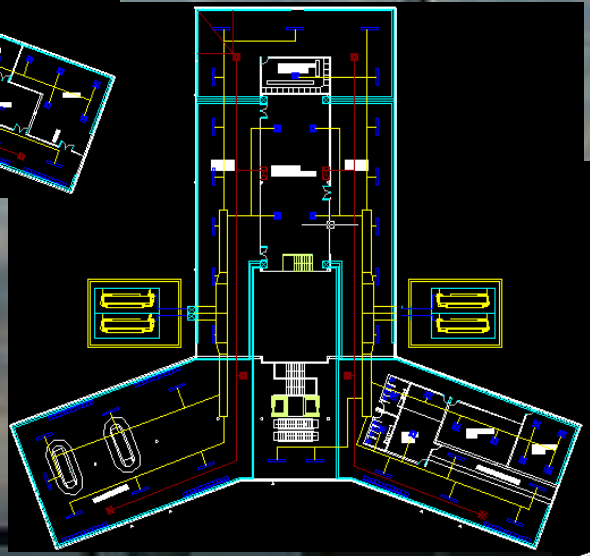


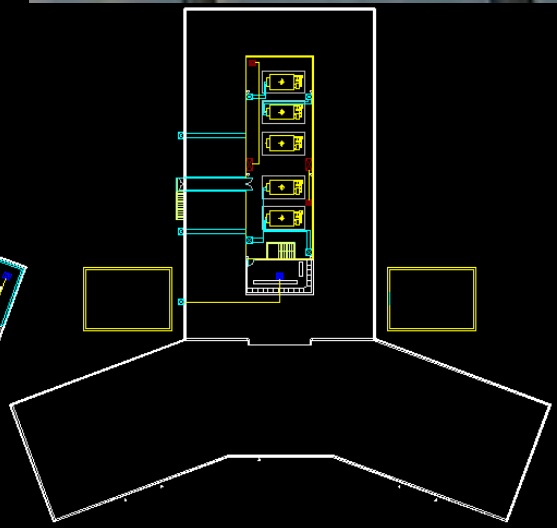
- **All connections are assumed to be “pin” connections and two representative connections were detailed**

