State · Of · The · Art On Pavement Overlay Procedures

Vol. II, Annotated Bibliography

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December 1983

Washington State Department of Transportation
Planning, Research and Public Transportation
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16. Abstract

This report is presented in two volumes. The first volume summarizes the state-of-the-art on pavement overlay design and presents a research plan to develop an overlay design procedure for the Washington State Department of Transportation (WSDOT). The second volume contains an annotated bibliography of significant pavement overlay literature published since 1968.

The state-of-the-art review presented in Volume I addresses pavement evaluation using nondestructive testing and subjective ratings. These are discussed along with the topics of traffic and seasonal variations. Pavement overlay design concepts are identified and discussed. A research plan is presented for the development of a pavement overlay design system for WSDOT.

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STATE-OF-THE-ART ON PAVEMENT OVERLAY DESIGN PROCEDURES

VOLUME II - ANNOTATED BIBLIOGRAPHY

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December 1983

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TABLE OF CONTENTS

PREFACE

This is a listing of publications pertaining to pavement overlays. The material presented here was obtained from literature searches of nine data bases. The purpose of this listing was to consolidate the titles and abstracts of available publications which have potential use in conducting a state-of-the-art review of pavement overlay design procedures.

References are organized into two categories, titles with abstracts and titles without abstracts. Within the categories, references are listed according to declining yearly chronology, i.e., 1982, 1981, 1980...Within each year, references are ordered alphabetically according to title. A subject index is presented in the last section.

TITLES WITH ABSTRACTS

1 371352 DA

AIRPORT PAVEMENTS TOTALLY RECYCLED

McGraw-Hill, Incorporated

Engineering News-Record VOL. 209 NO. 16 Oct 1982 pp 28-29

AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

SUBFILE: EIT; HRIS

The reports on the methods of recycling old asphalt overlay material into new full-depth pavements and overlays and shows how old portland cement and asphaltic concrete is put to various uses.

2 372929 DA

APPLICATION OF ASPHALT RUBBER ON NEW HIGHWAY PAVEMENT CONSTRUCTION

Morris, GR; Chen, NJ; Di Vito, JA

Transportation Research Board

Arizona Department of Transportation

Transportation Research Record N888 1982 pp 43-47 12 Fig. 1 Tab. 9 Ref.

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

Asphalt rubber has been used for many years as a stress-absorbing membrane (SAM) or stress-absorbing membrane interlayer (SAMI) for both rigid and flexible pavement overlay systems in Arizona with satisfactory performance. In 1977, a new experimental application of asphalt rubber was used to build a low-volume highway pavement between Dewey and I-17 on AZ-169. Several experimental pavement sections were placed. After four years of service, only two sections are still in excellent condition with no cracks or ruts observed to date. One section consisted of a cement-treated base and the other a lime-fly ash-treated base. Each section received a SAMI and a 1-in wearing course. Other test sections failed, and constant patching is required to maintain a minimal level of service. Generally, cement-treated bases will always have shrinkage cracks that easily reflect through any asphalt concrete surface layer if without special treatment to retard crack propagation. A finite-element procedure was used as an aid in explaining why a SAMI can be used effectively to eliminate reflective cracks. It was found that SAMIs can significantly reduce crack tip stresses due to thermal and traffic loads and provide longer service life of the asphalt concrete surface layer. (Author) This paper appeared in Transportation Research Record No. 888, Structural Performance of Pavement Systems.

3 369217 DA

ASPHALT OVERLAYS ON CRACKED AND SEATED CONCRETE PAVEMENTS

National Asphalt Pavement Association

Paving Forum 1982 pp 2-4 2 Fig.

SUBFILE: HRIS

This article describes a method that has been used successfully to limit reflection cracking on portland cement concrete roads resurfaced with hot mix asphalt. It consists of cracking the concrete slabs into pieces small enough to sufficiently reduce joint movement (and hence reflective cracking), rolling the pieces with a roller to "seat" the pieces firmly on the base or subgrade and overlying with asphaltic concrete. Since the technique uses readily available construction equipment and no materials are either removed or added, it has proven to be cost effective and energy efficient. A disadvantage of this method is the reduction of the portland cement concrete slab's structural strength which should be taken into account when designing pavement structures.

4 368180 DA

BACKCALCULATING NONLINEAR RESILIENT MODULI FROM DEFLECTION DATA

Hoffman, MS; Thompson, MR

Transportation Research Board

Louisiana State University, Baton Rouge; Illinois University, Chicago

Transportation Research Record N852 1982 pp 42-51 10 Fig. 10 Tab. 20 Ref.

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

A method (ILLI-CALC) is presented for backcalculating nonlinear resilient moduli based on the interpretation of measured surface deflection basins. ILLI-PAVE, a stress-dependent finite-element pavement model, was used to generate data for developing algorithms and nomographs for deflection-basin interpretation. Nonlinear stress-dependent material characterizations are directly incorporated into the ILLI-CALC procedure. Solutions presented are for conventional flexible pavements composed of an asphalt concrete layer, a typical crushed-stone base layer, and a fine-grained subgrained subgrade soil. ILLI-CALC is illustrated for two different flexible pavements by using deflection data collected on several testing dates. Agreement is achieved between backcalculated material properties and laboratory-determined properties. Agreement is also achieved between measured and predicted deflection basins. The backcalculated parameters by using ILLI-CALC can be used as input for overlay design. The change in the stress state in the pavement-subgrade system caused by a change in the pavement cross section (overlay layer) is accounted for by the nonlinear stress-dependent characterization of the granular base and subgrade soil materials in the ILLI-PAVE model. (Author) This paper appeared in Transportation Research Record No. 852, Strength and Deformation Characteristics of Pavements.

5 103616 PR

BITUMINOUS RESURFACINGS ON RIGID PAVEMENTS

INVESTIGATORS: Noonan, JE

PERFORMING ORG: New York State Department of Transportation Engineering Research and Development Bureau 1220 Washington Avenue Albany New York 12232

SPONSORING ORG: New York State Department of Transportation; Federal Highway Administration Structures and Applied Mechanics Division

CONTRACT NO.: 035-1; HP&R

SUBFILE: HRIS

PROJECT START DATE: 6603

PROJECT TERMINATION DATE: 8206

The objective is to increase the life of bituminous resurfacings on rigid pavements. The main emphasis is on the reduction and retardation of reflection cracks. Although several methods tried were unsuccessful, others currently being attempted are proving to be effective.

6 935065 PB82-258070

Concepts for Developing a Nondestructive Testing Based Asphalt Concrete Overlay Thickness Design Procedure

(Final rept.)

Thompson, Marshall R.

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.

Corp. Source Codes: 034597031

Sponsor: Federal Highway Administratiion, Springfield, IL. Illinois Div.; Illinois State Dept. of Transportation,

Springfield. Bureau of Materials and Physical Research.
Report No.: FHWA/IL/UI-194
Jun 82 57p
Sponsored in part by Illinois State Dept. of Transportation, Springfield. Bureau of Materials and Physical Research.
Languages: English
NTIS Prices: PC A04/MF A01 Journal Announcement: GRAI8225
Country of Publication: United States
Contract No.: IHR-508
Preliminary flexible pavement asphalt concrete (AC) overlay thickness design concepts utilizing NDT (nondestructive testing) data are presented. The Illinois DOT Road Rater (8 kip peak to peak loading, 12 inch diameter plate) was the primary NDT device. Conventional pavements (surface treatment-granular base; AC surface + granular base), full depth asphalt concrete (AC surface + AC base), and stabilized base (with or without AC surface) pavements are considered. Field evaluation, NDT testing, NDT data interpretation, and overlay thickness determination procedures are proposed.

7 934749 PB82-252073
Continuously Reinforced Concrete Overlay of Existing Continuously Reinforced Concrete Pavement
(Interim rept.)
Crawley, Alfred B.
Mississippi State Highway Dept., Jackson. Research and Development Div.
Corp. Source Codes: 012401001
Sponsor: Federal Highway Administration, Jackson, MS. Mississippi Div.
Report No.: MSHD-RD-82-074-I; FHWA-MSHD-RD-82-074-I
Mar 82 98p
Languages: English
NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI8225
Country of Publication: United States
This report describes the design and construction of a 6-inch thick unbonded continuously reinforced concrete (CRC) overlay of a 20-year old continuously reinforced concrete pavement (CRCP) along with crack surveys for the first nine months after construction. This is the first time (to the author's knowledge) a CRC overlay has been placed over an existing CRCP. The existing CRCP was an experimental project when built. It had several features being tried for the first time in Mississippi, one of which led to the need for the overlay.

8 1369478 EI8304029478
CONTINUOUSLY REINFORCED CONCRETE OVERLAY ON TRUNK ROAD A3 AT HORNDEAN.
Gregory, J. M.
TRRL Suppl Rep 742 1982 23p CODEN: TSRLDG ISSN: 0305-1315
Languages: ENGLISH
The design, construction and early performance of a 1. 6 km long continuously reinforced concrete (CRC) overlay on Trunk Road A3 at Horndean in the United Kingdom are described. Two contiguous sections of CRC overlay were laid, one 110 mm thick and the other 130 mm thick. Reinforcement weighing 7. 05 kg/m**2 was used throughout both sections giving longitudinal steel percentages of 0. 71 for the 110 mm thickness and 0. 60 for the 130 mm thickness. Wide-flange beam joints were installed at the ends of the CRC overlay. 13 refs.

9 156589 PR

CRACK REFLECTANCE ON BITUMINOUS OVERLAID PCC PAVEMENT

INVESTIGATORS: Allen, HS; Allen, HS

PERFORMING ORG: Minnesota Department of Transportation 408 Transportation Building St Paul Minnesota 55155

SPONSORING ORG: Minnesota Department of Transportation; Minnesota Local Road Research Board

SUBFILE: HRIS

PROJECT START DATE: 7212

PROJECT TERMINATION DATE: 8412

A number of systems have been incorporated into overlay construction projects in an attempt to reduce the joints in the old pcc pavement from reflecting through the bituminous overlay. The earlier systems consisted of placing a bond breaker such as sand, fiberglass or rubberized membrane at each joint; none of these were effective. In 1976, several systems were tried, including open graded bituminous base, the old slab at 5-ft. intervals. In 1980 and 1981, several other tests sections were added to the study, consisting of cracking or sawing the inplace P.C.C., adding various depths of bituminous overlays and/or incorporating interlayer systems to reduce reflectance of the PCC joints.

10 1332063 EI8212112063

DESIGN AND PERFORMANCE OF BITUMINOUS FRICTION-COURSE MIXES.

Kamel, Nabil; Musgrove, G. R.; Rutka, A.

Ont Minist of Transp & Commun, Downsview, Can

Transp Res Rec 843 1982 p 40-50 CODEN: TRREDM ISSN: 0361-1981

Performance data from two major experimental field projects carried out in Ontario to develop bituminous friction-course mixes with improved texture and friction characteristics are presented. Design principles, construction, and subsequent performance characteristics of these skid-resistant pavement surfaces are discussed. Aggregate properties, gradations, and mixture characteristics that produce and maintain optimum texture levels with Ontario materials are identified. 14 refs.

11 912624 PB82-201369

Design of Overlays Based on Pavement Conditions, Roughness, and Deflections

(Final rept.)

McGhee, K. H.

Virginia Highway and Transportation Research Council, Charlottesville.

Corp. Source Codes: 057487000

Sponsor: Federal Highway Administration, Richmond, VA. Virginia Div.

Report No.: VHTRC-82-R31; FHWA/VA-82/31

Jan 82 46p

See also PB-279 882.

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8217

Country of Publication: United States

The report summarizes five years of research on the development and use of a pavement maintenance rating system and the development of two procedures for designing the thickness of overlays. The studies showed that objective rating systems can be used to prioritize pavements scheduled for resurfacing and that the procedures for overlay design based on the existing pavement structure and on traffic loadings are practical.

12 915441 PB82-245333
Early Performance of Some Experimental Bituminous Overlays in Kenya
Smith, H. R. ; Jones, C. R.
Transport and Road Research Lab., Crowthorne (England).
Corp. Source Codes: 056787000
Report No.: TRRL-LR-1043
c1982 66p
Also pub. in ISSN-0305-1293.
Languages: English Document Type: Journal article
NTIS Prices: PC A04/MF A01 Journal Announcement: GRAI8223
Country of Publication: United Kingdom
The report describes the performance of bituminous overlays on roads in tropical and sub-tropical environments in Kenya. Considerable hardening of the binder occurred throughout the depth of the overlays during the first five to seven years, but negligible rutting developed. The main form of deterioration was cracking which was initiated at the surface of the overlays.

13 368064 DA
THE ESTIMATION BY THERMAL STRESS ANALYSIS OF REFLECTING CRACKS FORMED IN THE ASPHALTIC OVERLAY ON A CONCRETE PAVEMENT
Braunovic, P
Savez Drustava Za Ceste Hrvatske
Institut Za Puteve, Belgrade
Ceste I Mostovi VOL. 28 NO. 2 Feb 1982 pp 45-48 8 Fig. 1 Ref. Croatian
SUBFILE: TRRL; IRRD; HRIS
In the paper a description is given of the research project carried out at the Ohio State University. The project has investigated movements at the joints of the reinforced concrete pavement, as well as the appearance of reflection cracks in the asphalt overlay laid on this pavement. (TRRL)

14 1376631 EI8305036631
EVALUATION OF DIFFERENT OVERLAYS AND PROPOSED DESIGN METHOD.
Shivalingaiah, L.; Rajagopal, A. S.; Justo, C. E. G.
J Indian Roads Congr v 43 n 3 Nov 1982 p 489-521 CODEN: JIRCAA ISSN: 0046-905X
Languages: ENGLISH
This paper presents the details of studies on five test sections of overlays each of 100 meters length constructed over an existing flexible pavement. The actual thickness of overlay at each deflection observation point was determined by a network of spot levels before and after the overlays were constructed. The pavement and overlays were subjected to Benkelman Beam deflection studies and surface condition evaluation. 23 refs.

15 1352611 EI8302012611
FLEXIBLE PAVEMENT EVALUATION AND OVERLAY DESIGN.
Bandyopadhyay, Sudipta S.
Univ of Houston, Tex, USA
ASCE Transp Eng J v 108 n TE6 Nov 1982 p 523-539 CODEN: TPEJAN ISSN: 0569-7891
A rational method for flexible pavement evaluation and overlay design using the Dynaflect deflections is presented. Evaluation charts and design curves are based on the results of a comprehensive two-year study during which the Dynaflect deflections were systematically monitored on selected flexible pavements located strategically throughout Kansas. Various factors, including the pavement thickness, volume of traffic, subgrade soil type, temperature and average rainfall are taken into consideration. 40 refs.

16 369518 DA
FORECASTING REFLECTION CRACKING IN ASPHALT OVERLAY ON CONCRETE PAVEMENT BY THERMAL STRESS ANALYSIS
Braunovic, P
Druste za Ceste Hrvatske
Institut Za Puteve, Beograd
Ceste I Mostovi VOL. 28 NO. 2 Feb 1982 pp 45-48 8 Fig. 1 Ref. Croatian
SUBFILE: TRRL; IRRD; HRIS
The results of a research project carried out at the Ohio State University have been presented in a modified form. The project considers movements at the joints in reinforced concrete pavements, as well as the appearance of reflection cracks in an asphalt overlay on the pavement. (TRRL)

17 945707 PB83-119982
Long Term Observations of Performance of Experimental Pavements in Ohio
(Final rept.)
Majidzadeh, Kamran ; Elmitiny, Rashad
Resource International, Inc., Worthington, OH.
Corp. Source Codes: 074213000
Sponsor: Federal Highway Administration, Columbus, OH. Ohio Div.; Ohio Dept. of Transportation, Columbus.
Report No.: FHWA/OH-81/009
Jul 82 150p
Sponsored in part by Ohio Dept. of Transportation, Columbus.
Languages: English
NTIS Prices: PC A07/MF A01 Journal Announcement: GRAI8304
Country of Publication: United States
This report presents long term evaluation data and analyses for eight (8) experimental pavement projects constructed in Ohio. The study projects include both rigid and flexible pavements and are scattered throughout the state. Pavement age is currently approaching 10 years for some projects. The pavements were extensively monitored and tested at the time of construction, and during 1979 and 1980 as part of this research study. Collected data included pavement condition rating (PCR) of visible distress, Dynaflect deflection, test properties of core and subgrade samples, and estimated remaining structural life and overlay requirements.

18 964276 PB83-153288
Minimizing Reflection Cracking of Pavement Overlays
(Final rept)
Transportation Research Board, Washington, DC.
Corp. Source Codes: 044780000
Sponsor: American Association of State Highway and Transportation Officials, Washington, DC.; Federal Highway Administration, Washington, DC.
Report No.: TRB/NCHRP/SYN-92
Sep 82 48p
Sponsored in part by American Association of State Highways and Transportation Officials, Washington, DC., and Federal Highway Administration, Washington, DC. Report on National Cooperative Highway Research Program, Synthesis of Highway Practice.
Languages: English
NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8310
Country of Publication: United States
This synthesis will be of special interest to pavement designers, materials specialists, maintenance engineers, and others concerned with the performance of pavement overlays. Methods are presented for reducing reflection cracking in overlays. Reflection cracks can shorten the service life of overlays on both asphalt and portland cement concrete pavements. This report of the Transportation Research Board contains a discussion of the causes of reflection cracking and provides guidance on the methods of preventing this problem.

19 1281913 EI8207061913
PAVEMENT DEFLECTION MEASUREMENTS: STATIC AND DYNAMIC.
Bandyopadhyay, S. S.
Natl Soil Serv Inc, Houston, Tex, USA
Public Works v 113 n 1 Jan 1982 p 48-49 CODEN: PUWOAH ISSN: 0033-3840
A comparison of static and dynamic methods of pavement deflection for the purpose of condition evaluation and overlay design is presented. The decision process for overlay design is presented diagrammatically. 5 refs.

20 102078 PR
PERFORMANCE STUDY OF CONTINUOUSLY REINFORCED CONCRETE OVERLAY I-70N
INVESTIGATORS: Shah, GN
PERFORMING ORG: Maryland Department of Transportation State Highway Administration 2323 West Joppa Road Brooklandville Maryland 21022
SPONSORING ORG: Maryland Department of Transportation State Highway Administration; Federal Highway Administration Structures and Applied Mechanics Division
CONTRACT NO.: 141; HP&R
SUBFILE: HRIS
PROJECT START DATE: 7305
PROJECT TERMINATION DATE: 8212
THE OBJECTIVE OF THIS STUDY IS TO DETERMINE THE PERFORMANCE OF THE CONTINUOUSLY REINFORCED CONCRETE OVERLAY CONSTRUCTED ON A I-70N PROJECT IN HOWARD AND CARROLL COUNTIES, MARYLAND. THIS STUDY IS ALSO INVESTIGATING CAUSES OF FAILURE IN ADDED CRCP SHOULDER LANE.

21 1305163 EI8210085163
POST-TENSIONED CONCRETE OVERLAY OF AIRPORT RUNWAY.
Lamberson, Eugene A.
Dywidag Syst Inst USA Inc
Concr Constr v 27 n 3 Mar 1982 p 261, 263, 265-266 CODEN: CCCNAJ ISSN: 0010-5333
The paper describes the installation of a post-tensioned concrete overlay for a commercial airfield pavement at O'Hare International Airport in Chicago Illinois.

22 373139 DA
RESURFACING WITH PORTLAND CEMENT CONCRETE
Hutchinson, RL
Transportation Research Board
NCHRP Synthesis of Highway Practice N99 1982 90p Figs. Tabs. 123 Ref.
AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418
SUBFILE: HRIS
This synthesis is concerned with the resurfacing of existing portland cement concrete (rigid) and bituminous cement concrete (flexible) pavements with portland cement concrete (hereinafter referred to as "concrete"). Concrete resurfacings have been used for one or more of the following purposes: (a) to restore the rideability of the existing pavement, (b) to provide an appropriate surface texture to the existing pavement, or (c) to restore or increase the load-carrying capacity of life or both of the existing pavement. The term "resurfacing" is considered inclusive of all these purposes and is used throughout this synthesis instead of the frequently used term "overlay." This report deals primarily with highway experience, but city street, county road, and airfield experience have been included where it has been considered to be appropriate. (Author)

23 964035 PB83-148353
Road Design System (RDS)
(Software)
Krantz, Harvey ; Litten, Mack ; Klassen, Dwane
Forest Service, Fort Collins, CO.
Corp. Source Codes: 036135000
Report No.: USDA/DF-83/005
1 Nov 82 mag tape
Supersedes PB81-217424.
Source tape is in EBCDIC character set. Tapes can be prepared in most standard 7 or 9 track recording modes for one-half inch tape. Identify recording mode desired by specifying character set, track, density and parity. Call NTIS Computer Products Support Group if you have questions. Price includes documentation, PB83-148346.
Languages: English
NTIS Prices: CP T11 Journal Announcement: GRAI8310
Country of Publication: United States
RDS is used by the Forest Service nationwide for design of forest roads. It is suited for design of low standard single lane, dirt roads that follow the terrain. However, it can also be used for double lane paved roads. It consists of 256 subroutines. There are 38 main overlays which perform a portion of the road design process. The program RDS is the main driver of all the other overlays....Software Description: The system is written in Fortran 77 with 7 assembly language subroutines for the UNIVAC 1184 under EXEC 8, Level 37. It requires 65K words of core and a CALCOMP plotter for graphics

24 368638 DA
STRUCTURAL DESIGN OF CEMENTED PAVEMENTS LAYERS
Otte, E; Savage, PF; Monismith, CL
American Society of Civil Engineers
Van Wyk and Louw, Incorporated, South Africa
ASCE Journal of Transportation Engineering VOL. 108 NO. TE4 Jul 1982 pp 428-446 27 Ref.
AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017
SUBFILE: EIT; HRIS
A mechanistic structural design procedure for pavements containing cement- and lime-treated layers is outlined. The procedure includes provision for use of a range in traffic wheel loadings, fundamental material properties, and failure criteria, including fatigue. Layered elastic theory is utilized to calculate stresses and strains at critical positions in the pavement components, and these are compared with allowable values to minimize specific distress modes. Use of standard designs resulting from the more detailed analyses are discussed and explained.

2: 372931 DA
STRUCTURAL DESIGN OF FLEXIBLE PAVEMENTS: A SIMPLE PREDICTIVE SYSTEM
Uzan, J; Lytton, RL
Transportation Research Board
Technion-Israel Institute of Technology; Texas A&M University
Transportation Research Record N888 1982 pp 56-63 3 Fig. 1 Tab. 13 Ref.
AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418
SUBFILE: HRIS
During the past two decades, much effort has gone into the development of rational pavement design procedures that are intended to be integrated into a more general framework. The Federal Highway Administration has developed a computer program package known as VESYS II to predict the structural

responses and hence the integrity of flexible pavements. The program is quite formidable for the local design engineer. Therefore, a simple predictive system is needed to be widely used for the structural design of flexible pavements. A simple computer program package is presented that includes (a) regression formulas for tensile strain and rut depth computations, cracking prediction, and evaluation of the rut depth variance; (b) modification and calibration of the American Association of State Highway Officials (AASHO) Road Test serviceability model, where rut depth variance replaces the slope variance; (c) seasonal (monthly) characterization of pavement materials and discrete representation of axle-load distribution; and (d) special treatment for overlay analysis. The procedure is illustrated and the results are discussed. The good agreement between the results and measured values and the simplicity of the program make it very attractive. It could be programmed on a desk (micro) computer. (Author) This paper appeared in Transportation Research Record No. 888, Structural Performance of Pavement Systems.

26 372927 DA

STRUCTURAL PERPFORMANCE MODEL AND OVERLAY DESIGN METHOD FOR ASPHALT CONCRETE PAVEMENTS

Molenaar, AAA; Van Gurp, ChAPM

Transportation Research Board

Delft University of Technology, Netherlands

Transportation Research Record N888 1982 pp 31-37 12 Fig. 9 Ref.

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

The development of a structural performance model for flexible pavements is described. This model consists of a set of probability-of-survival curves in which the structural deterioration of pavement structures, which are characterized with their equivalent layer thickness, is given with respect to the number of load repetitions. The equivalent layer thickness is calculated according to Odemark's theory. It is shown that the equivalent layer thickness and the survival rate of the pavement can be determined by means of deflection measurements. Furthermore, it is shown how an in situ asphalt concrete fatigue relation can be derived for the construction considered. An overlay design chart based on the equivalent layer thickness concept is given, and an example of how the developed techniques are used for the overlay design of asphalt pavements is presented. (Author) This paper appeared in Transportation Research Record No. 888, Structural Performance of Pavement Systems.

27 987866 PB83-200014

Structural Performance of Pavement Systems

Nussbaum, P. J. ; Tayabji, S. D. ; Ciolko, A. T. ; Stanek, Floyd J. ; Colley, B. E.

Transportation Research Board, Washington, DC.

Corp. Source Codes: 044780000

Report No.: TRB/TRR-888; ISBN-0-309-03500-7

1982 93p

Library of Congress catalog card no. 83-8030. Also pub. as ISSN-0361-1981.

Paper copy also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, DC 20418.

Languages: English

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI8317

Country of Publication: United States

The 11 papers in this report deal with the following areas: prestressed pavement joint designs; prestressed pavement thickness design; comparison of solutions for stresses in

plain jointed portland cement concrete pavements; structural performance model and overlay design method for asphalt concrete pavements; structural performance evaluation of recycled pavements by using dynamic deflection measurements; application of asphalt rubber on new highway pavement construction; characterizing fatigue life for asphalt concrete pavements; structural design of flexible pavements: a simple predictive system; structural analysis of AASHO road test flexible pavements for performance evaluation; performance analysis for flexible pavements with stabilized base; and, measurement and prediction of forward movement and rutting in pavements under repetitive wheel loads.

28 368000 DA

TASMANIAN ROAD MAINTENANCE AND REHABILITATION STUDIES

Morris, PO

Australian Road Research Board 500 Burwood Road Vermont South Victoria 3133 Australia 0314-2205 0 86910 059 9

1982 pp 189-208 6 Fig. 1 Tab. 6 Ref.

SUBFILE: TRRL; IRRD; HRIS

This report discusses an area maintenance management system that has now operated successfully in the north east and other districts of the DMR Tasmania for a number of years One of its main advantages is that resources can be directed to road lengths of greatest need by means of work inspections and priority scheduling. A computer costing system, introduced to the north east district in 1976, is now operating successfully in all districts. Its main advantages are that it eliminates a lot of manual work and through fortnightly costing of some 31 maintenance activities or sectional lengths of road enables a close control on expenditure to be maintained throughout the year. This report also covers a study of the performance of lightly constructed roads subjected to heavy log haulage traffic. A CBR/ thickness curve was developed for new construction and tolerable deflection criteria for bituminous surfacings and bituminous concrete overlays necessary for rehabilitating such roads. A formula used for calculation of overlay thickness was subsequently verified through monitoring of overlaid sections (a). (TRRL) 19th ARRB Regional Symposium, Wagga Wagga, New South Wales, 1982. Program and Papers. This paper was presented in Session 5--Road Pavement Condition Rating System.

29 945547 PB83-117259

Thin Bonded P.C.C. Resurfacing: Interim Report Number 1

(Rept. Apr 81-Jun 82)

Temple, William H. ; Rasoulian, Masood

Louisiana Dept. of Transportation and Development, Baton Rouge. Research and Development Section.

Corp. Source Codes: 051354002

Sponsor: Federal Highway Administration, Baton Rouge, LA. Louisiana Div.

Report No.: LA-80-3P(B); RR-156; FHWA/LA-82/156

Jun 82 49p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8304

Country of Publication: United States

Contract No.: HPR-80-3P(B)

The purpose of this study was to evaluate the construction techniques and performance characteristics of the La. DOTD's first portland cement concrete resurfacing project which was constructed over a short section of an existing 9-inch concrete pavement located on US 61 north of Baton Rouge. The old pavement surface was cleaned with a device which blasted the surface with small steel shot. The resurfacing concrete consisted of a 5.8-bag, air-entrained limestone concrete with an average thickness of 4 inches. A water cement grout was used as a bonding agent and was sprayed on the old pavement immediately prior to overlay.

30 360088 PR

ALTERNATIVE FLEXIBLE OVERLAYS

INVESTIGATORS: Schwarting, P; Leonard, C

PERFORMING ORG: Osceola County Secondary Road Department Courthouse Sibley Iowa 51249

SPONSORING ORG: Iowa Department of Transportation

SUBFILE: HRIS

PROJECT START DATE: 8109

PROJECT TERMINATION DATE: 8703

The objective of this research is to construct and evaluate several cold-laid bituminous concrete base overlays which have the potential to reduce future maintenance and construction costs by preventing transverse cracking. The bituminous binders used for mixes were AC-5 (control), HFMS-2, CSS-1, MC-3000, MC-800, and SC-800. The materials were plant mixed at 180 deg F and laid with a conventional paver.

31 342070 DA

ALTERNATIVES IN PAVEMENT MAINTENANCE, REHABILITATION, AND RECONSTRUCTION

Asphalt Institute Asphalt Institute Building College Park Maryland 20740

May 1981 9p 3 Fig. 2 Tab.

REPORT NO.: IS-178;

SUBFILE: HRIS

Solutions to problems that develop throughout the life of an asphalt pavement system are presented. Maintenance work aspects described include patching and surface treatment (single and multiple surface treatment, sand, fog, and emulsion slurry seal). Rehabilitation aspects covered include pavement preparation, surface recycling, asphalt overlays, thin overlays, open-graded wearing surfaces, and structural overlays. Pavement reconstruction and recycling including cold-mix and hot-mix recycling are also discussed. More than one technique or a combination of techniques can be used to solve a specific problem. The techniques selected should be based on a thorough engineering analysis of the pavement's current and projected condition, use, and all other factors including its environment. This must be combined with a long-range program of planning and evaluation that takes economic aspects into account.

32 1315845 EI8211095845

APPLICATIONS OF POLYMER CONCRETE (SYMPOSIUM) 1980.

Kukacka, Lawrence E. (Ed.)

Brookhaven Natl Lab, Upton, NY, USA

Publ SP Am Concr Inst n 69, Appl of Polym Concr, Symp, San Juan, PR, 1980. Publ by Am Concr Inst, Detroit, Mich, USA, 1981 222 p CODEN: PSAIDE ISSN: 0193-2527

This volume contains proceedings of 14 papers developed at the meeting. Among others the following topics are covered - applications of polymer concrete in the construction industry; repairs of pavement overlays and bridge decks; use of epoxy and acrylic monomers in concrete mixture followed by curing; use of polymer concrete in electrical engineering; laboratory determination of show strength, compressive strength, and tensile strength, as well as of shinkage and durability; field tests. Technical and professional papers from this conference are indexed with the conference code no. 01216 in the Ei Engineering Meetings (TM) database produced by Engineering Information, Inc.

33 335714 DA

ASPHALT OVERLAYS FOR HEAVILY-TRAFFICKED PCC PAVEMENTS

Asphalt Institute Asphalt Institute Building College Park Maryland 20740

Feb 1981 22p 12 Fig. 3 Tab. 10 Ref.

REPORT NO.: Info Series No. 177;

SUBFILE: HRIS

Deteriorated portland cement concrete pavements can be readily overlaid with asphalt concrete. Indeed, this is the simplest, fastest and most efficient way of making such old pavements stronger, safer, and smoother-riding. There are five basic reasons for overlaying pcc pavements: A. To increase load-bearing capacity. B. To enhance ridability (smoothness). C. To increase safety by improving surface skid resistance, widening the pavement as required, and improving roadway geometrics. D. To extend the service life of the pavement by preventing the entry of water into the structure. E. To preserve the economic value of the pavement for both the owning authority and the user. (Automobiles and commercial vehicles are more fuel-efficient and require less maintenance on smooth pavements.) The classic problem encountered in overlaying pcc pavements has been the subsequent occurrence of reflective cracking (described as fissures in an asphalt overlay or surface course reflecting the crack pattern in the original pavement beneath). Reflective cracking is usually followed by disintegration of the overlay. This type of cracking can be prevented or minimized by proper preparation of the deteriorated pcc pavement and the application of the principles delineated in the following pages. First step in the upgrading procedure is thorough evaluation of the condition of the original pavement. The method for obtaining accurate results in such an evaluation is described in Section 2 of this publication. The second step, choosing the appropriate overlay design and thickness, is the subject of Section 3. Section 3 also includes descriptions and applications of the three categories of overlays discussed in this publication, which are: 1. Heavy Structural Overlay, which may include a Crack-Relief Layer. 2. Structural Overlay, which may include a Crack-Relief Layer. 3. Maintenance Overlay. The central focus of this publication is the application of thick overlays on heavily-trafficked highways and roads; however, asphalt overlays of 5 cm (2 in.) thickness are included in the Maintenance Overlay category. Section 4 discusses drainage, a most important consideration in the preparation for and placement of any asphalt overlay. (Author)

34 1302430 EI8209082430

ASPHALT PAVING TECHNOLOGY, PROCEEDINGS - ASSOCIATION OF ASPHALT PAVING TECHNOLOGISTS TECHNICAL SESSIONS, 1981.

Skok, Eugene L. Jr. (Ed.)

Univ of Minn, Minneapolis, USA

Asphalt Paving Technol v 50, Proc - Assoc of Asphalt Paving Technol Tech Sess, San Diego, Calif, USA, Feb 16-18 1981. Publ by Assoc of Asphalt Paving Technol, Minneapolis, Minn, USA, 1981 679 p CODEN: APATDV ISSN: 0270-2932

Proceedings include 22 papers that deal with recycling of various bituminous materials, construction of bituminous pavements and pavement overlays, properties of various bituminous paving mixtures, construction of bituminous roads, flexible pavements of asphaltic concrete and bituminous macadams, asphalt durability, and testing of various bituminous materials. Technical and professional papers from this conference are indexed with the conference code no. 00694 in the Ei Engineering Meetings (TM) database produced by Engineering Information, Inc.

35 345356 DA

BONDED PORTLAND CEMENT CONCRETE RESURFACING

Bergren, JV

Transportation Research Board

Iowa Department of Transportation

Transportation Research Record N814 1981 pp 66-70 2 Fig. 1 Tab. 7 Ref.

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

The experiences of the state of Iowa in developing and refining the process of resurfacing concrete pavements by using portland cement concrete (PCC) are described. The methods of evaluating the condition of the underlying pavement and determining the thickness of the resurfacing layer are discussed. Several projects that used PCC resurfacing to satisfy different roadway needs are described. Several methods of surface preparation, the methods of bonding, and the bond test results are included and discussed. It is concluded that bonding a layer of PCC 50-75 mm (2-3 in) thick to an existing concrete pavement is a viable alternative to bituminous resurfacing for the rehabilitation and restoration of concrete pavements. (Author) This paper appeared in Transportation Research Record No. 814, Pavement Management and Rehabilitation of Portland Cement Concrete Pavements.

36 345858 DA

CONCRETE COMES OUT ON TOP IN KENT OVERLAY TRIAL

Ridout, G

IPC Building and Contract Journals, Limited

Contract Journal VOL. 303 NO. 5318 Sep 1981 pp 20-21 5 Phot.

SUBFILE: TRRL; IRRD; HRIS

A 200 mm thick continuously reinforced concrete pavement (CRCP) is being laid on four 1 km long sections over the existing flexible carriageway of the A2 Boughton and Harbledown bypasses. The bypasses, using the guidelines of Road Note 29, were designed for a 20 year life, equivalent to 6.5 million standard axles. However, the unexpected growth in commercial traffic has led to the rapid deterioration of the road structure after only five years. Deflectograph surveys indicated that some 300 mm of hot-rolled asphalt overlay would be required to extend the design life by a further 65 million standard axles. The alternative 200 mm CRCP overlay being used in the trials has a 0.6 per cent, mid-slab reinforcement, and is laid a half lane width at a time using mortar-bedded guidance rails. Dowel bars have been cast along the centre line of the new carriageway to tie both half widths together. The ends of each trial section are anchored to the existing carriageway by four ground beams, 1200 mm deep and 600 mm wide spaced at 5 M centres. Three conventionally reinforced concrete slabs are cast adjoining either ends of the overlay and the transition is made by a black top regulating course. (TRRL)

37 334254 DA

CONCRETE OVERLAYS FOR CONCRETE AND ASPHALT PAVEMENTS

Lokken, EC

Purdue University West Lafayette Indiana 47907

Portland Cement Association

Apr 1981 Proceeding pp 211-220 3 Fig. 6 Tab. 10 Ref.

SUBFILE: HRIS

Concrete resurfacing of worn concrete pavements has been a fairly common practice in the United States for more than 60 years. Since the mid-1950's new construction on the Interstate System has taken precedence, and fewer concrete resurfacing projects were built. With the emergence of the 3R

program of pavement rehabilitation, restoration and resurfacing, new interest is being shown in the use of concrete as a more durable and permanent resurfacing material. A recent survey (1977) of 39 concrete resurfacing projects in the U.S. with plain or conventionally reinforced designs showed them ranging from 4 to 36 years of age, with an average age of 25 years. Their designs varied considerably; more than a third of the projects were plain concrete without reinforcement or dowels. The results of a 1975 survey of 23 CRC projects are reviewed and brought up to date with 1980 condition data. Designs using a thin layer of concrete bonded to the old slab have been employed as a resurfacing method in the U.S. for many years. The results of bridge deck resurfacing using a dense concrete mix have been particularly successful. The resurgence of interest in concrete pavement resurfacing has brought new emphasis on techniques and equipment to adapt this method to the level of other full-scale high speed paving operations. Current concrete resurfacing activities in the U.S. show a noticeable trend toward the use of concrete overlays to restore worn bituminous pavements. (Author) Proceedings of the 2nd International Conference on Concrete Pavement Design, held at Purdue University, April 14-16, 1981.

38 887898 PB82-141995

The Contribution of Pervious Macadam Surfacing to the Structural Performance of Roads

Potter, J. F. ; Halliday, A. R.

Transport and Road Research Lab., Crowthorne (England).

Corp. Source Codes: 056787000

Report No.: TRRL-LR-1022

c1981 24p

Also pub. as ISSN-0305-1293.

Languages: English

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8207

Country of Publication: United Kingdom

Although the spray-reducing properties of pervious macadam surfacing are well known, there is a distinct lack of information available about its structural performance. As a result its structural contribution is not considered in the design of new roads or bituminous overlays. The structural strengthening brought about by laying pervious macadam surfacings on existing roads has been assessed by using linear elastic theory to compute the stresses and strains induced in the pavements by vehicle loading before and after surfacing with the porvious macadam. These computations predicted a significant reduction in the magnitude of stresses and strains after surfacing, a result which was confirmed in practice by direct measurement on a full scale road pavement. Stress and strain computations were then used to determine the structural contribution of 40 mm of pervious macadam surfacing in terms of equivalent thicknesses of rolled asphalt surfacing and rolled asphalt and dense bitumen macadam roadbases for the present recommended designs of road pavements. (Copyright (c) Crown Copyright 1981.)

39 923408 PB82-238650

A Design System for Rigid Pavement Rehabilitation

(Research rept.)

Seeds, Stephen B. ; McCullough, B. F. ; Hudson, W. R.

Texas Univ. at Austin. Center for Transportation Research.

Corp. Source Codes: 043127093

Sponsor: Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div.; Federal Highway Administration, Washington, DC.

Report No.: CTR-3-8-79-249-2; FHWA/TX-81/41-249-2

Jan 82 332p

Portions of this document are not fully legible.
Languages: English
NTIS Prices: PC A15/MF A01 Journal Announcement: GRAI8221
Country of Publication: United States
This report describes the development, use, and applicability of a rigid pavement rehabilitation design system. RPRDS, developed for use by the Texas State Department of Highways and Public Transportation. Like other pavement design systems, RPRDS makes use of the systems approach to incorporate a number of pavement design and analytical models into a computer program, RPRDS-1, for the generation, analysis, and comparison of numerous pavement design strategies. Basically, RPRDS generates a number of feasible overlay design strategies based on user inputs, performs a present value cost analysis on each, and then presents those which are optimal.

40 930582 PB82-203191
Development of a System for the Evaluation of Pavements in Indiana
(Final rept.)
Yoder, E. J.
Purdue Univ., Lafayette, IN. Joint Highway Research Project.
Corp. Source Codes: 009058023
Sponsor: Federal Highway Administration, Indianapolis, IN. Indiana Div.; Indiana State Highway Commission, Indianapolis.
Report No.: JHRP-81-18; FHWA/IN/JHRP-81/18
30 Sep 81 25p
See also PB81-115735. Sponsored in part by Indiana State Highway Commission, Indianapolis.
Languages: English
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8218
Country of Publication: United States
Contract No.: HPR-1(19)
The Indiana Department of Highways is presently setting up a Pavement Management System. Personnel at Purdue University in cooperation with the Indiana Department of Highways Research and Training Center has conducted research on methods for evaluating pavements utilizing roughness data and deflection data. Four types of pavements were evaluated, flexible, overlay, jointed reinforced concrete and continuously reinforced concrete. This report summarizes research results.

41 1134931 EI810434931
DYNAMIC PAVEMENT DEFLECTIONS
Sharpe, Gary W.; Southgate, Herbert F.; Deen, Robert C.
DOT, Lexington, Ky
ASCE Transp Eng J v 107 n 2 Mar 1981 p 167-181 CODEN: TPEJAN ISSN: 0569-7891
In 1977 a methodology was developed to evaluate pavement performance using dynamic (Road Rater) deflections. Since then, additional research has resulted in modifying the procedures. The procedures presently used to evaluate flexible pavement structures are explored, and background information is included on various procedures used by others. A sample set of data is presented and evaluated. A key to the adequate design of an overlay for any pavement structure is to be able to determine reasonable values for design parameters that represent the condition of the existing pavement. A discussion is included on how the analyses of dynamic pavement deflections can be used to design overlays and to manage pavements. 29 refs.

42 1291173 EI8208071173

EVALUATION AND DESIGN OF OVERLAY THICKNESS OF AIRPORT ASPHALT PAVEMENT BY DYNAFLECT DEFLECTIONS.

Sato, Katsuhisa; Fukute, Tsutomu

Port & Harbour Res Inst

Trans Jpn Soc Civ Eng v 12 Nov 1981 p 291-292 CODEN: DGROAY ISSN: 0385-5406

This report describes the newly established methods for structural evaluation and overlay-thickness design of airport asphalt pavements by the use of Dynaflect. 1 ref.

43 872527 PB82-105792

Evaluation of Maintenance/Rehabilitation Alternatives for Continuously Reinforced Concrete Pavement

(Civil engineering studies (Interim) 1978-81)

Barnett, Terry L. ; Darter, Michael I. ; Laybourne, Ned R.

Illinois Univ. at Urbana-Champaign. . Dept. of Civil Engineering.

Corp. Source Codes: 034597031

Sponsor: Federal Highway Administration, Springfield, IL. Illinois Div.; Illinois State Dept. of Transportation, Springfield. Bureau of Materials and Physical Research.

Report No.: TRANSPORTATION ENGINEERING SER-28; UIUC-ENG-80-2011; FHWA/IL/UI-185

May 81 152p

Report on Illinois Cooperative Highway Research Program Ser-185. Sponsored in part by Illinois State Dept. of Transportation, Springfield. Bureau of Materials and Physical Research. Errata sheet inserted. See also PB80-128135.

Languages: English

NTIS Prices: PC A08/MF A01 Journal Announcement: GRAI8201

Country of Publication: United States

Contract No.: IHR-901

An evaluation of several maintenance/rehabilitation methods for an Interstate Continuously Reinforced Concrete Pavement (CRCP) in Illinois has been conducted. Maintenance and rehabilitation needs are increasing rapidly due to aging and heavy truck traffic on the Interstate system. Thus, efficient methods are greatly needed. The design, construction, performance, and costs of several maintenance and rehabilitation methods were evaluated including patching, cement grout and asphalt undersealing, epoxying of cracks, and an asphalt overlay. Information gathered will be very useful in the development of future maintenance activities and rehabilitation projects. Nondestructive Testing (NDT) deflections, reflection cracking, cost, and statistical analyses were used to evaluate the maintenance and rehabilitation methods.

44 885799 AD-A107 585/2

Evaluation of Membrane Interlayers for Prevention of Crack Reflection in Thin Overlays

(Final rept.)

Vedros, Jr, Philip J.

Army Engineer Waterways Experiment Station, Vicksburg, MS. Geotechnical Lab.

Corp. Source Codes: 002621007; 411412

Report No.: WES/MP/GL-81-8

Oct 81 106p

Microfiche copies only.

Languages: English

NTIS Prices: MF A01 Journal Announcement: GRAI8207

Country of Publication: United States

This report is the final report resulting from case studies of pavement performance conducted by the U. S. Army Engineer Waterways Experiment Station as requested by the U. S. Army Forces Command, Fort McPherson, Ga. The purpose of this study

was to determine if a layer consisting of an asphalt-rubber membrane or a nonwoven fabric placed under a thin asphaltic concrete overlay (2 in. or less) will stop reflection cracking from occurring in the overlay. Field tests of two asphalt-rubber membrane formulations and three nonwoven fabrics were placed on roads and airfield pavements at five Army installations in various areas of the United States. The initial report covered the actual construction and performance of the materials for a period of 6 months after construction. This report covers the performance of the materials after a period of from 3 to 4 years, during which annual inspections were made. The results of the field tests indicate that in a cold environment the use of these membranes does not prevent or retard reflection cracking from occurring. The asphalt-rubber material was not evaluated over a long enough period of time in a warm climate to determine if reflection cracking was sufficiently prevented or retarded to warrant use of this material. (Author)

45 1243232 EI8203023232

EVALUATION OF SEVERAL MAINTENANCE METHODS FOR CONTINUOUSLY REINFORCED CONCRETE PAVEMENT.

Yoder, Eldon J.; Florence, R. H. Jr.; Virkler, Stanley J.

Purdue Univ, West Lafayette, Indiana, USA

Transp Res Rec 800 1981 p 17-26 CODEN: TRREDM ISSN: 0361-1981

Research on continuously reinforced concrete pavement (CRCP) in Indiana made to evaluate other techniques for maintaining CPCP to determine the most cost-effective method is described. A test pavement on Interstate-65 south of Indianapolis was used. Maintenance methods investigated included normal concrete patching, bituminous patching, overlay by using asphalt concrete with and without prior undersealing and with and without installation of edge drains, undersealing by using asphalt only, drainage, and concrete shoulders. 4 refs.

46 334270 DA

EXPERIENCE WITH NONDESTRUCTIVE STRUCTURAL EVALUATION OF AIRPORT PAVEMENTS

Bush, AJ, III; Hall, JW, Jr

Purdue University West Lafayette Indiana 47907

Waterways Experiment Station

Apr 1981 Proceeding pp 385-397 12 Fig. 1 Tab. 9 Ref.

SUBFILE: HRIS

Nondestructive testing (NDT) has become an accepted and highly requested procedure for evaluation of airport pavements. This paper describes recent improvements and additions that have been made to the NDT procedure described in Federal Aviation Administration Advisory Circular No. 150/5370-11. The improvements described allow the application of the method to composite pavements, present a method for determination of the radius of relative stiffness from deflection basin measurements, and give procedures for computation of overlay thickness requirements. NDT evaluation results from a number of portland cement concrete airport pavements are presented, and responses from airport operators as to the usefulness of the results are discussed. (Author) Proceedings of the 2nd International Conference on Concrete Pavement Design, held at Purdue University, April 14-16, 1981.

47 870280 AD-A103 737/3

Fabric Installation to Minimize Reflection Crack on Taxiways at Thule Airbase, Greenland

(Special rept.)

Eaton, Robert A. ; Godfrey, Randy

Cold Regions Research and Engineering Lab., Hanover, NH.

Corp. Source Codes: 006594000; 037100

Report No.: CRREL-SR-81-10

May 81 35p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8201

Country of Publication: United States

Contract No.: 4K078012AAM1

In August 1978 two types of fabrics were placed on sections of taxiways 1 and 3 of Thule AB, Greenland, to study the ability of fabrics with an AC 2.5 overlay to minimize reflection cracking in severe climates. Both fabrics should retain durability and mechanical strength under Thule's arctic conditions. (Author)

48 333382 PR

FIELD EVALUATION OF CHEM-CRETE BITUMEN ADDITIVE IN ASPHALT CONCRETE OVERLAYS

INVESTIGATORS: Brown

PERFORMING ORG: Georgia Department of Transportation 2 Capitol Square Atlanta Georgia 30334

SPONSORING ORG: Georgia Department of Transportation; Federal Highway Administration Materials Division

CONTRACT NO.: 8010; HP&R

SUBFILE: HRIS

PROJECT START DATE: 8101

PROJECT TERMINATION DATE: 8601

Evaluate chem-crete treated mixtures using sand asphalt mix and crushed stone mix over 5-year period. Visual observation of constructed sections, rutting measurements, skid resistance and smoothness (PCA roadmeter or mays meter). Quarterly and semi-annual reports.

49 1266874 EI8206046874

FIRST POST-TENSIONED CONCRETE RUNWAY OVERLAY.

Anon

Highw Heavy Constr v 124 n 6 Jun 1981 p 74, 76 CODEN: HHCODD ISSN: 0362-0506

The paper reports how a pair of 400-ft. -long, 150-ft. -wide post-tensioned concrete overlays are being constructed over old runway at Chicago O'Hare Airport in six 25-ft. -wide lanes. Concrete is mixed in haul truck's drum for four minutes after plasticizer is added to reach the equivalent of a six-in. slump before being dumped around post-tensioning ducts in front of screw-type spreader.

50 885361 PB82-136680

Flexible Pavement Overlay Design Procedures. Volume 2. User Manual

(Final rept. Sep 77-Nov 80)

Majidzadeh, Kamran ; Ilves, George

Resource International, Inc., Worthington, OH.

Corp. Source Codes: 074213000

Sponsor: Federal Highway Administration, Washington, DC.

Report No.: FHWA/RD-81/033

Aug 81 127p

See also Volume 1, PB82-136672.

Languages: English

NTIS Prices: PC A07/MF A01 Journal Announcement: GRAI8206

Country of Publication: United States
Contract No.: DOT-FH-11-9315
This user manual outlines a procedure for the design of asphaltic concrete overlays on existing asphaltic concrete pavement surfaces. It is intended as a guide to the user on the type and form of information required as input to the procedure and contains all elements necessary for the user to prepare designs for flexible pavement overlays.

51 899787 PB82-168386
Framework for a Pavement Evaluation System
Metwali, El-Sayed Wafa
Purdue Univ., Lafayette, IN. Joint Highway Research Project.
Corp. Source Codes: 009058023
Sponsor: Federal Highway Administration, Indianapolis, IN. Indiana Div.
Report No.: JHRP-81-7; FHWA/IN/JHRP-81/7
13 May 81 258p
Prepared in cooperation with Indiana State Dept. of Highways, Indianapolis.
Languages: English
NTIS Prices: PC A12/MF A01 Journal Announcement: GRAI8212
Country of Publication: United States
Contract No.: HPR-1(18)
This research was set up to develop procedures and techniques for conducting pavement condition surveys (using the Roadmeter, Dynaflect and Skid Tester) to collect pavement condition information needed as input to the pavement management system. In-service pavements including flexible, overlay, jointed reinforced concrete and continuously reinforced concrete pavements were evaluated. The primary pavement unit used in this research is the contract section of the ISHC. Two primary experiments were designed and evaluated. The first dealt with examining the seasonal changes in pavement properties. This included deflection data, roughness and skid resistance. Regression correlations were developed for predicting maximum deflection of asphalt pavements from summer and fall measurements. An investigation was made to examine the change in expected service life of the designed asphalt overlay as a function of the error in estimating representative deflection at different levels of traffic volumes. The second primary experience was concerned with examining variability of pavement properties along the highway contract sections.

