URBAN SPRAWL CLASSIFICATION AND COMPOSITION ANALYSIS OF LAND USE INCLUDING GATED HOUSING DEVELOPMENT IN BANGKOK METROPOLITAN REGION, THAILAND

Background study of gated housing development in sprawl area

Siwaporn KLINMALAI* and Kiyoko KANKI**
シワポーン クリンマライ, 神吉 紀世子

Bangkok Metropolitan Region (BMR) is composed of a Mega-capital city and vicinity area and it shows the effect from the rapid urbanization with weak land use control. This research focuses the expanding residential development that transforms agricultural land into residential land that result in the large sprawl phenomenon in suburban and vicinity area. Through understanding of the characteristics of distribution of land uses classify an urban sprawl into four categories with unique characteristics in each the main type of residential development, a gated housing development, with great impact on the land use in BMR. It is necessary for gated housing projects to be addressed with specific solution base on characteristic of sprawling type in different areas.

Keywords : Urban Sprawl, Composition of Land Use, Gated Housing Development, Bangkok Metropolitan Region

1. Introduction

Bangkok Metropolitan Region (BMR) located at the middle region of Thailand and its geography is low plain and has consisted of many canal networks and rice fields. The region has been developed rapidly (Fig.1) without updated urban planning, while the urbanization has occurred by using road network instead waterway transportation, which has dominant in 1980. An American urban planning company and Thai government created the first land use planning of Bangkok since 1960(3). The expansion of urban area is substantially uncontrolled because it was late to try to control because the city was established over 80 years ago before and there was already expanded unplanned area. In case of the further planning it was also troublesome to control and allocate land for various land use, and to indicate direction of city growth. In addition, some researches about agricultural land use patterns in the north of urban fringe of Bangkok proved that difference of canal system reflects the difference residential type development(5). Many paddy fields became a low density of new housing developments and wastelands between60’s and 90’s, because urbanized area along road network obstructed accessibility of other land use(2). These situations have led to sprawl phenomena that was described in general urban sprawl definitions as disorder of low residential density development in suburban area, lack of multi-land use, and decentralized development on strip development(3). The wide part of the low residential density in BMR was occupied by gated housing development (GHD - new low residential development with the gate and walls developed by private sector), this paper is interested in the issue of sprawl impact study with GHD.

1.1. Emerging of Sprawl by Rapid Urbanization in BMR

Figure 1 presents the diffusion of urbanization in Bangkok and its greater area and housing estate development from 1930 to 2010. Now Bangkok city plans are applied to cover Bangkok city and its greater area, which are called together Bangkok Metropolitan Region (BMR). Total population of BMR reaches 10.4 million and the area is about 7,761.7 km² within 79 counties in 2011(4). Before 1992 when the seventh national economic and social

* Doctoral Student, Dept. of Arch. and Arch. Eng., Grad. School of Eng., Kyoto Univ., M. Arch.

** Prof., Dept. of Arch. and Arch. Eng., Grad. School of Eng., Kyoto Univ., Dr. Eng.
development plan (1992-1996) from the central government was launched, the outskirts area obtain extreme infrastructure network. Figure 1 shows that around 1995 high and rapid development of housing projects started flowing in outskirts area did not adequate many paddy fields area used to be spread. The including built-up area dramatically diffused from the city center to outskirts area of BMR as ribbon development particularly in vicinity area (Pathumthani and Samutprakarn province). Bangkok city began to control standard of housing unit development through residential regulations and acts as shown in timeline of figure 1. However, national plan and urban planning policy could not control city growth effectively. On the other hand, the plan and policy stimulated housing development in the large particularly in the northeast and northwest suburb of BMR along new road network as ribbon development. One of encouragement of this phenomenon is huge migration of population and high housing demand in that area (Fig.1). If public sector effectively planned to support infrastructure before housing development by private sector expand, problems and impacts or rapid housing development would be less. As the matter of fact, urban sprawl phenomena have been emerged rapidly in broad scale in BMR. It is known that GHD development occupy the large parts of the sprawled area, it is important to understand relation between sprawl area growth and gated housing development growth according to areas’ character via spatial classification to clarify area characteristic. The prospected outcome could be basic background for gated housing development study in the future to suggest solution for controlling sprawl situation in BMR.

