A METHOD OF DETERMINING SOCIAL AND ECONOMIC BENEFITS OF TRANSPORTATION CONSTRUCTION PROJECTS

Dr. BUI NGOC TOAN
University of Transport and Communications

Summary: *This paper presents an approach of determining basic social and economic benefits of road projects*

I. OBJECTIVES

Transportation construction projects are mainly conducted for the social and economic benefits purpose. However, some of the projects were not estimated and defined in a unite way. The article presents a method to define the benefits. This method can be used as a reference with respect to the process of planning and appraising of road projects.

II. CONTENT

The social and economic benefits of a project are gains that the project brings to society and economics. These advantages are normally estimated by making comparison between a situation of having the project and that of without the project.

A transportation construction project has major benefits as the following: (1) gains of reducing operation costs; (2) gains of saving passenger's time (and goods); (3) gains of decreasing number of accidents; (4) gains of environmental pollution mitigation. Besides, when assessing the efficiency of projects, changing distance of transportation and maintenance costs are also considered.

Profits of mitigating environmental contamination will be presented in section [1], whereas, the content of the article focuses on other types of benefits.

1. A method to define gains of reducing vehicle operation costs

Vehicle Operation Cost (VOC) comprises many costs of fuels and damages (motors, tires…). Of road constructions, these mentioned costs depend on road condition (geometrical structure, road surface…); activities of divers and traffic control capacity. VOC usually shows higher value with respect to sloping and rough roads. A method to determine VOC is presented in sections [2; 3].

One of the most ultimate target when constructing road structures is to reduce the value of VOC. Benefits, contained by decreasing vehicle operation costs accounted at t-th year, are calculated as the equation below.

$$B_t^1 = \sum_{i=1}^{m} 365.N_t^i.L_{new}\,(VOC_{old}^i - VOC_{new}^i)$$

(VND/year) (1)

Where, N_t^i - annual average daily traffic of the i-th type of vehicle in t-th year (units/day)

m - number of the vehicle unit (inluding good and passengers transportations) (units)

L_{new} - transport length of a new or reconstructe road (km)

$VOC_{old}^i; VOC_{new}^i$ - vehilce operation costs in two cases (having the project and without the project) (VND/vehicle.km).

2. A method to define gains of decreasing passengers travelling time

Time has its value and the human time value can be measured. Transportation construction projects aim to reduce time for travelling of passengers. Many studies demonstrates that saved time value of passengers largely depends on individuals (purpose of the trip, attitude...). In a simpler and more precise view, that is, defining time value of passengers bases on GDP of the section surveyed and types of vehicle.

2.1. A case of having data of traffic volume

With respect to section surveyed, if there is only data of traffic volume available (without data of passengers transportation capacity), the saving time value in t-th year will be calculated as the following equation.

$$B_t^3 = \sum_{i=1}^{m} 365.N_t^i.K_{avr}^i.\Delta t_i.G_{pac}^i \text{ (VND/year)} \quad (2)$$

Where, Δt_i - average saved number of hours per passenger when using i-th type of vehicle (hours)

G_{pac}^i - Value of a hour per passenger when using i-th type of vehicle (VND/person.hour)

K_{avr}^i - average number of passengers per i-th type of vehicle

+ car: 2.5 – 3.0 (people)

+ bus: 15-35 (people)

+ motorbike: 1.0-1.5 (people)

2.2 A case of having numbers of passengers transported due to vehicle types

$$B_t^3 = \sum_{i=1}^{m} Q_{t-pac}^i.\Delta t_i.G_{pac}^i \text{ (VND/year)} \quad (3)$$

where Q_{t-pac}^i - number of passengers transported of i-th vehicle type in t-th year (people/year)

3. A method to measure advandges of saving time for goods transportation

Apprerance of a transportation construction project can lead to a decrease of travelling time. In other words, goods can be quicker used. This advandtage can be estimated as a chance value due to the sooner use of goods.

3.1 A case of having data of traffic volume

In case of having data of traffic volume only (lack data of goods tranportation capacity), the saving time value for goods transport can be accounted as below.

$$B_t^4 = \sum_{i=1}^{m} 365.N_t^i.q_{avr}^i.\Delta t_i.G_{gds} \text{ (VND/year)} \quad (4)$$

Where, q_{avr}^i - average load of the vehicle transported i-th goods (tons/vehicle)

Δt_i - average saved number of hours of vehicle carrying i-th goods (hours)

G_{gds} -average time saved value of 1 ton of goods (VND/ton. hour)

3.2 A case of having data of goods tranported mass

$$B_t^4 = \sum_{i=1}^{m} Q_{t-gds}^i . \Delta t_i . G_{gds} \text{ (VND/year)} \quad (5)$$

where Q_{t-gds}^i - goods transported mass of i-th vehicle type in t-th year (tons/year).

4. A method to define gains due to a decrease of number of accidents

Transportation construction projects influece safety of passengers, goods and vehicles by changing traffic volume or tranportation condition. In other words, it can decrease or increase number of accidents. For instance, a new expressway upgrated for the quality purpose might increase accidents if there is no significant safety supplement. Therefore, the influence should be estimated.

To measure gains of reducing accidents, it is necessary to experience 2 steps. The first is to assess capability of decreasing collisions. The second is to measure the advantages of diminishing crashes.

In addition to the first step, a need is to approximate or predict the number of crashes happen on the road section considered. This can base on data bank of road types and road conditions after and before having the project [2; 3].

The number of accident decreased in t-th year on a j-th road section ΔA_t^j will be collected after accomplishing step 1. The advantages mentioned in the second step can be calculated as the following equation.

$$B_t^6 = \sum_j C_{acd} . m_t^j . \Delta A_t^j \text{ (VND/year)} \quad (6)$$

Where, C_{acd} - average lost for an accident. It can be defined by considering the database of the section surveyed.

m_t^j-Coefficient considering effects of situation of j-th road section in t-th year towards an accident.

III. CONCLUSION

This above mentioned approach is one of mainly methods to approximate social and economic benefits of transportation construction projects. Besides, there are many others methods which largely depend on specific condition (capital and database).

Reference

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