Structural Redesign

Alternate Structural design:

Gravity Loads:

The gravity loads utilized during the design were gathered from various sources. ASCE 7-02 was used to find the live loads the floor would encounter based on their use. The dead loads were gathered from various handouts from previous internships and also classroom experiences. Dead loads from the form decking and concrete were taken directly from the deck catalogues used. The following is the loading criteria used during the design process.

Live Loads:

Corridors – First Floor	100	PSF
Others	40	PSF
Lobbies	100	PSF
Mechanical Rooms	150	PSF
Storage (Light)	125	PSF
Dwelling Units	40	PSF
Partitions	20	PSF

Dead Loads:

Slab 5” w/ 20 gage TF125 U.L. P241	55	PSF
Brick	40	PSF
HVAC	5	PSF
Ceiling	2	PSF
Misc	3	PSF

Gravity Design:

Once columns were laid out in RAM Structural System, I was able to begin the layout of the floor system. Since the original design had a structural floor depth of either 8" or 10" (dependant on the presence of a topping on the 8" pre-cast hollow-core planks) it was important to me to try to maintain as small of a depth as possible. I was able to keep the structural floor depth to roughly 23". That is the depth of a W18x40 member and a 5" slab. Once the basic layout of the beams was determined, I concluded that there was an efficient way to determine the amount of steel being used. With this in hand, I was able to layout multiple possibilities and use the takeoff feature in RAM Structural System. I could then compare tonnage of steel used. It was my conclusion that a 4' spacing of beams was quite efficient. I was also able to conclude that a 6' spacing of joists on the roof was efficient. This is because cold formed steel will be used to create the sloped roof and will bear on the joists.

Wind Loads:

ASCE 7-02 was used to determine the applicable wind loads. According to 6.4.1.2, Spring Run Assisted Living may be considered to fall into the category of components and cladding. Since RAM Structural System has a module for wind loads, the following values were actually used during the lateral analysis. Following is the necessary information gathered from ASCE 7-02 followed by the modular for RAM Structural System.

