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Construction of Flyovers: An Empirical Study of Construction of Flyover from Jehangir Chowk to Rambagh Chowk Srinagar, Kashmir

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Abstract: ***To reduce traffic congestion at an at-grade intersection near a big city, one method is construction a flyover bridge at the old junction in two directions on one of the main highways. The flyover facilitates the traffic flow in the directions of the bridge, but the infrastructure cannot fully solve all of the problems especially on the secondary road. Under the bridge, although it relieves the traffic congestion at the intersection; the traffic signal still uses the same control as the "before" situation, that is the fixed time control plan. With the flyover bridge in place, it was found that about 30-35% of all traffic volumes diverted to the bridges, and time delay reduced by 30% over the same period. This paper which is one part of the first author's thesis presents the issues that still exist at the flyover-improved junction and makes suggestions to increase the benefits of the flyover such as creating a new cycle and phase times and improving the physical area under the bridge.***
Keywords: Flyover, Bridge design, Pile foundation, Rig machine, Correction, Comparison.

I. INTRODUCTION

Piles during these in the Middle Ages, pile foundations supported a wide assortment of structures in Venice and in Holland. Many years were made from trees, whose branches were trimmed, and were driven down with the small diameter at the bottom, until penetration of the soil was no longer possible. This condition, known as refusal, was a combined function of the soil stratigraphy and the limits of the driving mechanism. Driving was probably by hand mauls, hand-operated machine mauls, treadmill drivers, water wheel drivers and gang operated rams. The industrial revolution, with its utilization of steam power, changed the situation drastically. The first steam-activated pile hammer was invented by Nasmyth in 1845 and ushered in modern pile driving. Parallel to these developments, structures larger than those previously built, e.g. bridge piers and large buildings required pile capacities greater than those already available. A limited-access road known by various terms worldwide, including limited-access highway, dual-carriageway and expressway, is a highway or arterial road for high-speed traffic which has many or most characteristics of a controlled-access highway (freeway or motorway), including limited or no access to adjacent property, some degree of separation of opposing traffic flow, use of grade separated interchanges to some extent, prohibition of some modes of transport such as bicycles or horses and very few or no intersecting cross-streets. A controlled-access highway provides an unhindered flow of traffic, with no traffic signals, intersections or property access. They are free of any at-grade crossings with other roads, railways, or pedestrian paths, which are instead carried by overpasses and underpasses across the highway. Entrance and exit to the highway are provided at interchanges by slip roads (ramps), which allow for speed changes between the highway and arterial roads and collector roads.

II. MAIN FEATURES OF THE FLYOVER

A. Four lanes divided carriageway elevated road from Jehangir Chowk to Rambagh Bridge.
B. Two lanes, two separate major bridges for each direction traffic over flood channel at Rambagh each on either side of existing bridge.
C. Two lanes elevated road from Rambagh bridge to Rambagh (Beyond Y-intersection at Natipora Chowk) on airport road.
D. At Jehangir Chowk an upward ramp for traffic from Jehangir Chowk to Rambagh and a downward ramp for traffic from Rambagh to Jehangir Chowk.
E. Integrating existing Flyover with Proposed Elevated Expressway at Jehangir Chowk for left turning traffic from Dal Gate to Rambagh.
F. At Bakshi Stadium Chowk a left turn Upward Ramp from Jawahar Nagar road to Rambagh and Downward Ramp for traffic coming from Rambagh.

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G. To and Fro connection to the elevated highway for traffic on Natipora road by providing downward ramp on LHS form Natipora Y-junction and upward ramp on RHS starting from Natipora Y-junction.
H. Widening and Strengthening of two lanes at grade road on both sides of proposed elevated road on whole stretch of project.
I. Provision/ improvement of minimum 1.5m wide drain-cum footpath on both sides.
J. Providing at grade bigger size rotary for smooth traffic movement underneath the existing flyover at Jehangir Chowk. Provision of dividers and small rotaries at different locations of project stretch for smooth flow of traffic.
K. Provision of electrification and lighting arrangement for whole project stretch.
L. *Steps in the Construction of Flyover:* The following paragraphs will explain the Method of Statement for setting out pile points and pilling works:

