Analysis of Investment Feasibility to Pedestrian Bridge in Muara Teweh - Jingah

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Abstract: The research aimed to analyze the needs of the construction of the Crossing Bridge of Muara Teweh - Jingah. The type of the research including the applied research was research concerning the application of theory to solve certain problems. The location of this research was at the Bridge Crossing of Muara Teweh - Jingah in North Barito District. Data analysis technique was feasibility study. The result of the research showed that: (1) the construction of the Crossing Bridge of Muara Teweh - Jingah is needed to reduce the traffic density; the traffic of the daily transportation in the development area has an effort to balance the traffic volume with road capacity in order to avoid LOS decrease and increase people's prosperity level, (2) the celebration of the construction of Muara Teweh - Jingah Crossing Bridge in terms of technical and economic and cultural aspects, is stated to have fulfilled the feasibility, (3) the feasibility of bridge development in terms of economic and cultural aspects is fulfilled, because the value of BCR is greater than > 1.0 and interest rate that is applicable is equal to 12% (in 2015). Finally, the bridge construction is feasible to be implemented.

Index Terms: Bridge, BCR, IRR, NPV.

1 INTRODUCTION

AS a national economic artery in North Barito District, construction of the Crossing Bridge of Muara Teweh - Jingah is one of the efforts to improve the economy; the pedestrian bridge will connect the City of Muara Teweh and Jingah in North Barito District. By the approach of governmental policy, especially the handling of infrastructure in North Barito District, feasibility test will be conducted against the construction plan of Crossing Bridge of Muara Teweh - Jingah from technical aspect and economic analysis. It is a bridge infrastructure for pedestrian and vehicle of two wheels which will especially connect Muara Teweh – Jingah, to make it easier for the residents to interact with each other; it is expected to provide more benefits, especially for the daily activities of the people in the area. There are several transportation planning concepts that have developed up to now, and the most popular concept is the Four-Stage Transportation Planning Model. This planning model is a composite of several sub-models that each has to be conducted separately and sequentially, namely: accessibility of transport networks, the rise and pull of movement, distribution of movement, mode selection, route selection, and dynamic traffic flow. One of the most important things that a researcher must consider when starting the research is to determine the scope of the research, to define the zone system including the zonal distribution, and to identify the significant transportation network system affecting the inter zone patterns. The use of different zonal systems for one area of research causes difficulties in the use of data from the previous research and in making comparisons of the results.

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It is all due to the difference in zone system resolution used. The basic element in this simplification is the zone; the center of the zone is assumed to be the concentration of all the characteristics of the zone's movement. Accessibility is a measurement of the comfort or convenience of how a location of land use interacts with each other and the difficulty level of the location is achieved through a transport network system [1]. The rise of the movement is a modeling stage that estimates the number of movements coming from a zone or land use and the amount of movement pulled into a zone [2]. The condition of traffic performance in the road network can be known by looking at the volume or traffic flow passing through the road. It is because volume is the easiest characteristic to obtain [3]. In broad outline, the economic feasibility evaluation includes: economic analysis, consisting of: benefit cost ratio (B/C-R); net present value (NPV); economic internal rate of return (EIRR); first year rate of return (FYRR). Evaluating the feasibility of a project can be conducted by analyzing the four components mentioned above, or if it is possible, only two or more of the four components can be analyzed [4]. Benefit Cost Ratio (BCR) is a comparison between present value of benefits with present value of cost [5]. Thus, the benefit cost ratio shows the benefits gained each additional of one rupiah expenditure. BCR will describe its benefits and feasibility to be implemented if it has BCR > 1. If BCR = 1, then the business get no profit and no loss; therefore, it is up to the assessor of the decision makers to implement it or not. If BCR < 1 then the business is disadvantageous so it is better not to be implemented.

2 RESEARCH METHOD

2.1 Technical Approaches and Methods

a. Preliminary Survey

The survey is expected to provide suggestions and considerations for further detail surveys. The preliminary survey is a continuation of the agreed design preparation results as a guide for conducting field surveys activities covering literature study [6]. At this stage, the team has to collect the supporting data for the planning, both secondary data and other necessary data.

b. Approach Analysis of Feasibility Study Activities

In general, there are 2 methods of analytical approach used in

the feasibility study, namely:
1) Pre- and post-project analysis methods; and
2) Analysis methods with and without project.
Based on the implementation of Bridge Construction work,

it will use the method of conditions comparison approach: with and without project, as well as on the basis of public policy approach or economic analysis approach. The with-project approach is assumed to be a condition, where an investment is required, which is conducted to increase the capacity and bridge structure. Meanwhile, the without-project approach, it is assumed to be a condition, where no investment/project is conducted to increase the capacity and bridge structure, except to maintain the function of the bridge service; the approach is in the form of routine and periodic maintenance [7].

