ASPECTS OF DEFLECTION BASIN PARAMETERS USED IN A MECHANISTIC REHABILITATION DESIGN PROCEDURE FOR FLEXIBLE PAVEMENTS IN SOUTH AFRICA

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CONTENTS

<u>SYNOPSIS</u>

TITLE : ASPECTS OF DEFLECTION BASIN PARAMETERS USED IN A MECHANISTIC REHABILITATION DESIGN PROCEDURE FOR FLEXIBLE PAVEMENTS IN SOUTH AFRICA.

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The non-destructive measurement of deflection basins has come a long way from measuring only maximum deflection or radius of curvature and using empirical relationships in rehabilitation design. New equipment was developed world-wide and analysis techniques moved towards utilising the full deflection basin in fundamental analysis procedures.

This author addressed the problem of a proper description of the full deflection basin by doing a detailed literature survey on this subject. Various deflection basin parameters that describe the deflection basin are listed, as well as the various measuring apparatus related to them. The apparatus are all discussed in detail and related to the equipment available in South Africa.

The measurement of deflection basins with the road surface deflectometer (RSD) under accelerated testing with the fleet of heavy vehicle simulators (HVSs) are described in detail. An improved data manipulation procedure is proposed which simplifies the calculation of all the deflection basin parameters found in literature. Various models to fit the measured deflection basins are also investigated in an effort to describe the deflection basin in full too.

The measured deflection basin parameters of a bitumen, granular, cemented and light structured granular base pavement are discussed in detail as being tested with the fleet of HVS's. It is shown how the deflection basin parameters reflect the structural capacity of the various layers and behaviour states. A more accurate description of the behaviour states is made possible with the proposal of ranges for the various behaviour states for these deflection basins selected.

A literature study was carried out to investigate the various analysis procedures that use measured deflection basins as basic input in the characterization of materials. On the basis of this study, linear elastic programmes were used to calculate effective elastic moduli for each pavement layer, using measured deflection basins as input.

The possibility to relate typical distress determinants to measured deflection basins were investigated in the literature. Based on this, typical South African flexible pavement structures were analysed mechanistically and typical design curves were established for typical bitumen and granular base pavements. The effect of overlays were investigated too, resulting in typical overlay design curves.

In the final chapter the author endeavours to summarise the research by indicating how deflection basins can be measured and enhance the South African mechanistic rehabiltation design process. Only the latter rehabilitation design procedure is discussed with specific reference to the enhancement of the behaviour state identification, material characterization, analysis procedure and rehabilitation design with measured deflection basin parameters. The author ends off by giving an indication of the future research need in this field of deflection basins.

SAMEVATTING

TITEL :   ASPEKTE VAN DEFLEKSIEKOM-PARAMETERS GEBRUIK IN 'N MEGA-
               NISTIESE REHABILITASIE-ONTWERPPROSEDURE VIR BUIGBARE
               PLAVEISELS IN SUID-AFRIKA.

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Die nie-destruktiewe meting van defleksiekomme het 'n lang pad gevorder
vanaf die meting van slegs maksimum defleksie of krommingstraal en die
gebruik van empiriese verbande in rehabilitasie-ontwerp. Nuwe toerusting
is wêreldwyd ontwikkel en analise tegnieke het in die rigting van die
gebruik van die hele defleksiekom in meer fundamentele analiseprosedures
beweeg.

Hierdie outeur spreek die probleem van die volledige beskrywing van die
defleksiekom aan deur 'n diepgaande literatuurstudie oor hierdie
onderwerp te doen. Verskeie defleksiekom-parameters wat die defleksiekom
beskryf, word gelys, sowel as die onderskeie apparate wat daarmee
verband hou. Hierdie apparate word almal in detail bespreek en in
verband gebring met die toerusting wat in Suid-Afrika beskikbaar is.

Die meting van defleksiekomme met die padoppervlakte-deflektometer (POD)
onder versnelde toetsing met die vloot van swaarvoertuignabootsers
(SVN'e) is in detail beskryf. 'n Verbeterde datamanipulasie-prosedure
is voorgestel wat die berekening van al die defleksiekom-parameters ver-
eenvoudig soos gevind in die literatuur. Verskeie modelle wat gebruik is
om die gemete defleksiekom te pas, is ondersoek in 'n poging om die
defleksiekom ten volle te beskryf.

Die gemete defleksiekom-parameters van 'n bitumen, gebreekte klip,
gesementeerde en ligte struktuur korrelkroonlaag-plaveisel is in detail
bespreek soos getoets met die vloot SVN'e. Daar is getoon hoe die
defleksiekom-parameters die strukturele kapasiteit van die onderskeie
lae en gedragstoestande reflekteer. 'n Meer akkurate beskrywing van die
gedragstoestande is moontlik gemaak deur die daarstelling van grense
vir die verskillende gedragstate van die geselekteerde defleksiekom-
parameters.

'n Literatuurstudie is gedoen om die verskillende analise-prosedures wat van defleksiekom-parameters as basiese inset gebruik maak, in die karakterisering van materiale, te ondersoek. Op grond van hierdie studie is daar ook gepoog om gebruik te maak van liniêr elastiese programme om effektiewe elastiese moduli te bereken, vir elke plaveisellaag, vanaf gemete defleksiekomme.

Die moontlikheid om determinante vir oorspannendheid direk aan gemete defleksiekom-parameters te kan koppel, is in die literatuur nagevors. Op hierdie trant is daar toe tipiese Suid-Afrikaanse soepel plaveisel- strukture meganisties ontleed en sogenaamde ontwerpkurwes daargestel vir tipiese bitumen- en korrelkroonlaag-plaveisels. Die invloed van herdeklae is ook ondersoek en tipiese herdeklaag ontwerpkurwes is daargestel.

In die finale hoofstuk poog die skrywer om die navorsing op te som deur aan te dui hoe defleksiekomme gemeet kan word en die Suid-Afrikaanse meganistiese rehabilitasie ontwerp-prosedure kan versterk. Slegs laasge- noemde rehabilitasie ontwerp-prosedure is bespreek met spesifieke verwysing na hoe gemete defleksiekom-parameters die gedragstoestande kan identifiseer, materiale karakteriseer, die analise prosedure en rehabi- litasie ontwerp kan versterk. Die outeur eindig deur aan te dui wat die navorsingsbehoefte in die toekoms is ten opsigte van defleksiekomme.

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