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"Comparative Analysis And Design Of Pratt Truss Bridge And Warren Truss Bridge As Per AISC, And ASSHTO LRFD 2000 By using Autodesk Structural Analysis Software"

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***Abstract -** Truss bridges appeared very early in the history of modern bridges and are economical to construct. A bridge must be designed to safely resist all loads and forces that may reasonably occur during its life . These loads include not only the weight of the structure and passing vehicles, but also load from natural causes, such as wind load . The loads may act individually but more commonly occur as a combination of two or more loads applied simultaneously. In this paper to study the design of Pratt truss bridge and Warren truss bridge design and compare there results. The load effects like bending moment and shear force, Stress are to be found under factored load cases. The design is made based Finite element method. So in this study Pratt truss bridge and Warren truss bridge design and analysed by using ATUDESK STRUCTURAL ANALYSIS software and this software used to analysed and design the various types of structures like steel building , steel structures, truss bridges, etc. The study is made to compare the results of truss bridges of both Pratt truss bridge and warren truss type bridge, component, different parameter, load effect like stress, shear force, bending moment, deflection comparison, quantity of steel and concrete and construct and economical status . This both TRUSS bridges designed by AISC (American institute of steel construction) code and ASHTHO LRFD 2000 for loading. In this paper loading consider as dead load, wind load, as per AISC, moving load is H15 as per ASSTHO.*

Key Words: Structural analysis, Warren truss bridge, Pratt truss bridge, AUTODESK structural analysis professionals software, AISC, ASHTHO LRFD 2000, etc.

1. INTRODUCTION

The truss bridges are a load-bearing structures that they contain multiple vertical member, horizontal member , and diagonal members includes top chord, bottom chord. Truss bridges are maximum strength with minimum material quantity . The main part of truss bridge is floor beams, stringers, portal strut and bracing , sway bracings, lateral wind bracings , and deck this all parts of truss bridge. The trusses support the bridge and its weight over large span areas. Every truss bridges contain top chord and a bottom chord, and this both chord is horizontal member. The Top chords member is in compression and bottom chords member in tension. Diagonals member or post are connected to the vertical and horizontal top chord and bottom chord member. These diagonal members may be in compression or tension. Truss bridges are one oldest types of common and modern bridges. Following are the bridges compared in the project that bridges are common bridges is pratt truss bridge and warren truss bridge.

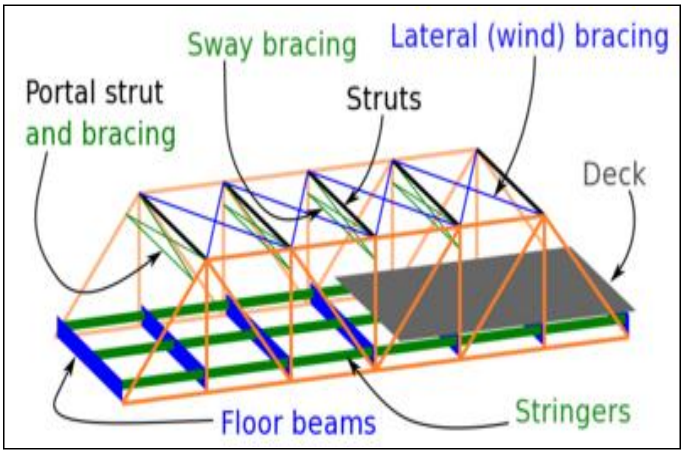


Fig.1. diagram for truss bridge

1.1 Pratt Truss bridge

Pratt truss bridges have been vertical members and diagonals members that member slope was downward to the centre. It is most commonly using for the railway bridges. The basic form of Pratt truss bridge includes triangular truss designs whose diagonal members slope toward the center of the bridge. When under load, this design makes diagonal members are tension, and vertical members are in suspension. self). If the diagonal members are made from the solid material such as metal bars, and when for heavy load bridge may needs need for implementation for reinforcements to the center area of the Pratt truss bridge, since that part of the bridge will always the strongest force loads in bridge. Pratt truss bridges are statically determinate structure. The Pratt truss became widely adopted, because its design was the very simple design , economical also , and easily erection of this bridge in the field. Following figures show the all parts of truss bridge.