2.2 Technical Aspects

a. Topographic Measurement

In this work activity, topographic measurement aims to collect coordinate data and elevation of the earth surface along a road trace plan within the corridor for the preparation of a topographic map with the scale of 1:1000, which will be used for road geometric planning.

b. Traffic Survey

The traffic survey aims to determine traffic volume, flow and conditions in roads and intersections, and to obtain the data of the average vehicle speed, as a basis for planning roads and bridges.

2.3 Data Collection and Analysis of Traffic Survey

a. Secondary Data Collection

The data are used to determine the area of study or area that will be affected, build road network model and determine further work steps in the framework of primary traffic surveys.

b. Primary Surveys

The types of surveys conducted in the course of completion of this Traffic Impact Analysis study include group of Inventory Survey, group of Traffic Counting Survey, and group of Trips Attraction Survey, as well as group of Origin Interview Survey. Meanwhile, the survey method is conducted by calculation, measurement (walking measures/wheel-meter), manual recording, and interviews to the respondents.

c. Hydrological Survey

The Hydrological Survey aims to find the necessary data in hydrological analysis which then be used in drainage planning. While drainage planning is necessary for determining the type and dimensions of drainage buildings, in addition to determining the shape of the road pieces itself [8].

d. Geological Survey

In this work activity, geotechnical investigations aims to map the distribution of soil/bedrock including the thickness of the soil, provide information on the stability of the road body, determine the type and characteristics of the road material, and identify the location of the source of the material including its quantity estimates. The purpose of this geotechnical investigation is a detailed geological engineering mapping, including base ground mapping and so on along the road plan with the aim of providing comprehensive information on:
1) Stability level of the road body planning and cause of damage to the road body in the site area.
2) Grouping and analysis of the characteristic of the base ground / subgrade plans in relation to the analysis of road pavement and other road building.

2.4 Economic Aspects

a. Project Costs

Costs included in the calculation of project costs are as follows:
1) Land Procurement Cost
2) Administration and Certification Cost
3) Design Cost
4) Construction Cost
5) Supervision Cost

b. Project Costs

The following costs are directly related to road and bridge projects, but are not considered as cost components in economic analysis, namely:
1) Vehicle operating costs from the traffic which are directly related to the project. The difference of the total vehicle operating cost between with-project and without-project conditions is taken into account as project benefits.
2) Road maintenance costs are directly related to the traffic that weighs on the road. The difference between the total cost of road maintenance between with-project and without-project conditions is taken into account as project benefits.
3) The value of travel time is directly related to the time savings due to the project. The difference between the total travel time between with-project and without-project conditions is taken into account as project benefits.
4) The cost of traffic accidents is directly related to traffic passing through the road. The decrease in accident costs which reflects improvements in safety as a result of the project is taken into account as project benefits.

c. Construction Salvage Value

There is a construction, for example construction of rigid pavement, at the end of the study period it still has significant salvage value, as it has a longer plan life. In order to have a fairly calculation on the cost of construction to other alternatives, then at the end of the study period, the remaining life of the construction should be determined, as well as the economic value. This salvage value of the construction becomes a negative cost in the calculation of economic feasibility [9].

d. Application of Alternatives that will be Created

1) The consultant should develop several alternative road handlings in addition to the "do-nothing" scenario.
2) In the initial stage, an alternative selection process will be analyzed in the next stage.
3) Election criteria should consider such factors as: traffic services, costs, potential for socioeconomic, environmental, and economic development.
4) The road handling alternatives should take into consideration factors: traffic characteristics and volumes, upcoming road networks, development around the site and availability of land, suitability with on-site topography,

environmental factors, gradual development potential and needs, ease of implementation, construction method, estimation of implementation and maintenance costs, as well as aesthetic factors.

5) The selected alternatives will be further analyzed by considering the gradual construction aspects and different construction types.
6) The consultant should conduct a comparison analysis to determine the chosen alternative. It should consider the economic and environmental technical factors. This analysis is conducted progressively during the study and written in detail in the final report.
7) If the weight system is applied for comparative evaluation, the applied weight system should first be subject to the task force's approval. The alternative troubleshooting will be made and will be analyzed at the next stage.
8) Interchanges configuration should consider some factors such as traffic characteristics and volumes, upcoming road networks, site development and availability of land, suitability to on-site topography, environmental factors, gradual development potential and needs, ease of implementation and maintenance, as well as aesthetic factors.
9) The selected results will be analyzed further by considering the relevant aspects.

Comparative analysis will be conducted to determine the selected alternatives by taking into account the economic and environmental technical factors.

