

Comparative Study On Design And Analysis Of Footover Bridge

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ABSTRACT

Foot over bridges provide grade-separated pedestrian movement across heavily trafficked corridors and require an efficient balance of strength, serviceability, material use, and economy. This study compares Warren, Pratt, and Lattice steel truss configurations for a 54 m span foot over bridge using STAAD.Pro. The three models use a 3 m pedestrian width and are assessed under dead, live, wind, and seismic loading reported in the thesis with reference to IRC SP:56, IS 875, IS 1893:2016, and IS 800:2007. The comparative results reported in the thesis give maximum resultant nodal displacements of 18 mm for the Warren truss, 46.462 mm for the Pratt truss, and 15.020 mm for the Lattice truss; all are below the reported allowable deflection of 216 mm. Maximum axial forces are 384.353, 470.580, and 430.549 kN, respectively, while the maximum vertical reactions are 583, 607.813, and 606 kN. The reported steel take-off is 492.457 kN (50.21 tons) for Warren, 800.769 kN (81.62 tons) for Pratt, and 573.266 kN (58.49 tons) for Lattice. Although the Lattice truss gives the lowest displacement, the thesis concludes that the Warren truss is the most efficient and cost-effective configuration because it combines lower axial force, lower support reaction, and the lowest steel weight.

Keywords: Foot over bridge; Warren truss; Pratt truss; Lattice truss; STAAD.Pro; Structural analysis; Steel take-off

I. INTRODUCTION

Foot over bridges (FOBs) provide a dedicated elevated path for pedestrians over busy roads, highways, and railway corridors. Their principal functions are to improve pedestrian safety, reduce interference with vehicular traffic, strengthen urban connectivity, and provide accessible crossing facilities in high-footfall locations.

For long-span steel pedestrian bridges, truss geometry directly influences load distribution, member forces, displacement, support reactions, fabrication complexity, and total structural weight. The thesis therefore compares three 54 m steel truss forms - Warren, Pratt, and Lattice - under a common set of geometric and loading conditions to identify the configuration that provides the best combination of structural performance and economic efficiency.

The study uses STAAD.Pro for three-dimensional modeling and structural analysis. AutoCAD is used for the bridge layout, while the stair and pedestrian-clearance configuration is developed with reference to IRC SP:56-2011 [11]. The comparison is centered on maximum resultant displacement, maximum axial member force, maximum vertical reaction, and steel take-off.

II. OBJECTIVES

- To analyze and evaluate Warren, Lattice, and Pratt truss configurations for pedestrian overbridge applications.
- To investigate the structural response of the three configurations under dead, live, wind, and seismic loading.
- To compare displacement, axial force, support reaction, and structural steel weight for the 54 m span models.
- To identify the most efficient truss configuration by balancing structural integrity, material weight, and economic viability.

III. LITERATURE SURVEY

Previous FOB studies cited in the thesis use STAAD.Pro and Indian design provisions to evaluate steel pedestrian bridges. Rajesh examined a steel railway-station foot over bridge with dead, live, and wind loads and emphasized economical section selection [1]. Prashanth and Gokulnath analyzed a Warren-truss foot over bridge and discussed structural behavior under environmental and service loads [2].

The thesis also reviews seismic analysis of foot over bridges [3], railway foot over bridge design [4], and cold-formed steel FOB construction [5]. These studies support the present comparative approach, in which alternative truss geometries are evaluated using common span, width, loading, and software-analysis conditions.

IV. MATERIALS AND METHODOLOGY

Bridge geometry and modeling

Three STAAD.Pro models were prepared for a 54 m span: Model 1 - Warren truss, Model 2 - Pratt truss, and Model 3 - Lattice truss. The source structure-data tables report a total structure height of 9.75 m, a 3 m gangway/pedestrian width, 150 mm slab thickness, and 2 mm GI sheet thickness. The stair configuration reports a total height of 6.75 m, three flights, 15 steps per flight, 2 m landings, 150 mm risers, 300 mm treads, and a 150 mm RCC slab.

Table 1. Common design and loading parameters reported in the thesis

Parameter	Reported value
Main span	54 m
Pedestrian/gangway width	3 m
Total structure height (model data tables)	9.75 m
Stair total height	6.75 m
Slab thickness	150 mm
GI sheet thickness	2 mm
Seismic zone	Zone II
Slab dead load	3.75 kN/m ²
Floor finish	1.5 kN/m ²
Live load	3 kN/m ²
Wind load used in model tables	1.85 kN/m ²

Fig. 1. AutoCAD plan view of the pedestrian bridge retained from the thesis.

