IPRO 315
PHANTASY HOTEL

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IPRO 315
DESIGN OF A LARGE SCALE STRUCTURE

BACKGROUND INFORMATION & OBJECTIVES

Spring 2009

Preliminary Design. Analysis found structural deficiencies.

Fall 2009

IPRO 315 focused on designing a 22 story "Phantasy Hotel" located in the western suburbs of Oakbrook, IL. The 315 design group was comprised of Architects & Engineers, working together to create architectural plans that the engineers could make possible through calculations. As a continuing IPRO from the spring 2009, the team was able to efficiently design the structure and fix the torsion problems of the previous years.

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DESIGN OF A LARGE SCALE STRUCTURE

TEAM ORGANIZATION

ARCHITECTURE DESIGN GROUP

- Building Design
- Green Roof
- Renderings
- Model

Namrata Hegde
Michael Cullen
Oladipo Animashaun
Steve Kuo
Dawveed Scully
Yoojee Kim

STRUCTURAL GROUP

- Steel structure
- SAP Models
- Foundations

Christpher Lee
Carmen Aguilar
Yongdoo Lee
Karol Rybaltowski
Alex Bauer
Shadi Yousef

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PROBLEM ORGANIZATION

STRUCTURAL

ARCHITECTURAL

Phase 1

- FLOOR PROGRAM
- FLOOR PLANS
- FINALIZE DESIGN

- FLOOR PROGRAM
- FLOOR PLANS
- FINALIZE DESIGN

Phase 2

- FINALIZE LOADS
- FINALIZE MODEL
- DESIGN STEEL
- FOUNDATION

- GREEN ROOF DESIGN
- FAÇADE DESIGN
- AESTHETIC DESIGN
- FINALIZE SCHEDULE

Phase 3

- FINALIZE SCHEDULE
- FINILIZE PLANS

- SCALE MODEL

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PHANTASY DESIGN GROUP

IDEAS

- MAKE MORE EFFICIENT
- DETAILED PLANS
- DETAILED SECTIONS
- GREEN ROOF
- MOVE THE CORE
- ADD MORE BATHROOMS

CHALLANGES

- FIX TORSION (TWISTING) PROBLEMS
- NO EXACT SITE
- GIVEN LAYOUT WAS HARD TO WORK WITH
- BATHROOMS

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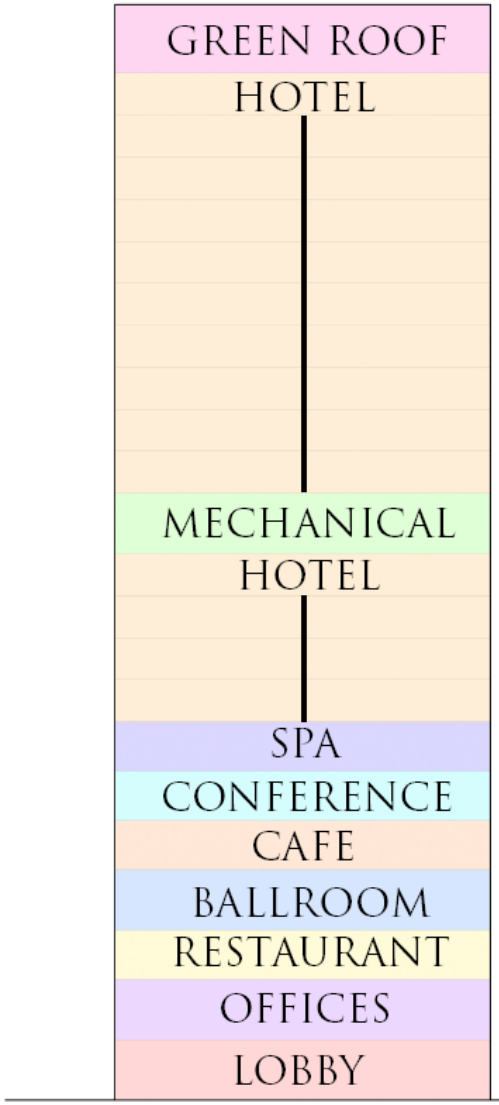
Phantasy Hotel Layout



Floor Heights:

Typ. Suite Floor: 8’

Lobby: 13’

Offices: 13’

Restaurant: 10’

Ballroom: 13’

Café: 10’

Conference: 10’

SPA: 10’

Mechanical: 13’

Total Building Height: 297’

Hotel:

Suites Per Floor: 10

Number of suite floors: 14

Total number of suites 140

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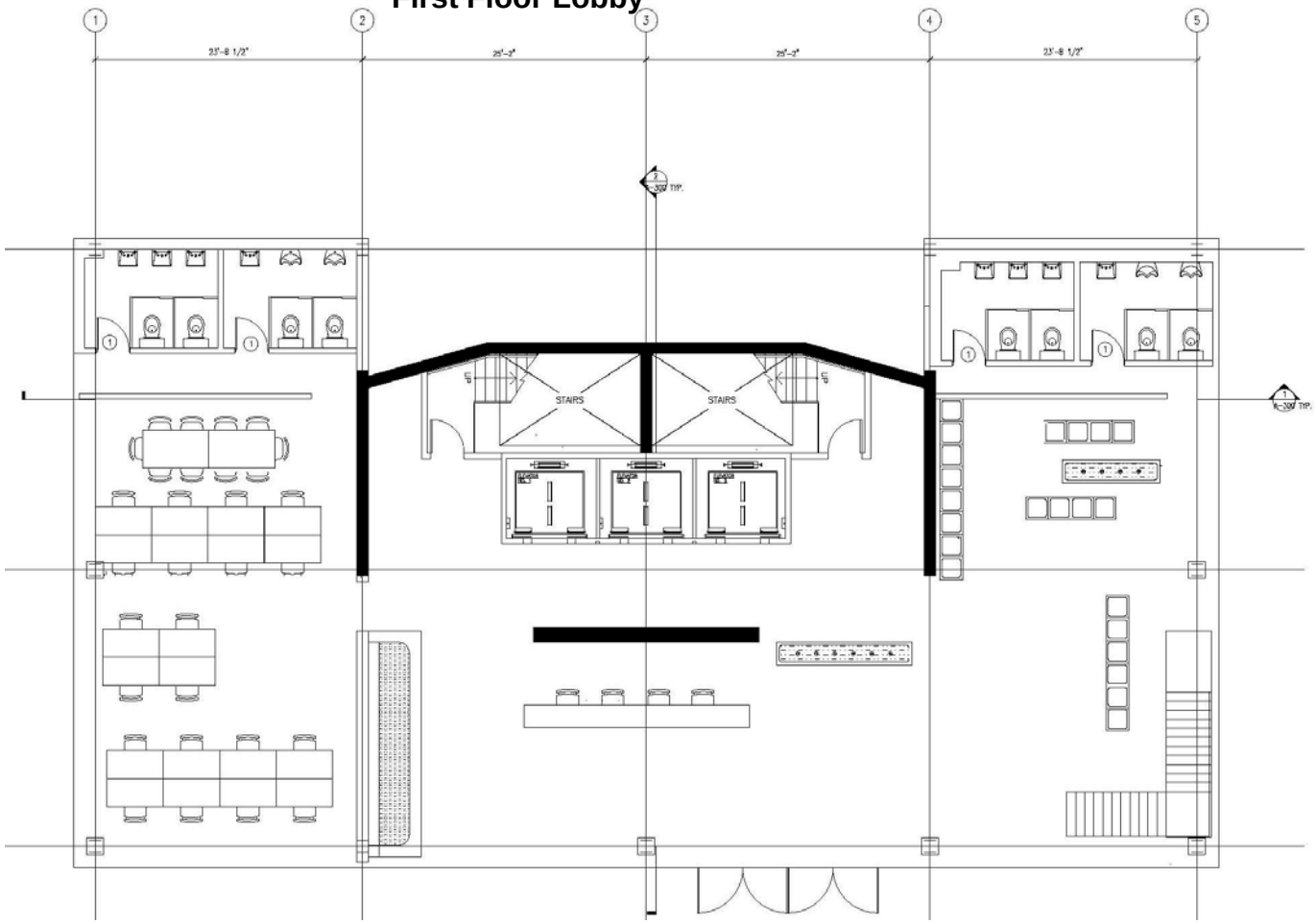
First Floor Lobby



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First Floor Lobby

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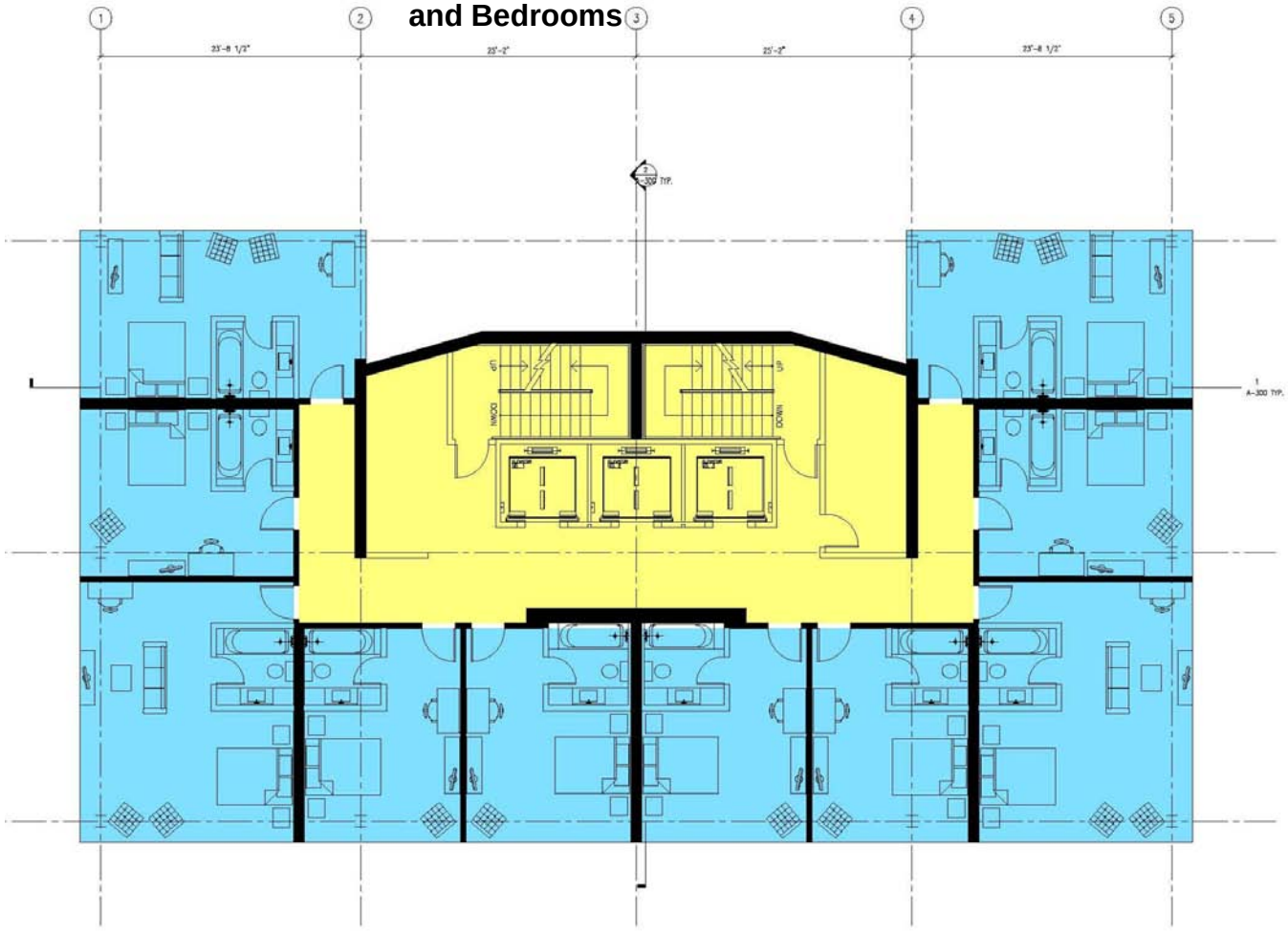
Typical Guest Floor Layout with Elevator/Stair Shafts and Bedrooms



