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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 ariver or valleywhile also removing an obstruction from theway and providing passage without collapsing. A passagewaymayalsobenecessaryforaviaduct,arailroad,across-drainage structure like a canal or an aqueduct, among otherthings.Thelengthofbridgesrangesfromafewmetrestosevera l kilometres. They are among the biggest systems evercreated by humans. The demands on materials and design areway too high. A bridge needs to be strong enough to supportboth its own weight and the weight of the people and vehiclesthat cross it. The building must also withstand a number ofnatural disasters, such as earthquakes, powerful winds, andtemperature changes. In this paper, we completed our work onatwo-lane,three-spanbridge.Tbeamsweretakenintoconsideration as integral components of the slab, as well as thespan's length and the thickness of the deck slab, for parametricanalysis. The deck thickness ranges from 150mm to 300mmwith a 50mm space in between, and the span lengths are 10, 15,and 18 metres. For IRC Class AA loading, which is trackedvehicle loading, a total of 12 bridge models were created andexamined. The outcome is formed by node displacement, slabdeflection,stressesinthedeckslab,stressesandbendingmomen tsinthelongitudinaland crossgirders.**

***Keywords*: Deck Slab, IRC Class AA loading, Stresses on Slab,Stresseson Girdersandpiers.Staadpro.,etc.**

I. INTRODUCTION

A bridge is a building that permits passage over anotherobstacle while continuing the method at a lower location.Additionally,thenecessarypassagemaybeforastreet,r ailroad, pedestrians, canal, or pipeline. It may be necessaryto crossa river, astreet,a railroad, oravalley.

The length of bridges ranges from a few metres to severalkilometres.Theyareamongthebiggestsystemsevercreat edby humans. The requirements for both design and materialsareveryhigh.Abridgeneedsto bestrongenoughtosupportbothits ownweightandtheweightofthevehicles andpeople using it. The building must also withstand a numberof 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 forpeople and vehicles to travel. The T-beam Bridge is by farthemostcommonlyusedtypeinthetento twenty-fivemetre span range. The primary longitudinal girders analysesand design as T-beams necessary with a portion of the deckblock, which is cast monolithically with the girders, gaverisetotheshape'sname.Overthirtymetresofsimplysupport ed T-beam span are uncommon because the loadingbecomestooseverea tthat point.

II. OBJECTIVEOFTHEWORK

Using the software Staad Pro v8i, the analysis of a 3-spanlane T-beam bridge is carried out using various spans of10m, 15m, and 18m, various span/depth ratios, and variouslongitudinal and move girder counts. The bridge model issubjectedtotheIRCeleganceAATrackedloadingdeviceinord er to obtain the highest bending moment and shear forcein the girder, maximum Stresses in the slab, and highestreaction and second at the aid. It is concluded that with theincrease in shear pressure, bending moment, and deflectioninthegirderandversionofstressesin slab.

IIIMETHODOLOGY

A Simply supported, five spans, two lanes RCC slab bridgedeck is taken into consideration. The span is varied from10m, 15m and 18m and intensity of the slab varies from150mm,200mm,250mmand300mmforallspans.Thebrid ge deck is analyzed for Dead load in addition to diverseeleganceofliveloadi.e.IRCloading.Comparison ofcrucialstructuralresponseparameter.Theanalysisisaccompli shedforvariousClassofIRCloading.

Staad Pro V8i Software is used to analyseT-BEAMbridgesforuniquespanswitharangeofthicknesses. STAAD.Pro combined with STAAD Beava canbe used to inspect bridges in accordance with AASHTOregulations.ThebridgestructurewasfirstbuiltusingS TAAD.ProandSTAAD.Toachievethegreatestloadresponse, Beava is used to locate the AASHTO 2002 loadpositions. Then, these loads that generate the greatest loadresponsescanbeimportedintoSTAAD.experiencedinload ing combos and load instances for layout and analysis.MaxVonMisstressescanvary.

