Infrastructural Rejuvenation for Tourism and Heritage Project in Kerala

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Abstract – *Kottayam (a district in Kerala state) is one of the exotic backwater sites which attract tourists throughout the year. Being a mountaineous region with scenic landscapes, backwaters, bird sanctuaries, temples and churches make this a place of tourist attraction. However, it had not made its full potential into a reality. The Government of Kerala plans to facelift one of the places that is used to be the livewire of the town- Kacherikadavu. Kacherikadavu, located 2 kms from one of the greatest attractions of the town-Thirunakkara Sree Mahadeva Temple, Kottayam, used to be the boat station of the region till around two decades ago. The old waiting shed and parcel office, which were built during the reign of Travancore rulers, exist there even now. In this paper, we explain how to develop Kacherikadavu as a heritage tourist spot. We plan to accompany the Government in transforming Kacherikadavu as a place of tourist attraction. The work is scheduled to be conducted in several stages which include site visits, feasibility studies and surveying of the area, followed by soil exploration studies. It is also intended to submit a design proposal to Government based on various studies. This work will mark the initiation of the contribution to the people of the state by using our gained knowledge in making Kacherikadavu as a place of socially and economically relevant one.*

Key Words*: *Tourism, Heritage Project, Pile foundation

1. INTRODUCTION

Tourism is a pure definition of travelling for recreation and leisure. It is a major source of income for many countries and it affects the economy as well [1]. Over the decades, tourism went through a continued growth and deepening diversification to become a major and one of the rapidly growing economic sectors in the world. Modern tourism is closely linked to development and encompasses a growing number of new destinations. Ultimately, these dynamics have turned tourism into a key driver for socio-economic progress. Kerala is one of the most popular tourist destinations in India and is known for its ecotourism initiatives. This study aims in restoring the lost glory of Kacherikadavu in Kerala, one of the landmark entry points to the eastern hinterlands of the erstwhile princely State of Travancore, is all set to be regained if an ambitious project by the Water Transport Department gets implemented. A thriving civilian landing spot for the boats that carried much of the traffic by the inland waterways during the yesteryear, had fallen on lean days with the rise of road transportation and interplay of conflicting interests.

Kacherikadavu is located near Kodimatha, Kottayam in Kodoor River. It is very close to the main attraction of the town –Thirunakkara Sree Mahadeva Temple. Kacherikadavu is selected for the boat jetty due to the closeness of the place to the town. The availability of hotels near Kacherikadavu also makes it an apt place for the tourists. In addition to these, there is lack of a good walkway in the town. So, the government of Kerala is taking serious action to develop the area into an attractive place for tourists as well as for local residents to spend their time along the river side [2].

The Project in Kacherikadavu is a relevant project as it aims at transforming Kacherikadavu into a tourist attraction [3]. The Kerala Government is taking all possible steps in developing the available resources in the State in the cheapest way possible to attract more tourists to the state. As a part of this, several tourism projects are being planned and several had been implemented. With the fall of water transportation, the kadavu (jetty) had turned into a cesspool with drains from Thekkumgopuram, the town and the KSRTC areas draining into the Kodoor River via Kacherikadavu.

The Department of Water Transport has nearly 50 cents of land at the jetty and in addition the State government has abandoned land adjacent to their land. The jetty lies at the head of nearly 1500 m canal from Kodoor River and the entire canal has now turned into a marshy mass on account of piling of the garbage carried by the drainage. The dilapidated image of Kacherikadavu boat jetty is been shown in the Fig-1. The project hopes to clean up the canal, establish a treatment plant, and beautify the area into a heritage site with ornamental lighting, pedal boats, restaurants, parking area and terminals for houseboats and motor boats.

In its new avatar, Kacherikadavu could emerge as the centre of inland water tourism industry in Central Travancore.

Fig -1: The dilapidated Kacherikadavu boat jetty

The survey and the soil studies are one of the main objectives of the project. The Survey includes Land Survey and also the contour survey of the area. Land survey will be conducted using total station. Soil studies including Atterberg Limits, Triaxial Test and Consolidation will be done [4-8]. The Results obtained from the Soil Studies will be submitted to the Water Transportation Corporation for Evaluation. Based on the results obtained from the soil studies, proper design will be planned. The Architectural design of the boat jetty and also a structural design of the foundation of the boat jetty will be proposed. The Architectural design will include the structures like Boat jetty, Walkways on both side of the canal, watch tower, Hanging Bridge, Coffee Shop, Children's Park, water sports terminal etc.

2. METHODOLOGY

The methodology includes the following steps:

A. Feasibility studies
B. Site Visits
C. Surveying
D. Soil investigation
E. Architectural design

A. Feasibility studies

Feasibility study is an evaluation and analysis of the potential of a proposed project which is based on extensive investigation and research to support the process of decision making. It is an analysis and evaluation of a proposed project to determine if it is technically feasible, feasible within the estimated cost and whether it will be profitable. It was conducted with an objective - unbiased approach to provide information upon which decisions can be based.

