

Study on Step-in Hybrid Planning System for Suburban Area Development and New Transit (HSST) Construction Introducing Behavior Simulation Considering Psychological Aspect

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To improve life environment in developing suburban area, new transit as public transportation is desirable. This paper is about the study on the plan of constructing High Speed Surface Transportation (HSST) in Shiga prefecture. As a new transit tool, HSST has been constructed and put into use in Aichi World Exhibition. Original plan will be evaluated in the step-in hybrid planning system, which includes the behavior simulation model. The cycling calculation will end with an optimal plan for the period. Considering possible promotion as time goes on, related projects, which produce correlation with the HSST plan, such as the NPO project of reconstruction on old Kusatsu River, will be added in evaluation as a step-in tactics in long period. In this study, behavior simulation is considered from psychological aspect based on theory of planned behavior, to see how people will change travel behavior after construction of HSST. To realize the model, questionnaires will be performed to collect the data for measuring attitude, subjective norm and perceived behavior control. The target of this study is to provide convenient, comfortable transportation service with high service level to citizens and to promote the new transportation style of HSST.

Keywords: Hybrid Planning, behavior simulation, psychology

1. Introduction of Research Background

(1) New Transit – HSST

HSST is the abbreviation of High Speed Surface Transportation. 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, which is the first commercial application in Japan. HSST provides fast and quiet transportation service, and it is good to the environment. And its maintenance and operation cost is lower compared to other traditional transits.

(2) Objective Location – Kusatsu City

Kusatsu City is located in Shiga Prefecture, with a population of about 130 thousand. It is one of the few potential cities with increasing population. There are three

main universities included: Ryokoku University, Shiga Prefecture Medical University, and Ritsumeikan University.

(3) Brief Introduction of This Plan

The HSST line under consideration will connect these three universities and the residential area to end with JR Kusatsu and Ishiyama Station, 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 accelerate the suburban area development.

(4) Current Transportation Situation

In weekday, there are about 46000 passengers in Ishiyama JR Station, 53800 passengers in Kusatsu JR Station. And in the middle of them, about 36000

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passengers arrive and leave from Minami JR Station, among which about 10000 students of Ritsumeikan University Students are counted. While in Seta JR Station, there are about 32000 passengers per day. Besides JR, bus network is the only public transportation covering this area. It can not satisfy the increasing travel demands and serve residents' life well. There is a strong desire to introducing other public transportation in Kusatsu City.

2. Scenario

The image map of HSST line is shown in Fig. 1. It goes through four main parts: A commercial zone, B Industry and social welfare zone, C academic and culture zone, and D scenic zone. People use private car, motorbike, bicycle and bus mostly for daily life: commuting to work, to school, shopping, leisure and hospital or other social welfare facilities now. After construction, what will the residents think about using HSST, and how many people will give up their old travel habits and use HSST for those social behaviors? What kind of change will HSST cause to daily life? And considering the NPO project of reuse old Kusatsu River, what kind of facilities should be designed? How much will the cooperative development do good to residents? The vision of Kusatsu City will be greatly influence, these projects shall be planned to contribute as

much as possible to the development of the area.

3. Planning Theory

In conventional research about transportation plan, data like OD, road network, land use and other zone attributes and so on were well collected. Recently, more and more researchers realized that this kind of study based on transportation itself was far from enough.

Though transportation plan is centered on transportation policies or infrastructure, transportation should be considered a tool for people to realize some activities. So it is so called that travel demand is a derived demand. There comes the necessity to find out what motivate people to travel. This will leads to the psychological analysis.

Many researches have been carried out to study the relationship of the behavior and psychology. In fact, most travel behaviors are planned to realize some social activities. In this study, acceptance and implementation of the new transit module will be evaluated using the Theory of Planned Behavior (TPB) (Ajzen & Fishbein, 1980) as a theoretical framework. TPB has been proved to be able to describe the psychological process to reach an intention, which is predicted to directly influence conduct of the behavior. The simulation frame has been shown in Fig. 2.

