

## A MEASUREMENT OF ADDITIONAL EFFECTS OF A NARITA AIRPORT ACCESS TRAIN

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**Abstract:** The cost benefit analysis on railway projects in Japan mainly deal with the benefit of user and supplier. It is based upon the principle that the construction cost should be withdrawn from fare income, which means beneficiaries should pay for the project. It'll be able to consider that not only direct railway users but also inhabitants around the railway line who might be potential users are benefited by the existence of the railway. If those inhabitants would recognize the existence of the railway in their mind, is it accountable for them to bear the construction cost partly? In this study, the new airport access express train to TOKYO NARITA (NRT) international airport is taken up as a case study. This study conducts the Customer Satisfaction (CS) survey as well as Stated Preference (SP) survey to those inhabitants, and develops a measuring model for effects of the existence of this train.

**Key Words:** Measurement of Additional Effects, Airport Access Express Train

### 1. INTRODUCTION

Japan has three international airports, NRT, OSAKA KANSAI and NAGOYA CHUBU. Even so NRT airport is the still most important among the above three airports because it covers whole of the Tokyo Metropolitan Area (TMA). However, it takes approximately 80 minutes by car and approximately 60 minutes by express train from the center of the TMA (fig 1). It should be said that the access condition of NRT is worse than the other international hub airports in Eastern Asia (fig 2). The Japanese government plans a new access railway project that will start to operation in 2010. The New Access line is extended from the existing line called as the New Town line that has been operated to the Chiba New Town. It is expected to take approximately 36 minutes between the center of TMA and NRT by express train.

The New Access line, which is a radius line, crosses over a peripheral line at a certain station where passengers can transfer with each other. This peripheral line is connected with existing railway network, areas with low accessibility to NRT shall change to be rather high. Even more if an express train would run directly on both of radius and peripheral lines with

free-gage train without any transfer, much more convenience would be brought. It is, however, estimated to cost 35billion yen additionally for construction of the facility for the direct connection. Therefore, the measurement of this kind of effect must be carefully implemented.

The cost benefit analysis on railway project in Japan does not deal with difficult measurement such effect as existence of railway itself, but does mainly with the benefit of user and supplier. It is based upon the principle that the railway construction cost should be withdrawn from fare income, which means beneficiaries should pay for the project. It will be able to consider that not only direct railway users but also inhabitants around the railway line who might be potential users are benefited by the existence of the railway. If those inhabitants would recognize the existence of the railway in their mind, is it accountable for them to bear the railway construction cost partly?

This study supposes the NODA line, which has low accessibility to NRT areas around itself, rides into the New Access line and to be direct connection line to NRT. This study conducts the CS survey as well as SP survey to inhabitants around the NODA line, and develops a measuring model for effects of the existence of this kind of the airport access express train to NRT.

