A Study on the Physical Model of Sustainable Urban Form

지속가능한 도시형태의 물리적 모형에 관한 연구

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※Keywords : Compact City, Physical Model, Decentralized Concentration, New Urbanism, Sustainable Development, Urban Form

Contents

I. Introduction

There have been growing concern about sustainable urban form in the field of urban planning and design, and it is based on the assumption that we can make our towns or cities more sustainable by appropriate manipulation of their form. It is now widely accepted that there are close relations between urban form and it's sustainability(Owens(1986); Breheny(1992); Jenks et al.(1996); Williams et al.(2000)). However, consensus is lacking about the exact nature of this relations, and meaningful researches on physical model of sustainable urban form have not been fully executed yet. If any advances in urban sustainability are to be made, the connections between urban form and a range of elements of town and cities, at all geographical scales, need to be established.

As Breheny (1992) said, if we can find proper methods to design and manage our cities so as to reduce the use of resources and pollution, it will be great help to solve the current global problem. But there are still few researches on "What kind of urban form is sustainable, and how can it be achieved?" so far. Based on this background, the purpose of this paper is to investigate the characteristics of physical model of sustainable urban form and to give the useful resources for sustainable urban development. In contrast to the previous literatures that focused on defining abstract urban form concerning sustainable development, this study tries to find concrete physical model of sustainable urban form.

To this end, I reviewed urban form in relation to sustainable development, first. Compact city as a sustainable urban form is discussed, and 'decentralized concentration' and New Urbanism as new sustainable urban form are examined. After this, I examined some physical models of sustainable urban form and executed brief case study in different spatial scale: region/city level; district/neighborhood level; and block/building level, later on. Based on the above study, I summarized major features of each physical model of sustainable urban form, and lastly draw some characteristics of sustainable urban form under the category of development pattern, land use, size, layout, shape, and access etc.

II. Overview of Sustainable Urban Form

1. Sustainable Development and Urban Form

According to Newman & Kenworthy (in Williams et al., 2000), there are four types of city in history: traditional pre-modern walking city, industrial transit city, modern automobile city, and post-modern sustainable city. Among them, the post-modern sustainable city is characterized as high-density local urban villages linked across city by transit, medium- and low-density areas around villages and no more sprawl, and based walking, cycling and transit mode transport system (<Table 2-1>).

Based on some descriptions about sustainable development and urban form, it appears possible to define sustainable urban form[1] through certain basic characteristics that it should posses. During the past decade, there have been some meaningful researches concerning the

<Table 2-1> Characteristics of four historical city types

	Traditional Pre-modern Walking City	Industrial Transit City	Modern Automobile City	Post-modern Sustainable City
Transport	walking	streetcars and trains	cars(almost exclusively)	·walking/cycling(local) ·transit(across city) ·cars(supplementary) ·air(global)
Urban Form	Walking city ·small ·dense ·mixed ·organic	Transit city ·medium-density suburbs ·dense mixed center ·corridors with green wedges	Automobile city ·high-rise CBD ·low-density suburban sprawl	Sustainable city ·local urban villages (high-density) linked across city by transit ·medium- and low-density areas around villages ·no more sprawl
Environment ·resources ·wastes ·nature orientation	 ·low ·low ·close to rural areas(dependent)	 ·medium ·medium ·some connections through green wedges	 ·high ·high ·little nature orientation(independent)	 ·low-medium ·low-medium ·close to nature

Source: Revised, based on Williams et al., 2000, p.119

1) Sustainable urban form is the physical and spatial forms which are both cause and effect of sustainable urban development, and it is not necessarily simple or fixed patterns. In this paper, a form is taken to be sustainable if it; enable the city to function within its natural and man-made carrying capacities; is 'user-friendly' for its occupants; promote social equity, and inclusive decision-making process(Ravetz, 2000; Williams et al., 2000).

relations between sustainable development and urban form, and much arguments of them focus on the linkage of urban size and density to transport and energy demand.

Although definite solutions have not come yet, and there are still much arguments on them, most all of researchers agree on the followings (Owens, 1986; Breheny, 1992; Jenks et al., 1996; Frey, 1999; Williams et al., 2000): ① Energy consumption per capita shows most high in the suburbs, and large city is less energy-efficient than medium city due to traffic congestion; ② Compact city reduces energy consumption and gas emission as the decrease of travel distance and mass transit, but 'decentralized concentration' is more energy-efficient urban form; ③ Elements of urban form such as location, density, size, service and facilities affect traffic mode and access, and among them, city size is the largest factor on traffic distance and modal shift.

