

**AN ASSISTED LIVING PRIVATE DWELLING UNIT BASED ON USER NEEDS**

by

Emily Maples Stumb

Thesis submitted to the Faculty of the Virginia Polytechnic Institute and State University  
in partial fulfillment of the requirements for the degree of

Masters of Science

in

Housing, Interior Design, and Resource Management

Dr. Julia Beamish, Chairperson

Dr. Karen A. Roberto

Dr. Rosemary Carucci Goss

May 7, 2004

Blacksburg, Virginia

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Advisor: Dr. Julia Beamish

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(ABSTRACT)

The United States is experiencing a rapid rise in its citizens aged 85 and older, which is the fastest growing segment of the population. By the year 2050 the population of adults 65 years old and older is predicted to double in size. This trend, referred to as the graying of America, has been a catalyst for researchers eager to fill gaps in appropriate housing options for this population. For the past decades assisted living has grown as such an option for senior housing.

The purpose of this study was to design an assisted living private dwelling unit based on criteria found in literature and in the findings of two research projects. Data were collected during site visits to five assisted living facilities as part of the Best Practices study. Data collected during the CAVE study, in which participants expressed preferences toward assisted living apartment designs, were also utilized.

Design criteria emerging from both studies were found to be in support of current literature. A design concept employing these criteria was developed. The design was presented through graphic techniques including plans, elevations and perspective drawings.

## **ACKNOWLEDGEMENTS**

I offer my sincere gratitude to Mrs. Ruth Baird whose generosity not only made this accomplishment possible, but provided an example of kindness that I will forever strive for.

Thank you to Dr. Julia Beamish, Dr. Karen Roberto, Dr. Rosemary Goss and also to Dr. McLain-Kark for affording me the wonderful opportunities to assist in their research projects. Not only have they provided a basis for this thesis but have surpassed my every expectation of the graduate school experience.

Thanks also to April Allen, Glenda Andes, Becky Strough, Ed Hertling and Mr. and Mrs. Tom Spotts for their help through this process.

A special thank you to my parents Wayne and Judy Maples, and my brothers David and Derek Maples who have always showed such confidence in me that I never truly learned to doubt myself.

I would also like to thank my husband Eric, whose selfless support and patience saw me through the end of this process.

Finally, I dedicate this thesis in the memory of my grandmother, Mrs. Allie Mae Garrison, who taught me about living and aging in grace.

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## **Chapter One: Introduction**

### ***An Aging America***

According to the United States Census Bureau the population of older adults is continually growing. In fact, throughout the history of the census, adults 65 years and older have been the fastest growing segment of the U.S. population. The census of 2000 became the first, and temporary, exception as low birthrates during the great depression meant that relatively fewer people turned 65 by 2000. However, the baby boom generation will reverse this trend considerably as they begin to reach age 65 in 2011. Furthermore, the oldest members of society, those individuals aged 85 years and older, are the fastest growing segment of the population. The trend toward a rising older population is projected to continue for the next five decades as we see the 65 and older population double in size by 2050. (Hertzel & Smith, 2001) How will society care for this ever growing number as they continue to age and grow frail?

### ***Statement of the Problem***

For many years the continuing rise in the older population and the forthcoming aging of the baby-boomers has been cause for an examination of the inevitable housing demand of the elderly. The growth of the aging and frail population, paired with a steady rise in the cost of long-term care, has resulted in an effort to keep older adults out of the institutional nursing home environment and in their communities for as long as possible (Jaffe, Pawasarat, & Howe, 1994). Suggs and Logan (1994) noted that one promising effort to accomplish this has been the advent of assisted living facilities. Assisted living allows for a bridge or “buffer” between the traditional “institutional” nursing home environment and independent living. It caters to individuals who need some assistance with physical needs, but not a great deal of skilled nursing care (National Center for Assisted Living [NCAL], 2004). Despite varying definitions and regulatory models of assisted living, the core philosophy of assisted living centers around the notion of providing older adults with a supportive housing option that preserves autonomy, privacy, dignity and independence (Frank, 2002). The physical design of an assisted living facility plays a critical role in upholding or hindering this

philosophy and contributes directly to the quality of life of those who make it home. Design has the ability to preserve health, a sense of well-being, dignity, independence, social opportunity, and a sense of home, or, if poorly executed, accomplishes none of these (Sloane, Zimmerman, & Walsh, 2001). As the “architectural cornerstone” of assisted living, the private apartment unit is truly the only residential option that fully supports the essential philosophy of privacy and autonomy that are definitive of assisted living’s goal (Brummett, 1997).

### ***Purpose of the Study***

The purpose of this study is to design an assisted living private dwelling unit based on criteria gained from existing literature, successful case studies, including site visitations, and a preference study of virtual assisted living apartment models.

### ***Objectives***

The objectives of this study were:

1. To investigate assisted living private space design and determine criteria for a successful design based on literature and regional data collection.
2. To develop a design of an assisted living private unit space suitable for southwest Virginia.

### ***Design Project***

A plan for an assisted living private unit was developed for Southwest Virginia. Design inspiration for this project were derived based on case studies of successful facilities, preferences for model designs, and criteria gained from literature.

### ***Justification of the Study:***

The philosophy of assisted living puts a great deal of emphasis on maximizing the residents’ dignity by preserving the autonomy, independence, and privacy of the residents (NCAL, 2004). An important aspect affecting privacy in assisted living is the design of the living unit itself (Mollica, 2001). The private dwelling unit is where the

resident spends most of his/her time and is primarily important in residents' housing satisfaction (Regnier, 2002).

A report, funded by the AARP Public Policy Institute, found that consumers of assisted living had "a strong preference" for private accommodations. The authors offer a poignant example of this sentiment given by one subject's quote: "If my mind is with me, and I am the person I am, I will never give up my privacy" (Public Policy Institute, 1998). Private or single-occupancy units are the private market standard for assisted living. Eleven states have based their licensure policy on privacy, emphasizing attached baths and kitchens for autonomy (Mollica, 2001).

Although a less expensive alternative to nursing home care, assisted living costs on average \$64 dollars per day or \$25,000 per year. The typical resident population has net assets approximating \$100,000, while 16% receive some form of financial help in order to meet the costs (Regnier, 2002).

In light of the emphasis assisted living places on the issue of privacy, a study reflecting criteria for the effective design of these spaces and the impact of those residing there may prove beneficial to the assisted living industry and consumers. An examination into the critical spaces that encompass the private dwelling unit could aid assisted living providers in determining cost effective allocation of those spaces.

## **Chapter Two: Review of Literature**

In order to explore the design impact of assisted living private spaces on the individuals residing there, it is helpful to examine the unique housing option that assisted living provides frail older adults. This chapter will discuss existing literature on the history and precedent for assisted living in the United States, the unique population assisted living serves, and environmental design criteria applying to assisted living facilities and their private spaces.

### ***The Advent of Assisted Living***

The concept of elderly people aging in place in an assisted residential setting first appeared in Northern European models. The United States began to explore this concept as part of continuing care retirement communities in the early 1980s. However, midway through the decade assisted living facilities were also being developed as freestanding residences (Frank, 2002). By 1999 assisted living accounted for 75% of senior housing development (NCAL, 2004).

### ***Typical Resident of Assisted Living***

In order to understand the significance of the assisted living unit as a design problem it is helpful to look at the typical resident of assisted living. According to a survey conducted by the National Center for Assisted Living (NCAL) in 2000, a “typical” resident of assisted living is a mobile woman between 75 and 85, with an average age of 80. Older adults of this age group in general share unifying traits which make them a unique cohort in terms of their housing needs and preferences. For instance, older adults are more likely than younger age groups to own their homes. As homeowners, they report a high level of attachment to their homes, having lived in them for many years. They are less likely than renters to move. If they do relocate, they usually move locally (Hertzel & Smith, 2001). Older adults moving into assisted living facilities usually make the move from their own homes, representing 46% of incoming residents. Other residents make the move from another assisted living facility (20%), hospital (14%), nursing facility (10%), or another independent living facility (9%) (NCAL, 2004).

On average, assisted living residents need assistance with two activities of daily living. Activities of daily living (ADLs) include; eating, toileting, transferring, bathing and dressing. Although, 19% of assisted living residents do not need help with any ADLs, 81% of residents need assistance with one, while nursing facility residents on average need assistance with 3.75 ADLs (National Center for Assisted Living, 2004).

### ***Frailty in the Designed Environment***

Among the assisted living resident population, there are numerous aspects of the aging process which contribute to frailty and the need for assistance with ADLs. Some declines occur as part of the normal aging process while others are a result of diseases or injuries (Whitbourne, 1999). Quality of life research has found the most common health problems cited by assisted living residents to be: depression, bone and joint pain, high blood pressure, anxiety, arthritis, confusion, heart problems, low vision, memory loss, and incontinence, although other ailments may be present (Ball et al., 2000). The following offers a brief description of pertinent health difficulties of older adults based on Salmon's (1993) classification of the physiological aspects of aging consisting of these categories:

1. Muscular-skeletal; affecting movement, balance, flexibility, strength and control.
2. Cardio-vascular and respiratory; affecting endurance and stamina.
3. Psychiatric; affecting memory, mental health and sense of well-being.
4. Perception and sensory; affecting environmental perception and communication.

#### ***Muscular-skeletal: Movement, Balance, Flexibility, Strength and Control***

The first category, musculo-skeletal, involves bone and joint disorders which may affect posture, mobility, flexibility and dexterity. These include, "rhumatoird arthritis, osteo-arthritis and osteoporosis". Rheumatoid arthritis affects the joints of the hands, wrists, elbows, feet, ankles and knees. Osteo-arthritis may affect any joint, especially weight-bearing joints such as the hip, knees, ankles and the lower spinal vertebrae. Depending on the joints afflicted by arthritis the effects of this disease include; difficulty walking, turning over in bed, turning the body in a seated position, a decline in manual dexterity, loss of grip strength, and a difficulty bending arms and legs. Either type of arthritis may cause extreme pain (Salmon, 1993).

Osteoporosis is a bone disease which causes severe loss of bone density. Its effect of weakened bones leads to an increased risk of fracture. This disease is most common in older women but does occur in older men as well.

Aside from disease, the normal aging process has an adverse affect on the aging body's muscular-skeletal strength, flexibility and balance. According to Koncelik (1996), older adults may experience a weakening of the leg muscles. As a result, muscles controlling a slow decent to a seated position may not be able to sustain the weight of the body over the course of the action. The effect is a sudden dip into the chair. When rising from a chair, they may also experience a more difficult time bending the knee to position the heels under the center of gravity. Older adults may sit for longer periods, but experience discomfort sooner as tissue is lost above the pressure points of the hips allowing them to press uncomfortably into the buttock's muscles (Koncelik, 1996).

Walking is also affected by the aging process. Salmon (1993), reports that an average healthy adult male will walk a normal pace of 43 inches per second while a frail elderly male would take 16 times as long. Contributing to this decrease in speed is a gradual change in walking stride to a shuffling gait classified as the inability to lift feet high above the ground (Salmon, 1993) and a swinging of the feet out in front of the center of gravity when walking (Koncelik, 1996). This gait, along with a loss of muscle strength, may cause older adults to fatigue more quickly when walking down long corridors or gradual inclines (Salmon, 1993; Koncelik, 1996). The shuffling gait also puts older adults at an increased risk of tripping over low objects such as changes in slope and flooring materials, which would not impede younger individuals, (Salmon, 1993).

Also contributing to the risk of falls in older adults is an increased sway, which is classified by incapacity to correct balance quickly enough to avoid falling. Unlike young adults, who are able to quickly adjust their body position when equilibrium is jeopardized, older adults are not able to compensate for imbalance quickly and sometimes fall as a result (Salmon, 1993). In order to maintain balance, older adults may have an increased need to brace themselves on railings or other aspects of the environment for stability (Koncelik, 1996).

Fine motor skills are also affected by normal age-related muscular-skeletal changes. Older adults may experience a decrease of strength in their palm for gripping. Grip strength has been measured to decrease from 95 pounds in young adults to 5 pounds in older adults. Strength of finger muscles is measured in “pinching strength” which has been found to decrease from 30 lbs. to 0 lb. in some older adults (Koncelik, 1996). These changes may affect the ability to manipulate virtually all aspects of the environment (Salmon, 1993).

### ***Cardio-Vascular and Respiratory: Endurance and Stamina***

Adults over the age of 65 have an increased risk of being afflicted with a cardio-vascular disease, including “hypertension, coronary artery malfunction and cardiac failure.” Arteriosclerosis, or hardening of the arteries, is most often the result of heart disease that causes heart attack. It may also affect the arteries of the brain or limbs, causing stroke or cramps consecutively. Disorders of the cardio-vascular system may require limited activity or in some cases require total rest. Salmon (1993) proposes that cardio-vascular disease is perhaps the most potent important reason that assisted environments for the older adult should seek to reserve energy and in doing so, should pay particular attention to the pitch of staircases, height of beds and accessibility of cupboards (Salmon, 1993).

Respiratory disorders include bronchitis, asthma, pneumonia, pulmonary tuberculosis, pulmonary obstruction, and lung cancer. Bronchitis is characterized by shortness in breath and difficulty breathing. Salmon (1993) writes that cold and damp conditions may contribute to this condition and that aging-in-place in old drafty houses should be avoided. Pulmonary tuberculosis requires treatment in dust-free environments.

### ***Psychiatric: Memory, Mental Health, and Sense of Well-Being***

In their quality of life study, Ball and colleagues (2000) found that the most common mental health problems experienced by assisted living residents were depression and anxiety, which resulted in negative outlooks. Depression was reported by 54% of participants, while anxiety was reported by 34%. Causes of this mental distress were losses of independence, previous homes and former activities, physical and mental capacity, and loved ones. Loneliness was also experienced by 44% of

residents, who cited “missing families” and the inability to participate in previous activities as causes. Boredom was seen by 36% of providers to be a difficulty for residents and was linked to a deficiency in meaningful activities and social relationships.

Another mental problem facing the assisted living resident population is dementia. Dementia is caused by diseases and not part of the normal aging process (Cohen & Weisman, 1991). Dementia strikes at the very root of self, personality, social and cognitive functioning (Qualls, 1999). Although only 6-8% of adults 65 years and older are diagnosed with dementia, its effects are progressive, irreversible and the risk of dementia doubles with every five years. Thus, adults aged 85 years have a 30% risk of experiencing dementia. Dementia is classified as cognitive deficits in memory, language interruption, difficulties with abstract thought process such as planning, and, despite any physical ailment, the inability to carry out motor activities. The two most common forms of dementia are Alzheimer’s disease and vascular dementias, together accounting for 90% of all cases (Qualls, 1999). Alzheimer’s disease alone accounts for 50-60% of all dementia cases and ranks fourth in the United States for cause of death in the elderly population. More than 1.5 million in the United States are afflicted with the disease and 60-70% of all nursing home patients have been diagnosed with it. Effects of the disease include deficiencies in social skills, tendencies to wander, and reduced control of the environment (Cohen & Weisman, 1991).

### ***Perception and Sensory: Environmental Perception and Communication***

Several aspects of the normal aging process and age-related disease processes affect individuals’ ability to interact with the environment and others effectively. These changes may include visual impairment, auditory impairment, reduced tactile sensitivity and alterations in the senses of taste and smell (Brummett, 1997).



**Visual impairment.** Older adults experience a decline in visual acuity, as a result of the normal aging process. The structure of the eye changes with age. The lens grows thicker, harder, and more opaque with a yellow cast. Less light is allowed to enter the retina due to atrophy in the iris dilator (Whitbourne, 1999). As a result of these changes older adults' vision is compromised. They experience difficulty in adjusting their vision for abrupt changes in light levels, glare, and focus distance. Typically by age 60 the lens has lost all ability to focus on objects at close distance, a condition known as presbyopia. Color differentiation, especially between green, blue and violet may be difficult as a result of the yellowing of the lens (Whitbourne, 1999). To accommodate for these physical limitations and achieve visual acuity, older adults need more light. Adults at age 60 need twice as much light as they did at age 40 (Barker, Barrick & Wilson, 1995).

The above age-related vision changes focuses on a general loss of clarity across the visual field. However, older adults are more susceptible to experience visual disorders which create areas of non-vision. Most common of these visual impairments for older adults is a loss in the "central area" of the visual field, or macular degeneration. Macular degeneration accounts for 60% of all vision disorders in older adults. Adults suffering with this condition have a resulting field of vision which is "missing a piece" in the center. Although individuals with macular degeneration may appear to move safely about their environment without apparent difficulty using their peripheral vision, they are unable to read signs or recognize faces. A loss of color perception is often present in conjunction with this condition (Barker et al, 1995).

A common condition creating an opposite view is glaucoma in which only the center of the field of vision is perceptible. This is also known as tunnel vision. As a result, the navigation of an environment is much like that of moving toward the end of a dark tunnel, slow and without a view of hazards on either side (Barker et al, 1995).

Patchy vision across the field is characteristic of diabetic retinopathy. The resulting visual condition is one in which the scene appears to "merge together" and blur making it very difficult to navigate the environment. A cataract is a condition which also affects the eye's entire visual field, blurring the scene and dramatically reducing the appearance of details (Barker et al, 1995).

**Auditory impairment.** Age-related hearing loss is known as presbycusis which is a general term describing the result of different physical changes of the ears anatomy (Whitbourne, 1999). Some loss of hearing, especially of high frequencies, is common in older age (Salmon, 1993), although more prevalent in men than women (Whitbourne, 1999).

Among the challenges hearing loss may cause, such as difficulty hearing an alarm sound or door bell ring, is the detrimental affect on the perception of speech. In communicating with a hearing-impaired adult it may be useful to speak in a lower tone. Difficulties in communication due to hearing loss may result in strained relationships. Furthermore, because a hearing-impaired adult has to focus more intently on the message to hear it, listening can be “more draining of cognitive resources” (Whitbourne, 1999).

Salmon (1993), writes that amplification may aid in communication, but may cause distraction or annoyance for others, or further damage to hearing. He notes that rare cases of severe deafness may cause “mild hallucinations”, whereas amplification of a television may aid one person to hear it more clearly while causing a hearing-impaired neighbor to “hear voices” in the next room. He cites the need for proper insulation between walls in order to use amplification effectively. Insulation may also assist in reducing background noise and reverberation which hinders auditory perception in older adults with hearing loss (Whitbourne, 1999).

**Tactile sensitivity.** A reduced sensitivity to tactile stimulation is a common impairment for older adults and may lead to an increased risk of burns and scalding. Further, if heating is inadequate, older adults may be at a decreased risk to recognize the onset of hypothermia. Thus, care should be taken to control these risks in the environment (Salmon, 1993). However, positive tactile stimuli, such as items to pick-up and manipulate, may provide assisted living residents with an opportunity to interact with the environment in a positive way, thus decreasing boredom and increasing satisfaction (Sloan, Zimmerman & Walsh, 2001).

**Senses of smell and taste.** The senses of smell and taste are integral parts of the enjoyment of food, which has a direct impact on the nutrition and health of an older adult. A general decline in these senses may be seen as a result of the aging process.

However, the degree of sensory loss, as well as which category of the sense is affected (i.e. sweet tastes or acrid odors), vary greatly across individuals (Whitbourne, 1999). Aside from loss of appetite, which may result from these declining senses, an inability to recognize environmental hazards may cause a risk to the individual. For instance, the sulfur warning of a natural gas leak may be undetectable or the foul taste of spoiled food may go unnoticed (Whitbourne, 1999).

### ***Definition of Assisted Living***

Evaluation of the current literature on assisted living exposes the unanimous opinion that a definition of assisted living continues to elude researchers and policy makers. According to Mollica (2001), one prominent source of confusion seems to be licensing categories. He notes that although all fifty states license facilities, which may be marketed as assisted living, only 29 states use the term “assisted living” when licensing. To further blur the picture, he adds that some states have added assisted living licensing categories while keeping older ones like residential-care facilities and personal care homes; and other states do not even require assisted living facilities to be licensed if residents utilize services from outside agencies (Mollica, 2001). The many terms states apply to assisted living are not necessarily equivalent in what they offer as a housing option. (Frank, 2002) The following will explain some of the differences.

### ***Regulatory Models of Assisted Living: Is it all in the name?***

Many different names have been given to housing that could be marketed as assisted living; some include board-and-care, residential-care facilities, and personal care homes. Although regulatory approaches vary from state to state, each falls into one of four categories: umbrella model, board and care or institutional model, new housing and service model, and service model (Mollica, 2001).

The umbrella model provides regulations for assisted living facilities that utilize two or more types of housing and services. These could include: residential care facilities, congregate housing, multi-unit or conventional elderly housing, adult family care, and assisted living. Institutional models usually rise from older board and care regulations. They adhere to the minimum physical requirements, with resident units most often consisting of multiple-occupancy bedrooms and shared bathrooms. Evolving

from the board-and-care regulatory model, institutional models do not typically allow for skilled nursing to take place, although they make limited exceptions to accommodate aging-in-place (Mollica, 2001).

In contrast, the new housing and service model requires that facilities provide apartment settings and may define the minimum square footage of the units. Residents are allowed to be admitted and retained even if they would qualify for a nursing home environment. Finally, the service model focuses on the service provider over the physical structure of the facility. The residence could be the provider or an outside agency could be providing the services. This approach allows for the use of existing building code requirements rather than new licensing standards (Mollica, 2001).

### ***Overview of Virginia Regulations***

According to Mollica (1998), the Virginia state legislature has created a licensing structure for assisted living based on five guiding principles reflecting “personal dignity, freedom of choice, and fairness for all individuals”.(p.2) The principles are as follows:

- Residents are entitled to appropriate, safe and quality care;
- Each resident shall be viewed as an individual and empowered to make decisions regarding his care;
- Each residence should identify the types and extent of services offered and those services should reflect the needs of the population served;
- The resident should be entitled to remain in care as long as the facility is able to adequately care for the resident within the limitations established by law so that social ties and relationships may be preserved to the fullest extent possible; and
- Standards are consistent with the provision of cost effective services. (Molica, 1998, p.2)

According to the Commonwealth of Virginia, assisted living is defined as an adult care residence which provides care to residents, who as a result of physical or mental impairments, need help with at least two activities of daily living. Assisted living accommodates individuals who are dependent in behavior pattern (abusive, aggressive and disruptive).