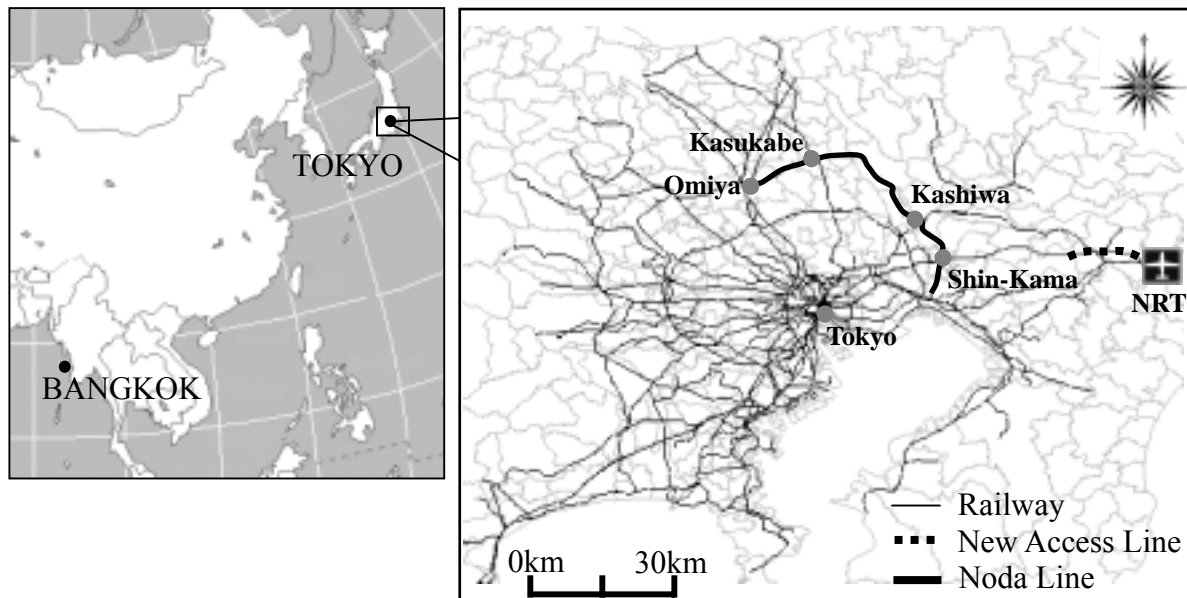


Figure 1 Tokyo Metropolitan Area

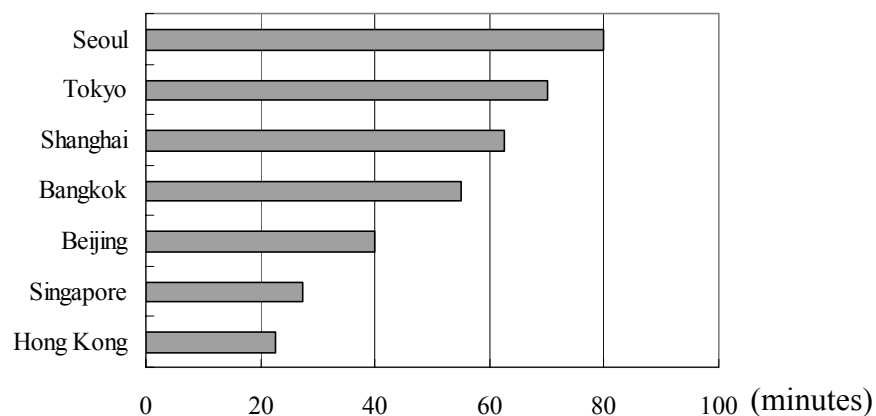


Figure 2 The Access Condition to the International Airport from Center City

## 2. OUTLINE OF THE SURVEY

This study conducts the CS survey as well as SP survey to inhabitants around the NODA line. The degree of satisfaction is cleared about the service of the NODA line by the CS survey. The most desirable project case is cleared by the SP survey. The survey carries out two times.

### 2.1 The First Survey

The first survey asks the degree of satisfaction for present service of the NODA line and chooses the most desirable project case.

The contents of the questions are follows;

Q1. How do you evaluate the total services of the NODA line?

- 1.Dissatisfactory
- 2.A little dissatisfactory
- 3.Fair
- 4.A little satisfactory
- 5.Satisfactory

Q2. How do you evaluate following items by classifying into 5 grades?

- (1) Purity of station
- (2) Comfortable in driving
- (3) Scenery along the NODA line
- (4) Atmosphere in the train
- (5) Frequency
- (6) Fare
- (7) Speed of the train

Q3. Which project cases do you desire realization?