1.2. Research Objectives

Due to sprawl area in BMR is too large to address problems with the same solution for whole area, the area identification is important to understand how specific areas can be clarified according to the different types of sprawl area in BMR. So, this paper aims to study such area identification through urban sprawl classification, and then based on physical composition of land use, the area location of GHD will be studied. The study area covers parts of suburban area of Bangkok City and five surrounding cities: Pathumthani, Nonthaburi, Nakornpathom, Samuthsakorn, and Samutprakarn, which are within the scope of BMR, sprawling qualification. For the analysis, we used the overall picture of BMR to grasp location and kind of land use, and the characteristic was examined. Then, category of sprawl and the impact of GHD will be discussed. Thus the objective is to understand urban sprawl in BMR through characteristic of sprawl (location of sprawl area, characteristic of land use, and sprawling development and growth) and to study GHD location in highly sprawl area (Fig.2).

1.3. Research Methodology

![Fig.2 Paper Framework](image-url)
Due to largeness of BMR, the area categorizing is necessary to understand the urban sprawl by classifying type of sprawl and analyzing their characteristics. This investigation begins from macro scale to micro scale approach (Fig.2). In chapter 1, we study general situation of sprawl in BMR and in Chapter 2, sprawl measurement literature was reviewed and we try to combine the factors of sprawl in BMR with the compatible indices to measure sprawl in BMR context. As shown later, in this stage, we found 9 factors for classification in macro and micro scale. In chapter 3, three indices (revision of land use planning, migration rate, and density of residential unit) were chosen for county level to illustrate location of feasible sprawl area. In chapter 4, focusing on sprawl area was classified with 6 factors: density of urbanized area, land use, period of urbanized area diffusion, diversity, decentralized development, and efficiency of infrastructure. The result was conducted by 1x1 square kilometer mesh analysis because this scale is conformed to census database used in macro scale. In chapter 4, the characteristic of GHD diffusion according to sprawl type in different location. The case study area was examined. The result 2 would be discovered in this stage as specification of different sprawling type and its impacts through GHD diffusion. Finally, conclusion synthesized from both results and proposes different and mutual characteristic of sprawl in BMR.

2. Sprawl Phenomena and Classification factors of BMR context

2.1. Literature review of sprawl measurement

Main researches of sprawl and urban development referred to basic process to distinguish sprawl definition and qualification. However, there is no common definition of sprawl. As definition of sprawl in terms of pattern and land development, sprawl is as continuous low density residential development on the metropolitan fringe, low density ribbon development along major suburban highways, and low density development to leave a patchwork of developed and undeveloped lands. An analysis of definitions of sprawl in the social science and planning literature suggest that definitions of sprawl can be grouped into various categories. Although sprawl situation is similar in many cities, but methodology to measure the extent of sprawl is various based on data source and cause of sprawl in different context that created unique indicators in different study areas. Most of the overseas studies commonly used multi-indicators by GIS analysis or statistical analysis in various aspects, common indices include: growth rate (population or built-up area), density (population, residential, employment), and spatial configuration (fragmentation or proximity). This method needs in depth database from public organization data, for instant, using Traffic Analysis Zone (TAZ) data for employment density (jobs/mile²) calculation to measure sprawl in concentration factor, hence, some indices based on Western urbanization context. Then they calculated these indices to analyze whole city, which could precisely reflect sprawl situation and compare with another cities. An Asian city, Beijing, cause of sprawl was defined that has to be an excessive urban expansion and the indices are used spatial configuration, such as area index, shape index, growth efficiency, such as horizontal density index, vertical density index, external impact, such as agricultural impact index, open space index. These measurement indices are some necessary statistic data that are not successive enough to calculate certain indicators, then, they are not so appropriate to directly apply all indices and methods to measure sprawl in BMR. This paper propose the sprawl indicators for measuring sprawl based on the case of Bangkok Metropolitan Region in Thailand according by sprawl causes and consequences.

