

Economic Value of Pavement for the Elderly:

Case Study of Bangkok, Thailand

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Abstract: Based on the concept of a livable and global age-friendly city, pavements are a public facility that the city should provide to the people. Appropriate pavements will be beneficial for the people, particularly for good quality of life for the elderly to move around in the city. This study explored the behaviour of the elderly in the use of pavements and the problems confronted. The study also evaluated the value of the pavement walking area as it reflected the benefits of pavements to the elderly by applying the Contingent Valuation Method (CVM). During March-May 2017, data were collected using interviews with 601 elderly living in Bangkok. The study indicated that the main problem for senior citizens regarding their use of pavements was from being disturbed by motorbikes riding on the pavements. The average value of pavement for the elderly was about THB 160 (USD 5.30) per person per year. Thus, the benefits of pavements to the elderly in Bangkok was approximately THB 158 million (USD 5.2 million) per year. Thus, policy makers should make proper budget allocations for elderly-friendly pavement management and seriously address the problems confronting the elderly in using pavements, to maximize the usefulness of pavements not only for the elderly but also for the public and to support a sustainable urban development.

Key words: economic value; pavement; elderly; contingent valuation method (CVM) **JEL codes:** R00

1. Introduction

At present, the demographic structure of the world and Thailand has changed and the number of the elderly has increased rapidly. According to Thailand's National Statistical Office (2014), the number of elderly accounted for 6.8% of the total population in 1994 but has since increased to 9.4%, 10.7% and 12.2% in 2002, 2007 and 2011, respectively. The survey in 2014 also showed that the proportion of the elderly in Thailand accounted for 14.9% of the population. In Bangkok, according to the Department of Provincial Administration, Ministry of Interior (2016), in 2005, with a low percentage of the elderly (9.86%), Bangkok had not yet become an elderly society under the definition given by World Health Organization (WHO) (2001), which is defined as a society with a population aged over 60, representing more than 10% or a population aged over 65, representing more than

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7%. However, with the percentage having moved up to 10.21% in 2006, this pushed Bangkok into the aging society category. The percentage has grown constantly, and by 2015, the proportion of the elderly in Bangkok was 15.77%. The average growth rate of the elderly in Bangkok during 2005-2015, was 4.88% per year.

Due to the above mentioned changes and trends, state welfare for the elderly is important and the Bangkok Metropolitan Administration (BMA) has introduced services for the elderly as a part of the BMA's management plan (2013-2017), which aims to provide comprehensive public facilities and services for the elderly such as transport service for the elderly using wheelchairs, wheelchair accessible pavement construction, renovation of walkways and crossings, and establishment of elderly care centers. Projects and measures, set up in the BMA's management plan (2013-2017) aim at a better quality of life for the elderly (Strategy and Evaluation Department, Bangkok Metropolitan Administration, 2013). This approach by the BMA is in line with the concept of Livable City and Global Age-friendly Cities, defined by the World Health Organization (WHO, 2007), placing emphasis on the elderly participation, in terms of needs, preferences, decision and life style choices, and resource allocation. The payement is a kind of public services that the city should provide to promote a good livable, environmentally and age-friendly city, as stated in the WHO's guidelines. Pavements should be appropriate for the public. In particular, appropriate pavements will contribute to the good quality of life for the elderly to enjoy living in the city. Therefore, studying the demand for pavement uses by the elderly will help to understand the needs of the elderly for using pavements and will enable them to participate in the development of pavements in Bangkok to improve their quality of life. The pavements in Bangkok are regarded as public services that the state must supply to the public without pricing, unlike a general private good or service.

Therefore, in order to support the respective BMA's executives to supply pavement walking areas to satisfy the needs of the elderly and to apply economic analysis for rational decision making to provide pavement walking area for the elderly effectively, the purposes of this study were to examine the behaviour of the elderly in the use of pavements and to evaluate the economic values of pavement walking areas by applying the Contingent Valuation Method (CVM). The results of the study can be used as a guideline for other public service delivery to the elderly.