Virginia does not require assisted living facilities to provide apartment settings. In fact, up to four people may share a room with a required minimum of 80 square feet

per occupant. Single rooms must have 100 square feet for new construction. The required ratio of toilets to residents is 1:7 and tubs/showers to residents is 1:10 (Molica, 1998)

Under Virginia law residents are not to be admitted or retained if they exhibit the following health related requirements:

- Ventilator dependent
- Dermal ulcers unless a stage III ulcer is healing
- Airborne infections in a communicable stage
- Psychotropic medications without an appropriate diagnosis and treatment plan
- Nasogastric tubes
- Individuals who present a danger to themselves or others;
- Individuals requiring continuous nursing care (around the clock observation, assessment, monitoring, supervision of medical treatment by a licensed nurse);
- Individuals whose physician determines otherwise, individuals who require maximum physical assistance as documented by an assessment and meet Medicaid nursing facility level of care criteria; or
- Individuals whose health care needs cannot be met in the specific adult care residence as determined by the residence. (Molica, 1998, p.2)

Each resident must be evaluated annually by the Uniform Assessment Instrument, unless a resident experiences a significant decline in condition, in which case an assessment is completed at the time of decline. This assessment is used to create a resident specific service plan to be implemented with the resident, family, and any care managers or providers (Molica, 1998).

In order to gain licensure, each facility must submit a written service plan describing the resident needs to be served and the aspects of services to be available. Residences must be capable of meeting scheduled and unscheduled service needs round the clock and provide a minimum of 14 hours of activities per week (Molica, 1998). Criteria to be met in the service plan are:

- Meet physical, mental, emotional and psycho-social needs,
- Provide protection, guidance and supervision;
- Promote a sense of security and self worth; and

- Meet the objectives of the service plan. (Molica, 1998, p.2)

Residents are allowed to administer their own medications. Staff may administer medications only after successfully completing a Board of Nursing certified medication training program (Molica, 1998).

Molica (1998) writes that staffing patterns for assisted living facilities must be appropriate to meet the required needs of the residents as stated in their plans of care. However, he does not explain how appropriateness is determined. Although, there are given requirements for staff training. Assisted living facility administrators must have “completed at least two years of post secondary education, one year of courses in human services or group care administration from an accredited college or a department curriculum specific to the administration of an adult care residence” (Molica, 1998, p.3). All staff are required to have an awareness of the facility’s purpose and services, its daily routines, and the regulations for the facility in relation to their responsibilities. These should include knowledge sufficient to carry out emergency plans and confidentiality of treatment. All staff are subject to a required background check and may be denied employment based on previous criminal convictions.

Since Molica’s (1998) compilation of state requirements the following amendments have been made to the regulations. As of the 2002 meeting of the Virginia General Assembly, facilities have the right to have a licensed clinical psychologist determine the cognitive capacities of a potential resident prior to the admittance of the individual. Further, facilities are held accountable to post residents rights and responsibilities, rather than the facilities implementing policies and procedures (Virginia State Board of Social Services, 2002)

### ***Accessibility Standards***

Accessibility standards are important criteria to use in the planning of assisted living facilities. The American National Standard for Accessible and Useable Buildings and Facilities (ANSI A117.1) is one of the oldest set of standards used in the United States and provides guidance for commercial and residential settings (ANSI, 1998). The original guidelines were developed in 1961 and were last revised in 1998. Currently the guidelines are being overseen by the International Code Council and are incorporated into the International Building Code. The A117.1 standards were the basis for the Fair

Housing Accessibility Guidelines, which apply to multi-family housing built after 1991. The guidelines cover information about clearances at doorways, and in kitchens and bathrooms (Stratton & Crosbie, 2001).

### ***Medical and Residential/Social Models of Care***

The assisted living housing option in the U.S. has evolved to include two models of care, the medical model and the residential or social model. The more traditional medical model focuses primarily on medical service for the “patient,” while the residential model, a relatively new concept, is more focused on the individual autonomy of the “resident” (Frank, 2002). In her research, Frank found that providers saw both aspects as needed in order to ensure that the needs of the older adult are met. However, distinguishing which model should take precedent in a given circumstance could prove a real dilemma for nurses and aids trained in the medical model of care (Frank, 2002), and pose risks for providers as well as residents (Carder, 2002).

Carder (2002), in her research on how the social model affects assisted living practices, identifies two types of liability that facility administrators must address in training and practice. The first category involves the traditional liabilities associated with harm to residents; the other involves the financial liability of not maintaining full-occupancy.

Risks that the resident imposes on him or herself are often difficult to deal with in a social model of care. Carder offers an example of this type of risks as a diabetic who chooses to eat cake. How does a nurse decide when to intervene in this instance? In a nursing facility the resident would not be allowed to eat cake. However, in the ALF the provider “must balance respect for the individual’s autonomy and rights as an adult to make choices, even risky ones, with their institutional responsibility to see that this individual does not cause harm to herself [himself] or others” (Carder 2002, p.12). It seems a certainty that no facility would protect an individual’s autonomy if they were threatening other residents. However, Carder (2002) identifies the gray area which arises when potential risky behaviors such as, cooking, and smoking.

Aside from the category of traditional liabilities, facilities must also consider the financial liability of maintaining full-occupancy. Carder states that facilities must

maintain a “balance between the business goals of maintaining full occupancy against retaining residents whose behaviors are offensive to others”. (p.13)

The traditional liability concerns of the facility operations are often addressed by the resident signing a Managed Risk Agreement (MRA). The agreement asks the individual conducting risky behavior to acknowledge it as such, and to accept responsibility for all negative results of this behavior. Carder (2002) states, however, that the MRA has not been tested in court.

The second type of liability concern is more difficult to address. Carder offers the example of an instance where one resident’s eating habit is so “gross” that offends other residents so much that they decide to move. This becomes an income liability for the facility. Although financially risky for the facility, this behavior is not physically harmful to anyone and the resident’s right to age-in-place must be considered.

### ***Assisted Living Issues***

Issues affecting the assisted living environment spur from an interdisciplinary gathering of research. Researchers have attempted to “bridge the gap” between the theoretical framework of environment-behavior research and the application of this knowledge by environmental designers. In doing so, the following principles have emerged within existing literature. These eight dimensions, gathered from design and applied policy literature, are as follows: social interaction, orientation and way-finding, stimulation & growth, familiarity and personalization, privacy and autonomy (Pynoos & Regnier, 1997; Sloane, Zimmerman & Walsh, 2001; Inman & Shea, 1996) and safety and security (Pynoos & Regnier, 1997; Sloane et al, 2001).

#### ***Social Interaction***

The assisted living environment may offer a unique opportunity for older adults to interact with their cohorts. Positive relationships between older adults can encourage emotional development and lead to more meaningful and stimulating experiences (Pynoos & Regnier, 1997). A primary reason for creating age-segregated housing is to facilitate casual social interaction. Interaction with age-related peers fosters an exchange of shared experiences and a support network for dealing with changes associated with aging, or just an outlet to discuss daily events. This type of interaction



has the capability to counteract loneliness and depression in the assisted living community (Regnier, 2002). Assisted living facilities provide a unique opportunity in comparison to the independent home, especially for many older adults who reside alone in compromising neighborhoods or far from family (Sloane et al., 2001).

### ***Orientation and Way-Finding***

Orientation is an important consideration in assisted living design. Residents' feeling of being lost in their environment can be frightening, cause stress and lower self-confidence (Regnier, 2002). New residents and visitors to a facility require the development of a "visual map" of the environment in order to effectively navigate it. Newcomers and those residents experiencing visual and memory problems may require assistance with way-finding. Some orientation aids include visual cues, adequate lighting and proper signage (Sloane et al., 2001).

Evidence of the importance of way-finding and architecturally legible design can be found in research conducted by Cohen and Weisman (1991). He discovered that significant problems in orientation existed among long-term care residents, citing both cognitive function and mobility impairments as difficulties in resident orientation with the environment. He found that the ability to move across a room without difficulty was as significant a factor of cognitive functioning. Latent cues or landmarks were found to be positively associated with orientation. For instance, physical aspects of the environment, such as elevators, furniture, color changes and plants, were noted as aids in orientation (Cohen & Weisman, 1987).

### ***Stimulation and Growth***

A goal of assisted living design should be to provide residents with a stimulating and challenging environment without inflicting stress or threatening safety (Sloane et al., 2001). Stimulating environments help keep older adults alert and engaged in activities (Regnier, 2002). Ideas for integrating stimulation into the assisted living environment include variations in color, pattern, and texture, and contrasts of finishes; and incorporation of areas for activities, such as pet therapy and musical performances (Regnier, 2002). A stimulating environment can also provide older adults with the opportunity for personal growth by providing access to media centers, computers, and a library (Inman & Shea, 1996).

### ***Familiarity, Personalization and “Homelike”***

Moving to a new residence is often a distressing event for older adults who have held a great attachment to their previous home. Assisted living design should seek to represent continuity between the past home experiences of residents and the assisted living experience. The facilities design should try to mirror the traditional housing vernacular of its region, and not an institutional environment (Regnier, 2002). A “homelike” environment can make the transition from home easier with decreased anxiety and depression (Sloane et. al, 2001). Residents’ units should accommodate personal furniture, pictures and keep sakes. (Imman & Shea, 1996; Sloane et al, 2001; Regnier, 2002). Since, the term “homelike” evokes an individual and personal meaning; the “homelike environment” should connect the individual with the facility (Sloan et al, 2001).

Eshelman, Evans, and Utamura (2003), found that residential features addressing personalization were important elements in housing satisfaction. In fact, “the two most important independent predictors of housing satisfaction were space for displaying personal possessions and the effective lighting of those displays to ensure they can be seen” (p.59). They link the importance of personalization of a space in creating a meaningful environment, reporting that “five of the eight most salient predictors of housing satisfaction were housing features that address meaning” (p.59).

Regnier and Pynoos (1997), write “the environment should remain as personal or individual as possible.” Personalization not only expresses the individual’s identity to others, but also solidifies the individuals own sense of identity (Regnier & Pynoos, 1997, p.46).

### ***Privacy***

Pynoos and Regnier (1997) define private space as one which provides “seclusion from company or observation where one can be free from unauthorized intrusion” (p.46). They note that privacy is most often achieved by providing an individual their own dwelling unit. Although, very frail older adults lose privacy as they require assistance with the most personal activities of daily living, the ultimate loss of privacy occurs when it is necessary to begin to share a home or room with others. Squire (2001) reports that research conducted by Counsel and Care (1992) found that

individuals in residential care settings cited the importance of “privacy, to be able to lock their room door” and to have “an en-suite bathroom” although these issues were not being addressed.

### ***Autonomy***

According to Reigner and Pynoos (1997) autonomy, control, and choice are interchangeable necessities for the positive social adjustment within the physical environment. These three concepts are the basis of independence, frequently the most valuable aspect of the frail elders’ life (Regnier & Pynoos, 1997). In a sense autonomy defines “home”. A capable individual in their own home enjoys the comfort of controlling aspects of their environment (i.e. lighting levels, temperature, privacy) and can come and go as they please. The importance of autonomy is found throughout the assisted living philosophy (Molica, 1998). However, it is not always easily adopted into practice. Autonomy is often in competition with security for the older adult. As elders increase in frailty they may need to move to more secure and supportive environments which by nature limit their choices. Furthermore, some professional caregivers find it difficult to break away from medical models of care which traditionally sacrifice autonomy in lieu of the best “medical” interest of the individual. Having autonomy means an individual is in control of life choices, even if the choice could be detrimental. Care settings based on the medical model have a difficult time allowing residents to make lifestyle choices which may be detrimental to their health (Carder, 2002).

### ***Safety and Security***

Above all else, the safety and security of residents should be emphasized. Safety is a key dimension addressed by assisted living legislation. Falls are the most frequent accident in assisted living facilities. Smooth, but not slick, flooring materials help prevent falls, as does proper lighting. Call buttons, located in the units, help residents reach staff for assistance. Fire is also a serious safety concern which is addressed in building codes which require such measures as alarms, sprinklers, multiple egress and fire-retardant materials (Sloane et al., 2001).

## ***Organizing Design Criteria for Assisted Living***

### ***Archetypal Spaces***

Research by Taliaferro (1998) has developed an archetypal place concept for assisted living private dwellings based on previous literature. She then tested her concept with the use of scale models. Participants of her study, residents of assisted living, were asked to evaluate the spaces in the models to determine their appropriateness within the assisted living dwelling unit. She found that the following categories of space should exist in each unit: Multiple rooms not shared by unrelated adults, a private and separate from sleep area, a full private bathroom, a kitchen for food preparation and dining area, storage space and a social area separate from private space (Taliaferro, 1998).

### ***Design Matrix***

Eshelman et.al (2003) took the assisted living issues and compared them against six categories of design decisions within a Design Decision Matrix. The matrix matches each of the above assisted living issues with types of design principles, such as allocation of space, spatial connectedness, finishes and furniture. The matrix takes the form of a table with design decisions running across the top and principles of design going across the bottom. In doing so, the matrix becomes an organizational tool for concept development of assisted living spaces.

### ***“Design-Relevant Tasks”***

Another research study seeking to develop systematic procedures to aid in senior housing design development was by Connell and Sanford (1997). They developed a conceptual framework which encompasses thirteen “activity domains” and forty-five specific “activities” within these domains that exist in housing design. They also developed a matrix system of organization for design criteria. Each activity (i.e. bathing) encompasses different tasks (i.e. turn water on / off) and environmental hardware implications (i.e. faucet dimensions and configuration). This work goes one step farther than Eshelman et.al’s (2003) design matrix in that it includes specific critical tasks which need to take place in each space and possible environmental attributes required to support them.

## ***Design criteria***

The following are specific design criteria that address the identified issues related assisted living in a residential model.

### ■ General design criteria

#### □ Accessibility:

- Elements which are wheelchair, scooter and walker accessible (Brummett, 1997).
- The avoidance of stairs (Barker et.al, 1995).
- Highlighted surfaces on necessary ramps, inclines and stairs (Barrick et al., 1995).

#### □ Aesthetics

- Elements for sensory stimulation such as bright colors, varied textures, and designs (Inman & Shea, 1996).
- Easily maintained and cleaned surfaces and textures (Inman & Shea, 1996).
- Elements to give a feeling of being able to control one's own territory (Inman & Shea, 1996).
- Quiet spaces free of unwanted background noise for reading, writing, or rest (Inman & Shea, 1996).
- Plants incorporated into the interior environment (Cohen & Weisman, 1991)

#### □ Walls

- Matt finishes in pale tones (Barker et al., 1995).
- No rough textures which can hurt trailing hands (Barker et al., 1995).
- Wall papers with small patterns, or light texture which are pleasing to those not visually impaired but do not impede those who are) (Barker et al., 1995).
- Wallpaper borders which can add variety (Regnier, 2002).
- Chair rails and skirting boards in a contrasting color which can serve as a navigational or directional aid (Barker et al., 1995).
- No floor to ceiling mirrors because they cause visual confusion) (Barker et al., 1995).

- No unmarked glass dividers (Barker et al., 1995).
- Doors
  - Finishes which contrast with the surrounding walls (Barker et al., 1995).
  - Contrasting hardware (Barker et al., 1995).
  - Highlighted edges with a contrasting color in case they are left open (Barker et al., 1995).
  - Door numbers about 3 inches in height, contrasting with the background (Barker et al., 1995).
  - Door numbers should be simple block letters (Inman & Shea, 1996) & (Barker et al., 1995).
- Floorings
  - Matt finishes contrasting with the walls (Barker et al., 1995; Inman & Shea, 1996)
  - No strong patterns (Barker et al., 1995).
  - Easily maintained and durable finishes (Inman & Shea, 1996).
  - Non-slip material with no loose rugs (Inman & Shea, 1996).
  - Changes in texture which aid way-finding or warn of a possible hazard (Inman & Shea, 1996)
- Ceilings
  - Matt finishes contrasting in color with the walls, having no strong pattern (Barker et al., 1995).
- Furniture
  - Finishes contrasting with the walls and floors (Barker et al., 1995).
  - Rounded edges (Barker et al., 1995).
  - Personal furniture (Regnier, 2002; & Cohen & Weisman, 1991).
- Lighting
  - Adequate lighting with easy-to-reach controls and no extension cords (Inman & Shea, 1996).
  - Switches, pull-cords, and handles contrasting with their backgrounds (Barker et al., 1995).

- Lighting controls, easily operable by the resident (Brummett, 1998).
- Pressure plate light controls which are easier to operate than switches (Cohen & Weisman, 1991).
- Windows / Natural light
  - No less than one window with a view and place to sit (Inman & Shea, 1996)
  - Skylights to increase ambient lighting (Cohen & Weisman, 1991).
  - Highlighted window edges (in case they are left open) (Barker et al., 1995).
  - Windows easily operable by residents (Regnier, 2002).
  - Windows with large and low sills (Regnier, 2002).
- Space Planning
  - Clusters of private units around public or semi-public spaces (Cohen & Weisman, 1991).
  - Activity areas with a clear differentiation of activities such as cooking, dining, hobbies and exercise (Cohen & Weisman, 1991).
  - Private spaces clearly separated within the residence (Inman & Shea, 1996).
  - Adequate space to accommodate major items of furniture that have personal meaning (Inman & Shea, 1996; Cohen & Weisman, 1991).
  - Areas to display personal items (Inman & Shea, 1996).
  - Spaces for memorabilia throughout (Cohen & Weisman, 1991; & Inman & Shea, 1996) .
  - Storage located in the kitchen, bedroom and entrance (Regnier, 2002).
- Outdoor space
  - No balconies less than 5-7 feet deep; unless French balconies, which are glass doors opening to a railing flush mounted to an exterior wall (Regnier, 2002).
  - Smooth flooring transitions into interior space (Regnier, 2002).
  - Adjacency to dwelling unit (Brummett, 1997)
  - Definition of space using plants or building configuration rather than fences (Cohen & Weisman, 1991).

- Visibility and accessibility of residents which encourages participation (Cohen & Weisman, 1991).
  - Easy observation by staff (Cohen & Weisman, 1991)
  - Raised beds to for planting and other activities (Cohen & Weisman, 1991).
  - Southern exposures (Cohen & Weisman, 1991).
  - Protection from excessive sun and wind (Cohen & Weisman, 1991).
  - Only toxic free plants and materials (Cohen & Weisman, 1991).
  - Flexible, movable seating which can be positioned for privacy, activity, sunlight and wind (Cohen & Weisman, 1991).
  - Double-functioning seating such as a low wall serving as a bench should (Cohen & Weisman, 1991).
- Way-finding
    - A theme reflecting continuity in color, furnishings, and finishes for specific areas (Cohen & Weisman, 1991).
    - Signage at a consistent height and location (Cohen & Weisman, 1991).
    - Memorable and unique landmark cues (Cohen & Weisman, 1991).
- HVAC, electrical & communication
    - Auxiliary heaters in the bathrooms where air exchange is present which prevents cold drafts) (Regnier, 2002).
    - Fresh air through the ventilation system, trickle vents and windows (Regnier, 2002).
    - Easy read controls and thermostats (Regnier, 2002).
    - Accessible outlets (Inman & Shea, 1996), contrasting with the background (Barker et al., 1995).
    - Adequate heating, cooling, and ventilation with easy-to-read-and-use controls (Inman & Shea, 1996) which are operable by the resident (Brummett, 1997).
    - Telephones with larger push buttons (Cohen & Weisman, 1991).
    - Emergency pull-cords in bathroom, bedroom, kitchen and living room (Inman & Shea, 1996).



- Heat sensors and smoke detectors in kitchen, bedroom, and living room (Inman & Shea, 1996).
- Inconspicuous access panels (Cohen & Weisman, 1991).
- Affordability
  - Elements selected within budget constraints (Inman & Shea, 1996).
- Private Dwelling Unit
  - General
    - Single occupancy resident apartments unless they are shared by choice (Brummett, 1997)
    - Residential looking finishes and furniture (Regnier, 2002).
  - Entrance
    - Significant architectural changes (Brummett, 1997) and changes in flooring materials (Regnier, 2002) to mark the transition from common to private space.
    - Accentuated doors for identification & personalization (Cohen & Weisman, 1991).
    - Slightly lowered ceiling to evoke a sense of intimacy (Regnier, 2002).
    - Alcoves for personalized art or furniture (Regnier, 2002).
    - Built-in shelves for personal memorabilia (Brummett, 1998).
    - Porch-like transitions which create opportunity to interact with people walking by (Cohen & Weisman, 1991).
    - Lights just inside the door which clearly illuminate the faces of visitors and the resident) (Regnier, 2002).
    - Side lights near the doors exterior which define the entry space) (Regnier, 2002).
  - Social area of unit
    - Separation from private areas (Brummett, 1997).
    - 3-way switches with one at entry (Inman & Shea, 1996).
    - Space for flexible furniture arrangement (Inman & Shea, 1996).

- Built-in entertainment furniture which eases access to outlets and eliminates trailing cables (Barker et al., 1995).
  - Built-in furniture should have sliding doors and rounded edges (Barker et al., 1995).
  - 5' turning radius (Inman & Shea, 1996).
  - Telephone jack near electrical outlet (Inman & Shea, 1996).
  - Adequate number of outlets supporting flexible furniture arrangement (Inman & Shea, 1996).
  - Comfortable chairs with a head rests (Inman & Shea, 1996).
  - Tables placed next to the seating (Inman & Shea, 1996).
  - Flexible space for hobbies and visiting (Inman & Shea, 1996).
- Unit Kitchen
- *General*
    - Complete accessible kitchens with sinks, refrigerators, electric stoves, ovens, countertops, homelike case work, and task lighting (Brummett, 1998; Regnier, 2002)
    - Open plans with large work surfaces which ease food preparation (Barker et al., 1995).
    - Food Preparation area (for snacks, washing dishes and other familiar activities) (Cohen & Weisman, 1991).
    - Dining locations in the kitchens as well as one other area (Inman & Shea, 1996).
    - Accessible space with 5' turning radius (Inman & Shea, 1996).
    - Open circulation areas (Barker et al., 1995).
  - *Work space*
    - Non-slippery flooring surfaces (Cohen & Weisman, 1991), wet or dry (Barker et al., 1995).
    - Non-slip, wax-free, vinyl flooring (Inman & Shea, 1996).
    - Wood-grained vinyl sheet flooring which feels residential in character (Regnier, 2002)

- Light, non-patterned flooring which helps to see dropped items (Barker et al., 1995).
- Knee space under counters (Inman & Shea, 1996).
- Rounded, contrasting counter edges (Inman & Shea, 1996).
- Multi-level or adjustable counter tops (Inman & Shea, 1996).
- Workspaces beside cook surface and refrigerator (Inman & Shea, 1996; Barker et al., 1995).
- Non-reflective work surfaces (Barker et al., 1995).
- Both light and dark colored work surfaces which provide options to prepare different foods with optimum contrast) (Barker et al., 1995).
- Neutral colored work surface if only one color available (Barker et al., 1995).
- A continuous sequence between the work surface, sink and range/oven/microwave (for transferring pots back and forth) (Barker et al., 1995).
- *Storage*
  - Lateral storage for pots and pans which prevents stooping and bending (Regnier, 2002).
  - Shallow shelving units at an accessible height, rather than units over or under work surfaces (Cohen & Weisman, 1991)
  - Roll-out shelving which prevents stooping and bending (Regnier, 2002).
  - Shelves between the counters and upper cabinets for frequently used items (Regnier, 2002).
  - Sliding doors on cabinets which reduce the risk of collision if left open) (Barker et al., 1995).
  - Accessible overhead cabinets (Inman & Shea, 1996).
  - D-shaped hardware on cabinets and drawers (Inman & Shea, 1996).
- *Appliances and fixtures*
  - Range / Oven / Microwave
    - Smart stoves that turn themselves off (Cohen & Weisman, 1991).

