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STATIC AND DYNAMIC BEHAVIOUR OF PRESTRESSED MONOBLOCK CONCRETE SLEEPERS (PMCS) SUBJECTED TO FREIGHT TRAIN LOADING

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MSc

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AUTHOR'S DECLARATION

I declare that the work in this report was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and the results of my own work, unless otherwise indicated or acknowledged as referenced work. This report has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Postgraduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

In Malaysia, freight trains without a doubt are used by various times which makes it as an important segment in the economic advancement of a serviceable transportation utilities in the country. Therefore, static and dynamic behaviour of prestressed monoblock concrete sleeper (PMCS) subjected to freight train loading need to be research further due to its major part as one of the important functions in railway services. In this study, experimental test, site investigation and finite element modelling were part of the studies to show the static and dynamic behaviour of PMCS involving freight train loading. In experimental process for the first objective, two tests were involved including static and fatigue load test. In static load test, positive and negative moment test were used according to Australian Standard (AS 1085.14 – 2012) to investigate the design and ultimate load of the PMCS under static loading respectively. From negative moment test, no crack appeared on KTMB and EPMI sides when load of 176.94 kN which is its design load subjected to PMCS, maintained for not less than 3 minutes. And, 2 PMCS were used in positive moment test and test until failure to obtain their ultimate load and load when the first crack appeared. Fatigue load test were divided by 3 phases which is pre-fatigue, fatigue and post-fatigue load test. The concrete strength on EPMI rail seat section are to be 86.263 Mpa or N/mm2 and 79.124 Mpa for KTMB rail seat section. Furthermore, the maximum load subjected on KTMB rail seat section is 410 kN. From the second objective, it shows that the value of deflection is higher at KM20.75 compared to KM26.25 which is 18.90 mm and 1.48 mm respectively. However, the deflection for freight train at KM26.25 is higher than at KM20.75. Therefore, the third objective of this study is to develop three-dimensional finite element model of PMCS using LUSAS to evaluate the behaviour of sleeper subject to static loading. Concrete element was modelled as stress element with hexahedral shaped element and prestressing tendon was modelled as bar element. Later, a validation of the finite element model through comparison with experimental load-deflection response is presented in this study. The deflection on LUSAS model and the experimental result at ultimate load of 400 kN is 7.717 mm and 7.074 mm respectively. Therefore, the difference in percentage is 8.69448 %. Fortunately, the information acquired is useful to future analysts as references to help any investigation concerning PMCS. Likewise, the data assembled can give vital details to keep any mishap from happening concerning the railroad.

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