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A Study On Resource Planning In Highway Construction Projects

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ABSTRACT

The Construction projects, especially the highway construction projects, uses huge amount of resources on and off the field in various forms of resources viz., materials, plants, equipments and human resources along with money, time and space. The uniqueness of the projects makes the resource planning a tedious job as the efficiency of each resource depends upon a huge number of working condition factors. A detailed study of resource planning and productivity can, thus help in good resource planning, better monitoring and overall controlling of the project. In highway projects, the same resource is often used for different activities and the productivity of that resource being different for different activities, it becomes inevitable to know the correct norms for correct estimation, planning and monitoring.

The main objective of this thesis work was to planning the main resources (i.e. the equipments, plants and manpower) deployed at a highway project by using Microsoft Soft Project Software.

Keywords – BRTS, Resource Planning

1 Introduction

Observing the trend in construction technology presents a very mix and ambiguous picture. On the one hand many of techniques and materials used for construction are essentially unchanged since the introduction of mechanization in the early part of twentieth century.

For example at the time of highway construction at the beginning of the nineteenth century most of the highway project report stated that ―the work could not have been done any faster or more efficiently in our days, despite all technological and mechanical advances in the time, since the reason being that no present system could possibly carry the spoil material away any faster or more efficiently then the system employed. No motor trucks were in the digging of soil everything ran on the rails foe cutting and filling of soil at different chainage to reduce the wastage of human resources and achieve maximum productivity. And because of quantity of soil and rain, no other methods have work so well to achieve the desired output.

In contrast to this view of one large project, it may also point to the continuous change an Improvement occurring in traditional material and technique. This continuous improvement in techniques help to plan and distribute the resources as per the requirement and efficient distribution of all these resources helps in close monitoring and actual progress of the work which includes resources like man, material, machinery and money with respect to their productivity.

2 Methodology

- First forecasting input and output is done in which the data wise requirement of project manpower, costly equipment, production costs, sales or earned value of work done and expected income.
- Then the planning the construction work force by determining the size of project work force, its structuring into functional groups and workers team and scheduling manpower recruitment to match task requirement.
- After this plan the construction materials which involves identifying the materials required, estimating quantities, defining specifications, forecasting requirements, locating sources material sample approved, material inventory.
- 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. Planning the construction standard cost, the cost plan uses standard cost work packages, work items or activities. Then finally plan construction budget which involves structuring of project functional organization into production, services and administration responsibility center, allocating resources with budgeted cost and finally compiling the project financial plan in the form of project master budget.

3 Resource Planning

3.1 Planning Construction Work Force

The project man power planning primarily focuses on determining the size of project work force, its structuring into functional groups and workers teams, and scheduling the manpower recruitment to match the task requirement.

This process chiefly involves identifying the trades or the skills required, establishing productivity standards to determine the number of worker needed to perform a given job in the specified time, data wise forecasting of workers requirements for accomplishing the project work and finally organizing the planned work force into operating work-teams having assigned programmed tasks.

3.2 Planning Construction Materials

Efficient material management in project environments calls for an integrated approach covering numerous functions such as materials planning and programming, materials purchasing, inventory control, store-keeping and ware housing, materials transportation and handling at site, materials codification and standardization and the disposal of surpluses. The material planning and programming, which is the key function on materials management is closely linked with the project planning and control set-up. Both these work together to develop a plan to procurement and stocking of construction materials so as to provide at site, materials of right quantity, at right prices from right source and at the right time.

The construction material planning involves identifying the materials required, estimating quantities, defining specifications, forecasting requirements, locating resources for procurement, getting material samples approved, designing material inventory and developing procurement plan to ensure a smooth flow of materials till the connected construction work are completed at the project site.

3.3 Planning Construction Equipment

Production task needing equipment include excavating, handling, transporting, filling, compacting, grading, hoisting, concreting, pre-casting, plastering, finishing, trenching, and laying of pipes and cables. The supporting equipment at project site consists of generators, transmission lines, pumping sets, other utility services equipment.

Construction equipment is indispensable in execution of modern high-cost, time-bound massive construction projects. It produces output with an accelerated speed in a limited time. It saves manpower, which is becoming ever more costly and demanding. It improves productivity, quality and safety and also adds a sense of urgency. Acquisition of equipment mass involves initial heavy investment but, on the whole, its ads to profitability by reducing the overall costs, provided it is properly planned, economically procured and effectively managed.