2.2. Sprawl classification factors in BMR

<table>
<thead>
<tr>
<th>Table 1 Factor for measurement sprawl development and its utilization</th>
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<tr>
<td><strong>Factor</strong></td>
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<tr>
<td>1. Land use Planning (LP)</td>
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<tr>
<td>3. Density of housing unit (DUU)</td>
</tr>
<tr>
<td>4. Density of urbanized area (DU)</td>
</tr>
<tr>
<td>5. Land use (LU)</td>
</tr>
<tr>
<td>6. Period of urbanized area diffusion (PD)</td>
</tr>
<tr>
<td>7. Diversity of land use (DLU)</td>
</tr>
<tr>
<td>8. Decentralized development (DD)</td>
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<td>9. Efficiency of infrastructure (EI)</td>
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General urban sprawl definitions are an urban growth pattern with disorder of low density development, lack of multi-land use, and decentralized development\(^8\). Based on BMR situation, sprawl refers to disorderly growth of residential land with low-efficient infrastructure towards suburban and vicinity area. According to sprawl situation in this study, 9 factors as shown in table 1 were driven measurement of sprawl from macro to micro scale. As LP, MR, PU, and EI are composed from causes of existing sprawl situation in BMR, while DH, DU, LU, DLU, and DD are from basic sprawl factors of measurement. LP, MR, and DH divided sprawl area from non-sprawl area such as inner city and rural area, and identified sprawl location by database in county level. Because a sprawl phenomenon is fragmental development, then county level classification could not be well depicted interior sprawl characteristics. It is necessary to convert county data to be mesh data by DU, LU, and PU. Dimension of sprawl area qualification was revealed in this stage, namely, understanding about age of area, developed area in each land use to examine sprawl development of BMR. Then remaining three factors are DLU, DD, and EI are applied to evaluate the characteristic of sprawl area in different sprawl situation.

3. Result 1: Location and Type of Sprawl Area in BMR

3.1. Sprawl Area Identification in Macro scale

![Fig. 3 Location of Sprawl and Non-Sprawl Area in BMR](http://www.dpt.go.th/referred-on/22/04/2011)

As the sprawl measurement concept above, density is a basic criterion to evaluate sprawling. At first, we checked how the location of sprawl area can be clarified by housing density. All of 79 counties in BMR are not sprawl situation; therefore, we have to divide non-sprawl area so we regarded that using statistic\(^5\) evaluation by sorting value of MR, DH, and LP. Before evaluation, the value was given in range of data as follow: 1) three ranges of migration rate including below 0.00% is declining, 0.01% – 1.99% is stable or slightly increasing, and above 2.00% is dramatically increasing 2) three ranges of housing density including below 2,000 units/km2 is low, 2,001-3,000 units/km2 is medium or average, and above 3,001 units/km2 is high 3) two types of number of planning revision including 0-2 times is not-well planning, and 3-4 times is well planning. Here we evaluate each district by
substitute for given range of factors are mentioned according to sprawl definition including high migration, low density of housing, and not-well planning were recognized. As seen in fig.3, we can recognize districts where is sprawl area emerging in peripheral area between rural and urban fringe (2). Overall of sprawl area located in partial vicinity area, including Nonthaburi, Pathumthani, Samutprakan, and SamutSakhon province, and perimeter of eastern and western Bangkok. The name list of 21 counties where sprawl is described in the table of Fig.3 and screened to analyze sprawl qualification and classification of sprawl state was recognized and examined in next section.