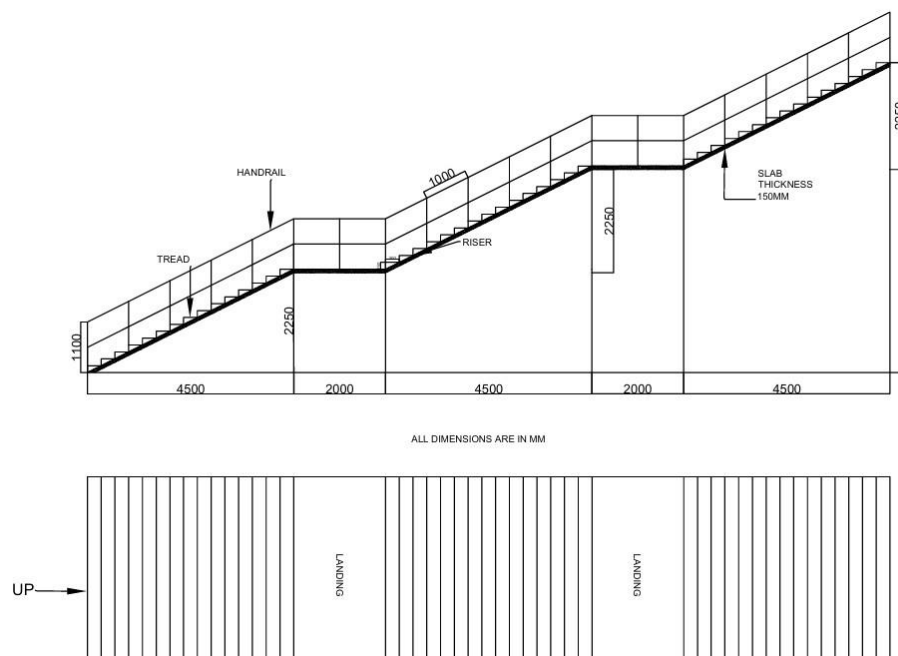


Fig. 2. Foot over bridge stair configuration retained from the thesis.

Load definition

Dead load includes the self-weight of modeled members and permanent components. Live load represents pedestrian and temporary service loading. The thesis reports a basic wind speed of 44 m/s, $K_1 = 1.0$, $K_2 = 1.05$, $K_3 = 1.0$, $K_4 = 1.30$, and a final design wind pressure of 1.85 kN/m². For seismic analysis, the reported parameters are Zone II with $Z = 0.1$, response reduction factor $R = 3$, importance factor $I = 1$, medium soil, 5% damping, and a calculated time period of 0.47 s in the X and Z directions.

Section selection and analysis

Steel member sections were selected through iterative STAAD.Pro trials to satisfy the load-bearing requirements of columns, chords, verticals, diagonals, bracing members, and stairs. The three models were then

evaluated for nodal displacement, beam/member force, support reaction, and steel take-off. The reported allowable deflection is $\text{Span}/250 = 54000/250 = 216 \text{ mm}$.

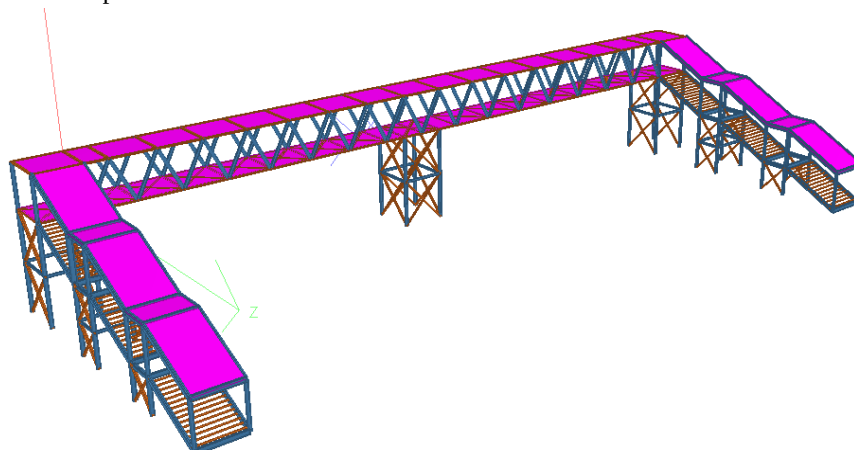


Fig. 3. Warren truss 3D model retained from the thesis.

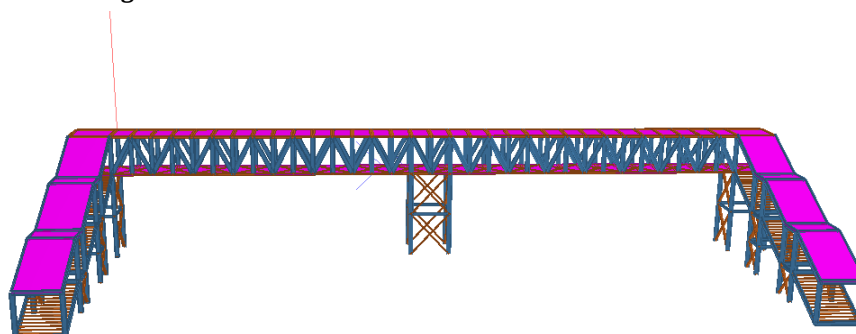


Fig. 4. Pratt truss 3D model retained from the thesis.

