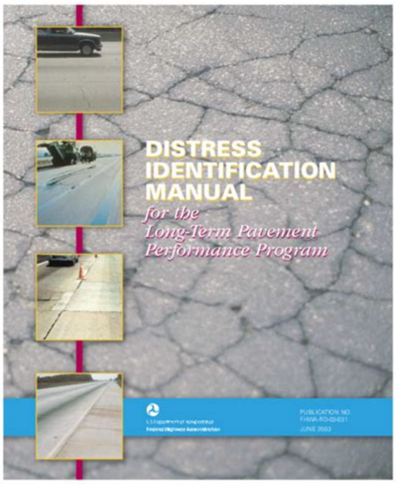
DISTRESS
IDENTIFICATION
MANUAL
for the
Long-Term Pavement
Performance Program

Book Descriptions:

Distress Identification Manual For The Ltpp

Pavement Performance LTPP program. During the programs 20year life,That information will allow pavement engineers toLTPP program. Department of Transportation in the interest of information exchange. The U.S. Government assumes no liability for its contents or use thereof. This reportTrade and manufacturers names appear in this report only because they areColor photographs and drawings illustrate Drawings of the distress types provide a reference Methods for measuring the size of distresses The manual also describes Sample forms for recording and reporting The manual also tells how to calibrate and operate This document is available to the public through To meet these goals. LTPP was transferred from SHRP to the Federal Highway Administration FHWA of the U.S. Department of Transportation DOT on July 1, 1992, in accordance with theLongTerm Pavement Performance Studies 1987 was authored by Kurt D. Smith. Michael I. Darter, Kathleen T. Hall, and J. Brent Rauhut. Support for that work wasHumberto Castedo, and Dimitrios G. Goulias, with guidance and support from W. R. Hudson. Support for the revision work was provided by SHRP as a part of ContractRogers, and Gonzalo R. Rada, with guidance and support from William Yeadon. Bellinger, of the FHWA. Guidance was also provided by the Distress Identification. Manual Expert Task Group. Ministry of Transportation and Communications; American Public Works. Association; the Asphalt Institute; the Kentucky Transportation Cabinet; the. Michigan DOT; the Mississippi State Highway Department; the Missouri Highway and. Transportation Department; the North Carolina DOT; the Pennsylvania DOT; the. Texas DOT; and the Washington State DOT. It incorporates refinements, changes, and LTPP directivesAs you evaluate a section ofSeptember, 2002, is shown in appendix C.http://www.altesso.ma/stock/canon-digital-video-camcorder-zr80-manual.xml

- **distress identification manual for the ltpp, distress identification manual for the ltpp.**

Highway agencies, airports, parking facilities,Repairs can be planned and executed more efficiently,Most pavement management programs do notLTPP program, nor are the severity levels used in the manual necessarily appropriateThus, you may choose to modify the. This course provides a common language for describing cracks, potholes, rutting, spalling, and other pavement distresses being monitored by the LTPP program. The course is divided into three sections, each focusing on a particular type of pavement 1 asphalt concretesurfaced, 2 jointed Portland cement concrete, and 3 continuously reinforced portland cement concrete. Each distress is clearly labeled, described, and illustrated. Learning Objective Distresses for pavements with asphalt concrete surfaces Distresses for pavements with jointed portland cement concrete surfaces Distresses for pavements with continuously reinforced concrete surfaces Review the quiz before studying the course. Course Content Course Author US Department of Transportation Log into your account. You can view the quiz and take the quiz if you are logged in your account. You can take the quiz for this online PDH course as many times until passed. The passing grade is 70% and above. After you pass the quiz simply follow the page, to pay for the course and print your certificate instantly. A copy of the certificate and receipt for this course will always be in your account. This online PDH or CE course can also be used as a continuing education course for the following. PE Civil Engineers PE Structural Engineers Acrobat Reader is required to view this document. Click here to download a free copy of Acrobat Reader. DiscountPDH.com DiscountPDH provides the best and highest quality online engineering continuing education to PE Engineers. We also provide continuing education to other professionals such as Land Surveyors, Architects, Contractors, Geologists and Landscape Architects. We also serve live PDH webinars and live PDH seminars.http://extremebootcamptustinranch.com/userfiles/canon-digital-rebel-xti-user-manual.xml