Efficiency:

Area of typ. floor	5,183 sq ft
Area of suites per floor	3,672 sq ft
71% Efficiency ratio	

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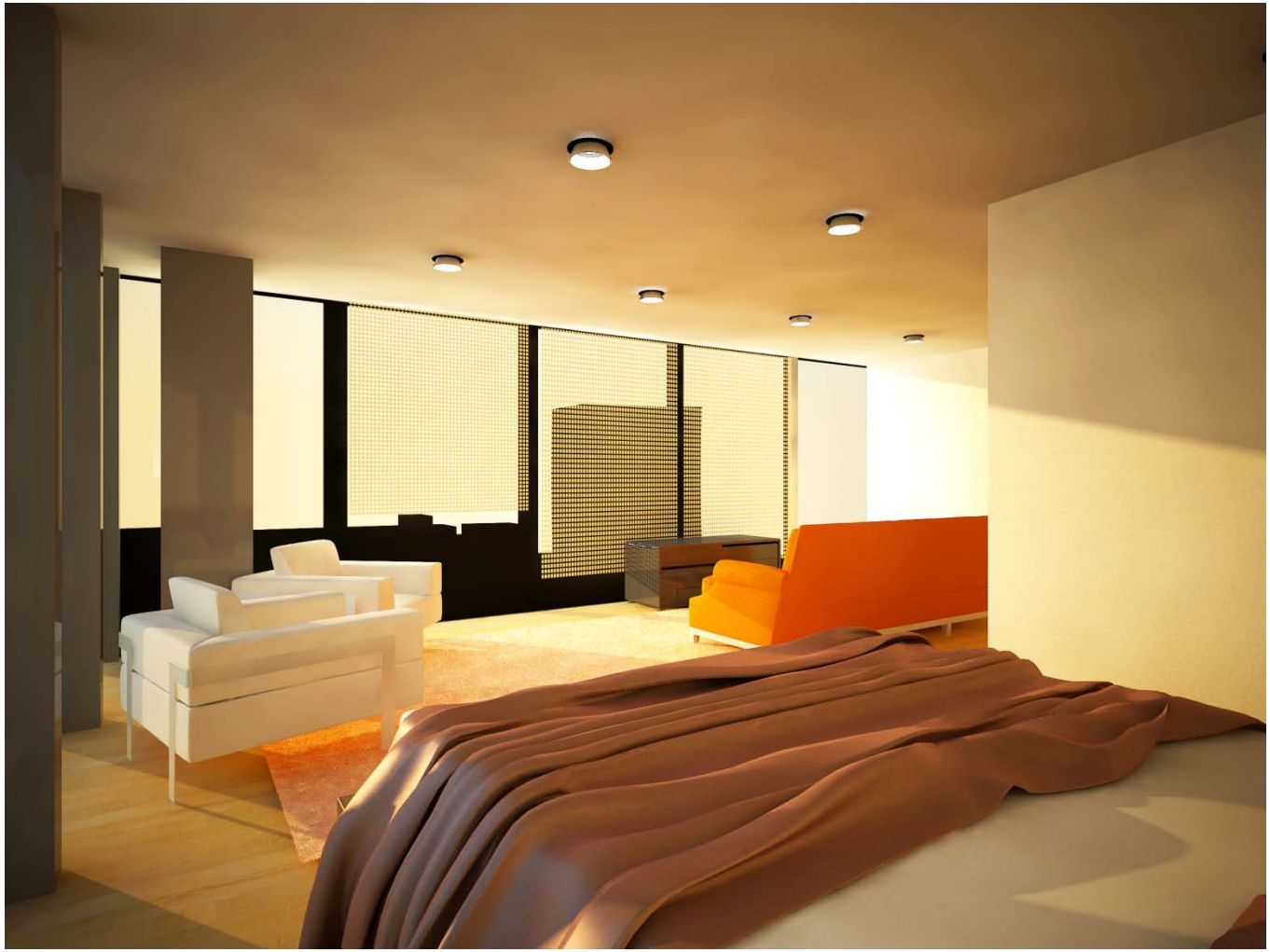
Typical Guest Suite