1) *Pile location Setup:-* Prior to the rig setup at the pile location existing utilities, obstacles or other underground services (telephone lines, electric cables, drainage system etc.) are to removed or relocated. The piling rig will drill from working platform level. The working platform and access to pile location shall be made with suitable hardcore material for the movement of the equipment and ready mixed concrete trucks.
2) *Installation of Temporary guide Casing:-*The position of the casing center shall be reconfirmed before starting of drilling and after completion of drilling. A temporary guide casing of an internal diameter slightly more than diameter of the pile will be installed. The temporary casing shall be installed into the ground with help of piling rig or with a Vibro hammer. The center of the temporary guide casing is the previous installed steel pin.
3) *Drilling Of Pile Bore Hole:-* The rotary rigs are utilized in this process. The hole will be drilled by means of a bucket equal to diameter of the pile from the working platform using a temporary casing. The supporting fluid shall be Bentonite slurry. The slurry support system relies on the presence of thyrotrophic mud water mix to maintain the stability of the side walls in drilled borehole. After fixing the guide casing the borehole will be drilled down on its final level. The buckets grabs the soil inside the hole deepens the bore. The bucket when filled up with soil is lifted from the hole and spoil is dumped outside. This process is continues till the final stratum is reached. The verticality of the drilled borehole shall be ensured to its full depth. . For cleaning the bottom of the borehole, a cleaning bucket will be used. To keep the quality of Bentonite during the drilling within the allowable limits a recycle process of cleaning the Bentonite from sand and silt is continuously done during the installation of the pile.
4) *Reinforcement Cage Installation:-* The reinforcement for the pile shall be in accordance to the requirements of the specification and the design of the pile. The reinforcement cages will be fabricated up to the designed length. The cage should be free from dirt. The pre-fabricated reinforcement cage will be lifted and placed in the pile borehole using the service crane. The cage will then be lowered to keep the top level at the designed level. Durable spacers shall be used at intervals to keep reinforcement cage in position. The spacers shall be PVC material or cement concrete and as per approved sample for clean concrete cover 75mm to the reinforcement.
5) *Concreting of pile:-* The concrete is delivered by means of truck mixers. The concrete will be received on site and delivery ticket will be checked for correctness in accordance with the approved mix design. The concrete will be checked for slump and temperature. Cube will be taken as per specification. The concrete will access the site only after concrete quality has been found in compliance with the specifications.
6) *Removal Of Temporary Guide Casing:-* After concreting, the guide casing will be withdrawn by the piling rig. A sufficient head of concrete will be maintained to prevent reducing in diameter of pile shaft by earth pressure, Bentonite slurry or soil and to prevent extraneous material from mixing with fresh concrete. The quantity of poured concrete volume will be measured and it will be compared with the theoretical volume. Soil from drilling of boreholes shall be removed from site to designated disposal areas.

M. *Tools used in the Construction of Flyover*

1) Total Station
2) Spirit Level
3) Rig Machine
4) Auger
5) Bulldozer
6) Concrete Mixer
7) Wrecking Bar
8) Bar Bending Machine

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9) Tremie Pipes
10) Iron Bars
11) Cranes
12) Concrete Cubes

III. LITERATURE REVIEW

Review of Literature helps to identify the concepts relating to the research topic and potential relationship between them. It also helps in appropriate analysis of data. Moreover it gives broader vision and even the secondary data to the research. Following literature is carefully reviewed and studied by the researcher.

Dzolev et al, This work presents the analysis of reinforced concrete Girder Bridge designed according to EN 1998-2, with the determination of the achieved ductility in plastic hinges at the target displacement for the designed seismic action, for confined and unconfined concrete cross sections, with and without the effects of geometric nonlinearity.

