The Initial Liveable Rating of Gated Residential Real Estate Designs: An Empirical Survey Based on Data from Bangkok Metropolitan Region, Thailand

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Abstract

This paper has 3 core purposes. Firstly, to provide the survey descriptive information of 3 financial terms (actual property selling-price (APP), gated residential real estate development cost (DC), and operation and maintenance expense (OME)), and the gated residential real estatedesign features in Bangkok Metropolitan Region (BMR), Thailand. Secondly, to indicate the initial liveable rating (ILR) for gated residential real estate designs in BMR. Finally, to cross tabulate the 3 financial terms with different initial liveable rating levels (ILRL) of gated residential real estate designs in BMR. This paper is based on an empirical survey of 50 subdivisions around BMR. The ILRL are developed by applying the norm-referenced method on summation of standardization value of each design feature. The survey data are employed to calculate the cross tabulation of each financial term with the ILRL. The survey results find that the financial items are useful for both developers and customers. The average APP and DC provide information on the project feasibility study for the developers, while OME is a necessary guideline for customers when estimating appropriate long-term community management expenses. Meanwhile, the survey data of design items reflect the current quantity and quality of gated residential real estate design and are useful for the designers when considering their design level. Finally, the ILRL is a simple indicator for deciding appropriate gated residential real estate designs. The cross-tabulation result could support the developers' planning process and provide information about the long-term expense during customers' selection process. The data for this study are gathered from primary surveys. The numbers of collected subdivision are limited by time and developers' permission. The design information is confidential; thus, name and specific location of the projects cannot be published. The paper provides broad information underpinning gated residential real estate development and identifies the simply ILR of gated residential real estate designs for BMR. The cross-tabulation data between the ILRL and 3 financial terms would be applicable to justify the impact of design on the development practises and assist the customers to make appropriate decisions.

Keywords: Initial liveable rating, gated residential, subdivision development, survey, Bangkok Metropolitan Region

1. Introduction

Neighbourhood effects on human well-being and urban sustainability development have received raising interest in recent years. Various research studies have focused to identify the designed for supporting the liveability of the residents who living in subdivision development. There is no standardised definition of liveability, however, Kennedy & Buys (2010) define the definition of liveability as "the well-being of a community and represents the characteristics that make a place where people want to live now and in the future". There are several studies indicate that high level of residents' liveability could encourage the human well-being and the urban sustainability development (Karol & Brunner, 2009; Alskait, 2003; UDIA (Qld), 2009; USGBC, 2008; Braubach, 2007). Meanwhile, the liveability affects to the increasing of property price (Jim & Chen, 2009), also relating the perceptions of beauty to the community (Suksawang, 2003), and affecting to sense of community in the neighbourhood (Rogers & Sukolratanametee, 2009). To conclude, the concept of liveability to a set of factors include of quality of life, health, sense of safety, perception of aesthetic, access to services, operation and maintenance expense, comfortable living standards, transportation system, and environmental quality.

The subdivision design items are categorized into 2 major categories, building and neighbourhood design (Rinchumpoo et al., 2010, Kennedy & Buys, 2010). Set of building features include of dwelling structure, blocks and lots sizes, and aesthetic feelings (Kennedy & Buys, 2010; Ben-Joseph, 2003), while the neighbourhood design items usually refer to project density, land use proportion, recreation area, green open spaces, greenery features, social facilities, street size and layouts, walkways, drainage facilities, transportation and traffic circulation, pollution, safety risks, and sense of community (Rodie & Streich, 2009; Southworth & Ben-Joseph, 2004; Ben-Joseph, 1995; Ben-Joseph, 2003).

Nowadays, various organizations in many countries have introduced several rating systems to measure the sustainability or liveability level of neighbourhood designs in subdivision development. For example, the U.S. Green Building Council, USA (USGBC) has been introduced the "Leadership in Energy and Environmental Design System for Neighbourhood Developments (LEED-ND)". LEED-ND is a voluntary rating system generally for the neighbourhood design and development. (USGBC, 2008; Travis, 2008; Karol & Brunner, 2009). Next, the EnviroDevelopment is an accreditation system from the Urban Development Institute of Australia, Queensland (UDIA (Qld)); Australia. The system addresses reducing environmental impact, improving environmental performance and supporting the economics aspect of developers. (UDIA (Qld), 2009). However, there are some of voluntary rating systems in BMR, such as the Environmental Impact Assessment Monitoring Award (EIA-MA) and Thai's Rating for Energy and Environmental Sustainability for new construction and major renovation (TREES-NC). The EIA-MA has been nominated by ONEP, cover to subdivision developments, which a development area larger than 100 Rai (160,000 m2) or more than 499 lots (ONEP, 2010). EIA-MA has some neighbourhood items, but its scope applies to specific large projects size only. Meanwhile, TREES-NC presents the assessment results by rating levels, there are 5 levels including of 1 uncertified level and 4 certified levels (Certified, Silver, Gold, and Green). However, mostly criteria focuses to building features and do not specific for neighbourhood design features (TGBI, 2010). Therefore, this current situation can conclude that the BMR still lacks appropriate rating system for gated residential real estate designs (Rinchumpoo et al., 2010).

On the other hand, the liveability is not only effect from the gated residential real estate design. There are at least 3 financial terms will be affacted from the design, which are the actual property selling-price (APP), gated residential real estate development cost (DC), and operation and maintenance expense (OME). This study defines the definition of APP as the total actual selling-price of the property located in the subdivision development, while DC and OME are considered to only the development cost, and operation and maintenance expense of non-saleable area or public area of the subdivision. The APP and DC support information on project feasibility study for the developers, while OME is a necessary guideline for customers for estimating appropriate long-term community management expense. The original unit and their calculation formula of APP, DC and OME of this study will be provided in Section 3.

In conclusion, this study, firstly, conducts the empirical survey of 50 subdivisions of BMR, and also provides greater understanding survey results of 3 financial terms, and the descriptive statistic on the quantity and quality on neighbourhood design items of subdivision developments in BMR. Unless the benefit of financial terms presented above, the survey data of design items reflect the current quantity and quality of gated residential real estate design and are useful for the designers for considering on their design. Next, according to the current situation of liveability rating system in BMR, this study indicates the initial liveable rating (ILR) of gated residential real estate designs in BMR. The ILR of this study will be separated into 5 rating levels by referenced to TREES-NC. The ILR is developed by applying the summation of standardization value of each neighbourhood design item, and then indicates the initial liveable rating levels (ILRL) by applying the norm-referenced method from the previous calculated ILR. Finally, this study presents the cross-tabulation data of 3 financial terms to the ILRL. The ILRL is the simple indicator to indicate the appropriate gated residential real estate designs, while the cross tabulation data are supported the understanding information between the design levels and the benefit of developers, and comparing the selling-price with long term expense for customers during their selection process. The results are expected to be applicable to justify the impact of design level to the subdivision development practise.

The remainder of this paper is organized as follows. Section 2 discusses relevant literature on the gated residential real estate design items. Section 3 presents the proposed methods of this study. Section 4 subsequently presents the empirical study results. Finally, conclusions are drawn in Section 5.

2. Gated residential real estate designs

Terms of neighbourhood has the ease meaning of neighbours' district or the district of local peoples or residents. The neighbourhood is the place that supports the social activity of the residents (Barton, 2000a, p. 4; Choguill, 2008). The broadly defines the "neighbourhood designs" as the design components of community and residents living support, including project characteristic, recreation area, social facilities, and transportation system (Warrick & Alexander, 1998; Benefield, 2009).

