



Materials study according to universal design for aging in place management

Estudio de materiales según diseño universal para la gestión del envejecimiento en el lugar

JUNPRATEEP, Chartchay [1](#); SEVISET, Somchai [2](#); EAKWUTVONGSA, Songwut [3](#)

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ABSTRACT:

This research explores materials management and the concept of universal design based on interviews with five experts, in order to conduct a dependence analysis of 30 houses currently inhabited by elderly. The results of the evaluation suggested five key factors that, in all of the studied areas, were found in inappropriate condition. Overall, the evaluation of environmental conditions provided a low mean ($\bar{x} = 2.13$, S.D.=0.77). With the problem condition therefore an important reason for the study supporting effective functioning and preparing environmental conditions suitable for elderly.

Keywords: materials, universal design, aging in place, management

RESUMEN:

Esta investigación explora la gestión de materiales y el concepto de diseño universal basado en entrevistas con cinco expertos, con el fin de realizar un análisis de dependencia de 30 casas actualmente habitadas por personas mayores. Los resultados de la evaluación sugirieron cinco factores clave que, en todas las áreas estudiadas, se encontraron en condiciones inapropiadas. En general, la evaluación de las condiciones ambientales proporcionó una media baja ($\bar{x}=2.13$, S.D.= 0.77), Con la condición problemática, por lo tanto, una razón importante para el estudio apoyando el funcionamiento efectivo y preparando condiciones ambientales adecuadas para los ancianos.

Palabras clave: materiales, diseño universal, envejecimiento en el lugar, gestión

1. Introduction

Thailand is currently considered an aging society, and it is expected to become a completely aged society by 2080. In preparation of basic requirements for the elderly to live with quality and happiness, it is important to focus on the effective management of facilities and to provide a safe environment for them, as inappropriate domestic environment can be dangerous (Lan et al., 2009) or it can hinder their daily lives (Julie & Joseph, 2004). Proper design concept will improve the elderly's performance of daily activities (O'Meara & Smith, 2006). The present study is thus a starting point to gain understanding about the concept of materials design, taking into consideration safety, material choices, and environmental management to support the proper functioning of the elderly. More importantly, These design for proper respond to the elderly's living behaviors in terms of efficacy and satisfaction. The study also proposes guidelines on the features of required basic physical environmental conditions. It is expected for research results to be useful and applicable for long term care of the elderly, especially during the current social transition of

Thailand, as it is necessary to properly arrange outdoor environmental conditions for the upcoming aged society.

The above information reflected that falling is one of the crucial problems that mitigates the elderly's quality of life, and that it consequently increases the burden of relatives and family members, including caregivers. Preventing falls or reducing risk of accidents is thus a key measure to prevent the elderly from being injured or disabled, to enable their self-care and to reduce the burden of relatives and family members. This current study therefore is an important factor to together and propose a universal design. In this way, it will not only benefit the elderly but also other groups including disabled persons, children and disadvantaged groups.

1.1. Objectives

1. To explore materials use and universal design for aging in place, functional problems and limitations.
2. To propose appropriate environmental features as guidelines for aging in place management for the elderly.

2. Methodology

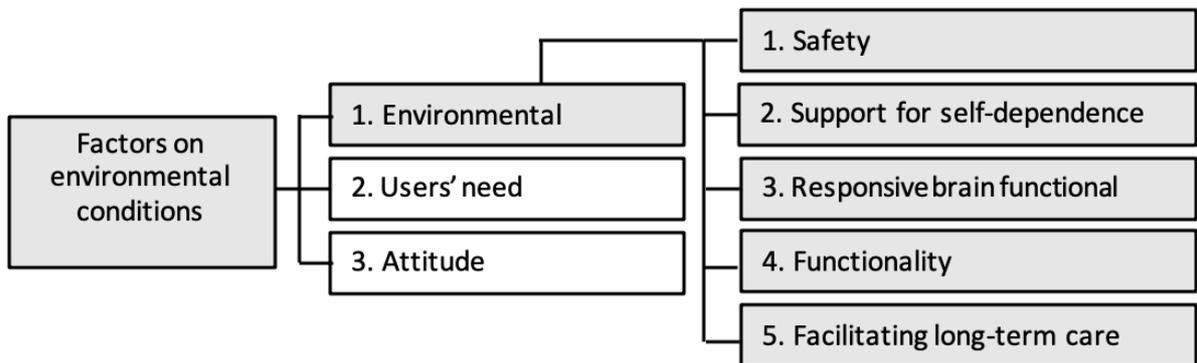
Information on materials study according to universal concept design for aging in place management was acquired and included in this research as follows.

