Comparing the Load Pattern on Box Concrete Gridder with Consideration of IRC and AASTHO

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Abstract - The structure used to carry a vehicular load that is Bridge that is used. The bridge may be made by steel or concrete and it can be simply supported girder, cantilever supported girder or it may be cable. This study focuses on simply supported bridges consisting of a bridge deck, bearings, girders, bent, column and abutments. Spans are considered to be straight and with varying length of this study. In India generally used mainly thee type girder box girder, I girder, T girder. In this study will make sure you that which girder is taking strength in his.

Key Words - *AASTHO, IRC, bridge deck, abutments,* bearings, girders

1. INTRODUCTION

Generally civil engineering structure are designed with the assumption that all applied loads are static. If we neglect the dynamic forces it may become the cause for disaster. There is two code we compared American and IRC indifferent loading condition under dynamic loading in different span of box girder. Two codes AASTHO and IRC 2014 codes are used for loading and carrying out study which will give the shear force and moment ratio and giving a factor of multiple. There is the dynamic loading impact effects and reduction in load intensity because of improbable coincident of simultaneous loaded lanes were separately incorporated in the analysis for each standard. There is we used different span 10mtr. 20mtr. 30mtr. 40mtr. 50 mtr.

1.1. GIRDER AND ITS TYPES

A bridge girder, which is a bridge that used girders as the means of supporting the deck. There is the bridge consists of three parts: the foundation (abutments and piers), the superstructure (girder, truss, or arch), and the deck.

In a beam or girder bridge, the beams themselves are the primary support for the deck, and are responsible for transferring the load down to the foundation .it could be made of concrete or steel - many shorter bridges, especially in rural areas where they may be exposed to overtopping and corrosion, will be utilizing in concrete box beams. Due to the properties of inertia, the height of a girder is the most significant factor to affect its load capacity .The term "girder" is typically used to refer to a steel beam. Material type, shape, and weight all factors affect how much weight a beam can hold. Longer span which deformation more compare to shorter span.

1.2. TYPES OF GIRDERS

• There is many type of girder like rolled steel/RCC girder is a girder that has been fabricated by rolling a blank cylinder of steel through a series of dies to create the desired shape. It creates standard I-beam and wide flange beam shapes up to 100 feet in length. This shape can also be cast in concrete which is now used in our study.

•Another type girder that is plat girder, a plate girder is a girder that is been fabricated by welding plates together to create the desired shape. The fabricator receives large plates of steel in the desired thickness, then cuts the flanges and web from the plate in the desired length and shape. Plate girders may have a more height than rolled steel girders and are not limited to standard shapes. Stiffeners are occasionally welded between the compression flange and the web to increase the strength of the girder. The ability to customize a girder to the exact load conditions allows the bridge design to be more efficient. Plate girder can be used for spans between 10 meters and more than 100 meters (33 feet to more than 330 feet).

•there is another type of girder which is a box girder (concrete or steel) or "tub girder"., that's why the suggest box shape. A box girder is particularly resistant to torsion and, while expensive, are utilized in situations where a standard girder might succumb to torsion or toppling effects. There is box girder consist of two vertical webs, short top flanges on top of each web, and a wide bottom flange connecting the webs together.

2. MODELLING

There is we used CSI bridge software to modelled and analyzed the bridge girder. To design the bridge and modelled the bridge we tried to as possible all specification were close to the bridge. The correct choice of modelling and analysis tools/methods depend on:

a) Importance of the structure
b) Purpose of structural analysis
c) Required level of response accuracy.

Based on this, the models are prepared for 2 lane and 4 lane bridge girders. The frame section properties, bearing properties, girder and deck section properties are defined in the components window. The box section details are given according to its design capacity. Foundation springs are assigned for analysis purpose. The loads are assigned according to the different codes for various bridge spans. Vehicle class of CLASS A TR, HSn-44, HL-93 and LM1 are loaded over the bridge deck according to IRC6, AASTHO respectively.

Beam:- A RCC beam of rectangular shape is considered having the dimension as 0.36*0.58 meters. The grade of concrete used is M-30.

Column:- RCC columns are used of 0.35*0.45 meters and of M-30 grade.

Slab thickness is taken as 140meters. In this way total 2 models are created having different parameters i.e. RCC fixed based model and RCC model with isolator in zone 5.

Material properties

For linear elastic materials, stresses are linearly proportional to strain(σ = Eϵ) as described by Hooke's Law . Girder bridges have existed for millennia in a variety of forms depending on resources available. The oldest types of bridges are the beam, arch and swing bridges, and they are still built today. These types of bridges have been built by human beings since ancient times, with the initial design being much simpler than what we enjoy today. As technology advanced the methods were improved and were based on the utilization and manipulation of rock, stone, mortar and other materials that would serve to be stronger and longer.

In Rome, the techniques for building bridges included the driving of wooden poles to serve as the bridge columns, and then filling the column space with various construction materials. The bridges constructed by Romans were at the time basis; however, very dependable and strong while serving a very important purpose in everyday societal life. As the industrial revolution came and went, new materials with improved physical properties were utilized; and wrought iron was replaced with steel due to steel's greater strength and larger application potential. Also RCC became popular depending upon the availability and site conditions

Various studies have been done to do a general assessment of bridge girders using European, American and other international standards. Also a study describing the bridge response due to Indian load condition is available. The differences in the Box and I girder is also available as a comparative study with different loading and criteria. Dynamic study giving the fundamental frequency helps to access the serviceability criteria for different bridge responses. So, this study helped a lot in giving a factor for calibrating the Indian loading with the international standards. Also checking the serviceability criteria and general assessment of bridge girder responses.