2. Literature Review

Pavement management of the walking area is directly beneficial to society and the people, Yabe et al. (2013) concluded that the value of pavements comprises two parts. The first part is pavements, as a public service, that the state must provide to the people. The value of the pavements is for every single person, so it is necessary to maintain such benefits, not only for the present generation but also for future generations. It can be mentioned that the value of pavements is the value of public enjoyment and must be preserved by the state management. The second part is pavements as a private service. Considering walking as an exercise, each person may be willing to pay in order to obtain benefit from walking on the pavement. As people in Bangkok, both those using and not using pavements, will benefit directly from the tidy appearance and better quality of life, public participation should be involved to cogently express their satisfaction and the problems in using pavement so the BMA can manage the pavement to meet the needs of most pavement users.

However, as the pavement is a non-marketed product without an explicit selling price, like any general private good in the market, the Contingent Valuation Method (CVM) can be used to estimate the economic values of the use of pavement for use by elderly people, by surveying how much they would be willing to pay for

specific pavement management in Bangkok. The evaluation will reflect the benefits they obtain from having the appropriate pavement in good condition for their use.

The concept of CVM is to estimate values by directly asking each respondent to express satisfaction or preference regarding goods or services consumption (pavement, for this study) under the given conditioned hypothetical scenario (Hanemann et al., 1991). Mitchell and Carson (1989) and Johansson (1993) explained that each consumer can rationally purchase goods and services for the maximum satisfaction (Eq. (1)), within a budget constraint (Eq. (2)):

$$Max \quad U = U (X, Z; SC) \tag{1}$$

s.t.
$$I = PX$$
 (2)

where X is a vector of the market products or services with market price or private goods, Z is a vector of non-marketed goods or services without an explicit selling price or public service values, SC is the socio-economic characteristics of the consumer (income, education, age, etc.), I is the income, and P is the price of a private good or service. Within the socio-economic factors of the consumer, the demand for private goods or services (X) can be represented using Eq. (3) in the form of price (P) and income (I):

$$X = X (P, I; SC)$$
(3)

When Eq. (3) is substituted in Eq. (1), the indirect utility function of the consumers (V) is obtained, which is a function of price (P), income (I) and the quantity or quality of public service (Z) as shown in Eq. (4):

$$V = U [X(P, I), Z; SC] = V (P, I, Z; SC)$$
 (4)

If there are changes in the quality or quantity of the public service (Z), then the utility function in Eq. (4) will change as shown in Eq. (5):

$$V = V (P, I, Z_1; SC) - V (P, I, Z_0; SC)$$
 (5)

Where Z_0 and Z_1 are the level of quality of public service (Z) before and after changes, respectively. Since the level of utility cannot be measured exactly, monetary measurement can assess the change in utility level. The amount of money will be reflected in the Compensating Variation (CV) shown in Eq. (6):

$$\Delta V (P, I - CV, Z_1; SC) = V (P, I, Z_0; SC)$$
(6)

CV refers to the maximum amount of money that would be taken from the consumers to keep them with the initial utility after a change. CV will reflect the willingness to pay (WTP) for the change in the public service in the study. In this study, the elderly, using the pavements in Bangkok, will derive greater satisfaction if the BMA improve the pavement walking area because they will obtain benefits from the improved walkable pavements (in the hypothetical scenario).

Most research on pavements has usually been conducted to study physical aspects, involving roles and functions (Srilertchaipanij, 2014), pavement design (Sirisali & Sawangjaroen, 2014; Woldeamanuel & Kent, 2015), social and health issues concerning safety in the use of pavements (Pongponrat & Phoompamorn, 2015), factors affecting pedestrian safety in the use of pavements (Pongphanich, 2015), the development of a walkability index (Dasri & Bejrananda, 2016) and the economic impacts of walking on the pavements (Litman, 2003). However, there has been limited research applying the CVM to estimate the values of public services, such as the evaluation of values of the green areas (Bejranonda & Attanandana, 2011) and the use of health care services (Liu et al., 2014; Bock et al., 2016; Shin et al., 2016). There has been research employing a choice model (CM) to evaluate the values of walking for health (Nomura et al., 2015).

