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Comparative Analysis of Truss Bridges

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***Abstract*—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 and snow. The loads may act individually but more commonly occur as a combination of two or more loads applied simultaneously. The project discussed analysis and design of steel truss bridge, the bridge is 70m long and 7.5m width and 6 m high, the spaces between the trusses in the roof are various, from the beginning we leave space that equal 0.5 m. The analysis was done by staad pro program. The project studied maximum axial forces, shear forces, torsional values & moment.**

Keywords—Pratt Truss Bridge, Howe, Warren, Staad Pro v8i.

I. INTRODUCTION

A bridge is a means by which a road, railway or other service is carried over an obstacle such as a river, valley, and other road or railway line, either with no intermediate support or with only a limited number of supports at convenient locations. Bridges range in size from very modest short spans over, say, a small river to the extreme examples of suspension bridges. The main advantages of structural steel over other construction materials are its strength and ductility. It has a higher strength to cost ratio in tension and a slightly lower strength to cost ratio in compression when compared with concrete. The stiffness to weight ratio of steel is much higher than that of concrete. Thus, structural steel is an efficient and economic material in bridges.

A. Objectives of the Present Study

1. To determine the reactions and member forces. The methods used for carrying out the analysis with the equations of equilibrium and by considering only parts of the structure through analyzing its free body diagram to solve the unknowns.
2. Create a structural optimization algorithm capable of finding the various reactions, when subjected to various load combinations and design constraints.
3. Comparing and analyzing the various constraints of different truss bridges models.

B. Various Truss Bridges

Pratt Truss Bridge

This type of truss has diagonal members that slope down towards the Centre, this type is completely differing of the Howe truss. The inner diagonals of the truss are having tension whereas compressive force acts upon vertical members. This truss was invented by Caleb Pratt and Thomas Pratt in 1844. This type is practical for spans up to 75 metres.

Warren Truss Bridge

It was patented by James Warren in 1848. It consists of longitudinal members joined by Cross members that are angled. Its forms alternatively inverted equilateral triangles ensure that no strut, tie or beam is subjected to bending or torsion strain nature forces.

C. Loads on Truss Bridges

Dead Load

The mass of the equipment load that has constant magnitude and attached to the structure permanently represents the dead load. It consists of the main truss weight the floor beams or girder weight and stringer of the floor system the dead load that acts on the member should be assumed before the design of the member. A member of structure should be designed in such a sequence that to as great an extent as practicable the weight if each member designed is a portion of the dead load carried by the next member to be designed.

Live Load

There are mainly four types of loadings whose usage depends on the purpose, location, and properties of the bridge. There are following type of loadings as listed:

IRC Class 70R Loading.
IRC Class AA Loading
IRC Class A Loading
IRC Class B Loading

II. PROBLEM STATEMENT

Analysis of steel truss bridge, the bridge is 70m long and 7.5 m width and 6 m high, the spaces between the trusses in the roof are various, from the beginning leave space that equal

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0.5 m, after that divided all spaces in 10 segment the length of each one equal 7m in the floor.

Project used the straight member and, in the beginning, and the end connected by welding point formed triangles, and this member affected by compression or tensile force, about the moment the same mean of torque is excluded in the trusses, Moreover, assume all the joint in the trusses is pin.