There are several studies of gated residential real estate design both of Thailand and international level. Started by Perry (1929) published the monograph about neighbourhood unit concept. The concept is well known as a blueprint for residential neighbourhood designs, which is influential today and for the future (Biddulph, 2007). The neighbourhood features include of institutional, social, and physical design which provides neighbourhood residents opportunities to interact with those within their neighbourhood boundaries. The design concepts of Perry (1929) focuses on important of neighbourhood centre, such as community school, should be located at the centre of the community and could be assessed without crossing a main street. The density of residential units per neighbourhood area should be suitable to their social facilities such as community centre, sport facilities, playground. In addition, the design of internal street should concern on both of pedestrian safety and aesthetic purposes. Moreover, the neighbourhood should dedicate enough space for recreation open space such as park, lake and other community activities area (Lawhon, 2009; Perry, 2007).

Recently, Choguill (2008) introduced the new idea about sustainable neighbourhood design by combination of several the design theories. The sustainable neighbourhood should be achieved economic, social, technical and environmental sustainability. However, the details of design components are almost similarly to design concept of Perry (1929), which consider to neighbourhood size, suitable location of community school and community centre to encourage walking rather than motor vehicles, clearly boundary for safety and sense of community, appropriate social facilities and services, good condition of internal street design and minimise of their major intersection, and provided the open space for variety recreation activities of the residents.

Number of researches or publications indicates the bundles of neighbourhood amenity designs. Those conclusive ideas demonstrate that there are 4 categories of neighbourhood designs; neighbourhood characteristics, recreation features, social facilities, and transportation system designs (Warrick & Alexander, 1998; Blair et al., 2004; Asabere and Huffman, 2009; Foltête & Piombini, 2007). The detail of each design items and their references are included in Table 1 above.

3. Research method

This study has 5 steps are as follow.

Step 1: Data collection

This study is based on data from primary field survey of 50 private subdivision projects in BMR. The first section of the survey focuses on the actual property selling-price (APP), gated residential real estate development cost (DC), and operation and maintenance expense (OME). Next section, the survey focuses on the details of gated residential real estate design items. The APP and property conditions are directly collected from the developers or project sale representatives. Meanwhile, DC, OME, and set of neighbourhood design items are extracted from the

Table 1. The definition of gated residential real estate design items

Categories/ Design items	Definition	Expected impact to liveability level
Neighbourhood characteristics		
Number of property lots	The number of property lot (LN) usually refers to size of the subdivision. According to subdivision standards of project size in BMR indicate that, LN < 100 lots is small size, 100 - 499 lots is medium size, and $\geq$ 500 lots is large size (Royal Thai Government, 2007, 2002b, 2002a, , 2009, 2003a, 2003b). It is not clear about the impact side to liveability, but some information indicate that the larger project size will be reduce the interaction between residents in the subdivision communities (Pasuthip & Panthasen, 2009).	[-]
Land-use diversity index (LUDI)	LUDI refers to the measurement of land-use variety in the subdivision. LUDI could be calculated by the Equation 1 below. $$LUDI = -\sum_{k=1}^{K}(P_k)\ln(P_k) \quad \text{(Eq.1)}$$ Where P_k is the proportion of the area dedicated to land use k in the subdivision. The larger value of LUDI indicates a more diverse land-use (Baranzini & Schaerer, 2007; Poudyal et al., 2009; Geoghegan et al., 1997).	[+]
Property unit per subdivision area (U/m2)	The Office of the National Economic and Social Development Board (NESDB) reports that property unit per subdivision area (PUA) is the important indicator for a liveable community. The standard suggests that the PUA should be 6.25 – 18.75 U/1,000-m2 for urban area, and 5.00 – 12.50 U/1,000-m^2 for suburban area (NESDB, 2002).	[-]
Multi dwelling types	Multi dwelling types is the subjective indicators affect to sense of community. The residents usually expect to live in the similar social level, which mean the similar type of dwelling in their subdivision. Therefore, the subdivision which include of multi dwelling type could be reduce the residents' sense of community, then effect to liveability level. Moreover, multi dwelling type can be measure by number of dwelling types, and ratio of each dwelling type including in the subdivision (Rogers & Sukolratanametee, 2009; Piputsitee & Kittikunaporn, 2006; Askew, 2002). There are 4 design items which are number of dwelling types (NDT), Single Detached House ratio (SHR), Duplexes ratio (DPR), and Townhouses ratio (THR).	
Neighbourhood identity design	The neighbourhood identity design is another affected to sense of community of the residents in subdivision development. Recently, Rinchumpoo et al.(2010) present that the neighbourhood identity design items are still lacking in the BMR standards. In addition, Barton (2000b) indicated that the design standards could be divided into 3 groups of architecture design, public arts and cultural symbolic. Therefore, it can be measured by number of dwelling design, public art, and cultural and religion symbolic. There are 3 design items which are numbers of dwelling design (NDD), numbers of public art (NPA), and numbers of cultural and religion (NCR).	
Other special design	There are some other special design items which affect to sense of community and neighbourhood identity design. They are not the typical design for subdivision development, such as conservation subdivision design, eco-village concept, specific design theme, and underground electrical line installation (Carter, 2009; Bosworth, 2007; Arendt, 2004; Takeuchi et al., 1998; Bandityanond, 2008).	[+]
Recreation features		
Park design	The recreation park is necessary to the residents who live in the subdivision. The recreation park normally consists of trees, tuft, grass field, lakes or ponds, sculptures, and multi-activity sitting area. The size of the recreation park has to big enough to support various activities of the subdivision members such as walking, jogging, meeting, and sport activities. Shapes of parks vary by the designers; however, it is frequently presented in rectangular or square and free form. Moreover, there are 2 types of park design, which are centralised and decentralised design. The centralised design defines that there is only 1 large recreation park in the subdivision, while the decentralised design have 2 or smaller parks distributed in the subdivision. There is no strong evident to support the relationship to liveability, but the centralised park design seem to make the higher satisfaction level to the residents. There are 7 design items which are park area (PA), park shape (PS), park design (PD), park service capacity (PSC), park at front ratio (PaF), park at middle ratio (PaM), and park at back ratio (PaB).	[+, park size] [-, park rectangular shape] [+, centralised park] [-, park at front] [+, park at middle] [-, park at back]

Table 1. The definition of gated residential real estate design items (continue)