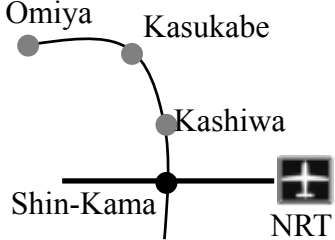
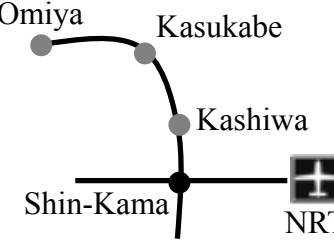
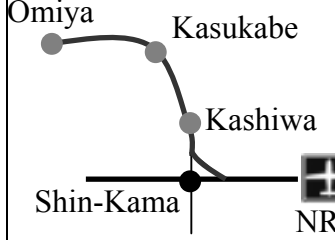
Case	1	2	3
Map			
LOS (Kashiwa To NRT)	No NODA Express Time : 60 minutes Fare : 1,160 yen Change: 1 time	NODA Express: 1time/hour Time : 45 minutes Fare : 1,660 yen Change: 1 time	NODA Express: 1time/hour Time : 35 minutes Fare : 1,430 yen Change: 0 time
Share	0 yen/year	300 yen/year	500 yen/year

Figure 3 The Project Cases

Q4. Agreement or objection about case3?

## 2.2 The Second Survey

The second survey shows again the project case in order to cancel the cognitive bias and asks the degree of satisfaction when an assumption project is realized.

The contents of the questions are follows;

Q. How does your degree of satisfaction for NODA line change if this project realizes?

- (1) To be dissatisfaction
- (2) To be a little dissatisfaction
- (3) To be fair
- (4) To be a little satisfaction
- (5) To be satisfaction
- (6) Not to change

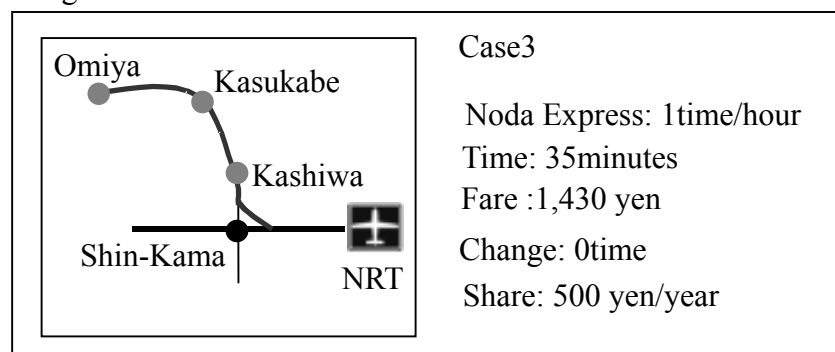


Figure 4 The Second Survey

## 3. THE RESULT OF THE SURVEY

**Summary of survey;** The survey is conducted in the areas around the NODA line. These areas are located the periphery around 30 kms far from the CBD. The distribution area is shown Figure 5 and summary of survey is shown Table 1.

