PARAMETRIC STUDY OF RC DECK SLAB BRIDGE WITH VARYING THICKNESS: TECHNICAL PAPER

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Abstract - Bridges variety in period from some meters to several kilometers. They are among the most important structures built by way of guy. The demands on layout and on materials are very high. A bridge needs to be sturdy enough to assist its own weight further due to the fact the weight of the individuals and cars that use it. The shape additionally must face up to several natural occurrences, including earthquakes, sturdy winds, and changes in temperature. Numbers of bridges have a concrete, steel, or wood framework & an asphalt or concrete route on which people and cars tour. The analysis of a 3-span lane T-beam bridge is finished by various the span of 10m, 15m, 18m, with various span/Depth ratio and quantity of longitudinal & cross girders using software program Staad Pro v8i. To gain most bending second and shear force in girder, most Stresses in slab and maximum response and second on the guide, the bridge fashions are subjected to the IRC magnificence AA Tracked loading device and concluded that with the increase in shear force, bending moment and deflection inside the girder and version of stresses in slab.

1. Analysis of Deck Slab

2. Analysis of Girders & Piers.

***Keywords*: Deck slab, IRC loading, Staad pro, stresses on Beam & Slab, etc.**

I. INTRODUCTION

A Bridge is a structure imparting passage over partner obstacle at the same time as not remaining the method at a lower vicinity. The required passage can also be for a street, a railway, pedestrians, a canal or a pipeline. The obstacle to be crossed can be a river, a street, railway or a valley.

Bridges variety in period from a few meters to several kilometers. They are among the largest systems built with the aid of man. The demands on design and on substances are very excessive. A bridge should be robust enough to support its personal weight in addition due to the fact the burden of the individuals and cars that use it. The structure moreover has to face up to several natural occurrences, which includes earthquakes, strong winds, and modifications in temperature. Numbers of bridges have a concrete, metallic, or wood framework & an asphalt or concrete route on which individuals and vehicles travel. The T-beam Bridge is a long way and away the most unremarkably followed type in the span range of ten to 20-five meter. The shape is so named because of the foremost longitudinal girders analyses & designed as T-beams imperative with a region of the deck block, that's cast monolithically with the girders. Simply supported T-beam span of over thirty meters are rare due to the fact the loading then turns into too critical.

Components of a Bridge

The Superstructure consists of the following components:

I. Deck slab
II. Cantilever slab element
III. Footpaths, if provided, kerb and handrails or crash limitations.
IV. Longitudinal girders taken into consideration in the layout to be of T-section
V. Cross beams or diaphragms, intermediate and give up ones.
VI. Wearing coat
VII. Cross beams or diaphragms, intermediate and cease ones
VIII. Wearing coat

The Substructure consists of the following structures:

I. Abutments at the intense ends of the bridge.
II. Piers at intermediate helps in case of a couple of span bridges.
III. Bearings and pedestals for the decking.
IV. Foundations for each abutments and piers can be of the sort open, well, pile, and so forth.

Description Bridge	
Bridge type	**T-Beam Deck Slab Bridge**
Span	**10m,15m and 18m**
Lane of Bridge	**Two lanes**
Carriageway Width	**7.5m**
No. of longitudinal Girder	**6**
No. Cross girder	**4**
Thickness of girder	**500mm**
Depth of girder	**500mm**
slab thickness	**150mm,200mm,250mm & 300mm**
Live load	**AA Class Tracked Vehicle**
Spacing of longitudinal girder	**2m c/c**

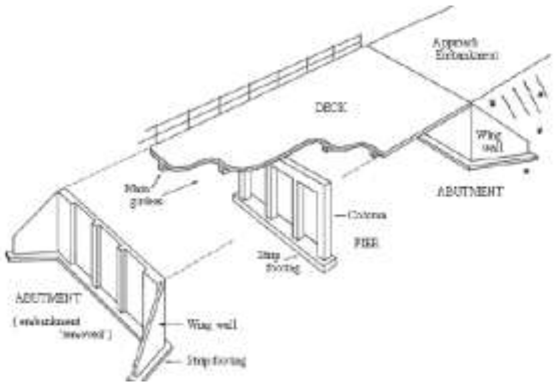

Figure 1 Component of bridge

II. OBJECTIVE OF THE WORK

The analysis of a 3-span lane T-beam bridge is performed by using various the span of 10m, 15m, 18m, with various span/depth ratio and number of longitudinal & move girders the usage of software program Staad Pro v8i. To obtain most bending moment and shear force in girder, maximum Stresses in slab and maximum reaction and second at the aid, the bridge models are subjected to the IRC elegance AA Tracked loading device and concluded that with the boom in shear pressure, bending moment and deflection in the girder and version of stresses in slab

