

Survey of Smart City Trends in the West: Transit-oriented Development and Mobility-as-a-Service

Part 1: Background and Purpose of this Survey

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1. Introduction

Public Transit-oriented Development (TOD)^{Note1} has been undertaken in various countries around the world with the goal of creating sustainable cities based on public transportation, and not dependent on automobiles. By closely integrating public transit development and land development, TOD can create a city form and space that reduces the need for traveling via personal car. With easy access to public transportation and a layout designed to be walkable and bikeable, it can be an exceptionally attractive place for people to live, work, learn, play and interact. Such an environment will also increase a city's economic competitiveness, reduce local pollution and global greenhouse gas emissions, and facilitate an all-inclusive development.¹ This idea of "a sustainable city based on public transportation that does not depend on personal cars" has been rapidly spreading in recent years due to the development of things like digital technology. Mobility-as-a-Service (MaaS) and other emerging mobility services are also at the heart of the concept.

In large cities in the United States and Europe, the latest TOD advancements for short-term and medium to long-term transportation and city planning include MaaS-related initiatives and plans for Mobility Hubs as nodes between TOD and MaaS. It is anticipated that the urban transportation infrastructure developed by TOD and the mobility services realized by MaaS will have synergistic effects.

Since many cities are still in the experimental stage, it is difficult to clearly measure the impact of MaaS on TOD with concrete quantitative data. However, cities in the West

are proceeding with TOD planning and development and efforts to implement MaaS in order to solve problems according to their different historical and social backgrounds. After summarizing the various backgrounds of these latest efforts and analyzing the relationship between the emerging mobility services of existing or planned/under construction TODs and MaaS, I would like to lay out the information that will be relevant to future initiatives in cities in Japan and Asia, and present it over multiple reports.

2. TOD in the United States and Europe

2.1 TOD

According to the Center for Transit-Oriented Development (CTOD), a non-profit research institute commissioned by the U.S. federal government that specializes in TOD,² the definition of TOD is a method of urban development that combines houses, offices, commercial facilities, and public spaces within an 800 meter radius around major public transport stations and connecting points that is (1) high density, (2) pedestrian-friendly, and (3) creates an area which serves a variety of uses.³ TOD is expected to promote the use of public transportation, reduce personal vehicle dependence, contribute to the environment, and improve transit connectivity.⁴ From the first construction of intercity railroads and trams in the latter half of the 19th century, until the arrival of the motorized society around the 1950s, the communities that formed by railway stations and surrounding areas were common forms of urbanization

seen around the world. However, as the use of personal cars became more widespread and the options for transportation increased, urban planning methods changed to take into account the need for expressways.⁵ From this context, in the latter half of the 1980s the term TOD emerged, which hearkened back to the earlier urban development method centered on public transportation. The term was defined by Peter Calthorpe, an American architect and urban development visionary, in his book published in 1993.⁶

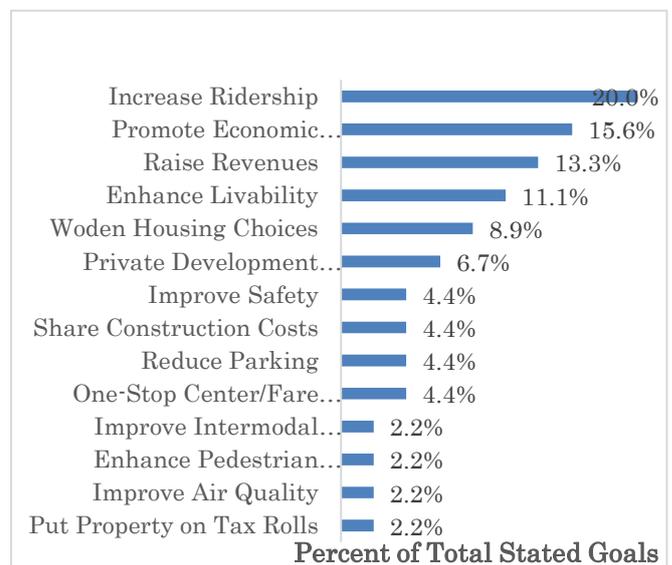
TOD is seen as an effective strategy for urban redevelopment as it is expected to revitalize the local economy and raise community awareness.⁴ On the other hand, TOD comes with complex development processes and financial and construction challenges. It's been pointed out that due to the rising cost of property near convenient transportation networks, there are harmful side effects, including a shortage of affordable housing, residents being evicted because of redevelopment, and the spread of commercial facilities. Looking at current TODs, various types can be seen, such as urban, suburban, residential, or business centric, depending on factors like the scale of the development area, the type of transportation network, land usage and population density.^{7,8}

2.2 Differences Between U.S. and European Views on TOD

In the United States, the main purpose of TOD is to bring economic benefits to public transportation and its surrounding communities, which have been declining due to the advent of the car-oriented world.⁹ It can be said that local government can be a tool that aims to eliminate overdependence on automobiles, reduce or prevent urban sprawl⁵ and at the same time, work towards more sustainable regional economic growth. In addition, the most commonly heard objective of TOD, according to U.S. public transportation agencies, is to increase the number of users (and fare income) by concentrating houses around stations (see Fig. 1).¹⁰ The U.S. Department of Transportation's Federal Transit Administration (FTA) also cites the examples below as benefits of TOD, and in cases when TOD is planned along with a federally run

transit project, things like financial and technical assistance can be offered to local governments.¹¹

