نشریه مهندسی عمران امیرکبیر

Amirkabir Journal of Civil Engineering

Amirkabir J. Civil Eng., 49(1) (2017) 49-50
DOI: 10.22060/ceej.2016.573

Calculation of Functional Costs Reduction in Economic Evaluation of Roads Rehalibitation (Case Study: Fasa-Zahedshar Main Road)

A. Mansourkhaki[1], S. R. Moosavi[1*], A. Rezaee-Arjrodi[2]

[1] Department of Road and Transportation Engineering, Iran University of Science and Technology, Tehran, Iran
[2] Transportation Research Institute, Housing and Urban Way Research Center, Tehran, Iran

ABSTRACT: In this study, to prevent pavement destruction and enhance the quality level, restoration and improvement of roads are carried out. The operational costs include fuel consumption, travel time, accidents, tires' wear and tear and so on. In the economic evaluation, reduction of such costs due to the improvement of the quality level of roads is considered as the project's benefits. In this paper, the benefits gained through roads' improvement (i.e. costs reduction) are compared with another one and then the priority of each one in the economic evaluation is determined using the results found from the B/C and Net Present Value (NPV) methods. For this purpose, the required model has been prepared using software written with the Visual Basic Programming Language and its output has been presented as the results of a case study carried out in Fasa-Zahedshahr main road. The evaluation of each element in the economic viability of roads' improvement projects is one of the specific features of the model presented in this paper.

Review History:
Received: 16 September 2013
Revised: 2 November 2014
Accepted: 3 January 2016
Available Online: 3 January 2016

Keywords:
Economic Evaluation
Net Present Value
The Operational Costs
The Evaluation of Each Element

1- Introduction

A very basic economic question that people ask in their personal and business activities is whether or not there is a balance between revenues, costs and investments under the present conditions and the benefits expected in the future [1]. Since road construction operations (new roads or improvement projects) are very expensive, the study and precise evaluation of the proper utilization of the financial resources will be quite necessary. In this paper, the appropriate economic evaluation methods have been explained along with the method of calculating the operation costs of the road construction projects. To study the case, 2008 information from the Fasa-Zahedan main road improvement project has been implemented using software designed for calculations, part of which will be presented in the following sections.

2- Methodology

In this study, the following six methods can be used for the economic evaluation of projects. According to the studies, to do the economic evaluations with the prepared software. The use of B/C and NPV methods is recommended [2]. Figures announced by the World Bank show the purchase capability of different countries and they can be used to convert the value of money. In 2007, this figure has been 45850 (for the USA) and 10800 (for Iran); dividing the latter two will yield the result [3]. To calculate the costs and benefits resulted from the implementation of the cost model of traffic accidents [3-5], such parameters as the fuel consumption, oil, tires wear and tear, vehicle maintenance [6] and travel time [7,8] were defined in the software.

3- Main contributions

Finally, to check the feasibility of the main road improvement (types A to D), software was designed (formulas required for the calculations were all based on experts' opinions and research results). Some of the input data required for the software were considered as defaults with the possibility of the new values to be recorded by the user. After the input data are entered in all the pages and confirmed by the user, the software analyzes them and stores the outputs in the form of an Excel File separating different data and their analyses results.

The software can not only check the cost-benefit relation of a project, but it is also capable of analyzing and economically prioritizing a number of projects. To test this, use was made of the economic-technical feasibility study results of Fasa-Zahedshahr main road that, compared with those of other available studies, had fewer problems.