Categories/ Design items	Definition	Expected impact to liveability level
Lake design	Lake is voluntary items for subdivision development in BMR. Lake normally include in part of recreation park. However, lakes are function as the flood restoration area (Arendt, 2004; Lee & Li, 2009; ONEP, 1999), and create the aesthetic scene for the subdivision (Kearney et al., 2008; Bourassa et al., 2005). There are 2 items for considering, lake area and location. The lake location can be divided into 3 locations, front, middle, and back compare to the entrance gate (Boonkham & Rochanasmita, 2002). There are 4 design items which are lake area (LA), lake at front ratio (LaF), lake at middle ratio (LaM), and lake at back ratio (LaB).	[+, lake size] [-, lake at front] [+, lake at middle] [-, lake at back]
Greenery features	Several studies conclude the strongly relationship between mature trees and residents' satisfaction and property value (McPherson, 1992; Vesely, 2007; Cho et al., 2008; Jim & Chen, 2009; Eves, 2009; Askew, 2002). Meanwhile, there are some study identifies the economic benefit of native plant in the landscape of neighbourhood design which effect to long-term maintenance and operation cost (Helfand et al., 2006; Calkins, 2005). There are 2 design items which are mature trees density (MTD), and native plant ratio (NPR).	[+]
Transportation system designs		
Connectivity index	The connectivity index (CI) is the measurement to quantify the street way connectivity. CI could be calculated by the Equation 2 below. $CI = \frac{SN}{IN}$ (Eq. 2) Where SN is the segment numbers, and IN is the intersection number of the street network in subdivision. A higher number of CI means that travellers have increased the route choice (Ewing, 1996; Matthews & Turnbull, 2007).	[+]
Traffic circulation	The traffic circulation pattern can be divided into 3 major patterns, gridiron, cul-de-sac, and loop. Gridiron pattern normally create more accessible to the transportation system, while less safety and privacy to the residents. Cul-de-sac pattern creates the opposite effect to the residents. It is more sense of safety and privacy, but not supports the accessibility of the travellers. Loop pattern seems to be worst pattern, but normally supports to the cul-de-sac. (Matthews & Turnbull, 2007, Southworth and Ben-Joseph, 2004; Asabere, 1990; Bally, 2010). There are 3 design items which are gridiron ratio (GCR), cul-de-sac ratio (CCR), and loop ratio (LCR).	[-, gridiron] [+, cul-de-sac] [-, loop]
Transportation capacity	The transportation capacity (TPC) is referred to size of right of way, street, and walkway on both of major and minor street. TPC is supported to the transportation activities of the residents, and also significant to residents' satisfaction. (Clifton et al., 2008, Ben-Joseph, 2003). For BMR, the Land Subdivision Act mandates 3 design items to consider in subdivision design which are width of right of way, street, and walkway (Royal Thai Government, 2000). There are 3 design items which are Width of right of way at major street (MjROW), width of right of way at minor street (MnROW), width of major street (MjSW), width of minor street (MnSW), width of walkway at major street (MjWW), and width of walkway at minor street (MnWW).	[+]

design drawings and their design documents. All of them are received the permission from developers and/or the Department of Land, Ministry of Interior. However, the price, cost, expense, and design items are confidential, thus name of developers, projects' name and specific location could not be published.

The characteristics of collected data of this study are as follows.

APP is in term of actual property selling-price per unit (Baht/Unit)

DC is in term of gated residential real estate development cost per project (Baht/Project)

OME is in term of operation and maintenance expense of public neighbourhood area per project per year (Baht/Project/Year)

gated residential real estate design items are in original unit.

After field survey, the APP, DC, and OME will be converted from different year into base year in 2010. This study adopts discount rate as 2.98 % per year by referred to average annual increasing rate (Rinchumpoo et al., 2011). The standard statistic of financial values and all subdivision design items will be determined.

Step 2: Data analysis

This study aims to present information of APP, DC, and OME in 2 terms, "per unit area", and "per property unit". The base year-converted data of APP, DC, and OME form Step 1 will be calculated by following in Equation 3, 4, 5, 6, 7 and 8 as below.

$$APPA_j = \left(\frac{\sum_{i=1}^{N_j}\left(\frac{APP_{i,j}}{LS_{i,j}}\right)}{N_j}\right) \quad \text{(Eq.3)}$$

$$DCA_j = \left(\frac{NDC_j}{PNS_j}\right) \quad \text{(Eq. 4)}$$

$$OMEA_j = \left(\frac{OME_j}{PNS_j}\right) \quad \text{(Eq. 5)}$$

$$APPN_j = \sum_{i=1}^{N_j}\left(\frac{APP_{i,j}}{N_j}\right) \quad \text{(Eq. 6)}$$

$$NDCN_j = \left(\frac{NDC_j}{LN_j}\right) \quad \text{(Eq. 7)}$$

$$OMEN_j = \left(\frac{OME_j}{LN_j}\right) \quad \text{(Eq. 8)}$$

Where $APPA_j$ is the average actual property selling-price per unit area (Baht/m^2) of project j,

DCA_j is the average neighbourhood development cost per neighbourhood area (Baht/m^2) of project j,

$OMEA^j$ is the operation and maintenance expense per neighbourhood area per year (Baht/m^2/Year) of project j,

$APPN_j$ is the average actual property selling-price per unit (Baht/Unit) of project j,

DCN_j is the average neighbourhood development cost per unit (Baht/Unit) of project j,

$OMEN_j$ is the operation and maintenance expense per unit per year (Baht/Unit/Year) of project j,

$APP_{i,j}$ is the actual property selling-price (Baht/Unit) of unit i of project j,

$LS_{i,j}$ is the lot size (m^2) of unit i of project j,

$N_{i,j}$ is the number of sample size of APP of project j,

DC_j is the neighbourhood development cost of project j,

OME_j is the operation and maintenance expense of project j,

PNS_j is the public neighbourhood size (m2) of project j,

LN_j is the lot numbers (Unit) of project j.

Step 3: Initial liveable rating score (ILRS)

For initial rating score development, each gated residential real estate design item will be converted to standardization score (Z-score). Then, summarize all design items of each subdivision project. This procedure is presented in Equation 9.

$$ILRS_j = \sum_{k=1}^{K}(ZN_k) \quad \text{(Eq. 9)}$$

Where $ILRS_j$ is the summation of Z-score of subdivision project j,

ZN_k is the Z-score of gated residential real estate design item k of project j.

However, some design items are on negative impact to liveability, so they will be counted in minus to the summation value (the details of expectation impact are presented in Table 1).

Step 4: Initial liveable rating level (ILRL)

This step aims to develop rating level criteria by applying the norm-referenced method. The norm-referenced method reflects the differences among individual items; usually apply for education grading, psychometric tests, and any rating system (Browning, 1997, Mertler, 2007). This study adopts the average (μ) of ILRS from Step 3 as the referenced value, and interval factor is equal to their standard deviation (SD). Then, the criteria to create 5 initial liveable rating levels (ILRL) are presented in Equation 10, 11, 12, 13 and 14 as follow.

$$ILRL\text{-}1: \quad \mu-(1.5\times SD) > ILRS_j \quad \text{(Eq. 10)}$$

$$ILRL\text{-}2: \quad \mu-(1.5\times SD) \leq ILRS_j < (\mu-0.5\times SD) \quad \text{(Eq. 11)}$$

$$ILRL\text{-}3: \quad \mu-(0.5\times SD) \leq ILRS_j < (\mu+0.5\times SD) \quad \text{(Eq. 12)}$$

$$ILRL\text{-}4: \quad \mu+(0.5\times SD) \leq ILRS_j < (\mu+1.5\times SD) \quad \text{(Eq. 13)}$$

$$ILRL\text{-}5: \quad ILRS_j > \mu+(1.5\times SD) \quad \text{(Eq. 14)}$$

Step 5: Cross tabulation

The cross tabulation of APPA, DCA, and OMEA from Step 2 and the ILRL from Step 4 will be presented in Section 4.

4. Empirical study results

Descriptive of survey data

There are 2 sets of survey data will be descripted, the data of 3 financial items and gated residential real estate design items. The details of financial items from 50 subdivision survey projects are presented in Table 2 below.