PARAMETRIC STUDY

A Simply supported, five spans, two lanes RCC slab bridge deck is taken into consideration. The span is varied from 10m, 15m and 18m and intensity of the slab varies from 150mm, 200mm, 250mm and 300mm for all spans. The bridge deck is analyzed for Dead load in addition to diverse elegance of live load i.e. IRC loading. Comparison of crucial structural response parameter. The analysis is accomplished for various Class of IRC loading.

Analysis of T-BEAM Bridge is done with the aid of the usage of Staad Pro V8i Software for special spans with various thickness. STAAD.Pro in aggregate with STAAD. Beava may be used to examine bridges as in keeping with the AASHTO code. STAAD.Pro is 1st accustomed construct the bridge structure and STAAD. Beava is used to find the AASHTO 2002 load positions to create the maximum load response. These loads that create the maximum load responses can then be transferred into STAAD. Seasoned as load instances to load combos for similarly analysis and layout. Variation in Max Von Mis stresses

1. The Principal stresses variation in deck slab
2. Node Displacement
3. Compressive and Tensile Stresses in pier
4. Shear force and bending Moment in Beam

Table No 1. Description of Bridge

SR. N	Span (m)	Width (m)	Depth (m)	Aspect ratio (Span /width)	Aspect ratio (Span /Depth)
1	10	10	0.15	1	67
2	10	10	0.2	1	50
3	10	10	0.25	1	40
4	10	10	0.3	1	33
5	15	10	0.15	1.5	100
6	15	10	0.2	1.5	75
7	15	10	0.25	1.5	60
8	15	10	0.3	1.5	50
9	18	10	0.15	1.8	120
10	18	10	0.2	1.8	90
11	18	10	0.25	1.8	72
12	18	10	0.3	1.8	60