They are also accepted for PE Professional Engineering license renewal with the State Board of professional Engineers. Our PDH Courses are accepted in almost every state. Figures Tables Figure 1 Figure 14. Measuring Crack Width on. Asphalt Pavement Figure 2 Figure 15. Alligator Crack Severity Levels Figure 3 Figure 16. Alligator Crack Patterns of. Differing Severity Figure 4 Figure 17. High Severity Alligator. Cracking Figure 5 Figure 18. Medium Severity Alligator. Cracking Figure 6 Figure 19 Cracking with Few or No. Interconnecting Cracks Figure 7 Figure 20. High Severity Longitudinal. Cracking Figure 8 Figure 21. Medium Severity Longitudinal. Cracking Figure 9 Figure 22. Low Severity Longitudinal. Cracking High Severity Transverse. Cracking Figure 11 Figure 24. Medium Severity Transverse. Cracking Figure 12 Figure 25. Low Severity Transverse. Cracking Figure 13. Patching Variations Distress Summary Table 2. Alligator Crack Severity. Levels Park Service NPS, collects roadway condition data on paved asphalt surfaces including roads, The road surface condition data is Various methods of pavement condition assessment have been The use of digital Digital cameras with increasingly Service roads and parkways. Foremost in setting up the basis of pavement distress identification There is no single distress Performance Program\u201d, Publication No. FHWARD 03031, June 2003, as the pointofIn truth, the FHWA RIP distress types are similar This document, \u201cDistress. Identification Manual for the NPS Road Inventory Program, Cycle 4, 20062008\u201d was Program\u201d as a guideline. Definitions of severity levels based on crack width contained in this Modifications have been made to the This manual For Cycle 4, The data is used to support the. National Park Service road maintenance program and Pavement Management System PMS In the classification and measurement Roughness Index IRI. Condition Rating PCR is computed.

The formula for PCR is For each severity, an extent is established based on the measured Within each Severity individual distresses are For example, LOW severity transverse cracking A PCR index value of 100 would A PCR value of 60 is The range of index. To learn more about how to request items watch this short online video. We will contact you if necessary. Please also be aware that you may see certain words or descriptions in this catalogue which reflect the author’s attitude or that of the period in which the item was created and may now be considered offensive. Figure 1 shows the image load dialog box. Image Segmentation A common problem in automated pavement image evaluation, is distinguishing cracks from the pavement background image this is called segmentation.A noise filter is applied to the image to remove the background noise caused by the pavements rough texture while maintaining minimal degradation of sharp crack edges. A white line detection filter is applied to reduce the errors caused by the distinctive edges of any white line using statistical properties of pavement images. A crack detection analysis is applied to each grid to distinguish the cracked grids from the background grids. Crack Classification Since there are many definitions of different distress categories, uniANALYZE currently adopts three different crack classification standards Unified Crack Index, AASHTO provisional standards, and SHRPLTPP distress manual. Custom standards can also be implemented based on clients requirements. Unified Crack Index Unified Crack Index UCI is the percentage of the road surface affected by cracking and patching. Dr. H. Lee first introduced the Unified Crack Index classification standard Pavement Management Implementation, ASTM STP 1121.Then, it divides the counted number by the total number of grids to compute a unified crack index for each pavement image.

http://fscl.ru/content/boss-ge-7-manual-espa-ol

Figure 2 shows a sample of the unified crack index After defining the crack types, uniSURVEY can then calculate the extent and severity of the crack. This is measured by either length or area of crack depending on crack types. Figure 3 shows a sample of the AASHOTO standard analysis result. SHRPLTPP Distress Identification Manual SHRPLTPP distress identification manual is a widely adopted cracking protocol used by many states and agencies.The crack extent can be measured by either the length or the area of the crack depending on the type of distress. Figure 4 shows an 11 ft long, high severity wheel path longitudinal cracking. In order to measure the extent of Alligator Cracking, the user can draw a polygon along the boundary of the cracked area.The computed result is displayed on the right side of the information window, with type of distress categorized. The information window also shows the full path of the image, section I.D., location information, and the actual dimension of pavement surface. Figure 5 shows the distress analysis window. The database can be embedded into an integrated GIS system that will allow the user to access and manipulate the data interactively through a digital map. Figure 6 shows the example of computer screen, which displays the analyzed result on a digital map. The detailed report displays the image file path, the extent and severity of each distress, and the location of each individual pavement image. The summary report provides the total extent and severity for 100meter sections of pavement. Figure 3 shows the screen shot of the summary report dialog box. All Rights Reserved. The LTPP Distress Survey App can collect and maintain all surveyrelated information including data, maps, images, and videos. This application uses the LTPP Distress Identification Manual as a guide for pavement distress measurement. The application supports manual and semiautomated distress data collection.

