FINAL REPORT
LANDSIDE PAVEMENT EVALUATION

JAA Jacksonville Aviation Authority

JAX Jacksonville International Airport

PREPARED BY:

THE LPA GROUP
TRANSPORTATION CONSULTANTS
A Unit of Michael Baker Corporation

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JACKSONVILLE INTERNATIONAL AIRPORT
LANDSIDE PAVEMENT EVALUATION

1.0 GENERAL

THE LPA GROUP INCORPORATED (LPA) conducted a Pavement Condition Index (PCI) survey of landside roadways and parking lots outlined by Jacksonville Aviation Authority (JAA) staff at Jacksonville International Airport (JAX). This is the first PCI survey completed on the landside pavements and will be the initial data point for future inspections. This report will detail the PCI results, make recommendations, and provide schematic cost estimates for suggested projects.

The PCI survey methodology adhered to the requirements set forth in the American Society for Testing and Materials (ASTM) 6433-03, "Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys". This ASTM mimics the process involved in airport pavement surveys recommended by the FAA for pavement management.

1.1 PCI METHODOLOGY

LPA's first step in this project was to complete an initial pavement investigation. The initial investigation provided the opportunity to identify visible pavement history. Visible historical items include areas of resurfacing, aged pavements, exclusive use for particular vehicles, and pavement trends. Measurements and notes were recorded for each section. The information collected and mapped in the initial investigation was taken back to the office to assist in the layout of pavement branches, sections, and sample units.

Branches are divided into Roadway, Parking, and Loading. Each branch received a separate identification called a *section*. If necessary, the branches were broken up into several sections, based on construction history and traffic patterns. Each section was broken down further into sample units. *Sample units* are the actual areas that were inspected. The number of sample units surveyed was determined by the pavement area and level of survey. This project was completed at a Network Level where the total surveyed sample unit area equaled a minimum of 10% of the total section area. The sample units were then visually surveyed, and pavement distresses were recorded on survey data forms. Additional details on the pavement hierarchy are provided in Section 2.0 of this report.

The layout of branches, sections, and sample units was prepared in Autocad and transferred to a GIS program. The GIS program was run on a tablet style GPS enabled computer. The tablet computer was used in the field to assist with locating pavement sections and sample units. Ultimately, the tablet computer cut down on the field time and interference with JAA's daily traffic operations.

Field inspections were primarily completed during daylight hours without any lane closures or other traffic prohibiting operations. The main entrance and exit road, Dixie and Yankee Clipper, had to be completed during night operations due to the heavy volume of traffic on these roads. With the assistance of JAA Police, Dixie and Yankee Clipper were completed in two nights. Inspections were completed with one, two-person team; additional staff was used during night work to assist with lane closures and overall team safety.

1.2 TERMINOLOGY

Asphalt Concrete Surface (AC) – Aggregate mixture with an asphalt cement binder. This term also refers to surfaces constructed of coal tars and natural tars for purposes of this test method.

Pavement Branch – A branch is an identifiable part of the pavement network that is a single entity and has a distinct function. For example; roadway, parking lot, and loading areas are separate branches.

Pavement Condition Index (PCI) – A numerical rating of the pavement condition that ranges from 0 to 100 with 0 being the worst possible condition and 100 being the best possible condition.

Pavement Condition Rating – A verbal description of pavement condition as a function of the PCI value that varies from "Failed to Good."

Pavement Distress – External indicators of pavement deterioration caused by loading, environmental factors, construction deficiencies, or combination thereof. Typical distresses are cracks, rutting, and weathering of the pavement surface.

Pavement Sample Unit – A subdivision of a pavement section that has a standard size range: 20 contiguous slabs for PCC landside pavement and 2500 square feet (+/- 1000 square feet) for landside AC pavement.

Portland Cement Concrete (PCC) Pavement – Aggregate mixture with Portland cement binder including non-reinforced and reinforced jointed pavement.

Random Sample – A sample unit of the pavement section selected for inspection by random sampling techniques, such as, a random number table or systematic random procedure.

PCI Critical Value – A value set to determine what PCI level to maintain pavements above. Default value is set for 55.

2.0 PAVEMENT NETWORK DEFINITION

2.1 BRANCHES

The airport maintained pavements were divided into branches, denoting a distinct part of the pavement network. Branch functions, designations, and overall condition are shown in the Branch Condition Report, provided in the appendix of this report.

2.2 SECTIONS

The pavement branches were then divided into sections. The Condition Layout Map, provided as an attachment to this report, depicts the pavement sections. The basis for the division of the sections followed the general guidelines listed below:

- Construction History: Pavement with same construction date.
- Pavement Materials: Branches with both rigid and flexible pavements were broken into separate sections and inspected independently.
- Use: Area within a like construction date that has a significant change in use. Such as an entrance to fuel farm or stopping motion caused by a gate arm.

Branch affiliations and PCI values for each section can be found in the Branch Condition Report and Section Condition Report, provided in the appendix of this report.

2.3 SAMPLE UNITS

The sample unit is the smallest area of pavement used in the survey. The sample unit represents the size of the pavement that was inspected on an individual basis. Each section was divided into the required number of sample units, based on the size of the section. The target sample unit size of 2,500 square feet was used for AC pavements, and 20 slabs for PCC pavements. Sample unit size is based on ASTM D-5340.

2.4 AREAS NOT INCLUDED

Since the subject of this study was to study landside pavement networks maintained by JAA, the following pavement features were not included in the pavement network definition:

- Pavement maintained by leaseholders or tenants.
- Pavements outside of the airport's property.
- Pavements excluded by JAA at the project scope meeting.

2.5 VISUAL CONDITION SURVEY

In order to quantify the distresses and provide a standardized condition of the pavement, the PCI method of inspection and evaluation was used. The PCI is a numerical indicator that rates the surface condition of the pavement. It provides a measure of the present condition of the pavement based on the distress observed on the surface of the pavement, which also indicates the structural integrity and surface operational condition (localized roughness and safety).

2.5.1 Survey Method

The establishment of the PCI followed three steps: First, the pavement was divided into sections. Next, the distress information was obtained from the pavement by visual inspections. Finally, the data was analyzed through Paver and a condition rating was determined for each section.

During the survey, observable distresses, such as fatigue cracking and rutting, were identified and measured. The distress severity was also recorded. See Table 2 for a complete list of PCC distresses and Table 3 for a complete list of AC survey distresses. Distress types and severities from these tables were recorded and entered into the Paver database.

The quantity of distresses was converted to a density. Knowing the density and severity, a deduct value was obtained. These deduct values were then subtracted from a perfect value (100) to provide a PCI value. These calculations were performed automatically by the Paver software.

Table 2: PORTLAND CEMENT CONCRETE DISTRESSES

Landside Pavement Distress	Landside Distress Type
21. Blow up/Buckling	Climate/Durability
22. Corner Break	Load
23. Divided Slab	Load
24. Durability Crack	Climate Durability
25. Faulting	Other
26. Joint Seal	Other
27. Lane/Shoulder	Other
28. Linear Cracking	Load
29. Patching (Large)	Other
30. Patching (Small)	Other
31. Polished Aggregate	Other
32. Popouts	Other
33. Pumping	Other
34. Punchout	Other
35. Railroad Crossing	Other
36. Scalling	Other
37. Shrinkage	Other

38. Spalling Corner	Other
39. Spalling Joint	Other

Table 3: ASPHALT CONCRETE (AC) AIRFIELD DISTRESSES

Landside Pavement Distress	Landside Distress Type
1. Alligator Cracking	Load
2. Bleeding	Other
3. Block Cracking	Climate/Durability
4. Bumps and Sags	Climate/Durability
5. Corrugation	Other
6. Depression	Other
7. Edge Cracking	Other
8. Joint Reflection Cracking	Climate/Durability
9. Lane/Shoulder Drop Off	Other
10. Longitudinal/Transverse Cracking	Climate/Durability
11. Patching, Utility Cut Patch	Other
12. Polished Aggregate	Other
13. Pot Holes	Climate/Durability
14. Railroad Crossing	Other
15. Rutting	Load
16. Shoving	Other
17. Slippage	Other
18. Swell	Other
19. Raveling	Climate/Durability
20. Weathering	Climate/Durability

2.6 DATA EVALUATION

Following the survey, the data was collected and entered into the Paver database. The Paver software was used to calculate a PCI value based on the visual distress survey data. The PCI number ranges from 0 to 100 and each PCI value has a corresponding Pavement Condition Rating (PCR), ranging from "Failed" to "Good." Table 4 shows the PCI and corresponding PCR.

Table 4: PCI/PCR VALUES

PCI	PCR	COLOR
100-86	Good	Dark Green
85-71	Satisfactory	Light Green
70-56	Fair	Yellow
55-41	Poor	Magenta
40-26	Very Poor	Light Red
25-11	Serious	Dark Red
10-0	Failed	Gray

2.7 MICROPAVER

A major component of the Pavement Management System (PMS) is the MicroPAVER (Paver) program. This project used MicroPAVER version 6.5. All of the condition data recorded on the survey data forms was entered into the program. The program calculated the Pavement Condition Index (PCI) for each section of the airport.

Although this project did not advance past the development of a PCI value, Paver can be used as a tool for establishing a PMS. The Paver files have been set up for future manipulation and developing a full PMS at a later time. A PMS can assist with forecasting maintenance and rehabilitation costs, prioritizing projects, and extending the life of pavement.

The initiative behind PMS's and Paver is to extend the pavements life cycle in an effort to prolong costly pavement reconstruction and overlays. Paver is designed to maintain pavements in good condition and allow pavements in poor condition to continue to deteriorate until unusable. The initiative behind pavement management is that pavements in good condition can be prolonged with low cost maintenance. Pavement sections with poor conditions have already passed the point of no return and deterioration slows down. Poor condition sections will require costly rehabilitation and therefore are delayed until no longer usable. Pavement sections in poor condition should be evaluated regularly for safety and the need for immediate "localized stop gap" repair, such as pot holes.

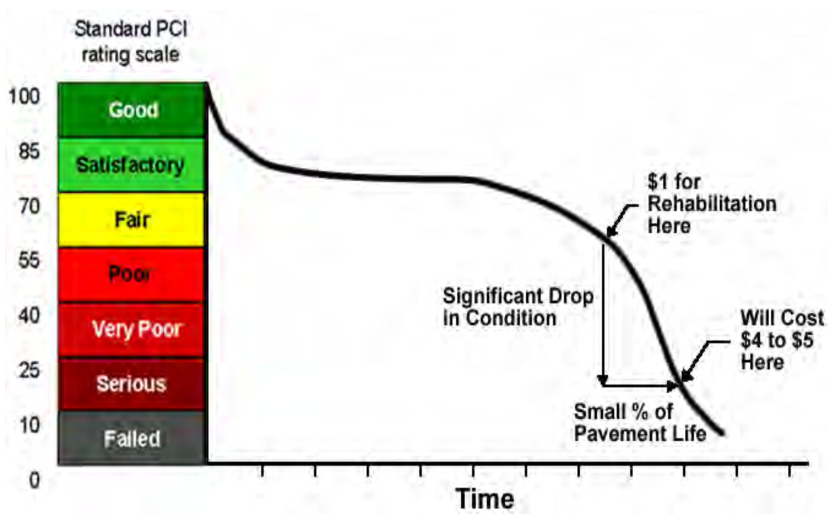


FIGURE 1: TYPICAL PAVEMENT LIFE CYCLE

Source: Pavement Management for Roads and Parking Lots, 2007

3.0 PAVEMENT CONDITION

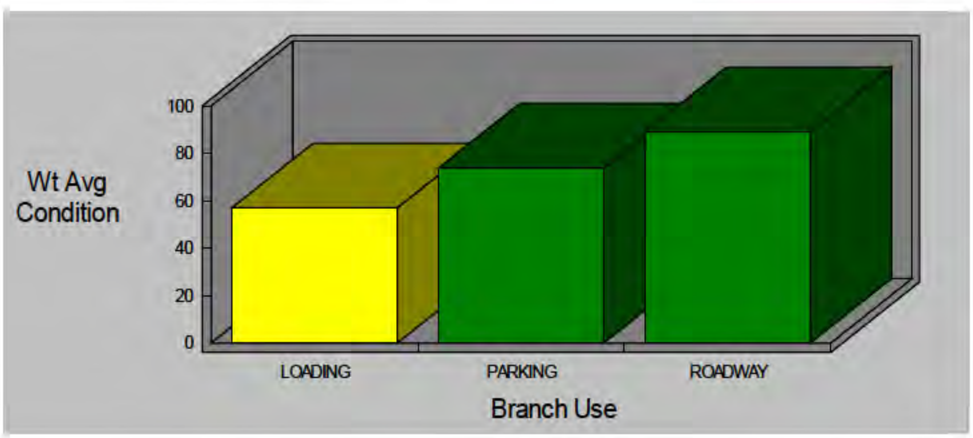
3.1 CURRENT CONDITIONS

The landside pavement was divided into three primary uses/branches to determine overall PCI values. Each use is made up of individual sections that are weighted based on the standard deviation. The weighted PCI values are used to develop a collective airport PCI value. The data for each use and overall PCI is shown in Table 5 below.