- Audio signals on ovens alerting that the oven is turned on and has reached its temperature setting) (Barker et al., 1995).
- Wall ovens with side-swinging doors (Inman & Shea, 1996).
- Range hoods with light sources and controls on front edge of counters (Inman & Shea, 1996).
- Large / easy to read controls on cooking appliances (Barker et al., 1995).
- Tactile and/or picture controls on appliances (Inman & Shea, 1996).
- Cook tops with front controls and master switch at back (Inman & Shea, 1996).
- Self-cleaning ovens (Inman & Shea, 1996).
- Microwaves (Inman & Shea, 1996).
- Non-glare oven lights (Barker et al., 1995).
- Non-glare range hood lights (Barker et al., 1995).
- Front operated appliances and controls (front operated), and adequate counter space (Inman & Shea, 1996).
- Refrigerator
  - Frost-free refrigerator on casters with large closed handles (Inman & Shea, 1996).
  - Adequate space for freezer (Inman & Shea, 1996).
- Sink
  - Easy to grasp sink plugs (Inman & Shea, 1996).
  - Faucet controls with two taps and lever handles (Inman & Shea, 1996).
  - Taps Located at the side of the sink (Inman & Shea, 1996).
  - Water temperature regulators (Inman & Shea, 1996).
- Lighting
  - High lighting levels (Cohen & Weisman, 1991).
  - Fluorescent overhead lighting which reduces shadows (Barker et al., 1995; Inman & Shea, 1996).
  - Natural daylight (Barker et al., 1995).
  - Incandescent task lighting over sink (Inman & Shea, 1996).

- Task lighting over dining area and sink (Inman & Shea, 1996).
- Accessible light switches (Inman & Shea, 1996).
- Strip lighting underneath wall cabinets or shelves (Barker et al., 1995).
- No exposed bulbs (Barker et al., 1995).
- **Electrical**
  - Electrical outlets at front edge of counters and above backsplashes (Inman & Shea, 1996).
  - Electrical plugs and sockets contrasting with the wall (Barker et al., 1995).
  - At least four double sockets around work tops (for safe positioning of appliances) (Barker et al., 1995).
- **Storage**
  - Overhead lighting at closet (Inman & Shea, 1996).
  - Well organized, easy-to-reach storage (Inman & Shea, 1996).
  - Sliding doors to reduce the risk of collision hazards if left open (Barker et al., 1995).
- **Bedroom**
  - Comfortable beds, chairs and tables at the sides of the beds (Inman & Shea, 1996).
  - Lighting controls, electrical outlets, phone and emergency pull-cords easily accessed from the bed (Barker et al., 1995).
  - Doors able to open wide against the walls (Barker et al., 1995).
  - Adequate storage for home entertainment electronics should be considered (Barker et al., 1995).
  - Adequate number of outlets allowing for furniture flexibility (Inman & Shea, 1996).
  - No patterned materials for bedspreads (Barker et al., 1995).
- **Bathroom**
  - **General**
    - 5' turning radius (Inman & Shea, 1996).

- 2'6" minimum door width (Inman & Shea, 1996).
- Adequate ventilation (Inman & Shea, 1996).
- Adjustable mirrors (Inman & Shea, 1996).
- Matte finishes (Barker et al., 1995).
- No coat hooks, door stops or other items protruding from the walls at head level (Barker et al., 1995).
- Non-slip surfaces (Inman & Shea, 1996).
- Outward swinging doors (Inman & Shea, 1996).
- Rubber backed washable carpeting to reduce risk of slipping (Cohen & Weisman, 1991).
- Flooring which is non-slip, water proof and easily cleaned. (Barker et al., 1995).
- Non-slip, wax-free vinyl flooring (Inman & Shea, 1996).
- Non-slip flooring which contrasts with the fixtures (Cohen & Weisman, 1991; Barker et al., 1995).
- Reinforced wall backing allowing grab bar adaptations (Brummett, 1997; Inman & Shea, 1996).
- Water proof walls with an easily cleaned surface (Barker et al., 1995).
- Grab bars contrasting with the walls (Barker et al., 1995).
- Grab bars installed beside shower and toilet (Cohen & Weisman, 1991).

- *Lighting and Electrical*
  - Lighting fixtures over the sinks, shower enclosures and one in the middle of the room (Regnier, 2002).
  - 250-watt heat lamps which provide warmth and added light (Regnier, 2002).
  - Fluorescent and incandescent light fixtures (Inman & Shea, 1996).
  - Light fixtures illuminating the users face but not visible in the mirror (Barker et al., 1995).
  - Task lighting over the sink (Inman & Shea, 1996). Protected low-voltage outlets (Inman & Shea, 1996).
  - Protected outlets at sinks accessible for wheelchair users (Inman & Shea, 1996).
  - Emergency pull-cords easily distinguished from other control cords i.e. lighting (Barker et al., 1995)
  - Emergency cords accessible from standing, sitting and lying positions, never located in the corner of the room (Barker et al., 1995).
  - Emergency call systems accessible from toilets and showers (Regnier, 2002).
- *Fixtures*
  - *Toilet*
    - Toilets located against at least one solid wall for grab bar installation (Regnier, 2002).
    - Elevated toilet seats (Inman & Shea, 1996), between 17-18 inches high (Regnier, 2002).
    - Room for transfer on and off toilet (Cohen & Weisman, 1991; Inman & Shea, 1996).
  - *Bidets* for cleanliness (Inman & Shea, 1996).
  - *Tub / Shower*
    - A 3 x 4 foot accessible shower (Regnier, 2002).
    - Seating in shower (Cohen & Weisman, 1991).

- Contrasting edges for tub which define the edge and depth (Cohen & Weisman, 1991).
- Deep soap dishes which prevent soap from falling on the floor (Cohen & Weisman, 1991 p113) Showers with thermostatic controls and a waterproof light source above it (Barker et al., 1995).
- Shower heads contrasting with the background wall (Barker et al., 1995).
- Clearly visible, shower controls, preferably with raised tactile symbols (Barker et al., 1995).
- Shower heads mounted 5 to 6 feet above the finished floor or with flexible hoses attached (Barker et al., 1995).
- Slip-proof shower floors (Cohen & Weisman, 1991).
- Tub surrounds for showers (Inman & Shea, 1996).
- *Sink*
  - Either a side entry position or a kick space under the sink (Regnier, 2002).
  - A magnified mirror for shaving or make-up application (Regnier, 2002).
  - A 30-36 inch wide three-part recessed medicine cabinet (Regnier, 2002).
  - Mirrors positioned so the user can get very close to its surface (Barker et al., 1995).
  - No vanity under the sink unless it is a roll-under type (Inman & Shea, 1996).
  - Two lever controls on the sink (Inman & Shea, 1996).
  - Water temperature regulators (Inman & Shea, 1996)



- Storage
  - Room for personal possessions including clothing, household equipment, and personal mementos) (Inman & Shea, 1996).
  - Sliding doors (Inman & Shea, 1996).
  - Secondary storage (Inman & Shea, 1996).

## Chapter Three: Methodology

The purpose of this study was to design an assisted living apartment for southwest Virginia based on relevant design criteria. Design criteria were identified through a literature search, case study findings from site visitations of five assisted living facilities, and participant preferences for simulated assisted living apartment designs. This study involved three phases: data collection, development of a design concept, and design presentation.

### **Data Collection**

This study involved data collected from two studies. The *Best Practices in Assisted Living Study in Rural Virginia*, funded by the Virginia Agricultural Experiment Station, and *Using the CAVE to Determine Residents' Preferences and Functioning in Assisted Living Private Spaces*, funded by the Andrus Foundation.

#### **Best Practices Study**

Data were collected for *The Best Practices Study* during case studies of five assisted living facilities in rural Virginia ranging in size and location. Researchers, including two faculty and three graduate students in the Department of Apparel, Housing, and Resource Management (formerly Near Environments), collected data in three different areas of the facility. Physical documentation was recorded; an environmental attributes survey was completed; interviews with the administration and staff were conducted; and photo documentation was taken of interior and exterior spaces. Data for each site were collected in a single day starting with a tour of the facility given by an administrator.

**Physical Documentation.** Physical documentation was taken of all interior and exterior areas accessed by residents. The areas around resident apartments were documented, noting the length and width of hallways, width and placement of doors, locks, lighting, seating and placement of elevators. Residents' apartments were measured noting the location and size of windows and doors (See Appendix A). Observations of flooring materials, lighting, and wall coverings were made. Special attention was given to residents' personal bathrooms, noting the location and dimensions of grab bars, toilets, and tub/showers. Locations of pull cords, electrical

outlets and telephone jacks were all noted. If the individual apartment included a kitchen, it was also measured in detail: recording cabinet and counter heights, location and type of appliances, and a description of finishes. An equipment list was also recorded noting the origin of these items being either provided by the facility or personally owned. Quick sketches of each of the apartment rooms were completed and compared with marketing floor plans.

***Environmental Attributes.*** Observations about the facility were also recorded on a standardized questionnaire. The questionnaire (See Appendix B) served as a tool to rank the “feeling of hominess” of the facility. Some aspects it addressed included overall scale, style of furniture, finishes, noise, and odors. For instance, the researcher would be asked to rank the floor covering according to its residential or institutional qualities. If the living areas were covered in industrial vinyl tile with rubber baseboards, the ranking would be “institutional.” If the flooring was a homelike patterned carpet with wooden baseboards, it would be considered “residential.” If an element exhibited both institutional and residential attributes, such as the case of a low pile patterned carpet with rubber shoe molding, then it would be ranked as dormitory. Each of the questions listed some examples of each residential, institutional, and dormitory attributes. For instance, some examples of institutional noise would be intercom and telephone systems. Residential noise would include personal conversation, music and television. A dormitory ranking would imply that each of these categories of noise were present on an equal basis.

During a debriefing meeting at the end of the data collection period, researchers went through their observation records item by item to clarify any questions regarding categorizing attributes. Dialogue was exchanged regarding classification of attributes of items not listed as examples of residential or institutional. For instance, if windows were a very large scale, non-operable and would typically fall into the “institutional” classification, but had true window panes and homelike window treatments, although not formally listed as examples of “residential”, the classification could at this time be discussed and a residential classification could be determined. After discussion of each item on the questionnaire the categorization ratings were tabulated for each researcher and recorded. Debriefing from each research group was also exchanged at this time.

**Interviews.** Interviews were conducted with the general manager, housekeeping manager, activities director, maintenance director and the manager of healthcare at each of the facilities. Interview questions sought information regarding policies, accommodation and maintenance for activity areas, outdoor spaces and resident rooms. A table describing the questions used for this study and facility responses may be found in Appendix C.

**Photo Documentation.** Digital photographs were taken of exterior and interior areas including lobbies, halls, dining rooms, nurses' stations, residents' rooms, private and public baths. These images were recorded to provide examples of findings emerging from the physical measurement, environmental attributes and interview data.

### **CAVE Study**

Data were also collected in the form of participant observations during a virtual tour of five assisted living apartments. These tours took place in the Cave Automated Virtual Environment (CAVE™). The CAVE is a virtual reality simulator powered by a supercomputer, which projects images onto three screens or "walls" and the floor of a 10' x 10' space. Images, projected in stereo are then viewed through stereo glasses allowing the user to see 3D images in full scale. For this study, a tracker on top of the glasses aided in corresponding the users head movements with a set navigation path through the virtual apartment tours. See Figure 1.



**Figure 1. Researcher and Participant in the CAVE™**

A volunteer sample of 60 seniors was used for the study. Prospective volunteers were reached through the Blacksburg Electronic Village Network (BEVnet), the Blacksburg community center senior activities office, a mailing list of retired faculty, researcher contacts, and flyers distributed throughout community buildings.

**Participants.** Criteria for individuals participating in the study were that they be 65 years of age or older, not currently living in assisted living, have 20/20 corrected vision, and have good balance. The age and housing requirement sought to assure participants were currently able to live independently. However, they may have begun to consider housing options for their advancing years. The vision criteria controlled for individual differences in visual perception of CAVE animated images. Good balance was needed to ensure a safe transfer to and from the CAVE area and to avoid motion sickness during the CAVE simulation.

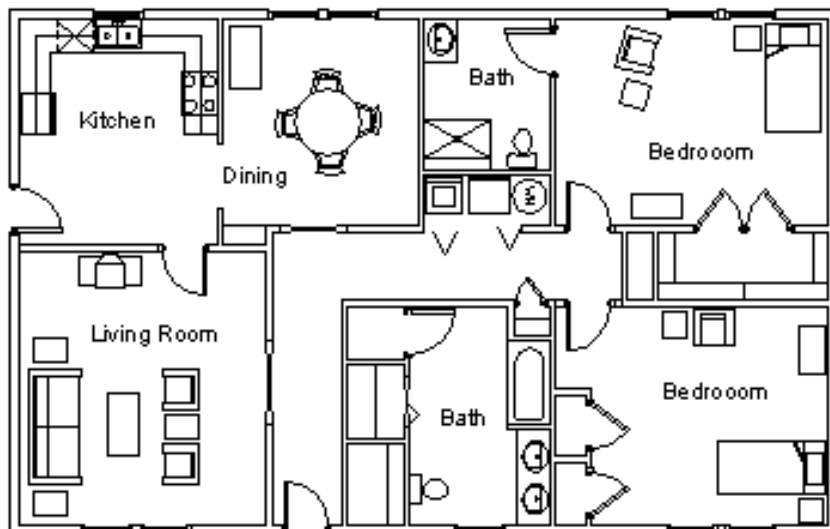
Individuals interested in participating in the study were directed to contact the Center for Gerontology at Virginia Tech and leave a daytime phone number. A research assistant then called to confirm their interest and criteria for participation. At this time a one-hour appointment was scheduled. To facilitate continuity in data collection one research assistant was responsible for all interviews and tours. Upon their arrival at the CAVE facility this research assistant presented an informed subject consent form (See Appendix D) which described the purpose of the study. After participants read and signed the consent form the research assistant explained the procedures of the study. An interview, approximately 30 minutes in length was conducted prior to the virtual tour of the models.

**Interview Schedule.** The interview schedule gathered information on participants' demographics characteristics, health, social activities, housing characteristics, and values (See Appendix E). Each participant was read the interview schedule while following along on a copy. The research assistant wrote the responses for each participant.

**Computer Generated Models.** One independent living town home, with the floor plan shown in Figure 2, was drawn to function as a reference of comparison to the assisted living apartments. Eight assisted living apartment models were developed for use in this study. The primary four models were; Social, Food Prep, Sleep and Storage.

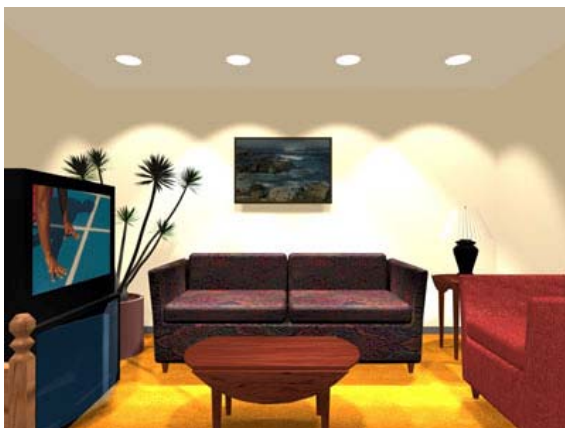
The assisted living apartments were drawn based on a range of average assisted living apartment sizes and the Virginia Department of Social Services regulations on spatial requirements for living spaces. Each apartment was 400 square feet.

**Figure 2. Independent living town home plan**



The spatial allocation between the models varied as 30 square feet was added to one space within the model. For instance, in the storage model the 30 square feet was utilized in the storage area making the storage space larger than the other models. Figures 3-5 note the differences between the remaining three models (Please note that plants and place settings were not included in the virtual tour in order to achieve a real time animation speed).

**Figure 3. Social area**



**The living area of the social model. Note added space for a T.V.**



**The living area of the other three models.**

**Figure 4. Food Preparation area**



**The kitchen area of the food prep model. Note added cabinet space.**

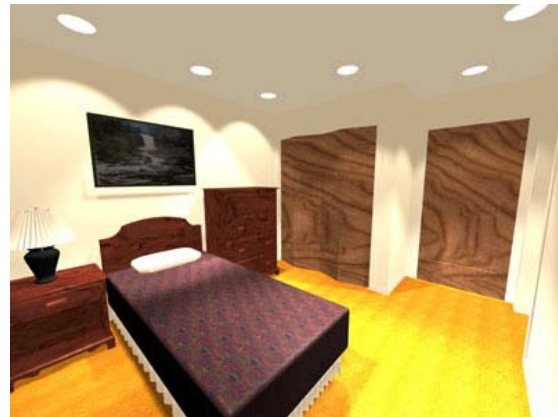


**The kitchen area of the other three models.**

**Figure 5. Sleep area**



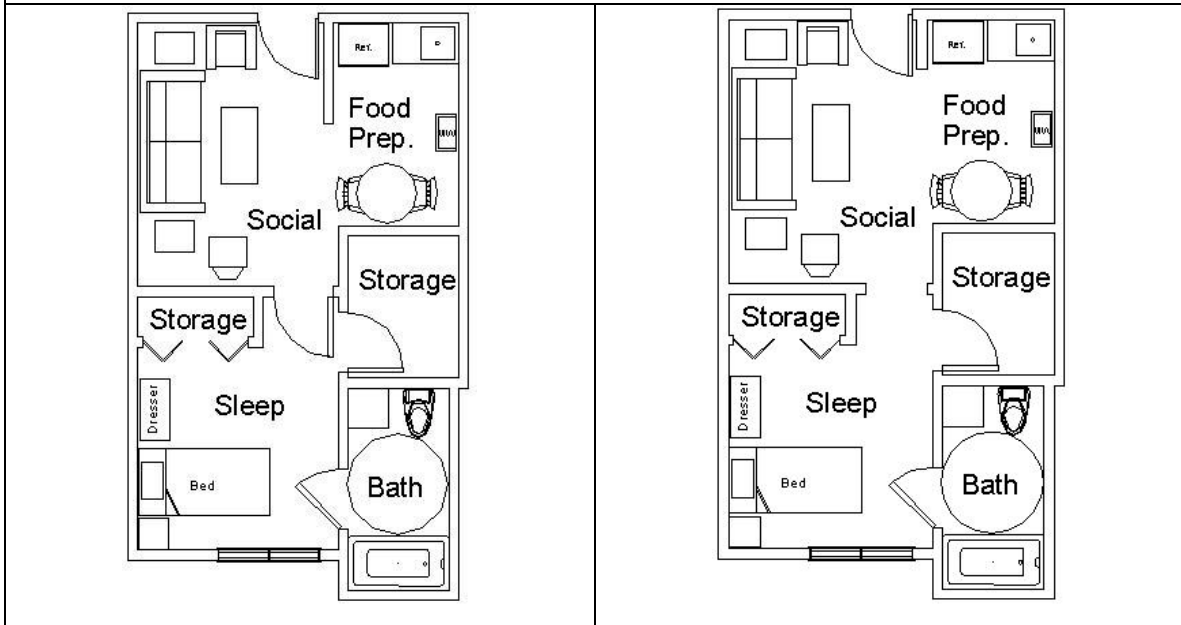
**The bedroom of the sleep model. Note the added chair.**



**The bedroom of the other three models.**

Each of the four apartment plans was then drawn with an open configuration. The open configuration differed from the closed plan in that the wall between the kitchen/dinning area and living area was reduced and the bedroom door was removed an example of this is seen in Figure 6. Figure 7 illustrates the spatial allocation for each of the apartment plans.

**Figure 6. Social model (Left) and Social model open plan (Right).**



**Figure 7. Apartment spatial allocations**

Model	Area	Open (sq. ft.)	Closed (sq. ft.)
Social	Sleeping	100	100
	<b>Social</b>	<b>130</b>	130
	Storage	60	60
	Food Prep.	60	60
	Bath	50	50
Sleep	<b>Sleeping</b>	<b>130</b>	130
	Social	100	100
	Storage	60	60
	Food Prep.	60	60
	Bath	50	50
Food Prep.	Sleeping	100	100
	Social	100	100
	Storage	60	60
	<b>Food Prep.</b>	<b>90</b>	90
	Bath	50	50
Storage	Sleeping	100	100
	Social	100	100
	<b>Storage</b>	<b>90</b>	90
	Food Prep.	60	60
	Bath	50	50



***Virtual tour procedures.*** Upon entering the CAVE simulator with the research assistant each participant was seated in the middle of the simulation area. The participant's chair location was marked by an overhead reference point, as well as a point on the floor, to assure that each participant viewed the tours from the same location. The research assistant was seated in an identical chair beside the participant. The research assistant was seated to the left of 59 participants and to the right of one participant to accommodate for hearing loss in that participant's left ear. To control for variations in the paths of the individual model walkthroughs a set navigation was utilized. Prior to loading the first model a tape recorder was turned on to record participant responses during the tours. Participant responses were also recorded by hand on the CAVE Procedures Form, which provided scripting text for the tours (See Appendix F).

