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A Study on Construction of Flyover to Avoid Traffic Congestion

Bhagyalaxmi Akkenepally, Galapati Deepa, B. Sony
Dept of Civil Engineering
Gurunanak Institute of Technology
Hyderabad, India
bhagya.laxmi98@gmail.com, Deepa.raman143@gmail.com, bsony.cegnit@gniindia.org

***Abstract* – Miryalaguda is a congested place in Nalgonda district and populated with above 1 lack, existed with 80 rice mills, many educational institutes, Hospitals, railway station, etc.. The Nagarjuna left canal also existed near to this. All agriculture carts are used to transport through this way so it was necessary to handle the heavy traffic and for uninterrupted connectivity of the transportation. Construction of flyover can be reduce traffic, fatal and non-fatal accidents and make the facility to perform more transportation. Accidents were avoided by constructing a fly-over about 1 km distance, at Hanmanpet Cross Road from Peddavoora to Addanki Road. It includes 11 piers and 2 Abutments and connects all four roads at a junction. Open foundation was used for all piers and Abutments. Total station was used to locate exact centre points of piers. JCB Vibromax and Cranes are used to excavate and strengthening of soil. In order to remove rock strata explosive materials were used. Dumpy level was used to give reduced levels for Reinforcement according to standards and specifications and also estimated the quantity of rock. PCC and VRCC concrete and Fe415 steel with diameters of 10mm,8mm,12mm,16mm ,20mm,25mm bars are used in construction. Many field tests like slump cone test and cube compressive strength tests are performed to find the strength of concrete. The risk and failure of bridge elements was analysed and problems were solved while constructing and also traffic jams, accidents, head on collision incidents have been reduced. It takes around 24 crores.**

***Keywords* – PCC, VRCC, Dumpy level, Piers, Abutments etc.**

I. INTRODUCTION

A flyover is a structure providing passage over a road without closing the away beneath. A Bridge is a structure which connects two points separated by a natural phenomena viz., river, valley, sea, any other water body but a Flyover is a structure which connects two or more points which are already accessible and is really flying over and/or across manmade structures viz., road, railway, building, and structures.

Components of flyover

The main parts of flyover structure are,

1.Foundations for abutments and piers: The design of foundation is an important part of the overall design for a flyover and affects to a considerable extent the aesthetics, safety and the economy of the flyover. The purpose of foundation is to transfer the load from the superstructure to the earth in such a manner that the stresses on the soil are not excessive and the resulting deformations are within acceptable limits.

2. Sub Structure (Piers): The portion of the flyover structure below the level of the bearing and above the foundation is generally referred as substructure. Piers are structures located at the ends of flyover spans at intermediate points between the abutments. The height of substructures is different for different piers. It is depends on level of PCC course and Bed Block level. Piers and Abutments shall be constructed with masonary, mass concrete or rein forced concrete.

Fig.1 Sub-structure(pier)

3. Bed Block

The pier cap or abutment cap (also known as flyover seat or bedblock) is the block resting over the top of the pier or the abutment. It provides bearing surface for the support of the super structure at the pier or abutment location and disperses the strip loads from the bearings to the sub structure.

Fig.2 Sub-structure (Bed block)

4. Bearing pedestal

These are supports the neoprene bearings and super structure. From this point camber should be provided to the structure. The depth of bearing pedestal are increases from outer edge to inner edge because the camber has provided to the slab on both directions.

Fig.3 Bearing pedestals

5.Neoprene rubber bearings:

Neoprene bearings are manufactured with fabric, iron materials and mould as multiple layers. Bearings provided a uniform transfer of loads from beam to sub structure. They permit beam rotation at bearing point due to deflection or misalignment. They absorb vibration and prevent sound transfer while reducing the destructive action of vibration between movable and stationary structural members. They also provide for movement caused by normal expansion and contraction. These are used extensively in bridge structures, pre stressed and pre cast buildings also used in industrial machinery and heavy equipment applications.

Fig. 4 Neoprene rubber bearings.

6. Cross girders: Cross girders are provided across the longitudinal girders.

7. Longitudinal girders: longitudinal girders are provided along the span of the slab.

8.Back wall: Back wall also known as dirt wall which is a small retaining wall just behind the flyover seat, preventing the flow of material from the fill on to the flyover seat.