Table 2 presents the minimum, maximum, and average value of actual property selling-prices, neighbourhood development costs, and neighbourhood operation and maintenance expenses. The information provides 2 types of each financial data which are the "per unit area" and "per property unit". This study focuses on the "per unit area" values which are beneficially on project development and management processes, while the "per property unit" values are presented for referencing purpose to the further continuous research study.

The APPA is 18,480.09 Baht/m^2, DCA is 3,312.75 Baht/m^2, and OMEA is 120.63 Baht/m^2/Year. In the meantime, the APPN is 5,775,328.37 Baht/Unit, DCN is 936,062.70 Baht/Unit, and OMEN is 27,111.15 Baht/Unit/Year. At this point, this study can estimate the percentage of DCA by APPA is about 17.93 %, while 16.21 % for ratio of DCN by APPN.

The APPA and DCA in Table 2 above can use as guideline of expected income and the development cost estimation for the developers, while the APPA and OMEA are useful for customers for considering on their property price compare with the long term management expenses.

The survey data of design items in neighbourhood characteristics category are presented in Table 3.

The minimum, maximum, and average value of each design items in neighbourhood characteristics category are presented in Table 3. However, to avoid unnecessary repetition, only items requiring further explanation will be discussed.

Number of property lots (LN) in the subdivision project represent to project size. The survey result in this study presents that the average LN is 251 units. Moreover, information in Figure 1 shows that the medium size projects are the largest sample proportion at 54.00 %, next are the small size projects at 34.00 %, while the large size projects are smallest from the survey samples at 12.00 %.

Table 2. Survey data of financial items

Financial items		per unit area (Baht/m^2)	per property unit (Baht/Unit)
Total property price	Minimum	7,016.06	1,585,000.00
	Maximum	32,121.09	20,904,000.00
	Standard Deviation	5,457.94	4,008,354.32
	Average	18,480.09	5,775,328.37
Neighbourhood development cost	Minimum	1,158.14	247,063.90
	Maximum	5,588.18	4,335,570.09
	Standard Deviation	1,291.94	838,642.86
	Average	3,312.75	936,062.70
Operation and maintenance expense (per Year)	Minimum	26.61	5,881.36
	Maximum	310.39	100,427.54
	Standard Deviation	59.41	16,848.39
	Average	120.63	27,111.15

Design items	Abbreviations	Minimum	Maximum	Average
Number of property lots (Unit)	LN	41	1,198	251
Land-use diversity ind ex	LUDI	0.539	1.005	0.768
Property unit per project area (U/1,000-m^2)	PUA	0.600	7.500	2.902
Multi dwelling type				
– Number of dwelling types	NDT	1	3	1
–Single Detached House ratio (%)	SHR	0	100	82
–Duplexes ratio (%)	DPR	0	100	9
–Townhouses ratio (%)	THR	0	100	9
Neighbourhood identity design				
– Number of dwelling design	NDD	1	11	5
– Number of public art	NPA	0	15	2
– Number of cultural & religion	NCR	0	2	1
Other special design				
– Underground electrical line	UEL	0	1	0.06

Table 3. The descriptive survey data of design items in neighbourhood characteristics category

The LUDI of this study is calculated from Equation [1], there are 3 land-use types which are saleable area, recreation area, and infrastructure area. The minimum LUDI is 0.539, maximum is 1.005, and the average is 0.768. Moreover, the information in Figure 2 presents that the average percentage of saleable area, recreation area, and infrastructure area are 66.82 %, 10.83 %, and 22.34 %, respectively.

Next design item is dwelling types ratio. The information from survey concludes that there are about 82 % of Single Detached Houses (SDH), 9 % of Duplexes (DP), and 9% of Townhouses (TH). Compared to BMR's dwelling types in 2008 (68 % for SDH, 4 % for DP, and 28 % for TH) (REIC, 2009), the proportions in this study are different. This is because, the survey of this study is a part of full research study which is intended to focus on the SDH-based subdivision developments.

Last design item is the other special design. The survey data presents that there is only underground electrical line (UEL) could be claimed as the special design item in the BMR's neighbourhoods. There are only 3 subdivision developments (6 %) which are installed UEL in their neighbourhood design.

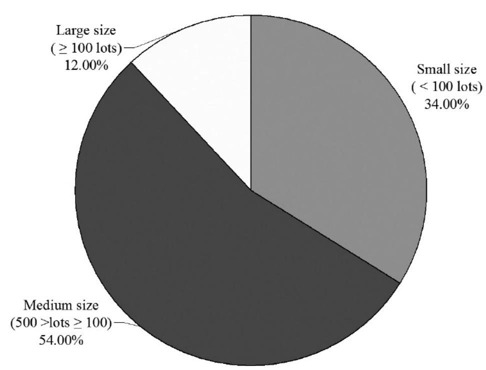

Figure 1. Project size proportions from survey samples

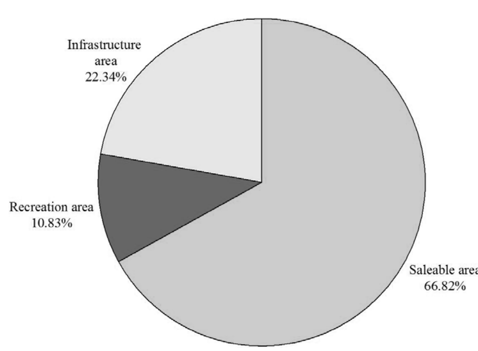

Figure 2. Land-use type proportions from survey samples

Table 4. The descriptive survey data of design items in recreation features category

Design items	Abbreviations	Minimum	Maximum	Average
Park design				
– Park area (1,000-m^2)	PA	0.200	46.576	8.920
– Park shape as rectangular shape	PS	0	1	0.62
– Park design as centralised park	PD	0	1	0.70
– Park service capacity (Unit)	PSC	40	1000	217
– Park location: at front ratio (%)	PaF	0	100	35
– Park location: at middle ratio (%)	PaM	0	100	54
– Park location: at back ratio (%)	PaB	0	100	11
Lake design				
– Lake area (1,000-m^2)	LA	0.000	21.837	1.798
– Lake location: at front ratio (%)	LaF	0	100	4
– Lake location: at middle ratio (%)	LaM	0	100	15
– Lake location: at back ratio (%)	LaB	0	100	81
Greenery features				
– Mature trees density (MT/m^2)	MTD	0.34	11.20	3.60
– Native plant ratio (%)	NPR	75	90	82

Next section is the survey data of design items in recreation features category which presented in Table 4 below.

The minimum, maximum, and average value of each design items in recreation features category are presented in Table 4. However, to avoid unnecessary repetition, only items requiring further explanation will be discussed.

According to Subdivision Acts, the recreation park is the mandatory design items for subdivision development in BMR; the minimum of recreation park area is 5 % of overall saleable area in the development projects (Royal Thai Government, 2007, 2002b, 2002a, 2009, 2003a, 2003b). Moreover, the park service capacity (PSC) will reflect to service capacity of the designed major park. In this study, PSC is measured by number of houses with in 300 m. walking distant to the nearest major recreation park (Boonkham & Rochanasmita, 2002). The average of PSC from the survey is 217 units. Next, the survey data shows that minimum lake area of the selective case study is 0.0 m^2. This number presents that lake is not the mandatory design item for subdivision in BMR.