3. Research Methodology

Full-scale survey data were collected from face-to-face interviewing of 601 respondents as representative of the elderly in Bangkok, aged 60 or above and using pavements for getting around, during March-May 2017. Bangkok, as the area of study was divided by the proportion of public area to the number of elderly people, into five groups: i) less than 6 m² per person, ii) 6-15 m² per person, iii) more than 15-20 m² per person, iv) more than 20-30 m² per person, and v) more than 30 m² per person, respectively. In each group, the sample size was proportional to the number of the elderly in the group. Data collection was undertaken during work days and on weekends, at various times during the day and evening in equal proportion, to ensure representative data were collected.

Prior to the data collection for analysis, the questionnaire was tested to reduce any problems with using the CVM (Whitehead et al., 1993) and to collect starting bids. The questionnaire, with open-ended questions, was tested in a pilot study with a sample of 30 people to estimate their willingness to pay for pavement management. The four starting bids with the highest frequency were THB 50, THB 100, THB 150, and THB 200 per person per year, respectively.

The questionnaire, used in the interview, consisted of five parts. The first part examined the pavement use behaviour of the elderly (such as pavement location, frequency of use, using time, main purpose of the use, experience of accidents). The second part inquired about their understanding of the physical features of the walking area of the pavement. The third part focused on the problems confronted by the elderly when using the pavement and the samples were allowed to prioritize the experienced physical problems in using the pavement (such as uneven pavement surface, insufficient width of pavement, insufficient sidewalk facilities, unsuitable height of pavement curbs). The fourth part was composed of the key questions about the hypothetical market of the CVM. The created scenario proposed that the BMA had a pavement management for the elderly project with a limited budget and asked the elderly to contribute their allowance towards this project. Under these circumstances, this was represented by whether the respondents would be willing to pay the starting amount of money in the questionnaire. Each respondent was given a different starting bid and asked to pay a random amount of money as the sequence of bids. The second bid was based on the respondents' response to the first bid. First, it would be doubled as a second bid if the starting bid was accepted and then the same question was asked. If the respondent accepted the second bid, then the valuation of the pavement management would be between the second bid and infinity. If the respondent did not accept the second bid, then the valuation would be between the first bid and the second. On the other hand, the starting bid would be cut in half, if the respondent did not accept the first bid and then the same question was asked. If the respondent accepted the second bid then the valuation of the pavement management would be between the first and second bids. If the respondent did not accept the second bid, then the valuation would be between the second bid and zero. These values were used as the CV estimates in this research. This part included the respondents' reasons for supporting or not supporting the project. The final part was socio-economic information of the respondents.

The questionnaires, containing the four different starting bids, were equally distributed to each area of the study. The respondents were randomly selected to be interviewed using one questionnaire with single amount for the starting bid to estimate the willingness to pay for the pavement management for the elderly project (as described in the hypothetical scenario).

A model was used to estimate the elderlys' willingness to pay (WTP) for pavement management or CV in

accordance with the regression analysis of Cameron (1988) by using Maximum Likelihood Estimation based on a lognormal distribution function, as shown in the Eq. (7):

 $(lowern_i, uppern_i) = a_0 + a_1 freq + a_2 dist + a_3 acci + a_4 safe + a_5 like + a_6 know + a_7 prob$

 $+ a_8 age + a_9 work + a_{10} inc + a_{11} incf + a_{12} mem + a_{13} mema + a_{14} edu$

 $+ a_{15}occ2 + a_{16}occ3 + a_{17}occ4 + a_{18}occ5 + a_{19}occ6$

The definitions of the variables analyzed in this study are shown in Table 1.

