OPTIMIZATION OF TRUSS TYPE STEEL BRIDGES

Karunarathna W.W.N.

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Degree of Master of Science

Department of Civil Engineering

University of Moratuwa

Sri Lanka

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This thesis was submitted to the Department of Civil Engineering of the University of Moratuwa in partial fulfilment of the requirements for the Degree of Master of Science

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Submitted by

Karunarathna W.W.N.

Department of Civil Engineering
University of Moratuwa
Sri Lanka

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DECLARATION

I hereby, declare, that the work included in this thesis in part or whole, has not been submitted for any other academic qualification at any institution.

Karunarathna W.W.N.

(Author)

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Certified by

UOM Verified Signature

Dr. Baskaran. K.

Supervisor/ Senior Lecturer

Division of Building & Structural Engineering

Department of Civil Engineering

University of Moratuwa

Sri Lanka

ABSTRACT

This work aims towards analyzing truss type steel bridges by 3-D finite element modelling using SAP2000. Details of different truss type steel bridges are discussed together with gathered information on such bridges found in Sri Lanka. State of the art, regarding design and assessment of truss type steel bridges were also reviewed. Scale-down model bridges were tested in the Structural Laboratory (UOM) and the test results were used to validate the SAP models and observe the overall behaviour. The actual failure loads and failure patterns were observed and compared with SAP analysis results.

3-D finite element modelling gives a clear image in modelling of truss type bridges, than 2-D finite element counterparts due to the facilities available to check the lateral stability of the bridges. This research contains some methods to improve the lateral stability of truss type steel bridges too. Failure study and analysis were done for some failed bridges in Sri Lanka using SAP 2000. Results predicted by SAP 2000 are compared with actual failure modes, loads and deflections.

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Span vs. tonnage graphs were obtained with optimum steel usage , for the selected truss type steel bridges which include common truss types used in the country and some of other efficient truss types. It contains span vs. tonnage graphs which were obtained for Modified Warren, Parker, Inverted Arch, Pratt and Tied Arch bridges which are used for pedestrians and light vehicles. The weights of the actual existing bridges are presented in the same graph (if applicable) and the reasons for deviation from the graph are also discussed. Set of span vs. tonnage curves were plotted for different truss types in same graph, for comparison purpose which shows tonnage required for each selected truss type, for given range of spans. Finally, some guidelines for local bridge designers, and some suitable truss types are recommended by considering minimum steel usage.

ACKNOWLEDGEMENT

First and foremost I would like to express my gratitude and deep appreciation to my supervisor Dr. Baskaran. K, Senior Lecturer, Department of Civil Engineering, University of Moratuwa for his invaluable assistance, advice and guidance throughout this project. This association has been interesting and rewarding.

Assistance and suggestions provided by Dr. (Mrs.) M.T.P. Hettiarachchi, Senior Lecturer, Department of Civil Engineering, University of Moratuwa and Prof. S.M.A. Nanayakkara, Professor, Department of Civil Engineering, University of Moratuwa, were fully appreciated.

I convey my gratitude towards Mr. Rohith Swarna, Director of RDA Engineering Services Division, Sri Lanka for providing important details on truss bridges in Sri Lanka and Mr. H.D. Hidallana Gamage, Final year student, Department of Civil Engineering, University of Moratuwa who has given great help during the entire research.

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I also like to thank Prof. M.T.R. Jayasinghe, Head, Department of Civil Engineering, University of Moratuwa, for making available all resources and facilities for this research work. The Senate Research Committee of University of Moratuwa should also be thanked for supporting and financing my research.

I appreciate very much invaluable support, encouragement and understanding shown by my mother, father and all of family members.

Finally, I would like to acknowledge with fraternal love, my colleagues and others who have assisted me in various ways whose contribution have led to the successful completion of this project.

Thank you

Karunarathna W.W.N

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