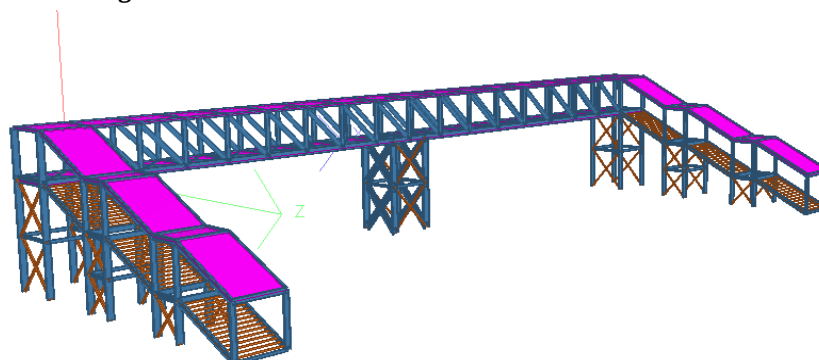


Fig. 5. Lattice truss 3D model retained from the thesis.

V. RESULTS AND DISCUSSION

Table 2. Comparative results for the 54 m Warren, Pratt, and Lattice trusses

Parameter	Warren truss	Pratt truss	Lattice truss
Node displacement (maximum resultant)	18 mm	46.462 mm	15.020 mm
Member force (maximum axial force)	384.353 kN	470.580 kN	430.549 kN
Reaction (maximum vertical reaction)	583 kN	607.813 kN	606 kN
Total steel weight	492.457 kN	800.769 kN	573.266 kN
Equivalent steel weight	50.21 tons	81.62 tons	58.49 tons

reported			
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Nodal displacement

The thesis comparison table reports maximum resultant displacements of 18 mm for the Warren truss, 46.462 mm for the Pratt truss, and 15.020 mm for the Lattice truss. The reported allowable deflection is 216 mm, so all three comparison values are within this limit. The Lattice truss gives the smallest displacement, whereas the Pratt truss gives the largest.

Source-data note: the detailed Warren node-displacement output retained in the supplementary results shows a maximum resultant value of 18.611 mm at node 293, while the thesis discussion and comparison table use the rounded value of 18 mm. Both source representations are preserved without recalculation.

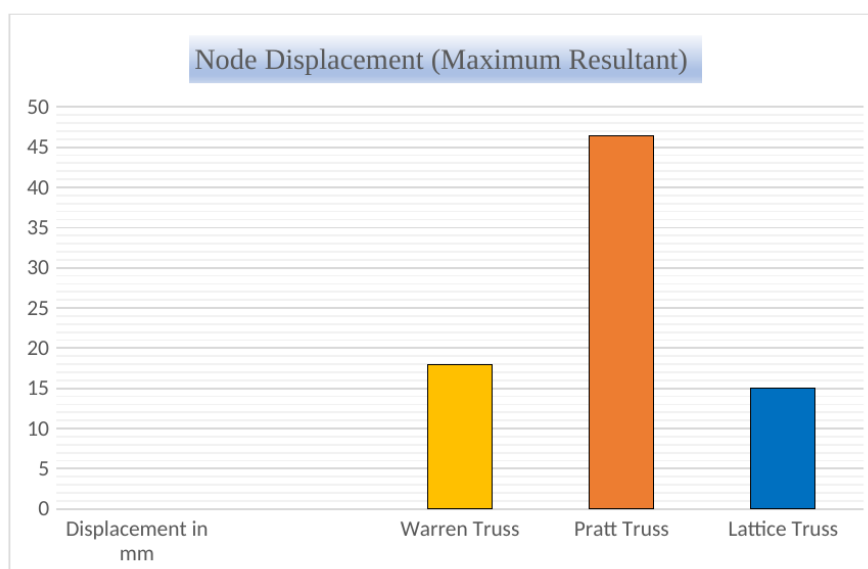


Fig. 6. Original thesis chart comparing maximum resultant nodal displacement.

Maximum axial member force

The maximum axial-force comparison is 384.353 kN for Warren, 470.580 kN for Pratt, and 430.549 kN for Lattice. The thesis interprets the lower Warren-truss axial force as evidence of a more balanced load path and a potential advantage for material optimization.

