Elderly Housing Design in Charlton, Massachusetts

A Major Qualifying Project submitted to the faculty of Worcester Polytechnic Institute in partial fulfillment of the requirements for the Degree of Bachelor of Science.

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March 3, 2010

Abstract

The design of an elderly housing facility provided the MQP team with experience pertaining to construction and project management characteristics that included architectural layout development, code analysis, cost estimation, and scheduling. A preliminary building plan was established by investigating spatial layouts and numerical data about room types and sizes for the allocation of living space and amenities. The code analysis was used to verify preliminary layouts and alter certain aspects in order for the facility to be code compliant. Technical specifications were then prepared to describe the assemblies of construction in the building process. Using the devised set of specifications, a cost estimate was completed to provide an approximate cost of the building process and all its components. The scheduling of the project allowed for an approximate determination of substantial completion and was also calculated using the information from the technical specifications. The completion of these characteristics made it possible to present the finalized building design, cost estimate, and time schedule.

Acknowledgements

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Authorship

This Major Qualifying Project was created and compiled by the shared contributions of all three group members. Each member satisfied his required responsibilities as well as attended group meetings, conducted research, and accomplished the required narratives involved for the finalization of this document.

Andrew Abderrazzaq was mainly responsible for the CAD drawings of the building as well as the specifications and cost estimate of construction. He used AutoCAD for building and room layout design and structural member layouts plus a number of spreadsheets to organize and calculate cost. Chris Lacagnina was primarily in charge of the site drawings and scheduling for the project. Like Andrew, he used AutoCAD for site and utility layouts and used a number of spreadsheets and Primavera software for the organization and calculation of a time schedule of the construction process. Derek Snow was responsible for the Program of Requirements aspect that included a code analysis for the project as well as the organization and finalization of this report. He used the Massachusetts Building Code and Town of Charlton Bylaws to follow code compliance for the design and construction of the facilities.

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Chapter 1: Introduction

The Elderly Housing project, located in Charlton, MA, is a theoretical design project for the accommodation of elderly persons in the surrounding areas. In order to gain a comprehensive understanding of an elderly facility and its development, an investigation was conducted on the needs of the older generation as well as how to provide for those needs. Important considerations were the growing population of people age fifty-five and over, usable building amenities, and practical layouts for living areas.

The overall population in the Unites States is growing alongside life expectancy. Due to the number of people born during the Baby Boom generation a large contribution will be made to the elderly population of the near future. As a result, the elderly community is much larger than in the past and requires more care from the younger generation. Like other age groups, they have specific needs to maintain a healthy lifestyle and minimize their limitations while getting older. The similarity between population and life expectancy relates to the fact that the needs of seniors will grow along with the needs of others and require the help of the working age population.

A major area for providing the necessary accommodations is elderly housing. The type and demand of housing for the elderly depends upon what they are able to afford and the amount of care that is needed. Much of the elderly population has low income and is limited in activity and also has a greater frequency of living alone when compared to households of younger people (Katsura, 1989). The adjustments to a housing facility should cater to these needs and provide the residents with a permanent location where they will live in a comfortable environment.

Three major housing types include nursing homes, assisted living facilities, and active (independent) retirement homes. Although similar in classification, the characteristics of care are quite different. Nursing homes provide 24 hour care and observation of occupants, most of whom are not capable of self-preservation. This includes skilled nursing and medical treatment for those with cardiac problems, chronic illness, or other serious disabilities as well as help with everyday activities. The majority of seniors residing in assisted living facilities has access to help from staff but do not always need full care for their daily routine. They also have less limitation to physical and mental activities that are included in the facility itself. Assisted living

facilities attempt to provide enough care for residents without taking away much of the independent living aspect. In an active retirement home, occupants live on their own in a living community that presents a household model. The residents of such a facility live independently around spacious areas and their care is limited since may require only general treatments.

The scope of the MQP group's work was to also assess the design requirements such as zoning, permitting, and building areas. In order perform these tasks; the group conducted a series of interviews with professionals who work in and around the town of Charlton, MA to obtain information regarding the needs for different types of facilities and the overall building process. This series of interviews with professionals familiar with the Charlton area and building process were important to discuss each aspect of our project. The interviews consisted of meeting with officials for town conservation, a town planning board, corporate communications of an elderly facility, and sewer and water commission. Through the interviews, the MQP team found the preliminary needs of the facility. These needs include a space for community socializing, open space for scenic landscape outside of the facility, and an area that provides a sense of a community within a community. It was also found that in order to make a sufficient profit from the facility; the design should take into account between 120 and 140 residents. From this information, a value of 130 residents was selected to be used for occupying the facility.

The team used the Massachusetts State Building Code and ADA Accessibility Guidelines for Buildings and Facilities to direct our project through a building code analysis that included aspects of fire protection. Along with the construction design characteristics of the building code, fire resistance and egress systems were investigated. After the completion of code compliance, building specifications, scheduling, and cost estimates were also conducted as an important economic part of the building design process.

Chapter 2: Literature Review

This chapter includes the background work relevant to the design of an elderly housing facility. The group's evaluation included an in-depth understanding of the needs of the older generation and how those needs shape the requirements of their living areas. The following sections explore these essential aspects of information that pertained to this project.

2.1 National Elderly Situation

The elderly growth in the United States has followed a very apparent trend over the last century. The older community has been substantiated as an integral part of the country in more ways than one. In 1900, about 1 in 25 people were part of the group that younger Americans were raised by, looked up to, and took advice from. Of the 3.1 million elderly at the time, 122,000 were age 85 and older and of those born in 1900 the life expectancy was 47 years of age (U.S. Department of Commerce, 1993). Figure 1 shows the largest percentage of the population located in the younger age brackets.

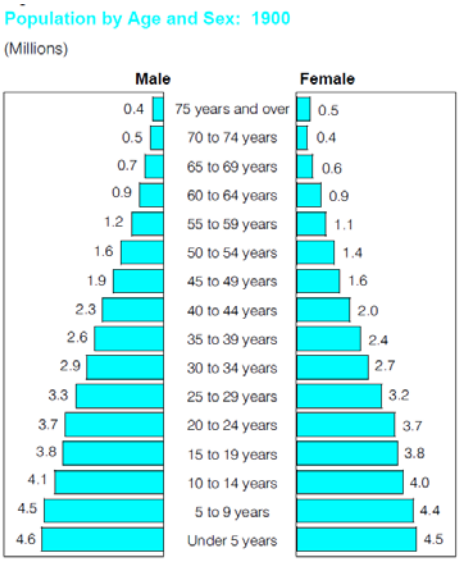


Figure 1: Population in 1900
(Source: U.S. Department of Commerce, 1993)

Over time, with medical breakthroughs and new knowledge of healthcare, life expectancy and the number of seniors has risen dramatically. By 1990, the elderly population had increased

tenfold and 1 in 8 Americans were over the age of 65 years old (U.S. Department of Commerce, 1993). This increase is illustrated in Figure 2.

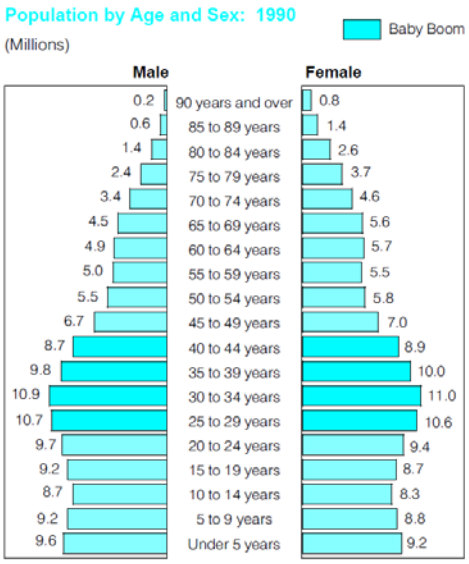


Figure 2: Population in 1990
(Source: U.S. Department of Commerce, 1993)

According to the U.S. Department of Commerce, "from 1990 to 2020, the elderly population is projected to increase to 54 million persons" and "…about 1 in 6 Americans would be elderly" (U.S. Department of Commerce, 1993). From the projected numbers in Figure 3, it is shown that a dramatic shift in the number of elderly people within the United States will take place.

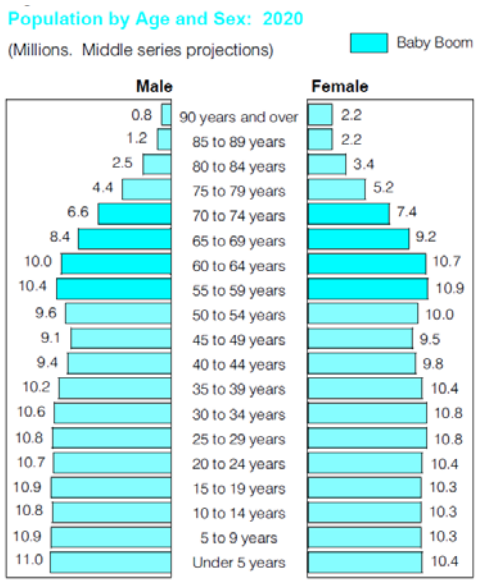


Figure 3: Projected Population by 2020
(Source: U.S. Department of Commerce, 1993)

Past data and projections have shed light on the fact that the elderly are becoming a much more prevalent group in our society as time passes and, since life expectancies have proven to be at an all-time high, many more of them need assisted care from a younger generation in their daily lives. Many of the older generation feel it necessary to stay at home for fear of giving up their living residence in which they had known for so long. However, a facility that encourages a sense of home and a social community while providing care and treatment is a very beneficial way to maintain a healthy lifestyle in the aging process.

By investigating the trends in elderly population over time, the team was able to get an understanding of the need for the housing of this generation. If the population was decreasing then the need for housing would not be high. However, as shown through the previously mentioned assessments, the elderly population is rising and prompts a need for sufficient living space. The group also noticed an important trend regarding gender. It is apparent that more women are at an older age than men, which implies that women tend to live slightly longer than men. This was an important discovery that would allow us to make extra considerations in the design efforts for the facility.

2.2 Case Studies: Independent and Assisted Living Facilities

By investigating the elderly population on a national level, it was found that people are living longer and there is a need for homes that are able to accommodate the needs of the elderly. The purpose of the MQP group's case study research was to use the information that was obtained to understand the needs of the community in a facility for seniors and to generate appropriate layouts that accommodate these needs. There are several ways of accomplishing this task. The first two ways are for the elderly to remodel their current homes either by themselves or by the help of a contractor. The modifications are based around a "gerontologic design". This design is the remodeling of an existing space in response to the deteriorating health of a home owner (Rosenfeld, 2008).

The third option, which pertains to our project focus, is for the elderly to move into a residence that already has the necessary modifications, but still a sense of community. As retirement communities became more popular in the United States in the 1960's it usually meant people were forced to relocate far away from family and friends due to the lack of facilities currently in operation. Today, the number of these communities is growing and becoming more local and having to downsize from a private residence no longer requires a large travel distance or has a lack in amenities that fit the new residents' needs.

Sun City Festival Facility

East of Phoenix, Arizona there is a 3,100 acre active-retirement home called the Sun City Festival and is considered a great place for the twentieth century retiree. Sun City Festival was created for adults, ages 55 and older, which are still considered active and assistance independent. This community invests a large amount into the social and physical aspects of living to maintain health. This means residents have the capability to leave the complex on their own or participate in numerous activities on-site that range from grocery shopping to 18 holes of golf. Fitness centers, such as the Sage Center that is located in the community, provide recreational use of pools and exercise rooms for clubs and classes with fitness instructors (Sun City Festival, 2009). The team project considers this type of active lifestyle and incorporates it into the design of our facility. The physical health of a resident is extremely important and allowing the use of fitness amenities for everyday use is very beneficial.

Figure 4: Typical Sun City Festival Home
(Source: Sun City Festival, Active Adult Community, 2009)

The living areas for the Sun City Festival retirement home include a variety of homes that promote independent living. Residents are part of the retirement community but still have a household to call their own. This provides a sense of ownership and also enjoyment in the fact that there can finally be less work and more play while maintaining a healthy lifestyle. The notion of community and ownership is another attribute that is instilled in our design of a facility. Although our approach combines the independent and assisted living styles, an elderly community must be in support of the active occupants and contribute to their good health like the Sun City Festival retirement home exemplifies.

Figure 5: Typical Interior of Sun City Festival Home
(Source: Sun City Festival, Active Adult Community, 2009)

Swedish Facility

In Sweden there is a need to accommodate the elderly who are in the final stage of their lives. There have been substantial studies regarding the health support system in elderly homes. One such study, called *Health Supportive Design in Elderly Care Homes*, explored design factors and their usefulness through a series of field studies and interviews.

> "According to this research, the valuable factors to support health and well-being for the elderly are as follows; 1) Community integration: In urban planning, these elderly care homes are generally places close to a residential area center or a city center. Services are often shared between residents and community members at large, consequently there is a flow of "visitors" of all ages connecting with the facility on a daily basis. 2) Homelike environment: A noteworthy aspect of Swedish elderly care homes is keeping the facility appearance as homelike as possible. The associations with home may be explored through the appearance and configuration of both the exterior and interior of the building. These homes seemed to be designed with a conscious aim to create a homelike setting. 3) Accessibility to garden and nature: The courtyard is a well developed concept in designing elderly care homes in Sweden. They are generally safe and easily accessible to the residents" (Design and Health).

Based on this idea, studies regarding a Swedish assisted living facility provided information that shows a number of elderly residents with caretakers utilizing their own space. A design for one of the facilities described a one level structure with one living area next to another and including a central common area where the residents can eat and socialize. The living areas resemble a hotel with a simple sleep area and private bathroom. This use for this facility is much like a nursing home, but the residents are given a sense of community even though they may not be able to complete certain tasks on their own (Rosenfeld, 2008). This facility was used to learn about other designs that can be occupied by people from the beginning of their retirement to their final resting days. Like the Sun City Festival housing, townhouses and apartments can be occupied by the active community, which allows residents to enter and exit the facilities as they wish. However, an assisted living area like the Swedish housing is appropriate for occupants that have trouble in maintaining their health in everyday life.

Based on the information obtained through case study research, it was decided that the design would involve an apartment style independent living area with at least a bedroom, bathroom, kitchen and living area, and be connected to a more centralized assisted living area that integrates similar ideas from each of these case studies. The assisted living design of the

Swedish senior-housing has had a great influence because of the ability to accommodate a number of elderly where a caretaker can assist more than just one person. The independent living design of the Sun City Festival area also had a great influence regarding the push for an active lifestyle among its occupants. Using these ideas, the team also decided to include amenities within the facility that promote the physical and social well-being of the residents. These services include a fitness center, banquet hall, and other useful spaces.

2.3 Space Standards and Layout Investigation

As another step in the evaluation of this project, the group has obtained and researched books about elderly living that include layout designs. The purpose of the investigation was to help the MQP team to get a basic understanding of what an elderly home looks like, as well as how an elderly home comes together by means of the flow of a basic layout. The books included Design of Assisted Living, 2007 by Victor Regnier, Home Design in an Aging World, 2008 by Jeffrey Rosenfeld, and VNR Metric Handbook of Architectural Standards, 1979 by Patricia Tutt and David Adler.

From Design of Assisted Living, 2007 by Victor Regnier and VNR Metric Handbook of Architectural Standards, 1979 by Patricia Tutt and David Adler, the MQP group found two general bedroom layouts and one basic general floor plan to be most helpful. As found in Appendix A, Sections A.1 and A.2, the two general bedroom layouts are from Design of Assisted Living and contain simple rectangular rooms that have easily accessible space and sufficient area for the use of each space.

The general floor plan that was investigated, shown in Appendix A, Section A.3, also had a simple design and kept the rooms and open spaces to square and rectangular shapes. It is designed with central usage areas for residents including sitting areas, a kitchen and dining area, a sewing room, and medical space with staff areas. This concept was discussed early in the project and it was agreed to use this idea since it was reiterated by the layout from VNR Metric Handbook of Architectural Standards. The team learned that the many layouts that were investigated were similar since it helps the accessibility of the residents within the facility. The investigated building layout from Appendix A also provided adequate space to accommodate many separate living areas for residents, which were located around the central amenities of the

building. This concept was also adopted for the accessibility issue, but also because it allowed a large number of living areas to be located within the building.

The preliminary design was based off of the information gathered from the investigation of the VNR Metric Handbook of Architectural Standards. Data about room types and sizes were taken from this text and placed in a chart to determine how much area should be allocated for living space, dining hall, lounge, kitchen, etc. Table 1 shows how much area each room is to account for in the preliminary design phase and all values from VNR Metric Handbook of Architectural Standards were converted from units of square meters to square feet. After one of the interviews, it was decided that an initial value of 130 occupants in two buildings would be used to form an elderly community based on the information obtained at the site visit. In the preliminary design 30 percent of the occupants in the buildings, 40 residents, are to be accommodated in 20 double rooms. Since the information from the book was based on a 40 person facility and the design for our group is based on 130 occupants, certain areas were multiplied by a factor of 3.25 to accurately depict the amount of needed space. These areas are denoted with an asterisk in Table 1.

Investigated Areas for Preliminary Design

Room	Total Quantity	Area per Occupant (square feet)	Occupant Load	Room Area (square feet)
Lobby	2	25	110	5,500
Bank	2	309	1	618*
Library Area	2	25	16	800
Mechanical Room	2	884	1	1,768*
Electrical Room	6	884	1	5,304*
Multi-use Banquet Hall	2	16	100	3,200
Kitchen	2	1,485	2	2,970*
Fitness Center	2	25	16	800
Outpatient Care	2	351	8	702*
24-Hour Staff Holding	2	351	8	702*
Elevator	12	-	-	600
Stairwell	18	-	-	3,000
Public Restroom	8	309	-	2,472*
Storage Closet	4	280	1	1,120*
Single Room	90	-	-	43,200
Living Room	-	-	-	*95*
Kitchen	-	-	-	*161*

Bedroom	-	-	*1*	*129*
Bathroom	-	-	-	*95*
Double Room	20	-	-	12,360
Living Room	-	-	-	*190*
Kitchen	-	-	-	*161*
Bedroom	-	-	*2*	*172*
Bathroom	-	-	-	*95*
Total 1	-	-	-	**85,116**
Corridor	1	15% of Total 1	-	12,767
Total 2				**97,883**

*Area per occupant multiplied by a factor of 3.25 because obtained information was based on a 40 person home.

Table 1: Investigated Areas for Preliminary Design

Chapter 3: Program of Requirements

This chapter illustrates the building code requirements for the preliminary layout and design of the elderly facility. It also provides an explanation of adjustments made to the design for code compliance. Using the Massachusetts State Building Code, the first step was to classify the facility for use and occupancy. Then, after the occupant loads were established, the allowable building heights and areas based on occupancy classification were found. Following the allowable height and area requirements, a construction type was chosen and means of egress within the facility was taken into consideration.

3.1 Building Codes and Fire Protection

The International Code Council (ICC) and National Fire Protection Association (NFPA) are two of the most recognized organizations for code development in the United States. In 1995 the International Code Council was established to "combine the codes of the three traditional regional model-building code organizations into a single national model" (NFPA, 2008). These three organizations included the Building Officials and Code Administrators (BOCA), the International Conference of Building Officials (ICBO), and the Southern Building Code Congress International (SBCCI). The BOCA code was primarily used in the northeast United States before the International Building Code (IBC) was formed by the ICC. In order to establish a complete set of codes and standards for the build environment, the NFPA created its own building code. "NFPA has historically been involved with the development of a model building code as early as 1905 through collaborative efforts of the National Board of Fire Underwriters, but a current up-to-date version was needed to cover structural design issues and other items normally found in a building code" (NFPA, 2008). The result of this need was the development of NFPA 5000, Building Construction and Safety Code in 2002.

Since a building code "is a law or regulation that sets forth minimum requirements for the design and construction of buildings and structures" (NFPA, 2008), it must first be adopted into law. The simplest way to make a code law is by reference. A state has the right to cite a code and make noted changes to their adopted code for enforcement. This decision is usually made by the state fire marshal. The reasons for the adoption of one code over another can vary, but one of the reasons may include the organization of each code. The IBC is a prescriptive code,

organized by major categories with subsections pertaining to related occupancy classifications and includes exceptions and special allowances for certain requirements. Unlike the IBC, NFPA 5000 is organized using major headings that represent occupancy classifications and include subsections for each aspect relating to a specific occupancy classification.

In conjunction with the building codes, the team considered the Americans with Disabilities Act of 1990 (ADA). The ADA is an Act that prohibits the discrimination against people with disabilities and requires acceptable accommodation for these people (NFPA, 2008). Since the group design project deals with elderly people, it is more than likely that a percentage of the residents will have disabilities. By applying ADA accessibility, the facility shall be more accommodating because of the "technically specific and prescriptive rules that give precise measures" (NFPA, 2008).

The state of Massachusetts, where the group's elderly facility was designed, had adopted the 2003 Edition of the International Building Code and resulted in the 7th Edition Massachusetts State Building Code (780 CMR). This, along with the Americans with Disabilities Act (ADA), is the code to which the elderly facility was designed, unless otherwise specified in this report.

3.2 Use and Occupancy Classification

The layout design approach began with determining an overall occupancy classification. Since the group project is based on the design and construction of an elderly facility, the classification was first considered by definition in Section 308.1 of the Massachusetts State Building Code. This Section states that an "Institutional Group I occupancy includes, among others, the use of a building or structure, or a portion thereof, in which people are cared for or live in a supervised environment, having physical limitations because of health or age are harbored for medical treatment or other care or treatment, or in which people are detained for penal or correctional purposes or in which the liberty of the occupants is restricted" (MA Building Code). More specifically, the facility the MQP team has designed was considered to be a Group I-1 occupancy classification, which is defined in Section 308.2 of both building codes as "buildings, structures or parts thereof housing more than 16 persons, on a 24-hour basis, who because of age, mental disability or other reasons, live in a supervised residential environment

that provides personal care services. The occupants are capable of responding to an emergency situation without physical assistance from staff" (MA Building Code).

After further research within Chapter 3 of the Massachusetts Building Code, it was discovered that the amenities within the building need to be taken into account. The group listed the amenities that would be included in the building to accomplish the rest of this important step. These include a bank, multi-use banquet room, library, fitness center, and outpatient care. The spaces listed are of Group A, B, and I occupancy classifications. By definition in Section 303.1 of the Massachusetts State Building Code, "Assembly Group A occupancy includes, among others, the use of a building or structure, or a portion thereof, for the gathering together of persons for purposes such as civic, social or religious functions, recreation, food or drink consumption or awaiting transportation" (MA Building Code). For the type of use in the Assembly occupancy by those spaces listed, the Group A classification is more specifically Group A-3. From Section 304.1, "Business Group B occupancy includes, among others, the use of a building or structure, or a portion thereof, for office, professional or service-type transactions, including storage of records and accounts" (MA Building Code).

Since most of the listed spaces are of occupancy other than that of I-1 and the building is occupied by two or more uses, the building must be considered Mixed Use occupancy by Section 302.3. Under the Mixed Use occupancy classification, two options are available. These options include Non-separated and Separated Use. A Non-separated Use requires height and area limitations to be applied to the entire building for each of the applicable occupancies. The worst-case occupancy with regards to construction type will then govern over the others and apply to the entire building. A Separated Use divides occupancy classifications by fire barrier walls or horizontal assemblies and each of the separated occupancy classifications will follow height limitations based on the use of the space and its construction type. "In each story, the building area shall be such that the sum of the ratios of the floor area of each use divided by the allowable area for each use shall not exceed one" (MA Building Code). Looking back to the Group A-3, B, and I-1 occupancies, Group A-3 classification is much more restrictive than Group B or I-1 using Table 503 of the Massachusetts Building Code and also classifies more of the previously listed amenities for the building.

After careful consideration of the requirements in Chapter 3 of the Massachusetts State Building Code, the team decided to classify the facility as Separated Mixed Use occupancy. Designing for a three story facility with amenities provided on the first floor, the Separated Mixed Use building will have Group A-3 classification on Floor 1 and Group I-1 classification on Floors 2 and 3. In this configuration for Separated Mixed Use occupancy, the fire separation between occupancy classifications must be in accordance with Table 302.3.2 in Section 302.3.2 of the Massachusetts State Building Code. Table 302.3.2, also found in Appendix C, Section C.1, requires a fire separation with a 2 hour fire rating between Group A-3 on Floor 1 and Group I-1 on Floor 2, but does not require a fire rated separation between Group I-1 on Floor 2 and Group I-1 on Floor 3.

3.3 Occupant Load and Allowable Room Area

After the space investigations from Chapter 2, the MQP group used the established occupant load of 130; the number of residents that would live in the facility. With the occupant load in place, the Occupant Load Section 1004 of the Massachusetts Building Code was used to find the maximum required area per occupant for a sleeping area. Provided in the said Section, Table 1004.1.2 in the Massachusetts Building Code allows a maximum floor area of 120 square feet per occupant in an Institutional sleeping area. This Table can also be found in Appendix C, Section C.2. Once this value was determined, the group was able to adjust the bedroom areas for both single and double rooms.

In addition to the bedroom areas, other spaces such as a kitchen, living room, and bathroom throughout the living area were adjusted according to ADA requirements for handicap accessibility. The ADA requirements played a large factor in the size of each space due to wheelchair requirements and other accessibility issues. These requirements are referenced in Appendix D, Section D.1 for Requirements for Installments. Some of the accessibility considerations included door and window size and placement, shower and sink spacing and location, other open area within the bathroom for toilet accessibility, and kitchen space requirements for wheelchair movement in certain kitchen types. Again, using a percent factor for occupants, the team designed for 30 percent of the residents to be housed in double-rooms so the number of single and coupled rooms to be permitted for the facility was then determined. These values were repeated as 20 double-rooms and 90 single-rooms. The next challenge was to

refit these rooms in the facility so it could provide enough floor area to incorporate them, as well as provide additional space for other uses.

The boundaries of the building were created as a simple rectangular design and then adjusted as the group decided that the facility would require a very large footprint or an excessive height to accommodate the large number of occupants. The investigated areas from the VNR Metric Handbook of Architectural Standards in Chapter 2 allowed the design to remain two identical buildings that would be placed on the lot. Half of the double-rooms and half of the single-rooms would be put in each of the two buildings. Using three stories, the room layouts were fit inside each facility and the team utilized the additional open area for the design of spaces to be used by the residents for their benefit. Like the bedroom design, the group used Table 1004.1.2 in the Massachusetts State Building Code to find other maximum areas per occupant and multiplied those areas by a specified number of occupants that were decided upon for each space to obtain a maximum allowed room area. Table 2 illustrates our criteria in the preliminary design process for amenities and living areas within each building.

Maximum Areas per Building per Number of People

Room	Quantity per Building	Max. Area per Occupant (square feet)	Occupant Load	Max. Room Area (square feet)
Lobby	1	7 net	110	770
Bank	1	100 gross	1	100
Library Area	1	50 net	16	800
Mechanical Room	1	300 gross	3	900
Electrical Room	3	300 gross	1	900
Multi-use Banquet Hall	1	15 net	100	1,500
Kitchen	1	200 gross	2	400
Fitness Center	1	50 gross	16	800
Outpatient Care	1	100 gross	8	800
24-Hour Staff Holding	2	100 gross	3	600
Elevator	6	-	-	300
Stairwell	9	-	-	1,500
Public Restroom	4	-	-	1,220
Corridor	-	-	-	8,000
Storage Closet	2	300 gross	2	600
Single Room	45	-	-	24,390
Living Room	-	-	-	*191*
Kitchen	-	-	-	*136*

Bedroom	-	*120 gross*	*1*	*120*
Bathroom	-	-	-	*95*
Double Room	10	-	-	7,360
Living Room	-	-	-	*249*
Kitchen	-	-	-	*150*
Bedroom	-	*120 gross*	*2*	*240*
Bathroom	-	-	-	*97*
Total				**50,940**

"Gross" floor area: Total area within exterior walls; "Net" floor area: Actual occupied area

Table 2: Preliminary Maximum Areas per Building

3.4 Room Area Comparison

After the preliminary area limitations were developed and a floor plan was modified to fit the amenities that the team wanted to incorporate into each building, it was possible to make a comparison between the actual areas of each space and the maximum allowable areas due to occupant load. The actual area of each room should be less than or equal to the maximum allowed. If a certain space was too large, it was adjusted to fit the allowable areas from Table 2 and therefore a comprehensive list of areas within each building was created in Table 3. After taking a closer look at the relationship between area and occupant load, the team found that using 130 residents to occupy the building would be sufficient. Since two buildings are used instead of one, it was confirmed that each building would contain 65 occupants and 10 double-rooms and 45 single-rooms would be placed over 3 floors per building.

In order to keep organized in the placement of rooms, room relationship diagrams were also created. These diagrams are shown in Figure 6 and Figure 7. In these Figures, it is shown that the buildings have a main lobby area from the front entrance the leads into a corridor that runs the entire length of each building. Off of the main corridor there is a main dining area and kitchen, ATM, fitness center, outpatient care area, public restrooms, and library for the use of the residents. Also on the first floor along the corridor are living areas that house both single and double sized rooms that facilitate handicapped residents. Mechanical and electrical rooms are also located on the first floor. There is elevator and stairway access to the second a third floor, which house the rest of the single and double rooms for the residents, as well as an electrical room, storage closet, 24 hour staff holding area, and a public restroom.

