

CARNEGIE MELLON UNIVERSITY

MASTER THESIS

Senior Community Center Proposal and Design

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*A thesis submitted in fulfilment of the requirements
for the degree of Master of Science*

in the

Building Performance and Diagnostics
School of Architecture

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Declaration of Authorship

I, Yujie XU, declare that this thesis titled, 'Senior Community Center Proposal and Design' and the work presented in it are my own. I confirm that:

- This work was done wholly or mainly while in candidature for a research degree at this University.
- Where any part of this thesis has previously been submitted for a degree or any other qualification at this University or any other institution, this has been clearly stated.
- Where I have consulted the published work of others, this is always clearly attributed.
- Where I have quoted from the work of others, the source is always given. With the exception of such quotations, this thesis is entirely my own work.
- I have acknowledged all main sources of help.
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Signed:

Date:

“My passion and great enjoyment for architecture, and the reason the older I get the more I enjoy it, is because I believe we - architects - can effect the quality of life of the people.”

Richard Rogers

CARNEGIE MELLON UNIVERSITY

Abstract

Prof. Volker Hartkopf
School of Architecture

Master of Science

**Senior Community Center
Proposal and Design**

by Yujie XU

The project of Senior Community Center started from Fall 2014. The goal of the project is to 1) analyze the feasibility and the potential benefit of a Senior Community Center near CMU Campus, 2) conduct case review of related design with specific focus on inter-generational relationship creation.

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Abbreviations

CMU	Carnegie Mellon University
OSHER	Academy of Lifelong Lniversity
CCRC	Continuing Care Retirement Center
SCU	Special Care Unit

Dedicated to my family, friends and my instructors. . .

Chapter 1

Background Information

1.1 Elderly Issue

The commonly adopted boundary age for the elderly is 65 years old in most of the developed counties [1]. From the 2010 U.S. census Demographic Profile Data, 13.1% of the population are over the age of 65. In Pittsburgh, this ratio is a little higher than the nationwide statistics (Figure 1.1), which is 13.8% (42,151), and 2.4% (7347) of the population are of age over 85 [2]. By 2030, 72.1 million (19%) of the U.S population will be elderly [3]

Geography: [Pittsburgh city, Pennsylvania ▾](#)

	Subject	Number	Percent
1 SEX AND AGE			
186	Total population	305,704	100.0
of	Under 5 years	15,109	4.9
186	5 to 9 years	13,026	4.3
▼	10 to 14 years	12,848	4.2
186	15 to 19 years	24,349	8.0
▼	20 to 24 years	42,212	13.8
186	25 to 29 years	30,648	10.0
▼	30 to 34 years	21,092	6.9
186	35 to 39 years	16,269	5.3
▼	40 to 44 years	15,721	5.1
186	45 to 49 years	17,805	5.8
▼	50 to 54 years	20,089	6.6
186	55 to 59 years	19,011	6.2
▼	60 to 64 years	15,374	5.0
186	65 to 69 years	10,913	3.6
▼	70 to 74 years	8,776	2.9
186	75 to 79 years	7,654	2.5
▼	80 to 84 years	7,461	2.4
186	85 years and over	7,347	2.4

FIGURE 1.1: U.S. census 2010 Demographic Profile Data (Pittsburgh) [2]

The awareness of the necessity for a senior community center near Carnegie Mellon University Campus emerged from a previous course project for Ecological Footprint in Fall 2013 conducted under instruction of Prof. Hartkopf. In the analysis of the campus neighborhood, the conflict between the relatively high ratio of senior population around campus and a lack of proper facilities for senior citizens was observed .

For improving quality of life of the neighborhood as a whole, providing access to safer, more affordable and more environmentally friendly housing choices for students and faculty members and reducing the travelling distance of faculty members to provide both more sustainable and more affordable housing choices, a GIS analysis was conducted

The series of analysis was conducted with ArcGIS 10.1 [4]. First the population density of senior citizen in the surrounding neighborhood was calculated. The percentage of population with an age above 65 was adopted as the metric of measuring the concentration of senior population[1]. From the visualization of the senior population distribution, one can observe that to the south of the campus, there is a large area with a very high senior population percentage (Figure 1.2).

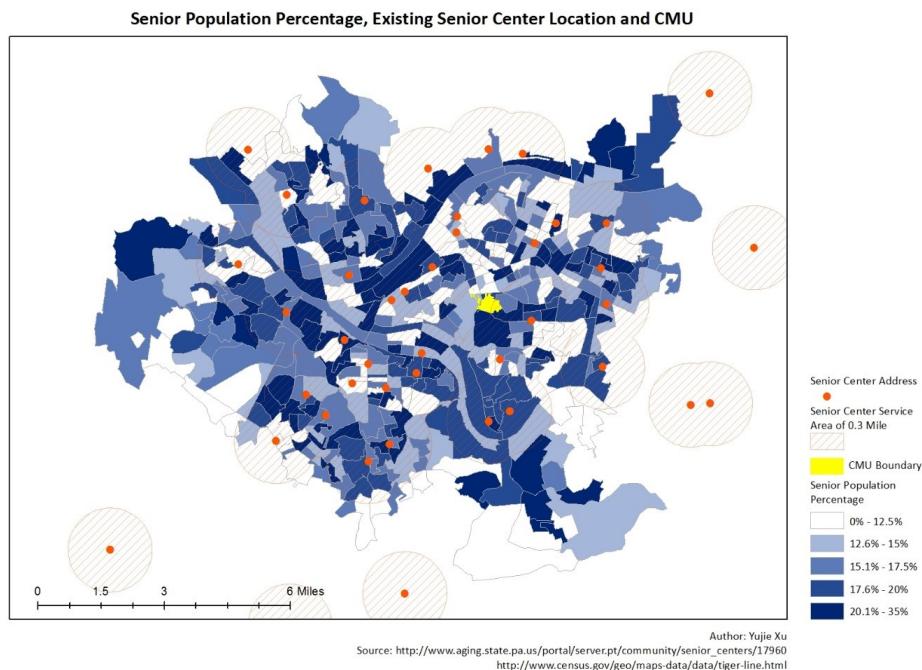


FIGURE 1.2: Senior Population Percentage, Existing Senior Center Location and CMU Campus Boundary

Then the existing senior centers around Pittsburgh was located on the map (Table A.1 [5]. See Appendix A for a list of senior centers located on the map arefAppendixA). A 0.3

mile service area buffer was created around each existing senior center facility by applying the approximation analyze. A service area gap around the campus where no senior center is within a proper walking distance was identified.

This analysis acts as a starting point of the proposal of a senior community center near CMU campus.

1.2 Proposed Site

1.2.1 Surrounding Buildings

The proposed site of the senior center is to the north of the CMU campus next to Doherty Apartment across Forbes Ave. It is currently a parking lot (Figure 1.3). To the north of the proposed site is the East Campus Parking Garage. To the west of the site lie the alumni house and the Fraternity/Sorority Quadrangle (Figure 1.4).



FIGURE 1.3: Site Location Ariel View [6]

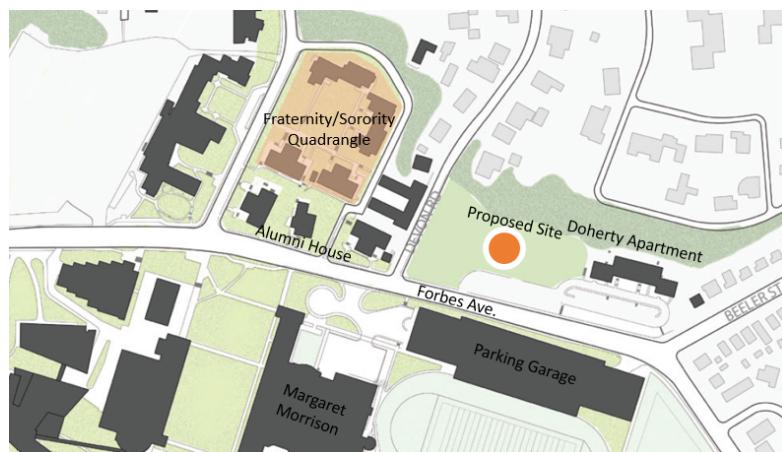


FIGURE 1.4: Surrounding Buildings [6]

1.2.2 Neighborhood Context

The proposed site of the Senior Community Center is to the north of Carnegie Mellon University, and is within the boundary of the Squirrelhill North Neighborhood (Figure 1.5), which contains the majority portion of the CMU campus. The remaining portion of the campus is within the North Oakland neighborhood.

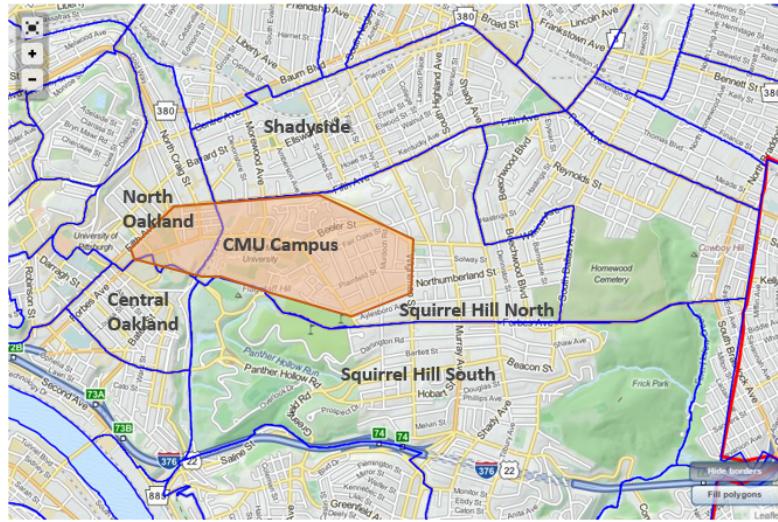


FIGURE 1.5: Neighborhood Context of Proposed Site [7]

The Squirrelhill North Neighborhood is in an urban setting. Its population density is 9713 person per square mile, much higher than Pittsburgh average (5532). This indicates a less sprawled urban space pattern and implies a higher chance of creating contact between the elderly and the society.

The neighborhood has a median household income of \$82,214, over twice of that of the Pittsburgh (\$35,947). The average household size is 2.1, These features suggest the community of the proposed site is relatively wealthier neighborhood with small household size.

There are 16% of foreign born residents. This high ratio of foreign born residents suggest 1) the more urgent need of a public life than a traditional community with mainly native residents. The foreign born residents potentially has less social contact than native residents and thus the community and social life might be a more important aspect than native residents. 2) The design of a new Senior Community Center should consider the cultural difference of senior residents and should provide diverse services that suits needs of different cultural background. The area has a much higher percentage of higher education attainment as a result of the presence of Carnegie Mellon University. [7] (Table 1.1)

	Squirrel Hill North	North Oakland	Pittsburgh
Population Density (people per sq. mile)	9713	14658	5532
Median Household Income / \$	82214	40931	35947
Median Rent / \$	1123	603	760
Percentage of Family Household	45.4	10.9	37.7
Percentage of foreign born residents	16	27.5	7.4
Housing Price	516844	167225	132337

TABLE 1.1: Neighborhood Statistics

Average number of cars or other vehicles in the houses of the neighborhood is 2.2 [7]. This ratio is high comparing with the relatively small household size. It implies a less sustainable traveling pattern. The design impact of the new senior center is that it should both consider enough parking space, and also the ways to demonstrate a sustainable travelling method by providing bicycle racks and car-sharing facilities like a zipcar spot. The zipcar locations near campus include the East Campus Garage and the parking lot to the west of Morewood Gardens.

The neighborhood is older than Pittsburgh average in terms of building built year. The average estimated housing value (2010) for detached houses are \$516,844, which is four times that of the Pittsburgh average of \$132,337. The median rent is \$1,123, which is also a lot higher than \$603 of Pittsburgh in general. This rent price is comparable to that of the renter occupied median housing cost in Stanford.

Stanford University locates at the bay area of the United States. This area has a tight housing market [8]. Facing this situation, the Stanford University has a four story 167-unit apartment under construction to be available for rent for faculty members and staff. There are 100 one-bedroom and 67 two-bedroom units in the complex. The location of the apartment complex is in close approximation to the campus and is within bicycle distance. [9].

The development of the Carnegie Mellon University and the affiliated IT and Computer Science Industry might one day put CMU in similar housing situation as Stanford University. The already high median rent of the campus neighborhood is one indicator of such a situation. Before the housing and land price raise too high, it is wise to prepare for the incoming housing market tightness and provide housing for the newly recruited faculty members (Table 1.2).

Monthly Housing Cost (Median)	Occupied	Owner Occupied	Renter Occupied
Pittsburgh	787	820	767
Stanford	1539	2,933	1,393

TABLE 1.2: Median Monthly Housing Cost

1.2.3 Historic Aspect

Looking back in history maps, the proposed site is vacant in 1900. From the 1904 history map, we can see a brick structured building belonging to M.C Shiller. In 1959, Doherty Apartments is built and has been functioning ever since. This indicates there are no major historic context needed to be reflected in the project design nor is there important historic landmark on the site to be protected (Figure 1.6).

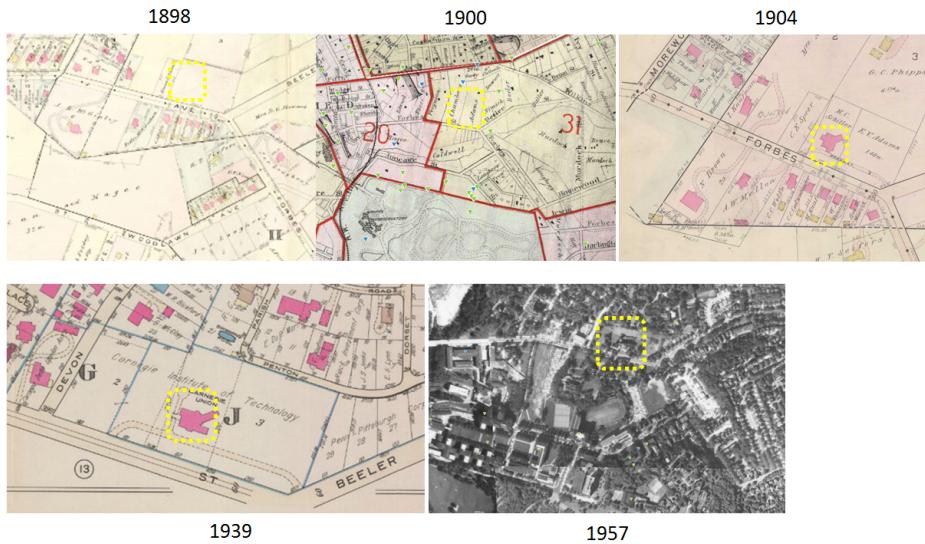


FIGURE 1.6: The History of the site from 1898 to 1957 [10, 11]

1.2.4 Physical Condition

There is an elevation difference between the south and the north of the proposed site. The north side is about 10m higher than that of the south. The height difference created a stage for more varied landscape design opportunities for creating connections between the senior center and the Doherty apartment, the former being housing for elderly, the latter being housing for young college students.