52 910609 PB82-199928
Heavy Duty Membranes for the Reduction of Reflective Cracking in Bituminous Concrete Overlays
(Construction rept. Apr-Sep 81)
Hoffman, Gary L. ; Norman, P. E. ; Knight, E.
Pennsylvania Dept. of Transportation, Harrisburg. Office of Research and Special Studies.
Corp. Source Codes: 046235007
Sponsor: Federal Highway Administration, Harrisburg, PA. Pennyslvania Div.
Report No.: FHWA-PA-RD-79-6
Oct 81 58p
Languages: English
NTIS Prices: PC A04/MF A01 Journal Announcement: GRAI8216
Country of Publication: United States
Contract No.: HRP-79-6
The prevalence of reflective cracking in asphaltic concrete overlays is a major factor contributing to the premature failure of the pavement system. This reflective cracking is caused by cyclic stresses induced in the overlay by movements in the underlying pavement. Recent work done with heavy-duty membranes has shown that they may be useful in retarding this

reflective crack formation. Seven different types of heavy-duty membranes were placed over Portland Cement Concrete pavement joints at one site in Pennsylvania before the roadway was overlayed with asphaltic concrete. Control sections, without any membranes, were also built into the project for comparison purposes.

53 922073 PB82-221706

Improvements to the Materials Characterization and Fatigue Life Prediction Methods of the Texas Rigid Pavement Overlay Design Procedure

(Research rept.)

Taute, Arthur ; McCullough, B. F. ; Hudson, W. R.

Texas Univ. at Austin. Center for Transportation Research.

Corp. Source Codes: 043127093

Sponsor: Federal Highway Administration, Austin, TX. Texas Div.

Report No.: CTR-3-8-79-249-1; FHWA/TX-81/30-249-1

Nov 81 320p

Prepared in cooperation with Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div.

Languages: English

NTIS Prices: PC A14/MF A01 Journal Announcement: GRAI8221

Country of Publication: United States

This report presents certain improvements to the Texas Rigid Pavement Overlay Procedure (RPOD2) with regard to materials characterization and fatigue life predictions. Suggestions are made for characterizing rigid pavement layers from Dynaflect deflections and material tests, and some guidelines for selecting design sections along the length of a road are presented. Finite element analysis is used to quantify the effect of pavement discontinuities on the stresses obtained from layered theory. Further finite element analysis is used in an attempt to relate the critical reflection stresses in an AC overlay to deflection measurements obtained before overlaying.

54 360787 PR

LABORATORY EVALUATION OF ANTI-REFLECTION CRACKING MATERIALS

INVESTIGATORS: Jimenez, RA

PERFORMING ORG: Arizona University College of Engineering Transportation and Traffic Institute Tucson Arizona 85721

SPONSORING ORG: Arizona Transportation Research Center Arizona Department of Transportation; Federal Highway Administration Structures and Applied Mechanics Division

CONTRACT NO.: HPR-1-21(186); HP&R

SUBFILE: HRIS

PROJECT START DATE: 8108

PROJECT TERMINATION DATE: 8208

To characterize various materials that have been used or proposed to serve as a strain attenuating layer (to minimize reflective cracking in asphalt concrete overlays) utilizing tests that simulate field-induced stresses. These tests will be related to the need of meeting certain performance requirements such as resistance to wheel loadings, causing repeated vertical and horizontal stresses and to temperature shrinkage causing tensile stresses in the pavement system.

55 365742 DA

LONG TERM OBSERVATIONS OF PERFORMANCE OF EXPERIMENTAL PAVEMENTS IN OHIO

Majidzadeh, K; Elmitiny, R

Resource International, Inc., Worthington, OH.; Federal Highway Administration, Columbus, OH. Ohio Div.; Ohio Dept. of Transportation, Columbus.

Jul 1982 150p

AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

REPORT NO.: FHWA/OH-81/009; PB83-119982

SUBFILE: NTIS

This report presents long term evaluation data and analyses for eight (8) experimental pavement projects constructed in Ohio. The study projects include both rigid and flexible pavements and are scattered throughout the state. Pavement age is currently approaching 10 years for some projects. The pavements were extensively monitored and tested at the time of construction, and during 1979 and 1980 as part of this research study. Collected data included pavement condition rating (PCR) of visible distress, Dynaflect deflection, test properties of core and subgrade samples, and estimated remaining structural life and overlay requirements. Sponsored in part by Ohio Dept. of Transportation, Columbus.

56 360064 PR

MAINTENANCE METHODS FOR CONTINUOUSLY REINFORCED CONCRETE PAVEMENTS. (I-65, 5 MILES, EXPERIMENTAL REPAIR)

INVESTIGATORS: Yoder

PERFORMING ORG: Purdue University Executive Building West Lafayette Indiana 47907

SPONSORING ORG: Federal Highway Administration Structures and Applied Mechanics

CONTRACT NO.: 398; HP&R

SUBFILE: HRIS

PROJECT START DATE: 7506

PROJECT TERMINATION DATE: 8206

A CRCP built about 1970 is experiencing premature distress. Various rehabilitation techniques - subdrains, subsealing, patching, overlays and concrete shoulders will be used in different combinations and the performance of these actions will be statistically compared to controls. Reports available in the trb record 485 and ACI sp.

57 872591 PB82-107095

Mechanistic Interpretation of Nondestructive Pavement Testing Deflections

(Civil engineering studies (Interim))

Hoffman, M. S. ; Thompson, M. R.

Illinois Univ. at Urbana-Champaign. Dept. of Civil Engineering.

Corp. Source Codes: 034597031

Sponsor: Federal Highway Administration, Springfield, IL. Illinois Div.; Illinois State Dept. of Transportation, Springfield. Bureau of Materials and Physical Research.

Report No.: TRANSPORTATION ENGINEERING SER-32; UILU-ENG-81-2010; FHWA/IL/UI-190

Jun 81 262p

Report on Illinois Cooperative Highway and Transportation Research Program Ser-190. Sponsored in part by Illinois State Dept. of Transportation, Springfield. Bureau of Materials and Physical Research.

Languages: English

NTIS Prices: PC A12/MF A01 Journal Announcement: GRAI8201

Country of Publication: United States

Contract No.: IHR-508

A method is proposed for the backcalculation of material properties in flexible pavements based on the interpretation of surface deflection measurements. ILLI-PAVE, a stress-dependent finite element pavement model, was used to generate data for developing algorithms and nomographs for deflection basin interpretation. Twenty four different flexible pavement sections throughout the State of Illinois were studied. Deflections were measured using the Benkelman Beam, the IDOT Road Rater, the Falling Weight Deflectometer, and an accelerometer to measure deflections under moving trucks. Loading mode effects on pavement response were investigated. The factors controlling the pavement response to different loading modes are identified and explained. Correlations between different devices are developed. Good agreement is achieved between backcalculated material properties and laboratory determined properties. Agreement is also obtained between measured and predicted deflection basins. The backcalculated parameters derived from the proposed evaluation procedure can be used as inputs for asphalt concrete overlay design.

58 341661 PR

MIXTURE DESIGN FOR ACP OVERLAYS

INVESTIGATORS: Kennedy, TW

PERFORMING ORG: Texas University, Austin Center for Transportation Research Austin Texas 78712

SPONSORING ORG: Texas State Department of Highways & Public Transp; Federal Highway Administration

CONTRACT NO.: 3-9-82-318; Contract

SUBFILE: HRIS

PROJECT START DATE: 8109

PROJECT TERMINATION DATE: 8208

The proposed study is a one-year feasibility study with the follow objectives: (1) determine the causes, i.e., state of induced stress, environment, and possibly construction, of severe distress in asphalt mixture overlays; and develop research plan for future work.

59 **NEW LIFE FOR CONCRETE STREETS.**

Hawbaker, Lonnie D.

Public Works v 112 n 4 Apr 1981 p 46-49 CODEN: PUWOAH ISSN: 0033-3840

The paper presents a detailed outline of a major street restoration project using portland cement concrete bonded overlay.

60 369819 DA

NON-WOVEN FABRICS IN PAVEMENT OVERLAYS

Baker, GL

Multiscience Publications Limited 1253 McGill College, Suite 175 Montreal Quebec Canada 0-919868-16-9

Maine Department of Transportation

Nov 1981 Proceeding pp 176-183 1 Fig. 1 Tab.

SUBFILE: TRRL; IRRD; HRIS; RTAC

The inclusion of non-woven fabircs between the existing pavement and bituminous concrete overlays has enjoyed very limited success in minimizing reflective cracking on projects in the state of Maine. The inclusion of a non-woven fabric does result in less reflective cracking than if nothing were done except placing an overlay directly on the cracked pavement, but it does not appear that the non-woven fabircs are significantly more effective in preventing reflective cracking than what MDOT labels a stone chip seal, which consists of a track coat plus approximately 15 pounds per

square yard of stone chips. Since 1976 MDOT has included several different non-woven fabrics between badly cracked bituminous concrete pavements and bituminous overlays as well as between a jointed concrete pavement and a bituminous overlay. Crack surveys are made periodically after the overlay is completed which allows comparison of the rate of reflective cracking in the overlay with non-woven fabric to the rate of reflective cracking in the same overlay without non-woven fabric. Data included in this report summarize the percentage of reflective cracks in the overlay with non-woven fabric and in the overlay without fabric. (a) (TRRL) Proceedings of the 26th Annual Conference of the Canadian Technical Asphalt Association.

61 1260197 EI8205040197
OPTIMISATION OF HIGHWAY MAINTENANCE USING THE HIGHWAY DESIGN MODEL.
Potter, David; Hudson, W. Ronald
Aust Road Res v 11 n 1 Mar 1981 p 3-16 CODEN: ARDRAH ISSN: 0005-0164
This paper describes an investigation into the effect of the maintenance/overlay policy on the cost to the highway authority and the cost to the road user over a specified analysis period. Two-lane rural roads with a range of pavement structures, pavement conditions and traffic volume are considered. The Highway Design Model is used to estimate both authority and user costs under a range of maintenance/overlay policies. Policies which minimize cost of operation (authority cost plus user cost) are determined, together with the sensitivity of cost of operation to maintenance/overlay policy. A method for incorporating future uncertainties (traffic growth, monetary inflation and available funds) is included. Refs.

62 366840 DA
PAVEMENT DEFLECTION MEASUREMENTS: STATIC AND DYNAMIC
Bandyopadhyay, SS
Public Works Journal Corporation
National Soil Service, Incorporated
Public Works VOL. 113 NO. 1 Jan 1982 pp 48-49 5 Ref.
AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017
SUBFILE: EIT; HRIS
A comparison of static and dynamic methods of pavement deflection for the purpose of condition evaluation and overlay design is presented. The decision process for overlay design is presented diagrammatically.

63 883139 PB82-131384
Pavement Management and Rehabilitation of Portland Cement Concrete Pavements
Zegeer, Charles V. ; Agent, Kenneth R. ; Rizenbergs, Rolands L. ; Curtayne, P. C. ; Scullion, T.
Transportation Research Board, Washington, DC.
Corp. Source Codes: 044780000
Report No.: TRB/TRR-814
1981 79p
Paper copy also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, DC 20418.
Languages: English
NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI8205
Country of Publication: United States
The 11 papers in this report deal with the following areas: economic analyses and dynamic programming in resurfacing

project selection; implementation of an urban pavement management system; pavement performance modeling for pavement management; illustration of pavement management: from data inventory to priority analysis; rehabilitation of concrete pavements by using portland cement concrete overlays; pavement management study: Illinois tollway pavement overlays; resurfacing of plain jointed-concrete pavements; design procedure for premium composite pavement; model study of anchored pavement; prestressed concrete overlay at O'Hare International Airport: in-service evaluation; and, bonded portland cement concrete resurfacing.

64 921999 PB82-220724

Payment Rehabilitation Using Dynaflect Data

(Final rept.)

Teng., T. C.

Mississippi State Highway Dept., Jackson. Research and Development Div.

Corp. Source Codes: 012401001

Sponsor: Federal Highway Administration, Jackson, MI. Mississippi Div.

Report No.: STATE STUDY-59-3; FHWA-MSHD-RD-81-056

Jun 81 42p

Sponsored in part by Federal Highway Administration, Jackson, MI. Mississippi Div. Portions of this document are not fully legible.

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8221

Country of Publication: United States

The primary purpose of this study was to take deflection measurements from Mississippi highways and relationships between traffic index, equivalent wheel load, and pavement thickness developed by others and produce criteria for pavement overlay design applicable to Mississippi highways. The study resulted in overlay design criteria and a computer program that are now being used by the Mississippi State Highway Department.

65 334258 DA

PERFORMANCE OF THIN BONDED PORTLAND CEMENT CONCRETE OVERLAYS ON MILITARY AIRFIELDS

Boyer, RE; Foxworthy, PT; Highter, WH

Purdue University West Lafayette Indiana 47907

Air Force Engineering and Services Center; Clarkson College of Technology

Apr 1981 Proceeding pp 255-264 26 Fig. 3 Tab. 14 Ref.

SUBFILE: HRIS

The United States Air Force has more than 20 years of experience with thin bonded Portland cement concrete overlays--5.1 to 10.2 cm (2 to 4 in.) in thickness. The construction history and performance of 14 features (a feature being defined as a pavement cross-section of like construction) involving thin bonded overlays at four Air Force bases are discussed in this paper. The features range in age from 13 to 21 years and include both runways and aprons. Traffic on the thin bonded overlays ranged from high volume, lightweight fighter aircraft to moderate volume, very heavy cargo, tanker and bomber aircraft. The construction procedure followed for each of the thin bonded overlays was similar. The surface of the original pavement was scarified to a depth of not less than .6 cm (1/4 in.) and all loose material was removed. When necessary, the pavement was cleaned with a detergent, flushed, and then etched with muriatic acid. The surface was again flushed, and a grout .15 to .3 cm (1/16 to 1/8 in.) thick was applied to provide a bond. The overlay was then applied quickly before the grout could dry. In general,

the overlays have performed quite satisfactorily. Condition surveys indicate that after 17 years most features are in VERY GOOD condition, and the remaining are in GOOD condition. Problems encountered with the overlays can be traced to faulty constructon procedures. Most notably, allowing the grout to dry prior to overlay placement and failure to match joints in the overlay with the underlying pavement have resulted in loss of bond and reflection cracking, respectively. (Author) Proceedings of the 2nd International Conference on Concrete Pavement Design, held at Purdue University, April 14-16, 1981.

66 372577 DA
PORTLAND CEMENT CONCRETE HIGHWAY PAVEMENT DESIGN: STATE-OF-THE-ART REVIEW
Madugula, M; Yedavally, S
Indian Roads Congress
Windsor University, Canada; Harley Ellington Pierce Yee Associates
Indian Roads Congress, Journal of VOL. 42 NO. 2 Nov 1981 pp 307-326 2 Tab. 116 Ref.
SUBFILE: TRRL; IRRD; HRIS
This paper reviews the design and serviceability of various types of concrete pavements reported in the US literature. Concrete pavement distress and rehabilitation methods are also discussed. The review indicates that current research on portland cement concrete pavements is concerned with the development of mathematical models and computer programs for the mechanistic design of rigid pavements, overlays, and pavement management systems. Topics such as joint failures, load transfer, subbases, shoulders and drainage are also receiving considerable attention. (TRRL)

67 1396588 EI8307056588
PREPRINT VOLUME FOR THE NATIONAL SEMINAR ON PORTLAND CEMENT CONCRETE PAVEMENT RECYCLING AND REHABILITATION, 1981.
Anon
Transportation Research Board, Washington, DC, USA
Prepr Vol for the Natl Semin on Portland Cem Concr Pavement Recycling and Rehabil, St. Louis, Mo, USA, Sep 27-30 1981 Publ by Transportation Research Board, Washington, DC, USA, 1981 193p
Languages: ENGLISH
This National seminar proceedings contains 22 papers. The topics covered include: rehabilitation of concrete pavements; drainage for Portland cement concrete pavements; structural repair of joints in pavements; profile correction and surface retexturing; preparation of concrete pavement for overlay; costs and energy considerations; quality control of recycled Portland cement concrete; environmental concern in recycling; urban recycling of expressway pavements; rural road recycling; rehabilitation of airport runways; uses of recycled pavements. Technical and professional papers from this conference are indexed with the conference code no. 02180 in the Ei Engineering Meetings (TM) database produced by Engineering Information, Inc.

68 1225526 EI8201005526
PREVENTION OF REFLECTIVE CRACKING IN ARIZONA.
Way, George B.
Proc Paving Conf 18th, Univ of NM, Albuquerque, NM, Jan 7-9 1981. Publ by Univ of NM, Albuquerque, 1981 p 262-278 CODEN: PPCODL
The paper presents recommendations based on over seven years of careful planning, construction, and objective data

analysis. Five treatments were found to have significantly reduced reflective cracking. They are: asphalt-rubber membrane seal coat under ACFC; asbestos plus 3 percent asphalt; heater scarification with reclamite (surface recycling); asphalt-rubber membrane flushed into asphaltic concrete overlay; and 200/300 penetration asphalt. In addition, application considerations are discussed. Findings from the studies led to the use of thin overlays with special treatments. The thickness of these thin overlays varies from 19 mm to 90 mm. If significant cracking is present on the existing highway before overlay, a special treatment is employed. Treatments include either asphalt-rubber or heater scarification.

69 1262606 EI8205042606

REHABILITATION OF CONCRETE PAVEMENTS BY USING PORTLAND CEMENT CONCRETE OVERLAYS.

Barenberg, Ernest J.

Transp Res Rec 814 1981, Pavement Manage and Rehabil of Portland Cem Concr Pavements, Rep Presented at the Annu Meet of the Transp Res Board, 60th p 29-34 CODEN: TRREDM ISSN: 0361-1981

The limitations and constraints of the different types of portland cement concrete overlays are discussed and a possible decision-criterion approach is described for use in evaluating the best overlay alternative. 16 refs.

70 345352 DA

RESURFACING OF PLAIN JOINTED-CONCRETE PAVEMENTS

Tyner, HL; Gulden, W; Brown, D

Transportation Research Board

Georgia Department of Transportation

Transportation Research Record N814 1981 pp 41-45 1 Fig. 1 Tab.

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

In 1975, the Georgia Department of Transportation placed a 1-mile concrete overlay test section on I-85 north of Atlanta, which has a high volume of truck traffic. The test area consists of 7.6 cm (3-in) continuously reinforced concrete (CRC), 11.4-cm (4.5-in) CRC, 15.2-cm (6-in) CRC, and a 15.2-cm (6-in) portland cement concrete (PCC) overlay. The primary objective was to determine the performance of various concrete overlay systems over a faulted jointed-concrete pavement. Some 16 asphaltic concrete overlay sections that had various thicknesses and treatments were placed adjacent to the PCC section in 1976. The performance obtained to date has indicated the importance of treatment of the existing pavement prior to placement of an overlay. Stabilization of moving slabs, replacement of fractured slabs, and patching and spall repair of the existing pavement are essential to the performance of the overlay. In addition, a level platform must be provided by grinding at the joints or by placement of a leveling course to prevent the overlay from being locked into the existing pavement by the faulted joints. Both 15.2-cm CRC and PCC sections, which have 4.6-cm (15-ft) joint spacing, are performing well at this time. The 15.2-cm thickness of concrete overlay should be considered minimum for resurfacing over concrete when there is heavy truck traffic. The results from the asphaltic concrete test sections indicate that the use of a waterproofing membrane or fabric with a 10.2-cm (4-in) asphaltic concrete overlay will reduce the occurrence and the severity of reflection cracking from the underlying joints. (Author) This paper appeared in Transportation Research Record No. 814, Pavement Management and Rehabilitation of Portland Cement Concrete Pavements.

71 360173 PR

STATE-OF-THE-ART IN FLEXIBLE PAVEMENT SPECIFICATIONS

INVESTIGATORS: Gangopadhyoy

PERFORMING ORG: Sheladia Associates, Incorporated 4711 Sarvis Avenue Riverdale Maryland 20840

SPONSORING ORG: Federal Highway Administration Materials Division

CONTRACT NO.: 81-C-00053; Contract

SUBFILE: HRIS

PROJECT START DATE: 8105

PROJECT TERMINATION DATE: 8305

Study involves a critical assessment of the current flexible pavement specifications employed by state highway agencies. The study considers both full-depth flexible pavements and one-course overlays, and construction requirements as well as materials requirements. The general framework for performance-related flexible pavement specifications is to be developed.

1376630 EI8305036630

STRENGTH EVALUATION OF PAVEMENT LAYERS BY DIFFERENT TESTING TECHNIQUES.

Phadnavis, D. G.; Rao, P. S. K. M.; Ram, Agia; Vij, G. K.

Cent Road Res Inst, New Delhi, India

Highw Res Bull (New Delhi) n 15 1981 p 17-45 CODEN: HREBDK

ISSN: 0376-4788

Languages: ENGLISH

This paper deals with the in-place evaluation of pavement layers using three different methods such as plate bearing tests, Benkelman beam deflection tests and vibration method based on wave propagation principle. The data pertaining to granular layers are presented andd analyzed in this paper.

73 334273 DA

STRUCTURAL MAINTENANCE OF CEMENT CONCRETE PAVEMENTS ASSESSMENT OF PRESENT IDEAS--RESULTS OF FRENCH EXPERIMENTS

Verhee, F

Purdue University West Lafayette Indiana 47907

Department of Technical Studies of Rds & Motrwy,Fr

Apr 1981 Proceeding pp 421-430 9 Fig. 1 Tab. 7 Ref.

SUBFILE: HRIS

Portland cement concrete pavements in France are of the nonreinforced, nondoweled type and are subject to very heavy traffic. This paper deals with the maintenance of pavements built prior to 1974 and whose structure does not incorporate certain recent design features such as lateral drainage. The pavements concerned can be placed in four categories according to their structural condition (from good to very poor condition). There are three types of structure maintenance corresponding to these different conditions. These are described in the paper along with the specific maintenance techniques applicable to each category. (1) Routine maintenance designed essentially to ensure proper pavement sealing. (2) "Medium" structural maintenance involving such techniques as lateral drainage of slab edge, reconstruction of shoulder edge without drainage, grouting under slabs, improving load transfer at joints (by joint blocking or keying), bituminous overlays (thinner than or equal to 15 cm). (3) Heavy maintenance consisting either of thick bituminous overlays or reconstruction in portland cement concrete of degraded lane only. Only the load transfer improvement techniques are not yet operational. Maintenance techniques to be used are determined on the basis of observed pavement deterioration. The choice may be bituminous overlays which modify the pavement structure, or maintenance for correcting the defects while conserving a cement concrete structure. (Author) Proceedings of the 2nd International Conference on Concrete Pavement Design, held at Purdue University, April 14-16, 1981.

74 851459 PB81-200578

Summary and Recommendations for the Implementation of Rigid Pavement Design, Construction and Rehabilitation Techniques

(Final rept.)

McCullough, B. F. ; Hudson, W. R. ; Noble, C. S.

Texas Univ. at Austin. Center for Transportation Research.

Corp. Source Codes: 043127093

Sponsor: Federal Highway Administration, Austin, TX. Texas Div.; Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div.

Report No.: CTR-3-8-75-177-22F; FHWA/TX-81/2-177-22F

Mar 81 165p

Languages: English

NTIS Prices: PC A08/MF A01 Journal Announcement: GRAI8119

Country of Publication: United States

Contract No.: HPR-3-5-75-177

In order to explain observations of significantly different performances for many of the rigid pavements in Texas, a quantitative evaluation was required to relate distress mechanisms to distress manifestation and to develop better predictors of performance. In theory, if all variables influencing the performance of a pavement structure could be correctly evaluated in all possible combinations of their magnitude, duration, and probability of occurrence, it would be possible to predict their effects upon the pavement and thus produce an ideal design. Methods previously used for the design and analysis of rigid pavements originated from concepts which were severely limited by the broad assumptions on which they were based. The CTR staff had previously derived underlying principles concerning the mechanistic behavior of composite materials. This report describes how these principles were used in the development of improved concrete pavement and overlay design procedures. Maintenance and rehabilitation studies were performed concurrently using information collected from condition survey and surface profile measurements. This information was analyzed in depth in the development of distress prediction models and suitable criteria for use in rehabilitation decision making. The implementation of several innovative rehabilitation techniques is also described.

75 1092607 EI801292607

SUMMARY OF CONCRETE OVERLAYS.

Lopez, Robert V.

PCA, Denver, Colo

Proc Paving Conf 17th, Univ of NM, Albuquerque, 1980. Publ by Univ of NM, Dep of Civ Eng, Albuquerque, 1980 p 165-173

CODEN: PPCODL

Concrete pavement overlays are new concrete surfaces built over existing concrete pavements as well as bituminous pavements with flexible bases or old concrete pavements which have already had one or more bituminous overlays. Overlays of old concrete pavement may be bonded, partially bonded, or unbonded. The type of overlay and the thickness will vary and depend to a large extent on the type and condition of the existing pavement to be resurfaced. The paper discusses the various types of concrete overlays, including applications and limitations, and reports on a number of projects that have been in service for several years.

76 348099 DA

SURFACE MAINTENANCE OF LOW VOLUME ROADS, AN EXPERIENCE RECORD

Quinn, M; Quinn, P

Svenska Vaegfoereningen Box 27115 S-102 52 Stockholm Sweden

Berger (Louis) International, Incorporated

1981 pp 289-304 3 Fig.

SUBFILE: TRRL; IRRD; HRIS

The paper relates the experience of a country engineer in a semi-arid area in maintaining a network of gravel and asphalt surfaced roads. The recommended method of maintaining the gravel surface is weekly or bi-weekly grading to bring the loose material into a windrow along the shoulder in the dry season and slowly spreading it back onto the surface during the wet season. The section on recommendations for asphalt surface maintenance advises the use of a hot mix plant for maintenance operations and gives the method used to maintain about 400 kilometres of asphalt pavement. The men and equipment necessary to carry out these maintenance tasks are discussed, although they vary widely depending on the efficiency of the government unit. Those shown are the minimum number required. The paper stresses the importance of continual inspection of the system as the only real planning tool for routine maintenance. The equipment available for establishing the need for overlay or strengthening of the pavement is discussed and some sample results are shown in graph form. (TRRL) Papers from the 9th IRF World Meeting, Roads Into the Future--Road Maintenance--TS5, held in Stockholm, June 1-5, 1981.

77 342330 DA

TWO-COURSE BONDED CONCRETE BRIDGE DECK CONSTRUCTION, "CONDITION AND PERFORMANCE AFTER SIX YEARS"

Tyson, SS

Virginia Highway & Transportation Research Council P.O. Box 3817, University Station Charlottesville Virginia 22903; Virginia Department of Highways and Transportation 1221 East Broad Street Richmond Virginia 23219; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590

May 1981 Final Rpt. 46p

AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

REPORT NO.: FHWA/VA-81/50; VHTRC 81-R50;

CONTRACT NO.: 1662; HP&R

SUBFILE: HRIS

This report presents the findings from a six-year study of two-course bonded concrete bridge decks constructed in Virginia. Each of three special portland cement concretes was applied as an overlay, or wearing course, on two experimental spans. The overlays were a latex-modified, a low-water/cement and a wire-fiber concrete. Two spans constructed by a conventional single-lift technique on nearby structures with ordinary concrete served as controls for the study. The report summarizes the evaluation of the construction, concrete properties, condition, and performance of the eight study spans through 1980. The condition and performance of the study spans warrant the use of two-course bonded bridge deck construction in four primary applications cited in the recommendations of the report. The latex-modified and low-w/c concretes exhibited improved resistance to chloride ion penetration as compared to ordinary concrete, but the wire-fiber concrete did not. Suggestions are made concerning a quality assurance program for the latex-modified concrete and a program for monitoring such installations to determine the particular conditions that may predispose them to cracking. (FHWA)

78 1127482 EI810327482
ANALYSIS OF IN SITU GRANULAR-LAYER MODULUS FROM DYNAMIC ROAD-RATER DEFLECTIONS.
D'Amato, Paul A.; Witczak, Matthew W.
Univ of Md, College Park
Transp Res Board Transp Res Rec n 755 1980 p 20-30 CODEN: TRREDM ISSN: 0361-1981
The objective of the study described was to investigate the ability of elastic-layer theory coupled with nonlinear dynamic modulus tests to predict pavement deflections in a way comparable to dynamic road-rater deflection measurements on three highway sections in Maryland. An investigation was undertaken to determine whether the effect of shear strain was responsible for the decrease in granular-layer modulus. It was found that the granular-layer modulus decreases with increasing shear strain and that shear strain is proportional to surface deflection. 10 refs.

79 1092605 EI801292605
ASPHALT CRACK RELIEF LAYER.
Donnell, Richard K.
NM State Highw Dep, Albuquerque
Proc Paving Conf 17th, Univ of NM, Albuquerque, 1980. Publ by Univ of NM, Dep of Civ Eng, Albuquerque, 1980 p 153-156 CODEN: PPCODL
Reflective cracks are cracks in a new asphalt overlay or surface course that reflect the crack pattern in the pavement structure underneath in the old road. They are caused by vertical or horizontal movement in the pavement beneath the overlay. There are several methods that have been used in attempts to eliminate or minimize reflective cracking. This paper discusses a method $EM DASH$ the asphalt crack relief layer $EM DASH$ used recently on a contract construction project on Interstate 40 near Grants, New Mexico. The material, placed between the old pavement and the new overlay, consisted of three and a half inches of open graded hot mix which was produced from 100% crushed limestone aggregate and a viscosity graded bituminous material.

80 851255 PB81-197394
Asphaltic Concrete Overlays of Rigid and Flexible Pavements
(Final rept. Oct 70-Oct 80)
Kinchen, Richard W. ; Temple, William H.
Louisiana Dept. of Transportation and Development, Baton Rouge. Research and Development Section.
Corp. Source Codes: 051354002
Sponsor: Federal Highway Administration, Baton Rouge, LA. Louisiana Div.
Report No.: FHWA/LA-80/147
Oct 80 93p
See also PB-274 047.
Languages: English
NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI8119
Country of Publication: United States
Contract No.: HRP-69-3B
This study represents the development of a mechanistic approach to asphaltic concrete overlay thickness selection for overlays of flexible, rigid, and composite pavements. The procedure utilizes a deflection analysis to determine pavement rehabilitation needs. Design guides for selecting the overlay thicknesses are presented. Tolerable deflection-traffic load relationships and the deflection attenuation properties of asphaltic concrete have been developed, representing the subgrade support conditions and properties of materials used in Louisiana. All deflection measurements on asphaltic concrete have been corrected for the effect of temperature. Deflection measurements taken before and after overlay were also adjusted to minimize the effects of seasonal subgrade moisture variation.

81 808662 AD-A090 609/9
Bonded Concrete Overlays: Construction and Performance
(Final rept.)
Darter, Michael I. ; Barenberg, Ernest J.
Darter and Barenberg Consulting Engineers, Urbana, IL.
Corp. Source Codes: 071815000; 411987
Report No.: WES/MP/GL-80-11
Sep 80 131p
Languages: English
NTIS Prices: PC A07/MF A01 Journal Announcement: GRAI8104
Country of Publication: United States
Contract No.: DACA39-79-M-0124
Several bonded concrete overlays have recently been placed on street, highway, and airfield pavements using new equipment and techniques. This report summarizes the current state of the art and industry experience as well as reviewing procedures and performance of older bonded overlays. A review and summary of (a) surface preparation of the existing slab, (b) joint and crack treatment, (c) bonding methods, (d) concrete overlay mixtures, (e) curing methods, (f) jointing techniques, (g) performance of recent overlays to date, and (h) the use of reinforcement in bonded overlays are included. Also, a list of important conclusions and research needs is provided. (Author)

82 334743 DA
CONCRETE OVERLAY CUTS PAVING COSTS
McGraw-Hill, Incorporated
Engineering News-Record VOL. 205 NO. 24 Dec 1980 p 40
AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017
SUBFILE: EIT; HRIS
The paper reports how Utah's Department of Transportation has cut the cost of rebuilding deteriorating Interstate routes on a lifetime basis by using a 10-in concrete overlay instead of recycled asphalt. New surface is expected to need less maintenance than asphalt.

83 824802 PB81-132458
Concrete Pavements and Pavement Overlays
Elkins, Gary E. ; Roberts, Freddy L. ; Kennedy, Thomas W. ; McCullough, B. Frank ; Ma, J. C. M.
Transportation Research Board, Washington, DC.
Corp. Source Codes: 044780000
Report No.: TRB/TRR-756; ISBN-0-309-03070-6
1980 57p
Library of Congress catalog card no. 80-607869. Also pub. as ISSN-0361-1981.
Paper copy also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, DC. 20418.
Languages: English
NTIS Prices: PC A04/MF A01 Journal Announcement: GRAI8109
Country of Publication: United States
The 7 papers in this report deal with the following areas: material property requirements for zero maintenance of continuously reinforced concrete pavements; limiting criteria for the design of continuously reinforced concrete pavements; nomographs for the design of steel reinforcement in continuously reinforced concrete pavement; implementation of new overlay design procedure in Texas; prevention of reflective cracking in Arizona; dynamic surface deflection measurements on rigid pavements compared with the model of an infinite plate on an elastic foundation; and fatigue cracking of asphalt pavements.

84 1092606 EI801292606
CONCRETE RESURFACING OF LOW-VOLUME ASPHALT ROADS.
Renier, E. J.
PCA, Minneapolis, Minn
Proc Paving Conf 17th, Univ of NM, Albuquerque, 1980. Publ by Univ of NM, Dep of Civ Eng, Albuquerque, 1980 p 158-164 CODEN: PPCODL
This paper deals with resurfacing using portland cement concrete over existing asphaltic concrete low-volume roads. Twenty-two miles of this type of construction was completed on five projects in Iowa in 1977-78. On two projects complete removal of existing asphalt surface was required prior to repaving with portland cement concrete. On the other three, the existing asphalt surface was retained as the base for the new concrete resurfacing. This paper discusses procedures developed to establish and control grade and portland cement concrete overlay thicknesses in the three cases where the old asphalt pavement was retained.

85 1143019 EI810543019
DEVELOPING A FUNCTIONAL SUBSYSTEM OF OVERLAY DESIGN USING DYNAMIC DEFLECTIONS.
Bandyopadhyay, S. S.
DOT, Topeka, Kans
J Civ Eng Des v 2 n 4 1980 p 443-457 CODEN: JCEDDB ISSN: 0190-0684
An increasing proportion of the major highway networks built during the fifties and the sixties are reaching the end of their designed lives. The tremendous increase in the maintenance cost requires a reliable, efficient, economical and simple pavement evaluation and overlay design system to provide the technical support required for a pavement management system or maintenance planning. Utilizing the measurements of pavement the development procedure of a functional subsystem of pavement condition evaluation and overlay design is presented. The scheme utilizes empirical method and multilayered elastic theory as an integral approach complementary to each other. 18 refs.

311733 DA
86 **DEVELOPMENTS IN PAVEMENT MAINTENANCE**
Morgan-Grampian (Professional Press) Limited
Civil Engineering Jan 1980 3p 1 Tab.
SUBFILE: TRRL; IRRD; HRIS
Of the 20 M tons of asphalt mix and over 1.5 M tons of bitumen and binders used in the UK annually, some 70% is used in resurfacing or overlaying existing pavements. This existing resource or reserve of material must be made use of to minimise the cost of new materials. The article discusses required properties of surfacing courses as follows - stability, flexibility, durability and surface texture. The main methods of restoring the surface texture and riding qualities are described in the following sections: (1) surface dressing: a process susceptible to adverse weather conditions, (2) overlay - hot rolled or macadam surface, (3) plane and inlay hot rolled or macadam surface. Developments allow combined planing and overlay which makes use of part or all of the existing material. In the repairing process the existing bituminous pavement is heated, scarified and reprofiled, and the new overlay is then bonded to the existing material. The main benefit of both methods is the direct saving of material and associated savings in haulage costs. (TRRL)

87 325979 DA

DYNAMIC SURFACE DEFLECTION MEASUREMENTS ON RIGID PAVEMENTS COMPARED WITH THE MODEL OF AN INFINITE PLATE ON AN ELASTIC FOUNDATION

Bush, AJ, III

Transportation Research Board

Waterways Experiment Station

Transportation Research Record N756 1980 pp 33-43 11 Fig. 5 Tab. 15 Ref.

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

The purpose of this study was to develop relations by using the Hertz theory of an infinite plate on a dense fluid subgrade between deflections measured at the point of and away from an applied load and the strength parameters of the pavement. An evaluation procedure was to be developed based on these relations, known pavement characteristics, and dynamic response data collected with the U.S. Army Engineer Waterways Experiment Station (WES) 16-kip vibrator. Deflection relations were established by using a computer program (PCADL) developed by the Portland Cement Association. The deflections were related to the radius of relative stiffness (l), which is a characteristic length dependent on the rigidity of the plate. Maximum stresses were predicted by using the General Dynamics Corporation's H-51 program. From these stresses, a relation was developed between the dynamic stiffness modulus, l, and the allowable single-wheel aircraft load (ASWL). Both destructive and nondestructive vibratory data were collectd on 28 different pavments. Destructive data were used to characterize the pavement material properties and then, by using conventional procedures, to predict the ASWL. Deflection basin data from the WES 16-kip vibrator were used to measure l by using the relations developed from the PCADL program. The study concluded that non-destructive test data can be used with more confidence than previously developed procedures to predict l and ASWL as a function of l. This paper appeared in Transportation Research Record 756, Concrete Pavements and Pavement Overlays.

88 322251 DA

EVALUATION OF STRESS ABSORBING MEMBRANE INTERLAYER (SAMI) IN IDAHO

Herendeen, H

Idaho Department of Transportation P.O. Box 7129, 3211 State Street Boise Idaho 83707 IR-80N-1(70)37 IR-80N-2(25)82

May 1980 Final Rpt. v.p. Figs. Tabs. Phots. 3 App.

REPORT NO.: Project 76-03-13;

CONTRACT NO.: DOT-FH-15-191; Contract

SUBFILE: HRIS

From the evaluation, it was concluded that many of the pre-existing longitudinal cracks have not reappeared. Furthermore, none of the pre-existing "alligator" or "ladder" type cracks have reappeared, within the two years tht these projects have been evaluated. The developer of the asphalt-rubber Stress Absorbing Membrane Interlayer (SAMI) system of controlling reflective cracking claimed tht their system would control longitudinal and "alligator" or "ladder" cracking but the system would not control transverse temperature type cracking. Therefore, the SAMI performed as expected. There were "control test sections" placed on both projects that did not have the SAMI. These sections received the same plant mix overlay as was placed ove the SAMI. Most of the pre-existing transverse cracks present in these sections reappeared but several have not to this date. Therefore, it is recommended that Stress Absorbing Membrane Intelayers be used only if "alligator" or "ladder" type cracking is expected to be controlled. (Author)

89 839656 PB81-172504

An Evaluation of the Current California Method to Determine AC Overlay Thickness

(Final rept. 1974-80)

Mann, Gary W. ; Matthews, J. A. ; Webster, J. T.

California State Dept. of Transportation, Sacramento. Office of Transportation Lab.

Corp. Source Codes: 040609016

Sponsor: Federal Highway Administration, Sacramento, CA. California Div.

Report No.: TL-633169; FHWA/CA/TL-80/28

Jun 80 39p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8115

Country of Publication: United States

An evaluation was made of the present overlay design method (Test Method No. Calif. 356) by investigating projects that had been in place for ten years or failed prior to the planned ten year design life. The investigation consisted of a search of office files and field condition surveys. The findings of this study support the deflection analysis method of overlay design that was implemented by the Transportation Laboratory in 1969.

90 333292 PR

EXPERIMENTAL CONCRETE OVERLAYS

INVESTIGATORS: Woodstrom, JH

PERFORMING ORG: California Department of Transportation Transportation Laboratory 5900 Folsom Boulevard Sacramento California 95819

SPONSORING ORG: California Department of Transportation; Federal Highway Administration Structures and Applied Mechnics Division

CONTRACT NO.: F81TL03; HP&R

SUBFILE: HRIS

PROJECT START DATE: 8010

PROJECT TERMINATION DATE: 8407

Evaluate various bonded overlays to determine costs and performance characteristics. This study will provide cost and performance data on thin concrete overlays which can be used by design engineers as alternatives to AC overlays.

91 368584 DA

EXPERIMENTAL SECTIONS ON STATE HIGHWAY 28; PART II EXPERIMENTAL SECTIONS OF ASPHALTIC CONCRETE PAVEMENT

Brouwers, JA; Vanuwers, JA; Gerardu, JJA; Vos, LC

Rijkswaterstaat P.O. Box 20906 The Hague Netherlands

Rijkswegenbouwlaboratorium; Directie Gelderland

Jul 1980 Monograph 45p 15 Fig. 7 Tab. 18 Phot. Dutch

REPORT NO.: No. 33;

SUBFILE: TRRL; IRRD; HRIS

In order to establish criteria for the choice of types of pavement with a view to rational design, maintenance and management of state highways it was decided to construct some experimental sections. The construction consists of an asphalt overlay on a 17 year old existing pavement, of asphaltic concrete 0.10 M thick and a 0.20 M lean concrete base on a sand subgrade. The structural design of the overlays is based on AASHO and TRRL methods. A stretch of 2.0 km of pavement was made of a 0.04 M layer of open textured asphaltic concrete and a 0.04 M wearing course of dense asphaltic concrete. Another stretch of pavement, 2.2 km in length, was made of a 0.06 M layer of gravel asphaltic concrete, a 0.05 M basecourse of open textured asphaltic concrete, and a 0.04 M wearing course of dense asphaltic concrete. In the laboratory Marshall tests and wheel tracking tests were carried out on these bituminous mixes. Detailed descriptions of the preparation of the bituminous mixtures and the construction of the overlays are given. (TRRL)

92 1159418 EI810759418

FIELD COOLING RATES OF ASPHALT CONCRETE OVERLAYS AT LOW TEMPERATURES.

Eaton, R. A.; Berg, R. L.

US Army Cold Reg Res & Eng Lab, Hanover, NH

CRREL Rep n 80-30 Dec 1980 17 p CODEN: XCRPAP

Six overlay test sections were placed on an existing test road in Hanover, New Hampshire, to gain experience in compaction of asphalt pavements at rolling temperatures as low as 150 $degree$ F. Results of the overlay tests showed that computer-modeled cooling curves can be accurate predictors of the actual asphalt overlay cooling with time. The effects of temperature upon compaction were determined and it was found that nuclear gages, when used and calibrated properly, successfully monitored mix density changes during compaction. 7 refs.

93 341123 DA

A FIELD STUDY ON THE STRENGTHENING OF CEMENT CONCRETE PAVEMENTS WITH FLEXIBLE OVERLAYS

Dhir, MP; Mitter, J

Indian Roads Congress

Indian Roads Congress, Journal of VOL. 41 NO. 2 Dec 1980 pp 229-331 6 Fig. 9 Tab. 20 Phot. 17 Ref.

SUBFILE: TRRL; IRRD; HRIS

The Central Road Research Institute, in co-operation with the Public Works Department (buildings and roads) of Uttar Pradesh, constructed a test track in 1965 on a section of the grand trunk road near Aligarh for studying in-service performance of about fifty different flexible overlays consisting of granular layers, bituminous layers, and their combinations of varying total thickness. The old cement concrete pavement had a thickness of 7.5 cm with different degrees of structural integrity. The road was carrying a traffic of about 8000 tonnes in 1965 which had increased to about 20000 tonnes by 1979. The performance of the various overlay designs was observed during the 14-year trafficking period through 6-monthly observations of surface deflection,cracking and other performance features. Aspects of design,construction and performance of the various overlays tried are discussed. The aspect of relative initial and total costs is also covered for a fuller picture of imperatives of strengthening thin concrete pavements with flexible overlays. (Author/TRRL)

94 812210 AD-A090 827/7

Flexible Pavement Analysis

(Final technical rept. Dec 78-May 80)

Snaith, M. S. ; McMullen, D. ; Freer-Hewish, R. J. ; Shein, A.

Birmingham Univ. (England). Dept. of Transportation and Environmental Planning.

Corp. Source Codes: 004136029; 411995

May 80 211p

Languages: English

NTIS Prices: PC A10/MF A01 Journal Announcement: GRAI8105

Country of Publication: United Kingdom

Contract No.: DA-ERO-78-G-125; 1T161102BH57; 01

Part I describes the pavement analysis program DEFPAV. The development of pavement models for two sections of road is described in detail; they predict the values of transient deflection and rut depth growth. The use of the program in analyzing the effect of surface temperature on transient deflections is described. An investigation of the effect of crack propagation through a bituminous surface layer is also reported. Part II describes a method of overlay thickness selection for flexible pavements. A rational selection of bituminous overlay may be made with the aid of a transient deflection measurement and a single computational procedure which is suitable for use on a modern programmable calculation. (Author)

95 885360 PB82-136672

Flexible Pavement Overlay Design Procedures. Volume 1. Evaluation and Modification of the Design Methods

(Final rept. Sep 77-Nov 80)

Majidzadeh, Kamran ; Ilves, George J.

Resource International, Inc., Worthington, OH.

Corp. Source Codes: 074213000

Sponsor: Federal Highway Administration, Washington, DC.

Report No.: FHWA/RD-81/032

Aug 81 184p

See also Volume 2, PB82-136680.

Languages: English

NTIS Prices: PC A09/MF A01 Journal Announcement: GRAI8206

Country of Publication: United States

Contract No.: DOT-FH-11-9315

The objectives of this research report is to provide the pavement engineer with a rational and ready reference to design procedures for asphaltic concrete overlay of flexible pavements based on elastic layer theory. The design procedures and the analytical techniques presented have been formulated to predict the structural fatigue response of asphaltic concrete overlays for various design conditions, including geometrical and material properties, loading conditions and environmental variables.

96 834038 PB81-158958

Flexible Pavement Performance Evaluation Using Deflection Criteria

(Final rept.)

Wedner, R. J.

Nebraska State Dept. of Roads, Lincoln. Div. of Materials and Tests.

Corp. Source Codes: 012631001

Sponsor: Federal Highway Administration, Washington, DC.

Report No.: RESEARCH STUDY-73-4; R80-2(536); FHWA-RD-81-S01071

Apr 80 121p

Languages: English

NTIS Prices: PC A06/MF A01 Journal Announcement: GRAI8113

Country of Publication: United States

Flexible pavement projects in Nebraska have been monitored for dynamic deflections, roughness, and distress for six (6) consecutive years. The program provided needed characterization of present surface condition, and data for evaluating rehabilitation needs, including amount of overlay. From analysis of data, factors were isolated for (1) determining structural adequacy of flexible pavements; (2) evaluating existing pavement strength and soil subgrade conditions; and (3) determining overlay thickness requirements. Other objectives satisfied were (1) development of terms for evaluating structural condition for pavement sufficiency ratings, and (2) evaluation of existing soil support value and subgrade strength province maps.

97 337939 DA

FLORIDA ECONOCRETE TEST ROAD POST CONSTRUCTION AND MATERIALS REPORT

Page, GC; Harper, LW

Florida State Dept. of Transportation, Gainesville. Office of Materials and Research.; Federal Highway Administration, Washington, DC. Structures and Applied Mechanics Div.

Nov 1980 134p

AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

REPORT NO.: FL/DOT/OMR-80/221; FHWA/RD-S01096; PB81-200099

SUBFILE: NTIS

Design, construction, construction control, materials testing, and project administration of a research project evaluating the feasibility of constructing a two-course pavement system utilizing three strength levels of econocrete as a base layer in conjunction with thin pavement surfaces is presented. Monolithic and overlay composite construction and elastic jointed pavement techniques are discussed.

98 325977 DA
IMPLEMENTATION OF NEW OVERLAY DESIGN PROCEDURE IN TEXAS
Seeds, S; McCullough, BF; Hudson, WR; Gutierrez de Velasco, M
Transportation Research Board
Texas University, Austin
Transportation Research Record N756 1980 pp 23-29 12 Fig. 2 Tab. 5 Ref.
AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418
SUBFILE: HRIS
A project is under way in Texas to adapt a version of the rigid pavement overlay design procedure developed for the Federal Highway Administration by Austin Research Engineers, Inc., into standard Texas State Department of Highways and Public Transportation (SDHPT) practice. This project is part of a cooperative research program between Texas SDHPT and the Center for Highway Research at the University of Texas. This paper provides some feedback on the use of this procedure and documents its successful application to an interstate rehabilitation and widening project in San Antonio. This project was unique in the sense that thickness and reinforcement designs were required for five different composite pavement structures that, by their nature, are not suitable for design by past empirical methods. In documenting the designs, the selection of design criteria, characterization of material properties, and thickness design recommendations for each section within the project are discussed. The paper provides a general description of the design procedure, discussion of the results of the design, conclusions about the applicability of the design model, and recommendations for further work. The validity and practically of the new procedure, as well as its applicability for nationwide use, are noted. This paper appeared in Transportation Research Record 756, Concrete Pavements and Pavement Overlays.

99 807789 PB81-108797
Maintenance Methods for Continuously Reinforced Concrete Pavements
(Final rept.)
Yoder, Eldon J.
Purdue Univ., Lafayette, IN. Joint Highway Research Project.
Corp. Source Codes: 009058023
Sponsor: Federal Highway Administration, Indianapolis, IN. Indiana Div.; Indiana State Highway Commission, Indianapolis.
Report No.: JHRP-80-4; FHWA/IN/JHRP-80/4
14 May 80 53p
Sponsored in part by Indiana State Highway Commission, Indianapolis. See also report dated Feb 78, PB-286 376.
Languages: English
NTIS Prices: PC A04/MF A01 Journal Announcement: GRAI8103
Country of Publication: United States
Contract No.: HPR-1(17)
Research on CRCP has been active at Purdue University for the ISHC since 1971. In late 1975, test sections were constructed on a section of I-65 south of Indianapolis, Indiana to evaluate various maintenance techniques that might

be adopted for this type of pavement. The road was stratified into 'similar' sections using deflection, cracking and breakup as selection criteria. Maintenance methods used included concrete shoulders, undersealing, asphalt concrete overlay, subdrains at the pavement edge and various combinations of these methods. In every case the pavement was patched prior to installation of the maintenance. Performance surveys were made every spring and fall through spring of 1979. The concrete shoulders and subdrains did not reduce the occurrence of distress to this pavement. Undersealing was an effective means of maintaining the pavements. No failures attributable to the underlying CRC occurred on the overlay section during the test period.

100 1252578 EI8204032578

OPTIMIZATION OF THE THICKNESS DESIGN OF ASPHALT CONCRETE.

Molenaar, A. A. A.; Van Gurp, C. A. P. M.

Delft Univ of Technol, Neth

Proc Conf Aust Road Res Board v 10 Pt 2, 10th ARRB Conf, Pavements, Sydney, Aust, Aug 25-29 1980. Publ by Aust Road Res Board, Victoria, 1981 p 31-44 CODEN: PCABDH

This paper describes a procedure for the optimization of the thickness design of overlays for asphaltic concrete pavements. This procedure is based on linear relations which exist between the equivalent layer thickness on one hand and the horizontal tensile strain at the bottom of the asphalt layer or the compressive vertical strain at the top of the subgrade on the other. 5 refs.

101 318893 DA

PAVEMENT EVALUATION AND OVERLAY DESIGN USING VIBRATORY NONDESTRUCTIVE TESTING AND LAYERED ELASTIC THEORY. VOLUME I. DEVELOPMENT OF PROCEDURE

Weiss, RA

Army Engineer Waterways Experiment Station Vicksburg MS Geotechnical Lab; Federal Aviation Administration, Washington, DC. Systems Research and Development Service

Mar 1980 176p

AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

REPORT NO.: FAA-RD-77-186-VOL-1; AD-A087186/3

SUBFILE: NTIS

A procedure is developed for determining the allowable load-carrying capacities and the required overlay thicknesses of airport pavements. A layered elastic theory approach is used with vibratory nondestructive tests supplying the dynamic responses of pavements. For a given pavement, a computer program SUBE is used to determine the value of the subgrade Young's modulus from the measured dynamic responses, and a computer program PAVEVAL, which is based on the layered elastic theory, is used to calculate the allowable load-carrying capacity and the required overlay thickness. Limiting subgrade strains and horizontal stresses in pavement layers are used as criteria for determining load-carrying capacities and overlay thickness requirements. Single- and multiple-wheel loadings are considered. Volume II of this report presents a validation of these procedures for three airport sites. (Author)

102 326005 DA

PAVEMENT EVALUATION AND OVERLAY DESIGN USING VIBRATORY NONDESTRUCTIVE TESTING AND LAYERED ELASTIC THEORY. VOLUME II. VALIDATION OF PROCEDURE

Weiss, RA; Hall, JWJ

Army Engineer Waterways Experiment Station Vicksburg MS Geotechnical Lab; Federal Aviation Administration, Washington, DC. Systems Research and Development Service

May 1980 57p

AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

REPORT NO.: FAA-RD-77-186-VOL-2; AD-A087716/7

CONTRACT NO.: DOT-FA73WAI-377; Contract

SUBFILE: NTIS

A method of pavement evaluation and overlay design based on vibratory nondestructive testing and layered elastic theory was developed in Volume I of this report. Volume II validates this method by comparing it with the conventional methods of evaluation and overlay design for rigid and flexible pavements. Three airport sites were used for the validation. Results of the validation showed good agreement between allowable loads determined from the NDT-elastic theory method and the conventional standard method. However, there was poor agreement between overlay thickness requirements determined from the two methods. (Author) .See also volume 1, AD-A087 186.

