Construction Technique of Railway Under Bridge By Box Pushing Method At Gouribidnur (Karnataka): A Case Study

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Abstract- *In last few years, considerable attention has been given to the use of superplasticizer as a chemical admixture in cement concrete mixture. However, the use of chemical admixtures in cement concrete is a very common solution to achieve high performance concrete. The past researchers have been underlined the use of chemical admixtures imparts the desirable properties to the cement concrete in both fresh and hardened state.*

This thesis work has been made an attempt to study the influence of the superplasticizer dose of 0.5, 1, 1.5, 2 and 2.5 percentage on the performance of the cement concrete, by using superplasticizer we can reduce the water demand of concrete mix.This study utilizes the Conplast sp430 which is a superplasticizer; it is used in the concrete mix with variable quantity i.e. 500 ml – 2,500 ml per 100 kg of cement. The use of superplasticizer helps in reducing the utilization of water and it also increases the strength of the concrete. The use of superplasticizer also helps in preservation of the environment by saving the water. The main objective of this research is to determine that what percentage the superplasticizer can be used in the concrete mix to achieve its target mean strength. The experimental tests for fresh and hardened properties of concrete for M25 grade are studied and the results are compared with normal concrete. In this ongoing research work it is concentrated on the use of superplasticizer for reducing the water demand in the mix. A series of tests were carried out to determine the slump value, compressive strength and flexural strength with and without addition of superplasticizer, the result shows that the increase of superplasticizer dose in the cement concrete mixture leads to gain of good ability in addition to slump. Additionally, there is also slightly increase in the compressive strength as well as flexural strength than that of normal concrete.

The Strength of cement concrete is a very important characteristic. This thesis investigated prior studies on the compressive strength and flexural strength of cement concrete as it relates to water-cement ratio, aggregate-cement ratio, aggregate size, quantity of admixture and compaction and compares those results with results obtained in laboratory experiments conducted on samples of cement concrete cube casted for this purpose.

I. INTRODUCTION

1. PROJECT DESCRIPTION:-

1.1 Introduction:-

The Site of the project comprises the section of National Highway 234 commencing from NH/Design Chainage Km: 364.360 to Km 365.670 near Gauribindanur in the State of Karnataka.

It Includes:- Construction of Proposed 4-Lane RUB and its Approaches in Lieu of Existing Level crossing No.41 at Km 365.110 (Railway chainage 73/2-3) on NH-234 at Gauribindanur bypass in the State of Karnataka by Box Pushing.

1.2 Index Map and Location plan of the Project:-

1.3 Salient Feature Of Project:-

Project	Construction of Proposed 4-Lane RUB and its Approaches in Lieu of Existing Level crossing No.41 at Km 365.110 (Railway chainage 73/2-3) on NH-234 at Gauribidanur bypass in the State of Karnataka.
Authority Engineer	Executive Engineer National Highway Division (Tumkur)
Employer	Ministry of Road Transport & Highway (MORTH), Government of Karnataka, National Highway Zone Bengaluru.
EPC Contractor	Ghai Construction Limited.
Section	From km 364+360 to 365+670
Length of the Project	1.31 KM.
Date of signing of Agreement	26-03-2018
Appointed Date	14-06-2018
Construction Period	24 Months (till 13-06-2020)
Site Comist of ---	
a. VOPs	2 Nos.
b. Box Culvert	1 No.
c. Pipe Culverts	2 Nos.
d. RUB	1 Nos.
e. Main Carriageway	1.31 km
f. Service Road	1.036 km (total Length)
Original Contract Amount	48.69 Crores (to be escalated as per EPC agreement)

1.4 Scope of Work In Project:-

1. Land:-

The Site of the RUB project comprises the land as described below:

S. No.	Existing Chainage (km)		Existing ROW (m)	Remarks
	From	To		
1	364.360	365.670	30	-

2. Dates for providing Right of Way:-

The dates on which the Authority shall provide Right of Way to the Contractor on different stretches of the Site are stated below:

S. No.	Design Chainage (Km)		Length (m)	Proposed ROW (m)		Dates for Providing ROW
	From	To		LHS	RHS	
(i) Full Right of Way						
1	364.360	365.225	865	15	15	On appointed date
2	365.355	365.670	315	15	15	
(i) Part Right of Way (Part Width)						
1	365.225	365.355	130	15	15	On appointed date
(ii) Balance Right of Way						
1	365.225	365.355	130	7.0	11.50	150 days from appointed date

3. Width of project highway and RUB:-

The width of highway and RUB shall be as below:

S. No.	Stretch	Type	Width (m)	Remarks
1	Approach section	Carriageway	2 x 11.0 1 x 11.0 2 x 10.5	400 m 725.50m 149.50m
		Crash Barrier/Railing	0.5	
		Earthen shoulder	2x1.5	
		Slip Road	2x3.750	
		Raised Median	4.0	
		Drain Cum footpath	2x1.5	
		Total	15 to 29	
2	RUB proper	Carriageway	2x10.5	Two independent Box cells (Length 35m)
		Crash Barrier/Railing	-	
		Edge Strip	-	
		Drain Cum foot Path	2x1.50	
		Median	4.0	
		Total	28	Total width of RUB includes 2x14.40+1.6(clear median gap)
3	Service Road	Carriageway	2x3.750	
		Earthen Shoulder	2x1.5	
		Crash barrier	2 x 0.5	Over Retaining wall

4. Realignments

Realignments are proposed at the following locations:

S. No.	Existing Chainage (Km)		Design Chainage (Km)		length (m)
	From	To	From	To	
1	-	-	364.360	365.670	1310

5. Service Roads/Slip Roads:-

Service roads/Slip roads shall be constructed at the locations and for the lengths indicated below-

S. No.	Design Chainage (Km)		Length (m)	Side	Remarks
	From	To			
1	364.560	364.840	280	LHS & RHS	-
2	365.232	365.470	238	LHS & RHS	-
3	Connecting village road to approaches on Madhugiri side		200m	-	-

6. Intersections:-

Major Intersection

S.No.	Design Chainage (km)	Type of Junction	At grade /Grade Separated	Road Leads to	Cross Road Type	Remarks
1	365.210	Rotary Junction	Grade separated	Dodballapur, Gauribidanur bypass road, Ap Border side	SH-9	Refer Plan

Note: Junction development includes development of Junction roads for a length of 200m on either side of VOP.

Minor Intersection

S.No.	Design Chainage (km)	Type of Junction	At grade /Grade Separated	Remarks
1	364.844	Rotary Junction	Village Road	At overpass location

7. Type of pavement:-

Type of pavement shall be flexible pavement. Rigid Pavement shall be considered for approach of limited height subway.

Sl.No	From (Km)	To (Km)	Length (m)	Type of pavement	Towards	Portion
1	364.360	364.460	100	Flexible	Madhugiri	Tapering
2	364.460	364.560	100	Flexible	Madhugiri	Straight
3	364.560	365.093	533	Rigid	Madhugiri	Retaining wall
4	365.093	365.128	35	Rigid	RUB	RUB
5	365.128	365.470	342	Rigid	AP Border	Retaining wall
6	365.470	365.570	100	Flexible	AP Border	Straight
7	365.570	365.670	100	Flexible	AP Border	Tapering

8. Roadside Drainage:-

Drainage system including surface and subsurface drains for the Project Highway shall be provided as per section 6 of the Manual. RCC covered drains with foot path shall be provided in the following stretches.

S. No.	Design Chainage (Km)		length (m)	Side	Remarks
	From	To			
1	364.560	365.198	638	LHS & RHS	-
2	365.222	365.470	248	LHS & RHS	-

9. Additional New Culverts:-

The following new culverts shall be constructed for width equal to the roadway width of the project highway & as per typical cross section given in the manual.

