A Review on Major Structure on Elevated Bridge for Metro Train

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Abstract

A metro system is a railway transport system in an urban area with a high capacity, frequency and the grade separation from other traffic. Metro System is used in cities, agglomerations, and metropolitan areas to transport large numbers of people. An elevated metro system is more preferred type of metro system due to ease of construction and also it makes urban areas more accessible without any construction difficulty. An elevated metro system has two major elements pier and box girder. The present study focuses on two major elements, pier and box girder, of an elevated metro structural system. Conventionally the pier of a metro bridge is designed using a force based approach. During a seismic loading, the behavior of a single pier elevated bridge relies mostly on the ductility and the displacement capacity. It is important to check the ductility of such single piers. Force based methods do not explicitly check the displacement capacity during the design. The codes are now moving towards a performance-based (displacement-based) design approach, which consider the design as per the target performances at the design stage. Performance of a pier designed by a Direct Displacement Based Design is compared with that of a force-based designed one. The design of the pier is done by both force based seismic design method and direct displacement based seismic design method in the first part of the study.

Keywords: Metro Train, Major Structure, Cost & Strength

I. INTRODUCTION

A metro system is an electric passenger railway transport system in an urban area with a high capacity, frequency and the grade separation from other traffic. Metro System is used in cities, agglomerations, and metropolitan areas to transport large numbers of people at high frequency. The grade separation allows the metro to move freely, with fewer interruptions and at higher overall speeds. Metro systems are typically located in underground tunnels, elevated viaducts above street level or grade separated at ground level. An elevated metro structural system is more preferred one due to ease of construction and also it makes urban areas more accessible without any construction difficulty. An elevated metro structural system has the advantage that it is more economic than an underground metro system and the construction time is much shorter.

II. LITERATURE REVIEW

To provide a detailed review of literature related to Metro bridge pier and Box Girder Bridge in its entirety is too immense to address in this thesis. However, there are many good references that can be used as a starting point for research. This literature review focuses on design of metro bridge pier and also review on research related to box girder bridges. The literature review is divided into two segments. First segment deals with the design of the pier and the second part deals box girder. The first part of the chapter reviews Design of Metro Bridge Pier by Force Based Design (FBD) Method and Direct Displacement Based Seismic Design (DDBD) Method. The Second part of this chapter is focused on Box Girder Bridges and brief discussion on its research.

Komatsu and Nakai (1966, 1970) presented several studies on the free vibration and forced vibration of horizontally curved single, and twin box-girder bridges using the fundamental equation of motion along with Vlasov’s thin-walled beam theory. Field tests on bridges excited either by a shaker or by a truck travelling at various speeds showed reasonable agreement between the theory and experimental results.

Chu and Pinjarkar (1971) proposed a finite element formulation of curved box-girder bridges, consisting of horizontal sector plates and vertical cylindrical shell elements. The method can be applied only to simply supported bridges without intermediate diaphragms.

Chapman et al. (1971) carried out a finite element analysis on steel and concrete box-girder bridges to study the effect of intermediate diaphragms on the warping and distortional stresses.

Lim et al. (1971) proposed an element that has a beam-like-in-plane displacement field. The element is trapezoidal in shape, and hence, can be used to analyse right, skew, or curved box girder bridges with constant depth and width.

Cheung and Cheung (1972) described the application of the finite-strip method for the determination of the natural frequencies and mode shapes of vibration of straight and curved beam-slab or box-girder bridges.

III. CONCLUSION

The parameter considered to present the behaviour of Single Cell Box Girder, Double Cell Box Girder and Triple Cell Box Girder bridges are radius of curvature, span length and span length to the radius of curvature ratio. These parameters are used to evaluate the response parameter of box girder bridges namely longitudinal stresses at the top and bottom, shear, torsion, moment, deflection and fundamental frequency of three types of box girder bridges.

REFERENCES