

Sustainable Development and Transit-Oriented Development Cities in Taiwan

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Abstract. The goals of transit-oriented development (TOD) in the United States are to restrain urban sprawls, promote efficiency of land development, protect environment resources, guide urban development patterns, and build a highly livable environment. Within this context, many strategies are gradually developed to achieve these goals. However, how can one know that TOD programs and strategies achieve claimed goals efficiently? The crux is lack of a system provided for making the effectiveness and efficiency of TOD strategies and programs. Thus, this paper aims at illustrating about sustainable development and TOD. In order to provide workable tools for achieving TOD goals, an evaluation model and implementation tools are suggested. It is hoped that this system can provide the government a guideline for managing urban development and land use policies.

Keywords: Transit-oriented development (TOD), Sustainable Development

1 Introduction

Many factors have begun to bring about a reconsideration of our metropolitan landscapes. Commuters in many regions of the country are increasingly frustrated with congestion and arduous commutes. Concern over sprawl and the loss of open space is growing. Air pollution, greenhouse gas emissions, and pressure on foreign and domestic oil supplies are in the public spotlight. Disillusionment with auto-dependent development (AOD) and sprawl is on the rise, at least anecdotally. And rising housing prices in many metropolitan areas have limited the residential choices and homeownership opportunities of a large part of the population, including many who are solidly in the middle class. (Belzer and Autler, 2002a; Cervero et al., 2004, Hall, 1998; Newman and Kenworthy, 1999) One recent study suggests that places with sprawling, auto-centric landscapes are poor economic performers. Using data from 46 international cities, Kenworthy and Laube (1999: 632) found gross regional product per capita was generally higher in less auto-dependent cities: Car use does not necessarily increase with increasing wealth, but tends to fall in the wealthiest

cities.

Therefore, in policy efforts to mitigate these problems, smart growth has emerged under sustainable development. Smart growth calls for building communities that are more hospitable, productive, and fiscally and environmentally responsible than most of the communities that have been developed in the last century. . . . [It] seeks to identify a common ground where developers, environmentalists, public officials, citizens, and others can all find acceptable ways to accommodate growth. (Porter, 2002: 1) TOD has recently become a popular tool to promote smart growth and sustainable development. TODs have been hailed as a model for integrating land use with transportation in the interest of smart growth (Calthorpe, 1993; Cervero, 1998; Newman and Kenworthy, 1999; Renne and Newman, 2002; Renne and Wells, 2004). According to Cervero et al., “TOD has gained currency in the United States as a means of promoting smart growth, injecting vitality into declining inner-city settings, and expanding lifestyle choices” (2004: 3). *The New Transit Town: Best Practices in Transit-Oriented Development* (Dittmar and Ohland, 2004) states that TOD is an essential part of the healthy growth and development of regional economies (Renne et al., 2005). TODs base urban development plans on transit systems, improving efficiency of land-use and transit operations. Theory and applications of TOD have been extensively studied, such as Beimborn et al (1991); Bernick and Cervero (1997); Cervero (1994); Corbett and Zykofsky (1999); Freilich (1998), and Moon (1990). The strategies discussed in these studies were classified into three dimensions by Cervero and Kockelman (1997): enhancing development density to raise transit ridership; diversifying land use to improve public transportation passenger convenience, and pedestrian-friendly design on walkways and transfer systems to increase the use of transit systems. Moreover, benefits of TOD will achieve goals of sustainable development (e.g., environmental, economic and social benefits) (Cervero et al., 2004; Wells and Renne, 2004; Renne et al., 2005).