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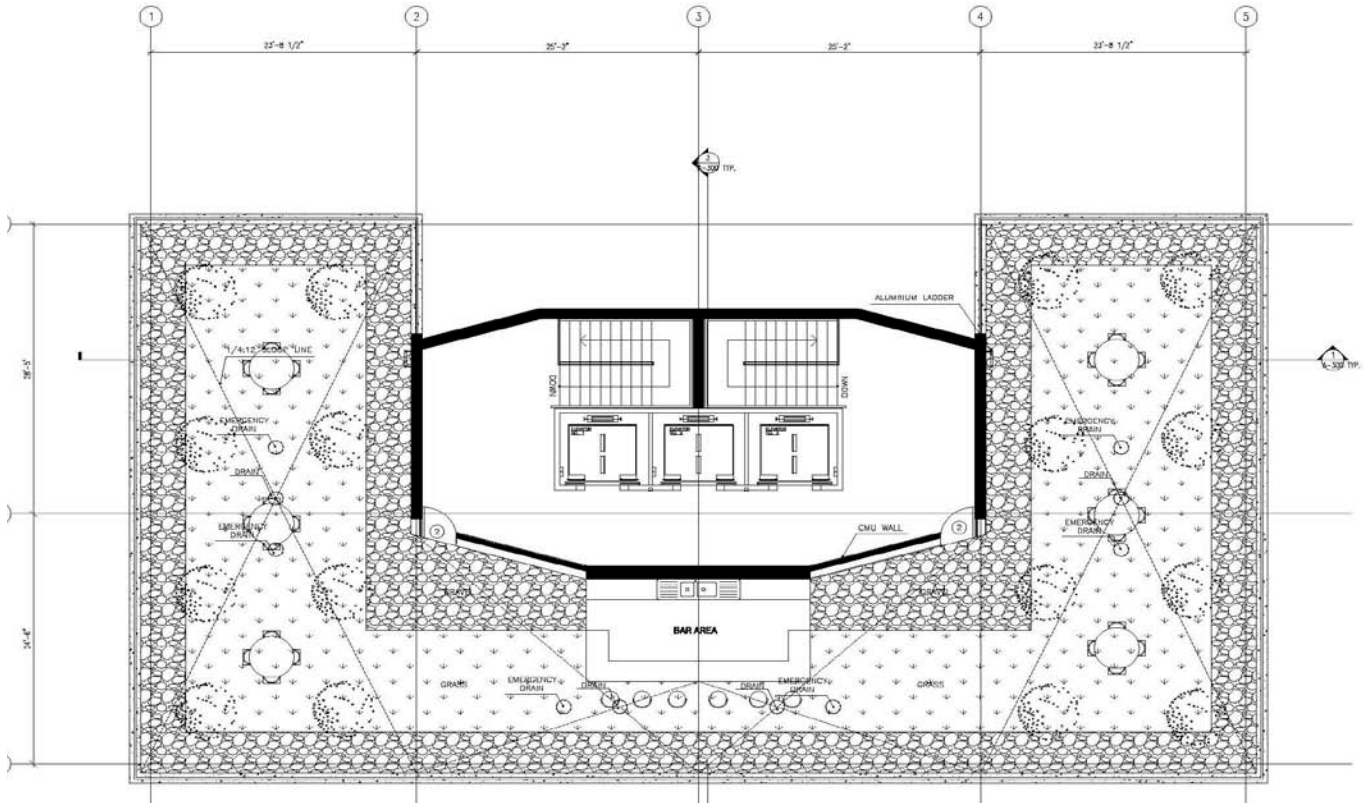
Green Roof



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Green Roof

BENEFITS

- Grow fruits, vegetables, and flowers
- Reduce heating loads on a building
- Reduce cooling loads on a building
- Reduce the city's average temperatures during the summer
- Increase roof life span
- Reduce stormwater run off
- Filter pollutants and carbon dioxide out of the air
- Help to insulate a building for sound.
- Filter pollutants and heavy metals out of rainwater
- Increase wildlife habitat in built-up areas

GREEN ROOF

A roof of a building that is partially or completely covered with vegetation and soil, or a growing medium, planted over a waterproofing membrane. There are two types of green roof, depending on the depth of planting medium and the amount of maintenance they need which are 'semi-intensive' or 'extensive'. Also, it classified by shape of the roof which are pitched green roofs and flat green roofs.