H V A C







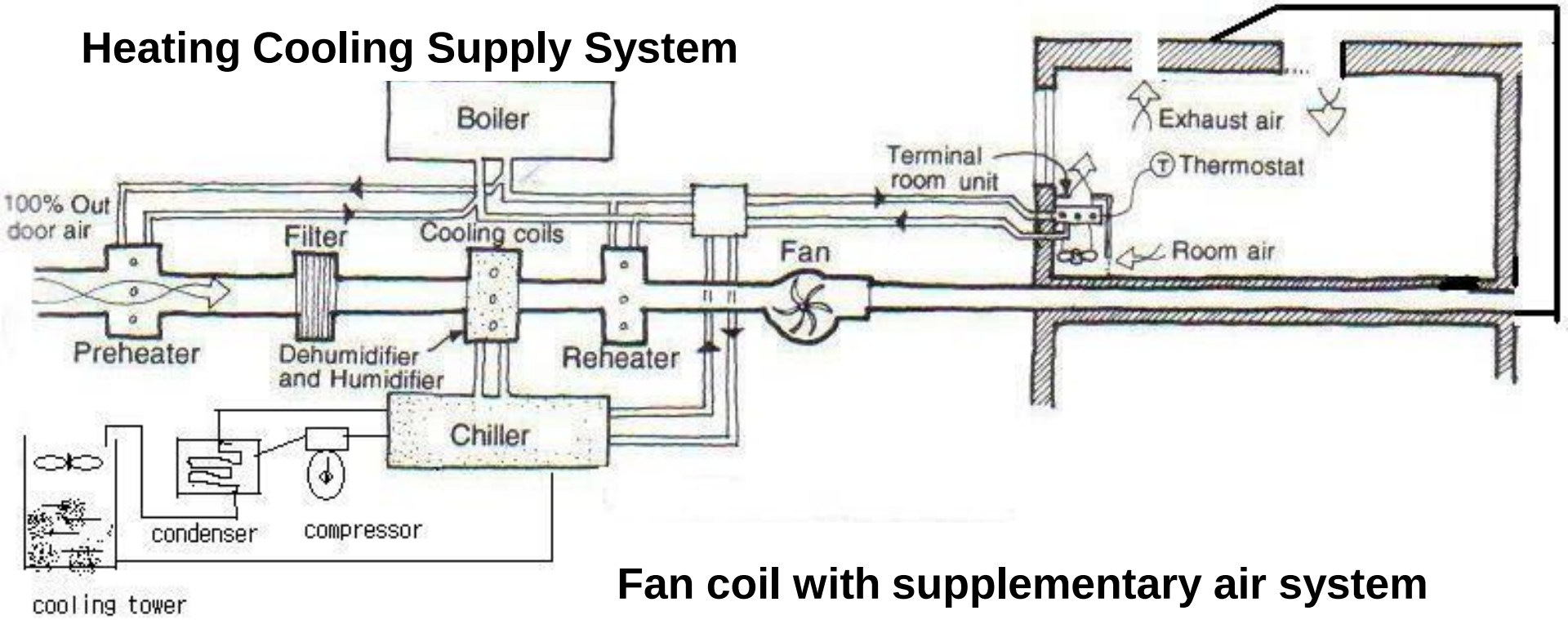


Purpose

- To prevent thermal bridges
- To isolate heat transfer through the roof

H V A C

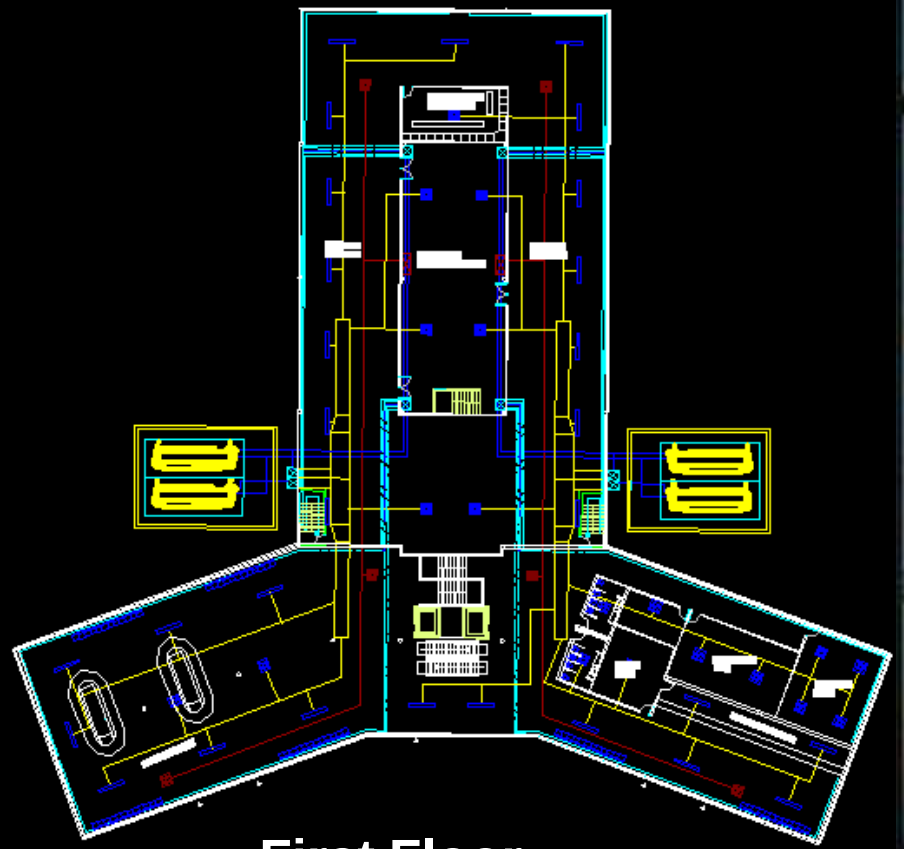
Heating Cooling Supply System



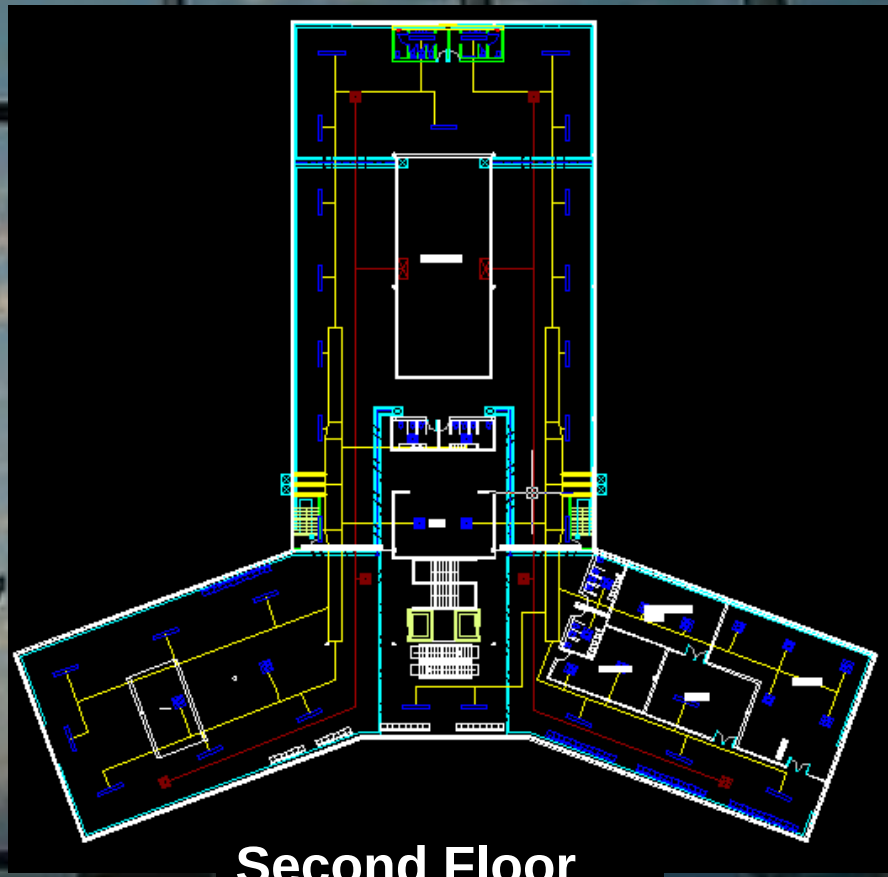
Fan coil with supplementary air system