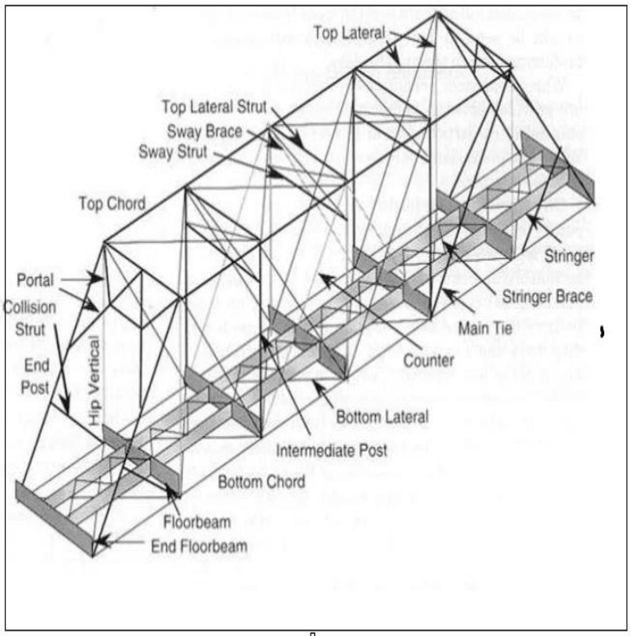


Fig.2. component of Pratt truss bridge.

1.2 Warren truss bridge

Warren truss bridge also contain top chord bottom chord , and diagonal bracings and stringers in the bridge and deck also. Warren truss bridge has been contain longitudinal members vertical and horizontal and diagonal member in the bridge. And in this bridge member joined only by the angle cross-members. This type of truss bridge form bye the equilateral triangles in the truss . this bridge is relatively light but this bridge was strongest and economical truss bridge. The equilateral triangles minimize the forces to only compression and tension.

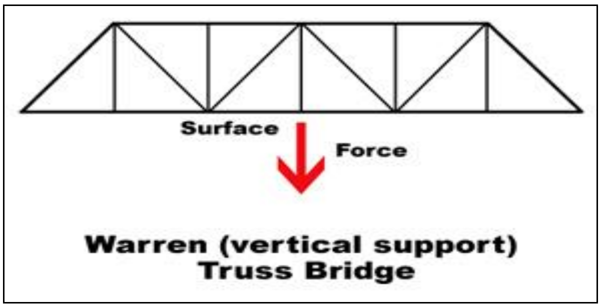


Fig.3 Warren truss bridge

1.3 Importance of Research Topic

In This research paper to study the types of truss bridge i.e. Pratt truss bridge and Warren truss bridge , and the parameter like stress, bending moment, shear force, displacement, of both bridge and compare the results. The bridge is design by AISC (AMERICAN INSTITUTE OF STEEL CONSTRUCTION) Standard, and moving load on bridge is as per ASSTHO LRFD Specification moving load on bridge H15 loading . The analysis and designing phase of these project work was done by using AUTODESK STRUCTURAL ANALYSIS PROFESSIONAL software. And calculate the quantity of steel and concrete. compare which bridge is economical bridge on weight of material.

1.4 Problem Statement

"Analyze and Design of Pratt truss bridge and Warren truss bridge as per AISC Code , ASSTHO LRFD 2000 specification, moving load applied on bridge is H15 loading, top length of bridge is 25.60m, bottom length of bridge is 32.00 m, height of bridge is 3m, no. of fields are 10, RC floor is 10 inch thick.

1.3 Objective of the study

(1) To analyse and design of Pratt truss bridge as per AISC method and ASSHTHO LRFD 2000 specification by using Autodesk structural analysis professional 2022 software.
(2) To analyse and design of Warren truss bridge as per AISC method and ASSHTHO LRFD 2000 specification by using Autodesk structural analysis professional 2022 software.

(3) To compare the result maximum and minimum moment, reaction, stress, displacement on different load condition.

(4) To Calculate quantity of material and compare the both quantity .

(5) To match quantity of steel materials by using weight and compare the different of quantity of material , find out economical truss bridge.

2. METHODOLOGY

1. Project topic finalization.
2. Literature survey.
3. Planning of truss bridge.
4. Analysis and design of Pratt truss using AISC Standard.
5. Analysis and design of Warren truss bridge using AISC standard.
6. Calculation of quantity of steel & reinforcement.
7. Comparing the respective results of both pratt truss bridge and warren truss bridge.
8. Conclusion.

2.1 Truss Bridge Analysis

The truss bridge is analyzing as per AISC , Material properties of steel member is as per American standard, section database as per AISC 15.0 American hot rolled shape (AISC Edition 15.0), and loading on the truss bridge dead load, wind load , data base is ASCE minimum design load ASCE 7-.05 and moving load is as per ASSTHO specification, steel design as per LRFD 2000 and the support is provided at 1 side is pinned support and other side is roller support on truss bridge.

2.2 APPROACH

i) Analysis of dead load, wind load is done by using the AISC with the help of AUTODESK STRUCTURAL ANALYSIS PROFESSIONALS 2022 software.

ii) Analysis of moving load i.e. vehicle load is AS PER AASTHO specification is carried out with the help of Autodesk structural analysis software steel design as per LRFD 2000.