103 814204 PB81-115297

Pavement Performance from Historical Data

(Final rept.)

Andersen, Donald A. ; Jorgenson, James L.

North Dakota State Univ., Fargo. Engineering Experiment Station.

Corp. Source Codes: 013171031

Sponsor: Federal Highway Administration, Washington, DC.; North Dakota State Highway Dept., Bismarck.

Report No.: FHWA-RD-80-S01038

Jun 80 86p

Sponsored in part by North Dakota State Highway Dept., Bismarck.

Languages: English

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI8105

Country of Publication: United States

Contract No.: HPR-3-79(B)

Historical performance data in terms of useful pavement life and surface condition were related to loading conditions, paving materials, and subgrade strength. The computer program 'Statistical Analysis System' (SAS) was used to explore the relationships which existed within the data. Pavement performance was evaluated in either one of two ways. For roadways which had been overlaid, the performance characteristic was taken as the useful life of the roadway between construction and overlay. For roadways which had not been overlaid since construction, the pavement surface condition parameters of roughness, cracking, and a combined rating were used to evaluate pavement performance. Some of the results of this research effort were as follows. The deterioration of pavements in North Dakota is more directly related to the age of the pavement than to the daily axle loadings or soil subgrade strength. This may be related to another finding that actual pavement life usually exceeded design life. An interesting outcome of the research which was not totally explainable was that pavements in the eastern Highway Department districts had considerably less cracking than those in the western part of the state.

104 811883 PB81-117970

Pavement Structure Evaluation of Alaskan Highways

(Final rept.)

McHattie, Robert ; Connor, Billy ; Esch, David

Alaska Dept. of Transportation and Public Facilities, Juneau.

Corp. Source Codes: 060726000

Sponsor: Federal Highway Administration, Juneau, AK. Alaska Div.

Report No.: FHWA-AK-RD-80-1

Mar 80 215p

Languages: English

NTIS Prices: PC A10/MF A01 Journal Announcement: GRAI8104

Country of Publication: United States

Contract No.: HPR-F09152

A three year study was implemented to review the construction and performance of pavement structures in Alaska. One hundred twenty uniform pavement sections were chosen and characterized by fatigue (alligator) cracking, thermal cracking, roughness of ride and peak springtime deflection levels. Sections were distributed throughout each principle climatic zone within the state. Materials were sampled to a depth of 54 inches and analyzed to determine their relationships to pavement performance. Results indicate correlations between soil fines content and several of the performance factors. Performance relationships were also found involving asphalt concrete thickness, pavement age and accumulated traffic loadings. Climate variables showed little correlation with performance except with major transverse thermal cracks. Deficit thickness-design requirements based on both supporting soils stability (R-value) and frost susceptability were compared with performance for a number of locations. While a trend was observed between existing overlay deficit and performance, the extra materials required by present Alaskan design methods apparently led to overly conservative structures in many cases. Alaska's pavement rating system was also correlated with a more conventional 'PSI' method as developed by New York State.

105 794121 PB80-213069

Performance of a Continuously Reinforced Concrete Overlay

(Final rept. Jul 75-Feb 80)

Bowers, David G.

Connecticut Dept. of Transportation, Wethersfield. Bureau of Planning and Research.

Corp. Source Codes: 029800004

Sponsor: Federal Highway Administration, Hartford, CT. Connecticut Div.

Report No.: 395-4-80-2; FHWA-CT-RD-395-4-80-2

Apr 80 35p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8024

Country of Publication: United States

Contract No.: HPR-395

The four-and-one-half-year performance of a 6-inch CRC overlay placed on two different underlying materials and a contiguous 8-inch CRC land newly constructed for purposes of widening is assessed. The design of the pavement incorporates nonaligned longitudinal joints between the old and new concrete. Transverse crack widths and spacings are determined for the various pavement lanes. Longitudinal cracking is assessed and a description of all types of defects is given. Conclusions are drawn and recommendations formulated on the basis of observation and condition surveys.

106 325978 DA

PREVENTION OF REFLECTIVE CRACKING IN ARIZONA

Way, GB

Transportation Research Board

Arizona Department of Transportation

Transportation Research Record N756 1980 pp 29-32 1 Tab. 4 Ref.

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

This report represents the culmination of more than seven years of careful planning, construction,and objective data analysis. The results should be of value to federal, state and local agencies concerned not only with the restoration of existing roadways but also with new highway construction. The recommendations contained herein refer to overlays--in particular, thin overlays of 102 mm (4 in) or less placed over existing badly cracked, rutted, or otherwise distorted bituminous pavements. Overlaying can also immprove skid resistance or rideability. However, no one treatment is a cure all for all roadway conditions. Rather, the recommended crack-preventing treatments should be integrated into a total overlay design that is carefully tailored to the nature of the distress. Five treatments have significantly reduced reflective cracking: (a) asphalt-rubber membrane seal coat under asphalt concrete finishing course (ACFC), (b) asbestos plus 3 percent asphalt, (c) heater as scarification with reclamite (surface recycling), (d) asphalt-rubber membrane flushed into asphaltic concrete overlay, and (e) 200/300 penetration asphalt. Application considerations are as follows: (a) one of the preceding treatments should be used in conjunction with a thin overlay of 102 mm (4 in) or less of asphalt concrete (AC), (b) application of an asphalt-rubber membrane seal coat under the AC or ACFC should be used with chips to provide direct transfer of vertical loads, (c) heater scarification should be to a depth of 19 mm (0.75 in) or more, and (d) the lowest possible viscosity AC asphalt with the slowest aging characteristics should be used. Findings from this project led to the use of thin overlays with special treatments. The thickness of these thin overlyas varies from 19 mm (0.75 in) to 90 mm (3.5 in). If significant cracking appears on the existing highway before overlay, a special treatment is used. Treatments include either asphalt-rubber or heater scarification. This paper appeared in Transportation Research Record 756, Concrete Pavements and Pavement Overlays.

107 343037 DA

PROCEEDINGS OF THE CONTINUOUSLY REINFORCED CONCRETE PAVEMENT WORKSHOP HELD AT NEW ORLEANS, LOUISIANA ON FEBRUARY 15 AND 16, 1978

Louisiana Dept. of Transportation and Development, Baton Rouge. Office of Highways.; Federal Highway Administration, Washington, DC.

Jun 1980 259p

AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

REPORT NO.: FHWA-TS-80-231; PB81-203820

CONTRACT NO.: DOT-FH-11-8852; Contract

SUBFILE: NTIS

This report contains all of the papers presented at a workshop on Continuously Reinforced Concrete Pavements (CRCP) which was held in New Orleans, Louisiana. The information presented at the workshop covered all aspects of CRCP including design, construction, and maintenance procedures. The primary emphasis was concentrated on maintenance procedures. The proceedings include papers on polymer patching, under sealing, and flexible and rigid overlays.

108 1092602 EI801292602

PROCEEDINGS OF THE PAVING CONFERENCE, 17TH, 1980.

Martinez, J. E. (Ed.)

Univ of NM, Dep of Civ Eng, Albuquerque

Proc Paving Conf 17th, Univ of NM, Albuquerque, 1980. Publ by Univ of NM, Dep of Civ Eng, Albuquerque, 1980 173 p CODEN: PPCODL

The proceedings contains 16 papers presented at the Conference, 13 of which are indexed separately. Among the subjects covered are pavement management related to materials, finance and manpower shortages, analysis of overturning crashes, highway construction zone safety, structural strength of pavements with open-graded bases, shale oil asphalts and mixtures, asphalt crack relief layers, asphalt and concrete overlays, and others.

109 333458 PR

RATIONAL METHOD FOR ANALYSIS OF PORTLAND CEMENT CONCRETE PAVEMENTS

INVESTIGATORS: Sharpe, GW; Southgate, HF

PERFORMING ORG: Kentucky Transportation Research Program Kentucky University Bureau of Highways, Div of Research, 533 South Limestone Lexington Kentucky 40508

SPONSORING ORG: Kentucky Department of Transportation; Federal Highway Administration Structures and Applied Mechanics Division

CONTRACT NO.: HYHPR-80-86; HP&R

SUBFILE: HRIS

PROJECT START DATE: 8101

PROJECT TERMINATION DATE: 8312

The objectives are (1) to use elastic theory to simulate road rater deflection measurements of portland cement concrete pavements, (2) to develop a procedure for evaluating portland cement concrete pavements using dynamic (road rater) deflections, (3) to incorporate the evaluation procedure into an overlay design procedure, (4) to confirm the evaluation procedure through empirical correlation with field mesured deflections, (5) to compare the analyses procedures developed in this study with evaluation procedures which have been developed by other organizations.

110 789166 PB80-200892

Reduction of Reflection Cracking in Bituminous Overlays on Rigid Pavements

(Interim rept. no. 2)

Noonan, James E. ; McCullagh, Frank R.

New York State Dept. of Transportation, Albany. Engineering Research and Development Bureau.

Corp. Source Codes: 023175003

Sponsor: Federal Highway Administration, Albany, NY. New York Div.

Report No.: NYSDOT-ERD-80-RR-80; FHWA/NY/RR-80/80

Jun 80 23p

Languages: English

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8022

Country of Publication: United States

Contract No.: NYSDT-35-1

This report describes attempts to control reflection cracking in bituminous overlays on rigid pavements. Three methods are discussed -- breaking the rigid pavement before overlaying, sawing joints in the overlay over those in the rigid pavement, and placing fiber-mesh mats over rigid pavement joints and cracks to dissipate local stress through the overlay. The results indicate that broken pavement and sawed joints are generally successful, but that mesh mats do very little to control reflection cracking. The feasibility and effectiveness of the three methods are compared.

111 910296 PB82-194820
Reflection Cracking Treatments - Alameda Avenue
(Final rept.)
LaForce, Robett F. ; Swanson, Herbert N. ; Donnelly, Denis E.
Colorado State Dept. of Highways, Denver. Div. of Transportation Planning.
Corp. Source Codes: 006687004
Sponsor: Federal Highway Administration, Washington, DC.
Report No.: CDOH-DTP-R-80-11; FHWA-RD-80-S01206
Oct 80 33p
Languages: English
NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI8216
Country of Publication: United States
This report describes the construction, testing, and performance of a crumb rubber-asphalt mixture used as a stress absorbing membrane interlayer and also Petromat to control reflection cracking on an urban highway. Test sections included the SAMI, Petromat, and standard overlay. The center portion of this road consisted of previously overlaid concrete pavement while the outside lanes were originally constructed of asphalt pavement with aggregate base. Findings indicate only fair performance in controlling linear cracking on the overlaid concrete and acceptable performance was not obtained from either treatment on the overlaid asphalt areas due to base problems.

112 333436 PR
RETARDATION OF REFLECTION CRACKING USING STABILIZING ADDITIVE 5990
INVESTIGATORS: Shelquist, RA
PERFORMING ORG: Iowa Department of Transportation Highway Division 800 Lincoln Way Ames Iowa 50010
SPONSORING ORG: Iowa Department of Transportation Highway Division
CONTRACT NO.: HR-222; Contract
SUBFILE: HRIS
PROJECT START DATE: 8007
PROJECT TERMINATION DATE: 8507
To evaluate the use of Asphalt Concrete Stabilizing Additive 5990 as a method of reducing reflective cracking in asphalt concrete overlays.

113 1243236 EI8203023236
SIMPLIFIED STRUCTURAL ANALYSES OF FLEXIBLE PAVEMENTS FOR SECONDARY ROADS BASED ON ILLI-PAVE.
Figueroa, Jose L.; Thompson, Marshall R.
Univ of Miami, Coral Gables, Fla, USA
Transp Res Rec 766 1980 p 5-10 CODEN: TRREDM ISSN: 0361-1981
A procedure based on the results of a stress-dependent finite-element computer model and used to calculate the resilient response parameters of conventional flexible pavements subjected to traffic loads is presented. Flexible pavements composed either of a granular base protected by a surface treatment or of an asphalt-concrete surface layer and a granular base are considered. Asphalt-concrete surface-layer thickness, base thickness, modulus of elasticity of the asphalt concrete, and subgrade resilient modulus at the break point are discussed. 8 refs.

114 1093461 EI801293461
STRETCHING YOUR ROAD MAINTENANCE DOLLAR.
Sandwick, Robert K.
Asphalt Inst, Long Beach, Calif
Proc Paving Conf 17th, Univ of NM, Albuquerque, 1980. Publ by Univ of NM, Dep of Civ Eng, Albuquerque, 1980 p 13-18
CODEN: PPCODL
This paper addresses the concept of reducing maintenance costs of asphalt pavements by proper design, construction and maintenance decisions. Design aspects emphasize proper methods to determine gradation and asphalt content. Construction discussions include proper laydown and compaction methods to achieve longevity of pavement life with minimal maintenance needs. Various maintenance methods include selection of proper maintenance procedures. Discussed are fog seals, slurry seals, overlay design and crack retention methods including surface recycling, pavement fabrics and slurry seal tack coats.

115 325022 DA
SUMMARY OF CONCRETE OVERLAYS
Lopez, RV
New Mexico University, Albuquerque Department of Civil Engineering Albuquerque New Mexico 87131 PPCODL
1980 pp 165-173
AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017
SUBFILE: EIT; HRIS
Concrete pavement overlays are new concrete surfaces built over existing concrete pavements as well as bituminous pavements with flexible bases or old concrete pavements which have already had one or more bituminous overlays. Overlays of old concrete pavement may be bonded, partially bonded, or unbonded. The type of overlay and the thickness will vary and depend to a large extent on the type and condition of the existing pavement to be resurfaced. The paper discusses the various types of concrete overlays, including applications and limitations, and reports on a number of projects that have been in service for several years. Proceedings of the 17th Paving Conference, University of New Mexico, Albuquerque, New Mexico.

116 333469 PR
THIN-BONDED PCC RESURFACING
INVESTIGATORS: Temple, WH
PERFORMING ORG: Louisiana Dept of Transportation & Development P.O. Box 44245, Capitol Station Baton Rouge Louisiana 70804
SPONSORING ORG: Louisiana Dept of Transportation & Development; Federal Highway Administration Department of Transportation
CONTRACT NO.: 80-3P(B); HP&R
SUBFILE: HRIS
PROJECT START DATE: 8004
PROJECT TERMINATION DATE: 8504
The purpose of this study is to evaluate the constructibility and performance of a one-mile thin-bonded PCC overlay. Pre-overlay and post-overlay data will include a pavement condition survey and a determination of the structural and functional adequacy (Dynaflect Device and Mays Ride Meter) of the pavement. The post-overlay will also include the acquisition of concrete cores and determination of the PCC resurfacing thickness and bond shear strength, as well as the other strength and durability tests.

117 784817 AD-A085 851/4

Use of Fabrics and Other Measures for Retarding Reflective Cracking of Asphaltic Concrete Overlays

(Final rept.)

Jackson, Ralph D.

Army Engineer Waterways Experiment Station; Vicksburg, MS. Geotechnical Lab.

Corp. Source Codes: 002621007; 411412

Sponsor: Federal Aviation Administration, Washington, DC. Systems Research and Development Service

Report No.: WES/MP/GL-80-2; FAA/RD-80/8

Mar 80 22p

Languages: English

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8021

Country of Publication: United States

Contract No.: DOT-FA78WAI-837

Prevention or control of reflection cracks in asphaltic concrete overlays has been a problem from the inception of this type of construction. The many different treatments that have been tried in an effort to solve this problem are: (1) reinforcement within and below the overlay, (2) bond breakers, (3) stress-relieving layers, (4) asphalt-mix additives, and (5) placement of fabrics between the existing pavement and the overlay. At the present time, no treatment has been tried that will completely prevent the formation of reflection cracks. Some treatments do delay the formation of cracks, while others do not appear to help at all. Indications are that fabrics do have some beneficial effects, such as a moisture barrier, even though the overlays develop reflection cracks. The fabrics that have been tried for the control of reflection cracks included: (1) Petromat, (2) Bidim, (3) Typar, (4) Cerex, (5) Mirafi, (6) Structofors, (7) Bituthene, (8) Protecto-Wrap, and (9) Fiberglass. Asphalt-rubber interlayers, as formulated by the Arizona Refining Company and the Sahuaro Petroleum Company, show promise in retarding reflection cracks. (Author)

118 301092 DA

ANALYTICAL STUDY OF MINIMIZATION OF REFLECTION CRACKING IN ASPHALT CONCRETE OVERLAYS BY USE OF A RUBBER-ASPHALT INTERLAYER

Coetzee, NF; Monismith, CL
Transportation Research Board
California University, Berkeley

Transportation Research Record N700 1979 pp 100-108 16 Fig. 2 Tab. 5 Ref.
AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418
SUBFILE: HRIS

The problem of the reflection cracking that is associated with the rehabilitation of existing cracked pavements by the application of an overlay is considered. A general-purpose finite-element program was used to determine the stresses in the overlay at the discontinuities in the underlying pavement, focusing on the effect of a rubber-asphalt stress-absorbing-membrane interlayer on these stresses. A number of variables--the thickness and stiffness of the overlay, interlayer, cracked layer, and subgrade as well as the crack width--were investigated for a specific load condition. It is shown that, under certain conditions, the inclusion of an interlayer membrane will significantly reduce the crack-induced stresses in the overlay and, hence, by inference, the probability of reflection cracking. Most of the analyses were directed at traffic-load-associated stresses, but a single thermal-stress analysis indicated that an interlayer is effective in reducing these stresses also. /Author/ This paper appeared in TRB Research Record No. 700, Pavement Evaluation and Overlay Design: A Symposium and Related Papers.

119 301093 DA

ATTEMPTS TO REDUCE REFLECTION CRACKING OF BITUMINOUS CONCRETE OVERLAYS ON PORTLAND CEMENT CONCRETE PAVEMENTS

McGhee, KH
Transportation Research Board
Virginia Highway & Transportation Research Council

Transportation Research Record N700 1979 pp 108-114 5 Fig. 4 Tab. 4 Ref.
AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418
SUBFILE: HRIS

Studies of methods used in Virginia to reduce the incidence of reflection cracking when portland cement concrete pavements or bases are overlaid with asphalt concrete are reported. The methods discussed are (a) the use of sand to break the bond between the portland cement concrete pavement and the asphalt overlay and (b) the use of a fabric that has a high tensile strength as a stress-relieving layer between the asphalt layer and the concrete base. The studies showed that neither the sand bond breaker nor the high-strength fabrics are effective in reducing reflection cracking where differential vertical joint movements are a significant factor. Further studies showed that high-strength fabrics can delay the onset of reflection cracking but that such cracking will eventually develop under the application of repetitive wheel loadings. /Author/ This paper appeared in TRB Research Record No. 700, Pavement Evaluation and Overlay Design: A Symposium and Related Papers.

120 731349 PB-298 876/4

Construction of an Ice-Retardant Overlay

(Research rept.)

Nittinger, Robert J.

New York State Dept. of Transportation, Albany. Engineering Research and Development Bureau.

Sponsor: Federal Highway Administration, Albany, NY. New York Div.

Report No.: RR-79-72; FHWA/NY-79/RR/72

Jun 79 28p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7924

Contract No.: NYSDT-143-1

Among the most dangerous highway hazards is the formation of ice. It forms when moisture is present as the temperature drops below freezing. During icing, maintenance crews spread heavy applications of salt, which forms a strong sodium-chloride solution having a severe corrosive effect on reinforcing steel, bridge superstructures, and automobiles. A proprietary asphalt additive has been developed and tried in Europe to alleviate these conditions. Basically an encapsulated calcium chloride, it is introduced into asphalt concrete during mixing and is released by the action of traffic. In theory, the pavement wears gradually, continually exposing additional capsules. This is an interim report covering problems encountered in batching operations and laboratory testing, in addition to documenting construction procedures, skid resistance, and overall pavement appearance. It was found that automated batching could not be used because the additive was held in the mineral filler bin and added after the introduction of bitumen. Manual batching thus was required. Due to the additive's hygroscopic state, laboratory test results were erratic. No unusual problems were found during construction; the pavement became oily in appearance, but tests produced adequate skid numbers, and after two rainstorms and heavy traffic the pavement appeared dry.

121 308880 DA

CONTINUOUS REINFORCED CONCRETE (CRC) OVERLAY EXPERIMENT AT HORNDEAN

Seymour, M

Cement and Concrete Association

Concrete Vol. 13 No. 11 Nov 1979 pp 12-14 3 Fig. 1 Tab. 7 Phot.

SUBFILE: TRRL; IRRD; HRIS

This improvement of an existing carriageway was carried out over a 1.8 km stretch of the A3 London-Portsmouth road. A description is given of the preparatory work, and the widening of the existing carriageway to receive the 9 M wide paver. The concrete overlay is without preformed joints or breaks in reinforcement for expansion jointing. Details are given of the offset longitudinal joint and the universal beam transverse joints at the ends of the experimental section. The author describes the train of concreting equipment, which included a specially adapted Guntert and Zimmerman slipform paver. The placing and folding of reinforcement for vehicle access is explained. A control section of bituminous material is to be laid at the northern end of the job. The specified air entrained concrete was transported to site in conventional truck mixers. (TRRL)

122 726052 PB-298 258/5

Establish Criteria for Rehabilitation of California Pavements

(Final rept. 1973-78)

Murray, Brian D.

California State Dept. of Transportation, Sacramento. Office of Transportation Lab.

Sponsor: Federal Highway Administration, Sacramento, CA. California Div.

Report No.: TL-633502; FHWA/CA/TL-78/36

Feb 79 68p

Languages: English

NTIS Prices: PC A04/MF A01 Journal Announcement: GRAI7922

Roadway condition records of various pavement treatments such as sand seals, screening seals, thin asphalt concrete blankets and structural overlays were evaluated to determine the treatments service lives. Roadways included in the study were those receiving the treatments during the periods 1965 to 1975. Service life for asphalt concrete pavements were generally based on the extent of alligator type cracking while for the small number of overlays over portland cement concrete, reflective crackling was the criteria.

123 848566 PB81-193856

An Evaluation of In-situ Elastic Moduli from Surface Deflection Basins of Multilayer Flexible Pavements: A Study of Flexible Pavement Base Courses and Overlay Designs, Second Cycle of Research at the Pennsylvania Research Facility

(Final rept.)

Anani, B. A. ; Wang, M. C.

Pennsylvania Transportation Inst., University Park.

Corp. Source Codes: 060387000

Sponsor: Federal Highway Administration, Harrisburg, PA. Pennsylvania Div.; Pennsylvania Dept. of Transportation, Harrisburg.

Report No.: PTI-7923; FHWA/PA-80/009

Nov 79 154p

Sponsored in part by Pennsylvania Dept. of Transportation, Harrisburg.

Languages: English

NTIS Prices: PC A08/MF A01 Journal Announcement: GRAI8118

Country of Publication: United States

Contract No.: HPR-75-2

Determination of in-situ modulus is an essential step in the nondestructive structural evaluation of flexible pavements. The research herein was undertaken to develop a method for evaluating the in-situ modulus of each pavement constituent layer by using surface deflection basins. The elastic layer theory and the Gaussian method of elimination were used to formulate surface deflection in terms of elastic modulus, load intensity, and layer thickness. The resulting equations were very complex, so that it was impossible to compute layer modulus directly from surface deflection basins. These equations, however, were used to analyze the effect of changing layer modulus on the surface deflection. On the basis of this analysis, a computer program for calculating in-situ modulus values from Road Rater deflection basins was developed, essentially by incorporating iteration procedures into the BISAR computer program. Using the developed computer program, the in-situ modulus of each pavement constituent layer of some of the experimental pavements at the Pennsylvania Transportation Research Facility was computed. The effect of various influencing factors on the in-situ moduli was investigated.

124 737188 PB-301 305/9

Evaluation of the Effectiveness of Fabric Reinforcement in Extending the In-Service Life of Bituminous Concrete Overlays

(Final rept.)

Mullen, W. G. ; Hader, Robert J.

North Carolina State Univ. at Raleigh. Highway Research Program.

Corp. Source Codes: 055200007

Sponsor: Federal Highway Administration, Raleigh, NC. North Carolina Div.

Report No.: ERSD-110-71-5; FHWA/NC-79/001

Jul 79 80p

Prepared in cooperation with North Carolina State Dept. of Transportation, Raleigh.

Languages: English

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI7926

Contract No.: HPR

Included in this final report is the description of tests of fabric and non-fabric treated overlays of a jointed unreinforced portland cement concrete pavement on US 70 in Orange County, North Carolina. Treatment of the overlays were for the purpose of determining their effectiveness in preventing or reducing reflection of joints and cracks in the original pavement through the 2 inch bituminous concrete overlay in an attempt to extend the service life of the overlay. Four continuous fabric and four strip fabric treatments were used in addition to four non-fabric treatments, one of which was the regular two inch I-2 overlay used for conrol. The fabric were three woven or non-woven polymeric materials and one of woven fiberglass. The four non-fabric treatments consisted of a surface treatment type mat course, a plant mixed mat coat, an opengraded mix course laid directly on the old pavement and covered with the I-2 mix, and the I-2 mix used for control. The test site was divided into six blocks with each of the twelve treatments repeated in each block. Total site is 3.5 miles long with each individual treatment 510 feet long.

715134 AD-A067 986/0

125 **Evaluation of the Effectiveness of Membranes for Prevention of Crack Reflection in Thin Overlays**

(Miscellaneous paper)

Vedros, Jr, Philip John

Army Engineer Waterways Experiment Station Vicksburg MS

Corp. Source Codes: 038100

Report No.: WES-MP-GL-79-4

Mar 79 148p

Languages: English

NTIS Prices: PC A07/MF A01 Journal Announcement: GRAI7918

This report is an interim report resulting from case studies of pavement performance conducted by the U. S. Army Engineer Waterways Experiment Station under contract order with the U. S. Army Forces Command. The purpose of this study was to determine if a stress-absorbing layer consisting of an asphalt-rubber membrane or a nonwoven fabric placed under a thin asphaltic concrete overlay (2 in. or less) will stop reflection cracking from occurring in the overlay. Field tests of two asphalt-rubber membrane formulations and three nonwoven fabrics were placed on roads and airfield pavements at five Army installations in various areas of the United States. This report covers the construction of the test areas and performance after a 6-month period. A final report will be prepared on the performance of each material after a number of years of annual inspections. (Author)

126 1015560 EI800215560
FABRICS BUILD BETTER ROADS.
Anon
Better Roads v 49 n 10 Oct 1979 p 8, 11 CODEN: BEROAW
Fabrics have been used for road construction, soil stabilization, drainage, filtration. Their use is relatively new and their initial application grew out of the fertile imagination of engineers in the petroleum and asphalt industries. Today fabrics are being used in rapidly growing quantities as they are being tested and proved in a variety of construction applications. The article traces the development of fabrics in road construction and pavement overlays, and lists currently available products.

127 964645 EI790864645
FINITE-ELEMENT ANALYSIS OF JOINTED OR CRACKED CONCRETE PAVEMENTS.
Tabatabaie, Amir M.; Barenberg, Ernest J.
Univ of Ill, Urbana-Champaign
Transp Res Board Transp Res Rec n 671 1978 p 11-19 CODEN: TRREDM
A finite-element computer program called ILLI-SLAB and written in FORTRAN IV is described. The procedure is based on the classical theory of a medium-thick plate on a Winkler foundation and can be used for the analysis of concrete pavements that have joints or cracks or both. The program includes consideration of various types of load-transfer systems such as dowel bars, reinforcement steel, aggregate interlock, or keyways by treating the dowel bars and reinforcement steel as linear-elastic string elements and the aggregate interlock and keyways as linear-elastic spring elements. The model is also capable of handling the effects of stabilized bases or overlays on the stresses and deflections in concrete pavements and of traffic loadings on concrete shoulders that may or may not have tie bars, continuously reinforced concrete pavements, and slabs of varying thicknesses. 22 refs.

128 1039253 EI800539253
GEOTEXTILES: ENERGY PRODUCT THAT CONSERVES ENERGY, SAVES MONEY.
Anon
Better Roads v 49 n 11 Nov 1979 p 24-25 CODEN: BEROAW
Engineers might be inclined to view the use of an energy (petrochemical) product as unwise in the face of the existing energy shortages, but applications suggest that their use actually saves energy when all the factors involved are considered. The initial use of the product was as a pavement reinforcing element, and the combined experience of companies interviewed for this article appear to establish without question that the fabrics effectively reduce reflective cracking in asphalt pavement. In addition, as the results are tabulated from different climatic areas of the country, they show that pavement laid over a fabric has an extended life and maintains a satisfactory surface much longer than conventional asphalt pavements. In addition, fabric utilization can make a two-fold contribution toward stretching budgets over more miles of road. In the first case, the actual road repair is accomplished with greater ease and in a shorter time. Then, after the fabric application, the amount of asphalt overlay required is definitely less, resulting in a saving on material. The article discusses application case histories.

129 349783 DA

HEAVY DUTY MEMBRANES FOR THE REDUCTION OF REFLECTIVE CRACKING IN BITUMINOUS CONCRETE OVERLAYS (CONSTRUCTION REPORT)

Hoffman, GL

Pennsylvania Department of Transportation Materials and Testing Division, 1118 State Street Harrisburg Pennsylvania 17120; Federal Highway Administration Region 3, P.O. Box 1086 Harrisburg Pennsylvania 17108

Oct 1981 54p

AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

REPORT NO.: FHWA-PA-RD-79-6;

CONTRACT NO.: 79-6; HP&R

SUBFILE: HRIS

The prevalence of reflective cracking in asphaltic concrete overlays is a major factor contributing to the premature failure of the pavement system. This reflective cracking is caused by cyclic stress induced in the overlay by movements in the underlying pavement. Recent work done with heavy-duty membranes has shown that they may be useful in retarding this reflective crack formation. Seven different types of heavy-duty membranes were placed over Portland Cement Concrete pavement joints at one site in Pennsylvania before the roadway was overlayed with asphaltic concrete. Control sections, without any membranes, were also built into the project for comparison purposes. This work will evaluate the ability of these membranes to reduce the occurence of reflective cracking over transverse and longitudinal joints and to function as a waterstop once cracking has occurred. (FHWA)

130 335744 DA

HIGHWAY PAVEMENT DISTRESS IDENTIFICATION MANUAL

Smith, RE; Darter, MI; Herrin, SM

Illinois University, Urbana 201 Engineering Hall Urbana Illinois 61801; Federal Highway Administration 400 7th Street, SW Washington D.C. 20590

Mar 1979 198p Figs.

AVAILABLE FROM: Government Printing Office Superintendent of Documents Washington D.C. 20402

CONTRACT NO.: DOT-FH-11-9175; Contract

SUBFILE: HRIS

This manual provides standarized identification of distress types associated with four types of conventional highway pavements. These include: jointed plain concrete, jointed reinforced concrete, continuously reinforced concrete, asphalt surfaced with granular or stabilized base and asphalt overlays over portland cement concrete. Each distress type is described along with its primary mechanism, levels of severity are defined, measurement criteria provided, and typical photographs of each type and severity are provided.

131 848526 PB81-192965

Load Equivalency Factors for Triaxle Loading; A Study of Flexible Pavement Base Courses and Overlay Designs, Second Cycle of Research at the Pennsylvania Transportation Research Facility

(Final rept.)

Wang, M. C. ; Anderson, R. P.

Pennsylvania Transportation Inst., University Park.

Corp. Source Codes: 060387000

Sponsor: Federal Highway Administration, Harrisburg, PA. Pennsylvania Div.; Pennsylvania Dept. of Transportation, Harrisburg.

Report No.: PTI-7922; FHWA/PA-80/007

Nov 79 157p

Sponsored in part by Pennsylvania Dept. of Transportation, Harrisburg.
Languages: English
NTIS Prices: PC A08/MF A01 Journal Announcement: GRAI8118
Country of Publication: United States
Contract No.: HPR-75-2
The objective of this research was to develop load equivalency factors of triaxle loading for flexible pavements. Load equivalency factors of triaxle loading were determined using the mechanistic approach, AASHO's empirical approach, and the semi-empirical approach. Three evaluation criteria were developed for the mechanistic approach: fatigue cracking, rutting, and performance. These criteria were developed by correlating pavement response with the performance of the experimental pavements at the Pennsylvania Transportation Research Facility. Using the BISAR computer program for spring weather conditions, the critical responses analyzed were maximum tensile strain at the bottom of the stabilized base course and maximum compressive strain on the top of the subgrade. The AASHO empirical approach was utilized to determine the load equivalency factor only of 76-kip (338-kN) triaxle loading. The experimental pavements were subjected to approximately 55,000 repetitions of 76-kip (338-kN) triaxle loading. The load equivalency factor was approximately 2.60 for the range of structural numbers studied and for a terminal serviceability index of about 2.0. The semi-empirical approach utilized the relationship between load equivalency factors and maximum subgrade compressive strain. The relationship for triaxle loading was established by using the previously determined factor, 2.60, and the relationships for both single and tandem axle loadings.

132 753963 PB80-131568
Maintenance Pavement Crack Repair Using Asphalt Roll-Roofing Material
(Departmental research rept.)
Kennedy, Temple R.
Texas State Dept. of Highways and Public Transportation, Austin.
Corp. Source Codes: 064423000
Sponsor: Federal Highway Administration, Austin, TX. Texas Div.
Report No.: SS-15.14; FHWA-TX-79-SS15.14
May 79 17p
Languages: English
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI8009
Country of Publication: United States
Asphalt roll roofing was first used for crack repair in the summer in 1977. This report describes the experiences of District 8 (Abilene) with the process. The procedure is described in step-by-step detail, accompanied by photographs. Some results and comments are: (1) roll roofing patches will not bleed through hot mix overlays; (2) pot holes do not develop as quickly as with other methods; (3) no special skills are needed by the maintenance crew to place the patches, and more cracks can be patched by this method than can be poured (1050 square yards/day versus 350 square yards/day of premix patches); (4) the cost is less.

133 739089 PB80-101710

Methodology for Predicting the Reflection Cracking Life of Asphalt Concrete Overlays

(Research rept. Sep 74-Mar 79)

Germann, Frederick P. ; Lytton, Robert L.

Texas Transportation Inst., College Station.

Corp. Source Codes: 015063000

Sponsor: Federal Highway Administration, Austin, TX. Texas Div.; Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div.

Report No.: TTI-2-8-75-207-5; FHWA/TX-79-09-207-5

Mar 79 150p

Sponsored in part by Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div.

Languages: English

NTIS Prices: PC A07/MF A01 Journal Announcement: GRAI8001

Country of Publication: United States

An experimental testing procedure has been established in the report, for quantitative analysis of overlays designed to reduce reflection cracking. From this testing procedure the overlay scheme that shows the most resistance to cracking can be chosen. The procedure uses crack propagation tests on overlay samples which are conducted on a machine called the 'overlay tester.' This machine was specifically built to stimulate the displacements resulting from temperature changes in the cracked or jointed pavement or base materials that are beneath an overlay. Various types of overlay samples were investigated on the overlay tester. These include samples with fabric, such as 'Petromat,' and samples composed of different grades of asphalt, AC-5, AC-10, and AC-20; various gradations, open graded, dense graded, and hot sand mixes; and different overlay thickness of one, two, and three inches.

134 301086 DA

OVERLAY DESIGN BASED ON FALLING WEIGHT DEFLECTOMETER MEASUREMENTS

Koole, RC

Transportation Research Board

Koninklijke/Shell-Laboratorium

Transportation Research Record N700 1979 pp 59-72 26 Fig. 2 Tab. 8 Ref.

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

The technique used for measuring deflections in an asphalt pavement by means of a falling weight deflectometer is described in some detail. Two models of the deflectometer that have different force ranges have been developed at Koninklijke/Shell-Laboratorium, Amsterdam. The deflectometer is used for the routine evaluation of pavements. The data it produces are of sufficient quantity and quality to serve as input for an analytical method of overlay design. The validity of the data and the interpretation method has been verified by wave-propagation measurements. The basic principles of the new Shell design method are outlined, with specific reference to the determination of overlay thicknesses. It is shown that the required thickness of an overlay depends on one of two criteria, subgrade strain and asphalt-fatigue strain, and that all designs must be checked to determine which of the two criteria is the limiting one. To illustrate this, several examples are given. Some possible refinements to the basic overlay design procedure are discussed, such as the incorporation of various mix characteristics and the procedure for use if the type of mix to be used for the overlay differs significantly from that of the existing pavement. /Author/ This paper appeared in TRB Research Record No. 700, Pavement Evaluation and Overlay Design: A Symposium and Related Papers.

135 301090 DA

OVERLAY DESIGN BASED ON VISIBLE PAVEMENT DISTRESS

Vaswani, NK

Transportation Research Board

Virginia Highway & Transportation Research Council

Transportation Research Record N700 1979 pp 89-94 4 Fig. 3 Tab. 9 Ref.

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

Data collected on 111 Interstate highway projects in Virginia were analyzed by using a multiregression procedure, and the rating coefficient for each type of distress was determined. From these coefficients, the total distress and the resultant maintenance rating for each pavement were calculated. The types of distress that were found to affect the maintenance rating are longitudinal cracking, alligator cracking, rutting, pushing, raveling, and patching. A method for designing the required thickness of an overlay was developed based on taking the thickness equivalency of an asphalt concrete overlay in Virginia as equal to 0.5 and the overlay thickness as a function of the ratio of the traffic, in terms of the number of 80-kN (18,000-lb (18-kip)) equivalent loads, carried by the pavement before the overlay to the traffic it would carry after the overlay, depending on the durability of the asphalt mix. This design method does not require the use of a deflection-measuring device. /Author/ This paper appeared in TRB Research Record No. 700, Pavement Evaluation and Overlay Design: A Symposium and Related Papers.

136 301083 DA

PAVEMENT EVALUATION AND OVERLAY DESIGN: A METHOD THAT COMBINES LAYERED-ELASTIC THEORY AND VIBRATORY NONDESTRUCTIVE TESTING

Weiss, RA

Transportation Research Board

Waterways Experiment Station

Transportation Research Record N700 1979 pp 20-34 14 Fig. 1 Tab. 16 Ref.

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

A procedure has been developed for the determination of the load-carrying capacity and required overlay thickness of airport pavements. The procedure combines a layered-elastic theoretical approach and vibratory nondestructive testing to determine the value of the Young's modulus of the subgrade. A computer program SUBE is used to determine the value of the Young's modulus of the subgrade from the measured dynamic response of a pavement. A computer program PAVEVAL is used to calculate the load-carrying capacity and required overlay thickness in terms of the structure of the pavement and subgrade and in terms of limiting strain and stress conditions. The procedure was evaluated by calculating the load-carrying capacity and overlay thicknesses for single-wheel and multiple-wheel loadings on rigid and flexible pavements. /Author/ This paper appeared in TRB Research Record No. 700, Pavement Evaluation and Overlay Design: A Symposium and Related Papers.

137 733536 PB-299 896/1

Pavement Evaluation and Overlay Design: A Symposium and Related Papers

Shahin, Mohamed Y. ; Darter, Michael I. ; Kohn, Starr D. ; Phang, W. A. ; Weiss, Richard A.

Transportation Research Board, Washington, DC.

Corp. Source Codes: 044780000

Report No.: TRB/TRR-700; ISBN-0-309-02848-5

1979 121p

Library of Congress catalog card no. 79-18461.

Paper copy also available from Transportation Research Board, 2101 Constitution Ave., NW, Washington, DC. 20418, PC$6.20.

Languages: English

NTIS Prices: PC A06/MF A01 Journal Announcement: GRAI7925

The 13 papers in this report deal with the following areas: evaluation of airfield pavement condition and determination of rehabilitation needs; pavement-condition ratings and rehabilitation needs; pavement evaluation and overlay design: a method that combines layered-elastic theory and vibratory nondestructive testing; pavement evaluation by using dynamic deflections; a rational system for design of thickness of asphalt concrete overlays; overlay design based on falling weight deflectometer measurements; mechanistic method of pavement overlay design; pavement evaluation and overlay design: summary of methods; procedure for design of overlays for rigid pavements for Texas state department of highways and public transportation; overlay design based on visible pavement distress; overlay design based on AASHO road test data; analytical study of minimization of reflection cracking in asphalt concrete overlays by use of a rubber-asphalt interlayer; and attempts to reduce reflection cracking of bituminous concrete overlays on portland cement concrete pavements.

138 301084 DA

PAVEMENT EVALUATION BY USING DYNAMIC DEFLECTIONS

Sharpe, GW; Southgate, HF; Deen, RC

Transportation Research Board

Kentucky Department of Transportation

Transportation Research Record N700 1979 pp 34-46 13 Fig. 1 Tab. 20 Ref.

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

Dynamic test deflections were duplicated by elastic theory by using the Chevron N-layered computer program. Dynamic surface deflections obtained by using the road rater were used in conjunction with elastic theory to analyze pavement behavior. A procedure was developed to use field-measured road rater deflections for the estimation of the elastic modulus of the foundation material and the determination of the equivalent thicknesses of new material that approximate the behavior of the structure. The estimated moduli and the equivalent thicknesses can be used as inputs to design overlay thicknesses. An analysis of the deflections of the first three sensors of the road rater also makes it possible to distinguish weaknesses in asphalt concrete layers from weaknesses in the supporting foundation. /Author/ This paper appeared in TRB Research Record No. 700, Pavement Evaluation and Overlay Design: A Symposium and Related Papers.

139 300223 DA

PAVEMENT MAINTENANCE WITH ASPHALT OVERLAYS

Wonson, KD

Australian Asphalt Pavement Association 991 Rathdowne Street Carlton North Victoria Australia 0 9596550 50

Bitupave Limited

Feb 1979 8 p. 14 Fig. 13 Ref.

SUBFILE: TRRL; IRRD; HRIS

There are a range of techniques available for assessing the present condition of a road pavement. Any one, or more likely, any combination of these methods will provide a suitable basis for assigning priorities to pavement maintenance. Although techniques used to assign a numerical value to the present condition of a road are well established, it can be seen from this paper that these techniques are in the process of being developed and refined. The techniques for designing asphalt overlays have been developed to the stage where they can be used with confidence. But also in this area there are new developments occurring - the use of the radius of curvature of the pavement surface under a known load in lieu of just the deflection measurement is relatively new. It is becoming increasingly necessary to take account not only of an acceptable riding surface, but of other factors such as safety and user inconvenience and consideration of these factors will become part of the pavement management system of the future. The assessment and design techniques now available make it possible to apply overlays at a later data. /TRRL/ From the Fourth International Asphalt Conference, Melbourne, February 1979.

140 301103 DA

PORTLAND CEMENT CONCRETE OVERLAYS OF EXISTING ASPHALTIC CONCRETE SECONDARY ROADS IN IOWA

Schnoor, CF; Renier, EJ

Transportation Research Board

Boone County, Iowa; Portland Cement Association

Transportation Research Record N702 1979 pp 75-82 12 Fig. 3 Ref.

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

Forty-two kilometers (22 mi.) of existing asphaltic concrete low-volume roads were resurfaced with portland cement concrete in five counties of Iowa during 1977. In two counties, complete removal of the old asphalt surface was required prior to repaving with portland cement concrete. In the other three, the old asphalt surface was retained as a base for the new pavement. This paper discusses procedures developed to establish and control grade and portland cement concrete overlay thicknesses in the cases where the old asphalt was retained. On one project grade was established and minimum thickness retained by use of a computer. Economics of design and construction procedures were determined by county engineers. Projects were approved by the Iowa Department of Transportation prior to construction. Thickness monitoring and required equipment modification was accomplished by contractor development and cooperation. The resulting pavements show that portland cement concrete overlays can be successfully constructed over existing asphaltic concrete roads on low-volume secondary systems with a minimum of surface preparation and can contribute a long-term economical solution to the ever-increasing cost of maintenance. /Authors/ This paper appeared in TRB Research Record No. 702, Low Volume Roads: Second International Conference. (Proceedings of a conference conducted by the Transportation Research Board, August 20-23, 1979.)

141 315542 PR

POTENTIAL USE OF DEFLECTION MEASUREMENTS TO ASSIST IN DESIGNING RECYCLED ASPHALT PAVEMENTS

INVESTIGATORS: Doty, RN

PERFORMING ORG: California Department of Transportation Transportation Laboratory, 5900 Folsom Boulevard Sacramento California 95819

SPONSORING ORG: California Department of Transportation; Federal Highway Administration Department of Transportation

CONTRACT NO.: F79TL05; HP&R

SUBFILE: HRIS

PROJECT START DATE: 7907

PROJECT TERMINATION DATE: 8206

The objectives of this research are to determine the effect of recycling asphalt pavements on roadway deflections, and to develop an overlay design method for recycled asphalt pavements based on deflection analysis. A deflection study of three roadways in California will be performed. These three roadways are scheduled for twenty-six lane miles of recycling during the coming year.

142 734228 AD-A073 484/8

Reflection Cracking of Bituminous Overlays for Airport Pavements; A State of the Art

(Final rept.)

McLaughlin, Aston L.

Federal Aviation Administration Washington DC Systems Research and Development Service

Corp. Source Codes: 340170

Report No.: FAA-RD-79-57

May 79 93p

Languages: English

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI7926

This report surveys current methods and practices pursued by various pavement authorities in an effort to reduce the incidence of reflection cracking of bituminous overlays. The most common theoretical, analytical and laboratory efforts in this connection are also presented. Latest information concerning these measures and their successes, failures and uncertainties is stated from interviews with cognizant personnel in the field, and at universities and government research agencies. Other information is presented from construction records, site visits and published material. The findings in this research effort are that the state of the art in preventing reflection cracking of bituminous overlays, excluding afew institutional efforts, has not developed along systematic lines and, to date, there is no methodology by which the degree of effectiveness of any method in place can be predicted under a variety of conditions. Also, field experimentation has not yielded reproducible results partly because of lack of good experimental design and statistical methods, adequate quality control and documentation of all significant variables. (Author)

143 763977 PB80-159395

Residual Stresses Due to Traveling Loads and Reflection Cracking

(Interim rept. Sep 74-Jun 79)

Yandell, W. O. ; Lytton, R. L.

Texas Transportation Inst., College Station.

Corp. Source Codes: 015063000

Sponsor: Federal Highway Administration, Austin, TX. Texas Div.; Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div.

Report No.: TTI-2-8-75-207-6; FHWA/TX-79/18+207-6

Jun 79 90p

Sponsored in part by Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div.
Languages: English
NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI8013
Country of Publication: United States
This report demonstrates some of the potential capabilities of the three dimensional mechano-lattice stress-strain analysis for predicting rut depth, fatigue cracking, corrugations and reflection cracking. The mechano-lattice analogy is the only technique available which is capable of predicting the behavior of linear or non-linear elasto-plastic or energy absorbing material subjected to directional traveling wheel loads. It is a rigorous technique that preserves equilibrium and has strain compatibility. The problems investigated in this report are: the repeated one directional pneumatic tire rolling on a single layer of a compacted elasto-plastic sand-clay-water mixture with various boundary conditions and the behavior of an elasto-plastic overlay with potential reflection cracking. The build-up of residual stresses and strains is demonstrated to have significant effects on the accuracy of present day pavement design and construction procedures including rutting and fatigue crack prediction.

144 197706 DA
A RIGID PAVEMENT OVERLAY DESIGN PROCEDURE FOR TEXAS SDHPT
Schnitter, O; Hudson, WR; McCullough, BF
Texas University, Austin Center for Highway Research, 200 West 21st Street Austin Texas 78712 CFHR-3-8-75-177; Federal Highway Administration Texas Division, Rm 826, Federal Office Building Austin Texas 78701; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763
May 1978 Intrm Rpt. 393 p.
AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161
REPORT NO.: FHWA/TX-79/177/13; CFHR-3-8-75-177-13; PB-295792/6ST
SUBFILE: NTIS; HRIS
The Texas State Department of Highways and Public Transportation (SDHPT) rigid pavement overlay design procedure was developed by evaluating, improving, modifying, and simplifying a recently developed Federal Highway Administration overlay design method. This overlay design procedure involves fatigue cracking and reflection cracking subsystems. Linear elastic layered theory is the basic model for computing stresses and strains in the pavement system for fatigue computations. The condition and remaining life of the existing pavement are considered in the fatigue cracking analysis, and thickness designs for practically all types of asphaltic concrete and portland cement concrete overlays on rigid pavements can be obtained using this computerized method. The reflection cracking analysis, intended for use with asphaltic concrete overlays, involves the computation of strains in the overlay due to horizontal, thermal, and vertical load-associated movements in the overlay. The final overlay thickness is selected to meet both the fatigue cracking and reflection cracking criteria. The design procedure uses four computer programs for pavement evaluation, overlay thickness design and reflection cracking analysis. A detailed User's Manual intended for use by Texas SDHPT is included in the report. It is recommended that this design procedure be implemented for trial use as soon as possible. This design method is a useful research tool as well as a practical design procedure.

145 309028 DA

TRIAL ROAD SLIPS ON CONCRETE COAT

Heywood, P

IPC Building and Contract Journals, Limited

Contract Journal VOL. 291 NO. 5222 Oct 1979 pp 40-41 3 Phot.

SUBFILE: TRRL; IRRD; HRIS

Details are given of the first trial length of continuously reinforced concrete overlay constructed in Great Britain on a stretch of the A3 trunk road near the Hampshire town of horndean. The trial section, 1600 M long, was split into two. Half the length was given a 130 mm thick overlay and a 110 mm thick layer was put on the other half. Content of deformed reinforcement fabric was 0,6 and 0,7 per cent respectively. Concrete for the overlay had a maximum 20 mm aggregate. A compaction factor of 0,88 plus or minus 0,03 was specified equivalent to approximately 25 mm slump. A Gunter and Zimmerman slip former was used. The 1600 M of 9 M carriageway was laid in six days. The maximum length laid in one day was 400 M. Concrete cylinders were taken to test the concrete's tensile strength. (TRRL)

146 310169 DA

WORKSHOP ON ASPHALTIC PAVEMENTS. BRISBANE, 1979. PAPERS

Australian Asphalt Pavement Association Queensland Branch Brisbane Queensland Australia

1979 Monograph n.p.

SUBFILE: TRRL; IRRD; HRIS

Papers presented at the workshop covered the following topics: raw materials - aggregates, binders, mix design, graphical method of combining aggregates, asphalt quality control, laboratory analysis for the control of asphaltic concrete mixture, manufacture, pavement configuration and cost evaluation, compaction of asphalt, asphaltic concrete surfacing, mix types and properties, design of asphalt pavements, contract supervision, overlay design for pavement reconstruction and strengthening, bituminous surfacing, reconstruction/strengthening of pavements, pavement evaluation and asphalt specifications. (TRRL)

147 189961 DA

CONTINUOUSLY REINFORCED CONCRETE OVERLAYS ON EXISTING PORTLAND CEMENT CONCRETE PAVEMENT

Dhamrait, JS; Schwartz, DR

Illinois Department of Transportation; Bureau of Materials & Physical Research, 126 East Ash Street; Springfield; Illinois; 62706

May 1978 Intrm Rpt. 38 p. 5 Fig. 8 Tab. 7 Ref. 1978

AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

REPORT NO.: FHWA-IL-PR-80; PB-293043/6ST

SUBFILE: HRIS; NTIS

Five experimental sections of CRC overlay over an existing resurfaced PCC pavement on Route US 40 were constructed in 1967 as part of Interstate Route 70 construction near Pocahontas, Illinois. Three thicknesses of overlay and two separate amounts of longitudinal reinforcement were used in the experimental sections. Observations and measurements were carried out over a 10-year period to evaluate the behavior of the experimental overlays under I-80 regular mixed traffic. During that period the pavements carried in excess of 7,000,000 equivalent 18-kip single-axle load applications with very little change in riding quality or level followed the normal trend for regular CRC pavement, and edge deflections were very small for all test sections. Changes in transverse crack width from summer to winter were small for all sections, and decreased with increasing slab thickness. Recommendations are included for design and construction of overlays relative to minimum overlay thickness, amount of longitudinal steel, use of a bituminous leveling course as a bond breaker, and tolerances for overlay thickness control during construction. /Authors/ Study title: IHR-36, An Investigation of Continuously Reinforced Concrete Pavement. This study is being conducted in cooperation with the Federal Highway Administration.

