

# Planning Analysis on Bridge Construction Possibilities and Challenges: A Review

Cayitho Calveen<sup>1</sup>, Andri Irfan Rifai<sup>2</sup>

<sup>1,2</sup>Faculty of Civil Engineering & Planning, Universitas International Batam, Indonesia

Email Correspondence: 2011005.Cayitho@uib.edu

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## ABSTRACT

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*In every construction project, there will be many challenges and problems that will be passed. Therefore, this research is conducted to see some of the issues that were experienced by previous projects so that mistakes do not occur and can prevent failures or delays in the construction of bridges which are a group of a large project and cannot be considered trivial and requires detailed research and analysis during the construction process as well as its design. Bridges are very complicated infrastructures. In many cases, bridge structures are subjected to high traffic volumes and high loads. Procedures to ensure safe, successful, and secure systems are therefore vital. The paper presents various possibilities in choosing idea bridges, structures, and management; project management is an important factor supporting the project's success by analyzing the project management so that objectivity can be achieved most efficiently. The data collection method was carried out by a literature review from some journals. The starting point for problems in bridge construction has many impacts that affect both the design and construction periods as well as the maintenance period and the usage period of the bridge can also have an effect on the age of the bridge and can be caused by the environment, the materials used can also have an impact on the quality of the bridge and its lifespan, and if it is not planned properly it can have negative impacts such as economic, environmental impacts and the most critical is the loss of life.*

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## 1. Introduction

Indonesia is a developed country with much development that goes through year after year; as a developed country, Indonesia has high intentions in construction and results in society [1]. These developments are not only from the construction of buildings and roads but major developments such as bridges which aim to become intermediary transportation routes for island areas around cities such as Batam, where in 2024, a bridge between islands and Tanjung Pinang will begin to be built, and it is hoped that this will help the country's economy to become more advanced [2].

The bridge, which is part of the road, is very necessary for the land transportation network system that will support the developing nation in the future. So to establish the stability of land transport traffic means of transportation which is a very important meaning for national development [3], as a real embodiment of distribution services which include transportation services and trading services which cannot be separated from one another, the road network system and bridges is the main thing to maintain its serviceability [4].

Therefore planning, construction, and rehabilitation, as well as fabrication, necessary attention as effectively and efficiently as possible so that the development of the bridge can achieve the intended bridge age target. On a larger scale, Indonesia is an archipelagic country that can use bridges for inter-island transportation. Indonesia has started to think about connecting the islands with bridges [5].

Bridges are very complicated infrastructures. In many cases, bridge structures are subjected to high traffic volumes and high loads. Procedures to ensure safe, successful, and secure systems are therefore vital [6]. The paper presents various possibilities for choosing idea bridges, structures, and management; project management is an important factor supporting the project's success by analyzing the project management so that objectivity can be achieved most efficiently. A literature review from some journals carried out the data collection method [7].

Reasonable construction project control is needed in every construction work activity, but not all construction actors can apply it correctly. The risk of construction failure, if it is not identified and allowed to drag on, will affect the quality of the building and will most likely result in failure to achieve the objectives of the building [8]. The success of the project implementation carried out by construction service companies is always associated with which project objectives can be met, both on time, on cost, and quality, including construction [9].

Construction failure, according to Government Regulation No. 29 of 2000, is a condition where construction work is not by the specifications of the work as stipulated and has been agreed in the construction work contract either in part or whole [10]. Bridge construction projects have unique characteristics and are complex, thus encountering various types of risk. The risks can affect the project construction's cost, time, and quality. Risk events may occur due to several risk factors [11]. Given the structure of the flyover and this underpass is significant and usually large scale, it is necessary to do so an assessment of what types of risks may occur during the construction of the flyover and the underpass, especially in Indonesia at the stages of conception, planning, and execution opera [12].

Several problems are similar, such as administrative delays in contracts, quality of work out of specification, lack of funds for construction, construction cost overruns, and work delays. This is caused by several factors, such as limited resources [13]. As well as difficult geographic and topographical conditions, as well as understanding regarding the management of risk is very influential on the issues of the problem. Facts on the ground show that negligence has occurred caused of a lack of understanding of risk management. The ability to understand and identify potential issues that will happen in each Project stage impacts the project outcome. In planning construction projects, time and costs are significant to know [14].