Rajeev Sharma (2015), This work deals with the evaluation studies for the existing, RC bridge using non-linear static analysis. For the seismic assessment of the bridge a 3 span bridge is selected which is located on the hind on river at Ghaziabad (Uttar Pradesh).this area is highly vulnerable to the seismic activity because it is lie in the Zone – 4 .so , the high magnitude earthquake may be occurs in this region(may be greater than 7 magnitude).

T. Pramod Kumar et al, This deals with the analysis and design of super structure of road cum Railway Bridge across Krishna River proposed on downstream side of existing bridge between Mahanadu road of Sithanagaram and P.N. Bus station, Vijayawada. The bridge is made of through type steel truss which carries two railway tracks at lower level and a roadway of three lane carriage way in the upper level. The span length matches with that of existing nearby Railway Bridge. Analyses of top floor members, truss members and bottom floor members are done using STAAD Pro.

Karthiga et al, This presents a linear analysis of the substructure of rail over bridge by considering IRS 25t railway loading and road over bridge by considering IRC class-A loading. Road over bridges are bridges over which the roadway can be operated. On the other hand, in rail over bridges, the rail track can be operated over the bridge. The aim of this paper is to determine the various types of loads acting on the structure and analyze the substructure of road over bridge and rail over bridge using STAAD Pro. The moment is obtained from STAAD Pro for road over bridge and rail over bridge and compared for the critical pier section. The loads and load combinations are considered with respect to IRS and IRC codes.

R. Monteiro et al, This work intends to readdress that issue from the modeling type point of view. Currently, most of the structural seismic analyses are carried out considering either fiber-based or plastic hinge structural models.

Chao Li et al, This work studies the seismic responses of corrosion-damaged RC bridges under spatially varying seismic ground motions. The chloride induced corrosion damage to the bridge is considered in the analysis.

A. Methodology:- Surveying

1) Research analysis and decision making.
2) Field work or data acquisition.
3) Computing or data processing.
4) Mapping or data representation.
5) Stakeout.

B. Pile Foundation

Pile foundations are the part of a structure used to carry transfer the load of the structure to the bearing ground located at more depth below ground surface.

C. Need of Pile Foundations

When it becomes impossible to provide the suitable surface foundation for a structure; the use of pile foundations becomes necessary, this situation arose from either the soil condition or the order of bottom layers, the nature of the loads transferred to the soil or the nature of the site and operational conditions. Many factors prevent the selection of surface foundation as a suitable foundation such as the nature of soil and intensity of loads, we use the piles when the soil have low bearing capacity or in building in water like bridges and dams. The main components of the foundation are the pile cap and the piles. Piles are long and slender members which transfer the load to deeper soil or rock of high bearing capacity avoiding shallow soil of low bearing capacity. The main types of materials

used for piles are Wood, steel and concrete. Piles made from these materials are driven, drilled or jacked into the ground and connected to pile caps. Depending upon type of soil, pile material and load transmitting characteristic piles are classified accordingly.

D. Classification of piles According to the Method of Installation of Piles

1) Driven or displacement piles
2) Bored or Replacement piles

E. Types of Piles based on Materials

1) Timber piles
2) Steel piles
3) Concrete Piles
4) Composite pile

Load chart test pile

S.NO.	PRESSURE READING DIVISION	GAUGE RAM Kg/cm2	AREA OF ACTUAL HYDRAULIC JACK cm2	LOAD IN MT	REMARKS
1	1	20	1589.63	31.792	1st INCREMENT
2	2	40	1589.63	63.584	2nd
3	3	60	1589.63	95.376	3rd
4	4	80	1589.63	127.168	4th
5	5	100	1589.63	158.96	5th
6	6	120	1589.63	190.752	6th
7	7	140	1589.63	222.544	7th
8	8	160	1589.63	254.336	8th
9	9	180	1589.63	286.128	9th
10	10	200	1589.63	317.92	10th

