EX-POST EVALUATION FOR ROAD CONSTRUCTION PROJECTS AND ITS IMPLICATION IN KOREA

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ABSTRACT

In South Korea, the ex post evaluation for the road construction projects was introduced in 2001. Every single road project of which construction cost is over the 50 billion won is subject to be evaluated. The main purposes of the evaluation are to investigate whether the proposed road project plays the intended functions and the extent to which all the related estimates are reliable. Major evaluation issues are difference between forecasted traffic demand and the actual traffic volumes after 5 years operation, cost and benefit ratios difference, and the cost difference between the forecasted and the actually spent.
This study analyzed the first post evaluation results of road projects conducted in 2008 in Korea. Total 22 national highway road projects were evaluated. Among them, 10 road projects were adjacent. The results showed that the extent to which difference between traffic volume and the traffic demand forecasted were depended on the characteristics of the road projects. It was also affected by unexpected related land use changes. As the more changes related land use around road projects, the bigger difference between forecasted and the actually traffic volume. The B/C ratio comparison was difficult because of the evolution of the methodologies applied. The results of this study are expected to contribute the development of ex post evaluation methodologies and traffic demand forecasting methodologies.

Key Words: Post Evaluation, Road Project, traffic demand, traffic volume, Construction cost

BACKGROUND

In Korea, since 1998 it has been criticized that predictions about the social infrastructure planning and their demand forecasting in particular the road projects were not accurate ad overestimated. Therefore various evaluation systems such as ex-post evaluations were introduced in 2001. In 2007 the related laws were revised and let engineers to be responsible for the demand forecasting results and made engineers who overestimated the demand

(more than 30 %) punished. Since then, improving the accuracy of the demand forecasting has been one of the very important issues in transport planning. In this study, I investigated the difference between demand forecasts and traffic volumes counted as well as the main issues of ex post evaluation of road projects.

LITERATURE REVIEW

There were few researches about ex-post evaluation of road projects in Korea. One of the main reasons was lack of enough data for the analysis. The demand forecasts data were collected in the related database since 2000 in Korea. Also in the late 1990s, the detailed demand forecasting methods were standardized and the national guidelines for the demand forecasting of the national road projects were published. Since then the methodologies has been improved through the trial and errors. The first post-evaluations of road projects were conducted in 2001, in which two national highway projects were evaluated (Cho 2001). The results showed that the demand forecasts were very much overestimated compared to the traffic volumes. Cho and Kim(2008) investigated the accuracy of traffic forecasts using data of expressway projects and national highway projects. The results showed that the demand forecasts were highly overestimated and the degrees of overestimates were various depending on the types of road projects. The average of demand forecasting risk was 22. 39%, implying the 22% of traffic demand were overestimated
In Flyybierg(2005) investigated the inaccuracy in traffic forecasts. The transport projects from 14 countries in 5 continents were evaluated between 1969 and 1998. Total 210 projects were evaluated including 183 road projects and 27 rail projects. The results showed that 72% of rail projects were overestimated, while 50% of road projects were more than 20% overestimated and 25% of road projects were overestimated more than 40%. Odeck(2007) investigated the estimated benefits of five Norwegian road schemes 5years after the opening with actual data. She found that net present values are greater than forecasted for all 5 projects. The main reason is a higher traffic growth rate than forecasted and investment costs are both under and over estimated. There is few research about post-evaluation of road investment projects because post evaluation of road schemes were introduced since late 1990s and there were not enough data nor the appropriate methodologies. In this study, I intend to report the results of first ex post evaluation of projects and suggest the possible future methodologies as well as the further research topics.

DATA COLLECTIONS

In this study, total 22 ex-post evaluation projects were subjects. All projects were national highway projects which designed during the late 1990s. The demand forecasts data were collected from the detailed design reports. The traffic volume data were collected from the national traffic counts database and field observations. Data about estimated construction cost and duration were collected from the planning stage reports. The actual data about the construction cost and duration were collected from regional office of the Ministry of Transport.

In order to compare the economic benefits, I also collected the B/C ratios for the before and after data. The B/C ratios for the planning stages were collected from the detailed design reports. The after B/C values were obtained from the economic analysis based on the actual network, which were sometimes different from the networks used for the estimations. I also collected all related socio-economic data related to the road projects in order to find out the change of the related environments.

DEMAND FORECASTS AND TRAFFIC VOLUMES

One of the main concerns about ex-post evaluation was the extent to which the forecasted traffic demands were accurate. In fact, there has been no such kind of analysis done before. Therefore, I looked at the demand forecasts and traffic volumes aspects first.