Variable	Explanation
lowern _i	The lower bound of willingness to pay for pavement management, given by the i th respondent
uppern _i	The upper bound of willingness to pay for pavement management, given by the i th respondent
freq	Frequency of use of pavement; $0 =$ regularly use and $1 =$ not regularly use
dist	Average walking distance on the pavement (meters)
acci	Experience of accident in the use of pavement; $0 =$ never experienced and $1 =$ experienced
safe	Security regarding travelling along the pavement; 0 = feel unsecured and 1= feel secured
like	Satisfaction with current pavement conditions; $0 =$ dissatisfied and $1 =$ satisfied
know	Knowledge about walking area of the pavement (score)
prob	Level of importance of problem using the walking area of the pavement by the elderly (score)
age	Age of the respondent (years)
work	Working status of the respondent; $0 =$ employed and $1 =$ retired or unemployed
inc	Average income of the respondent (THB per month)
incf	Average total revenue of the household (THB per month)
mem	Number of household members earning income (persons)
mema	Number of household members aged 60 and above (persons)
edu	Number of years of formal education of the respondent (years)
occ _i	Career i, for $i = 1, 2, 3,, 6$ for career of employee of private company, business owner/merchant, self-employed, employee/job seeker, and homemaker/ retired official/ unemployed, respectively. It was assumed that "employee of private company" was the baseline. 1 = pursue such career and 0 = do not pursue such career
a ₀ , a _j	Constants and coefficients of independent variable; j=1, 2,19, respectively

Table 1 Explanation of Variables in Maximum Likelihood Estimation Lognormal Distribution Function (Eq. (7))

4. Results and Discussion

4.1 Background of Respondents

The results showed that most respondents were married, male, average age of 67, and had completed a course at junior high school. They were unemployed, while most of working respondents were business owners and merchants. Their average personal income was THB 17,522 (US\$ 585) per month, funded by their financial sponsors. The number of their family members, earning income was four and the average total revenue of the household was THB 73,675 (US\$ 2,455) per month. The average number of elderly family members was two per household.

4.2 Elderly Respondents' Behaviour to Use Pavements

Most respondents used main street pavements (68%), followed by street/lane pavements (32%). They walked on the pavement every day. The average walking distance along the pavement was 703 meters per day (Figure 1). They used the pavement in the morning and evening (71%) with their family members (49%). The main purposes

(7)

for using the pavement were going out shopping, doing activities in the community, going to work, and going for exercise, respectively (Figure 2). Most respondents had never experienced an accident from walking on the pavements (93%), however they felt insecure when using pavements.

Figure 3 shows that most elderly respondents faced problems from using the pavement. The most common problem were motorcycles riding on the pavements, cars parking on the pavements, uneven pavement surfaces, narrow pavements, pavement encroachment from hawkers and public utilities, and lack of lighting at night, respectively. The elderly respondents attached importance to the problems associated with the physical use of pavements in Bangkok at the "Very important" level. From their point of view, the most important problems were uneven pavement surfaces, followed by the narrow pavements, and insufficient facilities for the elderly to use pavements, respectively (Table 2).



≥ 1500 m 10% >1000-1499 m 25% 500-1000 m 26%

Figure 1 Respondent's Walking Distance Along the Pavements

Figure 2 Respondents' Objectives of Using Pavements



Figure 3 Respondent's Problems of Using Pavements

						-			
		Impor	tant Level of pr	oblems ^{1/}		Total	Average	Level ^{2/}	Rank
Problems	Less	Somewhat	Moderately	Somewhat	Very	number ¹⁷	score		
Troblems	important	less	important	very	important				
	_	important	_	Important	_				
Unavan navamant surfagas	8	9	28	101	455	601	4.64	Е	1
Uneven pavement surfaces	(1.30)	(1.50)	(4.70)	(16.80)	(75.7)	(100.00)			
Narrow pavements (improper	9	19	20	235	318	601	4.39	Е	2
width of pavements)	(1.50)	(3.20)	(3.30)	(39.10)	(52.90)	(100.00)			
Insufficient facilities for the	10	14	75	195	307	601	4.29	Е	3
elderly to use pavements	(1.70)	(2.30)	(12.50)	(32.40)	(51.10)	(100.00)			
Inannranriata navamant aurh	10	23	73	237	258	601	4.18	D	4
mappropriate pavement curb	(1.70)	(3.80)	(12.10)	(39.50)	(42.90)	(100.00)			
Disconnection between	13	19	88	241	240	601	4.12	D	5
pavements and pedestrian	(2.20)	(3.20)	(14.60)	(40.10)	(39.90)	(100.00)			
facilities, such as pedestrian									
flyovers, crosswalks									
Lack of clear separation	20	17	75	247	242	601	4.12	D	5
between pavements and road	(3.30)	(2.80)	(12.50)	(41.10)	(4030)	(100.00)			
surfaces									
T1		41 1.4	1.1.	1		1 1 1	<u>.</u>		. 1

