TASKS AND TOOLS

1. Re-design of Gravity and Lateral System: Alternatives 1 & 2

Task 1: Conduct initial research

a) Confirm use of castellated beams vs. wide flange beams.

   a. Use Castellated beams (smart beams) and design them with the program found online from CMC (http://www.cmcsteelproducts.com/index.html). They are light, strong, cheap, and will aid in minimizing the floor depth (http://www.grunbauer.nl/eng/waarom.htm).

   b. RAM will not design castellated beams for a lateral system or with cantilevers. I designed the steel in RAM using W shapes. I then chose comparable shapes based on moment of inertia and shear area. I will try to update the shapes used in the model to reflect the shapes used, but keep them as W shapes so I can still analyze the shapes as the lateral system.

b) Confirm presence, location, and dimensions of sloped columns.

   a. Easily determined from laying the floor plans on top of each other but that is about it.

c) Determine if Washington, D.C. allows sub-grade mechanical equipment.

   a. As stated by structural engineers from Rathgeber-Goss Associates, mechanical systems in Washington, D.C. buildings may be located below grade as long as the intake and outtake openings for the system are located on opposite sides of the building. Rathgeber-Goss Associates routinely designs buildings in the Washington, D.C. area and therefore, the engineers on staff have a working knowledge of the buildings codes.

d) Determine if lightweight concrete is available in DC.

   a. Contacted Tony Horos 1-7-09 by phone. Was informed that a typical 4000 psi lightweight concrete mix is stocked by most batch plants in the D.C. area. Procurement time is the same as normal weight concrete.

Cost per cubic yard:	
4000 psi Lightweight	$111
2000 psi mudmat	$78
3500 psi	$83
4000 psi	$85
5000 psi high range	$89
5000 psi 3 day strip	$96

Task 2: Confirm all superimposed and gravity loads, according to ASCE 7-05

a) Check and revise all calculations for the gravity and superimposed loads.

   a. Make sure to double check the deck and concrete for the comparision study.

b) Consult with the structural engineer for confirmation.

Task 3: Establish and check trial member sizes

a) Design trial gravity member sizes based off gravity loads.

   a. Trial castellated gravity members designed in NWC and LWC by hand.

   b. Trial wide-flange gravity members designed in NWC and LWC will be completed by hand at a later date for a spot check.

   c. Completed with the computer as wide-flange beams. The wide-flange beams will be compared to castellated beams to determine those with comparable properties. These properties will be input into the computer as well and used for the lateral calculations.

   d. The castellated beams create acceptable floor-to-ceiling heights that the penthouse can stay and become a new floor. Smallest floor-to-ceiling height is 7.5' which is small, but still acceptable. It is better than the 6' ceilings created with the wide-flange beams. The penthouse would have to be eliminated with the wide-flange beams. The castellated beams also decreased the number of different beam sizes running throughout the building.

b) Determine which alternative will be used.

a. 1/20 Started computer model to determine which combination of materials will be used to design the lateral system. 1/22 finished preliminary design of LWC and NWC gravity system.

c) Revise gravity calculations and trial gravity member sizes to reflect alternative to be used.

d) Establish lateral loads based off trial member sizes.

a. Calculated Seismic and Wind loads

b. Updated Seismic loads for Moment and Braced frames based on the sizes.

e) Design trial lateral system based off trial lateral loads.

a. Started designing a preliminary lateral system for NWC Moment Frames. Finished the moment frame systems in NWC and LWC 2/3/09. Checked deflections, torsional effects, vertical irregularities.

b. Finished braced frame system in NWC and LWC 2/4/09. Checked deflections, torsional effects, and vertical irregularities.

f) Re-check gravity system and check lateral system based off the established lateral loads.

g) Re-design as necessary.

Task 4: Analyze lateral system

a) Create a computer model of the designed lateral system and assess system design based off of shear, overturning moment, building and story drifts and displacements, and fundamental periods. A key aspect of this task is to determine the placement of the braces so as to not interfere with the floor layout. It is also to determine which combination of materials and lateral system is to be used.

b) Determine if results are acceptable for service criteria and re-design lateral system as necessary.

a. Checked deflections, torsional effects, soft story, and vertical irregularities for the moment frames in NWC and LWC.

b. Checked deflections, torsional effects, soft story, and vertical irregularities for the moment frames in NWC and LWC.

c) If lateral system re-design is necessary, re-check the design of the gravity system to ensure no changes are needed. Perform spot checks and fine tune chosen design.