1.3 Previous Design Conducted

Ms. Anne-Marie Lubenau has completed a design of a senior center on this proposed site (Figure 1.7). The general form of the building consists of four major clusters: three major living cluster and one public cluster. Each of the four clusters is easily identified with the hipped roof above it. The public cluster locate on the southwestern of the site and the remaining three living clusters locate on the southeastern, northeaster and northwestern corner of the building.

The public cluster consists of a public library, a group kitchen, a lounge on the first floor, a computer cluster, a health suite on the second floor and some mechanical rooms and storage rooms in the basement. Each of the living cluster consists of 6 living unit per floor except for the first floor of the northeastern living cluster , which consists only 4 living units. There are in total 54 living units in the building. Between each of the adjacent cluster, there are some lobby or lounge area. The vertical transportation located in the center of each of the four cluster. There are 30 parking spot located in the basement with the entrance on the northeastern corner of the site.

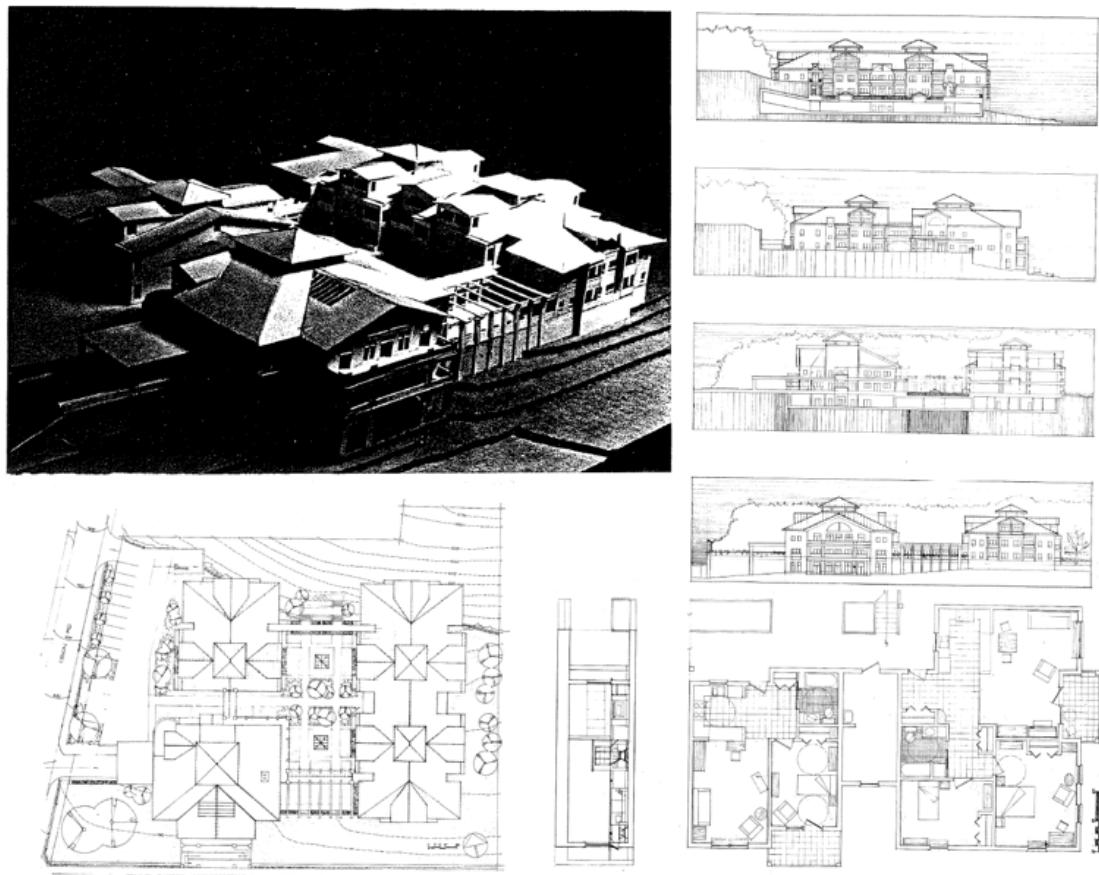


FIGURE 1.7: Senior Community Center Design by Ms. Anna Maria Lubenau

1.4 Climate

The site located in Pittsburgh, Pennsylvania. It is within the climate zone 5A, with 5957 Heating Degree Day (HDD) of 65°F and 5009 Cooling Degree Day (CDD) of 74°F . The design heating temperature is 8°F and design cooling temperature is 86°F [12]

From the psychrometric chart, we can see that the dry bulb temperature of the site ranges from 10 to 92 degree F. There is 17% of the time within the comfort range of 69 to 81 F. 80% of the time, the temperature is below comfort range and 3% of the time the temperature is above the comfort range. This indicates the major load for building in this area is heating. From the suggested strategies by Climate Consultant [13], about

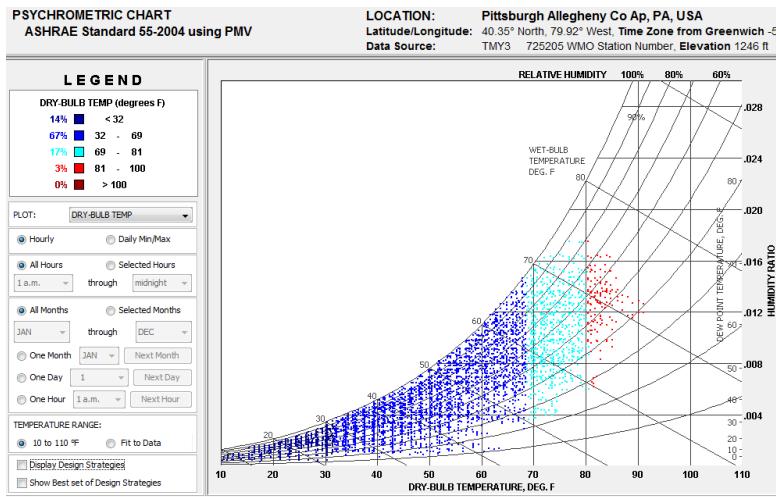


FIGURE 1.8: Psychrometric Chart [13]

half of the heating load should be met by heating devices with humidification. The passive strategies for heating season suggested by the software include: “Internal heat gain”, “Passive Solar Direct Gain (Low Mass)” and “Wind protection”. Internal heat gain is the heat produced by lighting, people activities and equipment operation that warms up the space. This source of heat gain is strongly dependent on the building usage and operation schedules and thus is not a very reliable source of heat gain. The “Passive Solar Direct Gain (Low Mass)” suggest that providing sun-facing glazing that let in the sunlight can increase the indoor temperature. “Wind protection” can prevent the heat loss from infiltration from building entrance. From the wind wheel, we can see in winter (Jan through Feb), the major wind direction is west. The wind with maximum speed comes from southwestern. The design implication is that the entrance should be arranged so that they are not facing these two directions and have wind protection fixtures at the entrances in winter.

The passive cooling strategies include: de-humidification, add sun-shading devices to windows.

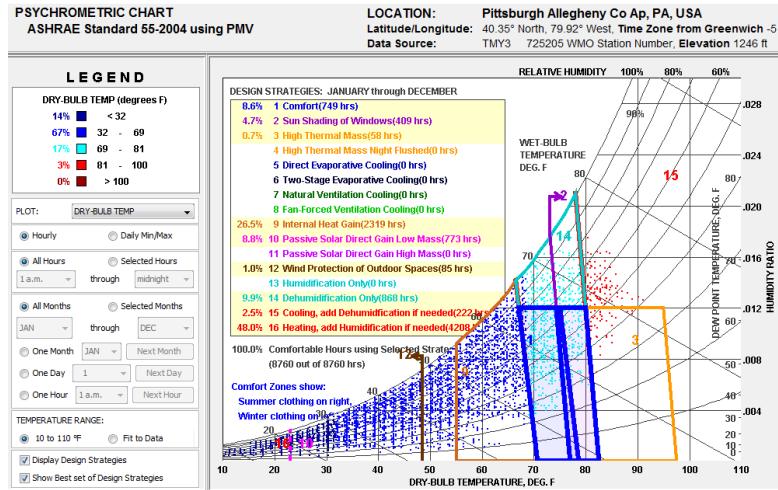


FIGURE 1.9: Phychrometric Chart with Suggested Strategies [13]

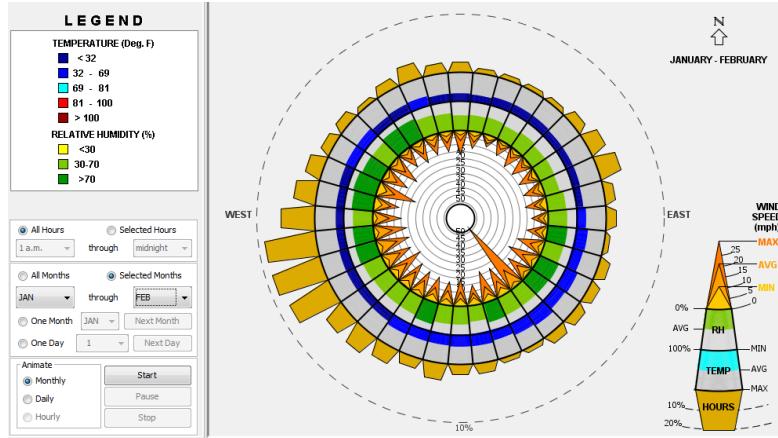


FIGURE 1.10: Wind Wheel [13]

1.5 Role of the Project

1.5.1 Bridge of Conversation between Different Age Group

As is addressed by Neyfakh [14], American society is confronted by severe age segregation, people are hashed into different “buckets” of ages groups and their social life is restricted to their own “bucket”. No more than 1/4 of the conversation about “important matters” happen between the elderly and people younger than 36; by excluding relatives, the figure dropped to 6%. Age segregation “sow distrust and prejudice between generations, and robs people of the chance to learn from those younger and older than them” [14]. The elderly benefit from reading to children and children or the young people can learn the life knowledge from the elderly.

One of the major focus of this project is to discuss methods to establish an inter-generation connection. The role of architecture in providing good quality of life for the

elderly is far more than just plugging in assisted living facilities and add some space for instant medical care. It is also about creating chances of meeting new people and about maintain the link to the society.

1.5.1.1 Creating Connections between the Elderly and Children

One of the elderly friend of Prof. Hartkopf shared his experience of meeting children in their field trip. Children are the only people that has the will to touch the elderly apart from the doctors that give them a shot of drug when they get sick. The age group of elderly is respected for their rich experiences along the development of mankind, but is suffering from a segregation as a side-effect of the development of the modern society.

The presence of a children's school and the Academy of Lifelong Learning ([OSHER](#)) on campus enables the possibility to create a connection between the life of senior citizens and the early education of the children in the children's school.

1.5.1.2 Creating Connections between Elderly and Student

The proposed site is to the east of a student apartment, Doherty Apartment. The design of a common space on the upper level of the senior center and the bridge from the senior center to the garage might become a common route for both the elderly and the young colledge students, which could create interactions between the age group of the elderly and young students.

Another approach to create the connections between these two age groups is through volunteering programs where the students can providing health or activity services for the elderly and the elderly can also volunteer to participate in some of the study project of students, especially in aging related areas [15].

In the discussion with directors in the childrens school, "Lunchtime Walking Buddy" was brought up. It can be an example of how volunteering opportunities can facilitate the connection between the two age groups: The path between the proposed site of the senior community center and the classroom of Lifelong Learning and the Children's School will bypass the playground. Track walking is an easy and effective physical exercise for both the elderly and the young. The problem for the elderly is they might encounter sudden fall while exercising. The volunteering lunchtime walking will benefit the elderly by allowing a supervised safer exercise for the elderly and it will benefit the young by providing them with the chance of conversation with people of rich life experiences.

Yet another approach is through providing some well designed common spaces. For example, the common space on the top level of the senior center could provide a nice study space and the basement will contain some extra music practicing rooms which might attract young student to come and use, and thus creating chances for the young and old to meet.

1.5.2 Center for Geriatrics (Aging Related) Researches

There are several geriatrics research groups in or around Carnegie Mellon University. The creation of such a center near campus can provide more interactions and hands-on experience with their research target and thus might assist the development of the related researches.

1.5.2.1 Connections to Quality of Life Technology (QoLT) Center

The focus of the QoLT center is “intelligent systems that improve quality of life for everyone while enabling older adults and people with disabilities” [16]. One of the promising research branch of the QoLT center that facilitates the connection to the Seniro Center is one of the four Testbed Systems: the Home and Community Health & Wellness (HCHW), whose goal is described as “to create and evaluate home and community-based solutions for assessing everyday functional status, providing appropriate feedback, and assisting rehabilitation in the natural environment for people with reduced capabilities due to disability or aging. HCHW systems will enable more older adults and people with disabilities to live independently.” [17]

The following are some project carried on by the HCHW system:

- **Health Kiosk**

The Health Kiosk system allows the elderly to track and record their health conditions including “blood pressure, blood oxygen level, handgrip, weight, hearing” etc. and remotely send the results to clinicians without an actual clinical visit. It provides senior citizens with easy monitoring and knowledge of their health conditions on a regular basis (Figure 1.11) [18].

- **Embedded Assessment of Wellness with Smart Home Sensors**

The system helps to monitor the abilities of senior citizens in performing everyday activities and provides information of the degree of physical ability declination. [19]

Some of the laboratory could be arranged inside the senior community center so that researchers will be able to conduct research experiments with elderly residents in their



Design prototype for the Multi-User Health Kiosk.

FIGURE 1.11: Health Kiosk [18]

natural setting. Just as the Corinne Dolan Alzheimer Center for Alzheimer's, some experiment settings or facilities could even be built into the architecture of the senior center itself [20].

1.5.3 Community Center for the Elderly and Other Residents

Although the proposed senior center will contain some amount of living units to the elderly with various degree of assistance: from the active independent elderly, to those need intensive assistance to those with special needs of assistance (Alzheimer Disease) even the “end-of-life” issue. One of the important roles of the center is to act as a community gathering space dedicated for all age groups of the surrounding neighborhood. As is discussed in more details in Chapter 2, this is one of the major approaches to enhance the inter-generation connections and create bounds to the society.

1.5.4 Demonstration of Advanced Building Technology and System Design

1.5.4.1 Urban Agriculture

Gardening / Horticulture is one of the shared activities of almost all age groups . It can create food, jobs and a chance of meeting and mixing of different age groups. Possible approaches of the project on Urban Agriculture include:

- Create Roof Gardens on the top floor of the parking garage and part of the Senior Community Center

The benefits of using green roof include: reducing stormwater runoff, protecting roof membrane, reducing heating/cooling load and reducing urban heat island effect [21].

- Create Vegetation facade for the Senior Community Center

These green space will act as a stage for common activities of children and elderly to happen; a place to hide from the noise of the urban jungle; a field to produce food and a classroom for teaching healthy eating habits.

1.5.4.2 Sustainable / Renewable Energy Source

- Solar Energy for electricity:
 - Integration of PV panels and green roofs.
 - Integration of PV panels and shading devices
- Geothermal
- Co-generation system within the building groups

1.5.4.3 Passive Strategy

- Design of building orientation and dimension of space to facilitate day-lighting and natural ventilation
- Rainwater collection and reuse
- Phase-changing material

1.5.4.4 Pre-fabrication of Building Components

- Using steel or alluminum as the main building structure material.
- Use a common mode for building design to minimize the number of distinct elements.