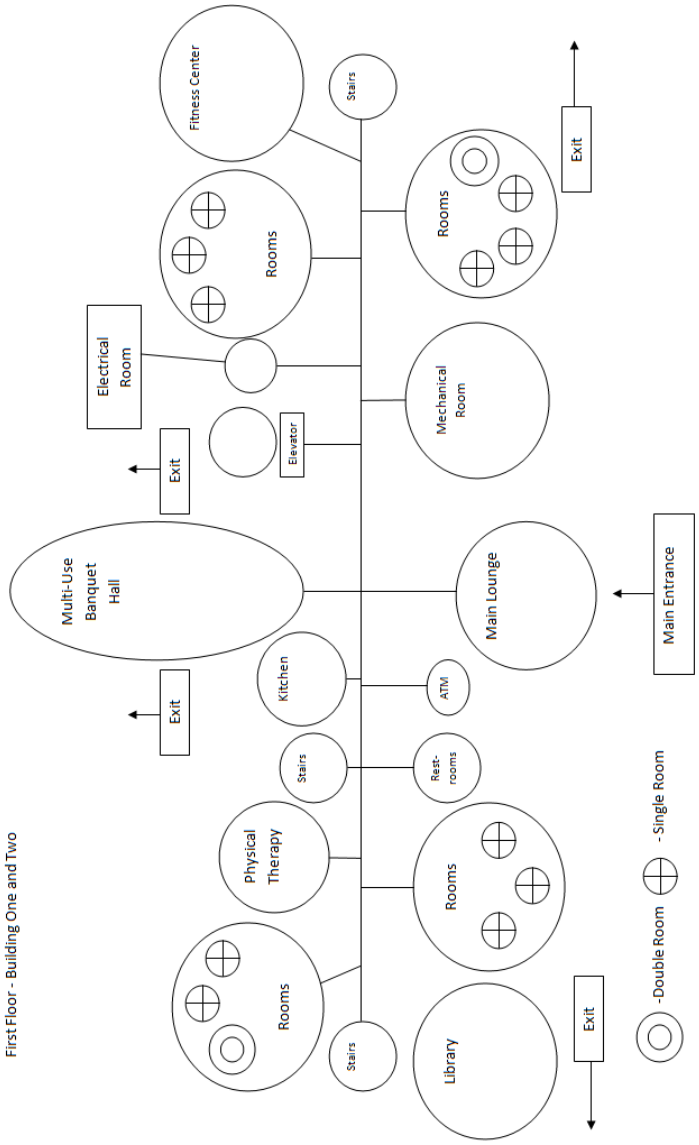


Figure 6: First Floor Room Relationship Diagram

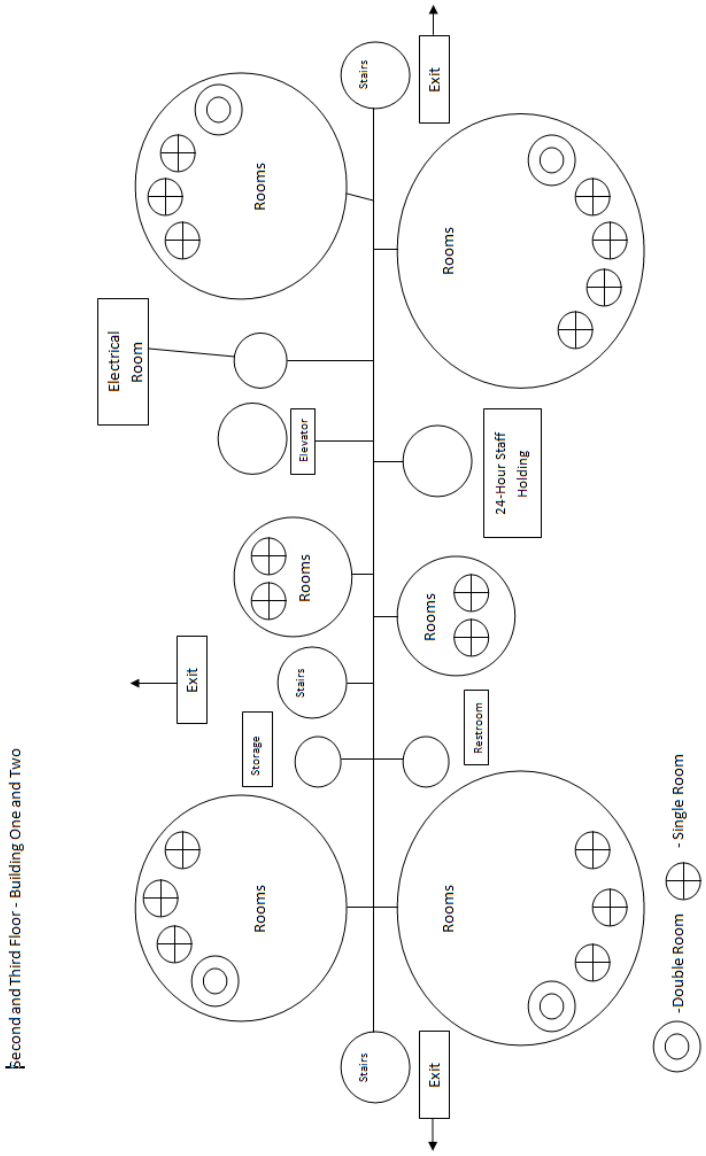


Figure 7: Second and Third Floor Room Relationship Diagram

The overall area of each stairwell is 160 square feet with a stair width of 4 feet and landings having a width of 8 feet. The width values were found in Section 1009 of the Massachusetts Building Code in which is stated that "such width shall not be less than 44 inches" (MA Building Code). Also from Section 1009, stair riser heights are required to be between 4 and 7 inches and a minimum of 11 inches for tread depth. Since the group decided on a floor height of 10 feet from the Town of Charlton bylaws that require a maximum height of the building to be 36 feet, the resulting stair riser height was 4.6 inches and tread depth of 12 inches. Two elevators are located in each facility and were designed according to ADA required

dimensions for the accessibility of wheelchairs. One has an area of 46 square feet and the other an area of 53 square feet. The larger elevator has the capability of accommodating a stretcher for emergency purposes. Public restrooms have a total area of 1,218 square feet, the mechanical room of 720 square feet, and electrical rooms of 631 square feet.

Maximum vs. Actual Area

Room	Max. Room Area (square feet)	Actual Room Area (square feet)
Lobby	770	759
Bank	100	92
Library Area	800	761
Mechanical Room	900	720
Electrical Room	900	631
Multi-use Banquet Hall	1,500	1,421
Kitchen	400	345
Fitness Center	800	766
Outpatient Care	800	789
24-Hour Staff Holding	600	580
Elevator	300	297
Stairwell	1,500	1,440
Public Restroom	1,220	1,218
Corridor	8,000	7,620
Storage Closet	600	422
Single Room	24,390	24,390
Living Room	*191*	*191*
Kitchen	*136*	*136*
Bedroom	*120*	*120*
Bathroom	*95*	*95*
Double Room	7,360	7,360
Living Room	*249*	*249*
Kitchen	*150*	*150*
Bedroom	*240*	*240*
Bathroom	*97*	*97*
Total for One Building	**50,940**	**49,611**
Total for Two	**101,880**	**99,222**

Table 3: Code Compliant Room Areas for Occupant Use

All spaces listed in Table 3 are less than the maximum allowable areas; therefore the actual total area of the building can be used since it is allowed to act as the governing value when determining allowable heights and areas and construction type for the buildings. When

compared to Table 1, the actual total area for two buildings is approximately 1,300 square feet larger. This is a minimal difference between the two values so the actual area is still applicable to the design.

3.5 Building Construction Material Type

Using the layout design and the total actual area for the buildings, the group found the first story to be approximately 18,590 square feet and the second and third story to be approximately 17,880 square feet. These values now include areas of all interior and exterior walls after the layout was designed and drawn. It was possible to then use Table 503 and the corresponding occupancy groups that have been classified for this building to find the construction type for the facilities. Table 503, referenced in Appendix C, Section C.3, provides an allowable height and area per story for such occupancy groups and their corresponding construction type. Knowing the area of the building and occupancy groups, the team was able to work backward to make the final decision on construction type. As previously mentioned in Section 3.2, the team had classified the buildings as A-3 and I-1 occupancy groups where A-3 was more restrictive than I-1 requirements with regards to height and area allowances. In Table 503, the team kept to the restrictiveness of group A-3 classification and then had a choice of construction types I through V. From Section 602 of the MA Building Code, Type I and Type II construction consist of noncombustible material, Type III construction has exterior walls made of noncombustible material and interior elements of any material permitted by the Code, Type IV construction consists of exterior walls of noncombustible material and interior elements made of solid or laminated wood, and Type V construction has all structural elements made of combustible material.

At first glance, the team's options with the restrictive A-3 occupancy and 18,590 square feet of area on the first floor were narrowed to only Type I construction. However, extra consideration was taken as the exceptions were researched. It was found that, according to Sections 504 and 506 of the Massachusetts Building Code, there would be a height, story, and area increase due to sprinkler system installation. By Section 504, buildings equipped throughout by an approved sprinkler system, "the value specified in Table 503 for maximum *building height* is increased by 20 feet and the maximum number of *stories* is increased by one" (MA Building Code). Also by Section 506, for buildings equipped throughout by an approved

sprinkler system, "the *building area* limitation in Table 503 is permitted to be increased by an additional 200 percent (I_s = 2) for buildings with more than one *story above grade plane* and an additional 300 percent (I_s = 3) for buildings with no more than one *story above grade plane*" (MA Building Code). The group had already planned to sprinkler each building so these exceptions provided an extra incentive. By having a sprinkler system installed throughout each building, the construction type options were broadened to a possibility of Type I through IV and Type VA.

It was agreed that noncombustible construction would be an effective choice on a fire protection standpoint for an elderly facility. Typically, Type I is made up of concrete construction. The team found this to have the most unrestricted allowance for height and area, yet it was decided that the facility did not need to be as structurally involved as a concrete structure entails. Even though concrete may be one of the less expensive building materials, the structural design surpasses the extent of our knowledge thus far for a facility design of this magnitude. Another possibility would have been Type II construction because it would provide some amount of protection when it came to the safety of the elderly residents inside the building with regards to fire protection. However, unprotected steel could pose a risk to life safety if it is not part of a structure with other fire-rated properties. Type IV construction offers another option; however, the minimal use of this construction type in the area and expensive cost to create and obtain timbers for adequate sizing directed us away from the use of heavy timber construction. Type V construction did not seem to have the necessary qualities to be used in the design and construction of the elderly facility since all areas would have to be framed in, whereas partitioning certain spaces would be much easier and more efficient. Finally, the last option was Type III, consisting of steel construction and exterior load bearing masonry walls. The group had decided that, due to the nature of the elderly facility and its use, the masonry and steel construction would be sufficient for the design with regards to structural stability and fire protection purposes.

Type IIIA and IIIB construction are subcategories that entail different allowable heights and areas. Both Types have noncombustible exterior walls with a permitted construction material for the rest of the building. Type IIIA typically has fire-rated construction besides its exterior walls, whereas Type IIIB is does not. At first glance, Type IIIA seemed to be an

adequate candidate with an allowed building height of 65 feet (3 stories) and an allowed building area of 14,000 square feet per floor. Including the height and area modifications, a Type IIIA construction would improve to an allowed building height of 85 feet (4 stories) and an allowed area of 28,000 square feet per floor. Type IIIB construction would improve from a building height of 55 feet, 2 stories, and building area of 9,500 square feet to a building height of 75 feet, 3 stories, and a building area of 19,000 square feet. Even though Type IIIB construction is typically unprotected with its interior construction, it was decided that unprotected steel would be used for its structural integrity and that the fire protection in the buildings could also be improved with the load bearing, fire-rated walls and other prescriptive direction from the codes. Therefore, Type IIIA construction is not entirely necessary.

To further show that Type IIIB construction is more beneficial in this case than Type IIIA construction; Table 601 (located in Appendix C, Section C.4) of the Massachusetts Building Code is used. According to Table 601, Type IIIA construction has a fire-resistance rating of 1 hour for building elements and 2 hours for the exterior walls. An automatic sprinkler system can be a substitute for the 1 hour rating provided that it is not also used for a height or area increase. Without the increase, the Type IIIA construction remains 3 stories at 14,000 square feet per story. At this point, both Type IIIA and Type IIIB construction have unprotected interior elements and 2 hour fire-resistance rated exterior walls and Type IIIB still allows the height and area increase due to sprinklers. With the increase, Type IIIB offers 5,000 extra square feet and Type IIIA would not be able to be used since the elderly facility requires approximately 18,590 square feet. The team decided that the results for Type IIIA would be insufficient for the required area that our design required. Type IIIB construction became the group's final decision.

3.6 Means of Egress

Once the heights and areas and construction type was confirmed, it was important to take another look at the building layout and consider the means of egress from the building. This is especially important since it is an elderly housing facility and accommodations and space requirements are vital to the safety of the occupants as they exit the building in an emergency. The first step was to establish the total occupant load per floor of each building. This was already done in part in Section 3.2 of this report. Tables 4 and 5 demonstrate this in an easy-to-read approach.

First Floor Total Occupant Load per Building

Room	Quantity per Floor	Occupant Load	Total Occupant Load
Bank	1	1	1
Library Area	1	16	16
Mechanical Room	1	3	3
Electrical Room	1	1	1
Multi-use Banquet Hall	1	100	100
Kitchen	1	2	2
Fitness Center	1	16	16
Outpatient Care	1	8	8
Single Room	11	1	11
Double Room	2	2	4
Total			**162**

Table 4: First Floor Total Occupant Load

Second and Third Floor Total Occupant Load per Building

Room	Quantity per Floor	Occupant Load	Total Occupant Load
Electrical Room	1	1	1
Storage Closet	1	1	1
24-Hour Staff Holding	1	3	3
Single Room	17	1	17
Double Room	4	2	8
Total			**30**

Table 5: Second and Third Floor Total Occupant Loads

The determination of the total occupant load per floor or each building allowed the group to find the required number of exits per floor by Table 1018.1 of the Massachusetts State Building Code. This table can be referenced in Appendix C, Section C.6 of this report. The group was then able to compare the number of required exits from the Massachusetts Building Code to the number of exits that were added to our layout in the preliminary stages. This comparison was used as a check to make sure that our design did not exceed the code requirements. Even though there are only 65 residents living in each building, the MQP team decided to take a conservative number and add the occupant loading as if each room was

occupied to its full capacity on each floor. In Table 4, it was shown that a governing value of 162 occupants should be used for the first floor and that 30 occupants should be used for the second and third floors by Table 4 above. From Table 1018.1, an occupant load between 1 and 500 results in a required minimum of 2 exits from the building. In this case, the team's layout design is sufficient since we include 5 exits on the first floor and 3 stairway exits on the second and third floors. Included on the first floor, each living space also has an exit out of each building from a glass door. The reasoning behind these extra exits is due to the group's decision that the occupants living areas on the first floor shall be primarily for handicapped residents. If a handicapped occupant were to live on the second or third floor, that occupant would have much more trouble evacuating the building than if they had been living on the first floor. Being located on the first floor and in an event that the handicapped residents are unable to make it to an exit stairway, they have the option of exiting the building from their own living areas.

Another important part of egress is the width of the exits and corridors that are in the buildings. The widths are also dependent on occupant load. Using Table 1005.1 of the Massachusetts State Building Code, shown in Appendix C, Section C.7 of this report, occupancies of anything but Hazardous H-1, H-2, H-3, and H-4 and Institutional I-2 with an approved sprinkler system requires 0.2 inches per occupant for stairways and 0.15 inches per occupant for other egress components. Using the governing value of 162 occupants again, the width per stairway is required to be at least 32.4 inches and at least 24.3 inches for other egress components. However, as stated previously, the width values for stairways were also found in Section 1009 of the Massachusetts Building Code and the section states that "such width shall not be less than 44 inches" (MA Building Code). This overrides the 32.4 inches and our design widths for the stairways are sufficient since out group had designed the stairways to be 48 inches wide. Also, since corridors would be considered a component of egress, the required width of 24.3 inches is not actually wide enough according to Section 1016 of the Massachusetts State Building Code. In Section 1016, "the minimum corridor width shall be as determined in 780 CMR 1005.1, but not less than 44 inches" (MA Building Code). Therefore, the group layout design for the corridor width is also sufficient since it was designed to be 96 inches. This value is also adequate in the most stringent occupancies with regards to corridor width. A minimum of a 96 inch corridor width is required for I-2 occupancies in areas where bed movement is likely. Should the use of the building be changed to house and care for elderly residents that are no

longer capable of self-preservation, the corridor width will not be the cause of any major renovations.

Widths of components of egress are only part of the dimensional and distance requirements. Exit access travel distances are another. By definition in Section 1015.1 of the Massachusetts State Building Code, "exits shall be so located on each story such that the maximum length of exit access travel, measured from the most remote point within a story to the entrance to an exit along the natural and unobstructed path of egress travel, shall not exceed the distances given in Table 1015.1" (MA Building Code). Table 1015.1 is referenced in Appendix C, Section C.8 of this report and provides the maximum travel distance in feet for the corresponding occupancy classification. The team's design for the elderly housing facility as Group A-3 and I-1, and equipped with an accepted sprinkler system, requires a maximum travel distance of 250 feet. The group layout design is acceptable on all floors since the maximum travel distance was calculated to be 205 feet so the exits provide enough exit access from the most remote areas and allow the travel distance to remain under 250 feet.

The remoteness of these exits were also checked by Section 1014.2.1 of the Massachusetts State Building Code to make sure that "where two exits or exit access doorways are required from any portion of the exit access, the exit doors or exit access doorways shall be placed a distance apart equal to not less than ½ of the length of the maximum overall diagonal dimension of the building or area to be served measured in a straight line between exit doors or exit access doorways" (MA Building Code). After reading through the exceptions to this requirement, the group also found that since the facility was to be sprinklered throughout "the separation distance of the exit doors or exit access doorways shall not be less than one-third of the length of the maximum overall diagonal dimension of the area served" (MA Building Code). The exception allowed the team a smaller percentage of the diagonal dimension to be used; therefore allowing a greater distance between exits. After calculating the required separation distances, the team was able to compare the values to the actual separation distances between exits. It was determined that the distances were appropriate and did not fall below the minimum requirements set by Section 1014.2.1.

3.7 Conclusions

Overall, the use and occupancy classification was found to be an integral part of the process within the Program of Requirements. Almost all of the information from the Massachusetts State Building Code was determined due to the classification group of each building. The occupant load was also an essential portion in determining allowable area requirements and components of the means of egress. Together, the building classification and height and area requirements led to the establishment of a construction type. The checks performed on the group layout design were done to ensure that the important areas of the design layout were code compliant. All of these aspects were integrated together in order to guide the transitions in the design process in a seamless manner.

Chapter 4: Site Analysis and Plan

The plot of land that the group is developing for an elderly facility is to be located in Charlton, Massachusetts. This location requires the compliance with the Town of Charlton, Massachusetts Zoning Bylaws. Since the facility will be occupied by senior citizens, the primary requirements to be followed are in Section 5.11 of the town Zoning Bylaws. This Section encompasses special permits for Senior Living Facilities and can be found for reference in Appendix B, Section B.4. The purpose of this bylaw is to "encourage residential development that provides alternative housing choices for people that are fifty-five (55) years of age and older" (Town of Charlton). These developments should be affordable and an efficient use of the plot of land.

A general requirement stated under Section 5.11 is the land used must total at least ten acres and should be located entirely within an Agricultural, Low Density Residential, Village, or Residential-Small Enterprise. The plot of land used by the group, shown in Figure 8, fits this requirement. The lot is 35.6 acres and is located in a Low Density Residential zoning district. The plot has access to Centre Depot Road and French Road, which allows the construction of roads to and from the building. The surrounding lots are not to be disturbed during construction so no more extra land will need to be purchased.

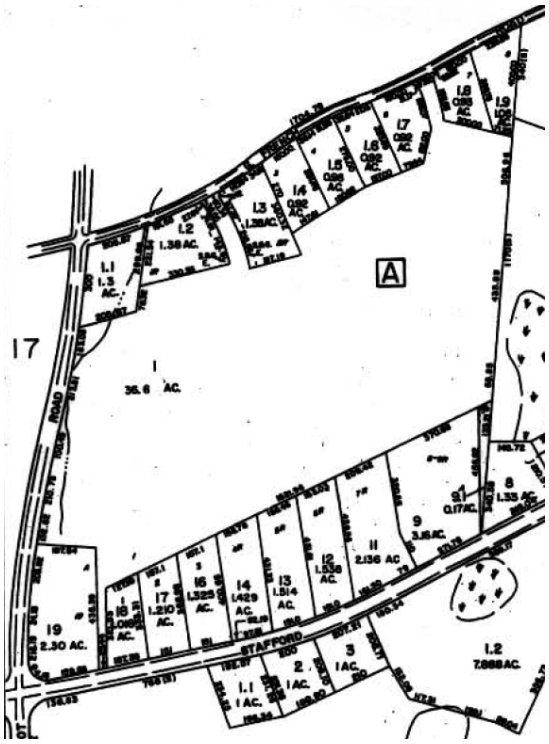


Figure 8: Plot of Land for Elderly Facility Use (Image not to Scale)

Concerning the placement and type of building that is allowed on the lot, there are some dimensional requirements stated in the bylaws. Structures must be at least 25 feet from front of the plot line and no less than 15 feet from either side or rear of the lot. The setbacks can be seen in Figure 9. If there is more than one building there must be a buffer zone of 36 feet between the structures. The structures must not exceed 36 feet in height, which is exclusive of basements. The two buildings from this project must be greater than 36 feet in height because of the pitched roofs, so a variance must be approved and provided by the town of Charlton for this to happen. A full list of these requirements can be found in Appendix B, Section B.4.

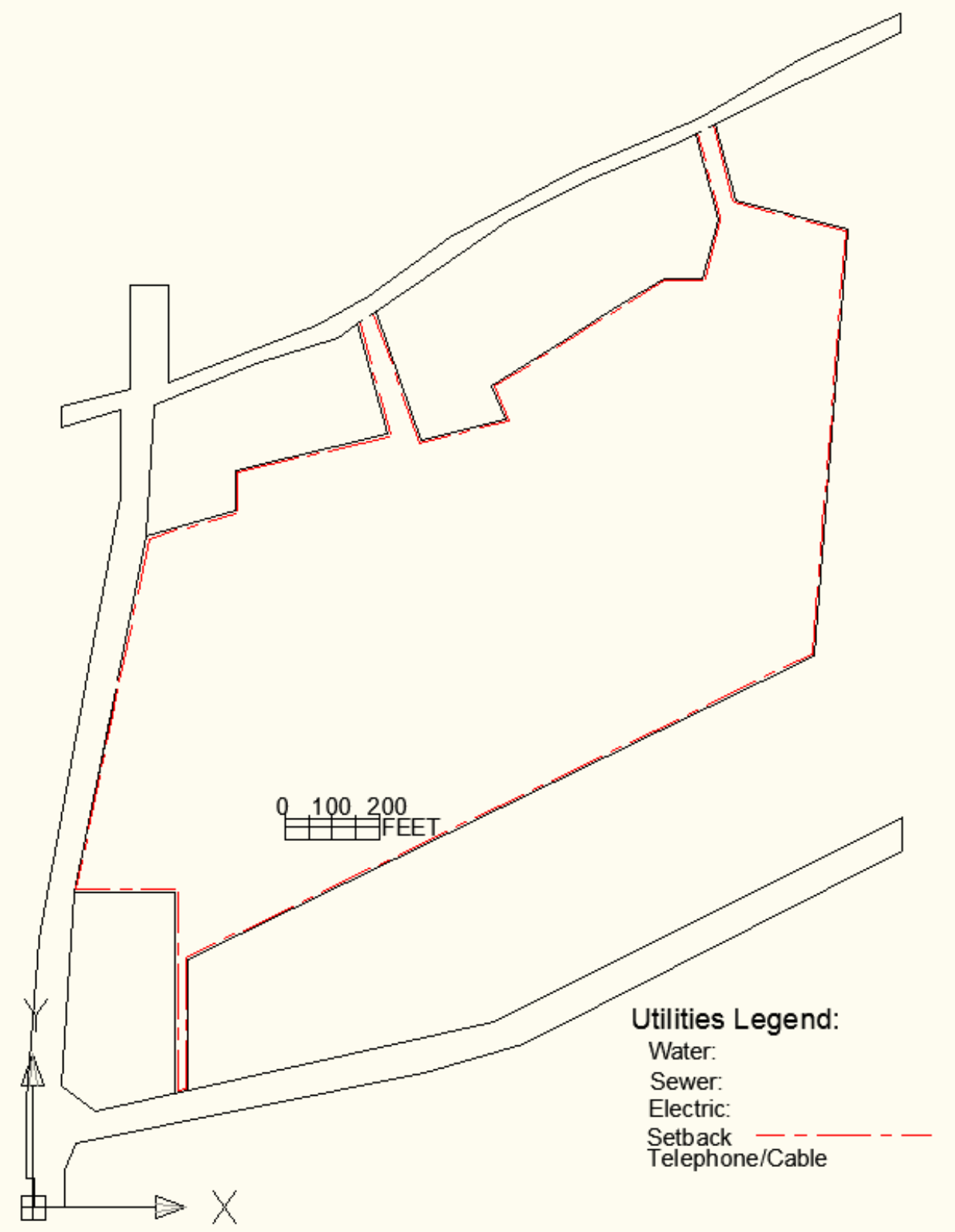


Figure 9: Site Plan Set Backs

For utilities, the site must be hooked up to public sewer and water. In Charlton there is a shortage of the public aspect of both of these because there are a great deal of water wells and septic tanks that are for private use. Fortunately, the site that is to be developed has access to public water from the town of Southbridge and public sewer. If for some reason the public sewer cannot be tapped into directly, it is possible to create a septic system that will eventually connect back to the public sewer system. There is one main issue regarding water demand. A pipe is needed to go uphill due to the landscape and location of the site and consequently there may not be enough flow at a specified pressure to reach the buildings located at the top of the hill. To remedy the problem, a pump station/house is needed to boost the pressure from the water main. The utilities and pump house can be seen in Figure 10.

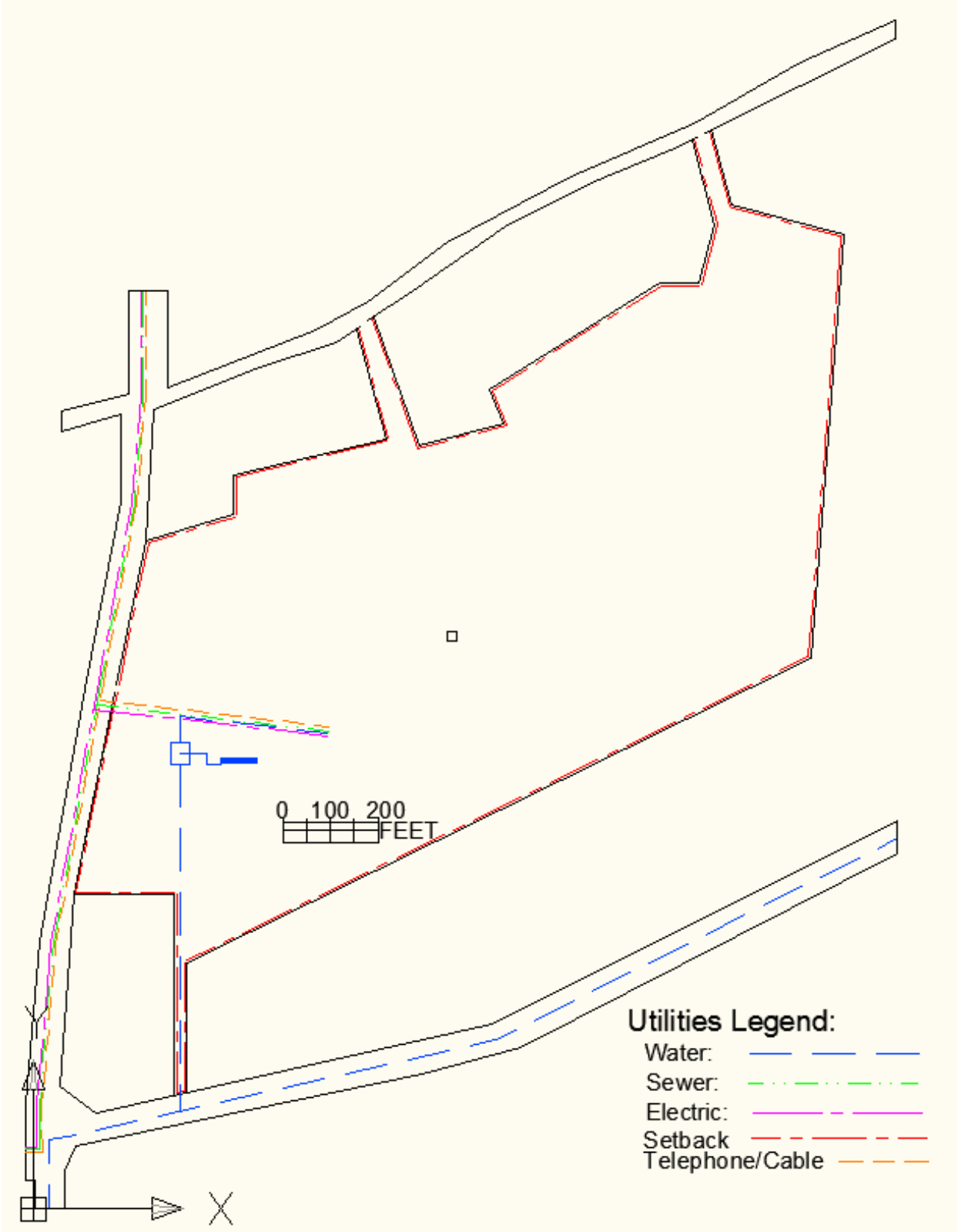


Figure 10: Site Plan Utilities

In the site plan, as shown in Figures 11 and 12, the two buildings are adjacent to each other with walkways connecting the two structures. There are also walkways around each building to accommodate the residents and staff walking areas when exiting from any section of the building. The buildings were located in the middle of the left boundary of the lot (Center Depot Road being considered the front side of the plot). One reason for this location is that is allows the buildings to have easier access to utilities; therefore keeping cost down to a minimum. Another reason for this location was to allow even access to the building from each entry point. The site consists of three entry points; one connected to Center Depot road and two others from East French Road. Each road has access to the parking lot, but the road stretching from East French Road to Center Depot Road can also be used for the main drop off area, ambulance access, and other emergency vehicle access for each building. The two parking lots consist of 100 spaces each, including a total of 20 handicap spaces needed for some of the residents and possible visitors. As an aesthetic addition to the plot, the roads and parking lots are surrounded by beautiful landscaping and include a water fountain between them.

As for the types of dwellings that are allowed in this zoning district, the facility falls within two different categories. One category is the Independent Living Retirement Housing and the other is the Assisted Living Facility. First, as defined in Section 5.11 of the town bylaws, a dwelling unit "shall mean one or more living or sleeping rooms arranged for the use of one or more individuals living as a single housekeeping unit with individual or congregate cooking, living, sanitary, and sleeping facilities, excluding mobile homes and trailers" (Town of Charlton). Requirements for an Independent Living Retirement Housing are that the dwellings must be equipped with a minimum of a kitchen, bedroom, bathroom and living area. These dwellings are more focused toward people who can function independently. For Assisted Living Facilities, a 24 hour staff and private dwellings that include independent kitchens as well as a common kitchen and dining area for the residents are required. These facilities are for adults that have difficulty functioning on their own.

