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BRIDGE AND FLYOVER CONSTRUCTION: A REVIEW

Mohd. Sajid Ali[1], Bipin Kumar Singh[2]
[1]M.Tech Scholar, [2] Head of Department
Civil Engineering Department, NIMS University Rajasthan, India.

Abstract: This paper review the waste specially the solid waste condition in India and focus on the process of waste recycling and using the waste for the process of building the roads.
Index Terms: Solid waste, waste recycling, and road from waste.

I. INTRODUCTION

Infrastructures are a key component for economy. Among them, transportation infrastructures are key for human life and economy. Also, inside the transportation systems, bridges are key components for associating individuals and conveying merchandise. Hence, bridges have been worked since numerous hundreds of years back, somehow, and the advances (and here and there land developments!!) of antiquated societies everywhere throughout the world have been identified with their capacity of building permanent bridges. The most illustrative of this could be the Roman Empire. After numerous era of bridge construction, these days we confront a long history of encounters that enable us to look to the advancement of bridge engineering along years and, in view of that, to attempt to extrapolate what is the most practical to come in the following future. The development in bridge engineering has been firmly connected to the key advances in the accompanying ranges: materials, construction procedures, and displaying. Construction systems and bridge typologies toward the start were administered by the mechanical properties and execution of accessible materials around then. Indeed, when the accessible materials were stone and masonry (materials that function admirably in compression however not in strain), the trademark bridge sort was the curve and the construction procedure, the platform of the total structure, on the grounds that the curve activity needs the total structure to create. For a considerable length of time, the curve was the main accessible bridge sort with respect to permanent bridges. Obviously, suspension and pillar designs were additionally accessible however regularly with brief use because of the toughness confinements of materials working in strain (vegetal strands) and bowing (timber). Just the appearance in the nineteenth century of new materials as iron and steel, with the capacity to oppose malleable anxieties permitted the introduction of permanent suspension and brace bridges. Later on, the mix of another material, concrete (like a counterfeit stone) and steel, framing fortified and prestressed concrete made workable for the "new stone" to oppose ductile activities and to join fragments between them. Something that was unrealistic with the "old stone"!!. This come about on an essential transformation in the realm of bridges. Indeed, segmental bridge construction was conceived, connected to it, and another gathering of construction methods for solid bridges: adjusted cantilever, incremental propelling, traverse by-traverse. These new construction procedures were likewise quickly received by the steel bridges. At long last, as of now in the twentieth century, the utilization of the PC made moderate the precise count and, along these lines, the plan and construction of exceptionally repetitive bridge sorts as link stayed bridges, and to demonstrate extremely confuse construction successions. From that point forward, it appears like bridge engineering identified with plan and construction of bridges had achieved a stationary point and no further pertinent advances were visualized. Bridge history demonstrates to us that for any significant transformation (or let us say a "preceding" and an "after") in the field, some pertinent truth ought to happen. There has been a "preceding" and an "after" in bridge outline and construction with respect to the come into scene of cement and steel. From that point forward, new materials have not showed up. Just as of late, fiber strengthened plastics (FRP) were converted into bridge engineering from the aeronautical field. Be that as it may, these new materials did not prompt applicable changes in bridge typologies or bridge construction plans, being its principle include, their sturdiness and high quality to weight proportion. There has been likewise a "preceding" and an "after" in-bridge construction since the presence of prestressing. Also, at last, there has been a "preceding" and an "after" in bridge plan and demonstrating since the presence of displaying systems and moderate computational techniques. No significant advances were found in construction forms after the improvement of propelling, adjusted cantilever, or traverse by-traverse strategies. No vital advances were seen too in bridge plan and auxiliary setups after the appropriation of steel and concrete and the utilization of PC displaying. As new materials, new construction forms and new demonstrating systems are not anticipated in the years to come as well, it appears that no "enormous unrests" must be normal in the ranges of bridge plan and construction.

