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A COMPARATIVE STUDY OF LIVE LOADS FOR A BRIDGE DECK WITH IRC AND AASHTO CODES.

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ABSTRACT-*The paper presents the comparison of the absolute structural parameters of the I-section concrete girder bridge of varying slab thickness 365mm to 815mm under AASHTO HS-20 loadings and IRC Class A loadings. The FEA Software Staad pro have been used to analyse the deck girder bridge. In this work the RC deck is modelled as the simply supported beam and the bridge deck spanning in the one direction. The Bridge deck has a persistent length as 10m and width as 12m. Different deck Thickness of the concrete bridge deck have been considered (365mm to 815mm). The moving live loads have been assigned to the concrete deck bridge as per specifications mentioned in AASHTO and IRC:6 codes. Class A loadings have been considered from Indian Code IRC: 6 Section: II and HS-20 Loading have been considered from the AASHTO LRFD HS-20. The study indicates that the values of the structure parameters of the I-section concrete girder bridge under AASHTO HS-20 Loadings are more when compared with the Class A loading of IRC. Thus there is a need for a more uniform and realistic principles and standards of loads in future.*

KEYWORDS: *LRFD, Moving loads, IRC,HS-20, IRC, Class A , Staad pro, AASHTO*

1.INTRODUCTION-Highway bridges all over the countries are need to be designed in such a way that they can carry heavy vehicular loads which are expected to run over them during bridge service life. Usually in all countries present truck loadings and their configurations are used to predict and forecast the loads that must be used for design for a safe and rational bridge design.
Reviews of the loading used in the paper have been discussed below
IRC Class A loading- This loading consist of a train of wheel loads (8 axles) which includes the two trailers of specified axle spacing and a driving vehicle. This loading was generated and proposed with the aim of covering the worst combination of axle loads and axle spacing. It is generally adopted on the roads where permanent bridges are needed to be constructed.

AASHTO LRFD HS-20 LIVE LOADINGS-AASHTO HS-20-44, where H stands for highway, S for semi-trailer, 20 Tons (325KN) weight of the 1st two axles was proposed by the American association of state Highway and Transportation officials in 1994. In order to generate a maximum positive moment in a span the two rear axles have a varying spacing that differs from 4.3 to 9m.

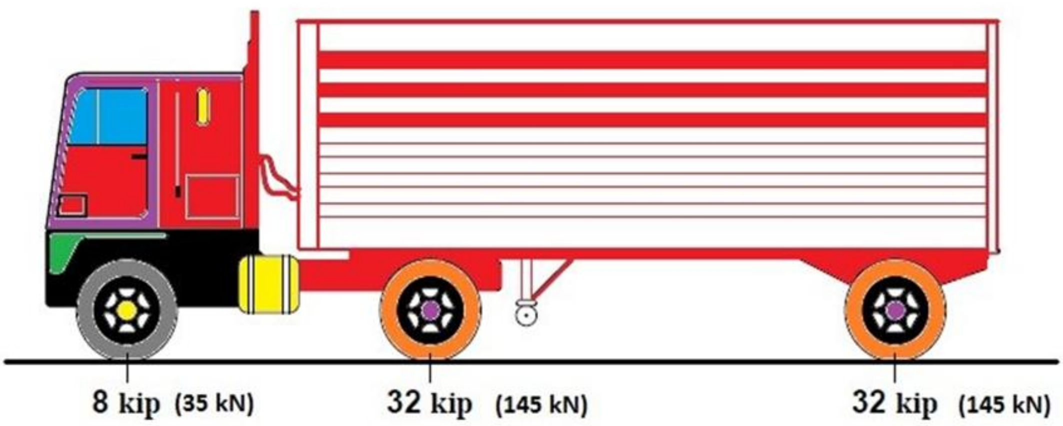

FIGURE 1: AASHTO DESIGN TRUCK (HS-20-44)

2. METHODOLOGY- In this work a virtual model have been generated with the help of the finite element analyses software Staad-Pro. This virtual model can be modified and rectified for various load classes and different supports. The types of loads considered are mainly self-weight of the whole structure and the moving live loads. The results for Class A loadings as well as the HS-20 loadings have been obtained. The parameters have been compared in the tabular table.