The order in which the models were shown was also constant for each participant. The townhouse was shown first, as an example of how spaces look in the CAVE, and thus controlled for any distractions caused by exposure to a new technology. Participants were encouraged to comment on the space; however, comments on this space were not considered in the study. At the end of the townhouse tour, the participants were read a scenario in which they were asked to imagine that they had become frail and wished to move into an environment that would better accommodate their changing needs. Tours of the four assisted living apartment closed plan models were then shown. During each of the tours the participants were asked to make comments on each of the rooms during set navigation stops. Participants were asked if the space in each of the rooms was appropriate for the respective activities in that room. After touring each of the four closed plan apartments, participants were asked to choose which of the plans they preferred. After the decision was made, the open plan version of the preferred plan was shown. The participants were asked whether they preferred the open or closed plan and to describe the reasons for this preference. Following the conclusion of the CAVE simulation tours, participants were asked four questions regarding their views of assisted living as well as the CAVE simulation viewing experience. All dialogue between the participants and interviewer was also recorded on audio tape and later transcribed.

### ***Development of a Design Concept***

In order to develop a design concept and programming requirements for an assisted living private dwelling unit that were pertinent to user needs, criteria gained from the two studies and the literature were evaluated. Physical documentation, environmental attributes, and interview findings collected during the *Best Practices* study, were examined for underlying design criteria supporting that found in the literature. *CAVE* study participant comments on the design aspects of the simulated apartments were also examined in terms of design criteria found in the literature. These two lists of criteria were then compiled, citing any discrepancies, additions or subtractions to those found in literature. Criteria of the resulting list were evaluated in terms of their relationship to specific archetypal areas of an assisted living private dwelling, and design-relevant tasks performed there. A design matrix was then used to organize the criteria. For an example of this see Appendix G.

### ***Design Development***

The design process for this project evolved in the following order:

1. Development of a design concept
2. Development of program requirements
3. Development of a visual identity for the unit
4. Design of the interior space including:
  - space planning to meet program requirements
  - selection of materials (lighting, furniture, and accessories)
  - verification of code compliance

### ***Design Presentation***

The final design is presented using the following:

- Floor plans, elevations, and detail drawings
- Materials boards of finishes, furnishings and accessories
- Isometric drawings

## Chapter Four: Findings

Data collected on assisted living private spaces through the *Best Practices* and *CAVE* studies are presented in this chapter. These data, along with criteria found in chapter two, were used to develop a design concept for an assisted living private dwelling unit.

This chapter is presented in three sections. The first section presents findings from the *Best Practices* case studies, including site physical documentation, environmental attributes, and staff interviews. The second section presents findings from the *CAVE* study regarding participant preferences, and comments about assisted living apartment designs. The final section compiles findings from these two studies with design criteria for assisted living private spaces found in the literature review. The resulting compiled list will then be utilized to form a design concept of an assisted living private dwelling unit in chapter five.

### ***Case Study of five Assisted Living Residences***

Five assisted living residences varying in size and location across Virginia were visited. Four of the five facilities offered only one private apartment option, the exception offered five. The following paragraphs offer general descriptions of the participating facilities.

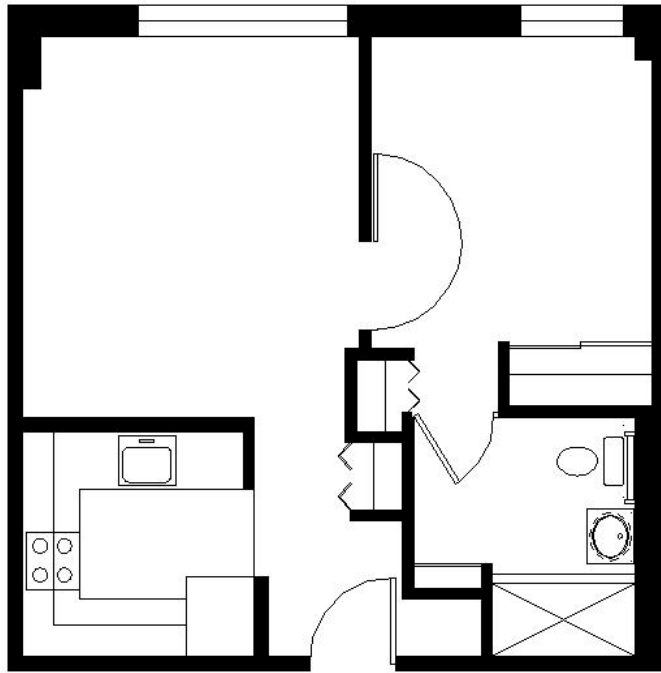
#### ***Description of Facilities***

***Culpepper Gardens.*** Culpepper Gardens was the only facility located within an urban environment, as well as the only high rise structure. One of its most distinguishing characteristics for the purposes of this study was the open kitchen offered in each assisted living apartment. The total size of this resident apartment was about 441 square feet. Figure 8 illustrates the exterior of the building, as well as the floor plan for the resident apartments.

**Figure 8. Culpepper Gardens**



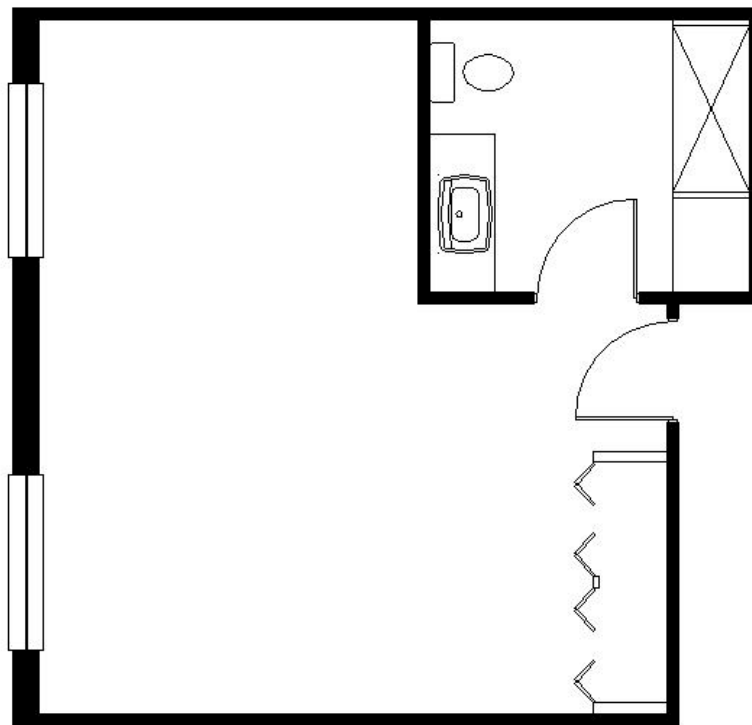
**Exterior View**



**Apartment floor plan.**

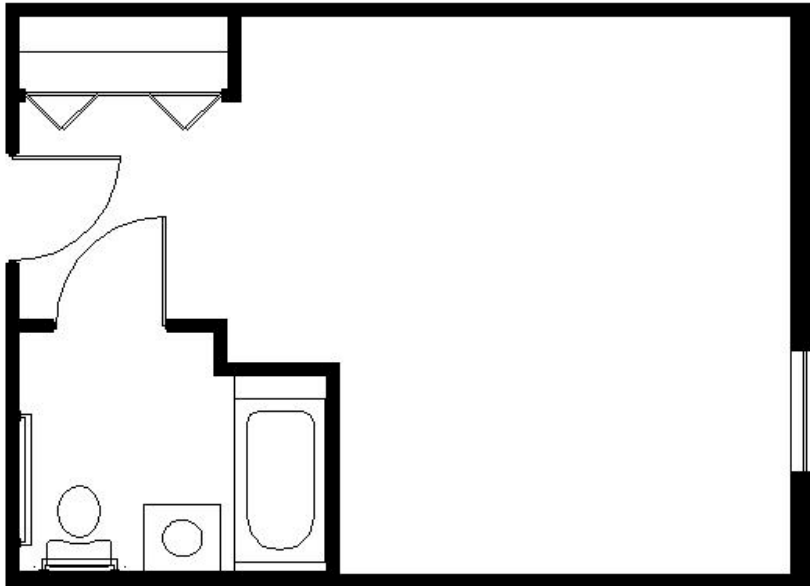
***The Oaks at Richfield.*** The Oaks at Richfield was located in a retirement community in a suburban/rural area outside a small city. It is a one story facility and has a maximum capacity of 90 residents. Figure 9 depicts the exterior of the facility, as well as the observed resident apartment floor plan, depicting emergency pull-cords. The total square footage for the apartment is 380.

**Figure 9. Exterior view and resident apartment floor plan of the Oaks at Richfield**



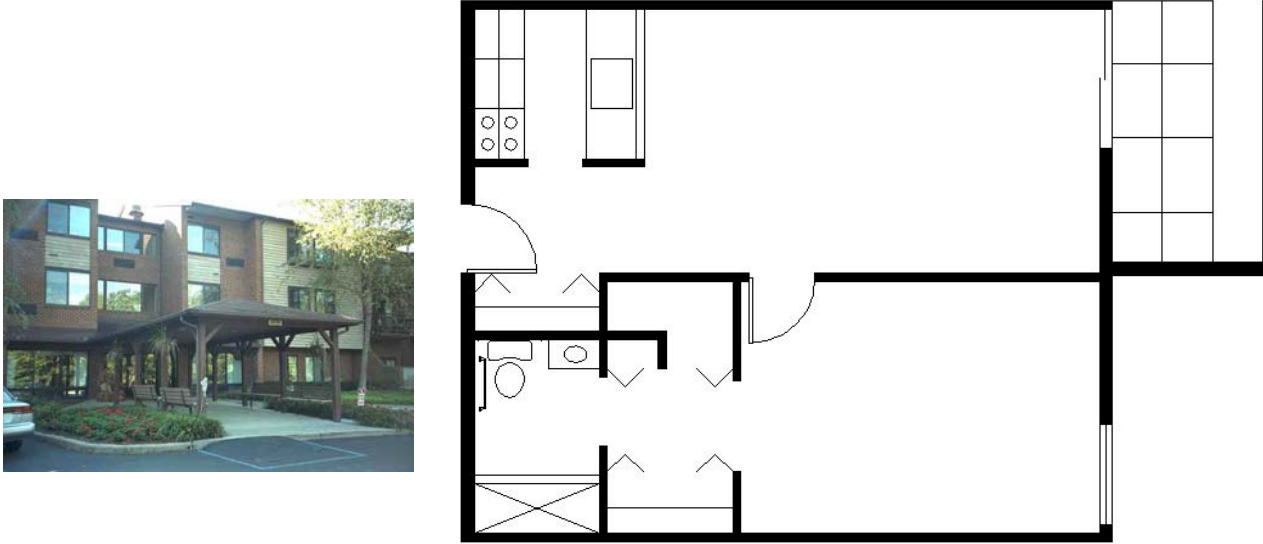
**Hickory Hill.** Hickory Hill is the only facility located in a rural area. The facility is one story and with a 60 resident capacity, and it was the smallest facility in the study. This facility's façade and resident unit floor plan are presented in Figure 10. The total square footage for this private dwelling unit is 315.

**Figure 10. Exterior view and resident unit plan of Hickory Hill**



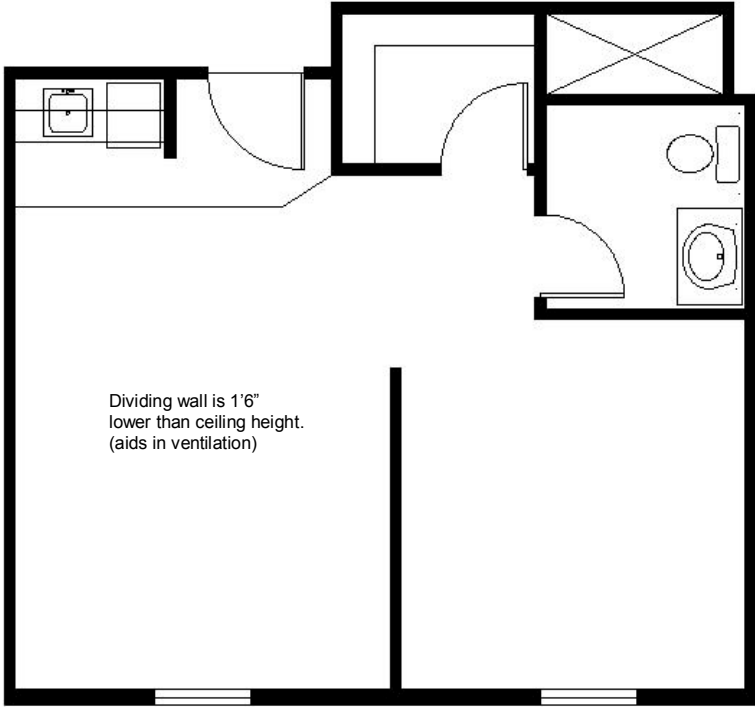
**Park Oak Grove.** At the time of this study this facility was occupied by 103 residents. It is located in a suburban area of a large city. The apartment unit observed had a total area of 550 square feet. Figure 11 shows the facilities exterior, and the smallest of five private apartment floor plan options.

Figure 11. The Park Oak grove exterior and resident apartment floor plan.



**Wheatland Retirement Community.** This facility is located in a commercial area of a town. The observed apartment was 518 square feet. Figure 12 shows the exterior of the facility as well as the floor plan of the observed unit.

Figure 12. Exterior view of Wheatlands and floor plan of a resident apartment.





### ***Areas Outside Private Dwelling Unit***

In order to glean insight into spatial allocation within assisted living private dwelling units, it is useful to examine what spaces are offered within the greater facility and community of observed sites. For instance, if external storage and activity facilities are provided, then including these spaces into the private unit becomes less critical.

**Storage.** All facilities had some provision for external storage in varying degrees. All five sites provided libraries to store and provide unlimited access to books and magazines. Each of the facilities also stored recreational equipment for residents' use; however, this equipment may or may not be available to residents at all times and without supervision. All but one site provided storage of hobby equipment for the residents' use. While half of the facilities made storage provisions for residents' personal hobby equipment, none of the facilities provided a locked storage unit for resident's personal belongings.

**Activities.** Activity rooms were observed at each of the five facilities, and were where scheduled and supervised activities occurred, ranging from bingo and parties to religious services and performances. Two of the facilities provided scheduled indoor gardening. All except one facility provided access to a kitchen for cooking and baking, two of these facilities allowed residents unlimited access to the shared kitchen. Each facility provided at least limited access to a kitchen area for snacks and drinks between meals. All five provided access to laundry facilities for personal laundry and encouraged able residents to participate in daily housekeeping duties for themselves and others. Three of the five facilities reported residents caring for either personal or shared pets. Each of the sites visited offered unlimited access to at least one outdoor area for residents to sit and / or stroll. All but one offered an outdoor area for residents to garden and participate in other recreational activities. The majority of facilities indicated at least some resident participation in activities beyond the facility.

### ***The Private Dwelling Unit***

Each of the facilities visited encouraged single occupancy, while making double occupancy provisions for residents desiring to share a unit or to cut costs with conjoined units. Provisions for privacy were made in each case to accommodate intimacy within the unit. Access to a resident's private dwelling unit was never unlimited to staff who in

all cases were required to knock prior to entering and in most were obligated to wait for an permissive response to come in.

**Materials and Finishes.** All except one facility reported that incoming residents utilize existing finishes; the exception allowed the resident or family member to choose finishes. Finishes ranked lowest of any category on the environmental attributes scale. Private unit wall finishes were almost unanimously ranked institutional across each facility. The only exception was one facility which researchers ranked between residential and dormitory; this facility utilized a wallpaper boarder. Each of the other facilities used white or light beige flat finish wall paint with no detailing. In one case the flat paint was reported to mar easily. Low-pile commercial carpet was used in each of the resident units and was reported as a cleaning challenge in two cases. However, one facility reported that the carpet was nine years old but wearing well. Staff at one facility reported the carpet was difficult for residents to walk on.

**Entrance.** Personalization of private unit entrances was universal throughout each site visit. Most commonly wreaths and other decorative details were used to distinguish units' doorways along the hall, nameplates were also used. Each of the facilities provided locks on private unit doors, although one required a request from the resident to do so. One facility provided peep holes in residents' doors at two levels to accommodate a standing individual or someone seated in a wheelchair and another provided door knockers

None of the researchers gave the entryways of any facility a low rating on the Environmental Attributes Scale. One unit entrance was ranked unanimously as having a dormitory appearance, while the others were rated highly residential. Finishes used in the hallways of each facility were rated unanimously as dormitory in style.

Entrance widths ranged from 33" to 36". The entrance to resident units in half of the facilities were mounted flush with the hallway; while the other half utilized alcoves inset from the hallway for pairs of entrance doors. Examples of these two entrance types may be seen in Figure 13.

There was no correlation between types of unit entry and the lighting used in them. One type of entrance utilized fluorescent ceiling grid fixtures above the door, compact fluorescent wall sconces and compact fluorescent ceiling cans in the hallway

while daylight illuminated the ends of the hall (a reported source of glare). Another alcove entrance used only fluorescent ceiling grid fixtures. In turn, one flush mounted entrance used both a fluorescent grid and incandescent wall sconces; while the other used only incandescent ceiling fixtures.

**Figure 13. Two types of apartment entries**



Resident doors flush with the hallway.



Resident doors inset into an seating alcove.

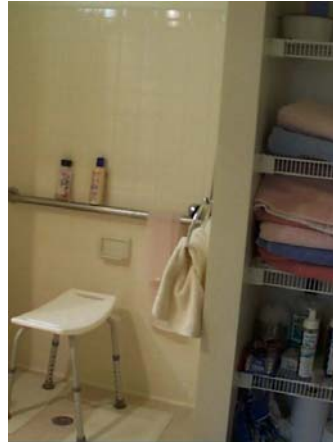
**Bathroom area.** In four of the five facilities the floor plan was arranged with the bathroom as a separate room within the bedroom area. This means that any visitor in need of the bathroom would have to proceed through the most private area to access it. All facilities' unit bathrooms were equipped with emergency pull cord call systems located between the toilet and sink, or between the toilet and shower / tub. Finish materials were either shiny vinyl tile or matte ceramic tile. Toilet seat heights ranged from 17" to 19 ½". All except one facility provided standard grab bars adjacent to the toilet.

Only one facility incorporated a roll-in shower to accommodate independent access for an individual in a wheelchair which was equipped with matt textured ceramic tile flooring, shower seat and surrounding grab bar (See Figure 14.). Two other facilities had transfer showers with a 3 ¼" lip above the floor (See Figure 15.). The remaining facilities offered smooth or lightly textured, molded fiberglass tubs. All facilities offered grab bars, although of varying sizes, in the shower.

**Figure 14. Roll-in shower, smooth transition with the floor**

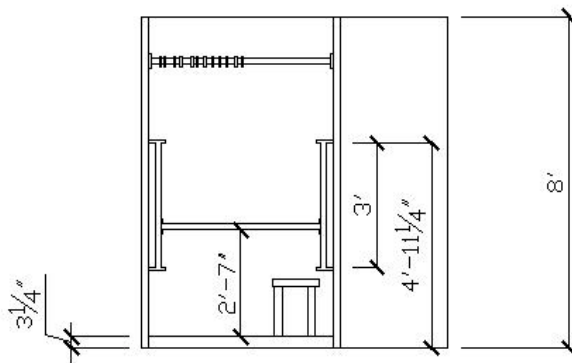


**Roll-under sink, tilted mirror and wrap-around grab bar in shower**



**Identical roll-in shower as left with seat and open storage shown.**

**Figure 15. Two examples of transfer showers**



**Note the vertical grab bars, seat is removable.**



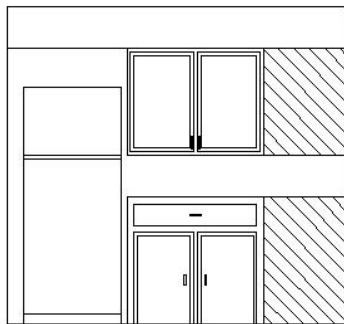
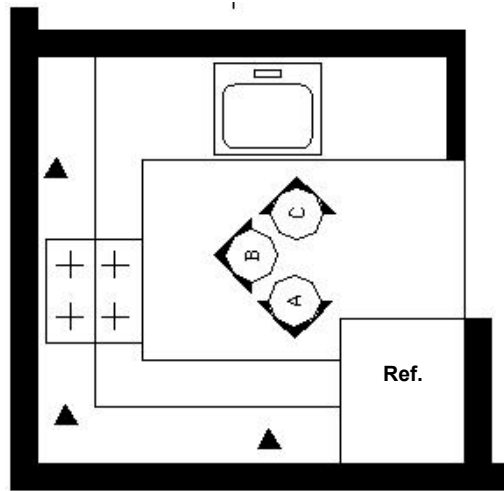
**The seat is permanently attached to the wall, but no grab bars.**

**Kitchen area.** Three of the five observed residences provided a food preparation area within the private dwelling unit. One facility provided residents with a kitchenette (See Figure 16) which included a one-wall built-in unit consisting of an under-cabinet refrigerator, microwave and entertainment size sink. The floor plan in Figure 12 shows the kitchenette location within the apartment. Two facilities included a full kitchen in the design of the private dwelling unit. The facilities which offered a full kitchen provided a 20" slide-in range, a 28" refrigerator, and a garbage disposal for each private dwelling unit. Both plans provided a clear space under the sink. Neither kitchen had a window, however, one provided an open kitchen plan which allowed natural daylight into the space via the living area. This design also provided roll-under counter space adjacent to the sink. A floor plan and elevations for this kitchen design is shown in Figure 17. The design exhibits several universal design features, such as a sink and lowered counters with knee space and lever handles. In order to accommodate some residents whose unlimited access to a cook top could cause safety concerns, a circuit breaker can be used to temporarily disable the range without the need to remove it.

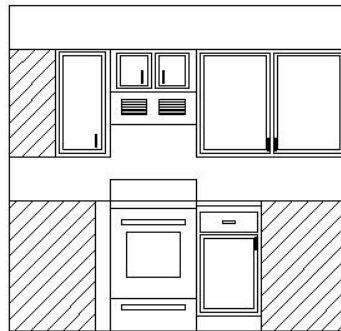
**Figure 16. Unit Kitchenette**



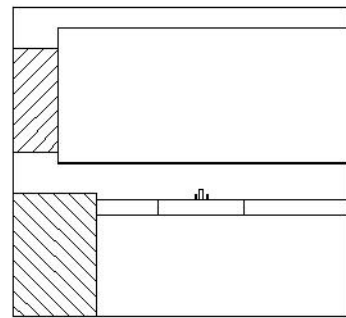
Figure 17. Culpepper Gardens Private Resident's Kitchen



Elevation A



Elevation B



Elevation C



Two point perspective of elevations A & B.



