

Developing Supportive Outdoor Activities for People with Early Stages of Dementia

by

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ABSTRACT

The research presented in this thesis aims to develop unfenced facilities and supportive surroundings where individuals with dementia can live comfortably, securely, relatively independently, and be positively integrated into their communities. Specialized organizations exist for people with dementia, providing care and ensuring safety by isolating them to specific fenced surroundings and facilities because of the difficulties they may face in the outside world. However, the present research provides an inclusive look at the future of people with dementia in terms of establishing an open and unrestricted environment which embraces them rather than isolates them. Therefore, the focus is on selecting a suitable outdoor layout and incorporating design concepts to create safe, comfortable, and meaningful outdoor activities and services in order to achieve successful and effective integration for people with early stages of dementia. The research approach is to propose investigated solutions and concepts that may help trigger patients' memory to support them outside the care centre. People with dementia experience difficulties recognizing routes or comprehending the cues that indicate the functions of buildings, thus the approach is to help avoid these difficulties by decreasing instances of disorientation, confusion, crowded and heavily trafficked areas, or sudden loud noises. The research presented herein develops a complete study to identify safe travel routes for people with dementia that prevent the risk of becoming lost or confused. This research aims to suggest changes in the surroundings of an existing senior home in Edmonton, Alberta, Canada. The anticipated solutions to achieve the primary research goal will target specific stages of the disease, the early stages, since patients in earlier stages will have better responses than patients in the advanced stages of dementia. The study will also reveal the potential difficulties people with dementia may confront outside the village as well as propose solutions for each obstacle. In summary, this research presents a humanitarian project that seeks to develop a

secure unfenced village and open environment for people with dementia by providing therapeutic and relaxing surroundings, which will allow them to live among, stay in contact with, and actively participate in their community at large.

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CHAPTER 1: INTRODUCTION

1.1 Research Motivation

According to the Alzheimer's Society of Canada (2017), the older adult population (aged 65 and older) formed 16.9% of the total Canadian population in 2017, which amounts to 5.8 million of the total population of 36 million. In fact, statistics indicate that 564,000 Canadians are currently living with dementia, accounting for 10% of the senior population, meaning that approximately 1 of every 10 seniors experiences at least some level of memory loss. In Alberta, older adults constituted 12% of the total population in 2016, of which 70,000 Albertans are living with dementia, which indicates a prevalence rate of 25 per 1,000. The number of dementia cases in Alberta is expected to rise to 110,000 in 2025 at which time the prevalence rate will increase to 35 per 1,000. An estimated 12,000 Edmontonians are affected by Alzheimer's and related dementia, comprising 17% of the total number of people diagnosed with dementia in Alberta. A study reported that 72% of people who are diagnosed with dementia over the age of 65 are women. The same study stated that 25,000 people are diagnosed with dementia each year in Canada. For this reason, the Canadian government allocated \$10.4 billion in 2017 divided into annual estimated direct and indirect costs related to caring for people with dementia. Total costs for caring for those living with Alzheimer's and other types of dementia reached \$10.7 million in 2017. 5 % of the budget for the Canadian Institutes of Health Research (CIHR) is invested to support dementia research.

Dementia consists of seven main phases divided into three groups where the symptoms and progression of the disease are dependent upon the type of dementia. These groups include 'early dementia stages', 'middle dementia stages', and 'late dementia stages'. The symptoms

become apparent during phase two, which is classified as early-stages. The symptoms accelerate and become more critical when the disease exceeds the early-stages. In the early stages, patients experience difficulties concentrating and remembering personal details from their past. Thereafter, they begin to forget their name or where they live and may begin to isolate themselves when they realize what is happening. Eventually, patients require extensive assistance to carry out daily activities with 24-hour surveillance. For this purpose, specialized organizations offer a safe interior environment and isolate patients with dementia from the outside world for their own safety. This study primarily aims to fill a research gap in the area of developing open environments, unfenced facilities, and supportive surroundings for positive and safe integration of individuals experiencing early-stages of memory loss difficulties. The present research will study approaches to increase the integration of people with dementia into the community.

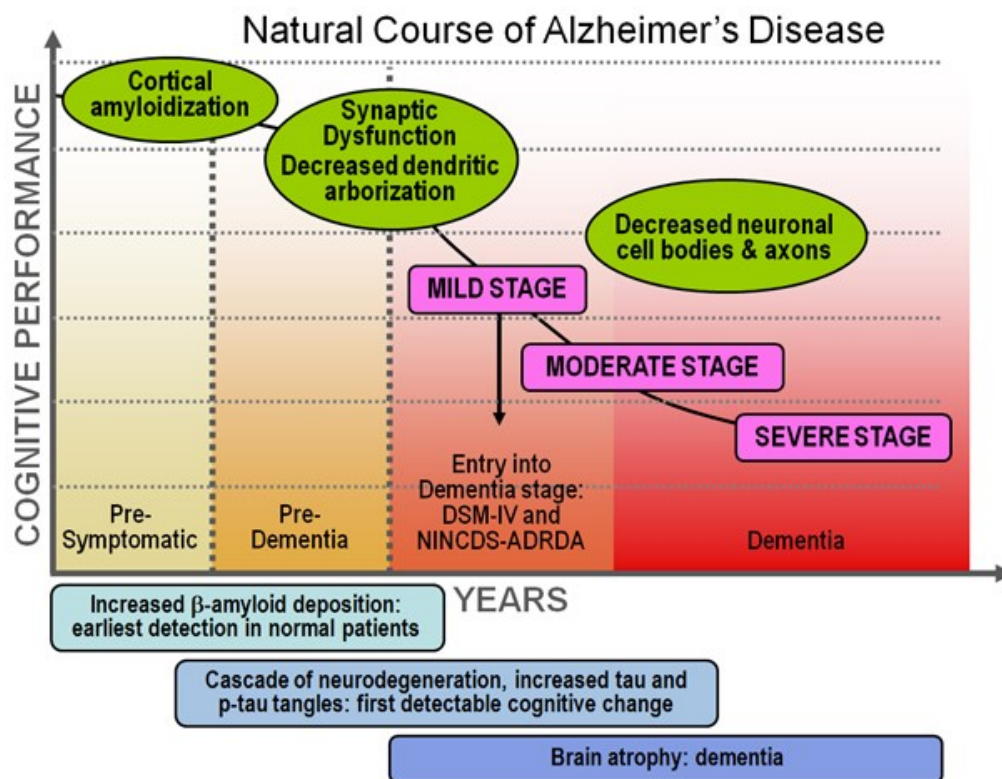


Figure 1.1: Relationship between dementia stages and cognitive performance of patients (Delrieu et al., 2011)

1.2 Research Objectives

The primary objective of this research is to provide solutions that will allow people with dementia to live relatively interactively in their community. Thus, scenic walking paths and park activities can add characteristics that define the outdoor spaces, create familiar, non-institutional surroundings, and provide higher levels of active outdoor engagement for people with dementia. Recommending solutions, which will be built based on existing literature, aim to guide people with dementia from the care facility to a destination that offers the opportunity for patients to interact with others and integrate the care facility within the community at large. Furthermore, proposed solutions attempt to improve the structure of sidewalks, traffic light systems, walkways, street intersections, and gardens for ensuring safety for people with dementia.

In Alberta, there are 143 facilities that provide care and support for people with dementia, 19 of which are located in Edmonton. Thus, this study aims to suggest changes in the surroundings of an existing senior home in Edmonton (SouthWoods) for improving the quality of life for people with dementia. At the time of this writing, the village is in the construction stage where four residential buildings are being built to host seniors. Also, a building is being specifically built for supporting and caring for people with dementia. For integration purposes, the destination of such a complex is important and will help people with dementia feel involved in their community; a garden will be constructed near Mill Creek Park, which is only 350 metre east of the village. Suggesting suitable ideas to safely guide people with dementia from the village to the park and back is the key objective of this research, taking into consideration any potential obstacles.

1.3 Research Approach

The approach followed to fill the research gap and achieve a new contribution begins with methods for developing the surroundings of the community to accomplish the positive integration of people with dementia. The second step to be addressed is defining the possible problems and obstacles that a person with memory loss may encounter while spending time outside the care facility. Consequently, this research provides qualitative studies as an evidence-based theory for recommending suitable solutions that are substantiated by the existing literature and theoretical framework to answer the research questions and accomplish the primary objectives. Thus, making reasonable claims is the approach to generalize design concepts of the proposed research findings, which aim to develop the surroundings of the community for people with dementia.

3ds Max studio software is the tool to build a 3D model for each finding in order to deploy all recommended ideas in the Edmonton case study. Therefore, remodeling the current aspects of the village and its surroundings is the first step toward having an overview of the advantages of the whole community. Additionally, the model will be essential in addressing the deficiencies and disadvantages that are not aligned with a safe and convenient environment for people living with dementia. For instance, deficiencies may include the materials of currently constructed sidewalks that hinder patients with memory loss in wayfinding activities.

The second step investigates the traveling routes that people with dementia should follow to safely reach another destination and then return to the village. This step will also be necessary for choosing the shortest path since the project primarily targets seniors who likely have mobility difficulties. The third step addresses the public garden as a destination people with

dementia will wish to access in the community. This step will investigate design criteria and suggested activities that will be applied to develop a therapeutic and relaxing garden space.

1.4 Thesis Organization

Chapter 2, the literature review, provides a background in the following four areas: (1) dementia and cognitive science that is related to neuropsychological dementia rehabilitation; (2) home design opportunities for people with dementia, which provides a comprehensive look at the efforts that support persons with dementia in terms of establishing a healthy interior environment; (3) outdoor fenced activities that support people with dementia and outdoor activities for seniors in general; and (4) the role of assistive devices for helping people with dementia with their daily activities to ensure safety and reduce the burden on caregivers and the healthcare sector.

Chapter 3 consists of the proposed research methodology and implementation, Also, it discusses the strategy for finding solutions to be applied in the community which in turn will help people with dementia with wayfinding and triggering their recall abilities. The methodology consists of five steps, four of which will be discussed in Chapter 3, from defining the problems and to how to engage people with dementia in the community.

Chapter 4 includes the case study, implemented solutions, and the conclusion; the fifth step of the methodology will also be discussed, which demonstrates the practical implementation of solutions in a village for people with dementia. Recommendations on the requirements for choosing a suitable location for a dementia care centre will also be provided. Finally, the conclusion will provide a summary of the research, the contribution sought to be achieved, the limitations of suggesting ways to validate the recommended solutions and proposed future developments. Additionally, three appendices are provided:

Appendix A: Technical provisions for the design and construction codes of public gardens. The codes highlight some of the standards of landscape and horticultural components according to the City of Edmonton.

Appendix B: Two locations are suggested in Edmonton that are suitable for establishing a village for people with dementia. These two locations are chosen based on the advantages and disadvantages of the location of the case study.

Appendix C: A proposed questionnaire with relevant questions about developing a community for people with dementia is provided for gathering information from respondents in order to obtain an overall measure of the attitudes, opinions, and recommendations of the respondents. This questionnaire is developed to target people who live in the community as well as educational and governmental institutions.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter provides an overview of the available literature on dementia and the various diseases that cause it. The goal of this research is to provide open environments, unrestricted facilities, and supportive surroundings for positive integration of people with dementia in a community. Little research has been carried out on the subject of developing outdoor activities and dealing with people with dementia outside the dementia care centre; therefore, this literature review explores the efforts of engineers and health organizations in the context of the indoor care facility environment to improve the lives of people with dementia and maintain their independence as long as possible. The exploration of these efforts provides the basis and evidence to suggest ideas that will assist people with dementia in the outside world and prepare outdoor activities that may improve patients' cognitive abilities. This chapter will address four main topics.

- (1) A background on various types of dementia regarding disease stages and the signs and symptoms associated with each type of disease. This section will also discuss psychological changes that occur in people with dementia.
- (2) A background on the role of the interior environment in helping people with dementia in terms of choosing a suitable interior design. This section will also discuss the role of safe living spaces to improve the memory and recall abilities of people with dementia.
- (3) A background on architectural outdoor design standards which in turn enable people with dementia to carry out activities outside the dementia care centre. This section will also investigate the role of gardening activities for behaviour management and quality of life improvement for people with dementia.

(4) A background on the role of assistive devices that can be used to assist people with dementia to carry out specific tasks taking into consideration the limitations and ethical considerations of using them.

2.2 Background on dementia diseases

According to Laine et al. (2008), dementia is a general term that describes a degenerative disorder that affects the brain and may lead to memory loss and personality changes as well as problems involving communication and language, ability to focus and pay attention, visual perception, and reasoning and judgment. According to the Alzheimer's Society of Canada, dementia can be defined as "an overall term for a set of symptoms that are caused by disorders affecting the brain. Symptoms may include memory loss and difficulties with thinking, problem-solving or language, severe enough to reduce a person's ability to perform everyday activities". Alzheimer's is the most common type of dementia of the various diseases that can affect a person's memory such as Parkinson's disease, Lewy body dementia, vascular dementia, frontotemporal dementia, and mixed dementia. Most dementia cases worsen over time and are irreversible. However, some types can be reversed with specialized treatments (Figure 2.1) (Andrews, 2008). Since dementia encompasses many types of brain disorders, the present research primarily focuses on traumatic brain injuries that cause impairment of intellect and memory.

Based on research conducted by the Alzheimer Society of Canada (2017), the global impact of dementia in 2017 affected 50 million people worldwide, and this number will increase to an estimated 75.6 million by 2030. Of those experiencing dementia worldwide, the percentage of people in the early stages comprise the majority, forming 57%. In Canada, 564,000 Canadians are living with Alzheimer's disease and other types of dementia. By 2031, this number is expected to rise to 1.4 million Canadians of which the percentage of patients who will still be in the early

stages of the disease will decrease to 51%. Alberta has the highest number of early-stage dementia patients in Canada. Considering the critical nature of this issue, the Government of Canada has allocated \$10.4 billion per year (since 2016) toward the health care system and annual costs in direct out-of-pocket patient expenses. This funding is primarily focused on providing medical treatment, required examinations, and building specialized rehabilitation centres for people with dementia. The total Canadian health care system costs and dementia-related expenses are expected to increase to \$16.6 billion per year by 2031.

Since Alzheimer's is considered the most common type of dementia, the support offered by specialized organizations has become increasingly costly due to the increasing number of people who are being diagnosed with Alzheimer's (Ernst & Hay, 1994). Dementia diseases affect females more than males where 72% of people diagnosed with diseases related to memory loss are women. Also, females with diabetes have a greater risk of developing vascular dementia than males (Chatterjee et al., 2016).

The disease falls into seven stages, from no dementia (stage 1), where a person functions normally and has no memory loss, to late-stage (stage 7). Each stage has different signs, symptoms, and average duration (tables 2.1-2.4) (Alzheimer Society of Canada, 2016b). Although receiving an early diagnosis could be an upsetting experience, it may allow patients and their family the opportunity to deal with the disease in a timely manner, thus the earlier a person discovers the disease, the greater the possibility of staying mentally healthy (Clare et al., 2003).

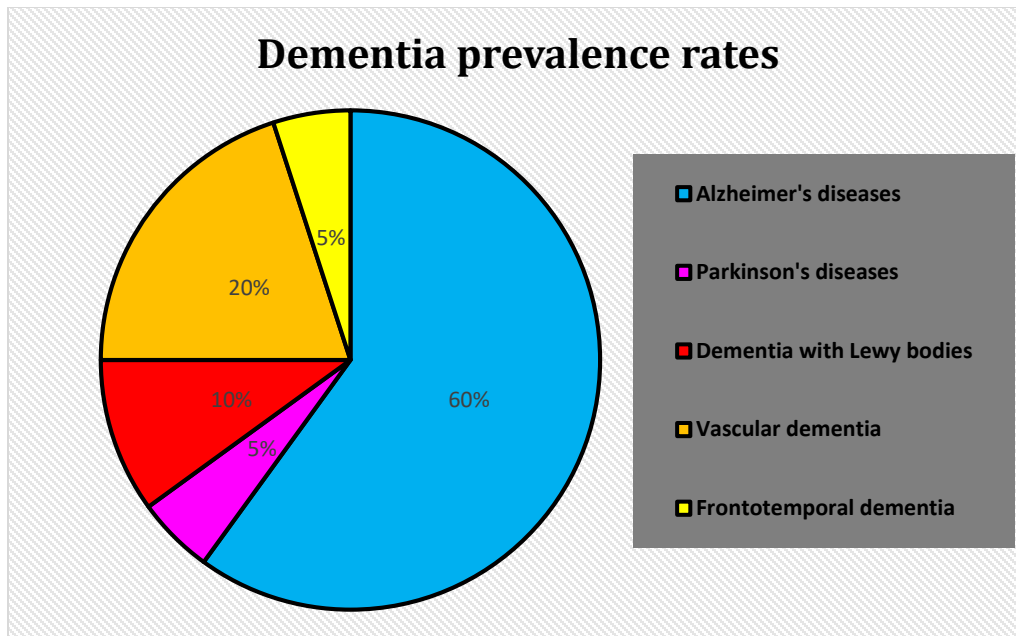


Figure 2.1: Types of Dementia (Alzheimer’s & Dementia Alliance of Wisconsin, 2009)

2.2.1 Social cognitive neuroscience view

Symptoms and signs of dementia diseases often go unnoticed, and earlier symptoms and signs are difficult to identify by the patients themselves or their family members. Because of this, the majority of people with dementia are diagnosed at stage 3, the symptoms, signs, average duration of which will be discussed later in the tables (2.1-2.4). Some forms of dementia diseases do not directly affect the memory, but rather affect other areas including personality, language, and cognition (Moniz-Cook, 2006). A study by Stern (2012) indicates that some patients have the ability to bear some of the symptoms and signs of dementia but are able to control some of the changes that occur and maintain function.

As reported by Stern, epidemiologic studies indicate that for people with higher educational or occupational achievement the probability of developing Alzheimer’s disease is less than for people with lower achievements in these areas. The utilization of mental abilities such as learning, language, thinking, reasoning, etc., offers the greatest long-term impact on preserving memory and brain function. In addition, Stern concludes that task performance ability and

resilience vary among people. For example, tasks include a person’s way of thinking, brain capabilities, and cognitive skills, all of which play an important role in helping reduce the risk of developing Alzheimer’s disease (Stern, 2012).

2.2.2 Background on Alzheimer’s disease

Table 2.1.
Generic information about Alzheimer’s disease (Alzheimer’s Association, 2013)

Alzheimer’s disease
<ul style="list-style-type: none"> • Most common form of dementia
<ul style="list-style-type: none"> • Comprises 60% to 80% of dementia cases
<ul style="list-style-type: none"> • In general, a slowly degenerative disease
<ul style="list-style-type: none"> • Occurs due to disruptions in communication among neurons

As mentioned above, there are seven stages of Alzheimer’s disease, and each stage is distinguished by different signs and symptoms. A sign of a disease is any objective evidence that can be noticeable in a patient by others, and a symptom is any subjective evidence that a patient experiences (Cox et al., 2014). The ability to receive the appropriate treatment depends on the accurate diagnosis of vital and nervous body functions and early recognition of the signs allows for appropriate therapeutic intervention (Korolev, 2014). Furthermore, the early screening or detection of dementia requires a strong understanding of the cognitive functions in the brain. When a patient transitions from earlier stages to later stages, the signs and symptoms become more critical and the probability of patients transferring to more advanced stages increases (Petersen et al., 2001). Additionally, there are some non-cognitive symptoms of dementia such as depression that can have rapid onset in patients, thus early therapeutic intervention is necessary in order to prevent these types of symptoms (Korolev, 2014).

2.2.2.1 Alzheimer’s disease stages, signs, and symptoms

Table 2.2.
Stages, signs, and symptoms of types of dementia (Alzheimer’s Association, 2013)

Diagnosis	Stage	Signs and Symptoms
No Dementia	Stage 1: No Cognitive Decline	<ul style="list-style-type: none"> • The person lives a normal life. • There is no memory loss. • The person is mentally healthy.
No Dementia	Stage 2: Very Mild Cognitive Decline	<ul style="list-style-type: none"> • The person begins to forget the names of some common objects. • Symptoms and signs are not obvious to the patient or the physician.
No Dementia	Stage 3: Mild Cognitive Decline	<ul style="list-style-type: none"> • The person begins experiencing increased forgetfulness, sometimes forgetting the way back home. • Having some difficulty concentrating; decreasing in work performance and brain function. • Having difficulties finding the right words to describe. • Symptoms and signs will be noticeable. • Average duration: 7 years before the onset of dementia.
Early-stage	Stage 4: Moderate Cognitive Decline	<ul style="list-style-type: none"> • Suffering from difficulties in concentrating. • Increasing the probability of getting lost in the case of traveling alone. • Unable to complete tasks efficiently. • Patients may deny their symptoms. • They start isolating themselves from family or friend because of socialization difficulties. • Physicians can detect the problem clearly. • Average duration: 2 years

<p>Mid-Stage</p>	<p>Stage 5: Moderately Severe Cognitive Decline</p>	<ul style="list-style-type: none"> • Patients need some assistance to complete their daily activities because of memory deficiencies, such as dressing, using the washroom or preparing meals. • The patients begin to forget their personal information continually such as their address or phone number and date of birth. • Average duration: 1.5 years.
<p>Mid-Stage</p>	<p>Stage 6: Severe Cognitive Decline (Middle Dementia)</p>	<ul style="list-style-type: none"> • Patients require extensive assistance to carry out daily activities. • They begin to forget the names of their family members and recent events. • Patients may not be able to remember some details of earlier life. • They also have difficulty carrying out simple tasks such as counting down from 10. • Physical problems begin to occur, such as loss of bladder or bowel control, or the ability to speak. • The disease may be accompanied by psychological problems such as changes in patients' personality. • Average duration: 2.5 years.
<p>Late-Stage</p>	<p>Stage 7: Very Severe Cognitive Decline (Late Dementia)</p>	<ul style="list-style-type: none"> • Patients in this stage require assistance most of the time in many daily activities since they do not have the ability to speak or communicate. • They often lose the ability to walk. • Average duration: 2.5 years.

2.2.3 Behavioural changes in people with dementia

Once a person is diagnosed with Alzheimer's disease, many behavioural changes begin to appear, and such changes result in distress among patients and caregivers. (Cerejeira, Lagarto, & Mukaetova-Ladinska, 2012). It is argued that people with dementia do not feel any psychological or physical pain due to the memory deficiencies they experience. However, studies have shown that people with dementia experience frequent psychological pain such as depression and physical pain such as headaches (Kovach et al., 1999). Having communication with a person with dementia has a positive impact on improving patients' mood and their quality of life. As the illness progresses, the patient's tendency to communicate will gradually deteriorate; however, "communication does remain possible at every stage of the disease" (Alzheimer Society of Canada, 2016).

According to the Alzheimer Society, it should be noted that dementia is not a natural part of aging because it is caused by diseases that damage the structure of the brain. It should also be noted that dementia diseases not only involve the loss of memory but also lead to many psychological effects such as difficulties in thinking and even speaking; therefore, caregivers are trained to provide specialized treatment for patients with dementia (Alzheimer's Society, 2017). Repeating tasks daily is considered to be an effective tool that caregivers can use because it allows people with dementia to respond to the task on a daily basis, which can be memorized as a part of their daily lives (Ferman, Smith, & Melom, 2008). Based on a study carried out by Söderhamn et al. (2012), the number of people with dementia is expected to dramatically increase in the future; thus, health care services and specialized organizations are confronting considerable challenges in the context of the amount of necessary care in the future. In the same study, qualitative interviews were conducted with nine female volunteers in southern Norway in

order to gather information from respondents to obtain an overall measure of volunteers' willingness to aid in a dementia care facility. As a result, volunteers were motivated to assist patients to participate in various indoor and outdoor activities and provide additional assistance as needed (Söderhamn et al., 2012).

2.2.4 Other types of dementia

There are other types of memory loss diseases, which are categorized as dementia. In comparison, the number of cases of patients who have been diagnosed with any of these diseases is less than the number of cases of patients who have been diagnosed with Alzheimer's disease (Alzheimer's Association, 2013).

2.2.4.1 Parkinson's dementia disease

Table 2.3.

Signs & symptoms of Parkinson's disease (Alzheimer's Association, 2013)

Parkinson's disease
<ul style="list-style-type: none"> • Similar to Alzheimer's in its late stages
<ul style="list-style-type: none"> • Accounts for 15 % of all cases of dementia
<ul style="list-style-type: none"> • Causes tremors, difficulty with concentration and judgment, memory problems, depression, problems with movement and muscle stiffness

Parkinson's disease (PD) is a leading cause of disability among the elderly. Parkinson's disease is a neurological degenerative disorder that leads to memory loss problems (Hirtz et al., 2007). PD is a chronic and progressive movement disorder, meaning that symptoms continue and worsen over time. This disease was discovered in 1817 by James Parkinson where the numbers reported that there are 5 million people worldwide are living with PD, and PD affects 1 in 100 people over the age of 60 (Kempster, 2004). Today, nearly 55,000 Canadians aged 18 or older have been diagnosed with PD and the disease is more likely to affect males than females. PD

involves the malfunction and death of vital nerve cells in the brain; the cause of PD remains unknown, but both genetic and environmental factors may be involved. Although there is presently no cure for this degenerative disease, there are treatment options such as medication, surgery, assistive technology, and assistive devices to manage the symptoms. (Emre, 2003).

Self-worth and self-esteem are correlated to one's ability to care for one's self, and the sense of independence this implies. This connection may go unnoticed until it becomes difficult for a person to perform simple tasks such as buttoning a shirt or cutting food (Postuma, Romenets, & Rakheja, 2012). Often people who are diagnosed with PD refuse assistance at first because of the loss of independence that may result as well as the accompanying impact on their state of mind. The main symptoms of PD are tremor (shaking) at rest, slowness of movement, the stiffness of the limbs and body, and impaired balance. Therefore, a significant focus is currently being placed on developing tools that will allow people who require assistance to remain as independent as possible rather than being entirely reliant on a caregiver (Fraiwan, Khnouf, & Mashagbeh, 2016).

According to Camilo's article in The American Physical Therapy Association, walking is difficult for people with PD because of the damage that occurs in the area of the brain that is responsible for movement. For this reason, it would be difficult to integrate people with PD dementia into a community that aims to enable people with dementia to safely walk up to a 350-metre distance. If a patient with PD dementia performs a movement, they will perform it slowly with their chest bent forward, resulting in a stiff appearance, and some patients become stuck in the middle of a movement and require assistance (Camilo, 2010). However, specialized training and exercises that aim to stretch tight muscles can help patients maintain some mobility, allowing them to carry out their simple day-to-day activities. (Brown, 2010).