Finally, the greenery features are needed more explanation, the mature trees density (MTD) in this study defined as number of mature trees per public neighbourhood area. These numbers of mature trees are collected by roughly estimation of mature trees in public neighbourhood area of the selected subdivision. Size of the trees which their bodies' diameter are bigger than 15.0 cm. will be counted as the mature trees (Veesommai et al., 2008; TGBI, 2010). The survey data shows that the average mature trees density is 3.60 MT/m^2. Moreover, the native plant ratio (NPR) is measured form random survey from the case study projects, and then rechecked by asking to the designers (if possible). Type native plants in this study are followed list of native plants from the Thai's Rating for Energy and Environmental Sustainability for new construction and major renovation (TREES-NC) version 1.0, provides by Thai Green Building Institute (TGBI) (TGBI, 2010). The average NPR is about 82 %. The greenery features will support natural conservation and aesthetic scene for residents in the subdivision.

Next section is the survey data of design items in social facilities category which presented in Figure 3 below.

Most of social facilities are not mandatory design items for subdivision in BMR. The wastewater treatment plant (WTP) is the mandatory design practically for EIA-involving project only. Therefore, the survey data show that there are 6 social facilities usually existed in the gated residential real estate designs for BMR. List of the social facilities including clubhouse (CH), swimming pool (SP), tennis court (TC), football field (FF), children playground (PG), and wastewater treatment plant (WTP). However, only CH, SP, and PG are more often existed in the neighbourhoods, while TC, FF, and WTP are not more often existed in the neighbourhoods. However, the number of WTP consists of number of EIA-involving projects as 6 projects.

Next section is the survey data of design items in transportation system designs category which presented in Table 5 below.

The connectivity index is calculated from Equation [2]. The survey data shows that the average is about 1.30. The traffic circulation of BMR's survey data shows that loop circulation is the largest proportion at 41 %, follow by gridiron circulation at 33 %, and the cul-de-sac is the least at 26 %.

Initial liveable rating level (ILRL)

According to Step 3 and Step 4 with Equation [10], [11], [12], [13], and [14], the result of initial liveable rating level (ILRL) is presented in Figure 4 below.

Figure 4 shows the ILRL results there are 21 projects (42 %) are rated as ILRL-2, while the 18 projects (36 %), 7 projects (14 %), and 4 projects (8 %) are rated as ILRL-3, ILRL-4, and ILRL-5, respectively. Meanwhile, there is no any project from the survey rated as ILRL-1. At this point, the ILRL-1 can be referred as the uncertified or failed initial liveable rating.

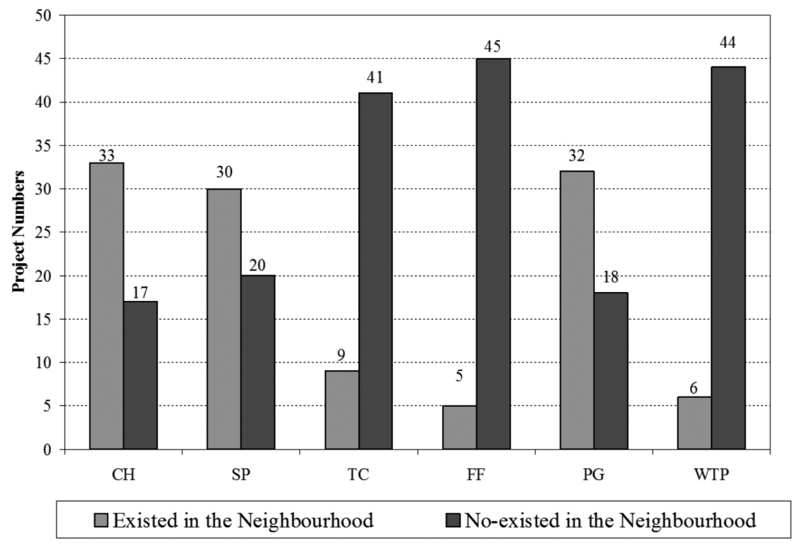

Figure 3. Numbers of subdivision project which existed of each social facility design items

Table 5. The descriptive survey data of design items in transportation system designs category

Design items	Abbreviations	Minimum	Maximum	Average
Connectivity index	CI	0.50	1.75	1.30
Traffic circulation				
– Gridiron ratio (%)	GCR	0	100	33
– Cul-de-sac ratio (%)	CCR	0	88	26
– Loop ratio (%)	LCR	0	100	41
Transportation capacity				
– Width of right of way at major street (m)	MjROW	8.0	27.5	14.1
– Width of right of way at minor street (m)	MnROW	8.0	14.0	9.4
– Width of major street (m)	MjSW	6.0	16.0	9.9
– Width of minor street (m)	MnSW	5.0	11.0	6.6
– Width of walkway at major street (m)	MjWW	1.0	2.5	1.8
– Width of walkway at minor street (m)	MnWW	1.0	2.0	1.4

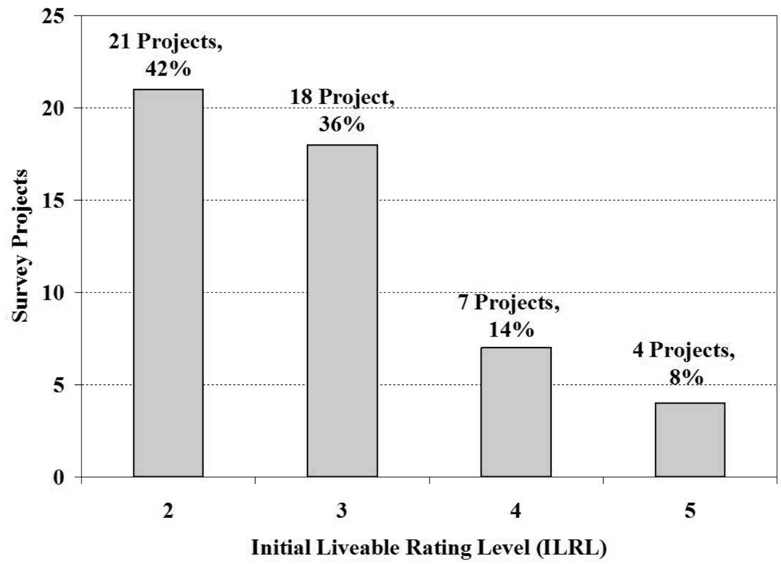

Figure 4. Proportion of surveyed projects by different ILRL

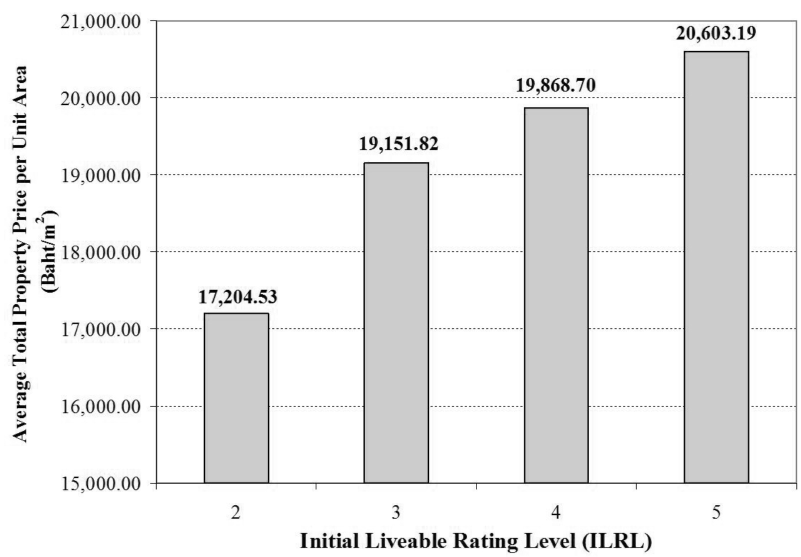

Figure 5. The comparison between the average APPA (Baht/m^2) and the ILRL

Cross tabulation results

This section presents the cross-tabulation results between 3 financial terms per unit area and the initial liveable rating level (ILRL). The results present in Figure 5 – 7 as below.