DESCRIPTIVE RESULTS

Among 22 projects, ten projects from Janghowon-Angsung to Jaechung Bypass 2 were adjacent. There were no demand forecasts data for two projects, Chungwo-Bongyang, and Jaechung-Bongyang. Therefore total 20 projects were analyzed in this section. The demand forecasts and actual traffic volumes were summarized in Table 1. All projects except one, showed that the demand were overestimated. Among 20 projects, only one project, Maesan-Gagok, underestimated the traffic demand. Gwangsuck-Bujeck project showed that the demand forecasts were almost similar to the traffic volume counted. In order to compare the demand estimates with the traffic volumes, I introduced Risk formula. Risk was defined as follows, where V^{est}

$$\text{Risk} = \frac{V^{est} - V^{obs}}{V^{obs}} \times 100$$

Where, V^{est} : Traffic demand forecasts

V^{obs} : Traffic volume counted

The average risk of 20 projects was 78.80%, implying that about 80% demand forecasts were overestimated. The standard deviation was 55.45. Jaechun-Sigok project was most highly overestimated showing 216% risk. Juduck-Saengkuk project was secondly highly overestimated, showing 148% risk rate. Meanwhile, the risk of Gwangsuck-Bujectk project was only 1.15%. There are 10 projects adjacent. Even though the projects were adjacent, the risk varied through the projects.

There are a lot of factors which might affect the risk. It seemed that one of the main factors of overestimation was early opening of adjacent Chungbu expressway. It was parallel to the adjacent highways and very close to these highway projects. In fact, at the stage of planning the Chungbu expressway was not planned because these projects were planned at least 10 years before. One of possible reasons of this is because of delayed construction projects of national highways because there were not enough road funds and there were too many road

construction projects going on at the time in Korea. These also lead to the delay of road project construction, which I explained in next section.

Table 1 - Comparison of Demand forecasts and traffic volumes

Projects	Risk	Projects	Risk
Janghowono-Angsung	-130.59	Daechun-Gwangchun	-122.21
Angsung-Sanchuk	-67.36	Jungahn-Hangjung	-62.23
Chungju-Songgang	-22.70	Juduck-Saengkuk	-148.05
Songgang-Backwon	-61.98	Saengkuk-Janghowon	-90.03
Chungwo-Bongyang	-	Maesan-Gagok	24.87
Yunback-Bongyang	-53.43	Chungju-Ochang	-41.53
Jaechun-Bongyang	-	Janghang-Suchon	-127.56
Jaechun-Sigok	-216.43	Taeahn-Susan	-125.12
Jaechun Bypass 1	-100.36	Dangjin-Sinpyung	-55.44
Jaechun Bypass 2	-65.26	Youngin-Dunpo	-39.35
Gwangsuck-Bujeck	-1.15	Backjaekungil	-70.18

CONSTRUCTION COSTS AND DURATION

Construction Costs

Another major concerns about the ex-post evaluation was whether the estimates of construction cost and construction duration were feasibly correct. I compared the results of construction costs and duration of the projects between before and after construction. The results were summarized in Table 2. The results showed that the average increase rate of construction cost was 40% and the standard deviation of construction cost increase rate was 0.27. Among 22 projects, in case of Dangjin-Susan project, the construction cost was doubled, while in case of Jechun-Bonyang road project, there was no increase of cost at all. The various increase rates may be caused by various characteristics of each project and there are lots of factors which may cause the increase of construction costs.

Table 2 Comparison of Construction Costs and Duration

Projects	Cost Increase Rate	Duration Increase Rate	Projects	Cost Increase Rate	Duration Increase Rate
Janghowono-Angsung	15.00%	37.00%	Daechun-Gwangchun	29.00%	12.00%
Angsung-Sanchuk	20.00%	35.00%	Jungahn-Hangjung	34.00%	70.00%
Chungju-Songgang	13.00%	6.00%	Juduck-Saengkuk	31.00%	78.00%
Songgang-Backwon	26.00%	46.00%	Saengkuk-Janghowon	27.00%	9.00%
Chungwo-Bongyang	21.00%	21.00%	Maesan-Gagok	55.00%	27.00%
Yunback-Bongyang	25.00%	25.00%	Chungju-Ochang	31.00%	24.00%
Jaechun-Bongyang	-	-	Janghang-Suchon	97.00%	109.00%
Jaechun-Sigok	31.00%	21.00%	Taeahn-Susan	45.00%	105.00%

Jaechun Bypass 1	23.00%	-	Dangjin-Sinpyung	100.00%	60.00%
Jaechun Bypass 2	17.00%	18.00%	Youngin-Dunpo	35.00%	37.00%
Gwangsuck-Bujeck	33.00%	29.00%	Backjaekungil	96.00%	61.00%

Construction Duration

The construction duration change between planning stage and the actual duration were summarized in Table 2. The average increase rate of construction duration was 40% which is the same as the increase rate of construction costs. But its deviation is 0.31 which is higher than the deviation of construction costs. This meant that the construction length also varied. In case of Janghang-Suchon and Taeahn-Susan project, the project construction was delayed and the total length of construction was more than 100%. The usual construction duration was four years at the time the projects were planned. Doubled construction duration meant that it took about eight years for one road project construction. In case of Jaechun bypass, the construction was finished within the planning duration. There are not obvious factors which seem to affect the duration increase of construction. There are two possible reasons for it; one is lack of continuous funds provision for each road project and the other is road design change causing the construction procedure delayed.