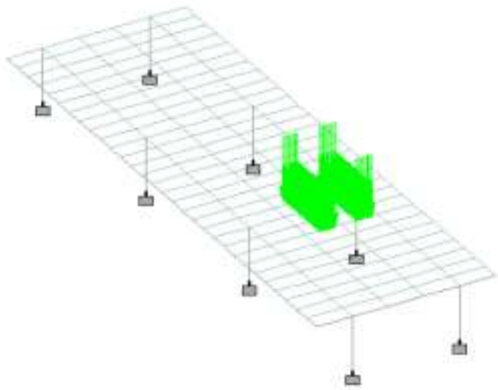

Fig 2: Vehicle Load Position at Mid Span on Bridge

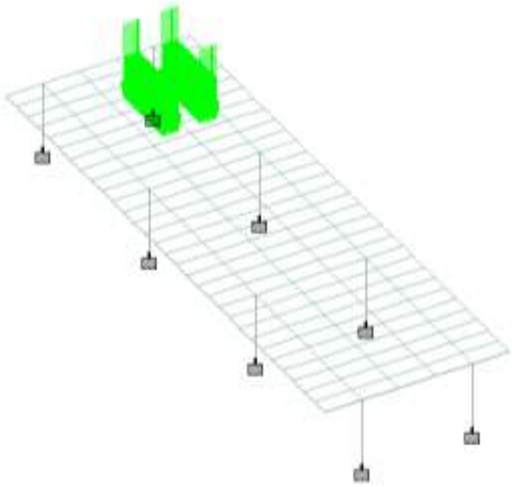

Fig 3: Vehicle Load Position at the edge on Bridge

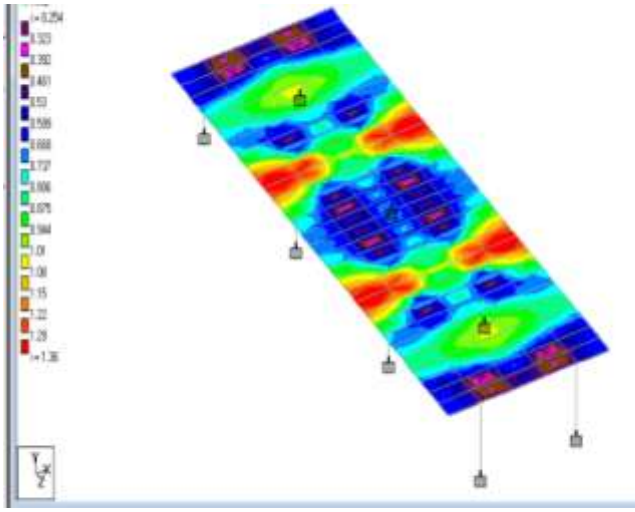

Fig 4: Stresses on Deck Slab

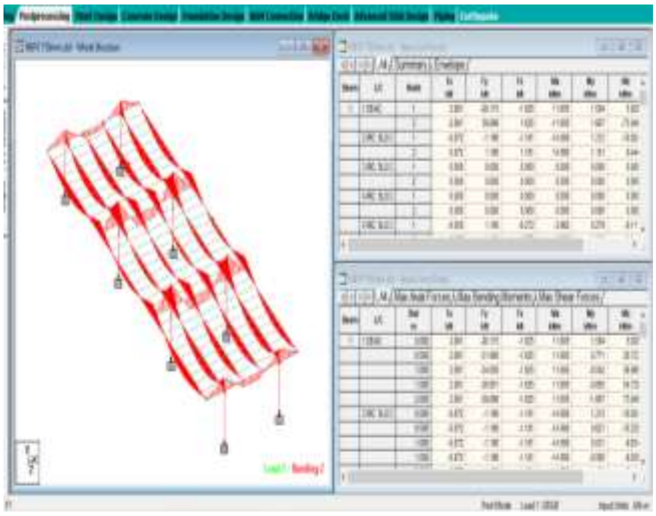

Fig 5: Stresses on Girder

III. RESULTSAND DISCUSSION

A. Principal Stresses on Deck Slab

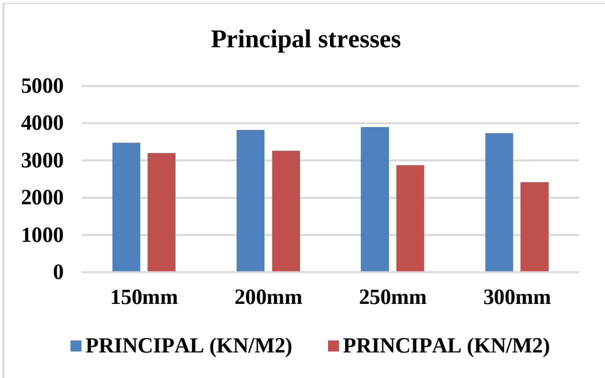

Fig 6: Principal Stresses on Deck Slab of 10m Span with varying thickness

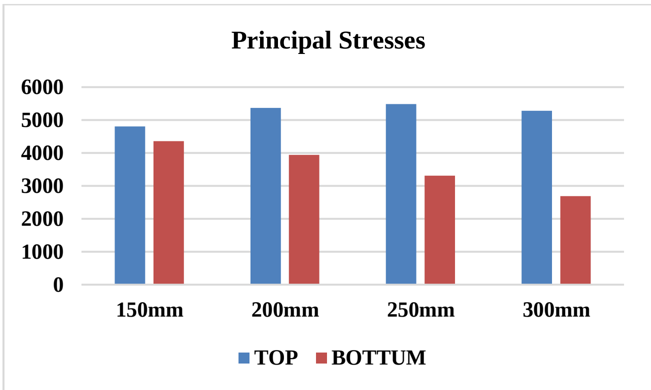

Fig 7: Principal Stresses on Deck Slab of 15m Span with varying thickness

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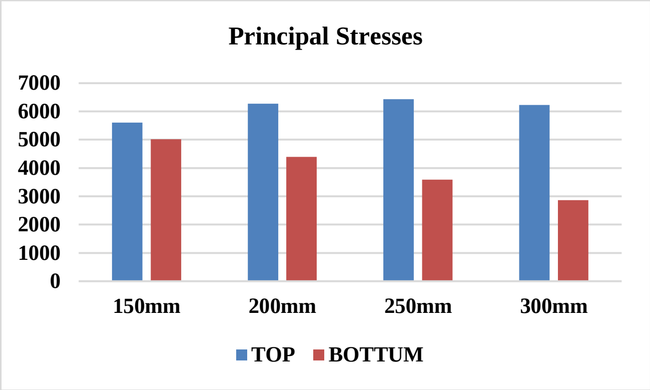

