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Web-system development for the feasibility of national road

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Abstract: ***For last three years, our research team have conducted the project named "Development of construction project management technology based on BIM/GIS platform." We developed construction cost estimation system as well as 3D modeling engine at the first two year and established a web-system which could estimate the benefits of the project and further analyze the economic and financial feasibility of the project. This paper mainly focused on the functions and specifications of web-system. The system was composed of two modules: economic feasibility estimation module and financial feasibility estimation module. While the economic feasibility estimation module determines economic feasibility of the project based on traffic demand forecasting from the public's perspective, the financial feasibility estimation module determine financial viability of the project using toll fee of the road from private entity's perspective. Compared with traditional feasibility study, the proposed system provide users with better flexibility which can make users easily to validate the project upon the change of project environments. The system was also verified with an already accomplished project. The verification showed that proposed system could provide satisfactory accurate results with reduced time and resources.***

Keywords: economic feasibility; financial feasibility; feasibility study; best route.

I. Introduction

"Development of construction project management technology based on BIM/GIS platform" project was three years project with two phases of system development. The objective of the project was to develop the system which enabled users to determine the best route based on cost-benefit analysis coupled with 3D visualization. At the first two years (1st phase) we developed cost estimation system and 3D modelling engine. At the third year (2nd phase), web-system for benefit estimation was developed. In this paper, the functions and specifications of the benefit estimation system was mainly discussed. The proposed system evaluated the economic feasibility of the construction projects based on the results of traffic demand analysis provided by commercial program. The system also evaluated the financial feasibility of the project in order to check the possibility of the privatization. After the system development, the system was tested to evaluate the accuracy of system with an already accomplished project. The test proved that the system could provide satisfactory accurate results with improved flexibility. Overall, the proposed system is expected to assist governmental agencies in making a decision for selecting a best route more efficiently

II. Benefit Estimation System

A. System descriptions

The benefit estimation system was developed on the web-system with a homepage (www.icce.re.kr). Using the user defined input and the results of traffic demand analysis, the system estimated 5 types of benefits defined by 'Guidelines on the investment evaluation of transportation facility [1]' and further evaluated the economic and financial feasibility of the project more easily and assisted decision making for investments more effectively. The evaluation process of the system was composed of 5 steps: project selection, input of traffic demand analysis, economic feasibility evaluation, financial feasibility evaluation and DB management.

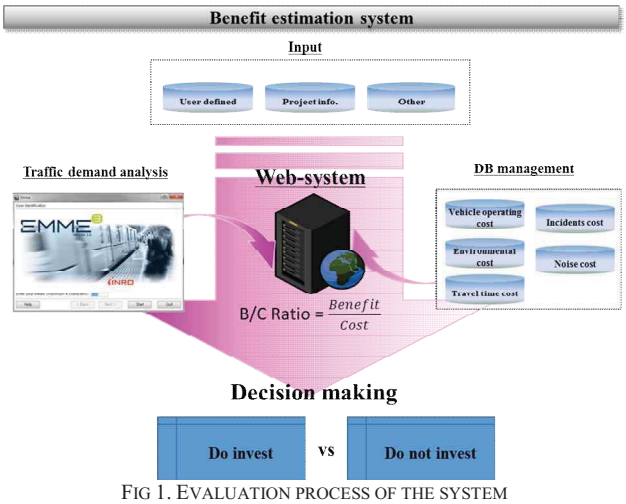

FIG 1. EVALUATION PROCESS OF THE SYSTEM

In project selection stage, user could input the project information by filing it or he manually input the information. In a same way, the user also easily uploaded the results of traffic demand analysis to the system. Then, the system evaluate the economic feasibility of the project. If the project was economically feasible, the proposed system automatically evaluated the financial

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feasibility of the project. In DB management step, the manager can change or edit the unit costs of travel. In this regard, the system provided two DB: typical and customized. Typical DB was came from 'Guidelines on the investment evaluation of transportation facility' and customized DB was developed by our research team. Figure 1 showed the overall evaluation process of the system. Details were discussed in following sections.

