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Overview on the Constructional Dynamics Types of Load on a Flyover

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***Abstract*:. Flyovers or grade separators are bridges built over a traffic intersection to allow people to literally 'fly over' the traffic. Flyovers were required on ring roads meeting arterial interchanges, over rivers ("where they are called bridges") or across railway lines. In the past, some flyovers were constructed in different urban locations in India.Thus it is necessary to construct the flyover which is sustainable. Quality and structural design matters a lot, otherwise constructing a flyover is just the waste of money. This paper present the overview of flyover, the constructional procedure of flyover as well as the types of load on the flyover.**

Keywords: Flyover, Construction, waste production, loads,

I. INTRODUCTION

The Flyover is made up of composite materials, namely concrete and metal structures. Loads are transferred to the depths of the soil with the help of piles foundation. Aluminum and steel structures are used as materials in the structural members of the deck and pier.

Flyover Design is done in order to implement the Flyover where land acquisition costs are high and in densely populated areas. Flyover design is a complex problem, calling ingenuity and practicality while satisfying the basic security and economic requirement. The basic design philosophy that governs the construction of a flyover is that a structure should be designed to support, with a defined probability of every action that is likely to occur in its intended life span.

In addition, the structure must maintain stability over time and during unprecedented action and should have sufficient firmness during its life span. India has a rich history of steel bridges and flyovers. This is usually a Flyover that passes through low terrains or at intersections of roads joining long distances with one span or multiple span constructions. The steel flyover is a good solution for long spans, construction in hilly areas, or terrain conditions. For construction of short and medium flyover, steel and composite concrete are used. In India because of the high population, most cities are saturated and traffic congestion is one of the major problems these cities are facing.

The construction of flyovers is the solution to this problem. But the construction of flyovers using R.C.C is time-consuming, and will affect existing traffic, and has a low-level earthquake resistance. Construction of flyovers using steel sections can overcome this failure however its initial construction costs are high. The flyover design has three main feature elements. First, the foundation conveys the loaded weight of the flyover to the ground; it contains elements such as columns (also called piers) and abutments. Abutment is the connection between the end of a flyover and a road carried by land which provides support for the final section of the flyover.

In recent years Flyover Design plays an important role in reducing and diverting the growing number of traffic in big cities. With the help of a Hydraulic jack the flyover can be transverse vertically. The Flyover is made up of composite materials, namely concrete and metal structures. Loads are transferred to the depths of the soil with the help of piles foundation. Aluminum and steel structures are used as materials in the structural members of the deck and pier.

Figure 1 Steel based Flyover Structures

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II. CONSTRUCTION OF FLYOVER

For easy traffic flow of agricultural goods and industrial goods without traffic congestion flyover or over bridges is essentially to overcome the traffic congestion required.

SLAB: Slabs are the plate elements which carry the loads primarily flexure. They usually carry vertical loads. Under the action of horizontal loads, due to a large moment of inertial they can carry quite large wind and earthquake forces, and transfer them to beams. A reasonable thickness of slab can act as a rigid diaphragm under the action of horizontal load the rigid diaphragm is plate whose all element displace equally in the direction of applied in plane loads. The slab with sufficient thickness acts as rigid diaphragm when in plane horizontal loads like wind or earthquake are acting on it due to its very large in plane moment of inertia. As a result, it constraints the connected column to deflect equally in given horizontal direction of wind or earthquake loads.

Figure 2 Slab of Under-construction Flyover

BEAM - Beams carry loads from slab and also direct loads such as masonry walls and their selfweights. The beam may be supported on the other beams or may be supported by column forming an integral part of the frame. Beams are primarily the flexural members.

Figure 3 Beams of Flyover

COLUMN - Columns are the vertical members carrying loads from beams and from upper columns. The loads may be axial or eccentric. The importance of the column is greater than that of the beams and slab. This is because, if one beam fails, it will be a local failure of one floor, but if one column fails, it can lead to collapse of a complete structure. The safety provisions adopted by the standards are therefore more for columns than for beams or slabs

Figure 4 Types of Column

FOUNDATION - Foundation is the load transmitting members. The loads from the columns and the walls to be transmitted to the solid ground through foundation.

Figure 5 Foundation of Flyover

LOAD AND STRUCTURE - The correct estimation of loads on a structure or a part of a structure leads the designer to the safe and economical design. It is very important that no load which is to be borne by the structure is over loaded.Estimation of different types of loads expected to be borne by the structure throughout its design life. Different kinds of loads may be estimated by using respective Indian Standard Codes of practice.