9.Abutments: An abutment is the substructure which supports one terminus of the superstructure of a flyover and at the same time laterally supports the embankment which serves as the an approach to the flyover. An Abutment consists of wing wall ,back wall etc.

Fig.5 Abutments

II. LITERATURE REVIEW

The Fly over Bridge consists of single span of 40.0m PSC box girder with 12.0m overall width for bridge proper and 6 V of 21.0m T-beam girder slab towards Narketpallyside and 5 V of21.0m T-beam girder slab towards Addanki side for Viaduct portion. State Highway Agencies face challenges because of aging of bridges, increasing traffic, using new materials, and lack of sufficient resources.

According to the National Bridge Inventory (NBI) data of 2005 available in the Federal Highway Bridge Management Information Systems Laboratory, there are more than 608,000 bridge structures (including culverts and tunnels) in the United States. If culverts and tunnels are excluded, the total number of structures designated as bridges by the National Bridge Inspection Standards (NBIS) is around 473,000 bridges. More than two thirds of these bridges were constructed before 1980, including one third constructed before 1960. More than 30% of bridges are considered deficient.

Steel, concrete, and prestressed concrete are the main material types used for most of bridges in the United States. Around 40% of steel bridges and 30% of concrete bridges are considered deficient (NBI 2005 in Bridge Management Information System Laboratory). To overcome the existing deficiencies of highway bridges, more than ten billion dollars per year over the next ten

years are needed for the repair and replacement of these bridges (Estes, et al. 2003b). Unavailability of adequate funds has been responsible for many of the decisions to defer maintenance (Golabi, et al. 1993). The limited resources of highway and bridge 2 agencies are not enough to fix existing deficiencies in bridges and maintain all bridges in need in good conditions.

Deterioration of bridges exposes them to more risks. Bridge management aims to identify bridges most in need of maintenance and apply efficient maintenance strategies to best utilize limited resources. The conditions of bridges in the United States are rated using two methods. The first method uses NBI condition rating for bridge deck, superstructure and substructure, while the second method uses more detailed data to describe the conditions of bridge elements. NBI condition rating describes the conditions of bridge deck, superstructure and substructure using a scale of 0 to 9 (FHWA, 1995). Element-level condition rating uses condition states to describe the conditions of bridge elements (AASHTO, 1997). The prediction of NBI condition rating from element-level condition rating was investigated (Hearn, etal. 1997; Al-Wazeer, et al. 2007b).

The main bridge management system in the United States, Points, uses the element-level condition rating method to describe the conditions of bridges. Developing models for risk assessment is the second item for recommended future research in Points Technical Manual (Golabi, et al. 1993). The research in this dissertation provides a methodology for bridge maintenance strategies based on risks associated with conditions of bridge elements. The methodology is a systematic approach for assessing risks based on failure probabilities and failure consequences of bridge elements and managing associated risks using efficient strategies of optimal maintenance actions.

The proposed methodology allows for the selection of optimal maintenance actions in the condition states of bridge elements based on both maintenance costs and risks associated with elements conditions. If a bridge engineer decides to apply a particular scenario of maintenance for some years and no maintenance for other years in a planning horizon, the methodology allows him/her to select the optimal actions corresponding to that scenario. The proposed methodology provides the optimal timing for implementing and/or deferring optimal actions in a planning horizon based on a trade off between risk reductions and maintenance costs while considering acceptable risk levels and budget constraints. The proposed methodology is a useful tool for making informed decisions to better utilize limited resources for managing existing bridges. The methodology integrates element-level maintenance policies with bridge-level priority ranking to define practical maintenance strategies for an inventory of bridges.

III. OBJECTIVES OF THE STUDY

The main objectives of this study are,

1. Construction of CC Diversion Roads
2. Providing Markings for Excavation
3. Laying of levelling course and Levelling
4. Providing Foundation Markings and placing Steel Reinforcement
5. Construction of Pier and its steel Reinforcement
6. Construction of Abutment and its steel Reinforcement
7. Construction of Hammer Bed Block and its steel Reinforcement
8. Construction of Bearing Pedestals and its steel Reinforcement
9. Placing Neoprene cushion material
10. Construction of Girders and
11. Construction of Slab

Need for investigation:

The aim of the investigation is to select a suitable site at which a flyover can be built economically as well as it should satisfy many conditions. Before construction of flyover it is essential to consider many factors such as the need for a flyover, the present and future traffic, sub soil conditions, aesthetics and cost.