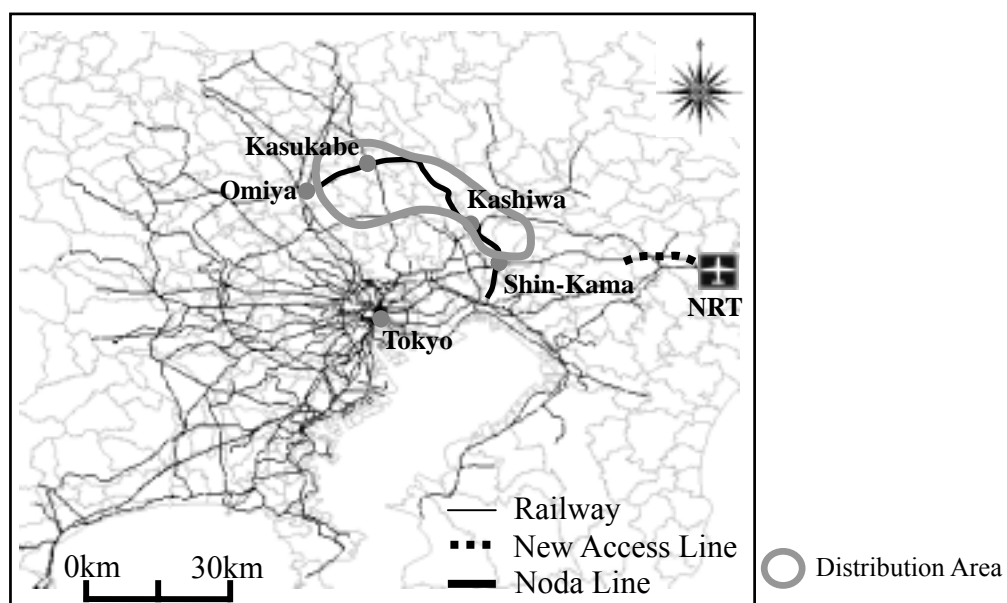


Figure 5 The Distribution Area

Table 1 Summary of Survey

Survey Period	(1) The first survey: the beginning of December 2003 (2) The second survey: the middle of December 2003
Survey Area	The area around the NODA line
Survey Method	a) Visiting and keeping method b) A mailing method
Distributed Questionnaires	(1) The first survey a) Visiting and keeping method : 364 b) A mailing method : 2,248  (2) The second survey a) Visiting and keeping method : 196
Responded Questionees	(1) The first survey a) Visiting and keeping method : 364(100%) b) A mailing method : 436(19.3%)  (2) The second survey a) Visiting and keeping method: 163(83.2%)
Fulfilled Questionnaires	(1) The first survey : 483  (2) The second survey : 163

**The degree of satisfaction about the NODA line;** It shows the result of scoring the degree of satisfaction about the services of the NODA line (dissatisfactory 1.0, a little dissatisfactory 2.0, fair 3.0, a little satisfactory 4.0, satisfactory 5.0). All item's scores are lower than 3.0. It means many users are not satisfied with the present services of the NODA line.

Table 2 Degree of Satisfaction about NODA Line

	single-track areas	double-track areas
Total	2.5	2.6
Purity of Station	2.5	3.0
Comfortable in driving	2.7	3.0
Scenery along the NODA line	3.3	3.1
Atmosphere in the train	2.7	2.8
Frequency	2.8	2.3
Fare	2.8	2.8
Speed of the train	2.7	2.7

**The most desirable project case;** It shows the most desirable project case each area. The single-track areas desire Case3 more than the double-track areas.

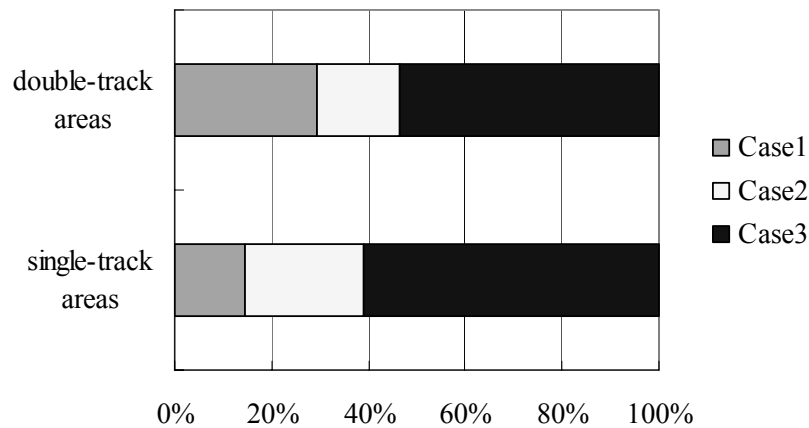


Figure 6 The Most Desirable Project Case

**The degree of agreement about case3;** It shows the degree of agreement about. 47% persons are agreement about case3.

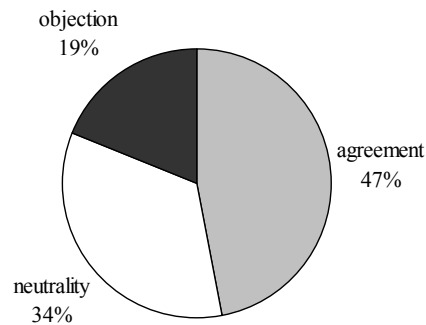


Figure 7 The Degree of Agreement about Case3

**Change of the degree of satisfaction;** It shows that the change of the degree of satisfaction when Case3 is realized. The present satisfaction is a lot of a little dissatisfaction. But if the Case3 is going on, a part of them slides to the satisfaction.