S.No.	Existing Chainage (km)	Design Chainage (km)	Proposed Spans/Openings (m)	Type of Culvert	Remarks
1	-	365.514	1x2.00x2.46	Box	-
2	-	Approach of VOP	1x1.2	Pipe	-
3	-	Approach of VOP	1x1.2	Pipe	-

1.5 AIM:-

Aim of the study is to identify the reasons which are important deciding factors for selection of the construction technique in a project

1.6 OBJECTIVE:-

Objective of the case study is to :

- Analyse the quantities of items (works) prepared in road estimator software.
- Analyse the construction schedule program prepared in ms project software.
- Comparing the project construction cost & construction time factors for both rob & rub construction.
- Checking the best fit viability of construction technique to be adopted based on construction cost & construction time.

II. LITERATURE REVIEW

A. Prasad and C. Panduranga Reddy, 2009 "While western world and the U.S have plunged into recession, But Indian Economy is being affected by the spill-over effects of the crisis (Chidambaram 2008) due to great savings habit among people. The most important lesson that we must learn from the crisis is that we must be self-reliant. Though World Trade Organization (WTO) propagates free trade, we must adopt protectionist measures so that recession does not affect our country."

Jayamani, M. And Dr. Asima Nusrath, 2011 "In the present situation, apartment system is appropriate in terms of accommodating more houses and people within reasonable costs. Land market situation, especially in the high income residential areas are already undergoing transition in architectural design. It is most likely that this change in the construction design may pass into the moderate income areas in the second stage and lastly, it may appear even in the low income residential areas. Traditional single housing system will eventually become costlier for construction and maintenance for a single owner."

Aviral Kumar Tiwari, et. al 2011 & 2013 "This study had examined the direction of causality between economic growth and construction flows both in static and dynamic framework. Subsequently, we incorporated those breaks dates in co integration analysis. Co integration analysis revealed that there was strong evidence of long-run relationship between economic growth and construction flows.

The results suggest that for the short-run, Indian government can focus on the development of construction sector as it increases GDP. However, in the long-run Indian government should gradually cut down her budget expenditure on construction sector. The work can be extended further by analyzing the issue under a multivariate framework"

Robin et al., 2009 T. Robin, G. Antonini, M. Bierlaire, *et al.* "The need of today is not just the pumping of liquidity in to the Indian economy but also in addition the injection of demand. The biggest challenges before India are to ensure monetary and fiscal stimuli work. Over the next year, source of growth should shift to manufacturing and possibly are covering agriculture."

Rakesh Sakale Hirendra Pratap Singh, 2018 Now a day's infrastructure construction increases due to development of our country. It requires large numbers of management staff & labours with high performance. Because as the performance of team increases, its work should be efficient and safely without any disturbance. Generally, a construction team consists of owner, Project Manager, Engineer, contractors and labour. Each team member has a definite role and responsibility about the project. The performance of team depends upon the

working of each team member because if any member do not obey his work then it affect on whole team work. Therefore the performance of team decreases. So for that it is necessary to act each team members as per the goals & objectives. The performance of the team can be increased by pre planning the well goals & objectives and using the simple methods for construction which reduce the confusions on team minds and makes the work safely. It is also increases with good leadership, relationship, proper communication and coordination. The purpose of this study is to identify performance of success which can help project teams to reach their intended goals with greater efficiency and the work completed within the estimated time and cost. To achieve objectives of this study, a response level table is designed on basis of objectives using a comprehensive literature review for the survey in two major residential construction projects. The response level table includes total main 7 factors which are team leadership, team goals & objectives, management support, roles & responsibility, team task processes, team relationship, team communication related and 31 sub response points. By taking personal interview, data collected according to response level and rating is given to each point. Rating is done by means of scoring from 1 to 5. Five gives high like response while one gives unsatisfactory response. A comparison is made between the two projects and suggestions are given to increase the performance of the team. From the study I conclude that the performance of team increases with developing the seven characteristics and solving the problem during the construction by the higher authority and maintaining good environments for the work.