148 737011 PB-301 125/1

The Design of New Road Pavements and of Overlays: Estimation of Commercial Traffic Flows

Thrower, E. N. ; Castledine, L. W. E.

Transport and Road Research Lab., Crowthorne (England).

Corp. Source Codes: 056787000

Report No.: TRRL-LR-844

c1978 19p

Also pub. as ISSN-0305-1293.

Languages: English

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI7926

In order to determine the required thickness of a new road pavement, or of an overlay on an existing road, the total commercial traffic in the nearside lane has to be estimated for the desired life of the pavement. For an overlay, the total commercial traffic since the last major strengthening is also needed. In the present Report, the estimates of traffic flow made in Road Note 29 for the design of pavements have been brought up to date and extended. A nomogram has been prepared to facilitate the estimation process. The computations have also been used to prepare a second nomogram to assist in estimating the past traffic that has been carried by a pavement. (Copyright (c) Crown Copyright 1978.)

149 650438 PB-279 882/5

Design of Overlays Based on Pavement Condition, Roughness, and Deflections. Part 1. Tentative Method for Overlay Design Based on Visual Pavement Distress

(Final rept.)

Vaswani, N. K.

Virginia Highway and Transportation Research Council, Charlottesville.

Sponsor: Federal Highway Administration, Washington, D.C. Structures and Applied Mechanics Div.

Report No.: VHTRC-78-R24; FHWA/RD-78-S0715

Jan 78 29p

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7816

Data collected on 111 interstate highway projects in Virginia were analyzed by multiregression analysis and the rating coefficient for each type of distress determined. By this means, the total pavement distress and, hence, the maintenance rating of each pavement was obtained. The types of distress that were found to influence the maintenance rating were longitudinal cracking, alligator cracking, rutting, pushing, ravelling, and patching. Then, a method for designing the required thickness of overlays was developed based on taking the thickness equivalency of an asphaltic concrete overlay in Virginia as equal to 0.5 (the thickness equivalency of an asphaltic concrete for new construction is 1.0) and the overlay thickness as a function of the ratio of the traffic, in terms of 18-kip (8, 160 kg) equivalents, carried by the pavement before the overlay to the traffic it would carry after the overlay, depending on the durability of the asphaltic mix. This design method does not require the use of a deflection measuring device.

150 653639 PB-280 920/0

Design of Overlays for Flexible Pavements Based on AASHTO Road Test Data

(Supplementary rept.)

Vaswani, N. K.

Virginia Highway and Transportation Research Council, Charlottesville.

Sponsor: Federal Highway Administration, Richmond, Va. Virginia Div.; Federal Highway Administration, Washington, D.C. Structures and Applied Mechanics Div.

Report No.: VHTRC-78-R37; FHWA/RD-78-S0718

Feb 78 30p

Supplement to report dated Jan 78, VHTRC-78-R24. Prepared in cooperation with Federal Highway Administration, Richmond, Va. Virginia Div.

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7817

Contract No.: HPR-1359

The need for a suitable method of designing the thickness of overlays and predicting the performance of the overlaid pavement has recently been recognized. The AASHTO Road Tests included studies on 99 overlays, but they failed to produce conclusive results and hence provided no guidance for overlay designs. In the present investigation the raw data on the 99 overlays tested at the AASHTO Road Tests were evaluated. In the process, the raw data on the pavements that were overlaid also had to be evaluated. A relationship between pavement serviceability, 18-kip equivalents, and the thickness index of the pavements before the overlay was determined and was found to apply to the overlaid pavements. Based on this relationship, the strength coefficient of the overlay was determined and a method of designing the thickness of an overlay was developed. This design method does not require the use of pavement deflection data by which the thicknesses of overlays are usually designed.

151 709456 PB-293 781/1

Design System for Asphaltic Concrete Overlays

(Interim rept.)

Southgate, Herbert F. ; Sharpe, Gary W. ; Deen, Robert C.

Kentucky Bureau of Highways, Lexington. Div. of Research.

Sponsor: Federal Highway Administration, Washington, DC.

Report No.: RR-511

Nov 78 33p

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7915

Contract No.: KYHPR-75-77; HPR-PL-1(14)

A method of designing asphaltic concrete overlays has been developed from (1) Kentucky's theoretical design curves, (2) an estimate of future traffic and the associated fatigue (five procedures are presented according to types of information available), (3) strength of subgrade on subject project (laboratory CBR tests or results of dynamic in-place tests such as the Road Rater), and (4) present condition of the existing pavement (from dynamic in-place tests, roughness measurements, or present serviceability index). Deterioration has been expressed as reduced or effective thicknesses of new-quality materials producing the same measured dynamic deflections. The total thickness required for the future traffic minus the effective or reduced thickness of the existing pavement is the overlay thickness required.

152 808129 PB81-115735

Development of a System for the Evaluation of Pavements in Indiana

(Interim rept.)

Mohan, Satish

Purdue Univ., Lafayette, IN. Joint Highway Research Project.

Corp. Source Codes: 009058023

Sponsor: Indiana State Highway Commission, Indianapolis.; Federal Highway Administration, Indianapolis, IN. Indiana Div.

Report No.: JHRP-78-21; FHWA/ISHC/JHRP-78/21

3 Oct 78 203p

Sponsored in part by Indiana State Highway Commission, Indianapolis.

Languages: English

NTIS Prices: PC A10/MF A01 Journal Announcement: GRAI8103

Country of Publication: United States

Contract No.: HPR-1(16)-2

The Indiana State Highway Commission uses subjective sufficiency ratings to determine highway needs. The research was initiated for the purpose of improving upon this and it had two specific objectives. (1) To set up a method of describing pavement performance in terms of measurements using the roadmeter, Dynaflect and skid tester and (2) To set up guidelines for a methodology for an on-going evaluation of pavement performance. In-service pavements including flexible, overlay, jointed reinforced concrete and continuously reinforced concrete pavements were evaluated. Ninety-four test sections, each 1 kilometer long, were evaluated for the pavement serviceability studies. Forty-six test sections were selected for deflection and skid studies. Present serviceability index (PSI) models were developed which relate PSR with roadmeter ratings alone, and with roadmeter measurements in combination with cracking, patching and other factors related to the pavement. Deflection studies have indicated that edge deflections should be used for overlay design. Various models were developed which permit estimation of spring deflections using fall deflections. Recommendations have been made for developing a pavement evaluation system. The system will work at two levels, (1) total network and (2) individual project level.

153 332304 PR

DEVELOPMENT OF METHODS, SUCH AS BENKELMAN BEAM DEFLECTION METHOD FOR EVALUATION OF STRUCTURAL CAPACITY OF EXISTING FLEXIBLE PAVEMENTS

INVESTIGATORS: Phadnavis, DG; Ratnan, SV

PERFORMING ORG: Central Road Research Institute, India Council for Scientific and Industrial Research P.O. Box CRRI New Delhi 110020 India

SUBFILE: IRF; IRRD; HRIS

PROJECT START DATE: 78

PROJECT TERMINATION DATE: 85

To develop the method for evaluation of structural capacity of existing flexible pavements and also for estimation and design of overlays for strengthening of weak pavements. In collaboration with the Ministry of Shipping and Transport and the State Public Works Departments and Universities.

154 193258 PR

EVALUATION OF METHODS OF REDUCING REFLECTION CRACKING IN BITUMINOUS OVERLAYS

INVESTIGATORS: Rutkowski, TS

PERFORMING ORG: Wisconsin Department of Transportation Division of Highways & Transp Facilities, Research Unit 3502 Kinsman Boulevard, P.O. Box 7878 Madison Wisconsin 53707

SPONSORING ORG: Wisconsin Department of Transportation; Federal Highway Administration Structures and Applied Mechanics Division

CONTRACT NO.: HP&R

SUBFILE: HRIS

PROJECT START DATE: 7804

PROJECT TERMINATION DATE: ND

Several experimental applications of fabric materials are being evaluated for control of reflection cracking in a bituminous overlay. The pavement overlayed is a 20-foot PCC pavement thirty years old. A 2-foot bituminous widening strip was added on each side as part of pavement overlay. Evaluation will consist of cost and performance comparisons.

155 193375 DA

FINITE-ELEMENT ANALYSIS OF JOINTED OR CRACKED CONCRETE PAVEMENTS

Tabatabaie, AM; Barenberg, EJ; Huang, YH; Chou, YT

Illinois University, Urbana; Kentucky University; Waterways Experiment Station

Transportation Research Record N671 pp 11-19 15 Fig. Tabs. 22 Ref. 1978

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

A finite-element computer program called ILLI-SLAB and written in FORTRAN IV is described. The procedure is based on the classical theory of a medium-thick plate on a Winkler foundation and can be used for the analysis of concrete pavemants that have joints or cracks or both. The program can include consideration of various types of load-transfer systems such as dowel bars, reinforcement steel, aggregate interlock, or keyways by treating the dowel bars and reinforcement steel as linear-elastic string elements and the aggregate interlock and keyways as linear-elastic spring elements. The model is also capable of handling the effects of stabilized bases or overlays on the stresses and deflections in concrete pavements and of traffic loadings on concrete shoulders that may or may not have tie bars, continuously reinforced concrete pavements, and slabs of varying thicknesses. The accuracy of the model for the prediction of stresses and deflections in concrete pavements has been verified by comparison with available theoretical solutions and the results of experimental studies. /Author/ This paper appeared in TRB Record 671, Analysis of Pavement Systems.

156 679901 PB-286 376/9

Maintenance Methods for Continuously Reinforced Concrete Pavements

(Interim rept.)

Virkler, Stanley J.

Purdue Univ., Lafayette, IN. Joint Highway Research Project.

Corp. Source Codes: 408729

Sponsor: Indiana State Highway Commission, Indianapolis.; Federal Highway Administration, Washington, DC.

Report No.: JHRP-78-1; FHWA-RD-75-S00776

Feb 78 90p

See also report dated Mar 76, PB-257 535. Prepared in cooperation with Indiana State Highway Commission, Indianapolis.

Languages: English

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI7901

Contract No.: HPR-1(15)

In late 1974, test maintenance sections were constructed on a section of I-65 south of Indianapolis, Indiana. The road was stratified into 'similar' sections of pavement using deflection, cracking, and breakup as selection criteria. Various types of measures including concrete shoulders, undersealing, asphalt overlay, and installation of drains with various combinations of these methods were applied as a means for strengthening the pavements. In each case the pavement was patched prior to the installation of the maintenance technique. Since its construction, performance surveys have been made each spring and fall using deflection measurements, crack counts and a general condition survey of the test pavements. Soil samples that were obtained during the construction were tested and the soil and subbase characteristics were evaluated. A cost analysis was performed with a time frame of two years and an estimated cost for a third year of maintenance of the pavements. The overlay methods exhibited good behavior over the two years of service. The subdrains and concrete shoulder methods produced less than expected performance.

157 674204 AD-A058 736/0

Nondestructive Evaluation Procedure for Military Airfields

(Final rept. 1 Jul-30 Sep 76)

Hall, Jr, Jim W.

Army Engineer Waterways Experiment Station Vicksburg Miss

Corp. Source Codes: 038100

Report No.: WES-MP-S-78-7

Jul 78 89p

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI7825

This report presents a procedure for the nondestructive evaluation of military airfield pavements. Nondestructive testing is performed with a 16-kip electrohydraulic vibrator, which measures the load-deflection response of pavements, and the results are reported as dynamic stiffness modulus (DSM). Correlations of the DSM to allowable single-wheel load are used with existing analytical relationships to give the allowable gross aircraft loads and required overlay thicknesses. The procedures described are based on findings from earlier research studies that are referenced. Testing techniques, data reduction procedures, computational methodology, and detailed examples were developed to satisfy the need for a rapid nondestructive test procedure. (Author)

158 1014685 EI800214685
NOTES ON PAVEMENT DESIGN AND REHABILITATION.
Monismith, Carl L.
Univ of Calif, Berkeley
Des and Constr of Flexible Pavements, Proc of a Resid Course, Leura, NSW, Aust, Aug 28-Sep 1 1978 Organ by Univ of NSW, through Unisearch Ltd, Kensington, NSW, Aust, 1978 v 2 p 1, 1-12, 31
The paper presents a comprehensive discussion of pavement design and rehabilitation. Among the topics covered are stresses and deformations in systems representative of pavement structures, compaction, stabilization, materials characterization, current and new design procedures, test roads, performance evaluation, maintenance and rehabilitation management, overlay pavement design, and pavement construction.

159 731343 PB-298 862/4
Pavement Deflection: Equipment for Measurement in the United Kingdom
Kennedy, C. K. ; Fevre, P. ; Clarke, C. S.
Transport and Road Research Lab., Crowthorne (England).
Report No.: TRRL-LR-834
c1978 28p
Languages: English
NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7924
Significant relationships have been established between the deflection of roads measured under a standard rolling wheel load moving at creep speed and their structural performance under traffic. This research is described in LR 832 and provides the basis for the prediction of the unexpired lives of pavements and for the design of bituminous overlays. Essential to the research studies and to the implementation of a design system for strengthening pavements is a convenient and reproducible method of deflection measurement. The report describes the Deflection Beam, which was used in the original studies, and its standardised method of operation in the United Kingdom. The Lacroix Deflectograph, an automatic technique of measuring deflections under a rolling wheel, is suitable for carrying out deflection surveys on long lengths of road. The machine as modified for use in the United Kingdom is described together with details of ancillary equipment required for carrying out deflection surveys. (Copyright (c) Crown Copyright 1978.)

160 706913 PB-293 166/5
Pavement Evaluation Using Road Rater Deflections
(Interim rept.)
Sharpe, Gary W. ; Southgate, Herbert F. ; Deen, Robert C.
Kentucky Bureau of Highways, Lexington. Div. of Research.
Sponsor: Federal Highway Administration, Washington, DC.
Report No.: RR-501
Aug 78 249p
Languages: English
NTIS Prices: PC A11/MF A01 Journal Announcement: GRAI7914
Contract No.: KYHPR-75-77; HPR-PL-1(14)
Dynamic test deflections have been duplicated by elastic theory using the Chevron N-layered computer program. Dynamic surface deflections obtained using the Road Rater have been used in conjunction with elastic theory to analyze pavement behavior. A procedure has been developed to use field measured Road Rater deflections to estimate the elastic moduli of the foundation material and to determine the equivalent thicknesses of new material which approximate the behavior of the structure. The estimated moduli and (or) equivalent thicknesses may be used as inputs to design overlay thicknesses. An analysis of the deflections of the first three sensors of the Road Rater also makes it possible to distinguish weaknesses in asphaltic concrete layers from weaknesses in the supporting foundation.

161 179880 DA

PAVEMENT OVERLAY: SAVINGS IN REDUCED MAINTENANCE

Airport Services Management VOL. 18 NO. 8 .Aug 1978 pp 16-17 1978

AVAILABLE FROM: Lakewood Publications 700 South 4th Street, Reprint Services Minneapolis Minnesota 55415

SUBFILE: ATRIS

A non-woven reinforcing fabric was used recently in reconstructing a runway at Naples Municipal Airport. The non-woven polypropylene filter fabric provides a stress barrier that increases fatigue life of the pavement and reduces reflective cracking. After filling the cracks in the pavement, the surface was cleaned with a power broom and a tack coat of asphalt cement was applied. The fabric was overlapped with a 10-inch overlap and an extra tack coat was applied to bond overlapping layers of fabric. A course of bituminous asphalt was laid down after the fabric. A tack coat was then applied before the final course of a specially designed asphalt mix.

162 300459 DA

PERFORMANCE STUDY OF THE BITUMINOUS CONCRETE SECTION OF THE JOHN F. KENNEDY EXPRESSWAY (I-95)

Beck, LD

Maryland Department of Transportation 2323 West Joppa Road Brooklandville Maryland 21022

Feb 1978 Final Rpt. 26 p.

AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

REPORT NO.: FHWA-MD-R-77-5;

CONTRACT NO.: AW076-114-046; HR&R

SUBFILE: HRIS

The main objective of this study is to evaluate the structural adequacy of the rehabilitated and resurfaced flexible pavement section of the JFK Expressway (I-95). This evaluation utilizes the "Asphalt Institute's Deflection Method for Designing Asphalt Concrete Overlays for Asphalt Pavements." Benkelman Beam static rebound deflection tests were made each spring for five years. Between 1973 and 1976, twelve of twenty-two areas did not show statistically significant changes. Of the ten areas showing change, one area was singled out in early readings for poor performance. Only three other areas showed statistically significant changes and had recommended overlays of 2" or more. /FHWA/ Prepared in cooperation with Department of Transportation, Federal Highway Administration.

163 **Portland Cement Concrete Pavements**

(Interim rept. 1967-77)

Dhamrait, Jagat Singh ; Schwartz, Donald R.

Illinois State Dept. of Transportation, Springfield. Bureau of Materials and Physical Research.

Sponsor: Federal Highway Administration, Springfield, IL. Illinois Div.

Report No.: PHYSICAL RESEARCH 80; FHWA/IL/PR-80

May 78 39p

Report on 'Continuously Reinforced Concrete Pavement.'

Languages: English

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7913

Contract No.: IHR-36

Five experimental sections of CRC overlay over an existing resurfaced PCC pavement on Route US 40 were constructed in 1967 as part of Interstate Route 70 construction near Pocahontas, Illinois. Three thicknesses of overlay and two separate amounts of longitudinal reinforcement were used in the experimental sections. Observations and measurements were carried out over a 10-year period to evaluate the behavior of

the experimental overlays under I-80 regular mixed traffic. During that period the pavements carried in excess of 7,000,000 equivalent 18-kip single-axle load applications with very little change in riding quality or level of service, without requiring any structural maintenance. Transverse cracking followed the normal trend for regular CRC pavement, and edge deflections were very small for all test sections. Changes in transverse crack width from summer to winter were small for all sections, and decreased with increasing slab thickness. Recommendations are included for design and construction of overlays relative to minimum overlay thickness, amount of longitudinal steel, use of a bituminous leveling course as a bond breaker, and tolerances for overlay thickness control during construction.

728116 PB-298 854/1

164 **Prediction of Pavement Performance and the Design of Overlays**

(Laboratory rept.)

Kennedy, C. K. ; Lister, N. W.

Transport and Road Research Lab., Crowthorne (England).

Report No.: TRRL-LR-833

c1978 74p

Also pub. as ISSN-0305-1293.

Languages: English

NTIS Prices: PC A04/MF A01 Journal Announcement: GRAI7923

The deflection of a flexible road pavement under a heavy wheel load moving at creep speed can be used to predict the future structural performance of the pavement and to design the strengthening of it by overlaying with bituminous materials. The present report describes the adjustment of measured deflections to standard values suitable for design purposes and their use, together with the appropriate traffic data, for the prediction of remaining pavement life and for the design of overlay thickness. The technique sometimes requires information from cores and trial holes to allow the appropriate decisions for a particular pavement to be made. (Copyright (c) Crown Copyright 1978.)

854075 PB81-203820

165 **Proceedings of the Continuously Reinforced Concrete Pavement Workshop Held at New Orleans, Louisiana on February 15 and 16, 1978**

Louisiana Dept. of Transportation and Development, Baton Rouge. Office of Highways.

Corp. Source Codes: 051354003

Sponsor: Federal Highway Administration, Washington, DC.

Report No.: FHWA-TS-80-231

Jun 80 259p

Languages: English Document Type: Conference proceeding

NTIS Prices: PC A12/MF A01 Journal Announcement: GRAI8120

Country of Publication: United States

Contract No.: DOT-FH-11-8852

This report contains all of the papers presented at a workshop on Continuously Reinforced Concrete Pavements (CRCP) which was held in New Orleans, Louisiana. The information presented at the workshop covered all aspects of CRCP including design, construction, and maintenance procedures. The primary emphasis was concentrated on maintenance procedures. The proceedings include papers on polymer patching, under sealing, and flexible and rigid overlays.

166 310051 DA

RECENT DEVELOPMENTS IN PAVEMENT DESIGN AND STRUCTURAL REHABILITATION

Monismith, CL; Finn, FN

Australian Road Research Board

California University, Berkeley

Australian Road Research Board Conference Proc VOL. 9 NO. 1 Proceeding pp 113-142 34 Fig. Refs.

SUBFILE: TRRL; IRRD; HRIS

This paper was presented as a special paper at session 6. This paper presents the results of recent investigations and design developments for both new and overlay pavements which are considered implementable at this time (1978). These developments improve the potential to: (a) accommodate changed loading requirements expeditiously; (b) better utilise available materials; and (c) accommodate new materials. The methodology takes advantage of the improved ability to predict specific modes of distress resulting from a variety of traffic (e.g. fatigue and rutting) and environmentally related (e.g. thermal fracture) causes. Essentially, structural pavement sections are selected to minimise particular distress modes. In this context both new and overlay pavement design may be thought of as a process whereby a pavement structure is checked, and modified if required to insure that the various forms of distress considered critical will be either precluded or their effects reduced to tolerable levels for the selected design period. A number of procedures presented at the fourth international conference on the structural design of asphalt pavements held in August 1977, utilise such an approach and are briefly evaluated within this framework. Included are summaries of the procedures developed by Shell Research, the National Cooperative Highway Research Program of the Transportation Research Board (NCHRP project 1-10B) and the U.S. Federal Highway Administration for overlay pavements. (a) (TRRL) Proceedings from the Ninth Australian Road Research Board Conference, Brisbane, 21-25 August 1978.

167 954811 EI790754811

REHABILITATION OF PLAIN PORTLAND CEMENT CONCRETE PAVEMENTS WITH ASPHALTIC CONCRETE OVERLAYS.

Gulden, Wouter

Ga Dep of Transp, Forest Park

Asphalt Paving Technol v 47, Proc Assoc Asphalt Paving Technol, Tech Sess, Lake Buena Vista, Fla, Feb 13-15 1978. Publ by Assoc of Asphalt Paving Technol, Univ of Minn, Minneapolis, 1978 p 635-644 CODEN: PRPTAA ISSN: 0066-9466

One of the main problems associated with asphaltic concrete overlays over jointed concrete pavements is the occurrence of reflection cracks over the old joints. Past practice has been to place thick overlays to delay the prossibility of water entering the pavement system as well as to reduce the number of reflection cracks. Many of the concrete pavements in Georgia are structurally adequate and would not require thick overlays if the deterioration due to the loss of base support could be stopped. Thick overlays, therefore, would not be justifiable from a structural viewpoint. In order to find an answer to the problem of reflection cracking, the Georgia Department of Transportation initiated a research study in 1975 to evaluate, in the field, the performance of several portland cement concrete and asphaltic concrete overlay systems. The paper discusses the design, construction and performance of the asphaltic concrete overlay test sections.

168 194296 DA
RESURFACING OF BITUMINOUS PAVEMENTS
Thurmann-Moe, T; Wold, OR
Norwegian Road Research Laboratory; .Gaustadalleen 25, Postboks 8109; Oslo 3; Norway
Dec 1978 pp 19-27 7 Fig. 9 Ref. 1 App. Norwegian 1978
REPORT NO.: Report No. 51;
SUBFILE: HRIS
Extensive use of studded tires had reduced the service life of the surfacing on heavily trafficed roads in Norway to 3- 4 years. The research on surfacing wear problems has therefore been given high priority. The paving mixes used for urban roads contain the highest possible amount of coarse aggregates in order to improve the resistance to wear. These very coarse mixes have to be laid in relatively large thicknesses, about 40 mm, in order to give a satisfactory surfacing. Due to this, the urban roads maintenance expenses are very high and a new, low cost resurfacing method was developed during the period 1968 to 75 by the Norwegian Road Research Laboratory, which is part of the Public Roads Administration. This method is based on the use of large infrared heaters and the laying of a thin overlay while the old surface is still hot and soft. The amount of surfacing material used is just sufficient to fill the ruts, and on the thin parts of this overlay the coarse new material is rolled into the old softened surface without any planing, scraping or other mechanical treatment. This method has been named the Heater Resurfacing Method, and the resurfacing costs are reduced to less than 40% the cost of a traditional resurfacing, and still give the same service life. /Author/

169 716364 PB-295 792/6
A Rigid Pavement Overlay Design Procedure for Texas SDHPT
(Interim research rept.)
Schnitter, Otto ; Hudson, W. R. ; McCullough, B. F.
Texas Univ. at Austin. Center for Highway Research.
Corp. Source Codes: 388101
Sponsor: Federal Highway Administration, Austin, TX. Texas Div.; Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div.
Report No.: CFHR-3-8-75-177-13; FHWA/TX-79/177/13
May 78 393p
Languages: English
NTIS Prices: PC A17/MF A01 Journal Announcement: GRAI7918
Contract No.: CFHR-3-8-75-177
The Texas State Department of Highways and Public Transportation (SDHPT) rigid pavement overlay design procedure was developed by evaluating, improving, modifying, and simplifying a recently developed Federal Highway Administration overlay design method. This overlay design procedure involves fatigue cracking and reflection cracking subsystems. Linear elastic layered theory is the basic model for computing stresses and strains in the pavement system for fatigue computations. The condition and remaining life of the existing pavement are considered in the fatigue cracking analysis, and thickness designs for practically all types of asphaltic concrete and portland cement concrete overlays on rigid pavements can be obtained using this computerized method. The reflection cracking analysis, intended for use with asphaltic concrete overlays, involves the computation of strains in the overlay due to horizontal, thermal, and vertical load-associated movements in the overlay. The final overlay thickness is selected to meet both the fatigue cracking and reflection cracking criteria. The design procedure uses four computer programs for pavement evaluation, overlay thickness design and reflection cracking analysis. A detailed User's Manual intended for use by Texas SDHPT is included in the report. It is recommended that this design procedure be implemented for trial use as soon as possible. This design method is a useful research tool as well as a practical design procedure.

170 905164 EI790105164
SHIFT TOWARD CONCRETE SEEN IN MINNESOTA OVERLAY TEST.
Anon
Eng News Rec v 201 n 7 Aug 17 1978 p 26-27 CODEN: ENREAU
The paper reports that the Minnesota Department of Transportation is experimenting with a bonded concrete overlay on a continuously reinforced concrete pavement. A 4,200-ft stretch of I-35W, badly spalled and weakened by chloride corrosion that has attacked the steel reinforcing, is being scarified $one quarter$ -in. to 1 in. to create a bonding surface for the 2 to 3-in. non-reinforced overlay.

171 194752 DA
STATE-OF-THE-ART REVIEW ON EQUIVALENT AXLE LOADING FOR FLEXIBLE PAVEMENT DESIGN
Anani, BA; Wang, MC
Pennsylvania Transportation Institute Pennsylvania State University University Park Pennsylvania 16802 PTI 7803
Mar 1978 Intrm Rpt. 26 p.
AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161
REPORT NO.: FHWA-PA-RD-75-2-6; PB-295581/AS
CONTRACT NO.: PennDOT Res Proj 752; HP&R
SUBFILE: HRIS
In an effort to estimate the damage associated with the heavier vehicles using today's highways, considerable work has been directed toward evaluation of load equivalency factors for different axle loads and axle configurations. Various methods of evaluating equivalency factors were reviewed. The AASHTO load equivalency factors were based on empirical performance data obtained at the AASHO Road Test. For the most part, other methods have been based either on pavement response (maximum surface deflection, maximum tensile strain, etc.) or pavement distress (rutting, fatigue cracking, etc.). The AASHTO equivalency factors were calculated for single and tandem axle configurations only. Accordingly, extrapolation has been required to evaluate newer axle configurations. The results of a survey (telephone, written correspondence, and research report review) indicate that the 18 kip (80 kN) single axle equivalency factors developed at the AASHO Road Test are still in wide use both in the United States and abroad. /FHWA/ This study was conducted in cooperation with the U.S. Department of Transportation, Federal Highway Administration. Project Title: A Study of Flexible Pavement Base Courses and Overlay Designs: Second Cycle of Research at the Pennsylvania Transportation Research Facility.

172 789465 PB80-204910
Statewide Flexible Pavement Performance and Deflection Study
(Final rept.)
Skog, John B. ; Matthews, James A. ; Mann, Gary W. ; Roberts, Donald V.
California State Dept. of Transportation, Sacramento. Office of Transportation Lab.
Corp. Source Codes: 040609016
Sponsor: Federal Highway Administration, Sacramento, CA. California Div.
Report No.: TL-633167; FHWA-CA-TL-78-28
Dec 78 128p
See also report dated Dec 68, PB-183 151.
Languages: English
NTIS Prices: PC A07/MF A01 Journal Announcement: GRAI8022
Country of Publication: United States
Pavement deflection measurements are used to evaluate residual 'in-place' strength of flexible pavement sections. Asphalt concrete structural overlay thickness requirements for 10-year service life extensions are determined based on

reduction of initial deflections to tolerable deflection levels for given conditions. Asphalt properties were studied to determine effects upon pavement performance and deflections of flexible pavements. Experimental materials and methods are studied under various climatic and traffic conditions in efforts to minimize or control pavement reflection cracking through AC overlays.

173 718687 PB-296 358/5
A Study of CRCP Performance: New Construction vs. Overlay
(Interim rept.)
Daniel, James I. ; Hudson, W. Ronald ; McCullough, B. Frank
Texas Univ. at Austin. Center for Highway Research.
Sponsor: Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div.; Federal Highway Administration, Austin, TX. Texas Div.
Report No.: CFHR-3-8-75-177-12; FHWA/TX-177-12
Apr 78 106p
Sponsored in part by Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div.
Languages: English
NTIS Prices: PC A06/MF A01 Journal Announcement: GRAI7919
Contract No.: CFHR-3-8-75-177
This report documents the performance of several continuously reinforced concrete pavements (CRCP) in Texas. Specifically, it involves a comparison of the performances of CRCP overlays and new CRCP construction for three projects: I35-2(45)175, located in Guadalupe County, I35-4(13)317, located in Falls and McLennan Counties (a two county project), and I35W-5(44)401, located in Johnson County. These projects were constructed by the Texas State Department of Highways and Transportation and each includes overlay and new construction built side by side. This report documents condition surveys performed on these pavements in 1975-76. The study compares observed performances of CRCP overlays and new CRCP and reports findings and trends. While the findings are far from conclusive, they can be useful for improving future designs.

174 194925 DA
THIN-BONDED CONCRETE OVERLAYS AGING ASPHALT
Dun-Donnelley Publishing Corporation
Highway and Heavy Construction VOL. 121 NO. 8 Aug 1978 pp 66-67
AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017
SUBFILE: EI; HRIS
Utilization of bonded concrete overlays to strengthen and resurface worn highway pavements in Iowa is reported and discussed. The prepared surface is sandblasted and blown clean and dry after cold planers have removed asphaltic wearing course and scarified the concrete base. /EI/

175 860879 EI780860879
ANALYTICAL MODELING AND FIELD VERIFICATION OF THERMAL STRESSES IN OVERLAY.
Majidzadeh, K.; Suckarieh, G. G.
Ohio State Univ, Columbus
Transp Res Board Transp Res Rec n 632 1977 p 44-48 CODEN: TRREDM
This paper describes analytical and graphical procedures for computing thermal stresses at joint locations in pavement overlays. Equations and nomographs are used to calculate stresses caused by horizontal and vertical movements of slabs. Both average temperature drop and maximum temperature differential expected in pavement slabs are determined from temperature distribution noted at time of overlay construction. Stresses caused by slab movement are calculated for different overlays.

176 617653 PB-274 047/0
Asphaltic Concrete Overlays of Rigid and Flexible Pavements
(Interim rept. no. 1, Oct 70-Sep 77)
Kinchen, Richard W. ; Temple, William H.
Louisiana Dept. of Transportation and Development, Baton Rouge. Research and Development Section.
Sponsor: Federal Highway Administration, Baton Rouge, La. Louisiana Div.
Report No.: RR-109; LA-69-3B; FHWA/LA/RR-109
Sep 77 74p
NTIS Prices: PC A04/MF A01 Journal Announcement: GRAI7803
Contract No.: HPR
This study represents the development of a mechanistic approach to asphaltic concrete overlay thickness selection for overlays of flexible, rigid, and composite pavements. The procedure uses a deflection analysis to determine pavement rehabilitation needs. Design guides for selecting the overlay thicknesses are presented. Tolerable deflection-traffic load relationships and the deflection attenuation properties of asphaltic concrete have been developed, representing the subgrade support conditions and properties of materials used in Louisiana. The tolerable deflection relationships may require minor adjustments as additional test sections reach the end of life condition. All deflection measurements on asphaltic concrete have been corrected for the effect of temperature. Deflection measurements taken before and after overlay were also adjusted to minimize the effects of seasonal subgrade moisture variation. Several advantages of this approach over existing methods include (1) the elimination of reliance on human judgement in an estimation of pavement strength, (2) elimination of the expenses and inaccuracies associated with destructive sampling and testing of pavement components, and (3) the ability to significantly increase sample sizes or points of evaluation within a pavement system.

177 617664 PB-274 068/6
Blow-ups on Resurfaced Concrete Pavements
(Final rept.)
Gress, David L.
Purdue Univ., Lafayette, Ind. Joint Highway Research Project.
Sponsor: Federal Highway Administration, Washington, D.C. Structures and Applied Mechanics Div.; Indiana State Highway Commission, Indianapolis.
Report No.: JHRP-76-25; FHWA/RD-77-S0656
Aug 77 154p
Revision of report dated Aug 76. Report on Pavement Blow-ups and Resurfacing. Sponsored in part by Indiana State Highway Commission, Indianapolis.
NTIS Prices: PC A08/MF A01 Journal Announcement: GRAI7803

The objective of this study was to determine if overlaying a concrete pavement significantly influences blow-up performance and to isolate those variables that affect blow-up distress. The field testing of the bare pavement and overlayed pavement consisted of monitoring deformation, temperature and moisture as a function of time. Moisture contents were determined by using newly developed moisture gauges imbedded within the concrete pavements. The laboratory testing consisted of a microscopic analysis, and the determination of thermal and moisture properties of selected pavement field cores. The microscopic testing included compositional analysis, general physical condition investigation, and the detection and measurement of infiltration of polished sections taken from the field pavement cores. Coefficients of thermal expansion for the oven dry and twenty-four hour saturation moisture states and the effect of moisture on expansion were determined on selected field pavement cores using a special heating chamber in conjunction with a sensitive deformation measuring system.

178 193529 DA
BONDED, THIN LIFT, NON-REINFORCED PORTLAND CEMENT CONCRETE RESURFACING
Johnson, ML
Office of the County Engineer, Clayton County; .Box 456; Elkader; Iowa; 52043
Sep 1977 34 p. Tabs. Phots. 7 App. 1977
CONTRACT NO.: Project HR-191; Grant
SUBFILE: HRIS
A Research Project involving two, three, four and five inches of bonded Portland Cement Concrete Overlay on a 1.3 mile Portland Cement Concrete pavement was conducted in Clayton County, Iowa, during September, 1977, centering on the following objectives: 1. Determining the mixing and proportioning procedures required in using a conventional, central mix proportioning plant to produce a dense Portland Cement Concrete mixture using standard mixes with super-water reducing admixtures; 2. Determining the economics, longevity and maintenance performance of a bonded, thin-lift, non-reinforced Portland Cement Concrete resurfacing course using conventional procedures, equipment and concrete paving mixtures both with and without super-water reducing admixtures; and 3. Determining if an adequate bond between the existing pavement and an overlay of thin-lift, dense, non-reinforced Portland Cement Concrete can be obtained with only special surface cleaning and no surface removal or grinding. As a result of this research, a number of conclusions were arrived at. 1. Normal mixing equipment and proportioning procedures could be used using a conventional central-mix proportioning plant. This was successful when used with super-water reducing admixtures. Only minor changes need be made in procedures and timing. 2. The time has been too short since the completion of the project to determine how the new pavement will perform, however, initially it appears that the method is economical and no reason is seen at this time why the life of the pavement should not be comparable to an all new pavement. The initial test results show that bond strength, regardless of which method of cleaning is used, scarifying, sand blasting or water blasting, far exceed what is considered the minimum bond strength of 200 PSI except where the paint stripes were intentionally left, thus showing that the paint must be removed. 4. It appears that either cement and water grout or sand, cement and water grout may be used and still obtain the required bond. /Author/ Report for the Iowa Highway Research Board.

179 752030 EI770752030
CONCRETE AND R-R-R (RESURFACING, RESTORING, AND REHABILITATION).
Ray, Gordon K.
Portland Cem Assoc, Skokie, Ill
Proc Paving Conf for 14th Meet, Univ of NM, Albuquerque, 1977 p 36-4 CODEN: PPCODL
The use of cement and concrete in resurfacing, restoration, and rehabilitation of existing pavements is discussed. The use of cement to stabilize failed flexible pavements on light-traffic roads and to recycle old concrete as subbase or concrete pavement in a new highway is described and illustrated by specific recent examples. The rehabilitation of concrete through the installation of edge drains and concrete shoulders where necessary to improve drainage and reduce slab edge deflections is included. The restoration of concrete pavements through the use of slabjacking or sub-sealing, patching, and grooving and grinding to improve riding qualities and restore adequate skid resistance is presented. Concrete overlays or resurfacing to provide additional structural strength or improve serviceability are described, including concrete overlays on both old bituminous pavements and old concrete pavements. 12 refs.

180 837156 EI780537156
CONSOLIDATION OF CONCRETE FOR PAVEMENTS, BRIDGE DECKS, AND OVERLAYS.
Anon
Transp Res Board, Natl Res Counc, Washington, DC
Natl Coop Highw Res Program Synth Highw Pract n 44 1977 67 p CODEN: NCHSBB
The paper presents a review of the literature and synthesis that focuses on recent research and field practice on consolidation of hydraulic-cement concrete for pavements and bridge slabs. Full-depth and overlay construction are also included. The synthesis also examines parameters affecting consolidation, methods of consolidation, construction practices, and current specifications. The questions of the adequacy of consolidation and methods by which consolidation can be measured are also addressed. The differences between pavements and bridge decks and the special requirements for bridge-deck concrete placement, vibration, and finishing are reviewed. Revibration to increase consolidation is also discussed. Special techniques have been developed for consolidation of extra-thin overlays, including specific equipment requirements and prompt vibration. 83 refs.

181 855112 EI780855112
DESIGN AND CONSTRUCTION OF CONTINUOUSLY REINFORCED CONCRETE AIRPORT PAVEMENTS.
Harvey, Gary G.
US Army Eng Waterw Exp Stn, Soils & Pavements Lab, Vicksburg, Miss
Tech Rep US Army Eng Waterw Exp Stn S-77-11 Aug 1977 92 p CODEN: XWTRBC
This report provides design procedures for continuously reinforced concrete (CRC) airport pavements. The basic physical-mathematical model and applicable analyses are discussed. Thickness design procedures for both new CRC pavements and CRC overlays are presented for both civil and military aircraft. Methods for designing steel reinforcement, construction joints, and terminal treatment systems are included. All of these procedures are recommended for immediate use. 27 refs.

182 646870 PB-279 523/5
Design and Performance of Pavement Overlays
Carmichael, R. F. ; McCullough, B. F. ; Hudson, W. H. ; McGhee, K. H. ; Wang, M. C.
Transportation Research Board, Washington, D.C.
Report No.: TRB/TRR-632; ISBN-0-309-02658-X
1977 54p
NTIS Prices: PC$2.80/MF A01 Journal Announcement: GRAI7815
The 7 papers in this report deal with the following areas: analysis of an operational rigid-pavement system for continuously reinforced concrete pavements; report on an experiment for continuously reinforced concrete pavement in Walker County, Texas; effectiveness of pressure-relief joints in reinforced concrete pavements; performance evaluation for bituminous-concrete pavements at the Pennsylvania State Test Track; design and performance of flexible pavements in the tropics; road test to determine implications of preventing thermal reflection cracking in asphalt overlays; and analytical modeling and field verification of thermal stresses in overlay.

183 170239 DA
DESIGN OF ASPHALT CONCRETE OVERLAYS USING LAYER THEORY
Treybig, HJ; McCullough, BF; Finn, FN; McComb, R; Hudson, WR
Michigan University, Ann Arbor; .Department of Civil Engineering; Ann Arbor; Michigan
Jan 1977 Proceeding pp 589-628 15 Fig. 8 Tab. 11 Ref. 4 App. 1977
SUBFILE: HRIS
This report is a user's manual for thickness design of flexible overlays for flexible pavements. The design procedure is limited primarily to fatigue cracking the rutting criteria. Three cases of existing pavement condition are recognized by the procedure. These subsystems are: 1) existing pavement with remaining life, 2) existing pavement mildly cracked, and 3) existing pavement severely cracked. Each requires input from the following areas: 1) deflection testing, 2) condition surveys, 3) traffic data, and 4) materials characterization. The deflection testing serves as an aid in establishing "design sections" and in characterizing the subgrade. The condition surveys are used to select the proper design subsystem. Traffic data must be in the form of 18-kip equivalent axle loads. The materials characterization consists of laboratory testing to determine modulus values for each material. The overlay thickness design involves the use of inputs from the above four areas along with an elastic layered theory computer program, a fatigue equation and a rutting equation to determine a thickness that satisfies both the fatigue and rutting criteria. A complete example problem solution for the remaining life subsystem is presented. /Author/ Volume I of proceedings of 4th International Conference on Structural Design of Asphalt Pavements, Ann Arbor, Michigan, August 22-26, 1977.

184 170238 DA
DESIGN OF ASPHALT OVERLAYS FOR PAVEMENTS
Bonnot, J; Autret, P; De Boissoudy, A
Michigan University, Ann Arbor; .Department of Civil Engineering; Ann Arbor; Michigan
Central Laboratory of Bridges & Highways, France
Jan 1977 Proceeding pp 557-588 25 Fig. 6 Tab. 4 Phot. 28 Ref. 1977
SUBFILE: HRIS
The paper first describes the method used to confirm the design of a pavement structure incorporating an old pavement

and an overlay. A multilayer elastic model is used; an equivalent traffic and an equivalent temperature are used to take into account the variations of axle loads and pavement temperature. The method attempts to take into consideration the probabilistic nature of pavement distress, resulting from the scattering of pavement thickness, overlay material composition, fatigue life, and bearing capacity of old pavement. Distress risk has been choosen as a function of traffic. The method attempts also to take into account in someway the effect of future maintenance on the overlaid pavement. The overlay design method has the form of a Catalogue of overlay structures in which overlays are calculated once for all. For the overlay of old flexible pavements, the various old pavements have been classified in 36 cases, according the deflection and thickness of old pavements. The overlay thickness has been calculated for each of these cases and for several traffic classes. It has been found that for overlays with cement of slag treated base, the overlay thickness depends only on traffic and deflection of the old pavement; and that for overlays with bituminous base, the overlay thickness depends on traffic, deflection on the old pavement, and thickness of asphaltic concrete in the old pavement. A method is also given for the design of asphalt overlay of old pavement with cement treated (slag treated) base. Two cases must be considered: the cement treated base shows fatigue cracks but has kept its cohesion, or has lost its cohesion. For old pavements of that type, overlay thickness are always high. /Author/ Volume I of proceedings of 4th International Conference on Structural Design of Asphalt Pavements, Ann Arbor, Michigan, August 22-26, 1977.

185 157012 PR

DEVELOPMENT OF OVERLAY DECISION GUIDELINES AND A PAVEMENT RATING SYSTEM FOR VIRGINIA

INVESTIGATORS: McGhee, KH

PERFORMING ORG: Virginia Highway & Transportation Research Council P.O. Box 3817, University Station Charlottesville Virginia 22903

SPONSORING ORG: Virginia Highway & Transportation Research Council

SUBFILE: HRIS

PROJECT START DATE: 7703

PROJECT TERMINATION DATE: 8501

To develop decision guidelines for field personnel evaluating flexible pavements for structural overlay purposes. Studies will include an evaluation of distress factors present in pavements to be overlaid during the 1977 season and the development of distress criteria to aid in the overlay decision-making process.

186 170243 DA

EVALUATION AND OVERLAY DESIGN FOR FLEXIBLE PAVEMENTS ON LOW VOLUME ROADS

de Kiewit, P; Koning, PC; Carmichael, RF; Hudson, WR

Michigan University, Ann Arbor; .Department of Civil Engineering; Ann Arbor; Michigan

Grontmij n.v., Netherlands; Austin Research Engineers, Incorporated

Jan 1977 Proceeding pp 674-696 15 Fig. 10 Tab. 16 Ref. 1977

SUBFILE: HRIS

The evaluation and overlay design of low volume pavements is a major expense for many governing bodies such as small cities and counties. All over the world such governmental agencies have many miles of flexible pavements to maintain; usually with only small staffs to handle the job. The problem is often complicated further because the agency does not have adequate funding. It is also becoming clear that in the

future the maintenance of road pavements will claim a greater part of the funds that are available for highway and road development. Because of these and other factors a rational pavement evaluation and overlay methodology is needed to assist the engineer and preserve the existing investment. To fulfill these needs, an evaluation and overlay design procedure has been developed based on dynamic deflection measurement, elastic layered theory, and behavioral models for fatigue and rutting. The most important aspects of this procedure are that it is 1) currently operational, 2) based on the best theory available, and 3) developed for easy use. This paper describes the procedure and illustrates it with an example problem applied to conditions in Holland. The criteria according to which maintenance operations are carried out are divided into three main groups: 1) Traffic criteria (geometry); 2) Structural characteristics, and; 3) Safety and comfort criteria. A total evaluation procedure must consider all of these elements. For practical application we have chosen a method which emphasizes these aspects, and recognizes the more relevant items for the type of road which is to be evaluated. In the case of the low volume roads, the structural element and the consequences of different maintenance strategies is important and this will be a main part of the paper presentation. Consultation with the road owner and his needs will establish the requirements for the consideration of the traffic, safety, and comfort aspects. /Author/ Volume I of proceedings of 4th International Conference on Structural Design of Asphalt Pavements, Ann Arbor, Michigan, August 22-26, 1977.

187 170254 DA

EVALUATION OF EXISTING PAVEMENT BASED ON DEFLECTION AND RADIUS OF CURVATURE AND OVERLAY DESIGN

Miura, Y; Tobe, T

Michigan University, Ann Arbor; .Department of Civil Engineering; Ann Arbor; Michigan

Nihon University, Japan

Jan 1977 Proceeding pp 862-875 27 Fig. 11 Tab. 10 Ref. 1977

SUBFILE: HRIS

To perform maintenance and repair of an asphalt pavement having reached its service limit, it is necessary to make a mechanical evaluation of the existing pavement and subgrade. On a road being in service, however, it is difficult to perform destructive examination. It is therefore needed to establish an evaluation procedure by non-destructive method. In view of this, the author et al. have dealt with a procedure for evaluating existing pavements by determining the stiffness moduli of the subgrade and pavement from data obtainable from the surface of pavement. There are two methods of dividing the existing pavement into two layers: one into the subgrade and pavement and the other into the asphalt treated layer and bearing layer. The former is suitable for evaluation by compressive strain of the subgrade and deflection and the latter, by tensil strain at the bottom of asphalt treated layer and radius of curvature. Field verification was made on local roads being in service about 10 years and by comparing the stiffness moduli of the subgrade and pavement, which were estimated from material testing of the existing pavement with due consideration for environmental and traffic conditions, to those estimated by non-destructive method. Since it was ascertained that not only deflection but also the stiffness moduli of the pavement and subgrade follow a logarithmic normal distribution, field measurements of deflection and radius of curvature were statistically treated to present an adequate procedure for determining a typical structure of existing pavements. As the existing pavement was evaluated by the two-layer system, overlay design was made by the three-layer system. That is, examinations were made assuming the pavement structure as being divided into the subgrade,

pavement and overlay when a limit is placed upon strain on the subgrade or deflection and as being divided into the bearing layer, asphalt treated layer and overlay when a limit is placed upon tensile strain at the bottom of asphalt treated layer or radius of curvature. The values of deflection and radius of curvature estimated by computation for two types of overlay used on the site were compared to the values measured after the overlaying. As the result, the computed values were found close to the average of the measurements, proving adequacy of the design. /Author/ Volume I of proceedings of 4th International Conference on Structural Design of Asphalt Pavements, Ann Arbor, Michigan, August 22-26, 1977.

188 192998 PR

EVALUATION OF NEW FHWA OVERLAY DESIGN PROCEDURES

INVESTIGATORS: Majidzadeh, K

PERFORMING ORG: Resource International, Incorporated Engineering Consultants 30· East Wilson Bridge Road Worthington Ohio 43085

SPONSORING ORG: Federal Highway Administration Structures and Applied Mechanics Division

CONTRACT NO.: DOT-FH-11-9315; Contract

SUBFILE: HRIS

PROJECT START DATE: 7709

PROJECT TERMINATION DATE: ND

This contract will evaluate the new pavement overlay design method developed by ARE Inc. Under contract DOT-FH-11-8544, and compare the effectiveness of it with other methods currently used by states or recommended by other agencies in the design of overlays for pavements.

189 163576 DA

EXTENDING PAVEMENT LIFE WITH ASPHALT OVERLAYS

Asphalt Institute; .Asphalt Institute Building; College Park ; Maryland; 20740

Mar 1977 12 pp 1 Phot. 1977

SUBFILE: HRIS

This booklet, which notes that the maintenance and upgrading of the existing road networks is one of the compelling requirements of the U.S. today, demonstrates how asphalt overlays can strengthen and upgrade pavements as traffic increases and as funds become available. Brief details are outlined of the following projects: Alabama 1968 (overlaid with 4 1/2 to 5 inches hot-mix asphalt over old concrete pavement; no maintenance to date, 1976); California 1970 (overlaid with 3 inches hot-mix asphalt and 1/2 inch open-graded plant mix seal; no maintenance to date, 1976); California 1969 (overlaid with 7 1/2 inches hot-mix asphalt at the center tapering to 3 inches at the edge, 75 feet from the center line; no maintenance to date); California 1960 (overlaid with 3 inches hot-mix asphalt; no maintenance up to 1975); Florida 1962 (overlaid with 5 inches hot-mix asphalt over old concrete pavement; minimal reflection cracking and maintenance to date, 1976); Iowa 1963 (overlaid with 2 inches hot-mix asphalt over old asphalt pavement; minimal maintenance to date, 1976); Maryland 1969 (overlaid with 4 inches hot mix asphalt over surface-treated gravel roadbed; minimal maintenance to date, 1976); Maryland 1960 (overlaid with 6 inches hot-mix asphalt over old concrete pavement; no maintenance to date, 1976); Mississippi 1962 (overlaid with 2 1/2 inches hot-mix asphalt); Washington 1964 (overlaid with 3 inches hot-mix asphalt; little or no maintenance to date, 1976).

190 782083 PB80-192693
Flexible and Rigid Pavement Overlay Design Procedure
(Final rept.)
Treybig, Harvey J. ; McCullough, B. Frank ; Jordahl, Peter R. ; Smith, Phil ; Von Quintus, Harold
Austin Research Engineers, Inc., TX.
Corp. Source Codes: 061915000
Sponsor: Federal Highway Administration, Washington, DC.
Report No.: FHWA-RD-77-133
Oct 77 105p
Languages: English
NTIS Prices: PC A06/MF A01 Journal Announcement: GRAI8019
Country of Publication: United States
Contract No.: DOT-FH-11-8544
This manual presents design procedures for overlays of both flexible and rigid pavements. The design procedure includes an evaluation of the existing pavement based on nondestructive deflection testing, condition surveys, and materials sampling and testing. Based on this information the pavement is divided into separate design sections and each section is classified according to its condition of cracking. An analysis to determine the required overlay thickness is then made based on the category to which the existing pavement is assigned. The overlay analysis makes extensive use of elastic layered theory and selects the overlay thickness based on the concept of failure by fatigue cracking or rutting. The design procedure uses three computer programs for the pavement evaluation and overlay thickness design. Input guides and illustrative problems for the use of these programs are presented in this report.