2.2.4.2 Lewy body dementia, Vascular dementia, and Frontotemporal dementia

Table 2.4.

Other types of dementia diseases and their signs & symptoms (Alzheimer’s Association, 2013)

Lewy body dementia	Vascular dementia
<ul style="list-style-type: none"> • A form of dementia that occurs due to a build-up of protein in the cerebral cortex 	<ul style="list-style-type: none"> • Referred to as post-stroke or multi-infarct dementia
<ul style="list-style-type: none"> • Forms 10 % of all cases of dementia 	<ul style="list-style-type: none"> • Forms 10 % of all cases of dementia
<ul style="list-style-type: none"> • Causes hallucination, imbalance memory loss and confusion, sleep disturbances 	<ul style="list-style-type: none"> • Causes confusion, speaking troubles, understanding speech difficulties, disorientation, vision loss
Frontotemporal dementia	
<ul style="list-style-type: none"> • Diagnosed in patients under the age of 60, and is responsible for 5 % of all cases of dementia 	
<ul style="list-style-type: none"> • Causes language difficulty, unwillingness to talk, weight gain, fear of social communication 	
<ul style="list-style-type: none"> • Affects patients’ personality and behaviour 	

2.2.5 Reminiscence Therapy (RT)

Reminiscence therapy (RT) is an alternative technique for people diagnosed with a progressive cognitive disorder to reflect on different aspects of their lives (Chaplin, 2011).

Developing a memory-care assisted-living facility that provides tangible items from the past can create spaces to rekindle pleasant memories (Woods et al., 2005). Exploring the life stories and narratives, focusing on recollections of memories from the past, of people with dementia revives memories and feelings (Rentz, 1995). The hippocampus is the region of the brain responsible for converting experiences into memory, thus memory loss can be explained by the damage that occurs to the hippocampus in patients with dementia. Despite this damage in the brain, patients will be able to recall older stored memories even into the later stages of the disease while more

recent events and experiences will not become memories (Schmid, 2011). Clothing can elicit memories and discussions of identity, embodiment, and culture, and recalling previous memories can enhance a patient's sense of importance and boost their social life (Buse & Twigg, 2016). In the Georgian Bay Retirement Home, a memory care provider in Penetanguishene, Ontario, Canada, a section of the facility has been built to recreate the look and feel of moments from the past dating back to the 1950s and 1960s. For example, a vintage kitchen and a garage with a 1947 Dodge automobile aim to encourage patients to share memories from their past which may lead to positive feelings (Sagan, 2015).

The concept of memory care involves the use of vintage images, sounds, and objects which will evoke memories of a certain time. For example, featuring items from the 1950s or 1960s, such as a pub, post office, or vehicle, will elicit patients to talk about the past and recall particular moments, events, or narratives of past experiences (Dempsey et al., 2014). Vintage objects can trigger the memories of people with dementia and lead to positive impact. For instance, setting up a glass box that displays some antiquarian masterpieces, memorial photos, or sculptures can trigger their memory, provide a rich source of narratives, improve mood, and reduce agitation. Moreover, vintage objects may help patients with wayfinding where they can link the object with its location as a landmark (Schweitzer & Errolyn, 2009). RT will not reverse the progression of dementia diseases and is not guaranteed to assist all patients. For this reason, the primary role of RT is to acknowledge a person's life history and stimulate comforting memories while maintaining a coherent sense of self in the present (Gonzalez et al., 2015). Reminiscent activities can alleviate the symptoms of dementia and bring patients out of being withdrawal back to positive times where they will be able to recall details of events long past (Chaplin, 2011).

2.3 Background on Home Design Opportunities for People with Dementia

For more than 25 years, the Alzheimer's Association has been supporting valuable Alzheimer's research and enhancing the care for improving the quality of life for people with memory-loss diseases (Alzheimer's Association, 2009). Ongoing efforts are being put forth for providing a healthy interior environment which in turn helps people with dementia live securely and independently to carry out their daily activities. "The most important thing for any designer working in dementia care is to recognize that dementia is a disability and any solutions they design need to offset the effects of the condition" (Timlin, G., & Rysenbry, 2010).

Designers and architects must consider several factors in terms of establishing a suitable interior environment when designing any project that focuses on people with dementia and the range of potential physical constraints that may accompany such a condition (Fleming, Kelly, & Stillfried, 2015). Design for (long-term) care facilities needs to focus on addressing the cognitive difficulties of patients by designing therapeutic and relaxing surroundings. Therefore, the design of such facilities plays a vital role in improving the quality of life for people with dementia, in addition to creating a social and physical environment that supports residents with their natural aging process (Day, Carreon, & Stump, 2000). People with dementia confront several challenges in large, unstructured, and populated spaces. Additionally, designers must consider several crucial aspects of dementia village design such as maximizing awareness and orientation, increasing a sense of safety and security, and providing the opportunity for social contact (Briggs, 2004).

2.3.1 Suitable interior design standards for people with dementia

Dementia centres are environments intended to provide safe living spaces which in turn support people with dementia in their daily activities (Department of Health, 2009). In a previous investigation on quality of life, Savell & Starkey (2015) concluded that quality of life in long-term

care facilities is a difficult concept to understand. To some, quality of life involves being independent while for other people it involves having strong relationships with family members and friends. Therefore, centres that support people with dementia should offer methods that foster both independence and social communication in order to maintain the quality of life of the residents. Savell & Starkey also mentioned that facilities and care providers should meet eleven crucial elements, referred to as psychosocial domains of dementia homes design, which include comfort, privacy, dignity, individuality, autonomy, spiritual well-being, security, relationships, functional competence, meaningful activity, and enjoyment; these elements allow people with dementia to feel at home (Savell & Starkey, 2015).

The element of comfort may differ among individuals and may depend on personal preferences such as types of furnishings or the type of mattress, and the colour of the room (Help the Aged, 2007). Promoting autonomy in activities of daily living for people with dementia is crucial for increasing patients' feelings of independence. Safety can be promoted by autonomy through providing handrails on walls and using suitable lighting in staircases, entrances, or exists, which all in turn help patients to walk independently (Help the Aged, 2007).

The next subsection will discuss the standards of some interior elements that can make the day-to-day activities of dementia residents easier and allow them to better interact with the built environment. When people with dementia begin to express their wishes and desires, this reveals the well-being they experience and the comfort in which they live (Briggs, 2004). The interior elements of dementia care facilities are numerous; the following section will focus on three elements: (1) the method of sketching floor layouts to facilitate wayfinding for people with dementia; (2) the design of entrances and exits in a dementia care centre to provide visible connections between the interior and exterior environment; and (3) the design of bedrooms that

correspond with the personal preferences of people with dementia and how they react to the different types of furniture, colours, and lighting.

2.3.2.1 Suitable design of floor layouts in dementia care centres

The functionality of a space designed for senior citizens is critical, and designers should consider every motion and activity of the users to ensure success when residents are able to carry out their daily activities with ease (Help the Aged, 2007). A study done by Briggs (2004), the primary purpose in designing a suitable floor plan for people with dementia is to increase the feelings of independence and self-confidence and to reduce any feelings of failure or imprisonment.

Whereas there is considerable evidence for the impact of specific design elements on problems associated with seniors in general, there is a link between the quality of the built environment and quality of life of seniors including people with dementia (Fleming et al., 2016). For example, using stairs in homes for people with dementia is not desirable; however, staircases are necessary design elements in most cases that are used to move from one level to another, but poorly constructed staircases may be the cause of the risk of falling (Shaw, 2007). From a cognitive perspective, dementia diseases affect the function of the brain, thus patients often suffer from visual difficulties such as photophobia, or increased sensitivity to light, and cataracts, or clouding of the crystalline lens in the eye. These visual difficulties hinder patients from making correct judgment at the right time to perform a movement since the brain is incapable of communicating with the muscles (Mandal, 2012).

When stairs are a necessary design element, designers should address some of the stair component standards such as the staircase, geometrical design, handrail design, lighting, and step design. To illustrate some of these standards, for instance, precautions are necessary in forming

the shape of tread nosing edges of stairs, which should not be sharp, and handrails are essential to support patients when walking in order to increase their sense of independence (Afifi, 2012). People with dementia often experience difficulty with massive spaces, spaces with many doors, and long corridors, all of which result in confusion and stress. For this reason, a home designed for people with dementia should be a therapeutic environment that aims to provide secured dementia care (Ministry of Health and the University of Auckland, 2016).

2.3.2.2 Suitable design of entrances and exits in dementia centres

Spaces designed for seniors should be accessible by street-level entrances and should be equipped with no-rise entry ramps because many seniors have mobility difficulties that prevent them from moving easily (Fitz-Coy, 2017). The report entitled, “Design Guidelines for Continuing Care Facilities in Alberta” (Government of Alberta, 2014), addresses building standards for entrances and exits in facilities for people with dementia. The report indicates that entrances and exits should be designed in a way that allows people with dementia to easily recognize them. Designers should consider methods to make entrances and exits visible for older people since aging eyes need more light. One possible solution is installing a lighting system in order to make the components of entrances and exits (width, shape, steps, etc.) easily identifiable.

2.3.2.3 Suitable design of bedrooms in dementia centres

Bedrooms in dementia care facilities should provide comfort, amenities, and safety. Suitable bedroom design should address the points of access to and from the room and its connection with other associated services such as the bathroom and kitchen (Greasley-Adams et al., 2014). Interior designers should select suitable furniture for patients while also leaving the opportunity for patients to personalize their rooms. Designers should also consider the location of the bedroom in terms of the view from the room and the access points (Fleming, 2011). Dalke et

al. (2006) studied how colours can affect a person's behaviour and mood; however, colour preferences for people with dementia is a controversial topic and has yet to be researched thoroughly. However, people with dementia prefer colours that are limited to saturated primary colours such as blue, red and yellow, and secondary colours such as green, orange, and purple (Dalke et al., 2006). Also, research conducted by Rizzo et al. (2000) reveals that the colour preference ratings for people with dementia fall in the range of blue, red, and green (Rizzo, Anderson, Dawson, & Nawrot, 2000).

2.3.2.4 Suitable interior colours and lighting design in dementia centres

As people age, changes occur in the crystalline lenses in the eyes that affect vision as well as contrast and colour perception (Pacheco, Duarte, Rebelo, & Teles, 2010). Due to this reduction in contrast perception, colour contrast is the key to effective wayfinding and distinguishing other changes in the surrounding environment for seniors; however, high colour contrast is not recommended (Figure 2.2) (Benbow, 2014). As stated by Kowalske (2016), "By age 75, most people require twice as much light as the normal recommended standard, and nearly four times as much as a 20-year-old, to see satisfactorily". Many researchers have concluded that some environmental stimuli such as colours and lights can affect a person's behaviour and mood. For example, blue environments induce calmer feelings than orange environments since the blue colour is considered as a calming colour (Pacheco et al., 2010).



Figure 2.2: Example of acceptable colour contrast in a space for seniors (Benbow, 2014)

People with dementia respond better to matte surfaces than glossy or shiny surfaces, and effective use of colour contrast can facilitate independent living for people with dementia. Using prominent colour contrast can make objects in the interior environment more clearly distinguishable; for example, the colour of chairs should contrast with the colour of the wall and floor (Figure 2.4) (Possin, 2010). Considering colours in blue and green hues is preferable to colours in orange and red hues for people with dementia in terms of differentiating wayfinding and providing enough contrast for various elements. Moreover, high-intensity lights with a blue hue may reduce frustration, delay cognitive decline, and decrease feelings of depression (Marshall & Delaney, 2012).



Figure 2.3 Example of acceptable colour contrast between the doors, walls, and floor (Centre for Excellence in Universal Design, 2017)



Figure 2.4: Example of a floor with bold patterns that could cause confusion for patients (Centre for Excellence in Universal Design, 2017)

Lighting in a dementia care facility is also a critical issue since improved lighting systems can reduce dark areas and shadows on the floor. Adequate lighting systems may also help compensate for poor eyesight. A suitable lighting system can assist patients with wayfinding by increasing the concentration of lighting on paths, stairs, or entrances, which assists them to differentiate the directions of the paths (Figure 2.6) (Torrington, Tregenza, & Noell-Waggoner, 2007). A suitable lighting system can compensate for the lack of lighting in spaces that do not have direct access to daylight, and can also help to add more light in spaces to increase visibility (Benbow, 2014). Material type, texture, and furniture should be addressed to allow patients to easily carry out their daily activities. For example, while wood can be slippery and reflect sound, carpet can absorb noise and provide comfortable movement; notable features, such as an aquarium or fireplace, can also function as landmarks for navigation (Dickinson et al., 2001).



Figure 2.5: Example of well-chosen lighting system in a space for people with dementia (Montefiore Home, 2017)



Figure 2.6: Acceptable colour contrast for a light fixture in a space for seniors (The dementia center, 2012)

According to Schweitzer & Errollyn, certain objects can trigger memories for people with dementia. These types of objects can have a positive impact on people with dementia; for instance, setting up a glass display box containing antique masterpieces, commemorative photos, or sculptures can trigger their memory to think about distinct moments from their past (Figure 2.7). Moreover, Schweitzer & Errollyn also concluded that such objects can assist patients with wayfinding since they can connect the object with its location as a landmark in the care facility in which they reside (Schweitzer & Errollyn, 2009).



Figure 2.7: Memory box located at Sir Moses Montefiore Home for people with dementia (Montefiore Home, 2017)

2.4 background on architectural outdoor design standards

Gardening is an activity that assists in behaviour management and promotes a positive quality of life for people with dementia; gardens or parks can increase the sensory abilities of people with dementia. One of the most significant benefits of outdoor spaces in terms of health for people with dementia is connecting with nature and exposure to natural light, which increases their sense of freedom and autonomy (Schwarz & Rodiek, 2007). According to the Alzheimer's Association, 6 out of 10 people with dementia have a tendency to wander rather than remain stationary, sitting in a chair or on a bench for example. Wandering may result in the patient becoming lost or feeling trapped (Alzheimer's Association, 2017). From an architectural perspective, the design of the exterior environment should be aligned with the interior environment in order to increase the feeling of living with natural elements for people with dementia (Halsall & MacDonald, 2015).

There are two common categories for gardens that assist people with dementia. The first category is the therapeutic garden, which stimulates all five senses by specifically choosing the materials and plants. The second category is the horticultural landscape, which is a healthy

environment to heal social, cognitive, physical and psychological issues. “A garden environment for people with dementia is best to be a combination of both a healing garden and a horticultural therapy/therapeutic landscape” (Cochrane, 2010). Gardens that cultivated for people with dementia should be supported by both the therapeutic and horticultural concepts to enhance the general health and well-being of the patients. For this reason, this section will discuss the suitable design of therapeutic and horticultural outdoor landscapes for people with dementia.

2.4.1 Environmental press theory

The Environmental Press theory involves the interaction between a person and their environment. In terms of persons with dementia, the environmental press reveals the direct relationship between a person’s abilities and the demands of their environment and provides a context for care providers to help patients adopt behaviours that are compatible with the environment by exploiting their competencies. Persons with dementia possess limited ability to manage the environmental press, so personal caregivers can adapt the physical and social environment to suit a person’s competence level and increase their competency by exercising interactive skills and abilities. Caregivers can use approaches that target specific areas of concern in order to motivate the emotional memory, procedural memory, and social skills of people with dementia. The aim of this approach is to engage patients in overlearned behaviours, which helps change their behaviours positively and maximize their functional competence; hence, reducing the environmental press. The types of materials play a significant role to develop meaningful activities where it causes more constructive engagement and more pleasure and reduce agitation and aggression (Jarrott & Gigliotti, 2010).

2.4.2 Therapeutic garden

A therapeutic garden, or healing garden, is an outdoor garden space designed primarily to promote human health both physically and psychologically and to provide for the social and spiritual needs of users (Vapaa, 2002). Therapeutic gardens are increasingly being recognized as an important support for people with dementia because it promotes a sense of well-being and it improves their quality of life. In the context of dementia care facilities, providing an outdoor space that meets the needs of the users is the ultimate goal; however, directing people affected by memory loss among the various components in such a garden requires the consideration of some specific design aspects (Day et al., 2000).

Schwarz & Rodiek discuss in their book that people with dementia can learn using the procedural memory, which is the responsible for knowing how to perform certain procedures such as walking or talking and trigger problems with short-term memory caused by dementia. Thus, the procedural memory ability can be activated through routine and repetitive tasks, so repeating a particular task several times helps them learn and memorize the task, thereby increasing the patient's independence. A well-designed therapeutic garden can help people with dementia overcome difficulties related to their knowledge of the time of day and month or season of the year (Figure 2.8) (Schwarz & Rodiek, 2007).

As discussed in section 2.3.2.4, persons with dementia have the ability to memorize objects. Thus, the placement of landmarks, such as a gazebo, a flower path, a perennial tree, a fountain, or a sculpture, can assist people with dementia to employ these landmarks in wayfinding as they connect these landmarks with their physical locations. In addition, the role of landmarks is to increase independence for patients. To effectively apply landmarks, designers should install

landmarks prominently near pathways to allow patients to make lasting connections between landmarks and pathways (Figure 2.9) (Schwarz & Rodiek, 2007).



Figure 2.8: Gardens may help patients knowing time and date from the surrounding environment (Elpers, 2016)



Figure 2.9: Gazebo or pergola is one of the objects that can help patients with wayfinding (uclachoralmusic, 2017)

2.4.3 Horticultural therapy

Horticultural therapy is another method of therapeutic solutions to assist a person with dementia to adapt to the surrounding environment. Experts in horticultural therapy break down gardening activities into smaller components to suit the abilities of the patients and use adaptive equipment to reduce the environmental press and provide a positive social environment. Patients

could be involved in horticultural activities through modifications prepared by a therapist to enable them to work independently on a task to test their cognitive abilities (Hall et al., 2016). For example, the therapist may demonstrate repeatedly to a group of people with dementia how to fill a pot with soil and plant a small seedling. As a result, the more cognitive patients will be engaged in the entire sequence of steps, including the more difficult steps of the process, using tools with safety features, while persons with limited cognitive ability may be able to fill the pots with soil or plant the cuttings into filled pots. As claimed by Jarrott & Gigliotti, some activities may be included in the therapy such as taking plant cuttings from a wide variety of spaces and planting them in pots of various sizes. The aim of this technique is to employ tactile olfactory and optical stimulation by carrying out an age-appropriate and enjoyable medium. Therefore, some of the significant outcomes of the horticultural therapy programs include increased socialization and opportunities to reminisce as well as improved self-estimation, physical functions, and independence and autonomy (Jarrott & Gigliotti, 2010).

2.4.4 How to achieve a well-designed therapeutic garden

Schwarz & Rodiek (2007) provide several rules that can assist garden designers in planning a therapeutic garden for people with dementia.

- (1) The outdoor environment should be complementary to the interior environment. For example, Figure 2.10 illustrates how paths of a garden for people with dementia should direct them through the activities of the garden and connect with an entrance to the interior of the building by a visible door.



Figure 2.10: Illustration of how paths can connect a garden with a senior house (Herb Gardening Gardens Dementia, 2017)

- (2) Therapeutic gardens should be separated and isolated from public streets or sources of noise (Figure 2.11). However, the design of the garden is preferred to provide not only an inward view but also outward view. Thus, it is recommended to employ materials such as low shrubs or a short see-through fence with enough spacing rather than tall trees or solid walls in order to avoid negative feelings for patients such as confinement or isolation (Figure 2.12).



Figure 2.11: Example of a dementia home isolated from surroundings (Sir Moses Montefiore Home for dementia in Australia) (Montefiore Home, 2017)



Figure 2.12: Example of appropriate use of barriers in a dementia garden (Beaumont Villa: Dementia Garden, 2017)

- (3) The entrances and exits of the garden should be visible from all areas to allow for direct access from the care facility to the garden and back again. Constructing visible landmarks such as an arbor or a shaded courtyard at the entrances and exits will be helpful for patients to easily recognize the entrance or exit.



Figure 2.13: Example of objects that help patients with wayfinding (Erskine Park Home) (Howard, 2012)

- (4) Designers of the therapeutic garden should carefully choose the material and furniture for both the soft landscape and hard landscape. Designers should also consider the types of flowers and trees that are to be planted in the garden. For instance, some plants and trees have sharp branches and others are poisonous, all of which could harm users.
- (5) According to research conducted by Filan & Llewellyn-Jones (2006), the addition of domestic animals such as rabbits or cats offers additional therapy. However, this type of activity should be carried out under caregiver supervision.
- (6) To reduce any potential confusion of disorientation for people with dementia in wayfinding, deploying direct and short paths with 90°-angles can simplify their movement from one place to another. Straight paths promote visibility for people with dementia, and it is preferable to offer shortcuts to reduce the length in cases of long paths. Paths should also be wide enough to accommodate wheelchair users. Using signage is also helpful to direct patients from one place to another.

Finally, appropriate material selection plays a significant role in terms of providing a safe environment for people with dementia. For that purpose, Red Holland paving stone (Figure 2.15), which is made of clay, is a suitable material for outdoor pathways in homes for people with dementia. Beneficial properties of this material include its durability: it is able to withstand severe weather conditions. Red Holland paving stone is hollows inside, making it lightweight, so it can optimally reduce the consequences of falling if it happens. The texture of this material is dry and somewhat coarse, which to some extent prevents slipping, and snow or ice can also be removed easily. Moreover, this material is fire-resistant and can be constructed at the various pattern, but it is preferred to be constructed in a pattern with 90° angles to avoid confusion for people with dementia (Reig et al., 2013).

From the therapeutic and horticultural perspectives, there is a part of the brain that is responsible for the sense of smell such that memories may be triggered by certain smells. For example, the memory of people with dementia may be triggered by the scent of fragrant herbs such as mint, jasmine, roses, lavender, thyme or even wet leaves to conjure pleasant memories (Bakewell, 2010). Safety continues to be an important issue to illuminate dark spots in the garden and prevent falls or collision (Alzheimer's Society, 2017a)



Figure 2.14: Red Holland paving stone

2.5 Background on the role of assistive devices for helping people with dementia

This section provides a comprehensive look at the role of using assistive devices to assist people with dementia in their daily activities. The main goal of assistive devices is to improve the adaptive behaviours of patients and target their personal performance to achieve an optimum level of well-being and independence. There are several rehabilitative technological strategies and techniques that can assist individuals with dementia. People in the early stage of Alzheimer's disease respond better to all treatment strategies and techniques than patients in advanced stages (Clare et al., 2013). Caregivers play an important role in supporting patients and helping them to understand and implement these strategies and techniques (Kelly & O'Sullivan, 2015). Studies have shown that people with dementia can recognize and recall information when it is presented on a regular basis. People with dementia can also memorize and recall repetitive actions. For

example, they can recall information that has been presented in 5- or 10-second intervals, and the intervals can be gradually increased to 20 minutes when the presented information is continually presented in an organized manner (Golvers, 2005).

Technological strategies and techniques for cognitive and memory rehabilitation may directly focus on memories or cognition difficulties that interfere with a patient's ability to carry out specific tasks and activities. This interference can have an impact on a patient's ability to carry out direct real-life and more general rehabilitative activities (Clare, Wilson, & L., 2004). Wilson suggests that "cognitive rehabilitation can apply to an intervention strategy to enable clients/patients and their family to live with, manage, by-pass, reduce or come to terms with cognitive deficits precipitated by injury to their brain" (Wilson, 1997).

The primary concern among caregivers is how to manage behavioural symptoms such as walking independently, thus the technology should aim to reduce sensory barriers and increase the independent functioning of people with dementia. Therefore, assistive devices are advantageous in that it decreases sensorial, physicals and cognitive stresses due to environmental pressures, reduces behavioural symptoms and enhances the quality of life (Gitlin, Winter, & Dennis, 2010). Independence, safety, and well-being are the goals of using assistive devices; however, assistive devices does not only involve devices with high technological efficiency, but can also include simple and readily available products, such as electronic devices including smartphones and tablets, which can be deployed to help people with dementia to carry out everyday tasks and activities, support them socially, enhance their safety and maintain their health (Alzheimer's Society, 2017).

Although the use of assistive technology offers beneficial results, the importance of human contact and interaction should not be ignored. Assistive technology may lead people with

dementia to experience feelings of isolation and loneliness and does not eliminate all risk (Mihailidis & Fernie, 2002). A study by Serruya & Kahana (2008) discusses the aging process and decline in both physical and cognitive skills among elderly people. Also, it investigates practical ways of inventing devices that could be implanted in human brains to assist people with traumatic brain injuries by stimulating their memory. However, Niiler (2014) claims that using the implanted devices technique is very unlikely to be a cure for patients experiencing memory loss problems due to the cognitive impairments and cell loss in the brain. Since people with dementia experience, differing levels of cognitive impairment, their ability to understand and use high-tech devices will vary. Thus, assistive technology devices fall into two categories: active devices, which require a direct action and involvement from users to make them work; and passive devices, which can be automatically and remotely operated without any direct involvement from users. For this reason, people with dementia can generally use those devices that fall under the passive devices category (Bonner & Idris, 2012).

A traceable global positioning system (GPS) device will ensure that wandering is controlled, and it will enable caregivers to track the location of patients (Bonner & Idris, 2012). According to the Alzheimer's Society, tracking devices or location monitoring services provide a solution to prevent the risk of a person becoming lost. A study reported by Smith (2015), Drones have become one of the important advancement technology in human innovations due to the benefits they provide. For example, drones are used nowadays for early warning of forest fires, monitor highways and monitoring destructive and illegal activities such as poaching. Many researches of the drones have been carried out to investigate its role in tracking a human by giving out two-dimensional images and videos. Moreover, drones can detect human's movement since it can move freely in every direction of the air (Imamura, Okamoto, & Lee, 2016).

2.5.1 Limitations of assistive technology

As mentioned previously, the use of assistive devices for assisting people with dementia should not ignore the importance of human interaction and communication. The main benefit of assistive devices is to enable the user to perform tasks and carry out specific activities. Moreover, people with dementia may not be aware of how these devices work, so caregivers should choose devices that work automatically and remotely. Devices that deploy pre-recorded voice messages to prompt patients may scare or frustrate them, thus caregivers should teach patients how to use these devices through repetition. Other limitations include the need of electrical connection for use or for charging a battery prior to operation of some devices; also, some devices require a continuous internet connection, which could be an issue in cases of tracking or monitoring patients outdoors.