B. Site Visits

Three site visits were conducted at Kochi International Marina & nearby Boat Jetties, Kumarakom boat jetty and Kollam boat jetty, port. The following figures (Fig-2, Fig-3, Fig-4, and Fig-5) show the visited places.

Fig -2: Boat Jetties along Marine Drive

Fig -3: Kochi International Marina

Fig -4: Walkway at Kumarakom

Fig-5: Kollam Boat Jetty

C. Surveying

The surveying was conducted at the site using total station as it is the most accurate and user friendly survey. Instrument Used- Leica TS02: 405 series (Fig-6). The instrument was setup at two sites and the readings to the prism reflector were taken. Also, it provides clear idea

about the boundaries of the boat jetty, the configuration of the ground and also to know the contour levels at the location. The data which was obtained from the Total Station were transferred to the computer system and with the help of LISCAD software.

Fig -6: Total Station Leica TS02: 405 Series

D. Soil investigation

The soil investigation consists of various soil tests according to Indian Standards to calculate the engineering properties of soil for the foundation design.

The bearing capacity can be determined from the SPT value. So, suitable foundation is determined according to the bearing capacity.

a) **Atterberg Test** - The consistency of a fine grained soil is the physical state in which it exists. It is used to denote the degree of firmness. A fine grained soil can exist in four, namely, liquid, plastic, semi-solid o solid state. The water content at which the soil changes from one state to the other are known as consistency limits or Atterberg's limits.

Sample 1

Liquid Limit of The Given Soil, W_1 = 27%

Plastic Limit of given Soil Sample, Wp = 22.91

Plasticity Index, I_p = 4.09

Toughness Index I_t = 0.44

Since Ip of the given sample is 4.09, soil is Non plastic

The Fig -7 shows the graph of number of blows versus moisture content for the sample-1

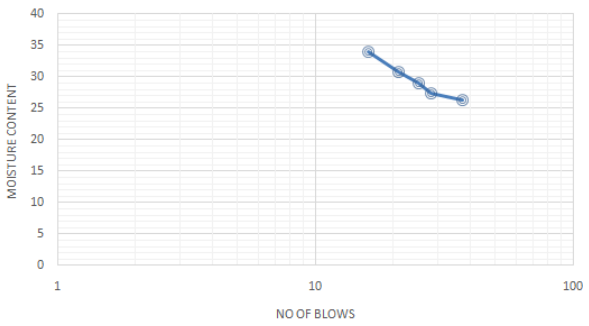

Fig -7: Sample 1-No. of blows vs. Moisture Content

Sample 2

Liquid Limit of The Given Soil, W_1 = 29.3%

Plastic Limit of given Soil Sample, Wp = 24.32

Plasticity Index, I_p = 4.98

Toughness Index I_t = 0.17

Since Ip of the given sample is 4.98, soil is Low Plastic

The Fig-8 shows the graph of number of blows versus moisture content for the sample-2

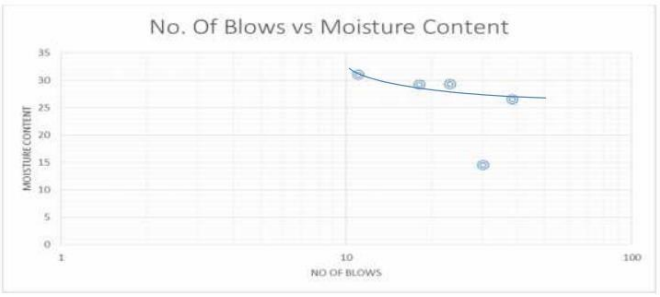

Fig -8: Sample 2-No. of blows vs. Moisture content

b) **Consolidation Test** - It is a process by which soil decreases in volume. it is the process in which reduction in water takes place by expulsion of water under long term static loads.

Sample 1

The Fig-9 shows the Square Root Time Fitting Graph for the sample-1. The C_v value obtained from the graph below is $7.13x10^{-4}$ m^3/s

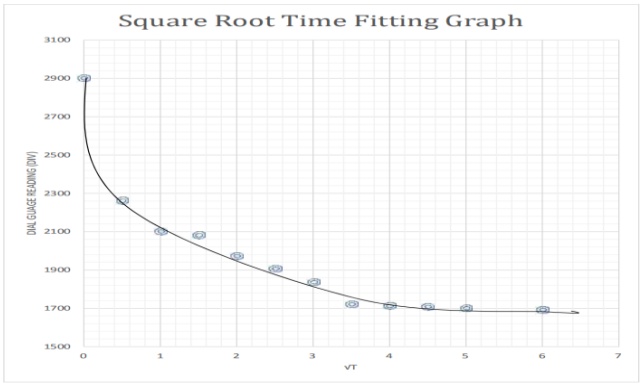

Fig -9: Sample 1-Square Root Time Fitting Graph

Sample 2

The Fig-10 shows the Square Root Time Fitting Graph for the sample-2. The C_v value obtained from the graph below is $6.14x10^{-4}$ m^3 /s