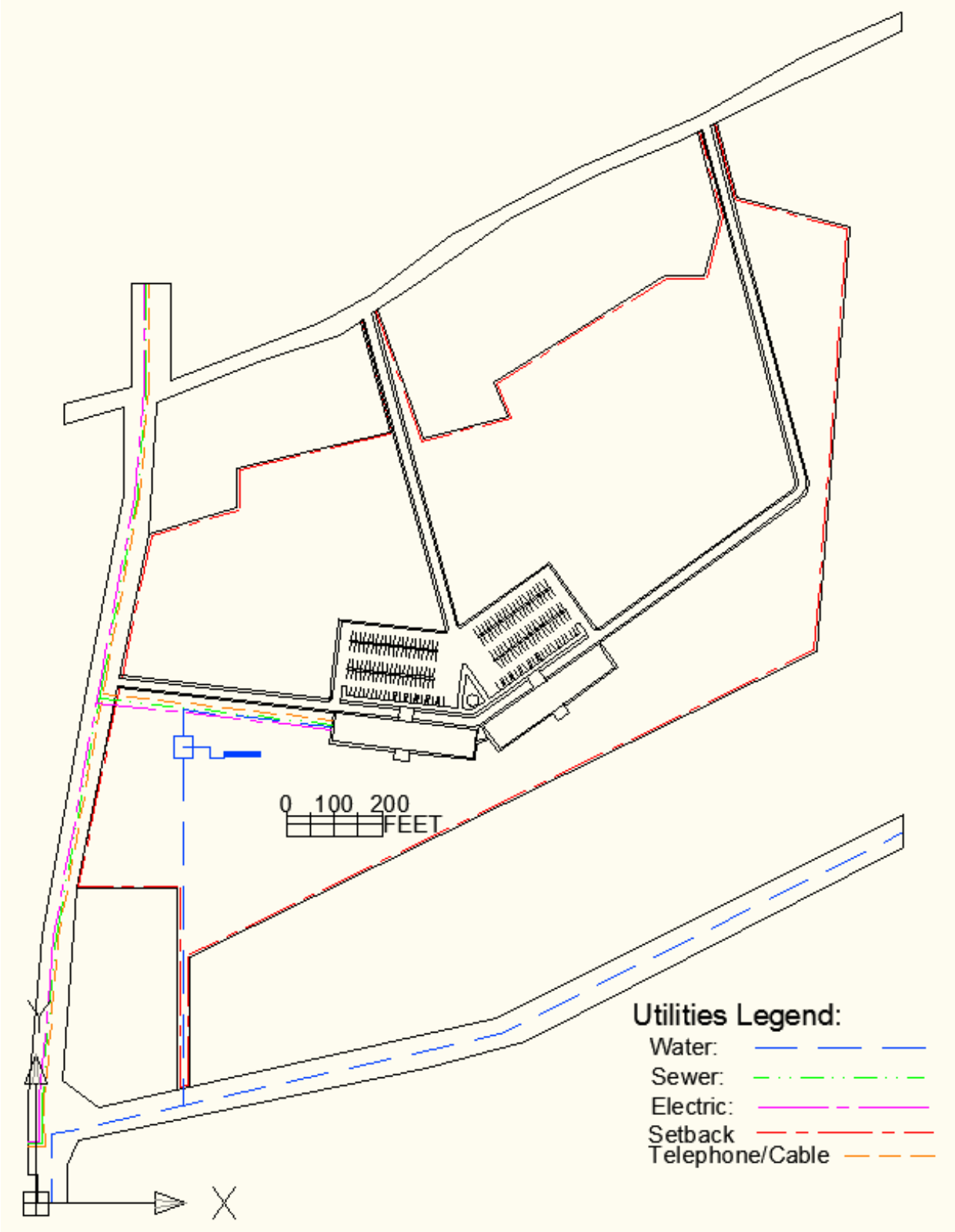


Figure 11: Complete Site Plan

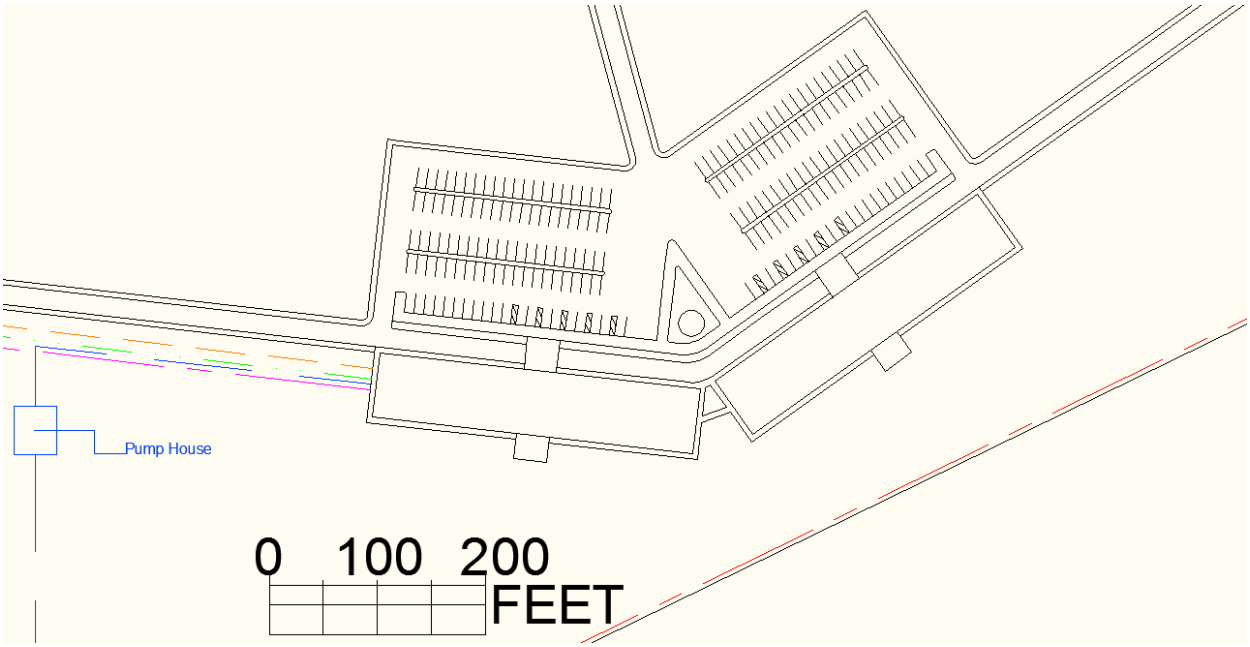


Figure 12: Site Plan Close-up

In order for the Planning Board to grant authority for Senior Living Development Special Permits, there is a certain procedure to follow; which is laid out in the bylaws. Step one is the pre-application phase where applicants are required to show a concept plan designed by a registered professional architect or engineer. The plans must include sites wetlands, topography, soil types and other unique features. Next is the Application phase where a special permit application and development plan must be applied for in accordance to the requirements of the bylaw. After this process the Planning Board may grant the applicant a Special Permit for a Senior Living Development if all the requirements are met and the positives outweigh the negatives for the town.

Chapter 5: Building Plans

The room layouts are a simple rectangular shape, which makes it easier for the steel erection contractor and carpenters because straight walls are easier to construct. Each room satisfies the Massachusetts Building Code and ADA regulations as referenced in Chapter 3. Each room is accommodated with a bedroom, bathroom, living/dining room and a full appliance kitchen. The single rooms, as seen in Figure 13, have three windows and the double rooms, as seen in Figure 14, have five windows to allow the entry of natural light for money savings and a view of the outside for the residents. For the double occupant rooms, the bedrooms are equipped with a large closet for their clothes and storage. For the single rooms, they are equipped with a dresser.

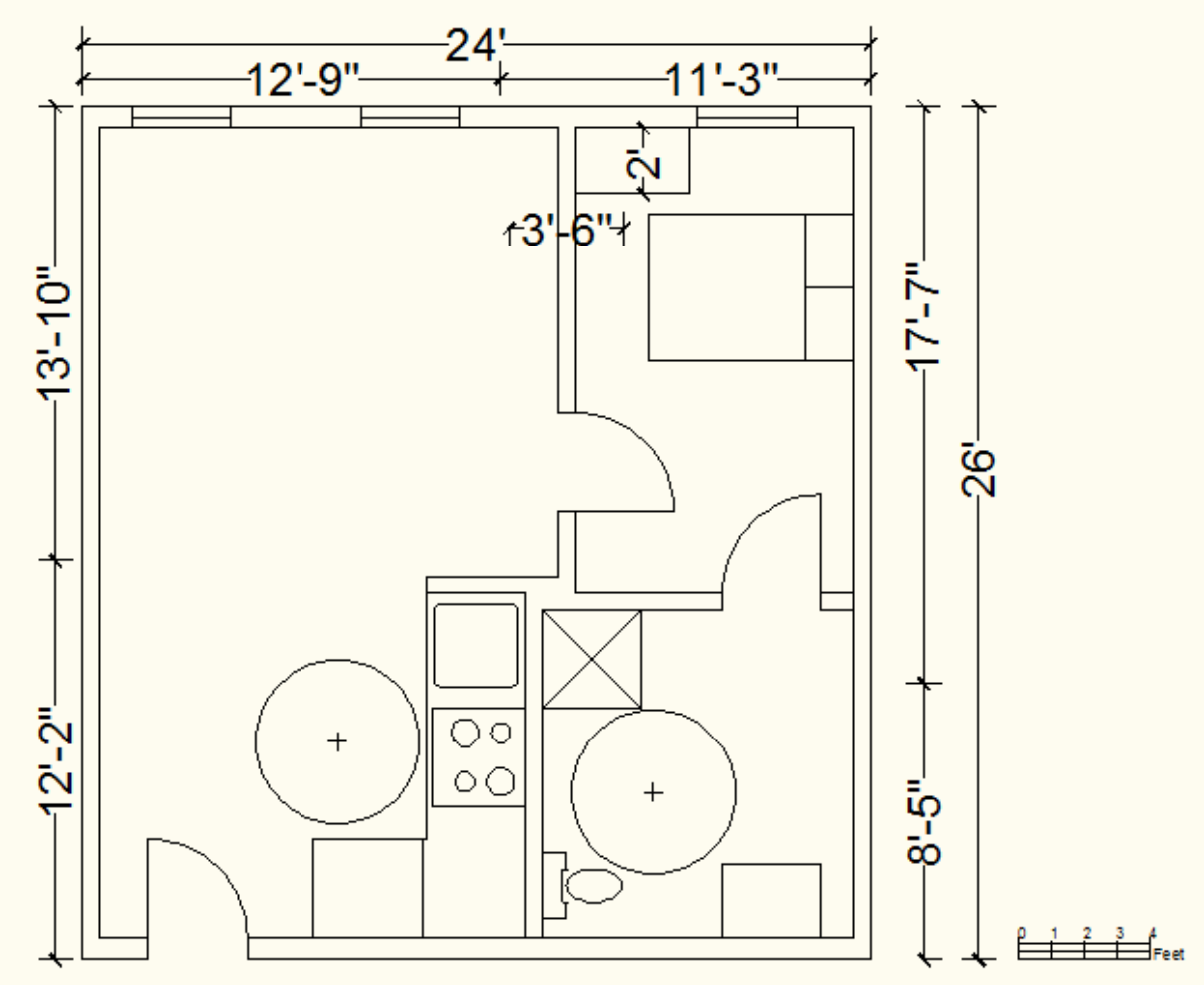


Figure 13: Single Person Living Area

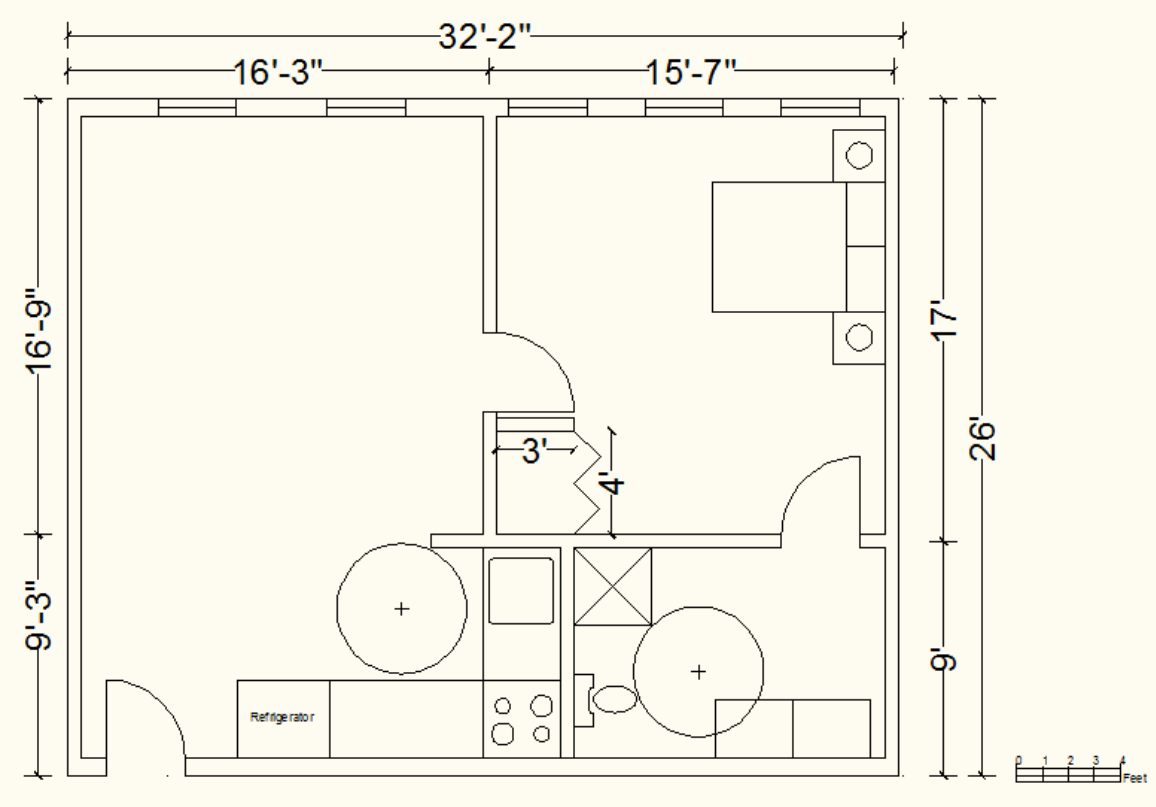


Figure 14: Double Living Area

For the building layout, indicated in Figures 15 and 16, the design was intended for three floors. The design entails the second and third floors being as residential as possible. The first floor must consist all of our fitness, outpatient care, library, and banquet areas. When designing the first floor those non-residential rooms were dimensioned and located in areas that would allow as many residential rooms on that level as possible. For the stairwells, their locations are decided upon by realizing that the travel distance from one end to the other of the building was too far to satisfy egress code requirements so a third stairwell was located in the middle to cut that travel distance in half and make it safer for the people occupying the building. Since elevators are not operational during a fire and people in wheelchairs cannot walk down stairs it was decided that all handicap residents are to be located on the first floor of the building. For extra precaution, an additional door is installed in to each handicap residential area to allow residences with limited mobility to exit the building as quickly and safely as possible.

Room Identification

1	Restroom
2	Kitchen
3	Outpatient Care
4	Library
5	Multi-Use Banquet Hall
6	Mechanical Room
7	Electrical Room
8	Fitness
9	Storage Closet
10	24-Hour Staff Holding
11	Lobby
12	ATM

Table 6: Room Number Identification Table for Figures 15 and 16

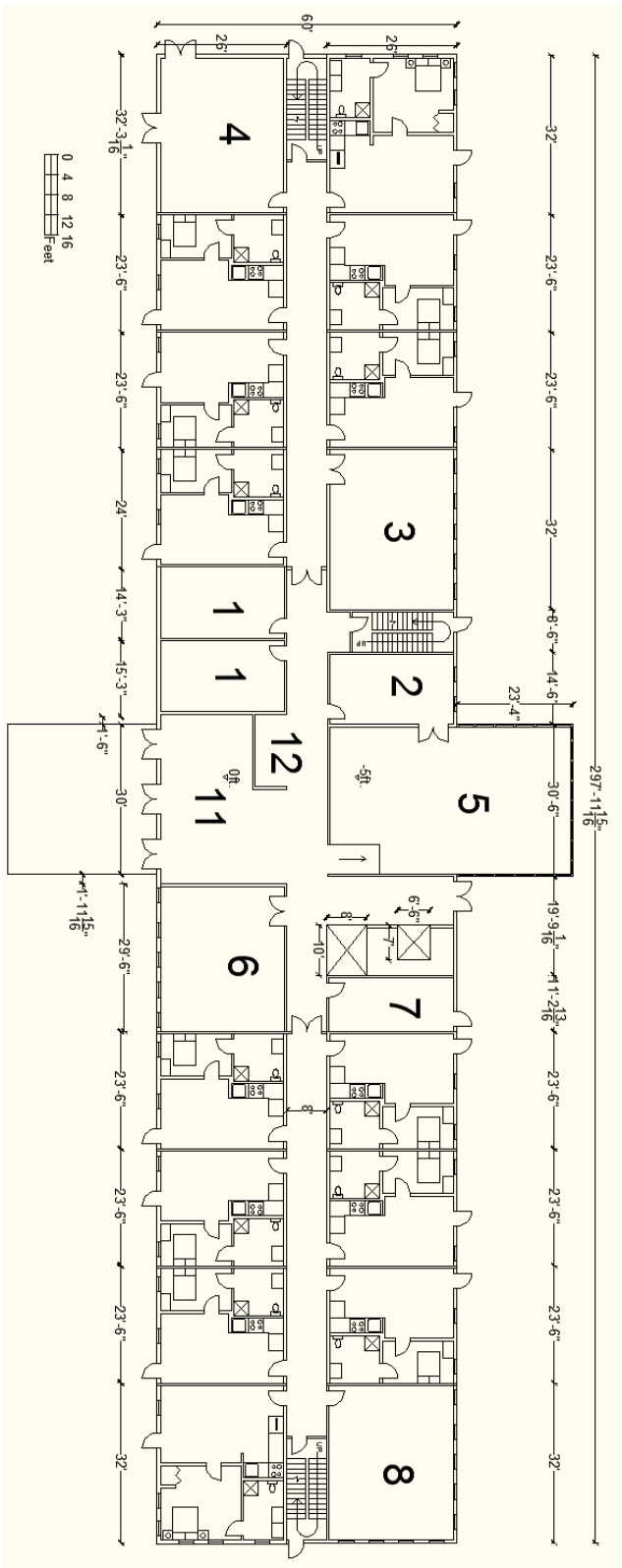


Figure 15: Floor Plan - First Floor

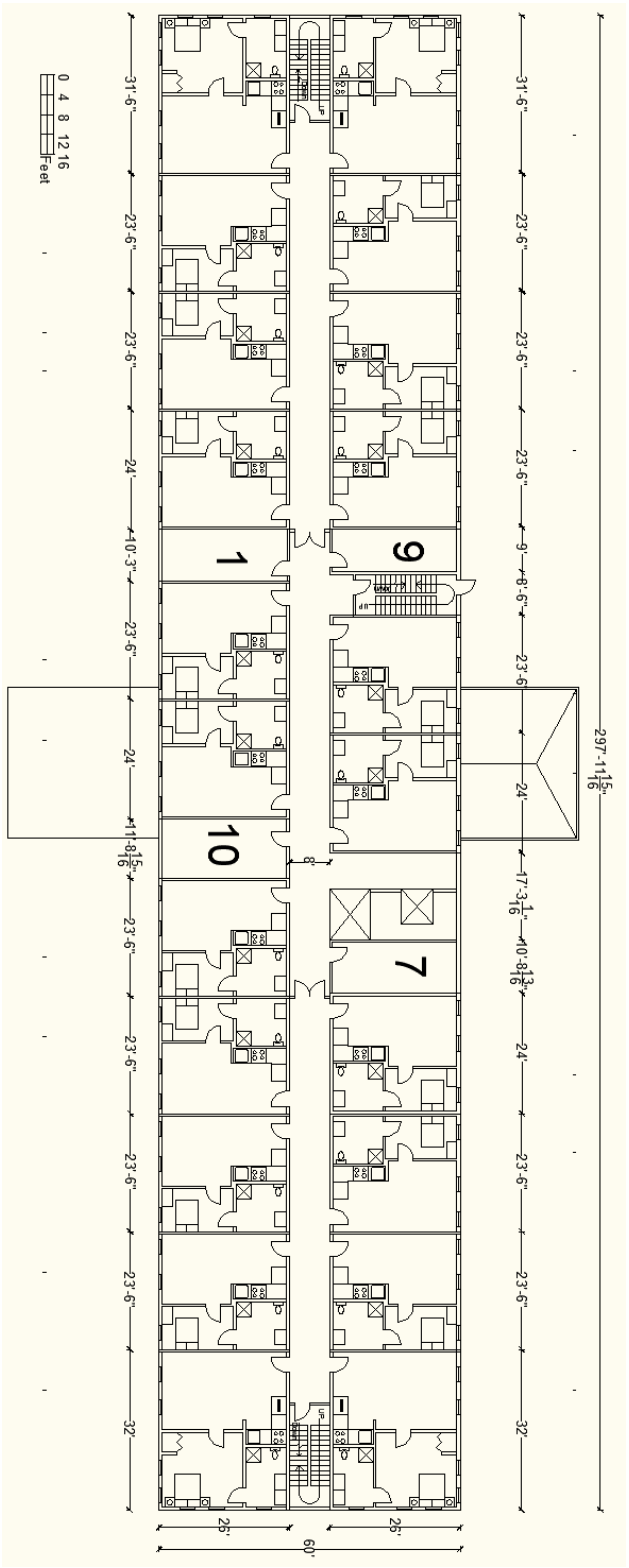


Figure 16: Floor Plan - Second and Third Floor

The structural steel is then designed around the layout of the buildings. The exterior walls consist of 4" Red Masonry Brick and 12" Load Bearing Concrete Blocks, as seen in Figure 19. For the steel construction the concept of structural bays is accomplished by creating similar steel design areas from the first floor all the way to the third floor. This makes the steel erection faster and more efficient. This can be seen in Figures 17 and 18. The Longitudinal beams are W 18 while the beams in the Transverse direction are W16. These beams allow for the necessary yielding strength for the buildings live and dead loads, along with allowing electrical and HVAC conduit and wiring running above the drop ceiling (Figure 19).

In Figure 19 the roof trusses are constructed with W 10 beams around the exterior of the frame and HSS 6 X 5 X ½ Tubular Steel. The roof structure will resist any wind and snow loads, along with holding the dead load of the asphalt shingles, ¼" plywood, and Batt insulation. Figure 19 also shows the reinforced spread footing which holds the W 8 columns for the steel structure of the buildings.

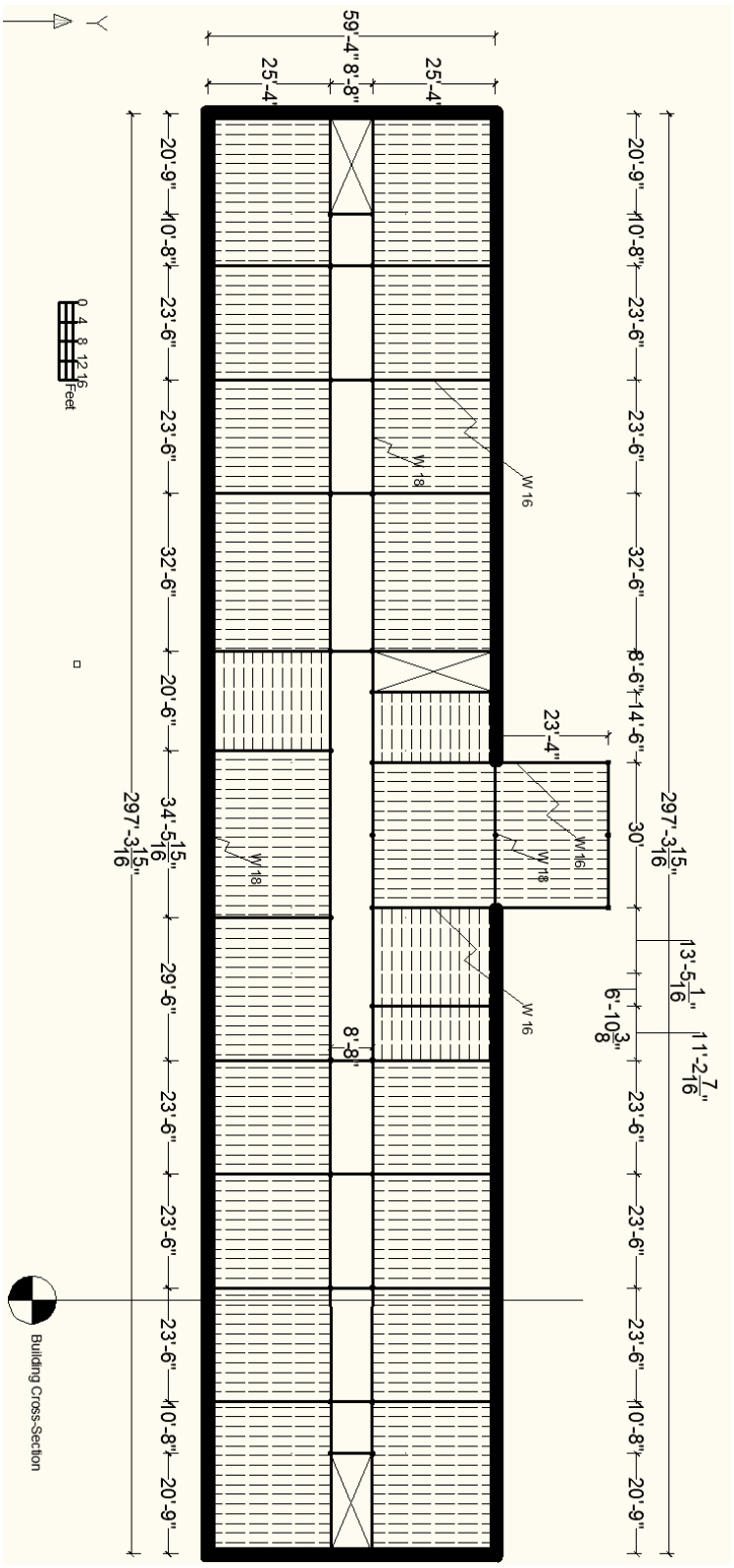


Figure 17: Structural Element Layout for First Floor

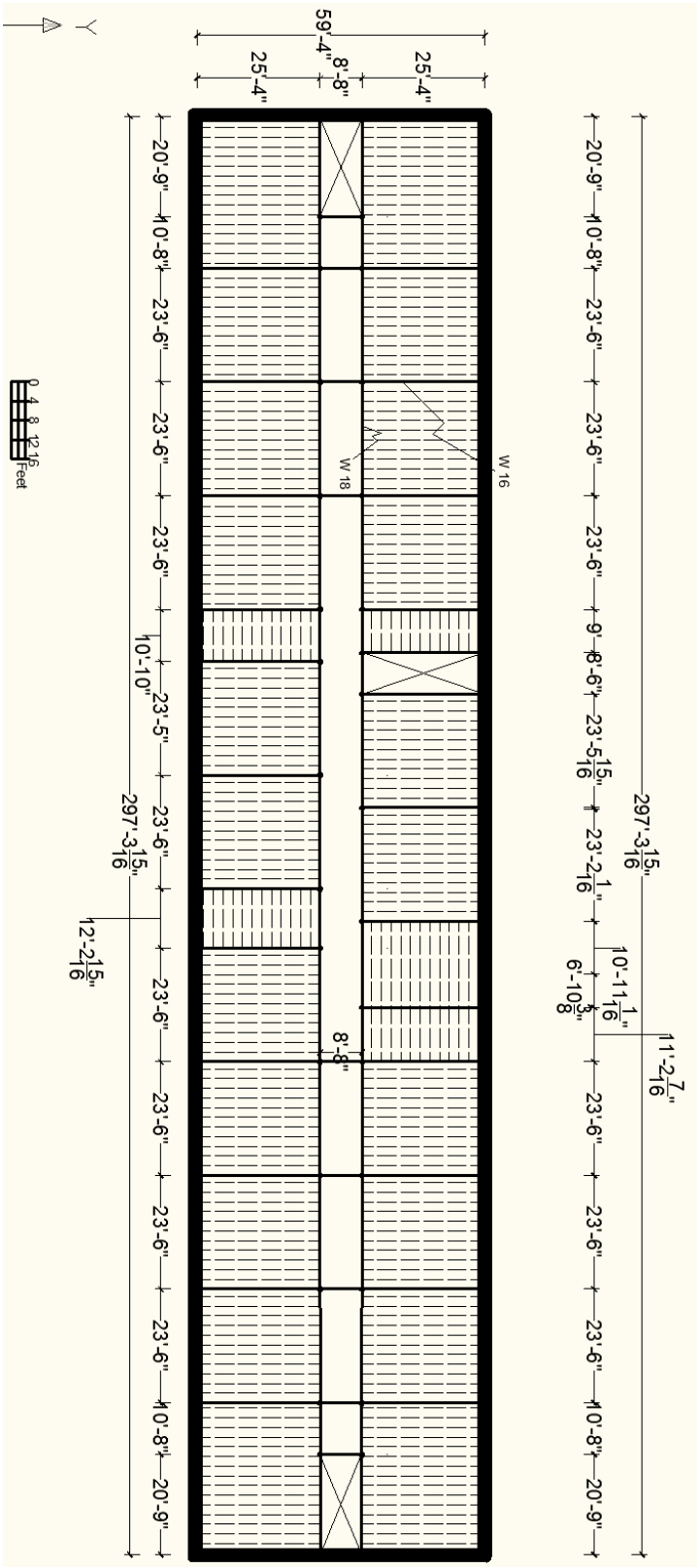


Figure 18: Structural Element Layout for Second and Third Floor

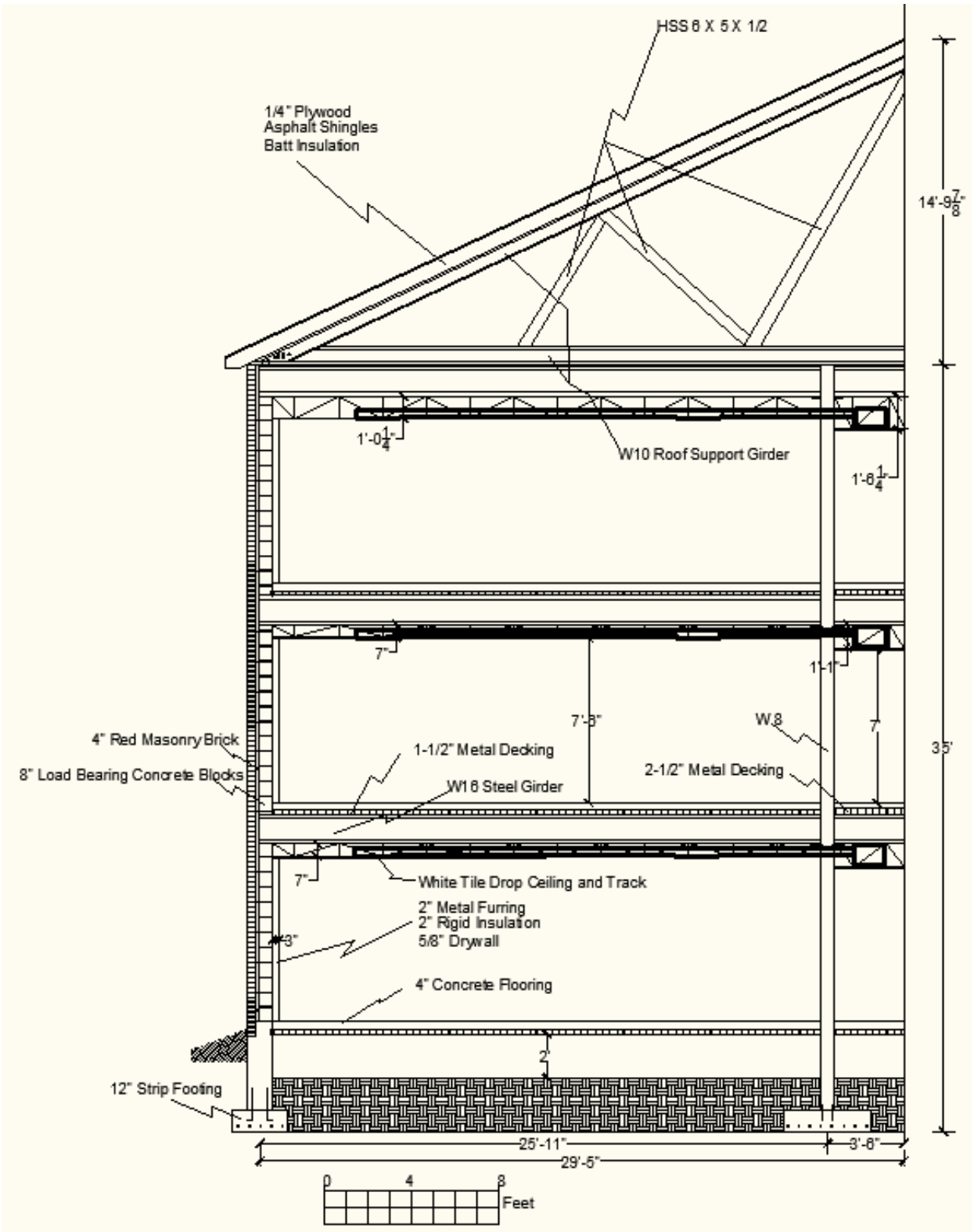


Figure 19: Building Cross-Section

Chapter 6: Building Specifications

This chapter illustrates the building specifications for the elderly facility. The specifications provide information about dimensions and types of materials to be installed in the buildings. The RS Means Assemblies Cost (2005) literature assisted with the assembly breakdown of the specifications. An assembly is a grouping of different construction components that are placed together to create a single construction item (i.e. an interior wall partition assembly consists of metal studs, insulation, and drywall components). The specifications are broken down into twelve divisions: Sitework, Foundation and Structural Work, Exterior Wall, Roof, Interior Construction, Interior Finishes, Conveying Systems, HVAC, Plumbing, Fire Protection, Electrical, Specialty Construction). This breakdown corresponds with the twelve divisions of the Uniformat classification from the literature, Managing the Construction Process. The Uniformat classification is commonly used in assembly cost take-offs because it allows for a faster and more accurate estimate; especially in the early stages of design.