H V A C

vertical fan coils are installed around the wall and wall corners

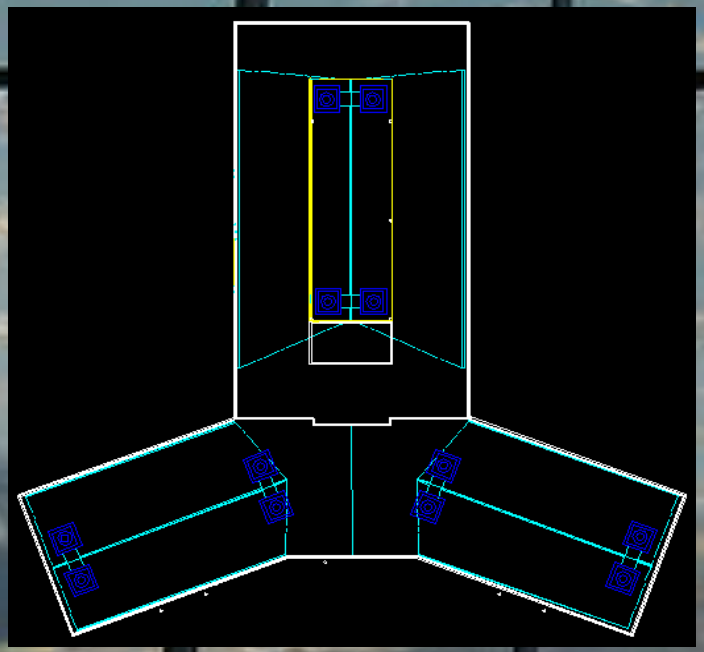


First Floor

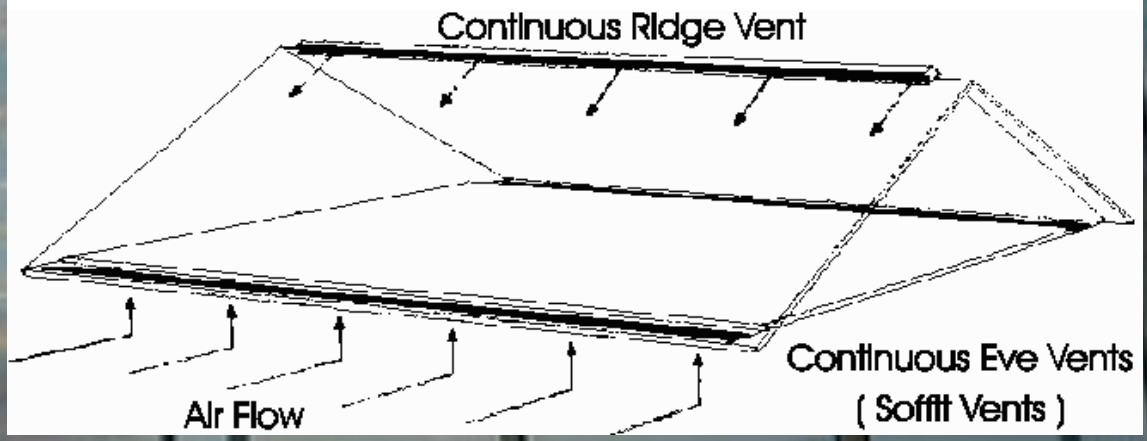


Second Floor

H V A C



In order to prevent heat loss through the roof, solar attic's ridge ventilators are installed



