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Management of Concrete Road Construction in Rural Area – A Case Study

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Abstract — In India rural road connectivity is a key component of rural development, since it promotes access to economic and social services, thereby generating increased agricultural productivity, non-agriculture employment as well as non-agricultural productivity, which in turn expands rural growth opportunities and real income through which poverty can be reduced in the country. The importance of rural development is identified and proved since ancient times once road communication is started development of civilization. Over the period of time the road construction technology developed its quality of road development significantly. The study is carried out using the survey methods, selected Karla village district Wardha as case study. The primary research literature survey was carried out related to the rural road network development, construction methodology, management techniques, study of government schemes for rural road development, concrete roads construction in Karla village in particular, use of software tools for rural road development management. The construction of the road is a part of the rural road development program known as 'PradhanMantri Gram Sadak Yojna'. Construction methodology and various management aspects such as planning, (using MSP) material planning and management, contract management, safety management, quality control and quality assurance were studied.

Keywords-planning of concrete road construction, management aspects, micro-soft project

I. INTRODUCTION

“A community without roads does not have a way out”

In India rural road connectivity is a key component of rural development, since it promotes access to economic and social services, thereby generating increased agricultural productivity, non-agriculture employment as well as non-agricultural productivity, which in turn expands rural growth opportunities and real income through which poverty can be reduced in the country. The rural roads in India form a substantial portion of the Indian road network. These roads are in poor shape, affecting the rural population's quality of life and Indian farmer's ability to transfer produce to market post-harvest. Over 30 percent of Indian farmer's harvest spoils post-harvest because of the poor infrastructure. Many rural roads are of poor quality, potholed, and unable to withstand the loads of heavy farm equipment. The study is carried out using the survey methods, selected Karla village district Wardha as case study. The primary research literature survey was carried out related to the rural road network development, construction methodology, management techniques, study of government schemes for rural road development, concrete roads construction in Karla village in particular, use of software tools for rural road development management. The construction of the road is a part of the rural road development program known as 'PradhanMantri Gram SadakYojana'. Construction methodology and various management aspects such as planning, material planning and management, contract management, safety management, quality control and quality assurance were studied. The Karla village is situated into Wardha district and comes under the grampanchayat. And the construction of road in Karla village is developing under the government scheme Pradhan Mantri Gram Sadak Yojana.,The road is about 400 m long & the important building nearby vicinity is Zillha Parishad School. The Pipari Meghe Gram Panchayat consists of two villages, Pipari Meghe & Karla. Both villages are interconnected with roads.

II. SALIENT FEATURE OF STUDY

Name of the project: Construction of Cement Concrete road at Karla Village, District Wardha, Maharashtra

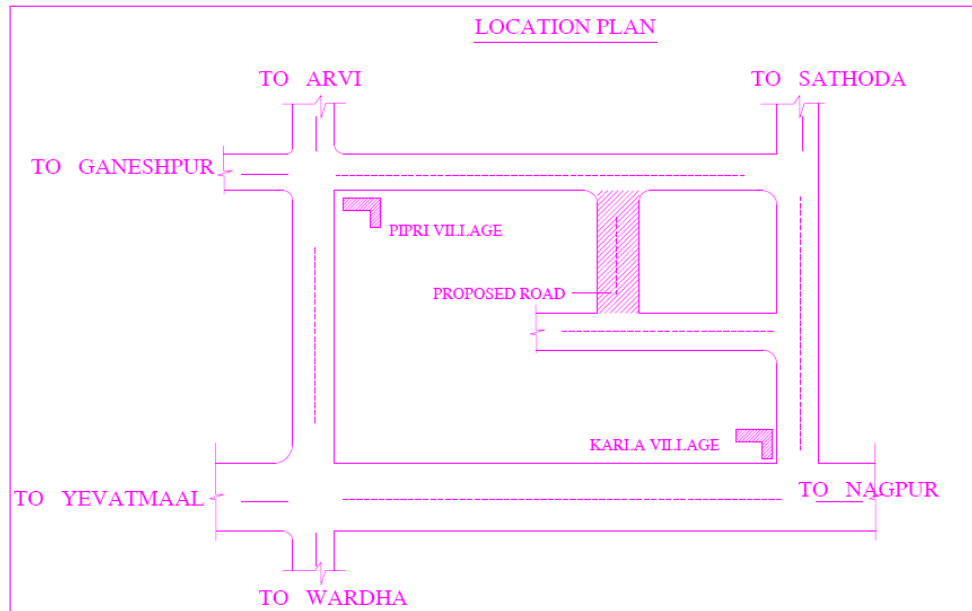


Figure 1.1. Location map

Cost of project: Rs. 18, 20, 200/-

Client: Public works department, Wardha

Consultant: ACE Engineering services, Nagpur

Contractor: Sajal Engineering Works, Sevagram, Dist- Wardha

Source of funding: State government and Central Government under “Pradhan Mantri GramSadak Yojna”