The project entitled analysis and design and execution of cross traffic works in railways using box pushing technique (RUB), illustrates about the work to be carried out for the widening of existing roads using box pushing techniques for rail under bridges. It also explains about the methodology involved in execution of box pushing technique. The design will be carried out as per Indian standards, particularly Indian railways standards, IRC, IRS, and IS CODES. In which the design of major components thrust bed, precast box used for the widening are done as per IRS codes. The design of pre-cast box is done using STAAD pro, it also includes the layout of reinforcement details of two important structures used in this method apart from conventional method i.e., thrust bed (main bed and auxiliary bed), pre cast box (A. **L. M. Kamakshi & A. Gayathri Devi, 2016).**

The topic entitled about issues involved during exaction of Railway under bridge using box pushing technique and its remedies, illustrate about the method of execution of railway under bridge and issues involved during execution by box pushing technique for widening of existing roads and its remedies. It also explains about the methodology involved in application of box pushing technique for construction of RUB (Railway under bridge). This topic primarily gives attention towards problems that arises during execution and its resolution **(K. ASUDULLAH KHAN, 2016).**

The project entitled analysis and design and execution of cross traffic works in railways using box pushing technique (RUB), illustrates about the work to be carried out for the widening of existing roads using box pushing techniques for rail under bridges. It also explains about the methodology involved in execution of box pushing technique. The design will be carried out as per Indian standards, particularly Indian railways standards, IRC, IRS, and IS CODES. In which the design of major components thrust bed, precast box used for the widening are done as per IRS codes. The design of pre cast box is done using STAAD pro, it also includes the layout of reinforcement details of two important structures used in this method apart from conventional method i.e., thrust bed (main bed and auxiliary bed), pre cast box. In railways whenever there is a need to make a underpass ,either for canal crossing, RUB'S(Rail under bridges), programme of widening existing railway culverts etc.BOX PUSHING TECHNIQUE is used. Since the work has to be done without interruption to rail traffic, box pushing technique is largely favoured in comparison to conventional methods. Present day Intensity of Traffic, both Rail & Road due to the fast development, is very heavy it cannot the disturbed, for construction of under bridges or Canal Crossings, drainage etc by conventional i.e. open cut system. Box Pushing Technique is developed where in R.C.C. Boxes in segments are cast outside and pushed through the heavy embankments of Rail or Road by Jacking. Keywords: Cross Traffic Works, Box Pushing Technique, Rail Under Bridge (RUB), IRC, IRS, IS Codes (**M.A.Rahman1, G. Raju, 2018).**

The intersection of railway track and the road at the same level is referred to a level crossing. In the urban areas the level crossing are generally monitored by qualified railway personnel who monitor the train movement and close the level crossing gate to stop the interfering road traffic but such closing of gates leads to congestion in road traffic and also causes loss of time to road users. Road under bridge and road over bridge are considered as solutions for avoiding level crossings of roads and railway track. There are 3 main methods in construction of road under bridge. Box pushing method, Cut and cover method, Rolling technique using RH girder. In this we discuss about the implements, soil friction, effects required, capacity of jacks and there uses, skew angles and at square angles **(Ranjeet. P1, D.V.S. Narshima Rao2, Mohd Akram Ullah Khan3, K. Hanumanthu, 2016).**

The project entitled analysis and design and execution of cross traffic works in railways using box pushing technique (RUB) ,illustrate about the work to be carried out for the widening of existing roads using box pushing techniques for rail under bridges . it also explains aboyt the methodology involved in execution of box pushing technique .The design will be carried out as per Indian Standards ,particularly Indian railway standards, IRC, IRS, IS CODES .In which design of major components thrust bed, precast box used for the widening are done as per IRS codes. The design of pre cast box is dome using STADD PRO, it also includes the layout of reinforcement details of two important structures used in method apart from conventional methods i.e. thrust bed (main bed and auxiliary bed), pre cast box **(Priyanka M. Rajput et. al 2019).**

2.4 CONCLUSION

Previous chapter, we have discussed on the impact of recession. To work on any research, we need to have the literature review also to know the history and current happenings in the industry. In this chapter we will discuss the literatures on the global recession, the measures taken by the Indian government. Some Indian construction companies are surviving in the current crisis, the literature printed on these companies is also mentioned.