For special spans with varying thickness, analysisof the T-BEAM bridge is carried out using the Staad ProV8isoftware.combinedSTAAD.ProandSTAAD.Accordin gtotheAASHTO code,Beavacan be usedtoinspect bridges. First used to build the bridge structure andSTAAD is STAAD.Pro. The AASHTO 2002 load positionsarelocatedusingBeavatoproducethegreatestloadresp onse.TransferringtheseloadsintoSTAADwillresultinthemaxi mumloadresponses.experiencedinloadingcombos to load instances for similar analysis and layout.MaxVonMisstresseschange over time.

1. Theprincipalstressesvariationindeckslab

2. NodeDisplacement
3. CompressiveandTensileStressesinpier
4. ShearforceandbendingMomentinBeam

TableNo1.DescriptionofBridge

DescriptionBridge	
Bridgetype	T-BeamDeckSlabBridge
Span	10m,15mand18m
LaneofBridge	Twolanes
CarriagewayWidth	7.5m
No.oflongitudinalGirder	6
No.Crossgirder	4
Thicknessofgirder	500mm
Depthofgirder	500mm
slabthickness	150mm,200mm,250mm& 300mm
Liveload	AAClassTrackedVehicle
Spacingoflongitudinalg irder	2mc/c

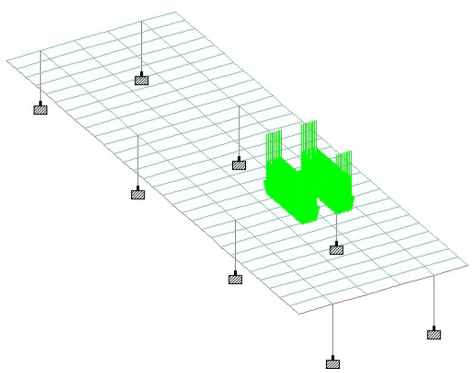


Fig1: VehicleLoadPositionatMidSpanonBridge

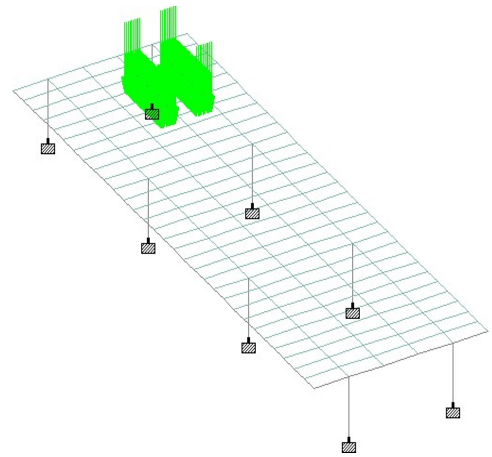


Fig2:VehicleLoadPositionattheedgeonBridge

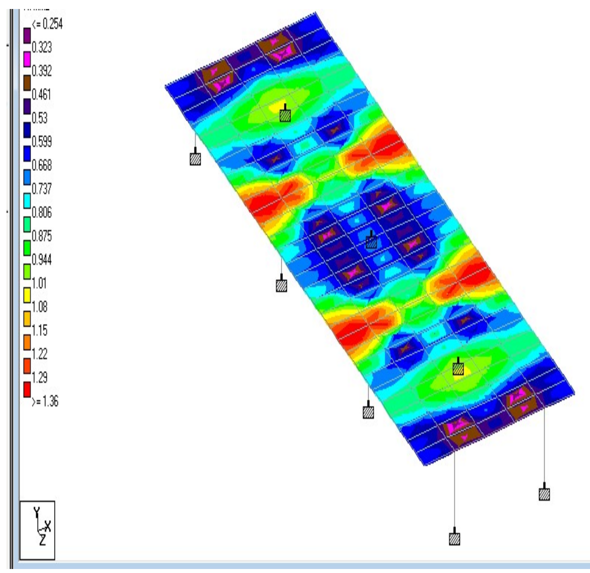


Fig3:StressesonDeckSlab

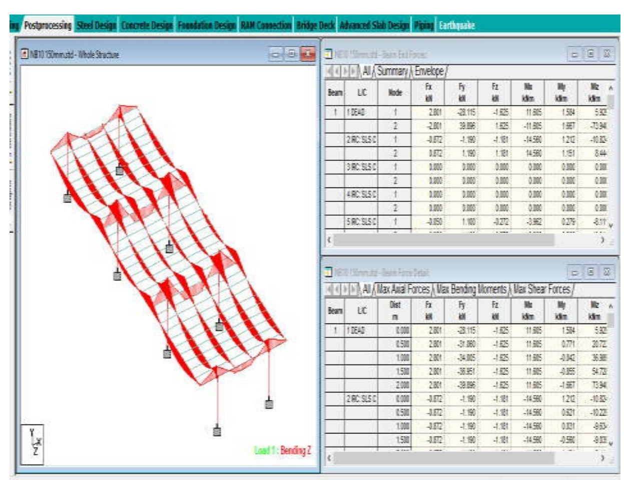
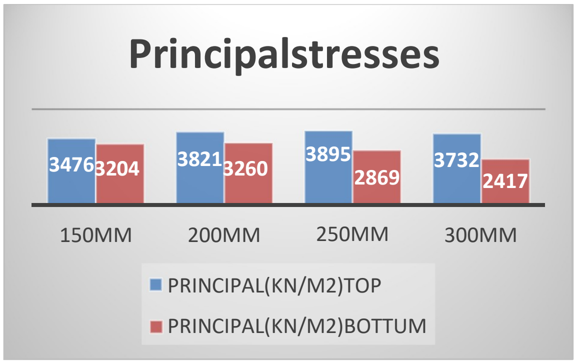
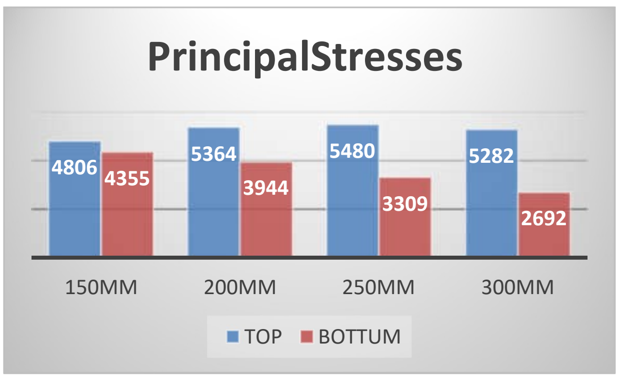


Fig4:StressesonGirder

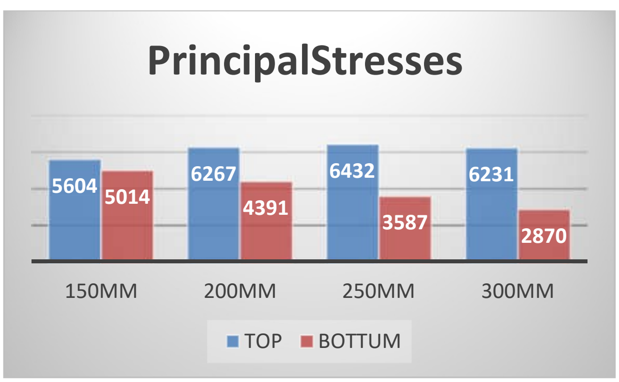
III. RESULTSANDDISCUSSION



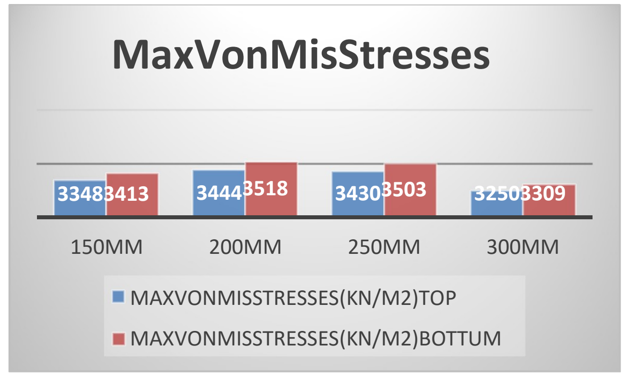
Graph1:PrincipalStressesonDeckSlabof10mSpanwith varyingthickness