Fig 8: Principal Stresses on Deck Slab of 18m Span with varying thickness

B. Max Von Mis Stresses on Deck slab

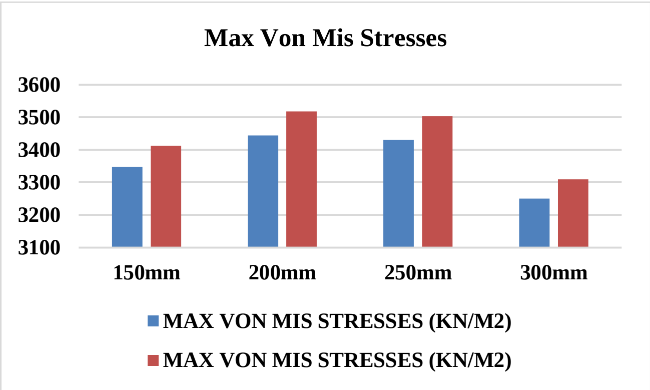

Fig.9: Max von mis Stresses on Deck Slab of 10m Span with varying thickness

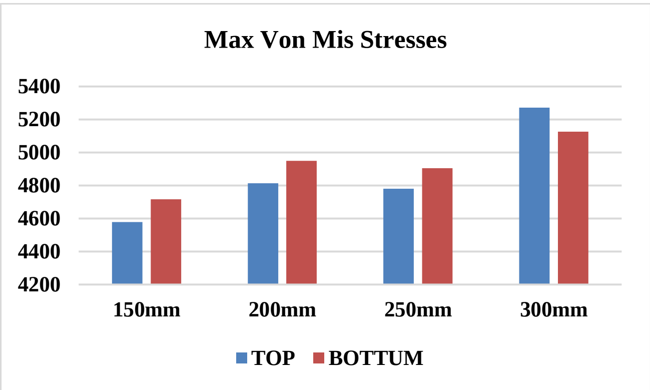

Fig.10: Max von mis Stresses on Deck Slab of 15m Span with varying thickness

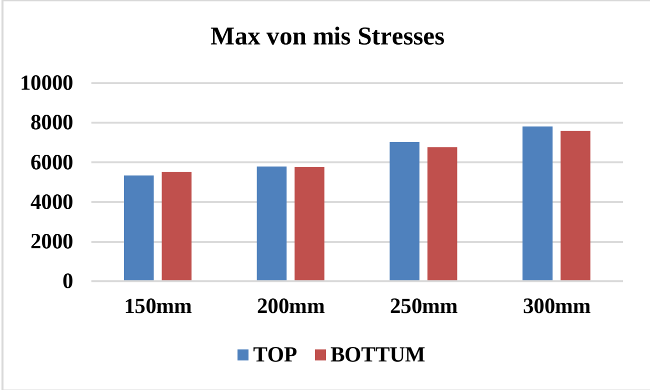

Fig.11: Max von mis Stresses on Deck Slab of 18m Span with varying thickness

C. Maximum Node Displacement

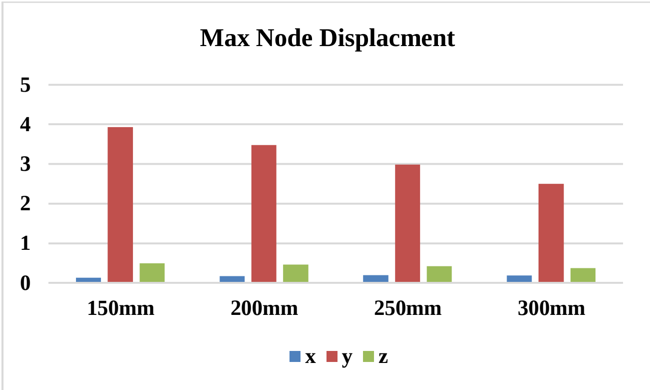

Fig.12: Maximum Node Displacement on Deck Slab of 10m Span with varying thickness