4. ANALYSIS AND DESIGN OF PRATT TRUSS BRIDGE

Design data : Length of top chord=32m
Length of bottom chord =25.6m
Height= 3m
No. of fields=10 nos

Loading on bridge is wind load, dead load, live load, moving load Code AASHTO
Vehicle name -H15
Load type
Concentrated load: F=53.38KN , X=0m, S=1828.8mm
Concentrated load: F=53.38KN , X=4267.2mm, S=1828.8mm

SECTION PARAMETERS: : TOP CHORD HP 18X181
BOTTOM CHORD: : W16X67
DIAGONALS: L 3.5x3.5x0.25 , L6X6X3/4, L5X5X3/4, L 3.5x3.5x0.25, L 3x3x0.1875,

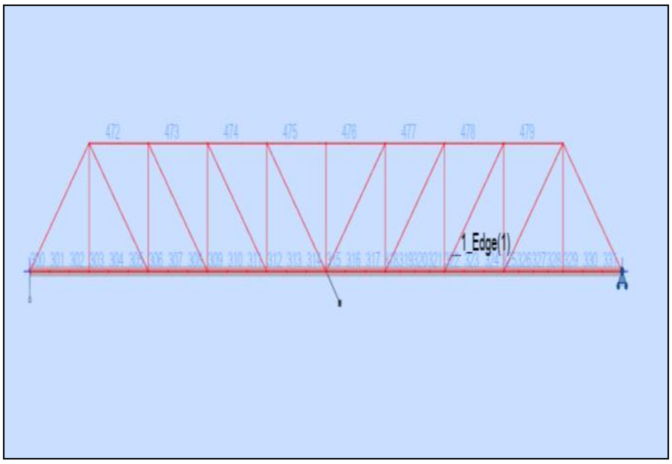


Fig 4. (Front View) 2-D Line Plan of Pratt Truss bridge.

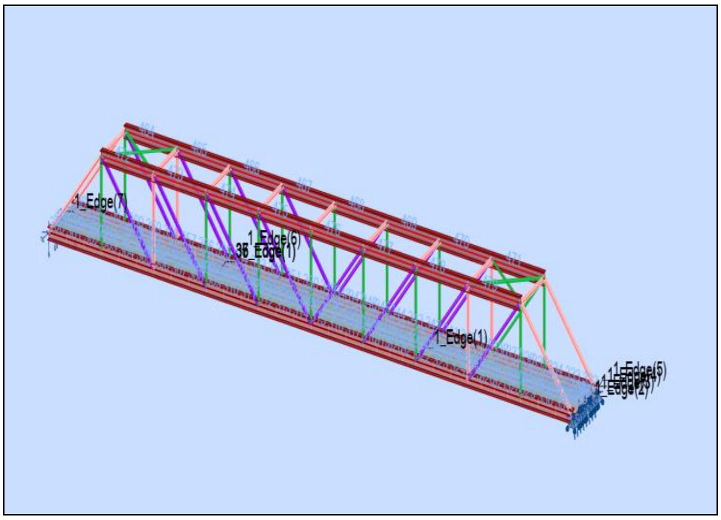
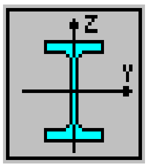


Fig 5. (3D View) 3D view of Pratt Truss bridge model.

Design of steel member section

STEEL MEMBER DESIGN

CODE: *LRFD Specification for Structural Steel Buildings, December 29,1999*
ANALYSIS TYPE: Member Verification
CODE GROUP:
Member: 209 Simple member
Point: 3 Coordinate: x = 0.53 L = 17.07 m
LOADS:
Governing Load Case: 9 MOVING LOAD /18/ 9/18*1.00
MATERIAL:
STEEL Fy = 248.21 MPa



SECTION PARAMETERS: W16X67

d=414 mm	Ay=8752 mm2
	Az=4154 mm2
	Ax=12645 mm2
b=259 mm	Iy=397084780 mm4
	Iz=49531540 mm4
	J=994793 mm4
tw=10 mm	Sy=1918191 mm3
	Sz=382365 mm3
tf=17 mm	Zy=2130318 mm3
	Zz=581741 mm3

MEMBER PARAMETERS:

Ly = 32.00 m	KLy/ry = 180.58	Lb = 32.00 m
Lz = 32.00 m	KLz/rz = 511.29	Cb = 1.00

INTERNAL FORCES: NOMINAL STRENGTHS:

Mux = -0.00 kN*m fuvy,mx = 0.00 MPa
Pu = -38.13 kN fuvz,mx = 0.00 MPa Pn = 3138.67 kN

Muy = 33.76 kN*m   Vuy = -0.08 Kn
Mny = 87.53 kN*m   Vny = 1173.10 kN
Muz = 0.02 kN*m   Vuz = 20.63 kN
Mnz = 144.39 kN*m   Vnz = 618.62 kN

