Introduction

Introduction:

The purpose of this report is to summarize my thesis project. Thesis was a 2 semester course in which I performed multiple analyses and a new design of the structural system of Spring Run Assisted Living. This report shows the steps I took during the analysis of the current design as well as the process of the new design. In addition to several figures is an appendix with my new design. Because of the changes made to the building, it was necessary to analyze how the exterior wall would be affected through heat loss and condensation. A cost and schedule comparison of the two designs was preformed.

Please note - While designing the building, it was necessary to make certain design assumptions and in no way should my report be used to call into question any aspect of the current design. This exercise was performed to gain a better knowledge of the overall building design and is for educational purposes only.

Architecture:

Spring Run Assisted Living is the newest building on Willow Valley Retirement Community's property. It is an 116,200 square foot, $11.8 million design-build project. The community is located approximately 5 miles south of the heart of Lancaster on Route 222. Although some residents are not independent, the ones who have the ability can travel to the borough on their own because of the close proximity.

A two toned brick façade with a mansard / false gabled shingle roof was used on this building to complement the existing buildings in Willow Valley Retirement Community. There are three wings making Spring Run Assisted Living a Y shaped building and each wing is anchored on the building end with a hipped roof tower. False windows are used to minimize the look of the blank exterior walls.

A porte-cochere was added at the grand entrance to allow for a tour bus to pass through. The entrance acts as a "grand hotel" entry lobby with a two story atrium. The first floor public thorough fare (from entry to dining room) is designed to reflect as a retail "main street" to the residents and visitors. This hall has access to dining, café, administration, rest rooms, library, mailroom, and lounge areas.

Project Team:

Owner	Willow Valley Retirement Community, Inc. 850 Willow Valley Lakes Drive Willow Street, PA
Designer / Builder	Paul Risk Associates, Inc. Quarryville, PA
Architect	Bernardon Haber Holloway Architects Kennett Square, PA
Structural Engineer	Baker Ingram and Associates Lancaster, PA
Electrical Engineer	Haller Enterprises Lititz, PA
Civil Engineer	RGS Associates Brownstown, PA
Interior Designers	JSA Architects Portsmouth, PA
Food Service Designer	Clark Food Service Lancaster, PA
Geotechnical Consultants	CVM Industries Huntington Valley, PA

Current Building Systems Background:

Electrical:

Willow Valley Retirement Community, Inc. owns their own primary electric grid on their property. All buildings are supplied with 480/277 volt secondary services. Electrical systems within the building are standard and include power, lighting, fire alarm, communications, data and sound systems. Emergency power is obtained through the use of diesel and natural gas powered generators.

Lighting:

The typical ceiling in Spring Run Assisted Living is a 2x4 ACT suspended ceiling. For this reason, the main lighting systems are 48" fluorescent bulbs.

Mechanical:

The majority of buildings in this retirement community are serviced by a water source heat pump system. This particular system uses a closed loop of circulated water to serve as the primary heat exchange media for both cooling and heating seasons. Heat is rejected from the loop with an outdoor cooling tower; heat is introduced into the loop through a gas boiler depending on the building demand for cooling or heating. This system is very efficient for large, full time occupied building such as Spring Run Assisted Living.

Structural System:

The 8" load bearing reinforced masonry walls are also the shear resistance for the building. The floors and roof are comprised of pre-cast concrete plank flooring along with a topping to make for a smooth surface. The use of a pre-cast floor system limited the distance of spans to 30 feet. There are steel columns where a masonry wall is not feasible. The load bearing masonry walls rest upon wall footings while the steel columns are supported by spread footings.

Telecommunications:

A communications duct bank parallels the primary electric grid throughout the property.

Transportation:

There are two elevators located near the main lobby/grand entry along with 1 stairwell at the end of each wing.

Fire Protection:

There are both passive and active fire protection systems. All masonry walls act as a fire wall and the pre-cast concrete floor planks contain their own fire rating. There is a full sprinkler system in all parts of the building to suppress a fire.

Exiting Structural Design:

Foundations:

The foundation system for Spring Run Assisted Living is concrete footings. These footings rest upon 1' of compacted structural fill and then bedrock. Since there are current two types of vertical gravity load resisting members, several steel columns and masonry walls, the footings vary based on use. Steel column footings are supported by spread footings while the masonry walls are supported using wall footings. Regardless of the footing type, all footings specified to be comprised of 3000 psi concrete with reinforcement bars of grade 60 while piers are to be 4000 psi concrete. Some of these reinforcement bars located in the wall footings are actually dowels which continue up and into the masonry walls.

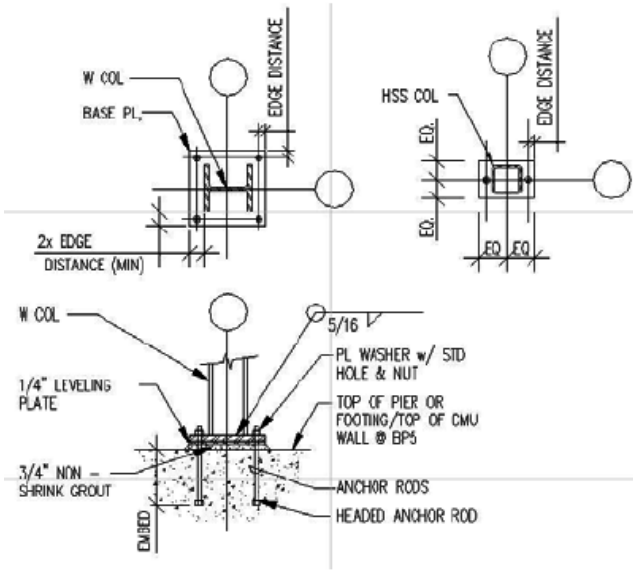

Figure 1

Structural Steel:

The main thoroughfare and open spaces on the ground level made it hard to find a way to make the building only dependant on masonry walls and thus the architect and engineer decided that columns would be necessary. There is 1 HSS column used with several more hot formed wide flange shapes. In certain instances, steel lintels are attached to these columns integrating the steel and masonry aspects of the building.

Masonry:

While the steel columns are only for gravity loads, the masonry walls serve a duel purpose. The masonry walls are the main lateral reinforcement for the building. The shear walls range from 14" CMU fully grouted below grade to an 8" CMU grouted at 48" o.c. as part of the fourth floor walls. For walls denoted as shear walls, there are to be 2 - #5 bars placed in the last two cells.

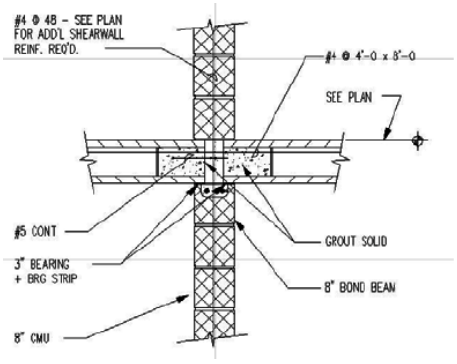

Figure 2

Structural Floor:

The structural floor is comprised of 8" pre-cast hollow core planks. These planks are specified to be 5000 psi concrete and are to be manufactured offsite. Also, the planks are denoted by the load they are supposed to carry and are to be designed by the fabricator or a registered professional engineer of their choosing. With the idea of unifying the building and having the masonry shear walls act as one rigid diaphragm, the planks are to connected to the wall which it is bearing on typically using #4 spaced at 48" o.c. Where the building will see heavy traffic, or at least where the presence of a visible joint in the flooring is unwanted, there is to be placed a 2" topping.