3.2. Characteristic of sprawl area and Classification of sprawl state in Micro scale

Fig.4 Factors for sprawl qualification by mesh data analysis

Then we investigated the selected sprawl areas (21 counties in Fig.3) according to remaining factors in table 1: DU, LU, and PU are similar condition together. DU was applied to arrange proportion of developed area occupation in 1x1 km2 into five levels, then, it was overlapped with LU, dividing into five types of land use because it was recognized different levels of developed area in the same land use. Next, PU (three periods in sprawl area) was overlaid and the outcome included 75 types of cell. This leads to understanding of main characteristic in a group as shown statistic in table 2. In order to recognize land use development of sprawl phenomena, we plotted cells in different period (PU) as shown in Fig.5. The result was revealed groups of similar land use and density in the same period into 12 groups of sprawl land use.

According to fig.5, the newly developed (after 2005) areas are 5 groups as follow; 1) low developed agricultural land use (0A-50A) 2) low developed low-residential land use (0R-50R) 3) low developed medium-residential land use (0M-25M), 4) low developed commercial and official land use (0C-25C),
and 5) low developed industrial land use (0I-50I). While the previously developed area (1995-2005) included other 5 groups: 1) highly developed agricultural land use (75A-100A), 2) highly developed low-residential land use (75R), 3) medium developed medium-residential land use (50M), 4) medium-highly developed commercial land use (50C-100C), and 5) highly developed industrial area (75I-100I). Lastly, the primitive developed area (1985-1995) consisted remaining 2 groups: 1) very highly developed low-residential land use (100R), and 2) highly developed medium-residential land use (75M-100M).

![Fig.6 12 groups on DLU, DD, and EI factor](image)

This leads to assumption of study that different type of urban sprawl cause to different consequences and to specific problems and solution for each area. Therefore, remaining sprawl measurement factors became the main indicators to classify these groups. The study applied 12 groups of speculation map with overlay analysis as shown in fig. 6 which their details and methods are described as follow;

1. **Diversity of land use (DLU) – Single land use:** the sprawl feature is a separation of different kind of land uses into distinct areas and would expect increasing the inconveniences such as traffic congestion, trip lengths, and travel times, while diversity would not. Therefore, land use planning map (Fig.4.1) was applied to diversity analysis by identifying number of kind of land use in one square that was ranges into three groups: 1 type, 2 types, and 3 types. Although, this factor is similar to LU but DLU aimed to emphasize the edge of land use, where is feasible to blend function with nearby land use. Group which contained large area of single land use means high sprawl-like on this dimension.

2. **Decentralization development (DD) – Ribbon development:** according to lacking of well planning and project development planning, it consequence to missing function of land development. There are a lot of housing development were built along a principle or minor arterial, which is a road to connect between city or region, called ribbon development. This consequence is obstruction of access from behind land to the road and aggravation of rare land potential. In order to investigate decentralized area (ribbon development), this study considered highly developed area (75%-100%) located along principle and minor arterial road.

3. **Efficiency of infrastructure (EI) – Inefficient infrastructure:** many reports of urban planning in BMR by relevant public sectors mentioned about consequence of non-systematic road network in BMR as haphazard development means development without plan (WP). This was illustrated with highly developed area (75%-100%) settled on local or narrow street not arterial, which can reflect inadequate infrastructure that effect on living environment and transportation. On the other hand, the planned area but still is low development, called planned without developed area not (WD) is also indicated inefficient infrastructure, in terms of they are low developed area (0%-25%) located on principle or minor arterial as vacant or waste space and wait for urbanization.