IV. STUDY AREA AND DATA COLLECTION

Alignment

The alignment of Fly Over Bridge starts in km 60.977 and runs up to 61.82 towards Addanki side with straight alignment on both sides of FOB up to viaduct portion. It crosses the Peddavoora- Miryalguda road at skew angle 11 degrees and two curves in embankment portion towards N'pally side and one curve towards Addanki side**.**

Fly Over Bridge Design and specifications:

The obligatory span (level portion) starts at km 61.367 and ends at km 61.407 on Addanki side The alignment crosses the Peddavoora- Miryalguda road @ a skew angle of 11 degrees and considered as normal crossing for the purpose of design.Piers P6 and P7 supports the obligatory span on Narketpally side, P5 is adjacent to common pier P6 and on Addanki side, Pier P8 is adjacent to common pier P7.

Span Arrangement & Other Details:

a. Four lane Fly-Over-Bridge 277.6 m (ch:61.2374 to 61.515 on Narketpally-Addanki road

b. Level portion 40.00 m (1span of 40.0 m PSC Box girder)

c. Viaduct portion:- 9 spans of 21.6 m effective span without footpaths for12.0m width , 2spans of 16.06 m effective span because the flyover is rotated about 4 degrees in side between P6 &P5.1 span of 40m effective span at junction.

d. Reinforced earth walls in Embankment portion:- Gravel filling in between R.E walls
beyond viaduct portion 260.40 m on N'pally side (ch:60.977 to 61.2374)and 305.00 m om
Addanki side ch; km 61.515 to 61.820)
e. Total length of retaining walls:565.4.00m Reinforced earth type walls with earth fill in
between
f. Proposed RCL 106.33 M at median Kerb
g. Gradients: N'pally side 1 in 35.852 Addanki side 1 in 30.402

Technical Details
The Narketpally -Addanki road is 10.0m carriageway with 12.0m formation width .The land width in this stretch is 45.0m. This road is sanctioned for up gradation of four lanning. Hence, it is proposed for four lanes of fly over bridge with 43.12m level portion and ramps in 1:35.8and1:30.4 gradients towards N'pally and Addanki sides respectively.

The ramps are proposed with viaduct up to 7.5height and the remaining with reinforced earth retaining walls filled with good earth and road crust. The viaduct portion is provided with 21.00 m span girder structure with 6 vents and 5 vents towards Narketpally and Addanki side respectively and 2 vents with 21.00m span for level portion. The length of level portion is 43.12m, viaduct portion with 6v of 21.00 m span for a length of 129.6 lengths towards Narketpally side and 5v of 21.00m span for a length of 108.0m towards Addanki side. The remaining ramp is with reinforced earth walls 260.40m towards Narketpally side and 305.00 m length towards Addanki side .

Preliminary data to be collected:
1) Type of investigations:
- Topographic investigation
- Geological investigation.
- Traffic investigation

1. Topographic investigation:
Reconnaissance survey should be perform before starting the construction. Identify the objects and permanent or temporary bench mark to locate the construction place in site map. Bench Marks identified in the site:

Table 1 Bench marks

S.No	Bench Mark Identified at	Bench Mark
1	Reliance Petrol Bunk	95.37
2	HP Bunk	96.89
3	Bharat Petrol Bunk	97.64
4	Manjeera Restaurant	97.13

2. Geological investigation
For testing the type of soil the samples has been taken from 0.6m, 1.5m & 1.5m depth for testing the undisturbed soil. As a result HDR, SDR, HR stratums are identified at a depth of 1.5m, 1.5m & 0.6m respectively. SPT test has conducted for testing the soil in laboratory (JNT, Osmania). Generally SBC(safe bearing capacity) has found as 28.095 T/SQM for A1&A2 ,For P1, P2, P3, P4, P5,P8, P9, P10, P11 it is found to be 33.931 T/SQM for P6, P7 is 35T/SQM.