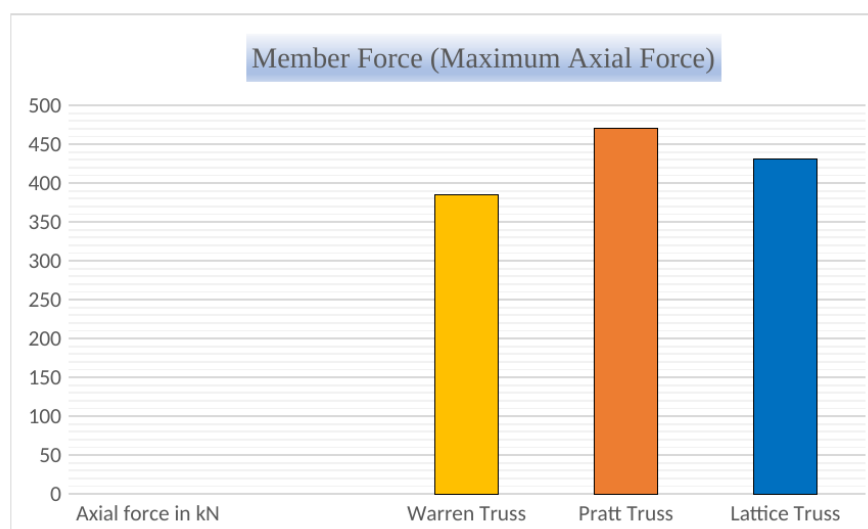


Fig. 7. Original thesis chart comparing maximum axial member force.

Maximum vertical reaction

The Warren truss has the lowest maximum vertical reaction in the thesis comparison, at 583 kN. The corresponding values are 607.813 kN for Pratt and 606 kN for Lattice. The thesis attributes these differences to the influence of truss geometry on load distribution and support demand.

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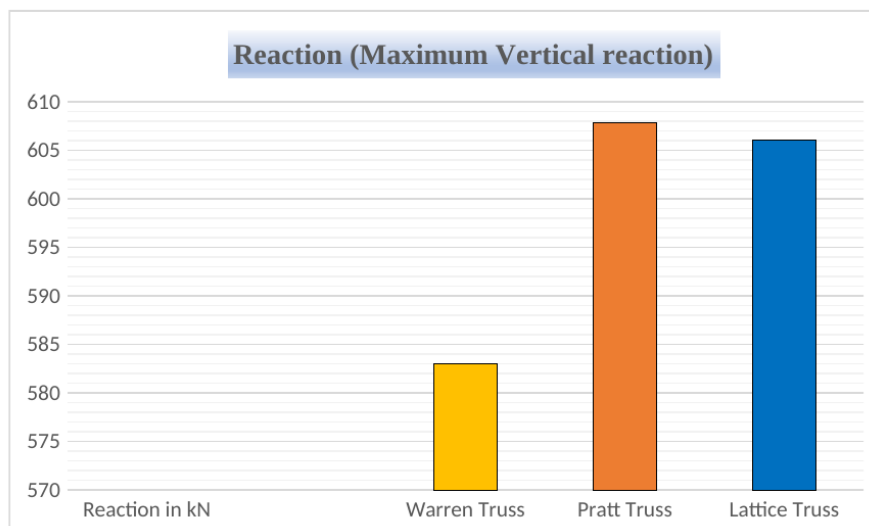


Fig. 8. Original thesis chart comparing maximum vertical reaction.

Steel take-off and economic comparison

The steel take-off is the principal material-efficiency indicator used in the economic comparison. Warren requires 492.457 kN of steel (50.21 tons), Lattice requires 573.266 kN (58.49 tons), and Pratt requires 800.769 kN (81.62 tons). The Warren configuration therefore has the lowest reported structural steel weight, while the Pratt configuration has the highest.

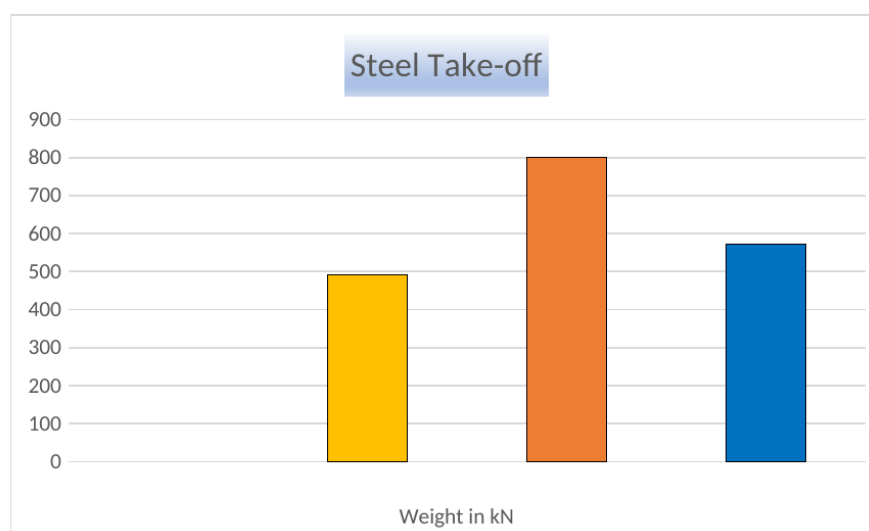


Fig. 9. Original thesis chart comparing steel take-off.