Table 2 showed groups of sprawl land use were allocated into sprawl type according by three factors as mentioned above. Number of cells of 75 types in 12 groups of sprawl land use was shown in percentage of area as shown in Table 2. Meanwhile, the value in sprawl situation column was shown both percentage and z-score because it could be compared and degree situation of sprawl. Finally, results were revealed 4 types of sprawl situation that will be investigated more in next chapter.
### Table 2: Level and Location of Sprawl Area 1 in BMR

<table>
<thead>
<tr>
<th>Group</th>
<th>Code</th>
<th>Land use*</th>
<th>Dens*</th>
<th>Period 1</th>
<th>Period 2</th>
<th>Period 3</th>
<th>Total</th>
<th>Diversity (DU)</th>
<th>Decentralized (DD)</th>
<th>Efficiency (EI)</th>
<th>Sprawl type</th>
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<tr>
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<td></td>
<td></td>
<td>%cell</td>
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<td></td>
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<td></td>
<td></td>
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<tr>
<td>G0</td>
<td>A</td>
<td>Agricultural</td>
<td>50%</td>
<td>8.00(7)</td>
<td>4.7(13)</td>
<td>7.15(9)</td>
<td>1.59(5)</td>
<td>3.6(11)</td>
<td>0.00(0)</td>
<td>0.00(0)</td>
<td>High-Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td>25A Agricultural</td>
<td>25%</td>
<td>3.2(4)</td>
<td>2.1(4)</td>
<td>3.2(4)</td>
<td>1.59(5)</td>
<td>2.1(4)</td>
<td>0.00(0)</td>
<td>0.00(0)</td>
<td>Low-High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>50A Agricultural</td>
<td>50%</td>
<td>1.5(5)</td>
<td>1.5(5)</td>
<td>1.5(5)</td>
<td>1.5(5)</td>
<td>1.5(5)</td>
<td>0.00(0)</td>
<td>0.00(0)</td>
<td>Medium</td>
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<tr>
<td>Total</td>
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<td></td>
<td></td>
<td>1.59(5)</td>
<td>3.6(11)</td>
<td>5.7(14)</td>
<td>1.59(5)</td>
<td>5.7(14)</td>
<td>0.00(0)</td>
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**Factor Legend:**

- **Agricultural** = Objective 1: to conserve agricultural environment to water management and flood way 2) to promote agricultural business in rural area
- **Low Residential density** = Objective 1: to support living environment in suburban area 2) to prepare for residential extension in suburban area 3) to maintain living environment between inner city and suburban area and surrounding sub-center, and transportation serviced area
- **Medium Residential density** = Objective 1: to prepare for residential extension from inner city and sub-center 2) to support residential area connected commercial center in suburban and industrial area 3) to support continued residential area from inner city in mass transportation serviced area
- **Commercial and Official** = Objective 1: to support for commercial and industrial, urban fringe 2) for commercial business district
- **Industrial** = Objective 1: for industrial estate such as cargo, logistic center of South East Asian region

**Land use* =** Land use definition as follow determination in land use comprehensive planning, Bangkok Administration

**Dens* =** Density of developed area in 1x1 km

**Settlement* =** location of cells connected to road network

**WP =** areas are developed without planned

**Z-score =** Simple statistic to consider value with average range: positive value = higher than average (H), negative value = lower than average (L)

**Grey cell =** highest numbers of cell in row

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4. Result 2: GHD Diffusion and impact in sprawl classification

After we recognize four types in chapter 3, here we investigated each character, especially from land composition, and location of gated housing development in those compositions. As GHD has a special character – full closed with one gated – composition and location is very important. To indicate characteristics and source of different empirical situation of sprawling in terms of land use, land development, land configuration, townscape, and residential projects.
4.1 Character of four sprawl classification

According to various land use and difference in sprawl in each type, we considered: 1) high migration rate of population, as shown in Fig.3 because it leads to high demand of housing development 2) largest area of land use in table 2 in each type of sprawl, namely, low developed agricultural, low developed residential, highly developed medium residential, and highly developed low residential land use, were selected for type A, B, C, and D.