1.5.4.5 Strategies for Maximizing the Indoor Environment Quality

- Water-based heating and cooling system to ensure both the energy performance and the acoustic quality of the indoor environment

- Floor-based mechanical system to ensure low pollutant concentration and space flexibility
- Transparent space boundary design to allow views to indoor and outdoor activities and to create spatial guidance for the elderly.
- Installing Personal Environment Module to account for stricter environment requirement from the elderly.

1.6 Design Choices and Concerns for Children and Elderly

Through the discussion with the administrators of the [children's school](#) of Carnegie Mellon University, Ms. [Sharon Carver](#), Director of Children's School, and Ms. [Allison Drash](#), the Administrative Coordinator, a lot of insights were acquired about different approaches about how children and elderly can be related.

1.6.1 Integrated Learning Opportunities

1.6.1.1 Dalcroze Eurhythmics

Music is a common activity shared by all age groups including the elderly and the young children. It is not only a delight for life but also a effective training for brain and physical dexterity development for children and the function maintenance of the elderly. One of such example is the Dalcroze Eurhythmics. It teaches music concepts through body movements.

Eurhythmics is a good candidate for creating common activities between the elderly and the children because: 1) it involves plenty of body movement which can be game-like for children and can be good exercise for the elderly 2) Marta Sanchez Dalcroze Training Center in Carnegie Mellon University has a high quality education in Dalcroze Eurhythmics that offers classes for both the children and the elderly.

1.6.1.2 Elderly Reading to Children

A nursing home in Tulsa, Grace Living Center has a collaboration with the Jenks public school. The facility provides two classrooms for 60 kindergarten students of grade 1 and 2 and preschool students. The elderly residents in the center can volunteer to become mentors for the children that assists children in both academic and social development. Children brought joy in elderly's life, and the elderly provided academic improvement

for children. The Jenks school found that “a smaller percentage of students from the GLC have required reading intervention” in their later studies. One example of the collaborated learning is the “book buddies” activities, where children and elderly form groups and read to each other severa times per week. Another example is the “shared study”, where the elderly and the children work on craft activities together such as making Christmas ornaments, scarecrows etc. There are also comparative course content when the elderly and children share their lifes of “then and now” [22].



FIGURE 1.12: Elderly meet School Children at Grace Living Center, Tulsa [23]

1.6.1.3 Horticulture

The term “gray and green”, introduced by Wright and Lund, means the positive effect of introducing green plants on the process of aging. Gardening reduces stress, nurtures stewardship [24]. Gardening activities is one of the common activities that benifit both the children and the elderly. The “edible garden” is mentioned by Tai et al. in the book Designing Outdoor Environments for Children [25]. Edible gardens can let children experience the whole gardening process from growing to harvest, promote physical activities and also teach children the knowledge of healthy eating, which contributes to the battle towards childhood obesity in the U.S [25], which shortens children’s lifespan expectancy by five years [26]. They also mentioned a type of “music garden”, where outdoor music instrument are incorporated in the design of garden environment.

Green space can also act as a healing and comforting power. There are two major types of such salutogenically designed gardens: the “healing or sensory garden” that provide passive assist to imporve healthy conditions. [26]. The “Healing Gardens” aims at providing a quiet and calming space away from urban environment noise, where “young and old can escape and emotionally revitalise”. The “Sensory Garden” provide a ways to open up the senses of visitors: visually, acoustically, variety in scents, tastes and touching experiences. “Therapeutic Gardens” actively conduct healing operations. There are specific therapeutic gardens for people with dememtia or mobility problem. A

common feature of such therapeutic gardens is raised bed, which is accessible for people in a wheel chair.

1.6.2 Mobility Issue

The mobility is a big issue that needs to be seriously dealt with for the two age groups to meet and have common activities. The elevation difference, staircases and busy roads can all potentially become barriers that prevents them from using the path we designed. Especially for children, in order to reach the proposed site of the senior center, they have to cross Forbes Ave. According to the safety requirement, the children need to cross the street with the presence of traffic lights, so the possible places to cross are either the crossing at Forbes and Beeler or at Forbes and Morewood. Such detouring can increase the travel distance and may cause the failure of establishing such a connection, especially when there are not enough cleaning and resting facilities as chairs and bathrooms along the path.

The presence of university center along the path is a great help. Since the building itself is already a well functioned and energetic gathering space that provides abundant cleaning and resting spaces.

One of the desired solution for the detouring and the crossing of Forbes Ave. is to create a bridge that directly connects the university center and the senior center. This solution can both shorten the distance and fulfill the required services along the path. But from the location of the University Center and the proposed site, the bridge directly connecting both will be too long to construct. So instead one solution could be to connect the parking garage or the University Center Extension currently under construction with the senior center. This bridge may not only act as a safe cross for the senior people, children as well as the students living in Doherty Apartment, but also an identification of the entrance to the campus zone.

The parking garage needs to be retrofitted so that it will not become an unpleasant spot along the route that only creates noise and exhaust gas, but a great view. One solution is to replace the top level of the garage with a roof garden. This will be further discussed in the section of the proposed design of the plants and green space in the senior center and along the path between senior center and children school.

Chapter 2

Case Study

2.1 General Design Considerations of Senior Population

The battle against age segregation is taking place at many places around the world. In Europe, the concept of “multi-generation” community center and the mix-generation housing becomes active alternatives for dealing with aging of the society [29].

Senior center is an active node in the community that supply resources to senior citizens and provide the community with aging related knowledge [27]. Main services offered at a senior center include: education on a broad range of topics including health, art, humanity, nutrition etc., volunteering opportunities, intergeneration programs, meal plans, health screening, physical training etc.

There are several main categories of housing choices for the elderly: independent living, assisted living facilities, Continuing Care Retirement Communities (CCRC), nursing homes, and special care facilities as Alzheimer’s care facilities [28]. The main difference are the degree of care provided. Residents of independent living communities differ from normal communities mainly in the demographic sence, i.e. the residents are limited to senior citizens. Assisted living had 24 hour staff and provide living services such as meal, laundry and bathing. It is meant for seniors that are not capable of living independently but are not in need of heavy medical care. Nursing home are more like hospitals with on site physicians and nurses that provide high degree of medical care in addiction to living services. CCRC provides a broad range of services that covers all the services provided in the housing types above and may include some dementia care [28]. Due to the awareness of the negative impact of relocation of seniors especially those with dementia, the CCRC prototype for senior living is the most suitable in the current case.

The senior community center under discussion in the current project is a combined community center and housing for senior citizens. It also integrates with the university population by providing common space to the community including university population, some housing units for newly enrolled faculty members and space for elderly-children common activities with the children from the children's school or from the community. These concerns make the function of the senior center in this project different from a traditional senior center setting. The case study in this section focuses more on the aspect specific to the project, such as the instances with mixed age groups, affiliated to a university, or a combined facility of living and research.

2.2 Elderly and Children Combined Facility

Several common approaches will be discussed in the following section that facilitates the connections between different age groups: multi-generation housing, multi-generation community centers, and adjacency between elderly housing and kindergarten

2.2.1 Multi-generational Housing and Neighborhood Center

In Europe, “multi-generational neighborhood centers” are alternatives to traditional senior centers that creates inter-generational connections. Its services expanded from traditional senior center to include community gathering, pre-school, infant care [29] and advice center that supports different age groups [30].

In Germany, the “multi-generation housing” program is a government funded program, which is also part of the “aging population plan” [30]. Coupled with the multi-generation housing, the multi-generation community center (or “multi-generation meeting house” [30]) acts as a space that assist elderly as well as other generation. It has several features: 1) community education that enables sharing of knowledges and skills between different age groups; 2) open meeting space that acts as the “public living room” that brings back the conversation and casual encountering between age groups 3) “mutual aid” create bounds between different age groups by offering and receiving help [30].

One early example of such multi-generation center is the mothers' centre in Salzgitter, Germany, was launched in 2006 by Ursula von der Leyen with the aim of creating opportunities of “encounter and contact between young and old” [30]. It is a one of the earliest examples of a combined center for children, the youth, mothers, the community and the elderly.



FIGURE 2.1: Public Living Room [30]

2.2.2 Mixed-generation Elderly Housing

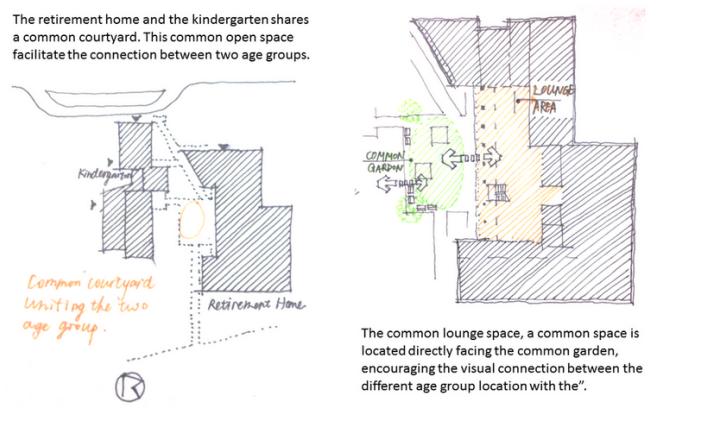
In Swabia, Germany, a housing program for elderly was created with 2/3 elderly residents and 1/3 of other age groups. The housing model aims at helping elderly age in place with helps from other generations in a “supportive environment” [29]. The common space is extensible and can hold a variety of activities arranged by social workers and the residents themselves. The activites take place in the common space include: morning play of children, affordable lunch for both the senior residents and people from the neighborhood, informal community gatherings and rent out space for other community events [29].

2.2.3 Elderly Housing Next to Kindergarten

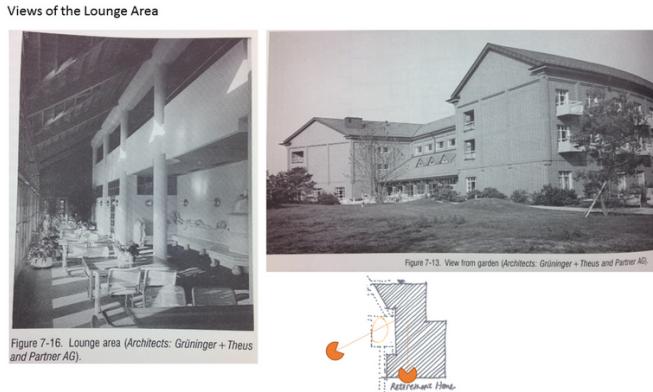
2.2.3.1 Altersheim Furttal, A Retirement Home in a Swiss Village

The retirement home is built near the city center with good public transportation. This connection provides the residents with a stronger connection to the society.

There is a kindergarten to the north of the retirement home. The connections between the two age groups are established with a common courtyard between the kindergarten and the retirement home. The interior space design strengthens this connection by arranging a two story “lounge space” adjacent to the common garden.



(A) Site Plan Layout of Altersheim Furttal and Kindergarten



(B) Views of the Lounge Area

FIGURE 2.2: Common Garden and Interior Design in Creating Connections between Different Age Groups

2.3 University Affiliated Senior Housing

2.3.1 Ithaca College and Longview Partnership

The Longview project is a combined effort of Ithaca College, Cornell University and City of Ithaca. It started as a renovation of Tompkins County Hospital and grew to a CCRC facility providing a variety of housing choices include independent living, assisted living and enhanced assisted living.

2.3.1.1 Connections between Longview and Ithaca College

The connections between the Longview program and Ithaca College include: education opportunities, access to school facilities, volunteering opportunities and therapy programs supported by students and staff from related medical programs.

Residents are provided with education opportunities: they have access to classes taught at Ithaca College or in the Ithaca classroom in Longview. School facilities such as libraries and gyms are open to residents to use. School recreational activities are also open for Longview residents such as sports, art and music events. Students volunteers participate in the activity arrangement of the Longview program. Students in the College Physical Therapy and Occupational Therapy help the staff members give physical trainings to elderly residents at Longview. This collaboration benefits both the college students and the staff and elderly residents at Longview. Students gain practice experiences and staff and elderly gain knowledge and skills for maintaining good physical conditions.

2.3.1.2 Site Plan and Building Layout

Longview community is located to the southwestern of the main campus of Ithaca College [31]. The main apartment building is a four story building with the main entrance on the third floor. The layout of the main apartment building includes four living wings and a common space at the center of each floor. To the north of the apartment building is the building for enhanced assisted living. In the west of the site, there are 22 units of duplex independent living units.

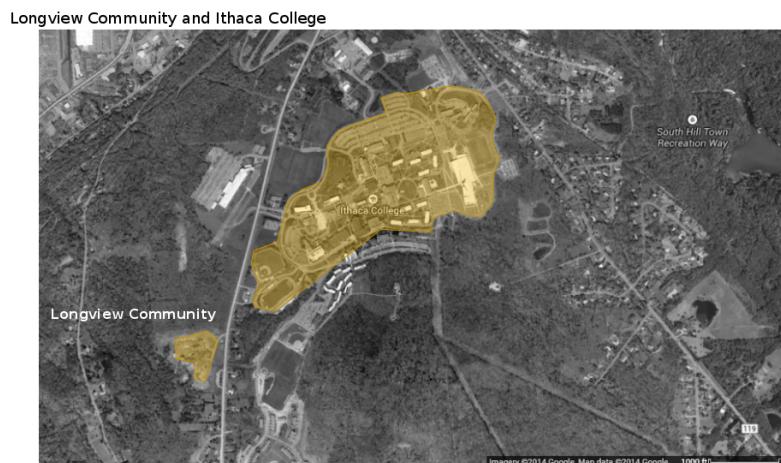


FIGURE 2.3: Aerial Longview [31]

2.3.1.3 Activities

Activities in Longview includes physical activities, gardening, intergenerational choir singing etc. As a result of the collaboration with Ithaca College, residents can take courses and have access to the college facilities such as library, gym and art performances. Recreational facilities in Longview include craft room, fitness room, game room, green



FIGURE 2.4: Site Longview [32]

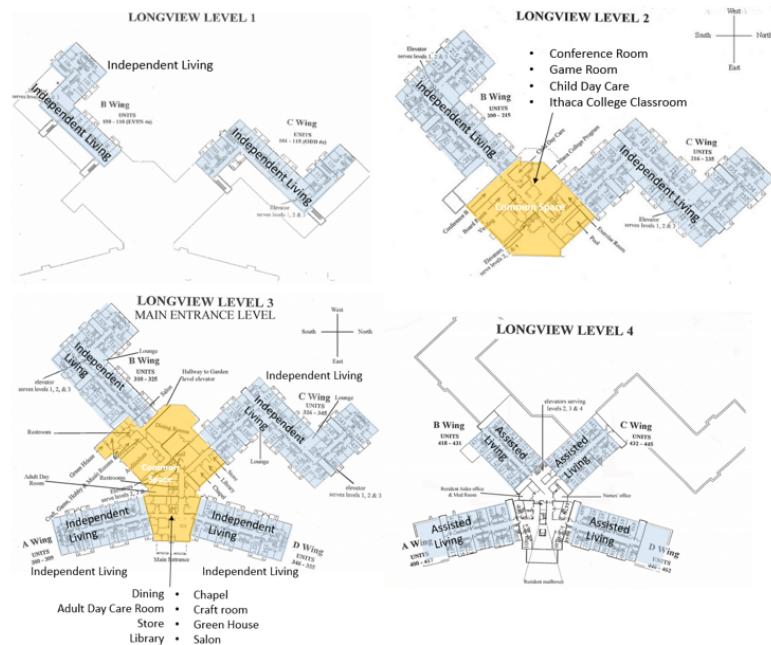


FIGURE 2.5: Building Plan Longview [33]

house, library, hair salon, massage room and walking trail landscape design on the west of the facility.