6.1 Specifications

Site Area: 36 Acres with medium density trees and miscellaneous shrubs.

Building Gross Area: Two Buildings @ 53,640 Square Feet Each

- 45 Single Rooms per Building
    - 11 Singles Rooms are located on the First Floor and are handicap accessible.
- 10 Double Rooms per Building
    - 2 Double Rooms are located on the First Floor and are handicap accessible.

Floor to Ceiling Height: Corridors are 7’-0” and the living areas are 7’-6”.

1. **Sitework**:
    1.1. Site clearing involves removing certain areas of trees and shrubs.
    1.2. Along with leveling the site to prepare it for construction.
    1.3. Provide and 6’ chain link temporary fence around the entire plot of land.
    1.4. Provide three roads at 20’ wide (10’ per lane) and 5” thick to facility. Two roads will be connected to French Road and one to Centre Depot Road. The roads will consist of Bituminous Concrete with a gravel base.

1.5. Cape Cod berm, with dimensions of 12” wide and 3” high, must run along the sides of each road.

1.6. Provide parking lot for 200 cars (20 being handicapped). The area consists of 6” Bituminous Concrete and a 6” gravel base.

1.7. Cape Cod berm, with dimensions of 12” wide and 3” high, must surround the exterior of the parking lot.

1.8. Provide Concrete walkways around each building for pedestrian access and mobility. The walkways will be 4’ wide with 4” of concrete on top of a 4” gravel base and follow the exterior of the buildings and connect the two building walkways together.

1.9. Provide landscaping with mature trees along each roadway to the facility and any other areas noted by the owner.

1.10. Provide Sewer to each building. The sewer will be connected to the Town of Southbridge sewer system along Centre Depot Road.

1.11. The proper excavation must be completed for the insertion of the sewer conduit. Each trench is 4’ wide with an 8’ depth and a 2:1 slope.

1.12. Provide Water to each building. The water will be connected to the Town of Southbridge water system along Stafford Street.

1.13. Each trench is 4’ wide with an 8’ depth and a 2:1 slope. The existing Pump House shed (seen on the site plans) will receive the flow from the water main to boost up the pressure to be sufficient enough to supply the requirements of the systems in both buildings. The proper excavation must be completed for the insertion of the water conduit.

1.14. Provide Electricity (this includes telephone and cable) to each building. The Electricity will be connected to the Town of Charlton electrical power along Centre Depot Road.

1.15. Each Electrical trench is 4’ wide with an 8’ depth and a 2:1 slope.

1.16. Provide necessary excavation for the insertion of footings and the foundation wall for the buildings. For exact location of excavation areas, please refer to the site layout plans.

2. **Foundation & Structural Work**:

2.1. Foundation consists of concrete strip footings steel reinforcement, at 2’-8” x 1’ thick.

2.2. Foundation consists of concrete spread footings with reinforcement at 4'x4'x1'.

2.3. Provide a reinforced concrete foundation wall that is 8" thick by 4' in height.

2.4. Provide waterproofing for foundation wall.

2.5. Structure is three floors of unprotected steel columns, beams and girders (W18 and W16 steel beams will be used), 1-1/2" metal decking, open web bar joists, 4" concrete slabs and with typical 30' x 30' bay size.

2.6. The elevator shafts are constructed with 12" concrete blocks, fire rated at 2 hours.

2.7. The stairway walls are constructed with 12" concrete blocks, fire rated at 2 hours.

2.8. Three (3) sets with 12 risers and landings will give access at each end and at the middle of the building for emergencies. The stairways should be equipped with a 2-hour fire rating.

2.9. The skeleton of the building will consist of unprotected W8 columns.

3. **Exterior Wall**:

3.1. Masonry façade to be constructed of 4" brick veneer that will not bear any load and 8" concrete blocks, which are to be load bearing. Attached to the concrete blocks will be 2" furring to accommodate for the 2" Owen Corning R-19 rigid insulation and installation of 5/8" drywall.

3.2. Double Hung punch windows are 3'x4' Pella Windows.

3.3. Provide a curtain wall on the exterior wall of the Multi-Use Banquet Hall. The dimensions of the curtain wall are 23'-4" X 30'-6" at a height of 4'-6".

3.4. Exterior Doors. Provide 8 units of all glass doors with aluminum frames at 3'x7' equipped with panic hardware. These doors will be located at the entrance, and at the exit of the elevator lobby.

3.5. Provide 12 units of all glass doors with wood frames from all first level handicap rooms.

3.6. Provide 7 units of aluminum partial window doors at 3'x7' with a two (2) hour fire rating and equipped with panic hardware. These doors will be located at all the stairways.

4. **Roof**:

4.1. Roof Structure. The main roof will be pitched at a 30 degree angle and be constructed with HSS 6 X 5 X ½ tubular steel trusses. The main roof will be covered with asphalt shingles, ¼" plywood with tar paper, and Owens Corning R-50 fiberglass rigid insulation. The roof will be equipped with gutters and downspouts.

4.2. Multi-Use Banquet Hall pitched roof will be angled at 30 degrees and covered with asphalt shingles, ¼" plywood with tar paper, and Owens Corning R-50 fiberglass rigid insulation. The roof will be equipped with gutters and downspouts.

4.3. Over-Hang flat roof will be covered with metal decking and single ply roofing.

5. **Interior Construction**:

5.1. Partitions are to be constructed with 4" metal framing, 5/8" drywall, and Owens Corning R-19 batt insulation. Green board will be used in area that moisture may be present (i.e. bathrooms and kitchens). Blue board will be present were plaster and paint will be applied (hallways). White board will be present were just paint is present (residential and other interior space where no moisture should be present).

5.2. For all public areas and private rooms, ceilings will consist of 2'x2' white drop ceiling tile with white metal tracking. The floor to finished ceiling height should be 7' in all hallways and 7'-6" in all private rooms.

5.3. Interior Doors. Provide wood veneer doors with Medium-Density Fiberboard (MDF) core at 3' x 7' per building. The doors are required to have a 2-hour fire-resistance rating.

5.4. For Public Restrooms provide 6' height toilet partitions, 4' steel grab bars, and 2' x 3' mirrors.

6. **Interior Finishes**:

6.1. Floor Finishes will consist of carpeting, laminate tile, hardwood, and rubber matting.

6.2. Lobby, hallways, resident's bedroom and living rooms, library, and ATM will consist of "All Square" carpet tiles.

6.3. Public and private bathrooms and kitchens, out-patient care, mechanical room, storage rooms, and 24-hour staff holding will consist of tile.

6.4. Tile pattern and color is to be DuPont Crema Terracotta. Multi-Use Banquet hall will consist of hardwood flooring. Type of hardwood is to be Jasson Brazilian Tigerwood.

6.5. Fitness center will consist of rubber matting.

6.6. All interior walls will be primed and painted. Benjamin Moore paint color is to be approved by the owner.

6.7. Residential Rooms. Bathrooms and kitchens will consist of granite veneer counter and table tops. Wood laminate casework will be present in the kitchen, bathroom, and bedroom (cabinets and dressers).

7. **Conveying Systems**:

7.1. One Passenger elevator at 6'-6" x 7'-0" one freight elevator at 8'-0"x10'-0" per building. The passenger elevator will be able to withhold 3,000 pounds.

7.2. The freight elevator will be able to withhold 10,000lb. As a typical Freight Elevator. The elevator shafts are to be constructed with 12" concrete blocks.

8. **HVAC**:

8.1. Provide central heating and cooling in all rooms and corridors. The required BTUs are TBD.

8.2. The central heating and cooling will be powered electrically. For central heating and cooling, the electricity will power an Air Handling Unit that will ventilate the hot and cold air through the duct work throughout the buildings. The number of Air Handling Units will be determined by the Engineer. Each residential room with be supplied with a thermostat so the residents can control the temperature themselves. The Fitness, Out-Patient Care, Mechanical, Multi-use Banquet Hall, and Library will also be supplied with individual thermostats. The Corridors, Restrooms, Stairways, and Lobby will be on the same thermostat system.

9. **Plumbing**:

9.1. Plumbing rough-ins and fixtures will be supplied in all bathrooms and kitchens in the buildings.

9.2. All rough-ins are to be constructed with copper piping. All the bathrooms must be roughed for sinks, toilets, stand-up showers (in residential bathrooms), and urinals (in public Men's Restrooms). Residential kitchens must be roughed for sinks, dish washers, and refrigerator. The main kitchen must be roughed for industrial sinks, dishwashers and refrigerator.

10. **Fire Protection**:

10.1. Sprinklers are to be present throughout the buildings that will be supplied via a fire pump.

10.2. Standpipes are located in the stairwells that will be supplied via a fire pump.

10.3. Fire pump located in the Mechanical Room will supply all sprinklers and standpipes.

10.4. Fire extinguishers are located on every floor in locations that satisfy the fire code.

10.5. Fire Alarms and smoke detectors are located in every room in the buildings.

10.6. The placement and quantities are to be determined by the Engineer.

11. **Electrical**:

11.1. Electrical power supply throughout both buildings. The amount of electrical power needed will be determined by the Engineer. The Electrical rough-ins are supplying the central heating and cooling system, lights, kitchen appliances (main and residential kitchens), circuit breakers, fire alarms and detectors, and any necessary power outlets.

11.2. There will also be an emergency generator system to power the building in case of a power outage.

11.3. The electrical outlets are duplex receptacles with 120V grounded at 4 receptacles per 1000 SF and wall mounted.

11.4. The electrical switches are wall mounted and are 2 switches per 1000 SF.

11.5. The light fixtures in the public areas are Type C fluorescent fixtures that are 2'x4' and are recessed in the acoustical ceiling. There are 11 fixtures per 600 SF.

11.6. The light fixtures in the residential areas are Type D incandescent fixtures that are cylinder and recessed in the acoustical ceiling. There are 39 fixtures per 400 SF.

11.7. The fuse box is a 100A fused box that is 60 HP and 575V.

12. **Special Construction**:

12.1. Furniture:

12.1.1. Residential Bedrooms:

- Bureau
- Full size (Single rooms) or Queen size bed (Double rooms)
- Residents may supply their own bedroom furniture.

12.1.2. Residential Living Room:

- Table and chairs
- Television
- Couches

Residents may supply their own living room furniture.

12.1.3. Residential Kitchen:

- Aluminum sink and faucet to match sink and countertop.
- Electric stove
- Refrigerator
- Microwave
- Dishwasher

12.1.4. Residential Bathrooms:

- Porcelain Toilets
- Porcelain Sink (His and Her sinks in the double rooms)
- Stand up Shower
- Above sink mirror
- Towel rack

12.1.5. Public Restrooms:

- Porcelain Toilets (urinals in Men's Restrooms)
- Aluminum Sinks
- Above sink mirrors
- Paper towel dispenser
- Soap dispenser

12.1.6. Main Kitchen:

- Aluminum industrial sinks
- Aluminum industrial dishwasher.
- Aluminum countertops
- Aluminum industrial convection oven
- Aluminum stove
- Microwave

12.1.7. ATM

- Local Bank ATM (serviced by the banks employees)

12.1.8. Fitness

- Treadmills
- Elliptical
- Weightlifting machines
- Sitting benches

12.1.9. Out-Patient Care

- Medical tables
- Privacy curtains
- Desks and chairs
- Computers
- Health monitoring equipment
- Emergency health equipment

12.1.10. Library

- Book shelves
- Books
- Tables and chairs
- Desk
- Computers

12.1.11. Multi-Use Banquet Hall

- Tables and chairs
- Televisions
- Projection screen
- Projection equipment

12.1.12. 24-Hour Staff Holding

- Beds
- Television
- Table with chairs

12.1.13. Laundry Room

- 3 washers and dryers
- Shelving

6.2 Conclusions

The building specifications clarify any assumptions about the project and refer to the RS Means Assembly Cost (2005), which is broken up into seven different sections: substructure, shell, interiors, services, equipment and furnishings, special construction, and building sitework. To make the specifications more organized, the seven sections of the Assemblies Cost Data were

divided into a total of twelve smaller segments. This division made the specifications more practical and easier to follow. These specifications are the basis for constructing the cost estimate. In the next chapter, the specification coding is translated to the cost estimate for assurance that no object or assembly is lost and to assist in an accurate cost estimate for the facility.

Chapter 7: Cost Estimate

Cost estimation was derived from using the RS Means Assembly Cost Data book (2005). To make the process of cost estimation more organized and accurate, our group used the same twelve divisions from the specifications. The items and prices are encompassed by a great deal of assumptions including the steel member size used in the roof structure, material type of certain interior finishes (residential furniture and countertops), conduit size for building utilities, etc.

After the raw estimate was complete, the addition of general requirements (17%), fees (5%), contingencies (5%), and inflation (13%) were added into the cost. This is shown in Table 7 which breaks down the pricing per specification section. The general requirement percentage covers documentation in office costs and cost of site office. The fee percentage covers the project overhead. The contingency percentage accounts for any cost that is lost due to acts of God. Inflation percentage accounts for the use of the 2005 edition of the RS Means Assemblies Cost Data book in the year of 2010. Finally, the cost was compared to a Quick-Cost estimate on the RS Means website. It was found that the calculated value of a nursing home in the Worcester County area with an area of 107,280 square feet for two buildings has an approximate price of $20,400,000. This can be compared to the project cost of approximately $20,843,000 and the breakdowns of costs are referenced in the spreadsheet located in Appendix E, Section E.1. Since the project cost of the elderly facility is a small percentage over the estimated price, it shows that our group estimate is valid.

Section	Description	Total Cost
1	Sitework	$1,581,810.89
2	Foundation and Structural	$2,154,207.16
3	Exterior Wall	$2,366,890.60
4	Roof	$143,426.74
5	Interior Construction	$977,164.60
6	Interior Finishes	$1,503,347.12
7	Conveying Systems	$459,000.00
8	HVAC	$472,032.00
9	Plumbing	$370,600.00
10	Fire Protection	$355,501.00
11	Electrical	$2,766,317.60
12	Special Construction	$1,424,776.20
	Subtotal	$14,575,073.91
	Inflation (13%)	$1,894,759.61
	General Requirements (17%)	$2,477,762.56
		$18,947,596.08
	Fee (5%)	$947,379.80
	Construction Contigency (5%)	$947,379.80
	Grand Total	$20,842,355.69

Table 7: Price by Specification Section

Chapter 8: Project Scheduling

This chapter describes the time scheduling process as well as any variations from the specifications. RS Means Building Construction Cost Data (2006, 64th Annual Edition) was used for the time scheduling of the project. It includes sixteen divisions: General Requirements, Site Construction, Concrete, Masonry, Metals, Wood and Plastics, Thermal and Moisture Protection, Doors and Windows, Finishes, Specialties, Equipment, Furnishings, Special Construction, Conveying Systems, Mechanical, and Electrical. However, the project scheduling was taken off in the twelve-division Uniformat. This format is used for major building elements while compared to the Masterformat which uses a more detailed breakdown of building elements. These differences account for varying units of measurement and can be observed from Appendix F, Section F.1 as well as in the quantities for all activities for scheduling. Through research, it was discovered that seven important categories of work for the building process can be used for an appropriate time schedule because of its simpler organization and practicality. These seven categories were obtained through the use of the twelve-division Uniformat and consist of Site Preparation/Site Setup, Foundation, Superstructure, Enclosure, Interior Construction, Furniture-Fixtures-Equipment (F, F, and E), and Paving/Landscaping components. The seven categories contain one or more divisions from the Uniformat and can been seen from Appendix F, Section F.1.

8.1 Site Preparation and Setup

Site Preparation and Site Setup refers begins the project construction aspect and allow following construction activities to begin. Site Preparation is expected to begin with perimeter fencing around the property using a standard 6 foot high chain link fence. This was chosen because it offered the lowest setup duration. Once the fence has been erected, the necessary equipment can be moved in to finish the Site Preparation. Site clearing has been planned to begin once fencing has been established and includes the removal of medium shrubs to trees. Once the specified area has been cleared, site grading and site setup can begin. Site setup will include the move in of trailers and temporary utilities and bathroom facilities. (Reference Specification Sections – 0.1, 0.2, 1.1, 1.2)

8.2 Foundation Work Specification

Once all site work has been completed utility and foundation excavation can begin. Unlike the Assembly Cost data in which measurements are done in linear feet, the Building Construction Cost Data is taken off in cubic yards of excavation and necessary calculations and conversions can be found in Appendix F, Section F.1. All excavation will be done with a three cubic yard capacity backhoe loading earthwork into a tri-axle truck to be hauled away because this offered the lowest duration in time to complete all excavation. Utility excavation will be trenched for the installment of sewer, water, and communication supply lines. Foundation excavation will consist of one large plot of earth to be excavated for the installment of spread and strip footings as well as the foundation wall. Unlike the Assembly Cost, where spread footings are calculated per each footing and strip footings and foundation walls are done per linear foot, Building Construction Cost Data takes off spread and strip footings in cubic yards and foundation walls in square feet. The necessary calculations and conversions can be found in Appendix F, Section F.1. From RS Means BCCD, all foundation work will include formwork, reinforcement, concrete, and placement. Once concrete work is finished, waterproofing will be adhered to foundation walls. RS Means BCCD is taken off per square foot, which differs from the RS-Means ACD take off that is done per linear foot. All necessary calculations and conversions can be found in Appendix F, Section F.1. (Reference Specification Sections – 1.9, 1.10, 1.11, 1.12, 1.13, 1.14, 1.15, 2.1, 2.2, 2.3, 2.4)

8.3 Superstructure

Once the foundations are complete, the superstructure can begin undergoing construction. The first activity will include the erection of steel. Unlike the ACD, which takes off steel erection per vertical linear foot, the BCCD takes off steel in per ton of weight. To calculate this, the reference section was used from the BCCD to approximate the number of pounds per square foot of steel needed to erect the buildings (8 pounds per square foot). Once the steel has been erected, the installment of the floors can begin.

The ACD takes off the floors as a whole unit which includes metal joists, metal decking, concrete slab forms, reinforcement, and concrete slabs. However, with BCCD, the floors needed to be taken off as individual activities. The differences between the two can be seen from

Appendix F, Section F.1. Once the floors have been installed the roofs and stairs can be installed. The main roof and banquet hall roof were taken off with steel trusses in the same fashion as the steel beams. The overhang was taken off per square feet of metal decking. Unlike the ACD, the BCCD activities for the roof needed to be broken up, and the units needed to be calculated and converted for the scheduling. Once the trusses and decking have been installed the rest of the roof will be installed. An average type of truss was used for the construction of the roofs since no truss was specified or calculated. The roof for the main building and banquet hall consist of plywood (done per square foot), tar paper (done per square), and asphalt shingles (done per square). The flat roof overhang consists of a single ply membrane (done per square). The weight calculations were obtained in the reference section of the BCCD. The stairs to be installed include handrails according to the BCCD. While the roofs are being constructed the elevator and stair shafts will be constructed. Once the installment of the elevators is completed the elevator shaft will then be done. (Reference Specification Sections – 2.5.1, 2.5.2, 2.5.3.1, 2.5.3.2, 2.5.3.3, 2.7, 2.8, 2.9, 4.1.1, 4.1.2, 4.1.3, 4.1.4, 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.3.1, 4.3.2)

8.4 Enclosure

As the superstructure activities are completed, construction can move on to the enclosure of the building. To begin construction of enclosure, scaffolding will be set up around the building for the installment of the exterior walls. This activity will be taken off per hundred square feet of exterior wall. Once scaffolding for the building has been completed, the exterior wall can then be started. The use of an exterior wall activity that included face brick, blocking, reinforcement, and wall ties was used in order to save time for the project. While the activity of installing the exterior wall is being done, the installment of windows and exterior doors can be started with a delay from the bricklayers in order for work to be provided. After the exterior wall is completed, the curtain wall will begin construction. While this activity is underway the installment of roof insulation, gutters and downspouts can also begin construction. (Reference Specification Sections – 2.6, 3.1.1, 3.1, 3.2, 3.3, 3.4, 3.5, 3.6, 4.1.5, 4.1.6, 4.1.7, 4.2.5, 4.2.6, 4.2.7, 7.1, 7.2)

8.5 Interior Construction

Only after the enclosure of the building can interior construction begin. This is because most activities are weather sensitive and must be protected from these elements. This is important to the project since of its location. The New England area is known for its harsh winters with storms and this is why it is important to get the enclosure finished before mid-November. Construction will begin with the installment of the HVAC galvanized steel ductwork with is to be taken off in pounds unlike the ACD method that is taken off in square feet. To calculate the linear footage of ductwork needed for the building, the group assumed that two ducts ran the length of the building in the central corridors at an average of 15 linear feet per room. Once these calculations were obtained, the reference section from the BCCD was used in order to obtain a weight of 10 pounds per linear foot of ductwork. The installation of the partition systems had to be broken up by activity according to the BCCD, unlike the ACD where partitions included all activities. While the ductwork is underway the installation of metal studs can begin construction. For this activity it is assumed that metal studs will be 16 inches on center. After the metal stud activity has progressed the installation of all interior applications can begin.

The installation of all plumbing and electrical rough-ins will begin after HVAC work is completed. The assumption that the project will need 346 plumbing rough-ins and 645 electrical rough-ins will be needed. This assumption was made due to not having the proper knowledge and details to obtain a proper take-off of rough-ins needed. For this activity, it is also assumed that one worker complete 64 rough-ins per day. After rough-ins is completed, the installation of the fire pumps and emergency generator systems can begin. The installation of standpipes will be connected once the fire pumps have been installed. Sprinkler head installation will begin following the standpipes. However, in ACD the sprinkler heads are taken off in square feet, which differ from the BCCD where it is done per each sprinkler head. This lead the group to assume that a need for 1000 sprinkler heads between both buildings was needed for the project. This assumption was made based on knowledge of approximate sprinkler spacing for square footage and occupancy use. After these activities are completed the construction of the partitions can start. This will begin with the installation of drywall to metal studs following the task of insulating all walls. After partitions are completed, painting can commence. While painting is

underway the installation of ceiling grid and tiles as well as fire and smoke alarms can begin being installed. It is assumed that a total of 206 fire and smoke alarms will be needed. Installation of 18" x 18" HVAC diffuser can begin installation following the completion of the ceiling. It is assumed that each room will consist of four diffusers while the hallways will consist of two diffusers per section and the banquet hall having eight.

Once painting is complete, electrical finishes can be installed to the building. It is again assumed that 645 electrical finishes will be needed as well as one worker able to install 64 per day. This same assumption was made off the prior assumption of electrical rough-ins. Flooring and bathroom mirrors can begin installation once the diffusers have been completed. This activity includes carpet, tile, hardwood, and rubber matting flooring. After flooring has been completed, the installation of bathroom partitions and millwork will begin. According to BCCD all bathroom partitions will include grab bars. Following completion of partitions and millwork the installation of public and private bathrooms can begin installation. This includes toilets, showers, urinals, and sinks. Fire extinguishers are to be installed while bathrooms are being constructed. It was determined from the MA Building Code requirements in Section 906 that a total of 24 fire extinguishers are needed for two buildings. (Reference Specification Sections – 5.1.1, 5.1.2, 5.1.3, 5.2, 5.3.1, 5.3.2, 5.4.1, 5.4.2, 6.1.1, 6.1.2, 6.1.3, 6.1.4, 6.6, 6.7, 8.1, 8.2, 9.1.1, 9.1.2, 9.1.3, 9.1.4, 9.1.5, 9.1.6, 9.1.7, 9.1.8, 10.1.1, 10.1.2, 10.1.3, 10.1.4, 10.1.5, 11.1, 11.2)

8.6 Furniture, Fixtures, and Equipment

When all interior finishes have been completed, the move-in and construction of all furniture, fixtures and equipment is able to begin. All furniture, fixtures, and equipment can be seen in Appendix F, Section F.1 according to BCCD standards. The following assumptions were made for specialty installation: for full and queen size beds, one worker can install 16 beds per day, for televisions one worker can install 50 per day, for couches two workers can install 30 per day, for microwaves one worker can install 50 per day, for dishwashers one worker can install four per day, for ATMs two workers can install two per day, for computers two workers can install 16 per day, and for shelving one worker can install five per day. (Reference Specification Sections – 12.1.1, 12.1.2, 12.1.3, 12.1.4, 12.1.5, 12.1.6, 12.1.7, 12.1.8, 12.1.9, 12.1.10, 12.1.11, 12.1.12, 12.1.13)

8.7 Paving and Landscaping

The final construction for the project will include paving and landscaping. This is done so no roads, concrete, or landscaping will be damaged and need replacing due to other trades installing work items. Final paving will include the paving of the parking lot, three access roads, sidewalk and Cape Cod-berm. Unlike the ACD take off method for which the three access roads and sidewalks are calculated in linear feet, the BCCD method takes off in square feet. This is the same for the parking lot which is taken off in square feet according to the BCCD. This differs from the ACD where the parking lot is taken off per car. The necessary calculations and conversions can be seen in Appendix F, Section F.1. (Reference Specification Sections – 1.3, 1.4, 1.5, 1.6, 1.7)

The chronological order for the project can be seen from Appendix F, Section F.1 and is broken up by each division specified earlier in the chapter. The order can be viewed by number, which specifies when a project activity will begin. This is shown with fence erection as activity number one while the following activity is second. These types of activities after another and can only begin when the previous activity is 100 percent complete. However, some activities can begin while others are still being constructed. This is shown in Appendix F, Section F.1 by example of the following activities of steel erection and floor construction. Steel erection begins as activity number ten in the schedule of the project with the construction of the flooring being 10.33. This denotation means that the floor construction can begin at 33 percent completion of the steel erection. This type of scheduling can be seen in other activities as well in Appendix F, Section F.1.

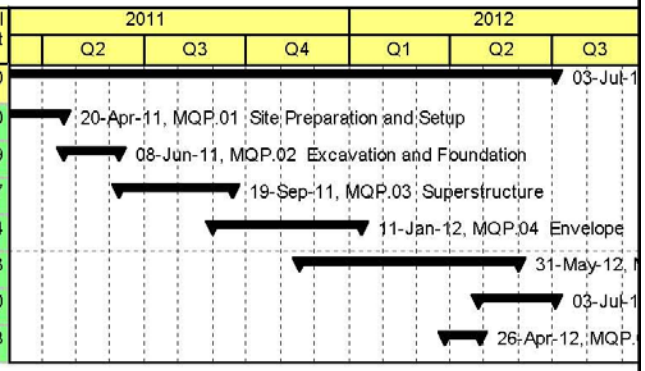
The installation of specialty construction was taken off by room. This assumption was made to provide an easier transition in specifying the time it will take to complete each room. It was also simplified when putting these activities into Primavera for the scheduling. The total project cost for the building is approximately 18 million dollars; giving an average construction time of 21 months for a project of up to 19 million dollars according to the General Requirements Reference Table R012157-20 for Construction Time Requirements in the RS Means Building Construction Cost Data book. Through the use of Primavera software, the group obtained project duration of just over 16 months, which was below the average construction time. However, there are also other activities that are not included that affect the total duration

of the project. These activities include acts of God such as weather, unforeseen site conditions, and the breakdown of equipment or materials as well as injuries to workers. All of these acts will affect activities during the project and can push back the substantial completion of construction. The contingencies were taken into account using a one month buffer time, which resulted a final project duration of just over 17 months and is still below the average construction time.