191 711790 EI770211790
FLEXIBLE PAVEMENT EVALUATION AND REHABILITATION
Bhajandas, Amar C.; Cumberledge, Gaylord; Hoffman, Gary L.
Pa Dep of Transp, Harrisburg
ASCE Transp Eng J v 103 n 1 Jan 1977 p 75-85 CODEN: TPEJAN
A method for evaluating a flexible pavement and designing overlays based upon its in-place strength is presented. Strength is determined through a nondestructive dynamic deflection device trade-named Road Rater. Statistical laws are used to determine the characteristic deflection of the pavement, which is then modified to standard conditions. AASHO Road Test data are then used to determine the permissible deflection depending upon the traffic that will be imposed during the overlay design period. Using the modified characteristic deflection and the permissible deflection, the thickness of the overlay required is then computed. The design process is computerized and several practical steps that identify cause and type of failure, which are to be taken in conjunction with the design are advised. 10 refs.

192 158288 DA
FOUR CONCRETE OVERLAY METHODS TESTED FOR STREET RESURFACING
Modern Concrete VOL. 40 NO. 10 .Feb 1977 3 pp 1977
AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017
SUBFILE: EIT; HRIS
To find a low cost long-lasting surface for existing streets, the city of Anderson, Indiana, has built a test section comparing several types of resurfacing using ready mixed concrete. The four different test sections are: 4 in. of concrete over polyethylene film; 4 in. of concrete placed directly on old pavement that has been broken up; 3 in. of concrete over old pavement using wire mesh; 4 in. of concrete over old pavement using impregnated paper strips to isolate existing cracks.

193 170244 DA

OPTIMAL DESIGN OF ASPHALT OVERLAYS

Ratiroiu, MD

Michigan University, Ann Arbor; .Department of Civil Engineering; Ann Arbor; Michigan

Polytechnic Institute of Temisoara, Romania

Jan 1977 Proceeding pp 697-709 7 Fig. 2 Tab. 20 Ref. 1977

SUBFILE: HRIS

This paper presents a new method for designing asphalt overlays when optimization is required at least from an economic standpoint. Two main situations are taken into account: the existing pavement needs only to be strengthened as no important distorsions are reported, the existing pavement is heavily rutted, cracked or disintegrated and it is supposed to undergo particularly deep investigation and--if necessary--a new and complete structural design would be done. Only the first situation is studied in this paper. The new method is based upon an energy approach which requires that the energy absorbed by the highway body, when deflection under exterior loading occurs, should not exceed a limited amount which is related to the composition and the value of the traffic the pavement is supposed to bear through the design period. The design criteria are based upon limiting tensile stresses at the bottom of the layers, shear stresses in the center plane of the layers and--most of all--requiring given bearing capacity of the "rejuvenated" pavement. Since only one layer (as overlay) may not fullfill all requirements derived from the design criteria, it has been assumed that in certain situations two layers would be necessary, such a solution being supposed to offer both economic and constructive advantages. The method also permits an iterative procedure in order to get an economic optimum. Since new developments have been made, both theoretical and experimental accuracy checks have been done. The method has been accepted for current overlay design and is now in use in parallel with the existing standardized method. Volume I of proceedings of 4th International Conference on Structural Design of Asphalt Pavements, Ann Arbor, Michigan, August 22-26, 1977.

194 720968 PB-296 607/5

Overlay Design and Reflection Cracking Analysis for Rigid Pavements. Volume 1. Development of Design New Design Criteria

(Final rept. on Phases 2 and 3)

Treybig, Harvey J. ; McCullough, B. Frank ; Smith, Phil ; Von Quintus, Harold

Austin Research Engineers, Inc., TX.

Corp. Source Codes: 408700

Sponsor: Federal Highway Administration, Washington, DC.

Report No.: FHWA/RD-77/66

Aug 77 245p

See also Volume 2, PB-296 608.

Languages: English

NTIS Prices: PC A11/MF A01 Journal Announcement: GRAI7920

Contract No.: DOT-FH-11-8544

Fatigue cracking and reflection cracking criteria were developed and incorporated into a design procedure for flexible and rigid overlays of rigid pavements. Linear elastic layered theory is the basic model used to compute stresses and strains in the pavement system, which are then input to the fatigue and reflection cracking models. The fatigue criteria developments resulted from analyses of the performance of rigid pavements at the AASHO Road Test. A regression analysis was performed to obtain a fatigue equation relating stress and wheel load repetitions prior to Class 3 and 4 cracking. The effects of voids beneath the pavement as well as the condition of joints are also considered in the fatigue criteria. The reflection cracking criteria developed resulted from a study of the mechanics of reflection cracking and literature reviews. Mechanistic equations were derived and incorporated into an analysis model for use in design.

195 720969 PB-296 608/3
Overlay Design and Reflection Cracking Analysis for Rigid Pavements. Volume 2. Design Procedures
(Final rept. on Phase 2 and 3)
Treybig, Harvey J. ; McCullough, B. Frank ; Smith, Phil ; Von Quintus, Harold
Austin Research Engineers, Inc., TX.
Corp. Source Codes: 408700
Sponsor: Federal Highway Administration, Washington, DC.
Report No.: FHWA/RD-77/67
Aug 77 170p
See also Volume 1, PB-296 607.
Languages: English
NTIS Prices: PC A08/MF A01 Journal Announcement: GRAI7920
Contract No.: DOT-FH-11-8544
This manual presents design procedures for flexible and rigid overlays of rigid pavements as well as a reflection cracking analysis procedure for flexible overlays. The design procedure includes an evaluation of the existing pavement based on non-destructive deflection testing, condition surveys, and materials sampling and testing. Based on this information the pavement is divided into separate design sections and each section is classified according to its condition of cracking into one of the three categories: (1) pavement with no cracking or Class 1 and 2 cracking, (2) pavement with Class 3 or 4 cracking, or (3) pavement that will be mechanically broken up. An analysis to determine the required overlay thickness is then made based on the category to which the existing pavement is assigned. The overlay analysis makes extensive use of elastic layered theory and selects the overlay thickness based on the concept of failure by fatigue cracking. For flexible overlays an analysis can be performed to determine if reflection cracking should be expected to occur. The design procedure uses four computer programs for the pavement evaluation, overlay thickness design, and reflection cracking analysis. Input guides and illustrative problems for the use of these programs are presented in this report.

196 688764 PB-288 623/2
Pavement Condition Evaluation Utilizing Dynamic Deflection Measurements
(Final rept.)
Majidzadeh, Kamran
Majidzadeh (Kamran), Worthington, OH.
Sponsor: Ohio Dept. of Transportation, Columbus.; Federal Highway Administration, Washington, DC.
Report No.: FHWA/RD-78-S0781
Jun 77 193p
Sponsored in part by Ohio Dept. of Transportation, Columbus.
Languages: English
NTIS Prices: PC A09/MF A01 Journal Announcement: GRAI7906
In this study, the research efforts were directed toward the development of pavement condition evaluation techniques and analysis procedures for flexible and rigid overlay pavement design. This investigation also included a detailed field evaluation of an experimental portland cement concrete pavement and the analysis of deflection responses of various test sites. A stepwise regression analysis was carried out to evaluate the relative significance of various design and construction variables on the pavement deflection under load.

197 653682 PB-280 971/3

Pavement Design Manual for Secondary Roads in North Carolina

(Final rept.)

Barnes, Bobby D.

North Carolina State Univ., Raleigh. Highway Research Program.

Corp. Source Codes: 387987

Sponsor: North Carolina State Dept. of Transportation, Raleigh.; Federal Highway Administration, Washington, D.C.

Report No.: ERSD-110-75-3; FHWA/RD-78-S0702

Aug 77 34p

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7817

A procedure for design of new low volume secondary roads and overlays has been formulated. The procedure relies on data obtained from soil surveys published by the U.S. Department of Agriculture rather than conventional field testing. Otherwise the design method generally follows accepted thickness design techniques currently recognized by the North Carolina Department of Transportation.

198 173942 DA

PERFORMANCE EVALUATION FOR BITUMINOUS-CONCRETE PAVEMENTS AT THE PENNSYLVANIA STATE TEST TRACK

Wang, MC; Larson, TD

Pennsylvania State University, University Park

Transportation Research Record N632 pp 21-27 9 Fig. 3 Tab. 11 Ref. 1977

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

The Pennsylvania State Test Track, which was completed in August 1972, will be used to develop engineering data and criteria for the design and construction of new pavements and for the improvement and maintainance of existing pavements. The test track is composed of sections with various base-course materials and different layer thicknesses. This paper presents the results of performance analyses for sections containing bituminous-concrete base. The analysis was made by using an elastic-layer computer program; only the spring weather condition was considered. Critical responses analyzed were maximum vertical compressive strain at the top of the subgrade, maximum radial tensile strain at the bottom of the base course, and maximum deflection on the pavement surface. Performance data collected included present serviceability index, rut depth, and cracking. Correlations between critical responses and pavement performance were established. These correlations permit prediction of pavement performance from pavement response determined in the spring season. A maximum compressive strain of 450 mu m/m (0.000450 in./in.) at the top of the subgrade, a maximum tensile strain of 120 mu m/m (0.000120 in./in.) at the bottom of the base course, and a maximum deflection of 0.51 mm (0.020 in.) on the pavement surface were established as the limiting criteria for flexible pavements with bituminous bases to withstand 1,000,000 applications of an 8165-kg (18-kip) axle load without significant fatigue cracking. Based on these limiting criteria, structural coefficients of the bituminous-concrete base and the crushed-limestone subbase were developed. The structural coefficients vary significantly with layer thickness. /Author/ This article appeared in Transportation Research Record No. 632, Design and Performance of Pavement Overlays.

199 163552 DA
PREVENTION OF REFLECTION CRACKING IN ASPHALT OVERLAYS WITH STRUCTOFORR, PETROMAT, AND CEREX
Smith, RD
Iowa Department of Transportation; .Highway Research Board, 826 Lincoln Way; Ames; Iowa; 50010
May 1977 Final Rpt. 20 pp 10 Fig. 5 Tab. 1 App. 1977
REPORT NO.: Project HR-158;
SUBFILE: HRIS
This report presents construction methods and results using three reinforcing fabrics to prevent reflection cracking in an asphalt overlay. The original highway in the rural area was Portland Cement Concrete 20 feet wide. It was widened by adding 2 feet of asphaltic concrete 10 inches deep on each side prior to resurfacing. Data are presented for the widening joint and transverse cracks in the rural area and for the random cracking in the urban area.

200 997121 EI791297121
PROCEEDINGS $EM DASH$ UNIVERSITY OF MICHIGAN INTERNATIONAL CONFERENCE ON STRUCTURAL DESIGN OF ASPHALT PAVEMENTS, 4TH, VOLUME 1, 1977.
Anon
Univ of Mich, Dep of Civ Eng, Ann Arbor
Univ of Mich Int Conf on Struct Des of Asphalt Pavements, 4th, Proc, v 1 Univ of Mich, Ann Arbor, Aug 22-26 1977 Publ by Univ of Mich, Dep of Civ Eng, Conf Exec Comm, Ann Arbor 932 p
Proceedings include 53 papers presented at seven sessions of the conference held every 5 years that deal with the predictive design procedures and general systems for the structural design of flexible pavements; the applications of simplified, fundamental design procedures for flexible pavements; design of asphalt overlays for pavements; and practical approaches to flexible pavement evaluation and rehabilitation.

201 173940 DA
REPORT ON AN EXPERIMENT FOR CONTINUOUSLY REINFORCED CONCRETE PAVEMENT IN WALKER COUNTY, TEXAS
McCullough, BF
Texas University, Austin
Transportation Research Record N632 pp 6-15 9 Fig. 4 Tab. 11 Ref. 1977
AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418
SUBFILE: HRIS
This report summarizes the findings that resulted from a 16-year study on the performance of a continuously reinforced concrete pavement placed on I-45 in Walker County, Texas. An examination of data provides numerous guidelines for design requirements and construction specifications of future projects in which this type of pavement will be used. Specifically, there were more failures for the pavement in which a lower percentage of reinforcing steel and higher curing temperatures were used. The data indicate that type 3 cement withstands higher steel stresses and that special attention should be given to concrete vibration at all times. The 7-year performance of a short section of an asphalt-concrete overlay with varying thicknesses indicates that the rate of failure and the deflection can be substantially reduced by increasing overlay thickness. /Author/ This article appeared in Transportation Research Record No. 632, Design and Performance of Pavement Overlays.

202 170423 DA

RESURFACING, RESTORATION, AND REHABILITATION OF INTERSTATE HIGHWAYS: CRITERIA AND LOGIC USED TO DETERMINE JANUARY 3, 1977, NEEDS AND ESTIMATES OF COSTS

Southgate, HF; Newberry, DC, Jr; Deen, RC; Havens, JH

Kentucky Department of Transportation; .Bureau of Highways, Div of Research, 533 South Limestone; Lexington; Kentucky; 40508

Jul 1977 Final Rpt. 26 pp 23 Fig. 2 Tab. 9 Ref. 6 App. 1977

CONTRACT NO.: KYP-77-56; Contract

SUBFILE: HRIS

This report documents procedures and brings together data and correlations used by the Kentucky Bureau of Highways in developing the Resurfacing, Restoration and Rehabilitation (R-R-R) Cost Estimate under a set of guidelines. Data compiled includes a list of interstate construction contracts, pavement roughness data, traffic volume data, vehicle classification, lane distributions, and damage factors for several types of vehicle classifications. Correlations are presented for both the serviceability index, designed fatigue life, existing structural worth, and between serviceability index and pavement roughness. Overlay thickness requirements were determined for rigid pavements and flexible pavements. Lastly, standard overlay design cross-sections and unit cost estimates are discussed.

203 173944 DA

ROAD TEST TO DETERMINE IMPLICATIONS OF PREVENTING THERMAL REFLECTION CRACKING IN ASPHALT OVERLAYS

Kher, R

Ontario Ministry of Transportation & Communic, Can

Transportation Research Record N632 pp 37-44 9 Fig. 3 Tab. 1977

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

In predominantly cold climatic regions, thermal cracking of asphalt pavements and its reflection through bituminous resurfacings is a problem of great concern to the pavement engineers. Reflection cracking causes poor riding quality prematurely, reduces the useful life of a resurfacing, requires accelerated maintenance, and results in an uneconomic use of physical and fiscal resources. Over the years, many treatments have been tried to minimize the reflection cracking in bituminous resurfacing. These treatments have exhibited varying degrees of success; however, none has been consistently successful under all conditions. In Ontario, Canada, eight test sections were constructed in 1971 to determine a viable alternative to the predominantly used conventional resurfacing. A special feature of this experimental road is the two test sections in which the existing asphalt surface was pulverized and used with or without additional asphalt binder as a base for the resurfacing. In this paper, the phenomenon of thermal cracking and its mechanisms and manifestations are discussed. The experimental road is described and the performance of its various test sections over the past 5 years is documented. An economic analysis is conducted in which the trade-offs between the initial construction and the future maintenance costs of various treatments are compared to the costs of a conventional resurfacing. This analysis concludes that pulverization of the existing pavement surface and use of that surface as a base for resurfacing is the most viable alternative to a conventional resurfacing. The paper also describes three full-scale contracts, totaling about 50 km (31 miles), in which treatment was recently used in Ontario. /Author/ This article appeared in Transportation Research Record No. 632, Design and Performance of Pavement Overlays.

204 668519 PB-283 385/3

A Sensitivity Analysis of Rigid Pavement Overlay Design Procedure

(Research rept.)

Nayak, B. C. ; Hudson, W. Ronald ; McCullough, B. Frank

Texas Univ. at Austin. Center for Highway Research.

Corp. Source Codes: 388101

Sponsor: Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div.; Federal Highway Administration, Austin, Tex. Transportation Planning Div.

Report No.: CFHR-3-8-75-177-11; FHWA/TX-78-17711

Jun 77 155p

Prepared in cooperation with Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div.

NTIS Prices: PC A08/MF A01 Journal Announcement: GRAI7822

Contract No.: CFHR-3-8-75-177

Presently there are no overlay design procedures or criteria for determining the structural value of existing pavement and its remaining life and for evaluating how the layers will function in an overlaid pavement. Furthermore, none considers fatigue, a primary failure mode or mechanism. Recently, Austin Research Engineers, Inc., under a Federal Highway Administration contract, developed a design procedure using elastic layered theory in an analytical model for overlays of rigid pavements which takes these factors into account. The procedure includes a computer program, RPOD1, which performs various aspects of the analysis required for the design. Depending on the type of existing surface conditions, void, bond, and materials used in the overlays, 22 combinations of pavements and overlays are possible. RPOD1 involves nearly 17 independent variables and the final response is the overlay thickness suitable for the projected traffic. This report describes a sensitivity analysis to establish the relative importance of the independent variables to the response, i.e., the required thickness. For the analysis, the standard deviation is selected as a basis of sensitivity to facilitate interpretation of the final results.

205 665597 PB-283 129/5

The Study of Pavement Overlay Design

(Final rept.)

Majidzaden, Kanran ; Suckarieh, George

Ohio State Univ., Columbus. Engineering Experiment Station.

Corp. Source Codes: 267250

Sponsor: Federal Highway Administration, Washington, D.C.; Ohio Dept. of Transportation, Columbus.

Report No.: FHWA/RD-78-S0740; OHIO-DOT-17-77

Mar 77 246p

See also report dated Jul 77, PB-283 136.

NTIS Prices: PC A11/MF A01 Journal Announcement: GRAI7821

Contract No.: EES-457

The main purpose of this study is to recommend a procedure for flexible overlay design over rigid pavements. The current overlay design procedures are based mostly on experience acquired in the field of pavement design. They are oriented toward reducing the pavement deflection and keeping it below a certain limiting value believed to critical; no detailed analysis of the pavement before and after rehabilitation is usually used. In the few methods where some structural analysis suggested, no tools are offered to help achieving the proposed analysis. The investigation is aimed toward a workable rational overlay design procedure, whereby the effect of load, climatic factors, pavement conditions such as joints and pavement history are incorporated. The design procedure is offered along with a computer program, discussions and some nomographs to help the designer analyze the rigid pavement structure before and after overlaying it. The sources of the

information and the analysis presented in this paper vary from existing methods of analysis found in the literature, to analysis done by the author to help build the recommended design procedure. (Portions of this document are not fully legible)

206 668343 PB-283 136/0

The Study of Pavement Overlay Design. Design Guidelines for Overlays of Existing Pavements: An Implementation Manual

(Final rept.)

Majidzadeh, Kamran ; Suckarieh, George ; Ilves, George

Ohio State Univ., Columbus. Engineering Experiment Station.

Corp. Source Codes: 267250

Sponsor: Federal Highway Administration, Washington, D.C.; Ohio Dept. of Transportation, Columbus.

Report No.: FHWA/RD-78-S0739; OHIO-DOT-18-77

Jul 77 106p

See also report dated Mar 77, PB-283 129.

NTIS Prices: PC A06/MF A01 Journal Announcement: GRAI7822

Contract No.: EES-457

In this study, simplified procedures for design of flexible and rigid overlays for flexible and rigid pavements are discussed. Numerical examples are provided for calculation of stresses, strains and pavement life expectancy. This implementation manual also provides techniques for utilization of deflection parameters and field measurement techniques for pavement overlay design purposes. In this design procedure, the effects of load, climatic factors, pavement conditions such as joints and pavement history are also incorporated. A directory of computer programs and research reports for assisting the designer are included in this implementation package. (Portions of this document are not fully legible)

207 170240 DA

A SYSTEM FOR THE PREDICTION OF PAVEMENT LIFE AND DESIGN OF PAVEMENT STRENGTHENING

Lister, NW; Kennedy, CK

Michigan University, Ann Arbor; .Department of Civil Engineering; Ann Arbor; Michigan

Transport and Road Research Laboratory

Jan 1977 Proceeding pp 629-648 17 Fig. 9 Ref. 1977

SUBFILE: HRIS

An investigation was made of possible direct correlation between deflection and the deterioration of roads, deterioration characterized primarily by the development of rutting on the wheel paths. The experimental programme designed to relate deflection measured by the Benkelman Deflection Beam to pavement condition and traffic is briefly described. The preliminary information presented at the last Conference has been greatly extended and confirm strongly defined relationships between deflection measured early in the life of the road and the onset of critical conditions defining the need to strengthen. When combined with further similar relations known to exist between critical deflections and the traffic carried, design charts for predicting unexpired pavement life can be drawn up: these are presented for the main types of pavement. A system for predicting pavement life and designing overlays from this type of information obtained on the the road by surveys using the Deflectograph and the Benkelman Deflection Beam is briefly described, with reference to other published work. The latest development in the design procedure is a computer programme capable of treating the variability of deflection in a consistent manner in such a way as to eliminate the risks of localised early failure or over design in the strengthened pavement. Assessment of successive 100m lengths of road on a moving average principle is used to define minimum cost solutions which are then used by the

engineer as the basis for designs which take into account engineering constraints. Deflection surveys carried out on a number of normal roads having a range of base types are compared with the predictions of the design charts presented. Samples are given of both new construction and strengthened pavements; one example where the design life of an overlay has now expired is considered in are detail. /Author/ Volume I of proceedings of 4th International Conference on Structural Design of Asphalt Pavements, Ann Arbor, Michigan, August 22-26, 1977.

208 654626 AD-A055 158/0

Subgrade Elastic Moduli Determined from Vibratory Testing of Pavements

(Final rept. Oct 74-Sep 76)

Weiss, Richard A.

Army Engineer Waterways Experiment Station Vicksburg Miss

Corp. Source Codes: 038100

Report No.: FAA-RD-76-158

Oct 77 124p

NTIS Prices: PC A06/MF A01 Journal Announcement: GRAI7818

Contract No.: DOT-FA73WAI-377

A layered elastic theory approach to the calculation of the allowable load-carrying capacity and required overlay thickness of a pavement requires the values of the static elastic moduli of the pavement layers and the subgrade. A method is developed for determining the subgrade Young's modulus by vibratory nondestructive tests performed on the pavement surface. The response of pavements and subgrades to dynamic loadings is nonlinear, so that a nonlinear dynamic model of pavement response was developed by which the subgrade Young's modulus can be obtained from the measured dynamic pavement response data. The value of the subgrade Young's modulus predicted by vibratory nondestructive field tests was checked by laboratory dynamic resilient modulus tests. This was done by developing a nonlinear theory of the dynamic resilient modulus test by which the Young's modulus of the subgrade soil sample can be extracted from the resilient modulus test data. (Author)

209 184724 DA

TESTS ON TREATMENTS FOR REFLECTIVE CRACKING

Way, G

Arizona Department of Transportation

Transportation Research Record N647 pp 10-14 4 Fig. 1 Tab. 3 Ref. 1977

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

Eighteen test sections with a thin overlay either of 31.8 mm (1.25 in.) of asphalt concrete or of 12.7 mm (0.5 in.) of asphalt concrete finishing course were built in 1971 and 1972 to determine to what extent they prevented reflective cracking. Of these 18,5 treatmetns were found to significantly reduce reflective cracking--heater scarification plus Petroset, asphalt rubber membrane interlayer, fiberglass, heater scarification plus Reclamitte, and 200/300 penetration asphalt. Other performance aspects, such as roughness, rutting, deflection, and asphalt properties are reported, and costs in terms of construction and actual maintenance are given. Each treatment's failure or success is reviewed and considered before determining the conclusions and recommendations. /Author/ This paper appeared in Transportation Research Record No. 647, Evaluating Bridge Structures, Pavement Maintenance, Roadside Management, Deicing Salts, Transport of Hazardous Materials.

210 820103 EI780320103
TEXAS USES FABRIC TO PROTECT PAVEMENT FROM CRACKS.
Coleman, Paul H.
State Dep of Highw & Public Transp, Odessa, Tex
Civ Eng (New York) v 47 n 12 Dec 1977 p 74-75 CODEN: CIEGAG
The Texas Highway Dept. applied 330,000 yd**2 of Petromat non-woven polypropylene fabric in four test sections of I-20 near Pecos, Texas, covering nine miles of the four-lane highway. The article tells why and how the fabric was installed and what Texas expects to learn from the test.

211 650876 PB-280 504/2
Trial of a Wire-Fibre-Reinforced Concrete Overlay on a Motorway
(Laboratory rept.)
Galloway, J. W. ; Gregory, J. M.
Transport and Road Research Lab., Crowthorne (England).
Report No.: TRRL-LR-764
1977 27p
Also pub. as ISSN 0305-1293.
NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7816
To evaluate the potential of wire-fibre-reinforced concrete for thin overlays on heavily trafficked concrete roads in Great Britain, a full-scale experiment was carried out on a length of reinforced concrete carriageway on the M10 motorway, which had been in service for 15 years and had suffered some cracking. The overlay was constructed in two thicknesses, 60 mm and 80 mm, and three fiber contents were used, 2.7, 2.2 and 1.3 per cent by weight of 0.5 mm x 38 mm Duoform wires. 16 test sections were laid, some of which were bonded to the original pavement slab and some only partially bonded. The total length was 200 meters. Mixing was performed at a nearby readymix concrete plant and a slip-form paver was used for laying. Expansion joints were formed in the wet concrete over the expansion joints in the original pavement; additional contraction joints were also formed in the overlay. After a year of heavy traffic examination of cores showed that the bonding technique was satisfactory, the partially bonded sections had no effective bond and that wire bond across cracks was effective. The best performance, in terms of surface cracking, after 2 years of traffic, appears to be given by the thicker partially bonded sections; damage is at present mainly limited to hair cracking. No final conclusions can yet be reached on performance since the road has not been subjected to any very cold weather. It remains to be seen whether the combined effects of heavy salt application and increased carbonation of the concrete in severe winters will permit sufficient corrosion of the fibers at cracks that they are no longer effective. (Copyright (c) Crown Copyright 1977.)

212 820101 EI780320101
ZERO-MAINTENANCE DESIGN FOR PLAIN JOINTED CONCRETE PAVEMENTS.
Darter, Michael I.; Barenberg, Ernest J.
Univ of Ill, Urbana
Int Conf on Concr Pavement Des, Proc, Purdue Univ, West Lafayette, Indiana, Feb 15-17 1977 Publ by Purdue Univ, West Lafayette, Indiana, 1977 p 565-600
Design procedures for heavily trafficked jointed concrete pavements have been developed to provide $left double quote$ zero-maintenance $right double quote$ performance over a specified design period. The term $left double quote$ zero-maintenance $right double quote$ refers only to structural maintenance, which includes such activities as crack repair, joint repair, slab replacement, slab grinding, patching, and overlay. The purpose of this paper is to present some major aspects of the development of these procedures and some of the results obtained. 26 refs.

213 762584 EI770962584
APPLICATION OF WATERWAYS EXPERIMENT STATION 7257-kg VIBRATOR TO AIRPORT PAVEMENT ENGINEERING.
Sanborn, A. F.; Hall, J. W. Jr.
SITE Eng Inc
Transp Res Board Transp Res Rec n 602 1976 p 100-106 CODEN: TRREDM
This paper describes the use of a the Waterways Experiment Station 7257-kg (16-kip) vibrator for the evaluation of load-carrying capacity and the design of bituminous concrete overlays for highly variable flexible pavements at commercial airports. The primary purpose of using dynamic testing was to provide a rapid, nondestructive, and independent system of measurement of existing pavement strength. 8 refs.

214 737534 EI770637534
ASPHALT PAVING TECHNOLOGY, VOLUME 45, 1976.
Skok, Eugene L. Jr. (Ed.)
Univ of Minn, Minneapolis
Proc Assoc Asphalt Paving Technol v 45 1976, Tech Sess, New Orleans, La, Feb 16-18 1976 629 p CODEN: PRPTAA
The Proceedings contains 24 papers, including a symposium on preserving investment in pavements, presented at the Conference. Discussions follow each paper. Among the subjects covered are reduction of oxidative hardening by hydrated lime, rapid viscosity testing, asphalt preparation from Athabasca bitumen, pavement evaluations and performance, deflection of an asphalt-paved steel bridge deck, overlay maintenance strategies, pavement management systems, sand asphalt in highway construction, foamed bitumen, air-blown asphalt and others. Selected papers are indexed separately.

215 752026 EI770752026
ASPHALT-RUBBER STRESS-ABSORBING MEMBRANES: FIELD PERFORMANCE AND STATE OF THE ART.
Morris, Gene R.; McDonald, Charles H.
Ariz Dep of Transp
Transp Res Board Transp Res Rec n 595 1976 p 52-58 CODEN: TRREDM
The paper reviews the performance of the asphalt-rubber seal coats placed since 1967 and the present state of the art of design and construction. It further reviews the potentials of stress-absorbing membranes placed to prevent reflective cracking of overlays placed over both flexible and rigid pavements; provide bridge deck protection; control differential movement of existing pavements constructed over expansive clays; provide economical construction for low-volume roadways; and provide improved elastomeric sealing of cracks and joints. 14 refs.

216 139826 DA
ACI MANUAL OF CONCRETE PRACTICE. PART 1--1976
American Concrete Institute; .P.O. Box 19150, Redford Station; Detroit; Michigan; 48219
325 pp Figs. Tabs. Refs. 1976
SUBFILE: HRIS
This manual contains current committee reports and standards concerned with materials and properties of concrete, construction practices and inspection, and pavements and slabs. Among the topics covered are the durability of concrete, condition survey of concrete in service, mass concrete for massive structures, the cracking of massive concrete, erosion resistance of concrete, proportions for normal, heavyweight concrete, structural lightweight concrete and no-slump concrete. Admixture and concrete, lightweight

aggregate concrete, compression test results of field concrete, the design of concrete structures subjected to field loading aggregates for concretes, and expansive cement concretes are also covered. Recommendations are made related to the practice for measuring, mixing, transporting and placing concrete, hot weather and cold weather concreting, curing, consolidation, inspection, concrete highway bridge deck construction, cast-in-place nonreinforced concrete pipe, and concrete formwork. Preplaced concrete is discussed, and placing of concrete is covered. Nuclear concrete and precast concrete forms for cast-in-place concrete are also covered. The section on pavements and slabs covers concrete floor and slab construction, concrete pavements and concrete bases, foundations and shoulders of concrete pavements, the prestressed pavement slab, continuously reinforced concrete pavements, and concrete overlays for pavements.

217 138894 DA

A BITUMINOUS MIX OF IMPROVED RESISTANCE TO DEFORMATION

Peattie, KR

IPC Building and Control Journals Limited

Surveyor - Public Authority Technology VOL. 147 NO. 4376 Apr 1976 pp 9-12 1 Tab. 5 Phot. 2 Ref.

SUBFILE: TRRL; IRRD; HRIS

The article describes the development of grave-bitume (gravel-bitumen) which has high resistance to permanent deformation under heavy loading. The bituminous mix has a strong stone skeleton with a high filler content incorporating a harder than normal bitumen and a higher proportion of crushed aggregate than previously used in French roadbases. Aggregate gradings are similar to those used in the UK for dense bitumen macadam, but the harder binder used is likely to make gravel-bitumen twice as stiff and possess a better fatigue behaviour. It is suggested that the material could be used in thinner layers than other roadbase materials, providing comparable structural performance. Experience with gravel-bitumen as a roadbase has led to its application as an overlay both in conjunction with asphaltic concrete surfacings or with a surface dressing as a seal. Measurements have shown that the material has a higher stiffness and elastic modulus than asphaltic concrete. /TRRL/

218 149798 DA

CONTINUOUSLY REINFORCED CONCRETE PAVEMENT OVERLAY OF EXISTING PORTLAND CEMENT CONCRETE OVERLAY

Stephenson, EL

Highway Focus VOL. 8 NO. 2 .Apr 1976 pp 90-93 4 Phot. 1976

SUBFILE: HRIS

The upgrading is reported of a 2-lane 20-foot wide (9" - 6" - 9") thick portland cement concrete roadway to a 4-lane divided section having 24 foot wide roadways. The continuously reinforced concrete section provided for 35 No. 5 longitudinal bars in the -inch thick section and 39 No.5 longitudinal bars in the 8-inch thick section. No. 4 transverse bars spaced at 30-inch 3-c were specified. The longitudinal steel was high strength grade. The evaluation of the center of the longitudinal steel is shown as T/2 + 1/2 from the subgrade with tolerance of + or - 1/2-inch. Observations related to cracking and pumping joints are recorded. Observations lead to the opinion that overlay of concrete with continuously reinforced concrete is entirely satisfactory and practical in areas where the use of salt for snow and ice removal is low.

219 153656 PR
EVALUATION OF RUBBER-ASPHALT FOR REHABILITATION OF FLEXIBLE PAVEMENTS
INVESTIGATORS: Gulden, W
PERFORMING ORG: Georgia Department of Transportation Office of Materials and Research 15 Kennedy Drive Forest Park Georgia 30050
SPONSORING ORG: Georgia Department of Transportation; Federal Highway Administration Department of Transportation
CONTRACT NO.: 2-76; HP&R
SUBFILE: HRIS
PROJECT START DATE: 7608
PROJECT TERMINATION DATE: ND
The objective of the study is to evaluate the use of rubber-asphalt as a binder for seal cost construction and as a stress relieving interlayer to reduce or eliminate reflection cracking. Three different fabrics, Petromat, Mirafi, Bidim, are also included in the experiment for comparison purposes

220 585440 PB-266 958/8
Experimental Overlays to Minimize Reflection Cracking
(Interim rept. Feb 71-Aug 76)
Bushey, Roy W.
California State Dept. of Transportation, Sacramento. Transportation Lab.
Sponsor: Federal Highway Administration, Sacramento, Calif. California Div.
Report No.: FHWA-CA-TL-3167-76-28
Sep 76 50p
NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7716
California's research on experimental asphalt concrete overlays to minimize reflection cracking has been in progress since 1971. An evaluation of various methods and systems is being made to determine their effectiveness in reducing reflection cracking in bituminous overlays. The purpose of this interim report is to present information on the construction of the experimental overlay projects and to report on their performance to date. An additional 0.12 foot AC placed in conjunction with a 0.08 foot maintenance blanket (0.20 foot total) is performing better than the experimental test sections on a project with thermal cracking. On two projects in Southern California with alligator cracks 1/8 inch wide or narrower and visible signs of pumping in the surfacing, the use of Petromat has extended the life of a one inch overlay by more than two years.

221 156000 DA
FATIGUE CRITERIA DEVELOPMENT FOR FLEXIBLE PAVEMENT OVERLAY DESIGN (ABRIDGMENT)
Treybig, HJ; Finn, FN; McCullough, BF
Austin Research Engineers, Incorporated; Texas University, Austin
Transportation Research Record N602 pp 39-42 2 Fig. 1 Tab. 9 Ref. 1976
AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418
SUBFILE: HRIS
A fatigue model based on analysis and observations of numerous different pavement designs are presented for use in asphalt concrete overlay design. New overlay design procedures are being based on elastic layered theory, and fatigue curve analyses are being based on the analysis mentioned. Thus a compatability exists between development and application. The fatigue model presented is based on one asphalt concrete only; therefore, procedures should be investigated to adjust for mix design by using laboratory data.

222 149794 DA
FIBROUS CONCRETE OVERLAY-FORT HOOD, TEXAS
Gay, LH; Hawley, JC; Lindsay, WJ
Highway Focus VOL. 8 NO. 2 .Apr 1976 pp 53-65 16 Phot. 1976
SUBFILE: HRIS
A 4-inch thick fibrous concrete was placed on an old asphaltic concrete in 20 ft. wide lanes with sawed joints every 50 feet. All joints were filled with premolded neoprene joint filler. The outer strips of concrete were tied across the joint with tie bars. The interior slabs were not tied. The mix used here consisted of 8 ingredients: fibers (round wires made from rejected brass coated wire used in automobile tires) comprising about 1-1/2 percent of the total mix; cement (5-1/2 sacks of type I); fly ash (replaced 3 sacks of cement and provided pozzolanic action); water (35 gals.); coarse aggregate (rounded aggregate of one size); sand; air entrainment agent to obtain about 4 percent air; and set retarder. The introduction of the fibers in the direction of the conveyor belt carrying other materials and at sufficient speed to prevent tumbling was important. It was also important that fibers be introduced into the mixer at a relatively high speed. Details are given of external vibration, flexure tests, shrinkage of the concrete, and the mix design. Questions which have been raised and which must be answered prior to initiating a full scale project are listed.

223 149797 DA
FIBROUS CONCRETE OVERLAY IN MINNESOTA
er, WC
Highway Focus VOL. 8 NO. 2 .Apr 1976 pp 79-89 18 Phot. 1976
SUBFILE: HRIS
The construction is reported of five 500-foot test sections of glass fiber and steel fiber portland cement concrete (PCC) overlays and a 1300 foot section of plain portland cement concrete overlay which were included as part of a contract for bituminous overlay. The surface overlayed was PCC which was fairly worn and had moderate transverse cracking. One inch long and flat steel and glass fibers were used. Details are given of the concrete mix per cubic yard. The concrete surface was sandblasted, then swept with a power broom, the epoxy bonding agent was sprayed on the surface, followed by the slipform paver, followed by transverse hand floating and brooming and then membrane curing compound. The steel reinforcing bars placed over the transverse cracks in the underlying pavement were held in position by small piles of concrete. Details are given of the overlay procedures. Problems associated with the glass fiber concrete and the balling of steel fibers are discussed. Inspections will be made to evaluate the performance of the overlays.

224 743523 EI770643523
FOUR CONCRETE OVERLAY METHODS TESTED FOR STREET RESURFACING.
Anon
Mod Concr v 40 n 10 Feb 1977 p 52-54, 57 CODEN: MOCRBM
To find a low cost long-lasting surface for existing streets, the city of Anderson, Indiana, has built a test section comparing several types of resurfacing using ready mixed concrete. The four different test sections are: 4 in. of concrete over polyethylene film; 4 in. of concrete placed directly on old pavement that has been broken up; 3 in. of concrete over old pavement using wire mesh; 4 in. of concrete over old pavement using impregnated paper strips to isolate existing cracks.

225 163002 DA

INFLUENCE OF THE INTERFACE CONDITION ON STRESS DISTRIBUTION IN A LAYERED SYSTEM (ABRIDGEMENT)

Uzan, J

Technion - Israel Institute of Technology

Transportation Research Record N616 pp 71-73 3 Fig. 8 Ref. 1976

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

The behavior of a system containing a number of homogeneous, isotropic linear-elastic layers is analyzed using a linear fictional model to simulate the real behavior at the interfaces. The results of the computations emphasize the influence of the interface condition on the stress distribution and hence on the design of pavements. In flexible pavements, the radial stress is strongly affected by the interface condition. The vertical stress and the deflection bowl are also affected, but to a smaller extent. Since the rational design of flexible pavements is based on the radial stress or strain at the bottom of the asphalt-concrete layer and on the vertical stress or strain at the top of the subgrade, the determination and use in design of the modulus of resistance to displacement between different layers should improve the design system and make it more realistic. In rigid pavement overlays also, the condition of the interface between the existing and the new surface is important. In the case analyzed, the partial bond (as defined by the Corps of Engineers) corresponds to a large value of the modulus of resistance to displacement. Since the existence of such a large value is questionable, the determination of realistic values will make the design of overlays more rational. This article appeared in Transportation Research Record No. 616, Soil Mechanics: Rutting in Asphalt Pavements, Embankment on Varved Clays, and Foundations.

226 617649 PB-274 042/1

Longitudinal Cracking in a Continuously Reinforced Concrete (CRC) Overlay in Connecticut

Bowers, David G.

Connecticut Dept. of Transportation, Wethersfield. Bureau of Planning and Research.

Sponsor: Federal Highway Administration, Washington, D.C. Structures and Applied Mechanics Div.

Report No.: 395-2-76-14.; FHWA/RD-77-S0657

Nov 76 50p

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7803

The cause of longitudinal cracking that developed in the middle lane of a three-lane continuously reinforced concrete pavement was investigated. Soil borings were removed for frost-susceptibility determination. Rebound deflections were taken to ascertain amount of relative resistance to deflection offered by different base courses underlying the CRCP. Pavement cores were also removed through the longitudinal joint sawed between the middle and outer lanes, which were placed simultaneously. The latter proved beyond a doubt that insufficient depth of longitudinal cut was the primary cause for the random longitudinal cracking.

227 760234 EI770860234
MAINTENANCE MANAGEMENT SYSTEM FOR ASPHALT PAVEMENTS.
Smith, Wayne S.; Monismith, C. L.
Woodward-Clyde Consult, San Francisco, Calif
Transp Res Board Transp Res Rec n 598 1976 p 17-25 CODEN: TRREDM

A Markov decision model was developed to define optimal overlay maintenance strategies for in-service asphalt concrete pavements. This model was initially quantified by use of the subjective opinions of experienced highway engineers, and provisions were made to update these initial estimates with field data by means of Bayesian statistics. Optimal maintenance strategies were determined by minimizing the expected present value of total costs associated with a pavement and were considered to consist of highway department maintenance costs and excess user costs. Overlay maintenance alternatives considered were thin, medium, and thick overlays. Results indicated that, when overlay maintenance was required, medium or thick overlays representative of 10- and 20-year design periods respectively were optimal. 14 refs.

228 743510 EI770643510
MAKE NEW STREETS OUT OF OLD.
Anon
Am City Cty v 92 n 3 Mar 1977 p 41-44 CODEN: ACCOD3

The paper reports how recycling, heater-scarification and thin overlays get more use as low-cost routes to stronger roads and aggregates were used as subbase materials to make the new pavement and saved the cost of using all-new materials.

229 726567 EI770426567
NUMERICAL ANALYSIS OF THERMAL CRACK PROPAGATION IN PAVEMENT OVERLAYS.
Chang, H. S.; Lytton, R. L.; Carpenter, S. H.
S&B Eng, Houston, Tex
Pap Presented and Discussed at the Int Conf on Numer Methods in Geomech, 2nd, Va Polytech Inst and State Univ, Blacksburg, Jun 1976 Publ by ASCE, New York, NY, 1976 v 1 p 526-539

During recent years the development and application of linear elastic and viscoelastic fracture mechanics concepts have progressed to a point where they now provide a rational design and experimental approach to the problem of crack propagation. The paper presents the results of a study of the prediction of thermal tensile stresses using the theory of linear viscoelasticity, the application of fracture mechanics principles to an overlay, the development of an efficient and accurate computer code to utilize the thermal stresses to predict stress intensity factors, and the predicting of overlay life as a function of material properties and stress intensity factor. 36 refs.

230 742505 EI770642505
OPTIMUM OVERLAY MAINTENANCE STRATEGIES FOR ASPHALT PAVEMENTS DEFINED USING A PAVEMENT MAINTENANCE MANAGEMENT SYSTEM.
Smith, Wayne S.; Monismith, C. L.
Woodward-Clyde Consult, San Francisco, Calif
Proc Assoc Asphalt Paving Technol v 45 1976: Asphalt Paving Technol, Tech Sess, New Orleans, La, Feb 16-18 1976 p 230-254 CODEN: PRPTAA

A pavement maintenance management system (PMMS) has been developed which defines and evaluates optimum overlay maintenance strategies for inservice asphalt concrete pavements. All aspects of the PMMS have been incorporated into a computer program. The purpose of the PMMS is to

examine available maintenance alternatives in terms of when and what type of overlay maintenance should be applied such that optimum utilization of available funds can be achieved. In addition, the PMMS assists in the long range planning for maintenance needs and the associated budgeting. The main emphasis of this paper is to present the results obtained using the PMMS. To provide some basis for evaluation, however, the essential concepts used in the development of the PMMS are briefly summarized. 15 refs.

231 644324 PB-278 612/7
Pavement Design, Evaluation, and Performance
(Transportation research record)
Transportation Research Board, Washington, D.C.
Report No.: TRB/TRR-602; ISBN-0-309-025710
1976 135p
Library of Congress Catalog Card no. 77-4926.
NTIS Prices: PC$5.40/MF A01 Journal Announcement: GRAI7814

The 23 papers in this report deal with the following areas: Economic considerations of faulting and cracking in rigid pavement design; maintenance-free life of heavily trafficked flexible pavements; mechanistic structural subsystems for asphalt concrete pavement design and management; use of condition surveys in pavement distress and performance relationship (abridgment); improved techniques for prediction of fatigue life for asphalt concrete pavements; pavement response and equivalences for various truck axle and tire configurations; fatigue criteria development for flexible pavement overlay design (abridgment); effect of pavement texture on traffic noise (abridgment); differential friction: a potential skid hazard; effects of abrasive size, polishing effort, and other variables on aggregate polishing (abridgment); automation of the Schonfeld method for highway surface texture classification; wear and skid resistance of full-scale experimental concrete highway finishes; skid number and speed gradients on highway surfaces (abridgment); correlation of data from tests with skid-resistant tires; field test and evaluation center program and skid trailer standardization (abridgment); impulse index as a measure of pavement condition; condition surveys for pavement structural evaluation; study of rutting in flexible highway pavements in Oklahoma (abridgment); application of waterways experiment station 7257-kg vibrator to airport pavement engineering; relationships between various classes of road surface roughness and ratings of riding quality (abridgment); a comprehensive pavement evaluation system applied to continuously reinforced concrete pavement; development of a pavement management system; and effects of pavement roughness on vehicle speeds.

232 742509 EI770642509
PAVEMENT EVALUATION WITH THE FALLING WEIGHT DEFLECTOMETER.
Claessen, A. I. M.; Valkering, C. P.; Ditmarsch, R.
K Shell-Lab, Amsterdam, Neth
Proc Assoc Asphalt Paving Technol v 45 1976: Asphalt Paving Technol, Tech Sess, New Orleans, La, Feb 16-18 1976 p 122-157
CODEN: PRPTAA

A pavement evaluation method has been developed on the basis of elastic theory by which structural properties of a pavement can be derived from the surface deflection and the shape of the deflection bowl under a test load. The method generally expresses the structural quality of an existing pavement in terms of effective layer thicknesses and Young's moduli for the materials. Results are better with instruments using short loading times, like the Falling Weight Deflectometer,

than with slow-speed instruments like the Benkelman Beam. The Falling Weight Deflectometer has proved to be an accurate, reliable and simple instrument for pavement evaluation. The force level and loading time adequately represent actual traffic. Values of effective asphalt layer thicknesses derived from the deflectometer results showed good agreement with values obtained from cores or construction reports. The structural properties derived from deflection measurements can be used in the Shell Design Charts to determine a required overlay thickness. 18 refs.

233 526386 PB-257 502/5

Performance of a Continuously Reinforced Concrete Overlay in Connecticut. Report 1, Construction

(Interim rept.)

Bowers, David G.

Connecticut Dept. of Transportation, Wethersfield. Bureau of Planning and Research.

Sponsor: Federal Highway Administration, Washington, D.C. Structures and Applied Mechanics Div.

Report No.: 395-1-76-8; FHWA/RD-76-S0521

Feb 76 42p

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7624

Contract No.: HPR-395

A three-lane (in both directions) continuously reinforced concrete overlay has been placed over an old two-lane concrete pavement built in accordance with both the 40-ft contraction-joint and 100 ft expansion-joint design. The pavement is unique in that of the 3 lanes, 1 1/2 are placed on a gravel base, while the other 1 1/2 lanes are over old concrete, resulting in nonalignment of longitudinal joints. Depth of pavement was increased from 6-inches to 8-inches in the outside lane, which falls entirely on the gravel. During the course of paving, leave-out sections were required to accommodate traffic. Special procedures to cool the pavement ends and reduce end movement were followed prior to and after placement of these sections. Data on initial crack frequencies are also presented.

234 133958 DA

PREDICTION OF THERMAL REFLECTION CRACKING IN WEST TEXAS

Chang, HS; Lytton, RL; Carpenter, SH

Texas Transportation Institute; .Texas A&M University; College Station; Texas; 77843

Mar 1976 Intrm Rpt. 102 pp 23 Fig. 59 Ref. 4 App. 1976

AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

REPORT NO.: FHWA-RD-76-S0464; TTI-2-8-73-18-3; PB-252084/-9ST

CONTRACT NO.: 2-8-73-18; Study

SUBFILE: HRIS; NTIS

An economical means of rehabilitating deteriorated pavement is through the use of an overlay. The performance of overlay systems has, however, been far from satisfactory as the performance of any one system has varied widely among different installation sites. This study presents a rational approach for the prediction of overlay life and gives recommendations which are expected to extend the life of overlays. The predictions are made using linear elastic and viscoelastic stress analysis and viscoelastic fracture mechanics. Initially, a prediction scheme for viscoelastic thermal stresses in the overlay and old asphalt surface is used to predict thermal stresses more accurately than any previous attempt. These stresses are then applied to the crack surface to study the effects of material properties on crack development. The stress intensity factors necessary for this analysis are calculated using the finite element

technique with the crack tip elements developed by Pian. Predictions of service life are made using the empirical relationship developed by Paris. The results show that there are three states of crack growth in an overlay each of which require different layered arrangements of material properties to lower the stress intensity factor and thus retard crack growth. The influence of viscoelasticity properties on reduction of crack growth are presented with the service lives for typical asphaltic concretes. Sponsored by the Texas State Department of Highways and Public Transportation; Transportation Planning Division. Research performed in cooperation with the Department of Transportation, Federal Highway Administration.

235 536453 PB-258 750/9

Prevention of Reflective Cracking in Arizona Minnetonka-East (A Case Study)

(Final rept. no. 11, Jan 71-May 76)

Way, George B.

Arizona Dept. of Transportation, Phoenix. Materials Services.

Sponsor: Federal Highway Administration, Phoenix, Ariz. Arizona Div.

Report No.: FHWA/AZ/HPR-224

May 76 98p

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI7701

Contract No.: HPR-1-13(224)

In conjunction with a thin overlay on flexible pavements (1-1/4in AC and 1/2in ACFC) 18 test sections consisting of various treatments were built in 1971 and 1972 to determine to what extent they prevented reflective cracking. From these 18 treatments five were found to significantly reduce reflective cracking. These treatments were: Heater scarification plus petroset; Asphalt rubber membrane interlayer; Fiberglass; Heater scarification plus reclamite; and, 200/300 penetration asphalt. Besides cracking, other performance values including roughness, rutting, deflection and asphalt properties are reported, costs in terms of construction and actual maintenance are given. From all of the above each treatments mechanism of failure or success is reviewed and considered in determining the conclusions and recommendations.

236 192750 PR

REDUCTION OF REFLECTIVE CRACKING IN FLEXIBLE PAVEMENTS WITH STRESS ABSORBING INTERLAYER MEMBRANES

INVESTIGATORS: Maag, RG; Valencia, J

PERFORMING ORG: Kansas Department of Transportation Research, Development and Implementation Section 2300 Van Buren Topeka Kansas 66611

SPONSORING ORG: Kansas Department of Transportation; Federal Highway Administration Department of Transportation

SUBFILE: HRIS

PROJECT START DATE: 7607

PROJECT TERMINATION DATE: 8612

Objective is to evaluate stress absorbing membranes for long term effectiveness in preventing or reducing reflective cracking through bituminous overlays constructed over badly cracked pavements. Both polypropylene fiber and rubber-asphalt membranes are being evaluated. Evaluations are being made on 10 different projects. Continuous fiber membranes are used on 6 projects, strips of fiber membrane on one project, and rubber-asphalt on 3 projects. Comparisons will be made with controls constructed conventionally with new hot mix. Construction was monitored and post constructed durability and performance will be measured on an annual basis.

237 572342 PB-265 456/4

Reflection Cracking in Bituminous Overlays

(Final rept. 1971-76)

Donnelly, Denis E. ; McCabe, Philip J. ; Swanson, Herbert N.

Colorado Div. of Highways, Denver. Planning and Research Section.

Sponsor: Federal Highway Administration, Denver, Colo. Colorado Div.

Report No.: CDOH-P/R-R-76-6; FHWA/CO/RD-76/6

Dec 76 80p

See also PB-219 122.

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI7712

Contract No.: HPR

Nine different treatments to the pavement were included in the design of an Interstate project in Colorado in anticipation of finding a method of reducing or eliminating reflection cracking through bituminous overlays. Each treatment is represented by two 1,000 foot (305 metre) long sections, and there were two standard sections which were used as a basis for comparison. The major item of work included in this project was a leveling course and a 2 inch (5 cm) overlay of an existing 3 inch (8 cm) bituminous pavement which brought this section of Interstate 70 to full standard design thickness. The linear cracking in the eight year old pavement before the overlay was placed averaged 41 feet (12.5 metres) per 1,000 square feet (93 square metres) and the alligator cracking averaged 36 square feet (3.3 square metres) per 1,000 square feet (93 square metres) of test section. Construction of the test sections began in September and was completed in October 1971. The treatments listed in the order of their performance for reducing reflective cracking were: Petromat (Polyethylene fabric), Slurry Seal, Rubberized Asphalt, Reclamite, Petroset, Hand Poured, Heater-Scarifier, Plant Mixed Seal, Squeegee Seal, and Standard (no treatment).