IV. CONCRETING

After confirming the pile has reached the termination level, the bailer pipes are removed from the borehole. The depth of borehole is determined preliminarily by measuring the length of the bailer pipes upon removal from the hole. Reinforcement cage is lowered vertically to the borehole, without disturbing the sides of the hole, after removing the bailer pipes. Adequate cover blocks are provided all around the cage to ensure sufficient cover. Sufficient stiffener bars also are provided to avoid sideways sway. Stirrups, stiffeners and laps are ideally welded to avoid breakage. Following this, the tremie pipes are lowered in to the borehole. The tremie pipes usually have a diameter of 200mm. The bottom of the bore hole is cleaned very carefully before starting the concreting. This is done by continuous flushing with fresh flushing mud. Consistency of flushing mud is checked and maintained, to avoid mixing of flushing mud with concrete. The bore hole is flushed for at least 30minutes prior to concreting. Sounding is done at the bore hole to precisely measure the bore depth. This measurement obtained by sounding is cross checked with the measured length of bailer pipes removed

from the borehole. Before starting the concreting works, the specific gravity of flushing mud at the bottom of the bore hole is brought down to 1.2, if it is more. The tremie is lowered to the bottom of the borehole, and a hopper is connected at the top of the tremie pipe. Concrete used for pile concreting shall have a minimum slump of 150mm. The joint between hopper and tremie pipe is closed with a steel plug before the first charge. The hopper is then filled with concrete to the full capacity. Once filled, the steel plug is removed to allow the concrete to flow down and replace the bentonite slurry present in the pipe. The bottom end of the tremie pipe is always kept embedded, at least 2m, within the laid concrete so that the bentonite is replaced from bottom upwards and the concrete is not mixed with water or bentonite. Only the initially poured concrete is in contact with the bentonite slurry within the borehole. The tremie pipe remains hollow after the first charge and each subsequent charge gets deposited within the already laid concrete. Concreting is done to at least 60 – 90cm above the cutoff level to ensure good concrete for proper embedment into pile cap. If the cutoff level is at ground level, the concrete is allowed to spill over till good concrete is visible. Once started, the concreting is continued uninterrupted till the end.

A. Tests performed for the construction of flyover

1) Standard penetration test.
2) Slump test.
3) Load tests performed on piles.
a) Initial test
b) Routine test
4) Vertical test.
5) Lateral load test.
6) Pull-out load test.

V. CONCLUSIONS

A. It is clear therefore, how much improvement has come to this field of Engineering. As earlier we used timber piles now we have techniques to develop concrete piles, steel piles of large diameters, so that they could be used for heavy traffic loads and of course in the building that has to bear a large amount of loads. So we can see new techniques are being developed day in day out to cater with different problems in an economical way.

B. In this project all latest machines and equipment's are used. Reinforcement cages are prepared on site. Rig machines and cranes are used to move the things from one place to another and for the installation of these reinforcement cages.

C. As the surveying has already been done, but the pile locations are always cross checked by the surveyor to remove any kind of error, which could have been generated if they wouldn't have done that. I can say each and every work was being neatly and keenly observed.

D. At each place of installation of piles, soil investigation is done by the geotechnical staff and samples are sent to the laboratory for further tests to determine various properties of soil. And also N-values are determined, on this basis depth of the pile is decided by the Designers and Design is provided according to these results.

E. Initial and Routine both the tests are performed at the site and settlements are checked by various tests which are performed under the above given heads like Vertical test, Lateral test, Pull out tests to check safety against the loads which can cause damage to the structure.

F. Concrete from each and every mixer is first checked by the engineers to know its Slump Value. And if the slump value comes out to be less than the required value, Admixture is added to the concrete present in the truck. And the concrete cubes are taken to the laboratory for 7 and 28 days strength tests to be carried out on them. So from all this we can conclude that each and every step taken in this project was neat and clean without any negligence from any one from the staff of engineers as well as workers.

G. Flyovers contribute a lot to the aesthetics of the city. The persons travelling on the flyover can enjoy the panoramic view of the city.

H. Through flyovers plenty of time is saved avoiding congestion.

I. Flyover ensures economical savings of fuel consumption.

J. Through flyovers pollution effect is reduced.

K. Flyovers reduce the risk of accidents.

L. Flyovers reduce the travelling time of the vehicles in toll plaza.

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Flyovers have many advantages, but shortcomings arise only because of some mistakes committed during their construction or due to improper planning etc.