2.5.2 Ethical considerations of using assistive devices

Assistive devices offer many benefits to people with dementia; however, monitoring or tracking people with dementia requires obtaining consent or permission from patients and their relatives. Patients should not be forced to use technology because it could threaten the person's privacy, autonomy, and well-being. A person with dementia should be involved in decisions given they are able, but in some cases, caregivers may be required to make decisions based on the person's best interest

CHAPTER 3: PROPOSED METHODOLOGY AND IMPLEMENTATION

3.1 Introduction

This chapter describes the methods that contribute to satisfying a research gap in regard to people with dementia, which is how to integrate dementia care facilities into communities by providing unrestricted facilities and supportive surroundings in order to enable patients with dementia to safely walk and participate in outdoor activities. The primary objective of this research is to trigger the memory of people with dementia and provide a safe path to travel between the village and a proposed public garden. As discussed in section 2.2.2, people with dementia experience extreme difficulties in concentration and mobility in the advanced stages of the disease. Hence, the proposed solutions will aim to target patients who are in the early stages (stage 1 to stage 4) since they will have better responses to the proposed strategies and techniques than patients in more advanced stages. Therefore, the methodology begins by defining the central problems in developing a supportive community for people with dementia and concludes by outlining suitable solutions to these issues. Solutions are based on analytical methods and conceptualized recommendations that would be applied in the community to achieve the main objective of the project. The expected solutions will be classified into the categories of technology, horticulture, health, design, safety, tracing, evoking, entertaining, warning, and guidance. The proposed methodology primarily consists of five steps (Figure 3.1), of which steps one through four will be discussed in this chapter. The final step, which involves the implementation of the outcomes from this chapter in a case study, will be discussed in Chapter 4.

Step one is applied to define the key problems that people with dementia may confront when spending time outside the confines of the care facility. The four problems that will be addressed include (Figure 3.2):

- (1) General developments for the community, including safety preparations, such as road signs and addressing medical needs for patients.
- (2) Construction of the travel paths that people with dementia should follow, where the recommended solution is to keep them on the paths while they spend time outside the care facility.
- (3) Provide a safe crosswalk for crossing the road for people with dementia and suggesting solutions to connect crosswalks with the travel path.
- (4) Construction of a therapeutic garden with meaningful activities for people with dementia.

Step two of the methodology is the most critical because it is the basis for building inferences and finding solutions to each of the defined problems. This step primarily involves the application of principles from current methods for supporting people with dementia. Thus, the purpose of this step is to provide a comprehensive look at the treatment and care process being provided for people with dementia. Moreover, these principles will focus on strategies and techniques for cognitive and memory rehabilitation that help people with dementia in terms of how they respond to the provided activities. These principles will also provide a guideline to determine applicable approaches to help people with dementia walk safely and independently outside the village.

Accordingly, step two divides the general principles found in the literature for supporting people with dementia into six features for developing supportive outdoor activities for people with dementia (Figure 3.2).

- (1) The existing support that is in place for senior citizens in general since the majority of people who are diagnosed with dementia is seniors.
- (2) Concepts from other fields, such as architectural engineering or technology, that can be applied to support people with dementia for guiding and orientating purposes.
- (3) The role of assistive devices that are utilized to support people with dementia in the interior environment and exploring whether these devices can be employed to help guide patients outside the village. The key role of assistive devices is to provide safety for people with dementia, monitor their daily activities, and enhance their awareness of locations.
- (4) The role of applying horticultural and therapeutic garden solutions in helping people with dementia in order to improve their physical, psychological, and mnemonic abilities.
- (5) The types of materials that can be used and implemented in a certain way to guide patients with dementia in certain directions.
- (6) Ideas and solutions based on what has been highlighted in the literature that directly discusses issues concerning dementia and any effort to date toward supporting people with dementia either in the interior environment or in the exterior environment.

The aim of analyzing these principles is to understand which ideas may benefit people with dementia in wayfinding and thereby help prepare the community for them.

After analyzing and studying the principles and previous efforts defined in step two, step three involves building suggested plans and solutions based on what has been derived from step two for developing the community. Applying the recommended solutions aims to discover how they will be constructed, how they will benefit patients, and how patients will interact with them. As it has been mentioned before that solutions aim to address social, safety, and design factors, and the expected solutions will be classified into categories. Engaging the local community is step four of the methodology, which explores ways to implement common outreach activities that aim to educate and engage members of the community in terms of understanding and including people with dementia. There are some requirements for positive integration; for example, members of the community must be provided with instructions and training on how to interact with patients with memory loss and the potential situations community members may confront. After determining what can be implemented in the community, step five involves building a 3D model for each solution and analyzing how all solutions work together as one unit to achieve the primary objective.

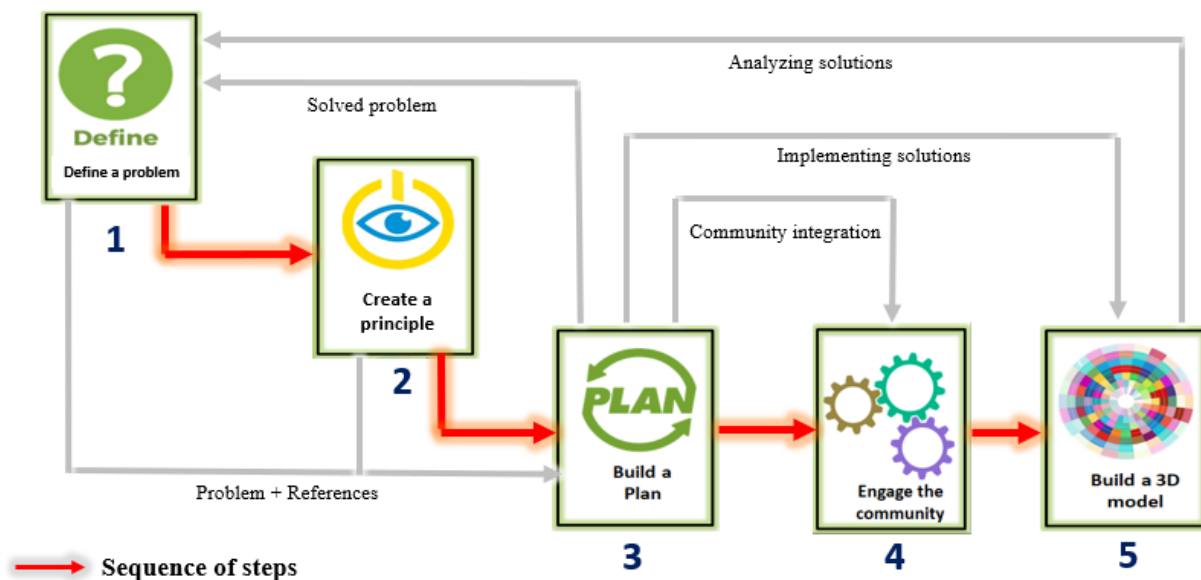


Figure 3.1: Proposed methodology

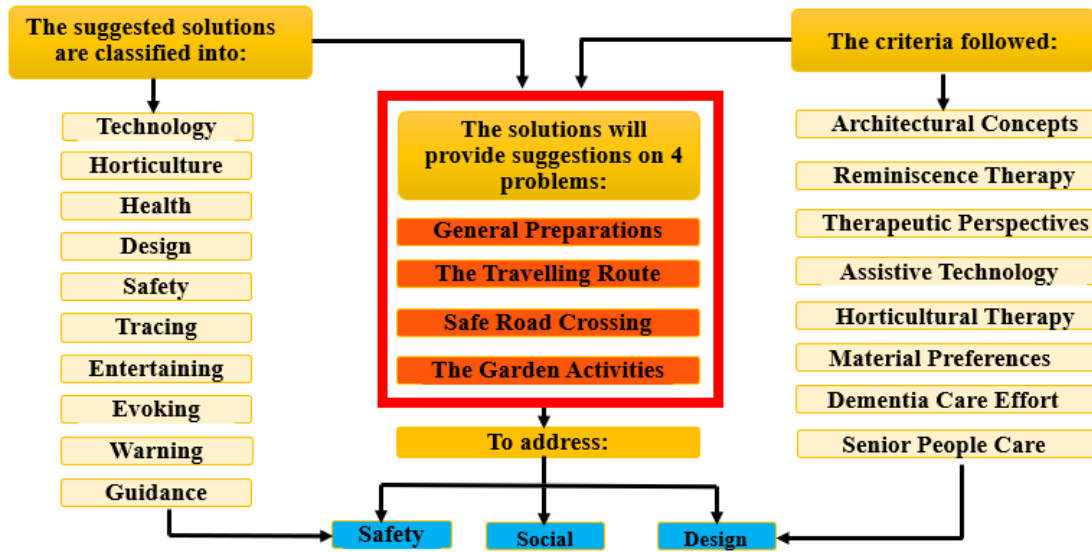


Figure 3.2: Main problems, issues to address, principles followed, and solution classifications

Safety is a major priority in the suggested solutions and should be considered at all times when individuals with dementia spend time outside of the care facility. Thus, prioritizing these solutions depends on the effectiveness of each solution to ensure safety for patients. Ensuring safety includes methods to prevent patients from becoming lost or confused. As discussed in Chapter 2, for instance, deploying specialized types of materials on walkways plays a significant role to help patients recognize the correct traveling route while applying spatial experience concepts helps patients remain within the boundary of the traveling route. This prioritization of recommended solutions is built on highly cited and investigated research that has been published to support the ideas and concepts of ensuring safety for people with dementia.

The importance of constructing recognizable objects that serve as landmarks for people with dementia is highly cited in the literature, and reminder devices are highly investigated in literature and widely applied to support patients in their indoor environments. Moreover, objects that serve as reminiscence therapy are also widely investigated in the literature due to their roles for increasing patient awareness of location. The role of colour and its impact on the behaviour

and performance of people with dementia is still poorly researched, and colour rating preferences for people with dementia are changeable based on the physical and psychological situations. Approximately 60 sources, including academic papers, articles, and theses, as well as websites, have been investigated in order to identify the key features for achieving the primary objective of the present research. A table recommending solutions for each problem is presented that includes a column indicating the number of studies investigated in this research that discuss and support each solution. Also, recommended solutions are numbered in order of importance to be applied to solve the problems and accomplish the objectives of the work.

3.2 Methodology Part 1: suggesting solutions for problem one-general developments

3.2.1 Defining problem one

As mentioned above, problem one involves specifying the general requirements of developing a community that accommodates people with dementia. These requirements include factors in regard to the village location such as the surroundings neighbourhoods and architectural perspectives. The proposed senior housing, located in the Hazeldean neighbourhood of Edmonton, Alberta, Canada, is being built and offers an environment where people with dementia can carry out various activities safely and securely (Figure 3.2). Two issues in regard to the location may affect the safety of people with dementia: (1) the village is adjacent to two main roads (on the west and south sides of the grounds) that experience heavy traffic during rush hour, and (2) the proposed garden is adjacent to a ravine and dense trees on the east side (Mill Creek Ravine). Proposed solutions for these issues will be discussed in this section.



Figure 3.3: The location of the village in accordance with the main roads and park (Google Earth, 2018)

3.2.2 Determining principles to assess problem one

The principles used to address the first problem will be created based on issues that concern seniors while other principles will be built on architectural concepts. Exposure to sunlight can be beneficial for seniors; however, as people age their skin is depleted of fat and water content and becomes thinner, and their skin becomes more sensitive to some types of sun rays such as UV light. As a result, UV light will penetrate the skin more deeply, and sun exposure may result in sunburn in a shorter period of time (Wilhelm, Cua, & Maibach, 1991). To reduce the risk of excessive sun exposure, the walking paths for people with dementia could be covered by gazebos, canopies, or pergolas, which provide a framework for climbing plants, and which feature an open lattice to allow some sun rays to penetrate. Handrails are necessary in many areas of seniors' residences in order to assist them with walking independently.

Another aspect of assisting seniors involves preparing members of the local community to interact with people with dementia; such developments may include signage that indicates the presence of seniors or a seniors' village in the area. The community residents need to be educated on methods to interact with people with dementia in order to promote communication and reduce difficult situations. Some of these methods include not asking too many questions, speaking in complete sentences, speaking quietly, making eye contact and using gestures, and providing an opportunity for patients to respond and express their feelings (Papastavrou et al., 2011). The layout of Edmonton is generally based on a gridiron plan (or grid plan), in which the city's streets and blocks are laid out and planned using orthogonal intersections; this grid-based method of urban planning assists with orientation, and promotes clear wayfinding. For the safety and well-being of the patients, the proposed walking paths for people with dementia should be carefully selected to avoid heavy traffic areas such as the adjacent main streets.

3.2.3 Building a plan for implementing the principles of problem one

Taking advantage of the existing grid plan, developing straight paths from the village to the garden is a feasible method to reduce any confusion associated with wayfinding for people with dementia. In kindergarten projects, ensuring the safety of children is an important factor that should be achieved. Designing kindergartens should go through studying the anticipated movement of children, which is an imperative factor to keep children away from danger resources such as streets (Ministry of Education - Japan, 2010). Similar to playgrounds or school zones, informative signage placed in prominent areas is useful for increasing awareness about the existence of the seniors care centre in the area and also for reducing the speed limit in that area. Following the same method for designing paths for young children the direction of the path that people with dementia should follow is recommended to be against the flow of traffic (in this case

the street to the west of the village) while access to the main street to the south is blocked by a row of houses. From an architectural perspective, it is recommended to design the main entrance of the building in the seniors' village to face toward the other side of the main street, which will be east-facing and toward the garden.

According to the circadian rhythm of the brain,; the performance of various tasks, such as sensory, motor, reaction time, memory tasks, and verbal tasks, will be higher in the morning than at any other times (Valdez & García, 2012). Thus, it is recommended to allow patients to do outdoor activities in the morning when the brain and memory tasks will be the most active. Participating in outdoor activities during the day allows patients to take advantage of daylight, which promotes clearer vision and sun exposure. However, the exposure time must be monitored in order to avoid any side effects such as sunburn or heat stroke. For this reason, gazebos, canopies, and pergolas will be constructed at various points of the traveling path from the village to the garden, which will be covered by climbing plants and lattices to allow some sun rays to penetrate.

To increase patient safety and their sense of independence, handrails would be necessary to be constructed along with gazebos to assist them with walking. The walking distance to reach to the public garden is approximately 350 metres; it is important to install rest areas along the path. Therefore, several benches will be placed at the midpoint between the village and the garden, and a pre-recorded voice, which will be activated through a device worn by the patients, will remind patients to take a break if necessary. Finally, a ravine is located nearby to the proposed garden, which may pose some danger for people with dementia. There are also dense trees in Mill Creek Park that may cause some confusion if they become lost. Therefore, the following list includes some proposed solutions that may be applied to reduce these risks before integrating people with dementia into the community:

- (1) Designing the garden in a way that positions its activities in the opposite direction of the park.
- (2) Implementing the spatial experience concept that directs paths to the activities of the garden and the way back to the village.
- (3) Applying a different texture that is difficult to walk on in the area between the garden and the park, which may trigger the patients' memory to prevent them from continuing to walk in the wrong direction.
- (4) Building a fence between the park and the garden to remove a pathway to the ravine and dense trees.
- (5) Providing people with dementia specialized clothing such as high visibility reflective jackets or vests to increase their visibility, making it easier to distinguish them in cases where they become lost.

3.2.4 Engaging the community

The local community has little involvement in terms of proposed general developments in the community for people with dementia. However, the significant role of the community will take place when people with dementia begin to wander into the community, and these primary roles include helping patients with wayfinding, crossing roads, carrying out activities, and providing assistance in cases when patients become lost or confused. It should be noted that the role of the local community primarily focuses on the time people with dementia spend outside the care centre.

3.2.5 Classifying, highlighting, and validating the suggested solutions and developments of problem one

Table 3.1.

Classification of solutions, developments, and purposes of problem one

	Suggested solutions and developments	Class of solutions and developments	Purpose
1	Warning signage	Warning & Safety	Alerting drivers and pedestrians.
2	The path direction from the village to the garden	Design, Safety & Guidance	Avoiding the risk of the surrounded main streets
3	Gazebos on the path	Health	Reducing the risk of sun exposure
4	Handrails	Guidance & Health	Assisting with walking independently
5	Benches at the half way from the village to the garden	Health	Taking rest of walking
6	Reminder devices	Technology, Warning & Guidance	Reminding patients about the time of taking the break.
7	Positioning the garden activities to the opposite side of the park	Design & Safety	Keeping patients away from the ravine of the park
8	The spatial experience concept	Design & Guidance	Keeping patients in the boundary of the garden
9	Changing the texture of paths nearby the park	Design & Safety	Discouraging patients to go towards the park
10	An adjacent fence to the park	Safety	Increasing extra safety for patients.
11	Specialized clothing for patients	Safety	Facilitating finding lost patients

Table 3.2.
Validating outcomes of problem one

Importance	Suggested solutions and developments	How is it supported?	How many times investigated in this work?
1	Reminder devices	Utilized in dementia care centres according to Alzheimer's Society	5
2	Gazebos on the path to reducing the risk of sun exposure	Applied in some existing therapeutic gardens such as Hogewey gated village in the Netherlands and Sir Moses Montefiore Home for Dementia in Australia	2
2	Handrails	Safety can be promoted by autonomy by providing handrails (Help the Aged, 2007)	2
2	Benches on the path between village and garden	Based on the need that the distance is a bit long for patients who may have mobility difficulties	2
2	Spatial experience concept	Applied widely in museums and shopping centres	2
3	Changing the texture of paths near the park area	The basis of implementation is different in this project, but this concept is used for guiding people with visual impairments	1
3	An adjacent fence to the park	Constructing fences is a way to block off entry to the park as safety precautions for patients.	1
3	Specialized clothing for patients	Based on the fact that high visibility reflective colours are easily distinguishable	1
3	Warning signage	Warning signage in school zones and seniors' villages	1
3	Path direction from the village to the garden	Based on requirements of designing kindergartens	1
3	Positioning garden activities to opposite side of the park	The requirements of designing kindergartens	1

Poorly researched

highly investigated

3.3 Methodology Part 2: suggesting solutions for problem two-the traveling path

3.3.1 Defining problem two

The second problem to consider prior to people with dementia performing outdoor activities is the method of designing and constructing the path that connects the village with a garden. The objective of this part of the methodology is to keep patients on the planned path during the time they spend outside the care centre, which will help caregivers to avoid any situations that may affect the safety of their patients. Solutions to this problem should address and improve cognitive and memory abilities for patients to carry out a specific task. Task performance is dependent on the stage of the disease a patient is experiencing, and the stage of the disease will determine how effectively patients can respond to the proposed solutions. The underlying cause of this problem is the unpredictable behaviours of patients, thus reducing triggers for these types of behaviours is the focus.

3.3.2 Determining principles to assess problem two

According to the stages of progression of dementia, the signs and symptoms become more critical from stage 5 onwards, and patients require additional attention and care as the stages progress. In this context, this research targets patients ranging from stage 1 to stage 4 since patients require less care and have better responses to various strategies and techniques. The proposed principles for problem two will consider the following aspects: (1) the role of assistive devices in helping people with dementia with wayfinding, taking into consideration limitations and ethical considerations of using them; (2) the role of applying horticultural and therapeutic garden solutions for directing patients; (3) as highlighted in the literature review in section 2.3.1, the standards of suitable interior design and gardens for people with dementia; (4) ideas or concepts from other

fields or areas such as architecture or technology that can support people with dementia; and (5) the role of reminiscence therapy to support older people and individuals with brain injuries.

3.3.2.1 Role of using assistive devices

The purpose of using assistive devices in caring for people with dementia is to manage behavioural symptoms and enhance communication techniques in order to simplify specific tasks. Many devices have been developed to assist people with dementia, who are still at the mild to moderate stage, for orientation or communication purposes. An effective device is one that serves to remind the user of important information or to carry out various tasks. This device functions based on a motion sensor such that when the device detects a movement nearby or if the user is approaching a specific place or object, a pre-recorded voice will automatically play to remind the user to carry out a particular action; such actions may include closing a door or changing direction on a walking path. Another type of reminder device plays a pre-recorded voice or a message at a certain time. For instance, a pre-recorded message can remind patients to take their medication, or it can inform users of the date and time (Alzheimer's Society, 2017).

3.3.2.2 Role of applying horticultural and therapeutic garden solutions

Applying horticultural and therapeutic garden solutions to assist people with dementia plays a significant supportive role and is an essential component of dementia care treatments. Therefore, allowing people with dementia opportunities to connect with nature is an important factor due to the psychological and cognitive benefits for them by providing access to meaningful outdoor activities. This section will provide the horticultural and therapeutic suggestions to be applied in the community for assisting people with dementia to safely walk from the village to the proposed garden. According to the literature reviewed in Chapter 2, memories may be triggered

by certain smells, so adding fragrant plants and trees may assist patients in recognizing the planned path they should follow.

3.3.2.3 Role of applying suitable materials

Selecting suitable materials will have a significant effect for providing safe walking paths for people with dementia and helping them with wayfinding. Unsuitable materials may lead to problems which in turn prevent people with dementia from performing tasks and participating in activities confidently and safely. For example, some materials become slippery when wet or may become soiled quickly, while other materials have sharp edges or uneven surfaces, all of which result in higher risk to patients since they may have difficulties with vision and mobility. Using two diverse types of materials on sidewalks to create a contrast in colour between the edge of the path and the main walking area help distinguish walking paths since elderly people often experience a reduction in contrast perception.

Other aspects to consider in regard to the continuity of materials in that applying more than one pattern on sidewalks may confuse people with dementia. Colours can also assist people with dementia to guide them from the village to the garden. However, seniors may begin to experience difficulty differentiating between colours that are similar. For example, the colour red may be perceived as a lighter hue such as pink since both colours are similar in terms of the wavelength. Also, since people with dementia often learn by repetition, using a similar texture along the walking path between the village and the garden can assist them with memorizing the recommended path.

3.3.2.4 Applying other applicable ideas

Architectural engineering offers a common concept called the spatial experience, which means fashioning the spaces within a building in a way that guides users to utilize and understand

the building to easily carry out their activities (Clarke, 2012). The spatial experience concept is widely applied in museums where the layout design enables visitors to view all the exhibits in the museum without having to revisit any areas (Figure 3.3). According to research outlined in Chapter 2, lights are used in the interior environment to direct people with dementia through a building and illuminate any areas with lower light. A specialized lighting system is used in some retail stores to direct customers through various departments (Figure 3.4). As discussed in section 2.4.2, remarkable objects can help people with dementia with wayfinding; for example, patients can link an object such as a gazebo with the entrance of the garden or an aquarium with a specific space in the care centre.

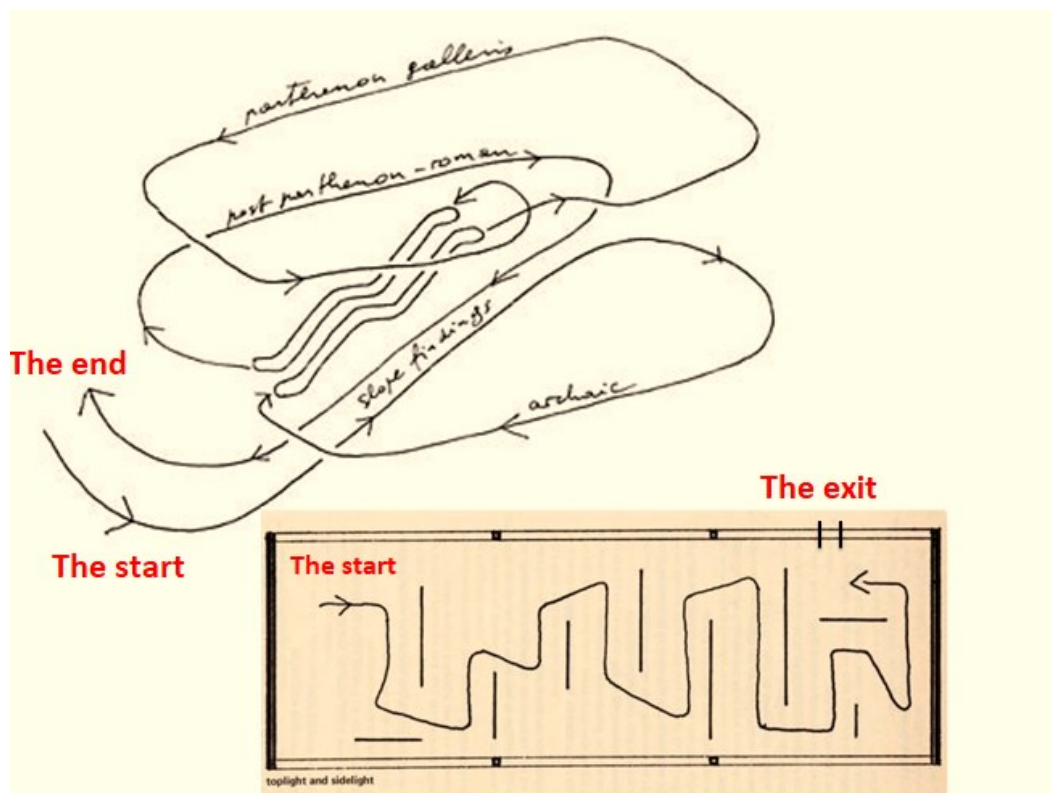


Figure 3.4: A sketch illustrates the spatial experience concept (Pinterest, 2017)



Figure 3.5: Reflected LED arrows as signage in a retail store (Garner, 2017).

3.3.2.5 Role of reminiscence therapy

Adding vintage items may boost patients' mental health by helping them to focus on recollections or memories from the past. The main purpose of reminiscence therapy is to reassure someone with dementia who may feel confused, making them feel more secure. Taking advantage of suggesting vintage ideas aims to keep patients on the right traveling route from the village to the garden. For example, cars from the 1950s or 1960s could provoke a sense of belonging for a person with dementia and alleviate symptoms of isolation or depression. Objects and buildings from the past can encourage people with dementia to enter into conversation and discussion about their identity, and culture, and designing a garden with old-style components can represent different aspects of their lives which in turn helps trigger memories.

3.3.3 Building a plan for implementing principles for problem two

The solutions to problem two offer methods to guide people with dementia along with the intended path between the village and the garden. For this reason, assistive devices will be helpful for providing safety for people with dementia, monitoring their daily activities, enhancing their

awareness of locations, and providing prompts and reminders. Therefore, assistive devices aim to facilitate how they carry out specific tasks; more specifically, reminder devices can be a significant method to develop a safe community for people with dementia thereby allowing patients to remain independent for as long as possible. For example, a pre-recorded voice that indicates when to begin crossing a road or a pre-recorded voice that alerts the user in the case of taking a wrong path. A pre-recorded message can also remind patients about time, and when they should leave and return to the village.