238 **REFLECTIVE CRACKING CAN BE STOPPED**

Aiken, HV

Reynolds, Smith and Hills

Asphalt VOL. 28 NO. 2 .Apr 1976 p 13 1 Phot. 1976

SUBFILE: HRIS

An overlay project to stop reflective cracking in a Jacksonville airport is described. Weathering cracks up to 2 inches, and the increasing use of a 30-yr-old pavement (consisting of 4 inches of mixed-in-place sand-asphalt topped by 2-inch overlay of asphalt concrete) prompted plans to upgrade the pavement. The plans consisted of the following phases: chemically removing plant growth from the craks; cleaning the pavement and eliminating wind-blown sand from the cracks; applying an asphalt-aggregate slurry seal to fill cracks; applying a surface treatment with coarse aggregate of 3/4-inch uniform size; and placing a hot-mix asphalt concrete course in 2 lifts totaling 3-1/2 inches in thickness.

239 153449 PR

STRESSES AND STRAINS IN ACHM OVERLAYS ON PCC PAVEMENTS

INVESTIGATORS: Welch, RC

PERFORMING ORG: Arkansas State Highway & Transportation Department 9500 New Benton Highway, P.O. BOX 2261 Little Rock Arkansas 72203

SPONSORING ORG: Arkansas State Highway & Transportation Department; Federal Highway Administration Structures and Applied Mechanics

CONTRACT NO.: HP&R

SUBFILE: HRIS

PROJECT START DATE: 7605

PROJECT TERMINATION DATE: 8112

The monitoring devices will be purchased and installed and then the monitoring will begin of the actual behavior of overlay in the vicinity of the former pcc joints. The devices will record horizontal and vertical movements to learn more about reflection cracking to be applied to design procedures.

240 177469 PR

STRESSES AND STRAINS IN A CHM OVERLAYS ON PCC PAVEMENTS

INVESTIGATORS: Welch, RC

PERFORMING ORG: Arkansas University, Fayetteville Department of Civil Engineering College of Engineering Fayetteville Arkansas 72701

SPONSORING ORG: Arkansas State Highway & Transportation Department; Federal Highway Administration Department of Transportation

CONTRACT NO.: HRC-51-2; HP&R

SUBFILE: HRIS

PROJECT START DATE: 7605

PROJECT TERMINATION DATE: ND

Static and dynamic measurements of displacements and stresses in ACHM (Asphalt Concrete Hot Mix) overlays of PCC pavements will be obtained in the vicinity of joints in conventionally jointed pavements and in the vicinity of cracks in continuously reinforced pavements. Three different overlay thicknesses will be used at each site. Displacements will be measured with induction coil sensors and stresses will be measured with strain gage diaphragm pressure cells. Temperature of pavement and subgrade will be monitored as will subgrade moisture.

241 139560 DA

STRUCTURAL OVERLAYS FOR PAVEMENT REHABILITATION

Bushey, RW; Baumeister, LK; Matthews, JA

California Department of Transportation

Transportation Research Record N572 pp 29-37 10 Fig. 1 Tab. 11 Ref. 1976

AVAILABLE FROM: Transportation Research Board Publications Office 2101 Constitution Avenue, NW Washington D.C. 20418

SUBFILE: HRIS

Research in California on the use of deflection measurements for asphalt concrete overlay design resulted in a revision to the California overlay design method presented at the Western Summer Meeting of the Highway Research Board in August 1970. Deflection reduction characteristics and tolerable deflection levels of asphalt concrete were revised based on the performance of highway projects under study since 1960. A higher initial deflection level will result in a slightly greater percentage of reduction for a given overlay thickness. An evaluation of the design method compares predicted versus measured deflections on 69 reconstructed highways. The deflection level after reconstruction can be predicted within plus or minus 0.008 in. (plus or minus 0.2 mm) with a 95 percent confidence limit by using the deflection reduction guide. Pavement deflections are measured by using the California traveling deflectometer, which provides a dynamic type of measurement while traveling along the roadway at 1/2 mph (0.8 km/h). An asphalt concrete overlay design guide was developed that simplifies the procedure for determining overlay thicknesses, but other factors such as the condition of the structural section and reflection cracking potential may alter the design. Since 1960, the overlay method has been used on approximately 450 different roadways. /Author/ Report prepared for the 54th Annual Meeting of the Transportation Research Board.

242 561788 PB-263 432/7
Asphalt Concrete Overlays of Flexible Pavements. Volume 1. Development of New Design Criteria
(Final rept)
Austin Research Engineers, Inc., Tex.
Corp. Source Codes: 408700
Sponsor: Federal Highway Administration, Washington, D.C.
Report No.: FHWA/RD-75/75
Jun 75 109p
See also PB-263 433.
NTIS Prices: PC A06/MF A01 Journal Announcement: GRAI7709
Contract No.: DOT-FH-11-8544
Fatigue and rutting criteria were developed and incorporated into a design procedure for flexible overlays of flexible pavements. The AASHO Road Test flexible pavement sections were used as a data base. Field studies were conducted to obtain data and materials were sampled and tested to determine modulus of elasticity values. The fatigue criteria developed in this report is based on observations of distress on in-service pavements along with mechanistic analyses using elastic layered theory to predict strains in the asphalt concrete. The traffic prior to the beginning of Class 2 cracking was combined with the strains to develop a regression model for fatigue. Rut depths, traffic, stresses, and strains were combined to develop a regression model for rutting. Consideration was given to the relation of rutting to temperature. The stresses and strains were predicted using elastic layered theory. A summary of the overlay design procedure is presented as well as a comparison with existing procedures. This volume is the first in a series. The other in the series is: Vol. 2. FHWA-RD-75-76 Asphalt Concrete Overlays of Flexible Pavements - Design Procedures.

243 561789 PB-263 433/5
Asphalt Concrete Overlays of Flexible Pavements. Volume 2. Design Procedures
(Final rept)
Austin Research Engineers, Inc., Tex.
Corp. Source Codes: 408700
Sponsor: Federal Highway Administration, Washington, D.C.
Report No.: FHWA/RD-75/76
Jun 75 96p
See also PB-263 432.
NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI7709
Contract No.: DOT-FH-11-8544
This report is a user's manual for thickness design of flexible overlays for flexible pavements. The design procedure is limited primarily to fatigue cracking and rutting criteria. Three cases of existing pavement condition are recognized by the procedure. These subsystems are: (1) existing pavement with remaining life, (2) existing pavement mildly cracked, and (3) existing pavement severely cracked. Each requires input from the following areas: (1) deflection testing, (2) condition surveys, (3) traffic data, and (4) materials characterization. The deflection testing serves as an aid in establishing 'design sections' and in characterizing the subgrade. The condition surveys are used to select the proper design subsystem. Traffic data must be in the form of 18-kip equivalent axle loads. The materials characterization consists of laboratory testing to determine modulus values for each material. The overlay thickness design involves the use of inputs from the above four areas along with an elastic layered theory computer program, a fatigue equation and a rutting equation to detemine a thickness that satisfies both the fatigue and rutting criteria. A complete example problem solution for the remaining life subsystem is presented. This volume is the second in a series. The first is: Vol. 1. FHWA-RD-75-75 Asphalt Concrete Overlays of Flexible Pavements - Development of New Design Criteria.

244 479892 PB-246 893/2

Bituminous Resurfacings on Flexible Pavements

(Final rept.)

Vyce, John M.

New York State Dept. of Transportation, Albany.

Sponsor: Federal Highway Administration, Washington, D.C.

Report No.: NYSDOT-ERD-75-RR31

Aug 75 34p

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7603

Contract No.: HPR-35-2

The report summarizes data collected over a 6-year period on 29 bituminous resurfacings on flexible pavement. Twenty-one were measured before the resurfacing was applied and all were measured periodically between 1969 and 1974. The measurements consisted of those necessary to compute serviceability indices, as well as Benkelman beam rebound deflections. The results showed that the standard 1- and 2 1/2-in. overlays used in New York State are sufficient to extend the serviceable life of a flexible pavement from a minimum of 6 to about 12 years. Several factors must be taken into account, however, when determining which roads should be overlaid and what thickness to use, including deflection magnitude, condition of the original pavement, and total asphalt thickness in relation to anticipated traffic loadings. A procedure using these factors is discussed, along with reasons for not depending solely on deflections in establishing necessary overlay thicknesses. The data, as a whole, indicate that New York's current practice for resurfacing flexible pavements is generally a good investment of maintenance money, providing an adequate service life for a reasonable period.

245 126290 DA

COMPREHENSIVE PROGRAM IS PUTTING STATE HIGHWAY SYSTEM IN IMPROVED CONDITION

Maryland Asphalt Paver Aug 1975 pp 2-4 7 Phot. 1975

SUBFILE: HRIS

Reinforcing and safety projects are underway in Maryland which involve approximately 490 miles of all types of state highways. The work undertaken includes grade preparation, drainage (extensive; includes pipe extensions, headwall construction, removal of old pipes etc.), pavement (some spot patching, hot-mix asphalt widenings, wedge-levelling, base and/or surface courses over existing pavement), shoulders (many miles of bikeways have been constructed in conjunction with shoulder improvements; hot-mix asphalt has been utilized in much of this work), extensive guard rail placement and worn out rail removal. The resurfacing program which has been in operation for some years has recently expanded the overlay program and put it on a regular basis. The program originates in the seven Highway Administration Districts where the conditions of the roads are analyzed, evaluated and their needs determined. The projects are developed in the District, sent to the Maintenance Department in Baltimore for correlation, scheduling and contract procedure, and then returned to the District for execution. The program which will cost approximately $28,000,000, will contribute positively toward highway safety, riding quality, pavement structural strength maintenance, skid resistance, traffic flow, cycling, aesthetics, and prevent vehicle wear.

246 135060 PR

DEVELOPMENT OF A RATIONAL OVERLAY DESIGN METHOD FOR PAVEMENTS

INVESTIGATORS: Havens, JH; Southgate, HF; Deen, RC

PERFORMING ORG: Kentucky Transportation Research Program Kentucky University, College of Engineering Lexington Kentucky 40506

SPONSORING ORG: Kentucky Department of Transportation Bureau of Highways; Federal Highway Administration Structures and Applied Mechanics Division

CONTRACT NO.: 75-77; HP&R

SUBFILE: HRIS

PROJECT START DATE: 7506

PROJECT TERMINATION DATE: 8200

The aims of the project are to develop an asphaltic concrete overlay thickness design system based upon elastic theory and the 1973 Kentucky Design Criterion for asphaltic concrete structures, to develop an overlay thickness design system for portland cement concrete pavement structures, and to confirm the overlay design methods through the use of empiricisms, Benkelman beam and Road Rater tests, and correlations of behavior with time and traffic histories. An intensive analysis of the US 60 Boyd County test data has been initiated to provide the correlation of measured deflections and deflection based upon elastic theory. A literature review of portland cement concrete pavement thickness design methods will be initiated. The second phase will initiate the development of the overlay design charts for asphaltic concrete pavement. The third phase will involve data gathering of load and traffic histories and locations overlaid portland cement concrete pavements. The fourth phase will involve testing of those pavements scheduled for overlaying. Where possible, these same pavements will be tested this fiscal year after the overlays are constructed. The constructed overlays will be tested. Evaluations of the before and after test data will be used to adjust the overlay design charts for asphaltic concrete pavements. Overlay thickness design charts for portland cement concrete pavements will be developed. The final report will be issued. Common-Objective Study.

134668 DA

247 **EFFORTS TO REDUCE REFLECTIVE CRACKING OF BITUMINOUS CONCRETE OVERLAYS OF PORTLAND CEMENT CONCRETE PAVEMENTS**

McGhee, KH

Virginia Highway & Transportation Research Council; .P.O. Box 3817, University Station; Charlottesville; Virginia; 22903

Nov 1975 25 pp 8 Fig. 6 Tab. 7 Ref. 1975

REPORT NO.: VHTRC 76-R20;

SUBFILE: HRIS

Studies of efforts to reduce the incidence of reflection cracking when Portland cement concrete pavements or bases are overlayed with asphaltic concrete, revealed that neither sand as a bond breaker nor high strength fabrics as stress relieving layers are effective in reducing reflection cracking where vertical joint movement is a significant factor. Conclusions are also presented regarding the use of a high tensile fabric as a stress relieving layers between two asphaltic concrete overlays of an old Portland cement concrete pavement on a weak subbase, and the use of two types of fabric as stress relieving layers between asphaltic layers and a concrete base on a very strong subbase and subgrade.

248 469782 PB-244 763/9
Evaluation of Synthetic Fabrics for the Reduction of Reflective Cracking
(Final rept.)
Carey, Donald E.
Louisiana Dept. of Highways, Baton Rouge. Research and Development Section.
Sponsor: Federal Highway Administration, Baton Rouge, La. Louisiana Div.
Report No.: LA-70-1B(B)
Apr 75 29p
Sponsored in part by Federal Highway Administration, Baton Rouge, La. Louisiana Div.
NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7524
Contract No.: HPR; La-HPR-1(12)
This report describes the application of two synthetic fabrics--a nonwoven, polypropylene fabric and a spun bonded, continuous filament nylon fabric--to existing distressed concrete pavement before overlaying with asphaltic concrete. It evaluates the effectiveness of the fabrics in relieving stress and reducing or eliminating reflection cracking in the asphaltic concrete overlay. A separate installation site was chosen for each fabric. Aerial photographs were taken of the original concrete pavement, and visual observations were made periodically at each site during the study to determine to what degree reflection cracks had occurred. Comparison of the test sections with the control sections has shown that the fabrics have neither eliminated reflection cracks nor reduced the degree of cracking. However, it is recommended that the Department continue to observe both fabric installation sites to determine whether either fabric test section will structurally out-perform its respective control section with the passage of time.

249 099296 DA
FIBROUS CONCRETE PAVEMENT DESIGN SUMMARY
Rice, JL
Army Construction Engineering Research Laboratory; .P.O. Box 4005; Champaign; Illinois; 61820
Jun 1975 Final Rpt. 13 pp 3 Fig. Refs. 1975
REPORT NO.: CERL-TR-M-134;
SUBFILE: HRIS
This report presents interim design guidance for fibrous concrete pavements for airfields. The Corps of Engineers' current design procedures are modified to account for the peculiarities of fibrous concrete. Included in the report are discussions of design procedures for slabs on grade and overlays. No recommendations are presented concerning production of fibrous concrete; however, souces of information about mix designs, batching, and handling are noted in references cited within the report.

250 759417 EI770859417
GREEN COUNTY, IOWA, CONCRETE OVERLAY RESEARCH PROJECT.
Knutson, M. J.
Publ SP Am Concr Inst n 51: Roadways and Airport Pavements, for Annu Meet, San Francisco, Calif, Mar 30-Apr 5 1974. Publ by Am Concr Inst, Detroit, Mich, 1975 Pap SP 51-10 p 175-195
CODEN: PSAIDE
The 42 different test sections of the Greene County Overlay Project will provide information on the following aspects of concrete pavement overlays: slab thickness, cement content, steel fiber content, joint spacing, bonding characteristics, initial square yard costs, maintenance costs, service life of different test sections, and comparison of fibrous concrete, continuously reinforced concrete paving with elastic joints,

mesh, and plain concrete overlays. The first objective, to determine the feasibility of batching, mixing, transporting, placing, finishing, and texturing of fibrous concrete with conventional central mix plants and slipform equipment has been achieved. Although many problems were encountered and solved, further improvements should be made in handling and mixing of fibrous concrete.

251 475636 AD-A017 511/7

Nondestructive Vibratory Testing of Airport Pavements. Volume I. Experimental Test Results and Development of Evaluation Methodology and Procedure

(Final rept. Oct 72-Nov 73)

Green, James L. ; Hall, Jim W.

Army Engineer Waterways Experiment Station Vicksburg Miss

Corp. Source Codes: 038100

Sponsor: Federal Aviation Administration, Washington, D.C. Systems Research and Development Service.

Report No.: FAA-RD-73-205-1

Sep 75 209p

See also Volume 2, AD-A013 681.

NTIS Prices: PC A10/MF A01 Journal Announcement: GRAI7601

Contract No.: DOT-FA71WAI-218

Conventional direct sampling methods of airport pavement evaluation interfere with aircraft operations; therefore, an evaluation procedure based on nondestructive vibratory testing was developed. The procedure considers the parameters of pavement thickness and strength, soil strength, landing gear characteristics, and load repetition through correlation of FAA direct sampling procedures with the nondestructive data from termed the dynamic stiffness modulus, which is calculated from a vibratory load-deflection graph. The results indicated the need for standardized vibratory testing equipment, and specifications for a suggested model were written. Evaluation procedures were developed for rigid and flexible pavements which consider the environmental factors of temperature and frost-thaw action, the importance of test locations and quantities, and stabilized layers. Appendix A presents results of two correlations: (a) elastic deflection and pavement performance and (b) dynamic E-modulus and CBR. Appendix B presents the nondestructive testing and performance results on U. S. Army Engineer Waterways Experiment Station test sections and the effects of bound pavement thickness on the nondestructive test results in an attempt to develop overlay design. Appendix C gives procurement specifications for recommended nondestructive test equipment. (Author)

252 134853 PR

OVERLAYS FOR PLAIN CONCRETE PAVEMENTS

INVESTIGATORS: Gulden, W

PERFORMING ORG: Georgia Department of Transportation Office of Materials and Research 15 Kennedy Drive Forest Park Georgia 30050

SPONSORING ORG: Georgia Department of Transportation; Federal Highway Administration Structures and Applied Mechanics Division

CONTRACT NO.: 7502; HP&R

SUBFILE: HRIS

PROJECT START DATE: 7511

PROJECT TERMINATION DATE: 8307

The aim of the project is to determine which of four concrete and sixteen asphalt overlay designs will adequately be able to provide rehabilitation of faulted and cracked pavements for a desired performance life. Existing pavement condition, overlay construction and overlay evaluation tests and observations will be conducted.

253 128249 DA
PAVEMENTS AND SURFACINGS FOR HIGHWAYS AND AIRPORTS
Sargious, M
Wiley (John) and Sons, Incorporated; .605 Third Avenue; New York; 10016
Calgary University, Canada
619 pp Figs. Tabs. 7 App. 1975
AVAILABLE FROM: Wiley (John) and Sons, Limited Baffins Lane
SUBFILE: HRIS; ATRIS
This book introduces the basic principles which must be known in dealing with pavements, and presents the theories and methods of pavement design. There are four parts, the first of which covers pavement types, loads, climate effects, subbases and stabilized soils. The second part deals with the methods of design and construction of flexible pavements for highways and airports, and how to analyze their costs. Part three is devoted to a similar discussion of modern and conventional rigid pavements of different types. Part four explains the methods of pavement rehabilitation, the design of overlays and pavement systems analysis. Design charts are included in the various chapters, along with carefully selected and solved examples to illustrate the procedures and methods of design. The book is written for professionals and researchers as well as people familiar with basic engineering courses.

254 485391 PB-248 836/9
Performance Study of the Bituminous Concrete Section of the John F. Kennedy Expressway (I-95)
(Interim rept. no. 2)
Beck, Larry D.
Maryland State Highway Administration, Brooklandville. Bureau of Research.
Sponsor: Federal Highway Administration, Washington, D.C.
Report No.: FHWA/RD-76-S0435
Sep 75 20p
See also Interim rept. no. 1, PB-225 539.
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI7606
Contract No.: FH-AW-75-114-46
The main objective of the study is to evaluate the structural adequacy of the rehabilitated and resurfaced flexible pavement section of the JFK Expressway (I-95). This evaluation utilizes the 'Asphalt Institute's Deflection Method for Designing Asphalt Concrete Overlays for Asphalt Pavements.' The average deflection value for all tested sites increased slightly between 1973 and 1974 tests; however, 1973 and 1974 values are lower than the average deflection values for 1970 or 1972 tests which were prior to the completion of the resurfacing program.

255 135478 PR
PILOT PROGRAM FOR EVALUATION OF THE STRUCTURAL ADEQUACY OF FLEXIBLE PAVEMENT FOR COUNTIES AND MUNICIPALITIES
INVESTIGATORS: Lukanen, EO; Ingberg, RC; Korfhage, GR
PERFORMING ORG: Minnesota Department of Transportation 408 Transportation Building St Paul Minnesota 55155
SPONSORING ORG: Minnesota Department of Transportation
SUBFILE: HRIS
PROJECT START DATE: 7508
PROJECT TERMINATION DATE: 8105
Procedures were developed for engineers to use in estimating the time until flexible pavements will need major repairs or an overlay. Data collection consists of traffic volume, vehicle distribution and truck weight information, Benkelman beam deflection, structural determination and embankment soil classification.

256 177789 PR

SECOND GENERATION OVERLAYS

INVESTIGATORS: Hellniegel, EJ; Quinn, J

PERFORMING ORG: New Jersey Department of Transportation 1035 Parkway Avenue, P.O. Box 101 Trenton New Jersey 08625

SPONSORING ORG: New Jersey Department of Transportation; Federal Highway Administration Structures and Applied Mechanics Division

CONTRACT NO.: 7778; HP&R

SUBFILE: HRIS

PROJECT START DATE: 7505

PROJECT TERMINATION DATE: ND

The objective is to develop the methodology for the previously overlaid portland cement and bituminous bituminous concrete pavements without sacrificing overhead clearance overhead, (2) introduction of undesirable cross undesirable cross slope or drainage problems. To determine if distress such as channeling corrugation and flushing may be overcome by other than overlay and to evaluate several procedures for the elimination or reduction of reflection cracking. Milling with inlays, thin and regular overlays of dense graded and open graded courses of bituminous concrete, will set the tenor for the method.

197607 DA

257 **A STUDY OF CRCP PERFORMANCE: NEW CONSTRUCTION VS. OVERLAY**

Daniel, JI; Hudson, WR; McCullough, BF

Texas University, Austin Center for Highway Research Austin Texas 78712 CFHR-3-8-75-177; Texas State Department of Highways & Public Transp Transportation Planning Division, P.O. Box 5051 Austin Texas 78763; Federal Highway Administration Texas Division, Rm 826, Federal Office Building Austin Texas 78701

Apr 1978 Intrm Rpt. 106 p.

AVAILABLE FROM: National Technical Information Service 5285 Port Royal Road Springfield Virginia 22161

REPORT NO.: CFHR-3-8-75-177-12; FHWA/TX-177-12; PB-296358/5ST

SUBFILE: NTIS; HRIS

This report documents the performance of several continuously reinforced concrete pavements (CRCP) in Texas. Specifically, it involves a comparison of the performances of CRCP overlays and new CRCP construction for three projects: I35-2(45)175, located in Guadalupe County, I35-4(13)317, located in Falls and McLennan Counties (a two county project), and I35W-5(44)401, located in Johnson County. These projects were constructed by the Texas State Department of Highways and Transportation and each includes overlay and new construction built side by side. This report documents condition surveys performed on these pavements in 1975-76. The study compares observed performances of CRCP overlays and new CRCP and reports findings and trends. While the findings are far from conclusive, they can be useful for improving future designs. Sponsored in part by Texas State Dept. of Highways and Public Transportation, Austin. Transportation Planning Div.

258 135794 PR

A STUDY OF FLEXIBLE PAVEMENT BASE COURSES AND OVERLAY DESIGNS: SECOND CYCLE OF RESEARCH AT THE PENNSYLVANIA TRANSPORTATION RESEARCH FACILITY

INVESTIGATORS: Larson, TD

PERFORMING ORG: Pennsylvania State University, University Park University Park Pennsylvania 16802

SPONSORING ORG: Pennsylvania Department of Transportation; Federal Highway Administration Structures and Applied Mechanics Division

CONTRACT NO.: 75-02; HP&R

SUBFILE: HRIS

PROJECT START DATE: 7504

PROJECT TERMINATION DATE: ND

This project covers the second cycle of research at the Pennsylvania Transportation Research Facility. The primary objectives are: (1) to determine the 18 kip (80 KN) single axle equivalency factors for heavily loaded triaxle vehicles; and (2) to continue the validation of the overlay design procedure now used in Pennsylvania. The facility is a one-mile oval track which is composed of 21 test sections constructed by full-scale, conventional methods. Thirteen of the test sections remain from the first cycle and the other 8 were constructed in the fall, 1975. By the end of May, 1978, the older test sections had been exposed to 2.3 million and the new sections had received 1.1 million equivalent 18 kip single axle loads. In the fall 1978, 7 sections were overlaid and one section was reconstructed. The entire test track will be subjected to traffic with triaxle trailers. Variables monitored include serviceability, distress, environmental conditions, failure manifestations, and deflection histories. The second cycle of research has been completed at the end of February, 1980. Pooled-Fund Study.

259 469332 AD-A015 469/0

Technical Information Pamphlet on Fibrous Concrete Overlays--Fort Hood Project

(Final rept.)

Williamson, G. R.

Army Construction Engineering Research Lab Champaign Ill

Corp. Source Codes: 405279

Report No.: CERL-TR-M-147

Aug 75 20p

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI7524

Contract No.: DA-4-A-764717-D-895; 4-A-764717-D-89504

The first full-scale nonexperimental steel fibrous concrete placement was completed in March 1974 at Fort Hood, TX. An overlay of 3,175 cu yd of concrete was placed on a Tactical Equipment Park adjacent to Building 9529. The existing pavement consisted of 5 to 7 in. of asphaltic concrete on a stabilized limestone base. The area is a maintenance hardstand for M-60 tanks, M-88 tank retrievers, and other tracked vehicles. Because of the severe wear and rutting caused by the action of the tracks, the flexible pavement surface has required replacement every 3 to 4 yr. Fibrous concrete was selected as a more lasting solution to the problem. This report details the placement procedures used on the Fort Hood project and recommends other suitable techniques. Cost and preliminary performance evaluations of the Fort Hood overlay are presented.

260 260980 DA

CONSTRUCTION COSTS REDUCED BY PAVEMENT REJUVENATION AND OVERLAYS

Allen, GJ; Howard, RL

Arizona Highway Department; .1730 West Jackson Street; Phoenix; Arizona; 85007

N491 pp 52-59 5 Fig. 14 Ref. 1974

SUBFILE: HRIS

A method (which is seen as a means of stretching available funds in this time of economic crisis) is described of restoring badly cracked pavements through a process of heater scarification followed by an asphaltic concrete finishing course application. The surface of the existing crack-up and usually dried-out pavements will be heated and scarified to a depth of approximately 0.75 inch, the scarified material will be rejuvenated and recompacted followed by the placement of an asphaltic concrete finishing course. Pavements of this type of rehabilitation have been in service for 2 or 3 years and the performance is judged exceptionally good. The procedure is outlined, and the characteristics of the heater unit used in the operation are discussed. The required depth of heat must be accomplished before any scarification is attempted, for once the surface is scarified, the fluffed up material acts as an insulator opposing any subsequent heat that might be applied. It is not effective to have a heater searification combination followed by a second such unit. With proper balance of heater units to pavement conditions, with the flame sheilded and/or positioned other than directly upon the pavement surface, the heating phase can be accomplished effectively and without emission control problems. Specifications require that in addition to scarifying the pavement to a depth of approximately 0.75 inch, the system should be designed that a tumbling action of the scarified material is effected. This will break and cause some mixing of the material. The leveling device is discussed. It has been found effective to accomplish the compaction while the material is still hot and before the rejurvenating agent is applied. Pneumatic tired rollers are used and the specification is made that the rolling shall be completed within one hour from scarification. The asphaltic concrete finishing course is described and the results of a cost study are discussed. This report was presented at the 53rd Annual Conference of WASHO, held in Portland, Oregon from June 2-6, 1974.

261 396847 AD-779 953/9

Continuously Reinforced Concrete Airfield Pavement. Volume II. Design Manual for Continuously Reinforced Concrete Overlay Pavements

(Final rept. Feb 72-Dec 73)

Treybig, Harvey J. ; McCullough, B. Frank ; Hudson, W. Ronald

Austin Research Engineers Inc Tex

Corp. Source Codes: 408700

Report No.: AFWL-TR-73-229-Vol-2; FAA-RD-74-33-2

May 74 87p

Sponsored in part by Army Engineer Waterways Experiment Station, Vicksburg, Miss. See also Volume 1, AD-780 511 and Volume 3, AD-780 512.

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI7416

Contract No.: F29601-72-C-0057; DOT-FA71WAI-218; AF-683M

The report constitutes Volume II of a four-volume series on design and construction of new and overlay continuously reinforced concrete airfield pavement, and contains a detailed procedure for designing overlay pavements. It contains procedures for evaluating the existing pavement and the materials composing the pavement, selecting the required overlay thickness, designing the transverse and longitudinal

reinforcing steel and designing the joints. The design procedures are presented in the form of a series of charts and nomographs from which design parameters may be obtained by entering with appropriate input parameters. A detailed procedure for resilient modulus testing is also provided. (Author)

262 468053 PB-244 558/3
Design of ACHM Overlays by Deflection Analysis
(Final rept.)
Rogers, J. E.
Arkansas State Highway Dept., Little Rock. Div. of Planning and Research.
Sponsor: Federal Highway Administration, Washington, D.C.
Report No.: HRC-30-FR
15 May 74 30p
NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7523
Contract No.: HPR
Asphaltic concrete hot mix (ACHM) overlays used for improving load carrying quality of a roadway have not as yet been designed according to specific criteria. Of the design procedures available, only deflections take into account the structural strength of an in-situ pavement. The report covers eight test sections that were tested in Arkansas during each season for a period of four years. Data were collected, reduced, and plotted on a series of graphs of temperature (pavement & ambient) vs. deflection (total & rebound). Regression analyses were performed on each set of data to fit a trend line and determine the relationship between temperature and deflection. The results are discussed. In most cases, ambient temperature influenced deflections to a greater degree than pavement temperature. For this reason, a flexible pavement design procedure should utilize ambient temperature.

263 446768 PB-241 077/7
Mixture Design Concepts, Laboratory Tests and Construction Guides for Open Graded Bituminous Overlays
(Final rept.)
Gallaway, Bob M. ; Epps, Jon A.
Texas Transportation Inst., College Station.
Corp. Source Codes: 347780
Sponsor: Federal Highway Administration, Washington, D.C.; Texas Highway Dept., Austin.
Report No.: TTI-2-10-74-36-1F
Oct 74 144p
Prepared in cooperation with Texas Highway Dept., Austin.
NTIS Prices: PC A07/MF A01 Journal Announcement: GRAI7513
A review of the literature together with field experience gained in Texas has resulted in a modification of the Federal Highway Administration design method for open-graded asphalt friction courses. The extension of this procedure involved the development of design curves for synthetic aggregate mixtures over a range of air void contents. Field surveys were made in four districts of the Texas Highway Department where open-graded asphalt friction courses. The extension of this procedure involved the development of design curves for synthetic aggregate mixtures over a range of air void contents. Field surveys were made in four districts of the Texas Highway Department where open-graded bituminous mixes have been placed as trial sections and/or contract jobs. Data collected include (a) freeze-thaw of field cores, (b) Mays Ride Meter measurements, (c) texture measurements by two methods, (d) water outflow measurements, (e) frictional performance, (f) construction guides and (g) types of expected or observed distress with suggestions for remedial action.

264 438277 PB-239 009/4
Pavement Design and Management Systems
Hudson, W. R.
Transportation Research Board, Washington, D.C.
Report No.: TRB/TRR-74-512; ISBN-0-309-02356-4
1974 79p
NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI7507
Actual cases of the application of pavement design and management systems by highway agencies are discussed in this record. Their purpose is to demonstrate that systems concepts can be applied to pavement design. Both expected advantages and difficulties encountered in implementing systems concepts are covered by the authors.

265 142784 DA
PAVEMENT MAINTENANCE AND REHABILITATION
Natal University Department of Civil Engineering Durban South Africa
VOL. 3 1974 Analytic 17 pp Figs. Tabs. Phots. Refs.
SUBFILE: TRRL; IRRD; HRIS
The following papers were presented at this session: Full depth asphalt in road rehabilitation, Van Dalen, B; Resurfacing of the Ben Schoeman highway with open-graded asphalt, Visser, AT, De Wet, LF and Marais, GP; An Approach to pavement management in South Africa, Curtayne, PC; Factors that affect pavement serviceability and future performance, Curtayne, PC and Walker, RN; A system framework for pavement rehabilitation, Hudson, WR and Finn, FN; The prevention of reflective cracking in asphalt overlays, Hugo, F and Raath, P; Maintenance problems of Kariba airport runway, Mathess, AJD and Hedderwick, PM; Design of asphalt overlays in Natal, Groth, PJ; The cold planer in pavement maintennce, Harrington, VR. /TRRL/ Proceedings of the Second Conference on Asphalt Pavements for Southern Africa, July 29-August 2, 1974, Durban, Session 8.

266 479838 PB-246 801/5
Pavement Rehabilitation: Proceedings of a Workshop Held at San Francisco, California on 19-22 September 1973
(Final rept)
Transportation Research Board, Washington, D.C.
Sponsor: Federal Highway Administration, Washington, D.C.; National Academy of Sciences-National Academy of Engineering, Washington, D.C.
Report No.: FHWA/RD-74-60
Jun 74 242p
Document Type: Conference proceeding
NTIS Prices: PC A11/MF A01 Journal Announcement: GRAI7603
Contract No.: DOT-OS-40022-1; HPR
A three and one-half day workshop was used as a forum to examine the broad field of pavement rehabilitation and related strategies applicable to both highways and airfields. Prepared state of the art papers were presented to document knowledge impinging on the pavement maintenance processes. These papers were used as background material for study by small working groups. A proposed research framework was formulated from an appraisal and evaluation of the workshop deliberations. This report contains the following: Proposed research framework; Evaluation of the workshop on pavement rehabilitation; A general framework for pavement rehabilitation; Surface evaluation of pavements-state of the art; Structural evaluation and overlay design for highway pavements-a review; Structural evaluation and overlay design methodology and airfield pavements-state of the art; Reflection cracking; The thermal cracking problem and pavement rehabilitation; Drainage and pavement rehabilitation; Urban area problems associated with pavement rehabilitation; Pavement rehabilitation highway maintenance problems; Special problems with airfield pavement maintenance.

267 265204 DA

PIONEER OVERLAY JOB USES FIBER-REINFORCED CONCRETE

ASCE Civil Engineering VOL. 44 NO. 1 .Jan 1974 pp 38-39 3 Phot. 1974

SUBFILE: HRIS

A fiber-reinforced concrete overlay was placed over 12,600 ft of 50-year old, 8.5 in. thick concrete pavement. The overlay thickness was varied in this research project. In various places it was bonded, unbonded by a plastic sheet, and partially bonded to the old pavement. Steel fibers of different lengths (1 and 2.5 in.), various concentrations, and different fiber cross-sections (round and rectangular) were used. Fourteen days after the concrete was poured, the flexural strength was 750-1,100 pis. A 2-step procedure is described for the solution of the fiber balling or clumping problem. The use is described of a vibrating screen to break up fiber balls before introduction of fibers to the concrete mix. In another method, fibers are added gradually after all other ingredients are in the mixer (in a central mix job), or 70 percent of the water is put in the mixer first, then aggregates, fibers, cement, and finally the other 30 percent of the water. Research on fiber-reinforced concrete is reported. It is recommended that water reducers be added to (to fiber-reinforced concrete) improve workability and permit reduction of the water/cement ratio. Tests revealed that a 6-in.-thick fibrous slab developed its first and second visible crack after 350 and 700 traffic loadings while a 10-in. plain concrete slab developed such a crack after fewer than 40 loadings. Steel fibers are the most commonly used but the investigation is reported of the use of alkali-resistant glass fiber. The likely future uses of fibrous concrete are briefly discussed.

268 206137 DA

PROBABILISTIC DESIGN CONCEPTS APPLIED TO FLEXIBLE PAVEMENT SYSTEMS DESIGN

Texas Univ, Center for Highway Research; .Darter, MI; Hudson, WR

May 1974 Res Rept 202 pp Figs Tabs Refs RES STUDY 1-8-69-123 RES REPT 123-18 3 APP 1974

SUBFILE: HRIS

A major problem in pavement design has been the inherent uncertainty and variation of the design parameters and models. Empirical safety factors and judgement factors have been applied to "adjust" for the uncertainties involved, but the result has been much overdesign and underdesign. A method was needed which would consider the variations and uncertainties of pavement design quantitatively and make it possible to design for A specific level of reliability. As a basic start in the solution of the problem, a theory and procedures were developed, based on classical reliability theory, to apply probabilistic design concepts to flexible pavement system design. The probabilistic theory and procedures have been both practical and useful as they have been implemented into the pavement design operations of the Texas highway department. Original implementation was with the deterministic fps-7 program, which was modified to include some probabilistic design capability and renamed fps-11. That version, which has been used by ten districts of the Texas highway department since late 1971, has been further developed to include variations occurring in individual pavement layers and subgrade, and the consideration of traffic forecasting error. The overlay mode was improved by making it possible to "adjust" the performance model to A specific pavement by considering its past performance history, and the new program was named fps-13 (cfhr).

269 325500 PR
ROAD ENGINEERING: PAVEMENTS
INVESTIGATORS: Cops, P; Sandman, CR; Wait, DA
PERFORMING ORG: South Australia Highways Department, Australia Materials and Research Laboratories 33-37 Warwick Street Walkerville South Australia Australia
SUBFILE: IRF; IRRD; HRIS
PROJECT START DATE: 74
PROJECT TERMINATION DATE: 8306
Aims are to 1) develop and maintain a system to monitor pavement condition for both strength and skid resistance, 2) locate and assess pavement materials for use in natural and stabilised form, 3) evaluate current methods of pavement design using S.A. conditions and materials, including the design of hotmix surfacings for particular applications, and 4) assess and improve current methods of pavement construction. Thickness overlay designs will be compared by testing of soil samples and by deflection measurement. Pavement deflection data will be correlated with construction history and observed in-service performance. An experimental road section will be established to evaluate in-service performance of road pavement types and relative equivalences of materials used, and current methods of pavement design compared with proposed NAASRA manual of "Pavement Thickness Design". The use of natural materials for pavement construction will be utilized and the effectiveness of stabilised local materials assessed particularly in areas of limited water supply such as the Stuart Highway. The effects of aggregate, surface texture, traffic and climate an skid resistance at selected sites, will be evaluated and polished stone values determined for local aggregates, as well as suitable limits for minimum skid resistance of South Australian roads.

270 759405 EI770859405
ROADWAYS AND AIRPORT PAVEMENTS.
Stingley, W. M. (Ed.); Pasko, Thomas, J. Jr. (Ed.)
Publ SP Am Concr Inst n 51, for Annu Meet, San Francisco, Calif, Mar 30-Apr 5 1974. Publ by Am Concr Inst, Detroit, Mich, 1975 283 p CODEN: PSAIDE
The volume contains 15 papers presented at the Symposium. Among the subjects included in the papers are rigid pavement design charts based on a finite element analysis, slipforming airfield pavements, proper vibration of concrete pavements, evaluation of parameters influencing performance of continuously reinforced concrete pavements, fiber reinforced concrete pavement performance, concrete overlays, prestressed concrete pavements, skidding resistance, and others. Individual papers are indexed separately.

271 468072 PB-244 579/9
Structural Overlays for Pavement Rehabilitation
(Interim rept. Jan 69-Dec 73)
Bushey, Roy W. ; Baumeister, Karl L. ; Matthews, James A. ; Sherman, George B.
California State Dept. of Transportation, Sacramento. Transportation Lab.
Sponsor: Federal Highway Administration, Washington, D.C.
Report No.: CA-DOT-TL-3128-3-74-12
Jul 74 24p
Prepared in cooperation with Federal Highway Administration, Washington, D.C.
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI7523
Contract No.: HPR
California's research on the use of deflection measurements for asphalt concrete overlay design has resulted in a revision

to the California overlay design method. Deflection reduction characteristics and tolerable deflection levels of asphalt concrete were revised based on the performance of highway projects under study since 1960. An evaluation of the design method compares predicted versus measured deflections on 69 reconstructed highways. Pavement deflections were measured using a traveling deflectometer which provides a dynamic-type measurement while traveling along the roadway at one-half mile per hour. The results are discussed.

272 125617 DA

TRAFFIC LOADING AND ITS INFLUENCE ON THE DESIGN OF FLEXIBLE PAVEMENTS AND OVERLAYS

Peattie, KR

Institution of Highway Engineers

Highway Engineer VOL. 21 NO. 12 Dec 1974 pp 9-17 4 Fig. 14 Tab. 15 Ref.

SUBFILE: TRRL; IRRD; HRIS

Proposals to alter the statutory axle loading limits in conformity with the intentions of the eec and the increasing number of heavy commercial vehicles coming into this country from abroad have focused attention on the relationship between traffic loading and the structural performance of pavements. On the basis of certain assumptions about the effects of increasing statutory axle limits on the actual loading of the vehicles, increases in structural damaging power corresponding to different statutory axle limits are evaluated. It is shown that a statutory limit of 13 tonnes would be likely to produce a smaller increase in damaging power than that currently existing between traffic flows in opposite directions at the same points in some of the major roads. The influence of these different levels of axle loading on the structural performance of pavements is investigated in several ways; the reduction in life that would result if the loading was increased above the original design level may be evaluated; and the increase in pavement thickness necessary to ensure that roads designed for different statutory axle limits would all have the same life can be estimated together with their relative costs. An alternative solution to the problems is to determine the thickness of asphalt overlay which would have to be applied to roads originally designed for a lower level of statutory axle limit to ensure that under increased axle loadings the same ultimate life would be obtained. The cost of these solutions is also estimated. (A) /TRRL/

273 081365 DA

THE USE OF THE DEFLECTION BEAM IN EVALUATING THE STRENGTH OF FLEXIBLE ROAD PAVEMENTS

Jermyn, TM

An Foras Forbartha St Martin's House, Waterloo Road Dublin 4 Ireland

Jan 1974 Series 46 pp 7 Fig. 6 Tab. 3 Phot. 12 Ref.

AVAILABLE FROM: An Foras Forbartha St Martin's House, Waterloo Road Dublin 4 Ireland

REPORT NO.: No. RC 110;

SUBFILE: TRRL; IRRD; HRIS

In this report the use of deflection techniques for pavement evaluation and the design of road strengthening measures in discussed. The long term performance of flexible pavements can be determined by the magnitude of the transient deflections which occur under traffic. Deflection histories can be prepared for any type of construction by relating the deflection measured under a standard wheel load to (A) The age of the road expressed in terms of the cumulative total of equivalent standard 8200kg (18,000lb) axle loads and (B) the condition of the pavement in terms of rutting and cracking.

Deflection histories thus derived can be used to evaluate an existing pavement's future traffic carrying capacity and thus indicate at what time strengthening will be necessary. Relationships can also be derived for the reduction in deflection brought about by overlays of different types and thicknesses. These, combined with deflection histories of overlaid pavements, can be used to prepare recommendations for overlay thickness to achieve any required extension of pavement life. The deflection beam which is used to measure deflections is discussed in detail. The results of experiments carried out to investigate some of the parameters which influence deflections as measured by the deflection beam are presented. A recommended standard procedure for using the deflection beam is included in an appendix to the report. /TRRL/

274 410417 PB-234 815/9

The Waco Ponding Project

(Interim rept. 1957-72)

McKinney, Jr., Robert L. ; Kelly, James E. ; McDowell, Chester

Texas Univ., Austin. Center for Highway Research.

Corp. Source Codes: 388101

Sponsor: Federal Highway Administration, Washington, D.C.

Report No.: CFHR-3-8-68-118-7

Jan 74 94p

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI7422

This report presents results of field studies conducted between 1957 and 1972 which were concerned with the effectiveness of ponding and lime stabilization of clay subgrade in minimizing volume change beneath portland cement concrete pavements. Potential Vertical Rise (PVR) was calculated to identify sections in need of ponding and the relationship of PVR to roughness and heaving of pavement is presented. The thickness of asphaltic concrete overlay required for pavement over untreated subgrade is compared to that required for concrete pavement placed over lime-stabilized subgrade, some of which was ponded. Although a study of underdrains was not intended to become a part of Research Report 118-7, it became noticeable that the result of connection of perforated underdrains to ditch drop inlets was to increase heaving and overlay repair thicknesses. A method for determination of 'desired' moisture content is presented in the report and it correlates fairly well with moisture contents obtained from below pavement after a period of several years had elapsed.

275 207506 DA
AFTER 12 YEARS...ZERO MAINTENANCE
Berry, LK
Asphalt Institute Quarterly VOL. 25 NO. 1 .Jan 1973 pp 10-1 1 Phot 1973
SUBFILE: HRIS
In October 1960 runway 7-25 at alameda naval air station on San Francisco bay received a three-inch asphaltic concrete overlay in two 1.5-inch lifts. Two three-wheel breakdown rollers, one 15-ton pneumatic roller, a 12-ton tandem roller, and one 30-ton pneumatic roller accomplished the compaction, in that order. To assure uniformity, all aggregate came from the same source, but three nearby asphalt plants were used. Two plant inspectors, two laydown inspectors, and a field laboratory staff performed the necessary control tests. The asphalt institute assisted during the construction phase in developing the rolling techniques and assisting with control testing at the asphalt plants and the field laboratory. For 1970 runway traffic averaged 10,124 operations per month 60% of it carrier-type aircraft with single gear loads of 20,000 lb. Records of the airbase show that no repairs have been performed on the runway since 1960. Inspection in July 1971 revealed minor cracking and ravelling, but none so severe as to require maintenance. The only foreseeable maintenance is A fog seal.

276 260357 DA
BENKELMAM BEAM DEFLECTIONS AND OVERLAYS
Smith, AD
National Roads Board, New Zealand; .Road Research Unit; Wellington; New Zealand
26 pp 2 Tab. 2 App. 1973
REPORT NO.: Bulletin No.116;
SUBFILE: HRIS
A questionnaire to determine the experience and practice of roading authorities in the use of Benkelman Beam deflections and overlavs was circulated among county and municipal authorities and Ministry of Works offices. The information and data received has been reported and analysed, and is considered to be representative of New Zealand practice. The main matters reported relate to the following in terms of flexible pavement: (a) Deflection equivalencies of materials. (b) Seasonal variation of deflections. (c)'Bedding down' characteristics of unbound granular layers as indicated by reduction in deflections. (d) Effectiveness of layers in reduction of surface deflections. The report proposes that a standard method of deflection measurement and analysis be recommended for use to enable development of a standard'good' practice for the following purposes: (1) Control of uniformity during construction. (2) To indicate change in structural behavious with time or due to trafficking. (3) As a guide to the structural design standard achieved by construction or overlaying. (4) To indicate strengthening to be added to an existing surface to upgrade the pavement to a specified structural design standard; strengthening being either by pavement, or overlay to an existing pavement.

277 210501 DA
DEFLECTION STUDY OF FLEXIBLE PAVEMENT OVERLAYS
Fingalson, WA; Robinson, TD
Minnesota Department of Highways; ./Office of Res Coord
Final Rpt 29 pp INVESTIGATION NO 630 1973
SUBFILE: HRIS
Beginning in 1968, bendelman beam deflection tests were run on 25 bituminous roadways located throughout the state. Tests were run before overlay, just after these projects were

overlayed, one year after, and two years after. The results were analyzed to determine the strengthening effect of the bituminous overlay. In conjunction with this study, Benkelman beam tests were run at various short intervals on a number of randomly selected flexible pavements. These results were used to develop a testing schedule (number and location of test points required) in order to assess the deflection characteristics of a flexible pavement within a given degree of accuracy. /ntis/

278 207680 DA
A DEFLECTION SURVEY TECHNIQUE FOR PAVEMENT EVALUATION IN DEVELOPING COUNTRIES
Smith, HR
Transport & Road Research Lab /UK/
N1r52 1973 R&d Rept 37 pp 8 Fig 7 Tab 12 Ref
SUBFILE: TRRL; IRRD; HRIS
THE ROLE OF DEFLECTION BEAM SURVEYS IN THE EVALUATION OF FLEXIBLE PAVEMENTS IS DISCUSSED. DEFLECTION STUDIES IN MALAYSIA AND ZAMBIA ARE DESCRIBED, FROM WHICH A SUITABLE SURVEY METHOD FOR USE ON TROPICAL ROADS, FOR THE PURPOSE OF DESIGNING STRENGTHENING OVERLAYS OR PAVEMENT RECONSTRUCTION HAS BEEN DEVELOPED. TESTING AT 100 M INTERVALS IN BOTH WHEEL-TRACKS IS RECOMMENDED WITH PROVISION FOR A HIGHER DENSITY OF TESTING IF THE ROAD DEFLECTION IS VARIABLE, IF THE ROAD SURFACE HAS AREAS OF VISIBLE DISTRESS, OR IF THERE ARE OCCASIONAL VERY HIGH DEFLECTION VALUES. DEFLECTION VALUES OF ROADS TEND TO EXHIBIT SKEWED DISTRIBUTIONS, BUT IT IS CONCLUDED THAT THIS IS NOT NECESSARILY A SIGNIFICANT FACTOR FROM THE POINT OF VIEW OF SURVEY ANALYSIS FOR PRACTICAL OVERLAY DESIGN. /AUTHOR/

279 215632 DA
FIBROUS CONCRETE PLACED 3-IN. THICK IN URBAN HIGHWAY TEST
Roads and Streets Feb 1973 1973
SUBFILE: HRIS
to demonstrate the feasibility of placing fibrous concrete pavement with conventional 24 ft. Wide pavement equipment, 3 in. Thick fibrous concrete overlay was placed on an 1100 - ft length of 8 lane divided thoroughfare with an average daily traffic count of 100,000 vehicles including 18 percent commercial units. The rapid strength gain of fibrous concrete, a paving schedule was set to resurface two lanes while traffic was maintained on the other two lanes. Paving was done between peak traffic periods. The fibrous concrete was designed to produce a flexural strength of 645 psi in 24 hr. And 920 psi in 48 hours. This was considered sufficient to allow traffic on the new concrete on the second day. A cubic yard of fibrous concrete was made up of 850 lb. Of cement, 906 lb. Of 1/2 in. Maximum size slag as coarse aggregate and 1570 lb. Of water. Airentraining, water-reducing admixtures and flat steel fibers were added to produce an air-content of 7 percent and A 4 in. Slump. Procedural details and problems encountered in practice are discussed. Surface preparation of the old pavement is described. The coordination of all facets of construction is reviewed.

280 207551 DA
FRICTION OVERLAY IMPROVES RUNWAY SKID RESISTANCE
Jones, MP
ASCE Civil Engineering VOL. 43 NO. 3 .Mar 1973 pp 45-8 1 Fig 2 Tab 3 Phot 1973
SUBFILE: HRIS
a porous asphalt "friction course" on the main runway at the naval air station, Dallas, Texas has performed admirably in

aiding runway drainage and preventing hydroplaning. The pavement friction coefficient has greatly increased and no deterioration from high pressure tires has been evident. Continuing research in friction course design and construction should aid eventual wider use for runways. The air force weapons laboratory (afwl) has the most ambitious research program to date. Afwl has constructed test strips of eight different friction mixes at kirtland air force base, and friction coefficients and performance are being monitored on a regular basis. Ncel has also been actively engaged in development of design criteria and construction specifications based upon their field studies of other agency experiences. If the friction course is to find its place as an accepted anti-skid measure on runways, the efforts of these and other agencies must be publicized and the merits of friction courses extolled throughout the airport industry.

281 352317 PB-223 661/0

Pavement Deflection Measurements and Their Application to Structural Maintenance and Overall Design

Norman, P. J. ; Snowdon, R. A. ; Jacobs, J. C.

Transport and Road Research Lab., Crowthorne (England).