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Green Roof

TYPE

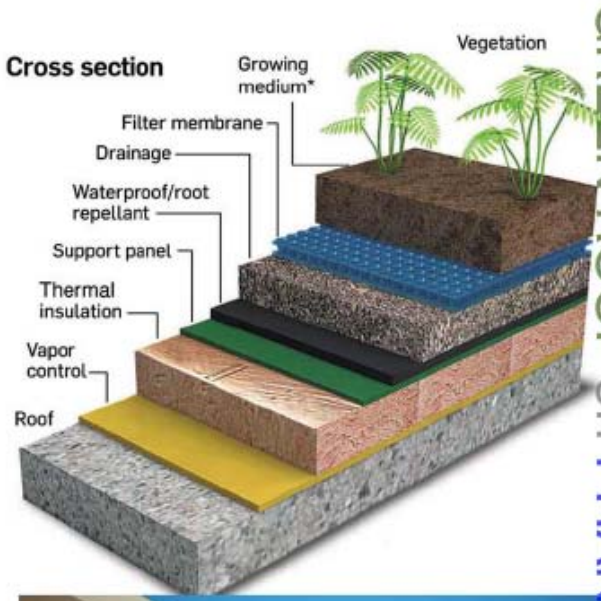
- Intensive Flat Green Roof

PURPOSE

- Create special recreation space to refresh people with fascinated view and nature

SYSTEM

- Built-in Place system
- 4” soil depth
- 1/4 : 12 slop
- 4 main drains and 6 emergency drains
- 344l.83 sf green roof area
- 60 pounds per square foot for plants and trees
- Roof Load Total 137673.2 lbs/sf



GREEN ROOF on PHANTOSY HOTEL

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Green Roof

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Steel Group

I. Procedure

1. Calculations Using Matcad
   Girder ⇨ Beam ⇨ Column
   (Load is assigned by AISC-7)

2. Based on calculations, steel members for the framework of the building are designed

3. SAP Modeling used for the Load Cases to determine Governing Load.

4. CAD Drawings of each floor details is added

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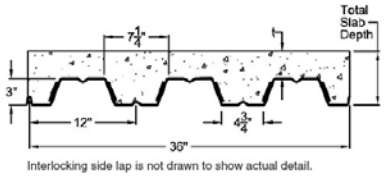
II. Detail

1. Deck : Composite floor deck is used (Vulcraft 3VLI)



Interlocking side lap is not drawn to show actual detail.

2. Economical Design:
   Based on Load cases calculation,
   Safe & Economical design

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III. Steel Design

1. Structural calculations using MathCadwere done to design a composite beam system
2. Girder and beam design using the Allowable stress Design Method (ASD)
3. Design of a typical Column section using the ASD method
4. Lateral Load Resisting System Shear wall

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Modeling

What is SAP 2000?

•Integrated software for structural analysis and design.

•Provides linear and nonlinear, static and dynamic analysis and design of three-dimensional structures.

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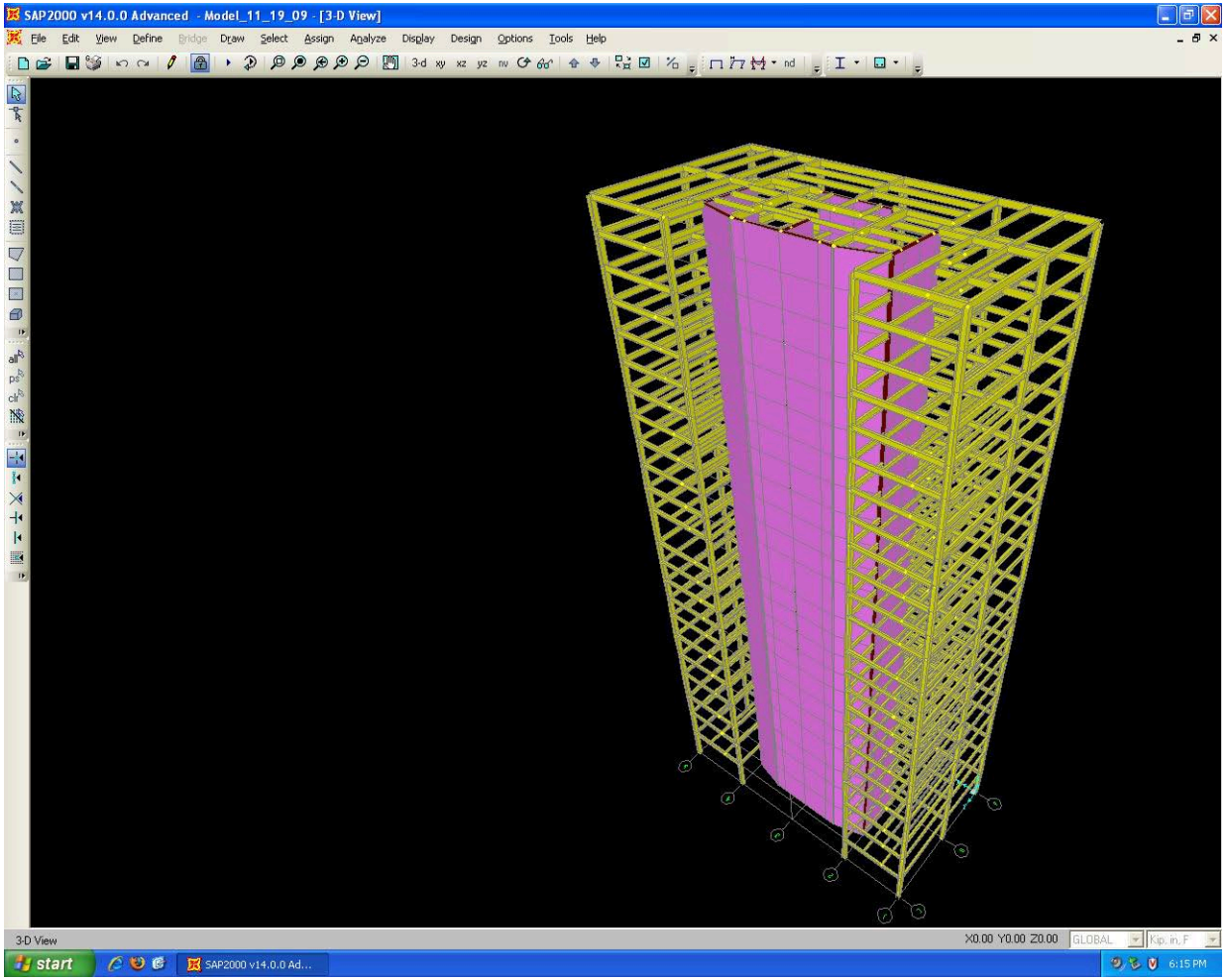
Modeling