Equipment planning for a project aims at identifying construction task to be undertaken by mechanical equipment, assessing the equipment required, exploring the equipment procurement options and finally, participating in the decision making for selecting the equipment.

4 Programme Objectives

The most general objective of planning is to improve to provide a link between the establishment of an effective productivity measurement system and the human task of improving organizational performance by means of changes in all or several elements of the organization-the people, structure, culture and technology. Some more specific objective of the programme could be:

- To improve managerial, planning and problem-solving skills.
- To improve teamwork and human relations.
- To set up an effective productivity information system.
- To trigger a breakthrough to a higher level of organizational performance.
- To help revitalize the organization and its climate

5 Case Study On B.R.T.S project At Visakhapatnam

5.1 History of Visakhapatnam

Visakhapattanamu, shortened and anglicized: Visakha/Vizag or Vizagapatnam is a coastal, port city & often called as **"The Jewel of the East Coast"** situated in the Indian state of Andhra Pradesh, located on the eastern shore of India, nestled among the hills of the Eastern Ghats and facing the Bay of Bengal to the east. It is the administrative headquarters of Visakhapatnam District and is also home of the Eastern Naval Command of the Indian Navy. Alternatively, it sometimes goes by its now mostly defunct colonial British name, Waltair. It is sometimes also referred to as the "City of Destiny".

According to the history, the city was named after the god of Valor-Vishakha. It was a part of the Kalinga Kingdom, under Ashoka's rule in 260 B.C. It passed on later to the Andhra Kings of Vengi. After this Pallava, Chola and Ganga dynasties ruled the city. In the 15th century, Visakhapatnam became a part of the Vijayanagar Empire. The Europeans, the Dutch, the French and the English established themselves from the 17th century onwards and used this as a major trading center to export textiles, ivory, tobacco, indigo etc. This port is well documented in the histories of these colonial powers as well as in Indian historical records. This coast played a major role during the reign of the Asaf Jahis and the Golcondas.The city is home to several state ownedheavy industries, one of the most advanced steel plants and has one of the country's largest ports and its oldest shipyard. It has the only natural harbour on the eastern coast of India. Tourists are attracted by its unspoilt beaches, nearby scenic Araku Valley and Borra caves, the 1 Ith-century Simhachalam temple and ancient Buddhist sites like Totlakonda & Bavikonda

spread across the area. As one enters the harbour, a Roman Catholic Church perched atop the Kanyamarykonda (Ross Hill), the Durga Konda with the shrine of a Muslim saint Ishaque Madina, and a temple nestled over the Venkateswarakonda hill instantly draws our attention and they exhibit the secular flavour of the town. The city hoasts a submarine museum, the first of its kind in South Asia, at Rama-Krishna Beach.

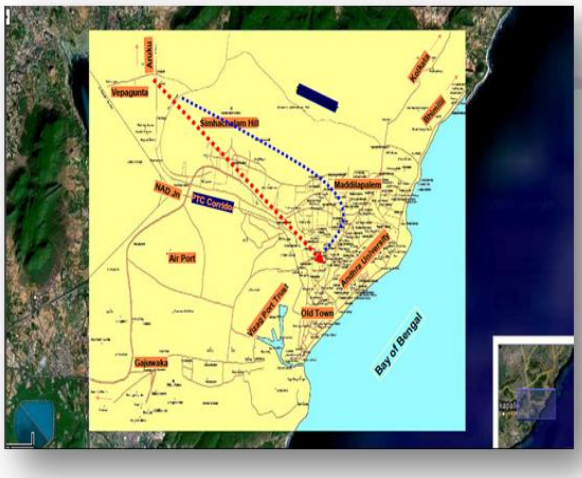

Fig 1 Map of Visakhapatnam

5.2 Transportation in Visakhapatnam

Visakhapatnam is well connected with daily flights from Hyderabad, Chennai, Delhi, Mumbai, Bengaluru, Tirupati and Kolkata. Visakhapatnam Airport has recently received permission to operate night flights. A new 10,000 feet long runway became operational to accommodate international flights and larger aircraft. The airport was one of the few chosen by the center for modernization including facilities like aerobridges and immigration booths.