Table 5: BRANCH CONDITION REPORT SUMMARY

Use Category	Number of Sections	Total Area (SqFt)	Arithmetic Average PCI	Average PCI STD.	Weighted Average PCI
LOADING	2	104,304.00	73.50	21.50	57.01
PARKING	24	6,812,385.00	83.50	16.66	73.78
ROADWAY	44	2,417,887.00	79.34	20.24	89.07
All	70	9,334,576.00	80.60	19.27	77.55

**STD – Standard Deviation*



Roadways and parking lot pavements are generally in satisfactory condition. Loading areas are in the bottom of the fair condition with a PCI of 57. The Loading branch consisted of 2 sections; Air Cargo Lot A and Delivery Lot A. Air Cargo Lot A is in poor condition resulting in a low condition for the branch. Air Cargo Lot A can be found on sheet C1.3 of the PCI Condition Map found in the appendix of this report. The overall PCI for all pavement sections is 77.55, which is in the middle of the satisfactory condition.

Table 6 is a brief report of the sections with a PCI value of 70 or below. These pavements are considered to be approaching, in, or below the critical range 65 – 55. The critical value is 55. Additional information is provided on these sections under the Recommendations chapter of this report.

Table 6: SECTIONS IN OR BELOW CRITICAL RANGE

	Branch ID	Section ID	Surface	Use	PCI	PCI Map Location
Below Critical Value (55)	P-CARGO (AIR CARGO LOT)	A	AC	LOADING	52.00	C1.3
	P-COLE (COLE FLYER LOT)	A	AC	PARKING	26.00	C1.3
	P-COLE (COLE FLYER LOT)	B	AC	PARKING	54.00	C1.3
	R-DELI (DELIVERY ROAD)	B	AC	ROADWAY	46.00	C1.2 & C1.3
	R-DIXIE (DIXIE CLIPPER ROAD)	A	AC	ROADWAY	7.00	C1.2
	R-PARK (PARKING ACCESS ROADS)	D	AC	ROADWAY	48.00	C1.2
	R-PECAN (PECAN PARK ROAD)	A	AC	ROADWAY	14.00	C1.5
Critical Range (65 - 55)	R-PECAN (PECAN PARK ROAD)	C	AC	ROADWAY	57.00	C1.2
	R-THOMAS (THOMAS IMESON AVENUE)	A	AC	ROADWAY	66.00	C1.2 & C1.5
	R-YANKEE (YANKEE CLIPPER ROAD)	A	AC	ROADWAY	64.00	C1.2
	R-YANKEE (YANKEE CLIPPER ROAD)	A1	AC	ROADWAY	63.00	C1.2
70> PCI >65	P-SURF (SURFACE PARKING LOTS)	A	AC	PARKING	69.00	C1.2 & C1.3
	R-TOLL (TOLL PLAZA ACCESS ROADS)	C	AC	ROADWAY	68.00	C1.2

3.2 FUTURE CONDITIONS

Pavement will deteriorate slowly while the PCI value is above the critical point. Once the pavement has passed the critical point, deterioration accelerates. Preventative maintenance can prolong the time for which the pavement is above the critical level, as shown in the Figure 1 in Section 2.7 of this report.

Without continued maintenance, pavements will deteriorate rapidly once they reach the critical PCI rating of 55. At this point costs will increase exponentially so it is important to provide maintenance early on to avoid costly repairs.

By implementing a PMS and applying the recommendations listed in the next section, pavement life will be increased. Increasing the pavement life has a significant cost benefit which will save JAA capital funds over time.

The recommendations provided in the next section demonstrate projects in need of immediate attention. A PMS plan can establish a maintenance schedule for all pavements, from good to failed, over a five year period, which would include projects and estimated costs. Micropaver has the capability to estimate deterioration rates to determine the best time to implement maintenance. Continued pavement surveys and Micropaver data updates, make the deterioration estimates more accurate. This project has been set up to take it to the next level and develop a full PMS.

4.0 RECOMMENDATIONS

4.1 MAINTENANCE AND REHABILITATION (M&R) PLAN

Maintenance and Rehabilitation is a major part of protecting infrastructure assets. Establishing and implementing an M&R Plan can be used as a tool to financially plan for future projects. With the results from this report and the recommendations below an M&R Plan can be developed for several years to come.

4.1.1 PCI Above 70

Pavements with a rating above 70 need a low volume of periodic maintenance. Maintenance would include crack sealing, silt buildup removal from pavement edge, rejuvenator, and in-pavement drainage inlet repair. These items are minor at the start but can become major problems if left unattended.

4.1.2 PCI Below 70

Pavements with a rating below 70 need additional attention since they are approaching, in, or below the critical range. Typically there is a specific load related distress resulting in the low score. This may be as small as a wheel rut or isolated pot hole to a high severity rut and alligator cracking. These areas of load related distress can be corrected through isolated repairs or full rehabilitation.

The sections listed in Table 6, summarize all of the pavements that fall into this category. In order to understand the magnitude of distresses for each of these sections, a more in depth examination was completed. In addition, maintenance and rehabilitation recommendations have been developed in conjunction with estimates of cost. *See Cost Estimate Section (pages 42-57) of this report for schematic construction costs*.

4.1.2.1 Air Cargo Lot A – Below Critical Value – PCI 52

The Air Cargo Lot is primarily used for semi-truck loading and unloading, with a few employee parking spaces. The pavement surface has significant weathering, cracking, and oil drippings. A more concerning issue is the failure located around the in-pavement inlets.

In making a decision on how to address this section, use becomes a factor since the need to spend money on rehabilitating this section may be further down JAA's priority list. For that reason, two recommendations have been made for this section.

The most expensive and long term recommendation is to mill and resurface the pavement. In addition, repair to the inlets and pavement surrounding them is needed. The schematic cost estimate of construction is $295,080.

In an effort to slow the deterioration, a less expensive option has been evaluated. In order to extend the pavement life it is recommended to repair/modify inlets, surface seal the pavement, seal large cracks, and full depth repair load failure areas. The schematic cost estimate of construction is $145,560.

4.1.2.2 Cole Flyer Lot A & B – Below Critical Value – PCI 26 & 54

The Cole Flyer Lot is located next to a vacant hangar located off of Cole Flyer Road. This lot has been broken up into two separate sections because of different ages of construction between the parking lot and access drive. It appears that the parking spaces next to the hangar were added at a later date. Even though the two pavements are different ages they both have similar distresses and the recommendations are the same.

The pavement area shows signs of surface cracking, which resembles alligator cracking. There is no evidence that this is a load related crack therefore it is not alligator, but it is believed to be a shallow surface or cosmetic crack caused by thermal expansion and contraction differences in the asphalt and surface seal. Pavement cores should be taken to verify. If the assumptions are correct, a surface seal shall be applied to the entire section. The schematic cost estimate of construction is $40,128.

4.1.2.3 Delivery Road B – Below Critical Value – PCI 46

Delivery Road B is primarily used by vehicles making deliveries to the terminal, landside. Other than the pavement being weathered and aged, there is a location of rutting and alligator cracking near the gate arm. A previous overlay is evident due to the loss in bond between the original pavement and the overlay. The overlay is peeling away in some locations. The overlay appears to be between ½" and ¾" thick.

It is recommended that the pavement be milled and resurfaced. The schematic cost estimate of construction is $36,456.

4.1.2.4 Dixie Clipper Road A – Below Critical Value – PCI 14

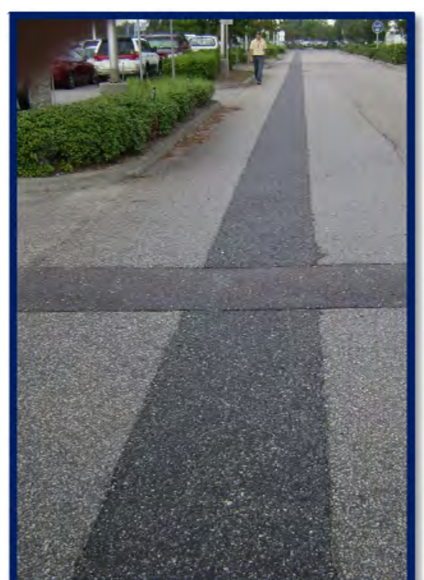
Dixie Clipper Road Section A is located at the exit of the parking garage. This section was in the worst condition. Distresses included load related alligator cracking and severe rutting. At this location there is a stop sign prior to entering the terminal loop road, which is causing a significant amount of point load.

Distresses of this magnitude require complete reconstruction to the pavement section. It is recommended to provide concrete pavement through this section as well as tie in to the bus exit area where similar distresses are found. Concrete pavement holds up well under point load conditions. The schematic cost estimate of construction is $40,224.

4.1.2.5 Parking Access Road D – Below Critical Value – PCI 48

Parking Access Road D is located in the long term surface parking lot. This road is used to access the parking aisles as well as the main road for patrons leaving the parking garage and adjacent parking lot. The road has several utility patches running through it in addition to other isolated areas of distress causing a poor ride quality.

It is recommended that the pavement be milled and resurfaced. Isolated full depth repairs are recommended. The schematic cost estimate of construction is $60,740.



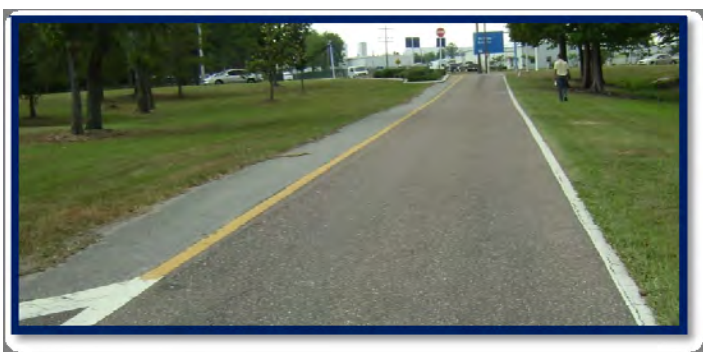
4.1.2.6 Pecan Park A – Below Critical Value – PCI 14

Pecan Park A includes the area where Yankee Clipper and Pecan Park Road connect to the south west. This area has various failing patches, alligator cracking, and the previous overlay is losing its bond to the pavement underneath. In addition, vehicles are leaving the pavement surface and driving on the grass shoulder causing damaged pavement edges.

Primarily, it is recommended to mill and resurface this area. Other possibilities to improve the pavement area include, widening and adding curb and gutter to eliminate vehicles from leaving the pavement. The schematic cost estimate of construction for milling, resurfacing, curb and gutter, and 2' widening is $52,500.

4.1.2.7 Pecan Park C –Critical Range – PCI 57

Pecan Park C includes the straight through section where it ties to Dixie Clipper Dr. This road had a small section of rutting at the stop sign and a failing patched area.



It is recommended that the small area (90'x15') be reconstructed. Another item to consider is shifting the edge markings over by 1'. The pavement width can accommodate the shift and it will help with keeping drivers from leaving the road. The schematic cost estimate of construction is $24,000.

4.1.2.8 Thomas Imeson Ave A – Critical Range – PCI 66

The investigation of Thomas Imeson resulted in isolated areas of severe distresses. There is an area where roots are pushing up the pavement creating a very poor ride quality and also areas of severe alligator cracking at the entrance to the Clarion hotel. These areas are isolated to a 40'x12' and 50'x12' footprint, respectfully.

It is recommended to repair these areas with full depth patches. In addition, the tree causing the damages due to its roots shall be removed. The schematic cost estimate of construction is $52,080.

4.1.2.9 Yankee Clipper Rd A – Critical Range – PCI 64

This portion of Yankee Clipper is located in the bus and taxi lane in front of the terminal passenger pick up area. This area has several standing water issues, curb and gutter damage, pavement scars from removed reflectors and old markings, failing patches, pavement cracking, and rutting at the exit. Although this pavement did not score the lowest, the location and use of the road make it rank at the top of the list for rehabilitation need.

It is recommended that the pavement be milled and resurfaced for the majority of the pavement surface. At the exit of the road where rutting and previous patching is evident, it is recommended to reconstruct this area with concrete, in conjunction with Dixie Clipper A. The schematic cost estimate of construction is $198,360.

4.1.2.10 Yankee Clipper Rd A-1 – Critical Range – PCI 63

This portion of Yankee Clipper is located in the passenger pick up lane, in front of the terminal under the passenger drop off bridge. This area does not appear to be designed to handle heavy rainfall since it is under an overpass. During our site visit we found several areas of standing water and pavement distresses caused by standing water. It was determined that the downspout system for the above bridge is rusted and leaking in numerous locations. Prior to completing any pavement rehabilitation project it is a necessity to replace or repair the current downspout system.