Caregivers can take advantage of GPS trackers or any other tracking devices and services to monitor patients with dementia and assist patients in cases where a patient becomes confused or lost. The use of modern drones can be beneficial for having an overhead view of the community in order to take photos or videos that can help to track the locations of patients. However, some types of drones produce a loud noise, which may intimidate people with dementia, so ensuring the drone flies at its maximum height will help to avoid this issue. It should be noted that the use of drones is restricted by some ethical considerations such as obtaining permission from residents of the surrounding neighbourhood. Drones must also be well-charged prior to use in order to monitor patients during their entire outing; also, monitoring larger areas would require more than one drone.

Some monitoring devices, such as a heart rate monitor attached to a wearable vest, can be taken into account to track a patient's physical performance in terms of the walking task. Additionally, the device can track a patient's psychological performance in case they get frustrated or scared when the heart beats become irregularly increased. The device can also enable caregivers to take the required assistance to prevent the problem from becoming worse (Alzheimer's Society, 2017).

Since memories may be triggered by certain smells, the therapeutic and horticultural garden solutions could be applied to keep patients on the planned path and avoid walking in the wrong direction. Therefore, that can be accomplished by planting shrubs and plants that have fragrant scents, such as mint, jasmine, roses, lavender, thyme, in an organized manner along the path between the village and the public garden. Alternatively, gazebos will be constructed on some parts of the path and covered by fragrant climbing plants such as lavender, the yellow jasmine and star jasmine (Figure 3.5). However, some of these plants mentioned above are not native to Alberta and do not grow well in cold climates such as Edmonton, which experiences severe cold weather in the winter. Jasmine usually flowers in warm climates where frosts are a rare occurrence. Nevertheless, if extra care and protection are provided to jasmine, it can grow and flower all the spring and summer season with temperatures as low as 10 F (Weaver & Anderson, 2012).

For avoiding plant growth problems and saving time, similar artificial smells can be used in place of real plants by applying similar fragrant plant oils to artificial branches and flowers. In addition, artificial scents could help patients follow the direction of the correct walking path. Scent application is recommended to be adopted and operated remotely by a caregiver only when people with dementia are participating in outdoor activities and turned off if patients are walking in a wrong direction.



Figure 3.6: Star jasmine climbing on arbor or gazebo (PAULO, 2013)

Designers can use saturated primary colours such as blue and red and secondary colours such as green to assist people with dementia in wayfinding. On the other hand, designers should avoid using colours that people with dementia have difficulties with such as the colours that fall in the gray range and pastels shades. When colours are employed for helping patients with wayfinding, it is suggested to use two colours to create a contrast between the edge and the path. Another option is using Red Holland paving stone along the edges of a path and a material of another colour in the centre of the path (Figure 3.6). As a result, it is strongly recommended that sidewalks for people with dementia should consist of two different types of materials with two different colours to enable patients to distinguish between the edges of the sidewalk and the path on which they should walk. An underground heating system, which is usually installed to help keep paths dry for cyclists, would be necessary in the winter months in case of snow, ice, or black ice. The purpose of using the heating system is to keep sidewalks dry to prevent the risk of falling for people with dementia.

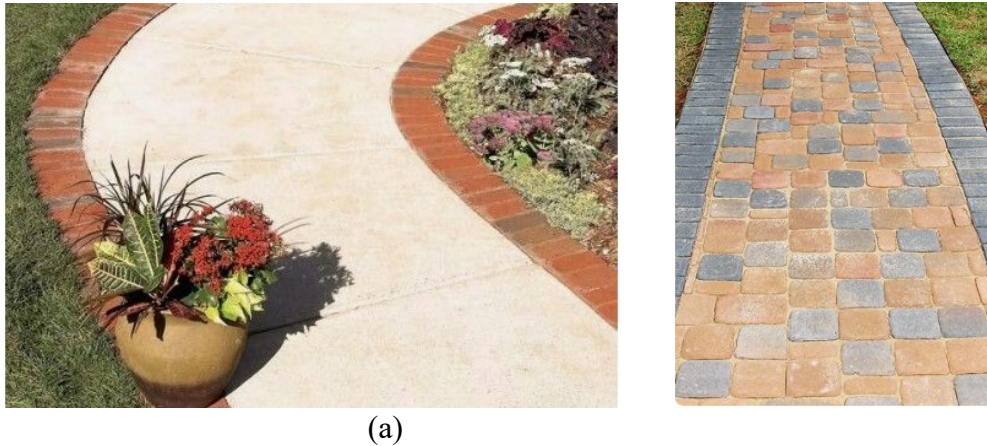


Figure 3.7: Examples of (a) well-constructed sidewalk with contrasting materials and colours (Clifford, 2017), and (b) problematic sidewalk construction using confusing patterns and uneven surface (Gardetto, 2017)

To prevent people with dementia from walking in wrong directions and becoming confused with other paths, other design ideas may help people with dementia stay on the planned path. For example, changing the texture of the material of other paths could trigger patients' memory and alert them to stop walking on the wrong path; for this purpose, spherical concrete cobblestones, which are commonly used to assist blind people in wayfinding, could be deployed on other paths for a short distance to differentiate between a different path and the intended path. Cobblestones should be coloured with either saturated primary colours or secondary colours that are recognizable by people with dementia in order to avoid the risk of stumbling, tripping, or falling.

The spatial experience concept is a supportive solution for positioning patients on the planned path in that it aims to provide the user with a path to travel from point A to point B and back again. To demonstrate, whether users walk in a forward or backward direction, they will reach a safe point of either the entrance or the exit (Figure 3.7). If we assume that a person with dementia becomes confused while they are walking from the village to the garden, they would have two options; either they continue walking forward until they reach the garden, from which

point the paths are designed to direct them back to the village, or they walk backward, or in the direction they had just come from, back to the village, thus both options result in safety. There is no evidence to suggest that a scared or confused person with dementia will choose to walk rather than to sit, but, as discussed previously in section 2.4, people with dementia tend to walk more than sit when they spend time in the garden. Moreover, the path that connects the care centre with the garden must be clearly marked and be situated directly ahead of patients, which reduces the chance of confusion. Finally, providing an opportunity for patients to walk in groups may encourage any patients who may be afraid to participate, and well-trained volunteers may help to guide them to the garden or back to the village.

Since people with dementia are generally able to recognize objects, a sculpture could be installed in a location near the entrance to the village, which can serve as a landmark for people with dementia. This landmark may assist patients to link its location with the care facility given that both are located in the same place, and as such can help them to return to the village if they become lost. Gazebos are one type of object that is easily visible and identifiable for people with dementia; constructing them along the path could also help patients remain on the planned path. Additionally, vertical projectors are recommended to be mounted on gazebos to project LED arrow signage onto sidewalks to direct people with dementia.

There is no explicit or clear evidence to confirm whether people with dementia will be able to recognize the projected arrows for guidance purposes. Alternatively, and as a suggestion, caregivers may use this idea to evaluate the performance and cognitive abilities of people who are still in the early stages of dementia by displaying information at intervals as discussed previously in section 2.5. For example, arrows will initially be displayed on a continuous basis; later on, they will begin to be displayed at 5- or 10-second intervals to see if patients can recognize and recall

information that is being presented on a regular basis. Gradually, the length of the intervals will be increased if the patient's performance improves over time (Golvers, 2005). Finally, recognizable vintage items, such as a telephone booth, could assist people with dementia to remain on the planned walking path and evoke memories from the past.

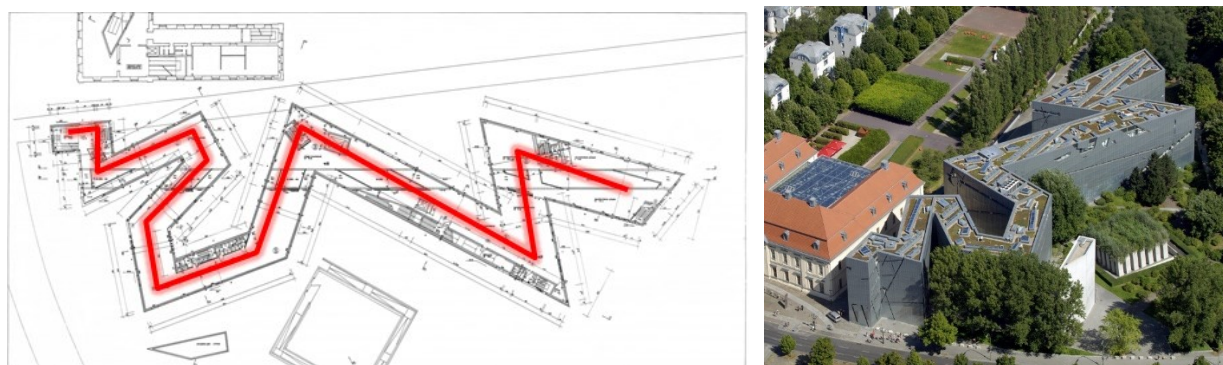


Figure 3.8: Example of spatial experience concept applied by the Jewish Museum, Berlin (source: Studio Libeskind, 2017).

3.3.4 Engaging the community

The local community can volunteer at the care facility to assist and guide people with dementia on walks from the village to the garden and back. However, interacting with people with dementia requires some training and instruction. The following list includes some important instructions for interacting with people with dementia (Papastavrou et al., 2011):

- (1) Avoid asking people with dementia too many direct or complicated questions because they may get frustrated or confused if they cannot find the answers.
- (2) Ask simple, yes or no questions; it is recommended to only ask one question at a time, leaving some time for them to respond before asking the next question.
- (3) Speak in complete sentences and allow them to speak for themselves; remember to include them in the conversation.

- (4) They enjoy conversing with people but remember to speak slowly, making eye contact and using gestures. They may be startled by high-pitch, sudden movements, and tense facial expressions.
- (5) Do not stand too close to a person with dementia, because it may make them feel intimidated.
- (6) Choosing an appropriate place, such as a garden or a room with good lighting, plays a significant role in obtaining benefits from the conversation.
- (7) Address them as a peer, being respectful, rather than as a patient or a young child.
- (8) Humour can be enjoyable and may relieve pressure, but do not laugh at their mistakes.
- (9) Use other techniques to help them understand any confusing phrases such as writing on a board or pointing to an object.
- (10) Encouragement is a very important tool.
- (11) Try to avoid any sense of competition among patients in cases of controversial topics, differences in opinions, or performing activities.

3.3.5 classifying, highlighting, and validating the suggested solutions and developments of problem two

Table 3.3. Classification of solutions, developments, and purposes of problem two

	Suggested solutions and developments	Class of solutions and developments	Purpose
1	Reminder devices	Technology, Warning & Guidance	Keeping patients on the planned path & warning in cases of walking in the wrong direction
2	GPS tracker	Technology & Tracing	Tracking the location of patients
3	Modern drones	Technology & Tracing	Tracking the location of patients

4	Monitoring devices	Technology, Health & Safety	Monitoring the physical and psychological health of patients
5	Fragrant smells	Guidance	Triggering memories and increasing the sense of place
6	An underground heating system	Safety	Keeping the path dry and free from ice
7	Saturated primary colours	Design & Guidance	Triggering memories & keeping patients on the planned path
8	Changing the texture of other sidewalks	Safety & Design	Discouraging patients from walking in wrong directions
9	The spatial experience concept	Design & Guidance	Keeping patients on the planned path
10	A sculpture near the village	Design & Guidance	Helping patients with wayfinding back to the village
11	Projected LED arrows	Technology & Guidance	Assisting patients with wayfinding
12	Red Holland paving stone	Design & Guidance	Helping patients with wayfinding
13	A vintage telephone booth	Evoking & Guidance	Triggering past memories

Table 3.4.
Validating the outcomes of problem two

Importance	Suggested solutions and developments	How is it supported?	How many times investigated in this work?
1	A sculpture nearby the village as a remarkable object	According to Schweitzer & Errolyn (2009), remarkable objects can help people with dementia with wayfinding. An example of this is the installation of a memory box at the Sir Moses Montefiore Home for Dementia in Australia	6

1	A vintage telephone booth as a reminiscence therapy	The Georgian Bay Retirement Home features a 1947 Dodge to encourage patients to recall and talk about their younger selves	6
2	Reminder devices	Utilized in dementia care centres according to the Alzheimer's Society	5
3	GPS tracker	Utilized in dementia care centres according to the Alzheimer's Society & according to research carried out by Bonner & Idris (2012) about the role of GPS	2
3	Modern drones	Practical role in taking aerial photos and videos for aerial surveying purposes	2
3	The spatial experience concept	applied widely in museums and shopping centres	2
4	Monitoring devices	Utilized in dementia care centres according to the Alzheimer's Society	1
4	Fragrant smells	According to Bakewell (2010), memories may be triggered by certain smells	1
4	An underground heating system	Used for drying and removing ice from cycling paths	1
4	Saturated primary colours	According to some tests conducted by Dalke & Rizzo (2006), colour preferences for people with dementia fall in the range of saturated primary blue, red, and green colours	1
4	Changing the texture of other sidewalks	The implantation is different in this project, but it is used for guiding people with visual impairments	1
4	Projected LED arrows	Applied in shopping centres for wayfinding purposes, but another key purpose in the present research is to test patients' performance	1
4	Red Holland paving stone	According to Dickinson et al. (2001), the type of material, texture, and furniture have a significant impact on the daily life of people with dementia. Red Holland paving stone is suitable in a place for senior people according to its unique properties	1

Poorly researched

highly investigated

3.4 Methodology Part 3: suggesting solutions for problem three-crossing roads

3.4.1 Defining problem three

Enabling people with dementia to safely interact with traffic and carrying out the task of crossing the road is a critical issue that needs to be solved before integrating them into the community. The primary objective of this section involves searching for solutions to facilitate the task of crossing the road for people with dementia and keeping them on the crosswalk in order to safely reach to the other side. The suggested solutions for this problem aim to stimulate the cognitive abilities of people with dementia and effectively trigger their memory to keep them on the planned path.

3.4.2 Determining principles to assess problem three

The principles for solving this problem are based on the following aspects: (1) assistive devices and their supportive roles for helping people with dementia with wayfinding, taking into consideration limitations and ethical considerations; (2) solutions that have been highlighted in the first problem, which talks about general developments in the community in terms of the importance of using appropriate signage and lowering the speed limit; (3) choosing suitable materials that could be used to help people with dementia stay on the correct walkway and not to be confuse or distracted. Memorable colours and landmarks may also help people with dementia to easily distinguish walkways and assist them in staying on the planned path, and (4) the role of using lighting systems for directing people with dementia towards the correct walking path.

3.4.3 Building a plan for implementing principles for problem three

Voice activation sensors may be very helpful to people with dementia when crossing the road, such that a sensor can be triggered automatically to stop any oncoming traffic that may be approaching the intersection. A more cautious approach would employ a reminder device to play

a pre-recorded message to remind patients about becoming prepared to cross the road before they reach the crosswalk and begin crossing and could alert them if they are walking in the wrong direction. A green spotlight and a pedestrian “walk” sign that are continuously illuminated may serve as useful indicators for patients to start crossing. On the other hand, it is suggested to install a red spotlight and a “do not walk” sign to indicate to patients to wait to cross and stay on the correct crosswalk. Additionally, to ensure that the intersection is free of cars, a specialized traffic light system can be installed. This system is operated remotely by a caregiver, and in cases where a person (or group of people) with dementia are approaching the crosswalk, all traffic lights in all directions will turn red before the patients begin crossing. To ensure extra caution, a red spotlight or a red flashing light facing the direction of the vehicles can be deployed besides traffic lights as an additional warning for drivers; and it is suggested to install a sign that prohibits drivers from turning right when traffic lights are red.

Red Holland paving stone is a suitable material that provides a safe surface and reduces the risk of falling for people with dementia. Applying the same concept of the traveling path, it is recommended to use another type of material on the edges of crosswalks to provide a contrast between the pathway and its edges. Since people with dementia can memorize objects, gazebos are recommended to be also constructed on both ends of crosswalks. The purpose of constructing gazebos in these locations is to provide a recognizable landmark for people with dementia to walk toward thereby helping them reach the other side of the walkway.



Figure 3.9: Example of crosswalks with (a) effective colour contrast for people with dementia (Chew, 2017), and (b) undesirable pattern (Design TAXI Crew, 2017)

3.4.4 Engaging the community

The local community plays a vital role in helping people with dementia to use crosswalks to safely cross roads, taking into consideration the instructions of how to properly interact with them. Volunteers can assist patients who may become scared or confused and guide them to the other side of the intersection. Volunteers can ensure that people with dementia are taking the suggested traveling route and can guide them back to the correct walking path in cases where patients become confused.

3.4.5 Classifying, highlighting, and validating the suggested solutions and developments of problem three

Table 3.5.
Classification of solutions, developments, and purposes of problem three

	Suggested solutions and developments	Class of solutions and developments	Purpose
1	A specialized traffic light system	Technology, Warning & Safety	Clearing cars from intersections
2	Preventing right turns when traffic lights are red	Warning & Safety	Avoiding any intimidating or dangerous action from cars

3	A green spotlight with “walk” sign	Guidance	Permitting patients to start walking
4	A red spotlight on opposite crosswalks	Warning & Safety	Preventing patients from taking wrong crosswalks
5	Red Holland paving stone & paint colours	Design & Guidance	Helping patients with wayfinding
6	Gazebos on both ends of crosswalks	Design & Guidance	Helping patients with wayfinding to garden and back to the village

Table 3.6.

Validating the outcomes of problem three

Importance	Suggested solutions and developments	How is it supported?	How many times investigated in this work?
1	Gazebos on either end of crosswalks as a remarkable object	According to Schweitzer & Errolyn (2009), remarkable objects can help people with dementia with wayfinding. An example of this is the installation of a memory box at the Sir Moses Montefiore Home for Dementia in Australia.	6
2	A specialized traffic light system	A new solution, but can be easily applied since it is a matter of switching on specific lights at certain times	1
2	Preventing right turns when traffic lights are red	Necessary for extra safety precaution	1
2	A green spotlight with “walk” sign	According to several studies, lights can assist people with dementia with wayfinding, as applied in the interior environment. The green colour is one of the primary colours.	1
2	A red spotlight on opposite crosswalks	According to many studies that lights can assist people with dementia with way-finding, and it is used in the interior environment. The green colour is one of the saturated primary colours	1

Poorly researched


 highly investigated

3.5 Methodology Part 4: suggesting solutions for problem four-activities for the garden

3.5.1 Defining problem four

The fourth problem defined in terms of community developments is the method of designing a therapeutic garden for people with dementia. Engaging patients affected by memory loss with nature may result in physical, mental, and age-related improvements as well as increased quality of life and sensory abilities. Developing a therapeutic garden requires the application of design standards and factors in regard to planning the paths and selecting suitable materials for the soft and hard landscape components that take into consideration the needs of people with dementia. Also, designers and caregivers are responsible for developing therapeutic and rehabilitation activities in order to achieve optimal well-being as well as addressing issues concerning the safety and independence of patients.

3.5.2 Determining principles to assess problem four

The principles for solving this problem are based on the following aspects: (1) the therapeutic garden and horticultural solutions for achieving beneficial health and behaviour-related changes in a positive way; (2) the role of using assistive devices and lighting systems to help people with dementia spend time in the garden safely; (3) architectural concepts and other applicable design ideas to keep patients within the boundary of the garden and help them return to the care centre after participating in the various activities in the garden; (4) the role of selecting suitable materials that facilitate safe walking and performing activities for patients; and (5) the role of reminiscence therapy, which triggers the memory of people with dementia to recall their past.

3.5.2.1 Role of applying therapeutic garden and horticultural solutions

Gardens play a key role in providing physical and psychological support to people with dementia; however, in light of environmental press theory, environmental changes should be minimized. To illustrate, the aim of the environmental press theory is facilitating activities for individuals with dementia, increasing their competence, and improving their behavioural skills for performing certain activities. Caregivers should determine how the environment can be adapted or modified to fit patients' functional, sensory, cognitive, and social abilities

3.5.2.2 The role of assistive devices and lighting systems

Tracking people with dementia while they spend time in, as well as traveling to and from, the garden is necessary to avoid accidents since the proposed garden is planned to be adjacent to a ravine at Mill Creek Park. Caregivers can use modern drones and GPS tracking devices to track and monitor patient locations as well as their physical and psychological performance. Since people with dementia may have visual difficulties, it is also important to install suitable a light system that illuminates the components of the garden and the edges of the walking paths in case of insufficient daylight.

3.5.2.3 Role of architectural concepts and other applicable ideas

Continuity in applying architectural concepts such as the spatial experience concept would be beneficial for guiding people with dementia through the various activities associated with the garden. The purpose of applying such concepts is to keep patients within the boundary of the garden, the paths of which are architecturally designed to facilitate the safe return to the village. The outline of the garden could be designed in a certain way to encourage patients to do and spend more time on specific meaningful tasks. As previously discussed in section 2.4.4, encouraging domestic animals in the proposed garden might be an assisted therapy for people with dementia.

3.5.2.4 Role of selecting suitable materials

In an effort to provide a safe environment for people with dementia, using certain types of materials in the garden could reduce the visual and mobility difficulties they may have. For example, the texture of the garden's paths should be easy to clean, because fallen leaves or other debris may reduce the path's contrast reducing the perception of the edges, which increases the risk of falling for people with dementia. Constructing paths with two different type of materials, where they can differentiate between the path and its edges, may improve the ability of people with dementia to remain on the planned path. Recognizable colours could be painted on the garden's paths or on prominent objects to direct patients to specific areas that offer various activities.

3.5.2.4 Role of reminiscence therapy

Given that vintage-themed buildings and objects will have a significant impact on people with dementia in order to focus on recollections of memories from the past, constructing an environment with tangible vintage items can create spaces to help patients recall memories and increase their socialization with other members in the community. According to the various literature discussed in section 2.2.5, past stored memories will remain available even into the later stages of dementia. For this reason, selecting vintage items will target past memories, including cultural heritage and identity.

3.5.3 Building a plan for implementing principles for problem four

Since one purpose of a garden is to maximize sensory responses for people with dementia, the proper types of plants and trees should be carefully selected to ensure that they are safe if a patient were to come in contact with them. For example, a cactus is one type of plant that is not safe to touch; and foxglove is one type of toxic plant. Trifoliolate is one type of plants that often

causes skin irritation, rashes, and blisters when touched. The Red Osier Dogwood is considered one of the plants that provide an aesthetic appeal; however, although its berries are edible, they are somewhat dry and may stick in the throat (Perry & Howes, 2011). Since seniors may begin to have difficulty deciphering certain colours, it is recommended that plants be clustered together, which may assist a person with dementia to see the flowers due to a greater contrast of colours. These types of gardens may also include some grassy areas to allow the users to sit down and rest and take in the sights and smells of their surroundings.

People with dementia can contribute to and be involved in horticultural activities in various ways, such as choosing their favourite plants and tree and planting them in the garden or in pots, or irrigating different parts of the garden, with the assistance of those with gardening experience. These activities will result in the enjoyment of patients, improving their physical functions, and increasing their social interaction with one another or with others who are visiting the garden. As a suggestion, one of the horticultural activities that may increase patients' cognitive abilities is to encourage patients to follow certain patterns with the various plants such as following circular or linear patterns based on the types and colours of plants. Caregivers should take into consideration some of the tools used for gardening activities, some of which may have sharp edges that may hurt patients if used incorrectly. It is recommended to use polished plastic tools for gardening, and well-trained volunteers from the community who have gardening experience should supervise patients during these gardening activities; there should also be a first aid kit on site as well as a person who is trained in administering first aid.

Providing areas such as gazebos for people with dementia to rest and relax in the garden can protect them from sun or wind. Because of the mobility problems patients may suffer from, walking paths should be flat and should not include steps. It is recommended to plant various types

of fruit trees to allow people with dementia to participate in the activity of picking the fruit they enjoy to eat. Trees, such as apple and cherry trees, can grow in a cold climate and offer a good colour contrast between the leaves and fruits.

Installing a suitable lighting system can help people with dementia in wayfinding and avoiding the risk of falling. Although natural sunlight can provide sufficient illumination, cloudy weather may cause difficulty in visibility for patients, thus a lighting system can be installed to provide appropriate illumination along the planned path to prevent the risk of falling or becoming confused or distracted. It is not recommended to use simple types of lights to avoid confusion.



Figure 3.10: Example of a lighting system illuminating the edge of the path and plants (Lockwood, 2017)

From the spatial experience perspective, designers of the garden can manipulate the width of the sidewalks and paths or implement the hierarchical paving concept, starting from a wider path to a narrower path. The purpose of applying this concept is to orient users and draw their attention to specific areas that offer activities. For example, when patients walk toward the narrower sections of the hierarchical paths, they would be encouraged to slow down and observe the activities or scenery in that part of the garden.



Figure 3.11: Example of hierarchical paving (Ced Stone Group, 2017)

The principle of applying saturated primary colours is recommended to help support wayfinding for people with dementia such as staying on the right path and staying within the boundary of the garden. To mark a path, it is suggested to use two colours to create a contrast between the edges and the path; or Red Holland paving stone can be used on the edges of the path and another colour in the middle. It is not recommended to utilize more than one colour on the path or draw a colourful pattern since this may confuse people with dementia or cause the risk of falling.

Adding and encouraging wildlife in the garden may be helpful for patients, such as squirrels, birds, or ducks. However, this task should be done under supervision to avoid any intimidating actions that could scare patients. Trained service dogs can assist people with dementia by guiding them along the path to and from the garden.

Taking advantage of reminiscence therapy, an old-fashioned car that has been converted into a bench would be an object that provokes old narratives from the past for a person with

dementia. A vintage barn at the garden may encourage patients to talk about their past and trigger their memory. The proposed village is located in the province of Alberta, where oil sands extraction and processing is a unique resource. For this reason, the presence of an oil field pump jack would provide a rich source of narrative and encourage patients to talk about their history. The technological revolution was moving slowly 50-60 years ago, thus simple tools had been used for a long time to do domestic chores. For instance, windmills were usually used to mill grain and pump water, thus constructing an adjacent old-style windmill to a pond with a stony-theme bridge would help patients recall details of events long past.

3.5.3 Engaging the community

There are many tasks that engage the local community; for example, the garden is an environment where people with dementia can communicate with other people, which supports the goal of this research. The local community can be involved in other ways such as helping patients with the horticultural activities. Some volunteers can also help patients if they become intimidated while interacting with domestic animals, and others can direct patients to the garden or care centre in case they become lost or confused.

