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Structural Analysis of Elevated Metro bridge

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Abstract - *A metro system is an important railway delivery system in a metropolitan region with a big restrict, recurrence, consisting of the evaluation partition from other activity. Metro System is utilized part of city groups, agglomerations basically, and metropolitan areas to move considerable portions of individuals. A raised metro machine remains similarly favored a form of metro gadget due to the fact regarding the simplicity of construction furthermore; it gives municipal regions greater open with no advancement strain. A raised metro device holds two unique components pier and box girder. The present-day examine makes a specialty of specific elements, pier and deck beam, of a raised metro auxiliary device. Generally, the dock of a metro platform is designed using a force-primarily based technique. Among a seismic stacking, the conduct of a solitary pier hoisted span relies upon because of the most element on the compliance and the uprooting frontier. It is vital to test the flexibility of such single piers. Force-primarily based tact's don't unequivocally check the removal restrict a number of the define. The codes are presently progressing in the direction of a success-based totally (dislodging based totally) plan technique, which holds the configuration in step with the objective exhibitions at the forming stage. Performance of a pier shaped by a Direct Displacement Based Design is contrasted, plus that of a force-based mentioned one. The define of the dock is finished via each force-based seismic configuration technique and direct elimination primarily based seismic define approach within the primary phase of the look at.*

Keywords- *Elevated Metro Structure, Bridge Pier, Box Girder Bridge, Direct Displacement seismic stacking, Performance Based Design, flexibility of single piers..*

I. INTRODUCTION

A metro system indicates an electric powered passenger railway transportation device in a metropolitan region with a massive limit, recurrence which includes the assessment separation from different hobby. Metro System has employed part of urban groups, agglomerations broadly speaking, and metropolitan regions to move full-size portions of individuals at excessive recurrence. The assessment detachment allows the metro to transport overtly, amidst fewer restraints plus higher speeds. Metro structures are commonly positioned in underground tunnelways, lifted bridges above road stage or degree secluded at ground stage. A heightened metro supporting device is likewise preferred one because of the uniformity of expansion moreover; it makes town regions greater reachable without a improvement problem. A raised metro primary system has the favoured perspective that it's miles in addition economic than an underground metro gadget, such as the development time is a good deal much less.

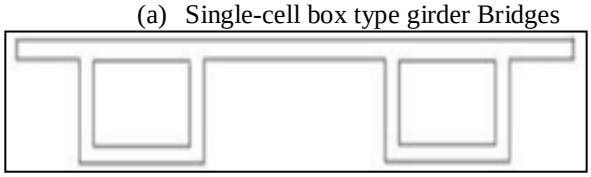
A lifted metro machine has couple noteworthy elements of pier and container girder beams. A traditional constructed metro span design is regarded in Figure 1.1. Bridge or container girder of a metro span requires pier to support every region of the branch and station systems. Docks are constructed in exceptional move-sectional shapes like tube-fashioned, curved, square, rectangular, and various systems. The piers studied for the current have a look at are inside the square cross-location, and it's miles It is positioned beneath station structure. A shared pier held for the cutting-edge examine is seemed in Figure 1.2

Enclose girders are hired inside the development of a raised metro rail span and the utilization of on a stage aircraft widely bent within the machine. Enclose girder spans present-day metro rail structures are entirely suitable in resisting torsional and twisting influences aroused via ebbs and flows. The torsional and twisting unbending type of field girder is due to the closed vicinity of the container girder. The box segment additionally holds massive twisting solidness, and there's a skilful usage of the complete pass-section. Box girder pass sections may come to be a unmarried cell, multi spine, or multi-cell as appeared in Figure 2

FIGURE 1.1 Typical Elevated Metro Bridge

FIGURE 1.2 Typical Pier

(a) Single-cell box type girder Bridges



(b) Multi Spine Box type Girder Bridges

(c) Multi Cell Box type Girder Bridges

FIGURE 2 Types of Box Girder

II. LITERATURE REVIEW

To exhibit a far reaching investigation of writing related to Metro connect dock in addition to Box Girder Bridge completely is too broad to even think about discussing in this postulation. By the by, numerous great sources can be utilized as a beginning case for audit. This writing audit focuses on the structure of the metro connect dock, including a talk on research related with boxing brace spans.

The writing assessment is part into two segments. First area arrangements including the arrangement of the dock including the subsequent portion arrangement box brace. The initial segment of the area assesses Design of Metro Bridge Pier by Force Based Design (FBD) Method further Straightforward Displacement Based Seismic Design (SDBD) Method. The second segment of this division is cantered around Box Girder Bridges in addition to brief audit on its examination.