The pavement has several areas of standing water and isolated areas of rutting and alligator cracking. Conflicting pavement markings were also found on the pavement which can confuse drivers.

Based on the visual field observations, it is recommended to address the downspout system, mill and resurface the pavement, and adjust grades to control the flow of water.

Given the location and use of the pavement, this area is ranked high on the list for rehabilitation. The schematic cost estimate of construction is $309,528.

4.1.2.11 Surface Parking Lot A – Approaching Critical Range – PCI 69

Surface Parking Lot A incorporates the majority of the surface parking lot to the south. Structurally the pavement appears to be in good condition. The majority of distress is related to weathering and raveling. There is some surface longitudinal and transverse cracking due to age and thermal expansion and contraction. Some of these cracks have vegetation growing in them. Areas around light pole bases have signs of water infiltration and related failures. Parking space markings are faded to the point where it is hard to determine parking locations.

Much of the distresses found can be mitigated by applying a herbicide and applying a pavement rejuvenator. The pavement rejuvenator will fill in cracks, provide bond for exposed aggregate, and gives the pavement a "new look" with a fresh coat of new paint. This will ultimately extend the pavement life.

Additionally, isolated repairs will be required around the light poles to prevent further damage to the pavement base and surface.

The schematic cost estimate of construction is $263,400.

4.1.2.12 Toll Plaza Road C – Approaching Critical Range – PCI 68

The pavement area through the toll plaza shows typical signs of ageing pavement. There are several longitudinal and transverse cracks along with areas of block cracking. At the entrance and exit of the toll plaza, rutting is apparent. Rutting is typical for this location but can be corrected with a thickened pavement section at the transition from asphalt to concrete pavement.

It is recommended that the pavements life could be extended by applying a rejuvenator to the pavement. Thickening the pavement section at the asphalt to concrete transitions is recommended to prevent further damage to the asphalt as well as protect against edge spalling on the concrete. The schematic cost estimate of construction is $96,960.

4.2 PROJECTS

Provided below is a project list for the upcoming years and the associated cost of each project. The cost estimate for each section is provided in the appendix of this report. The projects are defined by the limits of each section. Many of these areas are small and should be lumped together into a single project to improve bid prices.

SECTION	PROJECT SHORT DESCRIPTION	ESTIMATED COST
AIR CARGO LOT - A (SHORT TERM)	PATCH ISOLOATED AREAS, SEAL COAT, AND REPAIR INLETS	$145,560.00
AIR CARGO LOT - A (LONG TERM)	MILL AND OVERLAY ENTIRE SURFACE, PATCH FAILURE AREAS, AND REPAIR INLETS	$295,080.00
COLE FLYER LOT - A	SEAL COAT	$26,304.00
COLE FLYER LOT - B	SEAL COAT	$13,824.00
DELIVERY RD. - B	MILL AND RESURFACE	$36,456.00
DIXIE CLIPPER RD. - A	RECONSTRUCTION - REMOVE AND REPLACE WITH CONCRETE PAVEMENT	$40,224.00
PARKING ACCESS RD. - D	MILL AND RESURFACE	$60,740.00
PECAN PARK RD. - A	MILL, RESURFACE, 2' WIDENING, AND ADD CURB AND GUTTER	$52,500.00
PECAN PARK RD. - C	ISOLATED RECONSTRUCTION OF BASE AND SURFACE COURSE	$24,000.00
THOMAS IMESON RD. - A	ISOLATED FULL DEPTH PATCH AREAS, CURB REPAIR, AND TREE REMOVAL	$52,080.00
YANKEE CLIPPER RD. - A	RECONSTRUCT WITH CONCRETE IN ISOLATED AREA, MILL, RESURFACE, AND CURB REPAIR	$198,360.00
YANKEE CLIPPER RD. - A1	RECONSTRUCT WITH CONCRETE IN ISOLATED AREA, MILL, RESURFACE, AND REPLACE OVERHEAD STRUCTURE DOWNSPOUTS.	$309,528.00
SURFACE PARKING LOT - A	PATCH FAILURE AREAS AND SEAL COAT	$263,400.00
TOLL PLAZA ACCESS RD. - C	ISOLATED AREA OF FULL DEPTH PATCHING AND SEAL COAT	$96,960.00

Not included in the project list, are the continued maintenance projects that are needed on sections above 70. In order to prolong the pavement life, a proactive maintenance plan should be established. Continuous maintenance items include pot hole patching, pavement edge repair, shoulder grading, ditch management, crack sealing, seal coats, and spall repair.

4.3 INSPECTION FREQUENCIES

Recommendations for detailed inspection are based on the assumption that pavements in the critical range (65 or lower) need to be inspected more frequently than pavements above a PCI of 65.

For detailed inspections, pavements that are in the critical range need to be inspected every year, and pavements that are above the critical PCI need to have a major inspection every two years. Any reconstructed pavement that does not exhibit immediate distress should be inspected every two years. All future inspections should be input in to the Micropaver database.

If a PMS is established at a later date, the data collected from this inspection and any future inspections can be used.

5.0 OUTCOME

On December 16th, 2011, a presentation was given to JAA on the results and recommendations of the pavement study. A copy of the presentation is provided in the final report. Results and recommendations presented are outlined in sections 3.0 and 4.0 of this report. At the conclusion of the presentation a discussion was held with staff members on implementation of a Pavement Management System (PMS) and the immediate need for rehabilitation projects.

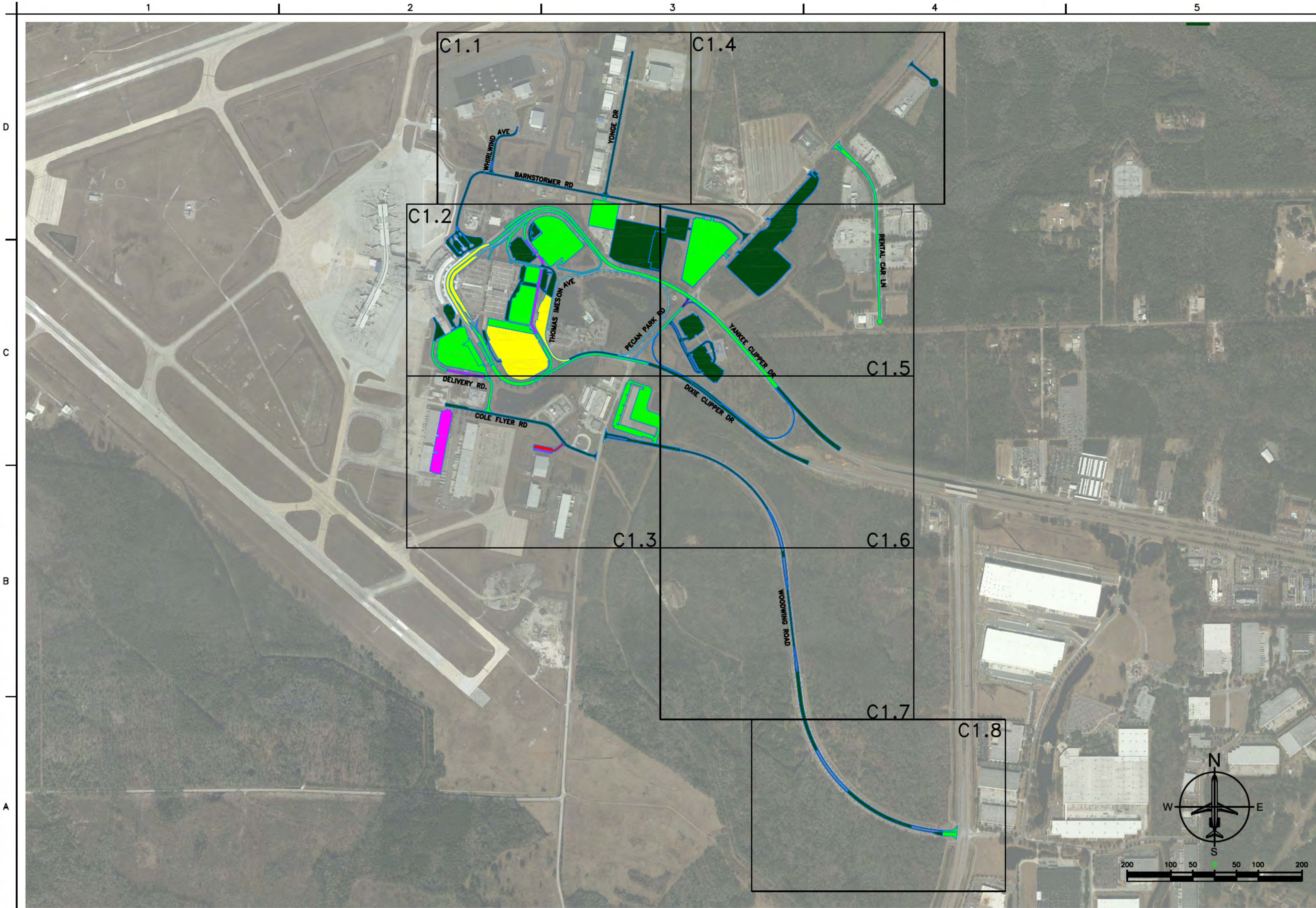
A scope and fee will be presented to JAA for inclusion of a PMS. In the meeting it was discussed that little additional work will be required to implement a PMS since the data collection and entry has been completed. The remaining tasks include researching and collecting historical pavement data, MICROPAVER program processing, budgeting scenarios, and reporting. The PMS is a useful tool for establishing maintenance and rehabilitation plans and budgets for the future.

For the immediate need of rehabilitation JAA determined that the roads listed below will be included in the scope and fee proposal for design in 2012.

- Air Cargo Lot – A (Short Term)
- Delivery Rd. – B
- Dixie Clipper Rd. – A
- Parking Access Rd. – D
- Pecan Park Rd. – A
- Pecan Park Rd. – C
- Thomas Imeson Rd. – A
- Yankee Clipper Rd. – A
- Yankee Clipper Rd. – A1
- Surface Parking Lot – A (Bid as an Additive)
- Toll Plaza Access Rd. – C

The recommended maintenance and rehabilitation as outlined in section 4.0 was agreed to as the approach for moving forward with design. The only area not included in the list but was recommended for repair is Cole Flyer Lot – A & B. This area will be addressed in the future when a tenant occupies the adjacent hangar.

PAVEMENT CONDITION INDEX (PCI) MAP



JAA Jacksonville Aviation Authority

BRIAN C. RUSSELL

LANDSIDE PAVEMENT EVALUATION - PHASE 1
JACKSONVILLE INTERNATIONAL AIRPORT

THE LPA GROUP INCORPORATED
Transportation Consultants

Designed by: RH
Drawn by: RN
Chk'd by: BR
Reviewed by: DH
Submitted by: BR
Date: MAY 2011
LPA Proj. No. 122843

SHEET INDEX

Sheet Reference Number: C1.0

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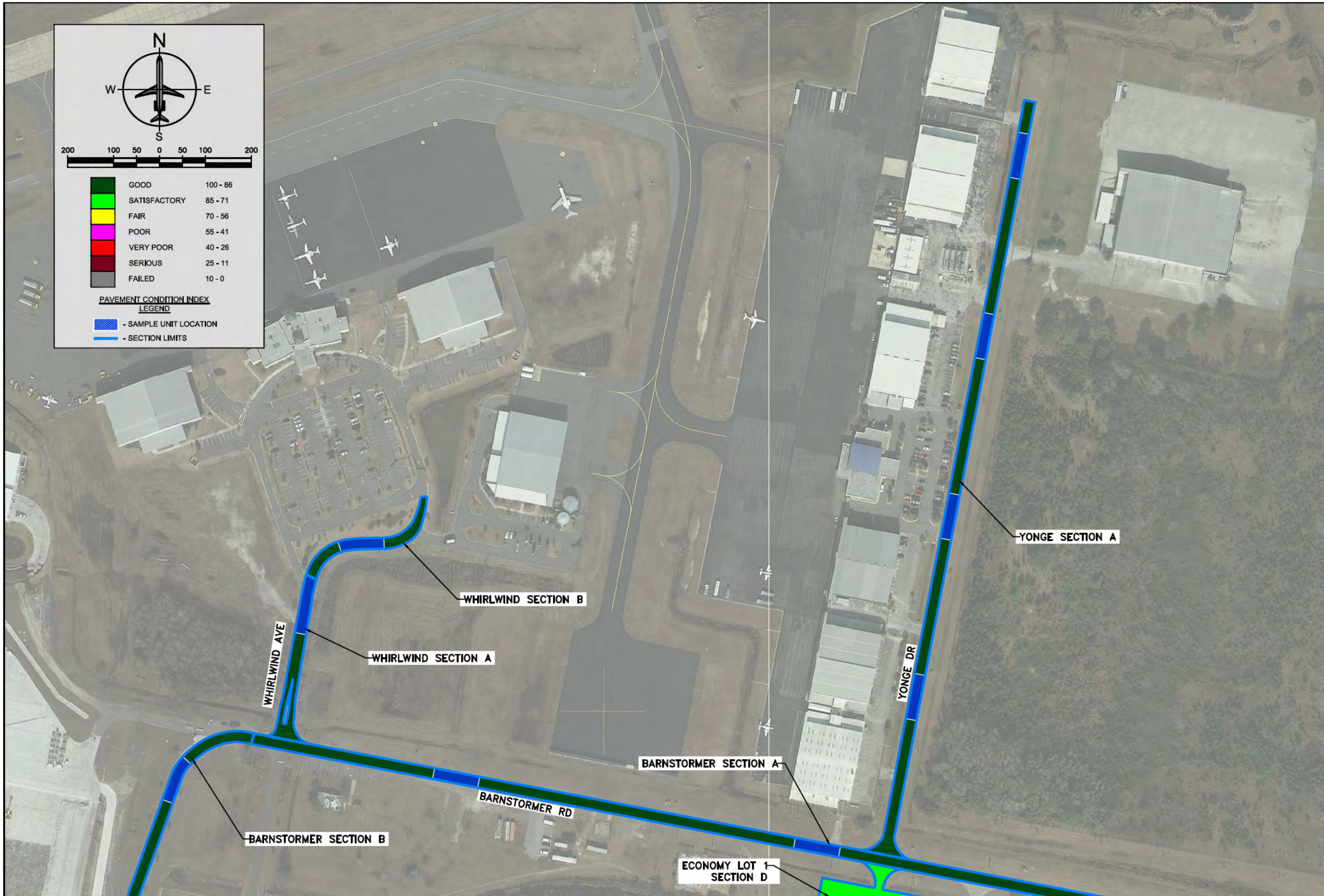