Visakhapatnam International Airport is coming up at S.Rayavaram, 50 km from the city. This will serve as the gateway and hub for international flights connecting South East Asia to the Indian subcontinent.

Visakhapatnam is one of the cities on the east coast of India connected by NH5, a major national highway and a part of the Golden Quadrilateral system of Indian highways connecting Chennai and Kolkata. The highway is an important route for transportation of cargo and people from these cities to and from Vizag. Visakhapatnam has a good network of roads. There are frequent buses to Vizianagaram, Srikakulam, Araku and Rajahmundry. There are even bus services toHyderabad, Vijayawada, Tirupati, Bengaluru, Chennai, Kolkata and few other parts ofOrissa and Karnataka.

People of Visakha make use of extensive public transportation provided by the APSRTC, which runs metro buses across various routes across the city and its suburbs. The city corporation is planning to dig subways, construct pedestrian overpasses and flyovers to address the traffic woes.

BRTS-Bus Rapid Transit System was approved for the city under the JNNURM. This will make use of dedicated lanes for buses allowing for an efficient, high speed mode of transportation for the public and significantly reduce traffic congestion, improving safety.

5.3 What Is BRTS?

BRTS combines many of the features of rail systems with the flexibility & cost savings of over-the-road vehicles.

There are seven major components to a BRT system. They are as follows

1. Running Ways: Vehicles operate on their dedicated bus lanes, thus maximizing speed and service.
2. Vehicles: Vehicles are clean, comfortable and efficient, and minimize boarding times to provide easier access for the differently-abled. „
3. Stations: Link the community with the BRTS. Designed to promote economic development, reduce travel time, encourage inter-modal connectivity and minimize boarding and "dwell" times, thus helping people reach their destinations more quickly
4. Service: Is frequent to obviate issuing a schedule. It is integrated with regional transportation systems and promotes inter-modal connectivity.
5. Route Structure: Route maps are easy-to-read.
6. Fare Collection: Quick & efficient collection of fares, preferably before boarding to save time.
7. Intelligent Transportation System: To monitor vehicle movement, provide updated information & improve safety. Enables signal prioritization, queue jumping, etc to reduce travel time.

The Visakhapatnam BRT system is intended to serve the ever growing population of the city with all the facilities aforementioned.

5.4 BRTS In Visakhapatnam

Bus rapid transport system, taken up under the Jawaharlal Nehru National Urban Renewal Mission JNNURM at a cost of INR 426.35 crore, has begun in some stretches and the Chief Minister recently laid the foundation stone for the project. According to the Greater Visakha Municipal

Corporation, the project is scheduled to be completed by October 2010.

It is estimated that currently public transport accounts for 30% of all modes and the bus rapid transport system is intended to take it to 50% by 2011, taking in view the increasing traffic needs of the city. The two corridors The BRTS project comprises two corridors in the city viz.;

1. **PENDURTHI TRANSIT CORRIDOR**
2. **SIMHACHALAM TRANSIT CORRIDOR.**

The first corridor covers 20 kilometer from Pendurthi via Gopalapatnam, NAD, Kancharapalem and the railway station. The Simhachalam corridor stretches from Pendurthi to RTC complex via Vepagunta, Simhapuri Colonly road, Gosala, Adivivaram, Hanumanthawaka Junction and Maddilapalem. The project is being implemented by a special purpose vehicle with equity participation by the GVMC, the . AP Road Transport Corporation and the Visakhapatnam Urban Development Authority.

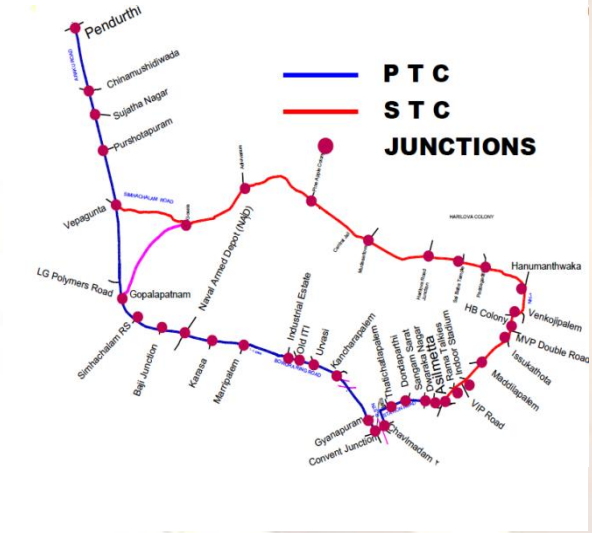

Fig 2 Showing Route Map of Two corridors of B.R.T.S. (For the above figure *S.D.-Simhachalam Depot, RLY STN. -Railway Station, R.T.C. -Road Transport Corporation Complex)