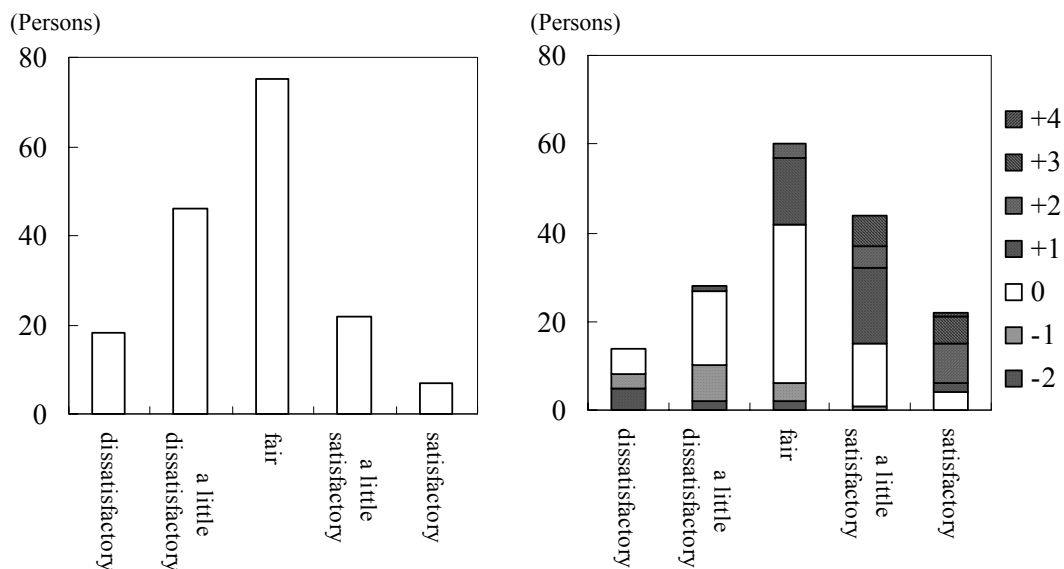


Figure 8 Change of the Degree of Satisfaction

## 4. DEVELOPING THE MODEL FOR MEASURING EXISTENCE EFFECT

### 4.1 Model scheme

The existence effect is to be calibrated as the summation of currency value which factors related non-users are converted to money. This study is applied the disaggregate model as the measuring existence effect model.

The model equations are formulated as below;

$$V_r = \sum_{i=1}^I \alpha_i x_{ri} + \sum_{j=1}^J \beta_j z_{rj} + \gamma c_r \quad (1)$$

$$P_r = \frac{\exp(V_r)}{\sum_{i=1}^3 \exp(V_i)} \quad (2)$$

where

$V_r$	:	deterministic component
$x_{ri}$	:	factor related users
$z_{rj}$	:	factor related non-users
$c_r$	:	share per year for the project case is realized
$\alpha_i, \beta_j, \gamma$	:	parameter
$P_r$	:	probability

### 4.2 Explanatory variables

The deterministic component is composed of a triple of types of variables related users, variables related non-users and share. Here, the usage frequency of NRT, the residence years, the area dummy, share per year for the project case is realized.

Table 3 Explanatory Variables

Variable		Explanation
User related	The usage frequency of NRT	The number of visiting NRT
Non-user related	The residence years around the NODA line	The number of year who living around the NODA lines
	The area dummy	1: the area is the single-track 0: the area is the double-track
Share	Share per year for the project case is realized	The share for the most desirable project case is realized

### 4.3 Parameter estimation

The total number of samples applied to the model is 483 those got the first survey. The estimated parameters of the model are listed in Table 4. Some parameters and the likelihood ratio are low. But it can read that people who live the area around the NODA line feel the existence effect of direct connection line to NRT.