Figure 5 presents that APPA of ILRL-2 (APPA$_{ILRL-2}$) is 17,204.53 Baht/m^2, while the APPA of ILRL-3 (APPA$_{ILRL-3}$), APPA of ILRL-4 (APPA$_{ILRL-4}$), and APPA of ILRL-5 (APPA$_{ILRL-5}$) is 19,151.82 Baht/m^2, 19.868.70 Baht/m^2, and 20,603.19 Baht/m^2, respectively. The Figure presents that there is only APPA$_{ILRL-2}$ below the average of survey data (18,480.09 Baht/m^2 in Table 2), while the rests are over the average. The percentage change of APPA$_{ILRL-2}$ to APPA$_{ILRL-3}$ is 11.32 %, while percentage changes are 3.74 % and 3.70 % for APPA$_{ILRL-3}$ to APPA$_{ILRL-4}$ and APPA$_{ILRL-4}$ to APPA^{ILRL-5}, respectively.

Figure 6 presents that DCA of ILRL-2 (DCA$_{ILRL-2}$) is 2,426.19 Baht/m^2, while DCA of ILRL-3 (DCA$_{ILRL-3}$), DCA of ILRL-4 (DCA$_{ILRL-4}$), and DCA of ILRL-5 (DCAILRL-5) is 3,429.32 Baht/m^2, 4,670.83 Baht/m^2, and 5,066.04 Baht/m^2, respectively. The Figure presents that there is only DCA$_{ILRL-2}$ below the average of survey data (3,312.75 Baht/m^2 in Table 2), the DCA$_{ILRL-3}$ is slightly higher the average, while the DCA$_{ILRL-4}$ and DCA$_{ILRL-5}$ are largely over the average. The percentage change of DCA$_{ILRL-2}$ to DCA$_{ILRL-3}$ is 41.35 %, while percentage changes are 36.20 % and 7.18 % for DCA$_{ILRL-3}$ to DCA$_{ILRL-4}$ and DCA$_{ILRL-4}$ to DCA$_{ILRL-5}$, respectively.

Figure 7 presents that OMEA of ILRL-2 (OMEA$_{ILRL-2}$) is 108.82 Baht/m^2/year, while OMEA of ILRL-3 (OMEA$_{ILRL-3}$), OMEA of ILRL-4 (OMEA$_{ILRL-4}$), and OMEA of ILRL-5 (OMEA$_{ILRL-5}$) is 115.92 Baht/m$_2$/year, 146.19 Baht/m^2/year, and 155.04 Baht/m^2/year, respectively. The Figure presents that OMEA$_{ILRL-2}$ and OMEA$_{ILRL-3}$ are below the average of survey data (120.63 Baht/m^2/year in Table 2), while the OMEA$_{ILRL-4}$ and OMEA$_{ILRL-5}$ are largely over the average.

However, the value of $OMEA_{ILRL-2}$ and $OMEA_{ILRL-3}$ are slightly difference, at the same time, $OMEA_{ILRL-4}$ and $OMEA_{ILRL-5}$ are also slightly difference. The percentage change of $OMEA_{ILRL-2}$ to $OMEA_{ILRL-3}$ is 6.52 %, while percentage changes are 26.11 % and 6.05 % for $OMEA_{ILRL-3}$ to $OMEA_{ILRL-4}$, and $OMEA_{ILRL-4}$ to $OMEA_{ILRL-5}$, respectively.

The results of cross tabulation above conclude that all 3 financial terms of subdivision developments in BMR are follow the law of diminishing return by the growth of ILRL. The results of APPA and DCA could indicate to the developers that the optimum point of subdivision development in BMR should be at ILRL-3. Because, the growth of $APPA_{ILRL-2}$ to $APPA_{ILRL-3}$ is quite high, but growth of DCA_{ILRL-2} to DCA_{ILRL-3} is slightly different compare to growth of DCA_{ILRL-3} to DCA_{ILRL-4}. On the other hand, the information of APPA and OMEA suggests that the customers should select the property from ILRL-5, this is because of it shows that the growth of $APPA_{ILRL-4}$ to $APPA_{ILRL-5}$ is slightly different, while the growth of $OMEA_{ILRL-}$4 to $OMEA_{ILRL-5}$ also slightly different too.

5. Conclusions

In conclusion, this chapter present the overall empirical survey data on both financial terms and gated residential real estate design items in BMR. The financial items are useful for both of developers and customers. The APP and DC support information in project feasibility study for the developers, while APP and OME are also necessary guidelines for customers in assessing the property buying-price, and estimating appropriate expense for long term community management. On the other hand, the survey data of gated residential real estate design items are reflected the current situation from the actual market products, and are useful for designers for selecting both quantity and quality of the design to support the residents' liveability in the subdivision. Finally, the initial liveable rating (ILR),