Table 2 Respondents' Views Classified by Important Level of Problems Associated with Physical Use of Pavements

The overall opinion level of importance, attached to the problems or obstacles associated with the physical use of pavements by the elderly in Bangkok was 4.29 = "Very important" level

Note: ^{1/} Figures in the upper row represent number of respondents, and numbers in brackets are the percentage of respondents

^{2/} Level of average score where A = Less important (1.00-1.80), B = Somewhat less important (1.81-2.60), C = Moderately important (2.61-3.40), D = Somewhat very important (3.41-4.20), and E = Very important (4.21-5.00)

4.3 Willingness to Pay for Pavement Management

4.3.1 Opinions on Supporting the Pavement Management Project for the Elderly

In the hypothetical case proposed for a project of pavement management for the elderly in Bangkok, most respondents agreed with the project (80%), yet they were not willing to pay for the project (73.6%) because the preparation of pavements for the elderly was considered to be the responsibility of the relevant government agencies and the government should approve the budget to support such projects. People should not have to pay. On the other hand, the respondents who indicated willingness to pay for the pavement management (21.1%) were willing to pay in the form of donations (96.1%). Their stated specific reasons were to enhance the quality of life of the elderly (82.7%), followed by the safety of pedestrians (69.3%), and participation in pavement management (48.8%), respectively.

In their response to the willingness to pay for the pavement management for the elderly in Bangkok, it was found that the opportunity for the elderly to refuse to pay for pavement management in Bangkok was higher, when the starting bid increased (Table 3).

Table 3	Percentage of Respondents Accepting or Refusing the Second Bid Regarding Willingness to Pay for Pavement
	Management for the Elderly in Bangkok

Starting hid (TUD per year)	Number of respondents (persons)	Pe	$T_{atal}(0/)$			
Starting blu (THB per year)	Number of respondents (persons)	Yes-Yes	Yes-No	No-Yes	No-No	10tal (70)
50	155	21.90	3.90	3.90	70.30	100.00
100	182	9.90	3.80	7.70	78.60	100.00
150	146	2.10	2.10	11.60	84.20	100.00
200	118	0.00	0.00	16.10	83.90	100.00

Note: Yes-Yes means respondent accepted both the first and the second bids

Yes-No means respondent accepted the first bid and rejected the second bid No-Yes means respondent rejected the first bid but accepted the second bid

No-No means respondent rejected both the first and the second bids

4.3.2 Willingness to Pay for Pavement Management by the Elderly in Bangkok

The mean of willingness to pay for the pavement management by the elderly in Bangkok was almost THB 160 per year, reflecting the benefits that the elderly received from using the pavement. In accordance with the average increased rate of elderly people in Bangkok during 2005-2015 of 4.884% per year, the estimated number of the elderly people in 2017 would be 988,694. Therefore, the value of the pavement walking areas, representing the benefits that seniors obtained from using pavements in Bangkok, was at least about THB 158 million per year (Table 4).

	THB per year	USD per year
Mean of willingness to pay (WTP)	159.15	5.31 million
Confidence interval (CI) of mean of WTP	138.80-179.50	4.63-5.98 million
Aggregate WTP	158 million	5.27 million
CI of aggregate of WTP	137.23-177.47 million	4.57-5.92 million

Table 4 Estimation of Mean and Total Values of Pavement Walking Areas

4.3.3 Factors Affecting Probability of Willingness to Pay for Pavement Management by the Elderly in Bangkok

From Table 5, work (the working status of the respondents) was the factor affecting the probability of willingness to pay by the elderly for pavement management in Bangkok. In other words, compared to the jobless respondents, the respondents with employment probably were less willing to pay for pavement management for the elderly in Bangkok because most working elderly respondents, with the financial burden of their own living expenses, were quite wary of any additional spending. Their income was spent only on what they deemed necessary. In contrast, the non-working respondents, having a retirement pension or receiving financial support from their descendants, did not have worries over their living expenses, so they were potentially aware of other issues, such as quality of life. Consequently, they tended to be more willing to pay than the working respondents for pavement management for the elderly in Bangkok.