COEFFICIENTS:
Fi b = 0.90   Fi t = 0.90   Fi v = 0.90

SECTION ELEMENTS:
UNS = Compact   STI = Compact

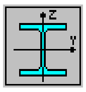
VERIFICATION FORMULAS:

Pu/(2*Fit*Pn) + (Muy/(Fib*Mny) + Muz/(Fib*Mnz)) = 0.44 < 1.00   LRFD (H1-1B)

Vuy/(Fiv*Vny) + fuvy,mx/(0.6*Fiv*Fy) = 0.00 < 1.00
Vuz/(Fiv*Vnz) + fuvz,mx/(0.6*Fiv*Fy) = 0.04 < 1.00   LRFD (F2-2) (H2-2)

Section OK !!!

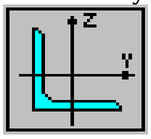
CODE: *LRFD Specification for Structural Steel Buildings, December 29,1999*
ANALYSIS TYPE: Member Verification
CODE GROUP:
MEMBER: 2   **POINT:** 2
CODE: *LRFD Specification for Structural Steel Buildings, December 29,1999*
ANALYSIS TYPE: Member Verification
CODE GROUP:
MEMBER: 2 **POINT:** 2   **COORDINATE:** x = 0.44 L = 11.20 m
LOADS:
Governing Load Case: 1 DL1
MATERIAL:
STEEL   Fy = 248.21 MPa



SECTION PARAMETERS: HP18X181
d=457 mm   Ay=23226 mm2
Az=11613 mm2
Ax=34323 mm2
b=457 mm   Iy=1257018905 mm4
Iz=405409409 mm4
J=8615991 mm4
tw=25 mm   Sy=5498770 mm3
Sz=1773444 mm3
tf=25 mm   Zy=6210697 mm3
Zz=2736640 mm3
MEMBER PARAMETERS:
Ly = 25.60 m   KLy/ry = 133.77 Lb = 25.60 m
Lz = 25.60 m   KLz/rz = 235.55 Cb = 1.00
INTERNAL FORCES: NOMINAL STRENGTHS:
Mux = 0.01 kN*m   fuvy,mx = 0.02 MPa
Pu = 473.86 kN   fuvz,mx = 0.02 MPa   Pn = 1070.61 kN

Muy = 52.79 kN*m   Vuy = 0.17 kN   Mny = 937.20 kN*m
Muz = -0.48 kN*m   Vuz = -0.12 kN   Mnz = 679.26 kN*m
COEFFICIENTS:
Fi b = 0.90   Fi c = 0.85   Fi v = 0.90
SECTION ELEMENTS:
UNS = Compact   STI = Compact
VERIFICATION FORMULAS:
Pu/(Fic*Pn) + 8/9*(Muy/(Fib*Mny) + Muz/(Fib*Mnz)) = 0.58 < 1.00   LRFD (H1-1A)
Vuy/(Fiv*Vny) + fuvy,mx/(0.6*Fiv*Fy) = 0.00 < 1.00
Vuz/(Fiv*Vnz) + fuvz,mx/(0.6*Fiv*Fy) = 0.00 < 1.00   LRFD (F2-2) (H2-2)
Section OK !!!

MEMBER: 5   **POINT:**   **COORDINATE:**
LOADS:
Governing Load Case: Manual
MATERIAL:
STEEL   Fy = 248.21 MPa



SECTION PARAMETERS: L6X6X3/4
d=152 mm   Ay=2903 mm2
Az=2903 mm2
Ax=5458 mm2
b=152 mm   Iy=11696103 mm4
Iz=11696103 mm4
J=670133 mm4
tw=19 mm   Sy=108714 mm3
Sz=108860 mm3
tf=19 mm   Zy=195006 mm3
Zz=195006 mm3
MEMBER PARAMETERS:
Ly = 4.39 m   KLy/ry = 94.75
Lz = 4.39 m   KLz/rz = 94.75
INTERNAL FORCES:
Mux = -0.00 kN*m   fuvy,mx = 0.11 MPa
Pu = 492.04 kN   fuvz,mx = 0.11 MPa   Pn = 844.47 kN
Vuy = 0.35 kN

NOMINAL STRENGTHS:
Vny = 432.37 Kn   Muz = 0.96 kN*m
Vuz = 0.67 kN   Mnz = 48.40 kN*m
Vnz = 432.37 kN
COEFFICIENTS:
Fi b = 0.90   Fi c = 0.85   Fi v = 0.90
SECTION ELEMENTS:
UNS = Non-compact   STI = Compact
VERIFICATION FORMULAS:
Pu/(Fic*Pn) + 8/9*Muz/(Fib*Mnz) = 0.71 < 1.00   LRFD (H1-1A)
Vuy/(Fiv*Vny) + fuvy,mx/(0.6*Fiv*Fy) = 0.00 < 1.00
Vuz/(Fiv*Vnz) + fuvz,mx/(0.6*Fiv*Fy) = 0.00 < 1.00   LRFD (F2-2) (H2-2)
Section OK !!!