Exposure category:	C
Kzt:	1.00
Base Wind Speed:	90.0 MPH
Importance Factor:	1.15

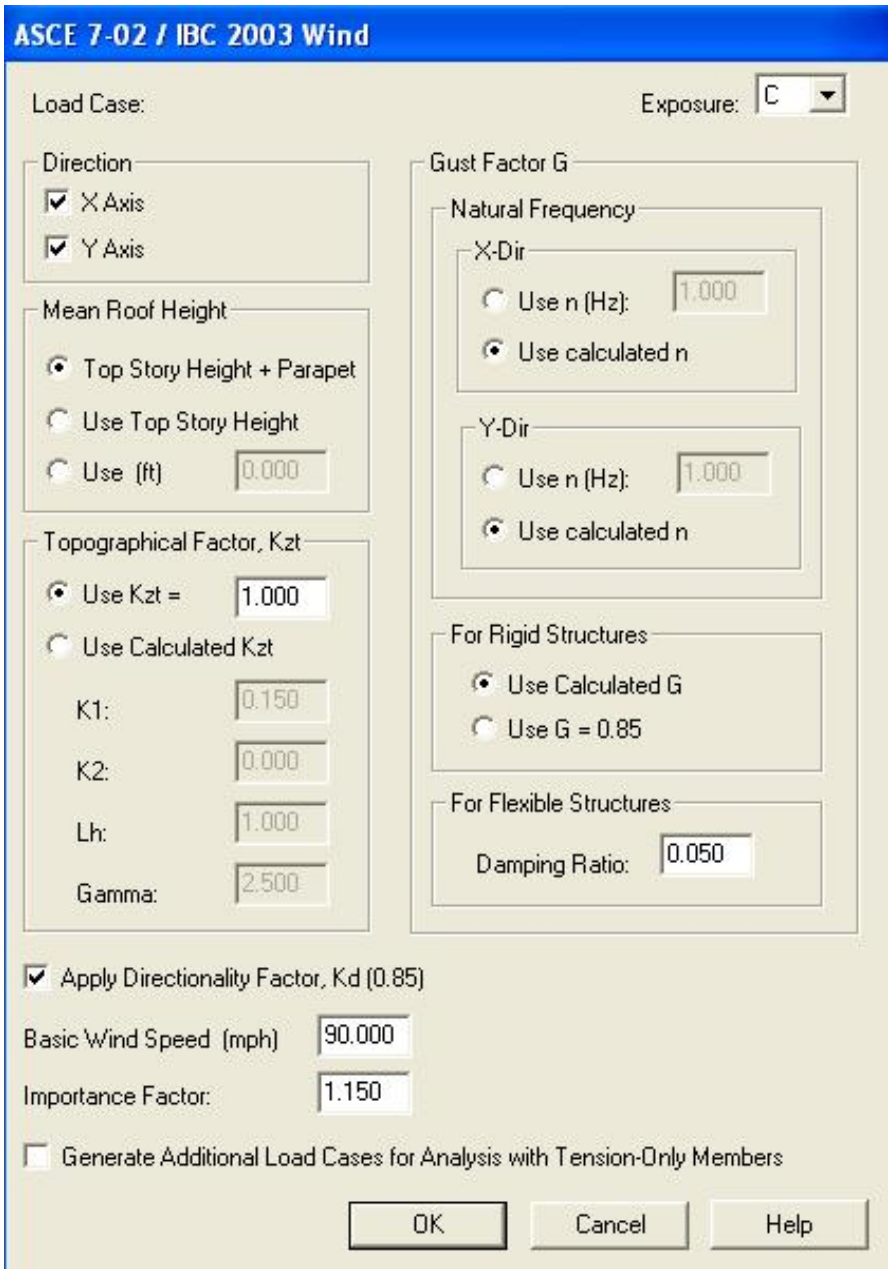

Figure 3: Wind Load Module

Seismic Loads:

Using the modular in RAM Structural System, I was able to use ASCE 7-02 to gather the necessary information to input. The following is information gathered from ASCE 7-02 and a sample of the RAM Structural System modular for seismic loading.

Seismic Use Group:	II
Site Class:	A
Ss:	0.279g
S_1:	0.075g
Importance Factor:	1.25
Response Modification Coefficient:	3.5

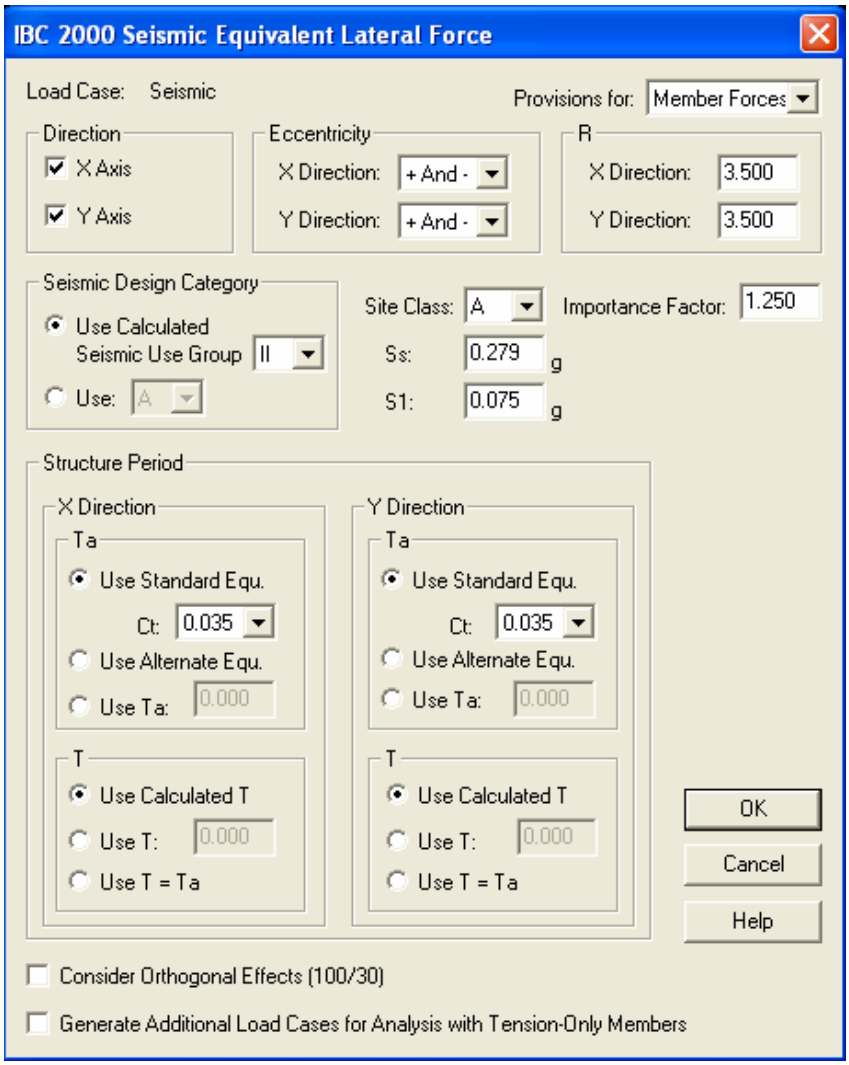

Figure 4: Seismic Load Module

Lateral Load Resistance:

The original design for Spring Run Assisted Living utilized shear walls. Since the new design is now a steel skeleton, it was necessary for me to determine the most efficient method of laying out frames. I completed this task by a very tedious process. Through trial an error, I was able to adjust members to be part of a frame to be only gravity members. I would systematically change members from gravity frame to lateral frame analyze how much it changed the overall building drift. I limited the building drift to l/400 in accordance with my design criteria. To be certain my building was not swaying this much I limited it 1". My worst case building drift occurred at column lines AW and 05W and was a total 0.98" in the building north south direction. Because of the complexity of the building and the lack of possible frames which would continue through the building, I needed to utilize a majority of the columns and beams to ensure limited drift. This can be seen in figure 5.

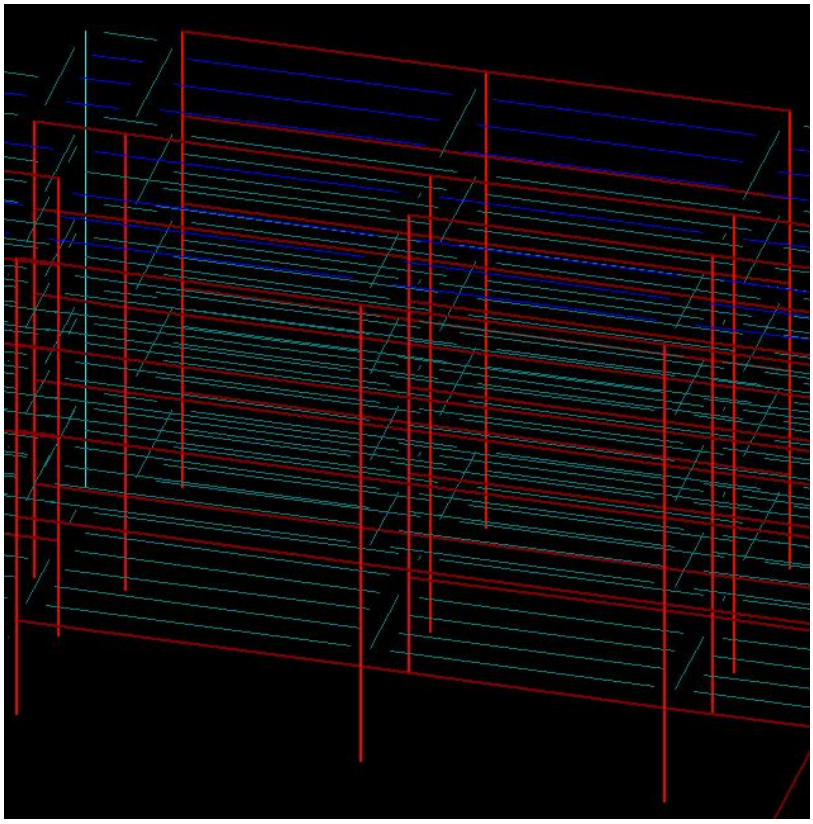

Figure 5: Sample of Frame Members

Foundations:

Due to the lack of sub-grade information which was obtainable, a final design was not performed for these footings. Although, it will be necessary to use spread footings rather than the original wall footings. Footing concrete would still need to be 3000 psi concrete, while any piers, which may be necessary, would need to be 4000 psi concrete.

More Final Design Considerations:

One of the most important parts to me about the alternate design was to avoid hindering the architect's plan for the interior. Unfortunately, the columns I used in my design would not be hidden by the interior walls. This obviously is not the first building in which this occurs so I am confident that the architect would be able to wrap the columns to make them less obvious.

Once the beams, joists and columns were finally designed, based on recommendations made to me by the structural engineer and various professors during class, I went through the building one more time and changed member sizes to ensure consistency. By doing this I can ensure a better price from the steel fabricator as well as ease of construction.

Since the new design is a steel skeleton, it is my opinion that the interior walls were no longer need to be masonry and I can switch these to steel stud partitions with 5/8" gypsum wall board on either side. This lessened the weight on the floors drastically. This process was also faster and cheaper. The backup to the brick veneer also did not need to be masonry any longer and thus; I changed it to a steel stud backup. This section is discussed further in depth in my breadth studies.