Analytical Study of Reinforced Concrete deck slab bridge with varying Span & Thickness

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Abstract- **A bridge is a building that creates a safe path over a river or valley while also removing an obstruction from the way and providing passage without collapsing. A passageway may also be necessary for a viaduct, a railroad, a cross-drainage structure like a canal or an aqueduct, among other things. The length of bridges ranges from a few metres to several kilometres. They are among the biggest systems ever created by humans. The demands on materials and design are way too high. A bridge needs to be strong enough to support both its own weight and the weight of the people and vehicles that cross it. The building must also withstand a number of natural disasters, such as earthquakes, powerful winds, and temperature changes. In this paper, we completed our work on a two-lane, three-span bridge. T beams were taken into consideration as integral components of the slab, as well as the span's length and the thickness of the deck slab, for parametric analysis. The deck thickness ranges from 150mm to 300mm with a 50mm space in between, and the span lengths are 10, 15, and 18 metres. For IRC Class AA loading, which is tracked vehicle loading, a total of 12 bridge models were created and examined. The outcome is formed by node displacement, slab deflection, stresses in the deck slab, stresses and bending moments in the longitudinal and cross girders.**

Keywords: **Deck Slab, IRC Class AA loading, Stresses on Slab, Stresses on Girders and piers. Staad pro., etc.**

I. INTRODUCTION

A bridge is a building that permits passage over another obstacle while continuing the method at a lower location. Additionally, the necessary passage may be for a street, railroad, pedestrians, canal, or pipeline. It may be necessary to cross a river, a street, a railroad, or a valley.

The length of bridges ranges from a few metres to several kilometres. They are among the biggest systems ever created by humans. The requirements for both design and materials are very high. A bridge needs to be strong enough to support both its own weight and the weight of the vehicles and people using it. The building must also withstand a number of natural disasters, such as earthquakes, powerful winds, and temperature changes. Numerous bridges have a wood, metal, or concrete frame and an asphalt or concrete path for people and vehicles to travel. The T-beam Bridge is by far the most commonly used type in the ten to twenty-five metre span range. The primary longitudinal girders analyses and design as T-beams necessary with a portion of the deck block, which is cast monolithically with the girders, gave rise to the shape's name. Over thirty metres of simply supported T-beam span are uncommon because the loading becomes too severe at that point.

II. OBJECTIVE OF THE WORK

Using the software Staad Pro v8i, the analysis of a 3-span lane T-beam bridge is carried out using various spans of 10m, 15m, and 18m, various span/depth ratios, and various longitudinal and move girder counts. The bridge model is subjected to the IRC elegance AA Tracked loading device in order to obtain the highest bending moment and shear force in the girder, maximum Stresses in the slab, and highest reaction and second at the aid. It is concluded that with the increase in shear pressure, bending moment, and deflection in the girder and version of stresses in slab.

III METHODOLOGY

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.

Staad Pro V8i Software is used to analyse T-BEAM bridges for unique spans with a range of thicknesses. STAAD.Pro combined with STAAD Beava can be used to inspect bridges in accordance with AASHTO regulations. The bridge structure was first built using STAAD.Pro and STAAD. To achieve the greatest load response, Beava is used to locate the AASHTO 2002 load positions. Then, these loads that generate the greatest load responses can be imported into STAAD. experienced in loading combos and load instances for layout and analysis. Max Von Mis stresses can vary.

For special spans with varying thickness, analysis of the T-BEAM bridge is carried out using the Staad Pro V8i software. combined STAAD.Pro and STAAD. According to the AASHTO code, Beava can be used to inspect bridges. First used to build the bridge structure and STAAD is STAAD.Pro. The AASHTO 2002 load positions are located using Beava to produce the greatest load response. Transferring these loads into STAAD will result in the maximum load responses. experienced in loading combos to load instances for similar analysis and layout. Max Von Mis stresses change over time.