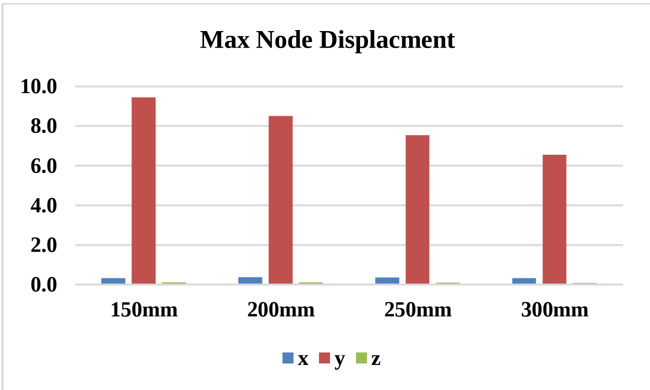

Fig.13: Maximum Node Displacement on Deck Slab of 15m Span with varying thickness

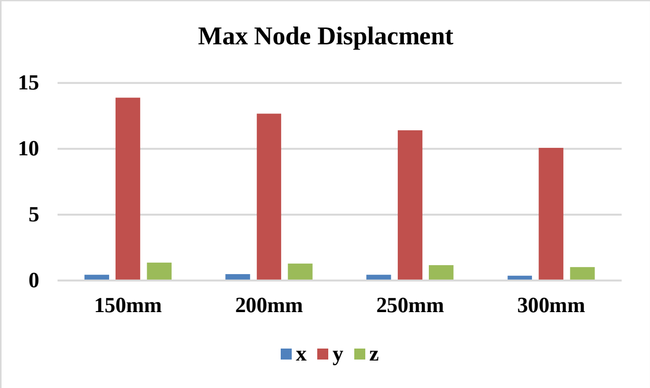

Fig.14: Maximum Node Displacement on Deck Slab of 18m Span with varying thickness

