Analysis And Design Of Rcc Bridge

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Abstract- *The Indian Road Congress has drafted the specifications resulting in simplified approach of design of box girder bridges. It was found that the following parameters are significant in the analysis & design of box girder bridges (Depth of Web, DLBM & LLBM at mid span section, DLBM & LLBM at mid support section, Prestressing Force, Eccentricity, Quantity of Steel & Concrete). The simplicity in the design procedure prompted in the development of excel sheets for design purposes. The excel sheets were developed & the analysis & design outputs we are verified with hand calculations.. Initially we are designed for M-40 then M-50 & M-60 Grade of concrete. The parameters listed above were plotted against the spans (Span Vs Depth of Web, Span Vs DLBM,LLBM, Total BM, Ultimate BM at Mid Span section & Also at Mid Support section, Span Vs Prestressing Force, Span Vs Eccentricity , Span Vs Quantity of Steel, Concrete, Span Vs DLSF, LLSF, Total SF, Ultimate SF)*

Keywords- Bridge, Sliding Bearings

I. INTRODUCTION

Bridge is a structure having a total length of above 6 m between the inner faces of the dirt walls for carrying traffic or other moving loads over a depression or obstruction such as channel, road or railway. The main parts of a bridge structure are Decking,consisting of deck slab,girders,trusses etc, Bearing for the decking, Abutment and piers, Foundation for abutment and piers, River training works,revetment for slopes for embankment at abutment, and apron at river bed level, Handrails,parapets and guard stones. Compared to I-beam girders, box girders have a number of key advantages and disadvantages. Box girders have better resistance to torsion, which is particularly of benefit if the bridge deck is curved in plan. Additionally, larger girders can be constructed, because the presence of two webs allows wider and hence stronger flanges to be used.

The numerous design & constructional aspects on prestressed concrete bridges with case studies for better appreciation by learned readers from the practical application point of view.[Kishore M et.al.]. Under smooth bridge entrance conditions, the mean dynamic bridge deflections were 1.13 times greater than static bridge deflections. Under rough bridge entrance conditions, mean dynamic bridge deflections were 1.44 times greater than static bridge deflections. [Franklin M.J. et.al.]. To achieve the potential realization of a durable concrete bridge deck system by incorporation of an ECC link slab, an innovative approach of designing the transition zone in a link slab has been proposed. [Shunzhi Qian, et.al]

II. CRITICAL STUDY OF IS SPECIFICATIONS

IRC:6-2000

Clause :201.1

1)IRC class AA Loading:This loading is to be adopted within certain municipal limits,in certain existing or contemplated industrial areas,in other specified areas,and along certain specified highways.Bridges desiged for class AA loading should be checked for class A loading also,as under certain conditions,heavier stresses may be obtained under class A loading.

2)IRC class A Loading:This loading is normally adopted on all roads on which permanent bridges and culverts are constructed.

3)IRC class B Loading: This loading is normally adopted for temporary structure and bridges in specified areas.

Clause :202.1 - Loads, Forces and Stresses

1) Dead loads
2) Live loads
3) Snow loads
4) Impact factor on vehicular live load
5) Impact due to floating bodies
6) Vehicular collision loads
7) Wind load
8) Water current
9) Longitudinal forces caused by tractive effort of vehicle
10) Centrifugal force
11) Buoyancy

12) Earth pressure including live load surcharge
13) Temperature effects
14) Deformation effects
15) Secondary effects
16) Erection effects
17) Seismic force
18) Wave pressure
19) Grade effect

Clause no 207.1 - Detailed of IRC Loading

Clause 207.1.1. For bridge classified under the clause 201.1,the designed live load shall consist of standard wheeled or tracked vehicles or train of vehicles.

Clause 207.1.2. Within the kerb to kerb width of roadway, the standard vehicle or train shall be assumed to parallel to the length of bridge, and to occupy any position which will produce maximum stresses provided that minimum clearances two passing or crossing vehicle.

Clause 207.1.3 For each standard vehicle or train, all the axles of a unit of vehicle shall be considered as acting simultaneously in position causing maximum stresses.

Clause 207.1.4 Vehicle in adjacent lanes shall be taken as headed in the direction producing maximum stresses.

Clause 207.1.5 The spaces on carriageway left uncovered by the standard train of vehicles shall not be assumed as subject to any additional live load unless otherwise specified in table.

Clause 207.3 Dispersion of load through Fill of Arch Bridges

The dispersion of load through the fills above the arch shall be assumed at 45 degrees both along and perpendicular to the span in the case of arch bridges.

Clause 207.4 combination of Live load

This clause shall be read in conjunction with clause 112.1 of IRC:5-1998.The carriageway live load combination shall be considered for the design as shown in table below.

