IPRO 302

A Conceptual Design of a Pedestrian Bridge Over State Street
Objectives

- To provide a conceptual design of a safe, convenient, accessible, economical, and aesthetically pleasing pedestrian bridge across State Street.
Aesthetic Design

- Each conceptual design should blend with the current architecture of the campus while taking said architecture further into the 21st century.
Constraints

- Aspects and guidelines that were taken into account when designing a bridge.
  - Codes
  - Loads
  - Internal Forces
Codes

- American Association of State Highway Transportation Officials (AASHTO)
- Chicago Building Code (CBC)
- Americans with Disabilities Act (ADA)
Loads

- Gravity Loads
  - Dead
  - Live
  - Snow

- Lateral Loads
  - Wind
  - Earthquake
Internal Forces

- Axial Forces
  - Tension
  - Compression
- Shear Force
- Bending Moment
- Torsion
Structural Design Process

1. Load Analysis
2. Internal Force Analysis
3. Initial Member Design
4. Computer Analysis
5. Final Design
6. Redesign Members
Now the Bridges!
Conceptual Design of a Pedestrian Bridge over State Street

Group 1:
- Sara Kryda, 5th Yr., Architecture, Structural Minor
- Christian Kunz, 5th Yr., Architecture
- Josh Sainer, 3rd Yr., Civil Engineering
- Matt Beauregard, 2nd Yr., Civil Engineering
- Chuan Fang Lin, 2nd Yr., Architecture
Architectural Drawings
Siteplan
Sitemodel
Perspective
View
Floorplan
Crossection
Construction
Connection Point
Structural Analysis
Load Combinations

- \[1.4D_L + 1.6L_L + \text{Self Wt.}\]
- \[1.2D_L + 0.5L_L + 1.3W_L + \text{Self Wt.}\]
Wind Load

- $F = q_z * G_H * C_f * A_f$
- Applied at points for simplicity
- Creates Overturning Moment
Gravity Loads

- Walkway live load
- Weight of Plexiglas cladding
- Weight of Steel
Load Transfer

- Truss Behavior
- Rings Every 8 feet
- Simply Supported at ends
Preliminary Analysis

- Treat as a solid beam
- Find moment of inertia and area of truss members
- Assume ring area = twice pipe area
- Ring = 14 in\(^2\)
- Truss Member = 7 in\(^2\)
SAP Analysis

IPRO 302
Axial Loads

- Bridge Behavior
Critical Members at Support

- Truss members under axial compression
- Bending moment
- Axial compression
Compression at Center of Bridge
Deformed Shape

- Greatest deflection at center
Beam Selection

- Preliminary Sizes
- Final Sizes
- Challenges in Beam Sizing
IPRO 302: Group 2

Chad Coley 2\textsuperscript{nd} Year Architect
Steven Horng 3\textsuperscript{rd} Year Computer Scientist
Stephen Leos 4\textsuperscript{th} Year Architect
Nhat Nguyen 3\textsuperscript{rd} Year Architectural Engineer
David Oxley 3\textsuperscript{rd} Year Civil Engineer
Conceptual Design

- Thought Process
- Materials
- Shape
Site / Roof Plan

1PRO 302
Elevation/Plan
Model
Truss Model
Truss Design
Truss Member Connection
Vertical Deflection
Lateral Deflection
Group Three

Cha
Kleps
Mogas
Schroeder
Simonsis
Group Background

- Yugene Cha- 4th year Architect
- Steve Kleps- 4th year Civil Engineer
- Marc Mogas- 5th year Architect
- James Schroeder- 3rd year Electrical Engineer
- Rebecca Simonsis- 2nd year Civil Engineer
Schematic Design
Preliminary Designs Concepts

- Gentle curve
- Bridge incorporated into park
- Simple structure
- Circulation
The Site
The Architecture
The Architecture
The Architecture
The Architecture
Structural Analysis and Design
Load Path Diagram
Loading of the Model in SAP2000
Exaggerated Deflections of the Model in SAP2000
Final Structural Design of the Bridge
Cross-Sections of the Bridge Members

**TYPICAL ARCH DIMENSIONS**

**TYPICAL CABLE DIMENSIONS**

**TYPICAL W12x72 DIMENSIONS**
Cross-section of the Decking

Typical Deck Dimensions

120.00"

2.00"

12.25"

IPRO 302
Thank you
We will now take any questions for any of the three groups