Primavera is a software program that assists engineers and contractors in obtaining a schedule and calculating a rough estimate for the completion of a construction project. Ninety-five new activities were created for the program file, which was then exported into an Excel file. Once the information was in a spreadsheet, the activity description and durations were copied and pasted from Appendix F, Section F.1 into the new Excel file. At this point, the data was imported into Primavera and activity relationships were then created. The relationships were created by going through each activity and selecting predecessors and successors of each. After this, the start and lag time were adjusted on specific activities to match the chronological order percentages from Appendix F, Section F.1. The main changes of lag and start times were adjusted along the critical path; the path that is most crucial for project completion. Below is the Primavera schedule summary for the construction of the elderly facility. A more detailed time schedule is referenced in Appendix F, Section F.2. The start date for the project is projected to be March 1, 2011 and the finish date is July 3, 2012.

Elderly Housing MQP | 2 Week Lookahead | 02-Mar-10 15:50

Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
MQP	Elderly Housing MQP	351	01-Mar-11	03-Jul-12	0
MQP.01	Site Preparation and Setup	37	01-Mar-11	20-Apr-11	0
MQP.02	Excavation and Foundation	35	21-Apr-11	08-Jun-11	279
MQP.03	Superstructure	73	09-Jun-11	19-Sep-11	207
MQP.04	Envelope	96	31-Aug-11	11-Jan-12	124
MQP.05	Interior Construction	140	18-Nov-11	31-May-12	23
MQP.06	Furniture, Fixtures, and Equipme	50	25-Apr-12	03-Jul-12	0
MQP.07	Paving and Landscaping	24	26-Mar-12	26-Apr-12	48



Actual Work | Milestone | Remaining Work | Summary

Page 1 of 1

TASK filter: All Activities

Chapter 9: Conclusions

The purpose of this Major Qualifying Project was to design an elderly housing facility that would meet the needs of the older community and provide the team with design experience having to do with a construction and project management standpoint that included code analysis, scheduling, and cost estimation. In order to complete this goal, the group formulated a series of objectives that included research and design that considers the main aspects of the design experience mentioned.

Beginning with the research and investigations regarding the preliminary layout and design of the facility, information was accumulated to help the team formulate a basis for a layout of the building and its interior arrangements. It was determined that independent living areas were a beneficial layout when attached to a more centralized assisted living facility within the same building. The independent living would provide residents with a sense of ownership and home-like experience while the assisted living aspect would attend to any short-term care-taking services.

After establishing the type of building that our group believed to be acceptable for the housing of the elderly, it was found that in order to make a sufficient profit from the facility; the design should take into account between 120 and 140 residents. From this information, a value of 130 residents was selected to be used for occupying the facility. Design requirements such as zoning, permitting, and building areas were also investigated and utilized. The plot of land to be developed for an elderly facility is located in Charlton, Massachusetts. This location requires the compliance with the Town of Charlton, Massachusetts Zoning Bylaws. The lot is 35.6 acres and is located in a Low Density Residential zoning district. The plot has access to two roads, allowing the construction of roads to and from the building. Since the surrounding lots are not to be disturbed during construction, no more extra land will need to be purchased. A variance is recommended since the building height is proposed to be greater than 36 feet as well. Utilities were added to connect to buildings from the main roads for electric and cable, and from surrounding areas for water and sewer.

The Massachusetts State Building Code and ADA Accessibility Guidelines for Buildings and Facilities was used to direct our project through a building code analysis in order to simulate the key investigations through the building process in getting the facility built for compliance in safety and efficiency. The building code analysis considered such information including occupancy classification, occupant load, allowances for height and area of building, construction type, fire-resistance ratings, and means of egress. After the completion of code compliance, it was found that two buildings that are three stories each and constructed of masonry exterior walls and steel interior members should be used instead of one building to accommodate the necessary number of residents.

The building was designed to accommodate 130 residents. The first floor of the building includes living areas for the mobility impaired as well as all of the main amenities for resident use. Disabled residents on the first floor have an easier exit from the building in case of emergency and are located closer to the main facilities within the building for simplification. Since active residents are designed to live on the second and third floors, facilities such as a main banquet hall, fitness center, and library were designed and placed on the first floor to allow all residents access. Once the buildings were designed and placed on the site with parking, utilities, and access roads, the state building code and town bylaws were used to verify the designs and make any changes.

Finally, technical specifications were developed to show an organized list of the dimensions and materials used in the construction process. From this developed list, cost estimation and scheduling took place for an approximation on how much the construction will cost and how long the entire construction project would take from start to finish. The cost estimation was developed using references that approximated cost per unit of measure according to material and assembly of materials. The building specifications allow the cost to be found since it provides the materials and their characteristics. Based on the values found through professional references, the total cost for the buildings and the rest of the construction process is $20,843,000. Using the appropriate references, the scheduling was based on materials of the construction process, the parts to be constructed, and the number of hours it would take a worker or team of workers to move through a task. All of the tasks that make up the entire construction project were accounted for and entered into software entitled Primavera for a professional

estimation of time to complete the project. According to the calculations in this report and by the software, the time to completion for the elderly facility is 17 months (starting March 1, 2011 and ending July 3, 2012).

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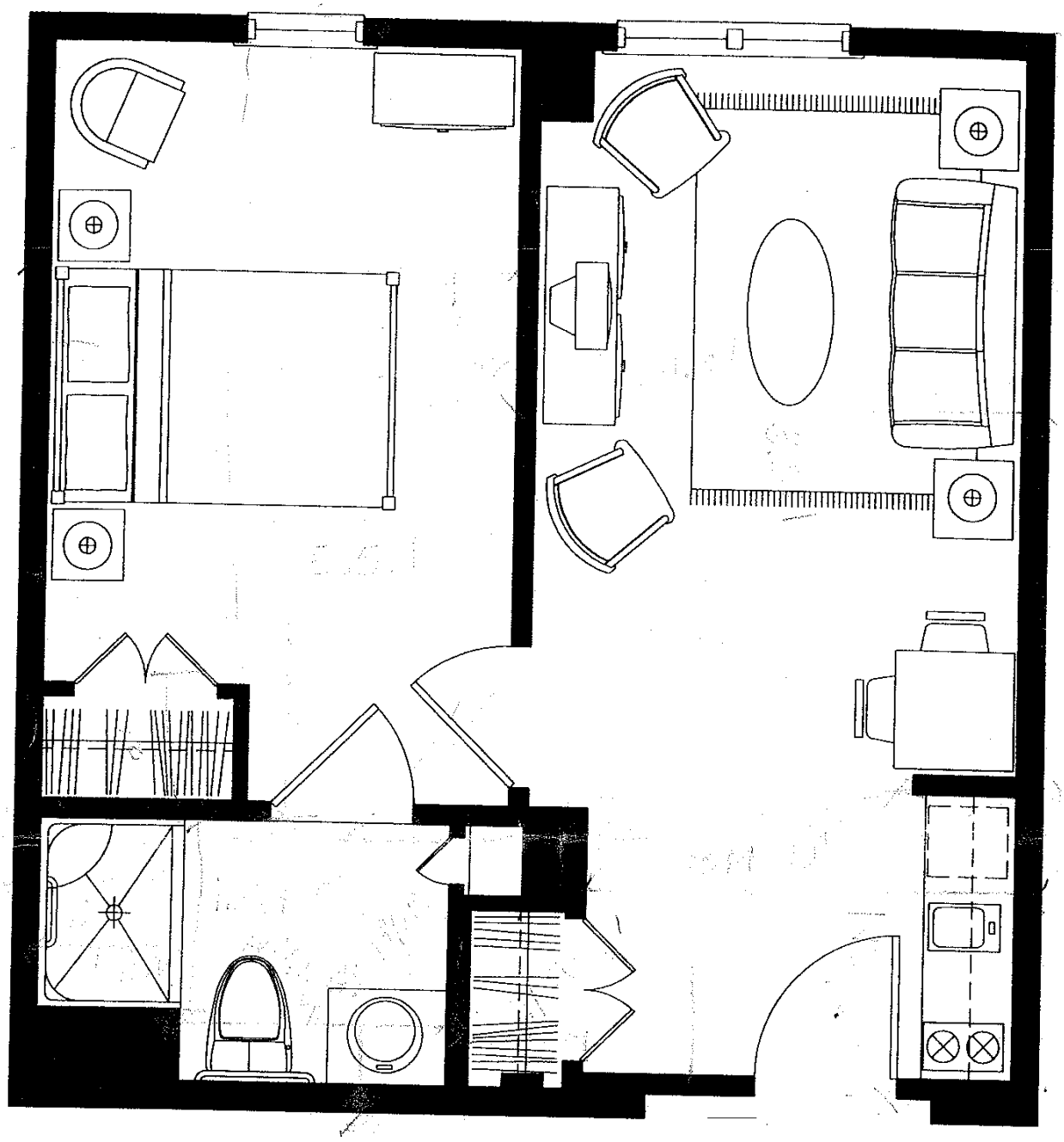
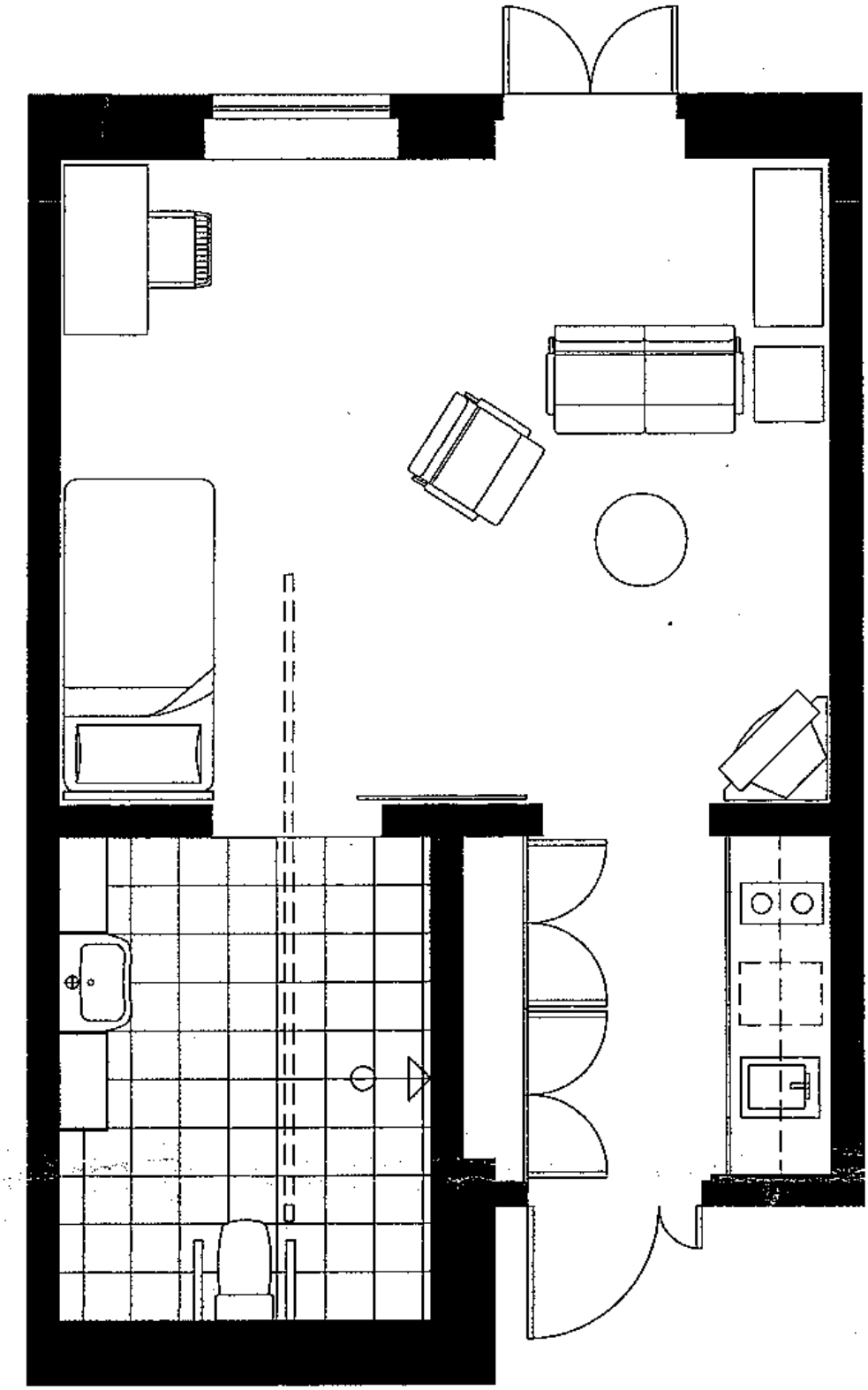
Appendix A: Researched Layouts

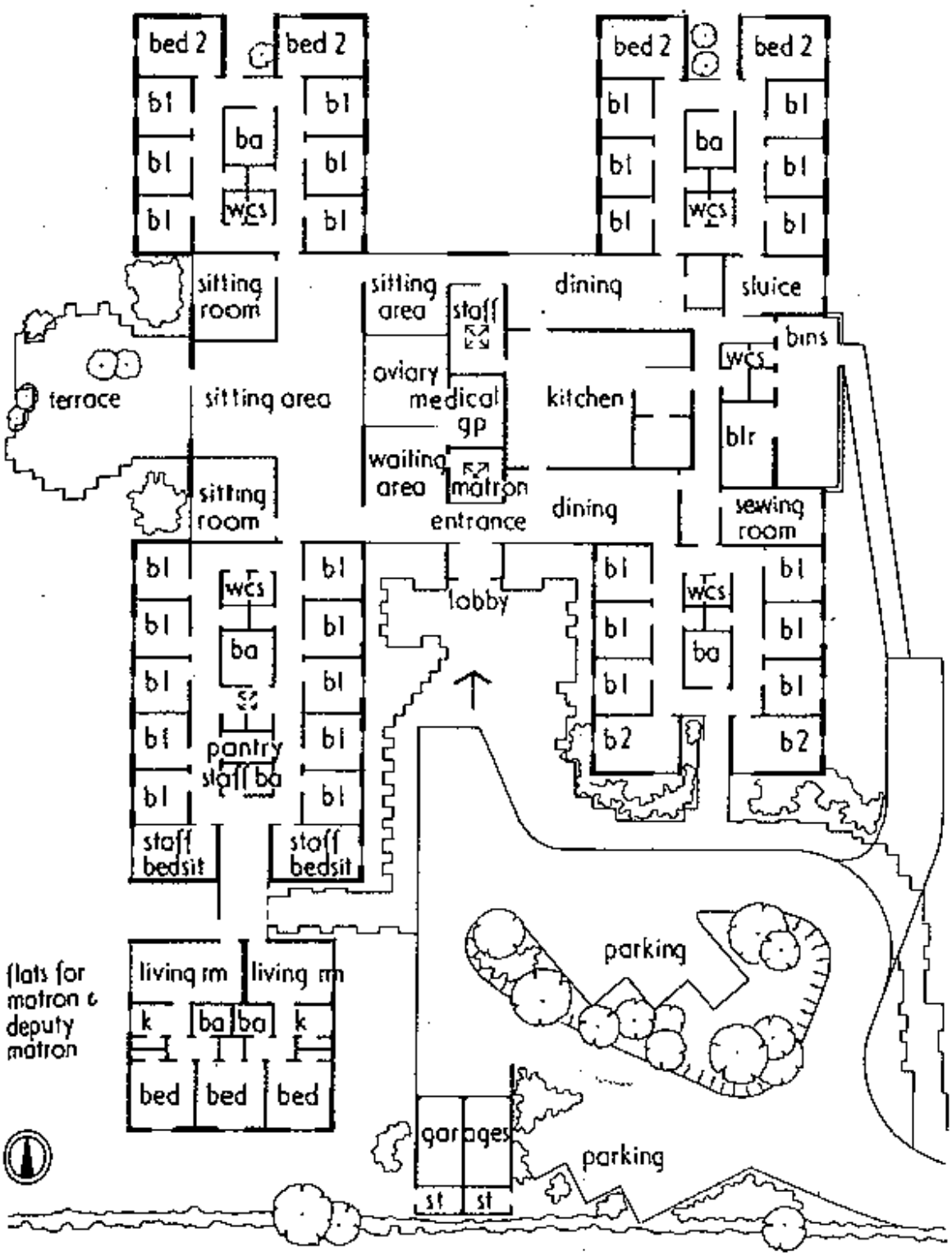
A.1 Living Area 1



A.2 Living Area 2

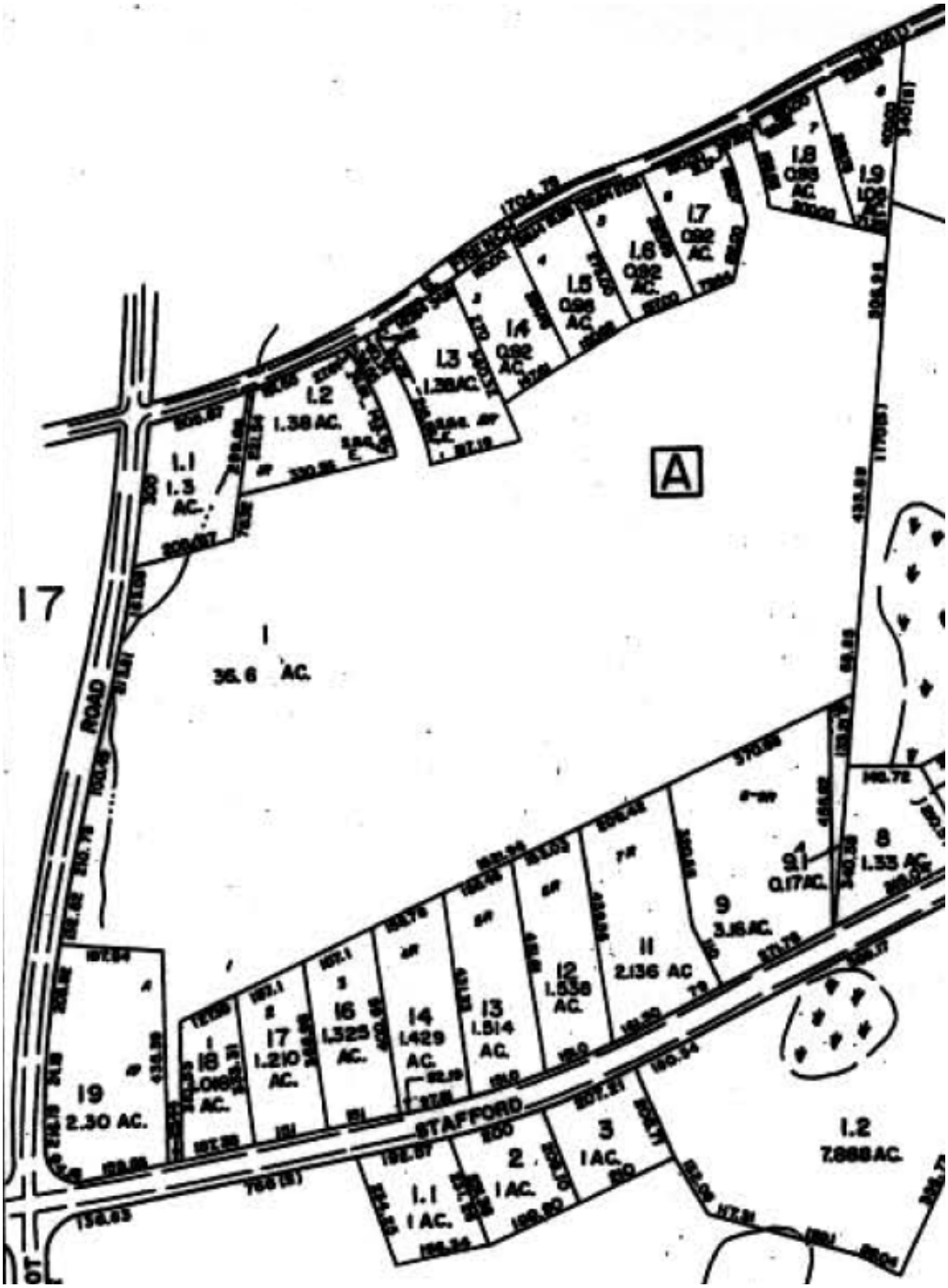


A.3 Building Layout



Appendix B: Site Plan and Zoning Bylaws

B.1 Assessors Map of Plot



B.2 Site Plan Application Requirements

8/09

Site Plan Application Requirements

The following information items are required to be prepared by site plan applicants in order to constitute a complete submittal to the Planning Board or Planning Office:

1. Twelve (12) complete copies of the prepared site plan.

2. One cover letter describing the project proposal along with one completed site plan application form (please use attached application form).

3. One complete abuttor's list prepared and certified by the Town Assessors Department. The abuttor's list must be certified as having been prepared within thirty (30) days prior to the scheduled site plan application submittal.

4. A complete public hearing certified mailing package consisting of the following:

   a. One (1) set of envelopes addressed to abuttor's list residents, abutting community Planning Boards, the Mass. DHCD and the Central Mass. Regional Planning Commission (CMRPC). See the attached list for addresses of abutting Planning Boards, DHCD and CMRPC.

   b. One completed USPS certified mailing green card and completed green card receipt for each of the mailing addresses required under 4.a. above. **Note:** Please leave the return address box on the back of the green card **blank**, the Planning Board Office will complete the return address information on behalf of the Planning Board.

   c. One check or money order to cover the cost of the public hearing certified mailing. Please make the check out to **Purchase Power**. Calculate the mailing fee amount by multiplying $5.54 times the number of mailings required. Add an additional $20 and **round the total upward to the nearest whole dollar** (i.e., round $45.37 to $46.00).

5. A site plan application fee of $750.00. Checks or money orders should be made-out to the Town of Charlton.

6. **Application Submittal Procedure:** Site Plan submittals are not accepted via either mail or drop-off delivery. All applicants are required to schedule via appointment a pre-application review meeting of the complete application package with Town Planner Alan Gordon. As part of the pre-application meeting, formal submittal of the site plan application to initiate the site plan review under M.G.L. Chapter 40-A and the Charlton Zoning By-Law will be scheduled.

Should you have any questions regarding the above submittal requirements, please feel free to contact the Planning Board Office at 508-248-2237.

B.3 Site Plan Review Application

10/05

CHARLTON PLANNING BOARD
SITE PLAN REVIEW APPLICATION

Date: _____

Pursuant to the provisions of Sections 3.2.1 and 7.1.4 of the Charlton Zoning Bylaw, the undersigned hereby applies to the Board for Site Plan Review for the property identified as Assessor's Map#_____, Block_____, Lot#_____; referenced in the Registry of Deeds in Book_____ Page_____.

Applicant: _____

Address: _____

Telephone: _____Fax:_____

Owner of Land: _____

Address: _____

Zoning District: _____

Current Land Use: _____

Proposed Land Use: _____

Total Lot Area: _____ Number of Proposed Buildings_____

Gross Square Feet of Proposed Building(s):_____

Number of Parking Spaces Required: _____ Proposed: _____

Is your project subject to the Wetlands Protection Act? _____

Signature of Applicant: _____

Date: _____ Fee: _____

****

For Planning Board Use Only:

Date of Submission: _____

Date of Public Hearing: _____

Decision Due Date: _____

Date Approved: _____ with Conditions? _____

Disapproved: _____

Site Plan Approval Expiration Date: _____

B.4 Town of Charlton Zoning Bylaw

5.10.10 Severability:

If any section of this bylaw is ruled invalid by any authority or a court of competent jurisdiction, such ruling will not affect the validity of the remainder of the bylaw.

5.11 Special Permits for Senior Living Facilities:

Purpose

The purpose of the Senior Living Bylaw is to encourage residential development that provides alternative housing choices for people that are fifty-five (55) years of age and older. For the purposes of this bylaw, housing units are intended for occupancy by persons fifty-five or over within the meaning of MGL Chapter 151B, Section 4, subsection 6, and shall comply with the provisions set forth in 42 USC 3601 et seq. This bylaw is also intended to promote affordable housing, efficient use of land and public infrastructure, and to preserve open space.

Applicability

In order to be eligible for a Special Permit for a Senior Living Development, the property under consideration must be a parcel or set of contiguous parcels held in common ownership, totaling at least ten (10) acres in size and located entirely within the Agricultural (A), Low Density Residential (R-40), Village (V), or Residential-Small Enterprise (R-SE) zoning districts as set forth on the Zoning Map. In a Senior Living Development, notwithstanding the provisions of the Table of Use Regulations (Section 3.2-Use Regulations), only those uses specified in this section 5.11 shall be allowed.

Types of Dwellings, Facilities, and Uses Permitted

The following use(s) are allowed as of right, subject to the dimensional and other requirements of this section 5.11: detached one-family dwellings. The following uses, facilities and structures shall be permitted only upon a Special Permit granted by the Planning Board: detached or attached dwellings of any combination, (other than the aforementioned use(s) permitted as of right); restorative care center, skilled nursing facility, clinic, congregate housing, assisted living facility, and accessory uses for in-house resident services such as exercise and recreational rooms or areas, a swimming pool, small convenience store, hairdressing shop, massage service, instruction in physical exercise or arts or crafts, a small theater for visiting live theater performances. Such in-house resident services accessory uses shall only be provided to residents and their guests and shall not display exterior advertising. The program of and facilities for in-house services offered by the Senior Living Development shall be specified in the Special Permit application and the scale of each service shall be in proportion to the number of dwelling units in the Senior Living Development and subject to approval by the Planning Board. All facilities shall fully comply with standards of the Architectural Access Board. Enclosed or non-enclosed walkways connecting buildings shall be permitted.

Independent Living Retirement Housing-As used in this bylaw, Independent Living Retirement Housing means private residential dwelling units, individually equipped with a minimum of a kitchen, bedroom, bathroom and living area. Geared toward independently functioning adults, this housing typically does not offer on-site supportive services but is designed to be barrier-free and may include emergency call features complemented by housing management and maintenance services.

Congregate Housing-As used in this bylaw, Congregate Housing means private dwelling units/apartments which may have kitchen facilities within a complex containing central dining and other common areas and is designed for an adult population requiring some supportive services including but not limited to meals, housekeeping, home health, and other supportive services. Congregate Housing under this section of the bylaw must obtain all required permits and/or licenses that are required to operate such facility by any department of the United States of America, the Commonwealth of Massachusetts and the Town of Charlton.

Assisted Living Facility-As used in this bylaw, an Assisted Living Facility means a twenty-four (24) hour staff along with private dwelling units which may contain independent efficiency kitchens, but which contain common kitchen, dining and other activity areas. Assisted living facilities are geared to an adult population which may have difficulty functioning independently and may require oversight including, but not limited to the provision of a full meal plan, transportation services, personal care and assistance with medications. Special care programs specifically designed for adults with memory loss are included in this category. Assisted Living Facilities under this section of the bylaw must obtain all required permits and/or licenses required to operate such facility by any department of the United States of America, the Commonwealth of Massachusetts, including certification by the Executive Office of Elder Affairs pursuant to MGL Chapter 19D, and the Town of Charlton.

Restorative Care/Skilled Nursing Facility-Includes any institution which provides services primarily to three or more individuals admitted thereto and which provides such individuals with the following long-term nursing, convalescent or rehabilitative care; supervision and care incident to old age; or retirement home care for elderly persons. This includes services provided by nursing homes, convalescent homes, long term care facilities, rest homes, infirmaries for older adults, and charitable homes for the aged. Restorative Care/Skilled Nursing Facilities under this section of the bylaw must obtain all applicable permits and licenses required by any agency of the United States of America, the Commonwealth of Massachusetts and the Town of Charlton.

Dwelling Unit-As used in this section 5.11, and notwithstanding the definition of "Dwelling Unit" set forth in section 2.1 of this Zoning Bylaw, the term "Dwelling Unit" shall mean one or more living or sleeping rooms arranged for the use of one or more individuals living as a single housekeeping unit with individual or congregate cooking, living, sanitary and sleeping facilities, excluding mobile homes and trailers. The intent of this definition is to define a "home" with private sleeping rooms rather than a dormitory arrangement of sleeping quarters.

General Requirements

An application for a Senior Living Development Special Permit must conform to the following standards:

1. Occupancy of dwelling units shall be limited to persons fifty-five (55) years of age or older.

2. The minimum tract size shall be 10 acres.

3. All dwelling units must be served with public water service and be connected to the public sewerage system. Subject to all other applicable bylaws, rules and regulations of the Town, including, without limiting the foregoing, those of the Board of Health and the Water & Sewer Commission, an on-site waste treatment facility (package treatment plant), approved by the Mass. Department of Environmental Protection (DEP), may be substituted for public sewer, and an onsite water supply system may be substituted for public water, if the Town Water & Sewer Commission deems the connection to public water service or public sewer service to be infeasible.

4. A minimum of 30% of the parcel shown on the development plan shall be contiguous open space, excluding required yards and buffer areas. Not more than 25% of the open space shall be wetlands, as defined pursuant to MGL Chapter 131, Section 40. The open space shall be subject to the conditions set forth in Section 5.7-Flexible Development provided that the term "senior living development" shall be substituted for the term "flexible development" in said conditions.

5. A minimum of 10% of the total units shall be affordable in perpetuity. For the purposes of this section "Affordable Units" shall be defined as units affordable to people or families with incomes as set by the Department of Housing and Community Development (DHCD) for this purpose. Affordable units shall be dispersed throughout the development and shall be indistinguishable from market rate units. The Charlton Housing Authority shall be responsible for choosing purchasers or tenants, and monitoring and ensuring the long-term affordability of the units.

6. The maximum number of permitted housing units within all permitted Senior Living Developments in the Town of Charlton shall be limited to a number equivalent to ten percent (10%) of all existing residential units (excluding Senior Living development units) located in the Town of Charlton. The Board of Assessors shall establish the number of residential housing units as of January 1 of each calendar year.