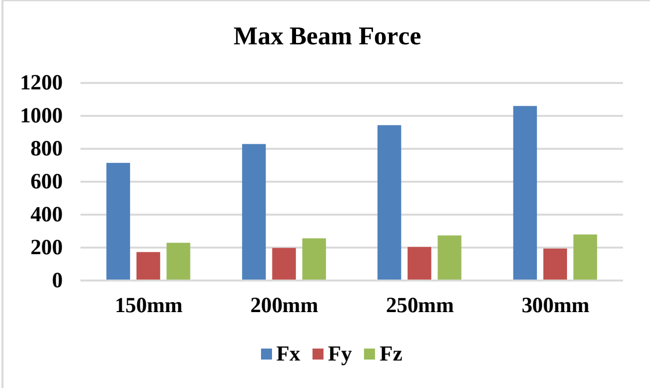

Fig.18: Maximum Shear force on Beam of 18m Span with varying thickness

D. Maximum Shear force on Deck slab

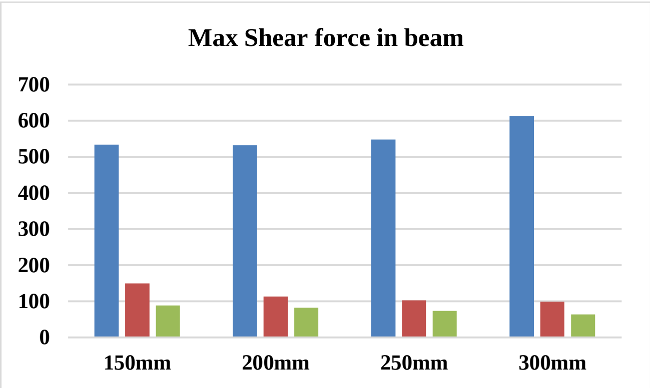

Fig.15: Maximum Shear force on Beam of 10m Span with varying thickness

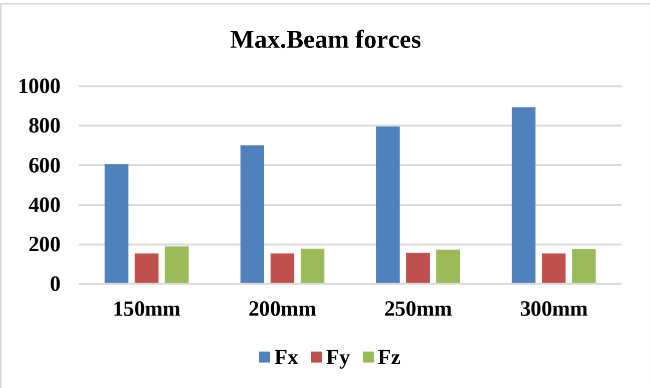

Fig.17 Maximum Shear force on Beam of 15m Span with varying thickness

E. Maximum Bending Moment on Deck slab

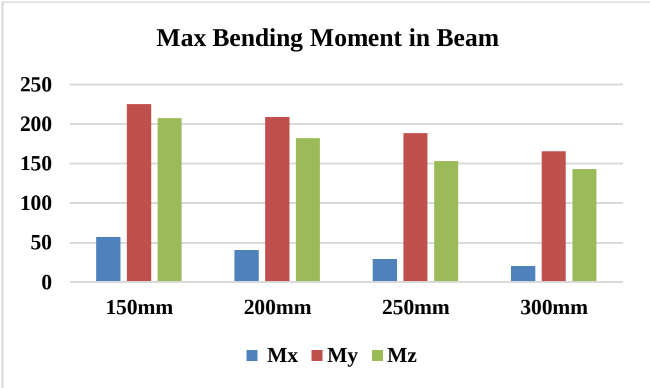

Fig.19: Maximum Bending Moment on Beam of 10m Span with varying thickness

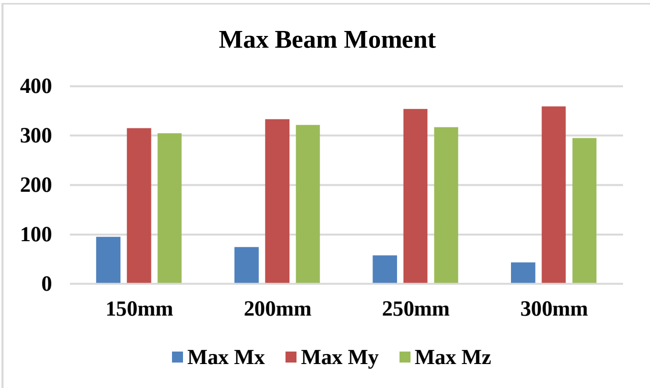

Fig.20: Maximum Bending Moment on Beam of 15m Span with varying thickness

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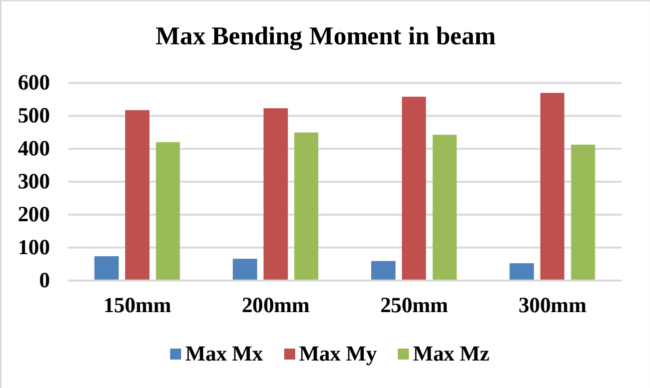