B. Project selection and input for traffic demand analysis

The proposed system was linked with previously developed Cad-system. Thus, when user selected the project, the corresponding project information was directly uploaded to the web-system. In case of traffic demand analysis results, the data format was fitted to EMME2/EMME3, which were most widely utilized in traffic demand analysis program. Table I showed the definition of mode and link used in the proposed system. The mode and link was adopted from the '2012 basic information regarding traffic analysis in capital area.'

TABLE I
DEFINITION OF MODE AND LINK TYPE [2]

Mode	Description	Mode	Description
a	Auto	x	Express bus
p	Pedestrian	g	Regional bus
t	Truck	m	Metro bus
s	Subway	l	Community
r	Rail	u	Circular
e	Express rail	c	Etc bus
Link	**Description**	**Link**	**Description**
100	Zone connection link	105	Local road1
101	National expressway	106	Local road2
102	Expressway	107	City and county road
103	National road	108	Ramp
104	State road		

In most cases, the results of traffic demand analysis included every link type of the project. However, decision maker often change the included link types depending on the type of project. To solve this issue, we installed the interface which enabled the user to easily change the included link types depending on the type of project.

C. Evaluation of project feasibility

Previously indicated, national guideline defined 5 types of benefits for feasibility study. The benefits were value of operation cost saving, incidents cost saving, noise cost saving, environmental cost saving, and travel time saving. The benefit estimation process was automatically conducted as soon as the traffic demand analysis data was uploaded. Then, the system evaluated economic feasibility of the project using project cost data and estimated benefits. The system also evaluated financial feasibility of the target projects, this function was only performed when the project was economically feasible. While economic feasibility implied the viability of project from public' perspective, financial feasibility represented that from private entity's perspective. Table II showed the differences between economic and financial feasibility analysis. As seen in table II, the biggest difference between economic and financial feasibility was that economic analysis considered benefits of traffic demand analysis from public point of view and financial feasibility analysis reflected revenue of operating the facility from private entity's perspective.

TABLE II
ECONOMIC FEASIBILITY VS FINANCIAL FEASIBILITY [3]

Category	Economic feasibility	Financial feasibility
Benefits	Estimated from traffic demand analysis	Estimated from cash inflow and outflow
Costs	Exclude financial expenses	Include financial expenses
Perspectives	From public	
Analysis m	NPV, IRR, B/C ratio	FNPV, FIRR, R/C ratio
Discount rate	Social discount rate	Financial discount rate

When the feasibility evaluation was completed, the system provided the detailed report regarding feasibility study results with cash flow projections of analysis period.

III. CASE STUDY

Case study was conducted to test the accuracy of the proposed system. Followings were basic information regarding the previously accomplished project. The feasibly study was carried out in 2012. The target project was 4-lane expressway construction and total project cost was 1,690 billion (Kwon). The comparison results for feasibility study between proposed system and accomplished project were presented in table III.

TABLE III
COMPARISON RESULTS

Method	Previous project	Proposed system
B/C	1.253	1.231
NPV	5457.5 (mil. Kwon)	5038.5 (mil. Kwon)
IRR	7.08 %	7.09%

The results showed that the proposed system could provide satisfactory results and would be applicable to a real construction project.

IV. CONCLUSION

This study proposed a web-system which can be applicable to evaluate the feasibility of the project. As seen in the case study, the proposed system would provide a satisfactory accurate result with reduced time and resources. Finally, the system would be utilized by governmental agencies in establishing the long-term plan for national road network effectively.

REFERENCES

Here are the examples of references format:

[1] Ministry of land, infrastructure and transport, "Guidelines on the investment evaluation of transportation facility", 2012.
[2] Metropolitan Transportation Authority, "2012 basic information regarding traffic analysis in capital area", 2012.
[3] Korea Development Institute, "Guidelines for the feasibility study 5th edition", KDI, 2008.