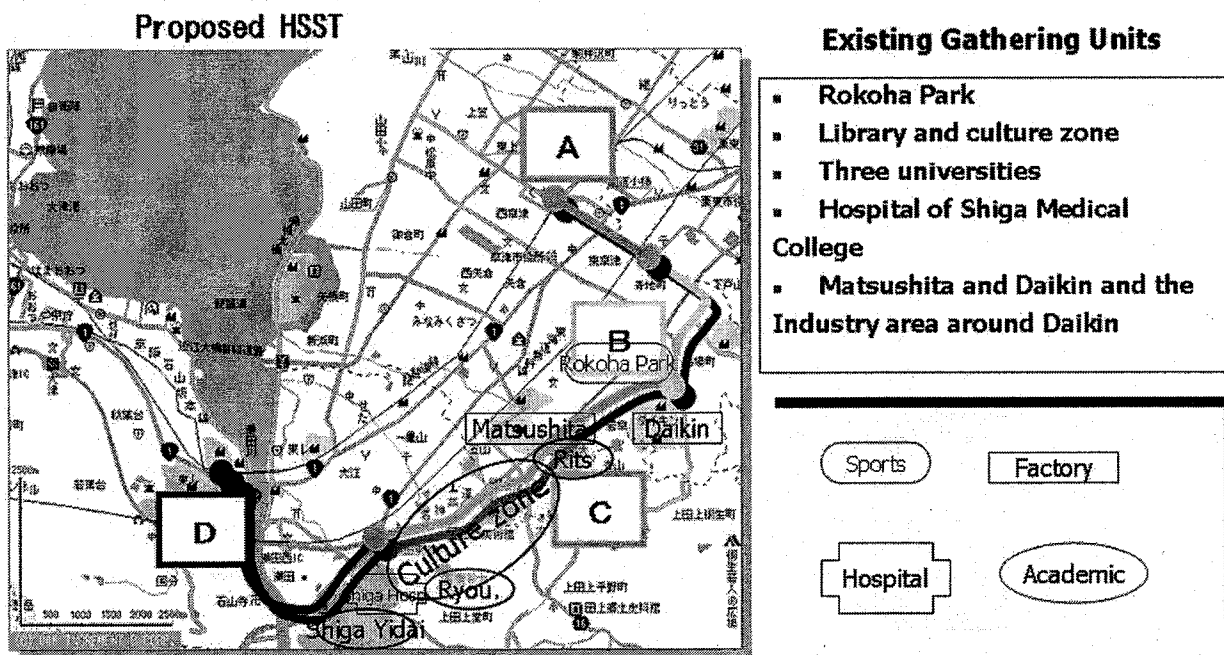


Fig.1 Proposed HSST Line and Stations

Attitudes are a function of beliefs about the behavioral outcome and an evaluation of how those outcomes are desirable. Normative influences are what an individual believes others think they should do (normative beliefs) and how many individuals feel influenced by these social referents (motivation to comply). Perceived behavior control is perceived ease or difficulty in performing a behavior. Therefore, the model does not include any background variables, such as age, marital status, or education. These demographic variables are posited to indirectly influence behavioral intention and behavior through their interactions on the three elements mentioned above. Questionnaire survey will be performed by two steps: pilot survey to get belief items and wide survey for measuring data of each item. Brief-based measure of each element is obtained by applying the expectancy-value formula to the measuring data.

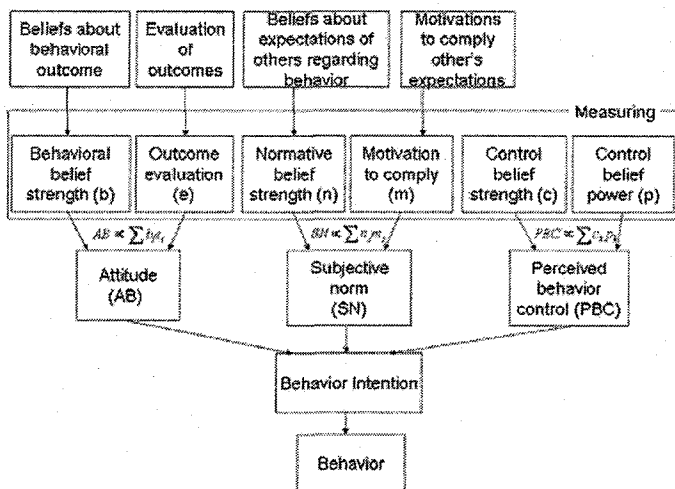


Fig. 2 Frame of Psychological Analysis

The construction of behavior simulation model will contribute as an important part to the step-in hybrid planning system (shown in Fig. 3). The optimal searching starts from the input of current situation and original plan. Change the plan like the scale of stations will produce change in behavior simulation system. If the change is in positive direction, modification of plan will be continued, until convergence appears, which means the period optimal plan is got. Regarding the longer time change and the desire for more service contents, related projects, which produce correlation with the HSST plan, such as the NPO project of reconstruction on old Kusatsu River, will be added in evaluation as a step-in tactics in long period. This method