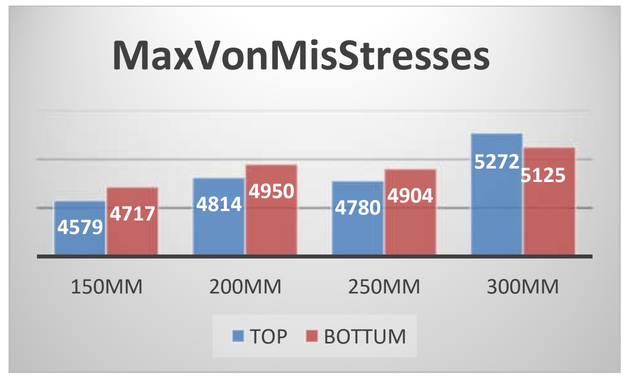
Graph2:PrincipalStressesonDeckSlabof15mSpanwith varyingthickness



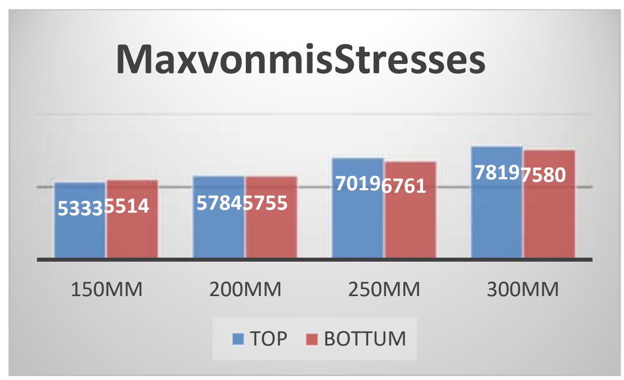
Graph3:PrincipalStressesonDeckSlabof18mSpanwith varyingthickness



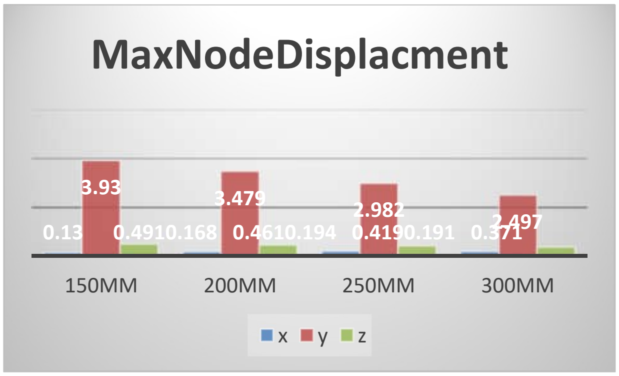
Graph.4:MaxvonmisStressesonDeckSlabof10mSpanwit hvarying thickness



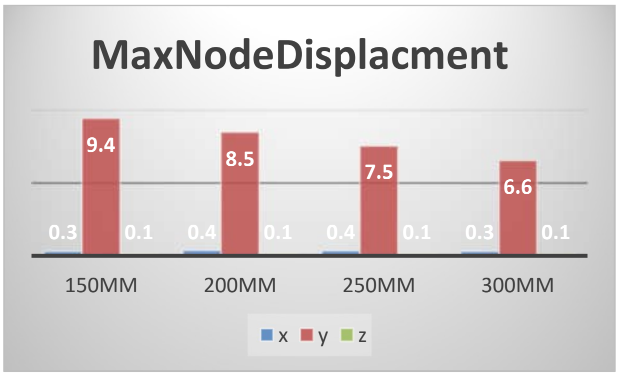
Graph.5:MaxvonmisStressesonDeckSlabof15mSpanwit hvarying thickness



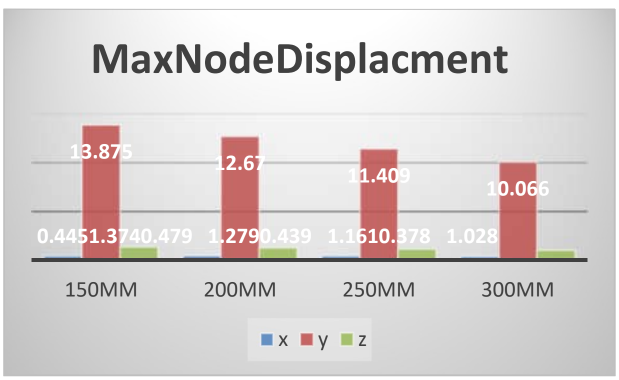
Graph.6:MaxvonmisStressesonDeckSlabof18mSpanwit hvarying thickness



