Analysis and Design of Superstructure - Earthquake Resistant Bridge – A Review

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ABSTRACT

This project deals with the RCC design of an earthquake resistant bridge. The location is near railway station in THANJAVUR which is facing major traffic problem due to the train moving & the Public felt inconvenient to cross the busy Track. We have done a traffic survey and designed all the structural parts for the project.

The bridge is having 10m span Length .The slab is designed by Limit stress method as per the recommendation of IRC:-21-2000 and IS 456-2000. Dead & live load for the Pile Column, slab, beam. All the elements are designed by using M25 Concrete Grade, & Fe415 Grade steel.

All the Drawings are draft by using AutoCAD 2016 and analysis by STAAD-PRO and Manual Design calculation for RCC structural design.

Keywords--- Earthquake Resistance, Deck Slab, Traffic Survey, Plastic Hinge, Super Structure

I. INTRODUCTION

The every major earthquake, to increase the capacity demand of the structure to counteract. The last decade that new Planning have been developed to manage this problem economically. The current IS Code Practice has towards a performance- based engineering design, wherein it’s on serviceability & safety under different level of magnitude of earthquakes. There is an increasing realization that apart from techniques for improving ductility. There have been methods of preventing dislodgement of superstructure at the severe earthquake. This is used in economical earthquake resistant design of bridge superstructure.

Our project deals with the RCC design of an earthquake resistant bridge. The location is near railway station in Thanjavur which is facing major traffic problem due to the train moving & the Public felt inconvenient to cross the busy Track. We have done a traffic survey and designed all the structural parts for the project.

II. OBJECTIVES

This Projects Deals with an Earthquake resistant’s Bridge. The RCC Design of Superstructure is Calculate by manual calculation and Analysisisby using STAAD.PRO.

III. PLASTIC HINGING AND DURABILITY

There is a difference in seismic design aspects of bridges and buildings. There suite degree of indeterminacy of bridge structure stored used potential of dissipating energy and loadre- distribution. In bridges, the super structures are the main structural elements for resistanceearthquake. Forenergydissipation, ductilebehaviouris necessary during flexure of the structural elements under lateral earthquake loads. The formation of plastic hinges or flexural yielding is permitted to occur in elements during evere shaking to bring down the lateral design forces to acceptable levels. The yielding would lead to damage, plastic hinging are restrict design atpointsaccessileforinspectionandrepair, That is part soft thesubstructurethatlie from foundation upwards. There is No plastic hinges are allowed to occurinthe foundations or in the bridge deck.

IV. SUPERSTRUCTURE DISLODGEMENT PREVENTION AND INTEGRAL BRIDGES

Bearings are comparatively fragile and brittle elements. The Types of bearings(metallic, elastomeric, pot, etc.) can be designed lateral force. The capacity of sustaining lateral forcesofabout25-30%oftheverticalload (IRC-1999).The larger lateral forces occurrence of ZonesI VandV (IRC-2000;BIS-2002),It issuitable and economical to provide resistance to Lateral forces separately by other structural element. The Superstructures have adequate strength or exist seismic Load, though this requires to be checkedin the
design work with IRC(2000). Application of vertical seismic load for pre-stressed concrete structures in combination with other closely connected loads is also required. In many earthquakes, the superstructure was displaced and had fallen onto the ground or was damaged due to unsupported caused by large displacements of elastomeric bearings or due to out-of-phase displacement of piers. The following counter failure measures are suggested:

- Provide reaction blocks or types of seismic control for preventing dislodgement of super structure at pier,
- Provide necessary support lengths for superstructure on pier,
- Design and construct integral bridges where by the substructure and superstructure can be made monolithic.

V. LITERATURE REVIEW

Kaar et al., (1960) investigated the development of continuity in precast, prestressed concrete bridge T-girders used in conventional designs for extending span lengths. The conventional design used deformed reinforcement in the CIP deck slab over the T-girders to provide continue designed for resisting the live loads. Kaar et al. (1960) carried out the load tests on the connection detail where the deformed rebar in the deck slab is made continuous over the supports and resists the negative bending moment. This detail also included the use of a diaphragm over the piers extending laterally between the T-girders on the side. The width of the diaphragms was greater than the spacing between the ends of the T-girders, which helped to provide lateral restraint to the compressive strength of concrete. The results from this study found that this continue connection detail was desirable as it permits sufficient redistribution of moment and an easy to construct and relatively economical.

Mattock et al., (1960) carried out additional tests on the continue connection for precast, prestressed concrete bridge T-girders with introduction of all details for resisting the (+) moments resulting from shrinkage and creep of concrete. They conducted static and dynamic load tests on 1/2-scale component specimens of a double-span continue connection between the T-girders with CIP deck and diaphragm. The results from all the static load tests to confirmed the results determined by Kaar et al. (1960). From the dynamic test using repeated moving loads applied to the free ends of the girders, the researchers found that the connection can potentially resist a definite number of all applications of design loads without failure. However, the breath of the cracks and the resulting flexible of the connection were found to be large. They tested two connection details of all (+) moment resistance: (i) Fillet arc welding the projecting of all ends to the reinforcement bars toa structural steel angle, and (ii) bending the projecting ends of the reinforcement to form right angle hooks and lapping them with the longitudinal diaphragm reinforcement.

Bishop et al., (1962) proposed the plate connection in this weld connection, the beams were first erected stress as normal spans. The end of one beam was jacked upward at the first support, and the second supported beams were connected by welding together the all plates cast into the ends of the top and bottom flanges. The raised end was lowered to the final position, thus developing a bending moment at the support equal to that caused by the self-weight of the continuous beam. Though this appeared to be an innovative solution, there were so drawbacks. First, this method changed the loading conditions under the self-weight of beam from simply supported to a cantilever. The needed for extra reinforcement in the higher part of the beams. Second, it was difficult to construct. The steel plates, especially the bottom ones, were not easy to weld because of the limited space, and the welded plates could destroyed the casting concrete of diaphragm.

ESTIMATE:

The cost of the project includes expenditure on various items from planning to they early maintenance up to the end of the project. They are;
1) Cost of preliminary survey
2) Cost of acquisition of land
3) Cost of superstructure
4) Maintenance & Operation cost
5) Cost of tools and plants
6) Cost of establishment of construction.

TRAFFIC SURVEY

Traffic survey was made on 25.09.2016, in the project site from 6.00pm to 9.00pm. The survey time was selected on the most traffic study as an average of peak hour. The site was observed and thenumber of vehicles passed was converted to Passenger car units (PCU’s).

TRAFFIC PROJECTION

The passenger car unit of a vehicle type has been found to depend upon the vehicle size, and speed of the vehicle type and environment. They are not dependent on the flow and road width 10000 PCU/hr. The capacity of the junction was estimated at 16547 PCU’s/hr. The design period is 30 years. First two years would be taken for the construction. So the traffic is projected for 32 years, and then the design is made.

ADVANTAGE

- After the construction of Bridge, Can control the Traffic
- And also, The Public no need to wait for train Passing
- There is no major effects (failure) (or) collapse of Bridge

VI. CONCLUSION

In this Work vehicle traffic survey was conducted to know the hourly Passenger Car Unit (HPCU) at near Train Intersection, Thanjavur. From survey the value of HPCU of the intersection is 6547, by considering future taking the design Period of 30 years.
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