2. Sustainable Urban Form

1) Compact City

Many researchers believe that, among the various urban forms, compact city is an ideal sustainable urban form[2]. They list various properties of compact city, but there are some common features such as integrated and intensified land use, compact development, mixed land use, centralization of function and activities, and self-sufficient form etc.

<Table 2-2> Properties of compact city

Researcher	Major properties
Newman and Kenworthy (1989)	more intensive land use; centralized activity; higher densities
Elkin et al. (1991)	intensification of use of space in the city; higher residential densities; centralization; compactness; integration of land use; some form of self-containment
Breheny and Rockwood (1993)	high density; mixed use; growth encouraged within the boundaries of existing urban areas with no development beyond the city's periphery

Source: Jenks et al., 1996, p.54

2) There is not clear definition of compact city yet, but several authors describe the compact city in contrast to other competing settlement pattern(Owens and Rickaby (in Breheny, 1992), Breheny(1992), Haughton and Hunter(1994)).

as shown in <Table 2-2>(Thomas and Cousins, in Jenks et al., 1996).

The general characteristics of compact city seems to be: a moderately dense urban system, composed of major cities and with satellites that accommodate most of the growth; with intervening open areas of sufficient size to be agriculturally productive; with high levels of accessibility; with facilities for urban recycling; with CHP systems and ambient energy sources; and sufficient greenery in all areas to remind everyone of their reliance on nature. The whole approximates to a modern version of Ebenezer Howard's Social City (Breheny, 1992).

Both of the proposed and opposed to the compact city support the concept of 'decentralized concentration', the concept of a multi-nucleated city or even city region in which uses concentrated in the mono-core of the compact city are dispersed into a number of smaller centers forming the nuclei of urban districts or towns or 'villages'. Rickaby et al. (in Breheny, 1992) also indicate that high density linear development is less efficient than 'village dispersal' patterns of growth. They suggest that a right rail rapid transit system between decentralized concentrations of development would increase the attractiveness and energy efficiency of form.

Centering the concentration of land use and transport, Buxton (in Williams et al., 2000) argues three types of urban form: dispersed city; urban consolidation; and urban self-containment. He addresses that urban self-containment is an alternative to the others and proposes the redevelopment of areas close to the public transport locations into centers. This model, like 'decentralized concentration', aims self-containment in centers, and integration between land use and public transport use[3].

2) New Urbanism

Responsive to the suburban sprawl, the New Urbanism has emerged as an alternative model of suburban as well as urban (re)development. The New Urbanism recalls certain features of the American urbanism

3) This model contrasts with both the dispersal model, with its separated uses linked by road transport, and the conventional consolidation model, in which intensification occurs any where in existing or new suburbs, in an incremental manner.

which existed around of last century. Land use is organized by a concept of a neighborhood which allows access to the public facilities by pedestrians as well as by automobile. This means the provision of such community facilities as the post office, and retail and commercial stores at the core of the community and within a 1/4 mile to 1/2 mile radius of the residential land uses. Congress for the New Urbanism(CNU) [4] advocates the restructuring of public policy and development practices to support the following principles: neighborhoods should be diverse in use and population; communities should be designed for the pedestrian and transit as well as the car; cities and towns should be shaped by physically defined and universally accessible public spaces and community institutions; urban places should be framed by architecture and landscape design that celebrate local history, climate, ecology, and building practic e[5].

Neighborhoods of New Urbanism, that are compact, mixed-use and pedestrian friendly; districts of appropriate location and character;

<Table 2-3> Comparison of New Urbanism and conventional land-use theories

New Urbanism	Conventional Land-use Theories
The location of commercial establishments and public facilities at the physical center, surrounded by a ring of residential land use	· Concentric Zone Theory
The location of development along a transportation axis, such as transit or a bus line	· Hoyt's Sectorial Theory
Urban and suburban districts are distinguished by a variable density and (size) hierarchy of (sub)centers	· Location-accessibility Models · Multiple Nuclei Theory

Source: Banai, 1998. p.174

4) Congress for the New Urbanism (CNU) is a San Francisco-based non-profit organization that was founded in 1993. It works with architects, developers, planners, and others involved in the creation of cities and towns, teaching them how to implement the principles of the New Urbanism. These principles include coherent regional planning, walkable neighborhoods, and attractive, accommodating civic spaces. CNU has over 2,000 members throughout the United States and around the world. It sponsors annual conferences, known as Congresses, for the sharing and discussion of best practices in New Urbanism(http://www.cnu.org/).