MATCHLINE C1.4

MATCHLINE C1.2

MATCHLINE C1.5

JAA Jacksonville Aviation Authority

BRIAN C. RUSSELL FL P.E. No. 72035

Rev.No.	Description	Date	Appr.

LANDSIDE PAVEMENT EVALUATION - PHASE 1
JACKSONVILLE INTERNATIONAL AIRPORT

THE LPA GROUP INCORPORATED
Transportation Consultants
2500 BELFORT ROAD, SUITE 110
JACKSONVILLE, FLORIDA 32256
TEL: (904) 380-2500
FAX: (904) 380-2501
CORPORATE LICENSE No. 00004307

Designed by: RH		Date: MAY 2011	Rev.
Dwn by: RN	Chkd by: BR	LPA Proj. No. 1222843	
Reviewed by: DH		Drawing code:	
Submitted by: BR		File name: Plot date: Plot scale:	

PAVEMENT CONDITION INDEX MAP

Sheet Reference Number: C1.1

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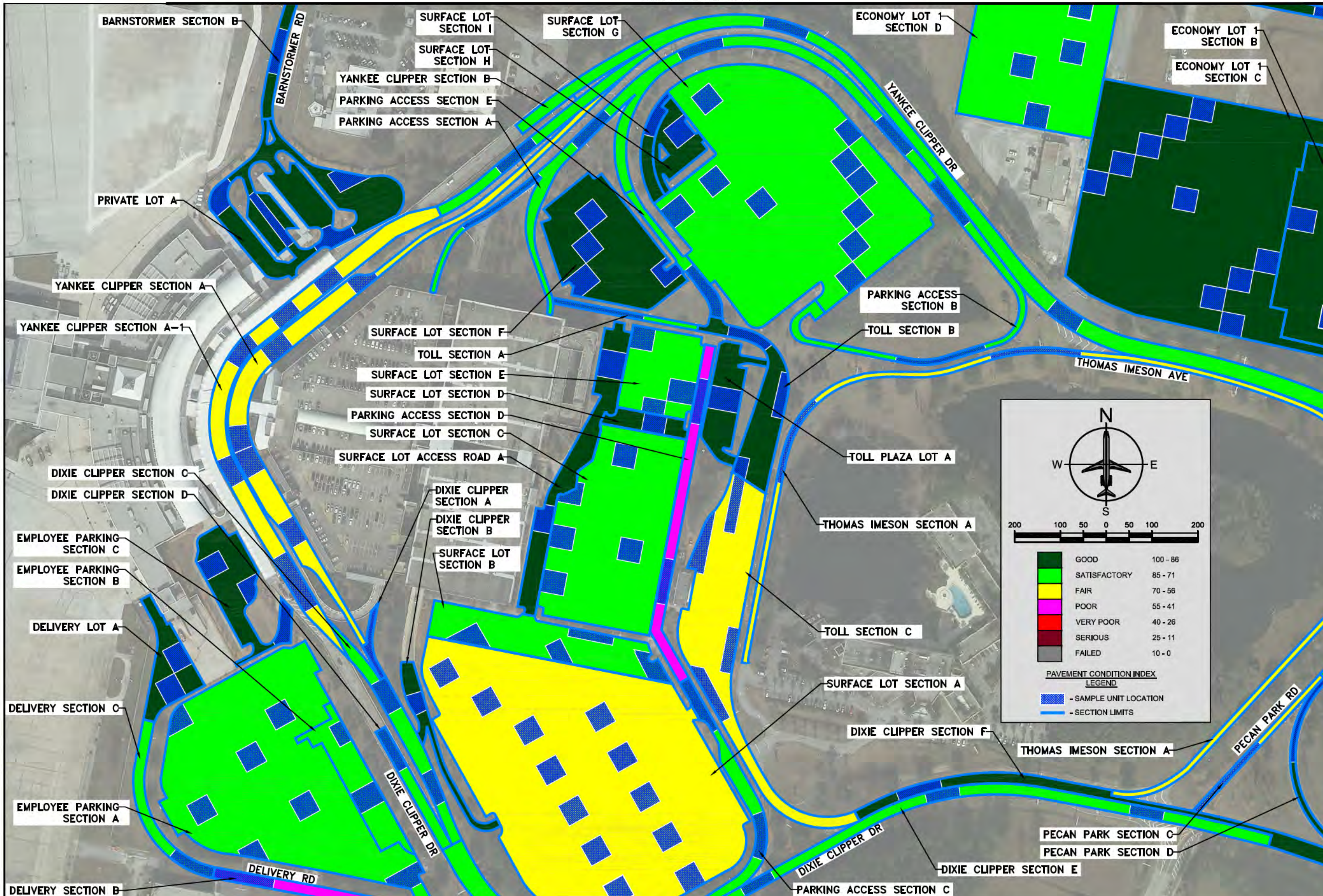
MATCHLINE C1.1



MATCHLINE C1.3

MATCHLINE C1.5

JAA Jacksonville Aviation Authority

BRIAN C. RUSSELL FL P.E. No. 70205

Rev. No.	Description	Date	Appr.

LANDSIDE PAVEMENT EVALUATION - PHASE 1
JACKSONVILLE INTERNATIONAL AIRPORT

THE LPA GROUP INCORPORATED
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Designed by: RH		Date: MAY 2011	Rev.
Dwn by: RN	Chkd by: BR	LPA Proj. No. 122843	
Reviewed by: DH		Drawing code:	
Submitted by: BR		File name: Plot date: Plot scale:	

PAVEMENT CONDITION INDEX MAP

Sheet Reference Number: C1.2

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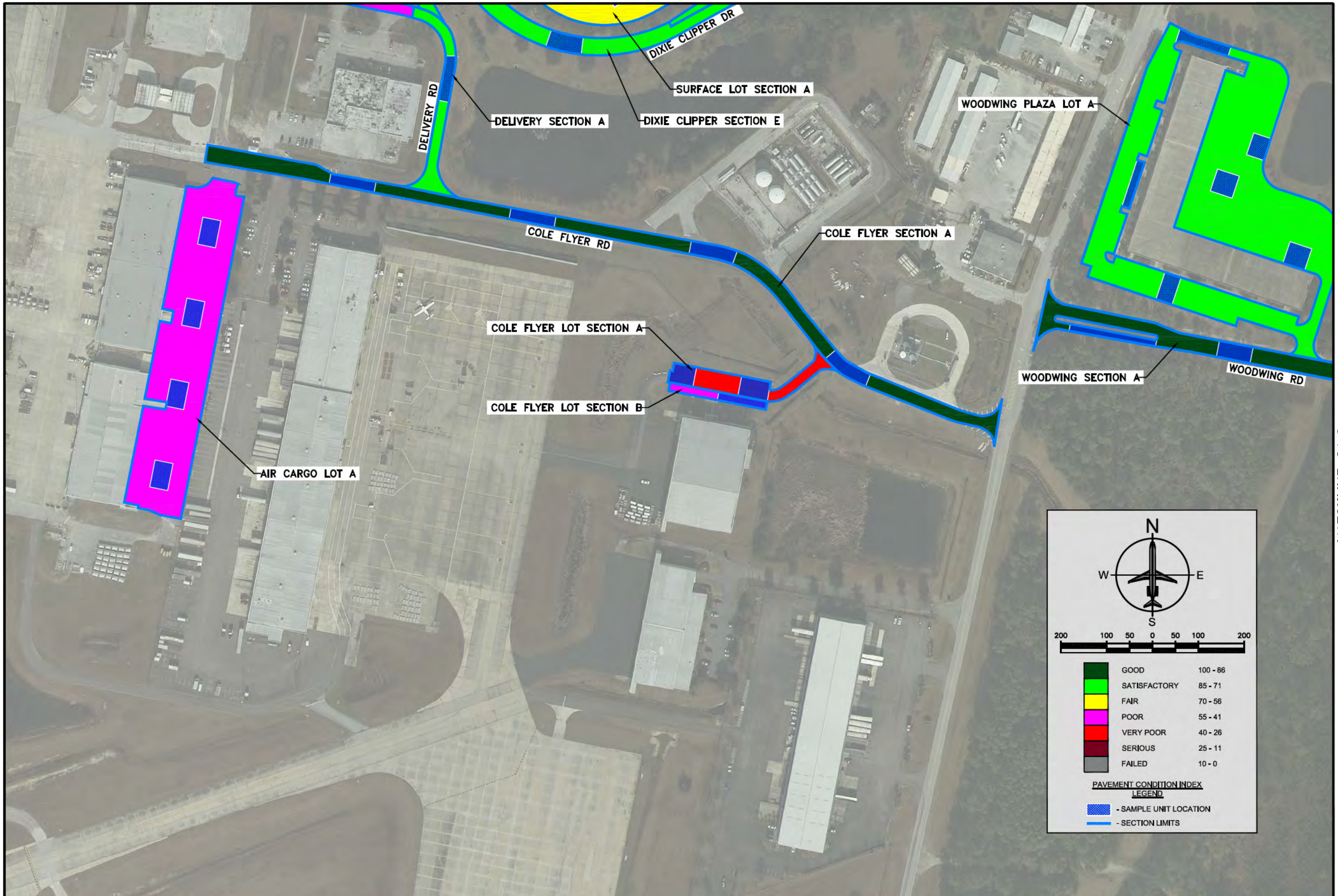

MATCHLINE C1.6

JAA Jacksonville Aviation Authority

BRIAN C. RUSSELL FL. P.E. No. 72005

LANDSIDE PAVEMENT EVALUATION - PHASE 1
JACKSONVILLE INTERNATIONAL AIRPORT

THE LPA GROUP INCORPORATED
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2500 BELFORT ROAD, SUITE 110
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Designed by: RH	Date: MAY 2011	Rev.
Dwn by: RN	Ckd by: BR	LPA Proj. No. 122843
Reviewed by: DH	Drawing code:	
Submitted by: BR	File name: Plot date: Plot scale:	

PAVEMENT CONDITION INDEX MAP

Sheet Reference Number: C1.3

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MATCHLINE C1.1

MATCHLINE C1.5

JAA Jacksonville Aviation Authority

LANDSIDE PAVEMENT EVALUATION - PHASE 1
JACKSONVILLE INTERNATIONAL AIRPORT

THE LPA GROUP INCORPORATED

Designed by: RH | Date: MAY 2011 | Rev.
Dwn by: RN | Chk by: BR | LPA Proj. No. 122843
Reviewed by: DH | Drawing code:
Submitted by: BR