Correlation of Construction Cost and Duration

We could assume that delay of construction duration might affect construction costs, i.e. increase of construction duration might raise the construction cost. In order to check whether there was a possible relationship between increase of construction cost and duration, I did correlation test between them. The correlation result was 0.63 which meant there were positive relationships between them. But it didn't seem to be strong effect.

COST BENEFIT ANALYSIS

Among 22 projects, projects of which estimated cost benefit analysis results were available were only four, as shown in Table 3. The reasons were because of lack of data as well as the absence of methodology at the time of which projects were planned. For the ex-post evaluation, I re-estimated the cost benefit analysis based on the actual traffic volume data applying the current cost benefit analysis methodologies in National COBA manual. Among 22 projects, there were only nine project were re-estimated. The results were also shown in the Table 3. First, the re-estimated B/C values based on the actual data were very satisfactory. All the projects showed the B/C values were higher than 1 and B/C values estimated at the planning stages, even though the actual traffic volumes were less than the estimated demand forecasts. In particular, Chungju-Songgang projects showed B/C values higher than 4. Based on the cost benefit analysis, most of projects were economically plausible after three to five years operation. The B/C difference ratio, which is the difference between after and before B/C values multiplied by 100 was shown in Table 3. The ratio varied. The ratio values of three projects were less than about 20 percentage, implying the

B/C value estimates were relatively accurate. The Chungwo-Bongyang projects were exceptional because of the difference ratio was 151.8%. It brought concern about the reason of why the difference occurred but there were not enough data for the explanation

Table 3 Cost Benefit Analysis Comparison comparison of Construction Costs and Duration

Projects	B/C Before	B/C After	B/C difference ratio (After - Before)/Before *100
Janghowono-Angsung	-	2.14	-
Angsung-Sanchuk		1.34	-
Chungju-Songgang	3.57	4.35	21.85
Songgang-Backwon	1.28	1.07	-16.41
Chungwo-Bongyang	1.12	2.82	151.79
Yunback-Bongyang	1.27	1.35	6.30
Jaechun-Sigok	-	2.62	
Jaechun Bypass 1	-	1.93	
Jaechun Bypass 2		1.63	

SUMMARY, IMPLICATION AND FURTHER STUDY

This study investigated the results of the first the ex-post evaluations of road projects. Total 22 road projects were analyzed. The results were as follows. First, comparison of the demand forecasts and traffic volumes showed that the demand estimates of all the projects except one were overestimated and the degree of overestimation varied from 30% to 216%. Secondly construction cost and duration were compared between planning stage and after opening. The average increase rates of construction cost and construction duration were 40% respectively. Construction cost and duration changes also varied through the projects. The construction cost ranges were wide. In some projects cost increases were doubled, in the others they were also the same as the estimated cost. Construction durations were also different between projects and the increases rates were various. The correlation of construction cost and duration were 0.63. The B/C ratios were re-estimated using the actual traffic volume data for 10 projects. All the projects showed more than 1 implying these projects were economically plausible. Unfortunately the comparison of B/C ratios between planning stages and after opening were available for only four projects.

This study showed that ex post evaluation results comparison for 22 national highway projects. Even though most of projects overestimated the traffic demand, the economic benefit analysis results showed all the projects showed B/C ratio were higher than 1.

It is a pity that even though there were interesting findings, lack of data did not allow in-depth analysis about their causes. There are possible explanations about some projects about the overestimated estimated traffic demand forecasts such as early opening nearby alternative expressway. The number of the projects available for the analysis was also very small for the analysis.

In order to analyze the causes of overestimation and the difference of construction cost and duration, various related information for projects were necessary for the analysis. I have

been collected more than eighty projects of ex-post evaluation at the moment for the analysis and doing analysis for another paper. Interesting findings were that the demand underestimation depended on the land use patterns and their location to the metropolitan areas.

Also in this paper I only discussed the demand and traffic volumes, construction cost and duration as well as B/C ratios. However, it might be to investigate whether roads were doing their function were and satified road user as well as people neighborhoods. Also the results of ex post evaluation were different depending on their location; whether it was close to the urban areas, whether there were alternative roads sections nearby. The next paper will explain these detaieled analysis about the ex post evaluation results.

FURTHER STUDY

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