2.1. Conceptual framework

Factors contributing to the successful use of housing environmental conditions need to be considered in a holistic environmental approach that includes three factors: appropriate physical environmental conditions, users' needs, and policies and attitude of caregivers that promote the use of outdoor spaces (Calkins 1988; Marsh 1981; Weisman 1981b). This study encompassed all of these three factors with a focus on exploring environmental design of suitable buildings. It involved a domestic and international review of literature, opinion interviews with experts and, finally, it drew conclusions on environmental conditions in relation to Thailand's tropical climate based on the following five features.

1. Safety for the elderly means safe environmental condition in terms of prevention of accidents from use and fall prevention.
2. Promoting self-dependence means environmental condition that can be used by the elderly themselves.
3. Responsive brain functional system means environmental condition that reduces stress and stimulates brain use.
4. Functionality means environmental condition that facilitates the use of outdoor spaces in tropical climate.
5. Facilitating long-term care means environmental condition that is easy to care for and functions effectively.

Figure 1
Conceptual framework for material aging in place management factors



2.2. Methodology

This research employed a qualitative research approach of survey research type, with the following procedures.

1. Reviewing design principles and concepts including other conditions that affect material use and elderly housing environmental spaces..
2. Developing an evaluation form on the features of material use and elderly housing environmental space for elderly.
3. Selecting sample area and sample population by means of purposive sampling considering the homes with the elderly actually living all day.
4. Conducting a survey and evaluation of material use and bathroom environmental space in the elderly's homes, observing and recording space using behavior, and interviewing with the elderly.
5. Analyzing and processing the survey results to identify the current problems of space condition, considering the relation of space use with the conditions of material use and home bathroom environmental space, and proposing key features of appropriate environmental conditions for elderly.

2.3. Population and sample

To examine the spaces and risk factors for domestic accidents among the elderly, the study areas were purposively selected under the following criteria: houses currently inhabited by the elderly; management of indoor and outdoor spaces for proper living; house owner consent for the survey; and houses being located in Thailand's Phitsanulok province.

Figure 2
Some selected field activities in the study areas in the homes currently inhabited by elderly



The government assigned the Phitsanulok province as the area where prompt action had to be taken on the 20-Year National Strategic Framework (2016–2036) regarding the support for aging society, and as the area to formulate 10-Year Development Strategies for Aging Society. In this light, specific importance was placed on selecting this province as the area for the investigation. A purposive sampling method was used to recruit five experts and 30 homes in the area of Phitsanulok, Thailand. The consideration criteria focused on the homes where the elderly actually lived in all day so as to capture space use behavior and various contexts of all routine activities. It is intended for the results of this research to help support the government's policies and to provide a design to solve problems, reducing risk of falls among the elderly due to inappropriate bathroom environment and other existing problems in the current aging society.

2.4. Research instrument

To ensure technical validity of this research, the following instruments were used:

- Informal interviews which offered clear conclusions of data and needs of the sample, since the elderly were the key informants from Phitsanulok province, Thailand. Which is an important sample in the study.
- Survey was conducted to investigate the study area, analyze the factors and real situation in the homes actually living by the elderly. The focus was the material exist of problems aging in place of elderly.

The above results were then submitted to experts for their review of content validity as determined by an index of item-objective congruent (IOC), and language validity. Content validity was reviewed by 3 experts with IOC of 0.89 referring to the following interpretation criteria.

1) Item with IOC between 0.50-1.00 provides acceptable validity

2) Item with IOC < 0.50 provides unacceptable validity and requires improvement

- Research instrumentation took on the following procedural steps (Petchroj L, Chamniprasart A., 2006: 113-121).

Step 1 Prepare the data, consider theories related to research objectives

Step 2 Choose open-ended questions

Step 3 Define the questions need to be asked

Step 4 Draft the questionnaire for investigation by the scope of objectives and submit to experts for a review.

