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

**Structural**
- Vladimir Kovacevic
- Daniel Salabaj
- Michael Heatwole
- Gary Wang

**Runway**
- Jung Il Seo
- Edwin Vargas

**HVAC**
- Jong Yoon Lee

**Faculty Advisors:**
- Ralph Muehleisen
- Eduardo DeSantiago
Architecture

Exterior Views
• 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
**Structural Floor Plans**

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

Wind Load

- Wind tunnel test required by ASCE
- Building approximated by “T” shape and both structures evaluated independently, assuming no beneficial mutual interaction
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.
Extensive structural analysis was performed to determine the minimum required sections for each member.

W12 and W14 shapes almost exclusively used.
To facilitate the construction, certain members were over-designed and the supporting structural members check for final design.
All connections are assumed to be “pin” connections and two representative connections were detailed.
**Purpose**

- To prevent thermal bridges
- To isolate heat transfer through the roof
Heating Cooling Supply System

Fan coil with supplementary air system
vertical fan coils are installed around the wall and wall corners
In order to prevent heat loss through the roof, solar attic’s ridge ventilators are installed.
Total cost of HVAC
$1,151,605
<table>
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<th>Original Materials</th>
<th>Absorption Coefficient</th>
<th>Acoustics Materials</th>
<th>Absorption Coefficient</th>
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<tr>
<td>Tectun Ceiling Tile</td>
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<td>Ceilencio Ceiling panels</td>
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<td>Painted Gyp. Board</td>
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<td><strong>Reverberation Time</strong></td>
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<td><strong>0.77 seconds</strong></td>
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</tbody>
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Reverberation time is the time it takes for sound to decay in a room.

Reverberation Time = 0.05V/∑A

∑A = ∑Sα = sound absorption coefficient
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
Runway

Bloomington Regional Airport
Runway

1.5% slope

Taxway base

base

200

A

A1

T

0.75 T

0.9 T
Total cost of construction of the runway $322,030
Conclusion

The total cost of the structure built in Bloomington, Illinois $10,117,842
Questions ?
Thank you for coming

We hope you enjoy the rest of your time here