2.3.1.4 Housing Choices and Unit Design

There are 100 units of independent living apartment units in the Longview community. The unit types of independent living include small studio, one-bedroom unit and two-bedroom unit. All three types of living units include kitchen, bathroom and a balcony. The studio has a combined living room and bedroom while the other two types have

separate living room and bedroom. The size of studio, single bedroom and large bedroom are 465 sq.ft., 600 sq.ft. and 858 sq.ft. [34].

100 units of Independent Living apartments (Studios, one-bedroom and two-bedroom)

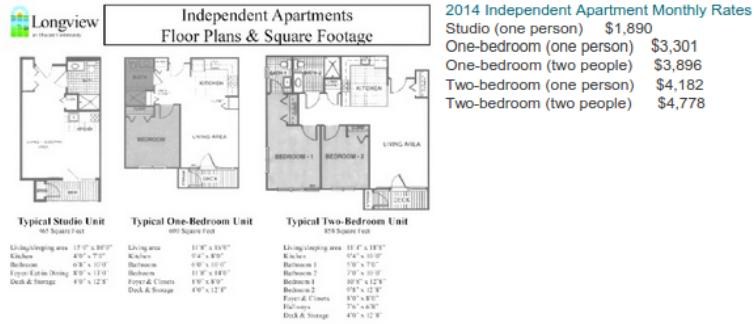


FIGURE 2.6: Independent Living Unit, Longview [34]

There are also 22 Independent living Patio Homes to the west of the main apartment building providing high level of living quality. The Patio unit has a total area of 1355sq.ft. (without garage) [35]. Each living unit include two bedrooms , two bathrooms: one with shower and the other with bathtub, a living room, a kitchen, a laundry room, a garage and a patio.



FIGURE 2.7: Patio Living Unit, Longview [32]

There are 60 assisted living units, providing 24-hour assistance, on site nurse and emergency pull cords. The assisted living unit is 250sq.ft., smaller than the independent living units. It includes a bath room, a combined living and sleeping area and a small refrigerator. No kitchen or balcony is included in the assisted living units. There are also 24 enhanced assisted living units with additional cares for residents with memory problems. These units located on the “Garden Level” with secure system that monitors exits. Residents and families also have the option to wear a bracelet sensor for closer monitoring. The enhanced assisted living units is 220 sq. ft. with the same function layout as the assisted living units.

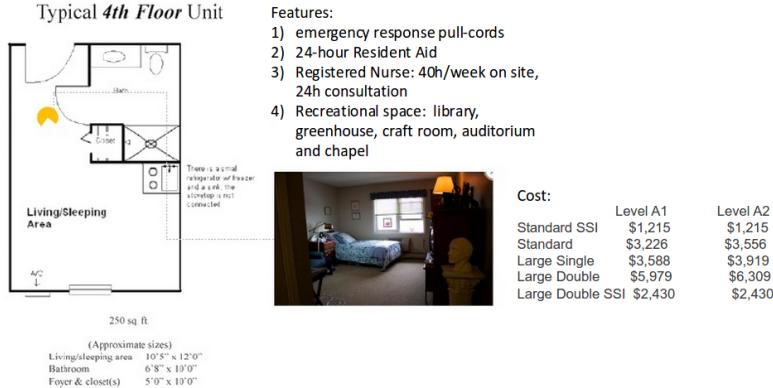


FIGURE 2.8: Independent Living Unit, Longview [36]

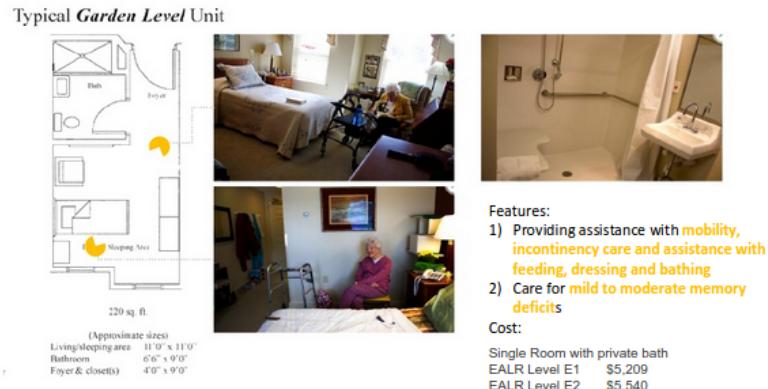


FIGURE 2.9: Independent Living Unit, Longview [37]

2.4 Dementia Assisted Living

2.4.1 General Introduction

“Dementia is an umbrella term for a group of cognitive disorders typically characterized by memory impairment, as well as marked difficulty in the domains of language, motor activity, object recognition, and disturbance of executive function – the ability to plan, organize, and abstract.” [38] Dementia, or its most common form Alzheimer, is common in the senior population and should be considered during the design process of elderly care facilities. There are 5 million Alzheimer victims in the U.S. and every 1 out of 3 seniors die in dementia. Women are more vulnerable to dementia and 2/3 of the Alzheimer victims are women [39]. This section conduct some related case study on elderly caring facilities for people with Alzheimer Diseases.

2.4.2 Design Features and Concerns for Alzheimer Care

The physical space acted as a “therapeutic resource” in improving the wellbeing and help reduce the seriousness of dementia [40]. Relocation of individual dementia victims to new environments can increase the possibility of depression and mortality [41]. This implies the necessity for dementia dedicated space be incorporated in all categories of senior housing. If there are not such space in an existing housing program, when resident develops dementia, they will have to be relocated to facilities that has dementia care, which might cast negative impact on the relocated elderly.

The living unit for cognitively impaired people are commonly referred to as Special Care Unit (SCU). The SCU environment have positive impact on “communication, self-care, social function and mobility” status of dementia victims [40]. It also reduce emotional strain and increase satisfactions. The typical features of a SCU unit include: less rooms, small room sizes, private rooms and dining space, access to outdoor environment etc [40]. Smaller cluster size showed positive effects on reducing agitation level, aggressiveness, anxiety and depression [40]. The positive impact of smaller cluster group setting also includes relief of stress and negative attitude of relative care-givers [40, 42].

Special acoustic feature should be added to create a balance between “sensory overstimulation” and “deprivation”, i.e. create a space that is neither too noisy nor too quiet. Since people with dementia tend to also have visual difficulties, the suggested visual environment is low glare, high contrast and increase lighting level [40]. The “bright light treatment” showed improvement on sleep patterns [43].

For enhancing way-finding, common design suggestions include: provide views to the outside environment which gives hint of location; create “landmarks”, large signs; increase lighting level of public spaces etc. Increase the portion of hallway and reduce the portion of corridors reduces disorientation [40]

One of the key features of Alzheimer Care facilities is the living units should have direct access to enclosed gardens with shaded porches or trees. Walking path should form a loop.

The hierarchical pattern of the public to private space transition is one of the key feature of the cognitively impaired residents [44]. Private bath and bedrooms are preferable and the location of public circulation area should be away from the hallways of private living units. Providing views to the outside in order to reinforce the day-night rhythms. The activity groups should be 10-12 persons [44].

2.4.3 Cases

2.4.3.1 Path Design

One common feature for dementia care facilities is the “wandering loop” structure of path design. The following examples demonstrate some approaches of such path design.

The partition design of the common space can form a wandering path. In this community based residential facility, a loop is formed around the L shaped partition wall. The path connects living room, dining room, kitchen and activity space (Figure 2.10).

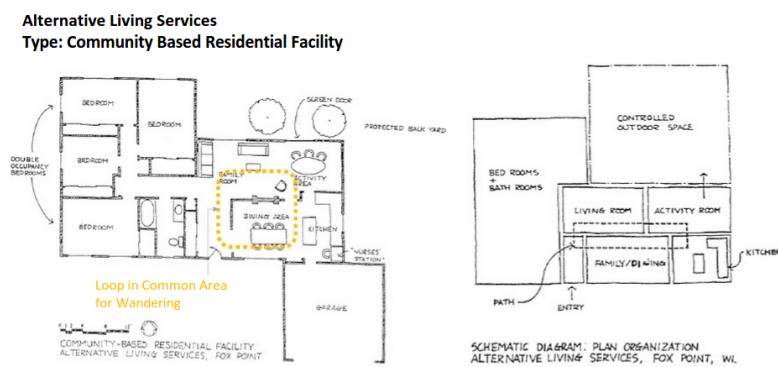


FIGURE 2.10: Wandering Path, community residential [45]

The Cedar Lake Home is a free-standing Dementia care facility. The pavement around the inner garden forms a wondering path(Figure 2.16).

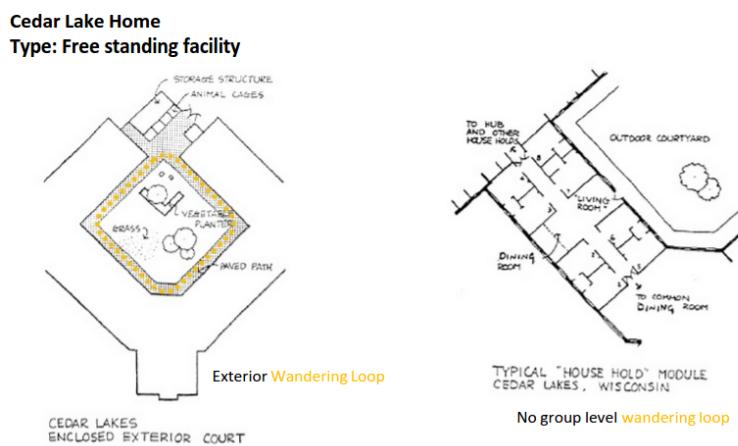


FIGURE 2.11: Wandering Path, Cedar Lake Home [45]

The Philadelphia Geriatric Center designs the wandering path with a different floor covering

The Weyauwega Health Care Center has a outdoor garden between two branches of dementia care housing units. The indoor and outdoor space together forms a closed-loop wondering path.

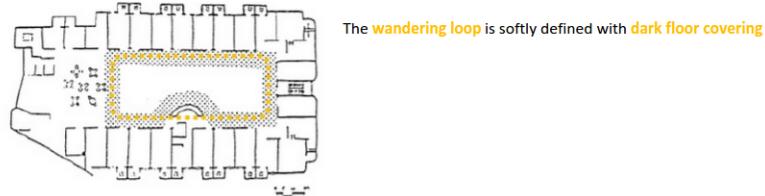


FIGURE 2.12: Wandering Path, Philadelphia Geriatric Center [45]

Weyauwega Health Care Center

Type: Long-term care facility including intermediate and skilled care, rehabilitation unit, and 16 units for people with dementia

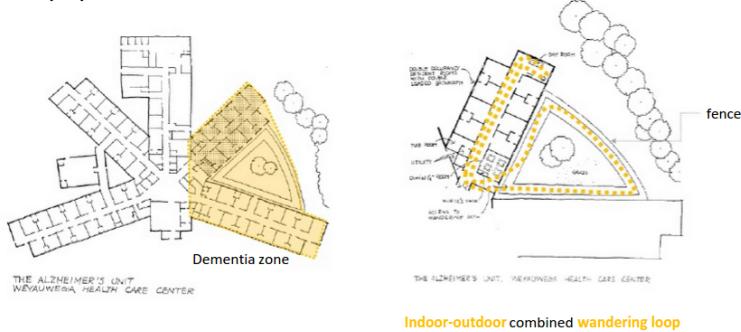


FIGURE 2.13: Weyauwega Health Care Center [45]

The John Douglas French Center has a hierarchical common space design (Left) and a wide wondering path around the center housing units.

John Douglas French Center for Alzheimer's Disease

Type: free standing specialized facility for Alzheimer's Disease victims

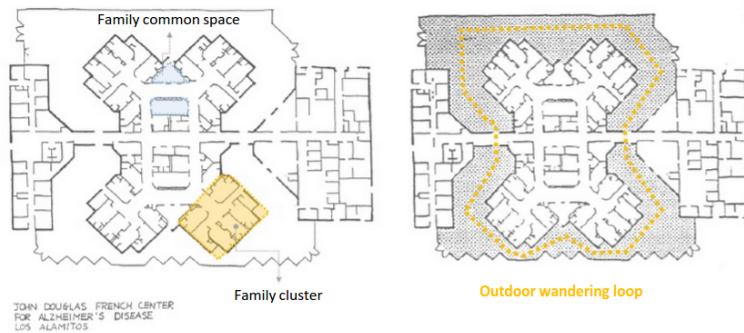


FIGURE 2.14: John Douglas French Center [45]

The Corinne Dolan Center is one of the most frequent appearing example of Alzheimer's care facilities. It is a research based facility. The architecture design respond to the special research need by creating a perfectly symmetrical plan that contains two identical branches. It facilitates a comparison study between the experiment group and the control group (Figure 2.15) [20].

There are two wandering paths, a inner cycle that surrounds the common area for both branches, and an outer cycle that surrounds the whole building.

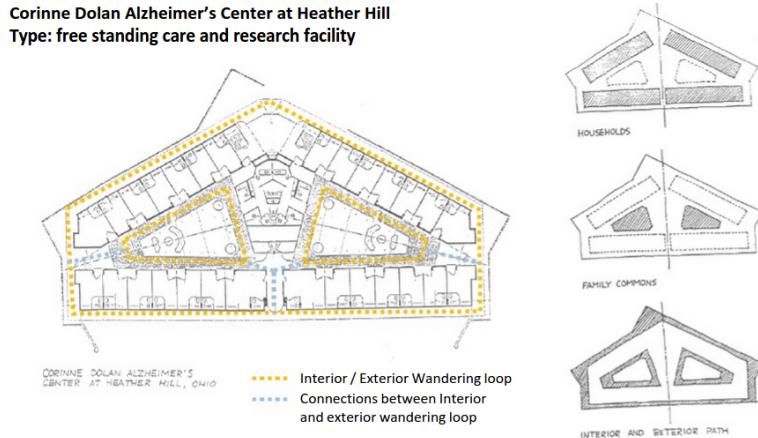


FIGURE 2.15: Corinne Dolan Alzheimer's Center [45]

2.4.3.2 Public to Private Space Transition

The Cedar Lake Home project implemented a hierarchical public space (Figure 2.16, Figure 2.17). The adjacent group of eight living units form a group and share a common space in the center of the group. The common space of each group joins the garden in the center of the building. It acts as the next level of common space. The two X shaped cluster shares a common entrance space (marked as J).