Overall comparison

The Lattice truss gives the lowest displacement, but the Warren truss combines the lowest reported axial force, the lowest maximum vertical reaction, and the lowest steel take-off. On this basis, the thesis identifies the Warren truss as the most efficient and cost-effective configuration for the 54 m span. The conclusion also notes that the Warren geometry uses fewer joints and structural members than the Lattice arrangement, reducing fabrication complexity and labor requirements.

VI. CONCLUSION

- All three 54 m truss models satisfy the thesis-reported allowable deflection of 216 mm, with comparison-table displacements of 18 mm for Warren, 46.462 mm for Pratt, and 15.020 mm for Lattice.
- The Warren truss has the lowest reported maximum axial force at 384.353 kN, compared with 470.580 kN for Pratt and 430.549 kN for Lattice.
- The Warren truss also has the lowest reported maximum vertical reaction at 583 kN, compared with 607.813 kN for Pratt and 606 kN for Lattice.

- Steel take-off is lowest for the Warren truss at 492.457 kN (50.21 tons), followed by the Lattice truss at 573.266 kN (58.49 tons) and the Pratt truss at 800.769 kN (81.62 tons).
- Synthesizing the structural and material-use indicators, the thesis concludes that the Warren truss is the most efficient and cost-effective configuration for the investigated 54 m foot over bridge.

SUPPLEMENTARY RESULT OUTPUTS

The following STAAD.Pro output tables are retained from the thesis as supporting evidence for the comparison. They preserve the detailed node-displacement, beam-force, and reaction summaries for each truss without altering the reported values.

Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	283	206:1.5 DL + 1.	6.928	-9.905	-4.905	13.045	0.002	-0.000	0.001
Min X	148	207:1.5 DL + 1.	-6.938	-9.911	-4.910	13.057	0.002	0.000	-0.001
Max Y	26	9:WLZ+	-0.204	1.359	3.584	3.839	0.001	0.000	-0.000
Min Y	148	206:1.5 DL + 1.	6.347	-12.200	-5.975	14.994	0.003	-0.000	0.001
Max Z	49	208:1.5 DL + 1.	0.002	-0.512	14.054	14.064	0.001	-0.000	0.000
Min Z	293	209:1.5 DL + 1.	-0.198	-10.610	-15.290	18.611	0.002	0.000	-0.000
Max rX	148	208:1.5 DL + 1.	-0.897	-11.486	-5.350	12.702	0.003	-0.000	0.000
Min rX	90	209:1.5 DL + 1.	-0.227	-3.535	-5.484	6.529	-0.002	-0.000	0.000
Max rY	314	206:1.5 DL + 1.	3.095	-2.017	-0.820	3.784	0.002	0.001	0.001
Min rY	193	207:1.5 DL + 1.	-3.098	-2.018	-0.819	3.787	0.002	-0.001	-0.001
Max rZ	330	206:1.5 DL + 1.	3.597	-2.275	-1.082	4.391	0.002	0.000	0.003
Min rZ	179	207:1.5 DL + 1.	-3.601	-2.276	-1.084	4.396	0.002	-0.000	-0.003
Max Rst	293	209:1.5 DL + 1.	-0.198	-10.610	-15.290	18.611	0.002	0.000	-0.000

Fig. S1. Warren truss node-displacement summary.

Beam Force Detail Summary

Sign convention as diagrams:- positive above line, negative below line except Fx where positive is compression. Distance d is given beam end A.

	Beam	L/C	d (m)	Axial Fx (kN)	Shear Fy (kN)	Fz (kN)	Torsion Mx (kN·m)	Bending My (kN·m)	Mz (kN·m)
Max Fx	705	209:1.5 DL + 1.	3.375	384.353	1.941	-1.771	0.003	-1.481	-2.993
Min Fx	202	208:1.5 DL + 1.	3.354	-251.530	0.715	-0.093	-0.002	-1.513	-0.321
Max Fy	551	201:1.5 DL + 1.	0	-2.117	19.993	-0.035	-0.006	0.072115	15.819
Min Fy	700	201:1.5 DL + 1.	3.000	-8.689	-21.062	0.002	0.001	0.053	11.642
Max Fz	143	209:1.5 DL + 1.	0	27.055	8.644	29.113	-0.002	-21.737	6.622
Min Fz	140	209:1.5 DL + 1.	1.500	27.235	-8.664	-29.126	0.002	-21.746	6.639
Max Mx	384	207:1.5 DL + 1.	0	4.519	8.703	-4.096	0.169	2.596	21.698
Min Mx	620	206:1.5 DL + 1.	0	4.519	8.702	4.094	-0.169	-2.595	21.688
Max My	140	209:1.5 DL + 1.	0	27.235	-7.461	-28.495	0.002	21.469	-5.455
Min My	140	209:1.5 DL + 1.	1.500	27.235	-8.664	-29.126	0.002	-21.746	6.639
Max Mz	384	209:1.5 DL + 1.	0	11.652	12.828	-1.092	0.105	0.343	28.553
Min Mz	339	207:1.5 DL + 1.	0	48.237	-14.516	0.840	0.007	-0.620	-20.766

Fig. S2. Warren truss beam-force detail summary.