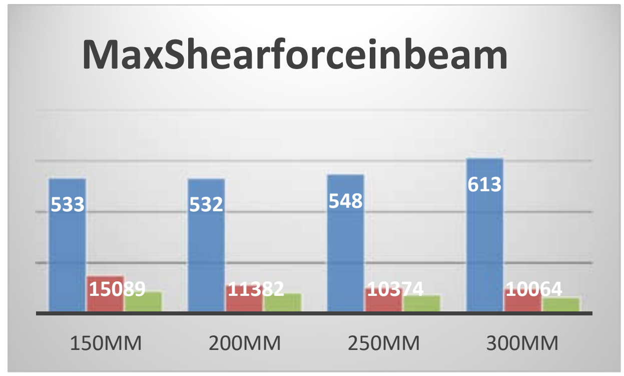
Graph.7:MaximumNodeDisplacementonDeckSlabof10 mSpanwithvaryingthickness



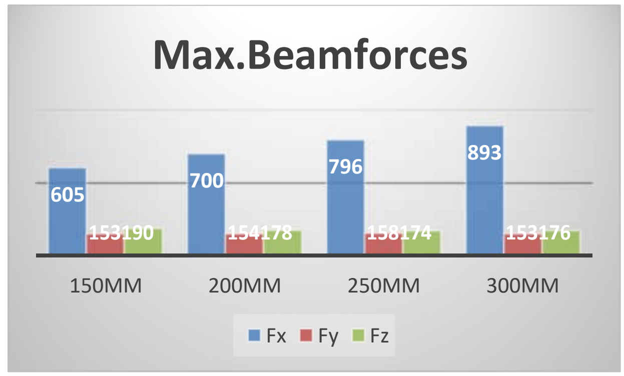
Graph.8:MaximumNodeDisplacementonDeckSlabof15 mSpanwithvaryingthickness



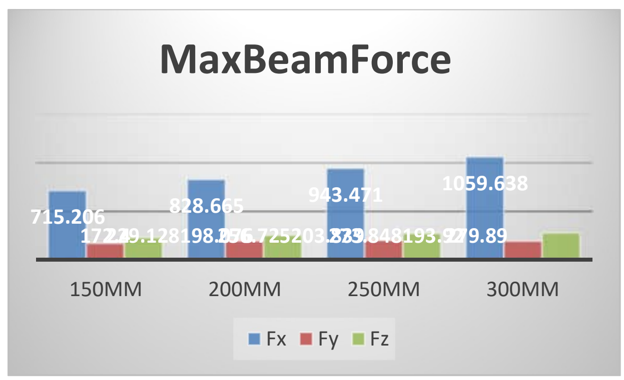
Graph.9:MaximumNodeDisplacementonDeckSlabof18 mSpanwithvaryingthickness



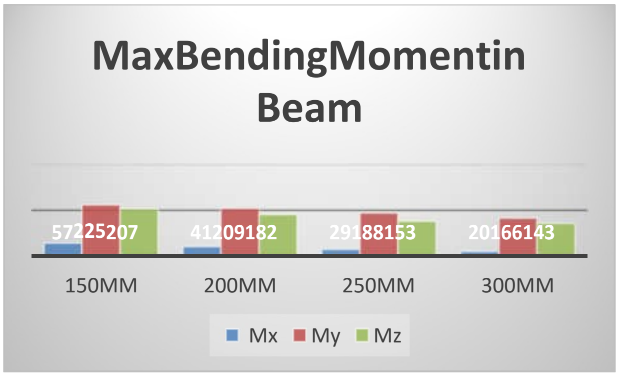
Graph.10:MaximumShearforceonBeamof10mSpanwithv arying thickness