3.5.4 Classifying, highlighting, and validating the suggested solutions and developments of problem four

Table 3.7.
Classification of solutions, developments, purposes of problem four

	Suggested solutions and developments	Class of solutions and developments	Purpose
1	Planting suitable plants and trees	Health & Safety	Selecting types that are safe if a patient were to come in contact with them
2	Cluster of plants	Horticultural	Enabling patients to recognize the flowers

3	Gardening activities	Entertaining & Horticultural	Enjoyment of patients, improving their physical functions, and increasing their social interaction
4	Productive garden	Entertaining & Horticultural	Entertaining activities for patients
5	Installing a suitable lighting system	Design & Safety	Reducing the risk of falling
6	Manipulating the width of the garden paths	Design & Guidance	Encouraging patients to walk in certain directions
7	Red Holland paving stone & Painting colours	Design & Guidance	Helping patients with wayfinding
8	Remarkable objects	Design & Guidance	Helping patients with wayfinding
9	Incorporating wildlife	Entertaining	Entertaining activities for patients
10	Using trained service dogs	Safety & Guidance	Guiding and protecting patients
11	Reminiscence therapy	Entertaining & Evoking	Triggering dementia patients' memories of the past

Table 3.8.
Validating the outcomes of problem four

Importance	Suggested solutions and developments	How is it supported?	How many times investigated in this work?
1	Remarkable objects	According to Schweitzer & Errolyn (2009), remarkable objects can help people with dementia with wayfinding. An example of this is the installation of a memory box at the Sir Moses Montefiore Home for Dementia in Australia.	6
1	Reminiscence therapy	The Georgian Bay Retirement Home features a 1947 Dodge to encourage patients to recall and talk about their younger selves	6

2	Gardening activities	According to Jarrott & Gigliotti (2010), horticultural activities are important for people with dementia for improving self-estimation, physical functions, and independence and autonomy	4
3	Planting suitable plants and trees	Sir Moses Montefiore Home for Dementia in Australia is a good example of using a heavy landscape as a supportive environment for people with dementia & Schwarz & Rodiek (2009) discuss the role of nature for people with dementia	2
4	Cluster of plants	It is needed to provide greater contrast for people with dementia	1
4	Productive garden	According to Jarrott & Gigliotti (2010) productive garden is a need for a specific purpose, which is to increase the sensory abilities since it is a part of a therapeutic garden	1
4	Installing a suitable lighting system	According to studies (Pacheco et al., 2010; Possin, 2010; Marshall & Delaney, 2012), lights can assist people with dementia with wayfinding and reduce the risk of falling and is a principle used in the interior environment. The colour of the lights should be saturated primary colours ranges.	1
4	Manipulating the width of the garden paths	It is supporting the spatial experience concept to direct users to a specific place and is generally applied in museums	1
4	Red Holland paving stone & Painting colours	According to Dickinson et al. (2001), the type of material, texture, and furniture have a significant impact on the daily life of people with dementia. Red Holland paving stone will be suitable according to its unique properties	1

4	Incorporating wildlife	According to Filan & Llewellyn-Jones (2009), incorporating wildlife in a garden for people with dementia is considered as an assisted therapy	1
4	Using trained service dogs	A concept used for guiding people with visual impairments and other disabilities	1




Figure 3.12 illustrates the most investigated areas in the literature that aim to support people with dementia in their daily activities. Based on the information presented in this chapter, recognizable objects, reminiscence therapy, and assistive technology form the base of the pyramid, comprising areas and fields that are highly investigated and cited in the literature due to their importance for helping people with memory loss problems. On the other hand, few studies have been conducted on colours and material preferences for people with dementia in dementia care centres. This pyramid can help builders determine which solutions should be adopted first due to their highly positive impact on establishing and developing a supportive community for people with dementia.

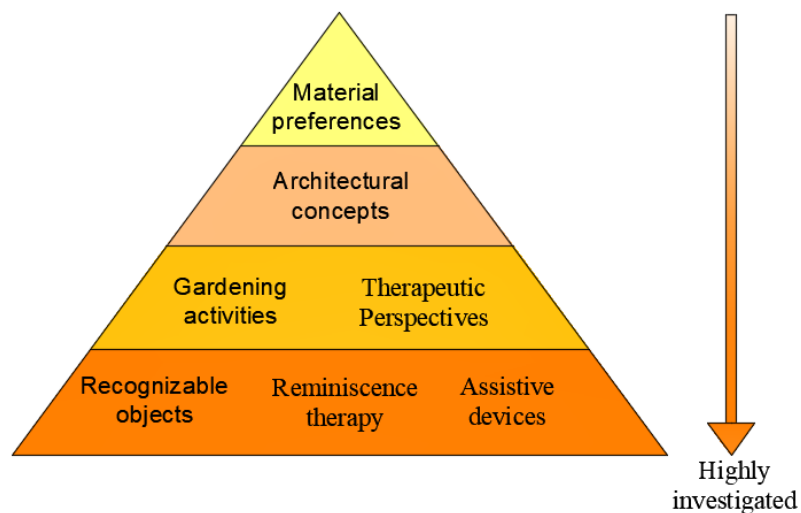


Figure 3.12: Pyramid of highly investigated areas in the literature for supporting people with dementia

Finally, it should be emphasized that the role of the local community is only focused on the time people with dementia spend outside the care centre. Engaging the local community in this project relies on people's inclination and willingness to volunteer, and volunteering can occur both inside and outside the care facility. The volunteering tasks that occur inside the care facility should be performed in a scheduled manner when the weather does not permit outdoor activities. The activities that can occur outside the care facility require more assistance from the volunteers based on well-planned activities and programs that improve patients' mnemonic abilities. To expand the scope of volunteering activities and attract a larger number of volunteers, the broader community in Edmonton, including educational and governmental institutions, could be engaged, and health organizations can help to increase the awareness of dementia. Volunteering may be organized in terms of training and choosing the best volunteers who can interact properly with people with dementia in difficult situations, and volunteers can be assisted by devices that can offer direct connections with specialized organizations or caregivers to report any sudden issues or accidents. The direct interaction between people with dementia and volunteers is suggested to be performed by the garden activities. However, it is recommended to only provide assistance to patients when there is an urgent need in order to increase patients' physical, psychological, and mnemonic abilities.

CHAPTER 4: CASE STUDY, IMPLEMENTATION AND CONCLUSION

4.1 Introduction

This chapter represents the final step of the methodology, which is implementing solutions that are concluded from Chapter 3. A 3D model is created for each solution and applied to a case study of a village that will house people with dementia. The purpose of applying all of the proposed solutions is to illustrate how they work together as an integrated unit to achieve the main objective of the proposed research. This chapter demonstrates how to prepare a community for hosting people with dementia, and how patients could safely walk into the community. The final step of the methodology is divided into five sections as outlined below.

(1) Building a 3D model of solutions for developing the community, which consists of the following sub-sections:

(a) building a 3D model of ideas to represent general developments to the community.

This subsection contains a brief discussion of the location of the village in terms of its eligibility for patients where the location requirements are built based on standards of choosing a suitable location for establishing a dementia care centre.

(b) building a 3D model of solutions which in turn keep people with dementia on the planned path when they are outside of the village.

(c) building a 3D model of ideas that can help people with dementia cross roads safely and stay on the correct path.

(d) building a 3D model of solutions to construct a friendly garden, which in turn integrates patients with other members of the community.

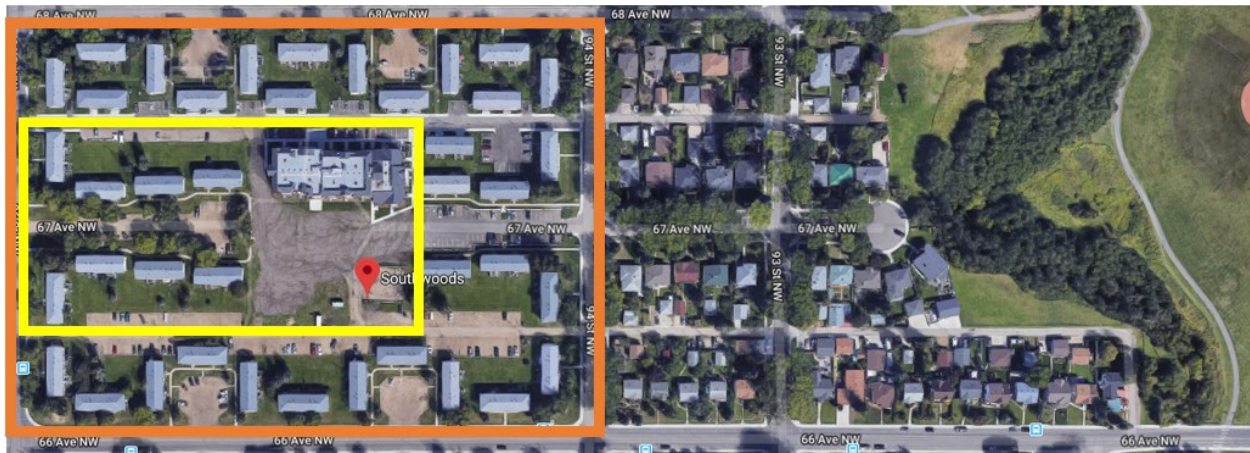
(2) Applying environmental and sustainable solutions in the community.

- (3) Discussing the hedonic analysis of establishing a village for people with dementia in a community.
- (4) Suggesting suitable locations for establishing a supportive community for people with dementia.
- (5) Highlighting the conclusion, contribution, limitations, validation, and future work.

4.2 Building a 3D model of solutions for developing the community

4.2.1 The location of the village

The proposed location of the dementia care facility is the Hazeldean community in Edmonton, Alberta. The facility, Southwoods Retirement Community, is a seniors' village and dementia patient care facility that is currently under construction. The complex will consist of five buildings, four of which will be designated as seniors' housing and one of which will be dedicated to the care of people with dementia. The primary purpose of the dementia care centre is to offer an activity-rich environment for patients who are experiencing memory loss, as well as to provide some exercises that improve their abilities to recall past memories (Figure 4.2). Also, the centre will provide full care, which in turn evaluates patients' performance, prepares meaningful activities to encourage them to participate, and provides therapeutic surroundings.



- The Hazeldean community
- Proposed location of seniors' housing and dementia care facility'



Figure 4.1: Location of the proposed village (Google Earth, 2018, Coordinates: 53.505°N 113.476°W)

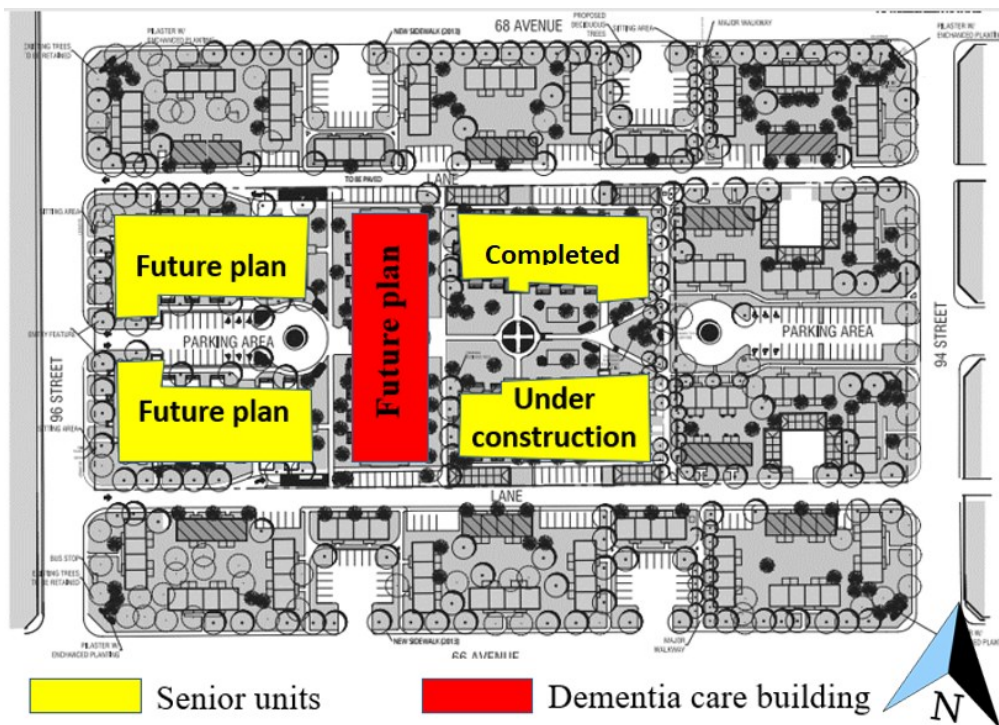


Figure 4.2: Proposed buildings in the village

4.2.2 Testing eligibility of location to build a dementia care facility

The care centre is located in south-central Edmonton, with somewhat limited access to the city centre, major shopping centres, and government departments; but, an elementary school is

situated one block west of the facility. Therefore, the location is considered quiet since it is some distance from crowded and noisy areas of the city. The village is approximately 500 metres south of a hospital, which targets aging individuals, and is able to provide prompt medical care for people with dementia in emergency cases (Figure 4.3). The proposed village site is surrounded by neighbourhoods with the exception of the elementary school to the west. Hence, the village is positively integrated into a community, which will promote the sense of integration for people with dementia rather than the sense of isolation. Given that the care centre is situated among neighbourhoods, residents of the community may be encouraged to volunteer to assist people with dementia with various activities (Figure 4.4).



Figure 4.3: Location of village in relation to key landmarks in the community (Google Earth, 2018, Coordinates: 53.505°N 113.476°W)



Figure 4.4: Neighbourhoods that surround the village (Google Earth,2018, Coordinates: 53.505°N 113.476°W)

From an integration perspective, it is not recommended to build a fence around the village after construction is complete in order to integrate it with the community. Since one of the buildings of the village is completed, the way of designing and constructing it saves the architectural character of the area where used materials are comparatively similar to what is usually used in the area (Figure 4.5). The location is approximately 450 metres west of Mill Creek Ravine, which is a public park. Taking advantage of the proximity of the park, as presented in Figure 4.6, it is suggested to construct a garden just adjacent to it, which would provide a destination for people with dementia to participate in activities. However, there is a ravine and dense trees that separate the two sides of the park, which could be a dangerous place for people with dementia if they become lost, thus Chapter 3 proposed solutions that may be applied to reduce these risks before integrating people with dementia into the community. The topography of the location is

mostly flat from the care center to the garden, which provides easy walking for people with dementia, and the way of urban planning the community follows the gridiron plan method that provides a straight movement with clearer straight visibility.



One of the village buildings



Houses of the surrounding neighbourhood

Figure 4.5: Village building design considers architectural characteristics of surrounding area



Figure 4.6: Proposed outline that connects village with garden

To reach the garden, people with dementia must cross two secondary roads that generally experience a low level of traffic; regardless of the amount of traffic, solutions will be offered to assist patients in safe crossing. Although there is the main road to the west of the care facility with relatively high traffic during rush hour, the path people with dementia will take from the village to the garden is on the opposite side of the care facility. Moreover, the location of the dementia care building is in the middle of the village where there is no direct access to the main road to the west. Also, if people with dementia take the proposed path that connects the village with the garden, the main street south of the care facility is blocked by houses of the adjacent neighbourhood and another large building of the potential village. The village is also surrounded by service roads from the south and north, which receive very low traffic (Figure 4.7). Since some infrastructure elements of the community such as sidewalks and roads were constructed a long time ago, it is recommended to renovate the elements that are in poor condition before integrating people with dementia.

Thus, the location of the village is relatively appropriate to establish a dementia care centre. The advantages of the location are higher than the disadvantages, of which there are possible suggestions to solve each disadvantage based on Chapter 3. However, there are some disadvantages and restrictions that cannot be completely avoided which in turn create obstacles for people with dementia. Table 4.1 summarizes the advantages of the village location with a brief description of the benefits of each one. Also, Table 4.2 summarizes the disadvantages of the village location, classifying them based on the risk impact of major and minor obstacles and provides potential solutions.

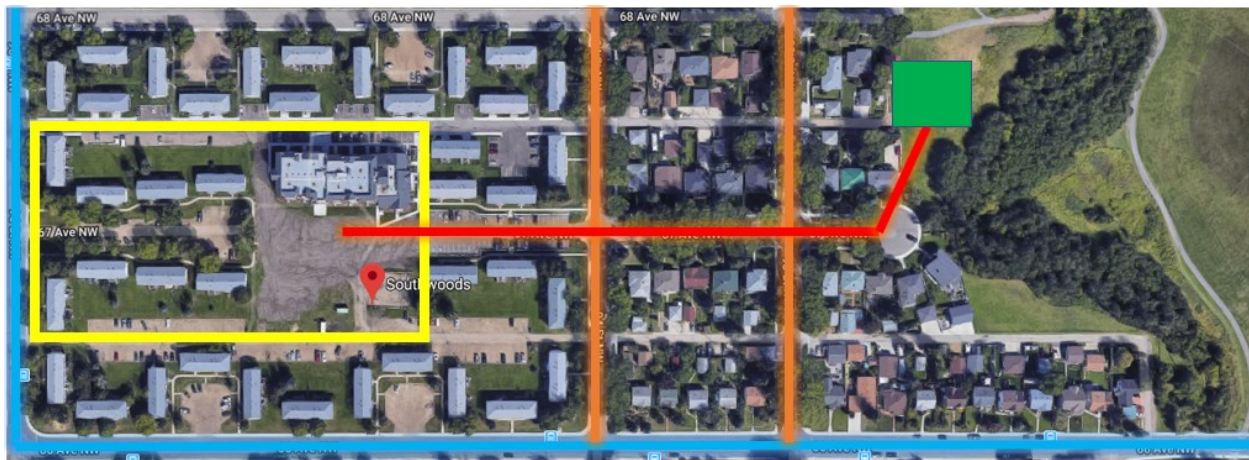
Table 4.1.
Advantages of village location

	Advantages	Benefits
1-	Flat topography	Provides walkability
2-	Gridiron plans method	Provides clearer visibility
3-	Near to a hospital	Provides prompt medical care
4-	Surrounded by neighbourhoods	Increases sense of integration & encourages volunteering from community
5-	Far from noisy areas	Results in a quiet and safe place
6-	Near a park	Provides beautiful scenery

Table 4.2.
Disadvantages of village location

	Disadvantage	Class	Proposed solutions
1-	Adjacent main roads	Major	<ul style="list-style-type: none"> • Positioning the path on the opposite side • Blocking them by trees • Placing the entrances on the opposite side • Avoiding rush hour times for activities
2-	The long distance between the village and the garden	Minor	<ul style="list-style-type: none"> • Placing dispersed benches along the path • Utilizing suitable material on paths • Employing proposed ideas to encourage patients to walk
3-	Crossing roads	Major	<ul style="list-style-type: none"> • Replacing stop signs with specialized traffic lights • Constructing spotlights for alerting • Crossing from one side to avoid confusion

			<ul style="list-style-type: none"> Employing proposed ideas for directing to the planned path
4-	Infrastructure elements in the poor condition	Minor	<ul style="list-style-type: none"> Renovating and repairing elements patients will use
5-	Ravine and dense trees in the park	Major	<ul style="list-style-type: none"> Positioning the garden activities on the opposite side of the park Using the spatial experience concept to keep patients on the boundary of the garden Constructing a fence Engaging patients in safe activities to reduce the tendency to wander



- Proposed location of seniors' housing and dementia care facility'
- Proposed garden
- Proposed walkway
- Main streets
- Secondary streets



Figure 4.7: Location of roads that people with dementia will cross

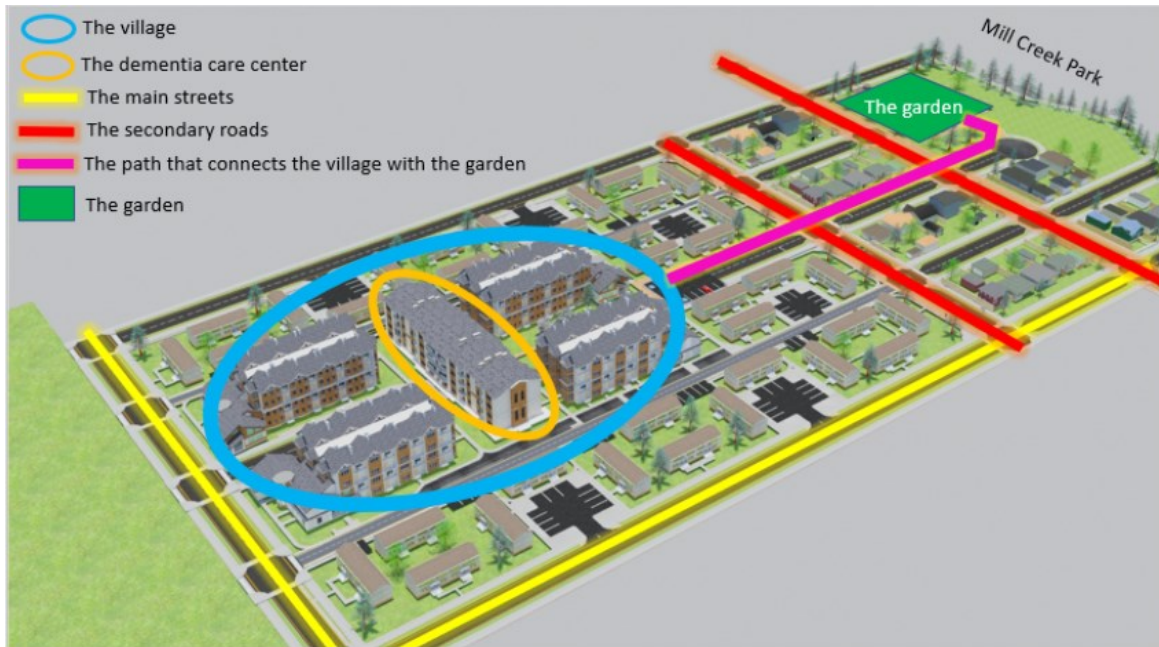


Figure 4.8: Components of the community

4.2.3 Building a 3D model for the general developments

This section comprises the sixth step of the methodology, which is building a 3D model that includes all recommendations to be applied in the community. The solutions to the first problem aim to clarify some important requirements for developing the community before integrating people with dementia. The proposed developments address safety, social and design issues for supporting people with dementia and serve to inform others within the community of the presence of the care facility. Figure 4.9 presents a 3D model of the community after the completion of the village construction.



Figure 4.9: Village buildings after completion

4.2.3.1 Avoiding busy streets

The planned path people with dementia will follow in order to travel to and from the proposed garden is planned to be on the opposite side of the care facility from the west main street; while access to the south main street is blocked by existing buildings. Also, the recommendations in regard to developing safe and secure sidewalks and walking paths aim to keep people with dementia on one path for the duration of the time they spend outside the village.

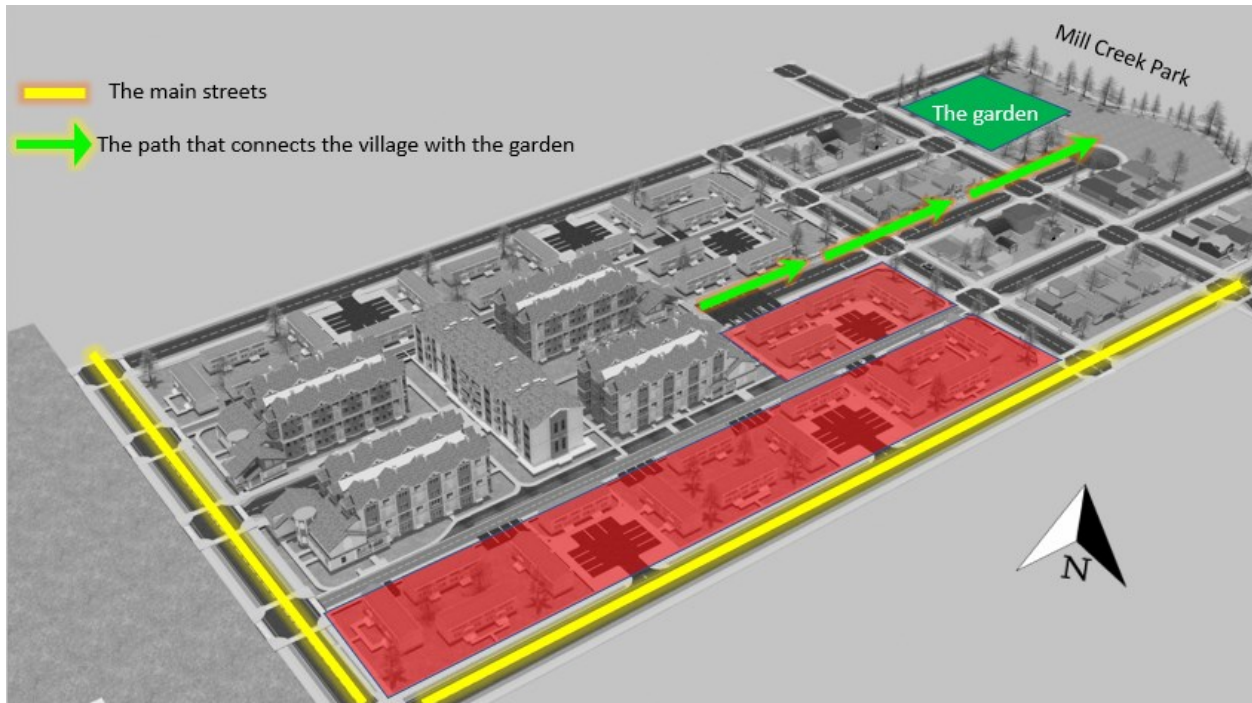


Figure 4.10: Direction of proposed path people with dementia will follow

4.2.3.2 Warning signage

It is suggested to install warning signage on all roadways directly adjacent to the care facility. This purpose of the signage is to alert the drivers of vehicles passing through the community of the presence of elderly people in the community as well as to reduce their speed due to the probability of them crossing the road ahead.



Figure 4.11: Warning signage

4.2.3.3 Reducing sun exposure

Moderate sunlight may benefit people with dementia; however, their skin can be sensitive to some types of sun rays such as UV light, so they may experience sunburn in a shorter period of time. To reduce the risk of sun exposure, some parts of the paths from the village to the garden are suggested to have gazebos, canopies, or pergolas, which are covered by climbing plants and lattices to allow some sun rays to penetrate.