5) CNU, 2000. *Charter of the New Urbanism.* The McGraw-Hill Company.

and corridors that are functional and beautiful, can integrate natural environments and man-made communities into a sustainable whole (Katz, 1994). It should be noted that, whereas, conventional land use theories generally described the physical pattern of urban growth responsive to 'natural' forms of socioeconomic change in an essentially unfettered market economy, the New Urbanism might be regarded as a normative or prescriptive model of 'growth management'(Banai, 1998).

III. Theory and Practice of Sustainable Model of Urban Form

1. Physical Models of Sustainable Urban Form

1) Overview of Models

There are several physical models of sustainable urban form but the most well-known ones are: Urban Task Force(UTF)'s model, TOD(Transit-Oriented Development) model, TND (Traditional Neighborhood Development) model, UV (Urban Village) model, SUM (Sustainable Urban Matrix) model, Frey's model, and Ravetz's model.

Among these models, UTF's, TOD,

<Table 3-1> Physical models of sustainable urban form

Model		UTF's	TOD	TND	UV	SUM	Frey's	Ravetz's
Researcher(s)		Urban Task Force	Peter Calthorpe	Duany & Plater-Zyberk	Urban Villages Campaign	Tigran Hasic	Hildebrand Frey	Joe Ravetz
Major Features		· urban regeneration · city center · design-based	· New Urbanism · suburbs · transit-oriented · design-based	· New Urbanism · suburbs · historic & traditional · design-based	· neo-traditional European style · urban & suburban · design-based	· New Urbanism · apartment block housing · planning-based	· macro- & micro-structure · planning-based	· dynamic model · holistic approach · planning-based
Sub-model Types		-	· Urban TOD · Neighborhood TOD	-	-	· Unit SUM · SUM Group · CNG · UV	· Macro Model · Micro Model	· Parrel Grid · Alternative Grid
Spatial Level	Region/ City	○	○				○	○
	District/ Neighborhood	○	○	○	○	○	○	○
	Block/ Building	○				○		○
Application		-	· Laguna West	· Kentlands	· Crown Street · Hulme · Poundbury	-	· Glasgow	· Greater Manchester

TND, and UV models put stress on American/European neo-traditional style and design-based approach on micro spatial scale. On the other hand, SUM, Frey's, and Ravetz's models mainly take planning-based approach on macro scale(<Table 3-1>).

2) Physical Models of Sustainable Urban Form

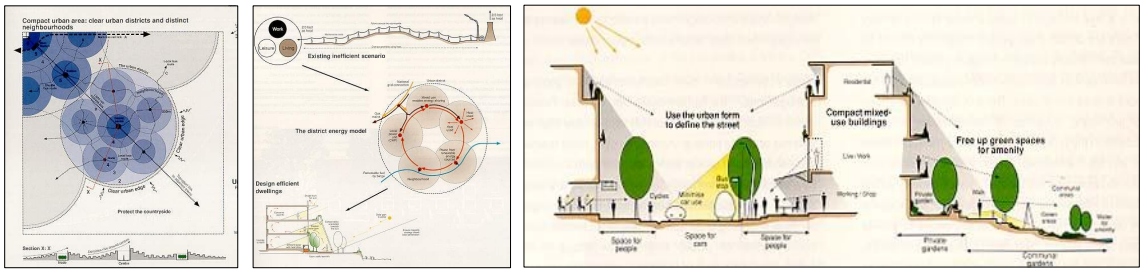
(1) UTF's Model

Urban Task Force(1999), which seeks 'urban renaissance' through sustainable urban regeneration in England, argues that compact city, based on traditional European high-density city such as Paris or Barcelona, should be a model of contemporary urban form. UTF describes the main principles of sustainable urban form as follows: clear urban districts and distinct neighborhoods; a clear movement hierarchy from city center to the home networks that link together residential areas to public open spaces and natural green corridors with direct access to the countryside; streets as outdoor living spaces to contain various demands of community; prioritizing walking, cycling, and public transport and reducing car use; integrated approach of land use and transport and compact and mixed land use.