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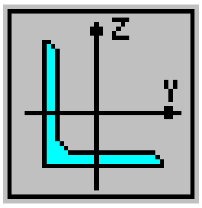
MEMBER: 11 **POINT:** 2
LOADS:
Governing Load Case: 1 DL1
MATERIAL:
STEEL Fy = 248.21 MPa



SECTION PARAMETERS: L5X5X3/4

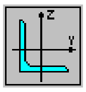
d=127 mm	Ay=2419 mm2
	Az=2419 mm2
	Ax=4503 mm2
b=127 mm	Iy=6534833 mm4
	Iz=6534833 mm4
	J=553588 mm4
tw=19 mm	Sy=73794 mm3
	Sz=73930 mm3
tf=19 mm	Zy=133391 mm3
	Zz=133391 mm3

MEMBER PARAMETERS:
Ly = 4.39 m KLy/ry = 115.15
Lz = 4.39 m KLz/rz = 115.15
INTERNAL FORCES:
Mux = -0.00 kN*m fuvy,mx = 0.11 MPa
Pu = -399.99 kN fuvz,mx = 0.11 MPa Pn = 1117.75 kN

NOMINAL STRENGTHS:

Muy = 0.61 kN*m Vuy = -0.06 kN Mny = 33.11 kN*m
Muz = 0.04 kN*m Vuz = 0.00 kN Mnz = 33.11 kN*m
COEFFICIENTS:
Fi b = 0.90 Fi t = 0.90 Fi v = 0.90
SECTION ELEMENTS:
UNS = Non-compact STI = Compact
VERIFICATION FORMULAS:
Pu/(Fit*Pn) + 8/9*(Muy/(Fib*Mny) + Muz/(Fib*Mnz)) = 0.42 < 1.00 LRFD (H1-1A)
Vuy/(Fiv*Vny) + fuvy,mx/(0.6*Fiv*Fy) = 0.00 < 1.00
Vuz/(Fiv*Vnz) + fuvz,mx/(0.6*Fiv*Fy) = 0.00 < 1.00 LRFD (F2-2) (H2-2)
Section OK !!!

CODE GROUP:
MEMBER: 8 **POINT:** 2
COORDINATE: x = 0.50 L = 2.19 m
LOADS:
Governing Load Case: 1 DL1
MATERIAL:
STEEL Fy = 248.21 MPa



SECTION PARAMETERS: L 3.5x3.5x0.25

d=89 mm	Ay=565 mm2
	Az=565 mm2
	Ax=1097 mm2
b=89 mm	Iy=832463 mm4
	Iz=832463 mm4
	J=16067 mm4
tw=6 mm	Sy=12845 mm3
	Sz=12873 mm3
tf=6 mm	Zy=23106 mm3
	Zz=23106 mm3

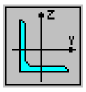
COORDINATE: x = 0.50 L

MEMBER PARAMETERS:
Ly = 4.39 m KLy/ry = 159.21
Lz = 4.39 m KLz/rz = 159.21
-
INTERNAL FORCES:
Mux = 0.00 kN*m fuvy,mx = 0.01 MPa
Pu = -159.68 kN fuvz,mx = 0.01 MPa Pn = 272.23 kN

NOMINAL STRENGTHS:

Muy = 0.15 kN*m Vuy = -0.00 kN
Mny = 5.74 kN*m Vny = 84.07 kN
Muz = -0.00 kN*m Vuz = 0.00 kN Mnz = 5.74 kN*m
COEFFICIENTS:
Fi b = 0.90 Fi t = 0.90 Fi v = 0.90
SECTION ELEMENTS:
UNS = Slender STI = Compact
VERIFICATION FORMULAS:
Pu/(Fit*Pn) + 8/9*(Muy/(Fib*Mny) + Muz/(Fib*Mnz)) = 0.68 < 1.00 LRFD (H1-1A)
Vuy/(Fiv*Vny) + fuvy,mx/(0.6*Fiv*Fy) = 0.00 < 1.00
Vuz/(Fiv*Vnz) + fuvz,mx/(0.6*Fiv*Fy) = 0.00 < 1.00 LRFD (F2-2) (H2-2) Vny = 360.31 kN
Section OK !!! Vnz = 360.31 kN

CODE GROUP:
MEMBER: 15 **POINT:** 1 **COO**
LOADS:
Governing Load Case: 9 MOVING LOAD /30/ 9/30*1.00
MATERIAL:
STEEL Fy = 248.21 MPa