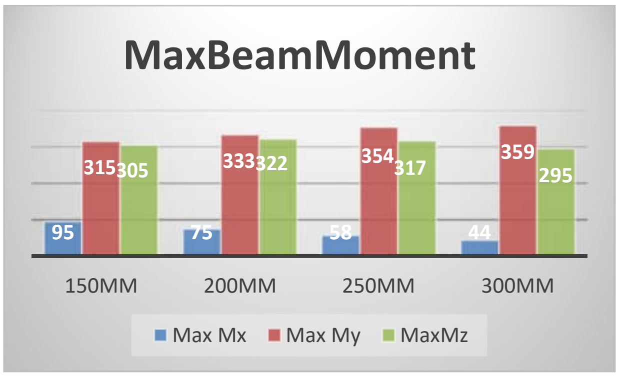
Graph.11MaximumShearforceonBeamof15mSpanwith varying thickness



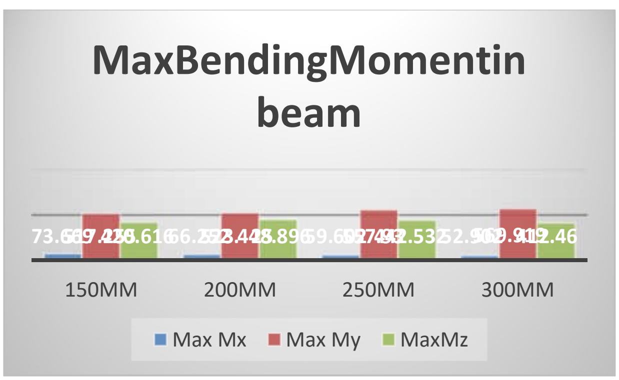
Graph.12:MaximumShearforceonBeamof18mSpanwithv arying thickness



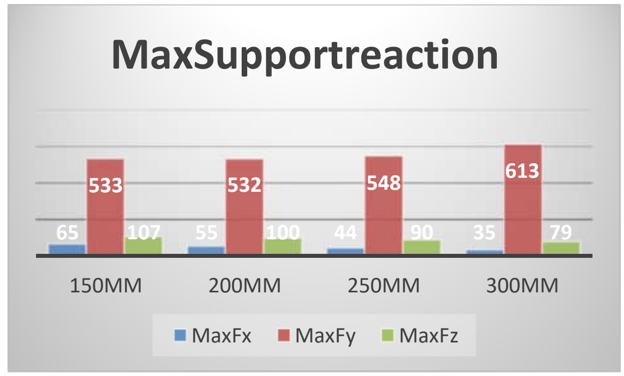
Graph.13:MaximumBendingMomentonBeamof10mSpanwithvaryingthickness



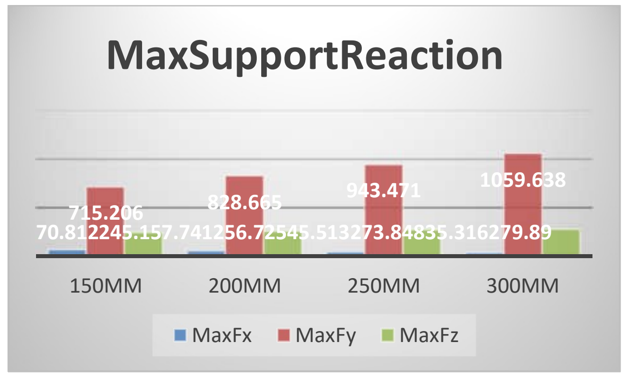
Graph.14:MaximumBendingMomentonBeamof15mSpanwithvaryingthickness



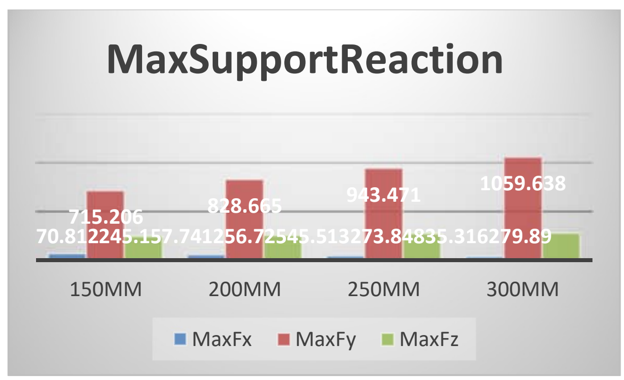
Graph.15:MaximumBendingMomentonBeamof18mSpanwithvaryingthickness