3 Results and Discussion

3.1 Socio-Economic and Cultural Aspects

a. Results of Community Questionnaires in the Study Area

Next, the questionnaire was distributed to obtain primary data in the study area in the Teweh Baru Sub-district and Muara Teweh City, the results of the questionnaire distribution can be seen in Table 1.

TABLE 1: *Village Distribution and Number of Respondents*

District	Sub-District	Village	Respondents	Presentage (%)
North Barito	Teweh Baru	Jingah	62	29
	Kota Muara	Jambu	66	31
	Teweh	Melayu	84	40
	Total		212	100

Distribution of questionnaires in the study area of Teweh Baru Sub-district, Jingah and Jambu Village obtain the data (100%) of respondents.

b. Results of Community Questionnaires in the Study Area

Behind this development, the people make some new expectations for their village. The expectations can be seen in Table 2.

TABLE 1: *Expectations on Bridge Construction*

Expectations and Suggestions	Frequency	Percentage (%)
Creating a new job field	98	46
There will be road improvements	14	7
There will be reasonable compensation for any relocations	27	13
There will be no flood around the site	19	9
Beneficial to the community around the study are	54	25
Total	212	100

The lack of employment in the villages caused the people to hope that with the construction of this bridge will create a new job field. Nearly 98 (46%) of surveyed respondents stated that for people whose land or houses were affected by this development should receive appropriate compensation. Next, there were 14 (7%) respondents, who wanted some improvements to the access of the highway. Access to the highway is an important factor as a medium of inter-regional liaison and economic distribution by villagers.

3.2 Economic and Financial Analysis

a. The Basics of the Approach

The basic criterion for measuring the economic benefits of an investment in the field of transportation is by conducting "with and without test" measurement. To compare costs and benefits that have different time flows, these costs and benefits are discounted by starting point of the payment time. There are various ways to measure costs and benefits. Among them are the net worth of the project and the internal rate of return. The net worth is the difference between cost and benefit over the economic life calculated at a discounted rate of equal amount. The internal rate of return is a discount rate of particular amount so that costs and benefits have equal amount. The consultant makes an analysis of the upcoming social conditions, including aspects of urban and regional development. This socio-economic analysis is an input to the process of forecasting traffic needs. Socioeconomic components include the inventory and analysis of socio-economic data of population; they are affected by project activities, such as loss of shelter, livelihood, agricultural land/plantation or public infrastructure. In determining the chosen route, the resettlement of displaced people should be considered. An estimate of the number of affected people for each route alternative should be taken into account.

1) The benefits of the project can be distinguished into two groups: direct benefits for road users and indirect benefits that other road users can enjoy.
2) The analysis at least includes the following components:
   a) Vehicle operating costs
   b) Travel time costs
   c) Road maintenance costs
   d) Benefits for regional development (additional value)

b. The Methods Used

There are various ways to measure costs and benefits. Among them is the net worth of the project and the internal rate of return. The net worth is the difference between cost and

benefit over the economic life calculated at a discounted rate of equal amount. The internal rate of return is a discount rate of particular amount so that costs and benefits have equal amount. The benefit cost analysis is performed by using the interest rate of 10%, 15%, and 20%, and the value of BCR and NPV is determined at the interest rate of 15%. The calculation is based on the 30 year age plan.

c. Feasibility Evaluation Model

The feasibility evaluation model used in this study is a feasibility evaluation by calculating Benefit Cost Ratio (BCR), Net Present Value (NPV), and Internal Rate of Return (IRR) values. Benefit Cost Ratio (BCR) is the value of comparison between the income stream and the cost stream.

d. Cost Analysis

In obtaining the price of ready-to-use work unit, it is necessary to analyze the unit price of materials and wages on the basis of the price of materials and wages that are applicable at the study area at the time of the study.

3.3 Economic Feasibility Evaluation

a. Analysis of Benefit Cost Ratio (B/C-R)

Benefit cost ratio is the ratio between present value benefit which is divided by the present value cost. The B/CR results of a project are economically feasible if the B/CR value is greater than 1 (one). This method is used to evaluate the feasibility of the project by comparing the total benefits to the total cost that has been discounted to the base year by using the value discount rate during the plan year. Benefit Cost Ratio of 1.676 is greater than 1.0, so alternative development project of C bridge has been feasible to be built.

b. Analysis of Net Present Value (NPV)

This method is known as present valuable method and is used to determine to what extents a plan has benefits within the analysis period. It is calculated from the difference between the present value of the benefit (PVB) and the present value of the cost (PVC).