3. PROBLEM STATEMENT- In this work a simply supported RC bridge have been considered with varying deck thickness to 365mm to 815mm. The length taken is 10m and the constant width as 12m. The bridge deck have been supported with the help of 4 girders. IRC class A and AASHTO HS-20 loadings have been considered. By the Staad pro 480 plates have been created with 525 nodes. The plates represents the concrete slab as whole and handle the stresses individually. A total f 16 models have been generated with the help of FEA software Staad-Pro. The plate element is discretized into finite element mesh of quadrilateral shell elements of size as 0.5mX0.5m. The quadrilateral shell having 4 nodes and six degree of freedom per nodes.

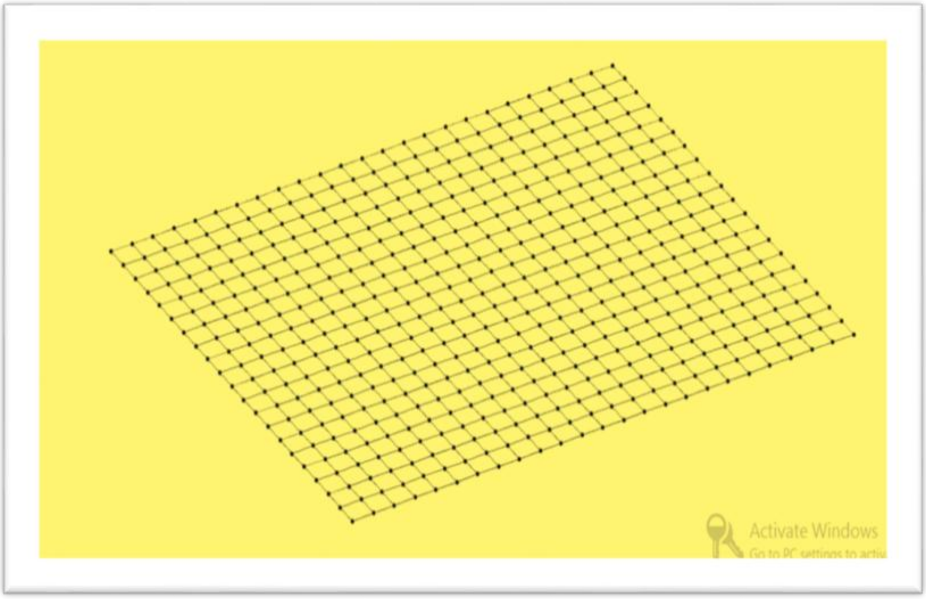

FIGURE 2: Isometric View of concrete slab (525 nodes)

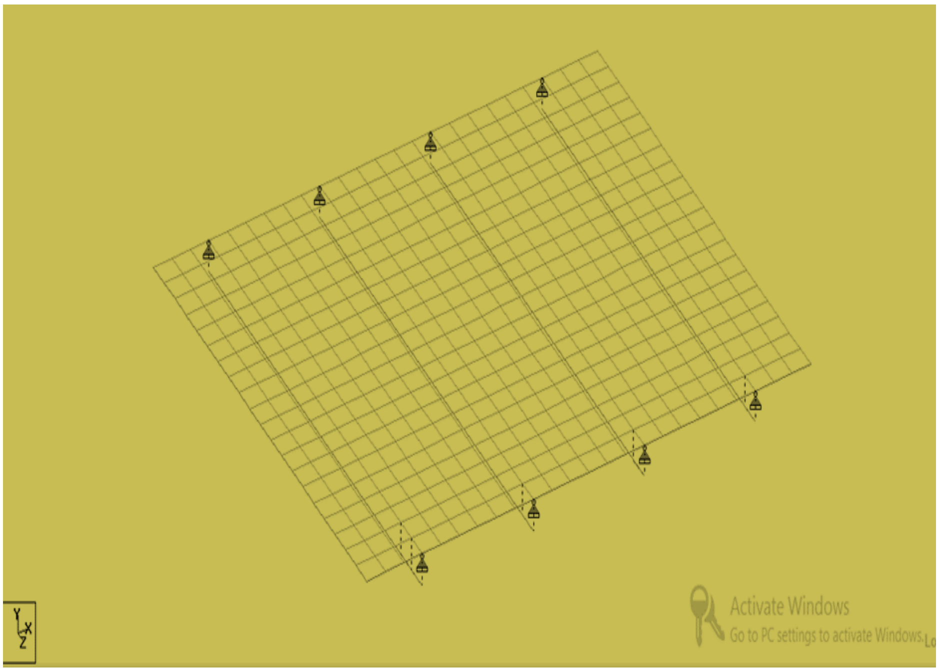

FIGURE 3: Isometric View of concrete slab and four supporting girders
(480 plates)