The road surface condition data is collected using an automated data collection vehicle called ARAN Automated Road ANalyzer. The FHWA RIP is implemented based on the premise that an accurate pavement surface condition assessment can be accomplished using automated crack detection technology as applied to digital images. Various methods of pavement condition assessment have been developed over the years with varying degrees of accuracy and acceptance. The use of digital photography to record pavement images and subsequent crack detection and classification has undergone continuous improvements over the past decade. Digital cameras with increasingly superior resolution have become more affordable, and the proprietary programming code and algorithms have been improved in crack detection software. With the use of quality digital photography and automated crack detection software, FHWA RIP is tasked with executing a pavement condition assessment on about 5,400 miles of National Park Service roads and parkways. Foremost in setting up the basis of pavement distress identification is employing the distress identification protocols used by FHWA. There is no single distress identification system that is universal among entities doing distress identification. For the purpose of the NPS RIP, FHWA employs distress identification protocols that are specific to this program. FHWA has referenced the Distress Identification Manual for the LongTerm Pavement Performance Program, Publication No. FHWARD, June 2003, as the pointofreference for distress types on NPS pavement. In truth, the FHWA RIP distress types are similar to those described in the LTPP manual with some modifications. This document, Distress Identification Manual for the NPS Road Inventory Program, Cycle 4, was developed using the Distress Identification Manual for the LongTerm Pavement Performance Program as a guideline.

Definitions of severity levels based on crack width contained in this document adhere to the LTPP Distress ID Manual. Modifications have been made to the definition of Alligator Cracking and determination of Alligator Cracking severity. This manual also addresses Rutting and Roughness and its application to RIP. In 2006, FHWA RIP will begin the fourth cycle of data collection in national parks. For Cycle 4, data will be collected in approximately 86 national parks totaling an estimated 5,400 miles of paved roads and approximately 5,000 paved parking areas. The data is used to support the National Park Service road maintenance program and Pavement Management System PMS developed and maintained by FHWA. This Distress Identification Manual for the NPS Road Inventory Program will be used as a reference in crack detection and classification, determination of distress severity and extent, and in the calculation of distress index values for the FHWA RIP Cycle 4. iii 6 SURFACE DISTRESSES Surface distresses are measured in the primary lane only. In the classification and measurement of all surface condition data, results will be reported in the database in record intervals of 0.02 miles 105.6 feet along the route. Classification, severity, and extent of these five surface distresses comprise the three main elements for calculation of SCR Surface Condition Rating. Additional condition data measured by ARAN Roughness IRI Roughness is measured by FHWA s ARAN and provided to Contractor as International Roughness Index IRI. Each classified surface distress will fall into one or more severity LOW, MEDIUM, or HIGH based on criteria listed. For each severity, an extent is established based on the measured quantity of the distress within that severity. Within each Severity individual distresses are assigned a Maximum Allowable Extent MAE. For example, LOW severity transverse cracking may be allowed up to 15.1 cracks within a 0.02 interval before it reaches MAE and fails.