Date of commencement: 17 January 2015

Defect liability period: 12 months from the date of completion of work

Performance bank guarantees: 10% of the Total Project Cost

Design life: For concrete roads the design life is considered as 20 years

Total length of project: 400 m proposed road as shown in fig above

Geometric Design of Concrete Road:

- The Geometric Design have been proposed as per IRC SP-20
- Roadway: The Roadway width is proposed 6.00m
- Carriageway: The Carriageway width is proposed 3.00m.
- Design Speed: The minimum design speed 30 Kmph.

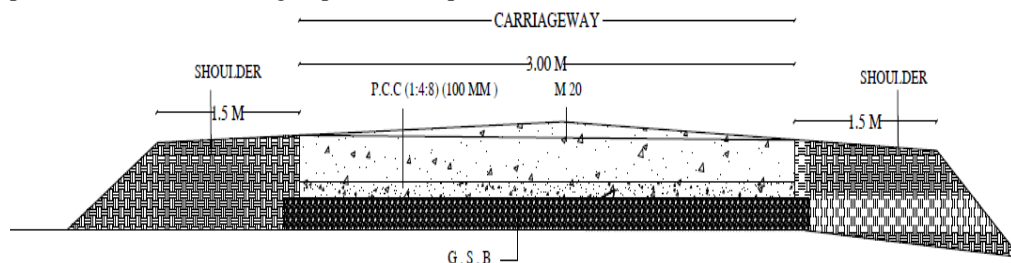


Figure 4.2. Cross section of road

III. SITE SURVEY

A site survey is an inspection of an area where work is proposed, to gather information for a design or an estimate to complete the initial tasks required for an outdoor activity. It can determine a precise location, access, best orientation for the site and the location of obstacles. The type of site survey and the best practices required depend on the nature of the project. The table 4.1 shows preliminary site survey information regarding construction of concrete road.

Table 4.1. Preliminary site survey information

1	Selection of alignment	The suitability of the existing track as the final alignment is examined, and need for avoiding sharp kinks and dwellings is explored.
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2	Soil survey	Samples of local soils are collected and tests like grain-size analysis, moisture-density relationships and CBR are carried out.
3	Material survey	The source of materials for forming the embankment, pavement layers and cross-drainage structures are identified and their leads established.
4	Pavement Design	Considering the soil strength, traffic and design life, pavement thickness is determined. Its composition is selected after exploring the ways to maximize the use of local materials.
5	Preparation of road drawings	Alignment Plans, Longitudinal Sections and Cross-sections are prepared.
6	Selection of specifications	The specifications for various items of work are selected, keeping in view need to adopt intermediate technology.
7	Estimation of quantities of items of work	Detailed quantities of each item of work are worked out.
8	Analysis of Rates	The rates for each item of work are analyzed.
9	Estimate	The estimated cost is arrived.

3.1 Preparation of Drawings

The following drawings were prepared after the preliminary site survey:

- Prepared location map showing the proposed road.
- Also prepared quarry map showing details regarding sources of materials.
- Detailed cross-sections.

3.2 Identification of Resources

The following resources (i.e. materials, the machinery and manpower) required for construction of the concrete road are locally available and will be arranged by the contractor from the approved quarries and suppliers or the department.

Following observations were made during the site visits:

- The construction material which involves identifying the materials required, estimating quantities, defining specifications, locating sources material sample approved, material inventory and locally available and will be arranged by the contractor from the approved quarries and suppliers or the department.
- Then planning construction equipment which aims at identifying the construction tasks to be undertaken by mechanical equipment, assessing the equipment required, exploring the equipment procurement and finally selecting the equipment based on the construction technology chosen for the road.
- Manpower's required for constructions of the concrete road are locally available.