4. INVESTIGATION- The self-weight is generated with the help of the geometry of the bridge section. The Poisson's ratio is taken as 0.17. The density of the concrete is taken as 23.5 KN/m^3 and the modulus of elasticity have been taken as 21.7KN/mm^2. The standard loadings considered are the HS-20 loadings from the AASHTO LRFD live loading and Class A loading from IRC 6: section II. The parameters of the bending moment torsion and the shear force have been considered with the two types of live loadings. The results are compared in the tables and the graphs.

5. ANALYSIS RESULTS- The results are compared of the four I section girder supporting the deck under IRC class A and HS-20 loadings. The parameters of the bending moment, torsions and shear force are compared with the varying thickness of the deck from 365mm to 415mm. The results can be seen in the tables and graphs below.

TABLE 1: VARIATION OF TORSION IN CONCRETE GIRDERS TORSION KNm

DECK THICKNESS (mm)	Girder 1		Girder 2		Girder 3		Girder 4	
	IRC	AASHTO	IRC	AASHTO	IRC	AASHTO	IRC	AASHTO
365	4.56	5.69	4.54	5.55	4.53	5.54	4.57	5.70
415	3.68	4.67	3.45	4.65	3.63	4.67	3.68	4.85
465	2.98	3.99	2.88	3.89	2.90	3.92	2.91	3.98
515	2.15	3.25	2.09	3.20	2.10	3.18	2.19	3.24
565	1.90	2.99	1.85	2.85	1.81	2.84	1.93	2.94
665	1.11	2.06	1.08	2.04	1.07	2.01	1.10	2.10
735	0.75	1.09	0.60	1.01	0.69	1.00	0.71	1.10
815	0.55	0.98	0.49	0.89	0.50	0.90	0.56	1.00