Reaction Summary

	Node	L/C	Horizontal FX (kN)	Vertical FY (kN)	Horizontal FZ (kN)	Moment MX (kN·m)	MY (kN·m)	MZ (kN·m)
Max FX	403	207:1.5 DL + 1.	116.888	529.737	66.850	-0.306	0.440	-9.677
Min FX	401	206:1.5 DL + 1.	-117.127	530.268	66.880	-0.306	-0.440	9.695
Max FY	401	209:1.5 DL + 1.	-76.934	583.394	103.063	2.005	0.598	2.397
Min FY	403	9:WLZ+	-29.213	-223.443	-46.371	-1.586	0.367	0.808
Max FZ	401	209:1.5 DL + 1.	-76.934	583.394	103.063	2.005	0.598	2.397
Min FZ	402	208:1.5 DL + 1.	-76.682	579.705	-100.551	-1.984	-0.593	2.402
Max MX	404	209:1.5 DL + 1.	-10.932	-89.521	38.425	2.773	-0.507	0.023
Min MX	401	208:1.5 DL + 1.	10.706	-86.936	-36.049	-2.751	-0.502	-0.028
Max MY	137	207:1.5 DL + 1.	7.697	76.765	14.072	-0.441	0.788	-15.762
Min MY	138	207:1.5 DL + 1.	7.921	54.460	-5.947	0.499	-0.784	-16.196
Max MZ	281	206:1.5 DL + 1.	-15.144	54.648	-4.273	0.768	0.537	21.351
Min MZ	146	207:1.5 DL + 1.	15.163	54.354	-4.088	0.770	-0.537	-21.380

Fig. S3. Warren truss reaction summary.

Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	232	206:1.5 DL + 1.	11.065	-11.614	-6.853	17.444	0.003	0.001	-0.000
Min X	95	207:1.5 DL + 1.	-11.048	-11.663	-6.688	17.402	0.003	-0.001	0.000
Max Y	29	9:WLZ+	0.026	1.357	14.088	14.153	0.002	-0.000	-0.000
Min Y	12	201:1.5 DL + 1.	0.187	-46.448	-1.130	46.462	0.001	0.000	0.000
Max Z	240	208:1.5 DL + 1.	0.857	-0.320	21.228	21.247	0.001	0.001	-0.000
Min Z	231	209:1.5 DL + 1.	3.128	-13.848	-30.774	33.891	0.003	0.001	-0.001
Max rX	339	201:1.5 DL + 1.	-0.454	-2.859	-0.817	3.008	0.015	0.000	0.011
Min rX	341	201:1.5 DL + 1.	-0.511	-2.344	-0.820	2.535	-0.016	-0.000	0.011
Max rY	348	201:1.5 DL + 1.	0.220	-0.965	0.150	1.001	0.001	0.003	0.002
Min rY	347	201:1.5 DL + 1.	0.323	-1.274	-0.676	1.478	-0.001	-0.003	0.002
Max rZ	339	201:1.5 DL + 1.	-0.454	-2.859	-0.817	3.008	0.015	0.000	0.011
Min rZ	10	201:1.5 DL + 1.	-0.395	-40.850	-0.835	40.860	-0.015	0.000	-0.014
Max Rst	12	201:1.5 DL + 1.	0.187	-46.448	-1.130	46.462	0.001	0.000	0.000

Fig. S4. Pratt truss node-displacement summary.

Beam Force Detail Summary

Sign convention as diagrams:- positive above line, negative below line except Fx where positive is compression. Distance d is given beam end A.

	Beam	L/C	d (m)	Axial Fx (kN)	Shear Fy (kN)	Fz (kN)	Torsion Mx (kN·m)	Bending My (kN·m)	Mz (kN·m)
Max Fx	63	201:1.5 DL + 1.	3.354	470.580	-0.827	-0.444	-0.005	-0.974	2.596
Min Fx	62	201:1.5 DL + 1.	3.354	-471.787	3.386	0.160	0.001	0.129	-5.114
Max Fy	9	201:1.5 DL + 1.	0	-47.015	132.701	0.188	-0.182	-0.104	102.566
Min Fy	663	201:1.5 DL + 1.	1.500	-6.033	-120.635	-0.042	0.226	-0.080	98.619
Max Fz	188	209:1.5 DL + 1.	0	0.909	2.947	10.379	0.007	-14.283	4.511
Min Fz	188	208:1.5 DL + 1.	0	0.014	3.579	-9.010	0.007	12.252	5.696
Max Mx	535	201:1.5 DL + 1.	0	17.249	64.428	-0.305	0.296	0.105	49.105
Min Mx	8	201:1.5 DL + 1.	0	13.842	-58.891	0.007	-0.274	-0.094	-46.670
Max My	188	209:1.5 DL + 1.	3.000	-1.120	2.947	7.854	0.007	13.067	-4.331
Min My	188	209:1.5 DL + 1.	0	0.909	2.947	10.379	0.007	-14.283	4.511
Max Mz	9	201:1.5 DL + 1.	0	-47.015	132.701	0.188	-0.182	-0.104	102.566
Min Mz	9	201:1.5 DL + 1.	1.500	-47.015	131.919	0.188	-0.182	0.179	-95.899

Fig. S5. Pratt truss beam-force detail summary.