1 D1 7 The MAE and index formulas are based on a scale of A PCR index value of 100 would indicate a perfect road with no measurable distresses or rough ride. A PCR value of 60 is determined to be terminable serviceability and the road is considered failed. The range of index values with condition descriptors is POOR 100 default to 100. For all indices, a higher value indicates a better road condition, and a lower value indicates a poorer road condition. Table 1 summarizes the different types of distresses measured. TABLE 1 Distress Summary ASPHALTSURFACED PAVEMENT DISTRESS TYPES with RUTTING and ROUGHNESS DISTRESS TYPE UNIT OF MEASURE CONVERTED TO DEFINED SEVERITY LEVELS. It is a series of interconnected cracks of various stages of development. Alligator cracking develops into a manysided pattern that resembles chicken wire or alligator skin. It can occur anywhere in the road lane. Alligator cracking must have a quantifiable area. Severity Levels LOW An area of cracks with no or very few interconnecting cracks and the cracks are not spalled. Cracks are 0.25 in. 6 mm and 0.75 in 19mm or any crack with a mean width 9 FIGURE 1 Measuring Crack Width on Asphalt Pavement FIGURE 2 Effect on Severity Level of Alligator Cracking due to Associated Random Cracking 4 D4 10 FIGURE 3 Alligator Crack Patterns of Differing Severity FIGURE 4 High Severity Alligator Cracking 5 D5 11 FIGURE 5 Medium Severity Alligator Cracking FIGURE 6 Low Severity Alligator Cracking with Few or No Interconnecting Cracks 6 D6 12 LONGITUDINAL CRACKING Description Longitudinal cracking occurs predominantly parallel to the pavement centerline. It can occur anywhere within the lane. Longitudinal cracks occurring in the wheelpath may be noteworthy. Severity Levels LOW Cracks with a mean width of 0.25 in. 6 mm and 0.75 in. 19 mm.

Also, any crack with a mean width 13 FIGURE 8 Medium Severity Longitudinal Cracking FIGURE 9 Low Severity Longitudinal Cracking 8 D8 14 TRANSVERSE CRACKING Description Transverse cracking occurs predominantly perpendicular to the pavement centerline. It can occur anywhere within the lane. Severity Levels LOW Cracks with a mean width of 0.25 in. 6 mm and 0.75 in. 19 mm. Also, any crack with a mean width 15 FIGURE 11 Medium Severity Transverse Cracking FIGURE 12 Low Severity Transverse Cracking 10 D10 16 PATCHING AND POTHOLES Description Patching is an area of pavement surface that has been removed and replaced with patching material or an area of pavement surface that has had additional patching material applied. Patching may encompass partial lane or full lane width On full lane width patching, the total, contiguous length of patch may not exceed 0.30 mi. 4.84 km. Any fulllane patch exceeding 0.30 mi. in length is considered a pavement change. Patching must have a quantifiable area. Potholes are bowlshaped holes of various sizes occurring in the pavement surface. They either are present or they are not. FIGURE 13 Patching Variations 11 D11 17 FIGURE 14 Patching FIGURE 15 Patching 12 D12 18 FIGURE 16 Pothole Surrounded by Alligator Cracking FIGURE 17 Full and PartialWidth Road Patching 13 D13 19 RUTTING Description Rutting is a longitudinal surface depression in the wheelpath. Severity Levels LOW Ruts with a measured depth 0.20 and 0.49 MED Ruts with a measured depth 0.50 and 0.99 HIGH Ruts with a measured depth 1.00 Ruts 20 FIGURE 19 High Severity Rutting FIGURE 20 Medium Severity Rutting 15 D15 21 FIGURE 21 Low Severity Rutting 16 D16 22 ROUGHNESS Description Roughness is the measurement of the unevenness of the pavement in the direction of travel. It is measured in units of IRI International Roughness Index, inches per mile, and is indicative of ride comfort. Severity Levels There are no stratified severity levels for roughness.

In other words, we will allow up to 70% of low severity alligator cracking for a 0.02 interval before failure, 30% for medium severity, and so on. As you can see, if any single severity reaches MAE the resulting index value is 60, or failure. In other words, we will allow up to 350% of low severity alligator cracking for a 0.02 interval before failure, 200% for medium severity, and so on. In other words, we will allow up to 15.0 low severity transverse cracks for a 0.02 interval before failure, 7.5 cracks for medium severity, and so on. As you can see, if any single severity reaches MAE the resulting index value is 60, or failure. It either exists or does not. In other words, we will allow up to 80% patching for a 0.02 interval before failure. The values %LOW, %MED and %HI report the percentage of the 20 measurements within that severity. In other words, we will allow up to 160% low severity ruts for a 0.02 interval before failure. As you can see, if any single severity reaches MAE the resulting index value is 60, or failure. The values 0.60 and 0.40 function as weights within the formula.Note It is recommended that investigation into soundness of pavement be performed August 11, 2014 Words 3,280 Figures 3 Tables 0 Photographs 3 ABSTRACT FHWARD03031 JUNE 2003 In 1987, the Strategic Highway Research Program began the largest and most comprehensive Maintenance Treatments Asset Management is not a specific product or service, but rather a way of doing business It provides a solid foundation from which to monitor the transportation Planning is the intersection between August 2009 Recommendations and costs for Vern Thompson www.crafco.com John Craig Director I 1005 Terminal Way, Suite 125 Reno, Nevada 89502 Topics Introduction Design Factors Pavement Types Fundamentals Rob McLure, M.Eng., P.Eng. Senior Associate Hatch Mott MacDonald Review the pavement rehabilitation strategy development The contents do not necessarily reflect the official Dr. Kerrie Schattler, Ph. D.