5.5 Need of the BRT Project in Visakhapatnam

- Visakhapatnam is a place of strategic importance in India. It is the head quarters of eastern naval command. Its natural terrain is peculiar. By having three sides covered by mountain ranges and the rest by Bay of Bengal Sea it is a safe place for defence. Because of the rapid industrial development and vast area Visakhapatnam has become GVMC with the ushering of international airport, railway headquarters and other major industries and educational institutions like five universities, tens of professional institutes and hundreds of colleges. It is inevitable to have BRTS. The infrastructure and transport system of all the above industries and institutions clearly shows the need of BRTS in GVMC. There are about 4.5 lakh (by Nov 2007) registered vehicles- 90% are cars & two Travel demand of 12 lakh passenger trips per day
- Private vehicles contribute to 65% of travel needs (7.81akh trips)
- Travel demand projected to grow to 16 & 28 lakhs trips per day by 2011 & 2021
- In future road capacity will be a constraint
- Transport network will not only require expansion but widening /strengthening, as ell
- Arrest this trend and promote public transport - target about 50% by 2011 (present share below 20%)

Therefore, planning, design and implementation of a high capacity public transport system is a pre-requisite Present Project Work

It is clear from the above route map that the corridors are by passing many existing major junctions of the city like National Armament Depot (NAD) , Karasa, Marripalem, 104 area (naval quarters), Industrial estate, Old Industrial Training Institute (ITI) , Urvasi, Kancharapalem. The GVMC is planning to signallise these major junctions. To cater for the vehicles which have to cris-cross the BRTS lanes. The GVMC is planning to signallise these important junctions. This decision of signalization has the following problems

The most important problem is that signalization causes stoppage to the BRTS buses. This is against the basic idea of non interrupted journey of BRTS. The other problems

- Long queues of traffic
- Signaling is a solution to the existing traffic problem but not to the future growth
- Number of accidents increases.

The present study involves identification of important junctions in Visakhapatnam which get altered due to introduction of BRTS and suggesting viable alternatives for smooth and uninterrupted traffic flow.

In this present work in view of the need of BRTS the necessary modifications in the existing NH-5 and other main roads are kept in the view that are to come in BRTS.N AD. a typical major junction in the NH-5 has been taken as a case study and the infrastructure has been designed. Data collection design of box culvert, design of foot over bridge,

design of pavement and surface drainage at the junction has been contemplated.