Graph.16:MaximumSupportreactionof10mSpanwithvaryingthickness



Graph.17:MaximumSupportreactionof15mSpanwithvaryingthickness



Graph.18:MaximumSupportreactionof18mSpanwithvaryingthickness

IV. CONCLUSIONS

1. Ithasbeendeterminedthatasspanlengthincreases, the Von Mis top and backside stresses inthe deck slab become more pronounced. Von Misstresses can increase up to 250mm with short spans(up to 10m), but if the slab depth is kept at 300mm,vonMisstresseswilldecrease.Whenthespanincreases from 15 to 18 metres and the slab's depthvariesfrom 150to300 millimeters,the stressesalso rise with slab depth, but they are minimal at300millimetersofthickness.
2. With an increase in span length, node displacementin the downward direction of Y will increase. Asopposed to a bridge with a 10 m span, this is seentwice in a 15 m span and three times in an 18 mspan.Whileforallspanstakenintoconsiderationinthestudy,theNodedisplacementintheYdownwarddirectionwilldecreaseasslabdepthincreases from 150 mm to 300 mm. In the X and Zdirections,thereisbarelyanyvariation.
3. Itisconcludedthatincreasingthebridge's spanfrom 10 metres to 15 metres and 18 metres willresult in an increase in the maximum shear force inthe longitudinal and cross girder. The shear forcewill be reduced even though the thickness variedfrom150mmto300mm.
4. The maximum bending moment in the longitudinaland cross girders will also increase as the bridge'sspanincreasesfrom10to15and18metres,respectively. The thickness ranged from 150mm to300mm,butI'llminimize thatfornow.
5. Maximumsupportreactionrisesasspanlengthincreases, and it falls as deck slab thickness risesfrom150mm to 300mm.

REFERENCES

[1] PrafulNK&BalasoHanumant,ComparativeAnalysis Of T-Beam Bridge By Rational Method AndStaad Pro, International Journal of Engineering Sciences&Research Technology,Vol.4,No. 6,june2015.

[2] Mr. Shivraj D. Kopare, Prof. K. S. Upase"Analysis ofPlateGirderBridgeforClass-AALoadings(TrackedVehicles), International Journal of Emerging Trends inScience and Technology, IJETST-Vol.||02||Issue||06||Pages2645-2655||June||ISSN2348-9480

[3] AnilkumarH,BSSureshChandra"FlexuralBehavior of Longitudinal Girders of RC T-Beam DeckSlab Bridge, IJSRD - International Journal for ScientificResearch & Development| Vol. 3, Issue 05, 2015 | ISSN(online):2321-0613

[4] Kalpana Mohan & S. P. Vijay Kumar "Analysis ofBridgeGirderWithBeamAndWithoutBeam,InternationalJournalofCivilEngineeringandTechnology,D.C.Volume 7,Issue5,September-October2016,pp.337–346,ArticleID:IJCIET_07_05_038

[5] ThanushreeH,SiddeshaH,DattatreyaJK,Dr.S.V.Dinesh " Analysis of Rcc and Psc Bridge DeckSlabforVariousSpans".InternationalJournalofScientific & Engineering Research, Volume 7, Issue 3,March-2016,pp859-863

[6] LindsayEdwardKleinPiers"FiniteElementAnalysis of a Composite Bridge Deck" Research ProjectofUniversityofSouthernQueensland

[7] Budi Ryanto Widjaja "Analysis And Design Of SteelDeck–ConcreteCompositeSlabs"Ph.D.ThesisofVirginiaPolytechnicInstituteandStateUniversity.

[8] Kearthi.S,Sivasubramanian.S.L,Deepan.R,Gopinath.M "Analysis Of T – Beam Bridge Deck Slab"InternationalJournalofResearchandInnovationinEngineering Technology ISSN: 2394 – 4854 Volume: 02Issue:12Pages:22–27

[9] Pragya Soni, Dr.P.S. Bokare "Review of DesignProcedure for Box Girder Bridges" International JournalforResearchinAppliedScience&EngineeringTechnologyISSN:2321-9653;ICValue:45.98;SJImpact Factor:6.887 Volume 5 Issue IX, September 2017pp-1928-1934.