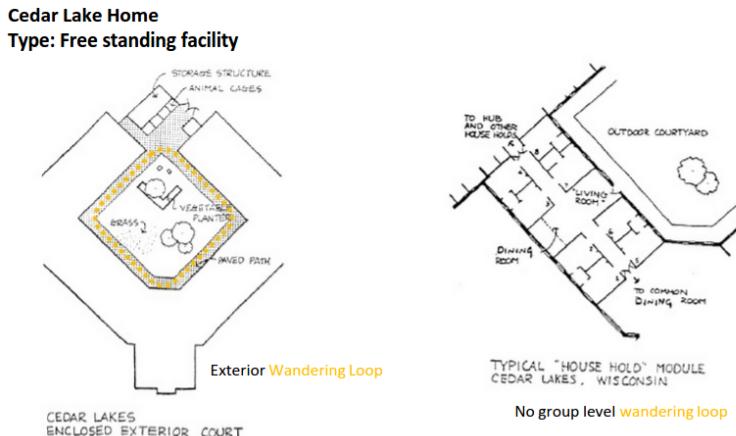


FIGURE 2.16: Hierarchical Public Space, Cedar Lake Home (small scale) [45]

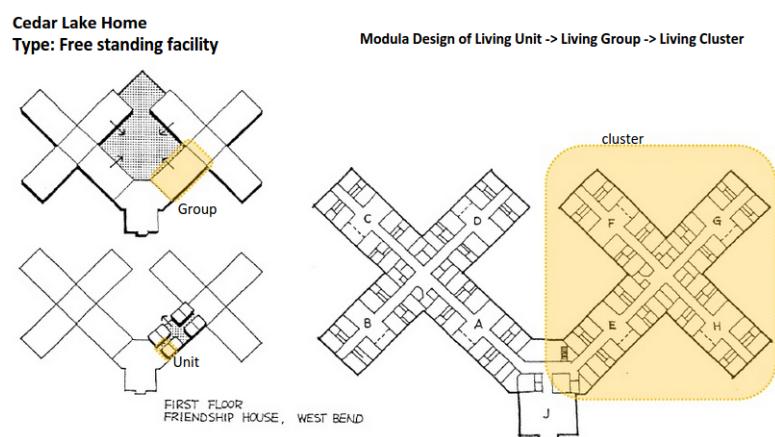


FIGURE 2.17: Hierarchical Public Space, Cedar Lake Home (large scale) [45]

Chapter 3

Preliminary Design

3.1 Design Specification

3.1.1 Major Functions

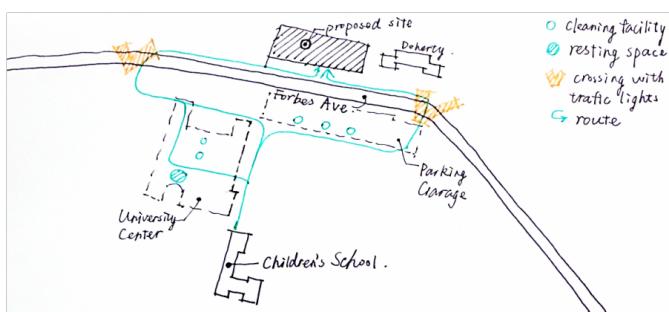
There are four major functions of the senior community center project:

1. Providing housing units to elder population in the surrounding communities. Providing choices of various degrees of care and the special care of Alzheimer's disease.
2. Providing housing for faculty members
3. As a result of the collaboration with the OSHER (Lifelone Learning Center), providing classrooms and administrative officies for OSHER.
4. Providing labs for aging related researches.
5. Create common space for inter-generation activities including roof garden, indoor garden, crafts room and music practicing rooms.

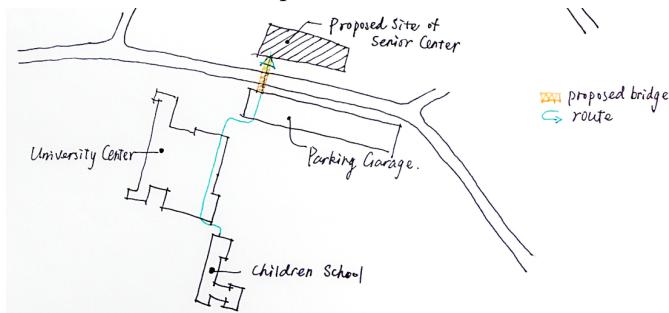
3.2 Site Planning

3.2.1 Bridge

The site plan of the building consider to create a bridge between the senior center and the parking garage. The major goal of this bridge is to provide the children and elderly a safe path crossing the Forbes Ave. between the main campus and the proposed site. The reasoning, as is mentioned in Chapter 1, is because the children in the children school will need to cross the Forbes Ave. at the crossings near Morewood Garden or near the Beeler Street where a traffic light is present. This detouring will make it harder for children to come and visit the elderly

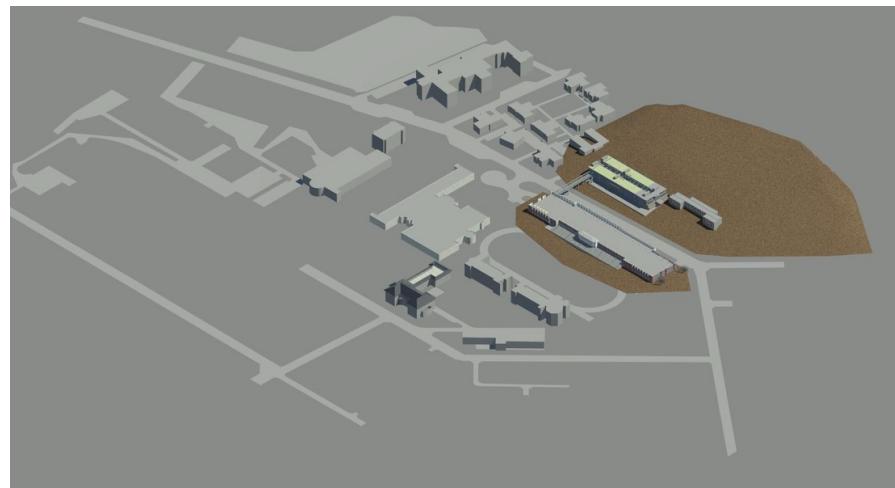


(A) Detouring Path from Children's School to the Proposed Site

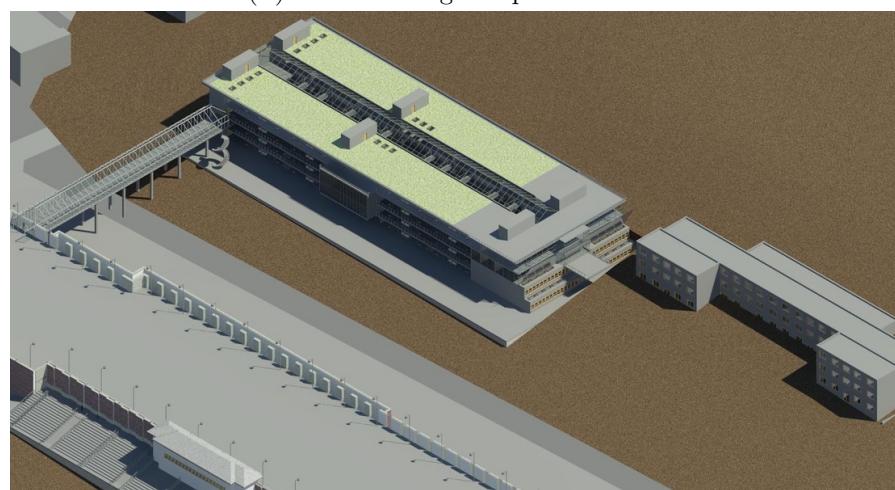


(B) Creating a Bridge to Reduce Detouring Distance

FIGURE 3.1: Bridge Connecting Parking Garage and Senior Center



(A) Site Planning Perspective View



(B) Site Planning Closer View

FIGURE 3.2: Site Planning

3.2.2 Common Entrance

An entrance facing east is also provided on the third floor of the senior center. The anticipation for this design choice is that the student from the Doherty Apartment can use the public space on the third floor and the bridge to cross the Forbes Ave Figure 3.1. By this design choice, an intersection node of routes is created for the elderly, the children and the young students, providing the opportunity for inter-generation connection. Thus a “public living room” was arranged on the top floor in the form of a cafe and some crafts room.

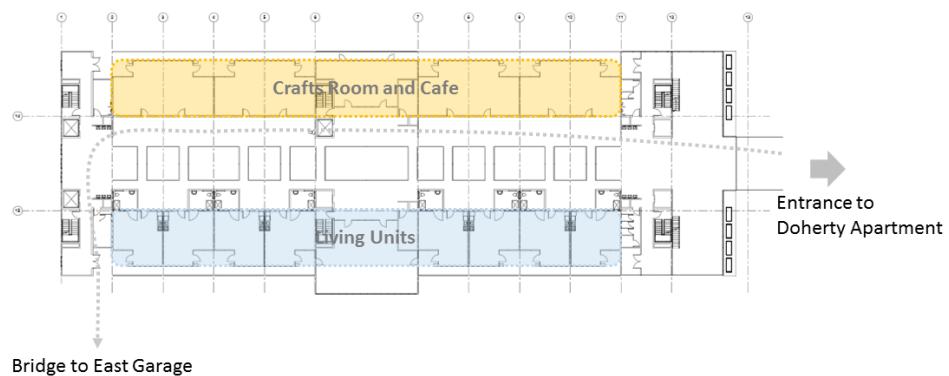


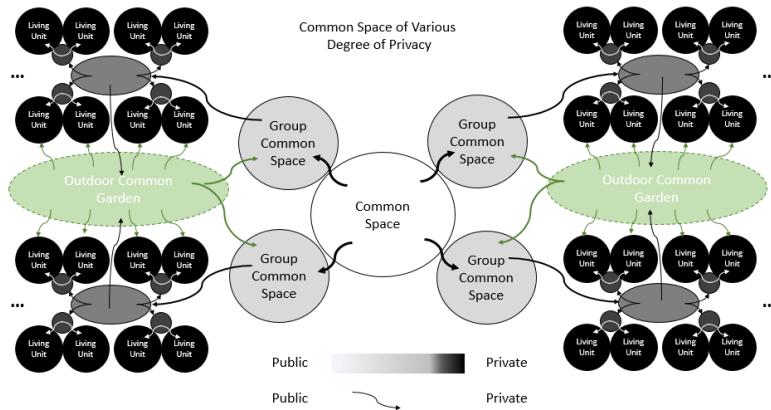
FIGURE 3.3: Common Space on Third Floor

3.3 Living Unit and Group Design

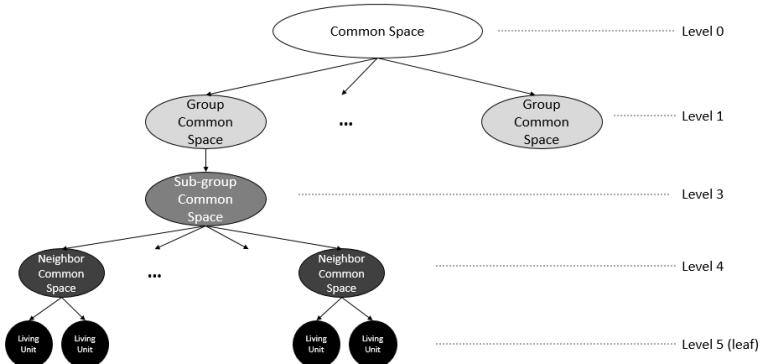
3.3.1 Topological Pattern of Living Cluster Design

There are two aspects of aging: the “biological process” and the “social process”. For the social process, as one become aged, one tends to encounter a dramatic change in his or her social roles, some tends to withdraw from previous responsibilities, some seeks to engagement in new social roles [?]. Providing a soft transition and a variety of choices is a key to maintain a balance between the social connection and the degree of privacy.

Also from the case study section, one of the key components for Alzheimer’s Care is to create a hierarchical public space. Upon the concern of both of the two aspects, the basic space structure of public-private-transition is defined recursively as depicted in Figure 3.4.



(A) Space Pattern: Soft Transition of Public and Private Space



(B) Tree Representation of Degree of Privacy Level

FIGURE 3.4: Space Pattern of Privacy Level Transition

By organizing space in this pattern, a group-assist living pattern is encourage. Residents might give and receive help from their neighbors and the living group, which can both provide a sense of self-achievement for helping others, to prolong the time of transferring

to a higher nursing degree and to strengthen bonds between residents. Since this is a mix-generational housing project: The housing project also provide housing unit to newly enrolled faculty members. The providing and receiving of aids could also facilitate the inter-generation connection.

Another concern is the varied degree layout facilitates privacy in care-giving and receiving with small nursing group. This provides the basis for creating a wide range of choices of different level of care.

Yet another consideration is to assign each group a common space and encourage the residents to arrange the decoration and space functionality, which increases the sense of belonging and also provides Alzheimer victims with more clues for way finding.

3.3.2 Design Living Unit

3.3.2.1 Basic Form of Living Unit

The basic form of the living unit include a living and bedroom (452 sq.ft.), a bath room (88 sq.ft) and a balcony. The living room includes an open kitchen. The design of living units account for the easiness for the turning over of wheel chair, so the room layout does not contain hard partition, which also take into account the in-room wandering path that concerns Alzheimer's disease victims. (Figure 3.5).

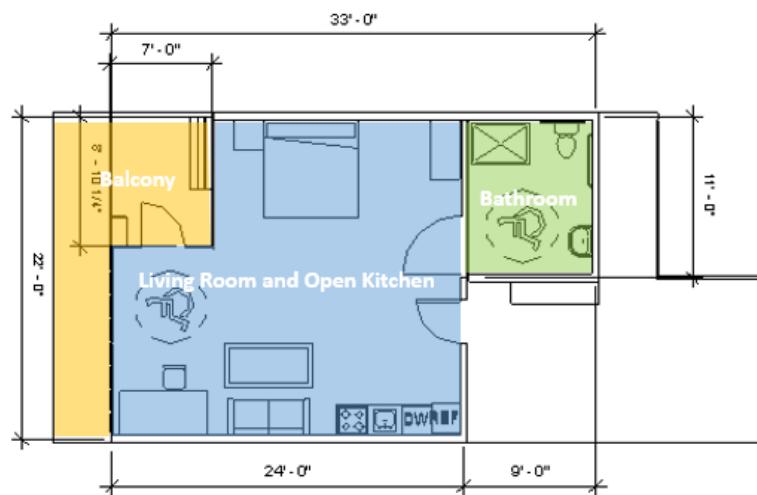


FIGURE 3.5: Plan of Living Unit



FIGURE 3.6: Perspective View of Living Unit

3.3.2.2 Combined Form of Living Unit

Two adjacent living unit could be combined to for a single two-bedroom two-bathroom living unit (Figure 3.7). This arrangement can adapt to elderly couples and families of faculty members (Figure 3.7).