Step 5 Prepare printed final questionnaires.

2.5. Data collection

1. Secondary data involves the data collected from relevant documents, texts, and similar research works.
2. Primary data involves the data collected with research instruments and the data captured from elderly group as guideline to implement the project.

2.6. Data analysis

The investigation of materials and according to universal design for aging in place management involves the data conclusions drawn from relevant documents, texts, interviews, and survey. The data was then interpreted by means of statistical analysis to describe the characteristics of qualitative and quantitative variables in terms of arithmetic mean or \bar{x} and standard deviation or S.D. The analysis was based on a 5-point rating scale of Likert scale, with the criteria shown below.

Mean scores 4.21 - 5.00 represent a highest level of propriety to materials design in place management for elderly.

Mean scores 3.41 - 4.20 represent a high level of propriety to materials design in place management for elderly.

Mean scores 2.61 - 3.40 represent a moderate level of propriety to materials design in place management for elderly.

Mean scores 1.81 - 2.60 represent a low level of propriety to materials design in place management for elderly.

Mean scores 1.00 - 1.80 represent a lowest level of propriety to materials design in place management for elderly.

3. Results

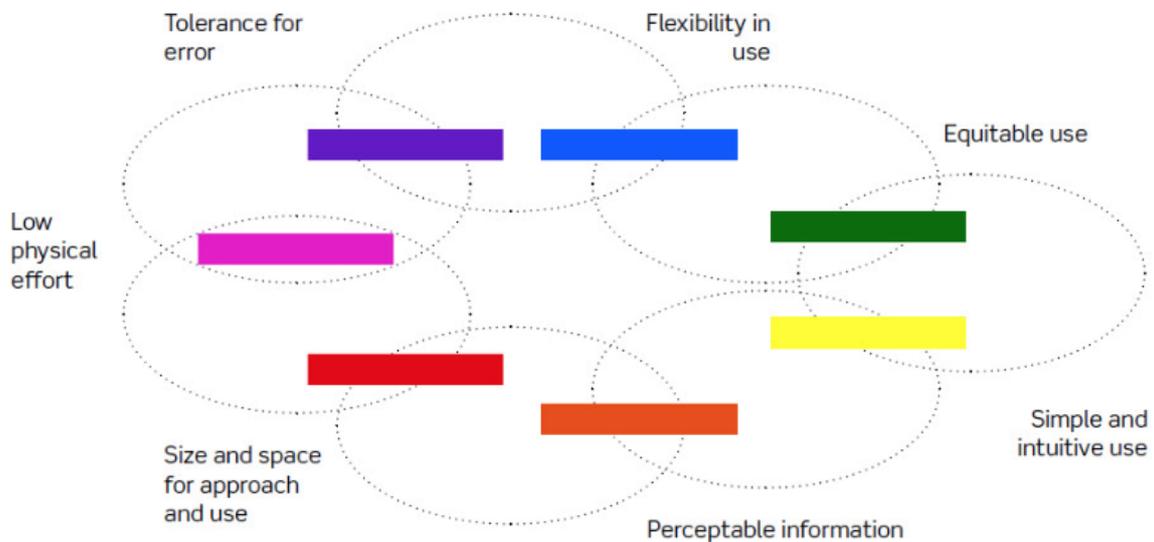
Results from explore materials use and universal concept design for aging in place management, functional problems and limitations, including design approach based on the conceptual framework significance of the universal design issues.

3.1. Proposed materials management to aging in place, guidelines from 5 experts.

It is proposed to create suitable and safe materials for aging in place management that facilitates functionality (Enabling Environments), to plan proper designs that offer comfort at old age and to reduce elderly problems by adopting universal design with seven key principles (Figure 3). (In a ring, links between UD principles can be understood by consideration of overlapping areas.)

Figure 3

Whether the very nature of the principles of universal design is holistic their mutual relationships may vary according to the context of design applications. By organizing them in a ring format, students may see multiple influences particularly in pairs of the principles. Their assignment is to interpret architectural applications of the principles that act in pairs.



Source: Mari Trommald. 2013. Trends in Universal Design.