Fig.21: Maximum Bending Moment on Beam of 18m Span with varying thickness

F. Maximum Support Reaction

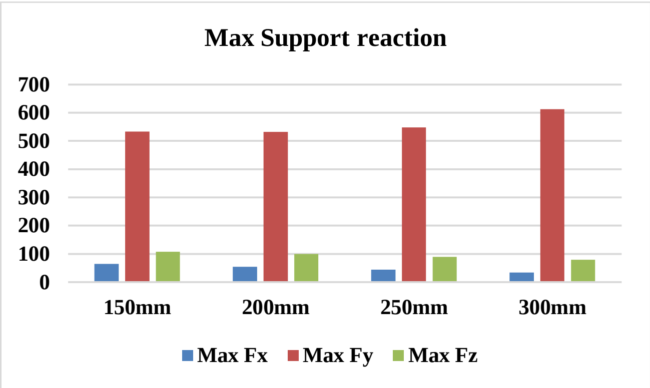

Fig.22: Maximum Support reaction of 10m Span with varying thickness

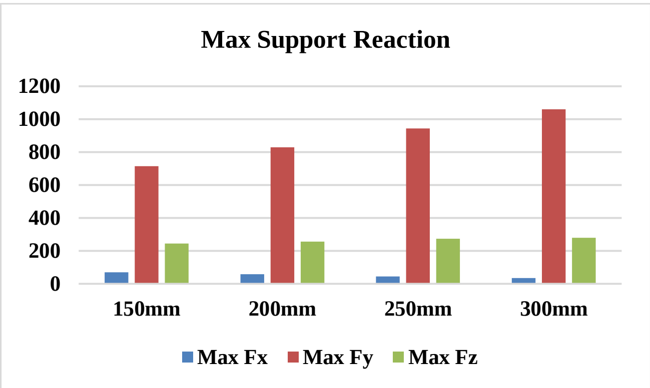

Fig.23: Maximum Support reaction of 15m Span with varying thickness

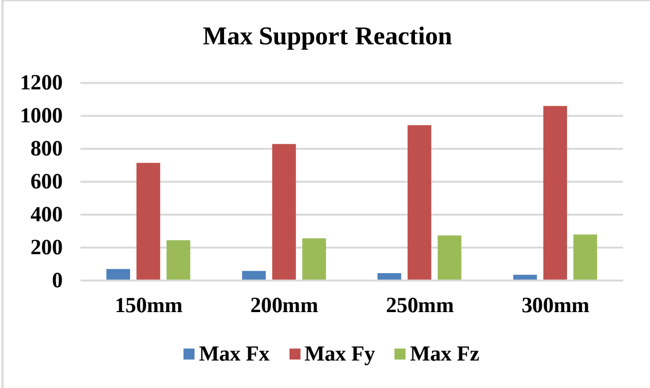

Fig.24: Maximum Support reaction of 18m Span with varying thickness

F. Maximum Compressive & Tensile Stresses on Pier

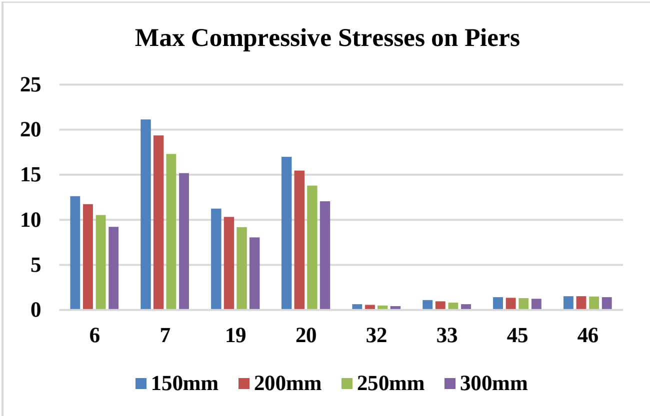

Fig.25: Maximum Compressive Stresses on pier of 10m Span with varying thickness

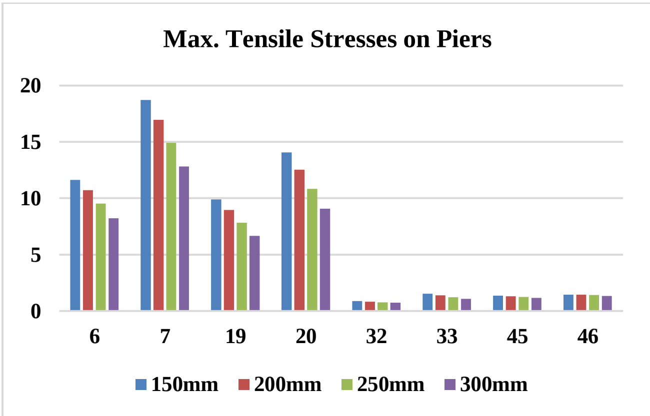

Fig.26: Maximum Tensile Stresses on pier of 10m Span with varying thickness

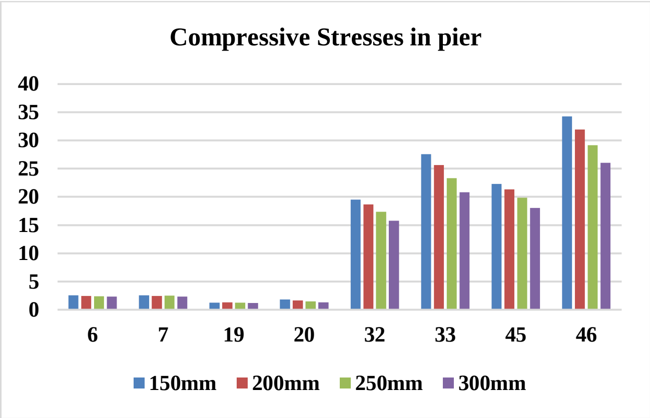

Fig.28: Maximum Compressive Stresses on pier of 15m Span with varying thickness

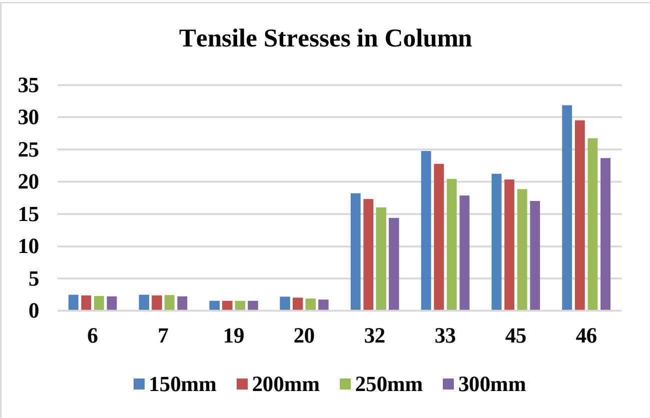

Fig.29: Maximum Tensile Stresses on pier of 15m Span with varying thickness

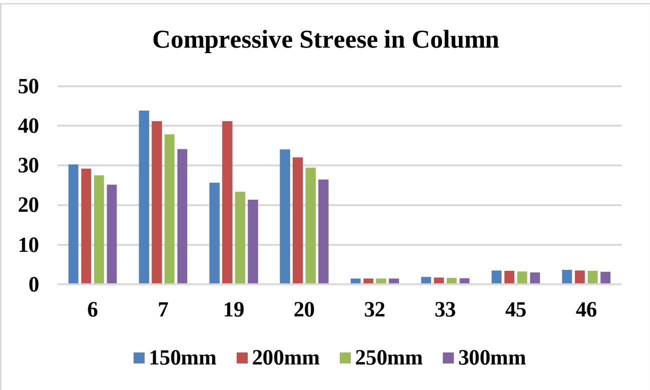

Fig.30: Maximum Compressive Stresses on pier of 18m Span with varying thickness

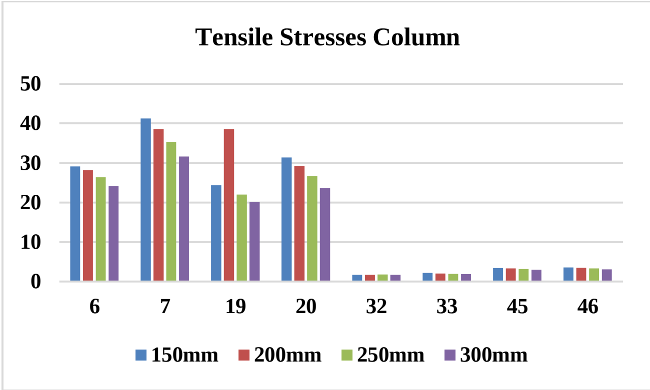

Fig.31: Maximum Compressive Stresses on pier of 18m Span with varying thickness

IV. CONCLUSIONS

Its concluded that the Principal pinnacle and backside stresses in deck slab greater increases with growing span period and top stresses increases with thickness but bottom stresses lower with growing the thickness of deck slab from 150mm to 300mm.

