

# Feasibility Study of a Regulatory Bridge at Kannattupadam across Kurumali River

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**Abstract**— Regulatory bridge is a hydraulic structure to control the flow of water through a water body. It can also act a bridge for commuting between the two shores of the river across which it is built. The present study focuses on the feasibility assessment of the need of a regulatory bridge at Kannattupadam, across Kurumali River. Presently a temporary bund is built each year at the proposed site to accommodate both water storage and two-wheeler traffic between the two banks of the river. The transportation infrastructure across the river is very weak, especially during the wet season. The periodic construction of the temporary bund will finally result in land filling and is not a sustainable approach. Considering the above situation, the need for a regulator cum bridge feasibility study had been intense for a considerable amount of time, and it initially appears that such a project is highly beneficial for the development of the area in terms of improving water storage and transportation facility; The main objective of our work is to investigate about the feasibility of a regulator cum bridge for the storage of river water and benefit analysis of the proposed bridge was conducted based on traffic survey and questionnaire survey among the road users and the people residing in the proposed location. The estimation of the quantities needed for the construction of regulatory bridge was obtained in the quantity survey. The amount which is required for the construction of the bridge for the following quantities was also estimated. Cost benefit analysis of the bridge was done so that the feasibility study for the bridge could be completed.

**Keywords**— Regulatory bridge, Cost benefit analysis

## I. INTRODUCTION

One of the most valuable resources in the world is water. Around 70% of the surface of the Earth is covered by water, just 3% of which is fresh water suited for human use. About two thirds of water present on the surface of earth cannot be used since it is hidden in frozen glaciers. 3 billion people suffer water scarcity and billions of people lack access to a source of safe drinking water. Yet those who have access to clean, safe drinking water tend to take it for granted and misuse it. Physical and economic water shortages are both possible causes of water scarcity. When natural water supplies can't keep up with demand, it's said that there is a physical water shortage. Primary goal of the project is to store runoff water of Kurumali River so that it will be available to the community for diverse uses and to supply water for any

potential future water delivery schemes. Also, it attempts to raise the quality of the local groundwater, which will increase the water supply for surrounding wells. Due to its easy availability and rechargeability, ground water is an important source of water for supplying needs. Unfortunately, the amount of groundwater is diminishing daily. Groundwater management and development must be done in a sustainable manner by optimizing the construction methods and by the use of sustainable and less permeable concrete for the construction [1]. By storing river water, we propose to Kannattupadam ways to lessen the water shortage.

## II. RECONNAISSANCE SURVEY

Preliminary investigations are made under the following categories.

### A. Engineering surveys and topographical mapping:

Engineering surveys are carried out with precise surveying instruments which include plane table survey, triangulation survey, aerial and photographic surveys. The primary objective is to prepare a topographic map of the area which should enable it to determine the precise location of the regulator site, the water spread of the reservoir and its storage capacity and the arrangement of the lines of communication, highways and railroads for movement of material of construction, heavy machinery and equipment.

### B. Geological investigations:

These are carried out to determine the water tightness of the reservoir basin, nature of rock formation and depth of overburden, characteristic rock features like seams, faults and fissures and the quality of materials in overburden or of the bed rock. The investigations are carried out in two stages: (i) surface exploration and mapping of the general features and (ii) subsurface exploration carried out through open pits, tunneling or drilling in the sides and bottom of the valley.

## III. METHODOLOGY

### A. Data collection

For the purpose of designing the regulator we collected details regarding the surrounding area of the spot in order to calculate the demand of water for that area. The map of the river is collected from the Panchayath office. We interacted

with some people living on the banks of the river and its surroundings to know more about the river and to know about the water availability.

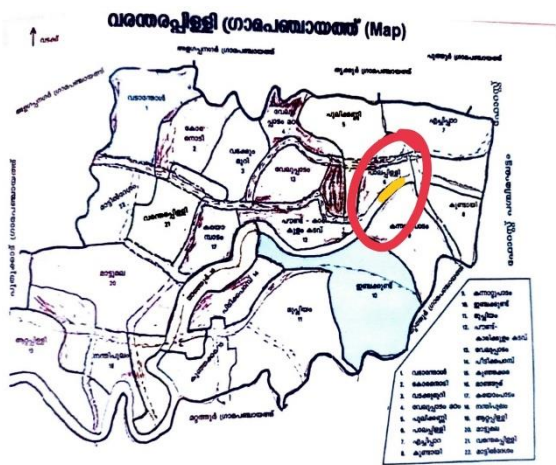


Fig. 1. Map of Varandarappilly panchayat collected form LSGD

### B. Surveying

Collection and gathering of information at the local level by conducting traffic volume and questionnaire surveys. Traffic volume survey is conducted for knowing the traffic volume in that area and that was conducted during a weekend and working day and traffic volume count is estimated in PCU units. The number of vehicles passing through the bridge was taken in a hourly interval for 12 hours on both days.

