Scientific Journal of Impact Factor (SJIF): 5.71
e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 6, Issue 09, September -2019

# MECHANIZED CONSTRUCTION TECHNIQUES FOR URBAN ROAD BRIDGE

(A Case Study of Vadodara City)

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**Abstract**: *As the day's advancing so is the technology and with the modernization there is an enhancement in construction and there are several advanced techniques in construction and so are the project acquired in such dedicated project. As we are conducting a case study of VMC project in Vadodara city so that we can find out the uses of mechanized equipment's for today's construction.*

## 1. INTRODUCTION

- A structure facilitating a communication route for carrying road traffic or other moving loads over a depression or obstruction such as river, stream, channel, road and railway is known as BRIDGE. It is constructed for purpose of providing passage over the obstacle. They allow people or vehicle to cross from one side to another. The communication route may be a railway track, a tram way, a road way, a foot path, a cycle track or a combination of them.

1.1COMPONENTS OF BRIDGE

1. SUPERSTRUCTURE

- It consists of structural members carrying a communication route. Thus, handrails, guard stones, and flooring supported by any structural system such as beams, girders, arches and cables above level of bearing constitutes of the bridge.

1.2 CONSTRUCTION OF BRIDGE IN VADODARA

- In Vadodara, the roads are very congested as per the population of city. So, it has become difficult to communicate easily. There are lots of junctions which lead to traffic jams. Solution to this is construction of bridge. For e.g., From Manisha cross road to Genda circle.

## 2. LITERATURE REVIEW AND STUDY.

- Modern bridges began with the introduction of industrially produced iron. They have evolved over the past 200 years as engineers came to better understand the possibilities inherent first in cast iron, then in wrought iron and structural steel, and finally in reinforced and prestressed concrete. These materials have led to bridge designs that broke completely with the designs in wood or stone that characterized bridges in Industrial revolution. In prehistoric times the first bridges were made my spanning the small streams with the help of logs of wood. Later, suspension type bridges were made by twisted creepers tied to tree trunks. The efforts were followed by lintel bridge consisting of a large piece of stone resting on two or more small pieces of stones. Later the timber bridge such as in medieval times were used, afterwards stone bridges and metal bridges were constructed. In ancient India, the period of Ramayana construction of bridges was well known. As per Ramayana "The son of Vishwakarma was the first bridge engineer who successfully constructed the 'Great Causeway' were the stone floats on the water. This bridge was popularly known as SETU SAMUDRA. In pre-British India, there used to be masonry arch bridges in the plains and a primitive type of rope suspension bridges or timber bridges in hilly areas. In those tines the construction of bridges depends mainly on the type of material locally available. Then in modern era of India, the railway bridges were constructed over the rivers. Further there has been a continuous search for the most effective design and construction technique.
- From literature studies of many researchers it has been found that to make communication of people and vehicles the bridge is to be constructed.

## 3. TECHNICAL PARAMETERS

- Length of Bridge: 3511 m
- Width of Bridge: 40 m
- No. of lanes: 4 to 6 lanes
- Average height of Piers from bottom to Pier cap: 6m
- Rise: 7.5 m up
- Fall: 7.5 m down
- Length of Girder: 25 m
- Foundation: 1.0/1.2 m dia. Bored cast in situ piles for bridge portion.
  : 0.75 m dia. bored cast in situ piles for Approach portion/open foundation.
- Width of Carriageway: 12.150 m for three lanes with extra widening at curvature, 7.50 m for two lanes, the up and down lane shall be with min. 3.75 m carriageway width or as required by client during execution, with crash barrier on both side, and other provisions required.
- Landscape Area: 23,840 m²
- Minimum Height: 5.5 m

## 4. OBJECTIVE OF STUDY

- Our aim of this case study is understanding latest construction methodology that is:

### 1. MANAGEMENT OF MATERIALS

The four primary materials used for bridges have been wood, stone, iron, and concrete. Of these, iron has had the greatest effect on modern bridges. From iron, steel is made, and steel is used to make reinforced and prestressed concrete. Modern bridges are almost exclusively built with steel, reinforced concrete, and prestressed concrete. From this project we will learn about the different materials used in every components of bridge.

### 2. MANAGEMENT AND OPERATION OF EQUIPMENTS

Different equipment's are used according to its purposes. For earthwork digging purpose excavator, dozer, compacter, etc. are used. For lifting heavy materials cranes are used such as tower crane, cable crane, tractor crane, truck mounted crane.

### 3. MAN POWER REQUIREMENT

- Work is done by machines but the skill comes from man's mind. The construction work is completed under the observation of civil engineers, architecture, workers, co-workers, equipment drivers, etc.

### 4. COST OF BRIDGE

The overall cost of bridge under our case study is 220 Crore.

## 5. SCOPE OF STUDY

- Learn the design process.
- Improving skills associated with collecting data and drawing meaningful conclusions.
- Recognize the necessity of good communication skills for engineers by completing memos, reports, drawings, and presentations.
- Experience the usefulness of concrete test.