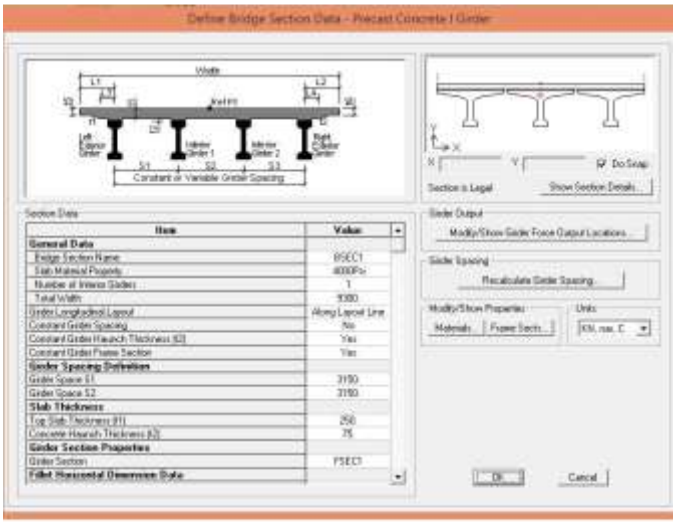


Fig 1 -RCC FIXED BASED STRUCTURE

3. ANALYSIS

The analysis consists of static linear analysis of dead loads. The moving load analysis responds to a variety of vehicle class load given under different country codes. A modal analysis is also conducted to calculate the mode shapes and the fundamental frequencies. All the three analyses have been simultaneously done to come across the torsion, bending moment and shear force of different bridge girder response to a variety of codes. Selecting the proper boundary condition has an important role in structural analysis. Effective modelling of support conditions at bearings and expansion jointsrequires a careful consideration of continuity of each translational and rotationalcomponent of displacement. For a static analysis, it is common to use a simplerassumption of supports (i.e. Fixed, pinned, roller) without considering the soil/foundation system stiffness. For specific projects, the nonlinear modelling of the system can be achieved byusing nonlinear spring/damper bearings are kept freely in all directions to calculate the mode shapes This will help in compiling data for performing comparative studies on girder loading by various vehicle load classes.

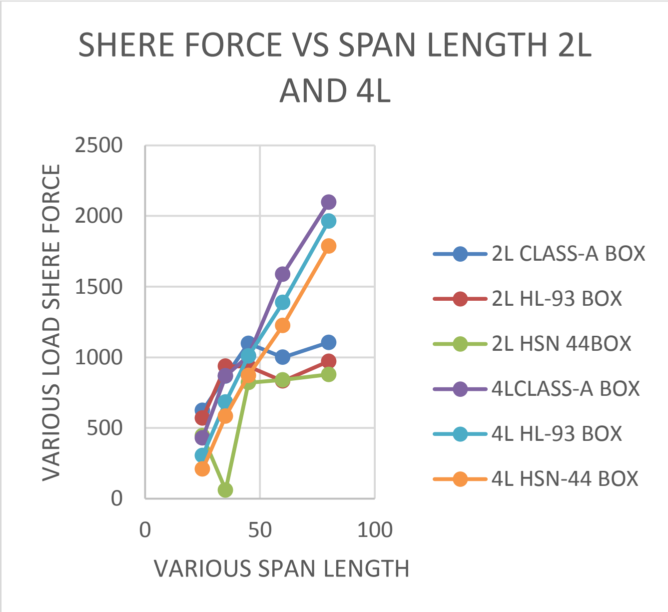
4. RESULT ANALYSIS

MAXIMUM BENDING, SHEAR AND TORSION RESPONS

The parametric and comparative study of box girder with various span. The maximum bending moment and shear force due to LM1 and Class A loading are for 2 lane and 4 lane I girder respectively. The maximum moment due to LM1 and HL-93 are for 2 lane and 4 lane Box girder respectively.LM1 and Class A loading gives maximum shear force for 2 and 4 lane Box girder respectively.. The bending moment values are nearly similar for both 2 lane HL-93 and Class A I-Girder and box girder span between 10 to 60m.but for 4 lane I-girder bending moment for 20m, Class A and LM1 gives nearby values whereas for 60 m Class A and HL-93 gave closer values. Also, for 4 lane Box girder Class A , HL-93 and LM1 loading shows almost similar moment values throughout all the spans. Shear force data shows IRC Class A and LM1 loading have closer value at 20 m span in 2lane whereas value of LM1 decreases while moving towards 60 m in 4 lane Box girders. In case of torsion IRC shows maximum value except for 2 lane Box girder in which it shows close value with LM1 at 20 m then increases and again came closer to LM1 value at 60m.

maximum moment ratios for 2,4 lane box girder from all specified loads

SHARE FORCE OF BIOX GIRDER AT VARIOUS SPAN LENGTH						
2 Lane box girder(kN-m)				4 Lane box girder(kN-m)		
Span (m)	CLASS A loading	HL-93 loading	HSn-44 loading	CLASS A loading	HL-93 loading	HSn-44 loading
25	623.23	570.25	444.47	429.78	305.47	208.45
35	866.45	936.47	60.345	868.45	683.25	583.45
45	1098.21	936.14	820.45	1009.478	1008.25	872.14
60	999.23	832.14	840.36	1587.147	1387.45	1225.6
80	1105.21	971.25	878.14	2096.36	1963.25	1785.45



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