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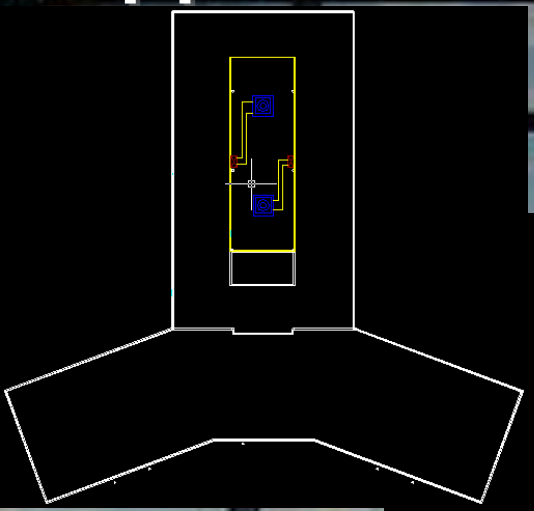
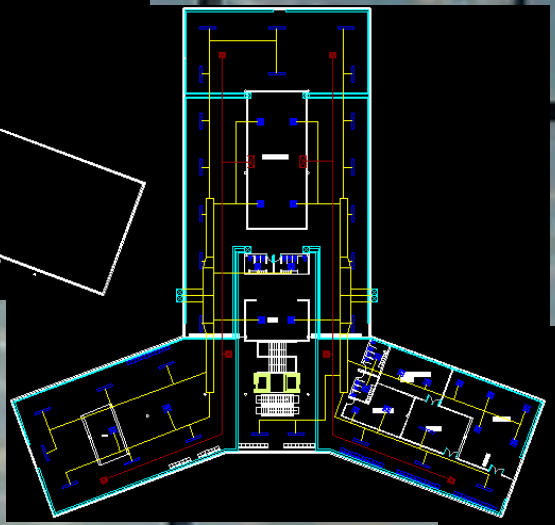
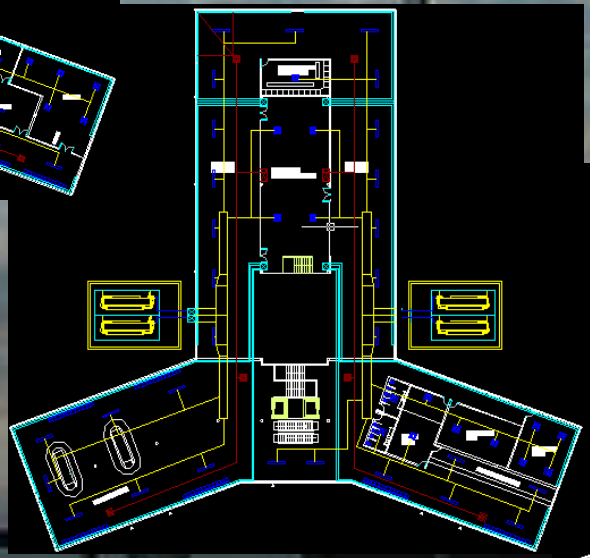
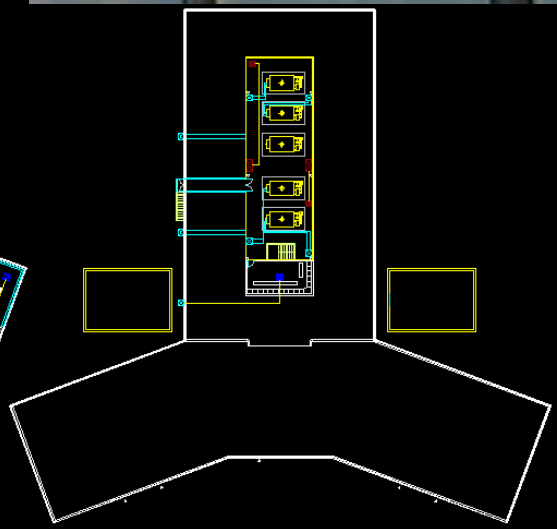








