Outline

• Project Overview
• Design Decisions
• Challenges
• Solution
Project Overview

Why this Project?
- Genesis Community of Transformation
- Suited Team Interests
- Reliable Contact
Project Overview

What is the Project?

• Multi-purpose building structural design
• Site plan and drawings
• Cost estimation

Project Location
Project Overview

Cultural Appropriateness and Stewardship

• Communication with Navy
• Construction Methods
• Choice of Materials
Project Overview

Transparency and Trust

• Great responsibility
• Recommend check by a licensed engineer
• Make all design information and files available
• Follow codes
Design Decisions

• Limits on scope
• Architectural
• Structural – STAAD.Pro Model
  – Beams
  – Columns
  – Shear Walls
  – Floor Slabs
  – Foundation
Architectural Design

- Fitness Center
- Assembly Hall
- Guest Rooms
- Offices
- Residence
Architectural Design
Structural Design

STAAD.Pro Model
### Structural Design: Loads

#### Design Stresses
- Concrete Reinforcing Steel: $F_Y = 414$ MPa
- Concrete: $f_c' = 27.9$ MPa

#### Design Loads

<table>
<thead>
<tr>
<th>Component</th>
<th>Load (kPa)</th>
</tr>
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<tbody>
<tr>
<td><strong>Roof Dead Load</strong></td>
<td></td>
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<tr>
<td>Ceiling</td>
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</tr>
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<td>Coverings, Roof and Wall</td>
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#### Live Loads
- **Roof**
  - 4790 kPa
- **Floor 9**
  - 4790 kPa
- **Floor 8**
  - 1916 kPa
- **Floors 1-7**
  - 4790 kPa

#### Wind Loads
- **Wind Speed**
  - 60 m/s
- Factor to account for wind speed increases due to hills ($K_{zt}$)
  - 1
- Factor accounting for wind direction ($K_d$)
  - 1
- Importance factor ($I$)
  - 1
- Internal pressure coefficient ($G_{Cpi}$)
  - 0.18

- **105 combinations according to ACI**
Modeling Checks

- Hand calculations
- Beam reinforcement area design

A9

FORCES IN kN
MOMENTS IN kNm
Beams

BEAM 5 MOMENT DIAGRAM

BENDING MOMENT Mz (kNm)

LENGTH (m)
Columns

Axial Compression

Bending Moment
Columns

Moment vs. Axial Force

φPn [kN]

φMn [kN-m]

Column 1

Column 2

Column 3
Shear Walls, Slab

- Shear walls designed according to minimum code requirements
- Slab designed as a beam of unit width
Cost Estimate

• By square foot:
  – $2 - $3.5 million

• Based on design:
  – Steel: $725/metric ton
  – Concrete: $100/metric ton
  – Total: $700,000

Phnom Penh Tower – 21 Stories
Challenges

- Reinforcement – Will it fit?
- Cracked model
- Foundation
Acknowledgements

- Professor Wunder, Advisor
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- Professor DeRooy, Structural Professor

Thank you!
Questions?

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