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

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**
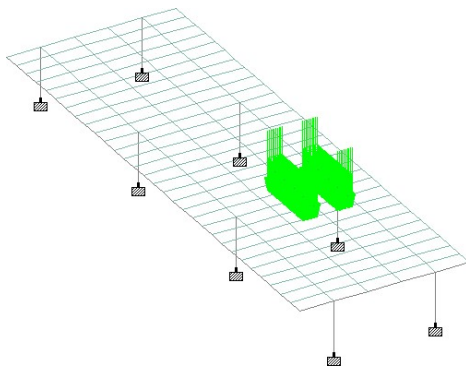
Fig 1: Vehicle Load Position at Mid Span on Bridge
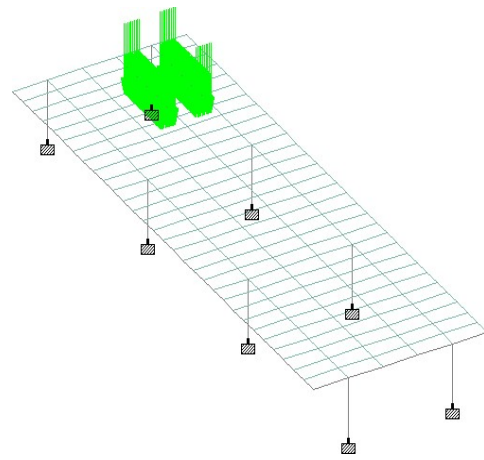
Fig 2: Vehicle Load Position at the edge on Bridge
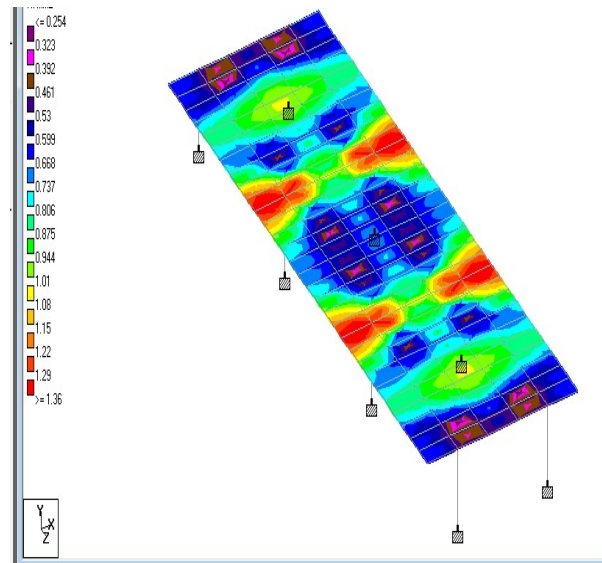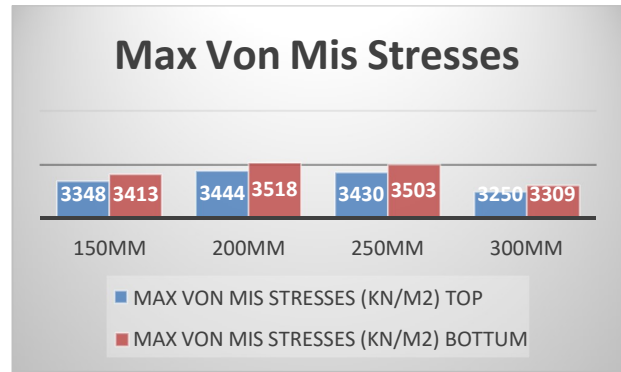