Determination of worst combination of loads that may occur at one throughout the life of structure. The standard codes of practice give guidelines for this. All the loads are not expected at the same time for example, IS-875, wind and seismic force need not be considered as acting simultaneously. The earthquake is a rare phenomenon. It is therefore very unlikely that the maximum earthquake coincides with maximum of other occasional forces like wind, flood etc., therefore for the design purpose these are assumed not to occur simultaneously.

III. DIFFERENT TYPES OF LOAD STRUCTURE

DEAD LOAD:

Dead loads are the load due to self weight of structure or structural members. Dead loads and static loads remain reasonably constant throughout the life of a structure. The unit weight of different materials may be taken from IRC:21-2000 code of practice for design loads for the buildings and structures part 1 dead loads.

LIVE LOAD:

Live loads are loads which are not steady unlike the dead loads they can change their magnitudes. Live loads are comprehensively described in tables 1 and 2 IRC:21-2000 part 2 imposes loads.

IMPACT LOAD:

Impact load are the loads caused by the vibration of live loads.

IV. LITERATURE REVIEW

.(Kusano & Jakobsen, 2021)Bridges remain the key components in any road network for infrastructure development. For use of prestress girder type bridges become popular for the reason that of its stability, economy, serviceability, aesthetic appearance and structural competence. The grillage analysis method for analysing bridge structures has been in use. In this work, an attempt is made to provide advise on grillage idealisation of the structure, as well as background information. The mesh layout is explained in detail. Analysis of proposal of prestressed concrete bridges are carried out using relevant IRC codes and IS codes. The bridge deck is analysed by grillage analysis. The present work was accepted out to exterior girder of span 28.2 m, width 12.5 m and with thickness of slab as 0.225m. The members are designed for maximum shear forces & bending moment. Losses of stress due to friction, anchorage slip, elastic shortening concrete & relaxation of stress in steel are also considered. The analysis has analysed by STAAD PRO software.

(Science, 2021)The increase of road segments are needed to overcome traffic congestion in Special Capital Region of Jakarta. Flyover is one of the efforts made to add road segments. The construction of flyovers will change the initial landscape and initial environmental tone. This change affects environmental, social, and economic conditions. All risks in construction activity must be managed to minimize their negative impact. Risks management starts with risk analysis by identification significant impact. This research aims to analyze the risks arising from the construction of flyovers. This analysis was carried out on the Becakayu flyover, which only began operating in 2017. Environmental risk is calculated based on parameters of opportunity, magnitude, level, frequency, and sensitivity of risks that may arise. Based on the results of the analysis, it was found that the construction of flyovers had a moderate risk to the environment during the construction phase. To minimize the risks that may arise, it is necessary to manage the risks that may arise through the construction process that meets the standards, the use of well- maintained equipment, the use of hazard signs, and the measurement of environmental quality during the construction phase

(*3D Modelling Using Structure from Motion Technique for Land Observation in Kelok 9 Flyover 3D Modelling Using Structure from Motion Technique for Land Observation in Kelok 9 Flyover*, n.d.)In a modern survey, information on the real condition of the study area is required to support the analysis and interpretation result of a study. However, obtaining information on the real condition in a wide covered area is difficult, particular in an area that hard to access and has varied topographic. The method that can imaging the real condition of a study area is observation using UAV/drone using structure from motion technique. Besides can be observed with a wide area, the detailed condition of the area

also can be visualized. Structure from motion (sfm) is the technique that determines the spatial and geometric relationship of the target area through the movement of the camera. In this research, the sfm technique was applied to create the 3 dimension construction of the Kelok Sembilan flyover. The result show, 3D construction has a high spatial resolution in 2.99 cm/pixel measured in Ground Sampling Distance (GSD). Meanwhile, the horizontal relative resolution is 5.97 cm, and the vertical relative resolution is 8.95 cm.

(Gaddam, 2021)The management of construction waste is important today. The term waste has a distinct consequence from one person to the next. Waste is not needed for the person who throws it out, a product or substance that does not comprise a value to anyfurther extent for the leading consumer and as a result thrown away The scarcity in the availability of aggregate for the production of concrete is one of the important problems facing by the construction industry. Appropriate use of the construction waste is a solution to the fast degradation of raw materials in the construction industry. This paper enlightens the importance of reduce, reuse and recycle (3R) concept for managing the construction waste in India

(Patil, 2019)Managing risks in Flyover construction projects has been recognized as a very important management process in order to achieve the project objectives in terms of time, cost, quality and scope. Construction of flyover projects were initiated in complex and dynamic problems resulting in circumstances of high uncertainty and risk, which were compounded by demanding many constrains. The general methodology to study relies largely on the survey questionnaire which will be collected from flyover project construction contractors and project managers of different sizes by mail or personnel meeting. The questionnaire prepared for the survey was formulated by seeing the relevant literatures in the area of construction management. This paper seeks to identify the risks factors that affect the performance of flyover projects as a whole and analyzed by using appropriate tools and technique and to develop a risk management. The questionnaire was divided into various categories. The responses were analyzed using the software of SPSS. Statistical analysis of responses on the factors was segregated into distinct sets of critical factor. This study aims to identify factors that affected flyover construction project and incorporating critical factors to improve the risk analysis. The extent of their contribution has, however, been observed to vary for a given level of project performance. The analysis results were expected to help project professionals to focus on a few factors and get the optimum results rather than giving attention to all the factors and not getting the proportionate results.