III. METHODOLOGY ADOPTED

3.0 Methodology Adopted:-

3.1 Understanding of the Project:

Bidder's understanding of the project as per Project Profile which is also delineates the various activities of work envisaged to the executed.

3.2 **Mobilisation:**

3.2.1 Mobilisation of personnel and equipment to carry out the initially scheduled activities will be started soon after the appointed date. All preparations shall be made in advance from the time we have been chosen as the successful binder and further vigorously, upon receipt of Lol so that work on the project does start on the "appointed date"

3.2.2 Personnel will be mobilised to address the initial contractual requirements such as, Temporary Camp, Plant and equipment, micro level planning, identification of material quarries & sources including procurement arrangements etc. to commence the project work as per schedule.

3.3 Work Plan:

The work plan is enclosed here with:

The work will be started simultaneously on several fronts.

The work will progress in this manner and at least at four locations including culverts, VUP, RUB and Retaining wall.

During the entire process the contractor shall interact with local traffic authorities to co-ordinate management of traffic during the construction phase, wherever it is essential.

IV. QUALITY CONTROL SYSTEM

4.1 QUALITY CONTROL SYSTEM:-

Purpose of Quality Assurance /Quality Control (QA/QC)

Quality Assurance / Quality Control (QA/QC) manual has prepared to describe to the organization and operational structure of the construction of the project and to present the general procedures and guidelines to be followed by this organization and operation structure in carrying out all aspects of the Construction tasks related to implementation of the contract works. QAS can be described as a set of doCumented process, which seek to provide confidence that the project output with fulfillment of the functional requirement. The quality System should encompass the organization, responsibilities, human resources, materials, equipment, processes, inspections, testing and other parameters of the project.

Every effort has been made to design this manual so that adherence to its guidelines will result in efficient, safe and consistent supervision of the works in strict conformance to the specifications and the contract requirements. This has led to the basic frame work of this manual being based on construction supervisor procedures consistent with standard international practice for high way widening construction project projects of this type, with specific guide lines and forms, Where appropriate, being generated based on standard practice in India in conformance with MORT&H and IRC. In all cases, however, it is important that all users of this manual understand the contract doCuments including the specifications are the controlling doCuments for the construction supervision process.

This system need to be implemented through the actions of the staff of project team in order to comply with

establish quality system, policies, Standard Operating Procedure and record keeping requirements.

Objective of the System

The QA/QC manual is devised with an objective to facilitate and overall coordination between the offices situated across the locations, the project sites and the project coordination office. After analysis of the data received by the project coordination office, a

MIS report can be generated by material engineer and sent to site offices in order to get an overall view of the project performance. This will enable site offices to work in tandem with one another and shall be successful in providing good quality of works.

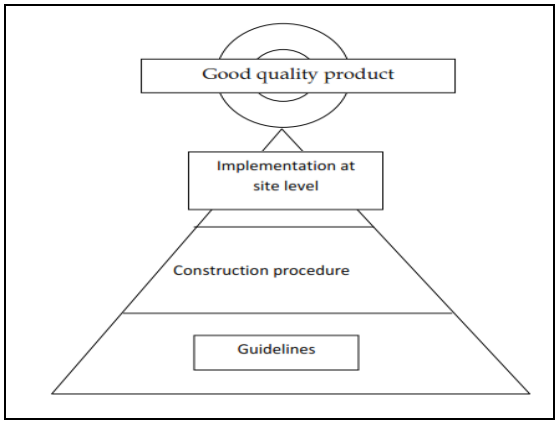
This doCument is an effort in this direction and shall enable day-to-day codified information exchange across project office. This will help in:

- Overall smooth coordination between offices
- Quicker compilation of project activities
- Instant –ready information for report generation
- Analysis of activities in regards quality of wish
- Substantiation of contribution made by CPM/ME to the site Engineers, to ensure the work complied with quality.