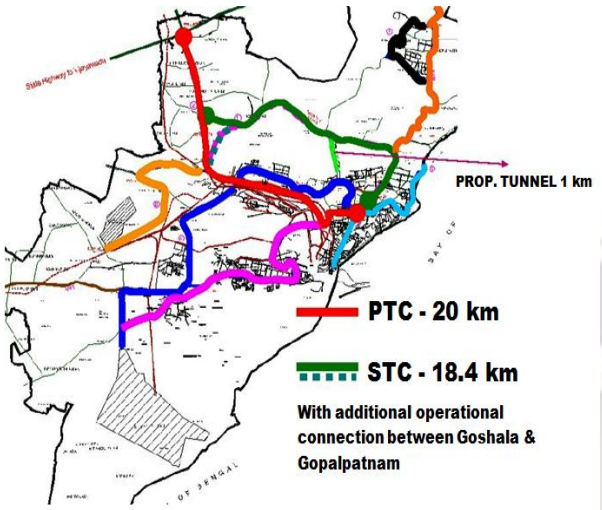

Fig 3 Routes of Map

5.6 Assumptions and Limitations of the Project Work

- STAAD report of the box culvert is not attached in the report
- Continuous box action is assumed in the box culvert design
- Drainage facilities are designed only for the changes in the junction
- CBR value for pavement design is assumed as per previous records. As the changes are pertaining to existing road, the levels are assumed to be uniform
- Estimation of cost is carried out only for the changes ; but not for the entire BRT project
- The suggested alternative layout of the junction is as shown in the following figures.
- The radius of the horizontal curves is 55m calculated from the centre of the junction
- The vertical gradient for the underpass and the flyover is 1 in 20
- The existing flyover towards the airport is at a distance of 123m
- All the changes made are well inside this constraint
- All the above parameters are taken according to IRC 86-1983, IRC 38-1970, IRC SP 50 1999, IRC 37-1984(2001), IRC SP 42-1994, IRC 54-1974.

6 Project Descriptions

The Employer: GVMC
The Engineer: Srei Infrastructure Finance ltd
The Contractor: GVR Infra pvt ltd
Source of funding: GVMC & JNNURM
Contract value : 160 crores
Date of commencement: 18th Oct 2008
Contract period: 24 months
Defect liability period: 12 months from the date of completion.
Performance Bank guarantees: 10% of the contract value.
TABLE 1 Different Equipments Deployed at BRTS Site Equipment Model name Make

Equipment	Model Name	Make
Excavator	Ex 200	Hitachi
Dozer	D50A 15/D6H	Beml/HM
Grader	720A-IV	Champion
Vibratory compactor	BW-212 D-2	Greaves Bomag
Grader	720A-IV	Champion
Vibratory roller	BW-212 D-2	Greaves Bomag
Wet Mix Plant	WM200	Gujarat Apollo
Batching Plant	CP-30	Stetter
Paver	Super 1800	Vogele
Tandem roller	IDD90	IR
Pneumatic Roller	PTR 220	IR
Hot mix plant	12300/4D	Parker
Wheel Excavator	A-312	Liebherr
Wheel Loader	L-544	Liebherr
TATA HYVA	Model- LPK 2516 TC38-6XI	Telco
Transit Mixer	LPT 2516TC	TATA
Water tanker	LPT 1510A/42-352	TATA

Table 2 Details of encumbrances for BRTS STC

Sl No.	CHAINAGE		Length (in mt)	SIDE	Area	Reasons
	From	To				
1	0+000	1+700	1700	LMV, LNMV, RMV & RNMV	Asilmetta Junction to Maddilapalem	Land to be acquired on both sides for 6m averages width to the existing road
2	4+525	4+550	25	LSR	Hanumanthawaka Junction	Hanumanthawaka Junction
3	5+740	5+810	70	RSR	Pedagadhili Junction	Obstruction due to existing school building, work is taken up as a additional work, beyond our scope, work is under progress. This can be complete by July, 2010
4	6+210	6+370	160	Total ROW	Chinagadili, Santapalem Village	Dismantling is completed, Debris Lifting and C & G under Progress
-5	6+370	6+830	460	Total ROW	Chinagadili, Santapalem Village	
6	7+290	7+350	60	BRT Half width	Sidhartha Junction	Temple to be shifted
7	8+100	8+225	125	Total ROW	Mudasarlova Park	Electrical Substation - Work is under progress and can be completed by July, 2010
8	9+650	10+050	400	Total ROW	Ramakrishnapuram Village	Total Village to be shifted
9	12+090	12+190	100	LMV & LNMV	Darapalem Village	Discussion are going on with habitants for issue of TDR Certificates
10	12+090	12+330	240	RMV & RNMV	Darapalem Village	Discussion are going on with habitants for issue of TDR Certificates

Fig 4 Resource work summary report

7 Conclusions

The visit to highway project site and study of available database in the project site reveals that the construction companies in India 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 present construction practices in India is still adopt the methodology of as and when required‘ resource management. Lack of professionalism leading to lack of detailed and meticulous planning and irrational decision making as per site management is concerned leading to under utilization of resources to a great extent. till now project resource planning is only limited to _planning and scheduling with time‘ but resource _mobilization and usage‘ planning according to their capacity and availability, ahead of time-in the planning stage, is still nobody‘s concern.