The currency value of factors related non-users those are considered the existence effect are high. The dummy of the single-track is especially high. Figure 9 shows the relation the existence effect and the residence years around the NODA line. This figure shows that the existence effect is higher whether it lives in the single-track area or the double-track area.

The summation of existence effect for samples who selected case.3 is calculated 726 yen/year.

Table 4 Estimated Parameters

	Estimated Parameters ( ) : t-value			Currency value (yen/year)	
	Case.1	Case.2	Case.3	Case.2	Case.3
Share		-0.000379 (-0.851)		-	-
The usage frequency of NRT	0	- 0.285 (-1.45)	0.592 ( 4.08)	-751	1,563
The residence years around the NODA line	0	0.029 ( 0.24)	0.011 ( 1.43)	5	29
The area dummy	0	0.793 ( 2.89)	0.818 ( 3.07)	2,094	2,161
Likelihood ratio		0.119			
Number of samples		483			
The average of the existence effect				208	726

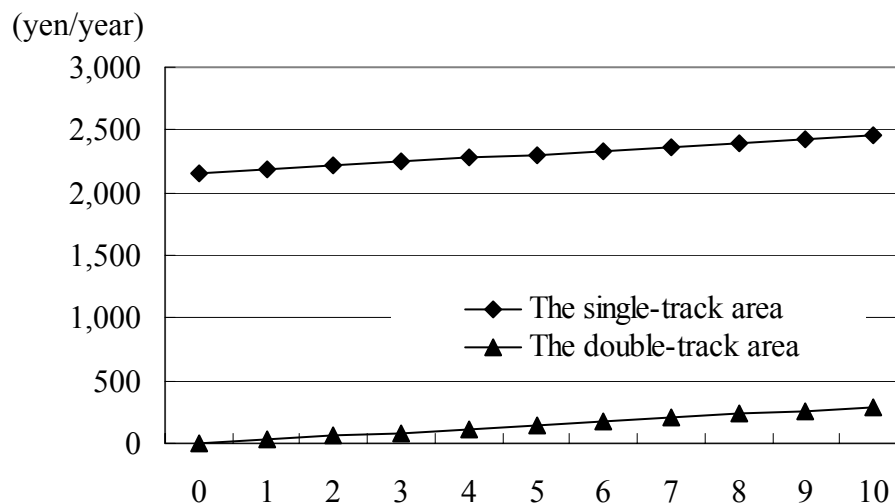


Figure 9 The Existence Effect

## 5. CONCLUSION

This study is carried out in order to measure the existence effect of direct connection railway line to the NRT. The NODA line is adopted as direct connection line.

The CS and the SP are carried out in order to know the degree of satisfaction about service of the NODA line and the most desirable project that the inhabitants around the NODA line think. These surveys clear that many users are not satisfied with the service of the NODA line and the area where the degree of satisfaction is lower desires the direct connection line to the NRT. Moreover, it turns out that the degree of the satisfaction to the NODA line may shift to the better by realizing the direct connection line to the NRT.

It estimates the parameters of the model as threefold choice problem. The explanatory variables apply the users related variables, the non-users related variables and the share. This study calculates the existence effect of the direct connection line to NRT by the parameters of



variables the non-users related divide by the parameter of the share. Although the model has parts those are statistically inferior, this model shows that being direct connection to the NRT can bring about the existence effect to inhabitants around the NODA line.

The railway project in Japan is based on the beneficiaries should pay for the project cost. Until now, just only the railway users are considered as beneficiaries. However, that a railway exists as it becomes clear by this study has brought about the existence effect to inhabitants of the area along the railway.

The result of this study is going to be the lead which finds out one of the new methods to a future railway project.

### ACKNOWLEDGEMENTS

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