On the contrary, there are millions of people living in the small metropolitan area in Taiwan. Since 1970s, two mutually reinforcing processes have characterized Taiwan Cities: decentralization and increasing reliance on the automobile. Urban planning without control has deteriorated natural resources as well as urban finances. For example, housing vacancy rate of Taiwan was 17.6% in 2000. The housing vacant units amounted to 1.23 million. This has distorted the demand and supply of housing market. Still, the local governments have permitted excessive developments that do not coordinate with the availability of infrastructure facilities. Moreover, heavy investment in roads and other implicit subsidies of automobile use, combined with comparatively low levels of transit funding, have facilitated decentralized urban development patterns and inefficient use of land (Lin and Li, 2005). These

development patterns, which we refer to as sprawl, have made transit service unviable or inefficient in most suburban areas and many urban areas and have reinforced automobile dependence. Sprawling developments are consuming land, congesting roads and highways, and leading to a host of other economic, environmental, and social problems. In other words, urban development in Taiwan has been going against sustainability. Consequently, in order to carry out the dreams of sustainable cities in Taiwan, The purpose of this paper was to identify transit-oriented development strategies and policy actions used in sustainable development efforts and to catalogue them.

2 Why is TOD Used in 21st Century for Urban Development?

During the past decades there has been a tectonic shift in consumer preference, employer location strategies and transportation planning values. Sitting, as it does at the convergence of these trends, transit-oriented development has the potential to form a new approach to development that builds on their synergy and results in places and regions that meet the demand for location efficiency mixed use neighborhoods, supports regional economic growth strategies and increases housing affordability and choice. TOD could be nothing less than the defining armature for fundamental rethinking about how we build communities and how we make regional policy and investment decisions. Nonetheless, two questions persist: What are we aiming for? And what is TOD, anyway? Surprisingly, both questions have remained largely unanswered in the decade-plus effort to implementation TOD (Dittmar and Ohland, 2004: 20). As a result, this paper discussed this issues form its history.

It is useful for us to achieve goals of TOD by understanding its history on the fist step. For purposes of this discussion, we have given each phrase for TOD to distinguish past from present and future. One definition of TOD historical phases, which has been adopted by Belzer and Autler (2002a:4-6), does a good job of capturing the historical changes of TOD:

2.1 Development-Oriented Transit

The fist phase, the early 20th century, development-oriented transit (DOT) more aptly describes these places than does TOD, since private developers built transit to serve their development rather than vice-versa (Belzer and Autler,2002a: 4; Dittmar and Ohland, 2004: 5). From the mid 1800s to the early 1900s, numerous eastern and midwestern cities developed in parallel with the invention and expansion of rail transit systems; the cities' growth patterns are closely integrated with the availability of transit and causing decartelization (Warner, 1962 ; Vance, 1964 ; Middleton, 1967 ; Fogelson, 1967 ; Porter, 1997).

Challenged by the tremendous flexibility of travel offered by automobiles, rail and

bus transit has steadily lost ground as the chosen means of movement throughout our metropolitan regions. In many cities, rail transit lines were ripped up and rail service abandoned. Since the 1920s, and increasingly since World War II, the locational freedom offered by automobiles has allowed development to spread out in patterns unsuited for service by rail transit. The steady decline of metropolitan development densities in the last half of the 20th century has been paralleled by decreasing use of bus and rail lines (Porter, 1997: 4). In the other hand, urban patterns in the early 20th century were guided by transit.

2.2 Auto-Oriented Transit

The second phase, the post-World War II period: Auto-Oriented Transit saw a precipitous decline in transit use and the dismantlement and abandonment of many rail systems. To the extent transit was still in operation, it relied much more heavily on buses as the primary mode in most regions. With the exception of some of the commuter suburbs around older cities, which continued to function reasonably well as transit-based communities, most transit had become a last resort rather than a reliable transportation option tied to development. As congestion worsened, a new generation of transit systems was planned and built. They were built primarily to relieve congestion, funding was provided entirely by the public sector, and little or no additional land was purchased by the transit agencies to ensure that there would be any link between current transit investments and future development patterns (Belzer and Autler, 2002a: 5; Dittmar and Ohland, 2004: 6). Urban patterns changed by two types of transportation, buses and transits, were called as auto-oriented transit (AOD) patterns.