Table 1

Significance of the design issues for good aging in place management from the in-depth interview with 5 experts. (based on the 7 principles of universal design)

Principles	(n=5)		
	\bar{x}	S.D.	Level
UD1. Equitable Use - The materials design is useful to all and corresponds the need of elderly.	4.40	0.55	High
UD2. Flexible Use - The materials design accommodates a wide range of change of each individual.	4.80	0.45	Highest

UD3. Simple and Intuitive Use - The materials design is easy to use without complexity and without complication.	4.60	0.55	Highest
UD4. Perceptible Information - The materials design helps communicate information that promotes sensory perception of users.	3.80	0.84	High
UD5. Tolerance for Error - The materials design minimizes accidental hazards and error in use.	4.60	0.55	Highest
UD6. Low Physical Effort - The materials design can be used efficiently and comfortably and with minimum force.	4.20	0.84	Highest
UD7. Size and Space for Approach and Use - Considering appropriate size and space materials accessible.	4.80	0.45	Highest
Total	4.46	0.60	Highest

Table 1 illustrates the results of in-depth interviews with five design experts regarding the guidelines and significance of materials study for aging in place management, based on the seven principles of universal design. As it suggests, it is important for the design to accommodate to the varying needs of each individual, having a mean of the highest level ($\bar{x} = 4.80$, S.D. = 0.45); for the design to be easy to use, without complexity or complications that could cause troubles, having a mean of the highest level ($\bar{x} = 4.60$, S.D. = 0.55); for the design to minimize accidental hazards, with a mean of the highest level ($\bar{x} = 4.60$, S.D. = 0.55); for the design to be possible to use effectively and comfortably and with minimum force, with a high-level mean ($\bar{x} = 4.20$, S.D. = 0.84); for the design to consider appropriate sizing and accessibility, with a mean of the highest level ($\bar{x} = 4.80$, S.D. = 0.45); for the design to be useful for all and to satisfy the needs of the elderly, with a high-level mean ($\bar{x} = 4.40$, S.D. = 0.55); and for the design to communicate information that promotes sensory perception of users, with a high-level mean ($\bar{x} = 3.80$, S.D. = 0.84). These results will allow to propose guidelines for materials study for aging in place management.

Table 2
Concept design for proper aging in place materials management according to individual features from in-depth interviews with five experts (based on the conceptual framework)

5 features of Propriety by Aspect	(n=5)		
	\bar{x}	S.D.	Level
1) Safety for elderly means environmental condition that is safe in terms of prevention of accidents from use and fall prevention	5.00	0.00	Highest
2) Support for self-dependence means environmental condition that is supportive to utilization by elderly themselves.	4.60	0.55	Highest
3) Responsive brain functional system means environmental condition that reduces stress and stimulates brain use.	4.80	0.45	Highest
4) Functionality means environmental condition that facilitates the use of outdoor spaces in tropical	3.80	0.84	High
	4.60	0.55	Highest

climate.			
5) Facilitating long-term care means environmental condition that is easy to care and functions effectively.			
Total	4.56	0.48	Highest

Table 2 presents five features from the in-depth interview with five experts. The concept design for aging in place materials management considers: safety for the elderly with a highest level mean ($\bar{x} = 5.00$, S.D.=0.00); promotion of self-dependence with a highest level mean ($\bar{x} = 4.60$, S.D.=0.55); responsive brain functional system with a highest level mean ($\bar{x} = 4.80$, S.D.=0.55); functionality with a high level mean ($\bar{x} = 3.80$, S.D.=0.84); and facilitating long-term care with a highest level mean ($\bar{x} = 4.60$, S.D.=0.55). The overall five features of materials management conditions were rated at a highest level with a mean of ($\bar{x} = 4.56$, S.D.=0.48).

3.2 Investigation of material exist in aging in place 30 houses areas.

The results hereby presented correspond to the study areas of 30 houses currently inhabited by elderly people. The collected data focused on the concept and attitude of the elderly regarding material use in housing environmental design, including design approach and material use in housing environmental design based on the conceptual framework.