2.1 Design of Pier

Routinely this docking of a metro scaffold is concocted rehearsing a power-based methodology. Present-day considers (Priestley et al., 2007) tend that the power-based examination may not unquestionably affirm the essential target exhibitions. The codes are directly driving towards an exhibition based structure technique, which examines the plan according to the point achievements at the plan organize. As the contemporary investigation center around the significance of uprooting based strategies to dock plan, a short introduction of the techniques, power-based and dislodging based structure.

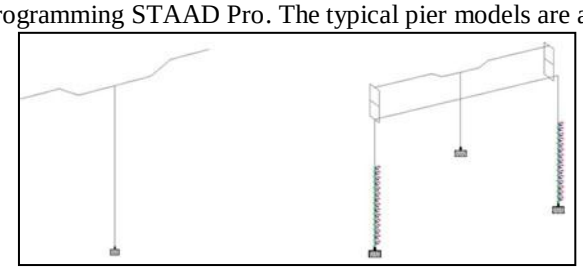
2.2 Power Based Form Scheme

Power Based Design Method (PFBD) holds the standard method to devise the metro connect dock. Under Force based arrangement plot, the underlying time of the development is assessed from highlight flexible stiffness's, which is determined dependent on the accepted geometry of the segment. The applicable power decrease factor (R) relating to the evaluated pliability limit of the auxiliary framework and component is picked in the power based plan and used toward

this first shear of the structure. The structure of a wharf by Force based seismic format plan is led out according to IS 1893: 2002 Code.

III. METHODOLOGY

The geometry of wharf held for contemporary research depends on the investigation information rundown of the Bangalore Metro Rail Corporation (BMRC) Limited. The docks watched for the investigation are set up in the raised metro station structure. The sufficient unmistakable quality of the alleged wharfs is 13.8 m. These arrivals are set up in Seismic Zone II, according to IS 1893 (Part 1): 2002. The demonstrating and seismic investigation remain showed out using the quantifiable segment programming STAAD Pro. The typical pier models are appeared in the figure.



(Type A) (Type B) Typical Pier Model

The material property considered for the present wharf investigation for cement and support steel are given in beneath

Properties of Material (Concrete)	
Compressive firmness of Material	61 N/mm^2
Density of Reinforced Material	25 kN/m^3
Elastic Modulus of Material	36000 N/mm^2
Poisson's Ratio	0.14
Thermal Expansion Coefficient	1.18 x 10 $^{-5}$ /^{0}C
Properties of Reinforcing Metal Used (Steel)	
Yield Strength of Steel	500 N/mm^2
Young's Modulus of Steel	205,001 N/mm^2
Density of Steel	78.6 kN/m3
Poisson's Ratio	0.31
Thermal Expansion Coefficient	1.21 x 10 -5 /0C

Table 1(a): Material Property for Pier

Design Load Utilized			
Load from Platform Level	**Load**	**Load from Track Level**	**Load**
Self-Weight	119 kN	Self-Weight	161 kN
Slab Weight	84 kN	Slab Weight	101 kN
Roof Weight	124 kN	**Total DL**	259 kN
Total DL	229 kN	SIDL	108 kN
SIDL	154 kN	**Train Load**	191 kN
Crowd Load	81 kN	Braking + Tractive Load	28 kN
LL on Roof	161 kN	Long Welded Rail Forces	57 kN
Total LL	239 kN	Bearing Load	21 kN
Roof Wind Load	83 kN	**Temperature Load**	
Lateral	241 kN	For Track Girder	21 kN
Bearing Load	15 kN	For Platform Girder	15 kN
		Derailment Load	81 kN/m

Table 1(b): Material Property Utilized for Pier type

To approve the limited component model of box support connects in SAP 2000, a numerical model from the writing (Gupta et al., 2010) is considered. The cross segment of essentially upheld Box Girder Bridge considered for approval of limited component model. Box support considered is exposed to two concentrated burdens (P = 2 X 800 N) at the two trap of mid range. Range Length expected in this investigation is 800 mm and the material property considered are Modulus of flexibility (E) =2. 843 GPa and Modulus of unbending nature (G) =1. 017 GPa.

IV. CONCLUSIONS

The execution assessment of planned wharf affirmed that Force Based Design Method may not normally affirm the presentation parameter requested, and in the quick case, the dock simply practiced the objective required. During the situation of Direct Displacement Based Design Method, picked dock accomplished the presentation factors more remote than focused Values.

The parametric examination on the conduct of box support extensions demonstrated that, Since the sweep of ebb and flow advance, responses parameter longitudinal weights on the crown and base, shear, torsion, while and redirection are checked for three kinds of box brace spans, in addition to it presents insufficient expansion for the first recurrence with respect to three sorts of box support connects due through the normal range length. As the compass time frame advance, responses parameter longitudinal worries at the top and base, shear, torsion, minute and avoidance are increments for three sorts of box brace scaffolds including critical recurrence drops for three kinds of box support spans.

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