Carriageway width	Number of lanes for design purpose	Load combination
1. Less than 5.3m	1	One lane of class a considered to occupy 2.3m.the remaining width of carriageway shall be loaded with 500Kg/m².
2. 5.3m and above but less than 9.6m	2	One lane of class 70R or two lanes of class A
3. 9.6m and above but less than 13.1m	3	One lane of class 70R for every two lanes with one lane of class A on the remaining lane or 3 lanes of class A.
4. 13.1m and above but less than 16.6m	4	One lane of class 70R for every two lanes with one lane of class A for remaining lanes ,if any, or one lane of class Afor each lane.
5. 16.6m and above but less than 20.1m	5	
6. 20.1m and above but less than 23 6m	6	

Analysis and Design of Bridge:

One fifty m span bridge is analysed and designed as per specifications. The details are presented below.

Data:

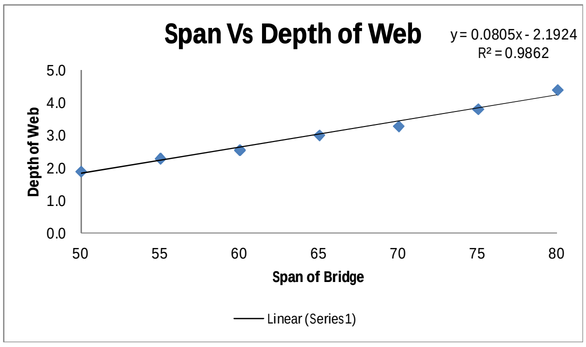
Span=50m,
Cross-section= box girder, dimension=2x2,
Road width=7.5m,
Foot paths=0.6m wide on either side of roadway,
Wearing coat=80mm,
thickness of web=300 to27K-15 Freyssinet type anchorages (27 strands of 15.2mm diameter in 110mm diameter cables)

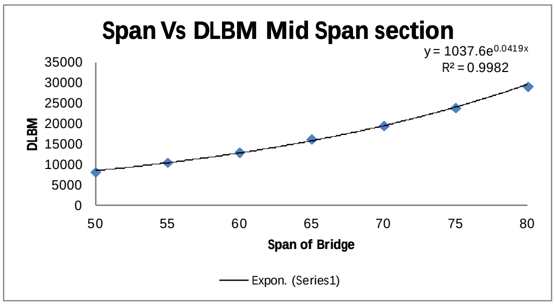
- Thickness of Top & Bottom Slab=300mm
- Concrete grade M-60
- Loss ratio=0.8
- Type of Tendons high tensile strands of 15.2mm diameter conforming to IRC:6006-2000
- Type of supplementary r/f:Fe415 HYSD

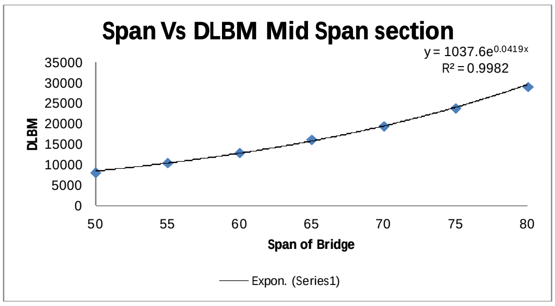
After preparation of an excel sheets for the span 50,55,60, 65,70,75 & 80m span, we are finding the results are as follows.

Grade of Concrete	Span	Height of Web
M-40	50	1.9
M-40	55	2.3
M-40	60	2.6
M-40	65	3
M-40	70	3.3
M-40	75	3.8
M-40	80	4.4
M-50	50	1.5
M-50	55	1.8
M-50	60	2
M-50	65	2.4
M-50	70	2.7
M-50	75	3.2
M-50	80	4.1
M-60	50	1.3
M-60	55	1.6
M-60	60	1.7

Grade of Concrete	Sp an	Mid Span Section (kN-m)			
		D.L.B.M.	L.L.B.M .	Tot. BM	Ultimate BM
M-40	50	8165.00	4298.53	12463.53	22993.81
M-40	55	10490.06	4728.38	15218.44	27556.04
M-40	60	12968.34	5158.23	18126.57	32348.08
M-40	65	16198.65	5588.08	21786.73	38268.18
M-40	70	19482.40	6017.94	25500.34	44268.44
M-40	75	23868.53	6447.79	30316.32	51922.26
M-40	80	29081.60	6877.64	35959.24	60816.5
M-50	50	7632.50	4298.53	11931.03	22195.06
M-50	55	9711.56	4728.38	14439.94	26388.29
M-50	60	11957.63	5158.23	17115.86	30832.03
M-50	65	14780.58	5588.08	20368.67	36141.09
M-50	70	18090.80	6017.94	24108.74	42181.04
M-50	75	21965.62	6447.79	28413.41	49067.91
M-50	80	28119.34	6877.64	34996.98	59373.11
M-60	50	7336.66	4298.53	11635.19	21751.31
M-60	55	9415.73	4728.38	14144.11	25944.55
M-60	60	11403.69	5158.23	16561.92	30001.11







III. CONCLUSIONS

- All the provisions for the design of RCC Bridges are given in IRC6-2000, IRC21-2000, IRC78-2000.
- The design output for any long Span Box Girder Bridge are given by developed excel sheets.
- The details which are obtained by analysis & design of Box Girder Bridges for any Span can be given from the mathematical models without doing lengthy calculations .

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