(1) Type A: New low development of agricultural area (further sprawl)

According to the results in table 2, over a half of whole sprawl area is in type A. Moreover, around 90% of area has been developed since 2005, as newly development area. Main areas are conserved to do agricultural business; therefore almost all area is single land use and contains few numbers of housing developments by private sector. Supporting reasons about feasibility of GHD settlement in this area are 1) location of type A at a certain distance from city center and at perimeter of sprawl area with road network including arterial and collector street expanded cross over to connect beside city, and 2) Mostly land use is agricultural land that control density and living environment by law. Hence, this area could not dominate developers to invest new housing project in this area. However, this is still being sprawl area because there is huge migration rate keep moving into the vicinity area and low density of settlement still existed. Supposing that government remain inactive to prepare well-finished infrastructure and planning, some problems would take place and in this area in the future. Therefore, it can be assumed that type A is further sprawl area. Fig.8 shows few GHD distributed on agricultural land use, their gated face to local street. There are lacking of mixed land use and only inconvenient transportation exists for residents.

(2) Type B: Supporting extension area with low to medium developed area (Initial sprawl area)

Sprawl type B contained low density of development in various land use. Though there are different land uses, they behave in similar way, namely, the values of three indicators are negative. This reflects the transition between Type A and Type C. The extent of Type B covered the second large number of whole sprawl area, also intervened territorial of every type (Fig.7). This type is connected with low developed area. Low density of residential development and GHD spread out widely across this. GHD project is with non-gated housing development. Some GHD has its location on local street and in such case there is no network to connect both parallel arterial sometimes located in mixture (Fig.7). Its GHD plot configuration is non-geometric form. Therefore, sprawl type B is as supporting area from surrounding higher developed area, which was fulfilled. The situation of Type B is as the beginning of sprawl, if lacking of well-finished planning and efficient infrastructure.
(3) Type C: Previous high-developed area in medium-resident and commercial area (late stage of sprawl area)

As shown in figure 6, location of sprawl Type C is attached with primary and minor arterial in the north and the south of BMR. The land use in this type is capable of development to urban area, including commercial-official, medium residential land use. The mixed land use, in addition, they connected to main road as a node of area. The z-score graph in Fig.7, obviously shows large ribbon development area was expanded but that there are few areas inefficient infrastructure. That new GHD are combined with other non-residential, namely, industrial or commercial land use (Fig.8). However, in such situation resident might face to environmental problem. This could be implied that type C has capability to improve an urban area.

(4) Type D: Highly developed area but inefficient infrastructure (critical sprawl area)

Highly development area in residential and non-residential was contained in this type while there are still some agricultural areas. Their characteristics conform to sprawl definition of BMR. Though the areas were developed in previous period, but infrastructure has been not enough, as shown in graph of Fig.7. Percentage of developed without well-finished planning area is higher than ribbon development area. Moreover, it also lacked of mixed land use but consisted of condense number of low density of residential area. It reflected critical sprawl problem for living environment, namely, number of population in that area is unbalance with capacity of infrastructure or urban facility. Residential areas is still increasing because their locations are nearby sprawl type C as urbanized area and also attached with arterial. This seems to be a perfect location for living, while it also motivates high demand of housing estate and leads to overwhelming of new housing development without enough planning. Highly developed agricultural land use is becoming to be a good sample for replacing agricultural land with residential land. This was the impulse by road network. Currently, the areas are almost occupied completely by built-up area such as a low residential area; despite land use is indicated to be agricultural area. Another problematic area is condense of highly developed area of low residential development where located remotely from main road and behind ribbon development area. New housing project development occupied land along the road network without relationship to canal, where old local communities still located at the same place along to the canals with access by small local road. GHD also replaces paddy fields and orchards with free-form shape. Figure 8 shows GHD is likely to be gathered between main road and canal routes, which distributing in some streets the accessibility to road network by non-GHD settlements.