7. No single structure containing Independent Living Retirement Housing shall contain more than 4 dwelling units.

8. The total number of dwelling units in a Senior Living Development shall not exceed 4 units per acre of buildable land unless a density bonus is granted under the following section. Buildable acreage shall be calculated by a registered land surveyor or civil engineer and shall not include any of the following:

   a. Land within a floodway or floodplain district as defined under Section 6-Flood Plain District.

   b. Fresh water wetlands as defined by MGL Chapter 131, Section 40.

   c. Land having slopes greater than 20%.

   d. Land subject to a conservation restriction which prohibits development.

   e. Land subject to any local, state, or federal law or regulation, right of way, public or other restriction, which prohibits development.

9. The Planning Board may grant density bonuses under the following provisions, provided however, that at no time shall there be more than six (6) units per buildable acre of land in the Development:

   a. Affordability: For each affordable housing unit provided above the minimum required 10%, one additional housing unit may be permitted.

   b. Open space: For each acre of preserved open space in addition to the minimum required, two (2) additional housing units may be permitted.

10. Public bikeways, pedestrian walkways or walking trails may be required by the Planning Board to provide circulation or access to schools, playgrounds, parks, shopping, transportation, open space and/or community facilities or such other purposes as the Board may determine to be appropriate to serve the needs of the development.

11. Any structure proposed in a historic district or on a parcel immediately adjacent to a historic district shall be submitted for review and approval to the Historical Commission.

Dimensional Requirements

1. Lot Area-Individual Independent Living Retirement Housing residential lots shall have a minimum lot area of ten thousand (10,000) square feet.

2. Lot Frontage-Individual Independent Living Retirement Housing lots within a Senior Living Development shall have a minimum of one hundred feet (100') of frontage on a public way or an approved subdivision way.

3. Setback Requirements-All structures shall be located no less than twenty-five (25') feet from the front lot line and no less than fifteen feet (15') from the side and rear lot lines.

4. Building Separation-Distance between structures shall not be less than thirty-six feet (36').

5. Buffer Areas-All dwellings and structures shall be located a minimum of fifty feet (50') from adjacent properties. Buffer Areas shall be retained in their natural vegetative state to the maximum extent feasible, except where adjacent to property used for agriculture purposes.

6. Building Height-No building shall exceed thirty-six feet (36') in height, exclusive of basements.

7. Parking-The development shall comply with the driveway and parking provisions of Section 4.2, Off-Street Parking and Loading.

Procedures

The Planning Board shall be the granting authority for Senior Living Development Special Permits.

1. Pre-Application. Applicants are required to present a conceptual development plan prepared by a registered professional architect, register professional landscape architect or registered professional engineer at a regularly scheduled Planning Board meeting. The plan shall include a detailed analysis of site topography, wetlands, unique land feature, and soil types. The purpose of this requirement is to help applicants and officials develop a better understanding of the property and to help establish an overall design approach that respects the intent of this bylaw, which is to provide alternative housing choices, protect open space, and promote efficient use of the land and infrastructure.

2. Application. Applicants are required to submit a special permit application and development plan, conforming to the requirements of this bylaw, to the Planning Board for approval under the provisions of 7.2 (Granting Authority). The development plan shall include a site plan under Section 7.1.4 (Site Plan Review).

a. If the development plan shows a subdivision of land as defined under MGL Chapter 41, Section 81-L, the applicant is required to also submit a preliminary subdivision plan and applications under the applicable Planning Board Subdivision Rules & Regulations at the time of application for a Senior Living

Development, and must obtain approval of the preliminary subdivision plan prior to submitting a definitive plan and application. All road networks and accompanying infrastructure shall be retained by the applicant and not accepted by the Town as public ways.

3. The Planning Board may grant a Special Permit for a Senior Living Development if the Board determines that all requirements under the bylaw have been met and that the benefits of the proposed use outweigh the detriments to the neighborhood or town.

4. The Planning Board may impose such additional conditions as it finds reasonably appropriate to safeguard existing neighborhoods or otherwise serve the purposes of this bylaw.

If any provision of this bylaw is determined to be invalid, it shall not affect the validity of the remaining provisions.

5.12 **Phased Growth**

5.12. 1 Purposed and Intent

This Section of the Charlton Zoning Bylaw is adopted pursuant to Article 89 of the Massachusetts Constitution in order to ensure that the issuance of building permits for new residential construction in the Town of Charlton is consistent with the Town's ability to provide infrastructure necessary to accommodate the new growth. This Section establishes a phased growth rate limitation consistent with historic growth rates experienced in Charlton, as described in the Master Plan for the Town of Charlton. The Master Plan demonstrates that the Town is unable to provide services and facilities at a pace equivalent to the rate of development and population growth experienced in the Town in the past decade. The Town seeks to ensure that growth occurs in a manner that can be supported by Town services, particularly adequate public safety, schools, roads, water, sewer, and human services at a level of quality expected by the citizenry and affordable to the Town.

5.12.2 Applicability

Beginning on the date when this section of the Bylaw was approved by Town Meeting, no building permit for a new dwelling unit or units shall be issued unless in accordance with the schedule set forth in this Section, unless exempted pursuant to Section 5.12.5 of this bylaw. This Section shall apply to all definitive subdivision plans, as well as to all Flexible Development projects proposed pursuant to Section 5.7 of this bylaw. Dwelling units shall be considered as part of a single development, for the purposes of development scheduling, if located either on a single parcel or contiguous parcels of land that have been held in common ownership at any time on or subsequent to the date of adoption of this bylaw.

B.5 Special Permit Application for Senior Living Development

10/05

CHARLTON PLANNING BOARD
SENIOR LIVING DEVELOPMENT SPECIAL PERMIT APPLICATION

Date: _____

Pursuant to the provisions of Section 5.11 of the Charlton Zoning Bylaw, the undersigned hereby applies to the Board for Senior Living Development Special Permit Approval for the property identified as Assessor's Map#_____, Block_____, Lot#_____; referenced in the Registry of Deeds in Book_____ Page_____.

Applicant: _____

Address: _____

Telephone: _____ Fax: _____

Owner of Land_____

Address: _____

Zoning District: _____

Current Land Use: _____

Proposed Land Use: _____

Total Lot Area: _____ Number of Proposed Buildings: _____ Units: _____

Gross Square Feet of Proposed Buildings(s):_____

Number of Parking Spaces Required: _____ Proposed: _____

Is your project subject to the Wetlands Protection Act? _____

Signature of Applicant: _____ Signature of Property Owner: _____

Date: _____ Fee: _____

****

For Planning Board Use Only:

Date of Submission: _____

Date of Public Hearing: _____

Decision Due Date: _____

Date Approved: _____ with Conditions? _____

Disapproved: _____

Senior Living Development Special Permit Approval Expiration Date: _____

Appendix C: Referenced Code Tables

C.1 Occupancy Separation

TABLE 302.3.2
REQUIRED SEPARATION OF OCCUPANCIES (HOURS)[a]

USE	A-1	A-2	A-3	A-4	A-5	B[b]	E	F-1	F-2	H-1	H-2	H-3	H-4	H-5	I-1	I-2	I-3	I-4	M[b]	R-1	R-2	R-3, R-4	S-1	S-2[c]	U
A-1	—	2	2	2	2	2	2	3	2	NP	4	3	2	4	2	2	2	2	2	2	2	2	3	2	1
A-2[e]	—	—	2	2	2	2	2	3	2	NP	4	3	2	4	2	2	2	2	2	2	2	2	3	2	1
A-3	—	—	—	2	2	2	2	3	2	NP	4	3	2	4	2	2	2	2	2	2	2	2	3	2	1
A-4	—	—	—	—	2	2	2	3	2	NP	4	3	2	4	2	2	2	2	2	2	2	2	3	2	1
A-5	—	—	—	—	—	2	2	3	2	NP	4	3	2	4	2	2	2	2	2	2	2	2	3	2	1
B[b]	—	—	—	—	—	—	2	3	2	NP	2	1	1	1	2	2	2	2	2	2	2	2	3	2	1
E	—	—	—	—	—	—	—	3	2	NP	4	3	2	3	2	2	2	2	2	2	2	2	3	2	1
F-1	—	—	—	—	—	—	—	—	3	NP	2	1	1	1	3	3	3	3	3	3	3	3	3	3	3
F-2	—	—	—	—	—	—	—	—	—	NP	2	1	1	1	2	2	2	2	2	2	2	2	3	2	1
H-1	—	—	—	—	—	—	—	—	—	—	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP	NP
H-2	—	—	—	—	—	—	—	—	—	—	—	1	2	2	4	4	4	4	2	4	4	4	2	2	1
H-3	—	—	—	—	—	—	—	—	—	—	—	—	1	1	4	3	3	3	1	3	3	3	1	1	1
H-4	—	—	—	—	—	—	—	—	—	—	—	—	—	1	4	4	4	4	1	4	4	4	1	1	1
H-5	—	—	—	—	—	—	—	—	—	—	—	—	—	—	4	4	4	3	1	4	4	4	1	1	3
I-1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	2	2	2	2	2	4	3	2
I-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	2	2	2	2	3	2	1
I-3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	2	2	2	3	2	1
I-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	2	2	3	2	1
M[b]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	2	3	2	1
R-1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	3	2	1
R-2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	3	2	1
R-3, R-4	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	2[d]	1[d]
S-1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	3
S-2[c]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
U	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

For SI: 1 square foot = 0.0929 m^2.
NP = Not permitted.
a. See exception to Section 302.3.2 for reductions permitted.
b. Occupancy separation need not be provided for storage areas within Groups **B** and M if the:
1. Area is less than 10 percent of the floor area;
2. Area is provided with an automatic fire-extinguishing system and is less than 3,000 square feet; or
3. Area is less than 1,000 square feet.
c. Areas used only for private or pleasure vehicles shall be allowed to reduce separation by 1 hour.
d. See Section 406.1.4.
e. Commercial kitchens need not be separated from the restaurant seating areas that they serve.

C.2 Occupant Load

TABLE 1004.1.2 MAXIMUM FLOOR AREA ALLOWANCES PER OCCUPANT

OCCUPANCY	FLOOR AREA IN SQ. FT. PER OCCUPANT
Agricultural building	300 gross
Aircraft hangars	500 gross
Airport terminal Baggage claim Baggage handling Concourse Waiting areas	 20 gross 300 gross 100 gross 15 gross
Assembly Gaming floors (keno, slots, etc.)	11 gross
Assembly with fixed seats	See 780 CMR 1003.2.2.9
Assembly without fixed seats Concentrated (chairs only—not fixed) Standing space Unconcentrated (tables and chairs) ***For A-2nc uses also note the prescriptive egress requirements of 780 CMR 1024 and 780 CMR 3400.3.***	 7 net 5 net 15 net
Bowling centers, allow five persons for each lane including 15 feet of runway, and for additional areas	7 net
Business areas	100 gross
Courtrooms - other than fixed seating areas	40 net
Dormitories	50 gross
Educational Classroom area Shops and other vocational room areas	 20 net 50 net

OCCUPANCY	FLOOR AREA IN SQ. FT. PER OCCUPANT
Exercise rooms	50 gross
H-5 Fabrication and manufacturing areas	200 gross
Industrial areas	100 gross
Institutional areas	
Inpatient treatment areas	240 gross
Outpatient areas	100 gross
Sleeping areas	120 gross
Kitchens, commercial	200 gross
Library	
Reading rooms	50 net
Stack area	100 gross
Locker rooms	50 gross
Mercantile	
Areas on other floors	60 gross
Basement and grade floor areas	30 gross
Storage, stock, shipping areas	300 gross
Parking garages	200 gross
Residential	200 gross
Skating rinks, swimming pools	
Rink and pool	50 gross
Decks	15 gross
Stages and platforms	15 net
Accessory storage areas, mechanical equipment room	300 gross
Warehouses	500 gross

For SI: 1 square foot - 0.0929 m^2

C.3 Allowable Building Heights and Areas

TABLE 503 ALLOWABLE HEIGHT AND BUILDING AREAS

Height limitations shown as stories and feet above grade plane.

Area limitations as determined by the definition of "Area, building," per floor.

GROUP		TYPE OF CONSTRUCTION								
		TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
		A	B	A	B	A	B	HT	A	B
	Hgt(feet) Hgt(S)	UL	160	65	55	65	55	65	50	40
A- 1	S A	UL UL	5 UL	3 15,500	2 8,500	3 14,000	2 8,500	3 15,000	2 11,500	1 5,500
A- 2	S A	UL UL	11 UL	3 15,500	2 9,500	3 14,000	2 9,500	3 15,000	2 11,500	1 6,000
A- 3	S A	UL UL	11 UL	3 15,500	2 9,500	3 14,000	2 9,500	3 15,000	2 11,500	1 6,000
A- 4	S A	UL UL	11 UL	3 15,500	2 9,500	3 14,000	2 9,500	3 15,000	2 11,500	1 6,000
A- 5	S A	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL	UL UL
B	S A	UL UL	11 UL	5 37,500	4 23,000	5 28,500	4 19,000	5 36,000	3 18,000	2 9,000
E	S A	UL UL	5 UL	3 26,500	2 14,500	3 23,500	2 14,500	3 25,500	1 18,500	1 9,500
F- 1	S A	UL UL	11 UL	4 25,000	2 15,500	3 19,000	2 12,000	4 33,500	2 14,000	1 8,500
F- 2	S A	UL UL	11 UL	5 37,500	3 23,000	4 28,500	3 18,000	5 50,500	3 21,000	2 13,000
H- 1	S A	1 21,000	1 16,500	1 11,000	1 7,000	1 9,500	1 7,000	1 10,500	1 7,500	NP NP
H- 2	S A	UL 21,000	3 16,500	2 11,000	1 7,000	2 9,500	1 7,000	2 10,500	1 7,500	1 3,000
H-3	S A	UL UL	6 60,000	4 26,500	2 14,000	4 17,500	2 13,000	4 25,500	2 10,000	1 5,000
H- 4	S A	UL UL	7 UL	5 37,500	3 17,500	5 28,500	3 17,500	5 36,000	3 18,000	2 6,500
H- 5	S A	3 UL	3 UL	3 37,500	3 23,000	3 28,500	3 19,000	3 36,000	3 18,000	2 9,000
I- 1	S A	UL UL	9 55,000	4 19,000	3 10,000	4 16,500	3 10,000	4 18,000	3 10,500	2 4,500
I- 2	S A	UL UL	4 UL	2 15,000	1 11,000	1 12,000	NP NP	1 12,000	1 9,500	NP NP
I-3	S A	UL UL	4 UL	2 15,000	1 10,000	2 10,500	1 7,500	2 12,000	2 7,500	1 5,000
I- 4	S A	UL UL	5 60,500	3 26,500	2 13,000	3 23,500	2 13,000	3 25,500	1 18,500	1 9,000

C.4 Fire-Resistance Rating Requirements

TABLE 601
FIRE-RESISTANCE RATING REQUIREMENTS FOR BUILDING ELEMENTS (hours)

BUILDING ELEMENT	TYPE I		TYPE II		TYPE III		TYPE IV	TYPE V	
	A	B	A[d]	B	A[d]	B	HT	A[d]	B
Structural frame[a] Including columns, girders, trusses	3[b]	2[b]	1	0	1	0	HT	1	0
Bearing walls Exterior[f] Interior	3 3[b]	2 2[b]	11	0	21	20	2 1/HT	11	0
Nonbearing walls and partitions Exterior	See Table 602								
Nonbearing walls and partitions Interior[e]	0	0	0	0	0	0	See 780 CMR 602.4.6	0	0
Floor construction Including supporting beams and joists	2	2	1	0	1	0	HT	1	0
Roof construction Including supporting beams and joists	1½[c]	1[c]	1[c]	0[c]	1[c]	0	HT	1[c]	0

For SI: 1 foot = 304.8 mm.

a. The structural frame shall be considered to be the columns and the girders, beams, trusses and spandrels having direct connections to the columns and bracing members designed to carry gravity loads. The members of floor or roof panels which have no connection to the columns shall be considered secondary members and not a part of the structural frame.

b. Roof supports: Fire-resistance ratings of structural frame and bearing walls are permitted to be reduced by one hour where supporting a roof only.

c. 1. Except in Factory-Industrial (F-1), Hazardous (H), Mercantile (M) and Moderate-Hazard Storage (S-1) occupancies, fire protection of structural members shall not be required, including protection of roof framing and decking where every part of the roof construction is 20 feet or more above any floor immediately below. Fire-retardant-treated wood members shall be allowed to be used for such unprotected members.

2. In all occupancies, heavy timber shall be allowed where a one-hour or less fire-resistance rating is required.

3. In Type I and II construction, fire-retardant-treated wood shall be allowed in buildings including girders and trusses as part of the roof construction when the building is:

i. Two stories or less in height;

ii. Type II construction over two stories; or

iii. Type I construction over two stories and the vertical distance from the upper floor to the roof is 20 feet or more.

d. An approved automatic sprinkler system in accordance with 780 CMR 903.3.1.1 shall be allowed to be substituted for one-hour fire-resistance-rated construction, provided such system is not otherwise required by other provisions of 780 CMR or used for an allowable area increase in accordance with 780 CMR 506.3 or an allowable height increase in accordance with 780 CMR 504.2. The one-hour substitution for the fire resistance of exterior walls shall not be permitted.

e. Not less than the fire-resistance rating required by other sections of 780 CMR.

f. Not less than the fire-resistance rating based on fire separation distance (see Table 602).

C.5 Fire-Resistance Rating Based on Fire Separation Distance

TABLE 602
FIRE-RESISTANCE RATING REQUIREMENTS FOR EXTERIOR WALLS BASED ON FIRE SEPARATION DISTANCE

FIRE SEPARATION DISTANCE (feet)	TYPE OF CONSTRUCTION	OCCUPANCY GROUP H	OCCUPANCY GROUP F-1, M, S-1	OCCUPANCY GROUP A, B, E, F-2, I, R[b], S-2, U
< 5[c]	All	3	2	1
≥5 <1	IA Others	3 2	2 1	1 1
≥10 < 30	IA, IB IIB, VB Others	2 1 1	1 0 1	1 0 1
≥ 30	All	0	0	0

For SI: 1 foot = 304.8 mm.

a. Load-bearing exterior walls shall also comply with the fire-resistance rating requirements of Table 601.

b. Group R-3 and Group U when used as accessory to Group R-3, as applicable in 780 CMR 101.2 shall not be required to have a fire-resistance rating where the fire separation distance is three feet or more.

c. See 780 CMR 503.2 for party walls.

C.6 Minimum Number of Exits

TABLE 1018.1 MINIMUM NUMBER OF EXITS FOR OCCUPANT LOAD

OCCUPANT LOAD	MINIMUM NUMBER OF EXITS
1-500	2
501-1,000	3
More than 1,000	4

C.7 Egress Width per Occupant

TABLE 1005.1 EGRESS WIDTH PER OCCUPANT SERVED

OCCUPANCY	WITHOUT SPRINKLER SYSTEM		WITH SPRINKLER SYSTEM[a]	
	Stairways (inches per occupant)	Other egress components (inches per occupant)	Stairways (inches per occupant)	Other egress components (inches per occupant)
Occupancies other than those listed below	0.3	0.2	0.2	0.15
Hazardous: H-1, H-2, H-3 & H-4	0.7	0. 4	0.3	0.2
Institutional: I-2	NA	NA	0.3	0.2

For SI: 1 inch = 25.4 mm. NA = Not applicable.

a. Buildings equipped throughout with an automatic sprinkler system in accordance with 780 CMR 903.3.1.1 or 903.3.1.2.

C.8 Exit Access Travel Distance

TABLE 1015.1 EXIT ACCESS TRAVEL DISTANCE

OCCUPANCY	WITHOUT SPRINKLER SYSTEM (feet)	WITH SPRINKLER SYSTEM (feet)
A, E, F-1, I-1, M, R, S-1	200	250[b]
B	200	300[c]
F-2, S-2, U	300	400[b]
H-1	Not Permitted	75[c]
H-2	Not Permitted	100[c]
H-3	Not Permitted	150[c]
H-4	Not Permitted	175[c]
H-5	Not Permitted	200[c]
I-2, I-3, I-4	150	200[c]

For SI: 1 foot = 304.8 mm.

Appendix D: ADA Accessibility

D.1 Requirements for Installments

Installments	Requirements
Ramps	- Level landings at each side • 60” minimum length - Landings should be as wide as the widest ramp leading to it - 60” x 60” minimum for change in direction - 1:12 maximum slope • 30 “ maximum rise between landings - Ramps having a rise greater than 6” or run 72 “ should have handrails (1-1/4”-2” φ) • Extend 12” horizontal past landings
Elevators	- Visible and audible call signals or lanterns centered at least 72” above floor - Raised characters and Braille floor signs on each side 60” φ - Call buttons 42” φ • Buttons ¾” • Floor buttons: minimum 35”-maximum 48” font 54” parallel. • Audible and Visible - Allow wheelchairs to enter and maneuver with reach of controls and exit - Car Dimensions • 68” minimum width for cars with side opening • 80” minimum for cars with center • 51” minimum clear car depth • 36” clear doorway
Kitchen	- Provide 60” diameter space for turning a wheelchair in U-shaped kitchens - Provide at least one work surface 36” wide adjustable in height from 28” to

	36” or fixed at a height of 34” above floor
Toilet Stalls	- Wheelchair accessible at least 60”wide, 56” deep wall-hung, 59” deep floor mounted - Depths increase 36” if door swings into stall - Grab bars, horizontal position 33” to 36” - Ambulatory access stalls 36” wide, 60” deep
Shower Stalls	- 36” x 36” - A seat shall be provided in 36” x 36” stalls - Grab bar diameter or width of gripping surface shall be 1-1/4” to 1-1/2” - Faucets and other controls shall be mounted on wall opposite the seat
Canes	- Cane range 6” minimum to 27” maximum side to side
Accessible Routes	- Walking surfaces with max slope 1:20 while marking everything - Floor surfaces should be firm, stable and slip resistant - Avoid changes in level and the use of stairs - Use ramps only when necessary - Facilities should be identifiable to the blind - Facilities should be usable: • For comfortable movement • Fixtures designed for disabilities - ¼” change in level vertical change from ¼” to ½” should be beveled with slope no greater than 1:2 • Greater than ½” must be ramped - 36” minimum clear width passage - 60” minimum clear width for 2 wheelchair to pass • 60” minimum clear φ or T-Shaped with arms(36” wide, 60” long) - Wheelchairs • 30” x 48” minimum clear floor space required for forward or parallel approach to object • Maximum reach height of 48” for

	reach depths up to 20” • Maximum 48” for reach depths up to 20-25” • 54” maximum and 15” minimum reach above the floor
Vehicular Parking	- Curbs • Ramps where crosses • Surface should be stable, firm, and slip resistant • As close as possible to building • 1:50 maximum slope for spaces and access aisles - 96” minimum with - 60” minimum access aisle • May be shared • Identify with signs - Vans • 98” height and access aisle minimum 96” wide • Passenger loading zones – 60” minimum access aisle, 20’ long
Doors	- Hardware easy to grasp • Without pinch or twisting the wrist - 48” maximum height above floor for hardware - Bottom 121” should have sheathing to be able to be open with wheelchair footrest - Force to push open no greater than 5.0 lbs - Thresholds no higher than ½”
Windows	- Same as opening door
Carpet	- Securely attached - Level cut pile, level loop, textured loop or cut and loop texture with max pile height of ½” - Fasten and trim all exposed edges to the floor surface - Bevel edge

Appendix E: Cost Estimation

E.1 Cost Estimation Spreadsheet

Spec. Section	*Work Description & RS Means Section*	*RS Means Code*	*Quantity*	*Units*	*Unit Price*	*Per Building*
	1) SITEWORK					
	Site Preparation					
1.1	Site Clearing	-	8	Acre	$ 1,500.00	$ 12,000.00
1.2	Site Grading	-	19,360	SY	$ 0.64	$ 12,390.40
1.3	Site Fencing	-	6681	LF	$ 4.68	$ 31,267.08
	Earthwork					
	Utility Excavation (G1030-805)	6980	2636	LF	$ 39.55	$ 104,253.80
1.11	Sewer					
1.13	Water					
1.15	Electrical					
1.16	Foundation Excavation (A2010-110)	5740	35760	SF	$ 14.49	$ 518,162.40
	Utilities (Conduit)					
1.12	Water Supply (G3010-110)	3220	1142	LF	$ 61.50	$ 70,233.00
	Water Pump (Pump House)					
1.10	Sewer (G3020-110)	5080	492	LF	$ 104.50	$ 51,414.00
1.14	Electricity/Telephone/Cable (D2090)	3120	983	LF	$ 41.25	$ 40,548.75
	Paving					
1.4	Three Access Roads (G2010-210)	2400	3073	LF	$ 104.50	$ 321,128.50

1.5	Cape Cod Berm (G2010-305)	1500	4800	LF	$ 3.33	$ 15,984.00
1.6	Parking Lot (G2020-210)	1620	200	CAR	$ 845.00	$ 169,000.00
1.7	Cape Cod Berm (G2010-305)	1500	1218	LF	$ 3.33	$ 4,055.94
1.8	Concrete Sidewalk (G2030-120)	1600	2110	LF	$ 17.55	$ 37,030.50
1.9	Landscaping	-	1	LS	$ 250,000.00	$ 250,000.00
	Mature Oak Trees, Loam and Seed, and Shrubbery					
	TOTAL					$ 1,581,810.89
	2) FOUNDATIONS/STRUCTURE					
2.2	Spread Footing 4' x 4' x 1' (A1010-210)	7300	68	EA	$ 218.50	$ 14,858.00
	Concrete, #7 Rebar, Form Work, and Vapor Barrier					
2.1	Strip Footing 2'-8" x 1' (A1010-110)	3100	1432	LF	$ 33.80	$ 48,401.60
	Concrete, #7 Rebar, Form Work, Keyway Form Work, and Vapor Barrier					
2.3	Foundation Wall (A2020-110)	1600	1432	LF	$ 68.50	$ 98,092.00
	Concrete, #7 Rebar, Form Work, and Vapor Barrier					
2.4	Foundation Wall Waterproofing (A1010-320)	2000	1432	LF	$ 4.63	$ 6,630.16
2.6	Concrete Block Elevator Shaft (B2010-117)	1240	3780	SF	$ 13.35	$ 50,463.00
2.7	Concrete Block Stairway Walls (B2010-117)	1240	10080	SF	$ 13.35	$ 134,568.00

2.9	W8 Column (B1010-208)	2800	2028	VLF	$ 36.30	$ 73,616.40
2.8	Stairs with handrails (C2010-110)	0550	24	PER FLIGHT	$ 3,600.00	$ 86,400.00
2.5	Floor Construction (B1010-250)	6800	106,570	SF	$ 15.40	$ 1,641,178.00
	Web Joist, Metal Decking, Concrete, W16 Beam, W18 Girder, 30 X 30 Bay Size					
	TOTAL					$ 2,154,207.16
	3) EXTERIOR WALL					
3.1	Brick Face Composite Wall - Single Wythe (B2010-132)	1200	89200	SF	$ 23.75	$ 2,118,500.00
	4" Red Masonry Brick, 12" Concrete Blocks, Wall Ties, Flashing					
3.2	3' x 4' Double Hung Pella Windows (B2020-102)	3100	434	EA	$ 383.00	$ 166,222.00
	3' x 7' Doors with frames and hardware (B2030-110)					
3.4	Aluminum	6300	16	EA	$ 1,995.00	$ 31,920.00
3.6	Aluminum Partial	6300	14	EA	$ 1,995.00	$ 27,930.00
3.5	Wood	2750	24	EA	$ 357.00	$ 8,568.00
3.3	Curtain Wall					

	Flush Tube Framing (B2020-210)	1100	698	SF	$ 19.70	$ 13,750.60
	TOTAL					$ 2,366,890.60
	4) ROOF					
4.1	Main Building Pitched Roof	-	17400	SF	$ 7.63	$ 132,762.00
	W10 Exterior Truss Beams, HSS 6 x 5 x 1/2" Interior Truss Beams, 1/4" Plywood, Asphalt Shingles, Owen Corning R-50 Insulation, Vapor Barrier					
4.2	Multi-Use Banquet Hall Pitched Roof	-	598	SF	$ 7.63	$ 4,562.74
	W10 Exterior Truss Beams, HSS 6 x 5 x 1/2" Interior Truss Beams, 1/4" Plywood, Asphalt Shingles, Owen Corning R-50 Insulation, Vapor Barrier					
4.3	Flat Roof Overhang	1800	1800	SF	$ 3.39	$ 6,102.00
	Metal Decking, Single Ply Roofing					
	TOTAL					$ 143,426.74
	5) INTERIOR CONSTRUCTION					
5.1	Partitions (C1010-124)	6250	112,820	SF	$ 4.67	$ 526,869.40
	5/8" Drywall, 4" Steel Studs, Owens Corning R-19 Insulation					
5.3	3' x 7' Wood Doors with frames and hardware (C1020-120)	3000	366	EA	$ 397.00	$ 145,302.00
5.3	3' x 7' Wood Fire Doors with frames and hardware	1000	24	EA	$ 570.00	$ 13,680.00
5.2	Drop Ceiling with 2' x 2' tile and tracking (C3030-210)	5900	107,280	SF	$ 2.59	$ 277,855.20

5.4	Public Restrooms (C1030-110)					
	Toilet Partitions	0420	12	EA	$ 863.00	$ 10,356.00
	Grab Bars	0150	16	EA	$ 84.00	$ 1,344.00
	Mirrors	0160	12	EA	$ 146.50	$ 1,758.00
	TOTAL					$ 977,164.60
	6) INTERIOR FINISHES					
	Flooring (C3020-410)					
6.2	Carpet	0060	75,098	SF	$ 4.25	$ 319,166.50
6.3	Laminate Tile	1620	28,988	SF	$ 2.71	$ 78,557.48
6.4	Hardwood	2120	1428	SF	$ 7.65	$ 10,924.20
6.5	Rubber Matting	1460	766	SF	$ 7.09	$ 5,430.94
6.6	Partition - Primer & 2 Coats Paint (C3010-230)	0080	112,820	SF	$ 0.90	$ 101,538.00
6.7	Millwork	-	1	LS	$ 300,000.00	$ 300,000.00
	Kitchen Upper and Lower Cabinetry, Bathroom Upper and Lower Cabinetry					
	Granite Veneer Countertops	0150	1940	LF	$ 354.50	$ 687,730.00
	TOTAL					$ 1,503,347.12
7.1	**7) CONVEYING SYSTEMS**					
	Passenger Elevator (D1010-110)	2300	2	EA	$ 88,000.00	$ 176,000.00
	Car, stops, and car finish					
7.2						
	Freight Elevator (D1010-110)	7600	2	EA	$ 141,500.00	$ 283,000.00
	Car, stops, and car finish					
	TOTAL					$ 459,000.00
8.1 & 8.2	**8) HVAC**					