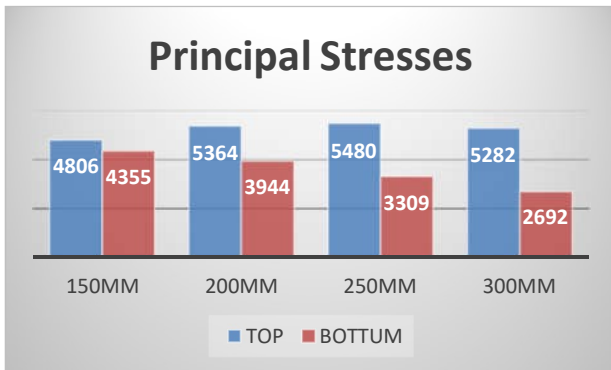**Fig 3: Stresses on Deck Slab**
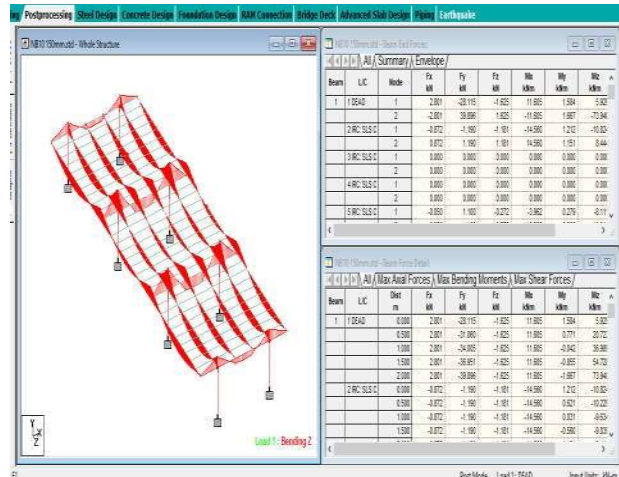
Fig 4: Stresses on Girder

III.   RESULTSAND DISCUSSION
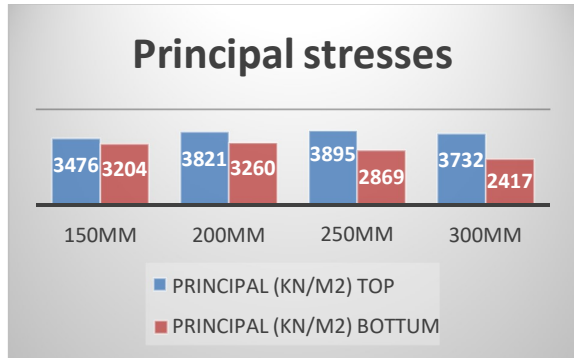
Graph 1: Principal Stresses on Deck Slab of 10m Span with varying thickness

Graph 2: Principal Stresses on Deck Slab of 15m Span with varying thickness
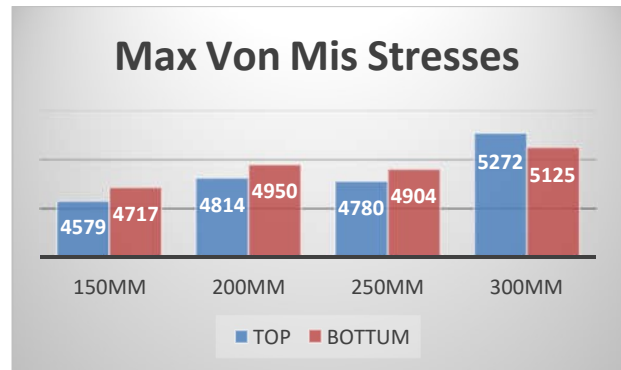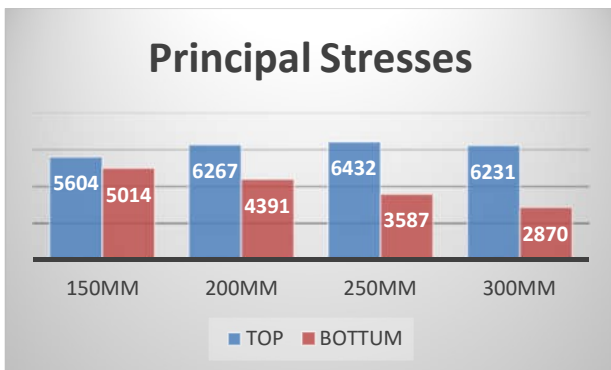