Report No.: TRLL-LR-571

1973 57p

NTIS Prices: PC E03/MF A01 Journal Announcement: GRAI7322

The transient deflection of road pavements under the passage of a heavy wheel-load has been related, by studies on experimental and normal in-service roads, to the long-term performance of the pavements. This provides the engineer with a relatively simple method of forecasting the performance and future structural maintenance requirements for existing roads. This report, which does not discuss the research background to the work, is intended to present to the engineer the information he requires to make and interpret deflection measurements. The use of the Deflection Beam is described in detail, together with the procedure for correcting measured deflections to a standard temperature of 20C. As an alternative and more rapid means of measuring deflection, the Deflectograph and its method of operation are described. Curves to correlate deflection derived from the two methods are provided. Deflection criterion curves, which take into account the changes in deflection which occur with age, are presented and used to estimate the life expectancy of pavements being considered for structural maintenance. Finally curves are provided from which the reduction in deflection and extension of life likely to accrue from the use of different thicknesses of rolled asphalt overlay can be deduced.

282 364783 PB-225 539/6

Performance Study of the Bituminous Concrete Section of the John F. Kennedy Expressway (I-95)

Stromberg, Francis J. ; Kinney, F. Stanley

Maryland State Highway Administration, Brooklandville. Bureau of Research.

Mar 73 27p

NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7402

Contract No.: FH-AW-73-114-46

The main objective of this study is to evaluate the structural adequacy of the recently rehabilitated and resurfaced flexible pavement section of the JFK Expressway (I-95). This evaluation was done using the Asphalt Institute's deflection method for designing asphalt concrete overlays for asphalt pavements. (Modified author abstract)

283 386296 PB-230 449/1
Probabilistic Design Concepts Applied to Flexible Pavement System Design
(Research rept.)
Darter, Michael I. ; Hudson, Ronald
Texas Univ., Austin. Center for Highway Research.
Corp. Source Codes: 388101
Report No.: CFHR-1-8-69-123-18
May 73 215p
Also available as Rept. no. TTI-1-8-69-123.
NTIS Prices: PC A10/MF A01 Journal Announcement: GRAI7411
A theory and procedures were developed, based on classical reliability theory, to apply probabilistic design concepts to flexible pavement system design. The probabilistic theory and procedures have been both practical and useful as they have been implemented into the pavement design operations of the Texas Highway Department. Original implementation was with the deterministic FPS-7 program, which was modified to include some probabilistic design capability and renamed FPS-11. That version, which has been used by ten districts of the Texas Highway Department since late 1971, has been further developed to include variations occurring in individual pavement layers and subgrade, and the consideration of traffic forecasting error. The overlay mode was improved by making it possible to 'adjust' the performance model to a specific pavement by considering its past performance history, and the new program was named FPS-13 (CFHR).

284 332644 PB-219 122/9
Reflection Cracking of Bituminous Overlays on Rigid Pavements
(Final rept.)
McCullagh, Frank R.
New York State Dept. of Transportation, Albany. Engineering Research and Development Bureau.
Report No.: SR-16
Feb 73 25p
Prepared in cooperation with Federal Highway Administration, Washington, D.C.
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI7313
Contract No.: NYSDT-35-1
Overlaying concrete pavements prolongs their service life, but the reflection cracking that ensues creates a new maintenance problem. New York State has tried several methods of retarding this cracking, with the following results: breaking the concrete pavement into small pieces has prevented reflection cracking but the overlay tested was far thicker than the normal section, and stone-dust bond-breakers did not retard reflection cracking. In addition, the extent of the statewide problem was surveyed, and three overlays near Albany are being observed closely from construction through subsequent service. (Author Modified Abstract)

285 211793 DA
"SKINNY MIX" BROADENS COST RANGE OF OVERLAYING AGING PAVEMENTS
Rural and Urban Roads VOL. 11 NO. 1 .Jan 1973 p 20-2 2 Tab 3 Phot 1973
SUBFILE: HRIS
in this method which costs only about $4,100 per two-lane mile, a sand asphalt mix is placed about 0.5 in. Deep by maintenance forces. The skid box consists of a small hopper mounterd on two skids about 20 ft. Long. An adjustable strike-off plate divided in the middle of the box, controls depth and cross-sectional shape. Three passes of the box are required to pave A 24-ft roadway. The box is lifted by the loader when A pass is completed, and transported back to start

new passes. The use of graders to place the mix is described. In this process in which the grader blade is modified by an underside horizontal shoe, the mix is dumped on the surface by the trucks spreading with their bodies raised and tailgates hooked. The mix design, and gradation limits of the mix when either the skid box of grader is used are tabulated. The asphalt used was ac-5. Good results have been obtained with 120 to 150 penetration grade liquid. Preliminary discussion focuses on the need to improve and maintain existing highways, the need to waterproof, the overlay method, and airvoids and grades.

286 215636 DA

SLIPFORM ULTRA-THIN OVERLAYS

Construction Equipment VOL. 47 NO. 4 .Apr 1973 pp 51-3 3 Phot 1973

SUBFILE: HRIS

field tests have shown that concrete mixes containing fibrous steel reinforcement develop high strength even in thin overlays. For instance, a typical mix has shown a 24-hour flexural strength of 645 psi and a 7-day strength of 1100 psi. A typical specification calls for 100,000-psi tensile-strength low-carbon rolled steel stock slit into fibers with a cross section of 0.022 by 0.01 inch. The American concrete paving association recommends a limit of 2--2.5% fiber by volume. Three problems that have to be faced in using fibrous steel are (1) supplying very large amounts of the fibers for the concrete batching plant, (2) keeping the fibers from balling, and (3) avoiding texturing approaches that disturb the particles at the slab top. The latter two problems appear to have been solved over the past two summers of trial applications, but the first appears to entail vibrating and grizzlies as an add-on. Mainline paving tests in Tampa and Detroit are discussed briefly. During the summer of 1973 an Iowa county has arranged for a variety of mixes and procedures to be used in a 3-mile overlay job. It is noted that parking lot pavements have been salvaged using fibrous concrete placed with hand tools.

287 327907 PB-219 233/4
Cold Asphalt Concrete Overlay
(Interim rept. Sep 71-Sep 72)
Scrimsher, Thomas ; Johnson, Melvin H. ; Sherman, George B.
California State Div. of Highways. Materials and Research Dept.
Report No.: CA-HY-MR-3542-1-72-48
Dec 72 48p
Prepared in cooperation with Federal Highway Administration, Washington, D.C.
NTIS Prices: PC A03/MF A01 Journal Announcement: GRAI7312
Contract No.: FHWA-G-2-8
The report discusses the construction and first year's performance of two cold asphalt emulsion mixtures placed in a 1 inch overlay on an existing asphalt concrete pavement. This overlay is the first project in a study to determine if cold mixed asphalt concrete can reduce particulate and aerosol emissions and at the same time provide a durable asphalt concrete pavement. Details of mixing and placing as well as condition surveys of the pavement are discussed. Air pollution measurements and laboratory analysis of the mixtures are also discussed. The downwind dust from the plant was the same for cold mix as the hot mix operation. The particulate and aerosol emissions of the cold mix were less than hot mix operations. However, pavement performance has not been equivalent to adjacent hot mix pavement overlays. (Author)

288 333499 AD-760 638
Construction of Fibrous Reinforced Concrete Overlay Test Slabs, Tampa International Airport, Florida
(Interim rept.)
Parker, Jr, Frazier
Army Engineer Waterways Experiment Station Vicksburg Miss
Corp. Source Codes: 038100
Report No.: FAA-RD-72-119
Oct 72 75p
NTIS Prices: PC A04/MF A01 Journal Announcement: GRAI7314
Contract No.: DOT-FA71WAI-218; FAA-082-420-014
The report describes the planning and construction of two fibrous reinforced concrete overlay test sections at TIA. The test sections included 4- and 6-in.-thick overlays located on a currently used parallel taxiway to one of the primary N-S runways. The test sections were inspected after about one month's traffic, and the condition of the overlays is described herein. Conclusions based on the construction of the test section indicate that fibrous reinforced concrete can be produced in a central mix plant and placed with a slip-form paver. Procedures and equipment for bulk handling of the fibers will have to be developed.

289 207457 DA
DEFLECTION ANALYSIS OF FLEXIBLE PAVEMENTS
Peterson, G; Shepherd, LW
Utah State Department Highways; ./Materials and Test Division
Jan 1972 128 pp Figs Phot 4 APP
SUBFILE: HRIS
there is a need to define not only the magnitudes of the deflection measurements but to use also the shape of the deflection basin. For this reason, three parameters are used to describe the basin curve. They are: (1) dynaflect maximum deflection (d.m.d.), the numerical value of the dynaflect's first sensor; (2) surface curvature index (s.c.i.), the numerical difference between the first and second sensors; and (3) base curvature index (b.c.i.), the numerical difference between the fourth and fifth sensors. By observing these parameters, a practical means of analyzing the pavement

structure is available. Computer programs utilized the IBM 360 computer and calcomp plotter in the analysis of the deflection basin shape as well as in the temperature and layer equivalency studies. In the temperature study phase, the objective was to find A temperature correction factor for use in eliminating temperature as a variable in deflection measurements. Literature was reviewed and a data collection plan conceived and implemented. It was found that the deflection- temperature relationship could not be separated from the many other variables involved. An overlay design procedure was established which uses the measured deflection on a weak pavement and the traffic data for that road section to find the required overlay thickness. This thickness could also be converted to a required structural number and then, based on layer equivalency, other materials could be used to strengthen the roadway. Areas of weak embankment could be detected prior to initial surfacing allowing corrections to be made on the embankment. A minimum embankment fill could be determined which the profile designer could use without apprehension of inadequate support. Using the dynaflect for construction control incorporates all levels of construction; however, to be utilized satisfactorily on embankment materials, the embankment must be graded to A smooth surface to allow access to the test area with the dynaflect. The factors of resilience, age of surfacing, density, moisture, soil support, and volume of traffic are treated briefly. /author/

290 261887 DA

DEFLECTION CRITERIA FOR FLEXIBLE PAVEMENTS AND THE DESIGN OF OVERLAYS

Lister, NW

International Conf Struct Design Asph Pvmts (3rd); .University of Michigan, Department of Civil Engineering; Ann Arbor; Michigan; 48104

Road Research Laboratory

VOL. 1 .Sep 1972 Proceeding pp 1206-26 24 Fig. 3 Tab. 13 Ref. 1972

SUBFILE: HRIS

The long-term performance of flexible pavements can be determined by the magnitude of the transient deflections which occur under traffic. A continuous programme of deflection measurements extending over fifteen years has been carried out on the full-scale road experiments in flexible construction built by the Road Research Laboratory. Over 300 experimental sections and in addition 30 lengths of major road whose construction is of particular interest have been tested annually with the Benkelman Deflection Beam under a wheel-load of 3175 kg (7000 lb). The measured deflections have been corrected for the influence of temperature on the stiffness of the bituminous components, and 'standard' deflections at 20 degrees C have been related (a) to the age of the road expressed in terms of the cumulative total of equivalent standard 8200 kg (18,000 lb) axle loads carried, and (b) to the condition of the pavement in terms of rutting and cracking. The deflection histories thus derived enable the development of critical conditions within the pavement when strengthening of the road would be most appropriate, to be related to deflection behaviour under traffic. Well-defined relations between standard deflection values measured early in the life of pavements and their lives have been established. For lives exceeding 1 million standard axles they are of the form life (deflection) cubed. For pavements with crushed stone, rolled asphalt and coated macadam bases under rolled asphalt surfacings the surves are similar, but acceptable deflection levels are lower on pavements with cemented bases. Charts making due allowance for the slow increase in deflection which takes place during the life of a pavement are being prepared to enable prediction of road performance from

deflection values measured at any time to be made. An example is given. Overlays have been applied to certain full-scale road experiments as they have been retired from service and deflection studies have been continued. The behaviour of overlays laid to strengthen normal roads is being similarly studied. Relations have been derived for the reduction in deflection brought about by over-lays of different thicknesses applied to various types of pavement on different subgrades. The results have been compared with those predicted from the application of multi-layer elastic theory. Deflection histories of overlaid pavements have been used to prepare recommendations for overlay thicknesses to achieve any required extension of pavement life. The implementation of recommendations for pavement strengthening is considered. /AUTHOR/ Presented at the Third International Conference on the Structural Design of Asphalt Pavements, Grosvenor House, Park Lane, London, England, Sept. 11-15, 1972.

291 206005 DA

DESIGN AND CONSTRUCTION OF TRANSPORTATION FACILITIES

Beaton, JL; Burke, JE; Sherman, GB; Kingham, RI; Spaine, LF

Highway Res Circular, Hwy Res Board N134 May 1972 5 pp 1 Fig

SUBFILE: HRIS

a systems approach that will isolate research needs and establish priorities is proposed. The overlay design formula considers five elements that are necessary for A more rational pavement design method: (1) behavior model; (2) material characteristics appropriate to the behavior model; (3) damage concept; (4) failure criteria; and (5) design criteria. Output from this portion of the system is modifiable on the basis of feedback processes. Research needs are listed in three areas: (1) needs related to system input data; (2) needs related to overlay design formulas; and (3) needs related to modifications to the design systems for new construction or the base design system for composite pavements.

292 261891 DA

THE DEVELOPMENT OF OVERLAY DESIGN PROCEDURES BASED ON THE APPLICATION OF ELASTIC THEORY

Grant, MC; Walker, RN

International Conf Struct Design Asph Pvmts (3rd); .University of Michigan, Department of Civil Engineering; Ann Arbor; Michigan; 48104

National Institute of Road Research, S Af

VOL. 1 .Sep 1972 Proceeding pp 1155-66 9 Fig 2 Tab. 32 Ref. 1972

SUBFILE: HRIS

In many cases it is economical and convenient to improve the structural condition of a pavement by means of an asphalt overlay. A number of different methods can be used for the design of the overlay, one of the most popular being based on deflection measurements and limiting deflection criteria. New methods based on a structural design approach have been proposed by various investigations. One of the difficulties of this approach is the measurement of the moduli of the various pavement layers to use in the theoretical calculations. This paper presents two new charts for designing overlays developed from the results of a theoretical analysis of model pavements using linear elastic theory. The one chart is used to determine the thickness of overlay required to reduce the deflection to the design limit. Since this chart was developed using a dual-load configuration which closely simulates that used in the Benkelman beam deflection test procedure, it is believed that it will give more accurate results than existing charts developed from consideration of a

single loaded area. It is proposed that design deflection limits for overlays constructed on asphalt surface roads with granular bases be obtained from the deflection-load repetition relationship developed by the asphalt Institute, and the assumption is made that this will limit distortion to an acceptable degree during the design period. The other chart is designed to eliminate cracking of the overlay and gives the relationship between radius of curvature and tensile strain in the asphalt layer for various thicknesses of asphalt. It is concluded that the use of these charts could be useful for designing overlays in cases where it is necessary to use simple evaluation techniques and simple overlay design procedures. However, it is shown that the stres-dependency of materials in the existing pavement can have a significant effect on the relationships established, and this can only be taken into account if more sophisticated testing and analysis procedures are used. Two simple methods are described for measuring the in-situ moduli of pavement layers. The first involves measurement of both deflection and radius of curvature, and on roads with thin surfacings enables estimations to be made of the base/subgrade modular ratio and of the base modulus. It is concluded that this information would be of particular value when having to make a decision on whether it would be worthwhile improving a road by means of an asphalt overlay. The second method uses measurements of the deflection at various depths within the pavement structure using a modified Benkelman beam procedure. This not only enables the vertical strains at any point to be calculated (from the change in deflection within a finite depth), but also enables the moduli of the various materials to be calculated using elastic theory. In this way any weak layers within the structure can be identified or the effect of an overlay or new loading condition on the vertical strains within the structure can be determined. An example of the use of the method is given in the design of an overlay to strengthen an airfield runway for the coming of boeing 747 aircraft. /AUTHOR/ Presented at the Third International Conference on the Structural Design of Asphalt Pavements, Grosvenor House, Park Lane, London, England, Sept. 11-15, 1972.

293 261933 DA

FAILURE CRITERIA FOR FLEXIBLE PAVEMENTS

Croney, D

International Conf Struct Design Asph Pvmts (3rd); .University of Michigan, Department of Civil Engineering; Ann Arbor; Michigan; 48104

Road Research Laboratory, UK

VOL. 1 .Sep 1972 Proceeding pp 608-612 4 Fig. 5 Ref. 1972

SUBFILE: HRIS

The term 'design life' when applied to a road pavement implies a terminal or 'failure' condition beyond which the performance of the pavement will be regarded as unacceptable. For design procedures based on past experience a relatively loose definition of failure has been acceptable, but with the growing interest in structural design procedures, failure criteria expressed in more exact physical terms are essential. This paper discusses the definition of the 'failure' conditon which has been accepted for flexible pavements in Britain. The 'critical' condition at which overlaying to extend the life of the pavement should be carried out, is also considered. Both these performance criteria have, for flexible pavements, been expressed in terms of permanent deformation, either expressed as a rut-depth or as total deformation from the original pavement level. Observations made on normal in-service roads and on closely observed experimental roads have shown that the criteria are not markedly different for pavements using lean concrete, bituminous macadam or unbound stone bases. The Present

Serviceability Index concept is not regarded in Britain as very applicable to the structural design problem because of its heavy dependence on riding quality factors, not necessarily associated with traffic stresses. However, an approximate correlation between the British approach and P.S.I. values is given. /AUTHOR/ Presented at the Third International Conference on the Structural Desigh of Asphalt Pavements, Grosvenor House, Park Lane, London, England, Sept. 11-15, 1972.

294 214201 DA

FIBROUS CONCRETE TESTED ON HIGHWAY

Engineering News-Record VOL. 189 NO. 16 .Oct 1972 p 16 1972

SUBFILE: HRIS

a slipform paver has placed a 3-inch-thick overlay of steel-fiber-reinforced concrete on a 1300-foot section of the four eastbound lanes of a Detroit highway with an adt of 100,000. The concrete contained six bags of cement per cubic yard. The steel fibers were added by a conveyor at 120 and 200 pounds/cubic yard, with each mix used on half the test area. Contraction joints were sawed at 50- and 100-foot intervals, while longitudinal joints were omitted in some sections. The section was textured transversely. As the fibers do not mix well with concrete until they are loosened up, they were tumbled inside A transit mixer, then poured onto a conveyor leading to the batch mixer. However, the needles formed new clumps when dumped and had to be raked from a loader and through a grate over the conveyor. A power shaker would have to be used for bigger paving jobs. Tests indicate three-day flexural strength over 1000 psi. Earlier tests show a 28-day strength of 2000 psi. It is predicted that the overlay will last at least 30 years.

295 206169 DA

A FULL-SCALE PAVEMENT-DESIGN EXPERIMENT IN MALAYSIA-CONSTRUCTION AND FIRST FOUR YEARS' PERFORMANCE

Bulman, JN; Smith, HR

Department of The Environment /UK/

Nlr5 1972 R&d Rpt 55 pp 12 Fig 22 Tab 32 Ref

SUBFILE: TRRL; IRRD; HRIS

A FULL-SCALE ROAD EXPERIMENT ON A HEAVILY-TRAFFICKED ROUTE IN KUALA LUMPUR IS DESCRIBED. THE EXPERIMENT WAS DEVISED TO INVESTIGATE THE RELATIVE STRUCTURAL VALUE OF DENSE BITUMINOUS-BOUND BASES AND CRUSHED-STONE BASES IN A TROPICAL ENVIRONMENT. SHORT SECTIONS OF ROAD WERE CONSTRUCTED WITH DIFFERENT BASE THICKNESSES OF BOTH MATERIALS. A COMMON SURFACING OF TWO COURSE BITUMEN MACADAM WAS LAID ON ALL THE SECTIONS. THE PERFORMANCE OF THE EXPERIMENTAL SECTIONS OVER FOUR YEARS HAS BEEN ASSESSED. ALTHOUGH FIRM CONCLUSIONS CANNOT BE DRAWN ON THE LONG-TERM PERFORMANCE OF THE PAVEMENTS OF THE BASIS OF ONLY FOUR YEARS' TRAFFICKING, THE CHANGES IN PAVEMENT CONDITION THAT HAVE OCCURRED INDICATE THAT THE BITUMEN-BOUND BASES ARE EQUIVALENT TO CRUSHED-STONE BASES 1.1/3 TIMES AS THICK. THE EARLY EVIDENCE INDICATES THAT THE RECOMMENDATIONS THAT ARE USED IN BRITAIN FOR THE DESIGN OF FLEXIBLE PAVEMENTS FOR HEAVILY-TRAFFICKED ROADS ARE ALSO VALID IN THE MALAYSIAN ENVIRONMENT. TENTATIVE DEFLECTION CRITERIA FOR ESTIMATING THE RESIDUAL LIFE OF MACADAM SURFACINGS IN THE TROPICS ARE GIVEN, AND THE EFFECT ON PAVEMENT DEFLECTION OF ADDING AN OVERLAY IS REPORTED. /AUTHOR/

296 207678 DA

INVESTIGATIONS FOR THE STRENGTHENING OF THE MAIN RUNWAY OF A CIVIL AIRPORT PAPER 292

Dhir, MP; Sandhawalia, PS

Indian Roads Congress

Indian Roads Congress, Journal of VOL. 34 NO. 4 Jun 1972 pp 721-785 11 Fig. 13 Tab. 14 Ref. 3 Ref.

AVAILABLE FROM: Engineering Societies Library 345 East 47th Street New York New York 10017

SUBFILE: TRRL; IRRD; HRIS; ATRIS

THE PAPER DISCUSSES INVESTIGATIONS MADE CONCERNING THE STRENGTHENING OF A MAIN AIRPORT RUNWAY TO AN L.C.N. 100 STANDARD. AS THE L.C.N. OF THE EXISTING PAVEMENT WAS NOT KNOWN, THE PAPER DESCRIBES THE METHODS USED TO DETERMINE THE STRUCTURAL CAPACITY OF THE EXISTING PAVEMENT. THE LEN LEVEL OF THE EXISTING PAVEMENT WAS ESTIMATED BY MEANS OF DIRECT LOAD TESTS, BY THE REVERSE-DESIGN METHOD AND FROM PAVEMENT PERFORMANCE DATA. ALTERNATIVE DESIGNS FOR FLEXIBLE AND RIGID OVERLAYS FOR DIFFERENT SECTIONS OF THE RUNWAY ARE MENTIONED. /TRRL/

297 545636 AD-A033 149/6

Investigation of Full-Depth Asphaltic Concrete Overlays on Highways

Hammitt, II, G. M.

Army Engineer Waterways Experiment Station Vicksburg Miss

Corp. Source Codes: 038100

Report No.: WES-MP-S-72-12

Apr 72 21p

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI7705

The purpose of this investigation was to conduct a study of Corps of Engineers pavement overlay design to determine if it would be possible to reduce the thickness of an overlay if a rigid pavement was overlaid with full-depth asphalt. This study indicated that for material meeting Corps of Engineers guide specifications, there would not be an equivalency ratio between asphalt-bound and unbound material. However, for material not meeting Corps of Engineers specifications, it is possible to upgrade these materials by the addition of asphalt and thereby reduce the thickness requirements for the asphalt-bound material.

298 273843 AD-742 337

Layered Pavement Systems. Part I. Layered System Design. Part II. Fatigue of Plain Concrete

(Technical rept. Apr 70-Mar 71)

Forrest, J. B. ; Katona, M. G. ; Griffin, D. F.

Naval Civil Engineering Lab Port Hueneme Calif

Corp. Source Codes: 248150

Report No.: NCEL-TR-763

Apr 72 78p

NTIS Prices: PC A05/MF A01 Journal Announcement: GRAI7213

Contract No.: YF38.534.002; 01001

The report describes a recent Naval Civil Engineering Laboratory study of airfield pavement overlay design that indicates that elastic layered analysis may be a better design approach than any other currently available technique. A finite element theory of analysis has been developed that considers horizontal sliding between layers, and the superimposed load effects of multiple-wheel landing gear. This theory also provides for automatic finite element mesh generation, and automatic plotting of stress, strain, and displacement output data. The report also presents a review of the literature about fatigue of plain concrete. It reveals information about beam and cylinder testing but discloses no conclusive experimental work on the fatigue behavior of

uniformly supported pavement slabs. Fatigue behavior estimates based upon beam and cylinder tests would necessarily have to be conservative and therefore self-defeating insofar as achieving economy of design by adoption of minimum feasible thickness of pavement slab overlays. (Author)

299 206102 DA
A METHOD FOR ASPHALT OVERLAYS
Pearring, JF
Arizona Conf Roads & Streets Proc Apr 1972 pp 16-28 6 Fig 1972
SUBFILE: HRIS
A method is presented for evaluating a road's condition, both geometrically and structurally. The first step in the evaluation process is the surface condition survey. The method used is the present serviceability rating (PSR) procedure developed at the AASHO road test, refined by the Canadian good roads association, and revised slightly by the asphalt institute. The nmext step is a structural condition survey to determine the current adequacy of the pavement as well as to predict its future service life with respect to traffic. This is accomplished through component analysis or rebound deflection analysis, both of which are explained using representative examples.

300 324109 PB-218 462/0
Nebraska Experimental Asphaltic Concrete Resurfacing Project F-171(12). Part IV
(Final rept.)
Silenieks, Janis
Nebraska State Dept. of Roads. Div. of Materials and Tests.
Report No.: RESEARCH STUDY-63-10C; R72-14(533)
Jul 72 24p
See also Part 3, PB-185 175. Report on Nebraska Experimental Asphaltic Concrete Resurfacing Project.
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI7310
Contract No.: HPR-1; F-171(12)
An asphaltic concrete overlay, consisting of 18 experimental sections, was constructed in 1961 to study the performance of several types of mixtures. Periodic inspections were made to determine cracking, rutting and wear, and cores were taken to monitor pavement density changes. No pavement failures caused by instability were observed in any section. Rutting was generally light, and there was no pavement bleeding. Several sections developed moderate to severe cracking, raveling and wear. In 1969 ten sections were overlaid with Type C asphaltic concrete. The remaining eight sections were in fair to very good condition in May, 1972. Voids in mineral aggregate filled with asphalt, calculated on the basis of final pavement density, showed very good correlation with the durability of the material. The performance of Nebraska Type A, Type C and Bridge Mix asphaltic concrete was good. (Author)

301 206045 DA
PAVEMENT INVESTMENT DECISION-MAKING AND MANAGEMENT SYSTEM
Phang, WA; Slocum, R
Highway Research Record, Hwy Res Board N407 pp 173-94 25 Fig 4 Tab 19 Ref 1972
SUBFILE: HRIS
there are two main phases to this report. The first phase is concerned with the development of investment cost data used in comparing alternative flexible pavement designs. An economic cost model that uses the present value of total costs over an analysis or service period is the basis for a technique of graphic presentation of total costs of a design over a range

of initial lives and with different surfacing lives. A pavement design model together with an overlay design model provides the background by which comparable design strategies can be worked out to provide pavements that will remain above selected serviceability limits over the service or analysis period. The pavement design and overlay models utilize Benkelman beam annual maximum rebound measurements, and serviceability levels of the pavement are represented by present performance ratings (ppr). Thickness- deflection curves for the different subgrade conditions encountered in Ontario province are developed from extensive field experience. Figures are presented that indicate the information flows needed to produce the investment data on which a pavement decision can be based. The second phase of the report considers the other information flows that are needed to supplement the first phase. These consist of highway geometrics, unit prices determinations, maintenance costs, and constraints due to skid resistance, funds available, and other considerations. For a management system to be fully operative, the pavement must be monitored after it is constructed to determine whether its subsequent behavior agrees with the prescribed pavement strategy. Such monitoring is important because the information gathered can then be used to adjust the design models so that future decisions would be based on more accurate predictions. A pavement management system flow chart shows how the two phases are interconnected. /author/

302 261890 DA

PAVEMENT OVERLAYING IN FRANCE-ORGANIZATION-SET UP

Fauveau, M; Siffert, M

International Conf Struct Design Asph Pvmts (3rd); .University of Michigan, Department of Civil Engineering; Ann Arbor; Michigan; 48104

Setra; Coordinating Centre Trappes

VOL. 1 .Sep 1972 Proceeding pp 1143-54 4 Fig. Refs. 1972

SUBFILE: HRIS

The first part of the communication comprises a general description of the organization of the technical highway services in France, and the original organization set up in France, and which has been in operation since 1964, to cope with the considerable increase in the need for pavement overlaying. The second part contains a detailed description of the organization of pavement overlay teams (P.A.R.'s) and of the Coordinating Centre. An organization chart is presented, and the authors define the missions of these bodies as they were originally conceived. The results achieved during the first five years of operation of the P.A.R.'s and the Coordinating Centre are given. In the light of the missions assigned to P.A.R.'s and the necessity of an evolution, the roles of the different services involved in the implementing of pavement overlay projects are than analysed. The current evaluation and the predictable evolution in the near future are presented in the light of the extent of the demands which arise. A more detailed analysis of an overlay project, from its original conception through its implementation to follow up observations, gives a clear picture of the interrelations between the various services concerned with overalys. This analysis reviews the resources available to the Administration for planning and following up its project and drawing useful information from it. Continuous measurement methods (deflexions, roughness and skidding resistance) provide elements for assessing the quality of the work carried out and how it stands up to conditions of use over a period of time. An overlaid pavement must possess characteristics such that it comes up to what the user expects of it; operations of the "half-way" type must be practically done away with, and curative maintenance must be replaced by preventive maintenance. /AUTHOR/ Presented at the Third International Conference on the Structural Design of Asphalt Pavements, Grosvenor House, Park Lane, London, England, Sept. 11-15, 1972.

303 263173 DA
REJUVENATION OF AFAILED ROAD PAVEMENT
Gilpin, BV
Australian Road Research Board Conference Proc VOL. 6 Pt4 .pp 23-38 2 Fig. 3 Tab. 2 Ref. 1972
REPORT NO.: Paper No 845;
SUBFILE: HRIS
The paper traces the history of a road pavement which showed signs of failure through cracking and loss of shape at a relatively early age. Despite continuing deterioration, extensive testing and experimenting finally led to the decision to rejuvenate the pavement by regulation and overlaying with bituminous concrete rather than to completely reconstruct. Deflection testing, using a Benkelman beam, was carried out on a number of occasions and subsequent deflections taken on the resheeted pavement suggest that the life of the pavement has been extended considerably. Conclusions include the importance of adequate initial compaction during construction, the value of the Benkelman beam as a research tool, the possibilities of pavement upgrading by means of overlays and finally, suggestions of topics for further useful research in this field.

304 276823 PB-209 870
Strengthening of Flexible Roads in the Tropics: The Use of Deflection Measurements
Bulman, J. N.
Transport and Road Research Lab., Crowthorne (England).
Report No.: TRRL-LR-444
1972 25p
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI7214
The use of deflection techniques for pavement evaluation and the design of road strengthening measures is discussed. The concept of deflection criterion curves is introduced and their role in the road strengthening design process is described. A deflection survey procedure using hand deflection beams is outlined and a method of analysing deflection survey data in a convenient form for overlay design is suggested. (Author)

305 868207 AD-894 275/7
Study of Reflection Cracking in Asphaltic Concrete Overlay Pavements, Phase I
(Technical rept. Feb 68-Oct 71)
Kanarowski, Stanley M.
Construction Engineering Research Lab. (Army), Champaign, IL.
Corp. Source Codes: 054831000; 405279
Report No.: AFWL-TR-71-142
Mar 72 113p
Distribution limitation now removed.
Languages: English Document Type: Bibliography
NTIS Prices: PC A06/MF A01 Journal Announcement: GRAI8126
Country of Publication: United States
Contract No.: AF-5224; 522401
This report encompasses the results of a literature search, a survey of state highway departments, and an on-site field inspection of techniques used by state and federal agencies to control reflection cracking in asphaltic concrete overlays principally on portland cement concrete pavements. Procedures were generally for the purpose of isolating the overlay from the effect of movement in the underlying pavement or reinforcing the overlay. These procedures are made more effective by measures designed to prevent or minimize the underlying pavement movement. The methods found helpful in reducing reflection cracking include wire mesh reinforcement in the asphaltic concrete (AC) overlay; use of bond breakers

between the portland cement concrete (PCC) and the AC overlay; addition of an aggregate base course over the PCC followed by an AC overlay; pretreatment of the old PCC, such as mudjacking, subsealing, or cracking the old pavement by heavy rolling or with a hydraulic or pneumatic hammer; use of additives and other modifications in the AC composition. Many of the test installations inspected are 3 to 13 years old and in good to excellent condition. Normally, when using regular AC overlay procedures, reflection cracking begins to show up within 1 year or season cycle and cracks are larger than when special techniques are used. Results of the study indicate that there is no known 100% effective method for eliminating reflection cracking. Overall, a number of techniques have substantially delayed serious transverse reflection cracking, appear to have reduced longitudinal reflection cracking at pavement widening joints, and have reduced maintenance considerably. (Author)

306 261889 DA

STUDY OF SOME ASPECTS OF STRENGTHENING THIN CONCRETE PAVEMENT WITH FLEXIBLE OVERLAYS

Dhir, MP

International Conf Struct Design Asph Pvmts (3rd); .University of Michigan, Department of Civil Engineering; Ann Arbor; Michigan; 48104

Central Road Research Inst of India

VOL. 1 .Sep 1972 Proceeding pp 1129-42 5 Fig 8 Tab. 11 Ref. 1972

SUBFILE: HRIS

Reported in this paper is a study on the strengthening with flexible over-lays of thin concrete highway pavements existing in India. Concrete panels of 10 ft. by 10 ft. by 4 in. were cast indoors with typical ground support conditions. Strain gauges were fixed to their under-faces by mounting the gauges on precast concrete blocks which were made integral with the slab concrete. Granular overlays of 3, 6 and 9 in. W.B.M. were constructed successively on one panel for testing, and similarly bituminous overlays of 2, 4 and 6 in. A.C. were laid on the other. Static load tests were carried out at interior, edge and corner positions using 12-in. diameter steel plates with loads applied up to 9000 lbs. Strains and surface deflections were measured. The load test data show that flexible overlays do bring about reduction in load stress in concrete slab but that reduction is relatively limited. Broadly speaking, 9-in. W.B.M. overlay or 6-in. A.C. overlay reduces the load stress to about 60 percent for all the three load positions. Analysis of the pavement as an elastic layered system corroborates the test measurements and indicates that even 4-in. concrete slab acts as quite a rigid base. Test data show that the equivalent angle of load dispersion for W.B.M. overlays increases from 33 deg.-34 deg. for interior loading to 37 deg.-38 deg. for edge loading to 45 deg.-47 deg. for corner loading. The corresponding values for A.C. overlays are 45 deg., 49 deg.-51 deg. and 51 deg.-53 deg. One inch of A.C. overlay is seen to be equivalent to 1.3-1.7 in. of W.B.M. overlay. Test data were also developed through measurements on outdoor sections on the effect of flexible overlays on temperature differential in concrete slab. The data show that the differential is reduced to about 50 percent by plus 4 in. A.C. overlay and to about 40 percent by plus 6 in. W.B.M. overlay. The study indicates that 4-in. concrete pavement cannot be saved from distress with reasonable thicknesses of flexible overlays under long term application of 9000-lb wheel load. Where thick subbases already exist, as for most of such roads in India, it would appear desirable to provide the flexible overlay from the point of flexible pavement requirements, keeping reflection cracking, etc. in view. Measures to take the operation of loads away from the

inside of the concrete edges would go to enhance the life of concrete slab. Reported in the paper are also broad indications available from 5-year performance study of about 50 different specifications of flexible overlays laid as an experiment on sections with cracked and uncracked concrete slabs. In the case of uncracked slabs, reflection cracking has developed in overlays of up to 6 in. thickness. There is as yet no reflection cracking in plus 4.5 in. overlays on cracked slabs. Asphaltic concrete, with a high binder content, has shown good resistance to reflection cracking. /AUTHOR/ Presented at the Third International Conference on the Structural Design of Asphalt Pavements, Grosvenor House, Park Lane, London, England, Sept. 11-15, 1972.

307 207450 DA

TEMPERATURE INFLUENCES ON DEFLECTION OF A DEEP STRENGTH BITUMINOUS CONCRETE PAVEMENT

Country Roads Bd, Victoria /Australia/; .1972

Jan 1972 3 pp 1 Fig 1 Tab ENG NOTE NO 99

SUBFILE: HRIS

the asphalt institute in its manual (ms-17) - asphalt overlays and pavement rehabilitation, presents a relationship between pavement deflection and temperature for pavements having more than 4 inches of bituminous concrete. A pavement was tested in Melbourne to verify the asphalt institute relationship. Deflection testing using a Benkelman beam was undertaken in may 1969 for pavement strength evaluation purposes, and again in 1971 to determine the influence of temperature on pavement deflections. The results are presented in tabular form. /author/

308 207679 DA

UNBONDED STRUCTURAL OVERLAYS

Shackel, B

Indian Concrete Journal VOL. 46 NO. 9 Sep 1972 pp 376-82 7 Fig 6 Ref

SUBFILE: TRRL; IRRD; HRIS

ALTHOUGH MOST METHODS OF COMPOSITE CONSTRUCTION REQUIRE FULL HORIZONTAL SHEAR TRANSMISSION AMONG ALL STRUCTURAL MEMBERS, THERE ARE, HOWEVER, ADVANTAGES IN ELIMINATING SHEAR TRANSMISSION WHEN STRENGTHENING CERTAIN TYPES OF EXISTING STRUCTURES SUCH AS PRESTRESSED OR SIMPLY REINFORCED CONCRETE SLABS AND BEAMS, BY USING STRUCTURAL OVERLAYS. THE PAPER BRIEFLY PRESENTS A DESIGN ANALYSIS OF UNBONDED STRUCTURAL OVERLAYS, AND DESCRIBES AN EXPERIMENTAL INVESTIGATION DESIGNED TO TEST THE VALIDITY OF THE ANALYSIS. SPECIAL EMPHASIS IS PLACED ON METHODS THAT CAN BE USED TO ELIMINATE HORIZONTAL SHEAR TRANSMISSION BETWEEN THE OVERLAY AND THE ORIGINAL STRUCTURE. /TRRL/

309 261894 DA

THE USE OF GAP GRADED MIXES IN ASPHALT OVERLAY

Knight, K; Groth, P; Akeroyd, FML

International Conf Struct Design Asph Pvmts (3rd); .University of Michigan, Department of Civil Engineering; Ann Arbor; Michigan; 48104

Natal University; Natal Roads Department; Mobil Oil Southern Africa Pty, Limited

VOL. 1 .Sep 1972 Proceeding pp 1178-87 6 Fig. 4 Tab. 15 Ref. Apps. 1972

SUBFILE: HRIS

A type of gap graded mix intermediate between continuously graded asphalt concrete and a high sand content gap graded rolled asphalt has been used in the Natal asphalt overlay programme with good results. A full scale overlay experiment

at Umbumbulu, trial sections at Tugela and a survey of some 150 miles of overlay already completed are described and their performance evaluated. The mix used appears to give good performance in layers thinner than called for in terms of current design methods. Explanations are given for its apparently superior flexibility and crack resistance over the more traditional asphalt concrete. Indirect tensile strength tests have been undertaken, which indicate a high tensile strength for this mix in the temperature ranges experienced in Natal. Economics of stage construction are possible because of the good performance of thin (less than 4") layers of gap graded mix even over old distressed pavements of high deflection levels. /AUTHOR/ Presented at the Third International Conference on the Structural Design of Asphalt Pavements, Grosvenor House, Park Lane, London, England, Sept. 11-15, 1972.

310 207389 DA

COMPREHENSIVE SYSTEMS ANALYSIS FOR PAVEMENTS

Kher, RK; Husdon, WR; Mccullough, BF

Highway Research Record. Hwy Res Board 1971 No 362, pp 9-20, 5 FIG, 17 REF

SUBFILE: HRIS

many variables within the broad categories of loads, environments, material properties, structural maintenance, progressive failure, economics, etc. Must be considered in an ideal design procedure for rigid pavements. The complexity of the problem demands that A procedure be evolved for analyzing various parts and assembling them in a coordinated effort called systems ahalysis. A conceptual rigid pavement system is presented that formalizes the myriad of interrelated variables into A series of mathematical models. The program utilizes over 100 input variables and analyzes numerous possible solutions generated within the boundaries defined by the constraints. The output is a set of pavement design strategies based on present worth of overall costs. Details with respect to selection of thickness, materials, reinforcement, and joints, as well as overlay patterns and predicted life, are presented for each design. /author/

311 225292 AD-725 533

Investigation of Pavement Surface Cracking, Amedee Army Airfield, Herlong, California

Vedros, P. J.

Army Engineer Waterways Experiment Station Vicksburg Miss

Corp. Source Codes: 038100

Report No.: AEWES-MISC-PAPER-S-71-15

May 71 27p

NTIS Prices: PC A03 MF A01 Journal Announcement: GRAI7115

Contract No.: DA-4-DM-78012-AQ-61; 4-DM-78012-AQ-6108

The purpose of this report is to present the results of an investigation conducted at Amedee Army Airfield in May and October 1970. An unusual problem occurred in the bituminous overlay pavement on the airfield, and this investigation was conducted to determine the cause of and possible remedies to this problem. The bituminous overlay was placed on the runway in the fall of 1969, and in the spring of 1970 dome-shaped upheavals about 1 ft in diameter and up to 1-1/2 in. high with star-shaped cracks on top occurred in the runway surface. A number of these dome-shaped bulges were sawed out of the pavement, and tests were made on the materials. Results of these tests are reported. (Author)

312 267078 PB-207 839

Investigation of Unbonded PCC Overlays

(Research rept.)

Spellman, Donald L. ; Woodstrom, James H. ; Neal, B. F.

California State Div. of Highways. Materials and Research Dept.

Report No.: M/R-635165

Sep 71 21p

NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI7210

Contract No.: FHWA-D-5-29

An investigation of unbonded PCC overlays placed over old PCC pavements is reported. Test sections were constructed to compare the effect of various materials as bond breakers. Performance was measured by the ability of the overlay system to prevent reflective cracking. It was concluded from these tests that an asphalt, such as MC-250, with a light sand cover to prevent pickup, reduces bond sufficiently to prevent reflective cracking, even when joint spacing is different from that of the base pavement. Wax base curing compound, specified as a bond breaker on one project, did not perform as well as anticipated. At a considerably higher cost, asphalt concrete also performs very well and is particularly worth consideration when leveling of the base pavement is necessary. (Author)

313 207458 DA

SEMINAR ON STRENGTHENING OF EXISTING ROAD PAVEMENTS

Indian Roads Congress Proc; .1971

Aug 1971 174 P 2 Fig

SUBFILE: HRIS

between 1951 and 1968 the number of vehicles on india's roads increased from 310,000 to 1,460,000. The increase in volume was accompanied by one in the hauling capacity of the vehicles and by heavier axle loads. Of the 965,000 km of roads at the end of 1969, almost 640,000 were still unsurfaced, and a large proportion had only a single-lane pavement. The increase in mobility is not being accompanied by an increase in the quality of the roads. In one of the addresses preceding the technical sessions s. N. Sinha, chairman of the organizing committee for the seminar, said that the principal prerequisite to strenghtening the existing pavements was evaluating them. The four technical sessions of the seminar dealt with the following topics: evaluation of existing flexible and reigid pavements, design aspects of strenghtening rigid pavements using rigid and flexible overlays, design aspects of strenghtening flexible pavements using treated and untreated materials and taking equivalency factors into consideration, and construction problems associated with strenghtening flexible and rigid pavements.

314 214105 DA

THIN POLYMER CONCRETE OVERLAY TESTED

Engineering News-Record Oct 1971 Vol 187, No 17, P 22, 1 PHOT

SUBFILE: HRIS

the first major test strip of a polyester resin overlay material is now under traffic on an access ramp to th New Jersey approach to the Lincoln tunnel under the hudson river. The material can be spread thin, set in an hour and is as strong as the concrete below. It is ridgid, can be formulated to match the elasticity and thermal expansion of existing concrete, and handles like no-slump concrete. Being more expensive than asphalt or portland cement concrete, it appears not to be a suitable substitute. It is however, less expensive and easier to mix and place than epoxies. Also, it is not sensitive to temperature and has a rough surface. Because an overlay is thin, there is no need to raise curbs, manholes and catch basins and can be applied on bridges without significantly raising dead load.

315 105638 PR

ASPHALTIC CONCRETE OVERLAYS OF RIGID AND FLEXIBLE PAVEMENTS

INVESTIGATORS: Kinchen, RW; Temple, WH

PERFORMING ORG: Louisiana Dept of Transportation & Development P.O. Box 44245, Capitol Station Baton Rouge Louisiana 70804

SPONSORING ORG: Louisiana Dept of Transportation & Development; Federal Highway Administration Structures and Applied Mechanics Division

CONTRACT NO.: 69-3B; HP&R

SUBFILE: HRIS

PROJECT START DATE: 7010

PROJECT TERMINATION DATE: ND

THE OBJECTIVES WERE TO ESTABLISH A DESIGN PROCEDURE FOR DETERMINING THE THICKNESS OF ASPHALTIC CONCRETE, TO REHABILITATE RIGID AND FLEXIBLE PAVEMENTS, AND TO ESTABLISH A METHOD OF PREDICTING LIFE ON EXISTING HOT MIX OVERLAID PAVEMENTS. THE PROCEDURE WAS BASED PRIMARILY ON PRE-OVERLAY AND POST-OVERLAY MEASUREMENTS OF DEFLECTION AND SERVICEABILITY, SUPPLEMENTED BY INFORMATION REGARDING THE SUBGRADE, PAVEMENT DISTRESS, ETC. /LDH/

316 218718 DA

THE EFFECT OF PAVEMENT BREAKING-ROLLING ON THE CRACK REFLECTANCE OF BITUMINOUS OVERLAYS

Korfhage, GR

Highway Research Record, Hwy Res Board 1970 No 327, pp 50-63, 8 FIG, 3 TAB, 2 PHOT, 2 REF

SUBFILE: HRIS

the purpose was to determine whether breaking a concrete pavement prior to being overlaid would result in any reduction in the amount of crack reflectance. This report describes the design, construction, and performance of A typical widening and resurfacing project, on a portion of which a 59-ton roller was used to crack the old concrete slab prior to construction. This process was found to significantly reduce some types of cracking and is recommended for future projects of this nature. /author/

317 211691 DA

EXPERIMENTAL FLEXIBLE OVERLAYS ON CEMENT CONCRETE ON NATIONAL HIGHWAY NO. 7 NEAR HYDERABAD

Swaminathan, CG; Nair, KP

Indian Roads Congress Road Res Bull 1970 No 14, pp 73-99, 2 FIG, 10 TAB, 22 PHOT, 2 APP

SUBFILE: HRIS

the details of construction of experimental flexible overlays on a thin cement concrete slab in varying degrees of distress on a national highway together with their performances observed over a seven year period are given. Out of ten different specifications tried, it was found that a 4 in. Thick asphaltic concrete or a 6 in. Water bound macadam layer surfaced with either a 1 1/2 in. Asphaltic concrete of A 3/4 in. Premix with seal gave satisfactory performance; the latter being more economical. /author/

318 **"GUSSASPHALT" OR POURABLE ASPHALTIC MIXTURES**

Puzinauskas, VP

Asphalt Institute

Feb 1970 Res Rpt 70-2, 12 PP

SUBFILE: HRIS

GUSSASPHALT IS A PAVING MIXTURE WHICH CAN BE POURED OR CAST IN PLACE. IT MAY BE DESCRIBED AS A SPECIAL MASTIC TYPE PAVING MIXTURE. THE BEHAVIOR OF GUSSASPHALT DEPENDS ON THE PROPERTIES AND RELATIVE PROPORTIONS OF ASPHALT CEMENT AND MINERAL FILLER.

IT FORMS A PRACTICALLY VOIDLESS PAVEMENT SURFACE THAT CAN BE ACHIEVED WITHOUT THE USE OF ROLLERS OR ANY OTHER COMPACTION EQUIPMENT. A NUMBER OF GUSSASPHALT CONSTRUCTION PROJECTS WERE VISITED IN GERMANY. THE SPECIFICATIONS FOR THE MATERIALS, CURRENT CONSTRUCTION PRACTICES, TESTING, AND PERFORMANCE OF GUSSASPHALT PAVEMENT SURFACES WERE REVIEWED. THE PRINCIPAL USE FOR GUSSASPHALT IS A SURFACING MATERIAL FOR HIGHWAY AND CITY STREETS. WHEN PORTLAND CEMENT CONCRETE BASE IS TOPPED WITH GUSSASPHALT SURFACE, ASPHALT CONCRETE BINDER IS USED AS AN INTERMEDIATE LAYER. GUSSASPHALT IS USED TO OVERLAY OLD ASPHALT, PORTLAND CEMENT CONCRETE AND COBBLE STONE PAVEMENTS WHICH NEED RENEWING, REHABILITATION OR IMPROVEMENT IN THEIR SKID-RESISTANCE PROPERTIES. GUSSASPHALT IS COMPOSED OF CRUSHED STONE, SAND, MINERAL FILLER AND ASPHALT CEMENT. THE SOFTNESS OR HARDNESS OF GUSSASPHALT IS CONTROLLED BY EITHER THE USE OF ASPHALT CEMENT OF DIFFERENT CONSISTENCIES OR BY SLIGHT ADJUSTMENT IN THE ASPHALT CONTENT. THE MANUFACTURE OF GUSSASPHALT, TRANSPORT, AND PAVING EQUIPMENT AND PAVING PROCESS ARE DESCRIBED. IT IS FELT THAT STRONG EFFORT SHOULD BE MADE TO DEVELOP THE USE OF THE MASTIC TYPE MIXES SUCH AS GUSSASPHALT IN THE UNITED STATES.