PAVEMENT CONDITION INDEX MAP

Sheet Reference Number: C1.4

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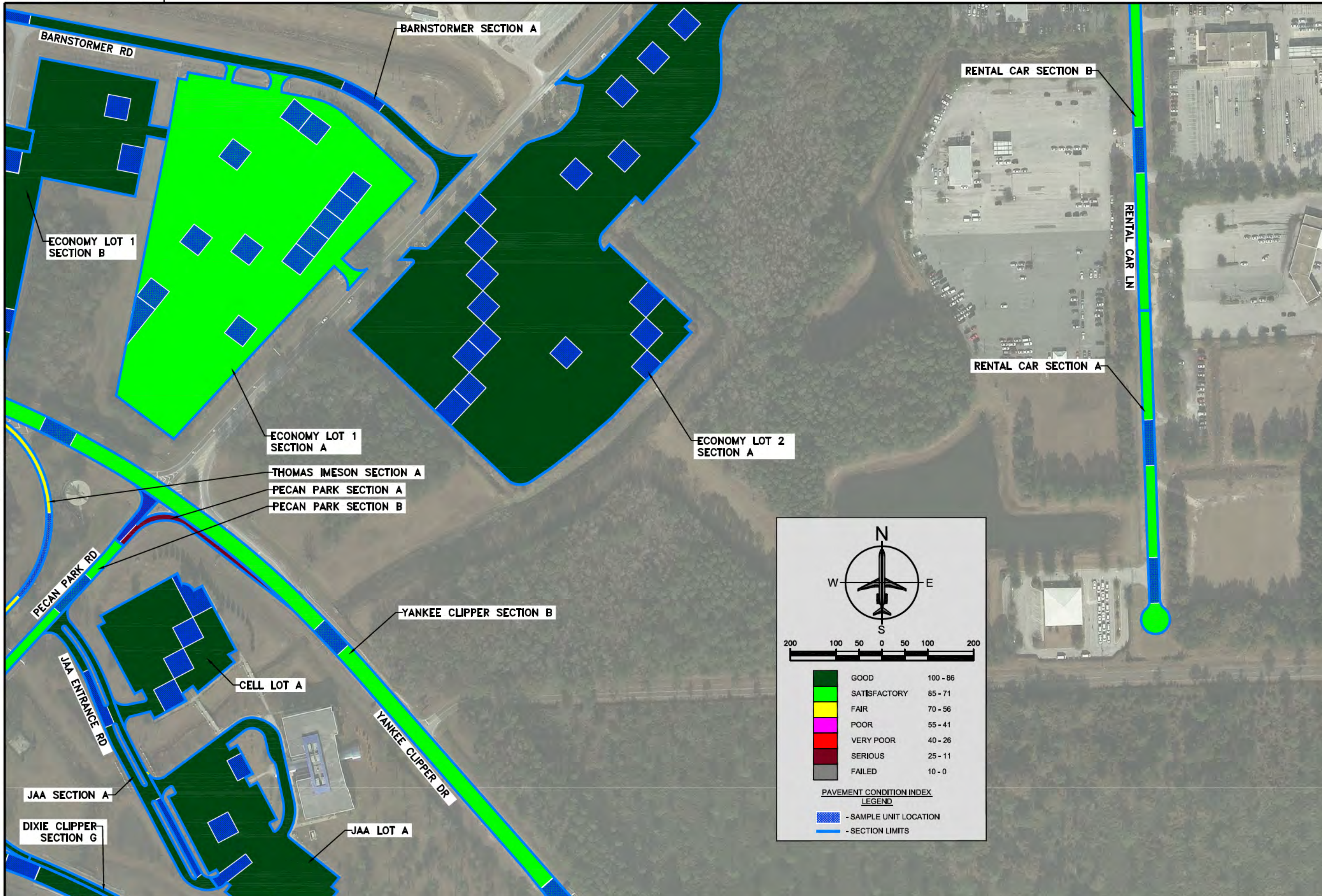
MATCHLINE C1.1

MATCHLINE C1.4



MATCHLINE C1.2

MATCHLINE C1.6

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JAA Jacksonville Aviation Authority

BRIAN C. RUSSELL FL. P.E. No. 72005

Rev. No.	Description	Date	Appr.

Designed by: RH | Date: MAY 2011 | Rev.
Dwn by: RN | Chk'd by: BR | LPA Proj. No. 122843
Reviewed by: DH | Drawing code:
Submitted by: BR | File name: | Plot date: | Plot scale:

LANDSIDE PAVEMENT EVALUATION - PHASE 1
JACKSONVILLE INTERNATIONAL AIRPORT

THE LPA GROUP INCORPORATED
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2500 BELFORT ROAD, SUITE 110
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CORPORATE LICENSE No. 00004307

PAVEMENT CONDITION INDEX MAP

Sheet Reference Number: C1.5

MATCHLINE C1.5

MATCHLINE C1.3

MATCHLINE C1.7

JAA Jacksonville Aviation Authority

BRIAN C. RUSSELL FL P.E. No. 72005

Rev.No.	Description	Date	App.

Designed by: RH	Date: MAY 2011
Dwn by: RN / Ckd by: BR	LPA Proj. No. 122843
Reviewed by: DH	Drawing code:
Submitted by: BR	File name: Plot date: Plot scale:

LANDSIDE PAVEMENT EVALUATION - PHASE 1
JACKSONVILLE INTERNATIONAL AIRPORT

THE LPA GROUP INCORPORATED
Transportation Consultants
2500 BELFORT ROAD, SUITE 110
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PAVEMENT CONDITION INDEX MAP

Sheet Reference Number: C1.6

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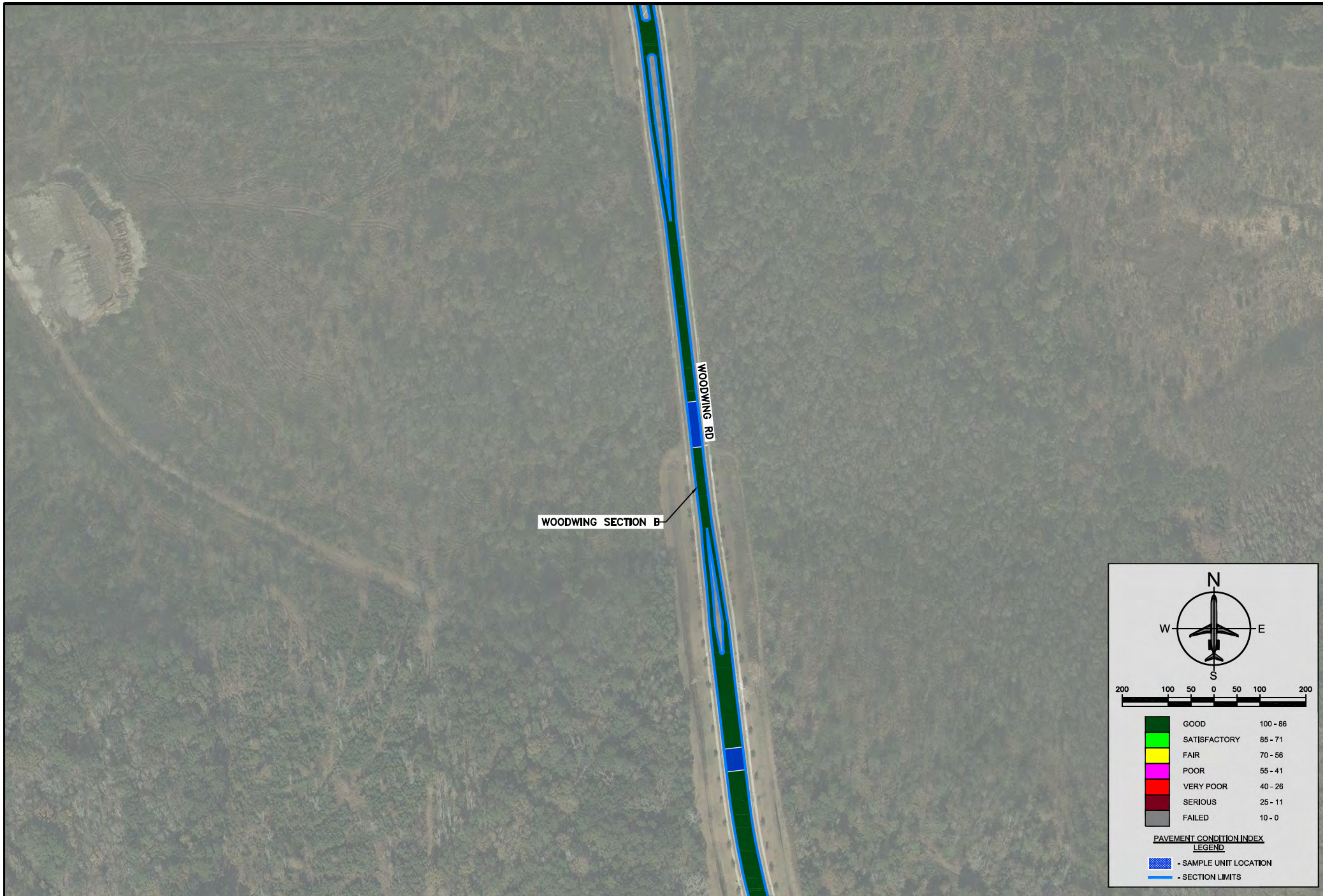

MATCHLINE C1.8

JAA Jacksonville Aviation Authority

BRIAN C. RUSSELL
FL P.E. No. 72030

Rev.No.	Description	Date	Appr.

Designed by: RH	Date: MAY 2011	Rev.
Dwn by: RN / Chd by: BR	LPA Proj. No. 122843	
Reviewed by: DH	Drawing code:	
Submitted by: BR	File name: Plot date: Plot scale:	

LANDSIDE PAVEMENT EVALUATION - PHASE 1
JACKSONVILLE INTERNATIONAL AIRPORT

THE LPA GROUP INCORPORATED
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TEL: (904) 380-2500
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PAVEMENT CONDITION INDEX MAP

Sheet Reference Number:
C1.7

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MATCHLINE C1.7

JAA Jacksonville Aviation Authority

Date: MAY 2011
LPA Proj. No. 122843
Designed by: RH
Chk'd by: BR
Drn by: RN
Reviewed by: DH
Submitted by: BR

LANDSIDE PAVEMENT EVALUATION - PHASE 1
JACKSONVILLE INTERNATIONAL AIRPORT

THE LPA GROUP INCORPORATED

PAVEMENT CONDITION INDEX MAP

Sheet Reference Number: C1.8

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BRANCH LISTING REPORT

Branch Listing Report

Pavement Database: JAX_PCI

NetworkID	BranchID	Name	Use	Number of Sections	True Area Unit: SqFt	Comments
JAX	P-CARGO	AIR CARGO LOT	LOADING	1	92,160.00	
JAX	P-CELL	COURTESY CELL LOT	PARKING	1	58,800.00	
JAX	P-COLE	COLE FLYER LOT	PARKING	2	1,691,370.00	
JAX	P-DELI	DELIVERY LOT	LOADING	1	12,144.00	
JAX	P-ECO_1	ECONOMY LOT 1	PARKING	4	2,494,200.00	
JAX	P-ECO_2	ECONOMY LOT 2	PARKING	1	769,540.00	
JAX	P-EMPLOY	EMPLOYEE PARKING LOTS	PARKING	3	405,920.00	
JAX	P-JAA	JAA PARKING LOT	PARKING	1	90,000.00	
JAX	P-PRIV	VIP PARKING LOT	PARKING	1	84,800.00	
JAX	P-SURF	SURFACE PARKING LOTS	PARKING	9	890,455.00	
JAX	P-TOLL	TOLL PLAZA LOT	PARKING	1	17,000.00	
JAX	P-WOOD	WOODWING PLAZA LOT	PARKING	1	310,300.00	
JAX	R-BARN	BARNSTORMER ROAD	ROADWAY	2	93,720.00	
JAX	R-COLE	COLE FLYER ROAD	ROADWAY	1	45,600.00	
JAX	R-DELI	DELIVERY ROAD	ROADWAY	3	28,800.00	
JAX	R-DIXIE	DIXIE CLIPPER ROAD	ROADWAY	10	240,192.00	
JAX	R-JAA	JAA ENTRANCE ROAD	ROADWAY	1	21,000.00	
JAX	R-PARK	PARKING ACCESS ROADS	ROADWAY	5	93,776.00	
JAX	R-PECAN	PECAN PARK ROAD	ROADWAY	4	23,580.00	
JAX	R-RENT	RENTAL CAR LANE	ROADWAY	3	1,013,400.00	
JAX	R-SURF	SURFACE LOT ACCESS ROAD	ROADWAY	1	23,625.00	
JAX	R-THOMAS	THOMAS IMESON AVENUE	ROADWAY	1	33,600.00	
JAX	R-TOLL	TOLL PLAZA ACCESS ROADS	ROADWAY	3	169,690.00	
JAX	R-WHIRL	WHIRLWIND AVENUE	ROADWAY	2	16,200.00	
JAX	R-WOOD	WOODWING ROAD	ROADWAY	3	275,960.00	
JAX	R-YANKEE	YANKEE CLIPPER ROAD	ROADWAY	4	298,640.00	
JAX	R-YOUGE	YONGE DRIVE	ROADWAY	1	40,104.00	

Branch Listing Report (Summary)

Pavement Database: JAX_PCI

Total Number of Networks:	**1**	
Total Number of Branches:	**27**	
Total Number of Sections:	**70**	
Total True Area:	**9,334,576.00**	**SqFt**
Average Branch True Area:	**345,725.04**	**SqFt**