- SAP 2000 Modeling



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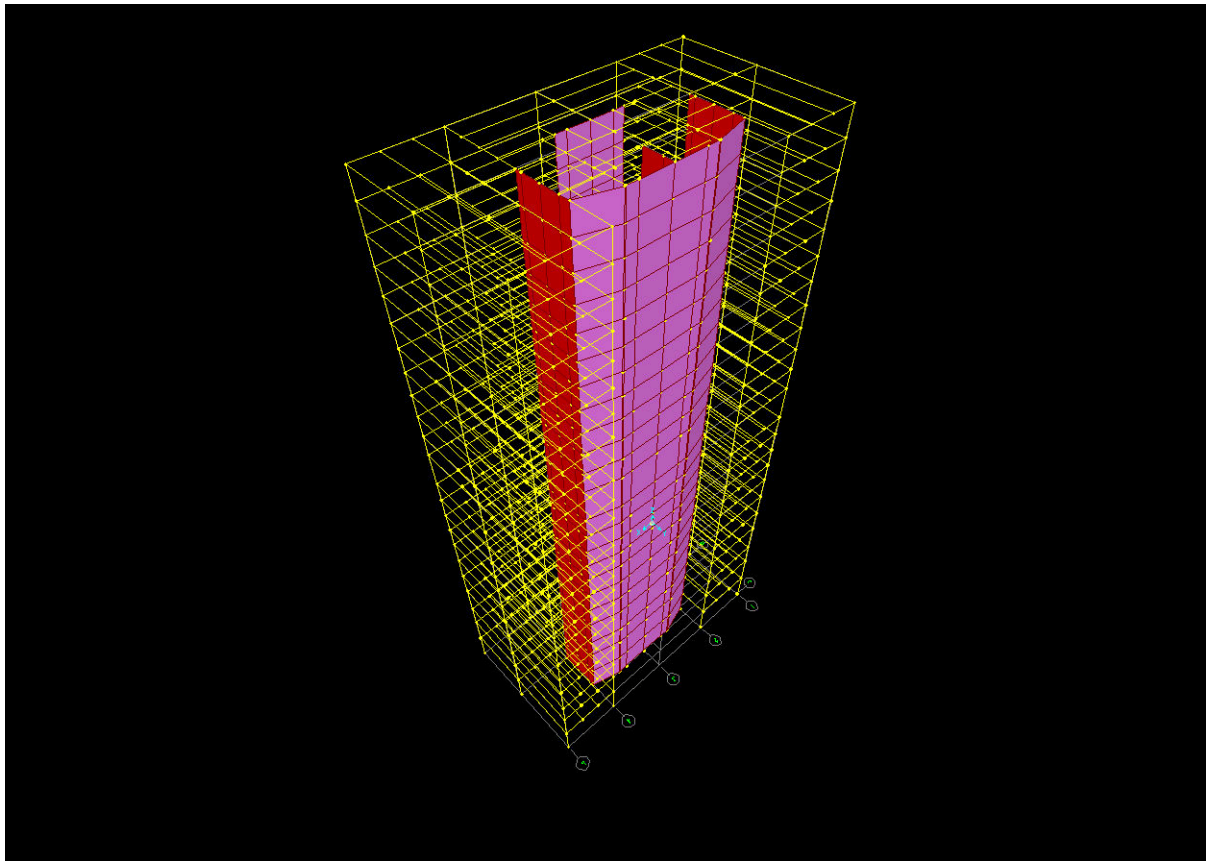
Modeling

