

# OPTIMIZATION OF PRESTRESSED CONCRETE RAILWAY SLEEPERS

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University of Moratuwa, Sri Lanka.  
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M. Eng. in Structural Engineering Designs

Department of Civil Engineering

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(09/8920)  
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Thesis/Dissertation submitted in partial fulfillment of the requirements for the degree  
M. Eng. in Structural Engineering Designs

Department of Civil Engineering

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## DECLARATION

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## ABSTRACT

In Sri Lanka cheapest and safest mode of transportation is railways. It has higher load carrying capacities. The load applied by trains is transferred to the ground through rails supported on railway sleepers. Basically there are two types of sleepers, and the prestressed concrete sleepers are the most common. The use of reinforced concrete sleepers increased the structural stiffness and omitted the problems that are associated with wooden sleepers. But there are inheriting problems such as heavy weight and crack formation under normal conditions. In future railway traffic will certainly be even faster than that of today. Therefore many on-going researches are directed towards finding solutions for above problems. This research is aimed on optimization of prestressed concrete railway sleepers. Generally, the cross section, the amount of prestressing steel, and the level of prestressing force are optimized to provide adequate capacity for both positive and negative moments at mid span and rail seat sections, respectively. This research was based on calculations. The calculations are done accordance with AS 1085:14-2003. Sleepers produced at Ekala yard and new options were selected for comparison. Spread sheet was developed to optimize the cross section in both steel and concrete. Most economical section was found using the spread sheet and Moment diagrams. From calculations it was found that number of tendons for Ekala sleeper can be reduced to 14 nos. with the same grade of concrete and it can be further reduced to 12 nos. with increased grade of concrete. Axle load capacity can be increased to 22 tonnes for Ekala sleeper with 14 nos. of tendons and with grade 60 N/mm<sup>2</sup> concrete. According to spread sheet and calculations for option 1, which has 16 nos. of tendons and the lightest sleeper among other options, gives the most optimized prestressed concrete sleeper in overall cost and the reduced weight. It is recommended to test small scale sleepers of this optimized sleeper and to use it in railway track to check the suitability of the optimized sleeper.

## ACKNOWLEDGEMENTS

First of all my sincere gratitude goes to my research supervisor Dr. K. Baskaran for giving me valuable advices, guidance and encouragement all the way through my research project. If it were not for my supervisor, Dr. K. Baskaran it would be a great challenge for me. When the time is very hard he was always behind me to take me to the correct path.

I appreciate the additional district engineer and personal assistant to general manager Railways (CGR), Eng. W. M. A. S. Amarawansa for giving me additional theoretical background about Sri Lankan railways, history and all other valuable information related to railways. Not only that he encouraged me a lot giving me precious reading materials such as books, journals and so on to expand my knowledge about the railway track and its components to continue with the research in an effective way.

I also sincerely thank all the staff members of Building and Structural Engineering Division for giving me a valuable opportunity to follow the master of engineering degree course in University of Moratuwa. Special thanks goes to Dr. (Mrs.) Nanayakkara for her great supervision throughout our M. Eng Degree Course.

Also I sincerely appreciate the head of Department of Civil Engineering University of Moratuwa Prof. M. T. R. Jayasinghe for his great advice and encouragement to complete the research project.

I acknowledge Chief Engineer Designs (SEC) D. T. Rajasekaran for helping me to complete my research in a successful manner. Also my sincere gratitude to the Works Manager Ekala precast yard-SEC, Eng. A. R. L. Wijebandara and Works Manager Dematagoda precast yard-SEC, Eng. Chaluka Hettiarachchi for giving me information on manufacture of prestressed concrete sleepers.

This to remind my lovely husband, senior software engineer M. P. Jayaweera for his kind co-operation, encouragement and care to do my research. My heartfelt gratefulness to my ever loving husband, without him successful completion of my research project would not have been possible. Finally I wish to thank for all who engaged with me to complete my research project.

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