OPTIMIZATION OF PRESTRESSED CONCRETE RAILWAY SLEEPERS

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(09/8920)

M. Eng. in Structural Engineering Designs

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

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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a Degree or diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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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 Magnel 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^2 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.

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