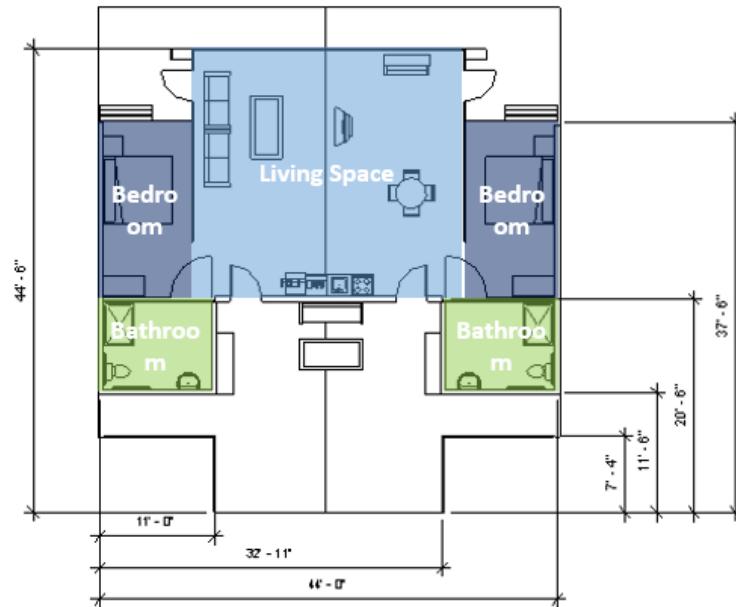


FIGURE 3.7: Plan of Two-Unit Group

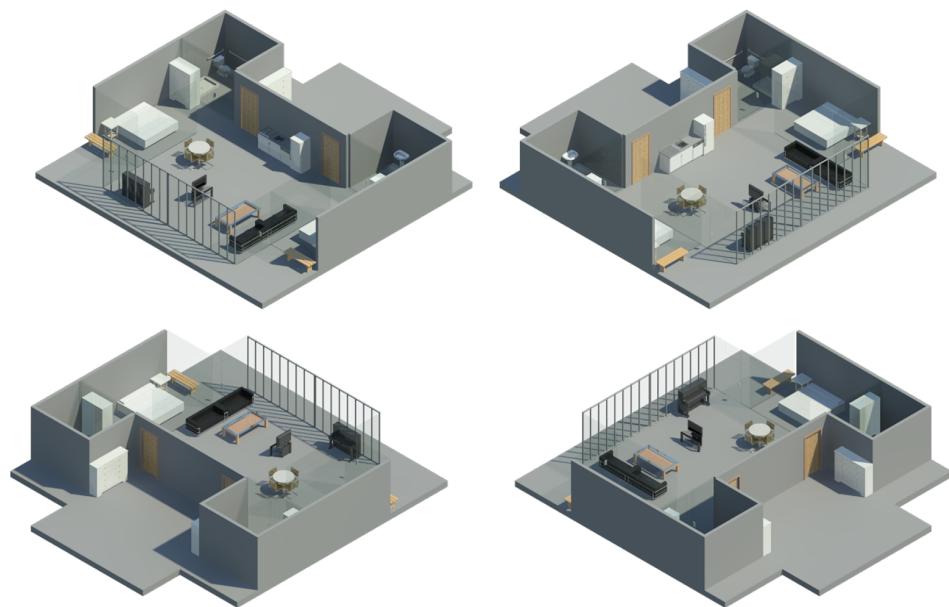
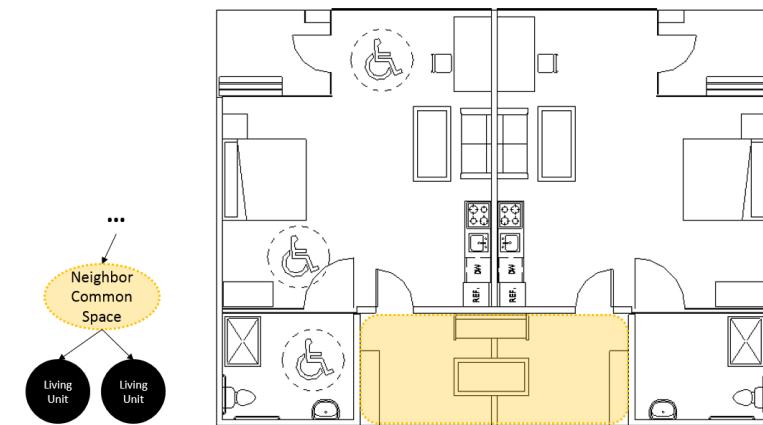


FIGURE 3.8: Perspective View of Two-Unit Group

3.3.3 Common Space between Living Unit

3.3.3.1 Two-Unit Common Space

A concave space in front of the entrance of the adjacent two unit defines a common entrance of the two neighboring units. Residents can customize the layout and arrangement of the common space together. This common space act as the bottom level of the hierarchical public-private space transition (Figure 3.9).



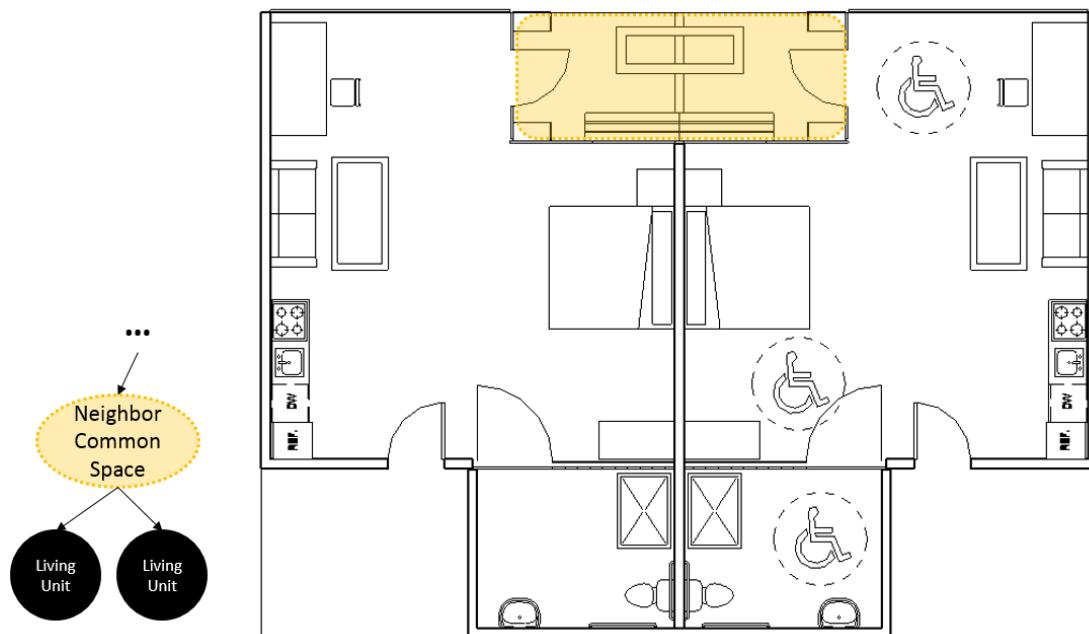
(A) Common Space of Two Unit: Common Entrance



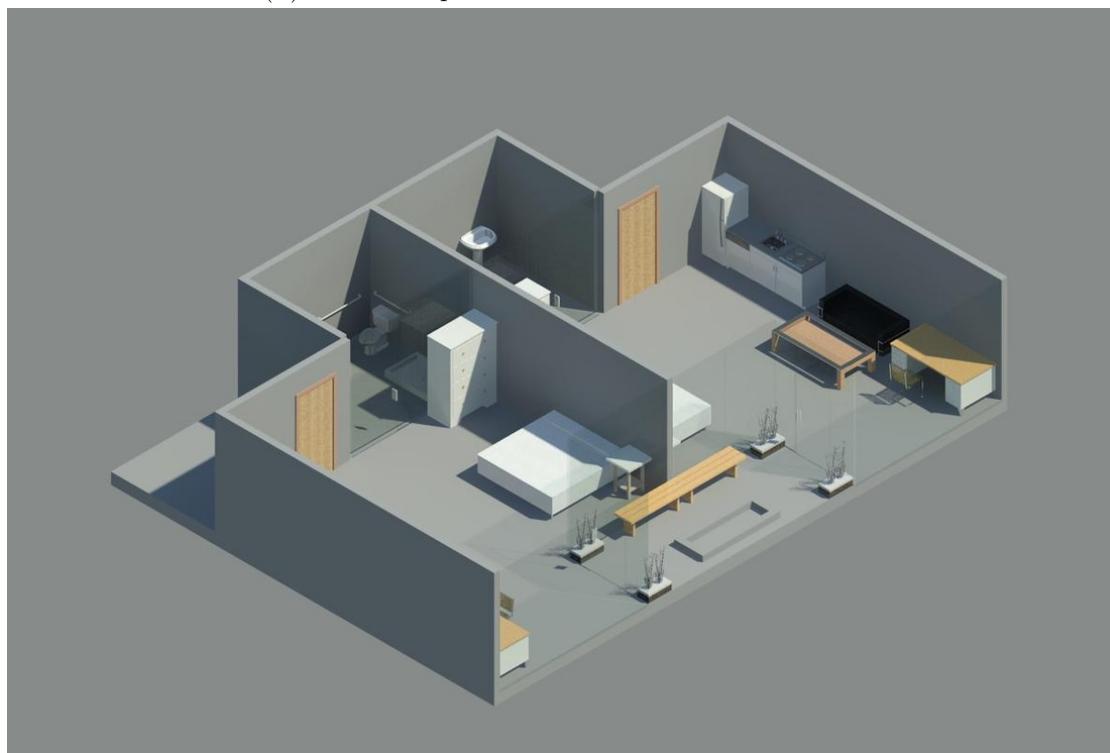
(B) Perspective View of Common Space of Two Unit: Common Entrance

FIGURE 3.9: Two Unit Common Space

The balcony acts as another common space shared by neighbors. Gardening activities can be undertaken at this area. Although not exactly depicted in the plan, the garden space should consider to be designed as raised garden to account for wheel chair users (Figure 3.10).



(A) Common Space of Two Unit: Common Garden



(B) Perspective View of Common Space of Two Unit: Common Garden

FIGURE 3.10: Two Unit Common Space

3.3.3.2 Eight-Unit Common Space

The common space of the eight unit shares the indoor garden on the ground floor. The common space on upper floors shares the common view to the lower floors.

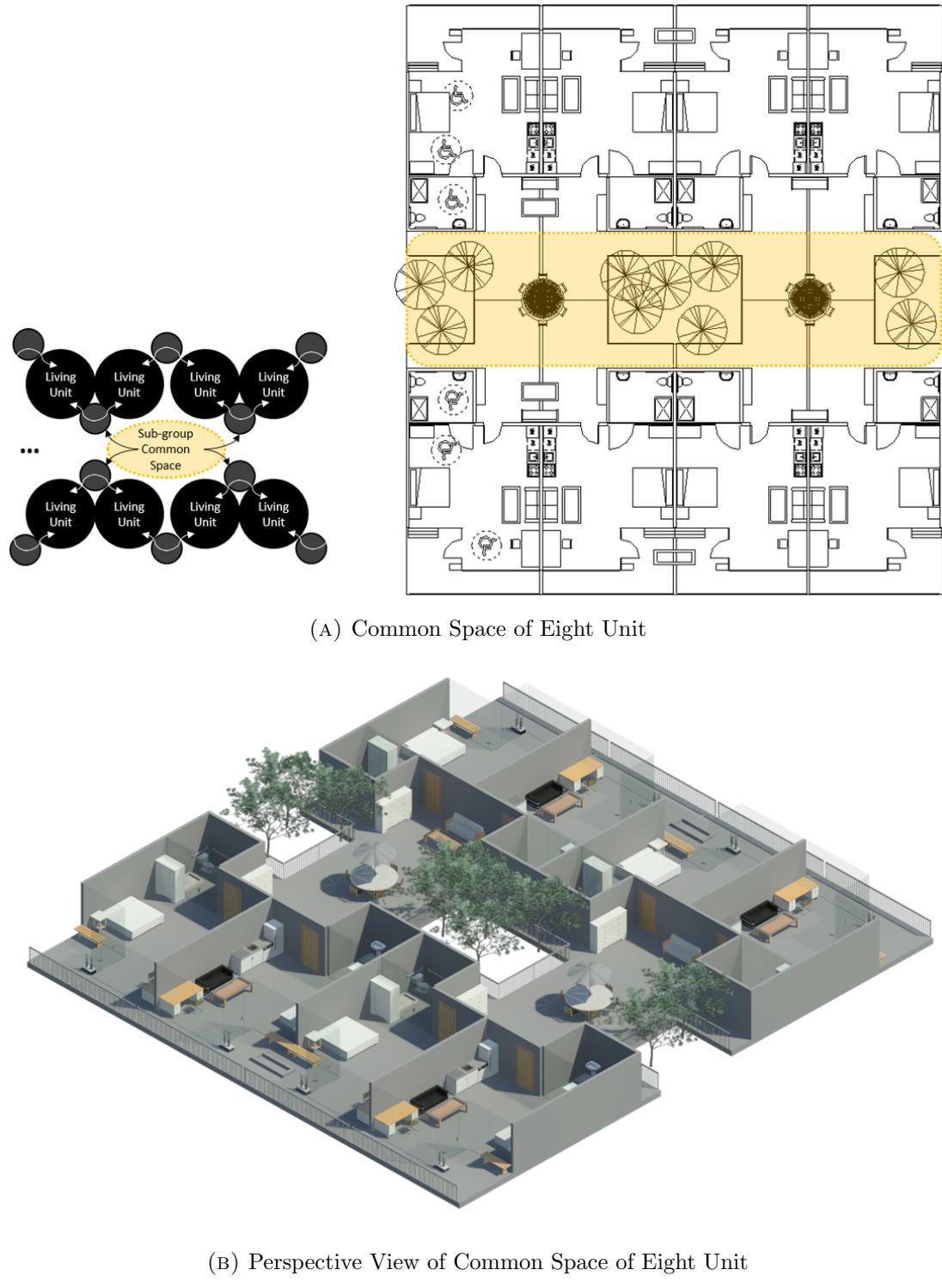
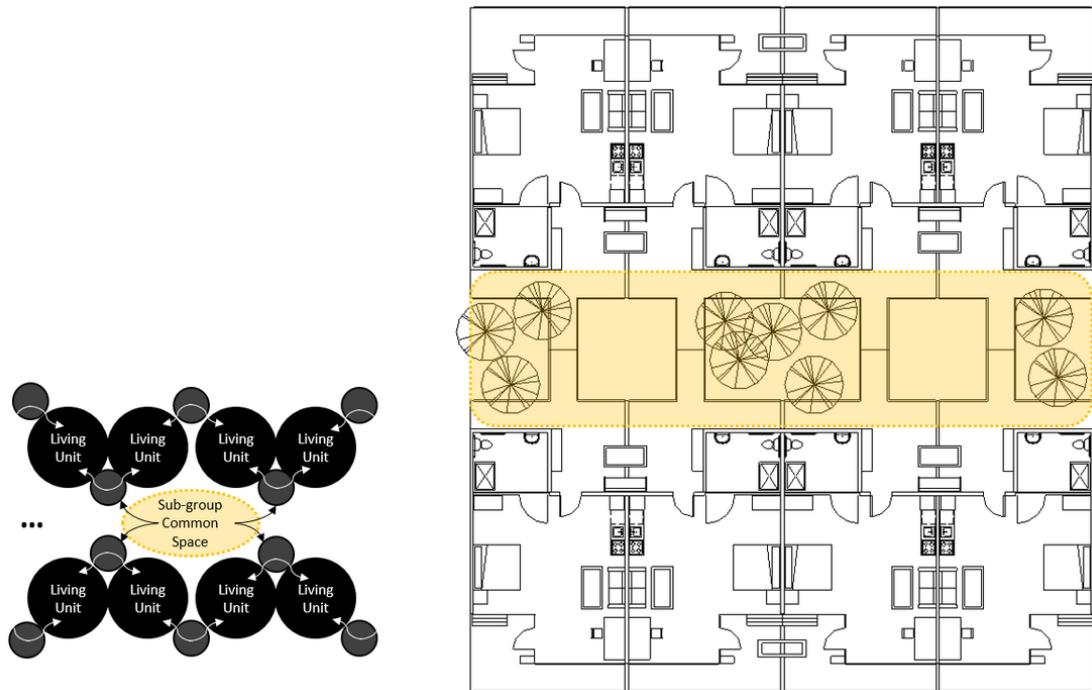


FIGURE 3.11: Eight Unit Common Space



(A) Common Space of Eight Unit: Upper Level



(B) Perspective View of Common Space of Eight Unit: Upper Level

FIGURE 3.12: Eight Unit Common Space: Upper Level

3.3.3.3 Common Space between Two Branches

There is a larger common space between the east and west living branch. It is on the top level of the common space hierarchy. It is outside of the classrooms on each floor. This space can act as both the gathering space for larger group activities of the elderly and can also become the extension of classroom space.