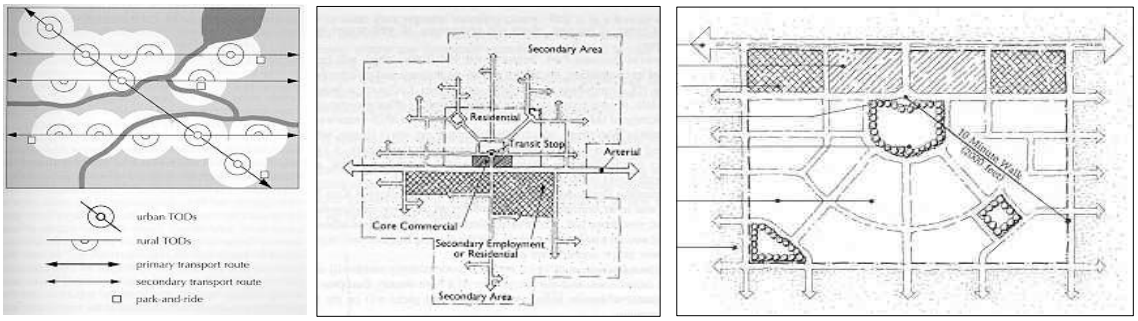
(2) TOD Model

Peter Calthorpe (1993) proposes the famous TOD(Transit-Oriented Development) model as a physical model of sustainable urban form based on the theory of New Urbanism described above. He categorized two types of TOD models; Urban TOD and Neighborhood TOD. The basic principles of TOD are: to organize growth on a regional level to be compact and transit-supportive; to place commercial, housing, jobs,

<Figure 3-1> UTF's Model



<Figure 3-2> TOD Model

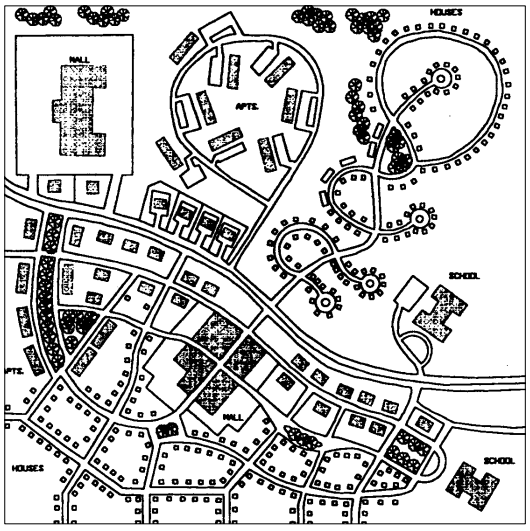


parks, and civic uses within walking distance of transit stops; to create pedestrian-friendly street networks which directly connect local destinations; to provide a mix of housing types, densities, and costs; to preserve sensitive habitat, riparian zones, and high quality open space; to make public space the focus of building orientation and neighborhood activity; to encourage infill and redevelopment along transit corridor within existing neighborhoods.

(3) TND Model

TND (Traditional Neighborhood Development) model proposed by Andres Duany and Elizabeth Plater-Zyberk(1991) has some common features with TOD model such as walkable neighborhood, clear public structure, mixed use of land and housing type, and harmony in building and space design, but it stresses more on the historic style and architectural form, control of building type, smaller development size, publicity of community rather than public transport. The basic principles of TND model are: ①The neighborhood has a center and edge. ②The optimal size of a neighborhood is a quarter mile from center to edge. ③The neighborhood has a balanced mix of activities-dwelling, shopping, working, schooling, worshipping and

<Figure 3-3> TND model

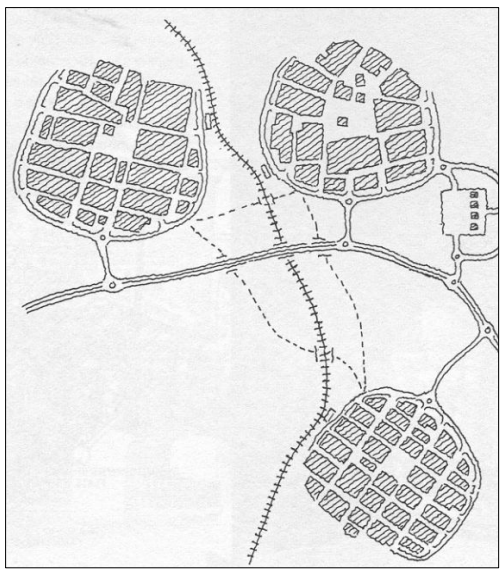


recreating. ④The neighborhood structures building sites and traffic on a fine network of interconnecting streets. ⑤The neighborhood gives priority to public space and to the appropriate location of civic buildings(Katz, 1994).

(4) UV Model

UV (Urban Village) model proposed by Urban Villages Campaign(Aldous, 1999) is a solution born out of disillusionment with conventional development practice in England by creation of 'urban villages' within the built environment. These villages are forms of development characterized by economic, environmental and social sustainability, and they should include : a variety of uses, such as shopping, leisure and community facilities alongside housing; a choice of tenures, both residential and commercial; a density of development that can help encourage the use of non-housing activities; a strong sense of place, with basic amenities within easy walking distance of all residents; a high level of involvement by local residents in planning and managing the development [6]. The Campaign takes the organic, holistic, urbanistic, polycentric, and aesthetic nature of pre-industrial quarters and villages, combines them with the community and management ideals of late nineteenth century and early twentieth century utopian models, and then integrates these with current objectives for sustainability, compact cities and collaborative planning (Fawcett, in Williams et al., 2000).