319 218717 DA

HEAVY PNEUMATIC ROLLING PRIOR TO OVERLAYING: A 10 YEAR PROJECT REPORT

Lyon, JW

Highway Research Record, Hwy Res Board 1970 No 327, pp 45-49, 2 FIG, 2 TAB, 1 REF

SUBFILE: HRIS

this report covers a 10-year field study to determine the practicability of using a pneumatic-tired, 50-ton roller to break and seat old concrete pavements before overlaying with hot-mix asphaltic concrete. The method is a comparative analysis of the behavior of various roadway sections under traffic employing different breaking and seating techniques of a 50-ton pneumatic roller and an impact hammer on A selected construction project with a wet subgrade. Results indicate that a 50-ton roller should be used in conjunction with an impact hammer, using 3 or 4 roller coverages for slab-breaking and seating on a wet subgrade to reduce deflection cracking. Specifications were developed but subsequent results, because of the general dryness of the subgrades on these projects, were not as successful as anticipated. Ten-year characteristics of the study project verified the initial study findings. The 50-ton roller used in conjunction with an impact hammer to break and seat old concrete pavements on wet or yielding subgrades can reduce reflection cracking, but its use on firm subgrades has not been effective. /author/

320 218753 DA

OVERLAY DESIGN USING DEFLECTIONS

Sherman, GB; Hannon, JB

Highway Research Board Special Reports 1970 No 116, pp 189-198, 7 FIG, 9 REF

SUBFILE: HRIS

this paper presents a summary of the pavement deflection measuring experience of the California division of highways. These measurements provide a means of determining in-place roadway strength under existing conditions. The California traveling deflectometer with A 15-kip test load is described as the standard deflection measuring device. Measurements obtained with this device are compared to those produced by the procedure of the Canadian good roads association or the Benkelman beam rebound procedure using an 18-kip load. Correlation data are presented for follow-up to deflection results obtained on projects reconstructed based on deflection studies. The various factors that influence a particular

design selection are described and shown in a schematic chart. As a result of a recent study, a relationship between Benkelman beam deflection under a 15-kip loading & subgrade modulus, k-value, is presented. A procedure is suggested, based on these criteria, to determine pcc overlay thickness design. /author/

321 244828 PB-204 078
Pavement Deflection as Pavement Overlay Criteria (Phase 1)
Cook, John C. ; Kruker, Milan
Washington State Univ., Pullman. Highway Research Section.
Report No.: PUB-H-33
Jul 70 73p
Prepared in cooperation with Department of Transportation, Washington, D. C.
NTIS Prices: PC A04 MF A01 Journal Announcement: GRAI7124
Contract No.: WSDH-Y-1202
Dynaflect equipment was used to measure deflections on 221 miles of Washington highways. In general, three types of pavement structure were included in the study, namely, asphalt concrete over cement-treated base; untreated aggregate base; and, untreated roadbed soil. A literature search was made to obtain background information on the use of the Dynaflect in other States. Acceptability of the equipment was established. Statistical problems of subjective ratings and magnitude of deflections are discussed. Conclusions show that the method developed for determining the need for resurfacing is compatible with the present rating system used by the highway department. (Author)

322 211655 DA
A PAVEMENT DEFLECTION STUDY TO DEVELOP AN ASPHALT OVERLAY DESIGN METHOD AND DISCUSSION
Kingham, RI
Association of Asphalt Paving Technologists Proc 1970 Vol 39, pp 186-206, 11 FIG, 28 REF
SUBFILE: HRIS
a method for determining the thickness required of an asphalt concrete overlay on an asphalt pavement is described. The method is based on a study of Benkelman beam pavement deflections and is supported by elastic theory, field observations, and engineering experience. /author/

323 218719 DA
A PAVEMENT OVERLAY DESIGN SYSTEM CONSIDERING WHEEL LOADS, TEMPERATURE CHANGES, AND PERFORMANCE
Mccullough, BF; Monismith, CL
Highway Resarch Record, Hwy Res Board 1970 No 327, pp 64-82, 9 FIG, 13 TABS, 3 PHOT, 10 REF, 1 APP
SUBFILE: HRIS
a recent review of current overlay design procedures revealed that a few bona fide procedures exist and that even the best of them, i.e., those based on deflection, have limitations and inconsistencies. Furthermore, the review emphasized the need for considering volume change stresses. The purpose of this paper, therefore, is to briefly discuss a recently developed overlay design procedure, which has been applied to 11 miles of interstate highway and 2 airports. A brief description of the overlay design system and its application is presented here; a detailed description is available. The general pavement system is discussed and applied to develop an overlay system that is applied to the design of an overlay for continuously reinforced concrete pavement in Texas. This design is discussed in terms of wheel load and temperature stresses. /author/

324 205876 DA

STRUCTURAL BEHAVIOR OF BITUMINOUS CONCRETE OVERLAY ON CEMENT CONCRETE PAVEMENT

Marwah, BR; Khanna, SK; Arora, MG

Highway Research Board Special Reports 1970 No 116, pp 215-226, 12 FIG, 1 TAB, 6 REF

SUBFILE: HRIS

the use of bituminous concrete overlays on cement pavement is gaining considerable popularity. No rational approach is yet available to define the structural behavior of this composite section. In this investigation, pressure-deformation and load-transmission characteristics of bituminous concrete overlays on uncracked rigid pavements were studied by testing model slabs of 4 ft (1.2M) square size. The base slabs of cement concrete were 2 and 3 in. (5 and 7.5cm) thick, and each one was separately overlaid with 1, 2, and 3 in. (2.5, 5, and 7.5cm) of bituminous concrete. The testing was carried out by static load tests at the interior by using rigid circular plates 6, 8, and 10 in. (15, 20, and 25 cm) in diameter. The surface deformations were observed with deflection dial gages, and the stresses developed in the base slab were measured by the use of electrical strain gages fixed underneath the base slab at the interior region. An equation was established to calculate the stress in the base slab. This equation has been used to determine the overlay thickness on existing uncracked rigid pavements. /author/

325 218751 DA

A STRUCTURAL RESTORATION SYSTEM FOR CONCRETE SURFACES

Shafer, HH

Highway Research Board Special Reports 1970 No 116, pp 48-50, 1 REF

SUBFILE: HRIS

the application technology of latex-modified pcc overlays is presented, with particular attention to bridge decks. It is noted that the quality control requirements are very stringent, so that the process requires integration of highly specialized materials, techniques, and team organization. The durability of the surfacing is shown by the fact that a half-inch section placed on a badly scaled and spalled Michigan bridge in 1957 is still giving good service in spite of the annual use of deicing salts.

326 197770 PB-195 490

The Translation of the Results of the Aasho Road Test to Useful Guides for Design in North Carolina

(Final rept.)

McCullough, C. R. ; Langfelder, L. J. ; Poole, M. R. ; Wallace, G. R. ; Nivargikar, V. R.

North Carolina State Univ., Raleigh. Highway Research Program.

Corp. Source Codes: 387987

Report No.: NCSU-ERD-110-60-5

Jul 70 144p

Prepared in cooperation with the North Carolina State Highway Commission and the Department of Transportation, Washington, D.C.

NTIS Prices: PC A07 MF A01 Journal Announcement: USGRDR7101

This research effort was a satellite project that was intended to develop Present Serviceability Index equations for flexible and rigid pavements in North Carolina and to study structural coefficients for flexible pavements. The Present Serviceability Index equations were determined by using statistical procedures for evaluating the results of Present Serviceability Ratios. The equations that were developed for both types of pavements are presented. The evaluation of the

structural coefficients for flexible pavements initially consisted of a study of existing pavements in North Carolina. It was found that no meaningful results on the structural coefficients could be obtained from the initial 65 test sections that were selected. An attempt to evaluate the rate of deterioration of flexible pavements revealed that the procedure of using a roughmeter to determine the PSI may indicate a relatively small change in PSI over a several year period. In many cases the pavements were overlayed even though no change in PSI had occurred. (Author)

327 215300 DA
ASPHALT OVERLAYS AND PAVEMENT REHABILITATION
Asphalt Institute Manual Series Nov 1969 No 17, 134 PP, 20 FIG, 6 TAB
SUBFILE: HRIS
CONTENTS: EVALUATION, DESIGN AND CONSTRUCTION PLANNING AND PROGRAMMING EVALUATING SURFACE CONDITION EVALUATING STRUCTURAL ADEQUACY PAVEMENT COMPONENT ANALYSIS PROCEDURE PAVEMENT DEFLECTION ANALYSIS PROCEDURE DESIGN OF ASPHALT OVERLAYS CORRECTING SURFACE DEFICIENCIES IN ASPHALT PAVEMENTS CORRECTING STRUCTURAL DEFICIENCIES DESIGN OF OVERLAYS FOR ASPHALT PAVEMENT STRUCTURES DESIGN OF OVERLAYS FOR PORTLAND CEMENT CONCRETE PAVEMENTS DESIGN OF PAVEMENT WIDENING AND SHOULDERS GEOMETRIC IMPROVEMENTS CONSTRUCTION PROCEDURES SMOOTHING OVERLAYS AND STRUCTURAL IMPROVEMENTS WIDENING TESTING PROCEDURES AND SPECIFICATIONS PROCEDURE FOR DETERMINING PRESENT SERVICEABILITY RATING COMPUTING STANDARD DEVIATION AND MEAN TEST VALUE PROCEDURE FOR MEASURING SURFACE ROUGHNESS PROCEDURE FOR SELECTING SAMPLING LOCATIONS BY RANDOM SAMPLING TECHNIQUE BENKELMAN BEAM REBOUND DEFLECTION TESTING PROCEDURE METHOD FOR PREDICTING MEAN PAVEMENT TEMPERATURE GUIDE SPECIFICATION FOR BREAKING AND SEATING PORTLAND CEMENT CONCRETE PAVEMENT.

328 218570 DA
ASPHALT OVERLAY DESIGN
Kingham, RI
Highway Research Record, Hwy Res Board 1969 No 300, pp 37-42, 3 FIG, 1 TAB, 14 REF
SUBFILE: HRIS
A PREDICTED $120 MILLION ANNUAL COST FOR HIGHWAY PAVEMENT AND SHOULDER MAINTENANCE IN THE U.S. BY 1975 POINTS OUT THE NEED FOR ASPHALT CONCRETE OVERLAYS TO BE STRUCTURALLY DESIGNED WITH AS MUCH PRECISION AS POSSIBLE IN ORDER TO MAKE THE MOST EFFICIENT USE OF THE TAX DOLLAR. FOR THIS PURPOSE, THE ASPHALT INSTITUTE HAS PREPARED A DESIGN MANUAL ENTITLED "ASPHALT, OVERLAYS, AND PAVEMENT REHABILITATION." THE MANUAL DESCRIBES TWO METHODS FOR DETERMINING THE THICKNESS REQUIREMENTS OF AN ASPHALT CONCRETE OVERLAY. THE COMPONENT ANALYSIS METHOD REQUIRES AN EVALUATION OF THE EXISTING PAVEMENT TO COMPARE WITH A NEW FULL-DEPTH ASPHALT PAVEMENT DESIGN. THE SECOND METHOD REQUIRES AN ANALYSIS OF PAVEMENT DEFLECTION AND IS PARTIALLY BASED ON ELASTIC-LAYERED THEORY. BOTH METHODS PROVIDE THICKNESSES OF ASPHALT CONCRETE DIRECTLY AND ARE BASED ON FIELD OBSERVATIONS AND ENGINEERING EXPERIENCE. THIS REPORT DESCRIBES THE NEW TECHNOLOGY RELATED TO EACH METHOD. /AUTHOR/

329 496341 PB-250 506/3
Development of the Asphalt Institute's Deflection Method for Designing Asphalt Concrete Overlays for Asphalt Pavements
(Final rept.)
Kingham, R. Ian
Asphalt Inst., College Park, Md.
Report No.: RR-69-3
Jun 69 24p
NTIS Prices: PC A02/MF A01 Journal Announcement: GRAI7611
Throughout the world there are a number of overlay design procedures for the strengthening of existing pavements. These procedures are based on local environment and it is difficult to extrapolate them to new areas and to new materials. Very few, if any, provide the designer with a thickness of asphalt concrete directly. This report presents the development of a deflection thickness design method for The Asphalt Institute's new design manual entitled Asphalt Overlays and Pavement Rehabilitation (MS-17). The method is based on elastic-layered theory and engineering experience with pavement deflections.

330 205938 DA
THE DESIGN OF CONCRETE OVERLAYS BY MEANS OF LAYERED THEORY THEORY
Nielsev, JP
New Mexico University; ./Proceedings 7th Paving Conference 1969 pp 32-83, 15 FIG, 6 TAB, 17 REF
SUBFILE: HRIS
the results are presented of a 5-year pavement research program, conducted by the naval civil engineering laboratory, in which theoretical and experimental studies were performed on the problem of concrete overlay design for flexible pavements, with special reference to marine and navy airport runways. The objective was to determine the feasibility of using overlays thinner than the minimum 6 inches now permitted. The Westergaard solutions and elastic layer theory were the analytic tools. The former were found to be conservative, and it was proved that the latter can serve as the basis for an overlay design procedure. While several problem areas require additional research before the procedure can be formalized, the results of the studies indicate that substantial savings in overlay thickness can be achieved without loss of rated load capacity. The theoretical and experimental studies are described, and a design procedure is outlined. Procedure is outlin&d.

159131 AD-856 136
331 **An Experimental Evaluation of a New Approach to Concrete Overlay**
(Technical note May 68-Jun 69)
Nielsen, J. P. ; Katona, M. G.
Naval Civil Engineering Lab., Port Hueneme, Calif.
Corp. Source Codes: 248150
Report No.: NCEL-TN-1038
Jul 69 50p
Distribution Limitation now Removed.
NTIS Prices: PC A03 MF A01 Journal Announcement: USGRDR7003
Contract No.: Y-F38-534-002-01-001
The report describes and presents the results of a pavement research program in which theoretical and experimental studies were conducted relative to the problem of concrete overlay design for flexible pavements. The objective of this study was to investigate the use of concrete overlays thinner than the minimum 6-inch overlay now permitted. This study was first approached by conducting a thorough theoretical investigation to determine if any theoretical reasons existed which suggested that a minimum 6-inch overlay should be used. Elastic layered theory was used in the analysis. An experimental program was initiated in which a series of ten concrete overlays were placed over an existing flexible pavement. (Author)

205787 DA
332 **K-VALUE-DEFLECTION RELATIONSHIP FOR AC PAVMENTS - FINAL REPORT**
Zube, E; Tueller, DO; Hannon, JB
California Division Highways /Materials and Research Department
Nov 1969 Research RePT NO 643449, 16 PP, 7 FIG, 2 TAB
SUBFILE: HRIS
AN EVALUATION OF A PRELIMINARY K-VALUE VERSUS DEFLECTION RELATIONSHIP FOR AC PAVEMENTS IS REPORTED. BY A LIMITED AMOUNT OF PLATE BEARING AND BENKELMAN BEAM DEFLECTION TESTS, THE K-VALUE VERSUS DEFLECTION RELATIONSHIP WAS FOUND TO BE VALID WITH MINOR MODIFICATION. A PROCEDURE IS PRESENTED BY WHICH PAVEMENT DEFLECTION MEASUREMENTS MAY BE UTILIZED TO PREDICT

THE K-VALUE OF AN EXISTING AC ROADWAY FOR PCC OVERLAY THICKNESS DESIGN. PCC OVERLAY DESIGN THICKNESSES DETERMINED BY TRANSIENT PAVEMENT DEFLECTION MEASUREMENTS ARE COMPARED WITH ARBITRARY PCC OVERLAY THICKNESS DESIGNS. IT WAS CONCLUDED THAT THE K-VALUE OF AN EXISTING AC ROADWAY CAN BE PREDICTED FROM PAVEMENT DEFLECTION MEASUREMENTS WHICH GENERALLY RESULT IN A REDUCTION IN PCC PAVEMENT THICKNESS REQUIREMENTS. /AUTHOR/

218663 DA

333 **OVERLAY AND WIDENING WITH HOT MIX ASPHALT CONCRETE**

Mckeogh, CA

Tennessee Highway Conference Proc Jan 1969 Bull No 35, PP 29-32

SUBFILE: HRIS

THE USE OF FULL DEPTH ASPHALT CONCRETE FOR WIDENING, AS USED BY MISSISSIPPI AND LOUISIANA, IS REVIEWED. A MAJOR PROBLEM IN THE DESIGN AND CONSTRUCTION OF AN OVERLAY AND WIDENING PROJECT IS THE PREPARATION OF THE OLD PAVEMENT FOR APPLICATION OF THE NEW SURFACE. A SUCCESSFUL METHOD OF PORTLAND CEMENT CONCRETE PREPARATION USED BY IOWA, FLORIDA AND LOUISIANA IS THE BREAKING OF THE MOVING SLABS BY A DROP HAMMER AND SEEDING THE BROKEN SLABS BY ROLLING WITH A 50-TON PNEUMATIC TIRE ROLLER. THIS IS USED EXCEPT FOR PORTLAND CEMENT WHICH IS WIRE MESHED REINFORCED. TO REDUCE THE EFFECT OF THE WIRE MESH, THE MESH WAS CUT WHERE THE SLAB WAS SCORED. FIFTY PERCENT OF THE SLABS WERE SEEDED SUCESSFULLY AND FIFTY PERCENT WERE REMOVED AND REPLACED WITH FULL DEPTH ASPHALT CONCRETE. FOR THE WIDENING OF AN EXISTING NARROW PAVEMENT LOUISIANA AND MISSISSIPPI SELECTED FULL DEPTH ASPHALT CONCRETE. THE WIDENING THICKNESS FOR AN EXISTING PAVEMENT OF PORTLAND CEMENT CONCRETE IS GENERALLY A COMPACTED THICKNESS EQUAL TO THE SLAB THICKNESS PLUS ONE-HALF INCH. WHERE THE EXISTING PAVEMENT IS ASPHALT, THE THICKNESS OF WIDENING IS FOUR INCHES. WHERE IT MAY BE FOUND NECESSARY TO PLACE THE WIDENING ON ONLY ONE SIDE OF THE PAVEMENT THE WIDTH IS USUALLY 6 TO 10 FEET. FOR SAFETY AND CONVENIENCE, THESE STATES REQUIRE THAT THE ENTIRE LENGTH OF EXCAVATED TRENCH MUST BE COMPLETED WITH COMPACTED ASPHALT CONCRETE AND OPEN TO TRAFFIC BY THE END OF THE WORK DAY. ONE CONTRACTOR WITH AN EFFICIENT OPERATION PLACED AN AVERAGE OF 2600 TONS OF FULL DEPTH WIDENING PER DAY.

218702 DA

334 **OAKLAND PROVES OUT HEATER-REMIX OVERLAY METHOD**

Public Works Nov 1970 Vol 101, No 11, PP 70-71, 4 PHOT

SUBFILE: HRIS

the heater--remix method of resurfacing roads has been gaining increased attention from highway departments, airports, and government agencies, particularly in the repair of asphalt pavements beyond their design capacities. The process, incorporating an asphalt- rejuvenating treatment, has been found to offer a better, more secure bond between old asphalt and new overlay than results from the normal method of tack coat and overlay commonly used. The process of using a liquid emulsion called reclamite on a heavily trafficked avenue in Oakland (Calif.) is described in detail.

335 218566 DA

PAVEMENT REHABILITATION: BACKGROUND AND INTRODUCTION

Swanberg, JH

Highway Research Record, Hwy Res Board 1969 No 300, pp 1-3

SUBFILE: HRIS

RAPIDLY INCREASING VOLUMES OF TRAFFIC ARE STRESSING ROADS BEYOND THEIR ORIGINAL ROAD-CARRYING CAPABILITY DESIGN. MUCH OF THE REHABILITATION AND REINFORCEMENT IS BEING ACCOMPLISHED BY

MAINTENANCE FORCES OR BY MAINTENANCE CONTRACTS, WHEREAS IT SHOULD BE ACCOMPLISHED BY RECONSTRUCTION. RECONSTRUCTION CONTRACTS ACCOMPLISH MORE THAN SIMPLY STRENGTHENING THE RIDING SURFACE. SUCH CONTRACTS USUALLY INVOLVE BRINGING ROADS UP TO MODERN STANDARDS BY WIDENING THE ROADWAY, WIDENING THE SHOULDERS, FLATTENING THE SLOPES, AND ELIMINATING HAZARDS SUCH AS EXCESSIVE VERTICAL AND HORIZONTAL CURVATURE. HOWEVER, RECONSTRUCTION REQUIRES THE COMMITMENT OF MORE FUNDS. FINANCES ARE INADEQUATE. A COMPREHENSIVE NEEDS STUDY IN MINNESOTA SHOWS ESTIMATES OF THE COST OF BRINGING THE STATE TRUNK HIGHWAYS UP TO STANDARD. BECAUSE OF LACK OF FINANCES, A RESURFACING PROGRAM IS BEING CONDUCTED TO MAINTAIN A REASONABLE STANDARD OF ADEQUACY. OVERLAYS OF BITUMINOUS SURFACING ARE PROVIDED TO FURNISH A GOOD RIDING SURFACE AND EXISTING SLOPING CURBS ARE REMOVED ON THE OLDER PAVEMENTS. THE COST FOR THIS TYPE OF PROGRAM ARE CITED. IF THE RESURFACING HAS A TEN-YEAR LIFE, WHICH APPEARS REASONABLE, WITH ADEQUATE ROUTINE MAINTENANCE, IT APPEARS TO BE A GOOD INVESTMENT. PRIORITIES FOR RESURFACING PROJECTS ARE BEING ESTABLISHED BY EMPLOYING THE PRESENT SERVICE ABILITY INDEX (PSI) USED ON THE AASHO ROAD TEST AT OTTAWA, ILLINOIS, FOR THE EVALUATION OF PAVEMENT SECTIONS. ON THE BASIS OF THESE SURVEYS, PAVEMENTS WITH LOW PSI RATINGS ARE RECEIVING FIRST CONSIDERATION FOR RESURFACING. THE UNIVERSITY OF MINNESOTA IS DEVELOPING RELATIONSHIPS FOR PREDICTING THE SURFACE LIFE OF FLEXIBLE SURFACES AND THE SERVICE LIFE AFTER RESURFACING. IT IS HOPED THAT THESE RATINGS WILL PROVE USEFUL FOR THE 1972 AND SUBSEQUENT RESURFACING PROGRAMS. DEPENDING ON THE CONDITION OF THE PAVEMENT, RESURFACING HAS VARIED FROM A SPOT LEVELING COURSE TO CORRECT THE MORE SERIOUSLY DETERIORATED AREAS, TO A LEVELING COURSE AND WEARING COURSE, AND FINALLY TO TWO COURSES CONSISTING OF LEVELING AND WEARING COURSES. THE AGGREGATE USE HAS BEEN ALMOST EXCLUSIVELY GRAVEL, WITH OR WITHOUT THE ADDITION OF FILLER TO THE WEARING COURSE MIXTURE.

336 145550 PB-185 221

Statewide Rigid Pavement Survey, Volume I

(Final rept.)

Walbeck, Eric S. ; Stromberg, Francis J.

Maryland State Roads Commission, Brooklandville. Bureau of Research.

Feb 69 139p

See also Volume 2, AD-185 222.

NTIS Prices: PC A07 MF A01 Journal Announcement: USGRDR6919

Contract No.: HPR-PR-1(4)

In 1959 Maryland undertook a field survey of all the rigid pavements in existence in the State. The first survey was completed in 1960 and a follow up completed in 1966. Defects in each pavement slab were classified as major or minor (1) inner or outer corner breaks, (2) transverse or longitudinal joint spalls, (3) longitudinal or transverse cracks, and (4) end failures, all according to predetermined survey definitions. An unsuccessful attempt was made to correlate pavement roughness with the various defects. Rudimentary comparisons were made between defects and design, construction, pavement properties, traffic and environment. The conclusions are necessarily vague because of the influence of the many uncontrolled variables. Relationships between defects and aggregate type, subbase type, shoulder type, curing method, joint formation technique, and pavement thickness are all examined. Special sections of the report are devoted to describing special experiments which were established to investigate (1) pavement growth in the field and laboratory, (2) blow-ups, (3) new joint seals, (4) concrete overlays, and (5) average strength and density of pavement concrete. Vol. 2 is an Appendix and contains the tabulated information from the survey. This final report was preceded by a report on the results of the first survey and eight (one for each district of the State and a summary) reports on the second survey.

337 218569 DA

TENTATIVE OVERLAY DESIGN FOR MINNESOTA ASPHALT PAVEMENTS

Skok, EL

Highway Research Record, Hwy Res Board 1969 No 300, pp 33 36, 6 TAB, 3 REF

SUBFILE: HRIS

A METHOD HAS BEEN SUGGESTED FOR DESIGNING AN OVERLAY ON AN EXISTING ASPHALT PAVEMENT FROM RECENT RESEARCH IN MINNESOTA. THIS METHOD MAKES A PREDICTION OF HOW LONG A GIVEN THICKNESS OF OVERLAY WILL LAST ON A PAVEMENT. A SPRING DEFLECTION OF THE PAVEMENT SECTION BEFORE OVERLAY IS DETERMINED BY MAKING A REBOUND DEFLECTION TEST DURING ANY NON-FROZEN PORTION OF THE YEAR, PREFERABLE IN JUNE, JULY, AUGUST, SEPTEMBER OR OCTOBER WHEN THE STRENGTH OF THE PAVEMENT IS LESS VARIABLE. THE DEFLECTIONS ARE CORRECTED TO AN 80 F DEFLECTION BY USING THE TEMPERATURE OF THE MAT. THE CORRECTION WAS FOUND TO BE A FUNCTION OF THE LEVEL OF DEFLECTION. THE FUNCTION OF TEMPERATURE FOR MINNESOTA ROADS WAS DETERMINED BY USING THE RESULTS OF THE AASHO ROAD TEST AND TEMPERATURE STUDIES MADE ON MINNESOTA TEST SECTIONS. BASED ON THE RESULTS OF A SPRING RECOVERY TEST PROGRAM OVER THE LAST FEW YEARS, IT WAS FOUND THAT THE STRENGTH OF A PAVEMENT SECTION IS DEPENDENT ON EMBANKMENT TYPE, TIME OF YEAR, AND SURFACE THICKNESS. AFTER THE SPRING DEFLECTION IS DETERMINED, A REDUCTION IN DEFLECTION IS ESTABLISHED FOR VARIOUS THICKNESSES OF OVERLAY. BEFORE AND AFTER TESTS ARE BEING CONDUCTED ON SECTIONS OVERLAID IN 1968 TO ESTABLISH THE DEFLECTION REDUCTION. THE CALCULATED LIST OF DEFLECTIONS WITH THE VARIOUS THICKNESSES OF OVERLAY CAN BE USED TO PREDICT THE NUMBER OF EQUIVALENT 18-KIP AXLE LOADS THAT A PAVEMENT SECTION CAN WITHSTAND BEFORE THE SERVICEABILITY WILL DROP TO 2.5, ASSUMING THAT THE PSI IS BROUGHT UP TO 3.9 OR 4.0 OR BETTER WITH THE ADDITION OF THE OVERLAY. THE MINNESOTA TEST SECTIONS HAVE SO FAR VERIFIED THE EQUATION DEVELOPED FROM THE AASHO ROAD TEST. A COMPUTER PROGRAM WAS DEVELOPED TO ESTIMATE TRAFFIC IN TERMS OF EQUIVALENT 18-KIP AXLE LOADS FOR 5, 10, 15, 20 AND 25 YEARS INTO THE FUTURE ON A GIVEN PAVEMENT SECTION.

338 205773 DA

USE OF LINEAR-ELASTIC LAYERED THEORY FOR THE DESIGN OF CRCP OVERLAYS

Mccullough, BF; Boedecker, KJ

Highway Research Record, Hwy Res Board 1969 No 291, pp 1-13, 16 FIG, 23 REF

SUBFILE: HRIS

THE DESIGN OF OVERLAY PAVEMENTS FOR UPGRADING EXISTING PAVEMENTS, ESPECIALLY RIGID PAVEMENTS, HAS PRESENTED A FORMIDABLE TASK FOR ENGINEERS IN THE PAST DUE TO THE LACK OF A RATIONAL DESIGN PROCEDURE. THIS PAPER JUSTIFIES THE USE OF LINEAR-ELASTIC LAYERED THEORY FOR THE DESIGN OF CONTINUOUSLY REINFORCED CONCRETE PAVEMENTS (CRCP) OVERLAYS OF EXISTING PAVEMENTS. THE BACKGROUND RATIONALE FOR SELECTING LAYERED THEORY INSTEAD OF CONVENTIONAL CONCRETE PAVEMENT DESIGN PROCEDURES FROM PLATE THEORY IS PRESENTED. A COMPARISON IS MADE OF THE MECHANICAL STATE OF STRESS, STRAIN, AND DEFLECTION DERIVED FROM LAYERED THEORY AND THE WESTERGAARD INTERIOR EQUATION WITH FIELD MEASUREMENTS OF PAVEMENT DEFLECTION AND STRAIN. THIS COMPARISON INDICATES THAT LAYERED THEORY IS AN ACCEPTABLE MODEL FOR THE DESIGN OF CRCP OVERLAYS. TECHNIQUES SUCH AS INCREASING THE SUBGRADE STIFFNESS WITH DEPTH BENEATH A PAVEMENT STRUCTURE ARE PRESENTED FOR DEVELOPING A REASONABLE CORRELATION BETWEEN PREDICTED AND MEASURED DEFLECTION. LAYERED THEORY IS APPLIED TO THE DESIGN OF A CRCP OVERLAY OF AN EXISTING JOINTED CONCRETE AIRPORT PAVEMENT FOR A SERIES OF JUMBO JETS. ALSO DISCUSSED ARE THE EFFECTS ON DESIGN OF AN INTERMEDIATE ASPHALT CONCRETE STRESS-RELIEVING LAYER BETWEEN CONCRETE PAVEMENTS. /AUTHOR/

339 205861 DA

VEHICLE WEIGHT REGULATION AND THE EFFECTS OF INCREASED LOADING ON PAVEMENTS

Ontario Dept Hwys, Downsview /Canada/; .Phang, WA

Nov 1969 Rept No Rr151, 16 PP, TABS

SUBFILE: HRIS

heavily loaded vehicles are particularly damaging to highway pavements and protective weight limitations safeguard the highway investment. Over the past four decades, the changing needs of transportation have required upward revisions in these weight limitations, and further upward revision is again under consideration. The reaction to loading of flexible and rigid pavements, the effects of different wheel loads on pavement life, their equivalence in terms of pavement damage, and the influence of adjacent axles, are described. Increased maintenance and strengthening overlays are needed for increased wheel loads. A 1967 vehicle survey showed the 85 percentaile single-axle load to be about 22 kips, so that raising the weight limitation from 18 kips to 20 kips would only result in regularization of those trucks with 20 kip single-axles now regarded as overloaded. Stricter enforcement must ensure that there is no upward shift in the loading specturm when the weight limitations are raised. Some aspects of economic limitations are presented and A license fee structure based on load equivalency factors is suggested. /HSRI/

340 218482 DA
ASPHALT RESURFACING PROCESS TESTED
Highway Research News, Hwy Res Board 1968
SUBFILE: HRIS
a process based upon salvaging the existing mat while resurfacing asphalt highways has been tested by the Wyoming highway department. Special mobile heater-raker units heat the existing surfaces, then scarify them to an appropriate depth (one inch on the test road). Two machines are used, one approximately 100 feet ahead of the other. They travel at one mile per hour and work one lane at a time. Following these units, a distributor sprays water and reclamite (A special formula emulsion which replaces lost oil qualities in the aged asphalt). The reclamite soaks into the surface, it is applied from 2 to 24 hours before a new 1 1/4-inch overlay is applied. The time factor is dependent upon the conditions. The end product is about two inches of new surface. /article/

341 207102 DA
FLEXIBLE PAVEMENT EVALUATIONS IN OKLAHOMA
Hartronft, BC
Association of Asphalt Paving Technologists Proc Feb 1969 Vol 38, pp 344-352, 2 REF
SUBFILE: HRIS
THE OKLAHOMA FLEXIBLE PAVING RESEARCH PROJECT WAS CONDUCTED TO EVALUATE PAVEMENT PERFORMANCE AND TO ASCERTAIN DESIGN CRITERIA FOR PAVEMENTS. A METHOD FOR VISUALLY RATING THE PRESENT CONDITION OF FLEXIBLE PAVEMENTS WAS ESTABLISHED IN 1955 AND IS STILL USED. THE FACTORS CONSIDERED ARE RIDING QUALITY, CRACKING, RAVELLING, DISTORTION, FAILED AREAS, AND THE MAINTENANCE PERFORMED. THE FINAL RATING IS A NUMERICAL RATING AND A DESCRIPTIVE RATING OF FAILURE, POOR, AVERAGE, GOOD, SUPERIOR OR EXCELLENT. IN ADDITION TO THE CONDITION AND MAINTENANCE CONSIDERATIONS, THE STUDY OF BENKELMAN BEAM DEFLECTION LEVELS AS RELATED TO THE PERFORMANCE CURVE INDICATED THAT A GIVEN LEVEL OF DEFLECTION FOR A SECTION OF PAVEMENT IS USUALLY RATHER CONSTANT UNTIL OVERSTRESSING OR FAILURE OF THE PAVEMENT OCCURS. THIS PAVEMENT PERFORMANCE EVALUATIONS SYSTEM HAS ALSO ALLOWED ESTABLISHMENT OF DESIGN CRITERIA, NOT ONLY FOR OVERLAYS OF EXISTING PAVEMENTS, BUT FOR STRUCTURAL DESIGN OF NEW PAVEMENT.

342 218440 DA
OVERLAYS FOR FLEXIBLE PAVEMENTS FOR THE 1968 INTERSTATE ESTIMATES
Hartronft, BC
Highway Research Record, Hwy Res Board 1968 No 254, pp 68-74, 8 FIG, 2 TAB, 7 REF
SUBFILE: HRIS
interstate funds for additional state construction were made available under the provision of im 21-1-67 issued by the bureau of public roads in January, 1967. However, certain criteria were required before a project could become qualified: the project must have been authorized for construction prior to October 24, 1963, the condition of the pavement must exhibit visual evidence of physical stress, and a complete structural analysis of the pavement design must establish a need for additional thickness. These considerations are to provide a serviceability index of 2.0, 20 years after the date of authorization of the initial pavement construction project. This paper explains the methods of determining conditions, determining structural adequacy, design analysis, and determining the thickness of overlay required for flexible pavements included in the 104 (b)5 report for the 1968 estimate of the cost of completing the interstate system in Oklahoma. A method is included to predict whether a project will meet the criteria prior to 1972 even though the present condition does not qualify for immediate overlay. Although this method of analysis was used for interstate pavements, it is one which may be adopted (and has been used prior to this time) on any system. /author/

TITLES WITHOUT ABSTRACTS

343 0037197 EIM8209037197
REHABILITATION OF CONCRETE PAVEMENTS.
Yrjanson, W. A.
Am Concrete Pavement Assoc, Arlington Heights, Ill, USA
Proceedings of the 19th Paving Conference and Symposium on Continuously-Reinforced-Concrete Pavement. Albuquerque, NM, USA Jan 11-13 1982
Sponsor: Univ of NM, Dep of Civ Eng, Albuquerque, USA; Univ of NM, NM Res Inst, Albuquerque, USA
Source: Proceedings of The Paving Conference 19th. Publ by Univ of NM, Dep of Civ Eng, Albuquerque, NM, USA p 59 1982
CODEN: PPCODL
Languages: English Conf. No.: 00979
Descriptors: PAVEMENTS-Concrete
Identifiers: CONCRETE CONSTRUCTION; REPAIR OF PAVEMENT OVERLAYS; ABSTRACT ONLY
Classification Codes: 406; 412; 405

344 0013261 EIM8207013261
BONDED CONCRETE RESURFACING.
Halm, Harold J.
Am Concr Pavement Assoc, USA
2nd International Conference on Concrete Pavement Design. West Lafayette, Indiana, USA Apr 14-16 1981
Sponsor: Purdue Sch of Civ Eng, West Lafayette, Indiana, USA ; Fed Highw Adm, Washington, DC, USA; PCA, Skokie, Ill, USA; Transp Res Board, Washington, DC, USA; Indiana State Highw Comm
Source: Publ by Purdue Univ, West Lafayette, Indiana, USA p 411-419 1981
Languages: English Conf. No.: 00189
Descriptors: ROADS AND STREETS-Concrete
Identifiers: CONCRETE PAVEMENT THIN BONDED RESURFACING; LOAD BEARING CAPACITY INCREASE; LACKING HIGH PRODUCTION COST-EFFECTIVE EQUIPMENT; SLIPFORM PAVING EQUIPMENT DEVELOPMENT; HIGH SPEED MILLING MACHINES; ESCALATING ASPHALT PRICES; FIBROUS REINFORCED RESURFACING IN IOWA; BONDED DENSE CONCRETE BRIDGE DECK OVERLAYS; THIN BONDED CONCRETE RESURFACING; CONCRETE PAVEMENT REHABILITATION
Classification Codes: 406; 412

345 0171184 EIM8307051184
CONCRETE PAVEMENT REHABILITATION - GEORGIA METHODOLOGY.
Tyner, Hugh L.
Georgia Dep of Transportation, Research & Development Bureau, Forest Park, Ga, USA
Preprint Volume for the National Seminar on Portland Cement Concrete Pavement Recycling and Rehabilitation. St. Louis, Mo, USA Sep 27-30 1981
Sponsor: Transportation Research Board, Washington, DC, USA; DOT, Federal Highway Administration, Washington, DC, USA
Source: Publ by Transportation Research Board, Washington, DC, USA p 27-49 1981
Languages: English Conf. No.: 02180
Descriptors: PAVEMENTS-Repair
Identifiers: EVALUATION OF JOINTED CONCRETE PAVEMENTS; TECHNIQUES OF REHABILITATION; CONCRETE AND ASPHALT OVERLAY; SEALING OF JOINTS; REPLACEMENT OF SLABS
Classification Codes: 406; 412; 411

346 0058047 EIM8212058047
DESIGN AND PERFORMANCE OF BITUMINOUS FRICTION COURSE MIXES IN ONTARIO.
Kamel, Nabil; Musgrove, G. R.
Gulf Can Ltd, Sheridan Park, Ont
1981 Annual Conference Preprints - Roads and Transportation Association of Canada. (Volume 2: Design, Construction and Maintenance.) Sep 1981
Sponsor: Roads and Transp Assoc of Can, Ottawa, Ont
Source: Publ by Roads and Transp Assoc of Can, Ottawa, Ont p E43-E76 1981
Languages: English Conf. No.: 01227
Descriptors: ROADBUILDING MATERIALS-Bituminous
Identifiers: PAVEMENT OVERLAYS; HIGHWAY SYSTEMS IN CANADA; FRICTION COURSE MIXES
Classification Codes: 406; 411; 931

347 0126595 EIM8301006595
EFFECTS OF CHANGING LOAD LIMITS ON PAVEMENT COSTS.
Carmichael, R. F. III; Treybig, H. J.; Roberts, F. L.
ARE Inc, Austin, Tex, USA
Preprints - ASCE Convention & Exposition (October, 1981). St. Louis, Mo, USA Oct 26-31 1981
Sponsor: ASCE, New York, NY, USA
Source: Preprints - ASCE Convention & Exposition Publ by ASCE, New York, NY, USA Prepr 81-542, 16p 1981
CODEN: ACEXE7
Languages: English Conf. No.: 00917
Descriptors: PAVEMENTS-Costs
Identifiers: POTENTIAL NEW LEGAL LOAD LIMITS; PAVEMENT MAINTENANCE AND REHABILITATION COSTS; DIFFERENT AXLE CONFIGURATIONS; DIFFERENT TRUCK SIZES; TRIPLE TRAILER UNITS, COST PREDICTIONS; BENEFIT PREDICTIONS; TRUCK ROUTE NETWORK ANALYSIS; MODAL SHIFT IN COMMODITY HAULING; FAILURE OF EXISTING PAVEMENT; OVERLAY LIFE
Classification Codes: 406; 911

348 0013259 EIM8207013259
EXPERIENCE WITH NONDESTRUCTIVE STRUCTURAL EVALUATION OF AIRPORT PAVEMENTS.
Bush, Albert J. III; Hall, Jim W. Jr.
US Army Eng Waterw Exp Stn, USA
2nd International Conference on Concrete Pavement Design. West Lafayette, Indiana, USA Apr 14-16 1981
Sponsor: Purdue Sch of Civ Eng, West Lafayette, Indiana, USA ; Fed Highw Adm, Washington, DC, USA; PCA, Skokie, Ill, USA; Transp Res Board, Washington, DC, USA; Indiana State Highw Comm
Source: Publ by Purdue Univ, West Lafayette, Indiana, USA p 385-397 1981
Languages: English Conf. No.: 00189
Descriptors: AIRPORT RUNWAYS-Testing
Identifiers: NONDESTRUCTIVE TESTING; AIRPORT PAVEMENT EVALUATION; COMPOSITE PAVEMENT APPLICATION; RADIUS OF RELATIVE STIFFNESS DETERMINATION; DEFLECTION BASIN MEASUREMENTS; OVERLAY THICKNESS REQUIREMENTS; AIRPORT OPERATOR RESPONSES; STRUCTURAL SUPPORT REQUIREMENTS; DYNAMIC LOAD SWEEP METHOD
Classification Codes: 431; 422

349 0019660 EIM8207019660
FACTORS AFFECTING PAVEMENT DEFLECTION MEASUREMENTS IN THE TROPICS.
Smith, H. R.; Jones, C. R.
Transp & Road Res Lab, Engl
Proceedings of the 3rd Conference of the Road Engineering Association of Asia and Australasia, Volume 1. Taipei, Taiwan Apr 20-24 1981
Sponsor: Road Eng Assoc of Asia and Australas; China Road Fed; Chin Inst of Eng, Taipei, Taiwan
Source: p 683-698 1981
Languages: English Conf. No.: 00446
Descriptors: PAVEMENTS-Overlays
Identifiers: ROAD SURFACES; PAVEMENT DETECTION
Classification Codes: 406

350 0171192 EIM8307051192
IOWA'S BONDED CONCRETE OVERLAYS.
Knutson, Marlyn J.
Iowa Concrete Paving Assoc, Des Moines, Iowa, USA
Preprint Volume for the National Seminar on Portland Cement Concrete Pavement Recycling and Rehabilitation. St. Louis, Mo, USA Sep 27-30 1981
Sponsor: Transportation Research Board, Washington, DC, USA; DOT, Federal Highway Administration, Washington, DC, USA
Source: Publ by Transportation Research Board, Washington, DC, USA p 115-124 1981
Languages: English Conf. No.: 02180
Descriptors: BRIDGES-Decks
Identifiers: DESIGN OF BONDED OVERLAY; HIGH PRODUCTION EQUIPMENT; MATERIALS FOR THIN LAYER BONDING; METHODS OF SURFACE PREPARATION
Classification Codes: 401; 412; 902

351 0013229 EIM8207013229
MECHANISTIC OVERLAY DESIGN PROCEDURES FOR RIGID PAVEMENTS.
Majidzadeh, Kamran; Ilves, George J.; May, Richard W.
Ohio State Univ, Columbus, USA
2nd International Conference on Concrete Pavement Design. West Lafayette, Indiana, USA Apr 14-16 1981
Sponsor: Purdue Sch of Civ Eng, West Lafayette, Indiana, USA ; Fed Highw Adm, Washington, DC, USA; PCA, Skokie, Ill, USA; Transp Res Board, Washington, DC, USA; Indiana State Highw Comm
Source: Publ by Purdue Univ, West Lafayette, Indiana, USA p 43-53 1981
Languages: English Conf. No.: 00189
Descriptors: PAVEMENTS-Overlays
Identifiers: OVERLAY DESIGN METHODS; VISUAL CONDITION RATING ; DEFLECTION RELATIONSHIPS; STRESS ANALYSIS METHOD; COUPLED FEM-MULTILAYER ELASTIC SUBGRADE PROGRAM; LOAD-INDUCED FATIGUE CRACKING; REFLECTION CRACKING ANALYSIS; LOAD-INDUCED SHEAR; TEMPERATURE INDUCED STRESSES; REFLECTIVE CRACK FORMATION ANALYSIS
Classification Codes: 406

352 0019644 EIM8207019644
OPEN GRADED MIXES USED FOR PAVING TIMBER HAUL ROADS.
Hsia, Frederick T.; Padgett, J. W.
US For Serv, USA
Proceedings of the 3rd Conference of the Road Engineering Association of Asia and Australasia, Volume 1. Taipei, Taiwan Apr 20-24 1981
Sponsor: Road Eng Assoc of Asia and Australas; China Road Fed; Chin Inst of Eng, Taipei, Taiwan
Source: p 447-459 1981
Languages: English Conf. No.: 00446
Descriptors: ROADBUILDING MATERIALS-Testing
Identifiers: PAVEMENT OVERLAYS; TIMBER HAUL ROADS; OPEN GRADED PAVEMENTS; BITUMINOUS MATERIALS
Classification Codes: 406; 421; 411

353 0019643 EIM8207019643
OVERLAY DESIGN OF A TIMBER HAUL ROAD.
Hsia, Frederick T.; Inouye, K. S.; Stuart, Edward III
US For Serv, USA
Proceedings of the 3rd Conference of the Road Engineering Association of Asia and Australasia, Volume 1. Taipei, Taiwan Apr 20-24 1981
Sponsor: Road Eng Assoc of Asia and Australas; China Road Fed; Chin Inst of Eng, Taipei, Taiwan
Source: p 429-445 1981
Languages: English Conf. No.: 00446
Descriptors: ROADS AND STREETS-Rural
Identifiers: PAVEMENT OVERLAYS; FATIGUE OF MATERIALS; FRACTURE MECHANICS; TIMBER HAUL ROADS
Classification Codes: 406; 421; 931

354 0015624 EIM8207015624
PORTLAND CEMENT CONCRETE AS A PAVEMENT OVERLAY.
Miller, Lawrence C.
PCA, Olympia, Wash, USA
32nd Annual Road Builders' Clinic Proceedings. Pullman, Wash, USA Mar 10-12 1981
Sponsor: Wash State Univ, Coll of Eng, Pullman, USA; Univ of Idaho, Coll of Eng, Moscow, USA; Wash State Dep of Transp, Olympia, USA; Idaho State Transp Dep, Boise, USA; Am Public Works Assoc, Wash State Chapter, USA; et al
Source: Annual Road Builders' Clinic Proceedings 32nd, Publ by Wash State Univ, Eng Ext Serv, Pullman, USA p 62-68 1981
CODEN: ABCPDX
Languages: English Conf. No.: 00107
Descriptors: PAVEMENTS-Overlays
Identifiers: ROADBUILDING MATERIALS; PORTLAND CEMENT CONCRETE; CONCRETE ROADS AND STREETS; CONCRETE CONSTRUCTION
Classification Codes: 406; 412; 405

355 0171191 EIM8307051191
PREPARATION OF PCC PAVEMENT FOR OVERLAY.
Treybig, Harvey J.
Austin Research Engineers Inc, Austin, Tex, USA
Preprint Volume for the National Seminar on Portland Cement Concrete Pavement Recycling and Rehabilitation. St. Louis, Mo, USA Sep 27-30 1981
Sponsor: Transportation Research Board, Washington, DC, USA; DOT, Federal Highway Administration, Washington, DC, USA
Source: Publ by Transportation Research Board, Washington, DC, USA p 104-114 1981
Languages: English Conf. No.: 02180
Descriptors: PAVEMENTS-Overlays
Identifiers: REPAIR OF CONCRETE AVEMENTS; TREATMENT OF EXISTING PAVEMENTS; APPLICATION OF REINFORCING FABRICS; SPECIAL ASPHALT SPECIFICATIONS
Classification Codes: 406; 412; 819; 411

356 0038577 EIM8209038577
REFLECTING PROPERTIES OF A ROAD SURFACE.
de Boer, J. H.
Adhesion Problems in the Recycling of Concrete (Proceedings of a NATO Advanced Research Institute). St. -Remy-les-Chevreuse, Fr Nov 25-28 1980
Sponsor: NATO
Source: NATO Conference Series, (Series) 6: Materials Science v 4. Publ by Plenum Press, New York, NY, USA and London, Engl p 349-350 1981
CODEN: NCSSDY ISBN: 0-306-40817-1
Languages: English Conf. No.: 00981
Descriptors: ROADS AND STREETS-Concrete
Identifiers: PAVEMENT OVERLAYS; REFLECTION PROPERTIES
Classification Codes: 406; 412; 741

357 0013257 EIM8207013257
RIGID PAVEMENT REHABILITATION DESIGN SYSTEM.
Seeds, Stephen B.; Hudson, W. Ronald; McCullough, B. Frank
Univ of Tex, Austin, USA
2nd International Conference on Concrete Pavement Design. West Lafayette, Indiana, USA Apr 14-16 1981
Sponsor: Purdue Sch of Civ Eng, West Lafayette, Indiana, USA ; Fed Highw Adm, Washington, DC, USA; PCA, Skokie, Ill, USA; Transp Res Board, Washington, DC, USA; Indiana State Highw Comm
Source: Publ by Purdue Univ, West Lafayette, Indiana, USA p 367-376 1981
Languages: English Conf. No.: 00189
Descriptors: ROADS AND STREETS-Maintenance
Identifiers: TEXAS RIGID PAVEMENT REHABILITATION DESIGN; SYSTEMS CONCEPT/ANALYTICAL MODEL COMPUTER PROGRAM; STRUCTURAL REHABILITATION; OVERLAY CONSTRUCTION; CONCRETE SHOULDER CONSTRUCTION; VARIABLE CONCRETE FLEXURAL STRENGTH; VARIABLE OVERLAY THICKNESS; DISTRESS/MAINTENANCE PREDICTION; OVERLAY CONSTRUCTION COST MODEL
Classification Codes: 406

358 0013224 EIM8207013224
2ND INTERNATIONAL CONFERENCE ON CONCRETE PAVEMENT DESIGN.
Anon
2nd International Conference on Concrete Pavement Design. West Lafayette, Indiana, USA Apr 14-16 1981
Sponsor: Purdue Sch of Civ Eng, West Lafayette, Indiana, USA ; Fed Highw Adm, Washington, DC, USA; PCA, Skokie, Ill, USA; Transp Res Board, Washington, DC, USA; Indiana State Highw Comm
Source: Publ by Purdue Univ, West Lafayette, Indiana, USA 456 p 1981
Languages: English Conf. No.: 00189
Descriptors: ROADS AND STREETS-Concrete
Identifiers: HISTORICAL REVIEW; CONCRETE PAVEMENT DESIGN PRINCIPLES; GENERAL DESIGN AND PERFORMANCE; COMPOSITE PAVEMENT DESIGN; AIRPORT PAVEMENTS; HIGHWAY PAVEMENTS; PAVEMENT MANAGEMENT; PAVEMENT REHABILITATION; OVERLAY DESIGN; CONTINUOUS REINFORCED CONCRETE PAVEMENTS
Classification Codes: 406; 431; 412; 411

359 0003831 EIM8207003831
STRENGTHENING OF SECONDARY ROADS - A NEW APPROACH.
Persson, Erland
Skanska Cementgjuteriet, Danderyd, Swed
9th IRF World Meeting (International Road Federation). (TS5: Road Maintenance.) Stockholm, Swed Jun 1-5 1981
Sponsor: Swed Road Fed, Stockholm
Source: Available from Organ Comm, IFR World Meet, Swed Road Fed, Stockholm p 273-280 1981
Languages: English Conf. No.: 00071
Descriptors: ROADS AND STREETS-Maintenance
Identifiers: PAVEMENT STRENGTHENING; PAVEMENT OVERLAYS; BEARING CAPACITY OF EXISTING ROAD; ASPHALT MIXES
Classification Codes: 401; 411

360 809665 ORDER NO: AAD80-14638
SOME CONSIDERATIONS ON REFLECTION CRACKING IN ASPHALT CONCRETE OVERLAY PAVEMENTS 355 PAGES.
COETZEE, NICOLAAS FRANCOIS (PH.D. 1979 UNIVERSITY OF CALIFORNIA, BERKELEY).
PAGE 282 IN VOLUME 41/01-B OF DISSERTATION ABSTRACTS INTERNATIONAL.
ENGINEERING, CIVIL
DESCRIPTOR CODES: 0543
INSTITUTION CODE: 0028

361 205921 ORDER NO: AAD78-17739
DESIGN PROCEDURE FOR ASPHALT CONCRETE OVERLAYS OF FLEXIBLE PAVEMENTS. 320 PAGES.
ZANIEWSKI, JOHN PAUL (PH.D. 1978 THE UNIVERSITY OF TEXAS AT AUSTIN).
PAGE 1884 IN VOLUME 39/04-B OF DISSERTATION ABSTRACTS INTERNATIONAL.
ENGINEERING, CIVIL
DESCRIPTOR CODES: 0543
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362 777456 ORDER NO: AAD79-19262
MOVEMENTS IN AN ASPHALT CONCRETE HOT MIX OVERLAY IN THE VICINITY OF OVERLAID JOINTS IN A PORTLAND CEMENT CONCRETE PAVEMENT. 284 PAGES.
DANTIN, TERRY JOSEPH (PH.D. 1978 UNIVERSITY OF ARKANSAS).
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ENGINEERING, CIVIL
DESCRIPTOR CODES: 0543
INSTITUTION CODE: 0011

363 192691 ORDER NO: AAD78-05875
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LIN, SHENG SHONG (PH.D. 1977 THE OHIO STATE UNIVERSITY).
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ENGINEERING, CIVIL
DESCRIPTOR CODES: 0543
INSTITUTION CODE: 0168

364 169018 ORDER NO: AAD77-17141
DESIGN OF FLEXIBLE OVERLAYS OVER RIGID PAVEMENTS. 242 PAGES.
SUCKARIEH, GEORGE G. (PH.D. 1976 THE OHIO STATE UNIVERSITY).
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ENGINEERING, CIVIL
DESCRIPTOR CODES: 0543
INSTITUTION CODE: 0168

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THE FINITE-ELEMENT ANALYSIS OF TWO-DIMENSIONAL OVERLAY PAVEMENT SYSTEMS. 289 PAGES.
BURANAROM, CHINAWOOD (PH.D. 1976 THE OHIO STATE UNIVERSITY).
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ENGINEERING, CIVIL
DESCRIPTOR CODES: 0543
INSTITUTION CODE: 0168

366 594881 ORDER NO: AAD70-13003
A PAVEMENT OVERLAY DESIGN SYSTEM CONSIDERING WHEEL LOADS, TEMPERATURE CHANGES, AND PERFORMANCE 418 PAGES.
MCCULLOUGH, BENJAMIN FRANKLIN (D.ENG. 1969 UNIVERSITY OF CALIFORNIA, BERKELEY).
PAGE 1262 IN VOLUME 31/03-B OF DISSERTATION ABSTRACTS INTERNATIONAL.
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DESCRIPTOR CODES: 0543
INSTITUTION CODE: 0028

SUBJECT INDEX

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