## 2. Literature Review

in construction, there will be many obstacles in project completion, especially as bridges where careful planning is needed, initial preparation to increase success in projects that are not easy, Uncertainty is inherent, and risk is dynamic. As the project progresses, an ongoing risk analysis will be more useful [15]. Risk analysis should be applied to all stages of the project life cycle, from conception, feasibility, and design, through development to implementation, operation, and maintenance. Risk analysis's contribution at each stage is different but essential. Risk analysis should start at a very early stage of the project process and needs to be done frequently. Only with the help of an ongoing process of risk analysis can the short and long-term impacts of the identified risks be determined and updated, thereby assisting decision-making and project management [16].

Risk can happen from various activities or plans for a move. Project risk affects multiple aspects, such as time, Performance, and money. The importance of a management project is to help control and plan the manager's choices for which option is the best for the company of higher chances for success for the project for Internal and External benefits [17].

The steps of risk management that can help analyze the project risk to prevent any problem that can appear while it is still running:

1. Identify: Identification the risk that can have the potential for the project.
2. Assign Ownership: after identifying the risk, divide tasks and the responsibilities of the threat and opportunity that can appear while observing and analyzing the cause.
3. Analyze the problem: discussion is needed for the team to prevent the risk that can happen and find solutions for any mistake that has already happened.
4. Respond: act on the mistake that already happens at the project to protect the performance of the task and take steps to prevent the risk that can occur also
5. Monitor: monitor the risk and changes that have already been made and analyze again for the outcome generated from the created responses created [18]; [19].

The success of a project is to provide sound financial benefits for the contractor; for this reason, during project implementation, it is necessary to control project financing or strict cost control. The problem is the need-to-know indicators of cost deviations that impact decreasing project performance [20]. The success of the bridge project when viewed from the comfort of the users of the bridge and the safety factor on the bridge at the risk that the bridge will receive. Project delays will result from losses on the part of Contractors, Consultants, and Owners, namely:

1. Contractor, Delays in project completion result in increased overhead due to increased length of execution time. Overhead costs include costs for the company, regardless of whether the contract is being handled [21].
2. Consultant, the consultant will experience a loss of time and be late in working on other projects if project implementation is delayed settlement.
3. Owner's side, Project delays on the part of the owner/Owner mean loss of income from that building should be used or leased. If the owner is the government, for facilities in general, for example, the hospital, delays are detrimental to public health services [22].

### 3. Method

data is essential in conducting research where data is needed as a strength and as a guide in doing research [23]. The research process requires an apparent benchmark problem to find a solution for the problem by observing, identifying, clarifying, and executing the problem [24]. This study used the systematic literature review (SLR) method or a systematic literature review, i.e., a type of review that collects several research studies and summarizes them to answer research questions using rigorous methods. A systematic literature review requires a more thorough and well-defined, comprehensive, and defined approach in detail on the timeframe in which the literature was selected [25].

SLR method is carried out systematically by following the stages and protocols that allow the writing process articles to be protected from bias and subjective understanding of the researcher. The data collection technique used in this study uses objects in the form of books, documents, magazines, scientific journals, newspapers, and encyclopedias. The course of this research is through 4 stages, namely, 1) The stage of identifying relevant research, 2) The stage of systematically criticizing research reports, 3) The stage of synthesizing the findings, and the stage of understanding the study's conclusions. Analysis of the research method, namely literature review, which is a way of collecting data from journals where it will re-filter the results from some journals, which will produce conclusions about the consequences and reasons for the delay in building a bridge and conclude the difficulties and things that need to be considered when planning and building a bridge [26] [27] [28] [29] [30]. The data used is secondary data obtained using the help of articles in national journals. Step- steps used in systematic literature review among others: 1) planning, in this step it is formulated the next stage and sets the pe question research; 2) review, this stage focuses on searching the literature from various articles in the database, then article the articles are grouped according to their type; 3) documentation,

in step Here, all the findings obtained from the article Selected articles are written and described, The findings become the basis for answering research questions [31].

#### 4. Result and Discussion

Many risks can arise from various aspects; it is necessary to subscribe to these risks to minimize unwanted things from happening. The problems of a large project such as a bridge can be divided into internal and external. Internal aspects arise from the company itself, such as examples of management arrangements and schedules that could be more effective, and planning in implementation in the field is different. The difference with the external is that it is an error from outside the company, such as the availability of hard-to-obtain materials (suppliers) or bad weather problems. It impacts the work's progress and the surrounding community's conditions, which may influence the project.