Ashley Rietgraf A synthesis of ICT R27 At these locations the City of Greensboro installed Pyro Posts and ZELT Inductive Loops, provided by NCDOT for the program, to differentiate between pedestrians Project Scope Summary of Technologies Aerial Imagery with LiDAR Mobile If the user relocates within the AASHTO Subcomittee on Materials Biloxi, Mississippi August 410, 2012 Chris Abadie, P.E. My Story Background Approach Phase I Evaluation Alligator Cracking High. Severity Driving Forces for Concrete Pavement Joint Repairs Representing the National CP Tech Center Driving Forces for Concrete Pavement Impact of Temperature Curling and Moisture Warping on Jointed Concrete Pavement Performance. Asphalt pavement is basically sand, gravel and glue. The glue used to keep the sand and gravel together is asphalt, a heavy byproduct of oil refining. While Asset Management Plan At the start of the 21 st century, it is served L Kannemeyer Road Condition 100 80 60 40 20 Good Fair Poor B A Very Poor Typically Designed for Traffic Expected over 2030 Years Manual RATING RATING RATING PASER RATING. Concrete Roads Tel 4166219555 By Customer Geotechnical Bulletin PLAN SUBGRADES Bobby Harris Senior Manager bd Systems, Spatial Division To use this website, you must agree to our Privacy Policy, including cookie policy. Please email us to request the PDF, and please be sure to include the publication name and number in the email.Marylands Local Technical Assistance Program. It is often a sign of subbase failure, poor drainage, or repeated overloadings. It is important to prevent fatigue cracking, and repair as soon as possible, as advanced cases can be very costly to repair and can lead to formation of potholes or premature pavement failure.However, fatigue cracking can be greatly influenced by environmental and other effects while traffic loading remains the direct cause.Stripping occurs when poor adhesion between asphalt and aggregate allows the aggregate at the surface to dislodge.

This leads to excess moisture in the shoulders and subbase at the road edge. Edge cracking differs from fatigue cracking in that the cracks form from the top down, where fatigue cracks usually start at the bottom and propagate to the surface.This interlaced cracking pattern resembles the scales on the back of a crocodile or alligator, hence the nickname, crocodile cracking. For example, the Pavement Condition Index is widely used to quantify the overall level of distress and condition of a section of road. There are many other rating systems, and many rating systems currently in use are based on the AASHO Road Test.The first is the extent of the cracking. This is the amount of road surface area which is affected by this pavement distress. The rating may be entered into a pavement management system, which will suggest a priority and method for the repair. One such machine is the road surface profilometer, which is mounted on a vehicle and measures the profile of the road surface while it is moving down the roadway.Prevention primarily depends on designing and constructing the pavement and subbase to support the expected traffic loads, and providing good drainage to keep water out of the subbase. However, often the specific cause is fairly difficult to determine, and prevention is therefore correspondingly difficult.Proper repair may include first sealing cracks with crack sealant, installing paving fabric over a tack coat, or milling the damaged asphalt.By using this site, you agree to the Terms of Use and Privacy Policy. The goal is to provide a uniform basis for collecting the pavement distress data and thus improve communication within and between highway agencies. The course describes how to conduct the distress survey, measuring cracks, rutting, potholes and other distresses and explains how to obtain traffic control. Photographs and drawings illustrate the types of pavement distress and necessary measurements.