In the present globalize business scenario, Indian construction companies have also started facing stiff competition from foreign competitors. In this tightrope sitituation even the big companies from India have to access their own strength and weakness according to sitituation. In order to assess their capabilities for utilization of resources and track their productivity status, the first step should be to keep and maintain their real time record and build a data base from the ongoing projects. Next step is to analyze the data and find out the productivity of resources, and compared them with expected/ budgeted norms and improvement initiative as applicable. The companies 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.

Apart from different technical factor affecting the productivity, the logistical arrangement at site plays a major role in the production rate. For major equipments, like slip form paver, batching plant, hot mix plant etc., the logistics is the key factor for determining the productivity.

7.1 Resource Planning

Equipment cost for any project comprises of mainly 20-30% of project cost plus additional cost for maintenance, repair and operation. Cost of equipment has to be controlled properly by efficient allocation of equipment for different phases of work. So for using equipment effectively and efficiently equipment becomes necessary. Equipment procurement is done after measuring productivity of every equipment.

Material cost for any project which is more or less invariable, it depend mainly on type of project work to be performed. Material planning is done to achieve requirement of project at different phases of construction work and it also reduces excessive wastage of material.

Manpower Planning is the process by which an organization ensures that it has the right number and right kind of people, at the right place, at the right time, capable of effectively and efficiently completing those tasks that will help the organization achieve its overall objectives. In any project, most of the activities are done ―team-wise‖ and productivity of individual labourers cannot be determined. Also teams productivity is depend on driving equipment such as grader, roller, paver etc

Planning of BRTS Road Project by using Microsoft Project 2007 for 013 KMS and Existing Carriage indicate poor planning of resources. Also equipment assign for total project is less as compared to required number. From the planning of BRTS highway project after allocating resources to various activities, we come to know if Equipments and manpower is provided as per required data which is analyze by using Microsoft Project-2007 as compare to actual used on site. It will help to complete project on time with specified duration as per contract.

8 Recommendations

A detailed work method and time motion study on each of the equipments used in the each type of activities in different site and environmental conditions is required.

Material usage standard should be maintain properly and Inward, Outward of material from store should be maintain.

Training Programs can improve the productivity of manpower, so training programs should be used on the site, and statistics of manpower productivity should be kept.

The productivity studies of the driving and non-riving resources, indicates that the planning and allocation of the non-driving resources can be done optimally and economically.

In order to determine the labour productivity, especially the operators and skilled labourers, the companies should concentrate more on keeping the records and analyzing the database from time to time to determine actual productivity.

A detailed study on the material supply chain and work chain management of the plant - hauler - equipment link and the logistic arrangement at site for major activities (like concrete paving) where a large number of resources are involved and time is the essence of the productivity is required.

For plants, the upward trend of productivity and shift hours in the nighttime during summer season recommends shifting of activities to nighttime for more productive output.

REFERENCES

1. WILLIAM BROTHER Bourdon, C.C., and R.W. Levitt, Union and Open Shop Construction, Lexington Books, D.C. Health and Co., Lexington, MA,1980.
2. A.E.Kerridge and C.H.Vervalin, Houston, 1986; A.E.Kerridge and C.H.Vervalin (eds.), Engineering and construction Project Management, Gulf Publishing Company, Houston, 1986.
3. CORDELL, R.H. Caterpillar Performance Handbook,18@+(th) Edition, Caterpillar, Inc., Peoria, IL,1987
4. S.W. Nunnally, Construction Methods and Management,second edition, Prentice-Hall,1986
5. Peurifoy, R.L., Construction Planning, Equipment and Methods, 2nd edition McGraw-Hill, NewYork,1970
6. PAULSON, B.C(1985)., Principles of Inventory and Materials Management, North Holland, New York,1985
7. TERSINE, R.J: Tersine, R.J., Principles of Inventory and Materials Management, North Holland, New York,1982
8. LANGE, J.E., and D.Q. MILLS, The Construction Industry, Lexington Books, D.C. Health and Co., Lexington, MA,1979.
9. PEURIFOY ROBERT L, SCHEXNAYDER C.J (2003)
10. GOSAIN RAJAT,1999 "Equipment Planning and Procurement For highsay Project, 1997-1999
11. CHITKARA, K K, 2004 "Construction Project Management", Tata McGraw Hill, New Delhi, 2004.
12. Julian E. and Daniel Quinn Mills, "The Construction Industry", Lexington Book, 1979.