1. Its concluded that the Von Mis top and backside stresses in deck slab more increases with increasing span length. With short span (up to 10m) von mis stresses increases up to 250mm, but depth of slab kept 300mm the von mis stresses will be decreases. When span increases 15m to 18m and depth varies from 150mm to 300mm the stresses also increases with depth of slab but it's quite minimum at thickness kept 300mm.
2. Node displacement in Y downward direction will be more Increase with increasing span length. It observes that twice in 15m span bridge and thrice in 18m bridge as compares with 10m span bridge. While the Node displacement in Y downward direction will be decreases with the depth of slab increases from 150mm to 300mm for all span considered in study. Negligible variation seen in X and Z direction.
3. It concludes that the Maximum shear force in Longitudinal and cross girder will be increases when increasing the span of the bridge form 10m to 15m and 18m. While the thickness varied from 150mm to 300mm the shear force will me minimize.
4. Similarly, the max bending moment in Longitudinal and cross girder will be increases when increasing the span of the bridge form 10m to 15m and 18m. While the thickness varied from 150mm to 300mm the moment will me minimize.
5. Maximum support reaction increases with increase in span length and it will be decreases

with deck slab thickness increases from 150mm to 300mm

6. Compressive and Tensile Stresses in piers will be increases with span length while the increasing the thickness of deck slab both the stresses will be decreases.

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