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Review Paper on Analysis and Design of RCC Box Bridge

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Abstract: There are various investigation that have been performed on performance of (RC) Box Bridges in previous with various load combination. The analysis and design of (RC) Box Bridges is miscellaneous assignment. Box Bridge consist of top slab, bottom (raft) slab, two outer walls. It is easy to construct does not need any complicated foundation. The research contract with the application of design frame-work of RC BOX BRIDGE like 2D and 3D analysis under various load combination, span/height proportion. Soil Interaction in which B M & S F is expanded in without soil interaction as compared to method soil interaction, effective width method, moment distribution method and genetic algorithm method are used. It is parallel and comparable with cushion and without cushion on Box Bridge with cushion more B M & S F occurred as compared to without cushion.
Keywords: Box Bridge, Span/Height proportion, Cushion, 2D & 3D FEM analysis, Effective width method, MDM and GAM.

I.   INTRODUCTION

1) *Bridge:* Bridge is a structure having a total length of above 6m between the inner face of dirt wall for carrying traffic or other moving loads over a depression or obstruction such as channel, road or railway.
2) *Minor Bridge:* A minor bridge is a bridge having a total length of up to 60m.
3) *Small Bridge:* Small Bridge is a bridge where the overall length of the bridge between the inner face of dirt wall is up to 30m & where individual span is not more than 10m.
4) *Culvert:* Culvert is a cross drainage structure having total length of 6m or less between the inner face of dirt wall.

Nowadays Bridge has gain a tremendous level of importance with massive technology of growth. The ordinary bridge has been replaced by creative profitable structural system. The dynamic dispersal of over-crowded traffic, economic application and attractive desirability has vast increased in Box Bridge these days in modernized highway. They are outstanding used in freeway due to its structural potency, serviceability, good reliability, attractive and economy of construction. They are adequate forms of erection of bridges because it minimize bulk weight. It has high twisting stiffness and strength

Box culvert contain top slab, bottom slab, and two outer wall assembled monolithic and perfect suited for road and railway bridge overpass with high embankment interchange a cascade with a determined flow. Reinforce concrete immovable structure box culvert with square or rectangular pass are used up to span of 5m. The height of the vent conventionally does not encroach 5m.

Box Bridge has got its name due to its arrangement, posture and the way it looks. It is economical due to its durability and flexibility and does not need any separate foundation. Bottom raft slab is directly resting in natural soil. For small discharge single cell box culvert is used and for larger discharge multi-celled box culvert can be operating. It is suited where the SBC of the soil is low. It is capable of engaging load coming from the top slab without development of crack. The dead load and super imposed load are distributed uniformly over the bottom raft slab accordingly reducing pressure in soil. It is very easy to assemble in field and designer to design in simplest way.

II.   LITERATURE REVIEW

Mohankar R.H and Ronghe. G.N (2010) furnish an argument on "Analysis and Design of Underpass RCC Bridge": The underpass is extremely (remarkable) accept in bridge construction it is used for traffic transfer. In this context of paper analysis of underpass RCC Bridge is carried out. The analysis of the Underpass is completely taking into account as fixed end condition. In this paper 2D & 3D analysis is taken out in view of six various loading and eight various combination from IRC: 6-2010.It is noted that the bending moment and shear force attain for 2D & 3D analysis are equal. A 2D model is adequately used for analysis for all load specified in IRC: 6-2010. Pooja Shende and Prof Manish Chudare (2018) furnish an argument on "Analysis of RCC Culvert using Software": In this context of the paper the analysis of culvert by software differ **Span/height** proportion including angle of friction. The objective of this paper is to examine the effect of cushion culvert for various load cases conforming traffic mode, hydraulics mode, soil quality position. Although the main goal is to examining the necessary limitation such as bending moment and shear