- SAP 2000 Modeling



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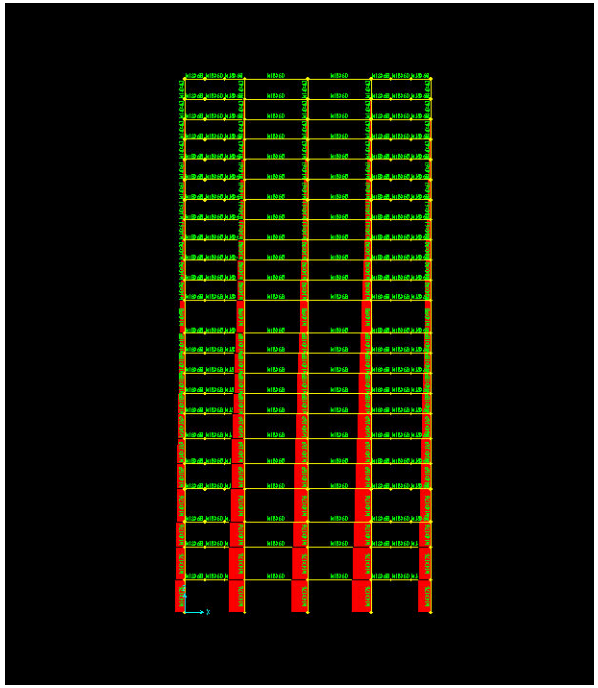
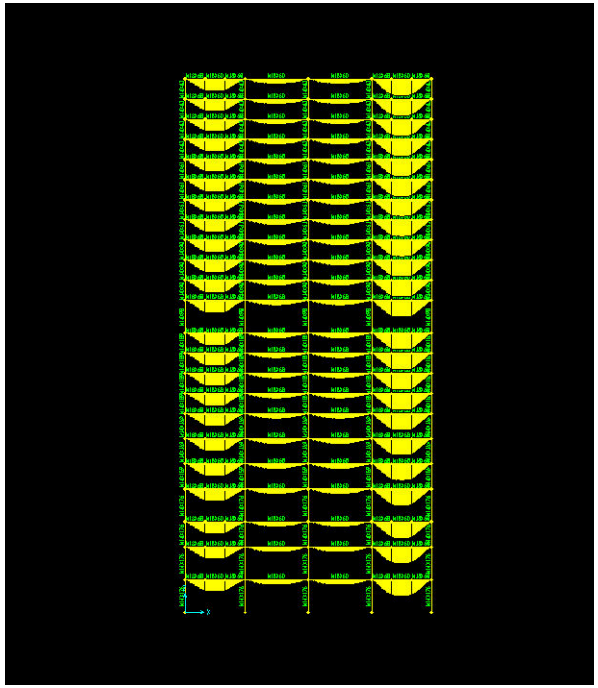
Modeling

- SAP 2000 Modeling





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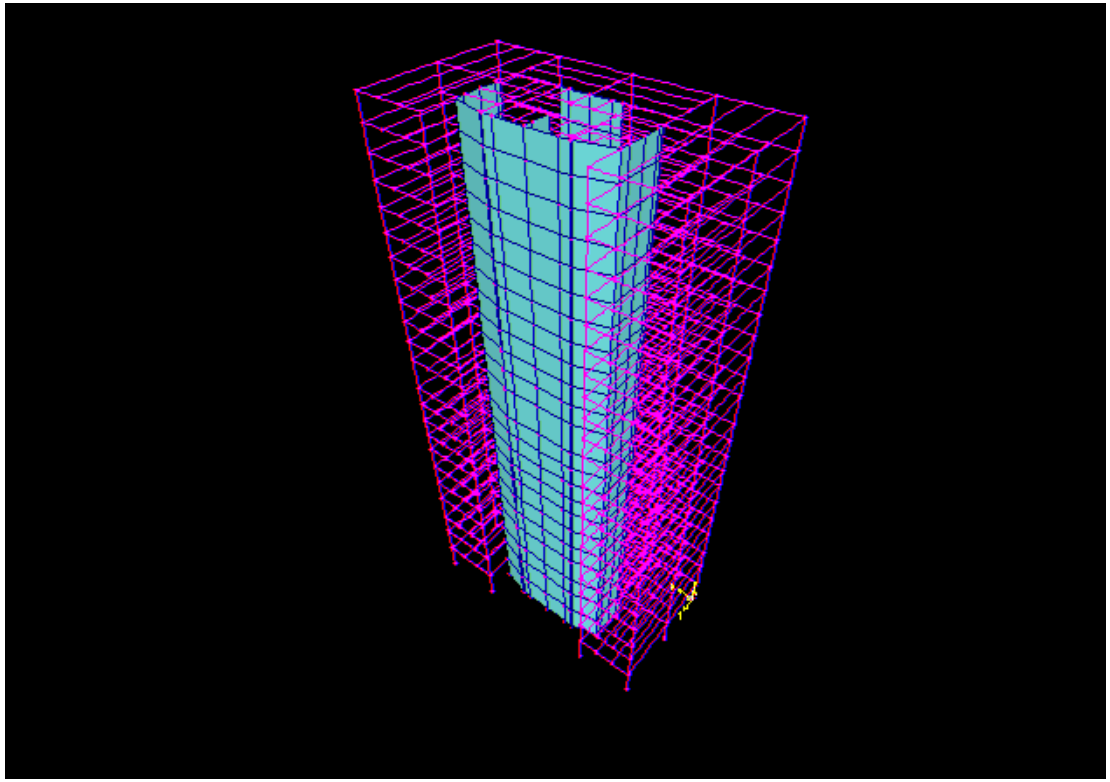
Modeling