Table 3
Detailed investigation of concept on material use and housing environmental design

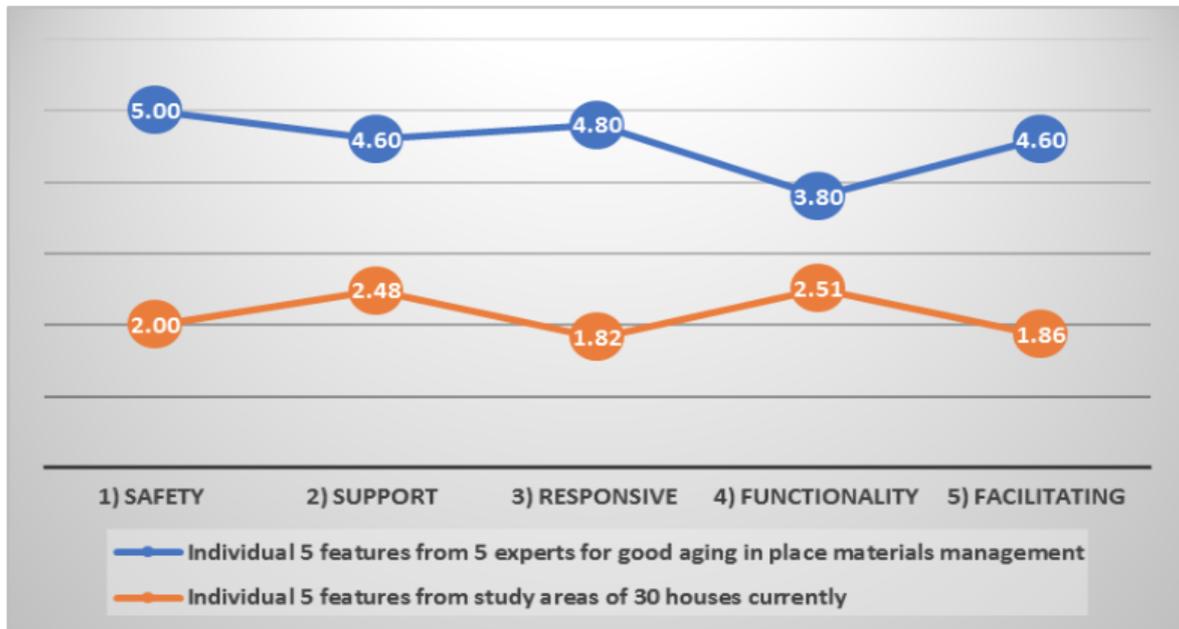
Propriety by Detailed Aspects	(n = 30)		
	\bar{x}	S .D .	Level
1) Safety			
1.1 Environmental design of walkways with slopes not exceed 1:12	1.50	0.57	Lowest
1.2 Material surface not too slippery to cause risk of accidents.	1.93	0.78	Low
1.3 Walkways with no less than 1.00 meter in width.	2.67	0.84	ModerateLow
1.4 Not too many split-levels along the walkways	1.93	0.98	Low
1.5 No dim or risk spot to cause danger	1.97	1.00	
Total of safety features	2.00	0.84	Low
2) Support for self-dependence			
2.1 Easy and uncomplicated for oneself to use spaces			ModerateModerateModerateLow
2.2 Suitable for elderly's physical changes	2.70	0.92	
2.3 Suitable for elderly's behaviors	2.77	0.97	Low
2.4 Easy, convenient, and quick to entry and exit even in emergency	2.83	0.91	
2.5 Easy for body movement with activities of daily living	1.97	0.72	
2.5 Easy for body movement with activities of daily living	2.13	0.57	
Total of support for self-dependence	2.48	0.82	Low
3) Responsive brain functional system			
	1.60	0.50	Lowest