Roll-under sink & counter, open to living room.

**Social area.** Two of the facilities provided a social area within the dwelling unit which was separate from a private /sleeping area. The other three facilities, which did not include a separate social area, provided space allocation for a sitting area within the sleeping area.

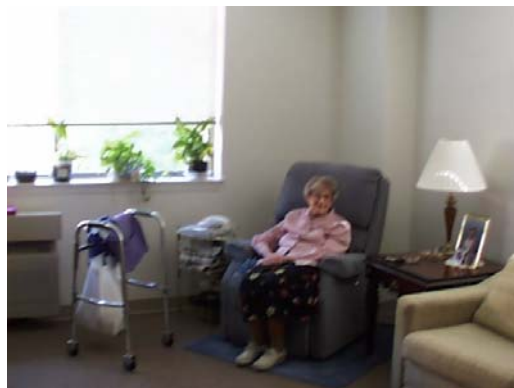
All five facilities provide unfurnished apartments allowing residents to bring furniture from their previous homes, with one facility reporting provisions to provide furniture for residents at their request. The majority of the facilities utilized existing finish materials rather than allowing the resident to select them. All five facilities reported the great majority of their residents own a personal television.

Each facility provided a window in the social area. The largest was 7'w x 5'h and included a ledge for growing plants or displaying memorabilia (See Figure 18). However, Artificial lighting varied among the units. Three utilized incandescent ceiling mounted fixtures for the main source of light within the social area, while two utilized overhead fluorescent fixtures.

**Figure 18. Facility's windows with ledges.**



**Empty apartment window with ledge (HVAC and window treatments shown).**



**Occupied apartment with plants and memorabilia on the window ledge.**

**Sleep area.** There were many similarities between the five facility resident sleeping areas. For instance, each of the facilities provided a window in the sleeping area for access to natural light and a view outdoors. One facility included a window ledge for growing plants or a display of memorabilia. Window treatments included the use of mini blinds, vertical blinds and fabric valances. Each also provided access to an emergency call system from the area. All walls were painted in a flat finish of a light color. Low pile, no pattern carpet was used on all floors.

**Storage.** All except one of the facilities provided storage at the entrance of the private units as shown in Figure 19. All had closets adjacent to the sleep area of the unit. Two had walk-in storage closets. One design, shown in Figure 20, combined a walk-in storage area with separate linen cabinet between the bedroom and bathroom.

**Figure 19. Two examples of entryway storage.**



**Closet at entryway of unit.**



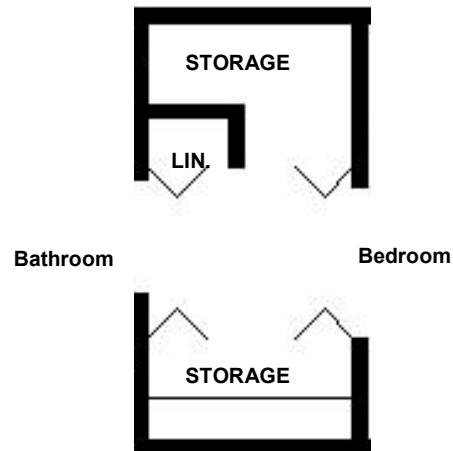
**Storage unit adjacent to entryway of unit.**



**Figure 20. Example of storage solution**



**Linen storage with bi-fold door open.**



**Adjacency of storage within the apartment (LIN depicts linen storage at left)**

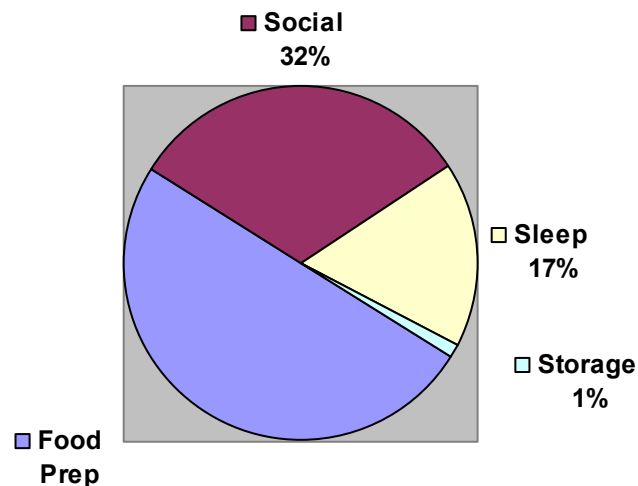
### ***Preferences Toward Assisted Living Private Apartment Designs***

The above findings describe physical observations of assisted living apartments as part of occupied facilities. However, data collected during the CAVE study provided insight into preferences of potential assisted living consumers. Although none of the participants of the CAVE study were current residents of assisted living, they were chosen to participate based on their age. As adults between the ages of 65 and 83 they were considered to be a cohort who might consider assisted living as a housing option. It was found that 91% of the sample had visited an assisted living facility and 85% of the sample thought it at least somewhat likely that they would make the move to assisted living in their future. The following findings describe their preferences and comments toward the assisted living apartment model designs.

### **Model Preference**

The Food Preparation model, which had the larger kitchen area, was the CAVE model most preferred. The Social model, which was the only model to show a television, was preferred by a third of the respondents. The Sleep model, which offered a larger bedroom with a chair, was less preferred than the first two, while only 1% of respondents preferred the Storage model, which had a larger storage area. The chart in Figure 21 describes the percentages of the model preferences. A large majority of respondents (91%) preferred the open version of their chosen model, in which the social area was open to the kitchen area and no bedroom door was present. For floor plans of the models refer to Appendix H.

**Figure 21. Model Preferences**



### **Respondent Comments**

The most common comments given during the virtual tours were on the size, lighting, and appliances in the assisted living units. The majority of participants commented that the apartment was too small. However, it was usually appropriate for area-relevant tasks. The majority of participants commented correctly on where the floating 30 square feet of space was allocated. Further, the comments on these larger areas were more positive, except for the larger storage area which was seen as too

large. Some suggestions for a better allocation of the storage space was to use some for a desk / computer area or for a sleeping alcove for an overnight guest. Seventy-two percent commented that more lighting was needed in at least one room. Of these, 23.5% saw a need for more window space in the social and kitchen areas. The need for both natural lighting and ventilation were cited as reasons for added windows, as the apartments only had one window located in the bedroom. Many participants expressed a desire for a cook top and/or conventional oven which was not present in any model. Others commented that the furniture style was unattractive. Despite negative comments the majority of participants rated the spaces as appropriate.

### ***Compilation of Design Criteria***

In compiling the design criteria found in these two studies, the criteria list in the Chapter 2 literature reviews is supported. In most cases the facilities visited in the *Best Practices* study incorporated suggested industry criteria for assisted living design in their private dwelling units. Because facilities were not chosen solely for their unit designs, not all suggested design criteria were observed. For instance, although literature recommends a window in every room of an apartment none of the visited facilities meet this implication. Each of the facilities had natural light on one side of the unit only. All of the units observed had double loaded corridors with only one exterior wall, a commonly used and economical construction method. Although finishes observed during site visitation met literature requirements for visual acuity of color and pattern, they were ranked very low on the Environmental Attributes Scale. Each apartment observed had a smaller overall square footage than suggested Northern European square footage models for apartments, yet was larger than the *CAVE* models (400 sq.ft.). Therefore, comments from the *CAVE* participants that the apartments were too small are consistent with suggestions for larger square footage found in the literature review, as well as the *Best Practices* apartment measurements. One further discrepancy occurs in that only two of the five facilities visited had a full kitchen, including a cook top. The *CAVE* study showed an overwhelming majority preference for the model with the larger kitchen and many participants commented on their desire for a

cook top. Literature suggests including a full kitchen in assisted living apartment design.

## Chapter Five: Concept Development and Design Presentation

Findings from the literature, the *Best Practices Study*, and the *CAVE* study were used to provide a basis for the development of the following design concept. The following is a description of the design concept and a presentation of the design. The design concept for this project draws from the findings discussed in Chapter 4 as well as the list of design criteria in Chapter 2. This project seeks to employ those findings into an assisted living facility private dwelling unit based on user needs.

### Concept Development

The following describes the process involved in programming for this project.

- Functional requirements and spatial allocation were established.
- An appropriate square footage for the assisted living dwelling unit was determined.
- A footprint and floor plan was designed to maximize natural light, economy and unit adjacency.
- Appropriate finishes and furniture were selected.
- A lighting scheme was developed.
- The project was assessed for conformity with ANSI requirements for multi-family housing and fair housing requirements.

### ***Spatial Allocation and Adjacencies***

The following describes considerations in determining the spatial allotment to perform required functions within the areas of an assisted living private dwelling unit. The adjacency requirements of these areas are also examined.

***Kitchen / Food Prep.*** Due to the majority preference toward the Food Preparation model of the *CAVE* study and participant preferences to have a cook surface, it was determined that space for a scaled down full kitchen would be incorporated into the design. Space for adequate storage and counter space at the appropriate heights for accessibility were also considerations for this space. The location of the kitchen / food prep area should be adjacent to that of the dining area.

**Storage.** Because storage space was given very little preference and in some cases even regarded as too expansive in the CAVE study, it was not given a large allocation of space in this project. Large storage areas were not predominately featured in the *Best Practices* study either. However, the study did reveal a consistency in placing storage at the entrance and adjacent to the sleeping area. In light of the literature review, storage should be present in each of the unit's activity areas.

**Bedroom / Sleep.** Spatial allocation for the bedroom started with the minimum square footage requirement in Virginia, which is 100 square feet of sleeping area. It also sought to include space for a chair, as a result of the CAVE study finding that an addition of a chair in the Sleep model greatly improved participant satisfaction with the space. According to literature, a resident managing incontinent behavior should be able to see the bathroom from their bed. Literature also states that the sleeping area should be a private area separate from the rest of the unit.

**Dining.** Based on recommendations in literature and the CAVE study, which provided an eating area in the kitchen, allocation of space for a dining area was considered. In each of the *Best Practices* facilities that provided a food-prep area, space for a dining table and chairs were also provided. A table and chairs were shown on plans of suggested furniture options within these facilities' brochures.

**Bathroom.** Spatial allocation for the bathroom included an accessible shower unit and a raised toilet. Also of concern was including front and side transfer space to the toilet from a wheelchair or scooter.

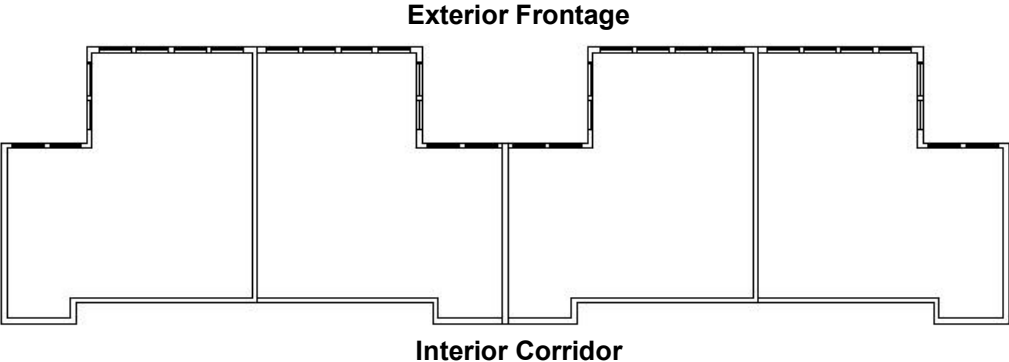
### **Unit Footprint**

. Since CAVE study findings and the literature suggest private full kitchens are an important aspect in assisted living design, an average square footage was taken of the two *Best Practices* facilities which possessed private, full kitchens and was found to be 446. The resulting area was rounded to 450 square feet for this project.

The building footprint was designed with three objectives in mind. The first was to incorporate as much natural light through window space as possible. This criteria was prevalent throughout literature and the CAVE study. The second goal was to develop a unit shell which would provide an effective and interesting fit with other units and / or public rooms and the exterior environment. Finally, the footprint was

conceptualized to be an affordable solution. An illustration of how these objectives were implemented is seen in Figure 22. Note the maximum window frontage without a long linear expanse. Also, the grouping of fixtures and utilities on neighboring walls reduces construction cost. The footprint also creates the opportunity for an entrance alcove, shared by two mirrored units off the interior corridor.

**Figure 22. Unit footprint and clustered units**



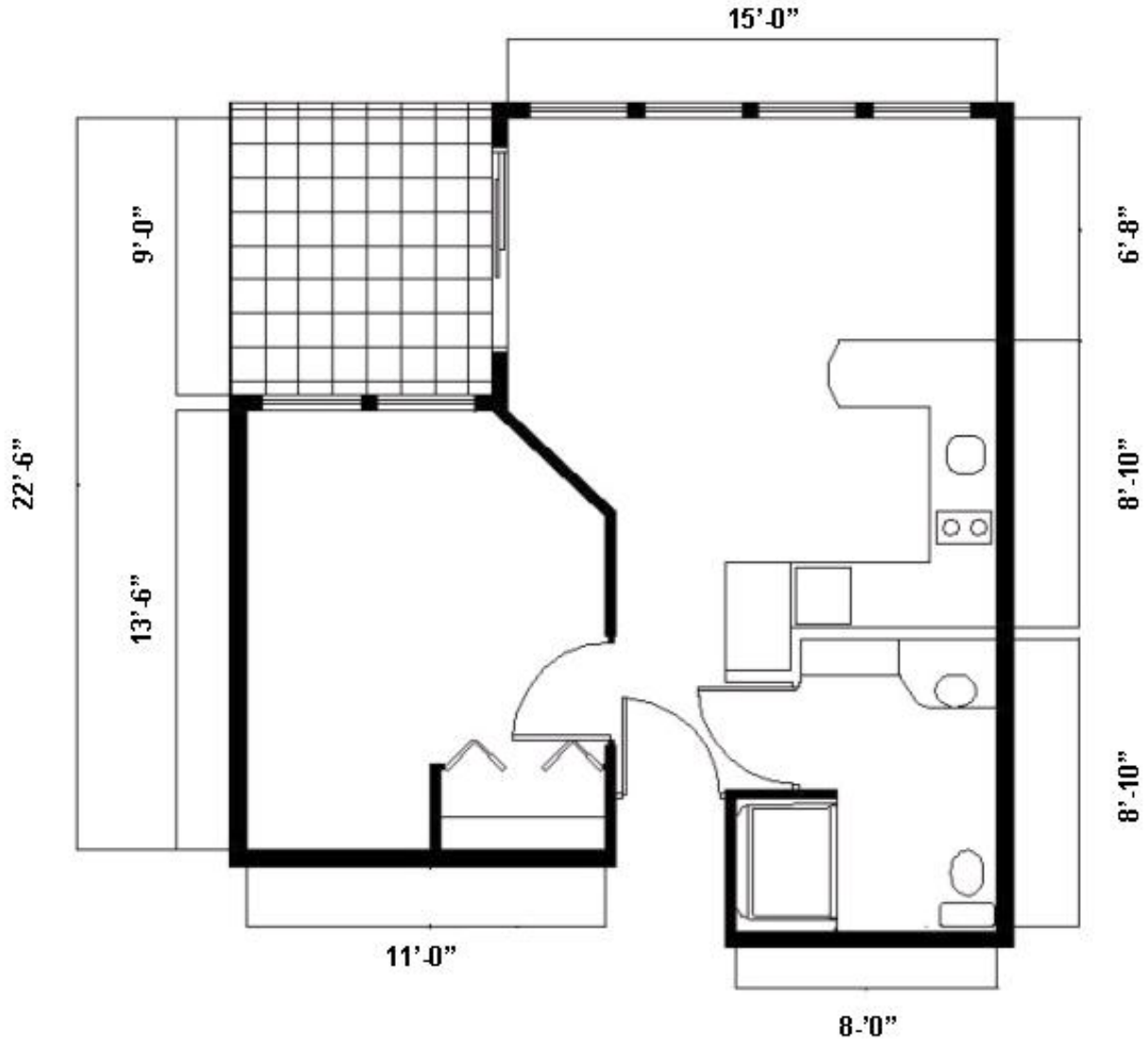
***Floor Plan***

The maximization of window area was key in the floor plan design. After examining the spatial requirements and the footprint considerations the following floor plan was developed (See Figure 23). Natural light is present in each of the rooms, except for the bathroom. The open configuration between the kitchen and living area allows for the maximum amount of natural light to diffuse into the space. A perspective of the living area windows is seen in Figure 24. While a roll-under counter allows for flexibility between work space and dining area.

The “L” shape footprint allows the formation of an outdoor patio, which would be protected by the building on three sides. The idea behind this configuration is that clusters of units could surround a shared outdoor courtyard adjacent to the semi-private patios. Patio doors may be locked without blocking the main egress if wandering becomes an issue for the resident. An angled wall and nook in the bedroom provide visual interest and varied options for furniture arrangement. The bathroom’s entrance is separate from the bedroom to alleviate the need for guests to pass through it, thus

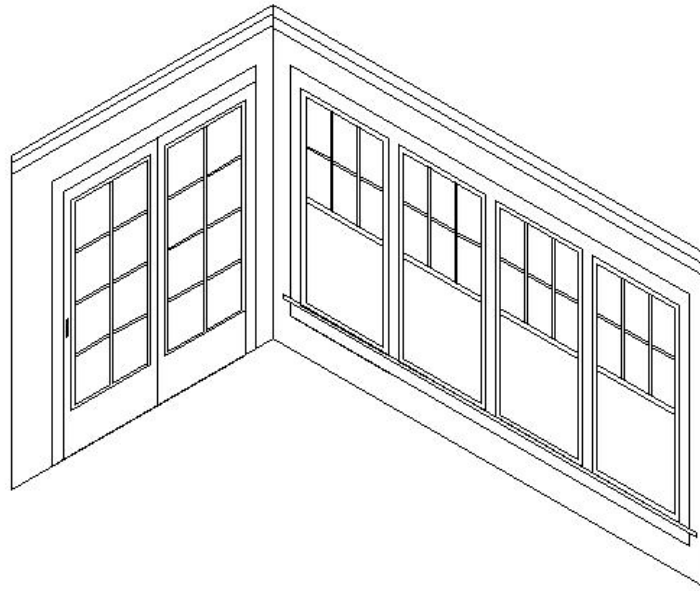
preserving the maximum amount of privacy. The bedroom is however located across the hallway from the bathroom in the event that visual cuing is needed.

Figure 23. Unit floor plan





**Figure 24. Social area window configuration**



### ***Finishes and Furniture***

**Floors.** As a result of their low ranking on the *Best Practices* Environmental Attributes Scale special attention was given to finishes. Commercial carpet, as the unanimous choice for flooring in private unit social and sleep areas, was seen as institutional and was sited as difficult to keep clean. Hardwood flooring, listed as an example of residential on the Environmental Attributes Scale was not observed in any of the site visits. Expense and maintenance are predicted reasons not to specify this material. However, sheet vinyl flooring and laminate options open up the possibility of the visual interest of hardwood floors with ease of maintenance and affordability. It may be installed throughout the space as a seamless transition option. Inlaid with a contrasting color around built-in cabinetry, it provides visual clarity an added safety feature.

**Walls.** Flat paint was found as the finish of choice for dwelling unit walls in each site visit, the CAVE study, and literature. Although light colors are preferred for older adults, stark white has a clinical / institutional feel. A pale, warm tone is a better choice. Slight variation in color and pattern between spaces can create visual interest without visually distracting or confusing the visually impaired adult. A good contrast between wall color and entities within the room also aids to safety and usability. An example of the lack of such contrast was seen in the CAVE study as some participants were unable to perceive a lampshade that was a similar color as the walls. Eggshell paint with a very slight sheen may be utilized without a glare threat if used in a properly lit room, yet it is easier to keep clean than flat paint.

**Built-ins.** Natural wood cabinetry evokes a feeling of home versus the institution. Wood laminate or synthetic laminate products may be used as a more cost effective alternative and the latter may ease maintenance as well. Cabinet doors may be easily and inexpensively painted a color contrasting color to prevent collision accidents. Edges of countertops should also be accented with a color contrasting color the floor and the overall counter color. This may be easily achieved with the use of synthetic solid surface of laminate products.

**Furniture.** Findings from each aspect of this study pointed to the importance of residents selecting and bringing their own personal furniture from their homes. Thus, for the purposes of this project photographs and measurements were taken from a participant who had begun to consider assisted living as a housing option. The participant, a Caucasian married woman over the age of 65, was visited by the researcher and asked to determine which pieces of furniture she would require, both of necessity and because of sentimentality, if she were to make the move to assisted living. Figures 25-27 present the furniture considered. Those pieces chosen for the plan are noted by their numbers corresponding to the furniture plan in Figure 28. In addition to these pieces, a built-in entertainment center was added in the living area following the suggestion in literature that it would house potentially hazardous and unsightly cords.