- SAP 2000 Modeling



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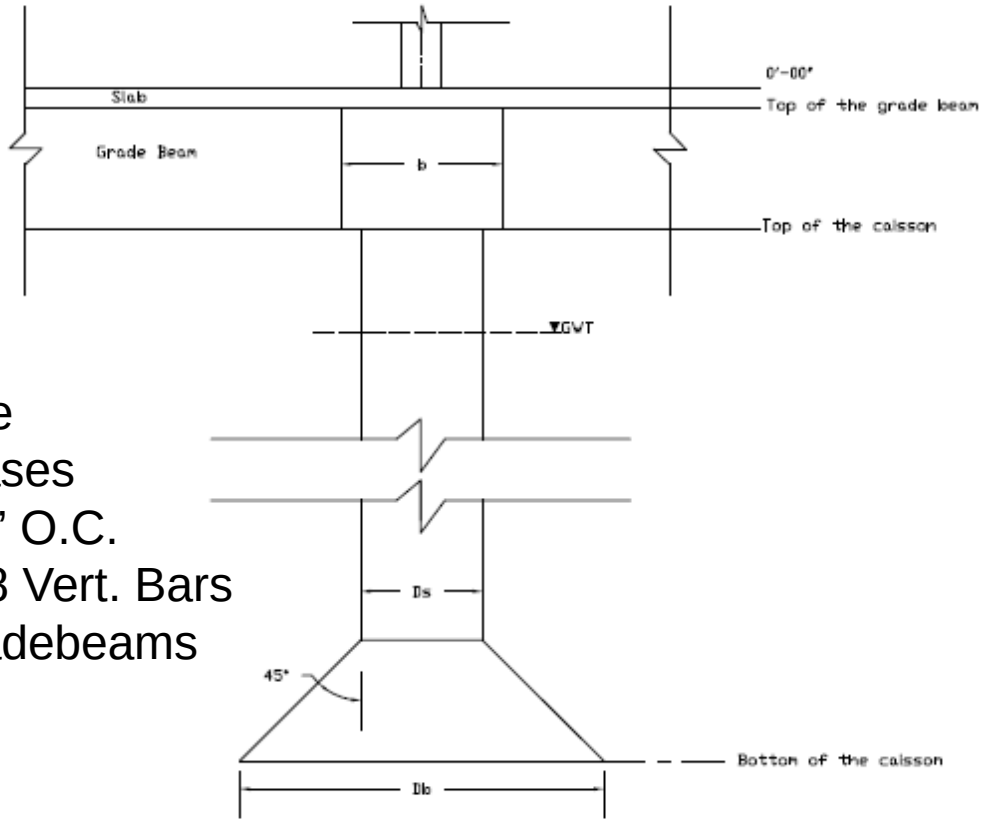
Foundation Group

95' Deep
45º Bell Angle
6'-17' Dia. Bases
#4 Ties at 18” O.C.
#10, #14, #18 Vert. Bars
Supports Gradebeams



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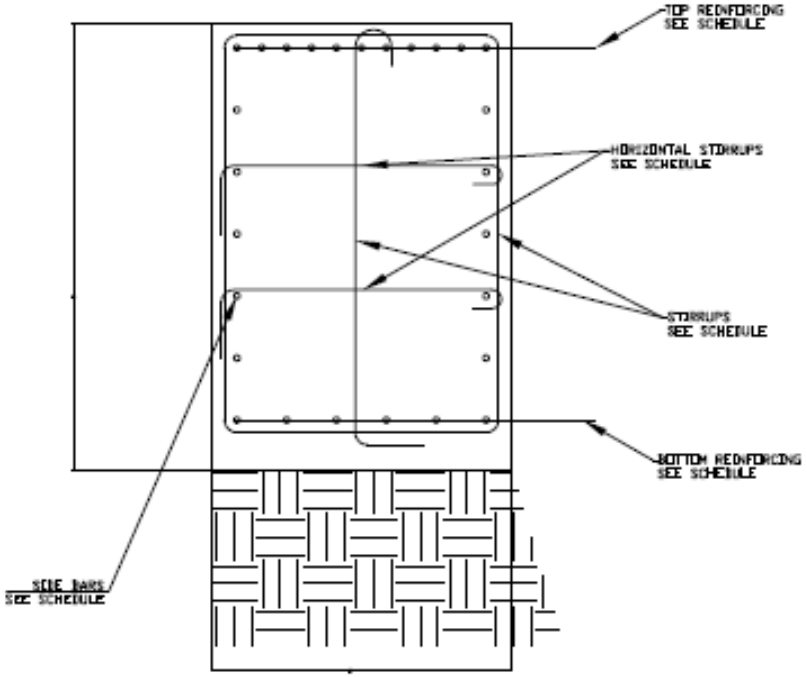

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CONCLUSION

- Importance of clear communication between disciplines
- Necessity of clear planning
- Importance of flexibility to accommodate possible changes
- Balance between delegation and cooperation
- “Big picture” view of individual design elements
- Experience with demands of real-world design projects


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