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Analysis of Prestressing in Prestressed Precast Concrete Girder in Bridges

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ABSTRACT: This paper summarizes the design and detailing of the prestressed girder of different sections with different grades by using STAAD-Pro software. Based on the different literature reviews we can identify the analysis and design of prestress girder under the different loading conditions. The objective is to provide the proper methods which will be helpful in the prestressed girder construction work.

KEYWORDS: Analysis, Prestressed Precast Girder, Bridges, STAAD-Pro, Excel Sheet

I. INTRODUCTION

Prestressed concrete components are similar to normal concrete but it has high strength concrete and high tensile steel wires. High-grade concrete is used in prestressed concrete because reinforcement imposes large pressure forces for members causing high stresses at the ends to be developed by anchoring equipment. The stress generated at the end of the beam can only be resisted by high strength concrete. Due to the high strength concrete, the cross-sectional area required for the member will decrease, reducing the dead load of the member. Steel is ductile and now is made to act in high tension by prestressing. Thus prestressed concrete is an ideal combination of two modern high strength materials. Prestress concrete is perfectly suited for the development of medium and long span bridges. Ever because the improvement of prestressed concrete with the aid of Freyssinet inside the early 1930s, the material has determined extensive application within the construction of long-span bridges, progressively changing steel which wishes high-priced renovation because of the inherent downside of corrosion underneath aggressive environment situations. This sort of superstructure is typically used for spans among 20 to 40 m. T or I-girder bridges are the maximum common instance below this category and are very popular due to their easy geometry, low fabrication price, smooth erection or casting and smaller useless hundreds. An I-beam girder is described through having the cross segment of the girder taking the form of the capital letter I. The vertical plate within the middle is referred to as the internet, and the top and backside plates are called flanges.

II. LITERATURE REVIEW

Jakub KRAJOVANEC (2021): In the case of prestressed concrete shape the most critical basis for defining load-carrying potential and final carrier existence. Numbers of prestressed concrete structures are about to attain their restriction of carrier lifestyles and they are exhibiting symptoms of degradation because of the conceptional mistakes, insufficient upkeep and environmental distress. Thus, it's miles essential to decide the fee of prestressing force thinking about the degradation of substances, such as corrosion of prestressing strands or wires. at the same time as assessing structure in provider, it's miles tough to apply magneto elastic sensors or use other direct strategies for figuring out the country of prestressing. Hence, the indirect strategies enable to analytically calculate the prestressing pressure based at the outcomes of size, e.g. pressure, strain, deflection, or width of the crack. The present paper focuses on numerical evaluation of prestressing in a twosome of precast prestressed concrete beams. For the numerical analysis, two oblique techniques are implemented, mainly noticed-reduce method and Crack initiation method.



Avinash Kumar Vidyarthi (2021): Commonly bolstered concrete construction, metallic creation or metallic composite creation is used. within the case of excessive spans, bolstered concrete production is uneconomical due to the bigger span, the go-segment is used greater effectively than the bolstered concrete cross-section. Prestressed concrete is used for long-span bridges with a span of greater than 10 m. conventionally, whilst calculating bridges, the superstructure and substructure are analyzed one at a time. The superstructure is mostly a grid made from major girders, transverse membranes and a deck slab. A grid of linear factors the columns of the principle girders is anchored. The superstructure is examined consistent with IRC: 62014 and according to IRC: 182000 for unconsidered gravitational masses and shifting vehicle hundreds. discount of the stress degree and additionally of the deflection in comparison to the immediately tendon profile.

Ahmed M. El-Basiouny (2021): This examine investigates experimentally and numerically the overall performance of externally prestressed reinforced high electricity concrete (HSC) beams with imperative openings. Seven externally prestressed rectangular HSC beams (six with vital openings and a reference solid beam) are loaded incrementally to failure. Experimentally, the results display that, the appearance of the first flexural crack and the flexural stiffness discount are largely ruled by way of beginning top. In assessment, the outlet period greatly affects the presence of the first shear crack and the acquired values of traces in stirrups. Moreover, the outlet duration and peak when blended can have an effect on the lines in top- and bottom-bars and the failure load of the teste beams. Numerically, a three-dimensional nonlinear finite detail evaluation using ANSYS has been carried-out to analyze seventy (70) externally prestressed HSC beams with vital openings. based totally on the numerical outcomes, a well-known component to predict the remaining second is generated and verified.

Dr. Navnath Khadake (2020): As Infrastructure of India is growing day by day It is essential to concentrate on 'Bridge engineering' & so that This paper is oriented about bridge component 'Girder'. The main aim of this paper is to deliver proper knowledge regarding Design methodology of Girder. RCC & PSC Girder comparison is discussed with various research paper references.

M. P. Choudhary (2019): Prestressed Concrete bridges in recent times have come to be the most extensively used amongst all different bridges. evaluation and design of such bridges are done as consistent with diverse trendy codes which gives fine solutions to maximum of the design engineers but at the side of that, a dressmaker would like to optimize the structure which is received to make it extra affordable and feasible to assemble. The design acquired should be safe for production taking into account its cost and structural power. Many forms of studies had been achieved for the optimization of bridges to acquire a cheap shape. because of that, this review has been achieved concerning various techniques of optimization for the girder bridges. also, various components of Prestressed concrete bridges were mentioned to compute the overall behaviour of the shape which incorporates diverse losses, stresses, cable profile, strands, codal provisions, and so forth, has been discussed in detail.

Saurabh Bagade (2019):Pre-stressed concrete sections are thinner and lighter than RCC sections, since high strength concrete and steel are used. Thinner sections in pre-stressed concrete results in less self-weight and hence overall economy. Cracks do not occur under working loads in the pre-stressed concrete sections. Even if a minute crack occurs when overloaded, such crack gets closed when the overload is removed. In this paper analysis and design of different types of prestressed concrete sections using pre-tensioning and post-tensioning methods is reviewed. Pre-stressing removes a number of design limitations that the conventional concrete faces. The deflections of the pre-stressed concrete sections are small as per conventional concrete.

Shubham Landge (2018): Bridge construction today has achieved a worldwide level of importance. Bridges are the key elements in any road network and use of pre-stress girder type bridges gaining popularity in bridge engineering fraternity because of its better stability, serviceability, economy, aesthetic appearance and structural efficiency. I-beam bridges are one of the most commonly used types of bridge and it is necessary to constantly study, update analysis techniques and design methodology. Structurally they are simple to construct. Hence they are preferred over other types of bridges when it comes to connecting between short distances. This present paper describes the analysis and design of longitudinal girder bridge. In this case analysis is done using STAAD- Pro software.

Milan Vaško (2017): The paper deals with the finite-element analysis of damage in reinforced concrete beam and prestressed reinforced concrete beam. The steel reinforcement is modeled using non-linear rebar elements and an elastoplastic model of the reinforcement is considered. The initial prestress is defined in the ropes that are used to



create the prestressed reinforced concrete beam. These ropes are also modeled using non-linear rebar elements and the elastoplastic material model. Created computational model allows the damage modeling of the reinforced and prestressed reinforced concrete beams under static loading.

IV. CONCLUSION

In this project, we have to analyze, design and detail a PSC bridge taking into consideration IRC Class AA tracked and wheeled vehicle loads as specified in IRC 6. The analysis and design is done for worst combination of loads. STAAD-Pro software will be used for analysis and to make analysis easy to calculate for other parts of girder by creating editable excel sheet, design girder economically and prestress the precast concrete girders safely and effectively.

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