BRANCH CONDITION REPORT

Branch Condition Report

Pavement Database: JAX_PCI NetworkID: JAX

Branch ID	Number of Sections	Sum Section Length (Ft)	Avg Section Width (Ft)	True Area (SqFt)	Use	Average PCI	PCI Standard Deviation	Weighted Average PCI
P-CARGO (AIR CARGO LOT)	1	720.00	128.00	92,160.00	LOADING	52.00	0.00	52.00
P-CELL (COURTESY CELL LOT)	1	240.00	245.00	58,800.00	PARKING	86.00	0.00	86.00
P-COLE (COLE FLYER LOT)	2	590.00	2,259.00	1,691,370.00	PARKING	40.00	14.00	26.06
P-DELI (DELIVERY LOT)	1	132.00	92.00	12,144.00	LOADING	95.00	0.00	95.00
P-ECO_1 (ECONOMY LOT 1)	4	2,223.00	975.00	2,494,200.00	PARKING	88.25	9.36	94.47
P-ECO_2 (ECONOMY LOT 2)	1	1,412.00	545.00	769,540.00	PARKING	98.00	0.00	98.00
P-EMPLOY (EMPLOYEE PARKING LOTS)	3	1,302.00	223.33	405,920.00	PARKING	81.67	4.78	76.26
P-JAA (JAA PARKING LOT)	1	450.00	200.00	90,000.00	PARKING	96.00	0.00	96.00
P-PRIV (VIP PARKING LOT)	1	265.00	320.00	84,800.00	PARKING	94.00	0.00	94.00
P-SURF (SURFACE PARKING LOTS)	9	3,218.00	206.22	890,455.00	PARKING	85.56	11.72	75.38
P-TOLL (TOLL PLAZA LOT)	1	250.00	68.00	17,000.00	PARKING	98.00	0.00	98.00
P-WOOD (WOODWING PLAZA LOT)	1	580.00	535.00	310,300.00	PARKING	84.00	0.00	84.00
R-BARN (BARNSTORMER ROAD)	2	3,905.00	24.00	93,720.00	ROADWAY	92.00	4.00	94.40
R-COLE (COLE FLYER ROAD)	1	1,900.00	24.00	45,600.00	ROADWAY	90.00	0.00	90.00
R-DELI (DELIVERY ROAD)	3	1,200.00	24.00	28,800.00	ROADWAY	65.67	14.06	65.67
R-DIXIE (DIXIE CLIPPER ROAD)	10	9,070.00	39.20	240,192.00	ROADWAY	79.90	26.21	87.71

Branch ID	Number of Sections	Sum Section Length (Ft)	Avg Section Width (Ft)	True Area (SqFt)	Use	Average PCI	PCI Standard Deviation	Weighted Average PCI
R-JAA (JAA ENTRANCE ROAD)	1	700.00	30.00	21,000.00	ROADWAY	97.00	0.00	97.00
R-PARK (PARKING ACCESS ROADS)	5	4,464.00	20.60	93,776.00	ROADWAY	75.40	13.81	75.93
R-PECAN (PECAN PARK ROAD)	4	1,565.00	15.00	23,580.00	ROADWAY	60.25	29.26	67.61
R-RENT (RENTAL CAR LANE)	3	2,625.00	816.00	1,013,400.00	ROADWAY	83.67	11.12	97.85
R-SURF (SURFACE LOT ACCESS ROAD)	1	675.00	35.00	23,625.00	ROADWAY	100.00	0.00	100.00
R-THOMAS (THOMAS IMESON AVENUE)	1	2,800.00	12.00	33,600.00	ROADWAY	66.00	0.00	66.00
R-TOLL (TOLL PLAZA ACCESS ROADS)	3	1,815.00	70.67	169,690.00	ROADWAY	83.67	12.28	74.26
R-WHIRL (WHIRLWIND AVENUE)	2	660.00	24.50	16,200.00	ROADWAY	91.00	3.00	91.33
R-WOOD (WOODWING ROAD)	3	6,882.00	47.00	275,960.00	ROADWAY	87.67	7.59	91.64
R-YANKEE (YANKEE CLIPPER ROAD)	4	8,115.00	37.00	298,640.00	ROADWAY	74.75	14.10	73.10
R-YOUGE (YONGE DRIVE)	1	1,671.00	24.00	40,104.00	ROADWAY	94.00	0.00	94.00

Use Category	Number of Sections	Total Area (SqFt)	Arithmetic Average PCI	Average PCI STD.	Weighted Average PCI
LOADING	2	104,304.00	73.50	21.50	57.01
PARKING	24	6,812,385.00	83.50	16.66	73.78
ROADWAY	44	2,417,887.00	79.34	20.24	89.07
All	70	9,334,576.00	80.60	19.27	77.55

SECTION CONDITION REPORT

Section Condition Report

Pavement Database: JAX_PCI *NetworkID: JAX*

Branch ID	Section ID	Last Const. Date	Surface	Use	Rank	Lanes	True Area (SqFt)	Last Inspection Date	Age At Inspection	PCI
P-CARGO (AIR CARGO LOT)	A	12/31/1899	AC	LOADING	P	0	92,160.00	05/24/2011	112	52.00
P-CELL (COURTESY CELL LOT)	A	12/31/1899	AC	PARKING	P	0	58,800.00	06/02/2011	112	86.00
P-COLE (COLE FLYER LOT)	A	12/31/1899	AC	PARKING	P	0	1,687,500.00	05/18/2011	112	26.00
P-COLE (COLE FLYER LOT)	B	12/31/1899	AC	PARKING	P	0	3,870.00	05/18/2011	112	54.00
P-DELI (DELIVERY LOT)	A	12/31/1899	AC	LOADING	P	0	12,144.00	05/17/2011	112	95.00
P-ECO_1 (ECONOMY LOT 1)	A	12/31/1899	AC	PARKING	P	0	393,000.00	05/18/2011	112	81.00
P-ECO_1 (ECONOMY LOT 1)	B	12/31/1899	AC	PARKING	P	0	1,786,200.00	05/18/2011	112	98.00
P-ECO_1 (ECONOMY LOT 1)	C	12/31/1899	AC	PARKING	P	0	225,000.00	05/18/2011	112	97.00
P-ECO_1 (ECONOMY LOT 1)	D	12/31/1899	AC	PARKING	P	0	90,000.00	05/19/2011	112	77.00
P-ECO_2 (ECONOMY LOT 2)	A	12/31/1899	AC	PARKING	P	0	769,540.00	05/17/2011	112	98.00
P-EMPLOY (EMPLOYEE PARKING LOTS)	A	12/31/1899	AC	PARKING	P	0	356,000.00	05/17/2011	112	75.00
P-EMPLOY (EMPLOYEE PARKING LOTS)	B	12/31/1899	AC	PARKING	P	0	18,600.00	05/17/2011	112	84.00
P-EMPLOY (EMPLOYEE PARKING LOTS)	C	12/31/1899	AC	PARKING		0	31,320.00	05/17/2011	112	86.00
P-JAA (JAA PARKING LOT)	A	12/31/1899	AC	PARKING	P	0	90,000.00	06/02/2011	112	96.00
P-PRIV (VIP PARKING LOT)	A	12/31/1899	AC	PARKING	P	0	84,800.00	05/24/2011	112	94.00
P-SURF (SURFACE PARKING LOTS)	A	12/31/1899	AC	PARKING	P	0	353,648.00	05/24/2011	112	69.00
P-SURF (SURFACE PARKING LOTS)	B	12/31/1989	AC	PARKING	P	0	42,282.00	06/02/2011	22	82.00
P-SURF (SURFACE PARKING LOTS)	C	12/31/1899	AC	PARKING	P	0	110,055.00	05/23/2011	112	79.00
P-SURF (SURFACE PARKING LOTS)	D	12/31/1899	AC	PARKING		0	7,896.00	05/19/2011	112	97.00
P-SURF (SURFACE PARKING LOTS)	E	12/31/1899	AC	PARKING	P	0	29,808.00	05/19/2011	112	75.00
P-SURF (SURFACE PARKING LOTS)	F	12/31/1899	AC	PARKING	P	0	64,500.00	05/19/2011	112	100.00
P-SURF (SURFACE PARKING LOTS)	G	12/31/1899	AC	PARKING	P	0	262,550.00	05/19/2011	112	73.00
P-SURF (SURFACE PARKING LOTS)	H	12/30/1899	AC	PARKING	P	0	13,696.00	05/26/2011	112	100.00
P-SURF (SURFACE PARKING LOTS)	I	12/30/1899	AC	PARKING	P	0	6,020.00	05/19/2011	112	95.00

Section Condition Report

Pavement Database: JAX_PCI *NetworkID: JAX*

Branch ID	Section ID	Last Const. Date	Surface	Use	Rank	Lanes	True Area (SqFt)	Last Inspection Date	Age At Inspection	PCI
P-TOLL (TOLL PLAZA LOT)	A	12/31/1899	AC	PARKING	P	0	17,000.00	06/02/2011	112	98.00
P-WOOD (WOODWING PLAZA LOT)	A	12/31/1899	AC	PARKING	P	0	310,300.00	05/18/2011	112	84.00
R-BARN (BARNSTORMER ROAD)	A	12/31/1899	AC	ROADWAY	P	0	75,000.00	05/12/2011	112	96.00
R-BARN (BARNSTORMER ROAD)	B	12/31/1899	AC	ROADWAY	P	0	18,720.00	05/26/2011	112	88.00
R-COLE (COLE FLYER ROAD)	A	12/31/1899	AC	ROADWAY	P	0	45,600.00	05/16/2011	112	90.00
R-DELI (DELIVERY ROAD)	A	12/31/1899	AC	ROADWAY	P	0	9,600.00	05/17/2011	112	73.00
R-DELI (DELIVERY ROAD)	B	12/31/1899	AC	ROADWAY	P	0	9,600.00	05/17/2011	112	46.00
R-DELI (DELIVERY ROAD)	C	12/31/1899	AC	ROADWAY	P	0	9,600.00	05/17/2011	112	78.00
R-DIXIE (DIXIE CLIPPER ROAD)	A	12/31/1899	AC	ROADWAY	P	0	2,400.00	06/25/2011	112	7.00
R-DIXIE (DIXIE CLIPPER ROAD)	B	12/31/1899	AC	ROADWAY	P	0	5,400.00	06/24/2011	112	93.00
R-DIXIE (DIXIE CLIPPER ROAD)	C	12/31/1899	AC	ROADWAY	P	0	18,000.00	06/24/2011	112	71.00
R-DIXIE (DIXIE CLIPPER ROAD)	D	12/31/1899	AC	ROADWAY	P	0	7,200.00	06/24/2011	112	74.00
R-DIXIE (DIXIE CLIPPER ROAD)	E	12/31/1899	AC	ROADWAY	P	0	62,112.00	06/24/2011	112	76.00
R-DIXIE (DIXIE CLIPPER ROAD)	F	12/31/1899	AC	ROADWAY	P	0	109,800.00	06/24/2011	112	97.00
R-DIXIE (DIXIE CLIPPER ROAD)	G	12/31/1899	AC	ROADWAY	P	0	18,480.00	06/24/2011	112	95.00
R-DIXIE (DIXIE CLIPPER ROAD)	H	12/31/1899	AC	ROADWAY	P	0	7,200.00	06/24/2011	112	99.00
R-DIXIE (DIXIE CLIPPER ROAD)	I	12/31/1899	AC	ROADWAY	P	0	4,800.00	06/24/2011	112	94.00
R-DIXIE (DIXIE CLIPPER ROAD)	J	12/31/1899	AC	ROADWAY	P	0	4,800.00	06/24/2011	112	93.00
R-JAA (JAA ENTRANCE ROAD)	A	12/31/1899	AC	ROADWAY	P	0	21,000.00	06/02/2011	112	97.00
R-PARK (PARKING ACCESS ROADS)	A	12/31/1899	AC	ROADWAY	P	0	42,960.00	06/25/2011	112	83.00
R-PARK (PARKING ACCESS ROADS)	B	12/31/1899	AC	ROADWAY	P	0	11,760.00	06/25/2011	112	84.00
R-PARK (PARKING ACCESS ROADS)	C	12/31/1899	AC	ROADWAY	P	0	14,400.00	05/24/2011	112	83.00
R-PARK (PARKING ACCESS ROADS)	D	12/31/1899	AC	ROADWAY	P	0	18,576.00	05/24/2011	112	48.00
R-PARK (PARKING ACCESS ROADS)	E	09/19/1990	AC	ROADWAY	P	0	6,080.00	09/20/2011	21	79.00
R-PECAN (PECAN PARK ROAD)	A	12/31/1899	AC	ROADWAY	P	0	3,600.00	06/25/2011	112	14.00