Total cost of HVAC

$1,151,605

A c o u s t i c s

	Original Materials	Absorption Coefficient	Acoustics Materials	Absorption Coefficient
	Tectun Ceiling Tile	0.48	Ceilencio Ceiling panels	0.89
	Painted Gyp.Board	0.095	Trenwyth CMU Block	0.81
	Sylatone Wall Panels	0.23	Decoustics Wall panels	0.93
Reverberation Time	1.23 seconds		0.77 seconds	

A c o u s t i c s

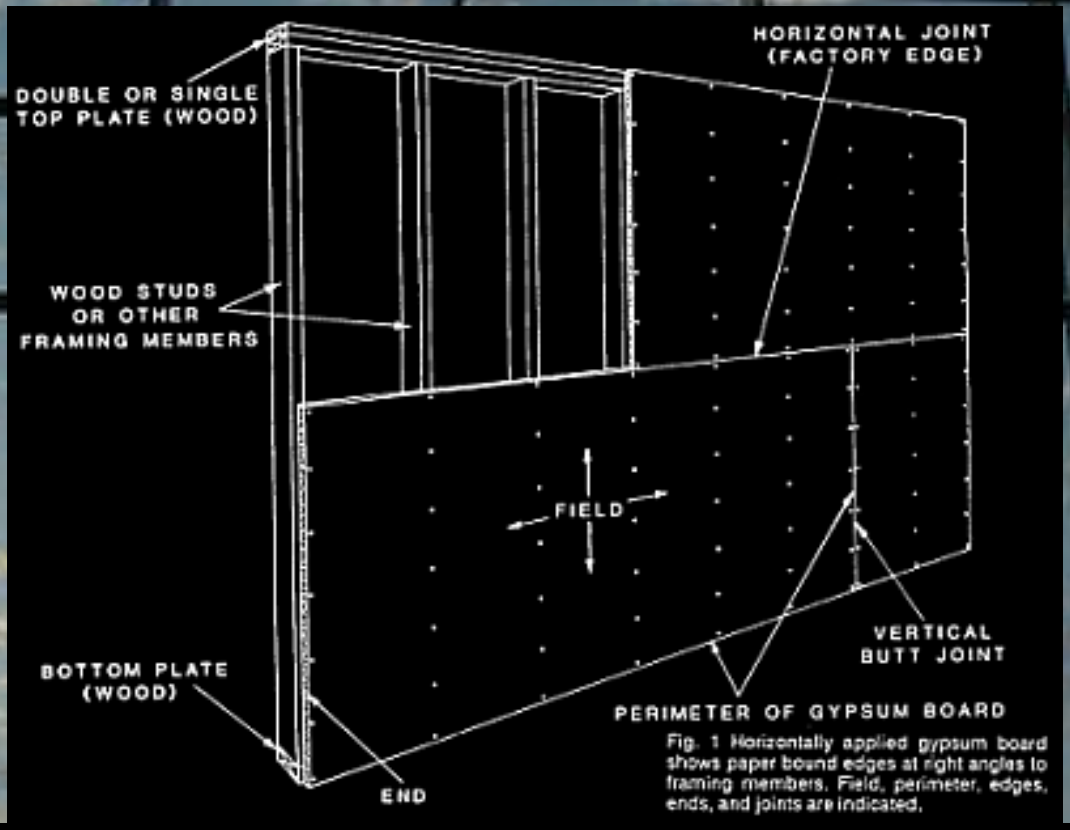


Fig. 1 Horizontally applied gypsum board shows paper bound edges at right angles to framing members. Field, perimeter, edges, ends, and joints are indicated.