Graph 3: Principal Stresses on Deck Slab of 18m Span with varying thickness

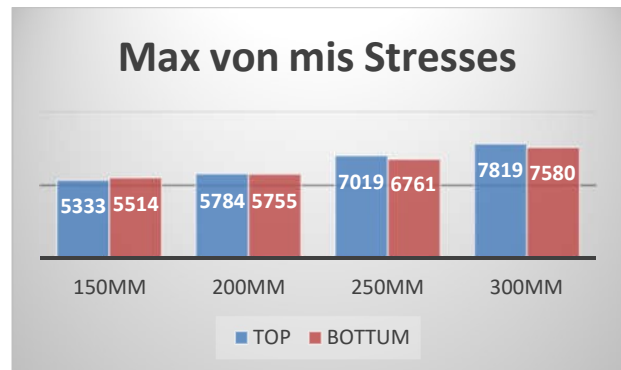Graph.4: Max von mis Stresses on Deck Slab of 10m Span with varying thickness
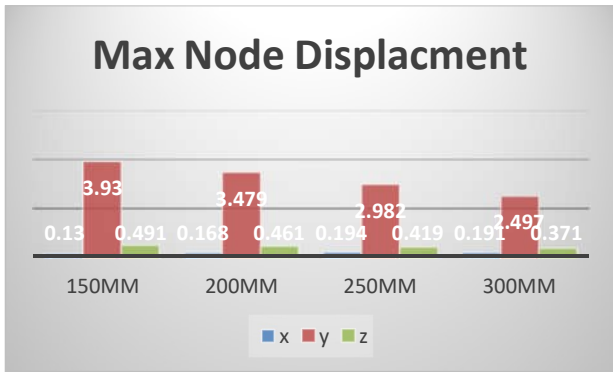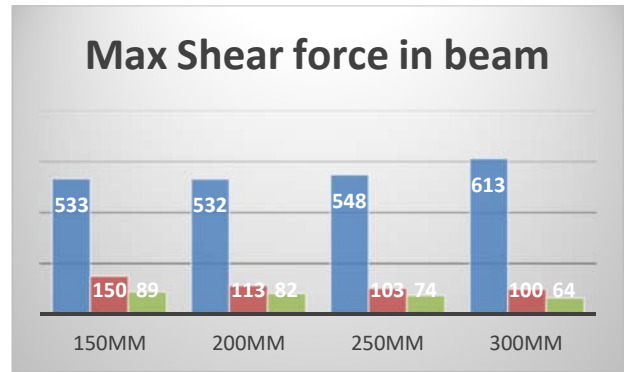

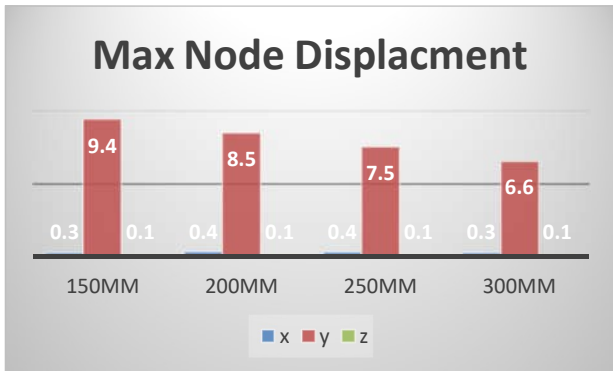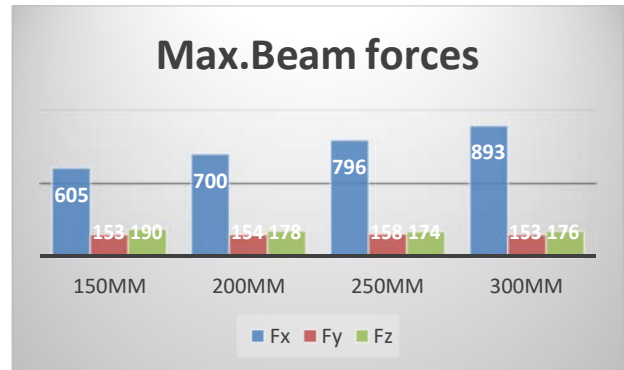Graph.5: Max von mis Stresses on Deck Slab of 15m Span with varying thickness

Graph.6: Max von mis Stresses on Deck Slab of 18m Span with varying thickness

Graph.7: Maximum Node Displacement on Deck Slab of 10m Span with varying thickness