A questionnaire survey is a method for collecting statistical data about the characteristics, attitudes, or behaviours of a group by asking some or all of its members standardized questions. Surveys, which are primarily helpful for descriptive research since they cover a wide range of populations, allow us to examine the scope and type of variations in people's characteristics, attitudes, and behaviours that are caused by geography and society. Typically, the goal is to gather data that can be used for statistical analysis. As a result, the selection of respondents, the degree to which questions relate to underlying concepts, and completion rates are all taken into consideration. Always keep the questions as objective as you can. Asking for input on a specific product or service that is still in the ideation stage, for example, is not a good idea. Instead of providing their thoughts about their actual experience with the product or service, the customer would have to imagine how they may experience it in order to complete the questionnaire.

The methods, profession, and science of surveying involve figuring out how to locate points on the ground or in three dimensions, as well as how far apart they are from one another. The following goals are accomplished with it: To identify, quantify, and depict land, three-dimensional objects, points-fields, and trajectories, to compile and evaluate geographic data, to use that data for planning and effective management of land, sea, and any structures thereon, and to conduct study on and develop the aforementioned procedures.

### C. Study Area

In the Thrissur district of Kerala, India, close to Pudukkad town is a panchayat called Varandarappilly. It is 65 km from Kochi City and 22 km from the city of Thrissur. There are 27,343 people living in the 102 km<sup>2</sup> that make up the Panchayat region. The adjacent villages include Nandipulam, Mupliyam, Velupadam, Palappilly, and Kallayi. The close-by Panchayats are Puthukkad, Mattathur, and Alagappa Nagar. The Kurumali river borders the Palappilly (ward 6) and Kannattupadam (ward 9) of Varandarappilly Panchayat. The site is located at the border near to a hanging bridge at across the river.

## IV. FEASIBILITY STUDY

A number of surveying techniques are adopted to study the feasibility of the proposed regulatory bridge at Kannattupadam across Kurumali river. Three different types of surveying such as traffic volume study, questionnaire survey and dumpy level surveying were conducted as a part of the reconnaissance survey to understand the present scenario in the project area.

Traffic volume study was conducted as per the standard procedure mentioned in IRC:SP:19-2001 and IRC:9-1972 to assess the present count of vehicles regularly traveling through the area and to assess the need of bridge to facilitate the traffic requirements along with a water regulatory structure.

A detailed questionnaire was prepared to assess the need of a regulatory bridge at the proposed location. The target respondents were the road users, residents and the farmers in and around the area surrounding the project area.

A dumpy level survey was conducted along the shore line of the Kurumali river near Kannattupadam to calculate the vertical levels and the horizontal extent along which the proposed structure is to be built.

### A. Traffic volume study[7]

During a predetermined time period, a traffic volume study counts the number of vehicles using a specific road or crossroads or intersection over a specified period of time. The study typically involves collecting data on the number of vehicles and the types of vehicles using the roadway.

The data collected during a traffic volume study is used for the design of new roads or the modification of existing roads to improve traffic flow and safety. The study may also be used to inform decisions related to land use planning, environmental impact assessments, and transportation policy development.

The study that had been conducted in this project involves collecting data on the number of vehicles passing through an existing bridge near Kannattupadam which is currently used for transportation purposes at the proposed project site. Traffic volume count had been taken on a weekday and weekend from 7:00 am to 7:00 pm. Survey that had been conducted on the weekend, 04/11/2022 (Sunday) showed 777 two-wheelers, 88 three-wheelers, 170 cars, 2 truck/minivans, 13 buses, 2 tractors and 29 pedestrians had used the bridge. The peak hour of traffic volume had been observed between 9:00 am and 10:00 am. The survey conducted on weekday, 08/12/2022 (Thursday) revealed 653 two-wheelers, 107 three-wheelers, 91 cars, 17 truck/minivans, 16 buses, 2

tractors and 7 pedestrians had used the bridge for transportation. The peak hour of traffic volume had been observed between 4:00 pm and 5:00 pm.

### B. Questionnaire survey

A questionnaire survey is a research technique used to gather information about a certain topic or issue from a large number of people. A series of questions are often included in the survey in order to elicit detailed information on respondents' knowledge, views, beliefs, attitudes, and behavior.

The minimum number of responses required for a questionnaire survey depends on the goals of the study and the statistical power required for the analysis. There is no fixed minimum number of responses for all studies as the sample size required depends on the population size, variability, and effect size. In general, the sample size should be large enough to ensure that the results are statistically significant and representative of the population being studied.