SECTION PARAMETERS: L 3x3x0.1875

d=76 mm	Ay=363 mm2
	Az=363 mm2
	Ax=703 mm2
b=76 mm	Iy=394587 mm4
	Iz=394587 mm4
	J=5661 mm4
tw=5 mm	Sy=7043 mm3
	Sz=7100 mm3
tf=5 mm	Zy=12684 mm3
	Zz=12684 mm3

MEMBER PARAMETERS:
Ly = 3.00 m KLy/ry = 126.65

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Lz = 3.00 m KLz/rz = 126.65
INTERNAL FORCES:
Mux = -0.00 kN*m fuvy,mx = 0.00 MPa
Pu = -28.51 kN fuvz,mx = 0.00 MPa Pn = 174.55 kN
NOMINAL STRENGTHS:
Vuy = -0.00 kN Vny = 54.05 kN
Muz = -0.01 kN*m Vuz = 0.00 kN Mnz = 3.15 kN*m
COEFFICIENTS:
Fi b = 0.90 Fi t = 0.90 Fi v = 0.90
SECTION ELEMENTS:
UNS = Slender STI = Compact
VERIFICATION FORMULAS:
Pu/(2*Fit*Pn) + Muz/(Fib*Mnz) = 0.09 < 1.00 LRFD (H1-1B)
Vuy/(Fiv*Vny) + fuvy,mx/(0.6*Fiv*Fy) = 0.00 < 1.00
Vuz/(Fiv*Vnz) + fuvz,mx/(0.6*Fiv*Fy) = 0.00 < 1.00 LRFD (F2-2) (H2-2)
Section OK !!!

4. ANALYSIS AND DESIGN OF WARREN TRUSS BRIDGE

Design data : Length of top chord=32m
Length of bottom chord =25m
Height= 7m
No. of fields=10 nos

Loading on bridge is wind load, dead load, live load, moving load Code AASHTO
Vehicle name -H15
Load type
Concentrated load: F=53.38KN , X=0m, S=1828.8mm
Concentrated load: F=53.38KN , X=4267.2mm, S=1828.8mm

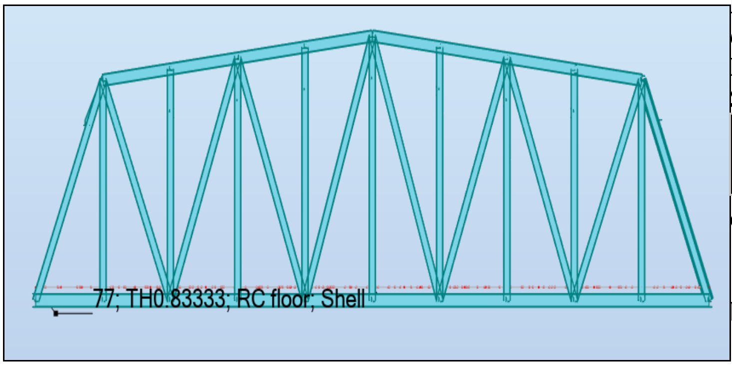


Fig 6. (Front View) 2-D Line Plan of Warren Truss bridge.

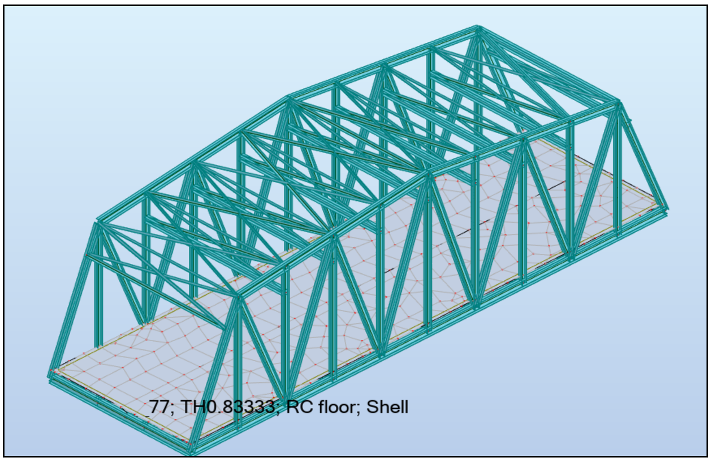


Fig 7. (Front View) 3-D view of Warren Truss bridge.