<Figure 3-4> UV model



(5) SUM Model

Another model of sustainable urban form in urban and suburban housing development, named SUM (Sustainable Urban Matrix), was proposed by Hasic (in Williams et al., 2000). This model is envisaged as

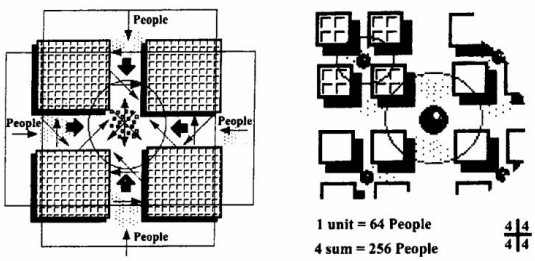
6) http://propertymall.com/uvf/forum.html

an integrated, coherent spatial neighborhood in an apartment block housing unit, which attempts to consolidate the neighborhood in a more socially and spatially sustainable way than at present. Each unit SUM is four stories high (with, additionally, the ground level and roof-top), with four apartments on each floor, and can be multiplied by four, creating a SUM group, with a maximum of 256 inhabitants. The unit of 1,000 inhabitants (four SUM groups) consists of a CNG (Close Neighborhood Group), and four CNG makes an urban village or a small town, with approximately 4,000 inhabitants. That is; a unit SUM → a SUM group → a CNG → urban village. The main elements or principles of the SUM model are: high quality spaces, inside and out; social interaction and vibrant neighborhood life; sense of, and attachment to, place; rich mix of uses and activities; walkability and livability; integration of spaces and framework of streets; cars in perspective and transport in focus; traditional values for contemporary needs; sustainable and eco-living for the future.

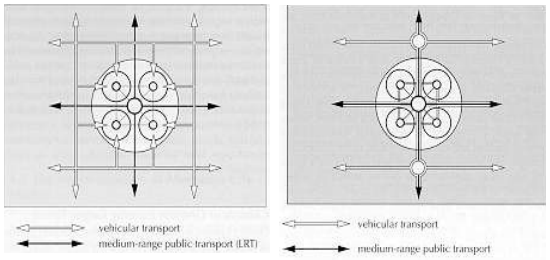
(6) Frey's Model

Frey (1999) seeks micro- and macro structures of a more sustainable city on various spatial scale. Concentrating on the impact of the criteria of sustainability on the micro- structure of the city or city region, with specific interest to the impact of demand for access to public transport and to local services and facilities by walking and cycling on the pattern of development clusters and provision centers, he suggests several physical models of sustainable urban form on the spatial hierarchy: urban neighborhood → urban district → town → city → city region.

<Figure 3-5> SUM model



<Figure 3-6> Frey's model



(7) Ravetz's Model

Ravetz (2000; in Williams et al., 2000) also searches for sustainable urban form in a city-region as a dynamic process of physical change with interaction with economic and social pressures and demands. In those researches, he argues sustainable urban form in the built environment under the category of the shape of the city, land and land uses, urban form and capacity, human scale neighborhoods, urban grain and texture, housing need and demand (residential density), and housing forms and layouts. While, as seen above, Urban Task Force (1999)'s cross-section through a residential district shows a tree-lined street enclosed by ground floor retail and commercial facilities and upper level apartments to enjoy views in private and communal gardens, Ravetz's urban block model, which aims at mixed uses, mixed household and mixed tenures within a clear hierarchy of external and internal space, also contains courtyards, cafe, roof gardens, balcony, basement, and maisonettes with step forms.

2. Case Study

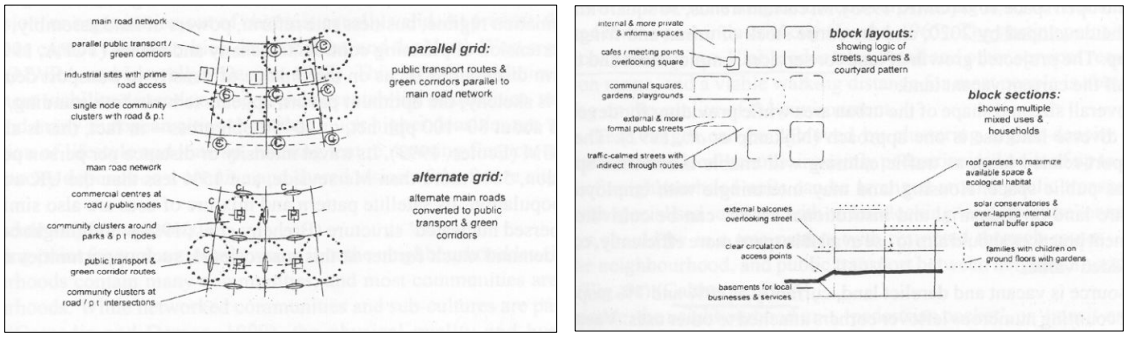
1) Analysis Framework

I set a framework to analyze the implementation of sustainable urban form model to real projects. This framework consists of several form