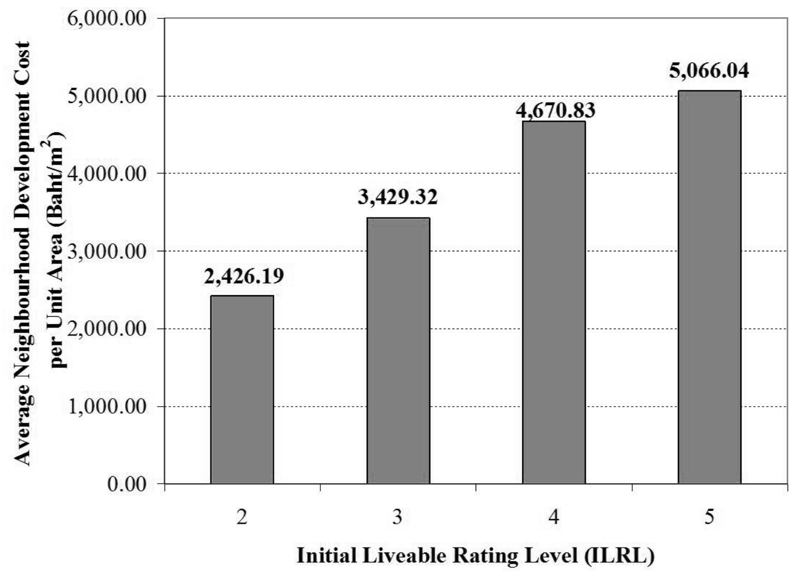

Figure 6. The comparison between average DCA (Baht/m²) and the ILRL

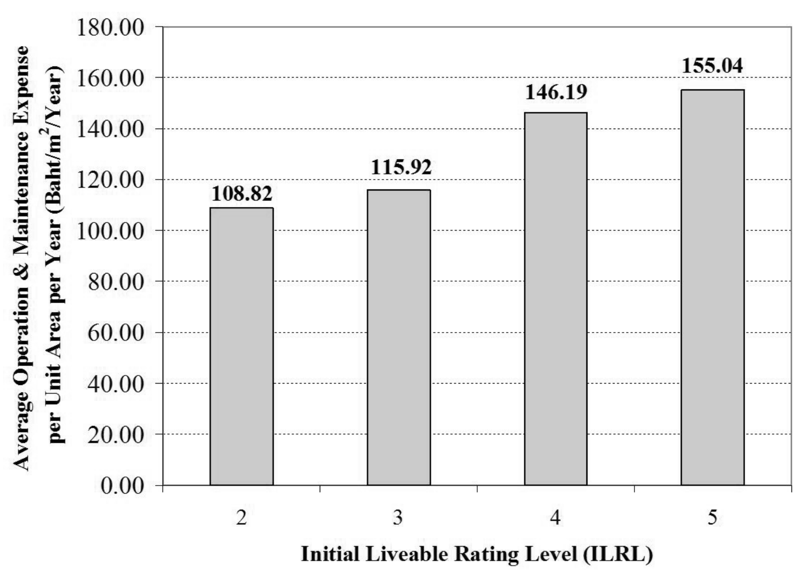

Figure 7. The comparison between average OMEA (B/m²) and the ILRL

and the initial liveable rating level (ILRL) are the simple indicators for customers during their selection process. However, the ILR in this study is developed under equal significantly of each design items, so it still has some limitation to represent the exact liveability level of the residents in the subdivision. Therefore, the ILR from this study is also useful as referencing rating indicator for furthermore complexity rating system research.

6. References

Alskait, K. (2003). Subdivision planning in Riyadh: problems and remedies. *Emirates Journal for Engineering Research, 8*(2), 39-50.

Arendt, R. (2004). Linked landscapes: Creating greenway corridors through conservation subdivision design strategies in the northeastern and central United States. *Landscape and Urban Planning, 68*(2-3), 241-269.

Asabere, P. & Huffman, F. (2009). The relative impacts of trails and greenbelts on home price. *The Journal of Real Estate Finance and Economics, 38*(4), 408-419.

Asabere, P. K. (1990). The value of a neighborhood street with reference to the cul-de-sac. *The Journal of Real Estate Finance and Economics, 3*(2), 185-193.

Askew, M. (2002). A place in the suburbs: making a neighborhood in the middle-class housing estate, Bangkok : place, practice and representation. London ; New York: *Routledge*. 170-193, 358 p.

Austin, M. E. (2004). Resident perspectives of the open space conservation subdivision in Hamburg Township, Michigan. *Landscape and Urban Planning, 69*(2-3), 245-253.

Bally, D. C. (2010). Thinking outside the blocks–Exploring alternatives to traditional neighborhood design. *ESRI International User Conference*. San Diego, CA.

Bandityanond, P. (2008). Property value added by green area (in Thai). TALA News.

Baranzini, A. & Schaerer, C. (2007) A sight for sore eyes: Assessing the value of view and landscape use on the housing market. *Cahier de Recherche*. Geneve: Center de Recheche Appliquee en Gestion.

Barton, H. (2000a). Conflicting perceptions of neighbourhood, In: Barton, H. (ed.) Sustainable communities: The potential for eco-neighbourhoods. London, *UK: Earthscan Publications*. 3-18.

Barton, H. (2000b). The design of neighbourhoods, In: Barton, H. (ed.) Sustainable communities: The potential for eco-neighbourhoods. London, *UK: Earthscan Publications*, 123-146.

BCA. (2008). *GreenMark for infrastructure: Version 1.0. Singapore: Building and Construction Authority (BCA)*, Ministry of National Development, Singapore Government.

Ben-Joseph, E. (1995). *Residential street standards and neighborhood traffic control: a survey of cities' practices and public officials' attitudes*. University of California at Berkeley, Institute of Urban and Regional Development.

Ben-Joseph, E. (2003). *Subdivision regulations: Practices & attitudes*. Lincoln Institute of Land Policy.

Benefield, J. D. (2009). Neighborhood amenity packages, property price, and marketing time. *Property Management, 27*(5), 348-370.

Biddulph, M. (2007). Introduction to residential layout. Oxford ; Burlington, MA, Butterworth-Heinemann.

Blair, J., Prasad, D., Judd, B., Zehner, R., Soebarto, V. I. & Hyde, R. (2004). *Affordability and sustainability outcomes: a triple bottom line assessment of traditional development and master planned communities*, Vol 1-Final report. Australian Housing and Urban Research Institute.

Boonkham, D. & Rochanasmita, K. (2002) *Recreation park in housing estate in BMA (in Thai)*. Bangkok, Thailand: Chulalongkorn University.

Bosworth, K. (2007). Conservation subdivision design: Perceptions and reality. Master of Science (Natural Resources and Environment), University of Michigan.

Bourassa, S. C., Hoesli, M. & Sun, J. (2005) The price of aesthetic externalities. *Journal of Real Estate Literature 13*(2), 165-188.

Braubach, M. (2007). Residential conditions and their impact on residential environment satisfaction and health: results of the WHO large analysis and review of European housing and health status (LARES) study. *International Journal of Environment and Pollution 30*(3/4), 384 - 403.

Browning, P. L. (1997). *Assessment guided practices Transition-in-action for youth and young adults with disabilities*. Alabama: Wells Printing.

Calkins, M. (2005). Strategy use and challenges of ecological design in landscape architecture. *Landscape and Urban Planning 7*3(1), 29-48.

Carter, T. (2009). Developing conservation subdivisions: Ecological constraints, regulatory barriers, and market incentives. *Landscape and Urban Planning 92*(2), 117-124.

Cho, S. H., Poudyal, N. C. & Roberts, R. K. (2008). Spatial analysis of the amenity value of green open space. *Ecological Economics 66*(2-3), 403-416.