- Increases both the number of public transportation users and the accompanying profits
- Facilitates public and private sector collaboration on initiatives and investments
- Spurs revitalization of nearby areas
- Increases the supply of affordable housing
- Provides economic benefits for surrounding landowners, companies, and stores
- Alleviates congestion and improves the environment
- Improves the safety of pedestrians and cyclists by strengthening non-motorized infrastructure



Source: TRB Transit Cooperative Research Program (TCRP) Report¹²

[Fig. 1] The purpose of TOD according to the public transit agencies in the U.S. (2004)

In addition, there've been calls for investment in urban public transit infrastructure and adjoining TOD based on the prediction of a higher proportion of the future population being traditional public transit users, such as older, unmarried, and non-white citizens.¹³

In contrast to the U.S., European urban development projects are rarely called TOD (a term which originated in the U.S.) as many of their cities were historically formed around transportation systems. However, the concept of

TOD has been practiced in Europe for some time, including the latter half of the 19th century when cities were formed around railways and immediately after World War II.¹⁴ In recent years, TOD has been supported and recognized in Europe particularly as a means of forming sustainable and environmentally friendly cities. In contrast to the United States, the tendency of TOD in Europe is not limited to developing around a single station, but instead incorporates a comprehensive plan at the regional level, forming a wide area network consisting of multiple stations and connecting points (transportation nodes). Holland's Rotterdam- The Hague is an example.¹⁵ This style of TOD is possible because urban environments in Europe tend to be denser than in North America in the first place.

3. Case Study: Responses to Emerging Technologies and Services Developed and Introduced for Implementing futuristic TOD-MaaS

As mentioned earlier, TOD is a more sustainable development method created in response to the advent of the automobile society and the reflections gained from various social problems caused by it, mainly in urban development from the postwar period to the present in the West, and especially in North America. As a result, it can be said that it has attracted renewed attention in recent years. This paper will now delve into TOD, which has been analyzed and considered in various ways, from the perspective of its relationship with MaaS, which is aimed to be implemented as a form of travel in urban areas in the future. In particular, it will consider how existing or planned/currently under construction TODs can incorporate emerging technologies and services required for implementing MaaS (which is still being developed and introduced), and thus lead to an increased value of the development area.

From the perspective of connecting TOD and MaaS, multiple transportation modes from the TOD area as the start and end points are prepared, and it's considered a functioning traffic hub when passengers can smoothly

transfer between these modes. With TODs equipped with these functions in advance, when MaaS is realized in the future, residents and commuters around the TOD can freely combine and transfer between different modes of transportation. According to a study by the American Public Transportation Association (APTA), it's been pointed out that, "A digital multi-modal mobility platform will be facilitated by a robust and well-integrated physical mobility system."¹⁶ It can also be expected that these TODs can promote transfers between different modes when people travel within an urban area using MaaS. If multiple TODs within a city already function as transportation hubs when MaaS becomes implemented, it's thought that existing transportation modes will then complement each other in improving mobility within the city.

The next reports will describe the current situation of three example cities that are promoting efforts to achieve sustainability in their city and their transportation— Stockholm in Sweden, Washington DC in the U.S., and Paris in France— and implications that can be gleaned from them.

	Sweden • Stockholm	USA • Washington, D.C.	France • Paris
Availability of MaaS in TOD areas	Implemented in 2019	Implementing gradually as supporting technologies and services emerge in TOD	Although progress has been made on the digital side, physical support for existing infrastructure is still in the experimental stage
Leading Organization	A top-down case with the cooperation of international organizations and countries.	A case where cooperation between public transportation in the city center and local governments is essential. Development is led by the private sector (and then examined and approved by the local government based on the city plan).	Both MaaS and TOD are led by public transportation agencies.
Characteristics	<ul style="list-style-type: none"> • -The birthplace of "UbiGo" (a subscription-type MaaS service), which has demonstrated support from the Swedish government and the EU. • In Stockholm, implementation began in April 2019 in multiple special areas including TOD cases. • The existence of MaaS is also reflected in regulations related to land use and city planning. For example, easing the requirements of a certain number of parking lots given the condition that MaaS is provided. 	<ul style="list-style-type: none"> • MaaS is implemented by local governments and public transportation agencies in the city center, guiding other local governments and transportation agencies in the suburbs. • TOD has a long history, and there are a mix of excellent cases, such as the past case of Arlington County and the most recent case of the Central Union Station where advanced redevelopment plans are under consideration. Here too, local governments, transportation agencies, and private developers collaborate. 	<ul style="list-style-type: none"> • For MaaS, France has a track record of leading the world in things like bike sharing. • In particular, public transportation agencies are taking the lead in developing and implementing MaaS applications now that the digitization of IC cards has been completed. • TOD works with local governments to develop land owned by public transportation agencies. • They are conducting pilot programs that also lead to MaaS in areas on the left bank of the Seine that are being redeveloped.
Population ^{Note2}	1.633 million, 1.76%	5.322 million, 1.36%	11.017 million, 0.52%
Examples of Advanced TOD	Hammarby Sjöstad District	Arlington County Metro Line (Rosslyn-Ballston)	Redevelopment of the left bank of the Seine (Rive Gauche)

[Fig. 2] Characteristics of each city in the case study

Note1) Abbreviation of Transit Oriented Development

Note2) Estimated for 2020, annual growth rate 2015-2020

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