force with or without cushion. Analysis and modelling of RCC Culvert is done in Stadd Pro. Factored bearing capacity of box culvert is expanded by 25% angle of internal friction and Span/height proportion are expanded. Earth pressure is decreased on walls by 15% as angle of internal of friction expanded and on the other hand it is expanded by 50% as Span/height proportion is expanded. Axial force of top slab is expanded by 15% as angle of internal of friction is enlarged and on the other hand it is expanded by 50% as Span/height proportion is expanded. Also shear force of box culvert are same for all member. Side walls axial force is established similar as angle of internal friction and on the other hand it is expanded by 10% as Span/height proportion is expanded. Side walls shear force is curtail by 15% angle of internal friction is expanded and on the other hand it is 50% L/H proportion is expanded. Base Slab shear force and moment is similar and on the other hand it is expanded by 10% as Span/height is expanded. Top slab bending moment is curtail by 15% as angle of internal friction and on the other hand it is expanded by 50% as L/H proportion is expanded. R.Shreedhar (2002) furnish a detail on "Computer Aided Design RCC Box Culvert": In this paper various load are taken into account for analyzing the box culvert the method is adopted (Moment Distribution Method) it is very common method and design the element of box culvert acting as top slab, bottom slab and side walls. The design is totally based on Working Stress Method. In this paper also present cad approaches in designing and framing box culvert to attain rapid flawless-solution of segmented aspect and fact detail reinforcement. In this paper the load is considered as. **a)** Dead Load, **b)** Live Load and **c)** Soil pressure on side walls it is totally done in excel sheet also in this paper the analysis and design of box culvert is for adequate crossway the nalla. Siva Rama Krishna and Ch.Hanumantha Rao (2017) furnish a detail on "Study on Box Culvert Soil Interaction": The main purpose of this paper is to rectify action of box culvert with or without interaction of soil. When it is evaluate with finite element method for soil interaction. It is evaluate for ultimate bending moment and shear force under metrological situation. It acquires loading from confer to IRC codes.

The methodology of this paper is

1) Earth Pressure
2) Width of the Member
3) Cushion
4) Live Load
5) Load combination & Cases
a) Earth pressure on side walls.
b) Water pressure inside the box culvert.
c) No surcharge loading on the other hand live load on top slab & water pressure on inside the culvert .and also modeling in ANSYS, soil interaction in ANSYS and comparison between soil interaction and without soil interaction.

It is seen that the top slab values is expand by 19% in without soil interaction situation when correlate to with soil interaction. The top slab values is expand by 27% in without soil interaction situation when correlate with soil interaction. The outer walls values is expand by 15% in without soil interaction situation when correlate with soil interaction (for bending moment only). The outer wall values i.e. shear force is expand by 31% in without soil interaction situation when correlate to soil interaction. The values of bending moment and shear force of bottom slab is expanded negligible in without soil interaction situation when correlate to soil interaction.

Mohini Dhande and Prof. M M Chaudhari (2017) furnish a detail on "Comparative Analysis and Design for a Deck Slab of Minor Bridge by Effective Width Method and Finite Element Method": Nowadays infrastructure is growing day by day in all over the world with rapid increasing in technology of technical engineering studies and implementation done by practical experience. Bridge is built to provide facilities to people and communication tract for transfer road movement to another place. Different types of bridges are there yet the better type of bridge is single span beam or slab which is resting on end support different method used for analyzing and designing the deck of bridge. In this paper comparative analysis is done for various span with various load combinations. In the past decades the bridge is made up of wooden support the beginning of bridge was built in 1840 by adopting trusses with moulded iron as tension upward and wooden plate for the other component. The methodology was used Limit State Method for designing and IRC: 6-2014 for load and stresses. In the past few year the Government of India has strictly told to committee the working stress method is not allowed in practice. Analysis is done with effective width of IRC:112-2011 are used FEM is used on software based also it is said that effective method is time consuming which is applied on al loads which is acting on the structure in that all dispersion values is calculate separately for all the loads.

$B_{effective} = \square\square x \ a \ x \ (a \ / \ I_0) + b_1$ The conclusion of these paper is FEM are correct for a large span bridge it provide fast result as related to analysis approach. Komal S Kattimani and R.Shreedhar (2013) furnish a detail on "Parametric studies of Box Culvert": Culvert are essential to be regulated under earth embankment for intersecting the stream canal, ponds. Culverts are essential to be