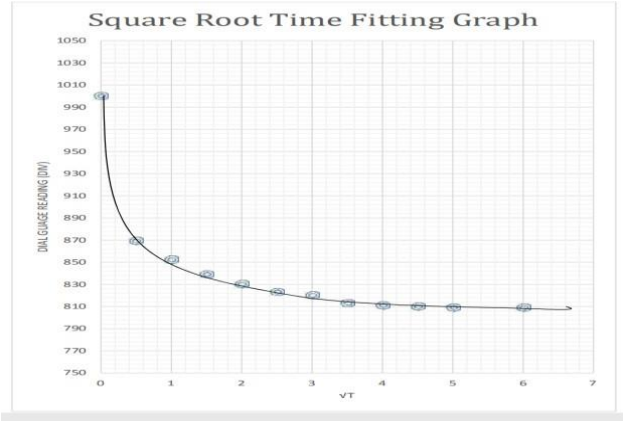

Fig -10: Sample 2-Square Root Time Fitting Graph

c) **Unconfined Compression Test** - This test is conducted only on clayey soils which can stand without confinement.

Sample 1

The Fig-11 shows the Stress Strain Graph for the sample-1. The soil sample is very stiff, since it has a compressive strength of 311 KN/m^2.

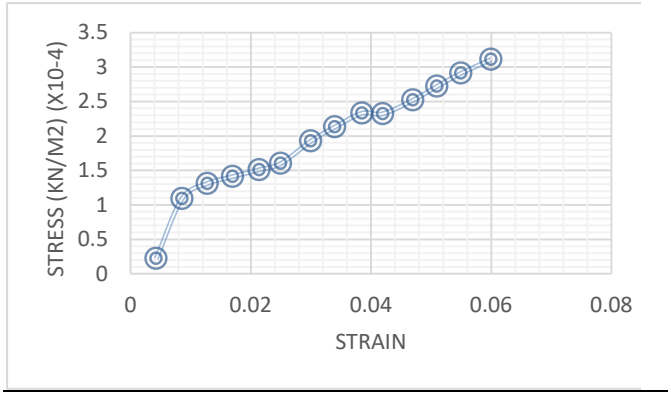

Fig -11: Sample 1-Stress Strain

Sample 2

The Fig-12 shows the Stress Strain Graph for the sample-1. The soil sample is hard, since it has a compressive strength of 604.1 KN/m^2.

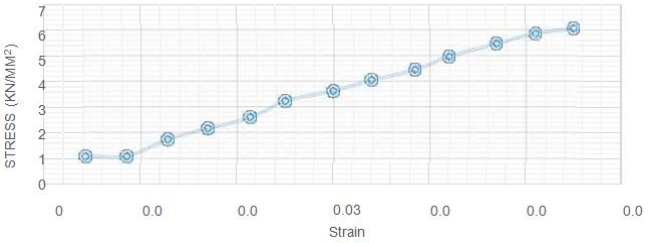

Fig -12: Sample 2-Stress Strain Graph

d) **Triaxial Test** - A Triaxial shear test is a common method to measure the mechanical properties of many deformable solids, especially soil (e.g. sand, clay) and rock, and other granular materials or powders.

Sample 1

The Fig-13 shows the Stress Strain Graph for the sample-1. The values obtained from the graph as follows:

Graph Cohesion, c = 2 KN/mm^2
Angle of internal friction, $\Phi = 15.5^0$

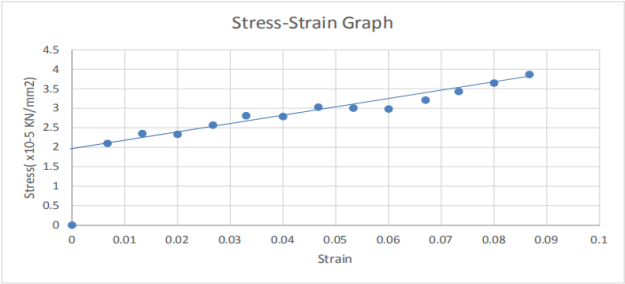

Fig -13: Sample 1-Stress Strain Graph

Sample 2

The Fig-14 shows the Stress Strain Graph for the sample-2. The values obtained from the graph as follows:

Graph Cohesion, c = 0 KN/mm^2
Angle of internal friction, $\Phi = 33.33^0$

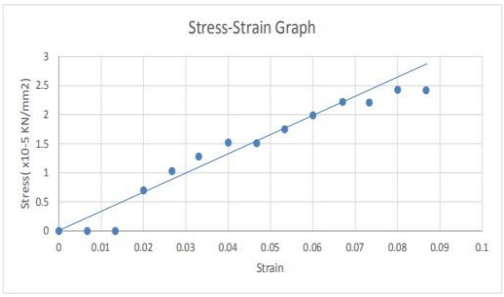

Fig-14: Sample 2-Stress Strain Graph

E. Architectural design

The Fig-15 shows the proposed architectural design for Kacherikadavu boat jetty.