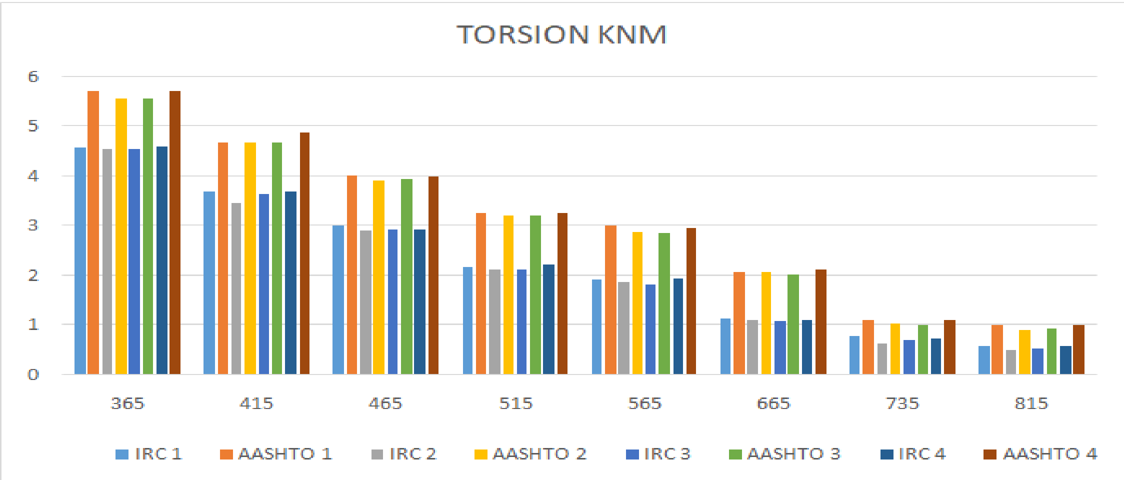

FIGURE 4 : VARIATION OF TORSION IN CONCRETE GIRDERS

TABLE 2 : VARIATION OF BENDING MOMENTS KNM IN CONCRETE GIRDERS

DECK THICKNESS (mm)	Girder 1		Girder 2		Girder 3		Girder 4	
	IRC	AASHTO	IRC	AASHTO	IRC	AASHTO	IRC	AASHTO
365	119.99	123.79	119.02	123.01	119.01	123.02	119.00	123.99
415	117.89	119.92	117.4	119.56	117.5	119.55	117.99	120.01
465	115.78	117.78	115.07	117.07	115.06	117.06	116.89	118.02
515	114.44	116.39	114.12	116.17	114.10	116.16	114.99	116.69
565	113.56	115.41	113.05	115.01	113.04	115.00	113.91	116.01
665	112.30	114.82	112.01	114.28	112.02	114.34	112.99	112.99
735	109.98	112.88	109.56	112.42	109.54	112.21	110.01	110.09
815	98.90	100.01	98.34	98.89	98.45	98.81	99.09	100.69

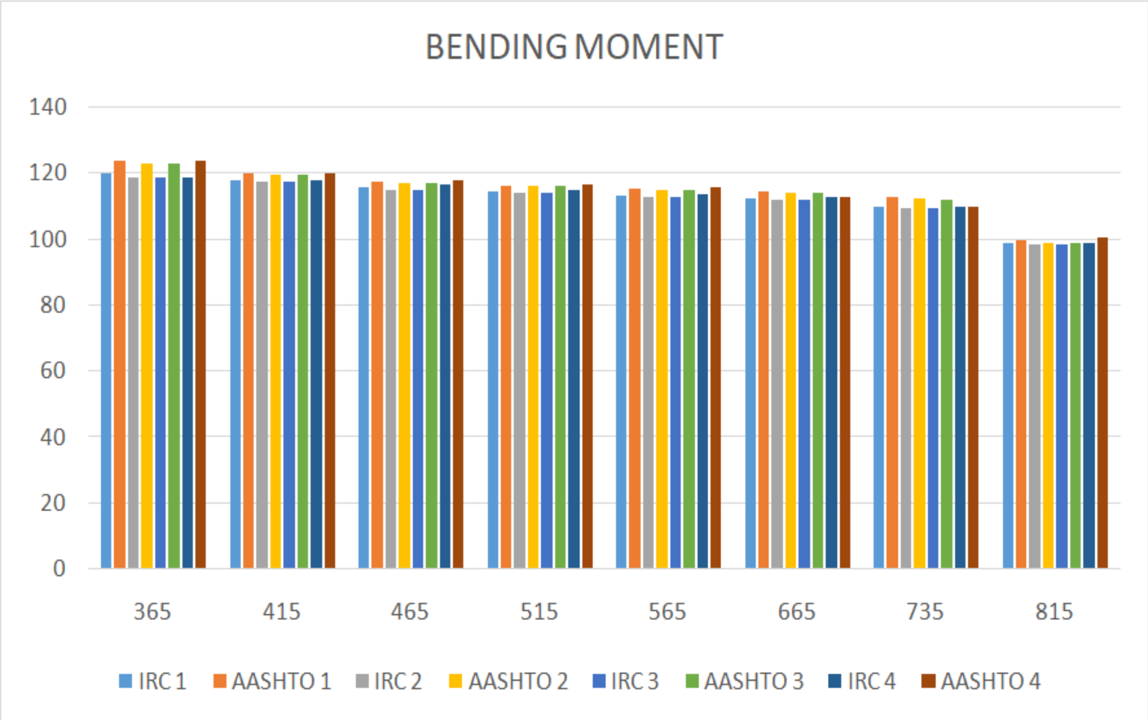

FIGURE 5 : VARIATION OF BENDING MOMENTS IN CONCRETE GIRDERS

TABLE 3 : VARIATION OF SHEAR FORCE KN IN CONCRETE GIRDERS

DECK THICKNESS (mm)	Girder 1		Girder 2		Girder 3		Girder 4	
	IRC	AASHTO	IRC	AASHTO	IRC	AASHTO	IRC	AASHTO
365	16.520	20.569	16.45	20.18	16.40	20.17	16.65	20.59
415	15.451	19.98	15.40	19.88	15.41	19.87	15.46	19.99
465	14.67	18.89	14.55	18.57	14.57	18.55	14.68	18.90
515	13.59	17.69	13.37	17.55	13.33	17.54	13.60	17.70
565	12.65	16.51	12.45	16.48	12.40	16.45	12.69	16.55
665	11.61	15.49	11.55	15.43	11.53	15.42	11.62	15.50
735	10.89	14.50	10.85	14.47	10.84	14.46	10.90	14.52
815	9.54	13.39	09.51	13.34	9.50	13.33	9.58	13.40