This project work questionnaire is conducted to both genders, male and female and up to 194 responses are collected, that is 91 male and 103 female. From the survey the majority of responses highly recommends the need of a regulatory bridge in the area of study. The analysis is presented below.

- The analysis of age groups who responded for the survey, it is observed that around 15 % were students and around 70 % of the respondents were working class.
- Based on the responses from the road users it can be concluded that local people and people from nearby town Palappally is travelling through this bridge to places on the other side of the bridge such as Vellikulangara, Kundai etc.
- About 50% of the respondents are currently using a bridge which showcases the need of the bridge for the day-to-day activities of the people living in and around that area.
- More than 70% respondents are using the bridge at least once or more than twice a day which shows the need of bridge in that area.
- More than 58% of the respondents supported two-wheeler over bridge at the proposed location and around 20% of the respondents supported for light vehicle over bridge.
- A few disadvantages suggested in the questionnaire were supported by the respondents. The main disadvantage of the present temporary bund is it cannot use all the year.
- All the respondents supported the need of regulator cum bridge among them more than 60% strongly agreed the need for bridge.
- More than 80% of the responses show that the bridge constructing should be made in such a way that vehicles can pass through it, in which more than 45% strongly agreed.

### C. Levelling

Before beginning to build roads, dams, or other constructions, levelling is one of the most crucial aspects of surveying. Finding a point's elevation in relation to a datum level that is above or below the earth is the focus of this area of surveying. Dumpy level, Tilting level, Wye level, Auto level are some of the instruments used for leveling.

In this study we used Auto level as the instrument. An automatic level is an optical tool that is used in conjunction with a levelling staff to establish or check points in the same horizontal plane and to establish the relative heights of objects or marks. It is frequently used in building and surveying to transfer, measure, and set heights of known objects or markings.

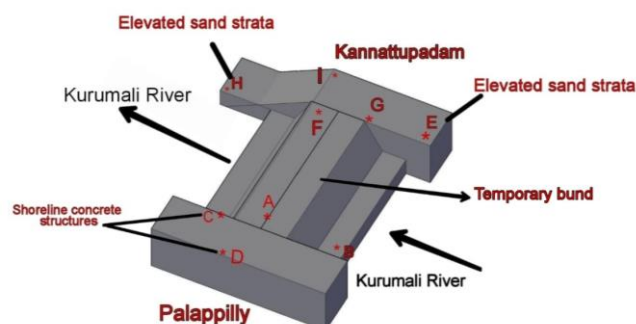


Fig. 2. Shoreline points at which reduced levels are calculated.

In this survey, the instrument was fixed on one bank (Kannattupadam) and sighted the other and took four levels and took levels on the same bank as of the instrument. Then fixed the instrument on the other bank (Palappilly) and took five levels on the other bank and one level on the same bank as of the instrument. Point C was fixed as the benchmark and reduced level of C was taken as +100. The reduced levels of other points were obtained using height of instrument method.[4]

Table 1 Calculation of Reduced level

Point	Back Sight	Intermediate sight	Fore sight	Height of instrument	Reduced level
C	1.40			101.40	+100
A		1.4			+100.005
D		2.82			+98.58
E		1.37			+100.03
B	4.13		3.89	101.64	+97.51
E		1.65			+99.99
F		1.76			+99.88
G		3.12			+98.52
H		3.13			+98.51
I			1.6		+100.04

Foundation level was fixed by conducting the auto level which is + 95.01. The stream bed level was also obtained from the surveying conducted which is +96.01. The level of road for transportation is also established as +103.81.

### V. QUANTITY SURVEYING AND ESTIMATION

The management of costs and quantities associated with building projects, including materials, labour, equipment, and other resources, is done through quantity surveying. The task of controlling and calculating the expenditures of a construction project falls to quantity surveyors from the beginning to the end.

Estimation is the process of determining the approximate cost of a project or a particular task within a project. Estimation is an essential aspect of quantity

surveying, as it involves determining the costs associated with the different stages of a construction project, including design, procurement, construction, and maintenance.

In this project quantity surveying as well as estimation is done for the regulatory bridge across Kurumali river at Kannattupadam. The structure is divided into different structural modules and then each module is then further divided into several other items for easy identification from the structural drawing. Volume of each module is calculated based on the dimensions recommended as per the design considerations in the reference work [5] as well as based on standard design practices. After calculating the quantity of material for a module the material used for construction of that structure is calculated.