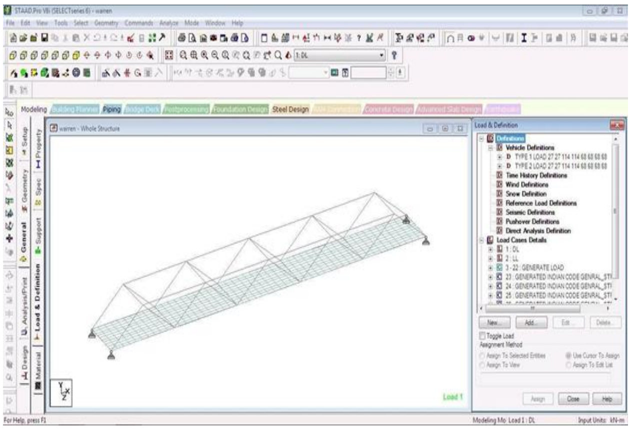

Fig. 1 Pratt Truss Bridge Model

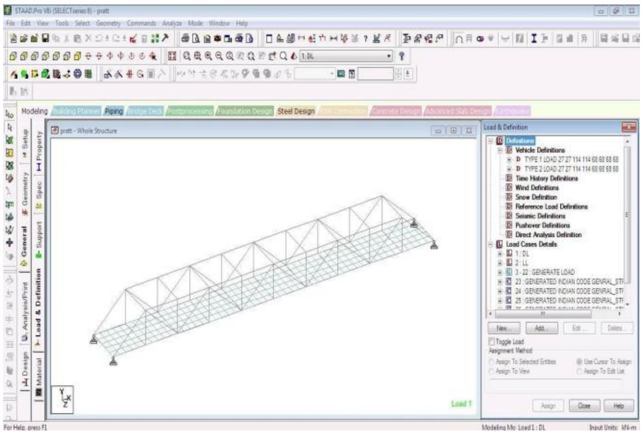

Fig. 2 Warren Truss Bridge Model

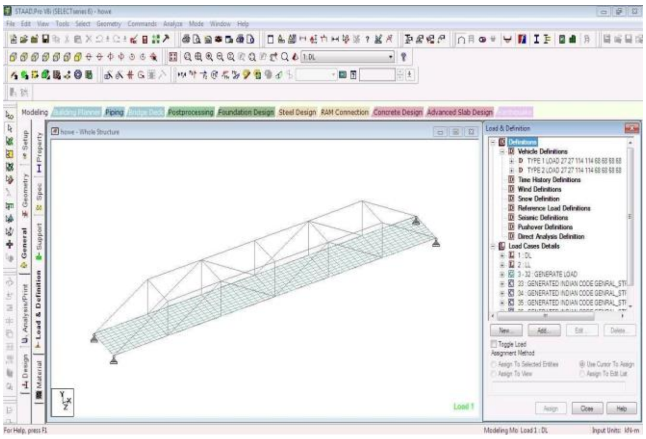

Fig. 3 Howe Truss Bridge Model

III. RESULT & DISCUSSION

A. Comparative Results of Shear Force (in KN)

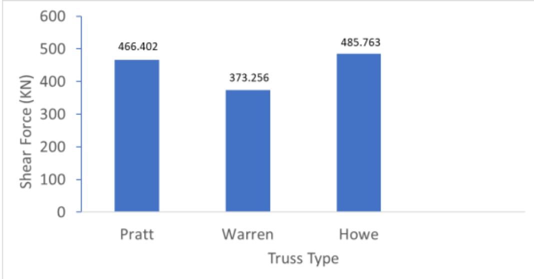

Fig 4 Shear Force KN

B. Maximum Displacement (in mm)

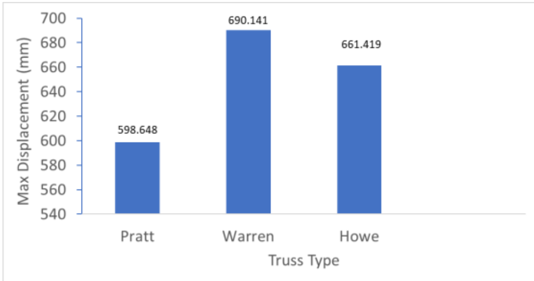

Fig 5 Max Displacement mm

C. Torsional Values (in KNm)

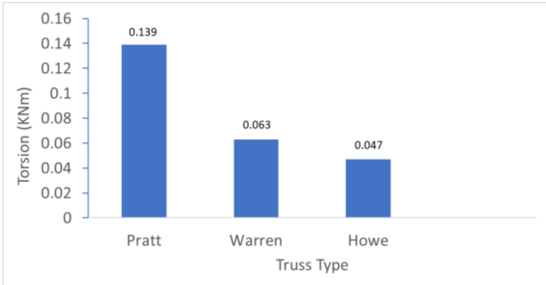

Fig 6 Torsion KNm

D. Support Reaction (KN)

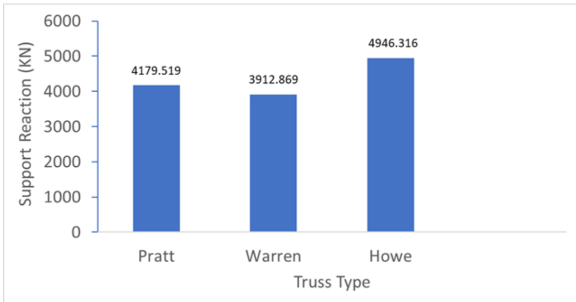

Fig 7 Support Reaction KN

E. Maximum Moment (KNm)

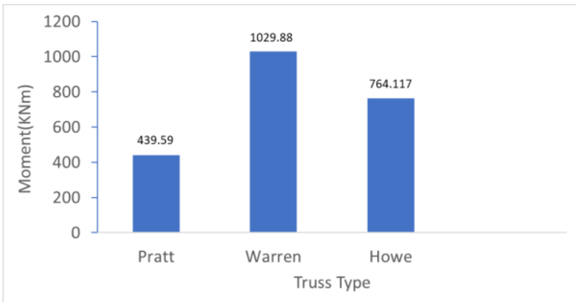

Fig 8 Moment KNm

IV. CONCLUSION

This project discussed the analysis and design of steel truss bridge, the bridge is 70m long and 7.5 m width and 6 m high, the spaces between the trusses in the roof are various, from the beginning by leaving space that equal 0.5 m, divided all spaces in 10 segment the length of each one equal 7m.

1. Maximum shear force value is for howe truss bridge which is 485.763 KN
2. Maximum displacement is 690.141 mm for warren truss bridge. This is 15% more than pratt truss bridge and 5% more than howe truss bridge.
3. Torsional value for pratt truss bridge is 30% more than howe truss & 22% more than warren truss bridge.
4. Maximum support reaction is 4946.319 KN for howe truss bridge.
5. Maximum moment occurred for warren truss bridge which is 1029.88 KNm. This value is 25% more than pratt truss bridge.

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