Fig. 6 Different types of soil layer

c) Traffic Intensity investigation
IRC has conducted the survey for traffic intensity and load bearing capacity. IRC has been declared that this flyover is passed through seismic zone I.

V. RESULTS

Table 2 Materials used for testing

S.No	Materials	Test performed on materials	Results
1	Cement	Fineness test	91%
2	Course Aggregate	1) Impact test	13.82%
		2) Crushing value test	33.96%
3	Fresh concrete	1) Slump cone test 2) Compaction Factor test	12.5cm from top 0.923Kgs
4	Fine aggregate	Bulking of sand	21.73%

Table 3 Compression test results for 7 days

S.No	Age in days	Cubes	Compressing laod in KN	Avg. Compressive load in KN	Avg. Strength in N/mm^2	Avg. Strength in Kg/mm^2
1	7	cube1	520	505	22.44	228.79
2	7	cube2	490			
3	7	cube3	505			
4	7	cube1	480			

5	7	cube2	490	500	22.22	226.5
6	7	cube3	530			
7	7	cube1	450	495	22	224.26
8	7	cube2	540			

Table 4 Compression test results for 14 days

S.No	Age in days	Cubes	Compressing laod in KN	Avg. Compressive load in KN	Avg. Strength in N/mm^2	Avg. Strength in Kg/mm^2
1	14	cube 1	620	610	27.11	276.36
2	14	cube 2	600			
3	14	cube 3	610			
4	14	cube 1	600	600	26.66	271.83
5	14	cube 2	580			
6	14	cube 3	620			
7	14	cube 1	630	612	27.2	277.26
8	14	cube 2	595			

Table 5 Compression test results for 28 days

S.No	Age in days	Cubes	Compressing laod in KN	Avg. Compressive load in KN	Avg. Strength in N/mm^2	Avg. Strength in Kg/mm^2
1	28	cube 1	730	727	32.31	329.36
2	28	cube 2	750			
3	28	cube 3	700			
4	28	cube 1	720	710	31.55	321.66
5	28	cube 2	710			
6	28	cube 3	700			
7	28	cube 1	740	727	32.31	329.36
8	28	cube 2	715			

Table 6 Sieve analysis for fine aggregates (sand)

S.No	Seive designation in	Wt retained	Cum wt retain	% Cum wt	% of passing	% of passing
			ed	retained		specified
1	10 mm	0	0	0	100	100
2	4.75 mm	5	5	0.1	99.9	90-100
3	2.36 mm	46	51	1.02	98.98	75-100
4	1.18 mm	812	863	17.26	82.74	55-90
5	600 microns	2006	2869	57.35	42.62	35-59
6	300 microns	1536	4405	88.1	11.9	8 30
7	150 microns	426	4831	96.62	3.3	0-10
8	Below 150 microns	169	5000	0	0	

Table 7 Sieve analysis of coarse aggregates

S.N	Sieve Designation (mm)	Weight retained	% wt retained Gms	% Cum wt retained	% Cum wt passing	% Required
1	63	0	0	0	100	100
2	40	590	590	10.8	89.2	95-100
3	20	1800	2390	43.9	56.1	30-70
4	10	2892	5282	97.2	2.8	10–35
5	4.75	150	5432	100	0	0-5

Construction of CC Diversion Roads: For diversion of vehicles CC pavements are constructed on both sides of the BT pavement (non -voiduct portion). CC roads are rigid pavements which have subgrade ,subbase,base course layers.

Materials are used: 12 mm dust for GSB,40 mm dust for WMM, 20mm sand,cement for DLC,20,12 mm sand ,cement for M35 layer.

Fig.7 Laying of CC road

Fig.8 Vibrating

2. Markings for Excavation and Excavation process:

2.1 Markings for Excavation:

For exact markings of foundation Pythagoras theory is followed.

$$a^2+b^2-c^2=0$$

i.e,. $a^2+b^2=c^2$

2.2 Soil Excavation: Based on markings the excavation should be performed.

Fig .9 During Excavation.

Fig.10 After Excavation.

3. Problems faced during the process of excavation:

3.1 Existing of rock strata: During the process of excavation it is quite natural that we face this problem. This problem can be overcome by following the simple process of blasting.

Fig .11 Existing of rock strata

Fig .12 Blasting of rock strata.