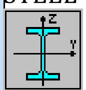
Design of steel member section

STEEL MEMBER DESIGN

CODE: *LRFD Specification for Structural Steel Buildings, December 29,1999*
ANALYSIS TYPE: Member Verification

SECTION PARAMETERS: : TOP CHORD W 18X97
BOTTOM CHORD: 16X89
DIAGONALS: L8X8X3/4, L6X6X3/4, L5X5X3/4, L 3.5x3.5x0.25, L 3x3x0.1875, W12X45, W12X65,W18X97,W12X50,W12X53,

CODE GROUP:
MEMBER: 1 **POINT:**
COORDINATE: x = 0.80 L = 80.00 ft
LOADS:
Governing Load Case: 2 WIND1
MATERIAL:
STEEL Fy = 248 MPa



SECTION PARAMETERS: W18X97

d=470 mm Ay=1250 mm2
Az=640 mm2
Ax=184 mm2
b=28 cm Iy=728400 mm4
Iz=83660 mm4 J=244 mm4
tw=1 cm Sy=30840 mm3
Sz=5930 mm3
tf=2 cm Zy=34580 mm3
Zz=9060 mm3

MEMBER PARAMETERS:
Ly = 32m KLy/ry = 153.14 Lb = 32 m
Lz = 32m KLz/rz = 451.86 Cb = 1.00
INTERNAL FORCES:
Mux = 0.00 KN*m fuvy,mx = 0.00 MPa
Pu = 26.334kn.m fuvz,mx = 0.00 MPa
Pn = 155.87 KN

NOMINAL STRENGTHS:
Muy = -0.00 kN.m Vuy = -0.00 KN Mny = 613.23 kn.m
Muz = -4.67 kn.m Vuz = 0.04KN Mnz = 737.96 KN.m
COEFFICIENTS:
Fi b = 0.90 Fi c = 0.85 Fi v = 0.90
SECTION ELEMENTS:
UNS = Compact STI = Compact
VERIFICATION FORMULAS:
Pu/(2*Fic*Pn) + (Muy/(Fib*Mny) + Muz/(Fib*Mnz)) = 0.02 < 1.00 LRFD (H1-1B)
Vuy/(Fiv*Vny) + fuvy,mx/(0.6*Fiv*Fy) = 0.00 < 1.00
Vuz/(Fiv*Vons) + fuvz,mx/(0.6*Fiv*Fy) = 0.00 < 1.00
LRFD (F2-2) (H2-2)
Section ok

5. COMPARING THE RESPECTIVE RESULTS OF BOTH WARREN TRUSS BRIDGE AND PRATT TRUSS BRIDGE

5.1 WARREN TRUSS BRIDGE RESULT

Table -1: Maximum And Minimum Reaction Force Calculation

Reaction Force (Kn)	Dead Load (Value)		Wind Load (Value)		Moving Load H15 (Value)	
	MAX (KN)	MIN (KN)	MAX (KN)	MIN (KN)	MAX (KN)	MIN (KN)
Fz=10kN	13.20	-13.12	4.49	-4.34	5.88	-40.39
Fy=10 kN	26.41	-27.30	7.13	-53.42	8.32	-1.31
FX=5 KN	23.28	-28.82	9.02	-8.93	8.00	-9.04

Table -2: Maximum And Minimum Moment Calculation

MOMENT (KN/M)	Dead Load (Value)		Wind Load (Value)		Moving Load H15 (Value)	
	MAX (KN/M)	MIN (KN/M)	MAX (KN/M)	MIN (KN/M)	MAX (KN/M)	MIN (KN/M)
Mz=50kNm	38.00	-13.53	19.01	-7.13	8.83	-4.83
My=10kNm	20.89	-42.12	4.21	-5.78	13.97	-240.40
Mz=5knm	0.38	-1.44	0.50	-0.04	0.16	-0.58

Table -3: Maximum And Minimum normal Stress Calculation Result
Vny = 375.46 kip
Vnz = 214.94 kip

Normal Stress (Mn/M²)	Dead Load (Value)		Wind Load (Value)		Moving Load H15 (Value)	
Stress max= 50 (MN/M²)	Max (MN/M²)	min (MN/M²)	Max (MN/M²)	min (MN/M²)	Max (MN/M²)	min (MN/M²)
S(Max)	38.00	-13.53	61.67	-1.62	8.83	-4.83
S(Min)	20.89	-42.12	1.63	-61.91	13.97	-240.40

Table -4: Maximum And Minimum bending Stress Calculation Result

Bending Stress (Mn/M²)	Dead Load (Value)		Wind Load (Value)		Moving Load H15 (Value)	
Bend Stress max=50 (MN/M²)	Max (MN/M²)	min (MN/M²)	Max (MN/M²)	min (MN/M²)	Max (MN/M²)	min (MN/M²)
S Max (My)	8.73	-1.71	2.83	-0.08	166.52	-8.74
S Max (Mz)	121.04	-1.91	60.55	-0.17	36.06	-10.24
S Min (My)	3.66	-211.18	0.16	-2.11	-17.20	-166.79
S Min (Mz)	5.38	-121.04	0.29	-60.55	1.33	-17.2

5.2 Bill Of Quantity & Material Warren Truss Bridge

Type	number	Total weight (kg)	Painting area (mm2)
steel	142	95958	1520100504.62
Concrete (deck)		177076	