Furthermore, mema (the number of household members, aged 60 and above) was the factor influencing the probability of willingness to pay for pavement management by the elderly in Bangkok. In particular, the more household members aged 60 and above in their family, the lower the probability of their willingness to pay. This may have been because the additional number of household members aged 60 and above more likely reflected the growing cost of living in the household, especially for relatively high expenses on medical and health services. This higher cost substantially diminished the affordability of the elderly. As a result, the probability of willingness to pay for pavement management for the elderly in Bangkok also decreased.

Moreover, occ3 (career of self-employment) was also a factor influencing the probability of willingness to pay for the pavement management by the elderly in Bangkok. That is, the self-employed respondents were more likely to be willing to pay for pavement management for the elderly in Bangkok, compared to the other respondents who worked as an employee of a private company. It could be assumed that most self-employed respondents were generally low-income people so that they frequently used pavements in their daily lives in order to save their money on transport. This group of respondents might have more opportunities to recognize the problems in using pavements. The probability of willingness to pay for pavement management by the elderly in Bangkok of the self-employed respondents was higher than that of the employees of private companies accordingly.

Variable	Coefficients	P-value	
constant	5.81994	0.0001	
freq	-0.00738	0.9620	
dist	-0.00016	0.1107	
acci	0.11969	0.5438	
safe	-0.20995	0.2100	
like	0.15626	0.3421	
know	0.00097	0.9922	
prob	0.03166	0.7607	
age	-0.00156	0.8874	
work	-0.37627	0.0262	**
inc	-7.6195E-6	0.3326	
incf	-5.9789E-7	0.8743	
mem	-0.03392	0.6025	
mema	-0.25400	0.0050	***
edu	-0.01429	0.4939	
occ2	0.42268	0.1257	
occ3	0.48469	0.0098	***
occ4	0.26007	0.4690	
occ5	0.24106	0.1410	
0006	0.16444	0.5647	
scale	0.37599	Normal scale	
$L_{og-likelihood} = -12780024$	Pseudo $R^2 = 0.1638$		

Table 5 Analysis of Factors Affecting Willingness to Pay for Pavement Management by the Elderly in Bangkok

Note: **, *** indicate statistical significance at the 95% and 99% confidence levels, respectively

5. Conclusion and Recommendations

This study attempted to evaluate the benefits obtained from the use of pavement walking areas by the elderly in Bangkok by using the Contingent Valuation Method. This approach is applicable for policy makers, planners, and stakeholders who are interested in urban development planning as they attempt to prepare public facilities such as the pavements for the aging society. The results revealed that most respondents usually used the main street sidewalks to go shopping. The average walking distance was about 700 meters per day. Most respondents felt unsafe and were dissatisfied with the current pavement conditions. The most important problem from their point of view was local motorbikes speeding on the pavements. Whereas, the main problems of physical use of pavements in Bangkok were uneven pavement surfaces, narrow pavements, and insufficient facilities for the elderly. The average value of willingness to pay for pavement management was about THB 160 (USD 5.30) per person per year. Thus, the value of the use of pavements by the elderly in Bangkok was approximately THB 158 million (USD 5.2 million) per year.

Thus, the BMA and other related agencies should address the problems confronted by the elderly in the use of pavements in Bangkok, such as efficiently enforcing the law on pedestrian pavements and forbidding motorcyclists from riding on the pavements, for the safety of the elderly and other pedestrians. The pavement surface should always be repaired and maintained to be in good condition that is suitable for walking by the elderly and the general public. In addition, the BMA should educate elderly people to be familiar with the benefits of pavement walking areas with awareness of being active participants in maintaining and informing the BMA about problems or annoyances in their use of pavements. The BMA should consider the value attributed to the pavement walking areas in this study as a guideline for proper budget allocation, pavement repair and maintenance, to provide quality pavements for the safe use of the elderly. This will enhance the quality of life for the elderly in the city.

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