2.3 Transit-Related Development

Rail systems generally create value for adjacent land, and transit agencies and the federal government see large-scale real estate development on transit agency owned property as a way to “capture” some of that value (Belzer and Autler, 2002a:5 ; Dittmar and Ohland, 2004: 6). The value of transit-related development has been well studied by the disciplines of urban economics, land economics and urban planning. In general, the more accessible a location, the higher its property values, all else being equal. For many years these experts assumed that transit was being displaced in importance by automobile, but in recent years there has been increasing recognition of the potential importance of public transit, and therefore the potential that proximity to quality transit service can increase nearby property values (Litman, 2002).

Today, most studies which have been compiled by Pickett & Perrett (1984), Huang (1994), the Transportation Research Board (1998), Diaz (1999), Lewis & Williams (1999), and Jonathan Hack (2002) financing for transit focus on U.S. cities

through value capture, where low density development and auto-dependency predominate. Studies have begun to emerge from developing countries, where denser cities and a more even modal split can be found. However, while this return is not necessarily sufficient to pay the total cost of the rail investment, it represents at least a partial reimbursement to public coffers. For this reason, transit agencies and the federal government have an interest in promoting intense development around transit stations (Belzer and Autler, 2002a: 5; Dittmar and Ohland, 2004: 6). Transit adjacent for land creating poverty values is benefits for land development and government. It is not necessarily good for urban development and patterns because transit-related development in advance doesn't have a blueprint which is through visionary planning and meaning.

2.4 Transit-Oriented Development

The final phase will be transit-oriented development. From 1970s, a number of researches had stated that transit systems have the potential to provide residents with improved quality of life and reduced household transportation expenses, while providing the region with stable mixed-income neighborhoods that reduce the environmental impacts of growth (Daniels, 1972; O'Connor, 1980; Ley, 1988; Rice Center, 1987; Bell, 1991; Douglas, 1992; Cervero and Landis, 1992).

Up until 1990s, transit systems were integrated in land development and urban design. Some new concepts, tools, and policies of urban and transportation planning (e.g., transit-supportive development, transit-friendly design and transit village) were advocated by Hilton(1968), Meyer and Gomez-Ibanez(1981), Smith (1984), Calthorpe(1993), Cervero et al.(2004) and so on. TOD is the most widely used term, however, and is thus what we will use here. Transit-oriented development can help address problems ranging from sprawl, traffic congestion and poor air quality, to the shortage of affordable housing and the need for reinvestment in urban core communities. In short, TOD is a multi-faceted tool that can be used to address some of our most pressing problems, and it holds the promise of making the American way of life more sustainable.

Transit-oriented development offers an alternative that is at once viable in the marketplace and socially beneficial. Transit-oriented development in the 21st century can be a central part of the solution to a range of social and environmental problems. TOD may seem like a remarkably prosaic and invocative term given such lofty goals. As the economical, environmental, social, commuting, and urban development trends described above progress, it is likely that the type of neighborhoods we envision will become increasingly attractive (Belzer and Autler, 2002a: 6). Defining goals of TOD that function complementarily is a crucial first step toward advancing sustainable development. The next step is to move that goals – in concept and reality – into the

mainstream of urban and transportation development.

3 Sustainable Goals and Definitions of TOD

Transportation-oriented development is including bus- and rail-oriented development as well as development along freeways (Lefaver, 1997). This paper takes a narrower definition, referring to development near to mass transit systems. While there is no single, all encompassing definition that represents the TOD concept in its many forms, most definitions of TOD nonetheless share common traits (Cervero et al., 2004). The following represents definitions of TOD found in the literature (see table 1). This paper's review takes a limited definition, referring to development near or oriented to mass transit corridors and stations. While there is no single, all encompassing definition that represents the TOD concept in its many forms, most definitions of TOD nonetheless share common traits. While such definitions vary in scope and specificity, most TOD definitions share several common elements:

- A. Density: raising density around transit stations with 1/4 to 1/2 miles;
- B. Diversity: mixed land use, extensive choices of housing and commuting;
- C. Design: pedestrian or friendly oriented design.