PRATT TRUSS BRIDGE RESULT

Table -1: Maximum And Minimum Reaction Force Calculation

Reaction Force (Kn)	Dead Load (Value)		Wind Load (Value)		Moving Load H15 (Value)	
	MAX (KN)	MIN (KN)	MAX (KN)	MIN (KN)	MAX (KN)	MIN (KN)
Fz=5kN	100.86	-99.54	0.41	-0.81	26.46	-27.17
Fy=5kN	2.64	-2.98	0.22	-0.16	0.40	-0.48
FX+ C , FX- T =100KN	985.65	-506.79	2.98	-3.04	146.01	-76.31

Table -5: Maximum And Minimum Moment Calculation

moment (KN/M)	Dead Load (Value)		Wind Load (Value)		Moving Load H15 (Value)	
	MAX (KN/M)	MIN (KN/M)	MAX (KN/M)	MIN (KN/M)	MAX (KN/M)	MIN (KN/M)
MZ=10kN/m	4.53	-3.96	0.84	-0.39	1.10	-0.92
My=10kN	237.11	-136.45	0.51	-0.59	65.59	-36.88
MX =e-003 KN/m	3.59	-0.97	0.16	-0.14	0.69	-0.23

Table -6: Maximum And Minimum normal Stress Calculation Result

Normal Stress (Mn/M²)	Dead Load (Value)		Wind Load (Value)		Moving Load H15 (Value)	
Stress max= 50 (MN/M²)	Max (MN/M²)	min (MN/M²)	Max (MN/M²)	min (MN/M²)	Max (MN/M²)	min (MN/M²)
S(Max)	97.92	-142.60	0.56	-3.94	19.31	-40.63
S(min)	88.81	-150 01	4.27	-0.54	19.01	--42.63

Table -7: Maximum And Minimum bending Stress Calculation Result

Bending Stress (Mn/M²)	Dead Load (Value)		Wind Load (Value)		Moving Load H15 (Value)	
Bend Stress max=50 (MN/M²)	Max (MN/M²)	min (MN/M²)	Max (MN/M²)	min (MN/M²)	Max (MN/M²)	min (MN/M²)
S Max (My)	22.84	-1.83	3.40	-0.04	14.95	-0.22
S Max (Mz)	11.43	-1.91	4.38	-0.10	4.39	-0.30
S Min (My)	2.25	-11.12	0.02	-3.88	0.35	-14.95
S Min (Mz)	2.03	-24.33	0.10	-3.82	0.35	-3.57

Bill Of Quantity & Material Pratt Truss Bridge

Type	Number	Length (m)	Unit weight (kG/m)	Member weight (kG)	Total weight (kG)	Painting area (m2)
STEEL						
HP18X18	2	25.60	269.40	6896.61	13793	135.22
L5X5X3/4	9	2.50	35.35	88.36	795	11.19
L5X5X3/4	9	3.00	35.35	106.04	954	13.42
L5X5X3/4	4	4.39	35.35	155.17	621	8.73
L6X6X3/4	5	4.39	42.84	188.07	940	13.14
L6X6X3/4	2	32.00	42.84	1370.90	2742	38.31
L 3x3x0.1	7	3.00	5.52	16.56	116	6.23
L 3x3x0.1	4	4.06	5.52	22.41	90	4.82
L 3.5x3.5	2	3.00	8.61	25.83	52	2.08
L 3.5x3.5	11	4.39	8.61	37.79	416	16.78
W16X67	2	32.00	99.25	3176.07	6352	116.91
Total per se						
HP18X18	2	51.20	269.40	13793.23	13793	135.22
L5X5X3/4	22	67.06	35.35	2370.30	2370	33.34
L6X6X3/4	7	85.95	42.84	3682.14	3682	51.45
L 3x3x0.1	11	37.24	5.52	205.55	206	11.04
L 3.5x3.5	13	54.29	8.61	467.36	467	18.86
W16X67	2	64.00	99.25	6352.15	6352	116.91
Total					26871	366.83

8. COMPARISON OF RESULTS

{A} For warren truss bridge : Steel Take off = 95958 kg

Total Quantity in kg = 95958 kg of steel s/c required

{B} For pratt truss bridge :- Steel Take off = 26877kg
1} Total Quantity in Kg = 26877 kg steel s/c required

9. CONCLUSION

Therefore, Cost of warren truss bridge = 95958x 67
= Rs. 6429186/-
Cost of Pratt truss bridge = 26871x 67
= Rs. 1800357/-

Therefore, Total Cost Saving Pratt truss bridge = 6429186 – 1800357
Rs. 4628829/-

Therefore 56.24% of the total cost saving in Pratt truss bridge so that Pratt truss bridge is proved to be economical bridge as compared to warren truss bridge.

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