Fig -15: Kacherikadavu Survey Plan

3. RESULT AND DISCUSSIONS

A. Design of Pile Foundation

The foundation is designed for the bored cast in situ RCC Piles. The concrete piles are so called because the material used for making the pile is concrete. Piles may be plain or reinforced concrete. They may have advantages of not being liable to decay. They are not subjected to destruction or deterioration under the influence of termites etc. they are unrestricted in length. The concrete piles have higher bearing capacity and hence the number of piles required will be less than the number of timber piles and hence it requires a foundation of lesser size. They need not be cut below the low water mark.

(i) The recommendations given above are based on the soil data as revealed in the boreholes actually taken at the borehole points. Variations if any at other points should be closely monitored during execution. Modifications should be made in the design, if necessary.

(ii) Recommendations made are specific for the proposed building suggested and static imposed loads. Alternate solutions may have to be considered once the column loads are known.

(iii) All the provisions in the Code of Practice IS: 14593-1998 and IS: 2911-2010, Code of Practice for Design and Construction of pile foundation shall be closely adhered to.

(iv) Every care shall be taken while setting out the pile locations and eccentricities shall be avoided.

(v) Structural capacity of the pile shall be adequate.

(vi) The load carrying capacities specified for piles are based on the minimum depth of socketing specified in the relevant IS codes. This shall be provided without fail.

(vii) Use of temporary casing during piling is advantageous. A minimum casing depth of 3m shall be adopted. Larger depths of casing are preferred.

(viii) Pile integrity test result may be used as an acceptance criterion.

(ix) Compressed air flushing may be employed to clean deep boreholes.

(x) Cutting tool/chisel used for piling should have the same diameter as the pile.

The Table-1 shows the structural detailing element for the pile design foundation proposed for the boat jetty.

Table -1: structural detailing element for the pile design foundation

Structural detailing element	Diameter (mm)	Centre to centre spacing (mm)
Longitudinal Reinforcement	25	50
Lateral reinforcement	8	160
Lateral Reinforcement near pile head	8	50

Lateral reinforcement near pile ends	8	60
Spacer forks and lifting holes	25 @centre	1500
	32 @ free ends	1500

Reinforcement diagram of the pile foundation is shown below in Fig-16.

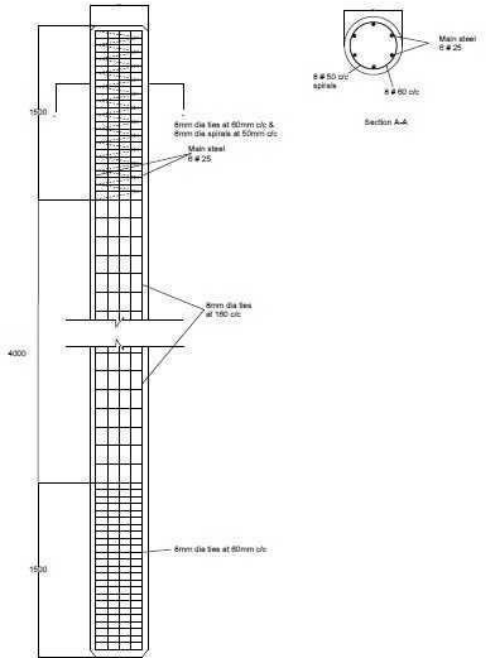

Fig -16 Reinforcement diagram

4. CONCLUSION

The execution of the work gave an insight into field condition which very much enhanced the practical experience of onsite conditions in excavation, boring and to meet the challenges outside the syllabus. The soil investigation consists of various soil tests according to Indian standards to calculate the engineering properties of soil for the foundation design. The study concludes that a pile foundation would be a safe and economical solution.

A combined design of pile in clay as well as pile in sand had to be considered. The soil investigation was completed to the best one. The building specifications were obtained and a general design was given to the structure for the foundation load calculation. The safe bearing capacities of piles of various diameters are calculated according to the soil investigation report even though the IS code specifies that a minimum of three piles are to be provided under a column, from economic and practical considerations the number of piles are limited to one pile.

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