II. FLYOVER TREND IN INDIA

Previously, a few flyovers were developed in various urban areas in India. In Chennai, the Gemini flyover was worked in the mid-seventies. In Delhi, flyover construction was activated by the Asian Games. Generally various flyovers have been developed all over India. Mumbai, Delhi, Chennai, Kolkata, Hyderabad and Bangalore represent more than 300 flyovers. The speculation adds up to more than about Rs 300 billion. What's more, the consumption on construction of bridges and flyovers is required to touch about Rs 2000 billion. With regards to such tremendous speculation, it is important to investigate the different parts of arranging, plan, specifying and construction of flyovers. Amid the developmental stages, ideas, for example, basic leadership, applied outline, plan organization, soil examination, extend administration office, institutionalization, new construction materials ought to be solidified. All the accessible choices for a specific area are considered before settling on the flyovers. Present and future activity development design, area of transport stops, natural effect and so on ought to be considered. From that point, a nitty gritty activity study and future populace of movement is led so as to decide the quantity of paths toward every path. The arranged format of the flyover is precisely maintained a strategic distance from aggravation to activity and augment the decongestion potential.

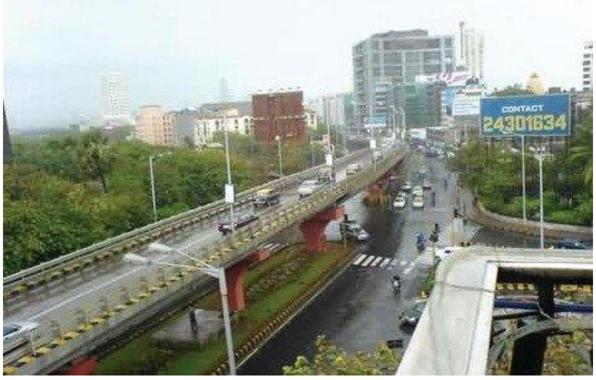

Fig 1. Thane Flyover Mumbai


Fig 2. AJC Bose Flyovers –Kolkata

III. INDIAN LOADING STANDARDS AND PERMISSIBLE STRESSES

The Indian Roads Congress (IRC) standards are appropriate to highway bridges. IRC loadings are conservative, not realized during the service life. Urban flyovers generally cater to cars, LCVs and buses. Heavier vehicles may use roads at ground level. IRC 70R/ Class AA loadings are not appropriate for flyovers, but often adopted. The IRC codes stipulate low permissible stresses, ignoring developments in high strength concrete and high grades of reinforcement steel. IRC codes specify minimum thickness for webs, deck slabs, pier walls etc which leads to avoidable increase in quantities, whereas these should be derived from design. In the past, hundreds of bridges have been built with web thickness of 150mm and are in satisfactory service for more than 40 years whereas the thickness now is more than 250mm.

Pile foundations

When piles are fully designed and detailed as per the Standard Codes, there should be no further conditions on the minimum number of piles. Flyovers have been constructed with pier resting on a single pile or on two piles in Malaysia and Bangladesh. However, in India, three or four piles per foundation is insisted upon which is not justified. The bottom of pile cap should be above water level to facilitate construction and obtain better quality concrete.

Piles generally transfer the loads both by friction and by end bearing. This aspect should be recognized in the design. Socketing of piles into hard rock may be justified in specific cases and should not be universalized. The depth of socketing if required should be judiciously chosen. Unduly harsh specifications in this respect lead to delays in construction and increased cost.

Piers

Urban flyovers are built over precious land. Hence the space occupied by the pier should be kept to the minimum. Ideally, circular piers of 1m to 2m diameter in high strength concrete should be adequate for up to six lanes of traffic. This is also aimed at providing a more durable concrete structure and eliminates the need for any type of coating to reinforcement and/or concrete surfaces.

The pier configuration can also be carefully chosen to eliminate pier caps. This reduces construction time. The full height of the pier is concreted in one lift to avoid construction joints and also reduce construction time. It is possible to precast the piers off-site, transport and erect them causing minimum disturbance to the existing traffic at site.

Superstructure

Most of the urban flyovers are built on heavily congested roads. Therefore in-situ work is reduced to the minimum. Beams, segments etc. are precast off-site, transported and erected during night. Precast pretensioned beams are extensively used for spans upto 45m. Indian flyovers use beams with conservative L/D ratio of 15-25 which will be expensive. In USA, pretensioned beams of large spans to 45m are in vogue with slender L/D ratio of 25 to 35.