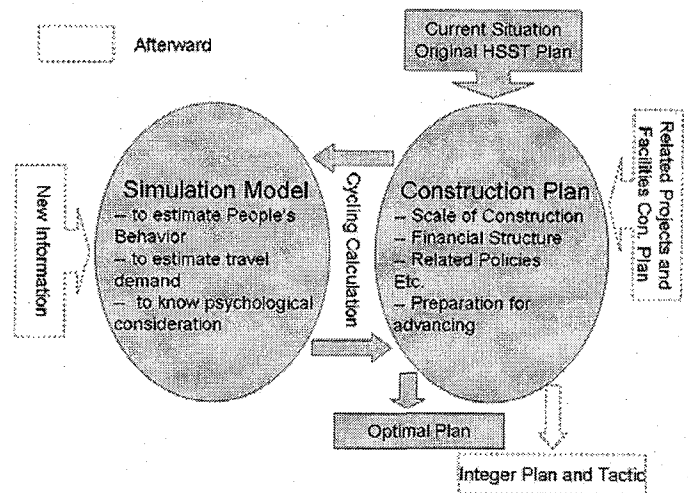


Fig. 3 Step-in Hybrid Planning System

has been proved to be rational in planning for construction.

4. Pilot Survey

Since the new transit is just under consideration, we carried out pilot survey from June 27 to July 10. The questionnaires and interviews were made to 109 Ritsumeikan students (average age 20.7), 73 Sakuraoga residents (average age 55.6) and 34 residents (average age 56.9) living along old Kusatsu River.

We provided supposed route, stations, and pictures of HSST in Nagoya and ticket fee for them to get as much perception as possible. Their daily life transportation situations were collected including by what, for what and how often and so on. And their attitude to the new transit HSST was asked to see who would probably change to use HSST in the future. Besides these, their desire for new facilities along the transit was considered.

5. Analysis and Conclusion

Since the new kind of HSST plan was just started, we only have the pilot data about some basic information of residents and students. However, these analysis were quite good preparation for further survey and study.

For students, we divided them into two categories: living inside Kusatsu and outside Kusatsu. Fig. 4 shows the change of students in transportation supposing HSST being constructed. Students living within Kusatsu would reduce use of other ways to commute to campus; while students living outside Kusatsu change reversely, which implied the

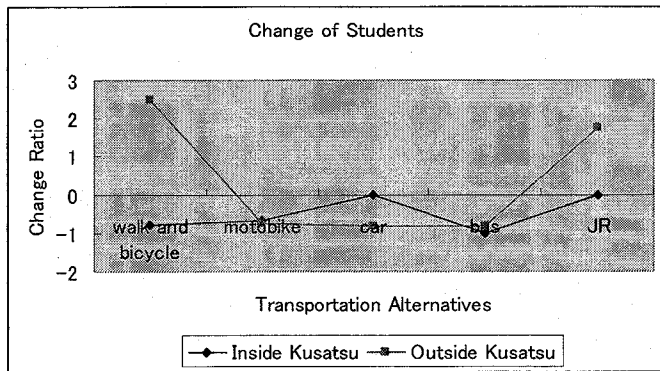


Fig. 4 The Change of Students on Transportation Choice

change from directly to campus by private ways to using public transits at near public stations. The use of increased as HSST introduced, which meant that the set use of JR and HSST would be competitive for students outside. The use of bus would be reduced for both groups most probably the current service level of bus was not so good. From students' statement, the price of transportation alternatives and the setting of stations or stops were highly considered. It could be said that the proposed ticket fee of HSST was quite reasonable and attractive. Besides those two factors, the new type transportation, the easy transfer from JR stations would induce this use of HSST.

For residents, four main activities were concerned: commute to work, daily shopping, leisure, commute to hospital or other social welfare facilities. The two resident areas are all in 500m scale from the proposed HSST line. From the survey, we found now, about 50% residents commuted to work by private car, which was one reason for increasing congestion in this area. About 72% households chose private car to do daily shopping. The ways to do leisure were fairly various in the data, probably because the contents of leisure were so different. For commuting to hospitals, in this case especially to the Hospital of Shiga Medial College, most people went by bus, where the bus stop is just at the main gate.

Considering the use of HSST, the residents who were using private car did not show great interest to change their habits. We think the information from questionnaire was not enough to convince them with better perception than car. And the current public transportation service, main bus, impressed them with inconvenient perceptions from the

interviews. But HSST did seem to be somehow attractive to those for leisure and commuting to hospitals.

We designed ten facilities for students to give scores, by which we grasped their desire for improving the quality of life. These ten items and their scores were listed as the following:

Facilities	Scores
Cafeteria	287
Shopping malls	227
Restaurant	214
Fast-food shops	207
Book and CD shops	132
Parking lots	113
Interior shops	109
Libraries	95
Sports center	62
Supermarket for daily shopping	32

The high needs of cafeteria, restaurants and fast-food shops were the reflection that the students wanted to make good use of the saved time by using HSST. And more desire of using HSST would be induced by setting these facilities near stations. While the hope for shopping was just correspondent to the dissatisfaction from interview about non-daily shopping, such as clothes and other amusement facilities. Since the population of the whole area is increasing, the consideration of shopping mall near stations would be counted in the near future.

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