Related to the many impacts that can result in a failure or delay in the construction process, especially in giant jobs such as bridge construction, an observation is needed of what impacts and errors can occur during bridge construction. The following are the results of data collection using the literature method, a review of the conclusions from several journals, along with the details:

Table 1. Summary of popular research

No	Title	Problem & Risk	Solution
1	Risk Assessment of Bridge Construction Project through cost management phases [32]	Risks to mega projects have significant value on the impact of their successful completion and the gains achieved. This study analyzes case studies of a 900 m-long bridge construction project. In this phase, the profit and risk levels are determined to complete the optimal project contract value; then, cost management is needed to help monitor the cash flow process.	Bigger projects tend to be riskier, so it's necessary to assess the value of bridge construction projects in the existence of a large potential risk is very necessary to help push the success of the project.
2	Highway Bridge Construction Resource Equilibrium Based on Genetic Algorithm Optimization Research [33]	The problem of starting a project arises from adjusting the project system in the initial project scheduling plan under the premise of a fixed project duration so that it can follow and adjust to the use of resources in the project.	Solutions to reduce project costs in the form of careful scheduling that needs to be planned carefully to be able to use existing resources to the fullest without the need to wait or idle existing resources so that project costs can be controlled and reduced to help in project finances
3	Infrastructure Development in Indonesia in Cooperation between Indonesia and China 2010 - 2018 [34]	Project owner certainly wants to finish this project within a short timeframe; however, due to the construction schedule projects that are too tight, complexity and the magnitude of the value of the project are considered out of sync with the setting of a schedule, which resulted in the withdrawal of the settlement process. There is a schedule and planning sequence of work in the process of preparation not systematically arranged, which results in too many contractor partners involved, and there needs to be more integration	The solution that is considered appropriate in overcoming obstacles and obstacles is that large projects need to be prepared carefully and have a timeline that is not too narrow even though they are pursuing a target of completion at a certain time so that a domino effect does not occur on other work. After that, coordination between project holders and contractors can also be avoided by relaxing the work timeline while maximizing the work that can be done in an extended time.

No	Title	Problem & Risk	Solution
		between the contractors. In terms of material and equipment, it was found that the material and the equipment used are not available according to what is needed.	
4	Analysis of Factors Causing Projects Delays Construction of Joyoboyo Bridge [35]	From the results of the study obtained by the data collection method obtained through the questionnaire method, the main problem was obtained from the main factors of the delay, which were caused by a lack of supervision and control on the project, which resulted in delays	From the results of the interviews and the data obtained from the Joyo Boyo Bridge project, it can be concluded what kind of acceleration measures will be taken which is conducted: <ol style="list-style-type: none"> <li>1. Carry out the erection process in a simultaneous and overlapping manner both on land and in rivers.</li> <li>2. Planning the preparation of Pre-order Material Precast</li> <li>3. Addition of workforce</li> <li>4. Do overtime system</li> </ol>
5	Optimization of Worker Assignments Using the Hungarian Method Modifications to the X Bridge Construction Project in the District North Central Timor [36]	Problems that are often encountered in construction are problems related to the selection of optimal and efficient use of resources. This problem is known as the assignment problem; the assignment problem is a problem regarding individual arrangements to carry out tasks so that the costs or time used for carrying out chores can be minimized costs and risks of delays in the project. This has an impact on the resulting outcome for the contractor in the opportunity to get the most out of the project by managing it effectively	from the results of research using the Hungarian method on the X bridge in North Central Timor District, which is recommended for research, use more work items, pay attention to the order of work, and be able to calculate using the help of software such as MATLAB. from the results of this study, it can be concluded that efficiently using labor from 29 days can be 25 days of work wages if it is managed properly and correctly.
6	Trade and Alternative Analysis Traffic Development Sawaibu Bay Bridge [37]	The main problem faced in West Papua Province is that there are still many road networks that have not been connected and several bridge points that have not been built due to the material requirements from suppliers to the place where the development project occurs being delayed in the time aspect, which can hinder work.	The resulting solution is in the form of a more regular order schedule manager as well as details in the schedule for ordering the goods needed and the selection of access roads that are more efficient in the delivery of materials and tools required for the project.
7	Bridges in a changing climate: a study of the potential impacts of climate change on bridges and their possible adaptations [38]	problems that arise from the effects of weather can result in field conditions from the time aspect and the quality of the project from the time aspect, delays can occur from delays in goods from suppliers, and inhibition of work which results in rain or extreme weather that makes it impossible to work.  From a quality aspect, if in the middle of concrete casting and while	Making a backup plan is needed at work locations with extreme weather which can help in providing solutions when having this kind of problem, such as what can be done if it rains when casting, can it be changed in time or speed up the casting work if there is a sign that it will rain.

