

Planning Analysis of New Transit System Project in Local Cities to Realize Transit-Oriented Development

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This paper is about the study on the planning of constructing High Speed Surface Transportation (HSST) in Kusatsu and Otsu, Shiga prefecture. These two cities face many problems, especially in transportation system because of the rapid growth in recent years. National level roads, expressway and railways pass the areas; however, the inner transportation situation can not satisfy the demand of local residents. HSST is considered as one of the alternatives to solve the problems and improve the existing transportation system. This study analyzes the travel characteristics of local residents, especially the activities based on major JR (Japanese Railway) stations like Kusatsu Station. And social psychology method is applied to conclude the utility function of new transit. The connection of HSST with JR is also focused to make the joint development go smoothly. Furthermore, transportation has close relationship with land use and local development. Related facilities are included in the planning to encourage the use of transit. The integrated effect and future vision of transit-oriented development is expected to be outlined as the conclusion.

Keywords: transportation system, transit-oriented development, HSST

1. Background

Rapid growth in the urbanized areas of Kusatsu and Otsu presents many challenges for local and regional policy makers. The capacity of transportation systems is not being expanded commensurate with growth in travel demand, and traffic congestion has reduced the capability of transportation systems to provide access and mobility.

Transit-oriented development (TOD) is defined in a recent study by the California Department of Transportation as “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.” It is “designed for pedestrians without excluding the auto” and can be achieved through either “new construction or redevelopment of one or more buildings whose design and orientation facilitate transit use”. While there is no “single, all-encompassing definition that represents the TOD concept in its many forms” (Cervero, Ferrell and Murphy, 2002), most definitions do

share common traits. The most notable of these traits are close proximity to a transit station, a mix of land uses, and conduciveness to transit riding, most often in the form of pedestrian and bicycle-friendly environs and nearby public spaces for riders.

As the popularity of transit-oriented development has increased over the past decade, so too have the number of studies examining factors that contribute to the success or failure of TOD projects, in terms of their ability to capitalize on the transit services available and increase rail transit usage.

2. Introduction of the HSST Project

The study is centered with the High Speed Surface Transportation (HSST) construction plan in Shiga prefecture. HSST has been developed as a new transit type for either inter-city or intra-urban transportation. One line has been constructed and put into use in Aichi World Exhibition, named as Linimo. HSST provides fast and quiet

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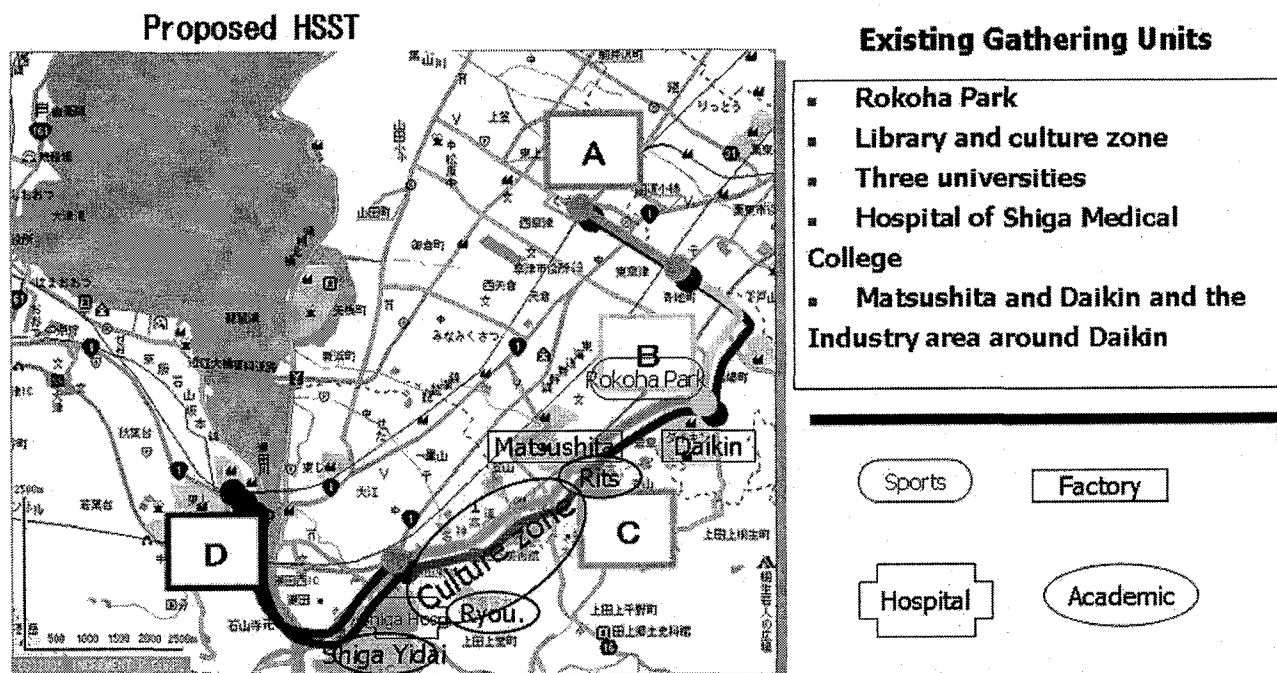