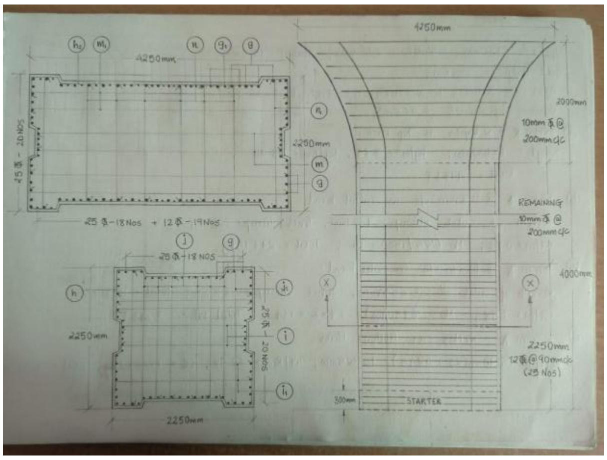
 

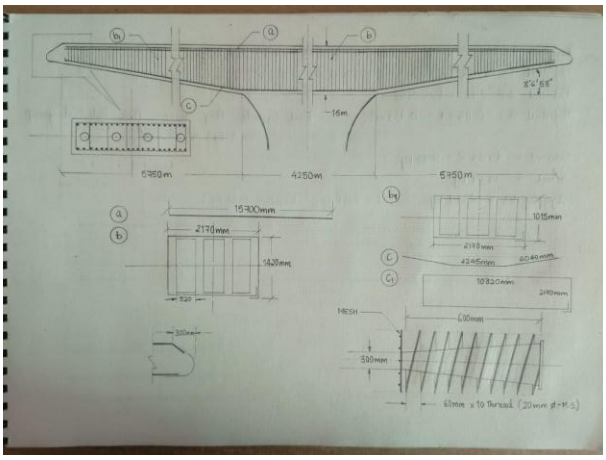
## 6. DESIGN OF PIER

- Piers are also known as intermediate supports between two abutments to overcome the load and deflection of span.
- Piers also contribute the load transferring to the soil.

❖ **We have calculated loads acting on pier and volume of concrete. We will compare it with the actual data later on when it will be calculated by architectures and engineers.**

- Height of pier : 5.5 m
- Width of pier : 2.25 m
- Length of pier : 2.25 m
- Volume of pier = 5.5*2.5*2.5
  = 28 cu. m
- Quantity of cement = 890 kg.
- Quantity of sand = 1424 kg.
- Quantity of aggregates = 2314 kg.
- Type of soil: Clayey.





**Volume of concrete required for pier cap and pier:**

- Area of triangle of pier cap
  =1/2 * 5.75 * 1.5
  = 4.31 sq. m
- Volume for two triangle sections
  = AREA * LENGTH
  =4.31*2.25s
  =9.69 cu. m
- For two sections
  =9.69*2
  =19.38 cu. M

- Central rectangular portion
  =2.25*2.25*1.5
  =7.59 cu. m
- Total pier cap quantity
  =19.38+7.59
  =26.97 cu. m
- Volume of concrete in pier
  =2.25*2.25*5
  =25.31 cu. M

- Dead load(D.L.) of each span = 2000 KN
- Live load(L.L.) of one span = 1000 KN or 350 KN
- Braking force = 140 KN
- Wind pressure on pier = 2.4 KN/ sq. m
- Density of concrete = 24 KN/ sq. m

1. D.L. and self-weight of the pier.

D.L. from supports
=2*2000
=4000KN

D.L. of pier
=volume*density
=2.25*((2.25+2.25)/2)*7*24
=850.5 KN

Total load
=4000+850.5
=4850.5 KN

Compressive stress @ base
=p/n
=4850.5/(2.25*2.25)
=958.12 KN/ sq. m

2. Stress due to eccentric live load.

Moment @ base
=1000*0.5
=500 KN*m

Sectional modulus (Z)
=I/y
= (2.25*2.25*2.5)/6
=1.9 cu. m

Max. Stress = (P/A) + (M/Z)
= (1000 / (2.25*2.25)) + (500/1.9)
= 460.68

3. Stress due to longitudinal breaking force.

Moment @ base
=140*7
=980 KN*m

Stress = (M/Z)
=980/1.9
=515.78 KN/ sq. m

Stress @ base = 515.78 KN/ sq. m

4. Stress due to wind pressure.

=area*density of wind
= ((2.25*2.25)/2)*7*24
=378 KN/ sq. m

Assuming the wind intensity acting at the height of pier.

M = 378*3.5
= 1323 KN*m
Z = (2.25*2.25)/6
= 0.84
Stress = M/Z
=1323/0.84
=1575 KN/ sq. m

## 7. CONCLUSION

- Hence we conclude that the utilization of time is less than the time required for the construction of bridges is less than the few years ago, due to introduction of mechanized equipment's and techniques in the construction field.

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