Reaction Summary

	Node	L/C	Horizontal FX (kN)	Vertical FY (kN)	Horizontal FZ (kN)	Moment MX (kN·m) MY (kN·m) MZ (kN·m)		
Max FX	345	207:1.5 DL + 1.	122.492	607.813	97.074	0.071	-0.112	-9.169
Min FX	343	206:1.5 DL + 1.	-124.361	568.510	88.477	0.091	0.241	7.938
Max FY	345	207:1.5 DL + 1.	122.492	607.813	97.074	0.071	-0.112	-9.169
Min FY	346	7:WLX+	-33.208	-132.312	21.717	0.037	0.283	1.998
Max FZ	73	201:1.5 DL + 1.	3.982	579.755	105.124	-0.667	0.463	-8.547
Min FZ	74	201:1.5 DL + 1.	3.669	490.085	-107.115	0.678	-0.470	-7.916
Max MX	346	209:1.5 DL + 1.	31.909	172.990	-17.686	1.709	0.016	-5.275
Min MX	345	208:1.5 DL + 1.	44.409	243.950	27.240	-1.593	-0.094	-5.627
Max MY	343	209:1.5 DL + 1.	-101.415	533.842	94.463	1.650	1.107	5.408
Min MY	76	207:1.5 DL + 1.	7.076	33.431	-4.978	0.582	-1.114	-12.797
Max MZ	219	206:1.5 DL + 1.	-14.374	42.820	0.741	0.493	0.911	17.712
Min MZ	84	207:1.5 DL + 1.	14.527	42.953	0.790	0.494	-0.929	-17.925

Fig. S6. Pratt truss reaction summary.

Node Displacement Summary

	Node	L/C	X (mm)	Y (mm)	Z (mm)	Resultant (mm)	rX (rad)	rY (rad)	rZ (rad)
Max X	220	206:1.5 DL + 1.	5.419	-0.334	-0.116	5.430	0.000	0.000	0.000
Min X	85	207:1.5 DL + 1.	-5.505	-0.345	-0.118	5.517	0.000	-0.000	-0.000
Max Y	230	207:1.5 DL + 1.	-2.596	1.297	-0.107	2.904	-0.000	0.001	-0.001
Min Y	30	201:1.5 DL + 1.	-0.484	-12.355	-0.985	12.404	-0.001	-0.000	0.000
Max Z	26	208:1.5 DL + 1.	0.172	-1.281	10.960	11.036	0.001	0.000	0.000
Min Z	60	209:1.5 DL + 1.	0.156	-0.931	-12.829	12.864	-0.001	-0.000	0.000
Max rX	56	208:1.5 DL + 1.	-0.133	-7.538	10.584	12.994	0.001	0.000	0.000
Min rX	47	213:1.2 DL + 1.	0.008	-6.834	-2.662	7.334	-0.002	-0.000	-0.000
Max rY	346	207:1.5 DL + 1.	-1.165	0.035	-0.009	1.166	-0.000	0.001	0.001
Min rY	348	206:1.5 DL + 1.	1.178	0.044	-0.019	1.179	-0.000	-0.001	-0.001
Max rZ	8	201:1.5 DL + 1.	0.229	-4.594	-0.327	4.611	-0.000	-0.000	0.002
Min rZ	10	201:1.5 DL + 1.	-0.148	-4.663	-0.286	4.674	-0.000	0.000	-0.002
Max Rst	30	209:1.5 DL + 1.	-0.177	-9.300	-11.792	15.020	-0.002	-0.000	0.000

Fig. S7. Lattice truss node-displacement summary.

Beam Force Detail Summary

Sign convention as diagrams:- positive above line, negative below line except Fx where positive is compression. Distance d is given beam end A.

	Beam	L/C	d (m)	Axial	Shear		Torsion	Bending	
				Fx (kN)	Fy (kN)	Fz (kN)	Mx (kN·m)	My (kN·m)	Mz (kN·m)
Max Fx	56	201:1.5 DL + 1.	0	430.549	-6.422	0.033	-0.002	-0.124	-21.277
Min Fx	59	201:1.5 DL + 1.	0	-422.345	-1.184	-0.072	-0.001	0.286	0.299
Max Fy	660	201:1.5 DL + 1.	0	-8.006	172.792	0.136	0.013	-0.099	144.253
Min Fy	9	201:1.5 DL + 1.	0	158.052	-170.231	0.014	-0.014	-0.01025	-110.631
Max Fz	396	209:1.5 DL + 1.	0	-4.607	-2.720	7.399	-0.005	-9.385	-6.329
Min Fz	171	209:1.5 DL + 1.	3.000	3.742	2.497	-7.585	0.003	-9.683	-4.990
Max Mx	247	207:1.5 DL + 1.	0	6.702	-0.202	-4.542	0.091	2.428	-1.372
Min Mx	478	206:1.5 DL + 1.	0	6.667	-0.227	4.517	-0.090	-2.406	-1.519
Max My	98	208:1.5 DL + 1.	0	127.309	0.193	-7.069	-0.004	9.148	2.836
Min My	171	209:1.5 DL + 1.	3.000	3.742	2.497	-7.585	0.003	-9.683	-4.990
Max Mz	661	201:1.5 DL + 1.	0	151.209	152.809	-0.134	0.022	0.019	153.968
Min Mz	660	201:1.5 DL + 1.	1.500	-8.006	172.792	0.136	0.013	0.105	-114.934