Table 2 Quantity surveying

Sl. No	Description	Amount Rs (in Lakhs)	Remarks
1	Total cost by calculation of all quantity	469	The volume of entire structure is considered
2	Labour cost	93	Consider 20% of total cost
3	Sub Total	563	
4	Water charge	5	Consider 1% water charge
5	Sub Total	568	
6	GST	79	
7	Sub Total	648	
8	CPOH	97	Consider CPOH as 15%
9	Sub Total	746	
10	Cess	7	Consider 1% cess
11	Total Amount in Lakhs	753	

## VI. COST BENEFIT ANALYSIS

In order to identify the best cost-effective solution for a given project, a cost-benefit analysis (CBA) is a method that estimates the project's expenses and benefits. The costs and advantages of the following are assessed by an effective CBA. Direct costs, indirect costs, intangible costs, opportunity costs, and expenses associated with possible risks are only a few of the costs. There are both direct and indirect benefits to a project. The structural design of the regulatory bridge is beyond the scope of the work hence the same has been adopted from an MTech project thesis [8] and the design proposed in the thesis and the standard design as per the published books and journals [2],[3],[6] are used for the quantity surveying and valuation of the proposed project.

### A. Benefits

The benefits of the proposed project are assessed with the help of traffic volume survey and questionnaire survey conducted in the proposed Kannattupadam area near Kurumali river. The benefits based on the survey are listed below.

- Increase the transportation facility across the bridge by providing two lane roadways for the local people.
- Groundwater replenishment can be done more effectively in summer seasons
- Availability of the water can be ensured throughout the year.
- Overutilization of resources can be avoided.

- Yearly construction of temporary bund can be avoided.
- Can considerably reduce the distance and time to travel.
- Regulate the flow of water in downstream.

### B. Cost

The cost of the project is assessed based on the quantity surveying conducted for the proposed regulatory bridge. The valuation of the same had been done and the total cost of the project is calculated to be Rs 7,53,50,000.00

Considering the direct and indirect benefits and the cost of the project it can be concluded that the proposed project is beneficial to the inhabitants of Kannattupadam particularly for the farmers around the area as well as for those who commute regularly between Kannattupadam and Palappilly.

## VII. CONCLUSION

This work is the feasibility study of constructing a regulatory bridge across Kurumali river at Kannattupadam. There are four objectives based on which the work was conducted and all the objectives are achieved. The scope of the project includes traffic survey and questionnaire survey at the proposed site. Based on which the benefits of the proposed bridge are listed and analyzed.

The feasibility study of the project is to be conducted by a traffic volume survey around the study area and questionnaire survey among the local people to assess the need and benefits of the proposed regulatory bridge. Major benefits of the project are identified based on the traffic volume study and questionnaire survey.

The topographic survey was conducted to assess the reduced levels for the proposed bridge. The alignment of the proposed bridge is adopted from the temporary structure at the site which is being rebuilt every year as per the requirement of the native people. The reduced levels of the bridge are determined based on the dumpy level surveying conducted at the site and the drawing of the same is prepared in AutoCAD and included in the project. It has been used while deciding the vertical extent of the structure in the quantity surveying.

The quantity surveying of the proposed regulatory bridge is conducted to calculate the cost of the project. The structural design details are adopted from the reference [5] and the quantity surveying and valuation of the same has been conducted. The approximate cost of the structure is assessed to be Rs 7,53,50,000.00.

The cost benefit analysis of a proposed regulatory bridge. The benefits are listed based on the traffic survey and questionnaire survey. It cannot be converted in terms of money as a few of the benefits are intangible. The cost is presented based on the latest rates from [8] Considering the cost and benefits in terms of tangible and intangible benefits the authorities may take suitable decision to proceed with the proposal.

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REFERENCES

- [1] Imad Shakir Abbood, Sief aldeen Odaa, Kamalaldin F. Hasan c, Mohammed A. Jasim “Properties evaluation of fiber reinforced polymers and their constituent materials used in structures – A review,” *Materials today: Proceedings* vol. 43 part 2 ,pp 1003-1008 ,2021
- [2] G. L. Asawa, *Irrigation and Water Resources Engineering*, New Delhi, India, New Age International(P) Ltd., 2006.
- [3] Santhosh Kumar Garg, *Irrigation Engineering and Hydraulic Structures*, 19th Edition, New Delhi, India, Khanna Publishers, 1996.
- [4] N N Basak, *Surveying and levelling*, New Delhi, India, Tata McGraw Hill Education Private Limited,1994..
- [5] Aiwin Levi, Alaka Menon, Angel Mariya Joseph, Sayooj K D , Investigation and design of regulator cum bridge at Kannattupadam across Kurumali river, July 2020
- [6] Delhi Schedule Of Rates 2014, The Authority of Director General CPWD, Nirman Bhawan , New Delhi.
- [7] IRC: 9-1972, *Traffic Census on Non-Urban Roads*, The Indian Roads Congress, Jamnagar House, Shahjahan Road, New Delhi, 1989.
- [8] PRICE software, e Platform for management of public works, Government Of Kerala. [https://price.kerala.gov.in/price3\\_pmu/](https://price.kerala.gov.in/price3_pmu/)