required for adjust the storm water on both embankment to curtail flood level. Culvert are of various model namely arch, slab and box constructed with various material like uncoursed ruble masonary, brick or rcc. Nowadays concrete culvert in pits are extensively used in highways underpass, minor bridge and fly over. In the study of research is that angle of dispersion, earth pressure, coefficient and depth of cushion subjected to top slab of box culvert. The angle of dispersion boost the potency of live load and total effect of moment to be considered also it seems that 45^0 can be treated for design as per IRC6-2000. The coefficient of earth pressure has a small consequence on final moment. It is economical design perceptive point of view 0.5 can be taken but it gives expandable result than 0.33. It is also studied in these paper that 0m cushion gives more result (BM & SF) than 5m cushion on box type culvert. Alia Osman Mohamed Ahmed and El Hussain Alrabi (2011) furnished a detail on "Development Formulation for Structural Design of Concrete Box Culvert": In this article examine the advanced of structural design of rcc culvert which is whether permitting and ground soil position in the Sudan. The general specification in (design manual for road and bridges (DMRB)) is used in the configuration of design of rcc box culvert also allusion from American Association of State Highway and Transportation Official (AASHTO) general requirement for highways and infrastructure. The composition has been practiced so many feasible problem out come by using these grouping as good as commercial usable software such as PROKON excellent result is conclude. These group contract with single, double and triple cell culvert. The approach of analyze of box culvert opposed from other bridge. Analysis and design is fixed frame with equal bending moment at edge support. Moment distribution procedures is used for finding the moment junction on frame. MDM approach give accurate result as well comparable with PROKON software. The MDM approach for double cell and triple cell culvert gives decent result when correlated with PROKON software.

Virendrasingh D.Chauhan et al (2017) furnish detail on "Analysis and Design of Box Type Multibareel Skew Culvert":- The statics of bridges arise and convert into box type multibareel skew culvert where movement of transport on the top of slab and water flows beneath the barrel. In this paper position of movement and transportation provision appeal square arrangement of pathway available for quick movement of transport and thus in order essential adoption of skew culvert. Thus we can afford skew culvert direct in item of different length of bridge in path of road approaches on either side does not need any and also solve dispute land of acquisition the project obtained good feasible and money saving purpose. Box Culvert is durable, inflexible and intact. Box Culvert is smooth to join with an elongation of broaden of the road doesn't required complicated foundation and simply lay on site. The settlement of top slab is low with rising a skew point. Longitudinal moment likewise reduce in skew method related to linear way. It could be allocated the cause way at any platform by fluctuating cushion. Dr.Abdul Hassan et al (2014) furnish a detail on "Optimal Design of Reinforced Concrete Box Culvert by Using Genetic Algorithm Method":- The paper display the optimal design of rcc box culvert is occupied smallest expenditure. The Genetic Algorithm is suggested approaches to progress the frame-work in MATLAB Software (2011) and the difference in this approaches by using sequential quadratic programmer (SQP) which is also based on MATLAB the grouping of problem add eleven designs. Two mathematical and nine are frame-work flexible for reinforcement arrangement and the thickness of upper, lowest and thickness of outer wall. A comparison was operate to fix leading public area and achieve the peak values for loading of public also it is seen that the genetic algorithm (GAs) development approach is good enough used for smallest cost i.e. minimum design of reinforced concrete. It is also studied that loading of public i.e. (starting point) and population size 100 give right values whereas without loading of public no merging alike with large public size. It is necessary for any optimization problem applying genetic optimal approach to import the merging application to examine the adequacy of endowing the optimum design with or without public and determining public proportion.

III. CONCLUSION

The Study of above literature review are as follows

A 2d and 3D analysis of rcc underpass is nearly same although 2D analysis is taken into practice. The length /height ratio is important aspect in analysis and designing because the bending moment and shear force is increased 15% to 20% it depends on the ratio gives changeable result. The main thing is that in above literature the IRC codes is used IRC-2000, 2010 and 2014 and designing purpose IRC21 (W S M) in one paper only CAD technique in designing and modeling. IRC 112-2011used for designing although it is seen that support condition are fixed. The B M of top slab & side wall is expanded in without soil interaction correlate with soil interaction and the bending moment of raft slab is expanded minute (small) in without soil interaction correlate with soil interaction. The effective width method is lengthy and delayed method for each wheel and workout area and intensity apply in software also it is studied tat finite element method is accurate for large span bridge. It is very easy to execute and does not need any complicated foundation it has various merits. It is also study that no cushion on structure gives more B M and S F as correlated to with cushion. The displacement of top slab is curtail with rising of skew angle. Genetic algorithm application is useful or optimization purpose. It depends on population size of the area, city and town.

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