3.1 Presence of elements to remind or refresh memories	1.63	0.61	Lowest
	1.77	0.77	
3.2 Noticeable marks of functions being in place to help reiterate cautions.	2.03	0.89	Lowest
	2.07	0.74	Low
3.3 Signs being established on how to use spaces			Low
3.4 Supportive atmosphere to perform daily living activities			
3.5 Surrounding atmosphere to generate positive feelings			
Total of responsive brain functional system	1.82	0.70	Low
4) Functionality			
4.1 Materials and environmental conditions suitable for climate			High
	3.50	1.11	Moderate
4.2 Floor-wall materials suitable for activities of daily living	2.80	0.85	Moderate
			Lowest
4.3 Taking into account enough light to ensure visibility	2.93	0.94	Lowest
	1.70	0.70	Lowest
4.4 Available spaces modifiable to changing functional context	1.60	0.56	
4.5 Electronic or technological devices available for modern equipment			
Total of functionality	2.51	0.83	Low
5) Facilitating long term care			
5.1 Beautiful materials used and environmental design			Lowest
	1.70	0.53	Moderate
5.2 Types of materials and building design relevant to the context	2.80	0.76	
			Lowest
5.3 Spaces provided to store and maintain equipment for elderly	1.57	0.68	Lowest
			Lowest
5.4 Spaces provided to manage elderly health care medicines	1.77	0.82	Lowest
	1.47	0.57	
5.5 Environmental design taking into account easy care			
Total of facilitating long term care	1.86	0.83	Low
Total	2.13	0.77	Low

Table 3 presents the results on material use and housing environmental design concept. It can be seen that the construction design, environmental management, and material choices for housing were not that suitable and effective, and lacked standards in systematic housing planning. Propriety was rated at a low level ($\bar{x} = 2.13$, S.D.=0.77), design of walkways with slopes not standard ($\bar{x} = 1.50$, S.D.=0.57), material surface not too slippery to cause accidents was rated at a low level ($\bar{x} = 1.93$, S.D.=0.78). These houses were mostly designed with too many split-levels and dim spots. Propriety of available spaces modifiable to changing functional context was rated at a lowest level ($\bar{x} = 1.70$, S.D.=0.70). Taking into account electronic or technological devices for modern equipment was rated at a lowest level ($\bar{x} = 1.60$, S.D.=0.56), spaces provided for elderly medicinal management and taking into account easy care were all rated at a lowest level ($\bar{x} = 1.77$, S.D.=0.82 and $\bar{x} = 1.47$, S.D.=0.57).

Figure 4
Five individual features relate to the in-depth interview with five experts and

to the results from study areas of 30 houses currently inhabited by elderly.



As presented in **Figure 4**, five features relate to the in-depth interview with five experts and to the results from study areas of 30 houses currently inhabited by elderly and useful for long term elderly care to support Thai social change toward the upcoming aged society. Major problems to be particularly concerned with regarding the way the elderly currently live include the following: safety at a low level ($\bar{x} = 2.00$, S.D.=0.84) wide opposite five experts show at concept design for proper ($\bar{x} = 5.00$, S.D.=0.00); environmental condition facilitating long term care was rated at the lowest level ($\bar{x} = 1.86$, S.D.=0.83); responsive brain functional system at a low level ($\bar{x} = 1.82$, S.D.=0.70) wide opposite five experts show at concept design for proper ($\bar{x} = 4.80$, S.D.=0.45); support for self-dependence at a moderate level ($\bar{x} = 2.48$, S.D.=0.82); and functionality at a low level ($\bar{x} = 2.51$, S.D.=0.83). The overall five features of environmental conditions was rated at a low level ($\bar{x} = 2.13$, S.D.=0.77).

4. Conclusions

The concept of materials management for elderly housing takes into consideration the management of spaces and risk factors of accidents of elderly in their home. It not only focuses on good ventilation as an architectural principle but also the tenet of universal design with seven key principles to properly accommodate the elderly. The preparation of the environmental condition should respond to the basic needs of the elderly: concern regarding environmental design of walkways with slopes, easy and uncomplicated ways to use spaces, modifiable spaces according to functional context.

For example, doorways should be approximately 1 m wide in a sliding door format in order to reduce normal door swing space and facilitate wheelchair and stepping inside the bathroom. The design of sinks half-mounted to countertops are strong enough to bear weight when used in standing position, installed with 0.75 m high from the upper edge and 0.65 high from the lower edge and tiled with granite for easy care, including lever handle mixer faucet to reduce force when use, and a mirror with the bottom edge 0.90 above the floor allowing to see the whole body. The most important factor to watch out for is safety, as the bathroom is the most frequent place where accidents happen among elderly. The design should consider even floors inside and outside of the bathroom while allowing proper water drainage. It is suitable to choose floor tiles with rough, non-slip surface but that offer a sense of warmth. Devices and vertical grab bars to support the body are fixed around the space inside the bathroom, with 3-4 cm diameter handle size located at 0.80 m high from the floor, using non-slip materials easy to use for body support. Bathroom space for the elderly should be 1.50 – 2.00 m minimum in diameter and barrier-free to accommodate the circulation of devices and wheelchair. Space is prepared for caregivers to assist in bathing, and the space requires some slope for water to flow quickly to drain pipe, including shower seat with 0.45 m high, easy to clean, with an adjustable shower, lever handle faucet, and grab bars for body support alongside. To prepare appropriate environment for elderly both interior and exterior of the bathroom, it is necessary to understand risk factors and real problems so that proper care and prevention standards can be established.