Fig.1 Proposed HSST Line in Kusatsu City

transportation service, which is good to the environment. And the maintenance and operation cost is lower compared to other traditional transits.

Kusatsu City and Otsu City are located in Shiga Prefecture, with a total population of about 460 thousand, yearly visitors over 1.5 million. The subject area lies in the middle part of the two cities, with three universities: Ryokoku University, Shiga Prefecture Medical University, and Ritsumeikan University. The planned HSST line will connect these three universities and the residential area to be ended with JR Kusatsu and Ishiyama Station (shown in Fig.1), totally about 11 kilometers, and it is to be extended in the future. The target is to provide convenient, comfortable transportation with high service level to citizens and to promote the new transportation style.

This blooming city has an increasing population and supplies labors for Kyoto-Osaka-Kobe metropolitan. Provided with nice nature around Lake Biwa, more immigration is expected to be settled in this area. New transit is considered to be able to activate those nature resort spots. It will also satisfy the strong demand of inner mobility for the universities, hospitals, and factories and so on. Recently, more and more new shops have been opened in this area, which can be an evidence of commercial potentiality. All these facilities are located quite sparsely. Since bus network is not enough, and there is high volume of car use, causing congestions often. About 53.6% transportation are realized by car, only 27.1% taking

railway or bus. Over 32.7% people did not think the bus network worked well. There is a strong desire for the development of new public transit system.

Not only the new transit, but also the related facilities are discussed in this study. Since the new transit is expected to connect those spots like universities, factories, hospitals and those residential zones. The urban activities will be encouraged most probably. And the attractive or desired facilities also help to encourage the use of new transit system.

3. Planning System and Process for Transportation and Related facilities

People realize different social activities, which can be analyzed from behavioral and psychological viewpoints, based on transportation system and land use as shown in Fig.2. In this case, the connection of new transit with JR and the joint development with bus network is to be considered for the impact of new transit to the existing transportation system. And the redevelopment or construction along the lines, especially around the stations will be regarded as the transit-oriented development. Improvement of transportation facilities and development of urban facilities has close relationship with the activation of social and economical activities. It is necessary to implement various system analyses about the mechanism of