**Figure 25. Living room furniture which would be required.**

		
<p><b>2 wing chairs (needed)</b> 28" x 34"</p>	<p><b>Small table &amp; Lamp (needed)</b> 27" x 13"</p>	<p><b>Small cabinet (sentimental)</b> 21" x 13"</p>

**Figure 26. Existing bedroom furniture**

		
<p><b>Dresser (required)</b> 39 1/2" x 17 1/4"</p>	<p><b>Double bed (would only need twin)</b> <b>and two night stands</b></p>	<p><b>Dresser (Not required)</b> 39 1/2" x 18 1/2"</p>

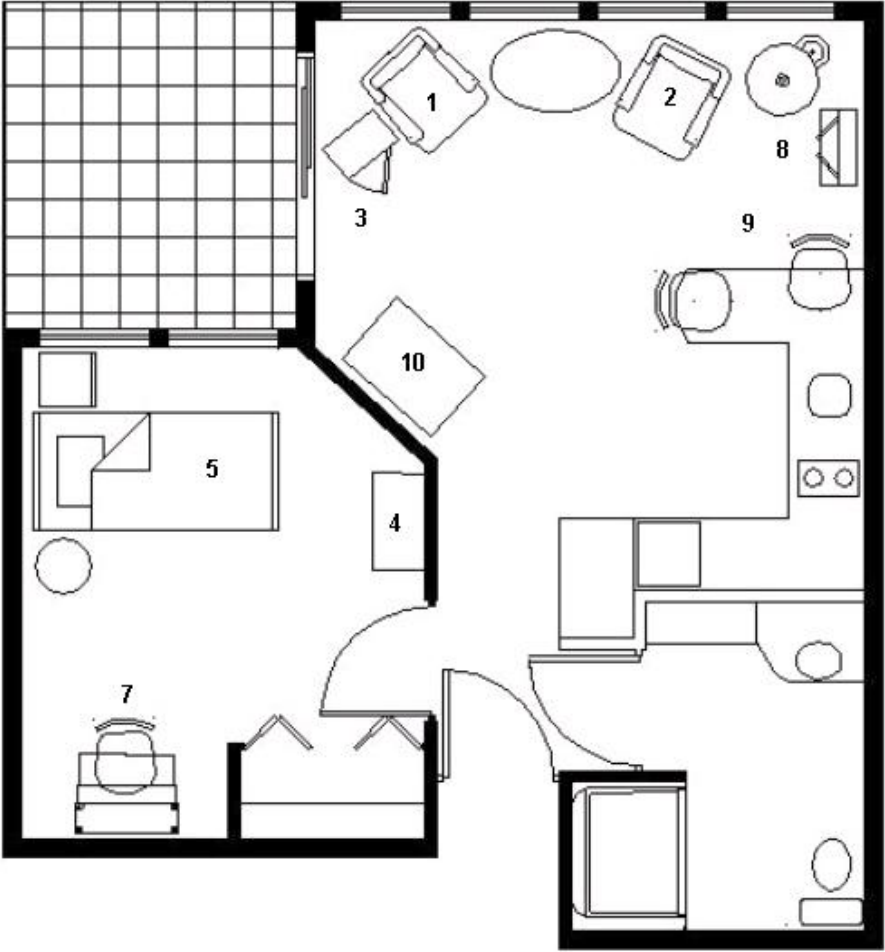
**Figure 27. Occasional pieces (none required)**

		
<p><b>Drop front desk</b> 32" x 30"</p>	<p><b>Cabinet</b> 25" x 13"</p>	<p><b>Table with two chairs</b></p>

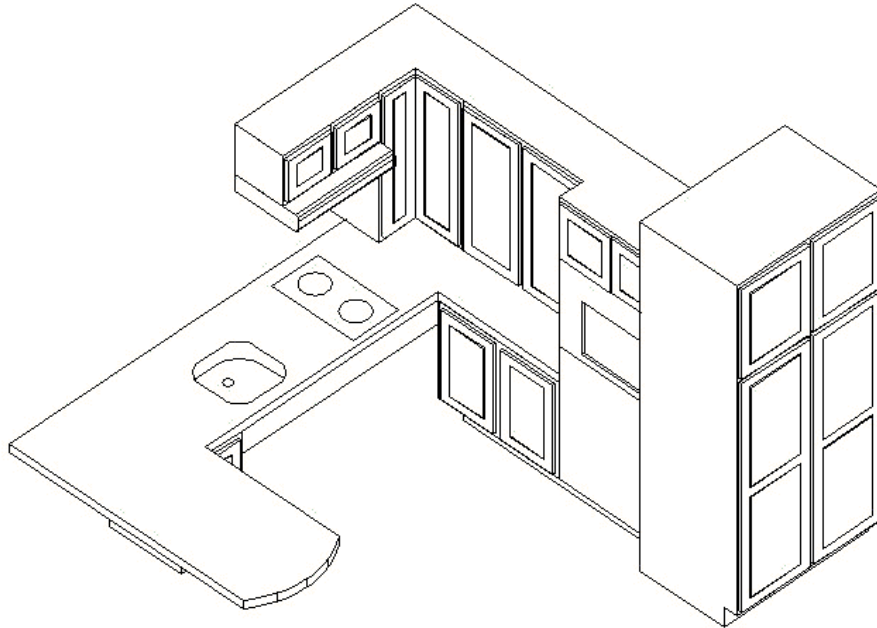
Because of findings reporting a preference for small allocations of space in each room, built-in cabinetry was incorporated into each of the areas, except for the bedroom

which has closet space. Figure 29 shows the furniture and cabinet configurations; for a cabinet schedule see Appendix J. Cabinets were chosen in compliance with ANSI guidelines.

Figure 28. Furniture plan



**Figure 29. Kitchen Isometric Drawing**



### ***Fixtures and Appliances***

A two burner, glass surface, electric cook top was chosen for the kitchen as a result of CAVE study participants' desire for a cook surface. The scaled down version does not require as much surface area and its smooth surface may be used for counter space if the unit is not in service. A scaled down micro fridge unit was also specified. It consists of a small refrigerator with a separate freezer and a microwave oven. The unit is mounted in a raised built-in unit for accessibility and visual continuity. Specified kitchen appliances and fixtures may be seen in Figure 30.

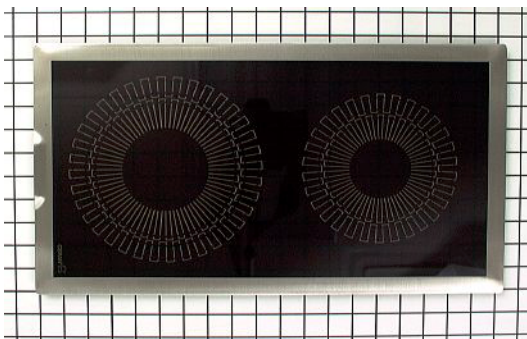
**Figure 30. Kitchen Fixtures and Appliances**



Microfridge mounted in cabinet.



Microfridge unit.



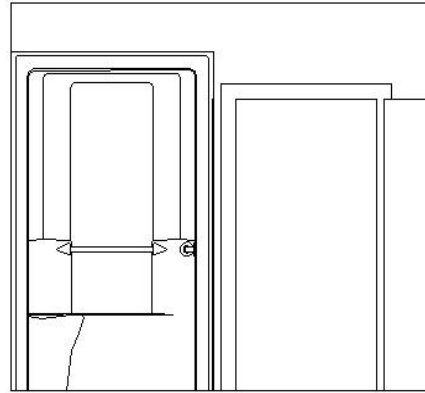
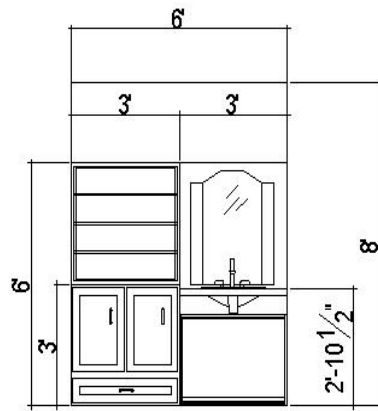
Two Burner glass top range. 12" x 21"



Sink 14" x 14"

Bathroom fixtures were selected for fair housing requirements and universal design. The shower is equipped with grab bars, a seat and a hand held shower head. The toilet seat is 17" above the finished floor and there is side and front clearance space for ease of transfer. The sink has a clear knee space under it and has a deep set drain also for this purpose. For bathroom elevations please see Figures 31 and 32.

**Figure 31. Bathroom sink and shower elevations**

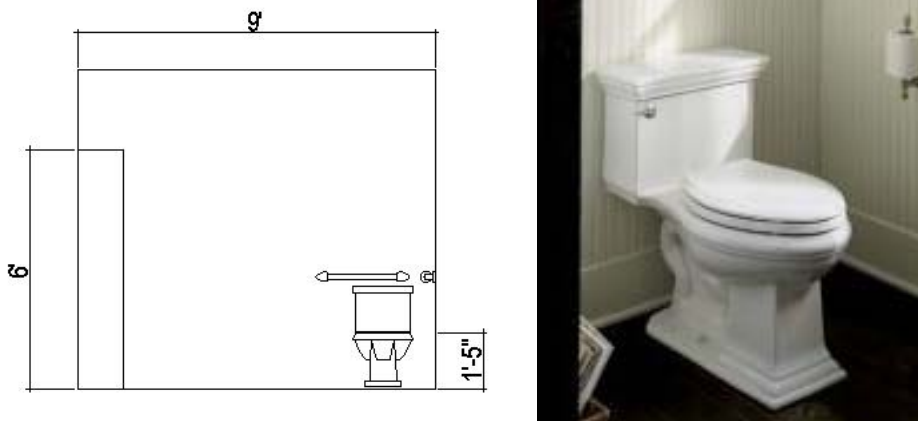


**Sink mounted under counter  
18 1/4" x 11" x 4"**



**Barrier free shower module  
45" x 37 3/4" x 84"**

**Figure 32. Toilet elevation**



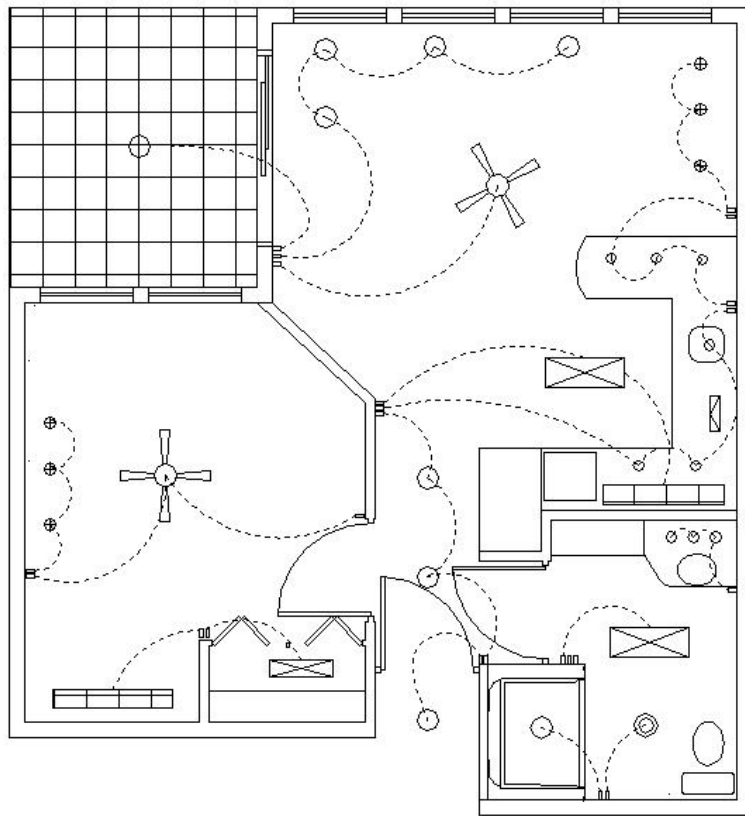
Front control toilet, 17" high, 12" rough in dimensions









### ***Lighting Design***

Guidelines for lighting design for older adults were utilized in this design. The footprint of the unit allows natural light into every room, except the bathroom. Filtered and diffuse ceiling fixtures were utilized to illuminate the spaces. Task lighting is utilized in the kitchen in the form of under cabinet reflector fixtures. The bathroom has indirect lighting in a soffit above the sink to diffuse light into the room. A lighted mirrored cabinet is also used, as well as a built-in fixture above the shower unit. Outlet provisions are made to accommodate adjustable lamps. Indirect lighting is utilized above the kitchen cabinets to diffuse light across the ceiling. All additional ceiling fixtures have shielded lamps. Figure 33 presents the lighting plan for this project.



Figure 33. Lighting plan.



-  Ceiling fan
-  Adjustable Spotlight
-  Compact Fluorescent Task
-  Fluorescent Ceiling Fixture
-  Range Hood Light
-  Heat Lamp
-  Wall Washing Soffit
-  Recessed Can

## **Summary**

As the demand for appropriate senior housing rises and assisted living facilities continue to be constructed, it is important to consider both cost and user needs. The needs of the resident should be considered above all else. While some design solutions may be wonderful solutions to environmental challenges for the older adult, in industry their cost often exceeds their feasibility. However, if user needs are carefully examined, funds may be spent to target them specifically, ensuring appropriate allocation of space without unneeded expense. With careful planning, each square foot may be used to the resident's best advantage, without the need to expand square footage. This project sought to present methods and solutions for designing the assisted living private dwelling unit based on user needs.

However, trade-offs exist in any design. While the footprint for this project, an "L" shape, created a more unique interior configuration than the typical square or rectangle unit, it also would require added expense in building costs (i.e. expensive roof lines). Furthermore, interior details could be added to increase the residential atmosphere. Moldings, soffits and other architectural elements add aesthetic appeal. However, their cost must be compared with the demand for these amenities and the increased cost they bring.

Future research regarding the affordability issue of assisted living private apartment design could glean an understanding of which criteria are worth their cost. In depth examination into the relationship of cost to durability, longevity, maintenance, and aesthetic impact may provide a more comprehensive understanding of assisted living apartment design.

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**Appendix A**  
Physical Observation Form

## Physical Observation of Assisted Living Facility

### Area Around Resident's Apartments Hallway

Length

Placement of doors

Lighting

Seating

#### Elevators

Placement

Seating nearby?

#### Doorways:

Personalization

Width

Lock

Placement

## **Resident's Apartment**

**Description / quick sketch (On back)**

**Emergency call system?**

**Flooring materials**

**Lighting**

**Wall coverings**

**Windows (location, height AFF, overall dimensions)**

**Outlet placement (AFF)**

## **Resident's Bathroom**

**Emergency call system?**

**Location / description**

**Dimensions / quick sketch**

**Flooring materials**

**Toilet**

**Height**

**Grab bar / supporting feature**

**Area in front (30" x 48" ?)**



**Tub / shower**

**Description (type)**

**Flooring texture**

**Grab bar**

**Area in front (30" x 48" ?)**

**Kitchen**

**Equipment list**

**Provided by facility**

**Owner's personal**

**Overall dimensions / quick sketch /elevations (On Back)**

**Universal features**

**Appendix B**  
Environmental Attributes

## Environmental Attributes of Assisted Living Facilities

### Observations

<b><u>Exterior</u></b>	
<b>1. Type / Style of Building</b>	
	Residential appearance - e.g. resembles individual home
	Dormitory appearance - e.g. resembles apartment complex, college dorm, or hotel
	Institutional appearance - e.g. resembles hospital or government building
<b><u>NOTES:</u></b>	
<b>2. Campus / grounds</b>	
	Residential in appearance – resembles individual home and yard
	Public in appearance - resembles apartment complex, college dorm, hotel
<b><u>NOTES:</u></b>	
<b><u>Hallway / corridors</u></b>	
<b>3. Entry / doorway to unit</b>	
	Residential in appearance - e.g. free entry
	Dormitory in appearance - e.g. entry noted
	Institutional appearance - e.g. entry limited
<b><u>NOTES:</u></b>	
<b>4. Visitors reception area</b>	
	Residential in appearance - e.g. full accommodations (coat closet, seating, guest toilet)
	Dormitory in appearance - e.g. limited accommodations (receptionist, seating, signage)
	Institutional appearance - e.g. no accommodations ( no coat storage, wayfinding problems, no seating)
<b><u>NOTES:</u></b>	
<b>5. Wall finish in hallways (more than half of total wall area)</b>	

	Residential in appearance - e.g. patterned wall coverings, wallpaper boarders, wood moldings wood paneling
	Dormitory in appearance - e.g. solid color / textured vinyl wall coverings, accent paint borders
	Institutional appearance - e.g. paint with no detailing, concrete block, ceramic tile
<b><u>NOTES:</u></b>	
<b>6. Flooring materials in hallways</b>	
	Residential in appearance - e.g. wood floor
	Dormitory in appearance - e.g. commercial carpet
	Institutional appearance - e.g. hard surface flooring
<b><u>NOTES:</u></b>	
<b>7. Lighting in hallways</b>	
	Residential in appearance - e.g. incandescent lighting
	Dormitory in appearance - e.g. fluorescent cove / soffit / indirect lighting
	Institutional appearance - e.g. recessed or ceiling mounted fluorescent fixtures with acoustical ceiling grid
<b><u>NOTES:</u></b>	
<b><u>Public Spaces (excluding residents' individual rooms)</u></b>	
<b>8. Arrangement of spaces</b>	
	Residential in appearance - e.g. short or no corridors, multiple social spaces, social spaces visible from sleeping rooms, no nursing desk
	Dormitory in appearance - e.g. short corridors, multiple social spaces, social spaces visible from sleeping rooms, nursing desk
	Institutional appearance - e.g. long double loaded corridor, single social space not directly visible from sleeping rooms, nursing desk
<b><u>NOTES:</u></b>	
<b>9. Adjacency of spaces / rooms</b>	
	Residential in appearance - e.g. functional relationship of rooms (kitchen, dining, social areas adjacent; residents rooms with adjacent bathroom)

	Dormitory in appearance - e.g. multipurpose rooms (activity / dining room), 2 bedrooms share an adjacent bathroom
	Institutional appearance - e.g. separate room for each activity (library, craft room, bathing room)
<b>NOTES:</b>	
<b>10. Use of furnishings to define use of spaces</b>	
	Residential in appearance - e.g. full use of furniture to define function of area (distinctly different dining and social space seating)
	Dormitory in appearance - e.g. limited use of furniture to define function (dining and social space use same seating in different color / upholstery)
	Institutional appearance - e.g. unable to identify function of area by furnishings (same seating in dining and social space)
<b>NOTES:</b>	
<b>11. Distinctness of fixed feature areas; variation / contrast one area to another</b>	
	Residential in appearance - e.g. much distinctiveness / variation (both public and residents' rooms are different colors, with different floor and wall coverings in each area)
	Dormitory in appearance - e.g. some distinctiveness / variation (public areas show some variation in colors, floor / wall coverings; resident's rooms are similar to each other)
	Institutional appearance - e.g. little distinctiveness / variation (public and resident's rooms are quite similar, little or no variation in color with similar floor / wall treatment)
<b>NOTES:</b>	
<b>12. Odors in the public spaces (hallways and social areas)</b>	
	Residential in appearance - e.g. body products, food, laundry odor, fresh air
	Dormitory in appearance - e.g. no noticeable odor, closed air circulation system
	Institutional appearance - e.g. urine, disinfectant, medicinal odor, stale,

	musty air
<b><u>NOTES:</u></b>	
<b>13.Noise in public spaces (hallways and social spaces)</b>	
	Residential in appearance - e.g. neighborhood sounds or nature sounds, domestic sounds; resident to resident conversations; TV or radio
	Institutional appearance - e.g. cart or equipment noise; staff conversations; pagers / intercom / muzak (Style of music: _____)
<b><u>NOTES:</u></b>	
<b><u>Social spaces</u> (Lounge / Dayroom)</b>	
<b>14.Wall finish in social spaces</b>	
	Residential in appearance - e.g. patterned wall coverings; wallpaper borders; wood moldings; wood paneling
	Dormitory in appearance - e.g. solid color / textured vinyl wall coverings; accent paint borders
	Institutional appearance - e.g. paint with no detailing; concrete block; ceramic tile
<b><u>NOTES:</u></b>	
<b>15.Flooring materials in social spaces</b>	
	Residential in appearance - e.g. area rugs; wood floor
	Dormitory in appearance - e.g. commercial carpet
	Institutional appearance - e.g. hard surface flooring
<b><u>NOTES:</u></b>	
<b>16.Interior detailing / accessorization of social spaces</b>	
	Residential in appearance - e.g. wood moldings; natural materials; fireplaces; rugs / carpeting; scenic pictures
	Dormitory in appearance - e.g. hard surface flooring, several identical furniture pieces; simulated natural materials; abstract art or posters
	Institutional appearance - e.g. high gloss flooring; little or no art; identical furniture pieces; plastic or metal materials dominate

<b><u>NOTES:</u></b>	
<b>17. Window areas in social spaces</b>	
	Small scale residential styled windows to integrate outside with interior
	Large scale multiple windows - e.g. "window walls" of fixed glazing
	No windows or positioned above eye level (clerestory or skylight) - e.g. interior seems isolated from outside
<b><u>NOTES:</u></b>	
<b>18. Lighting in social spaces</b>	
	Residential in appearance - e.g. incandescent lighting
	Dormitory in appearance - e.g. fluorescent cove / soffit / indirect lighting
	Institutional appearance - e.g. recessed or ceiling mounted fluorescent fixtures with acoustical ceiling grid
<b><u>NOTES:</u></b>	
<b>19. Illumination (natural and / or electrical) in social spaces</b>	
	Residential in appearance - e.g. rooms are adequately illuminated; without glare; with variation in light levels; easy adjustability of light levels, medium, and dark shadows
	Dormitory in appearance - e.g. rooms are illuminated based upon function and cost effectiveness; little glare; limited flexibility for change in light levels
	Institutional appearance - e.g. rooms are brightly and evenly illuminated; no potential to change light levels; glare problems; little shadowing
<b><u>NOTES:</u></b>	
<b>20. Area for small group interactions</b>	
	Residential in appearance - e.g. multiple areas on the unit with seating for 2-3
	Dormitory in appearance - e.g. multiple areas on the unit with seating for 4-6
	Institutional appearance - e.g. one lounge / day room with seating for more than 6
<b><u>NOTES:</u></b>	

<b>21. Area where solitary activities can occur in a group setting (e.g. reading, puzzles, snacking, solitary games)</b>	
	Residential - multiple activities in one area (eat-in kitchen)
	Dormitory - e.g. room defined by activity taking place (craft or activity or dining room, depending on activity taking place)
	Institutional - e.g. separate room for each activity (dining room, activity room, craft room)
<b><u>NOTES:</u></b>	
<b>22. Area for group activities</b>	
	Residential - e.g. multiple activities in one area (eat-in kitchen)
	Dormitory - e.g. room defined by activity taking place (craft or activity or dining room, depending on activity taking place)
	Institutional - e.g. separate room for each activity (dining room, activity room, craft room)
<b><u>NOTES:</u></b>	
<b>23. Ambiance of group social space</b>	
	Residential in appearance - e.g. residents feel comfortable to "be themselves"; style, fabrics, and finishes are informal; seating is comfortable, (family room or den atmosphere)
	Dormitory in appearance - e.g. seating is comfortable but room is more formal; style, fabrics and finishes are residential in appearance but selected to support formal interaction (formal living room or front parlor atmosphere)
	Institutional appearance - e.g. style, furnishings, fabrics and finishes are selected for durability and function (vinyl tile flooring, vinyl upholstery, geriatric seating, metal horizontal blinds)
<b><u>NOTES:</u></b>	
<b>Dining Area</b>	
<b>24. Meal time ambiance</b>	
	Residential - e.g. little or no waiting, conversational sounds; unobtrusive assistance