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

Graph.8: Maximum Node Displacement on Deck Slab of 15m Span with varying thickness
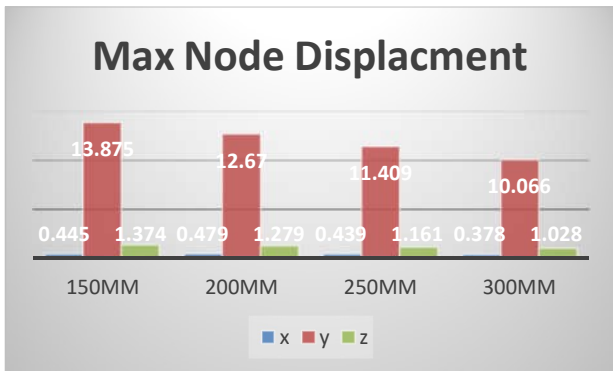

Graph.11 Maximum Shear force on Beam of 15m Span with varying thickness

Graph.9: Maximum Node Displacement on Deck Slab of 18m Span with varying thickness

Graph.12: Maximum Shear force on Beam of 18m Span with varying thickness
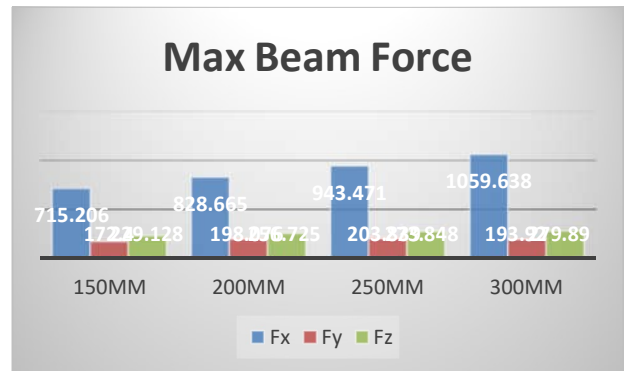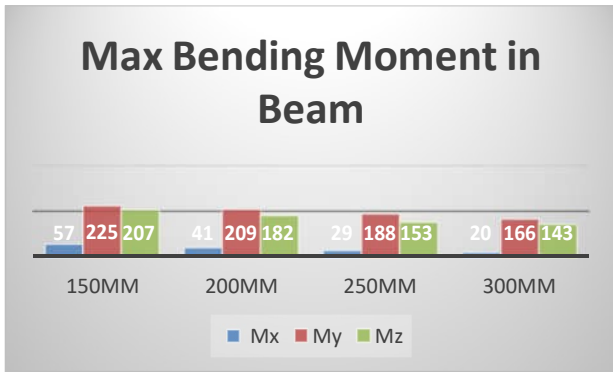
Graph.13: Maximum Bending Moment on Beam of 10m Span with varying thickness
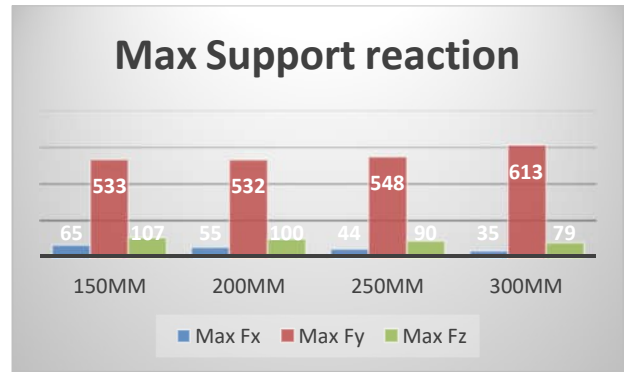
Graph.16: Maximum Support reaction of 10m Span with varying thickness