	Air Handling Unit (D3050-160)	1440	107,280	SF	$ 4.40	$ 472,032.00
	Ductwork					
	Diffusers					
	TOTAL					$ 472,032.00
9.1 & 9.2	**9) PLUMBING**					
	Residential Room - Fixtures (D2010-924)	1170	110	EA	$ 3,200.00	$ 352,000.00
	Rough-In					
	Toilet					
	Shower					
9.1 & 9.2	Sink					
	Public Area - Fixtures (D2010-922)	2220	8	EA	$ 2,325.00	$ 18,600.00
	Sink					
	Urinal					
	Toilet					
	Rough-in					
	TOTAL					$ 370,600.00
10.2	**10) FIRE PROTECTION**					
10.3	Standpipe (D4020-310)	0580/0600	6	PER FLOOR	$ 8,550.00	$ 51,300.00
10.1	Fire Pump (D4020-410)	3550	2	EA	$ 18,350.00	$ 36,700.00
	Sprinkler Heads (D4010-410)	0620	107,280	SF	$ 2.05	$ 219,924.00
	Residential Rooms					
10.4	Public Areas					
10.5	Fire Extinguishers (D4090-910)	0280	24	EA	$ 1,197.00	$ 28,728.00
	Fire and Smoke Alarms (D4090-910)	0040	206	EA	$ 91.50	$ 18,849.00
	TOTAL					$ 355,501.00
11.3	**11) ELECTRICAL**					
11.4	Electrical Outlets (D5020-110)	0320	107,280	SF	$ 1.87	$ 200,613.60
	Electrical Switches (D5020-130)	0280	107,280	SF	$ 0.36	$ 38,620.80

11.6	Light Fixtures					
11.6	Double Residential (D5020-214)	1120	16,744	SF	$ 29.55	$ 494,785.20
11.5	Single Residential (D5020-214)	1120	56,160	SF	$ 29.55	$ 1,659,528.00
11.7	Public Areas (D5020-280)	1240	34,376	SF	$ 10.50	$ 360,948.00
11.2	Electrical Fuse Box (D5020-165)	0680	2	EA	$ 911.00	$ 1,822.00
	Emergency Generator System	-	1	LS	$ 10,000.00	$ 10,000.00
	TOTAL					$ 2,766,317.60
	12) SPECIAL CONSTRUCTION					
12.1.1	Furniture					
	Residential Bedrooms:					
	Full Size Bed	-	63	EA	$ 1,100.00	$ 69,300.00
	Queen Size Bed	-	14	EA	$ 1,500.00	$ 21,000.00
12.1.2						
	Residential Living Room:					
	Table and chairs	-	77	SET	$ 1,200.00	$ 92,400.00
	Television	-	77	EA	$ 550.00	$ 42,350.00
	Couches	-	77	EA	$ 900.00	$ 69,300.00
12.1.3						
	Residential Kitchen: (E1090-410)					
	Aluminum sink and faucet	-	110	EA	$ 1,095.00	$ 120,450.00
	Electric stove	0140	110	EA	$ 1,766.50	$ 194,315.00
	Refrigerator	0220	110	EA	$ 2,497.00	$ 274,670.00
	Microwave	-	110	EA	$ 120.00	$ 13,200.00
	Dishwasher	0170	110	EA	$ 516.00	$ 56,760.00
12.1.4						
	Residential Bathrooms:					
	Above sink mirror	-	130	EA	$ 250.00	$ 32,500.00
	Towel rack	-	220	EA	$ 35.00	$ 7,700.00
12.1.5						

	Public Restrooms:					
	Paper towel dispenser	-	16	EA	$ 40.00	$ 640.00
	Soap dispenser	-	12	EA	$ 30.00	$ 360.00
12.1.6						
	Main Kitchen: (E1090-350)					
	Aluminum industrial sinks (D2010-410)	2080	4	EA	$ 1,325.00	$ 5,300.00
	Aluminum industrial dishwasher.	0130	2	EA	$ 7,880.00	$ 15,760.00
	Aluminum countertops (E1020-720)	0110	300	SF	$ 104.90	$ 31,470.00
	Aluminum industrial convection oven	0210	2	EA	$ 3,845.00	$ 7,690.00
	Aluminum stove	0200	2	EA	$ 4,947.00	$ 9,894.00
	Refrigerator	0110	72	SF	$ 128.60	$ 9,259.20
	Microwave	-	2	EA	$ 120.00	$ 240.00
12.1.7						
	ATM (E1010-110)					
	Local Bank ATM	0150	2	EA	$ 44,975.00	$ 89,950.00
12.1.8						
	Fitness (E1090-610)	0150	2	LS	$ 16,225.00	$ 32,450.00
	Treadmills		4	EA		
	Elliptical		6	EA		
	Weightlifting machines		6	EA		
	Sitting benches		4	EA		
12.1.9						
	Out-Patient Care (E2020-220)					
	Medical tables	0770	6	EA	$ 1,460.00	$ 8,760.00
	Privacy curtains	-	6	EA	$ 250.00	$ 1,500.00
	Beds	0200	6	EA	$ 1,000.00	$ 6,000.00
	Desks and chairs	0500	4	EA	$ 345.00	$ 1,380.00
	Computers	-	4	EA	$ 900.00	$ 3,600.00
	Health monitoring equipment	0320	6	EA	$ 3,250.00	$ 19,500.00

	Emergency health equipment	0710	6	EA	$ 14,500.00	$ 87,000.00
12.1.10						
	Library (E1020-230)					
	Book shelves	0110	120	LF	$ 412.00	$ 49,440.00
	Tables and chairs	0120	8	SET	$ 1,007.00	$ 8,056.00
	Desk (E2020-220)	0210	80	EA	$ 44.55	$ 3,564.00
	Computers	-	8	EA	$ 900.00	$ 7,200.00
12.1.11						
	Multi-Use Banquet Hall (E1020-320)					
	Tables and chairs	-	20	SET	$ 250.00	$ 5,000.00
	Televisions	-	6	EA	$ 550.00	$ 3,300.00
	Projection screen	0090	200	SF	$ 43.59	$ 8,718.00
	Projection equipment	0090	2	EA	$ 1,800.00	$ 3,600.00
12.1.12						
	24-Hour Staff Holding					
	Television	-	4	EA	$ 550.00	$ 2,200.00
	Table with chairs	-	4	EA	$ 250.00	$ 1,000.00
	Beds	-	10	EA	$ 800.00	$ 8,000.00
12.1.13						
	Laundry Room (E1010-610)					
	Washer	0170	6	EA	$ 3,164.00	$ 18,984.00
	Dryer	0110	6	EA	$ 2,989.00	$ 17,934.00
	Shelving (3 tiers)	-	10	EA	$ 85.00	$ 850.00
	TOTAL					$ 1,424,776.20
					Total:	$ 14,575,073.91

Appendix F: Scheduling

F.1 Schedule Order and Duration Spreadsheet

Specification Section	RS Means Coding	Item	# of Crews	Project Total	Units	Duration (Days)	Chron. Order
0.1	01560-250-0200	Erect Fence	2	6,681	L.F.	7	1
1.1	02230-100-0250	Site Clearing	2	8	Acre	2	2
0.2	01520-500-0500	Site Setup	2	1	Setup	4	3
1.2	02310-100-0100	Site Grading	2	19,360	S.Y.	24	4
1.10-1.14	02300-610-0510	Utility Excavation	2	3,124	C.Y.	4	5
1.15	02300-424-3900	Foundation Excavation	1	16,104	C.Y.	8	5
1.9	02530-780-2120	Install Sewer Line	1	1,142	L.F.	3	6
1.11	02510-730-2120	Install Water Line	1	492	L.F.	5	6
1.13	02580-420-5000	Install Electricity/Telephone/Cable	1	983	L.F.	5	6
2.2	03310-240-3850	Spread Footing	1	41	C.Y.	5	6
2.1	03310-240-3940	Strip Footing	1	142	C.Y.	7	7
2.3	03310-240-4260	Foundation Wall	1	5,728	S.F.	14	8
2.4	07160-150-0020	Foundation Wall Waterproofing	1	5,728	S.F.	1	9

2.9	05120-640-0300	Erect Steel	2	1,304	Tons	45	10
2.5.1	05210-600-0050	Install Floor- Metal Joists	2	536	Tons	22	10.33
2.5.2	05310-300-2400	Install Floor- Metal Decking	2	107,280	S.F.	11	10.33
2.5.3.1	03110-445-3050	Install Floor- Concrete Slab Forms	1	4,296	L.F.	10	10.33
2.5.3.2	03220-200-0100	Install Floor- Concrete Slab Reinforcement	4	3,261	C.S.F	23	10.33
2.5.3.3	03310-240-3150	Install Floor- Concrete Slab	1	107,280	S.F.	41	10.33
4.1.1	05210-600-0050	Install Roof- Main Building- Steel Trusses	1	40	EA	4	11
4.2.1	05210-600-0050	Install Roof- Banquet Hall- Steel Trusses	1	4	EA	1	11
4.3.1	05310-300-2400	Install Roof- Flat Overhang- Metal Decking	1	1,800	S.F.	1	11
2.8	05517-700-0100	Install Stairs	1	288	Risers	10	12
4.1.2	06160-900-0030	Install Roof- Main Building- 1/4" Plywood	1	17,400	S.F.	11	12
4.2.2	06160-900-0030	Install Roof- Banquet Hall- 1/4" Plywood	1	592	S.F.	1	12
4.3.2	07530-800-4800	Install Roof- Flat Overhang- Single Ply Membrane	1	4	Square	1	12
4.1.3	07510-700-1500	Install Roof- Main Building- Tar Paper	1	42	Square	1	12.25
4.2.3	07510-700-1500	Install Roof- Banquet Hall- Tar Paper	1	2	Square	1	12.25
2.7	04810-184-0300	Install Concrete Stair Shaft	2	10,140	S.F.	20	12.33

4.1.4	07310-100-0305	Install Roof-Main Building- Asphalt Shingles	1	42	Square	8	12.75
4.2.4	07310-100-0305	Install Roof- Banquet Hall- Asphalt Shingles	1	2	Square	1	12.75
7.1	14210-200-1675	Install Passenger Elevator	2	2	EA	10	12.75
7.2	14210-200-0575	Install Freight Elevator	2	2	EA	20	12.75
2.6	04810-184-0300	Install Concrete Elevator Shaft	2	3,780	S.F.	8	13
3.1.1	01540-750-0900	Scaffolding	1	446	C.S.F	19	13
3.2	08550-250-0200	Install Windows	2	434	EA	22	13.33
3.4	08100-600-0060	Install Exterior Doors- Aluminum	1	16	EA	5	13.33
3.6	08100-600-0260	Install Exterior Doors- Aluminum Partial	1	14	EA	5	13.33
3.5	08210-720-4640	Install Exterior Doors- Wood	1	24	EA	1	13.33
3.1	04810-540-0600	Install Brick Face Composite Wall	8	44,600	S.F.	41	14
3.3	08910-200-0150	Install Curtain Wall	1	698	S.F.	4	15
4.1.5	07220-700-1755	Install Roof- Main Building- Roof Insulation	6	17,400	S.F.	29	16
4.2.5	07220-700-1755	Install Roof- Banquet Hall- Roof Insulation	1	592	S.F.	6	16
4.1.6	07710-650-0012	Install Roof- Main Building- Gutters	1	1,200	L.F.	10	17
4.2.6	07710-650-0012	Install Roof- Banquet Hall- Gutters	1	100	L.F.	1	17

4.1.7	07710-400-0020	Install Roof- Main Building- Downspouts	1	240	L.F.	1	17.25
4.2.7	07710-400-0020	Install Roof- Banquet Hall- Downspouts	1	36	L.F.	1	17.25
1.3	02740-315-0020	Paving- Three Access Roads	2	61,460	S.F.	3	Last
1.5	02740-315-0020	Paving- Parking Lot	2	95,120	S.F.	5	Last
1.7	02775-275-0310	Paving- Concrete Sidewalk	1	8,440	S.F.	14	Last
1.4,1.6	02770-100-0200	Paving- Cape Cod Berms	1	6,018	L.F.	6	Last
8.1	15810-100-0580	Install HVAC- Ductwork	8	66,960	Lb.	29	1
5.1.2	09110-100-1600	Install Partitions- Metal Studs	4	112,820	S.F.	30	1.25
5.3.1	08210-900-0020	Install Interior Doors- Wood	1	366	EA	22	1.5
5.3.2	08210-950-0790	Install Interior Doors- Fire Doors	1	24	EA	2	1.5
9.1.1		Install Residential Room Plumbing- Rough Ins	1	330	EA	5	2
9.1.5		Install Public Area Plumbing- Rough Ins	1	16	EA	1	2
11.1	16136	Install Electric Rough In- Residential and Public	1	645	EA	10	2
10.3	13920-400-3350	Install Fire Pump	1	2	EA	3	3
11.2		Install Emergency Generator System	1	2	EA	2	3
10.2	13910-400-7160	Install Standpipe	1	36	EA	7	4
10.1	1390	Install Sprinkler Heads	4	1,000	EA	16	5

5.1.1	09250-700-2000	Install Partitions- Drywall	3	112,820	S.F.	19	6
5.1.2	07210-950-0860	Install Partitions- Insulation	3	112,820	S.F.	24	6.5
6.6	09910-920-0840	Paint	5	112,820	S.F.	23	7
5.2	09510-760-0800	Install Ceiling Grid and Tiles	8	107,280	S.F.	39	7.5
10.5	13720-065-3594	Install Fire and Smoke Alarms	2	206	EA	13	7.5
11.3		Install Electrical Finishes	1	645	EA	10	7.5
8.2	15850-300-0600	Install HVAC- Diffusers	5	636	EA	13	8
5.4.2	10810-100-3000	Install Restroom Mirrors	1	12	EA	1	9
6.1.1	09680-800-1100	Install Flooring- Carpet	15	75,098	S.F.	33	9
6.1.2	09310-100-3270	Install Flooring- Tile	4	28,988	S.F.	14	9
6.1.3	09647-100-5200	Install Flooring- Hardwood	2	1,428	S.F.	4	9
6.1.4	09653-100-5900	Install Flooring- Rubber Matting	1	766	S.F.	6	9
5.4.1	10165-100-0600	Install Toilet Partitions	1	12	EA	3	10
6.7	6400	Install Millwork	4	2,930	L.F.	18	10
9.1.2	15418-900-0150	Install Residential Room Plumbing- Toilet	2	110	EA	10	11
9.1.3	15418-500-3250	Install Residential Room Plumbing- Shower	2	110	EA	9	11
9.1.4	15418-600-4960	Install Residential Room Plumbing- Sink	2	110	EA	11	11
9.1.6	15411-700-	Install Public Area Plumbing- Urinal	1	8	EA	3	11

	3100						
9.1.7	15418-900-3000	Install Public Area Plumbing- Toilet	1	8	EA	1	11
9.1.8	15418-600-2100	Install Public Area Plumbing- Sink	1	8	EA	1	11
10.4	13960-200-2000	Install Fire Extinguishers	1	24	EA	1	11
12.1		Install Furniture					
		Residential Apartments:		90	Rooms	**30**	
12.1.1		Residential Bedrooms:				2	1
		Full Size Bed	4	63	EA	1	
		Queen Size Bed	4	14	EA	1	
12.1.2		Install Residential Living Room:				3	1
	12540-100-1020	Table and chairs	4	77	SET	1	
		Television	4	77	EA	1	
		Couches	4	77	EA	1	
12.1.3		Install Residential Kitchen Units:				21	1
	11460-100-1500	Aluminum sink and faucet , Range, and Refrigerator	4	110	EA	14	
		Microwave	4	110	EA	1	
		Dishwasher	4	110	EA	7	
12.1.4		Install Residential Bathrooms:				4	1
	10810-100-3000	Above sink mirror	4	130	EA	2	
	10810-100-6400	Towel rack	4	220	EA	2	

12.1.5		Install Public Restrooms:				**2**	1
	10810-100-6700	Paper towel dispenser	2	16	EA	1	
	10810-100-4600	Soap dispenser	2	12	EA	1	
12.1.6		Install Main Kitchen:				**8**	1
	15418-600-2300	Aluminum industrial sinks	2	4	EA	1	
		Aluminum industrial dishwasher.	2	2	EA	1	
	12310-750-3500	Aluminum countertops	2	100	L.F.	2	
	11420-110-0300	Aluminum industrial convection oven	2	2	EA	1	
	11420-110-7500	Aluminum stove	2	2	EA	1	
	11405-110-8350	Refrigerator	2	2	EA	2	
		Microwave	2	2	EA	1	
12.1.7		Install ATM					
		Local Bank ATM	2	2	EA	**1**	1
12.1.8		Install Fitness Equipment				**3**	1
	11484-400-1300	Treadmills	2	4	EA	1	
	11484-400-0400	Elliptical	2	6	EA	1	
		Weightlifting machines	2	6	EA	1	
		Sitting benches	2	4	EA	1	
12.1.9		Install Out-Patient Care				**7**	1

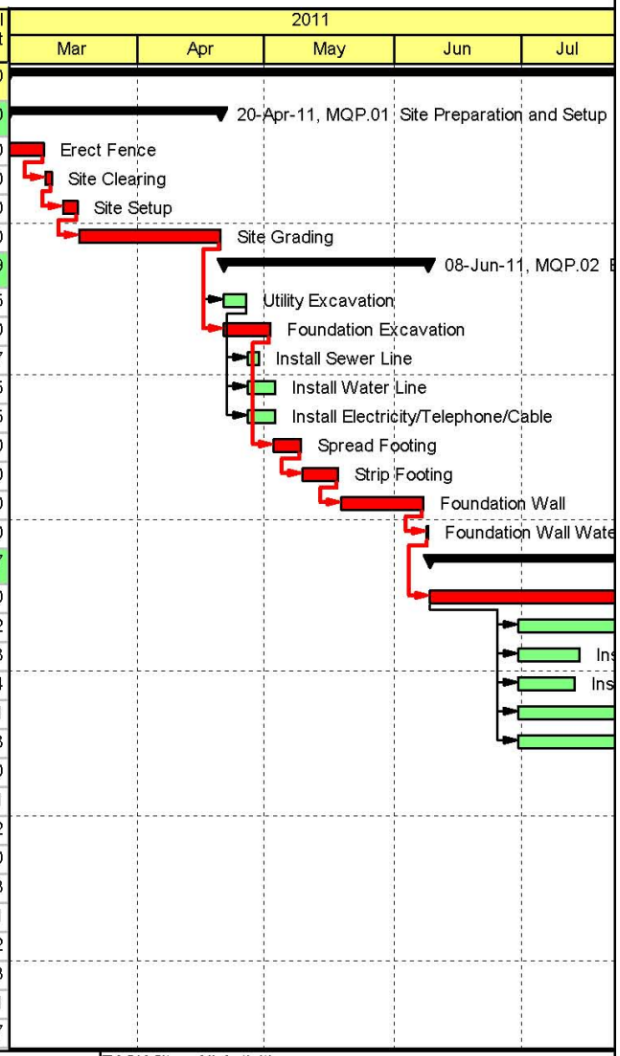
		Equipment					
	12560-400-0900	Medical tables	2	6	EA	1	
	12493-200-4020	Privacy curtains	2	6	EA	1	
	12560-400-0020	Beds	2	6	EA	1	
	12510-600-0020	Desks and chairs	2	4	EA	1	
		Computers	2	4	EA	1	
	11710	Health monitoring equipment	2	6	EA	1	
	11710	Emergency health equipment	2	6	EA	1	
12.1.10		Install Library Items				**10**	1
	11051-400-0020	Book shelves	2	120	LF	5	
	12560-700-7000	Tables and chairs	2	8	SET	1	
	12560-700-0100	Desk	2	80	EA	3	
		Computers	2	8	EA	1	
12.1.11		Install Multi-Use Banquet Hall				**3**	1
	12540-100-1020	Tables and chairs	2	20	SET	1	
		Televisions	2	6	EA	1	
	11136-500-1200	Projection screen	2	1	EA	1	
	11130-600-2600	Projection equipment	2	2	EA	1	
12.1.12		Install 24-Hour Staff Holding				**3**	1

		Television	2	4	EA	1	
	12540-100-1020	Table with chairs	2	4	EA	1	
	12560-400-0020	Beds	2	10	EA	1	
12.1.13		Install Laundry Room				**3**	1
	11119-450-5000	Washer	2	6	EA	1	
	11119-450-0500	Dryer	2	6	EA	1	
		Shelving (3 tiers)	2	10	EA	1	

F.2 Primavera Schedule

Elderly Housing MQP | 2 Week Lookahead | 02-Mar-10 15:55

Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
MQP	Elderly Housing MQP	351	01-Mar-11	03-Jul-12	0
MQP.01	Site Preparation and Setup	37	01-Mar-11	20-Apr-11	0
A1000	Erect Fence	7	01-Mar-11	09-Mar-11	0
A1010	Site Clearing	2	10-Mar-11	11-Mar-11	0
A1020	Site Setup	4	14-Mar-11	17-Mar-11	0
A1030	Site Grading	24	18-Mar-11	20-Apr-11	0
MQP.02	Excavation and Foundation	35	21-Apr-11	08-Jun-11	279
A1040	Utility Excavation	4	21-Apr-11	26-Apr-11	305
A1050	Foundation Excavation	8	21-Apr-11	02-May-11	0
A1060	Install Sewer Line	3	27-Apr-11	29-Apr-11	307
A1070	Install Water Line	5	27-Apr-11	03-May-11	305
A1080	Install Electricity/Telephone/Cable	5	27-Apr-11	03-May-11	305
A1090	Spread Footing	5	03-May-11	09-May-11	0
A1100	Strip Footing	7	10-May-11	18-May-11	0
A1110	Foundation Wall	14	19-May-11	07-Jun-11	0
A1120	Foundation Wall Waterproofing	1	08-Jun-11	08-Jun-11	0
MQP.03	Superstructure	73	09-Jun-11	19-Sep-11	207
A1130	Erect Steel	45	09-Jun-11	10-Aug-11	0
A1140	Install Floor- Metal Joists	22	30-Jun-11	29-Jul-11	242
A1150	Install Floor- Metal Decking	11	30-Jun-11	14-Jul-11	253
A1160	Install Floor- Concrete Slab Forms	10	30-Jun-11	13-Jul-11	254
A1170	Install Floor- Concrete Slab Reinforcement	23	30-Jun-11	01-Aug-11	241
A1180	Install Floor- Concrete Slab	41	30-Jun-11	25-Aug-11	223
A1190	Install Roof- Main Building- Steel Trusses	4	11-Aug-11	16-Aug-11	0
A1200	Install Roof- Banquet Hall- Steel Trusses	1	11-Aug-11	11-Aug-11	231
A1210	Install Roof- Flat Overhang- Metal Decking	1	11-Aug-11	11-Aug-11	232
A1220	Install Stairs	10	17-Aug-11	30-Aug-11	0
A1230	Install Roof- Main Building- 1/4" Plywood	11	17-Aug-11	31-Aug-11	218
A1240	Install Roof- Banquet Hall- 1/4" Plywood	1	12-Aug-11	12-Aug-11	231
A1250	Install Roof- Flat Overhang- Single Ply Membrane	1	12-Aug-11	12-Aug-11	232
A1260	Install Roof- Main Building- Tar Paper	1	22-Aug-11	22-Aug-11	218
A1270	Install Roof- Banquet Hall- Tar Paper	1	12-Aug-11	15-Aug-11	231
A1280	Install Concrete Stair Shaft	20	22-Aug-11	19-Sep-11	207



Actual Work | Critical Remaining Work | Summ...
Remaining Work | Milestone

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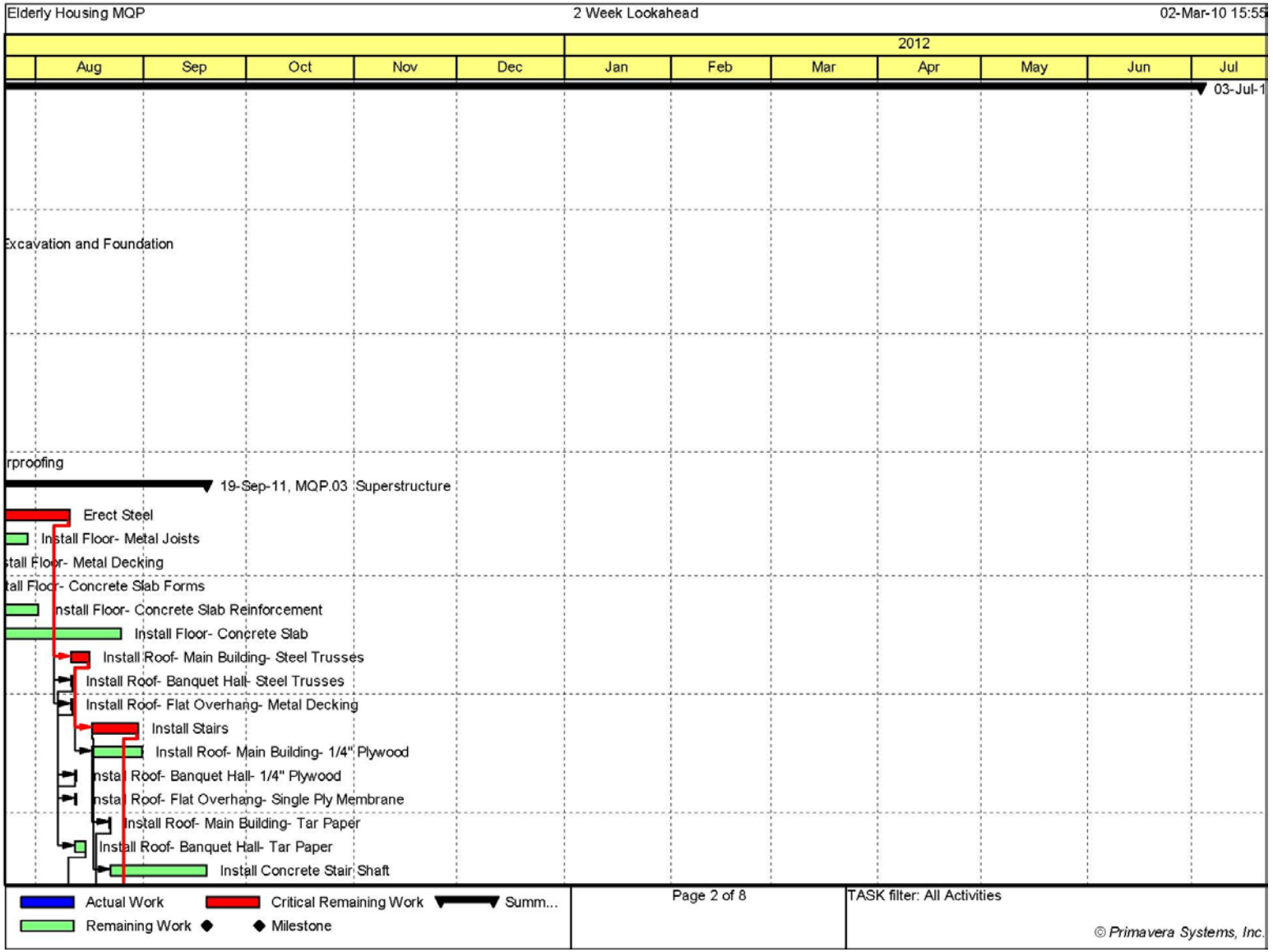
TASK filter: All Activities