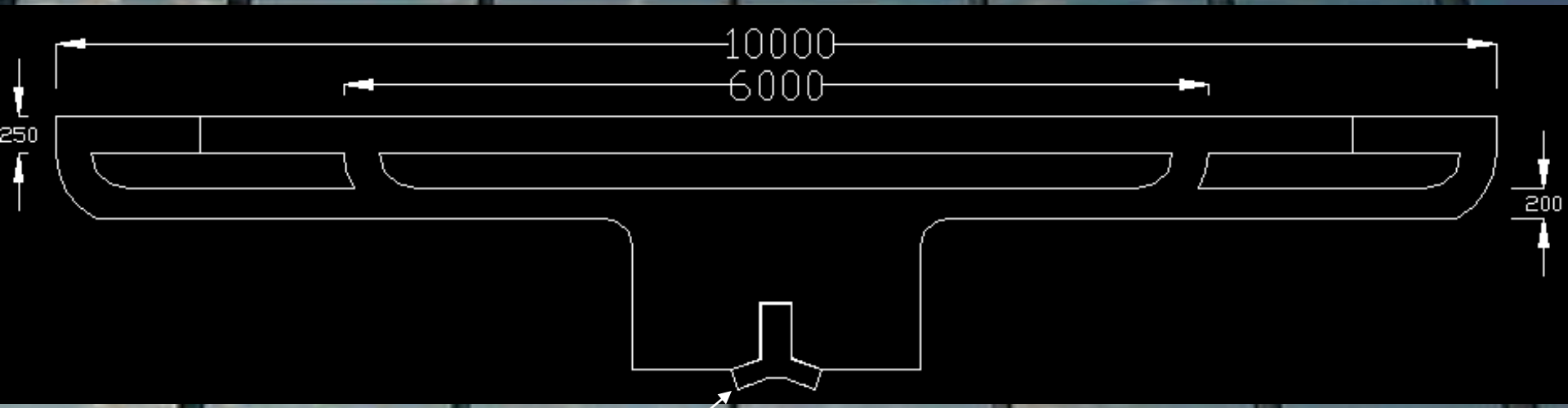
- **Reverberation time is time is takes for sound to decay in a room.**
- **Reverberation Time = 0.05V/∑A**
- **∑A = ∑Sα = sound absorption coefficient**

L i g h t i n g

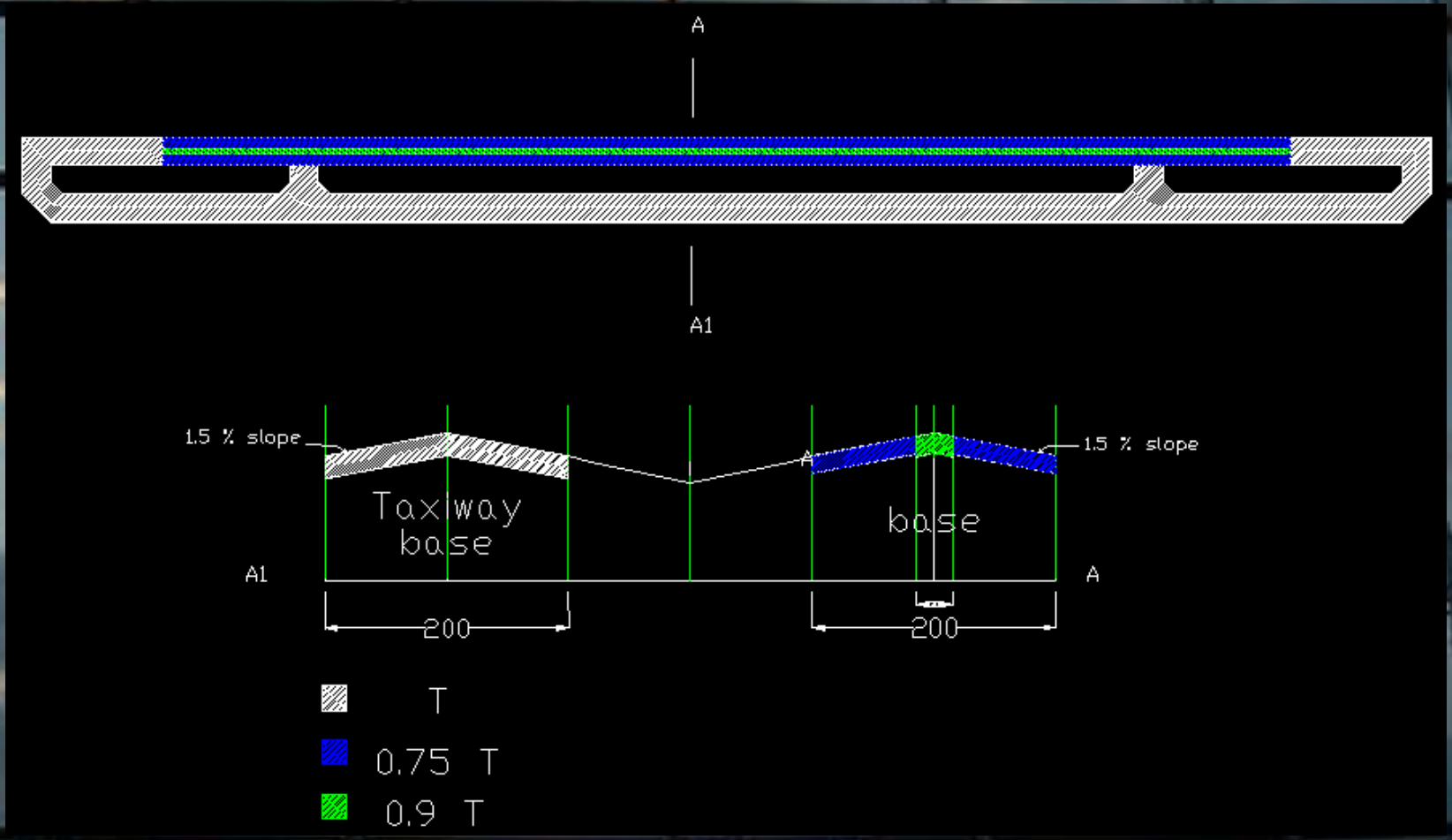
- **AGI32 was used to evaluate and model the lighting in the airport.**
- **The lighting for the airport was determined by the Illuminating Engineering Society of North America (IESNA) handbook**