3.2 Seepage of water- This problem persist due to the presence of excess ground water level. This can be overcomes by De-watering using pumps or motors.

Fig .13 Seepage water

Fig .14 De-watering using motor.

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4.Laying of levelling coarse and Levelling

4.1 Laying of levelling coarse

Levelling coarse is the process of laying concrete in the excavated place to maintain equal level at every point. Concrete used in the level coarse is of "nominal mix". It's ratio is 1:3:6 i.e 1 bag of Cement ,3 bags of Sand and 6 bags of coarse aggregates. Level coarse does not provide any strength to the structure, it is just laid to maintain level.

Fig.15 laying levelling coarse

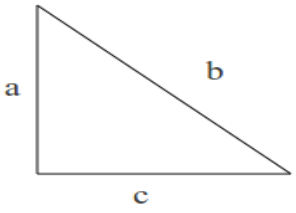
Fig .16 After levelling coarse

4.2 Levelling

levelling is the process of making the ground surface clean and reaching the required depth for foundation. For this procedure levels at different points are taken and ground surface is made to equal level. This process is brought out by the apparatus i.e "Dumpy Level".

5. Foundation Marking and Steel Reinforcement:

5.1 Foundation marking: After levelling coarse is layed marking are made for foundation according to the given design. According to our design P_1, P_2, P_3, P_4, P_5, P_8, P_9, P_{10}, P_{11} are of stepped rectangural footing P_6, P_7 are of trapezoidal footing. The dimensions of stepped rectangular footing are (8*4.6) m^2. The dimension of trapezoidal footing are (10*8) m^2. For foundation marking phythageorous therom is used.



$a^2+b^2=c^2$

c= Sqrt (a^2+b^2).

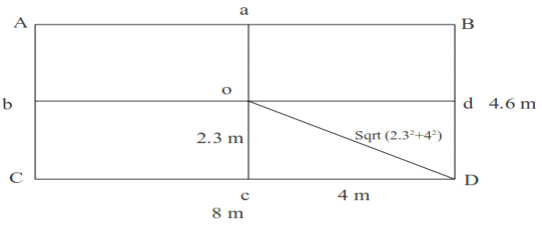


Fig .17 Marking for rectangular footing

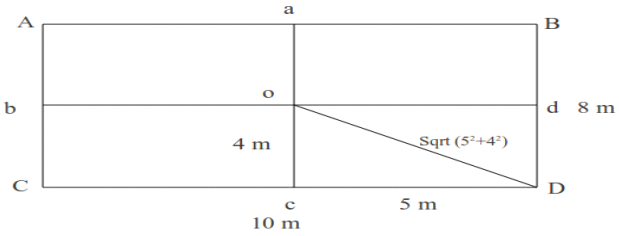


Fig .17 Marking for trapezoidal footing.

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Fig.19 Using tape survey giving markings for foundation.

Quantity of Steel and Concrete

Table 8 Quantity of Bottom Mat Steel for structures

Bottom Mat					
Structure	No. of bars along length direction	No. of bars along width direction	Length of bars along length direction (m)	Length of bars along width direction (m)	Quantity of steel (kgs)
Stepped Rectangular Footing	40	23	7.85	4.45	657.93
Trapezoidal Footing	50	91	7.85	9.85	2135.94
Abutment	30	60	12.55	6.55	303.95

Table 9 Quantity of Steel and Concrete for Footings

Footing				
Structure	Dia of bars	Steel (Kgs)	Total steel (Kgs)	Total Concrete(m3)
1.Stepped Rectangular Footing	10mm	338.892	3118.923	349.2
	16mm	636.187		
	25mm	2143.844		
2.Trapezoidal Footing	16mm	2657.858	7779.569	91.53
	25mm	5121.84		

Table 10 Quantity of Steel and Concrete for Piers

Pier			
Piers	No.of bars	Weight of steel(Kgs)	Concrete(m^3)
P_1	27	213.23	42.272
P_2	30	236.928	41.088
P_3	33	260.620	51.312
P_4	34	268.51	54.32
P_5	36	284.313	56.128
P_6	42	326.51	61.995
P_7	42	326.51	61.995
P_8	36	284.313	56.064
P_9	34	268.51	54.064
P_{10}	32	252.723	50.728
P_{11}	29	229.030	46.064
Total	375	2951.197	582.03