Fig. S8. Lattice truss beam-force detail summary.

Reaction Summary

	Node	L/C	Horizontal	Vertical	Horizontal	Moment		
			FX (kN)	FY (kN)	FZ (kN)	MX (kN·m)	MY (kN·m)	MZ (kN·m)
Max FX	343	207:1.5 DL + 1.	113.435	556.006	72.525	-11.000	2.200	-36.618
Min FX	341	206:1.5 DL + 1.	-115.522	562.741	72.464	-11.430	-2.209	37.369
Max FY	341	209:1.5 DL + 1.	-54.974	606.765	112.592	4.673	0.405	9.689
Min FY	344	10:WLZ-	-18.854	-231.859	54.658	7.824	-0.221	2.473
Max FZ	343	209:1.5 DL + 1.	51.508	597.059	113.536	5.233	-0.385	-8.504
Min FZ	342	208:1.5 DL + 1.	-46.608	543.911	-109.747	-3.684	-0.383	7.803
Max MX	342	209:1.5 DL + 1.	7.484	-138.563	50.041	19.832	0.358	1.242
Min MX	341	208:1.5 DL + 1.	1.778	-86.304	-48.634	-18.664	-0.325	2.241
Max MY	341	207:1.5 DL + 1.	62.325	-42.280	-8.506	-2.561	2.288	-25.440
Min MY	343	206:1.5 DL + 1.	-64.517	-48.614	-8.222	-2.129	-2.296	26.193
Max MZ	341	206:1.5 DL + 1.	-115.522	562.741	72.464	-11.430	-2.209	37.369
Min MZ	343	207:1.5 DL + 1.	113.435	556.006	72.525	-11.000	2.200	-36.618

Fig. S9. Lattice truss reaction summary.

Table S1. Steel take-off totals reported for the three truss configurations

Truss	Total weight (kN)	Reported tons
Warren	492.457	50.21
Pratt	800.769	81.62
Lattice	573.266	58.49

REFERENCES

- [1] S. Rajesh. "Design of A Steel Foot Over Bridge in A Railway Station, International Journal of Civil Engineering and Technology (IJCET), Volume 08 Issue 08 (2017): 1533-1548.
- [2] T. Prashanth and V. Gokulnath. "Design and Analysis of foot over bridge using STAAD PRO", International Journal of Civil Engineering and Technology (IJCET), Volume 09 Issue 01 (2018):639-651.
- [3] Mr. Aniket. "Seismic analysis of foot over bridge" International Research Journal of Engineering and Technology (IRJET), Volume 04 Issue 04 (2017): 2156-2159.
- [4] Gousamiya Saudagar et al. "Design of railway foot over bridge (Shelu)" International Research Journal of Engineering and Technology (IRJET), Volume 06 Issue 04 (2019): 3885-3890.
- [5] V. Chandrika et al. "Analysis and Design of cold formed steel foot over bridge", International Research Journal of Engineering and Technology (IRJET), Volume 06 Issue 03 (2019): 2941-2946.
- [6] Naveen Ram Kumar et al., "Pedestrian steel truss over bridge analysis and design at Saharsa railway station, Bihar", International Journal of Civil Engineering and Mechanics, Volume 08 Issue 01 (2021): 1-10.
- [7] Naveen Ram Kumar et al., "Pedestrian steel truss over bridge analysis and design at Saharsa railway station, Bihar", International Journal of Civil Engineering and Mechanics, Volume 08 Issue 01 (2021): 1-10.
- [8] Aman Kumar "Design and Analysis of foot over bridge using Staad pro" International Journal of Science and Research (IJSR), Volume 13 Issue 2 (2024).
- [9] S. Rajesh. "Design of A Steel Foot Over Bridge in A Railway Station, International Journal of Civil Engineering and Technology (IJCET), Volume 08 Issue 08 (2017): 1533-1548.
- [10] B. C. Punmia "Design of Steel Structures" Ashok Kumar Jain & Arun Kumar Jain Lakshmi Publications, New Delhi (2008).
- [11] Indian Roads Congress IRC: SP: 56 – 2011 Guidelines for Steel Pedestrian Bridges.