Section Ⅳ **Study on Hybrid Planning System for New Transit Construction Project at Suburban Area of the Local Core Cities**

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1. Introduction

The study is centered with the High Speed Surface Transportation (HSST) construction plan as one of the alternatives. HSST has been developed as a new transit type for either inter-city or intra-urban transportation. The proposed HSST line will cross the three universities and the residential areas to be ended with JR Kusatsu and Ishiyama Station, totally about 15.6 kilometers, and it is to be extended in the future. This article is the study on the first period of HSST, which is 6.5 kilometers long.

2. Ridership Prediction Model based on MNL

In order to make the ridership prediction, the person trip survey and related preference survey were made to larger scale including employees, students, householders and so on. 334 samples of 1000 distributed were collected. From the analysis, it is concluded that the distance to HSST station has strong influence to their intention. So in the preference questionnaire, the access and egress distances to the proposed HSST stations were surveyed; besides, we also proposed a shuttle bus system of community level to connect the HSST station and each part of residential area. In the MNL model, some conventional variables like cost and travel time were included, and variables related to distance and the bus systems were considered.

In this study, HSST will serve as a kind of the mid-distance transportation, the MNL model was made with three traffic mode of mid-distance level: bus, personal car and HSST. The MNL model is listed as the following.

$$P_m = \frac{\exp(V_m)}{\sum_{m=1}^{3}\exp(V_m)}$$ m=1: personal car; m=2, bus; m=3, HSST

$$V_{1n} = \beta_1 Z_{1n1} + \beta_2 Z_{1n2} + \beta_5 Z_{1n5} + \beta_6 Z_{1n6} + \beta_9$$

$$V_{2n} = \beta_4 Z_{2n4} + \beta_5 Z_{1n5} + \beta_6 Z_{1n6} + \beta_{10}$$

$$V_{3n} = \beta_3 Z_{3n3} + \beta_5 Z_{1n5} + \beta_6 Z_{1n6} + \beta_7 Z_{1n7} + \beta_8$$

Table 1: The Parameters for the MNL Model

Variables		Commute to work		Commute to School		Others	
		Parameter	T Value	Parameter	T Value	Parameter	T Value
Sex (1=male,0=femail)	β1	1.31240	3.67333				
Age	β2	-0.03510	-0.14407				
Distance to HSST stations (m)	β3	-0.00055	-0.83521	-0.00051	-1.44497	-0.00089	-1.27030
Distance to Bus stations (m)	β4	-0.00014	-2.25908	-0.00024	-0.51135	-0.00217	-1.50040
Traffic time (minute)	β5	-0.09530	-0.84788	-0.04050	-2.84129	-0.01643	-0.92305
Traffic cost (yen)	β6	-0.00560	-0.41672	-0.00526	-2.46148	-0.00210	-1.05510
Frequence in rush time (round/hour)	β7	0.12830	0.74975	0.22450	1.91247	0.02150	3.24160
Shuttle bus (1=yes, 0=no)	β8	3.53020	2.27488	0.70870	2.51780	1.62630	1.20480
Dummy of private car (1=yes, 0=no)	β9	1.24530	1.40768	-1.60310	-4.58630	1.65830	0.08547
Dummy of bus (1=yes, 0=no)	β10	1.00120	3.95320	1.31030	3.23310	0.81210	1.21530
Hitting ratio		77.3%		70.1%		65.5%	

Here, P_m is the choice probability of using transportation m; Z_{mni} is the i th variable of individual from zone n when using m; V_{mn} is the utility for individual from zone n when using m; βis the parameter for each variable; and the values are shown in Table 1.

In this study, only the first period project is dealt with. The related area is divided into five zones centering with the five stations. The OD data have been collected based on the zoning. The share and the amount of ridership by HSST have been calculated with the initial setting of ticket price and station positions and so on. In the following section, we will use the prediction model to provide useful information to the hybrid planning system.

3. Hybrid Planning System

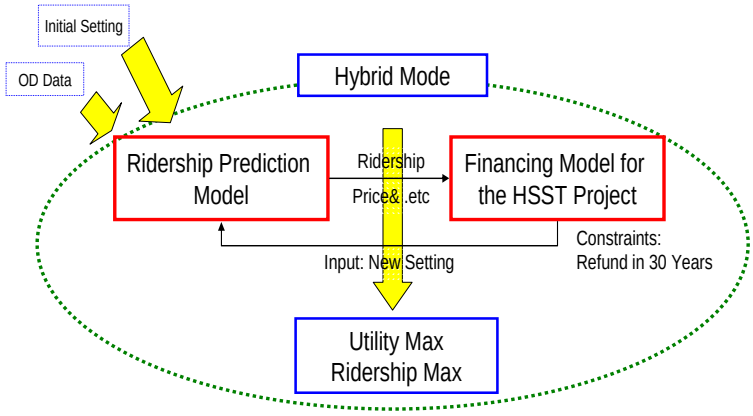

Fig.1: The Hybrid Planning System

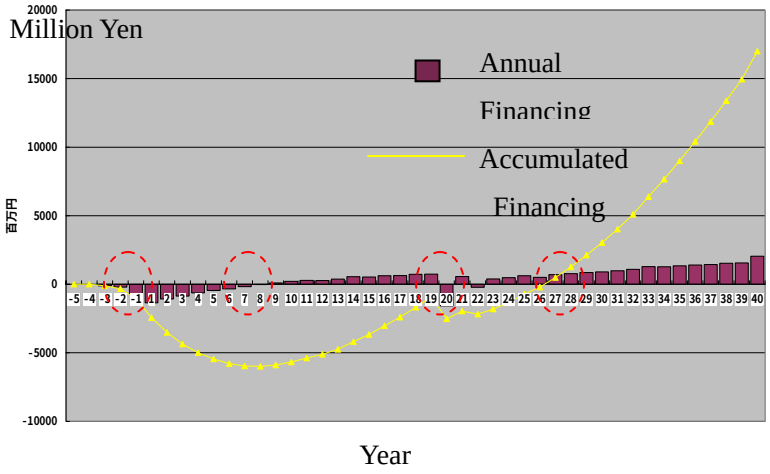

Fig.2: Financing Simulation with the Optimal Solution

The HSST project has been doubted about the huge investment and its refund. So financing problem is the one of the key-points and difficulties to realize this project. In this study, the financing simulation model was made based on the practical reference from the HSST construction company and it contains the cost of construction, the proportion of each investment source and its interest, the cost of operation and maintenance, the income from tickets and so on.

In the past study, the effective and practical hybrid model analysis method for planning and designing traffic facility was developed by Yamada, K. and Haruna, M. to release the traffic congestion caused by visitors to large scale shopping center in the district around the shopping center. In this study, the hybrid system combines the ridership prediction model and the financing model as shown in Fig.1.

The maximum of HSST utility and ridership can be obtained by information cycling between two models. We show the application of the price setting as the planning variables here. The amount of ridership changes according to the price. The information of ridership and price is inputted into the financing model to ensure the refundment in 30 years.

4. Conclusion

Fig.2 shows the financing simulation with the optimal solution concluded from the hybrid system. The average ridership of the first year is 29,673persons/day and the average ticket price is 211.84yen/person. The figure shows that in the 7th year, the annual financing will turn into the black, and the accumulation financing will get rid of the red in the 27th year, considering once large maintenance in the 20th year. By this analysis, we can ensure the financing feasibility to some extent. In the forward study, more factors such as the station facility can be treated through the hybrid system to find the optimal planning effectively and efficiently.