Table 11 Quantity of Steel and Concrete for Bedblock

Bed block			
Structure	Dia of Bars	Steel (Kgs)	Concrete(m^3)
Bedblock	16mm	1250.877	23.256
	25mm	740.42	
Total		1991.297	

Table 12 Quantity of Steel and Concrete for Abutment

Abutment			
Sturcture	Dia of bars	Quantity of Steel (Kgs)	Quantity of Concrete(m^3)
Abutment	8mm	1153.155	486.8577
	16mm	676.44	
	10mm	420.67	
	12mm	200.025	
Total		2450.29	

VI. CONCLUSIONS

The total estimated amount to worked out for this project is Rs.2630.00 Lakhs .The work shall be carried out as per standard specifications MORTH (4th Revision) APSS & relevant circulars issued by the department from time to times. Miryalaguda town in Nalgonda district is an important grade-1 municipality having a population of above one lakh and daily floating of 25 to 30 thousands with high activity of business as there are about 80 rice mills in town with F.C.I godown. The area comes under command area development with Nagarjuna sagar left canal with high yield of paddy giving livelihood to the thousands of labourers working from different places. The headquarters of member of Parliament and legslislative assembly is Miryalaguda. The town is developing in all aspects with number of educational institutions like degree and engineering colleges and good medical facilities. From the above details of requirements satisfied and reduced traffic by Construction of Fly Over Bridge at Hanumanpeta crossroads of Peddavoora, Miryalguda road in km 43/0-4 and Narketpally-Addanki road in km 61/2-4 in Miryalaguda town limits in Nalgonda Dist.

REFERENCES

[1] Clare, D., 2004, Private Communication
[2] RTA, 2003, Bridge Aesthetics: Design guidelines to improve the appearance of bridges in NSW, Collaboration of RTA.
[3] Frederick Gottemoeller, 2004, BRIDGESCAPE: The Art of Designing Bridge, John Wiley & Sons, Inc.,
[4] C. Michael Walton, William W. Millar, 1991, BRIDGE AESTHETICS AROUND THE WORLD, Transportation research board executive committee 746 References

[5] Ansari S A, Kothyari U C, Ranga Raju K G 2002 In uence of cohesion on scour around bridge piers.
[6] J. Hydraul. Res. 40: 717 729Indian practice on estimation of scour around bridge piers A comment 197
[7] Chitale S V 1988 Estimation of scour at bridge piers. J. Irrigation and Power (CBIP) 45: Chitale S V 1993 Indian practice of scour estimation limitations. J. Irrigation and Power 50: Graded R J 1972 Bed material characteristics of alluvial streams. J. Sediment. Geol. 7:
[8] Garde R J, Ranga Raju K G 2000 Mechanics of sediment transportation and alluvial stream problems.(New Delhi: New Age) Garde R J, Kothyari U C 1998 Scour around bridge piers. J. Ind. Nat. Acad. New Delhi, 64:569 580
[9] Gupta R K 2003 Case studies of bridges on alluvial clayey and boulder streams with regard to pier scour. Nat. Workshop on bridge scour, river training and protection works, New Delhi
[10] Huber F 1991 Update: bridge scour, civil engineering, New York: ASCEIndian Railway Standards, IRS 1985 Code of practice for the design of sub-structures and foundations of bridgesInglis C C 1944 Maximum depth of scour at heads of guide banks, groyens, pier noses and downstream of bridges, Annual Report (Technical), CWPRS, Pune Inglis C C 1947 Meanders and their bearings on river training. Proc. ICE, London, Maritime Paper No. 7
[11] IRC 1998 Standard speci cations and code of practice for road bridges, section 1, IRC: 5-1998 IRC 2000 Standard speci cations and code of practice for road bridges. section-VII, IRC: 78 2000
[12] Kothyari U C 1995 Frequency distribution of river-bed materials. J. Sedimentology 42:283 291 Kothyari U C 2003 Bridge pier scour in gravel cobble and cohesive bed rivers, Report submitted tothe IRC sub-committee to review the aspects of scour around bridge foundations
[13] Kothyari U C, Ranga Raju K G 2001 Scour around spur dikes and bridge abutments.
J. Hydraul. Res.39: 367 374