	Dormitory - e.g. short wait, muzak; obvious assistance with feeding
	Institutional - e.g. long waits, non-conversational noise (trays, carts, equipment); assembly-line assistance
<b><u>NOTES:</u></b>	
<b>25. Wall finish in dining area</b>	
	Residential in appearance - e.g. patterned wall coverings; wallpaper borders; wood moldings; wood paneling
	Dormitory in appearance - e.g. solid color / textured vinyl wall coverings; accent paint borders
	Institutional appearance - e.g. paint with no detailing; concrete block; ceramic tile
<b><u>NOTES:</u></b>	
<b>26. Flooring materials in dining area</b>	
	Residential in appearance - e.g. area rug; wood floor
	Dormitory in appearance - e.g. commercial carpet
	Institutional appearance - e.g. hard surface flooring
<b><u>NOTES:</u></b>	
<b>27. Window areas in dining areas</b>	
	Small scale residential styled windows to integrate exterior with interior
	Large scale / multiple windows - e.g. "window walls" of fixed glazing
	No windows or positioned above eye level (clerestory or skylight) - e.g. interior seems isolated from outside
<b><u>NOTES:</u></b>	
<b>28. Lighting in dining spaces</b>	
	Residential in appearance - e.g. incandescent lighting
	Dormitory in appearance - e.g. fluorescent cove / soffit / indirect lighting
	Institutional appearance - e.g. recessed or ceiling mounted fluorescent fixtures with acoustical ceiling grid
<b><u>NOTES:</u></b>	

<b>Residents' Rooms</b>	
<b>29. Personalization of entry way to the resident's room</b>	
	Residential in appearance - e.g. distinct personalization (personal items displayed such as pictures, mementos)
	Dormitory in appearance - e.g. limited personalization (name or photo of resident)
	Institutional appearance - e.g. no personalization (room number only)
<b><u>NOTES:</u></b>	
<b>30. Personalization of resident's rooms (more than half the rooms)</b>	
	Residential in appearance - e.g. resident has personalized room (rugs, furniture, curtains, accessories, mementos or awards; room is identified with occupant)
	Dormitory in appearance - e.g. some personalization (resident may have personal objects or furnishings but rooms still rather similar)
	Institutional appearance - e.g. little personalization (residents may have family pictures but otherwise room doesn't seem to belong to any one individual)
<b><u>NOTES:</u></b>	
<b>31. Wall finish in residents' rooms</b>	
	Residential in appearance - e.g. patterned wall coverings; wallpaper borders; wood moldings; wood paneling
	Dormitory in appearance - e.g. solid color / textured vinyl wall coverings; accent paint borders
	Institutional appearance - e.g. paint with no detailing; concrete block; ceramic tile
<b><u>NOTES:</u></b>	
<b>32. Flooring material in residents' rooms</b>	
	Residential in appearance - e.g. area rugs; wood floor
	Dormitory in appearance - e.g. commercial carpet
	Institutional appearance - e.g. hard surface flooring

<b><u>NOTES:</u></b>	
<b>33. Window operation in residents' rooms</b>	
	Operable by resident
	Operable by staff
	Not operable
<b><u>NOTES:</u></b>	
<b>34. Window area in residents' rooms</b>	
	Small scale residential styled windows to integrate exterior with interior
	Large scale / multiple windows - e.g. "window walls" of fixed glazing
	No windows or positioned above eye level (clerestory or skylight) - e.g. interior seems isolated from outside
<b><u>NOTES:</u></b>	
<b>35. Lighting in residents' rooms</b>	
	Residential in appearance - e.g. incandescent lighting
	Dormitory in appearance - e.g. fluorescent cove / soffit / indirect lighting
	Institutional appearance - e.g. recessed or ceiling mounted fluorescent fixtures with acoustical ceiling grid
<b><u>NOTES:</u></b>	
<b>36. Illumination (natural and / or electrical) in residents' rooms</b>	
	Residential in appearance - e.g.. rooms are adequately illuminated; without glare; with variation in light levels; easy adjustability of light levels, medium, and dark shadows
	Dormitory in appearance - e.g. rooms are illuminated based upon function and cost effectiveness; little glare; limited flexibility for change in light levels
	Institutional appearance - e.g. rooms are brightly and evenly illuminated; no potential to change light levels; glare problems; little shadowing
<b><u>NOTES:</u></b>	
<b>37. Noise in residents' rooms during the day</b>	
	Residential sounds - e.g. . neighborhood sounds or nature sounds, domestic sounds; resident to resident conversations; TV or radio

Institutional sounds - e.g. cart or equipment noise; staff conversations; pagers / intercom / muzak (Style of music: _____)
<b><u>NOTES:</u></b>

<b><u>Caregiver</u></b>	
<b>38. Staff / caregiver's greeting to resident indicates warmth, familiarity, and respect (e.g. genuine friendliness, knowledge of personal history; respect for resident as a person)</b>	
	Always or almost always
	Sometimes, more than half of the time
	Rarely ever, less than half of the time (or no greeting)
<b><u>NOTES:</u></b>	
<b>Additional Information</b>	

## **Appendix C**

Staff interview environmental attributes

**Environmental Attributes from Staff Interviews**

**Public Spaces (excluding resident's individual rooms)**

	<b>Access/storage to equipment for hobbies / crafts</b>			
	Wheatland	The Oaks	Hickory Hills	Culpepper
Very accessible	<input checked="" type="checkbox"/>			
Somewhat accessible			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Not available on the unit		<input checked="" type="checkbox"/>		
	<b>Accomodation for hobby equipment brought from home</b>			
	Wheatland	The Oaks	Hickory Hills	Culpepper
Encouraged			<input checked="" type="checkbox"/>	
Permitted				<input checked="" type="checkbox"/>
Not Permitted		<input checked="" type="checkbox"/>		
	<b>Access/storage of recreational equipment</b>			
	Wheatland	The Oaks	Hickory Hills	Culpepper
Very accessible	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Somewhat accessible			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Not available on the unit				
	<b>Access/storage of magazines / books</b>			
	Wheatland	The Oaks	Hickory Hills	Culpepper
Very accessible	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Somewhat accessible				
Not available on the unit				
	<b>Area where residents can garden indoors</b>			
	Wheatland	The Oaks	Hickory Hills	Culpepper
Unlimited access				
Sheduled times only			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Not available on unit				
	<b>Access to laundry facilities for personal laundry</b>			
	Wheatland	The Oaks	Hickory Hills	Culpepper
Unlimited access	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Avaiable upon request				
Not available				
	<b>Access to snacks / drinks</b>			
	Wheatland	The Oaks	Hickory Hills	Culpepper
Unlimited access	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Access w/ supervision			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
No access				
	<b>Access to a kitchen for cooking or baking</b>			

	Wheatland	The Oaks	Hickory Hills	Culpepper
Unlimited access	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
Available upon request		<input checked="" type="checkbox"/>		
Not available			<input checked="" type="checkbox"/>	

**Secured storage for personal possessions**

	Wheatland	The Oaks	Hickory Hills	Culpepper
Lock on residence door	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Locked storage on unit				
No locked storage				

**Outdoor spaces for residents**

**Area for residents to sit outdoors**

	Wheatland	The Oaks	Hickory Hills	Culpepper
Unlimited access	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Scheduled times only				
Not available on unit				

**Area for residents to stroll outdoors**

	Wheatland	The Oaks	Hickory Hills	Culpepper
Unlimited access	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Scheduled times only				
Not available on unit				

**Area for residents to garden outdoors**

	Wheatland	The Oaks	Hickory Hills	Culpepper
Unlimited access	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Scheduled times only				
Not available on unit		<input checked="" type="checkbox"/>		

**Area for residents to have outdoor recreation**

	Wheatland	The Oaks	Hickory Hills	Culpepper
Unlimited access	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
Scheduled times only			<input checked="" type="checkbox"/>	
Not available on unit				

**Residents' Rooms**

**Selection of surface finishes in resident's room**

	Wheatland	The Oaks	Hickory Hills	Culpepper
Resident or family	<input checked="" type="checkbox"/>			
Professional designer				
Knowledgeable staff person				
Existing utilized		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

**Selection of furnishings**

	Wheatland	The Oaks	Hickory Hills	Culpepper

Resident's own furniture	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Professional designer				
Knowledgeable staff person				
Existing utilized				

**Residents with personal televisions**

	Wheatland	The Oaks	Hickory Hills	Culpepper
Many more than half	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Some less than half				
Not permitted				

**Access to resident's room**

	Wheatland	The Oaks	Hickory Hills	Culpepper
Knock & wait for permit	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Knock then enter				<input checked="" type="checkbox"/>
Unlimited access				

**Involvement of residents' visitors in activities**

	Wheatland	The Oaks	Hickory Hills	Culpepper
Some / selected activities	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Little or no involvement				

**Resident non-medical transportation scheduling**

	Wheatland	The Oaks	Hickory Hills	Culpepper
Individually scheduled		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Regularly scheduled	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>		
None provided				

**Residents' participation in activities beyond the facility**

	Wheatland	The Oaks	Hickory Hills	Culpepper
Most, more than half				<input checked="" type="checkbox"/>
Some, less than half		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	
Few or no residents	<input checked="" type="checkbox"/>			

**Smoking on the unit**

	Wheatland	The Oaks	Hickory Hills	Culpepper
At residents request				<input checked="" type="checkbox"/>
At certain time / place	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	
Not permitted				

**Alcohol consumption**

	Wheatland	The Oaks	Hickory Hills	Culpepper
At residents request	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
At certain time / place				
Not permitted				

**Intimacy / sexual behavior**

	Wheatland	The Oaks	Hickory Hills	Culpepper



Privacy in residents' rooms	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Designated location				
Not permitted / facilitated				

**Restraints / drug control at night**

	Wheatland	The Oaks	Hickory Hills	Culpepper
No controls	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
No, but bedrails are used				
Yes				

**Residents with pets**

	Wheatland	The Oaks	Hickory Hills	Culpepper
Some residents have pets	<input checked="" type="checkbox"/>			<input checked="" type="checkbox"/>
Shared unit pet present			<input checked="" type="checkbox"/>	
No animals on unit				

**Residents participation w/ daily housekeeping**

	Wheatland	The Oaks	Hickory Hills	Culpepper
Expected if able	<input checked="" type="checkbox"/>			
Encouraged			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Rarely by resident request				

**Residents involvement in activities for others**

	Wheatland	The Oaks	Hickory Hills	Culpepper
Expected if able			<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Encouraged	<input checked="" type="checkbox"/>			
Rarely by resident request				

**Appendix D**  
Informed Subject Consent Form

## **Informed Consent for Participants of Investigative Projects**

### **Using the CAVE to Determine Residents' Preferences and Functioning in Assisted Living Private Spaces**

**Joan McLain-Kark, Principal Investigator**

You are invited to participate in a study about older adults' perceptions and performance in a simulated environment. This study involves 59 adults 65 and older in addition to you. The interview will take approximately 60 minutes. The interviews require you to sit while viewing the simulated environment. If at any time, you feel discomfort, you can withdraw or stop the interview. However, there should be no risk or discomfort to you during the interviews.

Your participation in this project will provide information to developers and designers of assisted living on how to design better housing for older adults. No guarantee of benefits has been made to encourage you to participate.

The results of this study will be kept strictly confidential. At no time will the researchers release the results of the study to anyone other than individuals working on the project without your written consent. The information you provide will have your name removed and only a subject number will identify your analyses and any written reports of the research.

The research project has been approved, as required by the Institutional Review Board for projects involving human subjects at Virginia Polytechnic Institute and State University.

I know of no reason I cannot participate in this study which will require me to answer questions and have measurements of reach taken.

I have read and understand the informed consent and conditions of this project. I have had all my questions answered. I hereby acknowledge the above and give my voluntary consent for participation in this project. If I participate, I may withdraw at any time without penalty. Should I have any questions about this research or its conduct, I will contact the individuals below:

Signed \_\_\_\_\_  
Date

**Joan McLain-Kark**                      231-xxxx  
Principal Investigator

**Julia Beamish**                        231-xxxx  
Co-Principal Investigator

**H.T. Hurd**                                231-xxxx  
Chair, IRB  
Research Division

## **Appendix E**

Interview Schedule / Questionnaire

CAVE PROJECT – INTERVIEW QUESTIONNAIRE (Draft – 3/18/01)

Thank you for your willingness to participate in our project about personal preferences and living arrangements in later life. Before we take you into the CAVE, I am going to ask you several questions about yourself, your living arrangements, and your involvement in a variety of everyday activities.

There are no right or wrong answers to these questions, just give me the response that is right for you.

**Part I. Living Arrangements**

I'm going to start by asking you several questions about your current living arrangements.

1. In what town and county do you live?

\_\_\_\_\_ (town)

\_\_\_\_\_ (county)

2. How long have you lived in this geographic area?

\_\_\_\_\_ 1. Less than one year

\_\_\_\_\_ 5. 21-30 years

\_\_\_\_\_ 2. 1 to 5 years

\_\_\_\_\_ 6. 31-40 years

\_\_\_\_\_ 3. 6-10 years

\_\_\_\_\_ 7. 41-50 years

\_\_\_\_\_ 4. 11-20 years

\_\_\_\_\_ 8. Over 50 years

3. Do you live in a . . .

\_\_\_\_\_ 1. A single-family detached home

\_\_\_\_\_ 2. A semidetached home like a townhouse or duplex

- \_\_\_\_\_ 3. An apartment complex
- \_\_\_\_\_ 4. A mobile home
- \_\_\_\_\_ 5. Other (specify): \_\_\_\_\_

4. Do you currently own or rent your home?

- \_\_\_\_\_ 1. Own
- \_\_\_\_\_ 2. Rent
- \_\_\_\_\_ 3. Other (explain): \_\_\_\_\_

5. How long have you lived in your current home?

- \_\_\_\_\_ 1. Less than one year
- \_\_\_\_\_ 2. 1 to 5 years
- \_\_\_\_\_ 3. 6-10 years
- \_\_\_\_\_ 4. 11-20 years
- \_\_\_\_\_ 5. 21-30 years
- \_\_\_\_\_ 6. 31-40 years
- \_\_\_\_\_ 7. 41-50 years
- \_\_\_\_\_ 8. Over 50 years

6. Who lives in your household with you:

- \_\_\_\_\_ 1. No one
- \_\_\_\_\_ 2. Spouse/Partner
- \_\_\_\_\_ 3. Son/Daughter
- \_\_\_\_\_ 4. Son/Daughter-in-Law
- \_\_\_\_\_ 5. Grandson/Granddaughter
- \_\_\_\_\_ 6. Parent
- \_\_\_\_\_ 7. Brother/Sister
- \_\_\_\_\_ 8. Friend
- \_\_\_\_\_ 9. Other (Please specify): \_\_\_\_\_

7. Have you made any of the following modifications in order to make your home easier to live? [If yes, ask approximately how long ago the persons made these changes]

	Yes (1)	No (0)	When (# of years)
Added brighter lighting inside			

Added more handrails or grab bars			
Added a ramp in place of steps or stairs			
Added lever faucets in place of knobs for turning water on and off			
Widened doorways			
Replaced door knobs with lever handles			
Installed an emergency response system that <u>automatically</u> notifies proper authorities in the case of medical or fire emergencies			

8. Have you ever confined your living quarters to one floor to avoid having to use stairs?

\_\_\_\_\_ 1. No                      \_\_\_\_\_ 2. Yes

Now, I have a few questions about planning for your future housing needs

9. Do you think your current residence is where you will always live? Why or why not?

\_\_\_\_\_ 1. No                      \_\_\_\_\_ 2. Yes

Explain: \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_

10. If you required someone to care for you, how likely is that that you would choose the following care options:

	Not Likely (1)	Somewhat Likely (2)	Very Likely (3)
Move in with a family member			
Have a family member move into your home			
Move in with a friend member			
Have a friend move in to your home			
Have a paid helper move into your home			
Move to an assisted living facility			
Other (explain):			

11. If you required someone to care for you and you decided to move to an assisted living facility, what size of facility would you prefer?

1. A small assisted living facility for 30 or less people  
 2. A median assisted living facility for 31 to 60 people  
 3. A large assisted living facility for more than 60 people  
 4. No preference

12. Have you ever visited an assisted living facility?

1. No  
 2. Yes



## Part II. Activities, Interests, Values

The next set of questions I am going to ask you will focus on the type of activities you like to do, your interests and interactions with others, and the things you value in life

I will start with some questions about your activities.

1. On a typical day, about how many hours would you say you:

- \_\_\_\_\_ 1. Watching TV
- \_\_\_\_\_ 2. Listening to the radio
- \_\_\_\_\_ 3. Reading
- \_\_\_\_\_ 4. Talking on the phone with family members
- \_\_\_\_\_ 5. Talking on the phone with friends

2. How often do you have face-to-face visits *in your home* with a least one member of your family (who does not live with you)

- |                               |                                 |
|-------------------------------|---------------------------------|
| _____ 1. Daily                | _____ 4. Several times a month  |
| _____ 2. Several times a week | _____ 5. About once a month     |
| _____ 3. About once a week    | _____ 6. Less than once a month |
|                               | _____ 7. Almost never           |

3. How often do you have phone conversations with a least one member of your family (who does not live with you)

- |                               |                                 |
|-------------------------------|---------------------------------|
| _____ 1. Daily                | _____ 4. Several times a month  |
| _____ 2. Several times a week | _____ 5. About once a month     |
| _____ 3. About once a week    | _____ 6. Less than once a month |
|                               | _____ 7. Almost never           |

4. How often do you have face-to-face visits *in your home* with a least one of your friends?

- |                               |                                 |
|-------------------------------|---------------------------------|
| _____ 1. Daily                | _____ 4. Several times a month  |
| _____ 2. Several times a week | _____ 5. About once a month     |
| _____ 3. About once a week    | _____ 6. Less than once a month |
|                               | _____ 7. Almost never           |

5. How often do you have phone conversations with a least one of friends?

- |                               |                                 |
|-------------------------------|---------------------------------|
| _____ 1. Daily                | _____ 4. Several times a month  |
| _____ 2. Several times a week | _____ 5. About once a month     |
| _____ 3. About once a week    | _____ 6. Less than once a month |
|                               | _____ 7. Almost never           |

The following statements describe preferences for everyday life. Some of the questions may sound similar to a few I've already asked, but I need you to answer them again so we have the same information for everyone who is participating in our project. Remember there are no right or wrong answers to these question, just give the response that is right for you.

I'm going to start with some statements about social activities. Please tell me how much you like to do the following:

- Responses:
1. not at all
  2. a little
  3. much
  4. very much

- \_\_\_\_\_ 1. enjoy spending time by yourself.
- \_\_\_\_\_ 2. enjoy spending time with small groups of people.

- \_\_\_\_\_ 3. enjoy spending time with large groups of people.
- \_\_\_\_\_ 4. like being a member of clubs, committees, or other organizations.
- \_\_\_\_\_ 5. enjoy being a group leader.
- \_\_\_\_\_ 6. would you enjoy living in the same room as someone else other than a spouse or family member.
- \_\_\_\_\_ 7. like to keep in weekly contact with my family.
- \_\_\_\_\_ 8. like to keep in frequent contact with my friends.
- \_\_\_\_\_ 9. enjoy physical contact with someone I care about (e.g., hugging, holding hands).
- \_\_\_\_\_ 10. enjoy contact with animals.
- \_\_\_\_\_ 11. like celebrating holidays and birthdays.
- \_\_\_\_\_ 12. enjoy meeting new people.
- \_\_\_\_\_ 13. enjoy being physically active.
- \_\_\_\_\_ 14. like to participate in religious/spiritual activities.
- \_\_\_\_\_ 15. like to volunteer my time to help others.
- \_\_\_\_\_ 16. enjoy music.
- \_\_\_\_\_ 17. enjoy doing crafts/handiwork/hobbies.
- \_\_\_\_\_ 18. enjoy watching TV.
- \_\_\_\_\_ 19. enjoy reading.
- \_\_\_\_\_ 20. enjoy cultural activities (e.g., concerts, theatre, museums).
- \_\_\_\_\_ 21. like to eat at restaurants.
- \_\_\_\_\_ 22. enjoy traveling.

Now I'm going to read you some statements about features of the environment. Please tell me how much you like the following:

- Responses:
- 1. not at all
  - 2. a little
  - 3. much
  - 4. very much

\_\_\_\_\_ 23. like to have the temperature where I live to be on the warm side.

\_\_\_\_\_ 24. like the lighting where I live to be on the bright side.

\_\_\_\_\_ 25. like to keep blinds/curtains open.

\_\_\_\_\_ 26. like to keep certain personal mementos on display where I live.

\_\_\_\_\_ 27. like to be where it is quiet.

\_\_\_\_\_ 28. enjoy being in a lively, noisy place.

\_\_\_\_\_ 29. like a colorful environment.

\_\_\_\_\_ 30. enjoy spending time outside.

\_\_\_\_\_ 31. like to have a place to lock my things.

\_\_\_\_\_ 32. like being in a place that has ramps, hand rails, and things like that.

\_\_\_\_\_ 33. like being in a place that has carpeting.

34. This next set of questions is a little different from the others. I am going to show you two value statements. From each pair, select the value that is most important in that pair to you. It may be difficult to decide, but I need you to make one choice for each pair.

\_\_\_\_\_ 1. Social standing and formal social life are important to me.

\_\_\_\_\_ 2. Personal enjoyment, self-expression and beauty are important to me.

\_\_\_\_\_ 1. Physical and mental health and the well-being of my family are important to me.

\_\_\_\_\_ 2. Durability and economy are important to me.

\_\_\_\_\_ 1. Personal enjoyment, self-expression and beauty are important to me.

\_\_\_\_\_ 2. Physical and mental health and the well-being of my family are important to me.

\_\_\_\_\_ 1. Durability and economy are important to me.

\_\_\_\_\_ 2. Social standing and formal social life are important to me.

\_\_\_\_\_ 1. Personal enjoyment, self-expression and beauty are important to me.

\_\_\_\_\_ 2. Durability and economy are important to me.

- \_\_\_\_ 1. Physical and mental health and the well-being of my family are important to me.
2. Social standing and formal social life are important to me.

**Part III. Health and Well-Being**

Now we are going to talk about your health and your feelings about yourself.

1. In general, would you say your health is:

- |                   |              |
|-------------------|--------------|
| ____ 1. excellent | ____ 4. fair |
| ____ 2. very good | ____ 5. poor |
| ____ 3. good      |              |

The following items are about activities you might do during a typical day. Does your health now limit you in these activities?