Span range

The span range directly results from the site conditions. The span length influences the selection of cross sections and also the erection method of 20 m beam are easily erected using a single 50 t crane. In order to improve the riding quality and economics, continuous decking for several spans without expansion joints is preferred. In case of flyovers in India, deck continuity has been practiced with expansion joints spaced about 100-150 m and this could easily be stretched to full length of flyovers.

The individual spans should be transformed into a full continuous system by using diaphragms and continuous deck slab at the supports. By eliminating bearings under each individual girder, the width and thickness of the pier can be substantially reduced.

In the developed countries, integral bridges are being realized with abutments integral with deck. Continuity of deck results in a more economical profile with reduction in the cross section, thickness and dead weight of the superstructure. It is possible to eliminate the wearing coat altogether with the use of high performance concrete.

Beam cross section
Many different types of cross sections have been used for precast beams. Precast T beams placed at 0.6m to 4m centres with in-situ concrete deck slab is common. In India, for a typical 30 m span, it was usual to provide four T beams for a 7.5 m carriageway. This was subsequently reduced to three beams and also two beams by many designers in order to realize the minimum quantities of concrete and/or steel. This does not necessarily result in overall economy and ease of construction. The deck slab construction is quite expensive because of larger spans between the two beams. It is difficult to contain all the reinforcements within the optimized cross sections with consequent problems of difficulties in placement and compaction of concrete.

High strength concrete
High strength concrete up to 80 MPa is now permitted in IS 456 2000. The Euro Code allows strengths up to 115 MPa. In India, the JJ flyover has been constructed with 75 MPa concrete. The use of concrete strengths of up to 85 Mpa cube strength allows longer span lengths and more economical structures for existing beam sections.
In India, compressive strength of 40-50 MPa is for pretensioned beams. A shallow section with a high strength concrete can be more cost effective than a deeper section with normal strength concrete.

Standardization
The Ministry of Road Transport and Highways (MORTH) has attempted to set up standard drawings for spans up to 40 m in reinforced and prestressed concrete. These are not been widely used as they are not economical.
In the absence of standardization in India, chaotic conditions prevail. No two designs, even by the same organization are identical. Formwork has to be manufactured for each flyover increasing the cost. The equipment in the precasting yard is not standardized, leading to duplication of work.

Project management
Traditionally, the engineers appointed by owners have been managing the projects. Employment of independent project management consultants (PMC) based on expertise in flyovers facilitate fast track construction. The PMC can assist the owners in soil investigation, preparation of tender documents, pre-qualifying the bidders, evaluation of tender documents etc. After the award of work, the PMC can proof check and recommend approval of contractor's designs, supervise the project, ensure quality assurance and certify the payments.

Quality assurance
Due to the speed of construction and pressure on supervisory personnel in fast track construction, unintended quality deficiencies may occur. Adoption of ISO: 9000 minimises quality deficiencies. The design and construction organizations should get ISO: 9000 certification or should atleast follow all the ISO: 9000 requirements in practice.

Reinforcement detailing
The detailing should use a minimum number of diameters of bars. It is always a good practice to standardize the diameter of the reinforcement to be used. This should be done after taking into account the easy availability of the respective diameters from the prime producers. Some diameters of TMT bars are either not being manufactured at all or not readily available, should be avoided in the designs.
The specification should only give reference to IS Codes. Phrases such as "Cold rolled, TMT, CRS" etc are not appropriate. Complicated shapes and multiple leg stirrups should be avoided as they increase the cost of construction. The designer should always provide the bar bending schedules to the construction team who will scrutinize and comment on the same if required, to facilitate construction.

Mineral admixtures
IS 456:2000 permits blending of mineral admixtures- flyash, GGBS etc – to produce blended cements or in the concrete batching plants. Concrete is sourced from RMC plants or automated batching plant at site. The mineral admixtures can easily be incorporated in the site mixed concrete without difficulty. The minimum cement content specified in the codes is really meant to be "minimum cementitious materials content". Thus when a minimum content of say 400 kg /m3 of concrete is specified it means sum total of cement plus mineral admixtures.

IV. CONCLUSION

Bridges and flyovers are connecting the various parts of a city and even country. They are always the pillars for the growth of the country's infrastructure. Our paper gives an overview about the standards and bridges and flyovers in india.

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