![Type A, Type B, Type C, Type D Diagram](image)

**Fig.8 GHD diffusion in sprawl classification**

5. Conclusion

| Table 3 Characteristic of different type of sprawl in BMR |
|---------------------------------|-----------------|-----------------|-----------------|
| Type | Further sprawl area | Initial sprawl area | Late stage of sprawl | Critical sprawl area |
| Location | Perimeter sprawl area | Among high developed area | Along with arterial | Along and remote the arterial |
| Land use | Agricultural | Low-Residential Medium-Residential Commercial Industrial | Medium Residential Commercial | Agricultural Low-Residential Industrial |
| Density of development | Low | Low to Medium | High | High |
| Diversity of urbanized area | Low developed area | Low developed area | High developed area | High developed area |
| Decentralized | Non-Ribbon | Non-Ribbon | Ribbon | Ribbon |
| Inefficiency infrastructure | Planned but not developed area | Planned but not developed area | Developed but not planned | Developed but not planned |
| Problems in area | Replacing agricultural area | Enclosing non-gated housing | Lack of well control mixed land use between residential and non-residential | Inadequate of infrastructure |
| GHD diffusion | Few numbers of GHD | Located on non systematic road network | Combined with other land use | Combined with former village and replacing agricultural |
| GHD problems | Inconvenient to travel to another land use beside agricultural | Inadequate of infrastructure, some street obtain too many projects | Environmental problems | Enclosed previous non-gated housing development |
According to table 3, characteristics of typology of land composition are related to with different sprawl type. Classification of sprawl in this study could show type of sprawl area. Common pattern of development is leapfrog that consists of small sub-center dispersely in low residential land use. However, there are distinct background and unique qualification in each type, it is necessary to address specific problems that could occur by different characteristic. We can learn different density, amount, and gathering forms of GHD according to types of sprawl. Specially, according to the different land composition local community, road network, and traffic congestion that can find impact of GHD is in difficult way of accessibility.

Notes
*1) Bangkok Metropolitan Region (BMIR), as the national plan, includes 6 administrative provinces are; 1) Bangkok city: 1,568.737 km², 5,702,595 people, 2) Nakornpathom: 2,168.327 km², 851,426 people, 3) Nonthaburi: 622.303 km², 1,678,071 people, 4) Pathumthani: 1,525.856 km², 956,376 people, 5) Samutprakarn: 1,004.092 km², 1,164,105 people, and 6) Samutprakarn: 872.347 km², 484,606 people. Total BMIR area is 7,761.662 km² and number of residents is 10,237,179 people. It consists of 69 counties in total. Source: http://th.wikipedia.org/wiki/%E5%85%B3%E4%B8%9A%E6%AD%A6%E7%82%9F
*2) Urban Fringe of BMIR is transition area between inner city and suburban. There is continuous urban growth in radius 10-20 kilometers from city center. Suburban refers to peripheral area of Bangkok city, mostly are agricultural land and some area is urban-rural area. Its radius is over 20 kilometers from center. Source: Thailand Environmental Institute (TEI), Assessment of Environmental Problems in Bangkok Metropolitan, 2006

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和文要約
本論文は、バンコク大都市圏における近年の急速な市街地拡大に着目し、都市郊外で増加しつつあるゲートーデ・ハウジング・プロジェクトが、スプロール開発によって生じている土地利用構造のなかでどのような配置を占めているかを明らかにするのを目的としている。これにより、ゲートーデ・ハウジング・プロジェクトの増加が、新住宅地の拡大の中で新旧住宅地の調和した進んだスマーズな交通を阻むとの問題意識に基づくものである。ここでは、既往研究によるスプロール開発の評価指標に、著者が作成した1 kmメッシュデータを適用して、対象エリアを11タイプに類型化し、その分布を把握し、土地の区画形状と大きく関連する課題集団、事例地別の土地利用と住宅開発の配置を把握し、タイプごとのゲートーデ・ハウジング・プロジェクトの立地・集積の特性を明らかにし、周辺にあたる影響を論じた。

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