Task 5: Consider implications of design

a) Conduct a parking study for the basement floor.

a. Finished AUTOCAD drawing to aid the parking study. Old vs. New Plans are drawn and can be compared in the report.

b. Ramsey, Charles George, and Harold Reeve Sleeper. Architectural Graphic Standards. Ed. Bruce Bassler. 11th ed. New York: Wiley, 2008.

b) Determine where the mechanical system will be placed in the building.

a. There is space in the parking garage for some of the mechanical system.

c) Re-design the foundation for the changes implemented.

a. Basic foundation study was conducted with P/A=Soil Bearing Pressure. Most P_{max} from the new design is slightly lesser than the original design, but probably not feasible to try to reduce the thickness of the slab because most P_{max} are close to the original. Also not feasible to take out the mat, due to the large area of the footers.

b. Waiting to look at a foundations textbook to double-check calculations.

d) Make minor adjustments to the architecture and floor layout as required.

a. As of now, only the parking level needs to be redesigned, if time permits, layout the new apartments on the top floor. The parking level has been redesigned.

2. In-Depth Cost and Schedule Analysis Breadth

Task 1: Schedule and cost impact

a) Use RS Means as a starting point for the impacts of the re-design.

b) Consult with the general contractor on the project team and some subcontractors from the area for more in-depth schedule and cost impacts.

   a. Made initial contact with GC about helping with scheduling. Floor plans are sent out and waiting on response.

c) Contact vendors and suppliers of the steel to decide on procurement and erection timing and cost implications.

   a. 1-13-09 contacted Robert Anderson of CMC for the southeast region. Asked for cost of steel for castellated beams and wide flange beams by poundage for comparison. The steel is easily shipped from the Virginia Plant (120 miles from the site). Need the actual design for cost analysis, send a materials list later in the semester. Materials list is sent and quote received.

   b. Lightweight vs. normal weight concrete cost and procurement time refer to 1.1-d

3. Mechanical Equipment Movement Analysis Breadth

Task 1: Equipment movement impact

a) Determine placement of equipment and how outside air will be drawn.

   a. There is space in the parking garage for some of the mechanical system.

b) Re-design the location of the ductwork.

   a. Not ductwork, it is now the pipes for the chillers.

c) Research waterproofing implications of the movement of the mechanical equipment and detail the waterproofing for the mechanical room.

   a. How will that area be drained? Waterproof the construction joints?

d) If time permits, conduct an acoustic and vibrations study and the impacts on occupants and suggest ways to mitigate any issues that may arise.

   a. This will need to be done since the AHUs are not moving from the penthouse anymore and will impact the new apartments on that floor.

4. Miscellaneous

Task 1: Final submissions

a) Write and organize final report. (Highlighted has been sent for review)

~~Cover Page~~
~~Abstract~~
Table of Contents
Executive Summary
Acknowledgements
~~Introduction~~
~~Background~~
~~Building Overview~~
~~Structural System Overview~~
Depth Study
Proposal
Gravity Loads
Lateral Loads
Load Combinations
Design Criteria
Evolution of Design
The Modeling Process
Implications of Redesign
Garage Column
Foundation
Blast and Progressive Collapse
Summary and Comparisons
Conclusions and Recommendations
Document and Code Review
~~Appendix A – Photographs~~
~~Appendix B – Gravity Loads~~
~~Appendix C – Lateral Loads~~
~~Appendix D – Garage Level Column Design~~
~~Appendix E – Foundation Checks~~

b) Organize faculty jury presentation.

c) ABET Evaluation

d) Final CPEP website update

Milestones

January 26th – Complete preliminary gravity design - DONE

February 9th – Determine lateral loads and start lateral analysis - DONE

February 23rd – Finish lateral analysis and fine tune gravity analysis - DONE

March 16th – Complete investigation into implications of depth design - DONE

Task	Break	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8	Week 9	Week 10	Week 11	Week 12	Week 13	Week 14	Week 15	Week 16	Week 17
	Dec. 22-Jan.10	Jan. 11-17	Jan. 18-24	Jan. 25-31	Feb. 1-7	Feb. 8-14	Feb. 15-21	Feb. 22-28	Mar. 1-7	Mar. 8-14	Mar. 15-21	Mar. 22-28	Mar. 29-Apr. 4	April. 5-11	Apr. 12-18	Apr. 19-25	Apr. 26-May 2	May 3-May 9
1.1-a										Spring Break - No Classes					Presentaion to Faculty Jury			Final Exams
1.1-b																		
1.1-c																		
1.1-d																		
1.2-a																		
1.2-b																		
1.3-a																		
1.3-b																		
1.3-c																		
1.3-d																		
1.3-e																		
1.3-f																		
1.3-g																		
1.4-a																		
1.4-b																		
1.4-c																		
1.5-a																		
1.5-b																		
1.5-c																		
1.5-d																		
2.1-a																		
2.1-b																		
2.1-c																		
3.1-a																		
3.1-b																		
3.1-c																		
3.1-d																		
4.1-a																		
4.1-b																		
4.1-c																		
4.1-d																		

Milestones are denoted by heavy lines between the weeks. Refer to the list of tasks for a listing of items.
Cell Strikethrough denotes task that is ahead of schedule and the allotted time was not necessary.
Orange fill denotes task on schedule
Blue fill denotes task that was started ahead of schedule.