Concourse	**7.5 footcandles**
Ticket Counters	**75 footcandles**
Baggage Checking	**30 footcandles**
Boarding Area	**15 footcandles**
Waiting Area	**15 footcandles**

R u n w a y

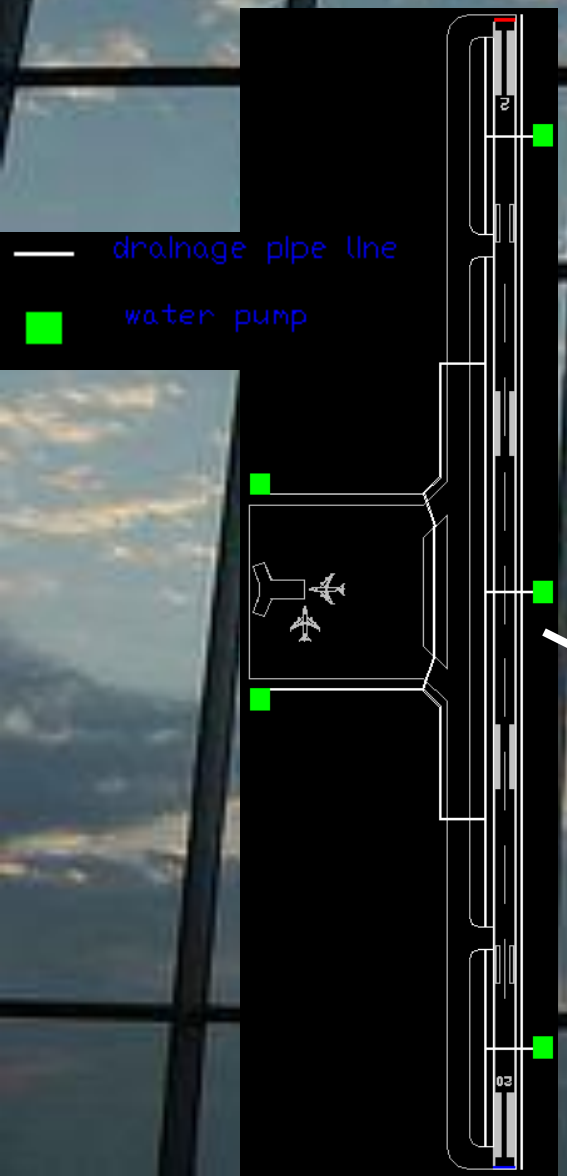


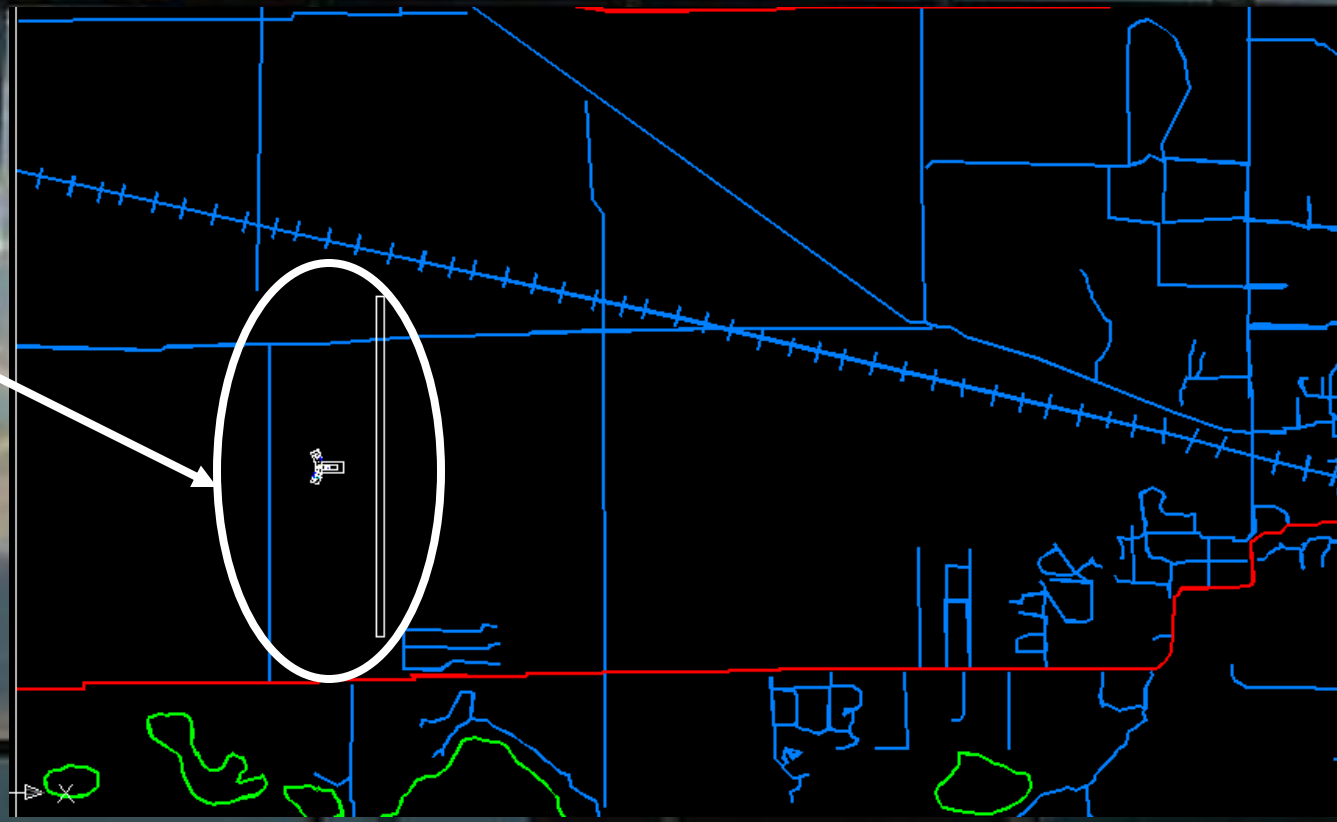
R u n w a y