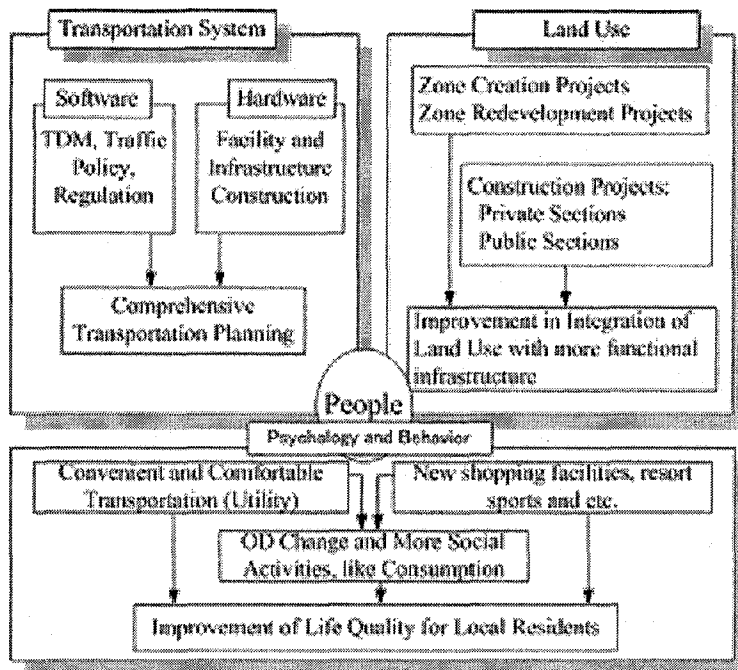


Fig.2 System Structure

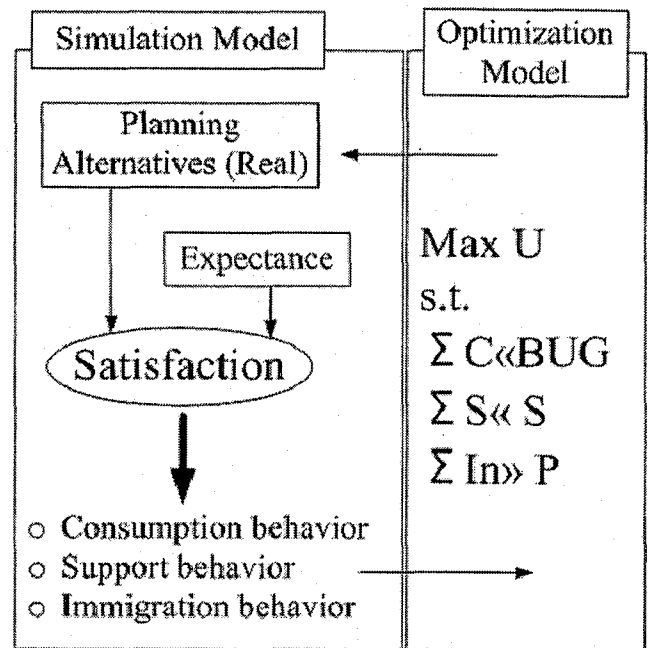


Fig.3 Hybrid Planning Model

traffic behaviors in actual urban activities aiming to establish an effective project planning system.

In this study, we have done the survey based on social psychological theory to find out the factors that influence satisfaction in using transit. The utility function for residents will be defined based on the information. Continuously, it is assume that when people get satisfied, they will take consumption behavior, support behavior (investment), and immigration behavior. And these behaviors will contribute a lot to the urban development and constructions of such facilities. So, we define maximizing the utility of people as the objective function in optimization model. Furthermore, there will be many constraints to ensure the feasibility of the construction from physical conditions including area, financial conditions including total budget and so on. For such a huge project, cost control is emphasized. The whole project is planned to be divided into three or more stages.

In the past study, the effective and practical hybrid model analysis method for planning and designing traffic facility was developed by Yamada, K. & Haruna, M. (2000) to release the traffic congestion caused by visitors to large scale shopping center in the district around the shopping center. The effect of each planning alternatives in each stage will be simulated and they will be feedback to the optimization model to tell us how to modify the plan. The

simulation model and optimization model can be incorporated into such a hybrid and cycle mechanism. We defined it the hybrid modeling system or hybrid planning system, as shown in Fig.4. The methodology is supposed to be useful in the study too. The dynamic hybrid planning will try to cover the maximization of utility function and financing management to ensure the possibility of the whole project. The financial evaluation will be treated not only to the HSST project, but also from the wider viewpoint for local development.

Therefore, it is discussed in this research the comprehensive transportation system construction planning of introducing HSST as the public transportation facilities and the management in operation design to ensure the realization. A series of topics (shown in Fig.4) will be considered as the following: the construction system of alignment and stations HSST, the redevelopment of squares in front of JR stations, the stops for shuffle buses at JR and HSST main stations, the construction of parking for bicycles and motorbikes, the construction of fringe public parking lots for park-and-ride and the construction of pedestrian access for aged, disable and children. And, the land use along HSST alignment and stations and the construction project design of the urban facilities and environmental facilities will be studied by verification case together with the operation methodology for realization.