No	Title	Problem & Risk	Solution
		work is going on and the occurrence of rain and extreme weather can have an impact on the quality of the bridge project if it is handled slowly.	
8	Implementation of Earned Value Concept in Replacement Projects of Nanga Samngut Bridge Kalimantan West [39]	Problems and obstacles often arise in the implementation of a construction project, and it is a normal phenomenon that must be anticipated for the project to proceed accordingly with a plan. For project implementation to keep going as planned, then control measures are needed, and an evaluation of the performance.	From the results of the discussion above can be taken the conclusion is Performance Time and Project Cost The project was carried out according to the conditions in which profit expenses incurred for the execution of work should be smaller than the budgeted cost should be issued by weight work that has been done.
9	Success Efficient and Efficient Factors Small Scale Land Procurement in Karanganyar District [40]	The problem is that small-scale land acquisition has not been regulated clear that there is no mechanism governing community refusal solutions both for location and land price, but the basis for land acquisition is for small scale. Only an agreement with the landowner. Small-scale land acquisition in Karanganyar Regency in the form of land acquisition for development purposes Wosusakas Regional SPAM and Kragan Bridge, where the procurement is carried out. The small-scale land has reached the stage of giving compensation.	Factors that assist in increasing the success of small-scale land acquisition for development in Karanganyar Regency, namely: 1) Arrangements regarding land acquisition planning for small scale shows that the essence planning and preparation in the stages of land acquisition by the government area. 2) Public consultation and socialization are a very important stage and must be carried out by the provisions in Article Law No. 2/2012 and Presidential Regulation governing land acquisition.
10	Evaluation of Bore pile Integrity Cross hole Sonic Logging (CSL) Method Development Balang Island Bridge II [41]	Problems begins when concrete is shot through a tremie pipe, will but the concrete cannot flow perfectly (happens blockage of concrete passing through the tremie pipe). Many things which cause this problem, including tremie pipes leak so that water seeps, concrete mixed with water causes the paste to disappear and leave aggregates clogged tremie pipe. Another problem to the cause of the blockage of the tremie pipe is the uniformity of the concrete mix is related to workability factor. Construction of cast-in-place drill piles situ) may experience some structural damage in the form of porous concrete, segregation of concrete material due to high vibration too strong or due to poor casting methods, leaching of cement material due to groundwater flow, cracking due to shrinkage of concrete, mixing of concrete with soil drilling mud	From the results of an evaluation of the integrity of the drilled pile with based on Cross hole Sonic Logging (CSL) method is obtained of the 17 poles tested, there was one pole that experienced. Abnormality namely poles number P1-64 with category P/D at the whole cross-section. Overall, it can conclude that the seventeen drilled piles tested. Showed good results, where the carrying capacity of each drill pole is still able to carry the same load exist with a sufficient factor of safety. For repair parts of the concrete that have defects can be done by coring and grouting methods.

No	Title	Problem & Risk	Solution
		(bentonite), and the cross-section reduction concrete (necking) due to the failure of the drill wall. This problem could jeopardize the performance of this foundation.	

The results of research from data collected from several different projects during the bridge construction using the literature review method can be concluded that seven problems arise from the internal and three issues arise from the outer side. The results of the chart above shows that the risks that arise from internal are very high compared to external; from the results of the research, it is obtained that internal threats occur from the most significant problems, namely planning and also arrangements in the field that are not mature and external risks that have an impact can be external impacts such as weather, people and road conditions in the area which result in a big challenge for development as significant as bridge construction.

## 5. Conclusion

The conclusion that can be obtained from this research is that bridge construction work has a very high risk in terms of quality, cost, time, and safety in the project. From some of the problems that have been collected from the results of other previous bridge projects, the main issues during construction can be detailed to help serve as a benchmark for avoiding these problems. These problems are divided into 2, namely risks, internal risks and external; these problems that have been described can give an idea of how much preparation and thought is needed to make a bridge to avoid hazards such as financial aspects, time, and quality and can also take lives. From the conclusions above, from the inner side, it can be specified that the internal ones that arise are caused by management that is not mature enough, such as in the field of planning and control of projects. Therefore the concluded solution is in the form of making a backup plan if things happen that are not wanted and also the need for deeper learning about bridge construction, such as examples of cases where the method of casting did not flow smoothly or which was beyond management's expectations in the field and from external aspects such as disputes from the surrounding community regarding the construction of the bridge, and extreme weather conditions that could effect on the schedule of the project and also the safety of the artistry that needs strict supervision. From the conclusion above, we can get that the bridge is a very complicated and large construction which is fatal if an error occurs in the quality and artistry. Therefore, it is recommended that deeper learning and more detailed planning of the construction work.

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