Figure 4.12: Adding elements to walking paths to reduce the risk of sun exposure

4.2.3.4 Handrails and benches

It is recommended to place several benches at the midpoint between the care centre and the garden due to the mobility difficulties patients may have. Also, gazebos are constructed with handrails to assist patients with walking and increase their independence (Figure 4.14). To increase the safety of people with dementia and other pedestrians, the path is separated from the street by one metre of the boulevard, which serves as a barrier (Figure 4.15).



Figure 4.13: Example of adding several benches for people with dementia



Figure 4.14: One-metre boulevard as a barrier between path and street

4.2.4 Building a 3D model for the suggested solutions of the traveling path

The solutions proposed for problem two aim to address methods to keep patients on the planned path while they are outside the village in order to avoid situations where patients become lost or confused. The path people with dementia should follow begins from the dementia care centre, crosses two secondary roads, and ends at the garden. According to the spatial experience concept, the paths of the garden are designed in a way that keeps patients within the boundary and

helps them to return to the care centre safely. This section develops a 3D model that illustrates how the proposed solutions help to guide people with dementia from the village to the garden and keep them on the suggested path.

4.2.4.1 Assistive devices

Voice-controlled Senior Wearables are a type of reminder device that plays a pre-recorded voice or a message at a certain time. These devices are widely used in dementia care centres to remind patients to carry out specific tasks such as to take their medication. This type of device could be used to provide safety for people with dementia and keep them on the suggested path by alerting them if they are about to take a wrong path (Figure 4.16a). GPS tracking devices (Figure 4.16b) can enable caregivers to track the location of patients and are generally used when a patient takes a wrong path and becomes lost. Modern drones can be beneficial by providing an aerial view of the community and are able to take photos and videos that can help monitor the location of patients (Figure 4.16c).

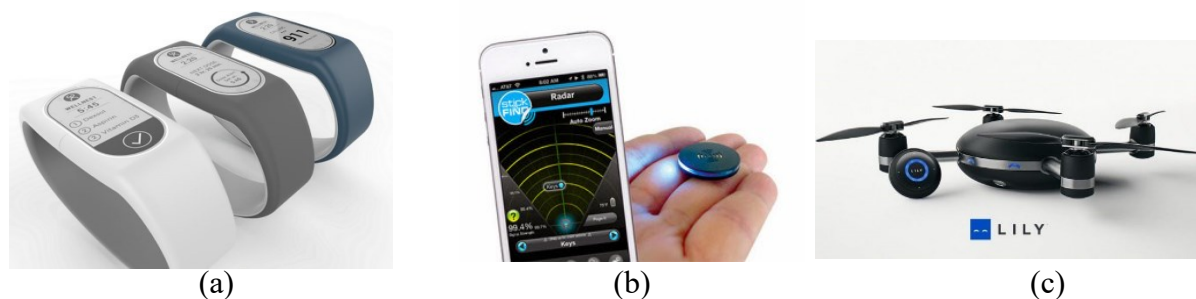


Figure 4.15: Examples of (a) voice-controlled wearable device for seniors (McQuarrie, 2017), (b) GPS tracking device (Simmons, 2015), (c) Modern drones (Buckley, 2017)

4.2.4.2 Scented plants

Since memories may be triggered by certain smells, therapeutic and horticultural garden solutions could be applied to keep patients on the suggested path. This can be accomplished by

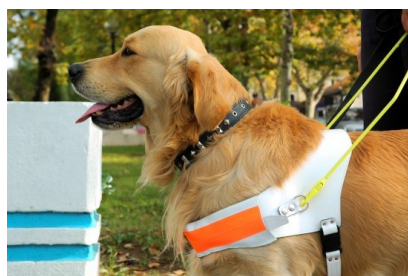
planting shrubs and plants that have fragrant scents, such as mint, jasmine, roses, lavender, or thyme along with the path between the village and the public garden.



Figure 4.16: Adding climbing plants with fragrant scents on gazebos or pergolas

4.2.4.3 Service dogs

Taking advantage of service dogs (Figure 4.18), which are often used to assist people with disabilities, such as visual impairment or reduced mobility, is another recommendation for assisting people with dementia to remain on the suggested path between the care facility and the garden. Service dogs can learn to help people with dementia in various ways, including walking on the suggested path to and from the garden.



4.17: Service dogs

4.2.4.4 Suitable colours and material

People with dementia tend to have the greatest success in recognizing colours that fall into the saturated primary colour and secondary colour ranges, such as red and green, respectively. The colour of the material that is recommended to be used on the path should provide a visible colour contrast between the path and its edges. Red Holland paving stone is a suitable material for constructing walking paths for seniors for several reasons, including its colour.



Figure 4.18: Texture of path that connects village with garden

4.2.4.5 Texture of paths

People with dementia can learn from repetitive tasks. Applying a different texture on pathways that people with dementia should not walk on may alert them to stop walking on such paths.

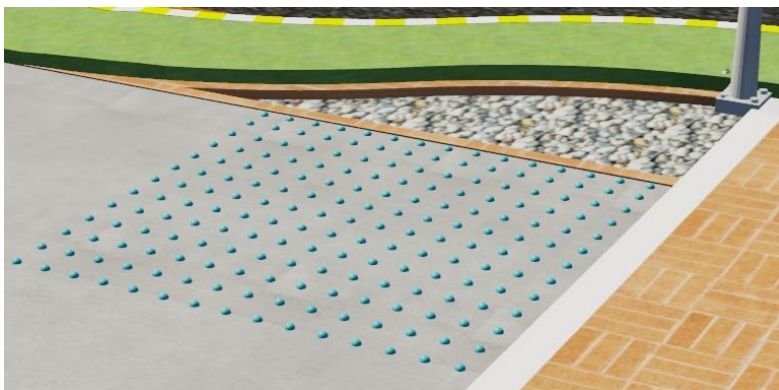


Figure 4.19: Example of changing texture of other paths

4.2.4.6 Spatial experience concept

Taking advantages of architectural concepts such as the spatial experience concept to keep patients on the suggested path by applying all the suggested ideas only on one path.

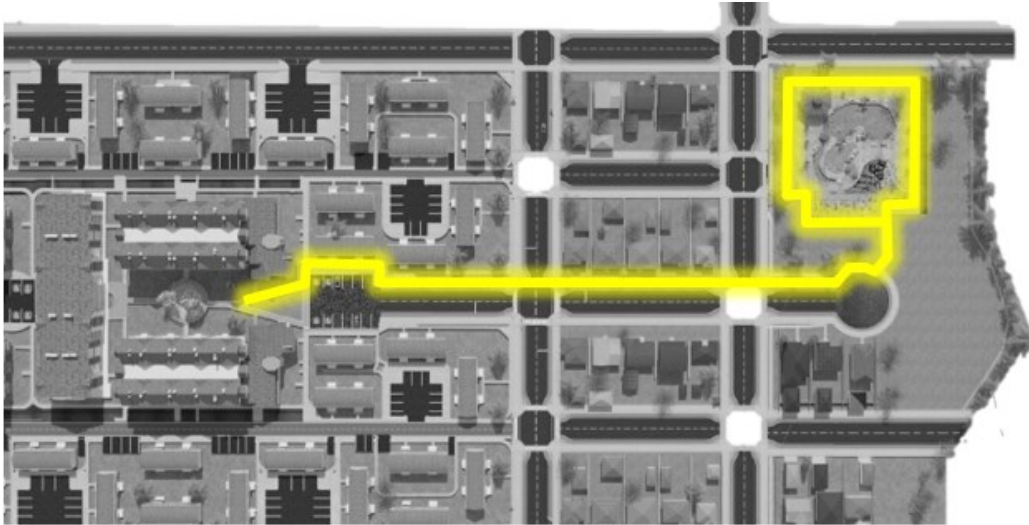


Figure 4.20: Example of spatial experience concept

4.2.4.7 Distinguishable objects

The idea of the distinguishable objects can assist people with dementia to employ these landmarks in wayfinding as they connect these landmarks with their physical locations. For this reason, a sculpture could be installed in a location near the entrance to the village, which can serve as a landmark for people with dementia and as such can help them to return to the village if they become lost





Figure 4.21: Example of constructing a sculpture adjacent to village

4.2.4.8 Reflected LED arrow.

Vertical projectors that reflect LED arrows could be helpful for directing and keeping people with dementia on the suggested path. Projectors can be remotely and automatically operated, and arrows can be reversed on the other side when patients come back.



Figure 4.22: Example of reflective LED arrows

4.2.4.9 Reminiscence therapy

A vintage telephone booth, which was widespread 50-60 years ago is depicted in Figure 4.23, the purpose of which is to trigger patients' memories to talk about the past.



Figure 4.23: A vintage telephone booth as reminiscence therapy

4.2.5 Building a 3D model for the suggested solutions of crossing roads

Crossing roads is considered a major issue for people with dementia could encounter where the way from the village to the garden pass through two secondary roads. Solutions to this problem should be addressing safety and independence issues for people with dementia. Solutions should also tackle how people with dementia realize the right time to start crossing. The amount of time people with dementia need to cross a road cannot be precisely measurable because of mobility difficulties they may suffer from. A 3D model of solutions illustrates how to control the traffic as soon as people with dementia across the roads, and what ideas help them stay on the right crosswalk to reach to the other side of the road.

4.2.5.1 Specialized traffic lights system

To avoid any intimidating actions could scare people with dementia while they cross a road, 4-way stop sign intersection is suggested to be replaced by specialized traffic lights system. This system can be operated remotely to switch on all traffic lights from all side to the red colour before patients start crossing, and it is recommended to install a sign that prevents cars from turning right when traffic lights are red. A green spotlight and a pedestrian “walk” sign that may serve as useful indicators for patients to start crossing. On the other hand, it is suggested to install a red spotlight and a “do not walk” sign to indicate to patients to wait to cross and stay on the correct crosswalk.



Figure 4.24: Example of specialized traffic light system

4.2.5.2 Distinguishable objects

It is important to be consistent with the type of material that is used for walking paths and crosswalks for people with dementia. Red Holland paving stone is recommended as the material for the main walking paths, along with another material that will provide a visible contrast between the walkway and its edges. Also, a gazebo is recommended to be installed right

after the walkway which will serve as a landmark, enabling patients to link it with the planned path.



Figure 4.25: Example of ideas that help people with dementia with wayfinding

4.2.6 Building a 3D model for the suggested solutions activities of the garden

A therapeutic and relaxing garden is the proposed destination for people who reside at this dementia care facility. Designing the garden requires the combination of various ideas and concepts which in turn improve the sensory, mental, psychological, and physical abilities of people with dementia (Figure 4.26). Consequently, activities and tasks should be developed in order to stimulate the brain in a way that reduces environmental changes. For this reason, this section will provide a 3D model containing the proposed solutions in order for the garden to effectively utilize patients' time. These solutions address safety issues for people with dementia in terms of keeping all activities within the limits of the garden. Also, it is recommended that people with dementia wear high visibility reflective jackets, which will allow them to be easily identified in the event of becoming lost.



Figure 4.26: Proposed garden

4.2.6.1 Cluster of plants

In order to provide greater colour contrast, it is preferred to cluster plants together in groups rather than spreading them randomly throughout the garden. There should be a colour contrast between flowers and leaves of each plant and tree to enable patients to recognize the flowers.



Figure 4.27: Example of plant clustering method in the garden

4.2.6.2 Horticultural activities

Caregivers can effectively utilize patients' time by developing some horticultural activities. For example, activities could involve planting cuttings or seedlings in pots or irrigating shrubs, which in turn will improve their physical function and social interaction (Figure 4.28). As a suggestion, one of the horticultural activities that may increase patients' cognitive abilities is to encourage patients to follow certain patterns with the various plants.



Figure 4.28: Examples of horticultural activities

4.2.6.3 Productive garden

The proposed garden is suggested to be productive by planting some fruit trees, which will allow people with dementia to pick the fruit they like. It is preferred to choose trees that have a good colour contrast between leaves and fruits for increased visibility.



Figure 4.29: Example of fruit trees in the garden

4.2.6.4 Lighting system

Installing a photovoltaic and induction lighting system in the garden in order to illuminate certain areas will help increase enjoyment and reduce the risk of falling for people with dementia. The lighting system is necessary when sunlight is blocked or insufficient.



Figure 4.30: Example of using a photovoltaic and induction lighting system

4.2.6.5 Manipulating the width of garden paths

Incorporating the design concept of manipulating the width of the paths or applying hierarchical paving will assist to orient patients and draw their attention to specific areas that offer various activities.



Figure 4.31: Example of various path widths and hierarchical paving

4.2.6.6 Signage for directing

It is suggested to install signage to assist in directing people with dementia through the activities of the garden. This signage can include arrows and illustrations.



Figure 4.32: Example of installing signage in the garden

4.2.6.7 Distinguishable objects in the garden

Since it is beneficial for people with dementia to be able to link objects with their locations, some distinguishable objects will be placed in the garden in order to assist in wayfinding and orientation. For example, as illustrated in Figure 4.33, a pond or a bridge can help remind them of the location of the gazebo at times when they may need to rest.



Figure 4.33: Example of installing landmarks in the garden

4.2.6.8 Incorporating wildlife in the garden

Incorporating wildlife in the garden may be beneficial for patients. For instance, squirrels, birds, rabbits, or ducks is an example of some of the activities people with dementia can participate in while in the garden.



Figure 4.34: Examples of wildlife in the garden

4.2.6.9 Avoiding the adjacent park

Positioning the activities away from the park will reduce patients' tendency to go toward the park. The suggested activities of the garden are planned to engage them while they are in the garden. The method of designing the garden paths supports the spatial experience concept, which aims to help patients remain within the boundary of the garden as well as to guide them back to the care facility (figure 4.35). Constructing a path with a different texture adjacent to the path to the park could prevent patients from walking toward the park. A fence between the park and the garden can provide additional precaution to prohibit patients from continuing to walk toward the park (figure 4.36).



Figure 4.35: Example of how spatial experience concept provides safety for patients

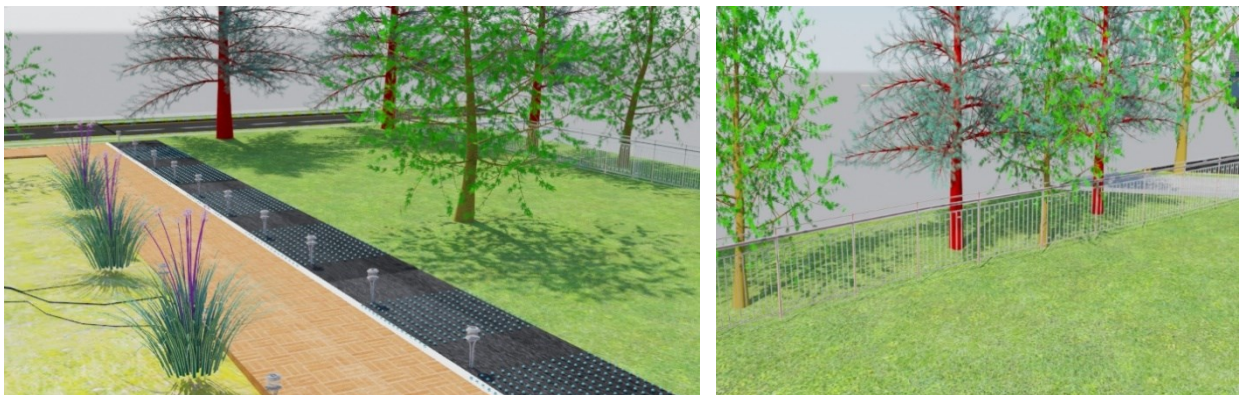


Figure 4.36: Examples of how to keep people with dementia away from dangerous places

4.2.6.9 Reminiscence therapy

Some examples of the application of reminiscence therapy include: (1) An old-style windmill that was used 70 years ago to mill grain and pump water. This style of windmills may help patients recall details of events long past. An old way of constructing a bridge with vintage textures adjacent to the windmill could also offer a visualization of an old environment that provides a rich source of old narrative (Figure 4.37). (2) the presence of an oil field pump jack would provide a rich source of narrative and encourage patients to talk about their history (Figure 4.38). (3) A vintage barn at the garden may encourage patients to talk about their past and trigger their memory (Figure 4.39). (4) an old-fashioned car that has been converted into a bench would be an object that provokes old narratives from the past for a person with dementia (Figure 4.40).



(a)



(b)



(c)



(d)

Figure 4.37: Examples of reminiscence therapy: (a) windmill and vintage bridge; (b) oil field pump jack; (c) a vintage barn; (d) old-fashioned car converted into a bench

4.3 Applying some environmental and sustainable solutions

A few of the proposed solutions result in environmental and sustainable developments for the community. These developments result in further economic and environmental benefits. Some solutions support green technology concepts that provide reliable technologies by using resources more efficiently while other solutions could reduce impacts of sudden climate changes. For example, to minimize the risk of flooding, sidewalks are recommended to be adjacent to a one-metre width of boulevard area (Figure 4.42), so the amount of rainwater falling on sidewalks will be absorbed. Thus, the amount of water that is drained out to the storage tank through a network of water drains will be less than usual, which reduces the chance of flooding to happen in severe rainy seasons. At the same time, constructing an adjacent boulevard can make a barrier between sidewalks and streets, which provides more safety for people with dementia and pedestrians.

Using a photovoltaic and induction lighting system is considered a green solution, and this system automatically shines on when the natural lighting is blocked or insufficient. This system could be used in the garden to illuminate the paths for people with dementia where using it reduces the risk of falling and offers economic benefits.

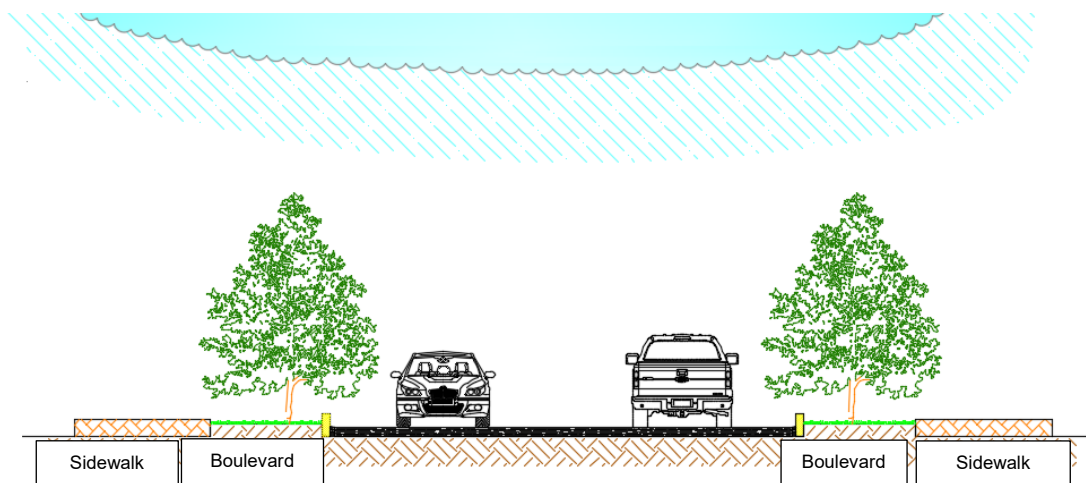


Figure 4.38: A sketch illustrates the idea of separating sidewalks from roads

4.4 Hedonic price analysis

Hedonic price is a model to identify the impact on the price factor of a product where the price is determined by not only internal characteristics but also external factors (Rosen, 1974). The housing market is an example of the hedonic price method where the price of any property is determined by various characteristics of the house such as size, age, or condition, as well as by amenities where some types of surroundings are considered attractive characteristics, which in turn increase the price of the property. A dementia care centre is one of the projects that does not affect the hedonic housing price within a community if the activities of the centre are conducted internally. However, providing external activities for people with dementia may be an unattractive aspect for some people in terms of real estate. Thus, choosing the location of the centre plays a key role in terms of the hedonic housing price. In the Hazeldean case study, the location is a disadvantage to the care facility due to the number of roads that must be crossed. The proposed solution to this obstacle requires using specialized traffic light systems equipped with the capability to switch the traffic lights in all directions to red in order to allow people with dementia to cross safely. As a result, using this system could be a disadvantage of buying a property in the area since driving through the village is considered to be an obstacle. On the other hand, the proposed public garden will be an attractive aspect, which would contribute to an increase in property prices in the surrounding area.

4.5 Suitable locations for dementia care centres

This section aims to provide a brief discussion about the requirements for selecting suitable locations to establish dementia care centres. These requirements can help developers or builders to understand the elements necessary to develop a supportive community for people with dementia. Suggestions are based on what has been presented in Chapters 2 and 3 in regard to the

requirements of selecting a suitable location for senior health centres. Also, some recommendations are derived from the advantages and disadvantages of the Hazeldean case study. The following list provides a summary of site selection priorities for establishing or developing a friendly community for people with dementia:

- (1) Integrating the village into a community that is surrounded by neighbourhoods.
- (2) Choosing a quiet location that is distant from noise sources and crowded places.
- (3) Choosing a location that is close to health centres.
- (4) Choosing a location that is distant from dangerous places such as rivers, highways, or forests.
- (5) Choosing a location with a flat topography to avoid using steps as a solution to move from one level to another.
- (6) Choosing a location in a newly-built area with high-quality standards of buildings and construction.
- (7) Choosing a location that is adjacent to parks or recreational centres.
- (8) Choosing a location that is suitable for planning activities that promote the gathering of patients with other people in the community.
- (9) Choosing a location where there is an opportunity for patients' families to live nearby, thereby allowing them to provide support.

The list above provides a guideline for building centres for people with dementia such that they outline the requirements for each location should achieve. In the opinion of the author, items one through six are crucial because they address several safety issues for patients. If we rank the list above by giving one point for each requirement, we can evaluate any location based on how many points each location will achieve. In other words, the more points a location achieves,

the more eligible that location is as a suitable site for a dementia care centre. After rating the location of the village in Hazeldean, the location achieves 6 points of a possible 9 points in total for the requirements, where 4 points have been achieved for the crucial requirements. Consequently, the case study location is relatively suitable for establishing a centre that supports people with dementia. However, the requirements that were not achieved should be solved by applying the recommendations and concepts from this research, which in turn reduce any risk.

Table 4.3.
Rating location of the dementia care centre of Hazeldean case study

Hazeldean Village		Result
1	Integrating the village into a community that is surrounded by neighbourhoods.	Achieved requirement
2	Choosing a quiet location that is distant from noise sources and crowded places.	Achieved requirement
3	Choosing a location that is close to health care centres.	Achieved requirement
4	Choosing a location that is distant from dangerous places such as rivers, highways, or forests.	Unachieved requirement
5	Choosing a location with a flat topography to avoid using steps as a solution to move from one level to another	Achieved requirement
6	Choosing a location in a newly built area with high-quality standards of building and construction.	Unachieved requirement
7	Choosing a location that is adjacent to parks or recreational centres.	Achieved requirement
8	Choosing a location that is suitable to planning activities that promote the gathering of patients with other people in the community	Achieved requirement
9	Choosing a location where there is opportunity for patients' families to live nearby, thereby allowing them to provide support	Unachieved requirement

The crucial requirements
 Achieved requirement
 Unachieved requirement

4.6 Conclusion

Developing a supportive community for people with dementia is a humanitarian project that seeks to provide a secure environment. The key purpose of such a project is to reduce the stress of daily activities and provide a therapeutic and relaxing environment that is necessary to maintain the physical and psychological health and quality of life of people with dementia.

Additionally, this research helps to particularly enable a person with memory difficulties to remain as independent and engaged as possible in a community. In general, these projects aim to support people with dementia beyond the basic care they receive from caregivers by encouraging patients with memory loss to perform and participate in meaningful activities in order to help them create unforgettable memories. Well-developed outdoor activities address the rights and needs of people with dementia for integration into a community by engaging and stimulating their physical and psychological competencies. Finally, to achieve the overall objective of the project, workers should be committed to be working together for supporting a patient with memory loss problem and enabling them to remain a part of the community.

4.7 Research contribution

Isolating people with memory loss problems results in creating barriers to engaging them in outdoor activities and reduces their ability and tendency to experience the outdoors. Therefore, removing barriers or fences is the significant contribution of this research by recommending investigated solutions through evidence-based theory and substantiated concepts for providing open environments, unrestricted facilities, and supportive surroundings for positive integration of people with dementia in a community. Thus, this may particularly result in providing a non-restrictive environment for individuals with early stages of dementia to engage in outdoor activities thereby enabling them to remain as engaged and independent as possible in the community.

If all suggested solutions and developments of the Edmonton case study are applied, and the cognitive performance of patients improves over time, to the author's knowledge this project will be one of few pioneer projects that prepare outdoor activities outside the grounds of a fenced village for people with dementia, enabling them to be positively integrated into a community. All suggested solutions and developments for the village to the walkways and the proposed garden are

planned to be adaptable to any other case study project, taking into consideration the variations in construction practices and landscape codes, weather conditions, and cultural differences. Correspondingly, the advantages and disadvantages will vary depending on location, but the disadvantages presented in the Hazeldean case study offer examples of obstacles that should be avoided in a project that targets people with dementia.

4.8 Limitations

There are several possible limitations a project of this nature may confront since few existing projects employ the positive integration of people with dementia within the local community. One of the major limitations is that all the solutions and recommendations presented in this research are built and investigated based on existing literature for developing the community. Therefore, any proposed solution may have deficiencies since a real-life case study application has yet to be conducted. As discussed in Section 2.2.5, memory loss problems can be described by the damage that occurs to the brain such that the manifestation of cognitive impairments will differ from one patient to another based on which parts of the brain are experiencing cell loss. As a result, the characteristics and personalities of patients differ one from another such that it is difficult to ensure that all solutions will fit the needs of or help improve the cognitive abilities of all patients. Correspondingly, there are several proposed solutions to address obstacles patients may encounter. To illustrate, if a solution is not helping a patient in the proposed manner, other solutions may be helpful to address the difficulty. This helps reduce the probability that patients may become confused about which action to perform in a given situation, thereby effectively achieving the primary objective of allowing people with dementia to participate in outdoor activities.

It should be noted that all proposed solutions have yet to be validated in a real-life setting. However, medical assistance is recommended as the next step to investigate and validate the applicability of applying the given solutions to the diseases based on scientific and medical analysis following the defined framework to examine the cognitive and sensory responses of patients. Gathering information from dementia care centres is one possible method to obtain an overall scope regarding care strategies and activities provided. Thus, validation processes could be achieved by conducting a survey and statistical study about supportive indoor activities provided for people with dementia, which helps provide comprehensive data which can be applied to create a decision matrix about how people with dementia may respond to outdoor activities by rating and examining their responses to each indoor activity.