<Table 3-2> Analysis framework

Aspect	Form Element
Macro Aspect	development pattern
	land use
	development density
	transportation
Micro Aspect	size
	layout
	shape
	landscape
	access
	materials

<Figure 3-7> Ravetz's model



elements such as development pattern, land use, development density, transportation, size, layout, shape, landscape, access, materials etc, and they could be categorized macro- and micro aspect as shown in <Table 3-2>.

2) Case Study

(1) Glasgow: Region/City Level

Glasgow is the largest city in a development belt stretching from the Firth of Clyde at its western end to the Firth of Forth in the east in Scotland. Frey (1999) applied his structure model to the western part of this belt to achieve a sustainable urban form on region/city level. The proposed development pattern of Greater Glasgow is 'decentralized concentration', and urban infill and redevelopment of inner city area with intensified and integrated land use are strongly recommended. In micro aspect, this city realizes the principles of sustainable urban form by achieving balanced mix of uses and activities, primary and secondary transport networks linking neighborhoods, districts, and town centers, core commercial area near transit stop, and so on<Figure 3-8>.

The resulting hierarchical structure of provisions centers and linkages of this city follows closely Frey's city model that seemed to be the most appropriate for the city region of Glasgow, the poly-centric net. The proposed structure of the conurbation is firmly based on the existing morphology and structure of Greater Glasgow, and is, therefore, not only feasible but also achievable without any major structure change to the city region and the conurbation.

<Figure 3-8> Glasgow

(2) Laguna West, California: District/ Neighborhood Level

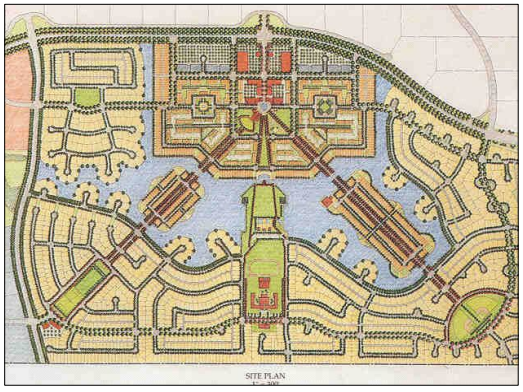
Calthorpe Associates designed this transit-oriented suburban new community containing 3,400 households and work places in 1,033 acre of former grazing land in the Sacramento area.

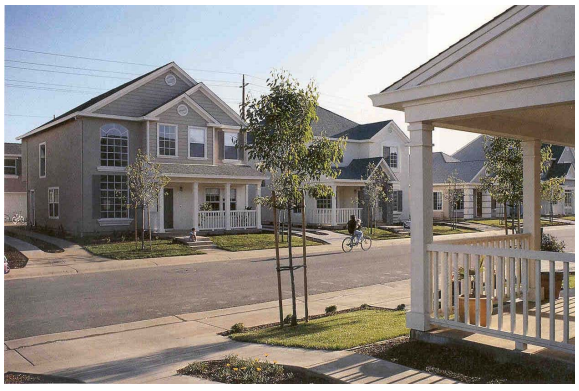
In aspects of development and land use, Grouping the light industry along the main road through Laguna West, not far from the town center, helps workers to reach transportation, eating places, shopping, child care, and other services. Many of the plant sites are within walking distance of the town center. According to the concept of TOD, core commercial area is located near mass transit stop whereas residential area surrounds it. Three main roads run from city hall that is located in the center of commercial area, so the shape of this city exactly resembles the TOD model.

Beyond the town center are lower-density "secondary areas" - residential areas where approximately 1,800 detached houses are planned. Streets radiating outward from the town center make it fairly easy for residents of this lower-density residential neighborhoods to reach the services and amenities in the city center.

A circular street in front of the town hall is a hub for bus routes, where an express bus runs from the town hall to downtown of Sacramento. It is believed that well-timed feeder buses between the town center and the commuter rail station can give Laguna West residents convenient access to the Light-rail system (Calthorpe, 1993; Langdon, 1994, http://www.cnu.org; http://www.lagnawest.com).