Branch ID	Section ID	Last Const. Date	Surface	Use	Rank	Lanes	True Area (SqFt)	Last Inspection Date	Age At Inspection	PCI
R-PECAN (PECAN PARK ROAD)	B	12/31/1899	AC	ROADWAY	P	0	9,600.00	06/25/2011	112	80.00
R-PECAN (PECAN PARK ROAD)	C	12/31/1899	AC	ROADWAY	P	0	4,800.00	06/25/2011	112	57.00
R-PECAN (PECAN PARK ROAD)	D	12/31/1899	AC	ROADWAY	P	0	5,580.00	06/25/2011	112	90.00
R-RENT (RENTAL CAR LANE)	A	12/31/1899	AC	ROADWAY	P	0	16,800.00	05/16/2011	112	73.00
R-RENT (RENTAL CAR LANE)	B	12/31/1899	AC	ROADWAY	P	0	36,600.00	05/16/2011	112	79.00
R-RENT (RENTAL CAR LANE)	C	12/31/1899	AC	ROADWAY	P	0	960,000.00	05/12/2011	112	99.00
R-SURF (SURFACE LOT ACCESS ROAD)	A	12/31/1899	AC	ROADWAY	P	0	23,625.00	05/24/2011	112	100.00
R-THOMAS (THOMAS IMESON AVENUE)	A	12/31/1899	AC	ROADWAY	P	0	33,600.00	06/03/2011	112	66.00
R-TOLL (TOLL PLAZA ACCESS ROADS)	A	12/31/1899	AC	ROADWAY	P	0	3,840.00	06/02/2011	112	85.00
R-TOLL (TOLL PLAZA ACCESS ROADS)	B	12/31/1899	AC	ROADWAY	P	0	33,250.00	06/02/2011	112	98.00
R-TOLL (TOLL PLAZA ACCESS ROADS)	C	12/31/1899	AC	ROADWAY	P	0	132,600.00	06/03/2011	112	68.00
R-WHIRL (WHIRLWIND AVENUE)	A	12/31/1899	AC	ROADWAY	P	0	9,000.00	05/16/2011	112	94.00
R-WHIRL (WHIRLWIND AVENUE)	B	12/31/1899	AC	ROADWAY	P	0	7,200.00	05/16/2011	112	88.00
R-WOOD (WOODWING ROAD)	A	12/31/1899	AC	ROADWAY	P	0	30,780.00	05/17/2011	112	94.00
R-WOOD (WOODWING ROAD)	B	12/31/1899	AC	ROADWAY	P	0	234,520.00	05/17/2011	112	92.00
R-WOOD (WOODWING ROAD)	C	12/31/1899	AC	ROADWAY	P	0	10,660.00	05/17/2011	112	77.00
R-YANKEE (YANKEE CLIPPER ROAD)	A	12/31/1899	AC	ROADWAY	P	0	65,000.00	06/24/2011	112	64.00
R-YANKEE (YANKEE CLIPPER ROAD)	A1	12/31/1899	AC	ROADWAY	P	0	45,000.00	06/24/2011	112	63.00
R-YANKEE (YANKEE CLIPPER ROAD)	B	12/31/1899	AC	ROADWAY	P	0	152,100.00	06/24/2011	112	74.00
R-YANKEE (YANKEE CLIPPER ROAD)	C	12/31/1899	AC	ROADWAY	P	0	36,540.00	06/22/2011	112	98.00
R-YOUGE (YONGE DRIVE)	A	12/31/1899	AC	ROADWAY	P	0	40,104.00	05/16/2011	112	94.00

PAVEMENT SUMMARY TABLE

MICROPAVER PAVEMENT SUMMARY TABLE

Network ID	Branch ID	Section ID	SURFACE	PCI	PCI Category	PCI Pct Climate	PCI Pct Load	PCI Pct Other
JAX	P-CARGO	A	AC	52	Poor	35	16	49
JAX	P-CELL	A	AC	86	Good	2	84	14
JAX	P-COLE	A	AC	26	Very Poor	14	86	0
JAX	P-COLE	B	AC	54	Poor	55	45	0
JAX	P-DELI	A	AC	95	Good	100	0	0
JAX	P-ECO_1	A	AC	81	Satisfactory	90	5	5
JAX	P-ECO_1	B	AC	98	Good	15	0	85
JAX	P-ECO_1	C	AC	97	Good	55	0	45
JAX	P-ECO_1	D	AC	77	Satisfactory	71	0	29
JAX	P-ECO_2	A	AC	98	Good	100	0	0
JAX	P-EMPLOY	A	AC	75	Satisfactory	51	39	10
JAX	P-EMPLOY	B	AC	84	Satisfactory	31	52	17
JAX	P-EMPLOY	C	AC	86	Good	100	0	0
JAX	P-JAA	A	AC	96	Good	7	36	57
JAX	P-PRIV	A	AC	94	Good	93	0	7
JAX	P-SURF	A	AC	69	Fair	90	4	6
JAX	P-SURF	B	AC	82	Satisfactory	57	19	24
JAX	P-SURF	C	AC	79	Satisfactory	82	9	9
JAX	P-SURF	D	AC	97	Good	100	0	0
JAX	P-SURF	E	AC	75	Satisfactory	37	50	13
JAX	P-SURF	F	AC	100	Good	0	0	0
JAX	P-SURF	G	AC	73	Satisfactory	75	0	25
JAX	P-SURF	H	AC	100	Good	0	0	0
JAX	P-SURF	I	AC	95	Good	100	0	0
JAX	P-TOLL	A	AC	98	Good	100	0	0
JAX	P-WOOD	A	AC	84	Satisfactory	52	0	48
JAX	R-BARN	A	AC	96	Good	42	0	58
JAX	R-BARN	B	AC	88	Good	12	0	88
JAX	R-COLE	A	AC	90	Good	22	78	0
JAX	R-DELI	A	AC	73	Satisfactory	100	0	0
JAX	R-DELI	B	AC	46	Poor	56	44	0
JAX	R-DELI	C	AC	78	Satisfactory	100	0	0

MICROPAVER PAVEMENT SUMMARY TABLE

Network ID	Branch ID	Section ID	SURFACE	PCI	PCI Category	PCI Pct Climate	PCI Pct Load	PCI Pct Other
JAX	R-DIXIE	A	AC	7	Failed	21	79	0
JAX	R-DIXIE	B	AC	93	Good	56	0	44
JAX	R-DIXIE	C	AC	71	Satisfactory	100	0	0
JAX	R-DIXIE	D	AC	74	Satisfactory	100	0	0
JAX	R-DIXIE	E	AC	76	Satisfactory	44	56	0
JAX	R-DIXIE	F	AC	97	Good	20	0	80
JAX	R-DIXIE	G	AC	95	Good	100	0	0
JAX	R-DIXIE	H	AC	99	Good	100	0	0
JAX	R-DIXIE	I	AC	94	Good	100	0	0
JAX	R-DIXIE	J	AC	93	Good	0	0	100
JAX	R-JAA	A	AC	97	Good	0	0	100
JAX	R-PARK	A	AC	83	Satisfactory	24	4	72
JAX	R-PARK	B	AC	84	Satisfactory	0	84	16
JAX	R-PARK	C	AC	83	Satisfactory	89	11	0
JAX	R-PARK	D	AC	48	Poor	25	47	28
JAX	R-PECAN	A	AC	14	Serious	30	59	11
JAX	R-PECAN	B	AC	80	Satisfactory	22	0	78
JAX	R-PECAN	C	AC	57	Fair	0	72	28
JAX	R-PECAN	D	AC	90	Good	44	0	56
JAX	R-RENT	A	AC	73	Satisfactory	19	69	12
JAX	R-RENT	B	AC	79	Satisfactory	53	0	47
JAX	R-RENT	C	AC	99	Good	100	0	0
JAX	R-SURF	A	AC	100	Good	0	0	0
JAX	R-THOMAS	A	AC	66	Fair	24	51	25
JAX	R-TOLL	A	AC	85	Satisfactory	13	24	63
JAX	R-TOLL	B	AC	98	Good	100	0	0
JAX	R-TOLL	C	AC	68	Fair	68	23	9
JAX	R-WHIRL	A	AC	94	Good	100	0	0
JAX	R-WHIRL	B	AC	88	Good	0	100	0
JAX	R-WOOD	A	AC	94	Good	100	0	0
JAX	R-WOOD	B	AC	92	Good	6	12	82
JAX	R-WOOD	C	AC	77	Satisfactory	51	0	49

MICROPAVER PAVEMENT SUMMARY TABLE

Network ID	Branch ID	Section ID	SURFACE	PCI	PCI Category	PCI Pct Climate	PCI Pct Load	PCI Pct Other
JAX	R-YANKEE	A	AC	64	Fair	39	49	12
JAX	R-YANKEE	A1	AC	63	Fair	11	66	23
JAX	R-YANKEE	B	AC	74	Satisfactory	29	64	7
JAX	R-YANKEE	C	AC	98	Good	5	0	95
JAX	R-YOUGE	A	AC	94	Good	27	0	73

SCHEMATIC COST ESTIMATES

ESTIMATE DATE: **21-Oct-11**

SECTION	***PROJECT SHORT DESCRIPTION***	***ESTIMATED COST***
AIR CARGO LOT - A (SHORT TERM)	PATCH ISOLOATED AREAS, SEAL COAT, AND REPAIR INLETS	$145,560.00
AIR CARGO LOT - A (LONG TERM)	MILL AND OVERLAY ENTIRE SURFACE, PATCH FAILURE AREAS, AND REPAIR INLETS	$295,080.00
COLE FLYER LOT - A	SEAL COAT	$26,304.00
COLE FLYER LOT - B	SEAL COAT	$13,824.00
DELIVERY RD. - B	MILL AND RESURFACE	$36,456.00
DIXIE CLIPPER RD. - A	RECONSTRUCTION - REMOVE AND REPLACE WITH CONCRETE PAVEMENT	$40,224.00
PARKING ACCESS RD. - D	MILL AND RESURFACE	$60,740.00
PECAN PARK RD. - A	MILL, RESURFACE, 2' WIDENING, AND ADD CURB AND GUTTER	$52,500.00
PECAN PARK RD. - C	ISOLATED RECONSTRUCTION OF BASE AND SURFACE COURSE	$24,000.00
THOMAS IMESON RD. - A	ISOLATED FULL DEPTH PATCH AREAS, CURB REPAIR, AND TREE REMOVAL	$52,080.00
YANKEE CLIPPER RD. - A	RECONSTRUCT WITH CONCRETE IN ISOLATED AREA, MILL, RESURFACE, AND CURB REPAIR	$198,360.00
YANKEE CLIPPER RD. - A1	RECONSTRUCT WITH CONCRETE IN ISOLATED AREA, MILL, RESURFACE, AND REPLACE OVERHEAD STRUCTURE DOWNSPOUTS.	$309,528.00
SURFACE PARKING LOT - A	PATCH FAILURE AREAS AND SEAL COAT	$263,400.00
TOLL PLAZA ACCESS RD. - C	ISOLATED AREA OF FULL DEPTH PATCHING AND SEAL COAT	$96,960.00
	TOTAL WITH LONG TERM=	**$1,469,456**
	TOTAL WITH SHORT TERM=	**$1,319,936**

SECTION: **DIXIE CLIPPER - A**

ESTIMATE DATE: **21-Oct-11**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
1	MOBILIZATION	1	LS	$3,100.00	$3,100
2	MAINTENANCE OF TRAFFIC	1	LS	$2,500.00	$2,500
3	PAVEMENT REMOVAL	240	SY	$15.00	$3,600
4	STABILIZED SUBGRADE	240	SY	$8.00	$1,920
5	6" LIMEROCK BASE	240	SY	$10.00	$2,400
6	8" CONCRETE PAVEMENT	240	SY	$75.00	$18,000
7	PAVEMENT MARKINGS	1	LS	$2,000.00	$2,000
				TOTAL=	**$33,520**
				20% CONTINGENCY =	**$6,704**
				DIXIE CLIPPER A GRAND TOTAL =	**$40,224**

SECTION: **YANKEE CLIPPER - A**

ESTIMATE DATE: **21-Oct-11**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
1	MOBILIZATION	1	LS	$15,100.00	$15,100
2	MAINTENANCE OF TRAFFIC	1	LS	$4,000.00	$4,000
3	PAVEMENT REMOVAL	450	SY	$15.00	$6,750
4	2" DEPTH PAVEMENT MILLING	4,600	SY	$5.00	$23,000
5	2" SUPERPAVE ASPHALTIC CONCRETE	560	TON	$110.00	$61,600
6	STABILIZED SUBGRADE	450	SY	$8.00	$3,600
7	6" LIMEROCK BASE	450	SY	$15.00	$6,750
8	8" CONCRETE PAVEMENT	450	SY	$70.00	$31,500
9	CURB & GUTTER REPAIR	1	LS	$4,000.00	$4,000
10	DRAINAGE IMPROVEMENTS	1	LS	$5,000.00	$5,000
11	PAVEMENT MARKINGS	1	LS	$4,000.00	$4,000