Although most of the suggested solutions are built on diverse references targeting the care of people with dementia both internally and externally, patients may face psychological and cognitive difficulties because of the environmental changes of participating in outdoors activities; such changes could be routine changes or excessive noises and crowds. The location of the community may be a physical obstacle for people with dementia in terms of the distance between the village and the garden. Recommended solutions may differ from one country to another due to cultural changes, building codes, and weather conditions where some of the proposed solutions are only applicable for the Edmonton-based case study. For example, a few of the objects presented as examples of reminiscence therapy characterize the Canadian culture and history such as the oil field pump jack. Furthermore, other solutions for the Edmonton case study are proposed based on the city's urban planning method, which is gridiron planning (or grid plan). Thus, this assisted in designing and applying architectural concepts on travelling routes that offer a straight path and clear visibility for patients. Finally, it is recommended that patients use assistive devices that fall

under the passive technological devices for assisting people with dementia to carry out daily activities given that they may have cognitive impairments thus causing difficulty in using active highly technological devices.

4.9 Proposed future developments

Future developments will depend on the performance of people with dementia and how they react and respond to the suggested solutions presented in this research. Edmonton experiences severe cold weather in the winter, thus performing outdoor activities would be at the discretion of the caregivers during winter months. To help maintain the level of activity of patients during the winter, other well-designed indoor activities should take place. For example, a greenhouse that has similar types of plants as the outdoor garden could be built at the dementia care facility, thereby allowing patients to perform many of the same activities during the winter.

Due to the distance from the village to the garden, people with dementia may not be able to walk to the garden daily. For this reason, other types of exercises that can be carried out in a gym setting can help keep patients physically active. If the physical and psychological performance of people with dementia improves over time, caregivers can decide if patients are capable to participate in outdoor activities more regularly. If their performance continues to improve, caregivers can extend the activities to outside the borders of the village, and outside the garden.

All suggested solutions and developments are planned and proposed to be used as guidelines that can be applied in any village for people with dementia. The mobility difficulties that people with dementia or seniors often have are one of the main obstacles, so it is strongly recommended to have the all unfenced outdoor activities near the dementia care centre. For example, Hogewey, a nursing home in the Netherlands, is a pioneer in the design of facilities for

specialized care of people with dementia. The facility has a completely fenced set of 23 houses, and indoor activities such as a town square, a supermarket, a hairdressing salon, a theatre, a pub, and a café-restaurant. Therefore, future research could include the design of an unfenced community that has nearby facilities to encourage integration between the local community and people with dementia.

Another possible future development may incorporate current virtual reality (VR) technology to explore dementia and the diseases that cause it. Thus, this technology can be applied by simulating a patient's nervous system in order to examine their cognitive responses to a given activity. If using this technology achieves positive results, it could be used for advanced levels of testing patients' cognitive abilities. Both proposed future works could be applied specifically to validate the physical and cognitive capabilities for patients before integrating them into the real world. This can be accomplished by building a simulation environment to provide a virtual community with virtual outdoor activities in order to provide caregivers with more informative feedback about patients' responses and reactions. As a result, this technology will help provide caregivers with an inclusive look at the types of activities that suit people with dementia as well as the obstacles and difficulties they may encounter.

REFERENCES

- Afifi, M. (2012). University of Alberta. *Environmental Engineering*.
- Alzheimer's & Dementia Alliance of Wisconsin. (2009). Types of dementia.
- Alzheimer's Association. (2009). Dementia care practice recommendations for assisted living residences and nursing homes. *Alzheimer's Association Campaign for Quality Residential Care*, 1–28.
- Alzheimer's Association. (2013). Alzheimer's disease facts and figures. *Alzheimer's & Dementia*, 9, 110–133. <https://doi.org/10.1016/j.jalz.2013.02.003>
- Alzheimer's Association. (2017). Wandering and Dementia | Caregiver Center | Alzheimer's Association.
- Alzheimer's Society. (2017a). Assistive technology - devices to help with everyday living. *Alzheimers.Org.Uk*, 1–17.
- Alzheimer's Society. (2017b). Five things you should know about dementia. *Alzheimer's Society*.
- Alzheimer Society of Canada. (2016a). Day to Day Series. *Day to Day Series - Communications*, (November), 1–12.
- Alzheimer Society of Canada. (2016b). Report summary – Prevalence and monetary costs of dementia in Canada (2016): a report by the Alzheimer Society of Canada. *Health Promotion and Chronic Disease Prevention in Canada*, 36(10), 231–232. <https://doi.org/10.24095/hpcdp.36.10.04>
- Andrews, M. E. (2008). Dementia care in remote northern communities: Perceptions of registered nurses. *ProQuest Dissertations and Theses*, 366.
- Bakewell, B. (2010). Memory Garden for People with Dementia.

- Beaumont Villa: Dementia Garden. (2017). dementia sensory gardens - Google Search | Beaumont Villa: Dementia Garden | Pinterest | Sensory garden and Gardens.
- Benbow, B. (2014). Interior-Decorating-c.pdf.
- Bonner, S., & Idris, T. (2012). Assistive technology as a means of supporting people with Dementia: A review. *Housing Learning & Improvement Network*, (July 2012), 18.
- Briggs, J. (2004). Dementia Care and the Built Environment. *Alzheimer's Australia*, 3(June), 1–16.
- Brown, L. (2010). Physical Therapy and Parkinson ' s Disease.
- Buckley, S. (2017). Lily Drone team says it has no timeframe for issuing refunds.
- Buse, C., & Twigg, J. (2016). Materialising memories: Exploring the stories of people with dementia through dress. *Ageing and Society*, 36(6), 1115–1135.
<https://doi.org/10.1017/S0144686X15000185>
- Camilo, S. (2010). Parkinson's Disease and Walking. *American Physical Therapy Association, Neurology Section*, 2010.
- Ced Stone Group. (2017). Paving. Retrieved November 25, 2017, from <https://www.pinterest.ca/pin/346073552603138766/>
- Centre for Excellence in Universal Design. (2017). Constructive Elements and Systems, 48–71.
- Cerejeira, J., Lagarto, L., & Mukaetova-Ladinska, E. B. (2012). Behavioral and psychological symptoms of dementia. *Frontiers in Neurology*, MAY.
<https://doi.org/10.3389/fneur.2012.00073>
- Chaplin, A. (2011). Holistic care and environmental design: the future for dementia care. *Housing, Care & Support*, 14(3), 91–97. <https://doi.org/10.1108/14608791111199769>
- Chatterjee, S., Peters, S. A. E., Woodward, M., Arango, S. M., Batty, G. D., Beckett, N., ...

- Huxley, R. R. (2016). Type 2 diabetes as a risk factor for dementia in women compared with men: A pooled analysis of 2.3 million people comprising more than 100,000 cases of dementia. *Diabetes Care*, *39*(2), 300–307. <https://doi.org/10.2337/dc15-1588>
- Chew, J. (2017). Crosswalks. Retrieved November 27, 2017, from http://www.ifiberonewsradio.com/news/local_news/blocks-of-railroad-avenue-close-thursday-night-friday-morning-for/article_bae5be80-3c1e-11e7-9cac-af81e4bd9488.html
- Clare, L., Bayer, A., Burns, A., Corbett, A., Jones, R., Knapp, M., ... Whitaker, R. (2013). Goal-oriented cognitive rehabilitation in early-stage dementia: study protocol for a multi-centre single-blind randomised controlled trial (GREAT). *Trials*, *14*(1), 152. <https://doi.org/10.1186/1745-6215-14-152>
- Clare, L., Wilson, B. A., & L., C. (2004). Memory rehabilitation techniques for people with early-stage dementia. *Zeitschrift Fur Gerontopsychologie Und -Psychiatrie*. <https://doi.org/10.1024/1011-6877.17.2.109>
- Clare, L., Woods, B., Woods, R., Moniz-Cooke, E., Orrell, M., & Spector, A. (2003). Cognitive rehabilitation and cognitive training for early-stage Alzheimer’s disease and vascular dementia. *Cochrane Database of Systematic Reviews*, *2*(4), CD003260. <https://doi.org/10.1002/14651858.CD003260>
- Clarke, A. (2012). Spatial Experience, Narrative and Architecture - Byera Hadley Award Report, 31.
- Clifford, K. (2017). Sidewalks.
- Cochrane, T. G. (2010). *Gardens that Care: Planning Outdoor Environments for People with Dementia*.
- Cox, A. P., Ray, P. L., Jensen, M., & Diehl, A. D. (2014). Defining “sign” and “symptom.”

Table of Contents, 42–48.

- Day, K., Carreon, D., & Stump, C. (2000). The therapeutic design of environments for people with dementia: A review of the empirical research. *Gerontologist*, *40*(4), 397–416.
<https://doi.org/10.1093/geront/40.4.397>
- Delrieu, J., Piau, A., Caillaud, C., Voisin, T., & Vellas, B. (2011). Managing cognitive dysfunction through the continuum of alzheimer's disease: Role of pharmacotherapy. *CNS Drugs*. <https://doi.org/10.2165/11539810-000000000-00000>
- Dempsey, L., Murphy, K., Cooney, A., Casey, D., O'Shea, E., Devane, D., ... Hunter, A. (2014). Reminiscence in dementia: A concept analysis. *Dementia*, *13*(2), 176–192.
<https://doi.org/10.1177/1471301212456277>
- Department of Health. (2009). *Living well with dementia : National Dementia Strategy*. *Living Well with Dementia A National Dementia Strategy* (Vol. 2009). <https://doi.org/291591b1p4k>
- Design TAXI Crew. (2017.). (45) Pinterest. Retrieved November 27, 2017, from <https://www.pinterest.ca/pin/456693218433970573/>
- Dickinson, J. I., Shroyer, J. L., Elias, J. W., Hutton, J. T., & Gentry, G. M. (2001). The Effect of Selected Residential Carpet and Pad on the Balance of Healthy Older Adults. *Environment and Behavior*, *33*(2), 279–295. <https://doi.org/10.1177/00139160121972990>
- dsc. The dementia center. (2012). Colour and Contrast | Dementia Services Development Centre | DSDC, Stirling.
- Elpers, J. (2016). Building a home where Alzheimer's patients can thrive.
- Emre, M. (2003). Dementia associated with Parkinson's disease. *Lancet Neurology*, *2*(4), 229–237. [https://doi.org/10.1016/S1474-4422\(03\)00351-X](https://doi.org/10.1016/S1474-4422(03)00351-X)

- Ernst, R. L., & Hay, J. W. (1994). The US economic and social costs of Alzheimer's disease revisited. *Am J Public Health, 84*(8), 1261–1264. <https://doi.org/10.2105/AJPH.84.8.1261>
- Ferman, T. J., Smith, G. E., & Melom, B. (2008). Understanding Behavioral Changes in Dementia, 1–19.
- Fitz-Coy, S. (2017). Steps for Converting a House into a Senior Friendly Home | SeniorLiving.com.
- Fleming, R. (2011). An environmental audit tool suitable for use in homelike facilities for people with dementia. *Australasian Journal on Ageing, 30*(3), 108–112. <https://doi.org/10.1111/j.1741-6612.2010.00444.x>
- Fleming, R., Goodenough, B., Low, L.-F., Chenoweth, L., & Brodaty, H. (2016). The relationship between the quality of the built environment and the quality of life of people with dementia in residential care. *Dementia, 15*(4), 663–680. <https://doi.org/10.1177/1471301214532460>
- Fleming, R., Kelly, F., & Stillfried, G. (2015). “I want to feel at home”: establishing what aspects of environmental design are important to people with dementia nearing the end of life. *BMC Palliative Care, 14*(1), 26. <https://doi.org/10.1186/s12904-015-0026-y>
- Fraiwan, L., Khnouf, R., & Mashagbeh, A. R. (2016). Parkinson's disease hand tremor detection system for mobile application. *Journal of Medical Engineering & Technology, 40*(3), 127–134. <https://doi.org/10.3109/03091902.2016.1148792>
- Gardetto, D. (2017). (42) Pinterest.
- Garner, D. (2017). Creative LED signage. Retrieved December 21, 2017, from <https://www.pinterest.ca/pin/74661306302246203/>
- Gitlin, L. N., Winter, L., & Dennis, M. P. (2010). Assistive devices caregivers use and find

- helpful to manage problem behaviors of dementia. *Gerontechnology*, 9(3).
<https://doi.org/10.4017/gt.2010.09.03.006.00>
- Golvers, D. (2005). Memory Rehabilitation in Early Dementia. *Hunter New England Area Health Service*, 29.
- Gonzalez, J., Mayordomo, T., Torres, M., Sales, A., & Meléndez, J. C. (2015). Reminiscence and dementia: A therapeutic intervention. *International Psychogeriatrics*, 27(10), 1731–1737. <https://doi.org/10.1017/S1041610215000344>
- Greasley-Adams, C., Bowes, A., Dawson, A., & McCabe, L. (2014). Good practice in the design of homes and living spaces for people living with dementia and sight loss, 32.
- Hall, J., Mitchell, G., Webber, C., & Johnson, K. (2016). Effect of horticultural therapy on wellbeing among dementia day care programme participants: A mixed-methods study (Innovative Practice). *Dementia*. <https://doi.org/10.1177/1471301216643847>
- Halsall, B., & MacDonald, R. (2015). *DESIGN for DEMENTIA Volume 2 - Research Projects Bill Halsall of the Halsall Lloyd Partnership and (Vol. 2)*.
- Help the Aged. (2007). Quality of life in care homes. A review of the literature.
- Herb Gardening Gardens Dementia. (2017). Dementia sensory garden - circular - residential care | Therapeutic gardens/dementia | Pinterest | Sensory garden, Dementia and Gardens.
- Hirtz, D., Thurman, D. J., Gwinn-Hardy, K., Mohamed, M., Chaudhuri, A. R., & Zalutsky, R. (2007). How common are the “common” neurologic disorders? *Neurology*, 68(5), 326–337. <https://doi.org/10.1212/01.wnl.0000252807.38124.a3>
- Howard, R. (2012). Expert design essential for a good Dementia Sensory Garden.
- Imamura, Y., Okamoto, S., & Lee, J. H. (2016). Human Tracking by a Multi-rotor Drone Using HOG Features and Linear SVM on Images Captured by a Monocular Camera, *I*, 8–13.

- Jarrott, S. E., & Gigliotti, C. M. (2010). Comparing Responses to Horticultural-Based and Traditional Activities in Dementia Care Programs. *American Journal of Alzheimer's Disease & Other Dementiasr*, 25(8), 657–665. <https://doi.org/10.1177/1533317510385810>
- Kelly, M., & O'Sullivan, M. (2015). STRATEGIES AND TECHNIQUES FOR COGNITIVE REHABILITATION. *Survival*, 31(July).
- Kempster, P. A. (2004). Michael J. Fox and his Parkinson's disease. *Movement Disorders*, 19(1), 105–106. <https://doi.org/10.1002/mds.10640>
- Korolev, I. O. (2014). Alzheimer's Disease : A Clinical and Basic Science Review. *Medical Student Research Journal*, 4(September), 24–33.
- Kovach, C. R., Weissman, D. E., Griffie, J., Matson, S., & Muchka, S. (1999). Assessment and treatment of discomfort for people with late-stage dementia. *Journal of Pain and Symptom Management*, 18(6), 412–419. [https://doi.org/10.1016/S0885-3924\(99\)00094-9](https://doi.org/10.1016/S0885-3924(99)00094-9)
- Kowalske, K. (2016). Why Lighting Is So Important When Designing for Dementia Patients | Progressive AE.
- Laine, C., Goldman, D. R., Blass, D. M., & Rabins, P. V. (2008). Dementia. *Annals of Internal Medicine*, 148(7), ITC4-1. <https://doi.org/10.7326/0003-4819-148-7-200804010-01004>
- Lockwood, B. (2017). HOW TO DO LANDSCAPE LIGHTING RIGHT!
- Mandal, A. (2012). Types of visual impairment, 2–5.
- Marshall, M., & Delaney, J. (2012). Dementia-friendly design guidance for hospital wards. *Journal of Dementia Care*, 20(4), 26–28.
- McQuarrie, L. (2017). Voice-Controlled Senior Wearables : wellnest.
- Mihailidis, A., & Fernie, G. R. (2002). Context-aware assistive devices for older adults with dementia. *Context-Aware Design*, 2(2), 173–189.

<https://doi.org/10.4017/gt.2002.02.02.002.00>

Ministry of Education - Japan. (2010). A Collection of Exemplary Design of Kindergarten Facilities, (June), 28.

Ministry of Health and the University of Auckland. (2016). Secure Dementia Care Home Design Information Resource. *New Zealand Government*.

Moniz-Cook, E. (2006). Cognitive stimulation and dementia. *Aging and Mental Health*, 10(3), 207–210. <https://doi.org/10.1080/13607860600725268>

Montefiore Home. (2017). Montefiore Home. Retrieved October 14, 2017, from <http://www.montefiorehome.com.au/residential-care/randwick-campus>

Niiler, E. (2014). Study set for brain stimulation device to help restore memory - The Washington Post.

Pacheco, C., Duarte, E., Rebelo, F., & Teles, J. (2010). Using virtual reality for interior colors selection and evaluation by the elderly. In *Advances in Cognitive Ergonomics* (pp. 784–792). <https://doi.org/10.1201/EBK1439834916-c78>

Papastavrou, E., Tsangari, H., Karayiannis, G., Papacostas, S., Efstathiou, G., & Sourtzi, P. (2011). Caring and coping: The dementia caregivers. *Aging and Mental Health*, 15(6), 702–711. <https://doi.org/10.1080/13607863.2011.562178>

PAULO, R. (2013). Pergola Plants Guide: Shade and Enhance Your Outdoor Space.

Perry, E., & Howes, M. J. R. (2011). Medicinal plants and dementia therapy: Herbal hopes for brain aging? *CNS Neuroscience and Therapeutics*. <https://doi.org/10.1111/j.1755-5949.2010.00202.x>

Petersen, R. C., Stevens, J. C., Ganguli, M., Tangalos, E. G., Cummings, J. L., Dekosky, S. T., & Examination, M. S. (2001). Practice parameter: Early detection of dementia: Mild Cognitive

- Impairment (an evidence-based review). *Neurology*, 56, 1133–1142.
<https://doi.org/10.1212/WNL.56.9.1133>
- Pinterest. (2017). Pinterest. Retrieved October 25, 2017, from
<https://www.pinterest.ca/pin/134756213823869661/?lp=true>
- Possin, K. L. (2010). Visual spatial cognition in neurodegenerative disease. *Neurocase*.
<https://doi.org/10.1080/13554791003730600>
- Postuma, R., Romenets, S. R., & Rakheja, R. (2012). Physician Guide Non-motor symptoms of Parkinson ' s Disease. *Parkinson ' s Clinical Guideline*, 1–42.
- Reig, L., Tashima, M. M., Borrachero, M. V., Monzó, J., Cheeseman, C. R., & Payá, J. (2013). Properties and microstructure of alkali-activated red clay brick waste. *Construction and Building Materials*, 43, 98–106. <https://doi.org/10.1016/j.conbuildmat.2013.01.031>
- Rentz, C. A. (1995). Reminiscence. A supportive intervention for the person with Alzheimer's disease. *J.Psychosoc.Nurs.Ment.Health Serv.*, 33(0279–3695), 15–20.
- Rizzo, M., Anderson, S. W., Dawson, J., & Nawrot, M. (2000). Vision and cognition in Alzheimer's disease. *Neuropsychologia*, 38(8), 1157–1169. [https://doi.org/10.1016/S0028-3932\(00\)00023-3](https://doi.org/10.1016/S0028-3932(00)00023-3)
- Rosen, S. (1974). Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition. *Journal of Political Economy*, 82(1), 34–55. <https://doi.org/10.1086/260169>
- Sagan, A. (2015). Canada's version of Hogewey dementia village recreates "normal" life - Health - CBC News.
- Savell, K. and, & Starkey, S. (2015). Quality of Life! | Dr. Keith Savell | Pulse | LinkedIn.
- Schmid, J. (2011). Reminiscence and Alzheimer's Disease.
- Schwarz, B., & Rodiek, S. (2007). Outdoor Environments for People with Dementia. *Journal of*

- Housing for the Elderly*, 21(1), 1–11. https://doi.org/10.1300/J081v21n01_01
- Schweitzer, P., & Errolyn, B. (2009). Remembering Yesterday, Caring Today: Reminiscence in Dementia Care. *Community Care*, (1791), 28.
- Serruya, M. D., & Kahana, M. J. (2008). Techniques and devices to restore cognition. *Behavioural Brain Research*. <https://doi.org/10.1016/j.bbr.2008.04.007>
- Shaw, F. E. (2007). Prevention of falls in older people with dementia. *Journal of Neural Transmission*, 114(10), 1259–1264. <https://doi.org/10.1007/s00702-007-0741-5>
- Simmons. (2015). The Ever-Shrinking GPS Tracking Device — And the Inevitable Privacy Debate that It Creates | Search and Seizure.
- Söderhamn, U., Landmark, B., Aasgaard, L., Eide, H., & Söderhamn, O. (2012). Volunteering in dementia care - A Norwegian phenomenological study. *Journal of Multidisciplinary Healthcare*, 5, 61–67. <https://doi.org/10.2147/JMDH.S28240>
- Stern, Y. (2012). Cognitive reserve in ageing and Alzheimer’s disease. *The Lancet. Neurology*, 11(11), 1006–12. [https://doi.org/10.1016/S1474-4422\(12\)70191-6](https://doi.org/10.1016/S1474-4422(12)70191-6)
- Studio Libeskind. (2017). Jewish Museum Berlin - Libeskind.
- Timlin, G., & Rysenbry, N. (2010). Design for dementia. *Helen Hamlyn Centre, Royal College of Art*, 31–33.
- Torrington, J. M., Tregenza, P. R., & Noell-Waggoner, L. C. (2007). Lighting for people with dementia. *Lighting Research and Technology*, 39(1), 81–97. <https://doi.org/10.1177/1365782806074484>
- uclachoralmusic. (2017). Design A Garden Yard Pathways Flower Bedsfruit Trees Posts Tagged Ideas Layout With How To Impressive – Modern Garden.
- Valdez, P., & García, A. (2012). Circadian rhythms in cognitive performance: implications for

neuropsychological assessment. *ChronoPhysiology and Therapy, Volume 2*, 81.

<https://doi.org/10.2147/CPT.S32586>

Vapaa, A. G. (2002). What are the defining characteristics that make a healing garden ?, 85.

Weaver, R. E., & Anderson, P. J. (2012). Jasmines, a diversity of plants with fragrant flowers 1, (38), 1–6.

Wilhelm, K. P., Cua, A. B., & Maibach, H. I. (1991). Skin Aging: Effect on Transepidermal Water Loss, Stratum Corneum Hydration, Skin Surface pH, and Casual Sebum Content. *Archives of Dermatology, 127*(12), 1806–1809.

<https://doi.org/10.1001/archderm.1991.04520010052006>

Wilson, B. a. (1997). Cognitive rehabilitation: How it is and how it might be. *J Int Neuropsychol Soc. Journal of the International Neuropsychological Society, 3*(5), 487–496.

Woods, B., Spector, A. E., Jones, C. A., Orrell, M., & Davies, S. P. (2005). Reminiscence therapy for dementia. In *Cochrane Database of Systematic Reviews*.

<https://doi.org/10.1002/14651858.CD001120.pub2>

APPENDIX A

Landscape and construction codes

The following are a few standards codes of the landscape and horticulture components such as sidewalks, sod, and planters (according to The City of Edmonton).

GENERAL NOTES

FOR SITE GRADING REFER TO ENGINEERS DRAWINGS.

FOR EXACT LOCATION OF ALL UNDERGROUND SHALLOW AND DEEP UTILITIES REFER TO ENGINEERS DRAWINGS.

ALL LANDSCAPE CONSTRUCTION AND MAINTENANCE TO BE COMPLETED BUT NOT LIMITED TO MINIMUM STANDARDS OF MOST RECENT EDITION OF LOCAL DESIGN AND CONSTRUCTION STANDARDS AND SPECIFICATIONS.

LANDSCAPE MAINTENANCE AND WARRANTY PERIOD FOR ALL LANDSCAPED AREAS TO BE 1 YEAR.

Sidewalks

Sidewalks should be accessible by way of curb ramps (Details 5500/5510). Street furniture (i.e. hydrants, manholes, water valves, etc.) and soft landscaping (i.e. shrubs, etc.) located within road right-of-way should be located a minimum 0.5m clear from the edge of all sidewalk to provide a clear path of travel. Hard landscaping (i.e. trees) should be located a minimum 1.0m clear from the edge of all sidewalks to provide enough clearance for the tree to mature while maintaining enough space to effectively maintain the sidewalk infrastructure.

	Adjacent Facility	Type	Material	Width
Sidewalk	Local / Collector	Monolithic	Concrete	1.5 m
Sidewalk/Walkway	Local/Collector/Arterial or Walkway Lot	Separate	Concrete	1.5 m
Sidewalk	Arterial	Separate	Concrete	1.5m
Shared Use Path	SWMF or Utility Lot > 10 m in width	Separate	Asphalt	3.0 m
Shared Use Path	Arterial	Separate	Asphalt	3.0m
Granular Walkway	Top of Bank & SWMF	N/A	Granular	1.5 m
Granular Walkway	TUC	N/A	Granular	3.0 m

TREE PLANTING SETBACKS

TREES SHALL BE SET BACK A MINIMUM DISTANCE, MEASURED FROM THE CENTRE OF THE TREE TRUNK, FROM ABOVE AND BELOW GRADE UTILITIES AND PROPERTY LINES AS FOLLOWS:

DISTANCE FROM LIGHT STANDARDS/POWER HARDWARE:	3.5m
DISTANCE FROM FIRE HYDRANTS:	3.5m
DISTANCE FROM STOP SIGNS:	3.5m
DISTANCE FROM YIELD SIGNS:	3.5m
DISTANCE FROM TRANSIT ZONES:	3.5m
DISTANCE FROM OTHER SIGNS:	2.0m
DISTANCE FROM PRIVATE PROPERTY ON WALKWAY ROW:	2.0m
DISTANCE FROM PRIVATE PROPERTY ON OPEN PARKLAND:	3.0m
DISTANCE FROM PRIVATE PROPERTY ON BOULEVARDS:	1.0m
DISTANCE FROM SHALLOW UNDERGROUND UTILITIES:	1.0m
DISTANCE FROM GAS AND OIL ROW:	CONTACT UTILITY
DISTANCE FROM DEEP UNDERGROUND UTILITIES:	1.5m
DISTANCE FROM SANITARY AND STORM SEWER SERVICES:	1.8m
DISTANCE TO SANITARY AND STORM SEWERS&MANHOLES:	2.0m
DISTANCE FROM WATER MAINS:	2.5m

DISTANCES FROM OVERHEAD POWER UTILITIES SHALL BE AS PER THE REQUIREMENTS ESTABLISHED BY THE UTILITY AUTHORITY.