Choguill, C. L. (2008). Developing sustainable neighbourhoods. *Habitat International, 32*(1), 41-48.
Clifton, K., Ewing, R., Knaap, G.-J. & Song, Y. (2008). Quantitative analysis of urban form: a multidisciplinary review. *Journal of Urbanism: International Research on Placemaking and Urban Sustainability, 1*(1), 17 - 45.
Eves, C. (2009). Assessing the impact of streetscape on residential property in lower to middle socio-economic areas. *16th Annual European Real Estate Society Conference*, 24-27 June 2009 Royal Institute of Technology, Stockholm.
Ewing, R. H. (1996). *Best development practices : doing the right thing and making money at the same time*. Chicago, American Planning Association.
Foltête, J.-C. and Piombini, A. (2007). Urban layout, landscape features and pedestrian usage. *Landscape and Urban Planning, 81*(3), 225-234.
Geoghegan, J., Wainger, L. A. & Bockstael, N. E. (1997). Spatial landscape indices in a hedonic framework: an ecological economics analysis using GIS. *Ecological Economics, 23*(3), 251-264.
Grammenos, F. & Tasker-Brown, J. (2010). *Residential street pattern design for healthy liveable communities* [Online]. New Urban Agenda Available: http://www.cardinalgroup.ca/nua/ip/ip02.htm.
Helfand, G. E., Sik Park, J., Nassauer, J. I. & Kosek, S. (2006). The economics of native plants in residential landscape designs. *Landscape and Urban Planning 78*(3), 229-240.
Jim, C. Y. & Chen, W. Y. (2009). Value of scenic views: Hedonic assessment of private housing in Hong Kong. *Landscape and Urban Planning, 91*(4), 226-234.
Johnson, D. E. (2008). *Fundamentals of land development*. New Jersey, John Wiley & Sons.
Karol, E. & Brunner, J. (2009) Tools for measuring progress towards sustainable neighborhood environments. *Sustainability, 1*(3), 612-627.
Kearney, A. R., Bradley, G. A., Petrich, C. H., Kaplan, R., Kaplan, S. & Simpson-Colebank, D. (2008). Public perception as support for scenic quality regulation in a nationally treasured landscape. *Landscape and Urban Planning, 87*(2), 117-128.
Kennedy, R. and Buys, L. (2010). Dimensions of liveability: A tool for sustainable cities. *Sustainable Building Conference*. Marid, Spain.
Lawhon, L. L. (2009). The neighborhood unit: Physical design or physical determinism? *Journal of Planning History, 8*(2), 111-132.
Lee, J. S. & Li, M.-H. (2009). The impact of detention basin design on residential property value: Case studies using GIS in the hedonic price modeling. *Landscape and Urban Planning, 89*(1-2), 7-16.
Matthews, J. & Turnbull, G. (2007). Neighborhood Street Layout and Property Value: The Interaction of Accessibility and Land Use Mix. *The Journal of Real Estate Finance and Economics 35*(2), 111-141.
McPherson, G. E. (1992). Accounting for benefits and costs of urban greenspace. *Landscape and Urban Planning 22*(1), 41-51.
Mertler, C. A. (2007). Norm-referenced test scores and their interpretations, Interpreting standardized test scores : strategies for data-driven instructional decision making. *Los Angeles: Sage Publications*. xiv, 253 p.
NESDB. (2002). *The indicators of urban development and livable community: Final report to Office of the National Economic and Social Development Board (NESDB) (in Thai)*. Bangkok, Thailand: Faculty of Architecture, Chulalongkorn University.
ONEP. (1999). *Guideline for environment impact assessment report: Residential, community services and resorts (in Thai)*. Bangkok, Thailand: Office of Natural Resources and Environmental Policy and Planning; Ministry of Natural Resources and Environment of Thailand.
ONEP. (2010). *EIA Monitoring Award 2009*. In: Office of Natural Resources and Environmental Policy and Planning (ed.). Bangkok, Thailand: Ministry of Natural Resources and Environment of Thailand.
Pasuthip, P. and Panthasen, T. (2009). *The promotion of interaction between residents in the subdivision communities by physical environment design* (in Thai). Payap University Journal, 20(2).
Perry, C. A. (1929). *The neighborhood unit: A scheme of arrangement for the family-life community In: Lewis, H. M. (ed.) Neighborhood and community planning*, regional plan of New York and its environs. New York. 2-140.
Perry, C. A. (2007). “The neighborhood unit” from regional plan of New York and its environs (1929), In: Larice, M. and Macdonald, E. (eds.) The urban design reader. New York: Routledge. 54-65.
Piputsitee, C. & Kittikunaporn, C. (2006). Real estate business handbook (in Thai). Bangkok, Thailand, FPM Consultant
Poudyal, N. C., Hodges, D. G., Tonn, B. & Cho, S.-H. (2009). Valuing diversity and spatial pattern of open space plots in urban neighborhoods. *Forest Policy and Economics, 11*(3), 194-201.
REIC. (2009). Newly completed and registered housing units in Bangkok and vicinities. Bangkok, Thailand: Real Estate Information Centre (REIC).

Rinchumpoo, D., Eves, C. & Susilawati, C. (2010). The comparison of international and local sustainable assessment tools of landscape design for housing estate developments: Case of Bangkok Metropolitan Region, Thailand. *8th International Conference on Construction and Real Estate Management (2010)*, 1- 3 December 2010 Royal on the Park Hotel, Brisbane, Queensland.

Rinchumpoo, D., Eves, C. & Susilawati, C. (2011). The property price model of subdivision development in Bangkok Metropolitan Region (BMR), Thailand: A hedonic pricing approach (under reviewing). *Journal of International Real Estate and Construction Studies*.

Rodie, S. N. & Streich, A. M. (2009). *Landscape sustainability*. Nebguide. Lincoln, NE, USA: University of Nebraska–Lincoln Extension educational programs

Rogers, G. O. & Sukolratanametee, S. (2009). Neighborhood design and sense of community: Comparing suburban neighborhoods in Houston Texas. *Landscape and Urban Planning, 92*(3-4), 325-334.

Royal Thai Government. (2000). Land Subdivision Act, B.E. 2543 (in Thai). *Royal Thai Government Gazette, 117*(45), 1-22.

Royal Thai Government. (2002a). Provision of land subdivision in Nakhon Pathom Province, B.E. 2545 (in Thai). *Royal Thai Government Gazette, 119*(3), 20-42.

Royal Thai Government. (2002b). Provision of land subdivision in Nontha Buri Province, B.E. 2545 (in Thai). *Royal Thai Government Gazette, 119*(36), 12-33.

Royal Thai Government. (2003a). Provision of land subdivision in Samut Prakan Province, B.E. 2546 (in Thai). *Royal Thai Government Gazette 120*(59), 46-66.

Royal Thai Government. (2003b). Provision of land subdivision in Samut Sakhon Province, B.E. 2546 (in Thai). *Royal Thai Government Gazette 120*(49), 69-91.

Royal Thai Government. (2007). Provision of land subdivision for residential and commercial in Bangkok Metropolitans Area, B.E. 2550 (in Thai). *Royal Thai Government Gazette 124*(21), 47 - 63.

Royal Thai Government. (2009). Provision of land subdivision for residential and commercial in Pathum Thani Province, B.E. 2552 (in Thai). *Royal Thai Government Gazette 126*(62), 92-107.

Southworth, M. & Ben-Joseph, E. (2004). Reconsidering the cul-de-sac. Access.

Sujaritpong, S. and Nitivattananon, V. (2009). Factors influencing wastewater management performance: Case study of housing estates in suburban Bangkok, Thailand. *Journal of Environmental Management 90*(1), 455-465.

Suksawang, W. (2003). *Visual perception and attitudes of the countryside landscape in Supan Buri province* (in Thai). Master of Architecture in Landscape Architecture, Chulalongkorn University.

Takeuchi, K., Namiki, Y. & Tanaka, H. (1998). Designing eco-villages for revitalizing Japanese rural areas. *Ecological Engineering, 11*(1-4), 177-197.

TGBI. (2010). *Thai's Rating for Energy and Environmental Sustainability for new construction and major renovation (TREES-NC) version 1.0* (in Thai). Bangkok, Thailand: Thai Green Building Institute (TGBI).

Travis, D. (2008). *What is LEED? Denver*, USA: Rocky Mountain Masonry Institute.

UDIA (Qld). (2009). *EnviroDevelopment standards version 2.* Queensland, Australia: Urban Development Institute of Australia (UDIA, Queensland).

USGBC. (2008). *LEED for neighborhood development rating system.* Washington, D.C, USA: U.S. Green Building Council (USGBC).

Veesommai, U., Siripanich, S., Menakanit, A. & Pichakum, N. (2008) *Plants for landscape architectural uses in Thailand*. Bangkok, Thailand, H.N. Group.

Vesely, É.-T. (2007). Green for green: The perceived value of a quantitative change in the urban tree estate of New Zealand. *Ecological Economics, 63*(2-3), 605-615.

Warrick, B. & Alexander, T. (1998). Changing consumer preferences, In: Schmitz, A. and Bookout, L. W. (eds.) Trends and innovations in master-planned communities. Washington, D.C.: Urban Land Institute. ix, 156 p.