Graph.14: Maximum Bending Moment on Beam of 15m Span with varying thickness

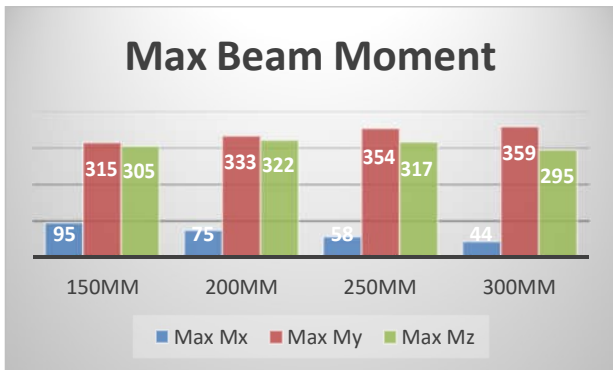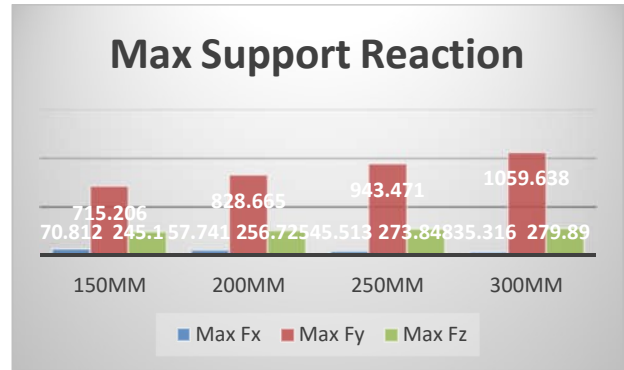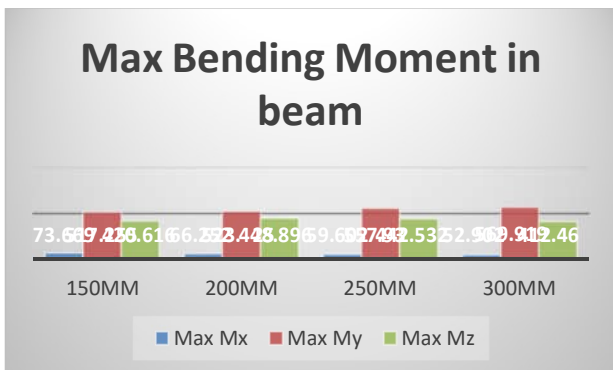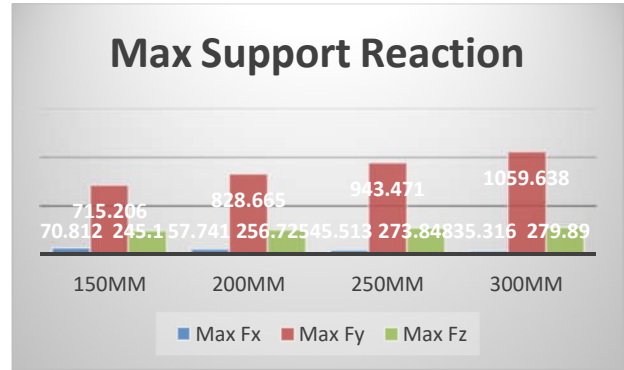**Graph.17: Maximum Support reaction of 15m Span with varying thickness**

Graph.15: Maximum Bending Moment on Beam of 18m Span with varying thickness

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

IV. CONCLUSIONS

1. It has been determined that as span length increases, the Von Mis top and backside stresses in the deck slab become more pronounced. Von Mis stresses can increase up to 250mm with short spans (up to 10m), but if the slab depth is kept at 300mm, von Mis stresses will decrease. When the span increases from 15 to 18 metres and the slab's depth varies from 150 to 300 millimeters, the stresses also rise with slab depth, but they are minimal at 300 millimeters of thickness.

2. With an increase in span length, node displacement in the downward direction of Y will increase. As opposed to a bridge with a 10 m span, this is seen twice in a 15 m span and three times in an 18 m span. While for all spans taken into consideration in the study, the Node displacement in the Y downward direction will decrease as slab depth increases from 150 mm to 300 mm. In the X and Z directions, there is barely any variation.

3. It is concluded that increasing the bridge's span from 10 metres to 15 metres and 18 metres will result in an increase in the maximum shear force in the longitudinal and cross girder. The shear force will be reduced even though the thickness varied from 150mm to 300mm.

4. The maximum bending moment in the longitudinal and cross girders will also increase as the bridge's span increases from 10 to 15 and 18 metres, respectively. The thickness ranged from 150mm to 300mm, but I'll minimize that for now.

5. Maximum support reaction rises as span length increases, and it falls as deck slab thickness rises from 150 mm to 300 mm.

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