According to above definitions of TOD, there are three main terms, density, diversity and design, so called 3Ds. Strategies of 3Ds are intended to increase transit ridership, increase walking and biking, and decrease the share of automobile trips. The design and mixed-use features of TOD may reduce both work and non-work automobile trips. Furthermore, these potential benefits can help amortize multi-billion dollar investments in rail transit infrastructure. Urban planning history provides accounts of promising ideas that did not realize its goals on implementation. TOD strategies are based on a theory that land uses near a rail transit stop will produce a different travel pattern than land uses in an automobile focused area. The best way to ensure that TOD can help solve urban challenges is to provide solid analytic evidence about its effectiveness (Lund et al., 2004: 1). In other words, numerous and various benefits of TOD contain economical, environmental and social effectiveness. Thus it can be seen that strategies of TOD are able to achieve goals of smart growth and sustainable development.

Table 1 Is TOD Goals Correspondent with Sustainable development

Literature	Definitions	Is TOD Goals Correspondent with Sustainable development		
		Eco.	En.	So.
Salvensen (1996)	Development within a specified geographical area around a transit station with a variety of land uses and a multiplicity of landowners.	✓		✓
Bernick and Cervero (1997)	A compact, mixed-use community, centered around a transit station that, by design, invites residents, workers, and shoppers to drive their cars less and ride mass transit more.	✓	✓	
Boarnet and Crane (1998)	The practice of developing or intensifying residential land use near rail stations.	✓		
Boarnet and Compin (1999)	TOD is consistent with the mixed-use, pedestrian-friendly character.	✓		
Maryland Department of Transportation (2000)	A place of relatively higher density that includes a mixture of residential, employment, shopping and civic uses and types located within an easy walk of a bus or rail transit center. The development design gives preference to the pedestrian and bicyclists, and may be accessed by automobiles	✓	✓	
Bae (2002)	A means of reducing automobile dependence, promoting more compact residential development and fostering mixed land uses.	✓	✓	
Belzer and Autle (2002b)	TOD focus on desired functional outcomes, not just physical characteristics, is an important next step. Three main outcomes or goals of TOD: location efficiency, choice, and value capture/financial return.	✓		✓
California Department of Transportation(2002)	Moderate to higher density development, located within an easy walk of a major transit stop, generally with a mix of residential, employment and shopping opportunities designed for pedestrians without excluding the auto.	✓	✓	
Still (2002)	A mixed-use community that encourages people to live near transit services and to decrease their dependence on driving.	✓	✓	
Cervero et al.(2004)	TOD is a tool for promoting smart growth, leveraging economic development, and catering to shifting housing market demands and lifestyle preferences.	✓	✓	✓
Lund et al.(2004)	TOD is intended to increase transit ridership, increase walking and biking, and decrease the share of automobile trips. The design and mixed-use features of TOD may reduce both work and non-work automobile trips.	✓	✓	

NOTE: Eco. =Economical Efficiency; En. = Environmental Protection; So. =Social Equality.

The main goals of TOD will also carry out dreams that our cities and counties are smart and sustainable. According to Cervero et al. (2004: 3), “TOD has gained currency in the United States as a means of promoting smart growth, injecting vitality

into declining inner-city settings, and expanding lifestyle choices.” TOD is not only implantation tools but also goals of smart growth. Moreover, according to definitions of this paper’s review (see table 1), goals of TOD are correspondent with concepts of sustainable development (e.g., economical efficiency, environmental protection, and social equality). We conclude that 3Ds’ strategies and concepts of TOD will guide urban development more sustainable (e.g., see figure 1). Basically, there are three key components in sustainable goals of TOD. First, environmental protection means that TOD will restrain land development from environmental sensitive areas and guide it to corridors and station of transit in order to protect ecological environment; second, economic efficiency means that high density and mixed development of land use around transit stations and corridors will raise transit ridership, promote economic development and improve location efficiency; third, social equality means that TOD will offer affordable housing with diverse type and more choices of transportation modes to keep social justice. Finally, the comprehensive and ultimate goals of TOD are sustainable development.