Quality Policy

The Quality policy initiated by management to ensure the achievement of goal i.e. Quantity delivered with quality to the entire satisfaction of customer. The aim of the management is "customer satisfaction is our motto". We, the management, adopt "Right decision in right moment is the best"; hence we are Decisive. We, the management are result orientated to the fullest satisfaction of the customer. Prevent increase in cost, if it is inevitable, minimize the impact. Reduce the construction time, and if not, maintain the schedule. If there is slippage persists, minimize the intent of slippage. Improve the quality to make it world standard without affecting the cost. Failure must not occur till final inspection.

Necessity of quality system



System Flow – Directions

A. System shall follow the route described in the operational flow chart below, which is self-explanatory on the system functioning. It can be implemented in following ways.

- Any **regular** or **surprise** voluntary site visit by a Consultant team member/staff can trigger the system. If fact, it is likely to be implemented in this manner alone as part and parcel of the duties and responsibility of the team members / staffs of the contractor. Every interaction between the site office (involved in any of the project activity) and head office (Narsinghpur) should be doCumented through this structured system. The mandatory / necessary number of visits for inspection is as defined for the project in the Frequency of Inspection list or Inspection Test Plan.

And

- A **request** from Contractor / Concessionaire to the Independent Engineer for Drawing / DoCument approval (DoCuments can be Methodologies, formwork design calculations etc.) or site inspection and construction work approval through **RFA/RFI** following certain progress at the construction process.

For example, whenever there is site clearance activity or reinforcement of foundation is in place and concreting to be started, the IC personnel should attend the site location as per the Request for Inspection details provided by the Contractor/ Concessionaire. Again, if there is a drawing submitted by Concessionaire, it has to be checked and approved IE authorized personnel.

B. At the time of every site visit or office interaction with site office, the Consultant team member / staff should be familiar with and ascertain what are the contractual requirements, Project quality assurance system,

environmental impact related statutory law. The IE site staff shall proceed with relevant checklist(s) along with the MIS Entry fields at the top of every checklist. Proper codification as described in this doCument and/or as developed from time to time should be followed *strictly* infilling up the formats & checklists, especially the data fields for MIS entry. This adherence to the codes specified is necessary to transfer the classified data into computer and also to achieve success with the overall objective of the system.

C. In case of any non-conformity from approved procedure and standards, Non- conformance report (**NCR**) should be issued by the Team Leader. The Concessionaire must address the issue with their concerned personnel and rectify the problem pointed out by Concessionaire. After proper modifications as suggested in the NCR, the Contractor / Concessionaire must submit a Corrective Action Report (**CAR**) along with a RFI for IE site visit and approval.

D. The filled up data is to be submitted to the Team Leader everyday, who after verifying the contents will give his comments and pass them to the operator on a day-to-day basis.

E. Staff deputed at distant/remote locations can submit the filled checklists for Chief Project Manager comments as per their convenience or after a delay as decided by the CPM based on their location and accessibility.

F. The computer operator / EDP person shall enter the MIS information from "**For MIS entry**" marked area daily, from the completed checklists, Non-Conformance Reports (if issued) and Corrective Action Report to the computer in specified entry format named MIS LOG.

Notes:

- Under normal conditions, latest by 2nd day including the Inspection Date, the compilation of MIS entry should reach HO, First day – site visit, Second day – CPM validation
- However, transmission of data to main office is done on every working day with the information passed on to the EDP operator on the previous working day.

Notes/ observations if any by the field Staff can be written on the backside of the checklists

V. RESULT & CONCLUSION

1. Analysis of quantities of items prepared by road estimator software.
2. Analysis of construction schedule prepared by ms project software.
3. Estimation of the Railway under Bridge is prepared by taking the rates from the CPWD Schedule of rates.
4. It has been found that the construction time required for Railway Under Bridge is very less as compared to the construction of Railway Over Bridge.
5. It has also observed that the cost of construction for the Railway Under Bridge is economical than Railway Over Bridge.
6. Finally it has been concluded that the viability of Railway under bridgeby box pushing method is adopted for construction of railway bridge.

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