(Tighare & Singh, n.d.)Construction industry has gained fast growth in recent decades due to the increase in population, growth in various industrial sectors and very fast increase in the industries and also due to new infrastructural projects resulted in the increase of construction industry drastically. Due to all these conditions demand of construction materials is large for the construction activities which resulted in the generation of large amount of construction wastages. Construction material wastage hence results in huge financial losses to contractors, builders, government authorities and to the customer and, to the country. Waste production due to the old structure demolition is more, than the wastage that occurs during construction of any structures, hence there is need to manage the constructional waste & demolition waste, as municipal solid wastes, is new subject in India. There is no proper estimate regarding the quantity of waste generated in India. The basic reason being in disciplinary and less focused in this issue.

(Sahu, 2018)Sustainability is a matter of prime concern, as we are using natural resources on a large scale. Day by day due to the increasing population, the need of building structures is increasing. This is the cause of the depletion of natural resources and have impact on the environment. So, in order to decrease the impact on environment, the construction industry has taken into account the construction and demolition waste which can be used as a substitute of the virgin materials. The recycling and reuse of the C&D waste is in trend these days in most of the countries. This review paper gives a brief summary of the recycled aggregate concrete (RAC) which are made up of recycled aggregates (RA) and about the properties of RAC over RA. All the results are discussed briefly in this paper.

(Suryani et al., 2020)The Construction of Antapani Flyover has caused traffic congestion. This paper is to find the solution of congestions to achieve the queuing standard allowed referring to PKJI 2014. The method of research uses deductive and inductive which are analysed using the risk analysis of traffic disruptions. The scope of analysis is focused on the two critical construction works, namely abutment and bridge wall works. The traffic congestion analysis considers the narrowing road due to construction disruption. The traffic congestion analysis was carried out by comparing the congestion of the existing construction with the construction method proposed. The three proposed alternative solutions are by the increasing road capacity, scheduling construction methods, and a combining solution those two alternatives. The results show that the best alternative solution to reduce traffic congestion during construction is a combined solution between the increasing road capacity and scheduling construction methods.

(Shubbar et al., 2020)The concrete structures deterioration in the last few decades required effective methods for evaluating and maintaining the structure condition. Currently, assessing the performance and safety of reinforced concrete (RC) structures relies on routine-based visual inspection (VI). However, there are another non-destructive test (NDT) technique that can provide a more accurate assessment of the

structures. Thus, in this study, a footbridge located in Liverpool, UK is chosen as a case study and has NDT techniques used for assessment. The main objective of this research is to determine the condition of structural bridge components and investigate its level of defect and deterioration using non-destructive tests. The methodologies involved are visual inspection, and NDT techniques include the rebound hammer, cover meter, Moisture Content & Depth of Carbonation Testing, Chloride Testing and Half Cell Test. The framework, when implemented with the best selection of NDT techniques, helps in determining the level of defect and deterioration of the structural bridge components and next recommendation regarding the condition of the bridge. The involved bridge structural components include column, deck, wall and staircase.

(Gaikwad, 2014)The percentage of environmental and production waste generated in construction industry is more as compare to waste generated in manufacturing industry. This waste can be eliminated by means of Lean construction tools. Lean construction tool is a comprehensive set of methodologies based on system of beliefs and principles which lead to maximizing value and minimizing waste. Value Stream Mapping is a tool which helps to analyze current state of different waste and propose improvements in future state. In this paper, Lean construction tool called value stream mapping is used to eliminate environmental and production waste. In the present study Value Stream Mapping is applied for the construction of flyover in order to reduce the waste generated during construction. For the present study piling work of Chedda Nagar flyover Mumbai is taken for value stream mapping. Value Stream Mapping is also helpful in material management and it also comply project schedule and quality standards. It is found that Value Stream Mapping is useful to manage work schedule and total quality control, which subsequently help to eliminate environmental and production waste.

CONCLUSION

In recent years Flyover Design plays an important role in reducing and diverting the growing number of traffic in big cities. With the help of a Hydraulic jack the flyover can be transverse vertically. The Flyover is made up of composite materials, namely concrete and metal structures. This paper has discussed overall construction of flyover and theoretically discussed types of load on it.

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