Results of the analyses have shown that the benefits resulted from the accident decrement (during the exploitation years) have the highest, and those from the travel time reduction (considering that the route decrement due to road improvement in this study has been considerably low-about 400 m) have stood the second. The third to the 5th places belong respectively to the vehicle maintenance, fuel consumption, and tires wear and tear with close figures (Fig. 1); the prices of the last 3 items have been calculated as percent of the fuel price. In this figure, the vehicle maintenance has been shown with green, tires wear and tear with red and fuel consumption

*Corresponding author, E-mail: sr.moosavi59@gmail.com

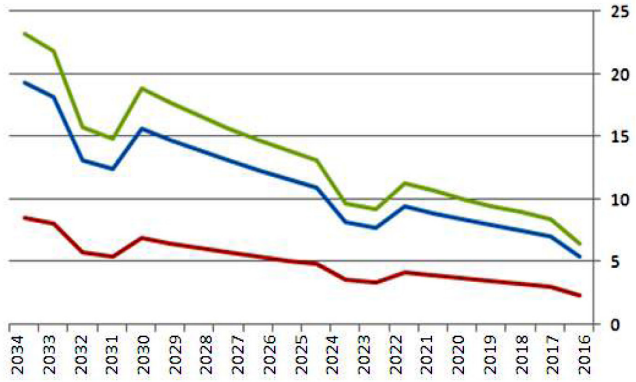

Fig. 1. Operation costs decrement after 2015

with blue.

In Fig. 1, there are some fractures in the years 2021 and 2030; this is because these are pavement overlay years; there is benefit reduction due to Pavement Condition Index (PCI) decrease and then there is benefit increase after the overlay is renewed.

4- Simulation results

Considering the input data, after the project completion and exploitation commencement, the accident and travel time reduction benefits reach from 25949 and 1194 million Rials in 2015 to respectively 339964 and 3857 million Rials in 2034 (the last year of the project time)

Since the route length reduction is very small in the improvement operations, and since the reduction in the costs of the fuel consumption, vehicle maintenance and tires wear and tear depends much on the route length, the benefit gain is not considerable. But, benefits from the reductions in the vehicle maintenance costs are more than those of the other items reaching from 6049 million Rials in 2015 to 23015 million Rials in 2034. Of course, the last 4 items show benefit reduction in 2021 and 2030 because of the PCI reduction, but they increase again after the improvements.

Refrences

[1] S. R., Moosavi; Optimizing Economic Evaluations in the Feasibility Studies of Road Projects, *M.Sc. Thesis, Civil Eng. Dept. (Transportation Branch), ISIU*, 2009.

[2] Factors Affecting the Evaluation and Technical, Economical, Social and Environmental Feasibility Study of Road and Railway Projects, Iran Ministry of Road and Transportation, *Deputy Training, Research and Technology, Transportation Research Institute (TRI)*, 2006.

[3] Group of Writers, WTO; Structure, Rules and Agreements, Business Printing and Publishing Co., *Affiliated to the Institute of Business Researches and Studies*, 2nd Printing, 2010.

[4] Behind Taraddod Consulting Engineers; Evaluating Costs of Traffic Accidents in Iranian Roads and Presenting the Related Software, Iran Ministry of Road and Transportation, *Deputy Training, Research and Technology*, 2006.

[5] Life-Cycle Benefit-Cost Analysis Model, California Department of Transportation, http://www.dot.ca.gov/hq/tpp/offices/eab/LCBC_Analysis_Model.html

[6] Gross National Income Per Capita 2007; Atlas Method and PPP, World Development Indicators Database, *World Bank, 17th Revision*, 2008.

[7] A., Arler; Economic Evaluation of Transportation Projects, Translated by F. Pakzad; *PBO, Iran Planning Institute*, 1957.

[8] Guidelines for Asphalt and Gravel Pavements, PBO, Deputy Administration, Financial and Human Resources, *Center for Scientific Documents, Museum and Publications*, 2004.

Please cite this article using:

A., Mansourkhaki, S. R., Moosavi, A., Rezaee-Arjrodi, "Calculating the Operational Costs Decrement in the Economic Evaluation of the Roads Rehabilitation (Case Study: Fasa-Zahedshahr Main Road)". *Amirkabir J. Civil Eng.*, 49(1) (2017) 165-173.

DOI: 10.22060/ceej.2016.573