<Figure 3-9> Laguna West





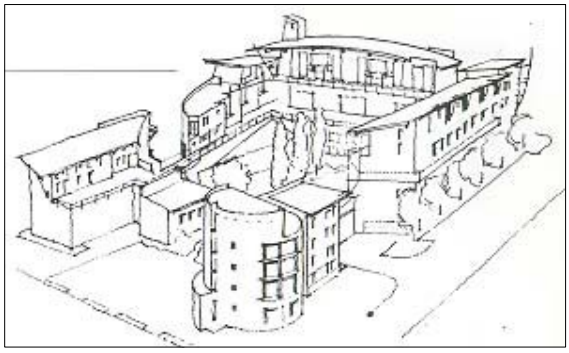
(3) 'Homes for Change', Manchester: Block/Building Level

This four- to six- story '18-hour-a-day' urban building complex in Hulme, which is one of the most significant urban regeneration projects of the 1990s in England, is a model of sustainable mixed-use housing project on building or urban block level. The planning approach was to produce an Urban Design Guide to characterize the vision for the area and the principles for the massing and positioning of the buildings. As a remarkable example of Urban Village, the U-shaped self-contained community development came to life through the collective energy of a group of 'alternative', educated, ecologically minded Hulme residents.

This project has many careful and sophisticated design considerations in land use, housing size, layout, shape, access, and choice of building materials and finishes etc. based on sustainability principles discussed above. The block housing comprises 50 co-operative maisonettes and flats and 1,500㎡ of managed workplace - including shops, offices, studios a small performance area which doubles up as a meeting room, and a cafe -, roof gardens, and communal landscaped courtyard. The workspace, built in a shell-and-core format to allow varying sizes and configurations of unit, is confined to the two first floors and has external entrances. The dwellings above are reached through a secured courtyard via open access decks.

Furthermore this scheme does incorporate a remarkable number of sustainable features such as recycled building materials, locally produced building materials to reduce transport cost, super-insulation standards for walls and roofs, solar gain and maximization of natural daylight, and

<Figure 3-10> 'Homes for Change'



so on(Rudlin, 1999; Fawcett, in Williams et al., 2000).

3. Review and Discussion

Through above literature study on sustainable urban form, and theory and practice of its physical model, the main findings can be summarized as follows: ①Each model and case project commonly has the characteristics of post-modern sustainable city in aspect of transport, urban form, and environment as shown in <Table 2-1>; ②Each model shows compact

<Table 3-3> Analysis of case projects

Aspect	Form Element	Characteristics	Case Project		
			Glasgow	Laguna West	Homes for Change
Macro Aspect	development pattern	· 'decentralized concentration' · urban infill or redevelopment rather than urban sprawl · establishing development or conservation corridors · intensified development near main transport nodes	● ● ● ●	 ●	 ● ●
	land use	· intensified and integrated land use · balanced mix of uses and activities · diverse types of housing and household · retail shops in core urban area	● ● ●	● ● ● ●	● ● ● ●
	development density	· high density urban village and medium/ low suburban housing	●	●	●
	transportation	· integrated approach with land use · mass transit rather than car	● ●	● ●	● ●
Micro Aspect	(neighborhood) size	· a quarter mile of radius (5-10 min.'s walk) · total population of 10,000-20,000 residents	● ●	● ●	● ●
	layout	· core commercial area near transit stop · civic buildings placed on preferential sites as landmark · priority of public space and facilities · cluster of high density housing with communal courtyard · energy-saving layout of building	●	● ● ●	● ● ● ● ●
	shape	· circular-shaped village preferred · loop or grid street pattern rather than cul-de-sac · housing with roof-top garden and basement		● ●	 ●
	landscape	· clear boundary of development area · traditional urban block · corridors defined by district and neighborhood · a careful treatment of corners, vistas and landmarks	● ● ●	● ● ●	 ● ●
	access	· local network by mass transit · a variety of street size and scales · linkage between house, job, services · walking, cycling, and transit preferred	●	● ● ● ●	● ● ●
	materials	· recycled building materials · locally produced building materials · solar gain and natural daylight			● ● ●

development pattern with integrated and mixed uses, pedestrian and mass-transit orientation, public and retail facilities such as town halls, religious buildings, schools, libraries, shops, and so on; ③The basic spatial and social unit of planning in the neighborhood, and a cluster of neighborhoods form an urban village or a town; ④Each case project basically contains a lot of elements and principles of it's model, but sometimes modify them according to existing context; ⑤Case study reveals the common characteristics in the following urban form elements: land use, development density, transportation, neighborhood size, layout, landscape, and access etc.