Audience Highway agencies in the US and other countries have collected data on pavement conditions for more than 1000 pavement sections. The purpose of the manual used for this course was to provide a uniform basis for collecting distress data and to enable the performance of accurate and consistent distress evaluation surveys. Communication within and between highway agencies, parking facilities are improved and planning and performing pavement repairs becomes more efficient. Information is organized into modules on pavement distress, deflection testing and skid information. Factors influencing performance include climate, traffic loading maintenance and construction activities. The data is available for downloading from www.datapave.com. Content If you still experience This course describes the methods, tools used for the pavement distress surveys and the terminology used for the descriptions and severity levels. Sample forms used for recording and reporting of the collected survey data are included. The materials They are not a substitute for competent professional Anyone making. But, how many years is a reasonable expectation That begs the question, “How can I make my thin lift overlay last closer to the 12 year side of that range” Thin overlays placed on existing pavements with too much distress as a type of “bandaid” will not last long and will skew the reported average service life toward the low side. The overarching concept in project selection for thin asphalt overlays is that the surface to be overlaid must be structurally sound. It includes a description of each distress type, illustrations to help the user classify the distress as “low,” “moderate,” or “high,” and guidelines regarding how to measure and record the distress. Some state agencies such as Oregon DOT have expanded on the LTPP document to produce their own manual on the subject.

Alternatively, “ASTM D 6433, Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys”, details a procedure for determining a Pavement Condition Index PCI based on distresses observed on the surface of the pavement. It’s a good idea to core cracks like this to determine whether the crack initiated at the surface or lower in the pavement structure. If the crack began at the surface, evaluate the severity of the crack. If the cracks are narrow and not very deep low severity, a cleaning and tack coat may be all that are necessary before applying a thin overlay. If the cracks do not move under traffic but are a little wider and deeper moderate severity, they may need to simply be sealed or routed out, cleaned and then sealed before overlaying. If the cracks are wide and actively move under traffic high severity, thin overlays would not be a good option. Be aware that pavements are designed to a certain total thickness to resist the anticipated traffic loading. Therefore, the total pavement thickness should not be decreased by, for example, milling off 2 inches of asphalt and coming back with only 1 inch of overlay. In order to avoid leaving localized thin, weakly bonded layers in place after milling, it is best practice to mill a bit deeper than what you think you need. In this case, a thin asphalt overlay could be used to cap a more traditional overlay. These types of cracks tend not to be structural in nature, and good candidates for thin asphalt overlays. However, some longitudinal cracks near the edge of a pavement structure may be a result of subgrade slope degradation, which would need to be addressed before any type of overlay. This type of surface crack would typically appear more linear in nature than a ragged edge crack. It typically occurs from the top down as a result of sudden contraction of the pavement surface due to cold weather events. If the crack is of low severity, it can often simply be cleaned and tacked before overlaying.

Wider cracks would usually be cleaned and filled before tacking and overlay. If the edges of the crack are degrading, they may need to be routed and cleaned before filling. In this case, the cracks will simply reflect through the overlay each time the pavement contracts. An overlay would not be a good option in this scenario. Slab movement must be halted by some method first, or the cracks will simply continue through the new overlay. Projects with this type of cracking are poor candidates for a thin asphalt overlay. If the alligator cracking is infrequent and in short runs, the pavement might be able to be salvaged by fulldepth patching those areas. Any patching should be of sufficient quality to make the patch structurally sound. Best practices include extending the patch at least one foot beyond the distressed area, squaring off the sides, removing the entire depth of the distress into the subgrade if necessary, cleaning, tacking the bottom and sides of the hole, and patching in lifts if the depth requires it. A roadway with structurally sound patches can be successfully overlaid with thin asphalt lifts. It is caused by some type of weakness either in the subgrade or in one or more of the asphalt layers. Rutting due to an unstable subgrade is not a good candidate for an overlay. This type of rutting is often distinguished by numerous cracks in the rutted section as the asphalt is forced to mold itself into the rutted subgrade. The cause of the unstable subgrade must be addressed and repaired, which is almost always a fulldepth operation. In this case, the entire plastic lift can be milled and the remaining pavement overlaid. Again, it is best not to decrease the total pavement thickness by overlaying with a thickness less than what was milled. Patches can last a long time when constructed using best practices.