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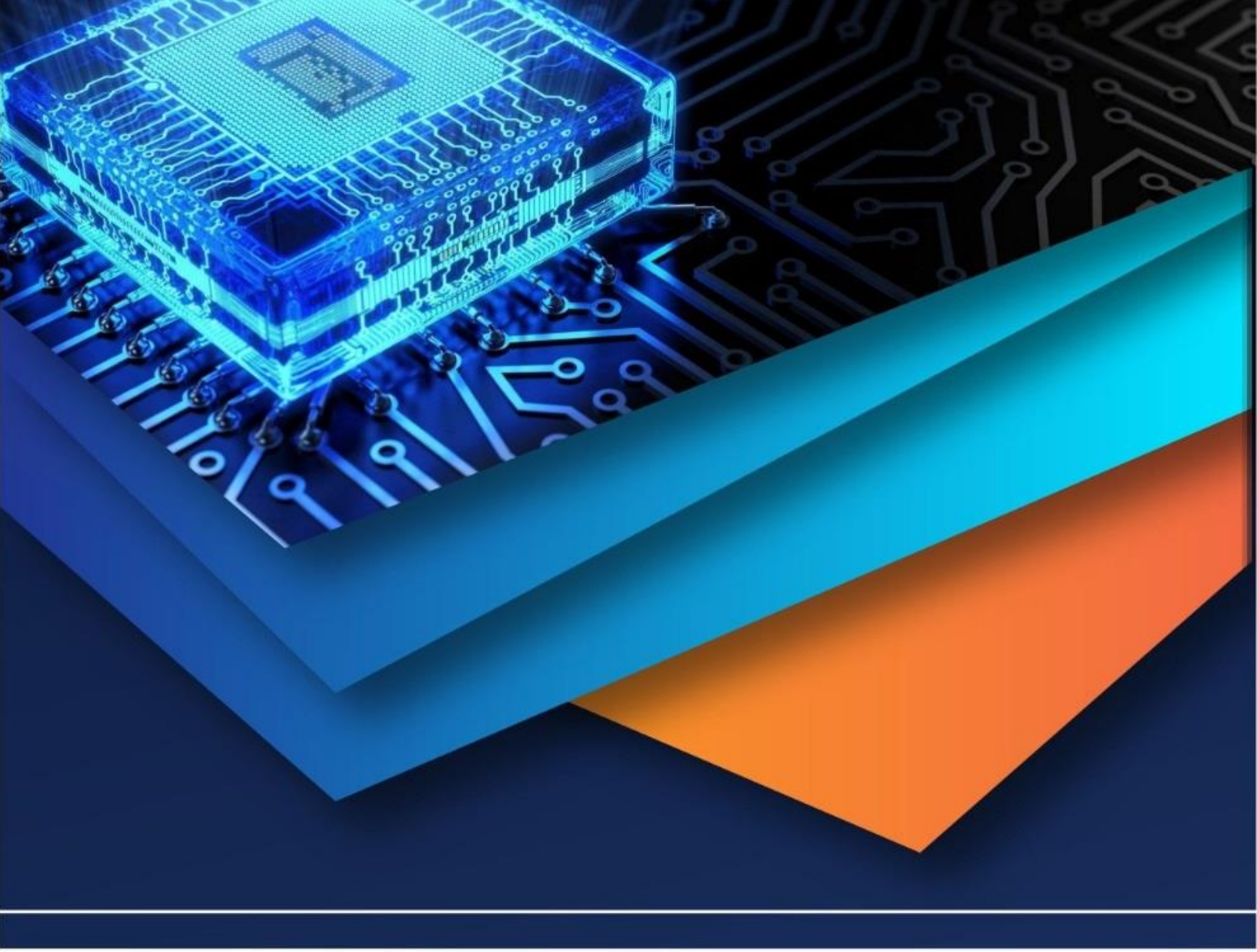

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