Reviewing all of this study, I can draw some issues and suggestions as follows.

First, our country recently has introduced new town and country planning system including "National Land Planning and Use Act(2000)[7]" and "Urban and Residential Environment Improvement Act(2003)", and it would promote to utilize the elements of sustainable urban form on macro- and micro aspect.

Second, many local governments actively take new urban policy concerning sustainable development such as 'decentralized concentration' in development pattern, mass transit policy in transportation[8].

Third, "Test Model City" like Namag New Town or Sangam Infill Project gives us opportunity to test the theory and practice of sustainable urban form and it's model, while large development project such as Gimpo New Town, Gangbuk Redevelopment requires to be developed in environmentally-friendly manner.

Fourth, our urban contexts including land use, development density, size, landscape etc are so different from those of developed countries that there are many limits to apply the theory of sustainable urban form such as compact city, New Urbanism to our city directly, so we should find properly modified Korean model of sustainable urban form.

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7) It prescribes the planning of District Unit Plan, Land Suitability Evaluation, Environmentality Study etc in various levels of urban and suburban development.

8) For example, Daejeon Metropoliran City currently tries to introduce mass transit system such as BRT(Bus Rapid Transit) or LRT(Light Railway Transit) in transportation policy.

IV. Conclusion

The major findings of this study can be summarized as follows: ① There are close relations between urban form and it's sustainability; ② Post-modern sustainable city is characterized as high-density local urban villages linked by transit, medium- and low-density areas around villages and no more sprawl, and based walking, cycling and transit mode transport system; ③ Compact city, 'decentralized concentration', and New Urbanism increasingly have been discussed as sustainable urban form; ④The most well-known physical models of sustainable urban form are UTF's model, TOD model, TND model, UV model, SUM model, Frey's model, and Ravetz's model; ⑤Each model and case study shows the common features in land use, development density, transportation, neighborhood size, layout, landscape, and access etc; ⑥The results of this study on physical model of sustainable urban form and it's application give us some meaningful issues and suggestions.

Sustainable City should not only satisfy human's basic needs but also reflect the inherent properties of each city or region. Although a study on the physical model of sustainable urban form could not presents a clear and concrete as the case- and place-specific research, it can give us many implications to urban planning policy and strategy to make our cities more sustainable.

But it is clear that urban sustainability is not dependent on form alone. Huge shifts in behavior and attitudes are also required. Concerning the sustainable urban form, as Williams et al. (2000) said, it is likely more important to emphasize on process rather than product and on objectives rather than standards. Most of all researchers stress on the need for flexible and adaptive approaches that can act as decision supports rather than prescriptive models and the need for inclusiveness through consensus-based decision-making.

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초 록

지속가능한 도시형태의 개념적 모형에 관한 연구

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※주요단어 : 개념적 모형, 뉴어바니즘, 도시형태, 분산적 집중, 압축도시, 지속가능한 개발

지난 수년간에 걸쳐 지속가능한 도시개발에 관한 이론적 혹은 실무적인 관심이 증폭되어 왔으며 지속가능한 도시형태에 관한 다수의 의미 있는 연구들이 진행되어 왔음에도 불구하고, 아직까지 형태적 연구에 관한 연구 성과는 미미한 수준이라고 할 수 있다. 이러한 배경에서 본 연구의 목적은 문헌연구를 통해 지속가능한 도시형태를 고찰하고 지속가능한 도시형태의 개념적 모형의 특징을 도출하고자 하는 것이다.

이를 위해 우선 지속가능한 개발과 도시형태와의 관계에 관한 이론적 고찰을 시도하였다. 또한 지속가능한 도시형태 이론으로서의 압축도시를 논한 후 새로운 지속가능한 도시형태 이론으로 인식되고 있는 '분산적 집중'과 신도시주의(New Urbanism)에 관해서도 고찰하였다.

이어서 지속가능한 도시형태의 물리적 모형이라고 할 수 있는 대중교통지향형 개발모형(TOD), 전통주의적 근린주구 개발모형(TND), 도시형 부락모형(UV), 지속가능한 도시 매트릭스모형(SUM) 등의 특징을 고찰하였고, 사례조사를 위한 분석의 틀을 설정한 후 지역/도시차원, 구역/근린차원, 지구/건물차원에서 도시형태 모형의 적용사례를 고찰하였다.

마지막으로 이상의 연구를 종합하여 지속가능한 도시형태 모형의 주요 특징을 고찰한 후 향후 우리나라 도시개발에의 정책적 시사점을 도출하였다.