Bibliographic references

- Archbold, P.G., Stewart, B.J., Greenlick, M.R., & Harvath, T. (1990). Mutuality and Preparedness as Predictors of Caregiver Role Strain. *Research in Nursing & Health*, 13(6), 375-84.
- Bechtel, Robert B., Marons, Robert W. and Michelson, William. *Methods in Environmental and Behavioural Research*. New York: Van Nostrand Reinhold, 1987.
- Cieirelli, V. (1981). Helping Elderly Parents: The Role of Adult Children. Boston: Auburn House.
- Census and Statistics Department (2012). Population census thematic report: Older persons. Retrieved June 2014, from <http://www.census2011.gov.hk/pdf/older-persons.pdf>.
- Census and Statistics Department (2013). Population and household statistics by district council district. Retrieved June 2014, from <http://www.censtatd.gov.hk/hkstat/sub/sp150.jsp?productCode=B1130301>.
- Connell, Bettye Rose, Jon A. Sanford, and Donna Lewis. "Therapeutic Effects of an Outdoor Activity Program on Nursing Home Residents With Dementia." *Journal of Housing for the Elderly* 21, (3-4): 194-209. Accessed August 11, 2016. doi:10.1300/j081v21n03_10.
- Chaninprasert V.(2006). Anthropometric Study of Thai Elderly. *A Thesis, Industrial Engineering, King Mongkut's University of Technology North Bangkok*.
- Ministry of Social Development and Human Security. (2004). *Elderly Person Act, B.E. 2546* (2003). Bangkok: J.S.
- Ministry of Social Development and Human Security. (2010). *The 2nd National Plan on the Elderly 2002-2021*. Bangkok: Theppenvanich.
- Ministry of Social Development and Human Security. (2009). *Situation Of the Thai Elderly 2008*. Bangkok: TQP.
- Molly Follette Story, M.S. IDSA. Principles of Universal Design. *Universal Design Handbook*. New York: Mc Grow - Hill. 2001.
- Pynoos, J., Mayeda, A., & Lee, C. (2003). Home Modification Resource Guide. Los Angeles, CA: University of Southern California, *The National Resource Center on Supportive Housing and Home Modification*.
- Ronald L. Mace on NC State University, College of Design. *Design.ncsu.edu*. Retrieved 2013-07-26.
- The Association of Siamese Architects under the Royal Patronage of His Majesty the King (2009). *Universal Design Code of Practice*. Bangkok: J.S.
- Sandra, H. C. (1980). Designing for aging: *Pattern of use (2nd ed.)*. London: The MIT Press.
- Shikder, Shariful H., Price, Andrew, and Mourshed, Monjur. "Systematic Review on the Therapeutic Lighting Design for the Elderly." Paper Presented in CIB World Building Congress 2010: Building a Better World, Salford, May 10-13, 2010.

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1. D.I.ED., Candidate in Industrial Education, Faculty of Industrial Education and Technology, King Mongkut's Institute of Technology Ladkrabang (KMITL), Thailand. Contact e-mail ck_architect@hotmail.com
 2. D.I.ED., Assistant Professor, Ph.d., Faculty of Industrial Education and Technology, King Mongkut's Institute of Technology Ladkrabang (KMITL), Thailand. Contact e-mail kssomcha@yahoo.com
 3. D.I.ED., Associate Professor, Ph.d., Faculty of Industrial Education and Technology, King Mongkut's Institute of Technology Ladkrabang (KMITL), Thailand. Contact e-mail momojojo108@gmail.com
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