3.4 Path Arrangement

The major concern for path design includes:

- To create more chance of encountering people, both the elderly residents and the young people.

- To accommodate the needs for the Alzheimer Disease victims.

A “wandering loop” (Figure 3.14) is needed to accommodate the behavior change for the Alzheimer Disease victims. For more detailed information, please refer to the case study in Chapter 3

There are four level of wandering path created in the design: living unit level, living group (of four living unit) level, interior wandering path within the whole building and the wandering path combines the interior and the balcony space.

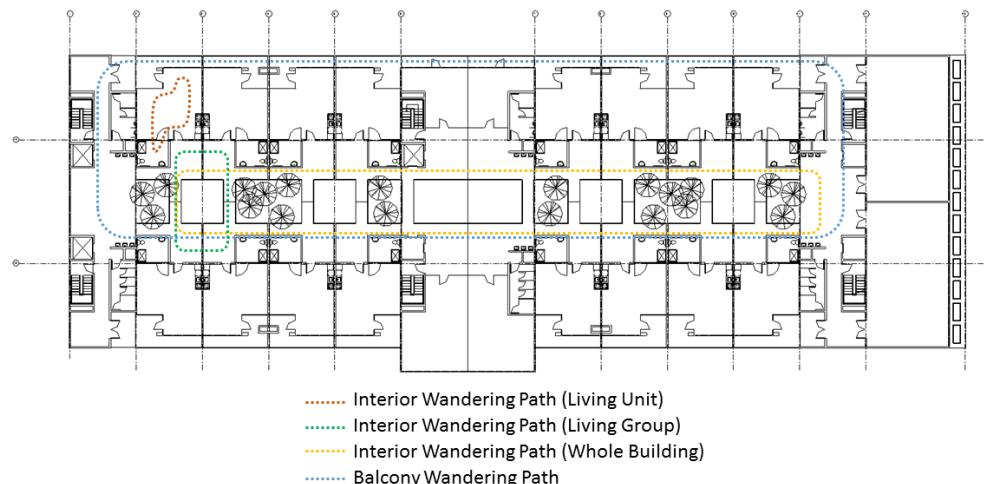


FIGURE 3.13: Wandering Path

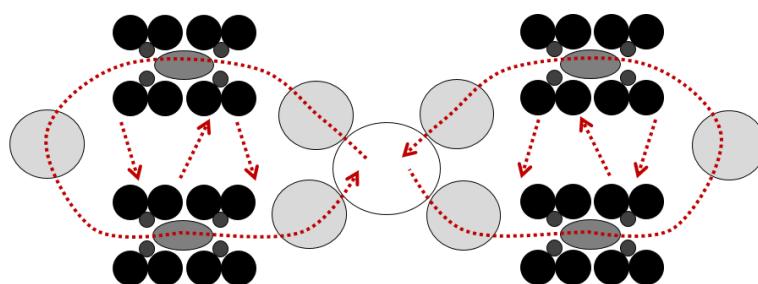


FIGURE 3.14: Plan of Wandering Path

3.4.1 Access to Nature

In order to allow for easy access to nature, the indoor garden is created between each of the two major row of living units, allowing for access to nature in the indoor environment Figure 3.15.

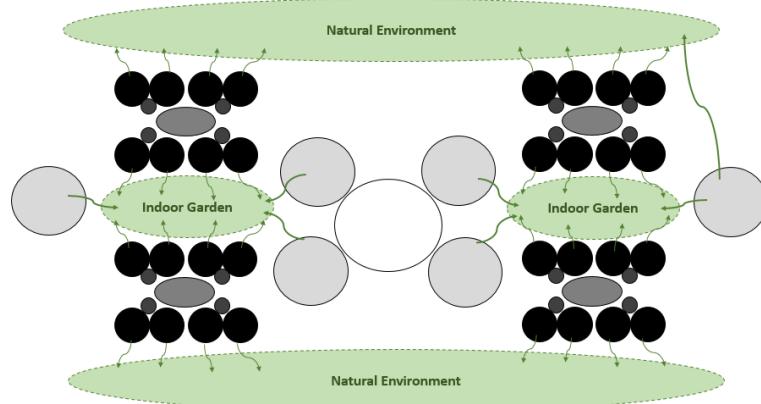


FIGURE 3.15: Access to Nature

3.5 Schematic for Sustainable System

The components involved in the sustainable system include roof gardens, rooftop pv system, green facade, rain collecting system and food production chain resulted from the gardening. A draft system integration diagram is shown in Figure 3.16