	<b>Yes, limited a lot (2)</b>	<b>Yes, limited a little (1)</b>	<b>No, not limited at all (0)</b>
2. Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling,			
3. Climbing several flights of stairs			

During the **past four weeks**, have you had any of the following problems with your regular activities as a result of your physical health?

	<b>Yes (1)</b>	<b>No (0)</b>
4. Accomplished less than you would like		

5. Were limited in the <b>kind</b> of activities which I participated		
--	--	--

During the **past four weeks**, have you had any of the following problems with regular activities as a result of an **emotional problem** (such as feeling depressed or anxious)?

	<b>Yes (1)</b>	<u>No (0)</u>
6. Accomplished less than you would like		
7. Didn't do activities as <b>carefully</b> as usual		

8. During the **past four weeks**, how much did pain interfere with your normal daily activities (inside and outside the home)?

- \_\_\_\_\_ 1. not at all
- \_\_\_\_\_ 2. a little bit
- \_\_\_\_\_ 3. moderately
- \_\_\_\_\_ 4. quite a bit
- \_\_\_\_\_ 5. extreme

For each of the following question, please give the one answer that comes closest to the way you have been **feeling during the past four weeks**. How much of the time during the **past four weeks**...

	All of the time (5)	Most of the time (4)	A good bit of the time (3)	Some of the time (2)	A little of the time (1)	None of the time (1)
9. Have you felt calm and peaceful?						
10. Did you have a lot of energy?						
11. Have you felt downhearted and blue?						

12. During the **past four weeks**, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

- \_\_\_ 1. all of the time
- \_\_\_ 2. most of the time
- \_\_\_ 3. some of the time
- \_\_\_ 4. a little of the time
- \_\_\_ 5. none of the time

13. Please tell me if you currently have any of the following health conditions...

- a. arthritis or rheumatism? YES NO
- b. cancer, a malignant tumor or leukemia? YES NO



c.	chronic lung disease such as chronic bronchitis, emphysema, or asthma?	YES	NO
d.	depression?	YES	NO
e.	diabetes or high blood sugar?	YES	NO
f.	heart problems?	YES	NO
g.	high blood pressure or hypertension?	YES	NO
h.	memory problems?	YES	NO
i.	osteoporosis?	YES	NO
j.	stomach or intestinal disorders?	YES	NO
k.	have you had a stroke?	YES	NO
l.	Do you have any other health problems that I have not mentioned? (please list)	YES	NO

14. Now I have a few questions about daily activities. Some of the activities may be things that you do not typically do, but I need to know if you are able to do them. During the last month,

a.	could you cook meals without any help from anyone else?	YES	NO
b.	could you drive a car?	YES	NO
c.	shop for groceries?	YES	NO
d.	how about heavy housework such as vacuuming, mopping or washing windows?	YES	NO
e.	could you do laundry without any help?	YES	NO
f.	how about light housework, such as dishes, dusting and straightening up?	YES	NO
g.	in the past month could you do minor household repairs?	YES	NO
h.	could you pay your bills without having someone else help you?	YES	NO

*Part IV. Demographic Questions*

This final set of questions will help us learn a little bit more about your background.

1. How old are you? \_\_\_\_\_

**2. Do you consider yourself to be White, African American, Asian, Hispanic or a member of some other ethnic group?**

- \_\_\_\_\_ 1. White
- \_\_\_\_\_ 2. African American
- \_\_\_\_\_ 3. Asian (Chinese, Japanese, Korean)
- \_\_\_\_\_ 4. Hispanic (Latino)
- \_\_\_\_\_ 5. Other/Mixed Race

3. Are you currently married, single, divorced, separated, widowed or living with your partner to whom you are not married?

- \_\_\_\_\_ 1. Married
- \_\_\_\_\_ 2. Single Divorced
- \_\_\_\_\_ 3. Separated
- \_\_\_\_\_ 4. Widowed
- \_\_\_\_\_ 5. Living with someone but not married

4. What is the highest level of formal education you have completed?

- \_\_\_\_\_ 1. Less than grade school
- \_\_\_\_\_ 2. Grade school
- \_\_\_\_\_ 3. Some high school

- \_\_\_\_\_ 4. High school grad (or GED)
- \_\_\_\_\_ 5. Trade/Voc School after HS
- \_\_\_\_\_ 6. Completed community college
- \_\_\_\_\_ 7. Some college
- \_\_\_\_\_ 8. College graduate
- \_\_\_\_\_ 9. Graduate School/Professional School

**5. For the majority of your life, would you say that you were mostly employed full-time for pay, part-time for pay, unemployed or a homemaker?**

- \_\_\_\_\_ 1. Employed full-time
- \_\_\_\_\_ 2. Employed part-time
- \_\_\_\_\_ 3. Unemployed
- \_\_\_\_\_ 4. Homemaker

**6. What was your primary occupation throughout your life?**

- \_\_\_\_\_ 1. Professional (doctor, lawyer)
- \_\_\_\_\_ 2. Managerial
- \_\_\_\_\_ 3. Administrative, clerical
- \_\_\_\_\_ 4. Engineering, technical
- \_\_\_\_\_ 5. Marketing, sales
- \_\_\_\_\_ 6. Skilled craft or trade
- \_\_\_\_\_ 7. Semiskilled occupation
- \_\_\_\_\_ 8. Homemaker
- \_\_\_\_\_ 9. Other [describe] \_\_\_\_\_

**7. Are you currently employed full-time for pay, part-time for pay, retired, unemployed or a homemaker?**

- \_\_\_\_\_ 1. Employed full-time
- \_\_\_\_\_ 2. Employed part-time
- \_\_\_\_\_ 3. Retired (Specify number of years \_\_\_\_\_)
- \_\_\_\_\_ 4. Unemployed
- \_\_\_\_\_ 5. Homemaker

**8. Please tell me your average annual income (from all sources before taxes)**

- \_\_\_\_\_ 1. \$8,590 or less
- \_\_\_\_\_ 2. \$8,591 - \$11,610
- \_\_\_\_\_ 3. \$11,610 - \$14,630
- \_\_\_\_\_ 4. \$14,631 - \$20,000
- \_\_\_\_\_ 5. \$20,001 - \$30,000
- \_\_\_\_\_ 6. \$30,001 - \$40,000
- \_\_\_\_\_ 7. \$40,001 - \$50,000
- \_\_\_\_\_ 8. more than \$50,000

**Appendix F**  
CAVE Procedures Form

## Procedure for CAVE

Respondent Number \_\_\_\_\_

1. Turn on room lights--have subject sit in chairs in back while setting up CAVE.
2. Put Sign "Research Session in Progress---Do not Disturb" on entrance door.
3. Log in IDFL on CAVE computer.
4. Open "Assisted Living" window.
5. Turn on 4 projectors in CAVE
6. Set two chairs about 1 foot back from center of CAVE.
7. Remove tripod and set wand and glasses in chair on left.
8. Have subject sit down in chair on the right.
9. Click on "townhouse" button.
10. Sit in chair with both glasses and wand. Explain procedure:

Warning:

If at any time you feel dizzy or nauseous during our virtual tour please let me know. I will help you to remove your glasses. This will alleviate these sensations.

**Mrs. or Mr. \_\_\_\_\_ I am first going to show you a townhouse. I want you to imagine you are living in this house. Right now, you should see double images [Put glasses on subject]. Now, you should not see a double image. [Check to make sure glasses are working. Put on tracking glasses].**

11. "Walk" through the townhouse. **We are going to tour this house by viewing each room. Tell me what you think of the rooms.**

**Now, imagine that you are becoming frailer and you desire to move into an apartment that is easier to keep up. Assisted living facilities offer personal and health services to people who need some help with daily activities. Typically there is dining services that provide three meals a day, housekeeping, and security, as well as nursing staff available on call for emergencies and medical supervision. It is not a nursing home and does not offer the level of care available in nursing facilities.**

**I am going to show you four different apartments in an assisted living facility. They each have the same amount of space, but it has been allocated differently in each one. For instance in one the living room is larger and in another the bedroom is larger. One has a larger kitchen, and one has more space allocated for storage. We are going to view each one and get your reactions.**

12. Load SOCIAL model.

**This is the first assisted living apartment we will view. We will go to each room and I will ask you a question about how you would feel about living in a space like this.**

13. Walk to chair.

**We are in the living room. Imagine that you are visiting with a friend.**

**Do you think the space is appropriate for this activity?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is it not appropriate?*

**What other comments can you make about the living room?**

13. Walk to kitchen.

**Now we are in the kitchen. Imagine that you are going to heat up a cup of water in the microwave and make tea or coffee and then sit over at the table.**

14. Walk to cabinet with microwave.

**Please try to reach and touch the microwave.**

15. Walk over to the table.

**Do you think the space is appropriate for food preparation tasks that you would need to complete in an assisted living facility?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is it not appropriate?*

**What other comments can you make about the kitchen?**

16. Walk to bedroom.

**Now we are in the bedroom. A full size bathroom is behind this door.**

**Do you think the space is appropriate for you to sleep, dress, and do other activities you normally do in your bedroom?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is the space not appropriate?*

**What other comments can you make about the bedroom?**

17. Turn to view the closets.

**There are two closets in this bedroom. One is a long narrow closet to the left and the other is a small closet to the right.**

18. Turn to view hall closet.

**Do you think this space is appropriate for you to store the things you would have with you?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is the space not appropriate?*

**What other comments can you make about the storage space?**

**We have completed the tour of this apartment. Do you have any other comments about this apartment?**



19. Load SLEEP model

**This is the second assisted living apartment in the same building. It is very similar to the first apartment and I'm going to ask you the same questions I asked before about each room.**

20. Walk to chair.

**We are in the living room. Imagine that you are visiting with a friend.**

**Do you think the space is appropriate for this activity?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is it not appropriate?*

**What other comments can you make about the living room?**

21. Walk to kitchen.

**Now we are in the kitchen. Imagine that you are going to heat up a cup of water in the microwave and make tea or coffee and then sit over at the table.**

22. Walk to cabinet with microwave.

**Please try to reach and touch the microwave.**

23. Walk over to the table.

**Do you think the space is appropriate for food preparation tasks that you would need to complete in an assisted living facility?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is it not appropriate?*

**What other comments can you make about the kitchen?**

24. Walk to bedroom.

**Now we are in the bedroom. A full size bathroom is behind this door.**

**Do you think the space is appropriate for you to sleep, dress, and do other activities you normally do in your bedroom?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is the space not appropriate?*

**What other comments can you make about the bedroom?**

25. Turn to look at the closets.

**There are two closets in this bedroom. One is a long narrow closet and the other is a small closet beside the bathroom.**

38. Turn to view hall closet.

**Do you think this space is appropriate for you to store the things you would have with you?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is the space not appropriate?*

**What other comments can you make about the storage space?**

**We have completed the tour of this apartment. Do you have any other comments about this apartment?**

**Do you see anything different between this apartment and the previous one?**

24. Load FOODPREP model.

**This is the third assisted living apartment in the same building. It is very similar to the other apartments and I am going to ask you the same questions about each room.**

25. Walk to chair.

**We are in the living room. Imagine that you are visiting with a friend.**

**Do you think the space is appropriate for this activity?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is it not appropriate?*

**What other comments can you make about the living room?**

26. Walk to kitchen.

**Now we are in the kitchen. Imagine that you are going to heat up a cup of water in the microwave and make tea or coffee and then sit over at the table.**

27. Walk to cabinet with microwave.

**Please try to reach and touch the microwave.**

28. Walk over to the table.

**Do you think the space is appropriate for food preparation tasks that you would need to complete in an assisted living facility?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is it not appropriate?*

**What other comments can you make about the kitchen?**

29. Walk to bedroom and sit on bed.

**Now we are in the bedroom. A full size bathroom is behind this door.**

**Do you think the space is appropriate for you to sleep, dress, and do other activities you normally do in your bedroom?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is the space not appropriate?*

**What other comments can you make about the bedroom?**

30. Turn to look at the closets.

**There are two closets in this bedroom. One is a long narrow closet to the left and the other is a small closet in the hallway to the right.**

31. Turn to view hall closet.

**Do you think this space is appropriate for you to store the things you would have with you?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is the space not appropriate?*

**What other comments can you make about the storage space?**

**We have completed the tour of this apartment. Do you have any other comments about this apartment?**

**Do you see anything different between this apartment and the previous one?**

32. Load STORAGE model.

**This is the fourth assisted living apartment in the same building. It is very similar to the other apartments and I am going to ask you the same questions about each room.**

33. Walk to chair.

**We are in the living room. Imagine that you are visiting with a friend.**

**Do you think the space is appropriate for this activity?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is it not appropriate?*

**What other comments can you make about the living room?**

34. Walk to kitchen.

**Now we are in the kitchen. Imagine that you are going to heat up a cup of water in the microwave and make tea or coffee and then sit over at the table.**

35. Walk to cabinet with microwave.

**Please try to reach and touch the microwave.**

36. Walk over to the table.

**Do you think the space is appropriate for food preparation tasks that you would need to complete in an assisted living facility?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is it not appropriate?*

**What other comments can you make about the kitchen?**

37. Walk to bedroom and sit on bed.

**Now we are in the bedroom. A full size bathroom is behind this door.**

**Do you think the space is appropriate for you to sleep, dress, and do other activities you normally do in your bedroom?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is the space not appropriate?*

**What other comments can you make about the bedroom?**

38. Turn to look at the closets.

**There are two closets in this bedroom. One is a long narrow closet to the left and the other is a small closet in the hallway to the right.**

39. Turn to view hall closet.

**Do you think this space is appropriate for you to store the things you would have with you?**

Yes \_\_\_\_\_ No \_\_\_\_\_

*[If no, ask]. Why is the space not appropriate?*

**What other comments can you make about the storage space?**

**We have completed the tour of this apartment. Do you have any other comments about this apartment?**

**Do you see anything different between this apartment and the previous ones?**

**Of the four assisted living apartments that I have shown you, which did you like the best?**

**Why?**

40. Load OPENPLAN version of the subjects' favorite model.

**This is similar to the apartment that you liked best, only with a more open plan. What is your impression about this apartment?**

**Do you like it as well as the closed plan?**

**Thank you, Mrs./Mr. \_\_\_\_\_, please sit here for a moment and then we will go into the room where we were before so I can ask you just a few more questions.**

### **Follow-Up Questions**

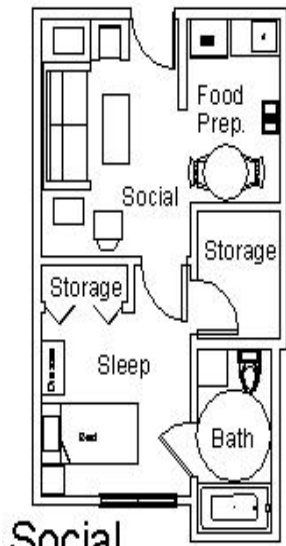
- 1. If you were very frail, would you choose to live in an assisted living facility? Why?**
- 2. In general do you think the models you have seen would provide adequate space for someone living in an assisted living facility?**
- 3. What did you think about viewing the apartments in a virtual environment?**
- 4. How effective was the virtual tour in helping you to understand the spaces as opposed to viewing a floor plan?**



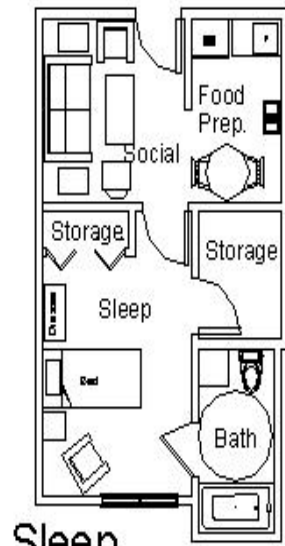
**Appendix G**  
Design Matrix

Design Matrix worksheet							
	General Unit	Entrance	Social	Food Prep.	Bedroom	Bathroom	Storage
<b>Design-Relevant Tasks</b>	Control Ambient Conditions Safety Response Ambulation (Moving around the unit)	Answer door. Operate hardware Recognize visitor	Work on projects (hobbies, paperwork) Visit Observe	Store and prepare food Eat Clean-up	Sleep Intimate Behavior Rest Dress	Undress Bathe / Shower Use toilet Groom	Recognize items Recover and replace items
Design-Behavior Principles							
Social Interaction		Porch-like					
Orientation / Way-finding /Accessibility	Accessible for all mobility aids No stairs Highlighted surfaces on level changes	Transition features and materials Lowered ceiling					
Stimulation / Growth							
Personalization / Homelike		Personalized doors Alcoves Built-in shelves					
Privacy	Single occupancy	Locks					
Autonomy		Lever handles Lights inside and outside					
Safety / Security		Peep holes Locks					
Aesthetics / Appearance/ Stimulation		Personalized doors Porch-like					

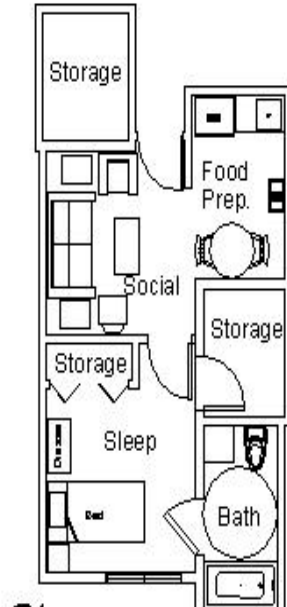
**Appendix H**  
CAVE Model Floor Plans



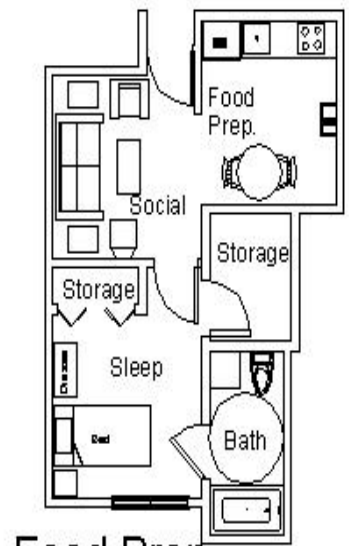
Social



Sleep












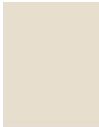



Storage

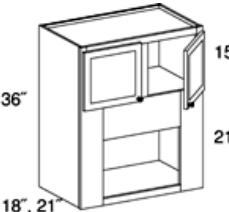
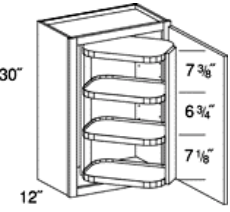
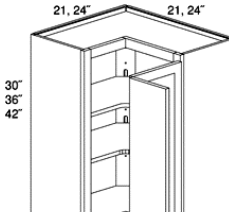
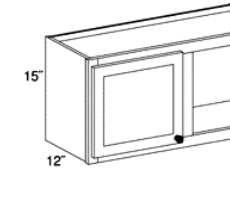
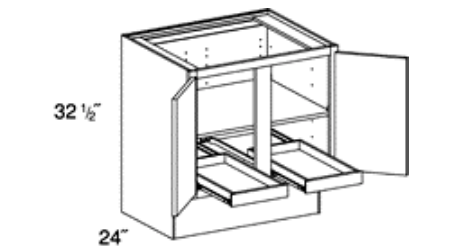
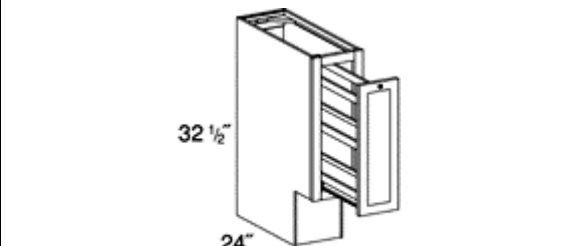
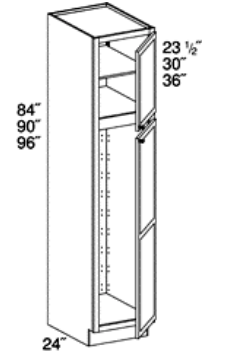
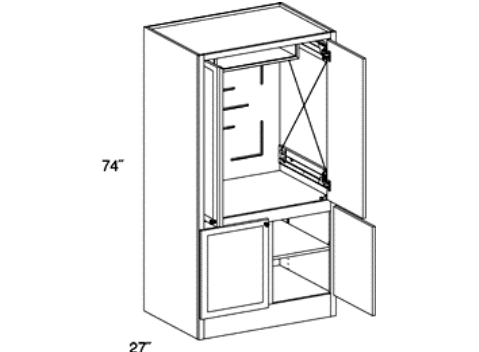
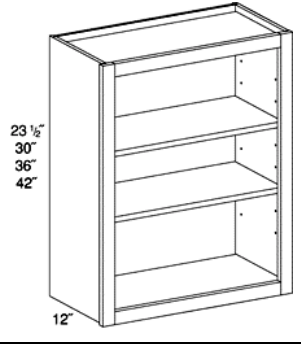


Food Prep

**Appendix I**  
Materials

Specified Materials					
	Social/Sleep	Food Prep		Bathroom	
<b>Flooring</b>					
	Vinyl sheet flooring with contrasting colors for use around cabinetry				
<b>Countertops</b>	N/A				
	Laminate countertops with contrasting colors for edges				
<b>Paint</b>					
	Unified paint color with the exception of contrasting wall behind toilet				

**Appendix J**  
Cabinet Schedule

Kitchen Wall Cabinets			
			
<b>24' Microwave cabinet</b>	<b>30'' Easy to reach cabinet</b>	<b>36'' Easy swing door cabinet</b>	<b>24'' Two door cabinet</b>
Kitchen Base Cabinets			
			
<b>30'' Cabinet with roll-out drawers</b>	<b>9'' Base pull-out pantry storage</b>		
Kitchen	Social	Bathroom	
			
<b>36'' Pantry unit</b>	<b>36'' Entertainment unit</b>	<b>36'' Stacked bathroom configuration.</b>	



## VITA

Emily Maples Stumb completed a Bachelor of Science degree in Interior Design at Appalachian State University in spring of 2000 and was accepted into the Masters program of the Department of Near Environments at Virginia Polytechnic Institute and State University in fall of 2000. While completing her bachelor's degree, she was employed by two residential design firms. During her graduate work, she was employed as a graduate assistant within her department. This thesis marks the completion of her Masters degree in the department of Housing, Interior Design, and Resource Management. She plans to practice in the field of interior design.