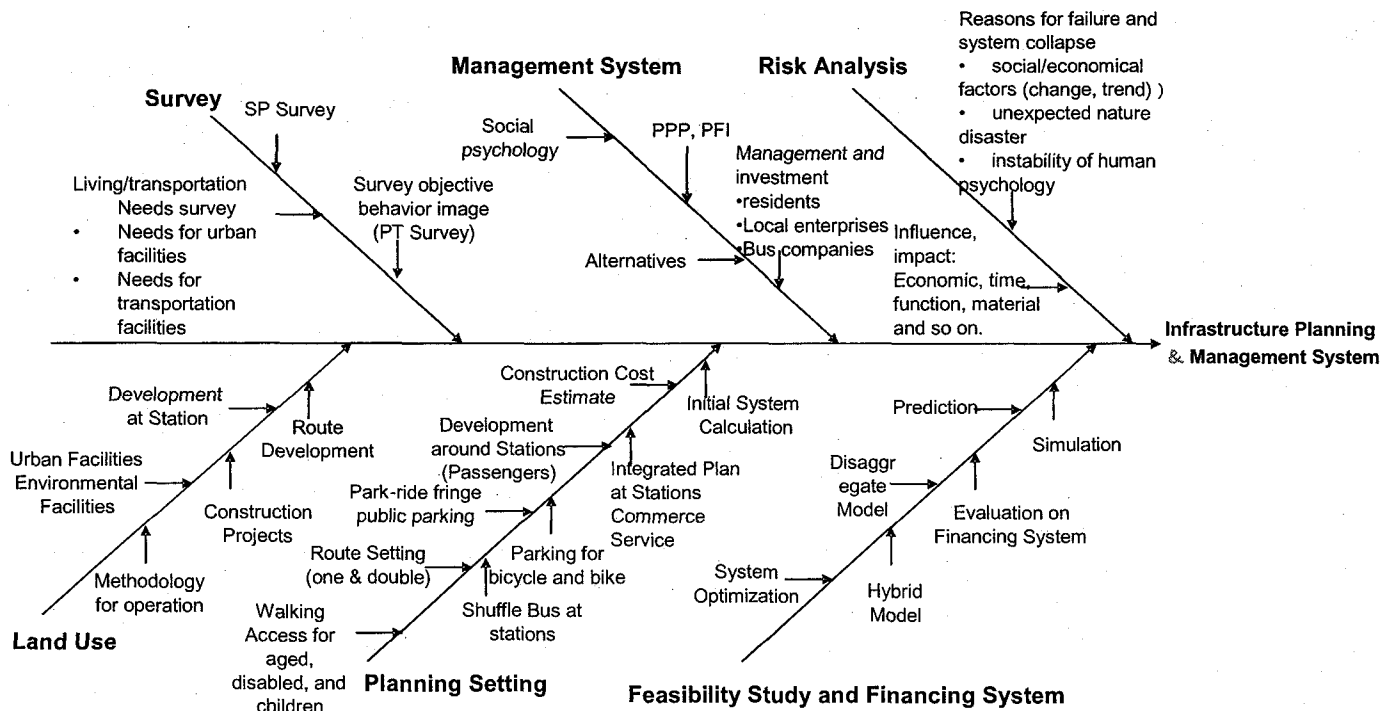


Fig.4 Tree of Infrastructure Planning and Management System

4. Conclusion

The research is expected to explore the methodology about transportation infrastructure planning for local cities and on multiple projects management systems for effective operation to realize the transit-oriented development in local area.

Reference

- 1) Arrington, G.B. (2000) Reinventing the American Dream of a Livable Community: Light Rail and Smart Growth in Portland. Paper presented at the 8th Joint Conference on Light Rail Transit Investment for the Future, Transportation Research Board: Washington, D.C.
- 2) Bernick, M. and R. Cervero. (1997) Transit Villageds for the 21st Century. New York: McGraw-Hill
- 3) Boarnet, M. and R. Crane. (1998) Public Finance and Transit-Oriented Planning: New Evidence from Southern California. Journal of Planning Education and Research, 17(3): p.206-219
- 4) Cervero, R. (1993) Ridership Impacts of Transit-focused Development in California. Monograph 45, Institute of Urban and Regional Development, University of California: Berkeley, CA.
- 5) Cervero, R. (1994) Transit-Based Housing in California: Evidence on Ridership Impacts. Transport Policy, 3: p.174-183
- 6) Cervero, R. and J. Landis 1997. Twenty Years of the Bay Area Rapid Transit System: Land Use and Development Impacts. Transportation Research A, 31(4): p309-333
- 7) Cervero, R., C. Ferrell and S. Murphy. (2002) Transit-Oriented Development and Joint Development in the United States: A Literature Review. TCRP research Results Digest Number 52, National Research Council: Washington, D.C.
- 8) Kitamura, R., P. Mokhtarian, and L. Laidet. (1997) A Micro-Analysis of Land Use and Travel in Five Neighborhoods in the San Francisco Bay Area. Transportation 24: p. 125-158
- 9) M,Haruna. M,Takebayashi. K,Yamada. H,Nakagawa. (2000) A Study on Systems Approach to Transportation Management Problem for Desirable Urban Development Applying Hybrid Planning Model Analysis. *Proceedings of Infrastructure Planning JSCE*, p.305-308
- 10) Stringham, M. (1982) Travel Behavior Associated with Land Uses Adjacent to Rapid Transit Sections. ITE Journal, 52(1): p. 18-22