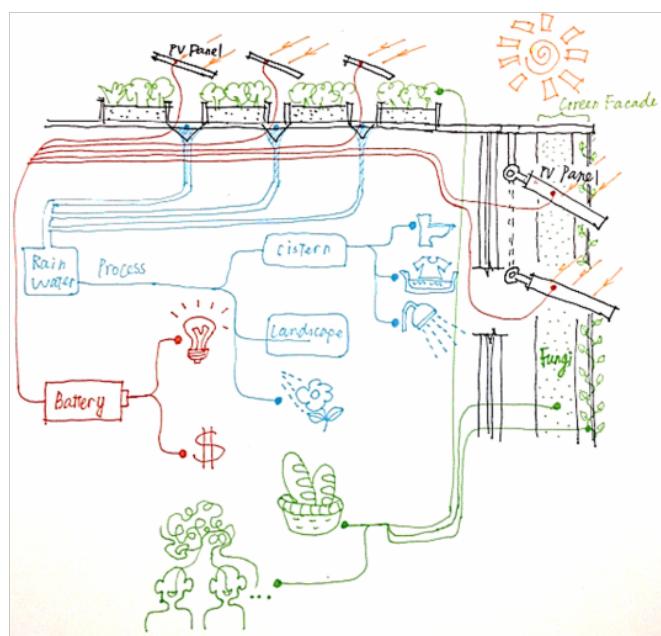


FIGURE 3.16: System Integration Draft Diagram

Chapter 4

Drawings

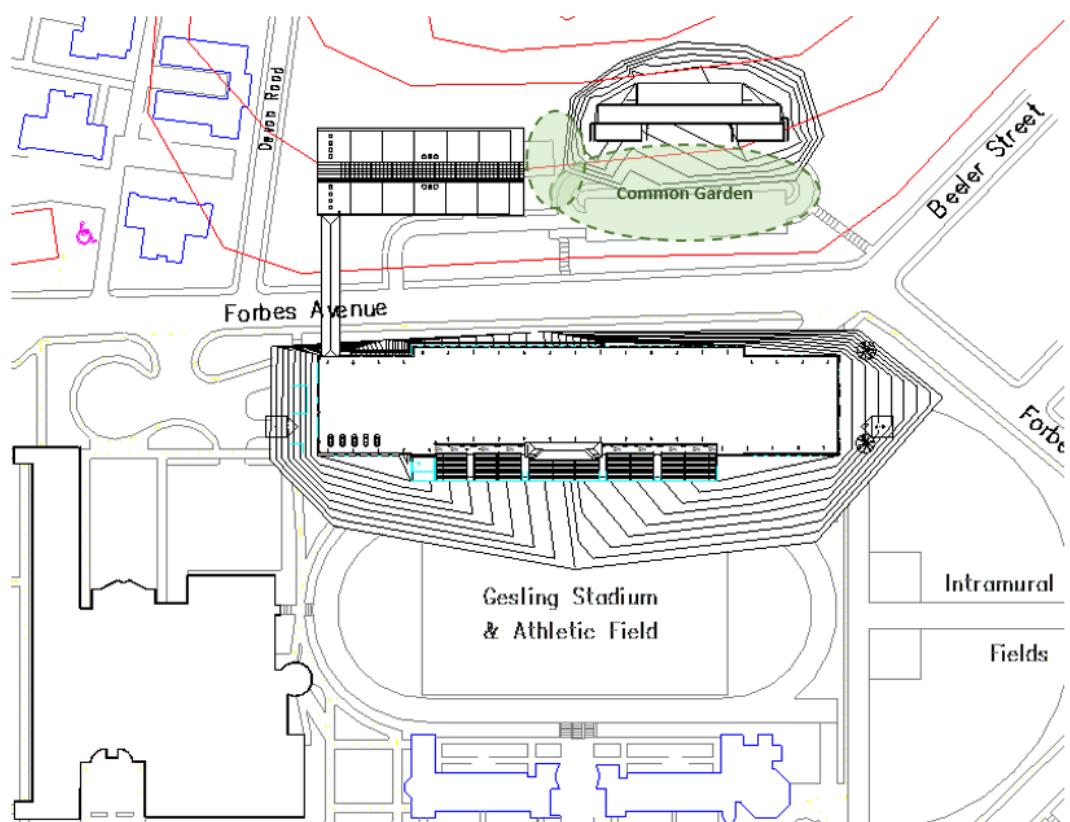


FIGURE 4.1: Site Plan

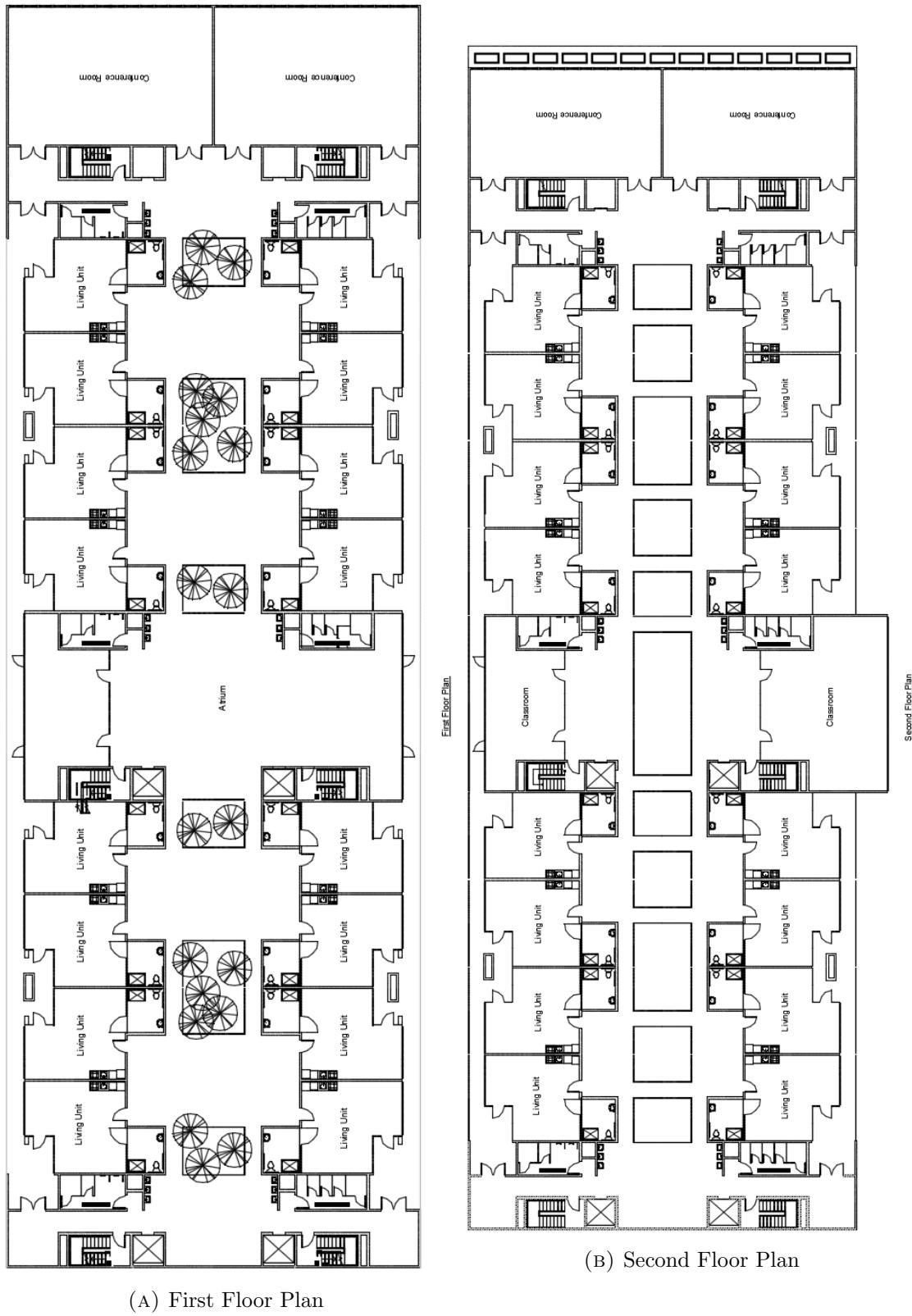


FIGURE 4.2: FloorPlan, First Floor and Second Floor

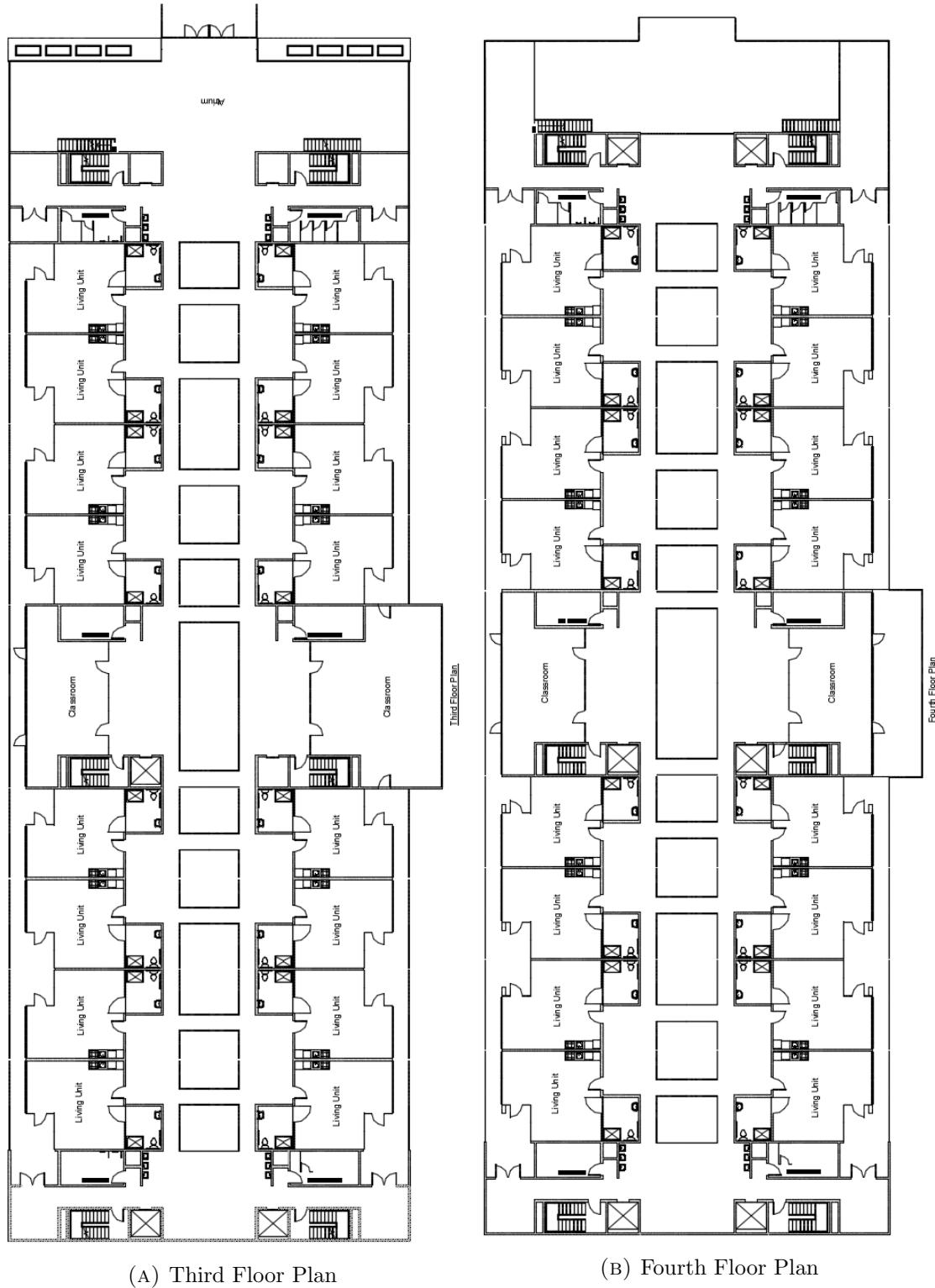


FIGURE 4.3: FloorPlan, Third Floor and Fourth Floor

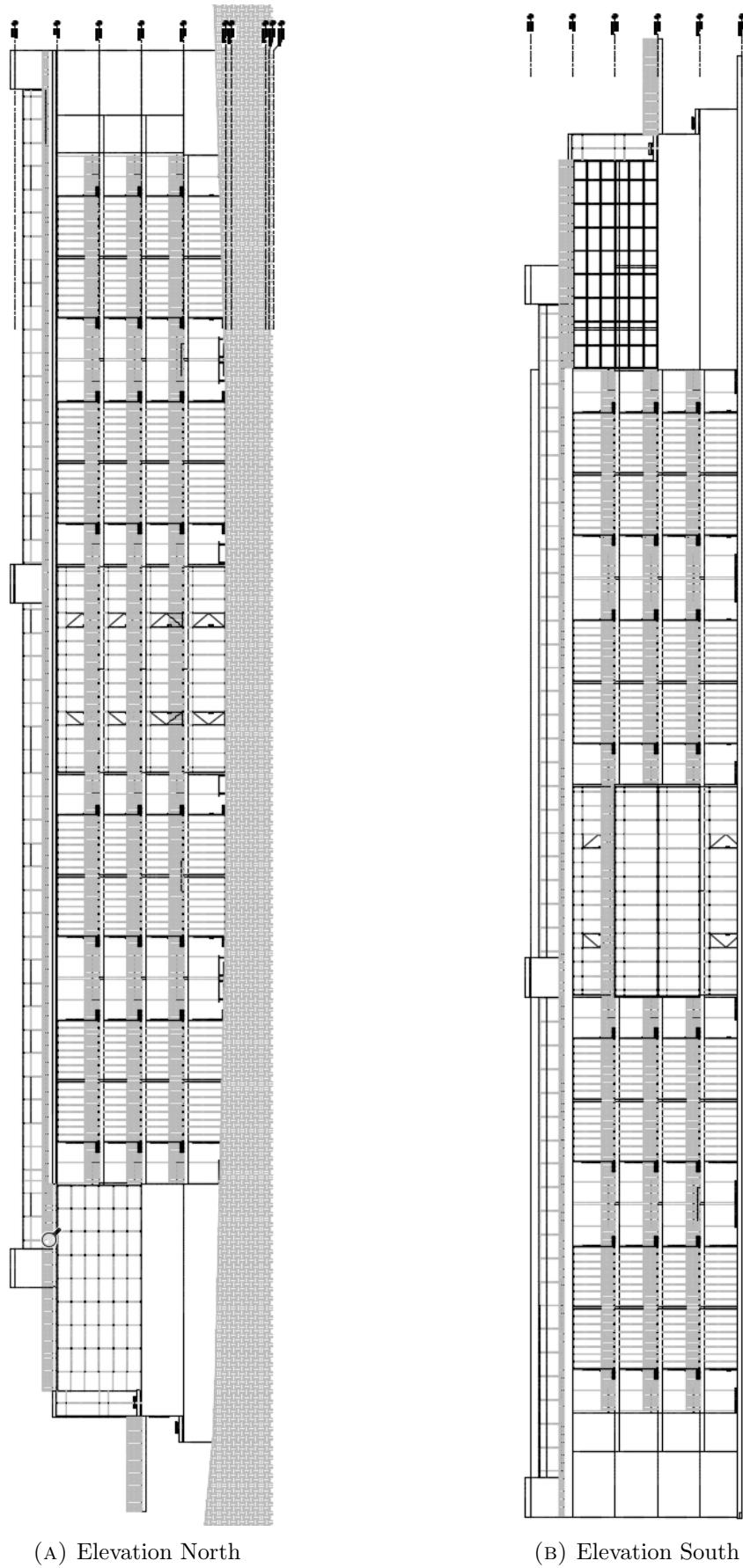


FIGURE 4.4: Elevation, North and South

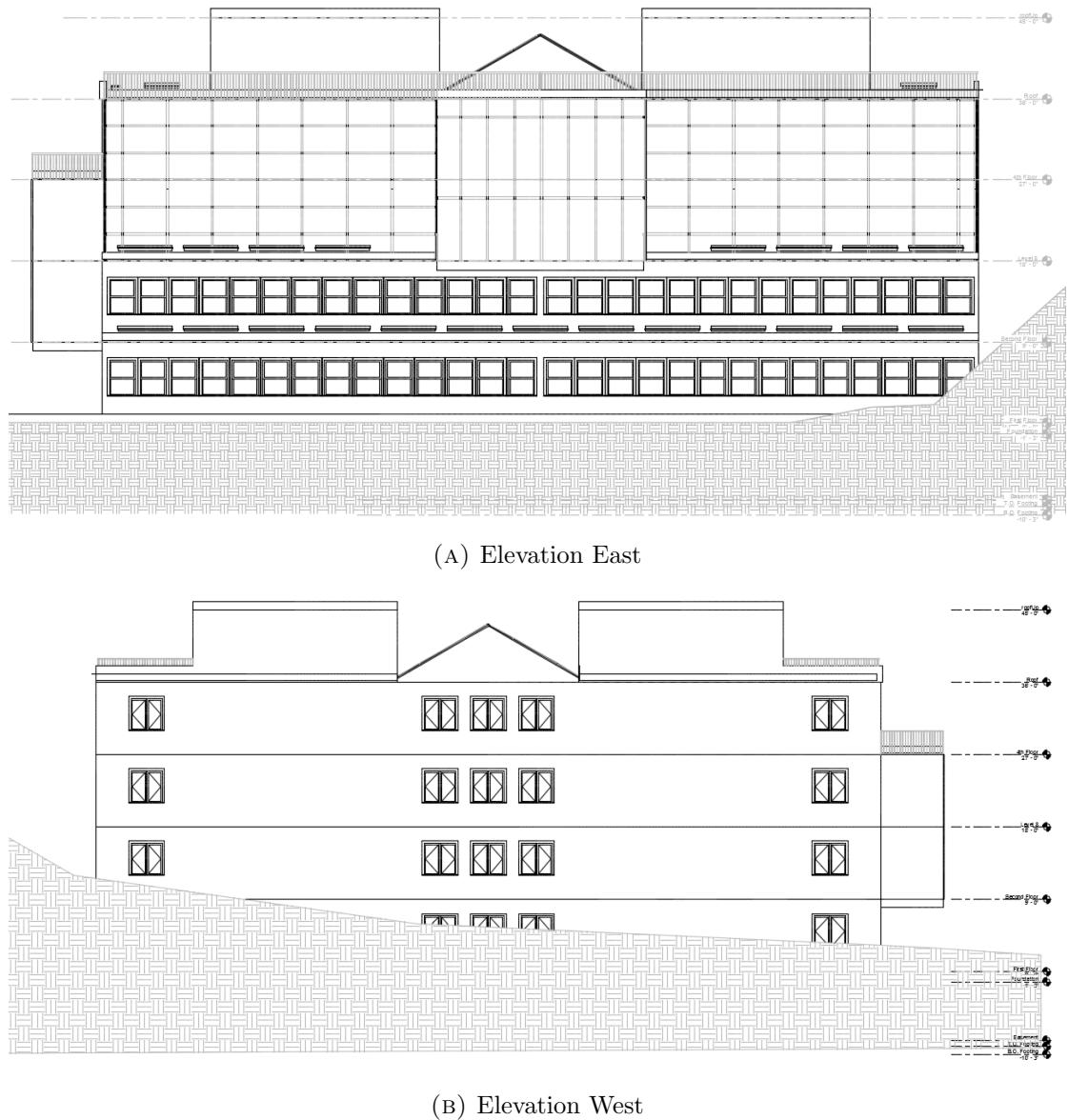


FIGURE 4.5: Elevation, East and West

Appendix A

List of Existing Senior Center

A.1 Senior Center Location

Name	Address	ZIPCODE
Swissvale Senior Center	7350 McClure Avenue	15218
McKinley Park Center	900 Delmont Avenue	15210
Leland Resource Center	5230 Wolfe Road	15236
Lemington Community Services	1701 Lincoln Avenue	15206
Etna Senior Center	18 Walnut Street	15223
Millvale Senior Center	917 Evergreen Avenue	15209
Allentown - Henry Kaufmann Center	2201 Salisbury Street	15210
Allentown - Hilltop Center	631 E. Warrington Avenue	15210
Lawrenceville Healthy Active Living Community Center	4600 Butler Street	15201
Glen Hazel Healthy Active Living Community Center	945 Roselle Court	15207
South Side (Market House) Healthy Active Living Community Center	12th, Bingham Streets	15203
Morningside Healthy Active Living Community Center	6944 Presidents Way	15206
Homewood Healthy Active Living Community Center	7321 Frankstown Avenue	15208
Center Without Walls	901 West Street	15221
K. Leroy Irvis Towers	715 Mercer Street	15219
Hill House Senior Service Center	2038 Bedford Avenue	15219
Hillsdale Resource Center	1444 Hillsdale Avenue Suite 15	15216

Knoxville Senior Center	320 Brownsville Road	15210
Seton Overbrook Senior Center	2199 Dartmore Street	15210
Elizabeth Seton Center	1900 Pioneer Avenue	15226
Carrick Senior Center	2019 Brownsville Road	15210
Northview Heights Healthy Active Living Community Center	533 Mt. Pleasant Road	15214
Northside Healthy Active Living Community Center	5 Allegheny Square	15212
Sheraden Healthy Active Living Community Center	720 Sherwood Avenue	15204
Brighton Heights Healthy Active Living Community Center	3515 McClure Avenue	15212
West End Healthy Active Living Community Center	80 Wabash Street	15220
New Image Senior Center	209 13th Street	15215
Stephen Foster Center	286 Main Street	15201
Forest Hills Senior Center	444 Avenue D	15221
PrimeTime Activity Center	440 Lincoln Avenue	15202
Plum Senior Center	499 Center - New Texas Road	15239
Penn Hills Senior Center	147 Jefferson Road	15235
Greenfield Healthy Active Living Community Center	745 Greenfield Avenue	15217
Beechview Healthy Active Living Community Center	1555 Broadway Avenue	15216
Hazelwood Healthy Active Living Community Center	5344 2nd Avenue	15207
Mt. Washington Healthy Active Living Community Center	122 Virginia Avenue	15211
Jewish Community Center of Greater Pittsburgh	5738 Forbes Avenue	15217
”Vintage Inc.”	401 N. Highland Avenue	15206
Polish Hill Senior Center	30th and Paulowna Streets	15219
Braddock Hills Center	3000 Locust Street	15221

TABLE A.1: Senior Center Location

Appendix B

Data Processing Log of GIS Analysis

B.1 introduction

The session records the data source and process of using GIS to conduct the analysis of senior population concentration and existing senior center.

B.2 Process

B.2.1 Building Base Map and Acquiring Geographic Data

1. Download Block Group shapefile from Census Bureau
2. Adding the Glock Group layer to the map file
3. Download user tools for retrieving data from the two zip file above http://www2.census.gov/acs2011_5yr/summaryfile/
4. Create a gdb folder “cmu.gdb” for this assignment and put all related files inside that folder
5. Import the table to the gdb folder
6. Create three new field in attribute table of “PABlkGrp”: “senior_male” for male population of above 65 years old, “senior_female” for female population of above 65 years old, one “totalPopu” for the total population within a block group. Join the population table to the layer “PABlkGrp”

7. Copy and retain the senior population and total population data then remove join
8. Change the projection of the layer of “PABlkGrp” from GCS to “NAD_1983_StatePlane_Pennsylvania_FIPS” using Geoprocessing -> Projection and transformation -> Project
9. Calculate senior people percentage over total population with field calculation:
[SeniorPopu] / [TotalPopu]

B.2.2 Using Geocoding to Add Senior Centers to the Map

1. Download table of senior center addresses as a csv file
2. Import the csv file to the cmu.gdb database
3. Use the “geocoding” tool in ArcGIS to project the locations of senior center to the map as a layer of point features
4. Create a 0.3 mile buffer around the point in the address layer.

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