NPV = B - C
= IDR 2.918.856.925.979 - IDR 1.741.269.662.839
= IDR 1.177.587.263.141

The result of NPV from pedestrian bridge construction plan at alternative location C is considered to be economically feasible because it produces NPV value of IDR 1.177.587.263.141, that is greater than 0 with 30 years operational period of Bridge C operation.

c. Analysis of Economic Internal Rate Return (EIRR)

The Economic Internal Rate of Return (EIRR) is the rate of return based on the determination of the value of the discount rate, in which all future profits currently valued at a certain discount rate are equal to the total value or the present value of the total cost. The interest rate of the IRR or the interest rate of the C bridge project is between 45 and 50%. Therefore, precisely, the interpolation of the following calculation is used.

$$IRR = 45\% + \frac{1.307.428.884}{1.307.428.884 + 489.007.915} . 5\%$$

$$IRR = 45\% + 3{,}64\ \%$$

So, the rate of profit for the implementation of the construction of Bridge C for 30 years is estimated to reach 48.64% > interest rate which is applicable at this time; it is equal to 12% (in 2015). Therefore, the construction of Bridge C is feasible to be implemented.

d. First Year Rate Analysis of Return (FYRR)

Supposed if the project is conducted in 2016 and the bridge can be operationalized in 2017, the FYRR will be 18.60% (the largest return between 2017 and 2047 and it is greater than the interest rate of bank loan in 2015 which reached to 12%.

4 Conclusions and Recommendations

4.1 Conclusions

a. The construction of the Teweh - Jingah crossing bridge is required for daily transportation, the decrease in accident rate, and the increase in the level of public welfare.

b. The feasibility of the construction of the Muara Teweh - Jingah crossing bridge in terms of technical and economic and cultural aspects are:
   1) Technical aspects can be seen based on the assessment conducted on the 4 alternative locations then the result can be obtained that the alternative location C has the highest value and is feasible to be the site of the construction of the Crossing Bridge.
   2) Economic and cultural aspects show that it can still be controlled in accordance with the above analysis; in addition, the community around the location of crossing bridge construction plan can accept the location and indicate that development in the area is capable of giving positive impacts: the expected impact. From the observation and analysis, it can be concluded that from socio-cultural aspect of society, with the existence of crossing bridge construction, it will not experience significant change; in addition, majority of people around the location of construction plan of crossing bridge are stating “agree" for the implementation of construction of Crossing Bridge to connect Muara Teweh and Jingah.

c. The feasibility of the crossing bridge construction of Muara Teweh - Jingah from the financial aspect:
   1) Condition of Bridge C is the most favorable condition:
   a) BOK value per year: IDR 88.128.959.832
   b) Saving BOK per year: IDR 797.553.580
   c) The value of BCR = 1.676
   2) The value of Benefit Cost Ratio is 1.676 which is greater than 1.0; therefore, the alternative development project of Bridge C has been feasible to be built.
   3) The NPV result of the pedestrian bridge construction plan at alternative location C is considered to be economically feasible because it produces a NPV value of IDR 1.177.587.263.141 that is greater than 0 with 30 years operational period of the Bridge C operational period.
   4) Interest Rate of IRR or interest rate of Bridge C project is between 45% and 50%. So, to be more precise, interpolation in the form of a calculation is used. The profit level of the implementation of the construction of Bridge C for 30 years, is estimated to

reaching 48.64% > the applicable interest rate at this time, that is equal to 12% (in 2015). So, the construction of Bridge C is feasible to be implemented. From the calculation in Table 15, it showed that if the project is conducted in 2016 and the bridge can be operationalized in 2017, the FYRR will be 18.60% (the largest return between 2017 and 2047 and it is greater than the interest rate of bank loan in 2015 which reached to 12%. Finally, from all aspects of the construction, the crossing bridge of MUARA TEWEH - JINGAH is "WORTHY TO BE BUILT".

4.2 Suggestions

a. Technical Aspects

1) At the planning time, it is necessary to select a suitable steel profile with the conditions at the site.
2) At the time of implementation, it should not interfere with the flow of river transportation at the site.
3) At the operational time, it is necessary to give wind detector at the site of the bridge to anticipate the strong winds.

b. Socio-Economic and Cultural Aspects

1) At the time of implementation, it should not disrupt the flow of land transportation around the site; it is necessary to regulate the traffic during the construction.
2) At the time of implementation, it is expected to recruit local workforce.
3) At the time of implementation, it is necessary to curb the workforce so as not to create anxiety to the community around the construction site.
4) At the time of implementation, it is necessary to keep the environmental sustainability around the construction site.

c. Financial Aspects

Due to the instability of the Indonesian economy, then it is necessary to anticipate the increase in construction materials prices that are needed at the time of construction implementation, because it will affect the calculation of bank interest and IRR, which has been analyzed in the previous FS.

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