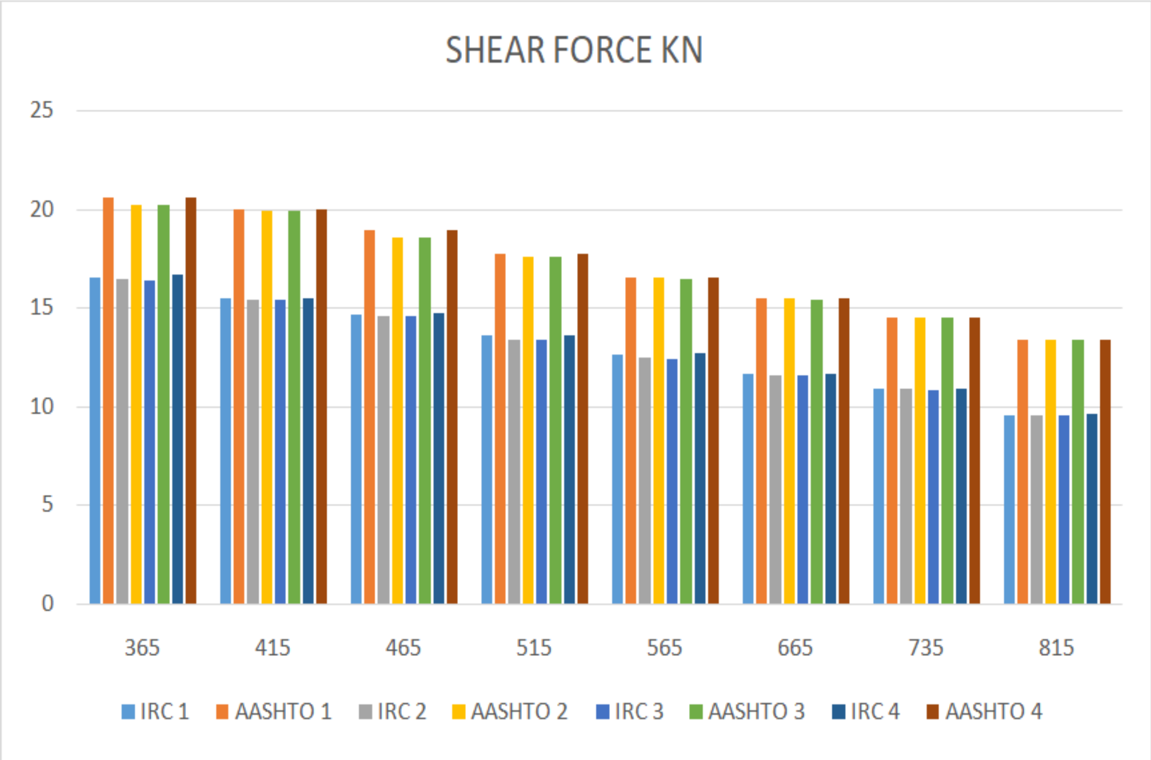

FIGURE 6: VARIATION OF SHEAR FORCE IN CONCRETE GIRDERS

6. CONCLUSIONS- Following results are obtained by the investigation done. It is obtained that the AASHTO HS-20 Loadings produce more values of bending moment as when compared with IRC Class A loading. The difference between the two values is 3.4% The AASHTO loads show a variation in torsional moment as well mainly because of the difference in the wheel configurations in the two different loadings. The torsional value is more in case of AASHTO. It is seen that the maximum shear force in beams mainly depends on the magnitude of loadings and as it is shown wheel load of AASHTO is more compared to IRC Class A loadings. The value of AASHTO shear force value is 17% more than that of IRC. Also with the increase in the deck thickness the cracking propensity tends to decrease.

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