Table 1.2 . Details of materials and its sources

SR. No.	Material	Source
1	Crusher Broken Metal	Yelakeli
2	Hand Broken Metal	Yelakeli
3	Local available Course Sand	Karla
4	Fine Sand	Shed gaon
5	Murum	Yelakeli
6	Cement	Wardha
7	Steel Reinforcement	Wardha

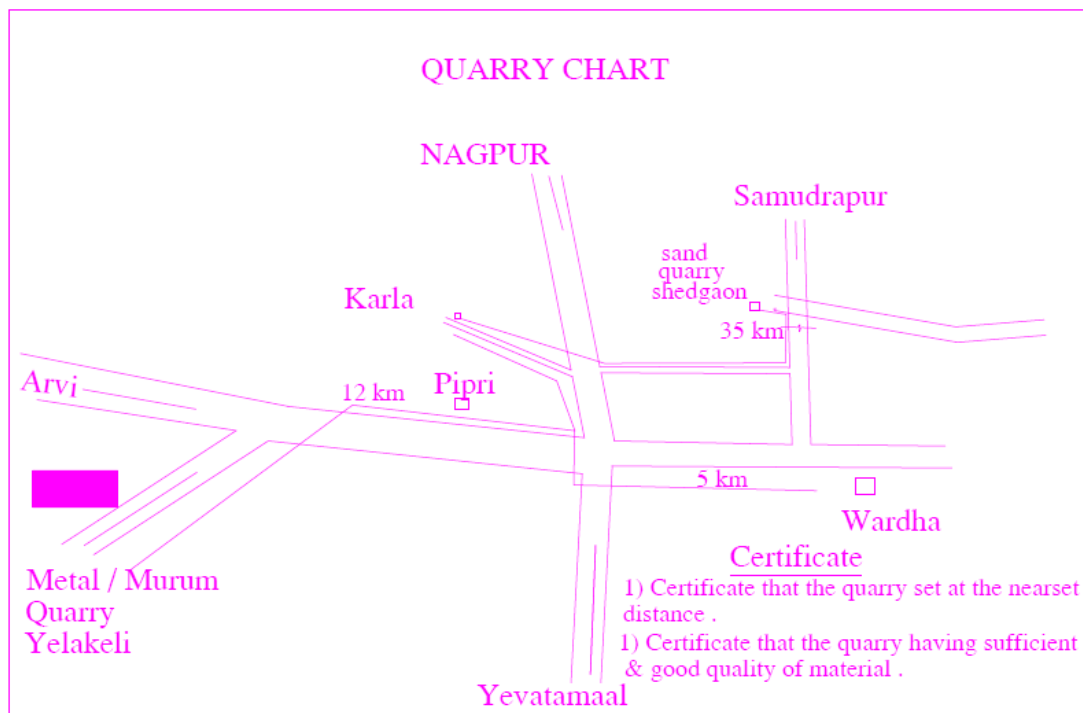


Figure 1.3. Quarry chart

Table 1.3. Details of plant and machinery

Sr. No	Description of		Output of Machine		Usage Rates in Rs.	
	Machine	Activity	Unit	Output	Unit	Rate
1	Concrete mixer 0.28/0.4 cum	Mixing of ingredients	cum/h	2.50	per hour	240.00
2	Needle vibrator	Vibrating cement concrete mix	cum/h	3.50	per hour	93.00
3	Plate vibrator	Compaction	cum/h		per hour	93.00
4	Tipper 5.5 cum/10 t	Carriage	cum/trip	5.50	per hour	619.00
5	Tractor with trolley	Transportation of materials	t/trip	3 to 5	per hour	364.00
6	Three wheel 80-100 kN static roller	Compacting /rolling			Per hour	449.00
7	Water tanker (Truck Mounted)	Carriage of water	liter / h	12000.00	per hour	459.00

IV. WORK BREAK DOWN STRUCTURE (WBS),

A work break down structure (WBS), in project management and systems engineering, is a deliverable oriented decomposition of a project into smaller components. A work breakdown structure element may be a product, data, service, or any combination thereof. A WBS also provides the necessary framework for detailed cost estimating and control along with providing guidance for schedule development and control. In a project or contract, the WBS is developed by starting with the end objective and successively subdividing it into manageable components in terms of size, duration, and responsibility which include all steps necessary to achieve the objective. A well-designed WBS makes it easy to assign each project activity to one and only one terminal element of the WBS. Work breakdown structure for the present project is as given below:

Table 1.4 . Work break down structure

• Construction of concrete road
• Visit of Government Engineers

<ul style="list-style-type: none"> • General conditions
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Receiving notice to proceed and sign contract
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Submit and insurance documents
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Prepare and submit project schedule
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Prepare and submit schedule of values
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Obtain work permit
<ul style="list-style-type: none"> • Mobilization
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Install temporary power
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Install temporary water services
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Set line and grade benchmarks
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Cleaning of road
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Setup of site office
<ul style="list-style-type: none"> • Excavation
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Excavation of road
<ul style="list-style-type: none"> • Filing of base
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Road base
<ul style="list-style-type: none"> • Base concrete
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ 1:4:8 concrete
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Curing
<ul style="list-style-type: none"> • Construction of main layer
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Constructing of first wearing course
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Second wearing course
<ul style="list-style-type: none"> <ul style="list-style-type: none"> ✓ Curing

V. PROCEDURE FOLLOWED FOR THE CONSTRUCTION OF CONCRETE PAVEMENT AT SITE

During construction of a cement concrete pavement, following steps were taken at site -

- Survey of proposed work was done by engineers including geographical details, soil properties and site investigation.
- After survey, a team of engineers prepared the working drawings of the project.
- After that engineer prepared the detailed estimate of proposed work including material requirement, equipments required and manpower requirements.
- Now excavation, construction of soil sub grade, base coarse and then construction of concrete slab is done.

VI. MANAGEMENT ASPECT OF CONCRETE ROAD CONSTRUCTION AT SITE

6.1 planning

The most commonly used basis for planning things out for the project is the BOQ prepared by the client. Contractor may have two major levels in planning- micro and macro level. Time, cost, material and labour are the four major types of planning undertaken on sites. Construction scheduling is a graphical representation, which shows the phasing, rate of construction activities with the starting and completion dates and the sequential relationship among the various activities or operations in a project so that work can be carried out in an orderly and effective manner.

For the proper planning of the present project undertaken Microsoft project was used for scheduling of activities.

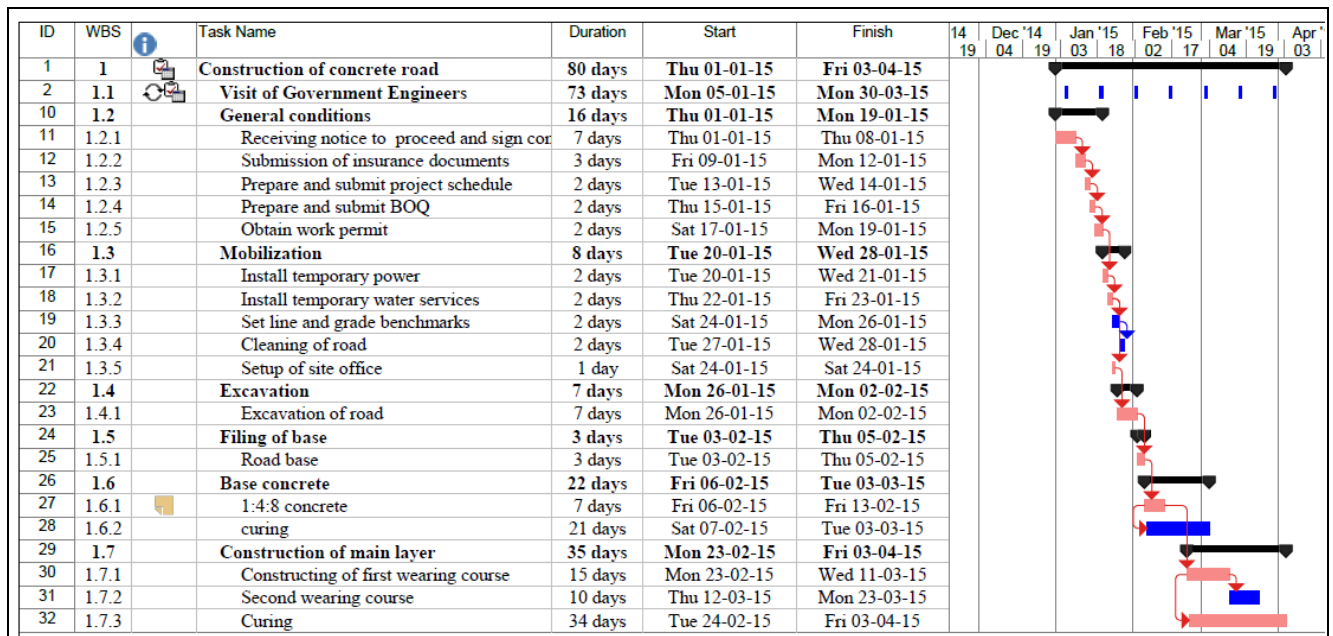


Figure 1.4 .Scheduling activities of proposed concrete road.

