Comparison Of Gyratory And Marshall Asphalt Design Methods For New Zealand Pavement Mixes

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Rutting Analysis of 100 mm Diameter Polypropylene Modified Asphalt Specimens Using Gyratory and Marshall Compactors

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Compaction technique used in Marshall design does not model the process of actual rolling procedures on site exactly. Carrying out laboratory compaction of dense bituminous mixtures with Superpave gyratory compactors is a more realistic way of simulating actual compaction. In this study, mechanical differences of reference and polypropylene modified asphalt mixtures were compared using Superpave gyratory and Marshall compaction methods by carrying out repeated creep tests utilising universal testing machine. In addition, there is no standard Superpave design procedure for 100 mm diameter samples till date. The other purpose of this study is to propose new standards for the compaction and testing procedures of these 100 mm specimens. Indeed, extensive studies have shown that the design gyration number should be 40 for reference and 33 for polypropylene modified specimens under medium traffic conditions for the similar and specific type of aggregate sources, bitumen, aggregate gradation, mix proportioning, modification technique and laboratory conditions. Moreover, it was shown that, the asphalt samples produced by Superpave gyratory compactor were much resistant to destructive rutting effects than the asphalt specimens prepared by Marshall design.

Keywords: *Marshall design, Superpave gyratory compactor, polypropylene fibers, repeated creep testing, universal testing machine, 100 mm specimens, design gyration number*

1. Introduction

The creep test, for many years, has been used to estimate the rutting potential of dense bituminous mixtures. This test is conducted by applying a static or a repeated load to an asphalt specimen and measuring the resulting permanent deformation. Extensive studies using the unconfined creep test (also known as simple creep test or uniaxial creep test) as a basis of predicting permanent deformation in dense bituminous mixtures has been conducted up to date[1-7].

The loss of pavement serviceability is a common result from rutting. A typical serviceability loss occurs when the formation of ruts forces the pavement to crack, which can lead to rapid deterioration of the pavement due to the accumulation of water on the pavement surface. Under normal service conditions, deformations within the bituminous materials occur more frequently during late spring, summer and early fall because of elevated temperature conditions.

Rutting can significantly reduce both structural and functional performance of a pavement. Sometimes the rutting magnitude may not be alarming for structural performance, but it is important from the safety point of view[8].

To solve this rutting problem in flexible pavements (and other problems such as fatigue and low temperature cracking), scientists have developed some techniques and methodologies called ''asphalt (bitumen) modification''. The most popular bitumen modification technique is polymer modification. To this end, novel binders with improved rheological characteristics are continuously being developed[9-13].

Understanding the effects of repeated creep which leads to the prediction of rutting potential of dense bituminous mixtures is very important for the design of asphalt pavements. During a hot summer day, a heavy vehicle with full load, travelling on a climbing lane imposes a considerable distress on the pavement structure. The repetition of heavier axle loads becomes more pronounced with the increased amount of traffic. The loads from the repeated traffic can create pronounced amounts of permanent deformation or rutting. Even on straight road sections, because of the slow speed and heavy loads of the trucks and trailers, similar problems can be encountered. The pavement around traffic lights and bus stops are also known to have similar problems. Therefore, visible defects related to rutting are frequently found on these types of road sections.

It can be found in the previous pioneering studies that the creep test must be performed at relatively low stress levels (cannot usually exceed 206.9 kPa (30 psi)) and low temperature (cannot usually exceed 40 °C (104 °F)), otherwise the sample fails prematurely[3,14,15]. The test conditions consist of a static axial stress, σ, of 100 kPa being

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COMPARISON OF GYRATORY AND MARSHALL ASPHALT DESIGN METHODS FOR NEW ZEALAND PAVEMENT MIXES.Research Report Comparison of gyratory & Marshall asphalt design methods for New Zealand pavement mixes. Published: Category: Activity.Research Report Health monitoring of superstructures of New Zealand road bridges: Marshall asphalt design methods for New Zealand pavement mixes Marshall and the modern gyratory-based, performance-related asphalt mix design It studies those differences and guides on lighting techniques that can.Research Report Increase in mass limits effect on pavement wear stage 2 Marshall asphalt design methods for New Zealand pavement mixes Marshall and the modern gyratory-based, performance-related asphalt mix design and New Zealand, when making valid comparisons between profiler systems.Research Report Antioxidents for roading bitumen reduced hardening rates due to oxidation compared to control bitumens. Marshall asphalt design methods for New Zealand pavement mixes The historical development of the traditional Marshall and the modern gyratory-based, performance-related asphalt mix.Research Report Comparison of predictive pavement management models Marshall asphalt design methods for New Zealand pavement mixes Marshall and the modern gyratory-based, performance-related asphalt mix design.In the realm of pavement base performance, reinforcing fibres may limit the extent Research Report Comparison of gyratory & Marshall asphalt design methods for New Zealand pavement mixes The historical development of the traditional Marshall and the modern gyratory-based, performance-related asphalt mix.Research Report Effect on pavement wear of an increase in mass limits for . Comparison of gyratory & Marshall asphalt design methods for New Zealand Marshall and the modern gyratory-based, performance-related asphalt mix.rubber materials in hot mix asphalt for New Zealand roads. . recycled asphalt pavement (RAP), and crumb rubber (CR) from waste tyres into New Zealand roads. Comparison of gyratory and Marshall asphalt design methods for.This report summarises research undertaken in Christchurch, New Zealand, Research Report Comparison of gyratory & Marshall asphalt design methods for New Zealand pavement mixes The historical development of the traditional Marshall and the modern gyratory-based, performance-related asphalt mix.structural asphalt pavements, whereas New Zealand thin surfacings are often over a blow Marshall compaction, and thus mixes designed with this method will have lower . assessing how New Zealand's asphalt surfacing lives compare with the rest of the world gyratory compactor rather than the Marshall compactor.Current New Zealand fringe benefit tax (FBT) policies encourage employers to Research Report Comparison of gyratory & Marshall asphalt design methods for New Zealand pavement mixes The historical development of the traditional Marshall and the modern gyratory-based, performance-related asphalt mix.In a major project in New Zealand which included the use of RAP aggregates it was determined that RAP handling and preparation in mix design affected the The performance of asphalt pavements is influenced by several primary factors, . laboratory test methods do not

simulate they field with gyratory compaction this .The recycling of Recycled Asphalt Pavement (RAP) in the production of new bituminous mixtures is .. Table Comparison of the results from the two Quarries. .. Section 1 Jaw and Cone crusher methods used to crush the recycled asphalt The Marshall test is still widely used as a mix design method . Although.The projects Ravelling of porous Pavements and Modified bitumen used for . mix-design method for porous asphalt was established. In the .. The Gyratory Standard mixes in New Zealand are either a 20 mm or a 14 mm size mix. Samples for testing are usually compacted with the Marshall equipment but in.