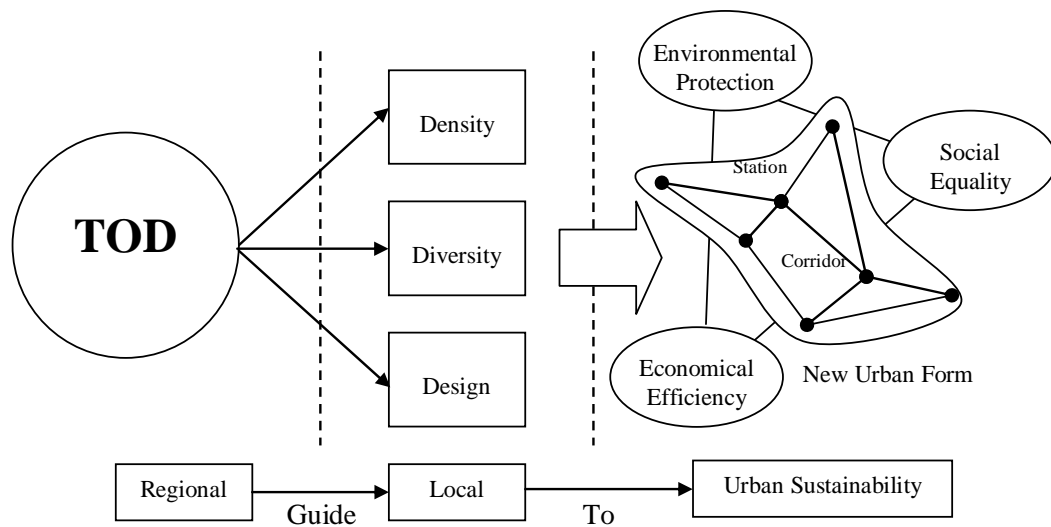


Figure1 Transit-Oriented Development and Urban Sustainability

4 Sustainable Strategies of TOD in Taiwan

Up until 1980s, Taiwan’s urban development was recognized as conflict with the concept of smart growth and sustainable development. It is found that current city and regional planning has depleted valuable resources through urban sprawling and land conversion in localities. Within this context, it is needed to study how to employ the concept of TOD to guide urban development patterns and to build a highly livable environment in order to reduce urban expansion. The purpose of promoting TOD is to

coordinate the urban spaces of living, working, shopping, and dwelling with orderly development along the corridors of the transportation systems. This will enhance the economic efficiency of land use development and infrastructure delivery, and improve the function of transportation system. By applying the concept of New Urbanism, urban design is implied for improving the neighborhoods around transit stations to create a livable and convenient place to attract people and office to move in.

TOD should develop from a regional aspect, deal with the main objectives of urban sustainability, integrate a public transportation system, and then be implemented at station planning level. As a result, TOD attempts to do or assist the following things:

- A. Evaluating development totality to help organize growth on a regional level to be compact and transit-supportive;
- B. Reserving sensitive habitat, riparian zones, and high quality open space;
- C. Encouraging infill and redevelopment along transit corridors within existing neighborhoods;
- D. Accelerating the construction of transit system and raising development density around transit to increase transit ridership, reduce motors' usage in CBD, release traffic congestion, and decrease air pollution;
- E. Diversifying land uses and providing a mix of housing types, densities, and costs to create a livable, convenient and self-sufficient city; and
- F. Regulating architecture design and parking space and creating pedestrian-friendly street network that directly connect local destinations.

5 Conclusions

Summarized it, this paper aims to connect sustainable and transit-oriented development planning. In the first, a discussion is on what are historical contexts of TOD in the past and why is it becoming new planning tools for achieve sustainable development in 21st century. Secondly, we find a definite relationship between sustainable goals for urban development and TOD by literature reviews. Finally, developing strategies is matching goals of sustainable development suitable for Taiwan.

According to literatures criticism and the nature of cities in Taiwan, TOD planning should take two scales: one is for metropolis and another is for areas around subway stations. The planning concepts should include: evaluating development totality, raising development density around subway stations, diversifying land uses, designing pedestrian-oriented environment, regulating architecture design and parking space, considering real estate market and sound financial institution and fund.

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