6.2 Contract Management

Contract management is the process that enables both parties to a contract to meet their obligations in order to deliver the objectives required from the contract. It also involves a good working relationship between the customer and the service provider. It continues throughout the life of a contract and involves managing proactively to anticipate future needs as well as reacting to situations that arise

The following contract documents formed the agreement, interpreted in the following order of priority:

- Agreement.
- Notice to Proceed with the Work (Work Order).
- Letter of Acceptance.
- Contractor's Bid.
- Contract Data.
- Special Conditions of Contract (SCC).
- General Conditions of Contract (GCC).
- Specifications.
- Drawings.
- Bill of Quantities (BOQ)

6.3 Safety During Construction

- The safety practices should be followed as per the safety standards norms
- Use of Personnel protective equipment
- Ensure the site safety inspection before the commencement of the road construction project
- Availability of barricades, drums, traffic cones, cylinders and signs around work zones were observed
- Construction machinery were used in careful manner
- Availability of No objection Certificate from the Water, Telephone and Electric Department and Grampanchayat.
- Development of shades for proper stacking of construction materials.
- Use of proper ventilated areas of hazardous chemical
- Well designed temporary diversions were observed.
- Training of labour handling the hazardous waste.

6.4 Waste Control During Construction

Following guidelines were made during the site visits:

- Order the amount of material need as accurately as possible.
- Arrange for 'just in time' deliveries to reduce storage and material losses.
- Ensure that deliveries are rejected if damaged or incomplete.
- Keep the site tidy to reduce material losses and waste.
- Promote good practice awareness as part of health and safety induction/training for workers on site.

6.5 Quality Control and Quality Assurance

In order to achieve the aim of building safe and durable roads economically, the road structure should meet certain requirements. The characteristics that such a structure should possess should be specified through codes of practices and enforced through contract documents. Laying down not only the technical specifications but the workmanship and the testing and acceptance criteria, Quality Control comprises the operational techniques of controlling quality. A Quality Assurance Standard is set when the Quality Control system is operational using human resources, trained to a particular standard. Quality Management includes quality planning to maintain a Quality Assurance Standard, as well as Quality Control. Quality Management which includes an external mechanism providing Quality Assurance and an internal mechanism to constantly improve the quality system is termed Total Quality Management (TQM)

VII CONCLUSION AND FUTURE SCOPE OF STUDY

7.1 conclusion

In India, during the last five decades, rural roads are being planned and program in the context of overall rural development, and tried to provide connectivity with some level of achievement.

The survey study shows that the rural roads play a pivotal role in development of Karla Village and its connected villages. For the growth and development of society in Karla Village of Wardha District. As per the current inspection the internal road of 400 meters is not constructed which hassles the life of Karla & Pipri Meghe village. The peoples facing the day to day problems due to unconstructed road in the village. With conclusion of road construction development plan the two different villages will be ease with day to day road hassles' and obstacles and binds the people, agriculture, farms, and schools hubs and support in easy & fast transportation, connecting schools, culture in the society and growth & development of Karla villages.

- From study we conclude that the proper planning of work reduces the time period and resources required for the construction and minimize of chances of delay of work.
- The visit to project site and study of available database on the project site reveals that the contractor as well as government department have neither yet realize the necessity of detail study of their own resources nor have develop their accounting system for research and development purpose has evident from the lack of useful and relevant data from the site.
- The contractor should not only concentrate on activity oriented planning, but also at the same time should plan mobilization and usage of resources well before execution work started.
- The use of new materials and technologies is not becoming popular in our country mainly due to lack of awareness. Failure to instill confidence in the field engineers by addressing their problems can be another reasons, the third being non-availability of suitable standard equipments.

7.2 Future Scope of Study

The village development plan must be develop for new settlement of people in the village. In future with the rise of human population the organized roads should plan and connecting the Karla village with other near villages for socioeconomically development .The planning of various other departments such as telephone, water, and electricity should plan development activities prior to the development of rural road development. A detailed work method and time motion study on each for the various resources may be done. Feasibility survey for various roads to be constructed may be done in our region. Maintenance management studies may be carried out for various existing concrete roads in rural areas.

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