WHERE POSSIBLE, LANDSCAPE IMPROVEMENTS AND PLANT MATERIALS ARE SUGGESTED TO HAVE INCREASED SETBACKS FROM UTILITIES.

IN THE EVENT A MINIMUM CLEARANCE OF 1.0m MAY NOT BE MAINTAINED FROM THE EDGE OF THE EXCAVATION BY THE TREE SPADE, THE INVOLVED UTILITY MUST BE CONTACTED FOR APPROVAL AND/OR SAFETY PROCEDURES, E.G. BY HAND DIGGING.

DISTANCE FROM LOW, INTERMEDIATE AND HIGH-PRESSURE PIPELINES AS TO BE OBSERVED AS DICTATED BY THE PIPELINE AUTHORITY.

SETBACK DISTANCES APPLY TO ALL TREE AND TREE FORM SHRUB SPECIES. SPECIES WITH SUCKERING ROOT SYSTEMS OR LARGE HANGING CANOPIES MAY REQUIRE INCREASED SETBACKS, E.G. POPLARS AND WILLOWS. REFER TO SECTION 7.4 OF THE CITY OF EDMONTON DESIGN AND CONSTRUCTION STANDARDS.

PLANTING SCHEDULE

BOTANICAL NAME	COMMON NAME	COMMENTS
TREES		
Malus x adstringens 'Durple'	Gladiator Crabapple	60 mm cal. min., 3.5 m ht. min., b. & b.
Malus 'Spring Snow'	Spring Snow Crabapple	60 mm cal. min., 3.5 m ht. min., b. & b.
Malus 'Thunderchild'	Thunderchild Crabapple	60 mm cal. min., 3.5 m ht. min., b. & b.
Syringa reticulata	Japanese Tree Lilac	60 mm cal. min., 3.5 m ht. min., b. & b.
SHRUBS		
Hydrangea 'Annabelle'	Annabelle Hydrangea	60 cm ht. min., 5 major basal branches, potted (2 gal.)
Physocarpus opulifolius 'Little Devil'	Little Devil Ninebark	60 cm ht. min., 5 major basal branches, potted (2 gal.)
Ribes alpinum	Alpine Currant	60 cm ht. min., 5 major basal branches, potted (2 gal.)
Spiraea bumalda 'Goldflame'	Goldflame Spirea	60 cm ht. min., 5 major basal branches, potted (2 gal.)
Calamagrostis x acutiflora 'Karl Foerster'	Karl Foerster Feather Reed Grass	1 gal. pot

PLANTING NOTES

ONLY NURSERY GROWN PLANT MATERIAL WILL BE ACCEPTED. ALL PLANTS SHALL BE No.1 GRADE NURSERY STOCK AND CONFORM TO STANDARDS OF THE CANADIAN NURSERY TRADES ASSOCIATION AND THE LANDSCAPE ALBERTA NURSERY TRADES ASSOCIATION.

PRIOR TO INSTALLATION OF TREES AND SHRUBS, THE CONTRACTOR SHALL ENSURE COORDINATION WITH ALBERTA FIRST CALL TO STAKE ALL UTILITIES. ALL PLANT MATERIAL TO HAVE REQUIRED SETBACK FROM UTILITIES. NO TREE STAKES WITHIN 1.0m OF POWER LINE.

PRIOR TO INSTALLATION OF TREES AND SHRUBS THE CONSULTANT OR THE CONSULTANTS REPRESENTATIVE WILL APPROVE STAKING OF ALL TREES AND SHRUB BEDS. CONTRACTOR TO NOTIFY CONSULTANT 48h PRIOR TO INSPECTION.

IF EXCAVATIONS ARE REQUIRED CLOSER THAN 1.0m TO UNDERGROUND POWER, PHONE, CABLE AND GAS ALIGNMENTS, HAND DIGGING UNDER THE SUPERVISION OF THE AFFECTED UTILITY IS REQUIRED. THE CONTRACTOR SHALL NOTIFY THE CONSULTANT AND THE APPROPRIATE UTILITY TO APPROVE, REVIEW AND DEFINE SAFE PROCEDURES FOR THESE EXCAVATIONS.

SUBSTITUTION OF PLANT MATERIAL TO APPROVAL OF CONSULTANT.

ENSURE ALL TREES HAVE A STRONG SINGLE LEADER AND ARE STRAIGHT BODIED, NICELY GROWN TREES WITH A TYPICAL SHAPE. THE CONSULTANT RESERVES THE RIGHT TO REJECT INFERIOR PLANT MATERIAL.

TREES PLANTED IN STRAIGHT LINES WITH EQUAL SPACING WHERE APPLICABLE.

ALL SHRUB BEDS c/w 300mm MIN. DEPTH LIGHTLY COMPACTED TOPSOIL.

SHRUB SETBACK SHALL BE 450mm MIN. FROM EDGE OF SHRUB BED.

EDGING: USE 6"x6" PRESSURE TREATED TIMBER EDGING BETWEEN SOD/SEED, ROCK MULCH AND PLANTING AREAS. TIMBER EDGING TO BE FASTENED TO THE GROUND WITH METAL SPIKES AT 1200mm O.C. NO EDGING IS REQUIRED FOR SINGLE TREES IN GRASS AREAS. EDGING TO BE FLUSH WITH SOD OR SEED.

MULCH: USE 100mm DEPTH MIN. SHREDDED CONIFEROUS WOOD MULCH FOR TREE, SHRUB AND PERENNIAL BEDS. NO LANDSCAPE FABRIC REQUIRED FOR SHREDDED WOOD MULCH AREAS UNLESS NOTED OTHERWISE. PROVIDE MULCH SAMPLES TO CLIENT FOR APPROVAL.

ROCK MULCH: USE 150mm DEPTH GREY LIMESTONE, AGGREGATE SIZE 6" MINUS, OR APPROVED ALTERNATE, ON LANDSCAPE FABRIC FOR ALL AREAS INDICATED ON PLAN. PROVIDE MULCH SAMPLES TO CLIENT FOR APPROVAL.

ALL LANDSCAPE CONSTRUCTION AND MAINTENANCE TO BE COMPLETED BUT NOT LIMITED TO MINIMUM STANDARDS OF MOST RECENT EDITION OF LOCAL DESIGN AND CONSTRUCTION STANDARDS.

LANDSCAPE WARRANTY AND MAINTENANCE TO BE 1 YEAR MINIMUM.

MLB700-W-A

700 SERIES



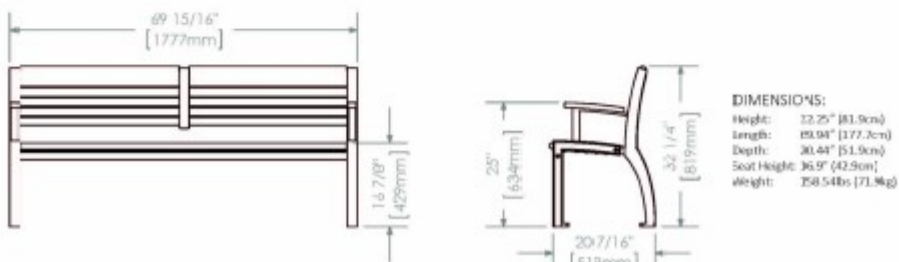
MATERIALS: Bench ends are made from solid cast aluminum. The seat employs 1.38" x 1.5" (3.5 cm x 3.8 cm) and 1.38" x 4.00" (3.5 cm x 10.2 cm) ipe slats.

FINISH: The Maglin Powdercoat System provides a curable finish on all metal surfaces. Wood slats are finished with penetrating sealers.

INSTALLATION: The bench is delivered pre-assembled. Holes (0.5") are provided in each foot for securing to base.

TO SPECIFY: Select MLB700-W-A
Choose:
- Powdercoat Color

OPTIONS:
- Plaque
- Skate Deterrent

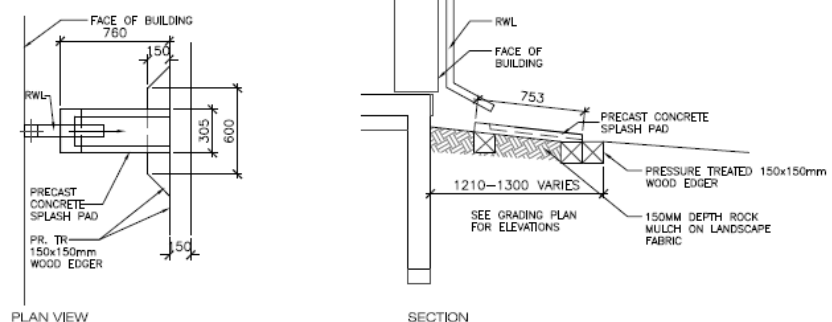


SOD NOTES

SOD TO BE DROUGHT TOLERANT, FRESHLY CUT AND HEALTHY WITH STRONG, FIBROUS ROOT SYSTEM, CONTAINING MAXIMUM 2 BROAD LEAF WEEDS AND TEN OTHER WEEDS PER 40sqm. SOD - SOIL PORTION SHALL BE A MAXIMUM OF 40mm AND A MINIMUM OF 25mm.

USE MANDERLEY "LESS WATER SOD" OR APPROVED EQUIVALENT ALTERNATE.

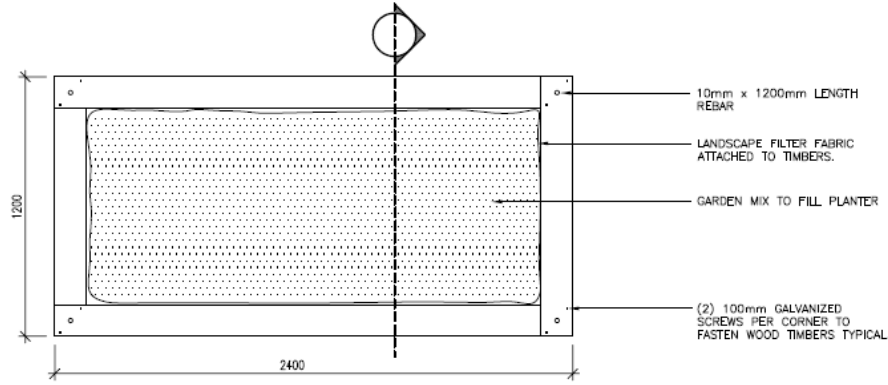
SOD INSTALLED ON 100mm TOPSOIL TYPICAL.



TYPICAL SPLASH PAD & ROCK MULCH BORDER DETAIL

TIMBER PLANTER DETAILS

DETAILS

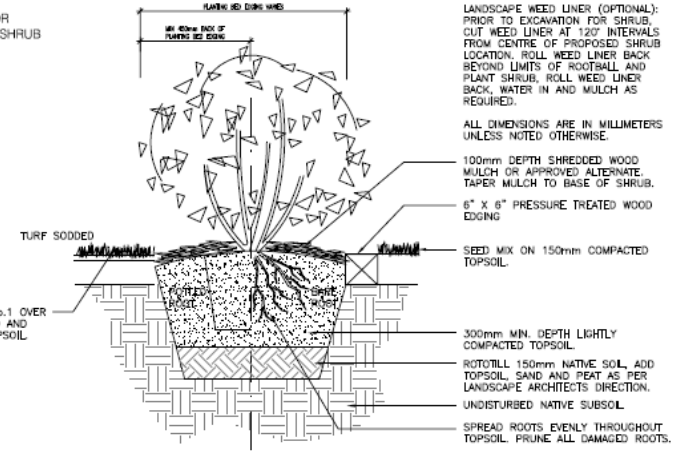


PLAN VIEW

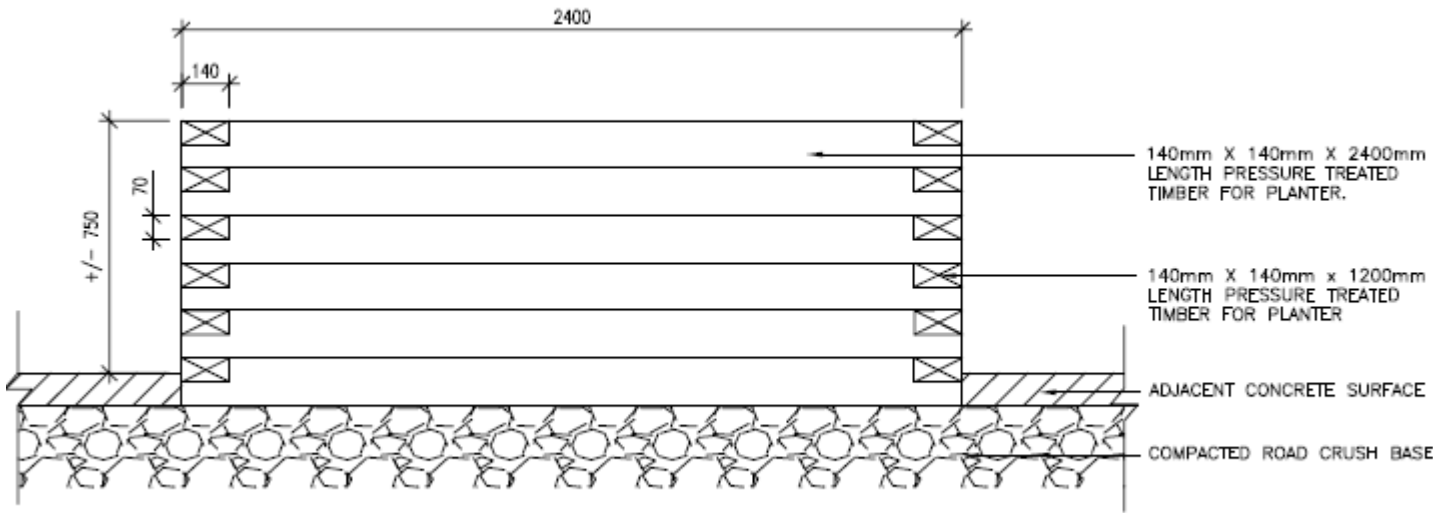


CONCRETE CURB DETAIL
15%

DECIDUOUS OR CONIFEROUS SHRUB



TYPICAL SHRUB PLANTING DETAIL
SECTION



ELEVATION

NOTES:

IF MINIMUM UTILITY SETBACKS PERMIT, POSITION TREE STAKES INTO DIRECTION OF PREVAILING WINDS.

ALL TREE STAKES TO MAINTAIN MINIMUM 1.0m CLEARANCE FROM ALL U.G. POWER, TELEPHONE AND GAS ALIGNMENTS.

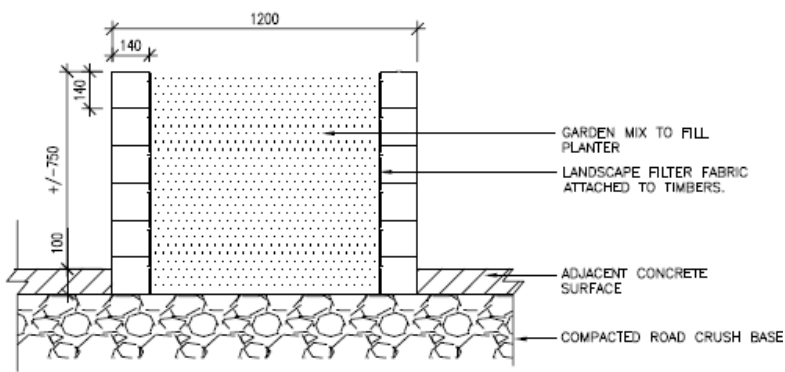
DIG ALL ROOT HOLES BY HAND WHEN CLOSER THAN 1.0m TO U.G. POWER, TELEPHONE AND GAS ALIGNMENTS.

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED OTHERWISE.

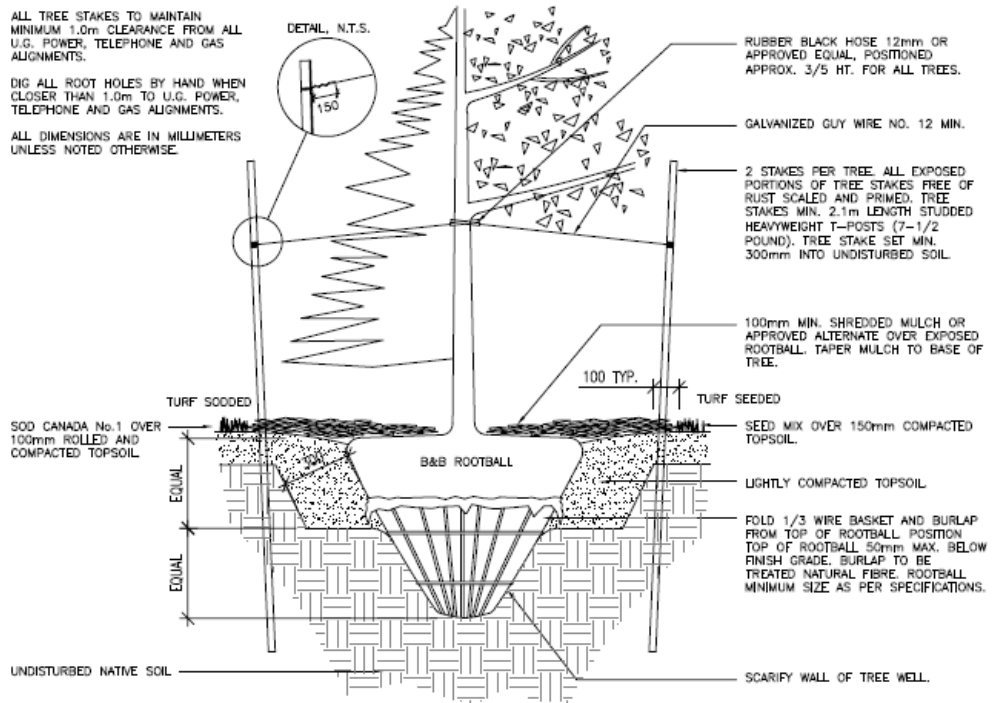
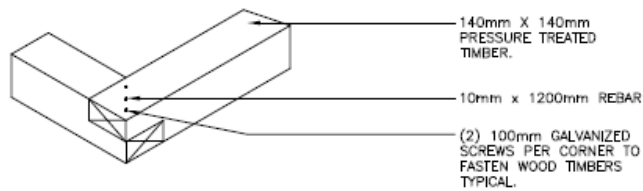
CONIFEROUS LESS THAN 3.0m HEIGHT

DECIDUOUS LESS THAN 100mm CALIPER

NOTE:
PRUNE ONLY DEAD OR DISEASED TREE LIMBS.



SECTION



TYPICAL TREE PLANTING DETAIL
SECTION

N.T.S.

APPENDIX B

Proposed locations for establishing dementia care centre in Edmonton

There are many locations in Edmonton that are suitable for building care centres for people with dementia, thus after choosing random locations and applying the nine requirements, there are two locations that achieve the 6 most important requirements and received a higher rating. The first location that achieved 8 requirements is Holyrood, which is a residential neighbourhood in the Bonnie Doon area of south-east Edmonton; the second location that also achieved 8 requirements is Casselman, which is a residential neighbourhood located in north-east Edmonton.

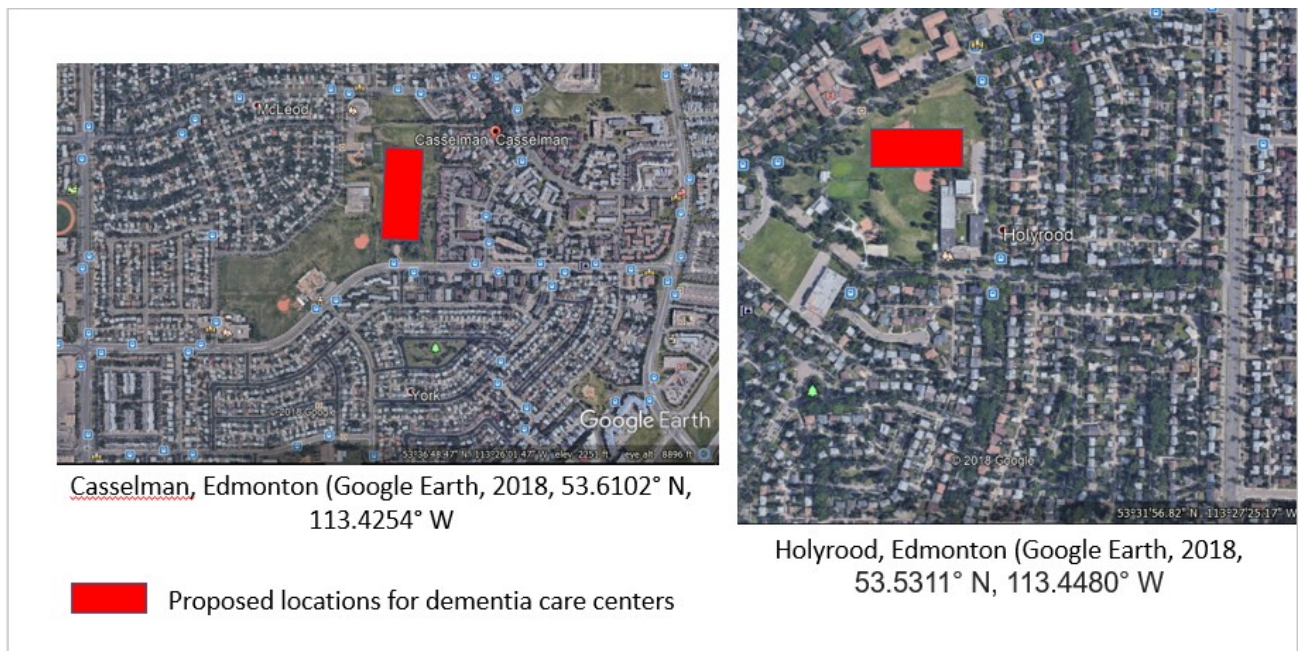


Photo 1: The two proposed locations for a dementia care centre in Edmonton

	Casselman	Result
1	Integrating the village into a community that is surrounded by neighbourhoods.	Green
2	Choosing a quiet location that is distant from noise sources and crowded places.	Green
3	Choosing a location that is close to health care centres.	Green
4	Choosing a location that is distant from dangerous places such as rivers, highways, or forests.	Red

5	Choosing a location with a flat topography to avoid using steps as a solution to move from one level to another	Green
6	Choosing a location in a newly built area with high-quality standards of building and construction.	Green
7	Choosing a location that is adjacent to parks or recreational centres.	Green
8	Choosing a location that is suitable to planning activities that promote the gathering of patients with other people in the community	Green
9	Choosing a location where there is opportunity for patients' families to live nearby, thereby allowing them to provide support	Green

The crucial requirements
 Achieved requirement
 Unachieved requirement

Table 1: Rating Casselman example for establishing a dementia care centre in Edmonton.

	Holyrood	Result
1	Integrating the village into a community that is surrounded by neighbourhoods.	Green
2	Choosing a quiet location that is distant from noise sources and crowded places.	Green
3	Choosing a location that is close to health care centres.	Green
4	Choosing a location that is distant from dangerous places such as rivers, highways, or forests.	Green
5	Choosing a location with a flat topography to avoid using steps as a solution to move from one level to another	Green
6	Choosing a location in a newly built area with high-quality standards of building and construction.	Green
7	Choosing a location that is adjacent to parks or recreational centres.	Red
8	Choosing a location that is suitable to planning activities that promote the gathering of patients with other people in the community	Green
9	Choosing a location where there is opportunity for patients' families to live nearby, thereby allowing them to provide support	Green

The crucial requirements
 Achieved requirement
 Unachieved requirement

Table 2: Rating Holyrood example for establishing a dementia care centre in Edmonton.

APPENDIX C

Questionnaire

Suggesting questions and requesting recommendations will be provided by a questionnaire that primarily aims to gather information to obtain an overall measure of the attitudes and opinions of the respondents. This questionnaire will target people who live in the community as well as educational and governmental institutions. The main focus of the questionnaire is to ask people about their opinion and of how they feel about living in a neighbourhood with people with dementia, about volunteering and assisting patients, and about suggestions and recommendations.



Developing a supportive community for people with dementia



This is a brief survey for gathering information about the current research project that is being conducted in your community.

1. Are you familiar with the term Dementia?

- Yes
- No

If not,

Dementia is an overall term for a set of symptoms that are caused by disorders affecting the brain. This may include memory loss and difficulties with thinking, problem-solving, or language.

2. How long have you lived in this neighbourhood?

- Less than a year
- 1 – 5 years

- 5 – 10 years
 - 10 – 15 years
 - More than 15 years
-

3. Are you familiar with the rising figures of the aging and dementia population?

- Yes
 - No
-

4. How would you feel about having dementia patients living in your neighbourhood?

- Comfortable
- Slightly Uncomfortable
- Strongly Uncomfortable

Please explain your answer

5. Have you cared for a dementia patient before?

- Yes
 - No
-

6. Have you heard of any efforts globally to integrate people with dementia into existing communities?

- Yes
- No

- Please explain your answer

7. Do you think that people with dementia should live independently from other seniors or it is a good idea to integrate them with others?

- Living independently
- Living with other seniors

8. Do you see this neighbourhood as being fit for people with dementia to live in?

- Yes
- No
- Unsure

Please explain your answer

9. Do you find yourself having a role to play in supporting people with dementia?

- Yes
- No

If yes, please specify

10. Would you be willing to assist a patient within the neighbourhood if necessary?

	Yes	No
Guide them if they're lost	<input type="radio"/>	<input type="radio"/>
Communicate with them	<input type="radio"/>	<input type="radio"/>

11. Do you see further changes being made in your neighbourhood to allow dementia patients to cope with their surroundings?

- Yes
- No

If yes, what changes do you expect to see?

12. What is your opinion on construction in your neighbourhood regarding accommodations for patients to cope with their surroundings?

- Agree
- somewhat agree
- Indifferent
- somewhat disagree
- disagree

13. Regarding the previous question, do you support the government act to develop a national plan for dementia research and solutions?

- Yes
- Unsure
- No

14. Do you support the University of Alberta's research project based on the integration of patients and seniors into this neighbourhood?

- Yes
- Unsure
- No

15. Do you have any questions, comments, or concerns?