R u n w a y

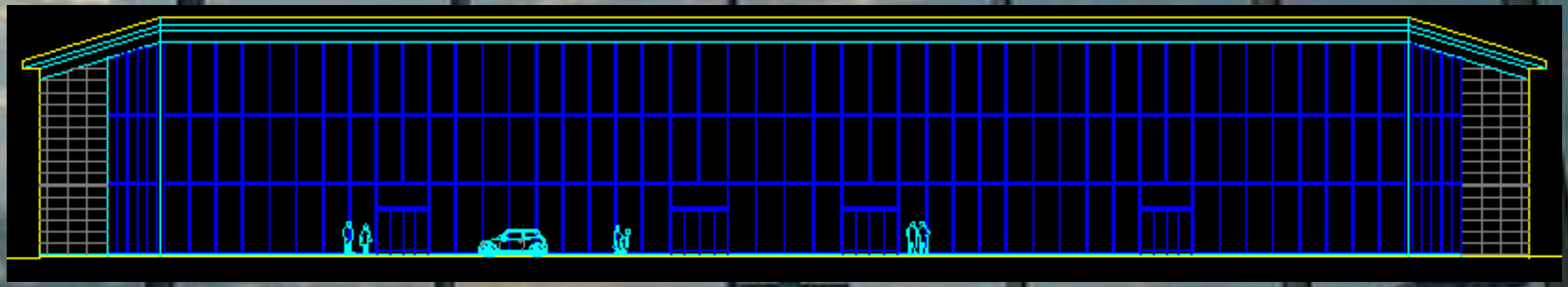
Total cost of construction of the runway $322,030





Conclusion

<u>The total cost of the structure built in Bloomington, Illinois</u> $10,117,842



Questions ?


Thank you for coming
We hope you enjoy the rest of your time here