[10] NeerajKumar"TheeffectofvaryingspanonDesign of Medium span ReinforcedConcrete T-beamBridge Deck"The International Journal of Engineeringand Science Volume || 6 || Issue || 5 || Pages || PP 53-56||2017||ISSN(e):2319–1813ISSN(p):2319–1805

[11] Y.YaduPriyaandT.Sujatha"ComparativeAnalysisof PostTensionedT-BeamBridgeDeckbyRationalMethodandFiniteElementMethod"International Journal of Research in IT, Management andEngineering,ISSN2249-1619,ImpactFactor:6.123, Volume06Issue09,September2016,Page9-17

[12] SandeshUpadhyayaK.,F.SahayaSachin"AComparativeStudyOfT-BeamBridgesForVaryingSpanLengths"InternationalJournalofResearchinEngineering and Technology Volume: 05 Issue: 06 ,Jun-2016pp-394-398

[13] Ibrahim S. I. Harba "EFFECT OF SKEW ANGLEON BEHAVIOR OF SIMPLY SUPPORTED R. C. T-BEAMBRIDGEDECKS",ARPNJournalofEngineeringandAppliedSciencesVOL.6,NO.8, AUGUST2011ISSN1819-6608pp-1-14

[14] Job Thomas & S. Ramadass "Parametric Study ofShear Strength of Concrete Beams Reinforced with FRPBars"J.Inst.Eng.IndiaSer.A(September2016)97(3):273–284

[15] TanmayGupta&ManojKumar"InfluenceofDistributedDeadLoadsonVehiclePositionforMaximumMomentinSimplySupportedBridges"J.Inst.Eng. IndiaSer.A (June 2017) 98(1-2):201–210, DOI10.1007/s40030-017-0188-0

[16] YogitaGupta,SuneetKaur&NitinDindorkar"Bridge FailureDuetoInadequateDesignofBedProtection" J. Inst. Eng. India Ser. A (December 2017)98(4):555–560

[17] SanjayTiwari&PradeepBhargava"LoadDistribution Factors for Composite Multicell Box GirderBridges"J.Inst.Eng.IndiaSer.A(December2017)98(4):483–492

[18] SaibabuSundru"AssessmentofReplacementBridge using Proof Load Test" J. Inst. Eng. India Ser. A(March 2018)99(1):155–163

[19] Vikas Gandhe, Pawan Patidar "Parametric Studiesfor Suitability of Steel Bridges, International Journal ofPureandAppliedResearchinEngineeringandTechnology , Volume2(9):44-53

[20] Ilze Paeglitea, Juris Smirnovsa, Ainars Paeglitisa"Dynamic behavior of pre-stressed slab bridges" ElsevierProcediaEngineering172(2017)831–838

[21] TangudupalliMaheshKumar,J.Sudhamani"AnalysisOfT-BeamDeckSlabBridgeInDifferentMethods" International Journal For TechnologicalResearchInEngineeringVolume4,Issue12, August-2017,pp-2702-2708

[22] Haymanmyintmaung,kyawlinnhtat"Investigationof IntegralBridgeEffectunderDynamicLoading"InternationalJournalofScientificandResearchPublications, Volume 7, Issue 5, May 2017, ISSN 2250-3153,pp-567-574

[23] Eugene J. O'Brien and Damien L. Keogh "UpstandFiniteElementAnalysisofBridgeDecks"Elsevier ComputersandStructures,69(6):671-683http://hdl.handle.net/10197/4054

[24] V Raju, Devdas Menon "Analysis of Behaviour ofU-Girder Bridge Decks" Proc. of Int. Conf. on AdvancesinCivilEngineering2010,pp28-32

[25] Junichiro Niwa a, Fakhruddin a, Koji Matsumoto b,Yuji Sato c, Masahiko Yamada c, Takahiro Yamauchi"Experimental study on shear behavior of the interfacebetween old andnewdeckslabs"Elsevier2016