Elderly Housing MQP
2 Week Lookahead
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Excavation and Foundation
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19-Sep-11, MQP.03 Superstructure
Erect Steel
Install Floor- Metal Joists
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tall Floor- Concrete Slab Forms
Install Floor- Concrete Slab Reinforcement
Install Floor- Concrete Slab
Install Roof- Main Building- Steel Trusses
Install Roof- Banquet Hall- Steel Trusses
Install Roof- Flat Overhang- Metal Decking
Install Stairs
Install Roof- Main Building- 1/4" Plywood
nstall Roof- Banquet Hall- 1/4" Plywood
nstall Roof- Flat Overhang- Single Ply Membrane
Install Roof- Main Building- Tar Paper
Install Roof- Banquet Hall- Tar Paper
Install Concrete Stair Shaft
Actual Work
Critical Remaining Work
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Remaining Work
Milestone
Page 2 of 8
TASK filter: All Activities
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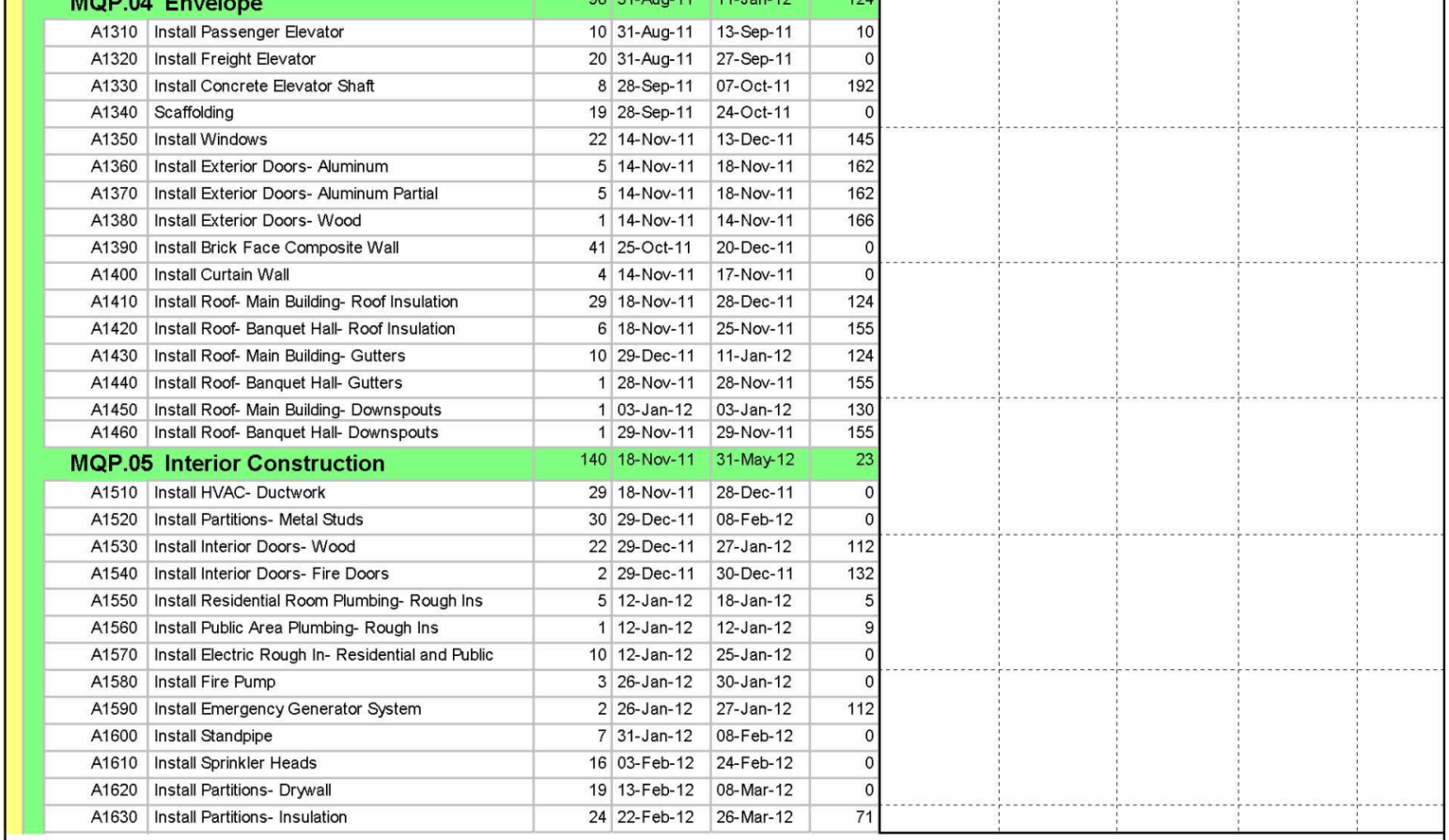
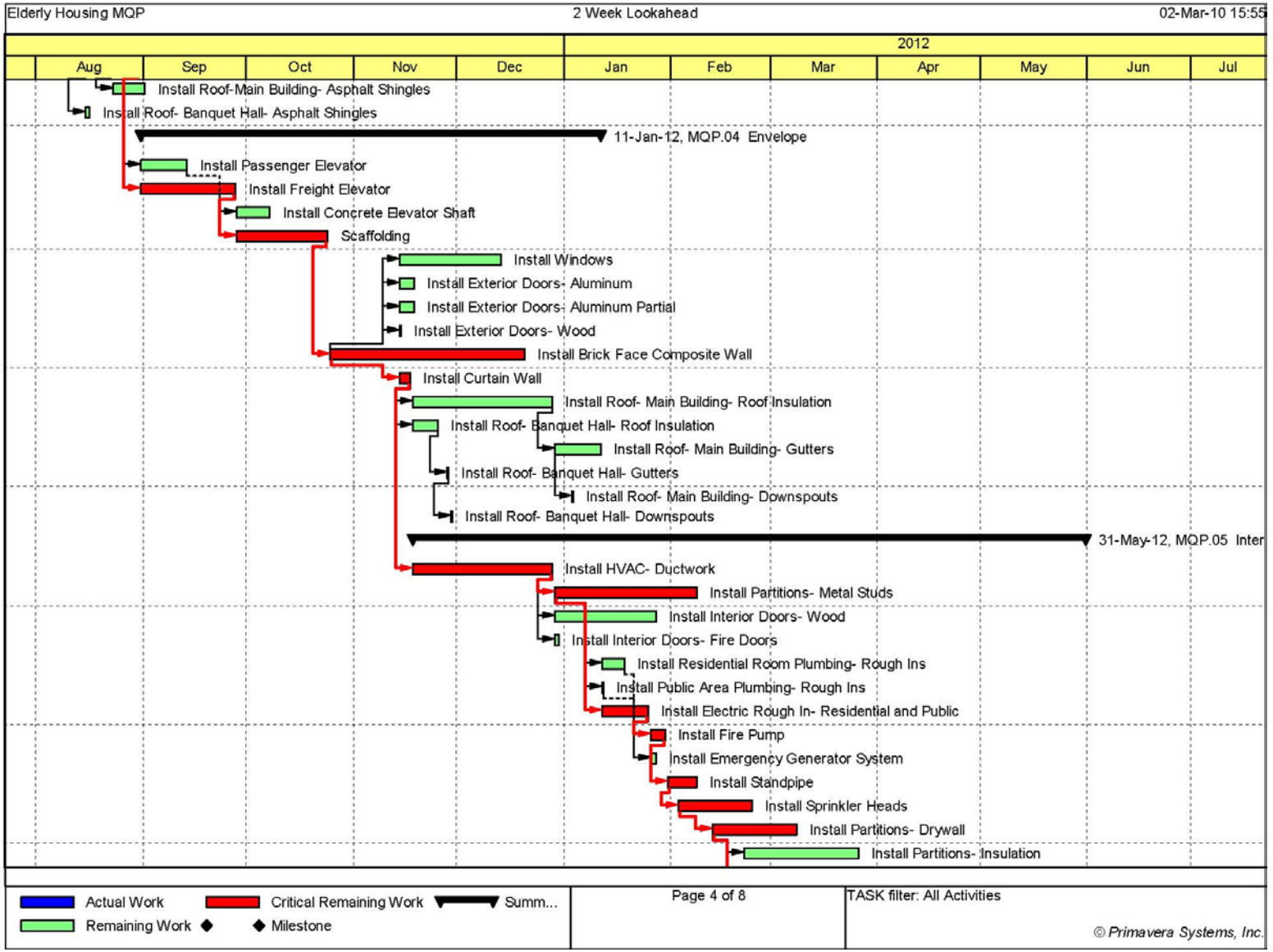
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
A1290	Install Roof-Main Building- Asphalt Shingles	8	23-Aug-11	01-Sep-11	218
A1300	Install Roof- Banquet Hall- Asphalt Shingles	1	15-Aug-11	16-Aug-11	231
MQP.04	**Envelope**	96	31-Aug-11	11-Jan-12	124
A1310	Install Passenger Elevator	10	31-Aug-11	13-Sep-11	10
A1320	Install Freight Elevator	20	31-Aug-11	27-Sep-11	0
A1330	Install Concrete Elevator Shaft	8	28-Sep-11	07-Oct-11	192
A1340	Scaffolding	19	28-Sep-11	24-Oct-11	0
A1350	Install Windows	22	14-Nov-11	13-Dec-11	145
A1360	Install Exterior Doors- Aluminum	5	14-Nov-11	18-Nov-11	162
A1370	Install Exterior Doors- Aluminum Partial	5	14-Nov-11	18-Nov-11	162
A1380	Install Exterior Doors- Wood	1	14-Nov-11	14-Nov-11	166
A1390	Install Brick Face Composite Wall	41	25-Oct-11	20-Dec-11	0
A1400	Install Curtain Wall	4	14-Nov-11	17-Nov-11	0
A1410	Install Roof- Main Building- Roof Insulation	29	18-Nov-11	28-Dec-11	124
A1420	Install Roof- Banquet Hall- Roof Insulation	6	18-Nov-11	25-Nov-11	155
A1430	Install Roof- Main Building- Gutters	10	29-Dec-11	11-Jan-12	124
A1440	Install Roof- Banquet Hall- Gutters	1	28-Nov-11	28-Nov-11	155
A1450	Install Roof- Main Building- Downspouts	1	03-Jan-12	03-Jan-12	130
A1460	Install Roof- Banquet Hall- Downspouts	1	29-Nov-11	29-Nov-11	155
MQP.05	**Interior Construction**	140	18-Nov-11	31-May-12	23
A1510	Install HVAC- Ductwork	29	18-Nov-11	28-Dec-11	0
A1520	Install Partitions- Metal Studs	30	29-Dec-11	08-Feb-12	0
A1530	Install Interior Doors- Wood	22	29-Dec-11	27-Jan-12	112
A1540	Install Interior Doors- Fire Doors	2	29-Dec-11	30-Dec-11	132
A1550	Install Residential Room Plumbing- Rough Ins	5	12-Jan-12	18-Jan-12	5
A1560	Install Public Area Plumbing- Rough Ins	1	12-Jan-12	12-Jan-12	9
A1570	Install Electric Rough In- Residential and Public	10	12-Jan-12	25-Jan-12	0
A1580	Install Fire Pump	3	26-Jan-12	30-Jan-12	0
A1590	Install Emergency Generator System	2	26-Jan-12	27-Jan-12	112
A1600	Install Standpipe	7	31-Jan-12	08-Feb-12	0
A1610	Install Sprinkler Heads	16	03-Feb-12	24-Feb-12	0
A1620	Install Partitions- Drywall	19	13-Feb-12	08-Mar-12	0
A1630	Install Partitions- Insulation	24	22-Feb-12	26-Mar-12	71




Elderly Housing MQP
2 Week Lookahead
02-Mar-10 15:55
2012
Aug
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Install Roof-Main Building- Asphalt Shingles
Install Roof- Banquet Hall- Asphalt Shingles
11-Jan-12, MQP.04 Envelope
Install Passenger Elevator
Install Freight Elevator
Install Concrete Elevator Shaft
Scaffolding
Install Windows
Install Exterior Doors- Aluminum
Install Exterior Doors- Aluminum Partial
Install Exterior Doors- Wood
Install Brick Face Composite Wall
Install Curtain Wall
Install Roof- Main Building- Roof Insulation
Install Roof- Banquet Hall- Roof Insulation
Install Roof- Main Building- Gutters
Install Roof- Banquet Hall- Gutters
Install Roof- Main Building- Downspouts
Install Roof- Banquet Hall- Downspouts
31-May-12, MQP.05 Inter
Install HVAC- Ductwork
Install Partitions- Metal Studs
Install Interior Doors- Wood
Install Interior Doors- Fire Doors
Install Residential Room Plumbing- Rough Ins
Install Public Area Plumbing- Rough Ins
Install Electric Rough In- Residential and Public
Install Fire Pump
Install Emergency Generator System
Install Standpipe
Install Sprinkler Heads
Install Partitions- Drywall
Install Partitions- Insulation
Actual Work
Remaining Work
Critical Remaining Work
Milestone
Summ...
Page 4 of 8
TASK filter: All Activities
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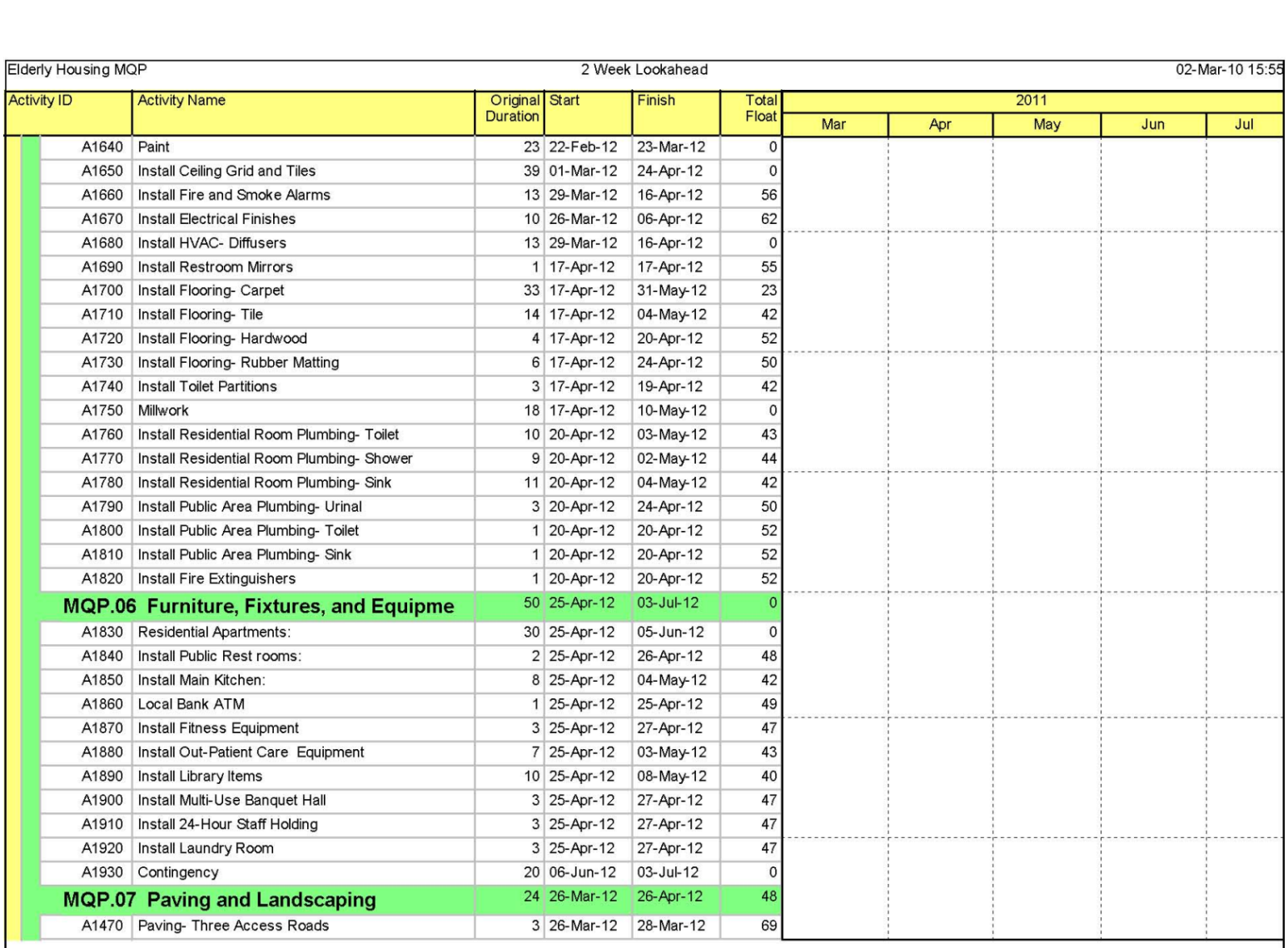
Elderly Housing MQP | 2 Week Lookahead | 02-Mar-10 15:55

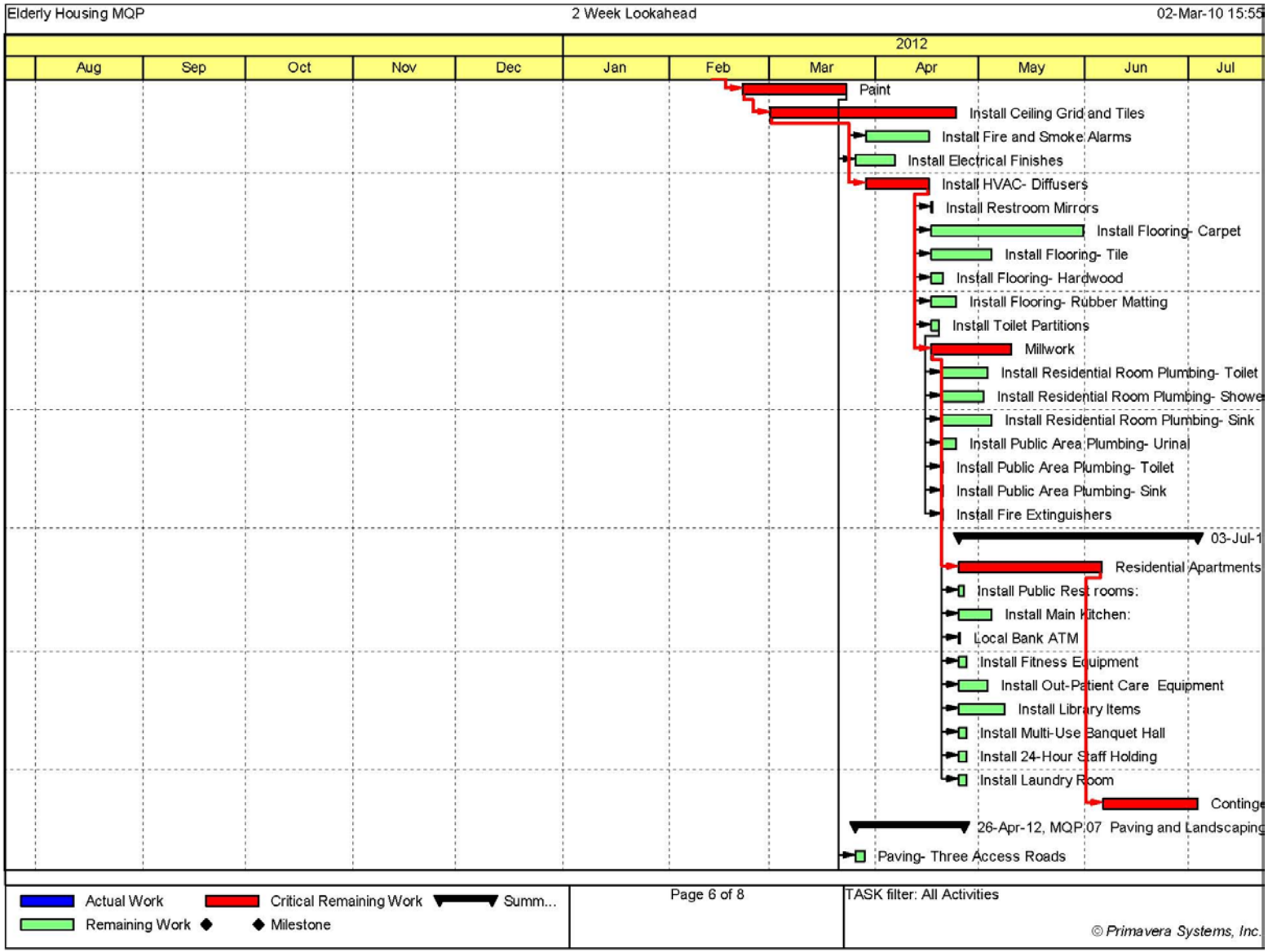
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
A1640	Paint	23	22-Feb-12	23-Mar-12	0
A1650	Install Ceiling Grid and Tiles	39	01-Mar-12	24-Apr-12	0
A1660	Install Fire and Smoke Alarms	13	29-Mar-12	16-Apr-12	56
A1670	Install Electrical Finishes	10	26-Mar-12	06-Apr-12	62
A1680	Install HVAC- Diffusers	13	29-Mar-12	16-Apr-12	0
A1690	Install Restroom Mirrors	1	17-Apr-12	17-Apr-12	55
A1700	Install Flooring- Carpet	33	17-Apr-12	31-May-12	23
A1710	Install Flooring- Tile	14	17-Apr-12	04-May-12	42
A1720	Install Flooring- Hardwood	4	17-Apr-12	20-Apr-12	52
A1730	Install Flooring- Rubber Matting	6	17-Apr-12	24-Apr-12	50
A1740	Install Toilet Partitions	3	17-Apr-12	19-Apr-12	42
A1750	Millwork	18	17-Apr-12	10-May-12	0
A1760	Install Residential Room Plumbing- Toilet	10	20-Apr-12	03-May-12	43
A1770	Install Residential Room Plumbing- Shower	9	20-Apr-12	02-May-12	44
A1780	Install Residential Room Plumbing- Sink	11	20-Apr-12	04-May-12	42
A1790	Install Public Area Plumbing- Urinal	3	20-Apr-12	24-Apr-12	50
A1800	Install Public Area Plumbing- Toilet	1	20-Apr-12	20-Apr-12	52
A1810	Install Public Area Plumbing- Sink	1	20-Apr-12	20-Apr-12	52
A1820	Install Fire Extinguishers	1	20-Apr-12	20-Apr-12	52
MQP.06	**Furniture, Fixtures, and Equipme**	50	25-Apr-12	03-Jul-12	0
A1830	Residential Apartments:	30	25-Apr-12	05-Jun-12	0
A1840	Install Public Rest rooms:	2	25-Apr-12	26-Apr-12	48
A1850	Install Main Kitchen:	8	25-Apr-12	04-May-12	42
A1860	Local Bank ATM	1	25-Apr-12	25-Apr-12	49
A1870	Install Fitness Equipment	3	25-Apr-12	27-Apr-12	47
A1880	Install Out-Patient Care Equipment	7	25-Apr-12	03-May-12	43
A1890	Install Library Items	10	25-Apr-12	08-May-12	40
A1900	Install Multi-Use Banquet Hall	3	25-Apr-12	27-Apr-12	47
A1910	Install 24-Hour Staff Holding	3	25-Apr-12	27-Apr-12	47
A1920	Install Laundry Room	3	25-Apr-12	27-Apr-12	47
A1930	Contingency	20	06-Jun-12	03-Jul-12	0
MQP.07	**Paving and Landscaping**	24	26-Mar-12	26-Apr-12	48
A1470	Paving- Three Access Roads	3	26-Mar-12	28-Mar-12	69



Actual Work | Critical Remaining Work | Summ...
Remaining Work | Milestone

Page 5 of 8

TASK filter: All Activities


Elderly Housing MQP
2 Week Lookahead
02-Mar-10 15:55
2012
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Jun
Jul
Paint
Install Ceiling Grid and Tiles
Install Fire and Smoke Alarms
Install Electrical Finishes
Install HVAC- Diffusers
Install Restroom Mirrors
Install Flooring- Carpet
Install Flooring- Tile
Install Flooring- Hardwood
Install Flooring- Rubber Matting
Install Toilet Partitions
Millwork
Install Residential Room Plumbing- Toilet
Install Residential Room Plumbing- Showe
Install Residential Room Plumbing- Sink
Install Public Area Plumbing- Urinal
Install Public Area Plumbing- Toilet
Install Public Area Plumbing- Sink
Install Fire Extinguishers
03-Jul-1
Residential Apartments
Install Public Rest rooms:
Install Main Kitchen:
Local Bank ATM
Install Fitness Equipment
Install Out-Patient Care Equipment
Install Library Items
Install Multi-Use Banquet Hall
Install 24-Hour Staff Holding
Install Laundry Room
Continge
26-Apr-12, MQP.07 Paving and Landscaping
Paving- Three Access Roads
Actual Work
Remaining Work
Critical Remaining Work
Milestone
Summ...
Page 6 of 8
TASK filter: All Activities
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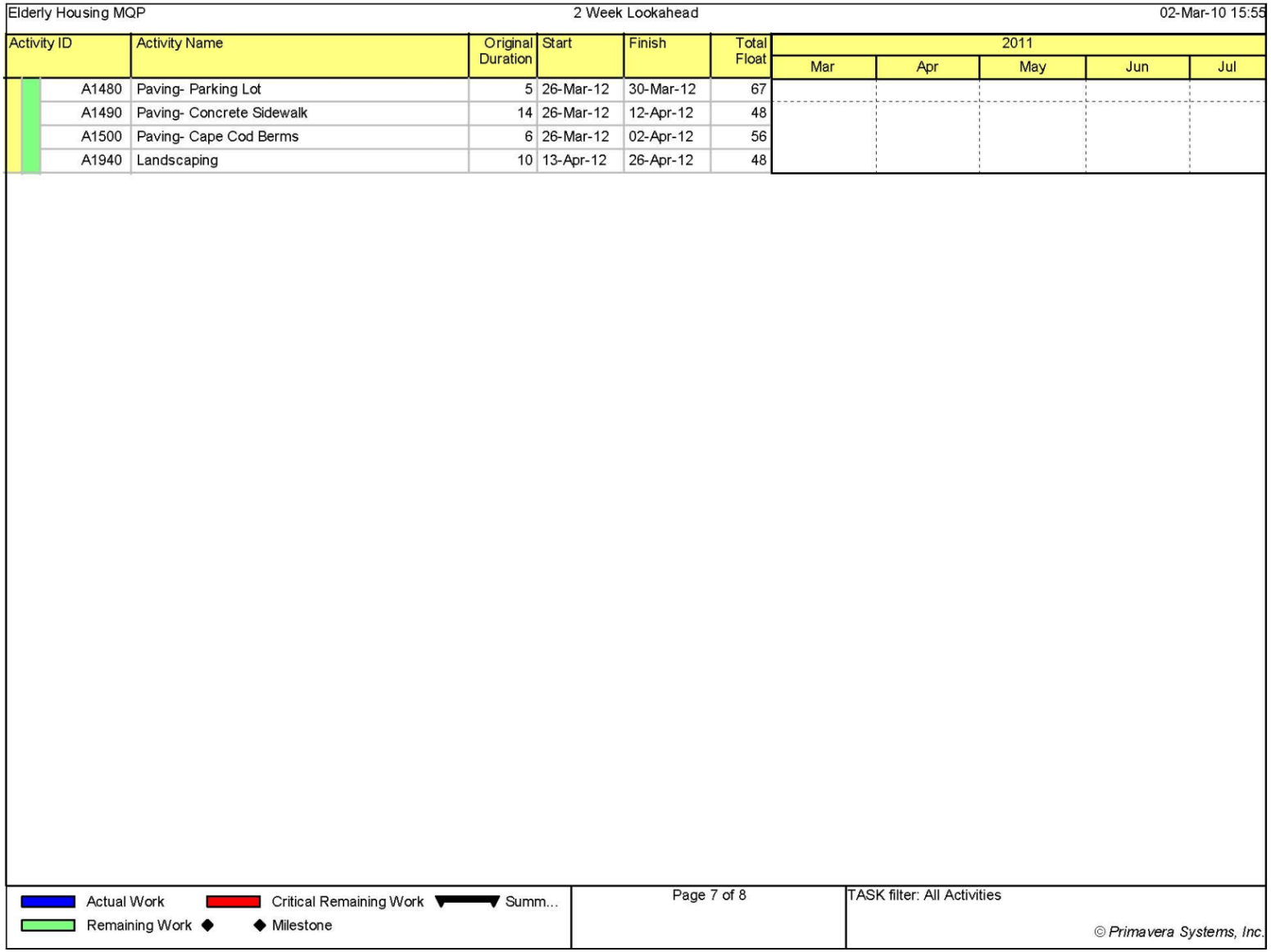
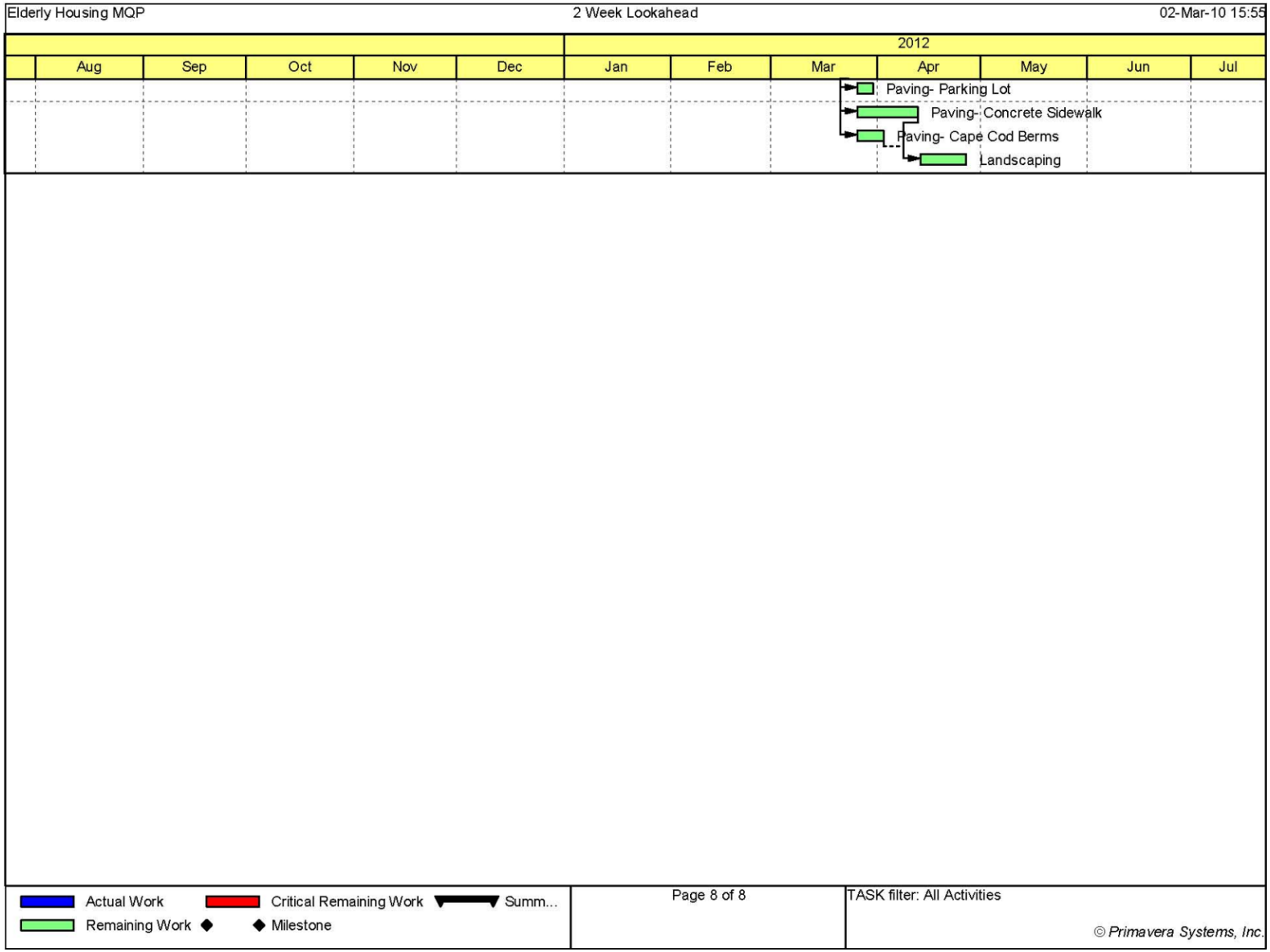
Activity ID	Activity Name	Original Duration	Start	Finish	Total Float
A1480	Paving- Parking Lot	5	26-Mar-12	30-Mar-12	67
A1490	Paving- Concrete Sidewalk	14	26-Mar-12	12-Apr-12	48
A1500	Paving- Cape Cod Berms	6	26-Mar-12	02-Apr-12	56
A1940	Landscaping	10	13-Apr-12	26-Apr-12	48




Elderly Housing MQP
2 Week Lookahead
02-Mar-10 15:55
2012
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Paving- Parking Lot
Paving- Concrete Sidewalk
Paving- Cape Cod Berms
Landscaping
Actual Work
Remaining Work
Critical Remaining Work
Milestone
Summ...
Page 8 of 8
TASK filter: All Activities
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Appendix G: Site Visit Pictures

G.1 Masonic Home (The Overlook Life Care Community)