TOTAL=	**$165,300**
20% CONTINGENCY =	**$33,060**
YANKEE CLIPPER A GRAND TOTAL =	**$198,360**

SECTION: **YANKEE CLIPPER - A1**

ESTIMATE DATE: **21-Oct-11**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
1	MOBILIZATION	1	LS	$24,000.00	$24,000
2	MAINTENANCE OF TRAFFIC	1	LS	$5,000.00	$5,000
3	PAVEMENT REMOVAL	1,080	SY	$10.00	$10,800
4	2" DEPTH PAVEMENT MILLING	4,200	SY	$5.00	$21,000
5	2" SUPERPAVE ASPHALTIC CONCRETE	510	TON	$110.00	$56,100
6	STABILIZED SUBGRADE	1,080	SY	$8.00	$8,640
7	6" LIMEROCK BASE	1,080	SY	$15.00	$16,200
8	8" CONCRETE PAVEMENT	1,080	SY	$65.00	$70,200
9	DOWNSPOUT SYSTEM REPLACEMENT	1	LS	$35,000.00	$35,000
10	DRAINAGE IMPROVEMENTS	1	LS	$6,000.00	$6,000
11	PAVEMENT MARKINGS	1	LS	$5,000.00	$5,000

TOTAL= $257,940

20% CONTINGENCY = $51,588

YANKEE CLIPPER A1 GRAND TOTAL = $309,528

SECTION: **PARKING ACCESS RD - D**

ESTIMATE DATE: **21-Oct-11**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
1	MOBILIZATION	1	LS	$5,000.00	$5,000
2	MAINTENANCE OF TRAFFIC	1	LS	$3,000.00	$3,000
3	PAVEMENT REMOVAL	30	SY	$40.00	$1,200
4	2" DEPTH PAVEMENT MILLING	2,023	SY	$5.00	$10,117
5	2" SUPERPAVE ASPHALTIC CONCRETE	250	TON	$110.00	$27,500
6	FULL DEPTH PATCH	30	SY	$60.00	$1,800
7	PAVEMENT MARKINGS	1	LS	$2,000.00	$2,000

TOTAL=	**$50,617**
20% CONTINGENCY =	**$10,123**
PARKING ACCESS RD D GRAND TOTAL =	**$60,740**

SECTION: **PECAN PARK RD. - A**

ESTIMATE DATE: **21-Oct-11**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
1	MOBILIZATION	1	LS	$4,000.00	$4,000
2	MAINTENANCE OF TRAFFIC	1	LS	$5,000.00	$5,000
3	2" DEPTH PAVEMENT MILLING	850	SY	$6.00	$5,100
4	STABILIZED SUBGRADE	80	SY	$20.00	$1,600
5	6" LIMEROCK BASE	80	SY	$30.00	$2,400
6	2" SUPERPAVE ASPHALTIC CONCRETE	120	TON	$120.00	$14,400
7	TYPE F CURB AND GUTTER	275	LF	$30.00	$8,250
8	PAVEMENT MARKINGS	1	LS	$3,000.00	$3,000
				TOTAL=	**$43,750**
				20% CONTINGENCY =	**$8,750**
				PECAN PARK RD A GRAND TOTAL =	**$52,500**

JACKSONVILLE INTERNATIONAL AIRPORT (JAX)
SCHEMATIC COST ESTIMATE

SECTION: **PECAN PARK RD. - C**

ESTIMATE DATE: **21-Oct-11**

ITEM NO.	***ITEM DESCRIPTION***	***QUANTITY***	***UNIT***	***UNIT PRICE***	***EXTENSION***
1	MOBILIZATION	1	LS	$2,000.00	$2,000
2	MAINTENANCE OF TRAFFIC	1	LS	$2,000.00	$2,000
3	PAVEMENT REMOVAL	150	SY	$40.00	$6,000
4	RE-WORK BASE	150	SY	$20.00	$3,000
5	3" SUPERPAVE ASPHALTIC CONCRETE	30	TON	$200.00	$6,000
6	PAVEMENT MARKINGS	1	LS	$1,000.00	$1,000
				TOTAL=	**$20,000**
				20% CONTINGENCY =	**$4,000**
				PECAN PARK RD C GRAND TOTAL =	**$24,000**

JACKSONVILLE INTERNATIONAL AIRPORT (JAX)
SCHEMATIC COST ESTIMATE

SECTION: **THOMAS IMESON RD - A**

ESTIMATE DATE: **21-Oct-11**

ITEM NO.	***ITEM DESCRIPTION***	***QUANTITY***	***UNIT***	***UNIT PRICE***	***EXTENSION***
1	MOBILIZATION	1	LS	$4,000.00	$4,000
2	MAINTENANCE OF TRAFFIC	1	LS	$3,000.00	$3,000
3	PAVEMENT REMOVAL	620	SY	$15.00	$9,300
4	FULL DEPTH PATCH	620	SY	$30.00	$18,600
5	CURB & GUTTER REPAIR	1	LS	$5,000.00	$5,000
6	TREE REMOVAL	1	LS	$500.00	$500
7	PAVEMENT MARKINGS	1	LS	$3,000.00	$3,000
				TOTAL=	**$43,400**
				20% CONTINGENCY =	**$8,680**
				THOMAS IMESON RD A GRAND TOTAL =	**$52,080**

SECTION: **AIR CARGO LOT - A**
LONG TERM SOLUTION

ESTIMATE DATE: **21-Oct-11**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
1	MOBILIZATION	1	LS	$22,400.00	$22,400
2	MAINTENANCE OF TRAFFIC	1	LS	$3,000.00	$3,000
3	PAVEMENT REMOVAL	1	LS	$5,000.00	$5,000
4	2" DEPTH PAVEMENT MILLING	10,200	SY	$5.00	$51,000
5	2" SUPERPAVE ASPHALTIC CONCRETE	1,200	TON	$110.00	$132,000
6	FULL DEPTH PATCH	1	LS	$15,000.00	$15,000
7	INLET REPAIR	3	EA	$5,000.00	$15,000
8	PAVEMENT MARKINGS	1	LS	$2,500.00	$2,500
				TOTAL=	**$245,900**
				20% CONTINGENCY =	**$49,180**
				AIR CARGO LOT A GRAND TOTAL =	**$295,080**

SECTION: **AIR CARGO LOT - A**
SHORT TERM SOLUTION

ESTIMATE DATE: **21-Oct-11**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
1	MOBILIZATION	1	LS	$11,100.00	$11,100
2	MAINTENANCE OF TRAFFIC	1	LS	$1,000.00	$1,000
3	PAVEMENT REMOVAL	1	LS	$5,000.00	$5,000
4	REMOVAL PAVEMENT MARKINGS	2,500	SF	$2.00	$5,000
5	ASPHALT REJUVENATOR	10,200	SY	$6.00	$61,200
6	FULL DEPTH PATCH	1	LS	$15,000.00	$15,000
7	INLET & PIPE REPAIR	3	EA	$6,000.00	$18,000
8	PAVEMENT MARKINGS	2,500	SF	$2.00	$5,000
				TOTAL=	**$121,300**
				20% CONTINGENCY =	**$24,260**
				AIR CARGO LOT A GRAND TOTAL =	**$145,560**

SECTION: **COLE FLYER LOT - A**

ESTIMATE DATE: **21-Oct-11**

ITEM NO.	***ITEM DESCRIPTION***	***QUANTITY***	***UNIT***	***UNIT PRICE***	***EXTENSION***
1	MOBILIZATION	1	LS	$2,000.00	$2,000
2	MAINTENANCE OF TRAFFIC	1	LS	$1,000.00	$1,000
3	REMOVAL PAVEMENT MARKINGS	230	SF	$4.00	$920
4	ASPHALT REJUVENATOR	1,600	SY	$10.00	$16,000
5	PAVEMENT MARKINGS	1	LS	$2,000.00	$2,000
				TOTAL=	**$21,920**
				20% CONTINGENCY =	**$4,384**
				COLE FLYER LOT A GRAND TOTAL =	**$26,304**

SECTION: **COLE FLYER LOT - B**

ESTIMATE DATE: **21-Oct-11**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
1	MOBILIZATION	1	LS	$2,000.00	$2,000
2	MAINTENANCE OF TRAFFIC	1	LS	$1,000.00	$1,000
3	REMOVAL PAVEMENT MARKINGS	190	SF	$8.00	$1,520
4	ASPHALT REJUVENATOR	500	SY	$10.00	$5,000
5	PAVEMENT MARKINGS	1	LS	$2,000.00	$2,000
				TOTAL=	**$11,520**
				20% CONTINGENCY =	**$2,304**
				COLE FLYER LOT B GRAND TOTAL =	**$13,824**

SECTION: **DELIVERY RD - B**

ESTIMATE DATE: **21-Oct-11**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
1	MOBILIZATION	1	LS	$3,000.00	$3,000
2	MAINTENANCE OF TRAFFIC	1	LS	$1,000.00	$1,000
3	2" DEPTH PAVEMENT MILLING	1,180	SY	$6.00	$7,080
4	2" SUPERPAVE ASPHALTIC CONCRETE	140	TON	$120.00	$16,800
5	PAVEMENT MARKINGS	1	LS	$2,500.00	$2,500
				TOTAL=	**$30,380**
				20% CONTINGENCY =	**$6,076**
				DELIVERY RD B GRAND TOTAL =	**$36,456**

SECTION: **SURFACE PARKING LOT - A**

ESTIMATE DATE: **21-Oct-11**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
1	MOBILIZATION	1	LS	$20,000.00	$20,000
2	MAINTENANCE OF TRAFFIC	1	LS	$4,000.00	$4,000
3	PAVEMENT REMOVAL	1	LS	$3,000.00	$3,000
4	REMOVE PAVEMENT MARKINGS	7,000	SF	$2.00	$14,000
5	ASPHALT REJUVENATOR	32,000	SY	$5.00	$160,000
6	FULL DEPTH PATCH	1	LS	$8,000.00	$8,000
7	PAVEMENT MARKINGS	7,000	SF	$1.50	$10,500
				TOTAL=	**$219,500**
				20% CONTINGENCY =	**$43,900**
				SURFACE PARKING LOT A GRAND TOTAL =	**$263,400**

SECTION: **TOLL PLAZA ACCESS RD - C** ESTIMATE DATE: **21-Oct-11**

ITEM NO.	ITEM DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	EXTENSION
1	MOBILIZATION	1	LS	$8,000.00	$8,000
2	MAINTENANCE OF TRAFFIC	1	LS	$2,000.00	$2,000
3	PAVEMENT REMOVAL	400	SY	$15.00	$6,000
4	REMOVAL PAVEMENT MARKINGS	2,000	SF	$2.00	$4,000
5	ASPHALT REJUVENATOR	7,800	SY	$6.00	$46,800
6	FULL DEPTH PATCH	400	SY	$25.00	$10,000
7	PAVEMENT MARKINGS	2,000	SF	$2.00	$4,000
				TOTAL=	**$80,800**
				20% CONTINGENCY =	**$16,160**
				TOLL PLAZA ACCESS RD C GRAND TOTAL =	**$96,960**

PRESENTATION

JAA
Jacksonville
Aviation
Authority

Jacksonville International Airport

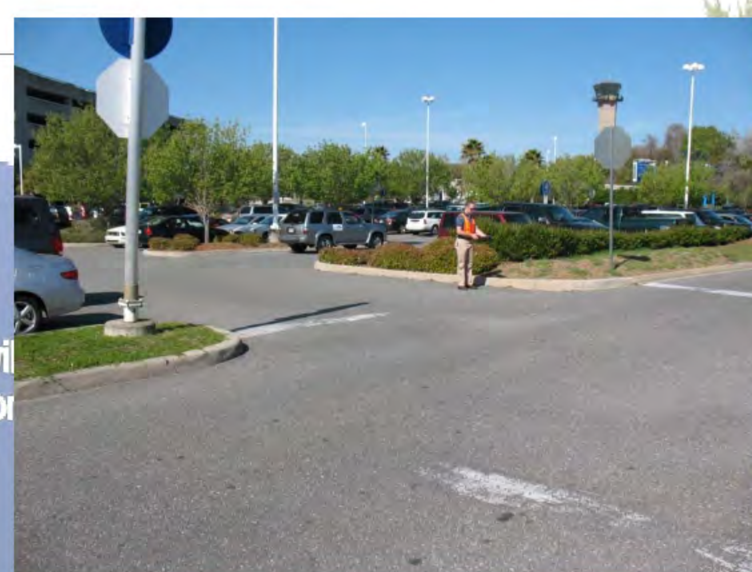
Landside Pavement Condition Report

THE LPA GROUP
TRANSPORTATION CONSULTANTS
A Unit of Michael Baker Corporation

JAA
Jacksonville Aviation Authority

Section 1 – Methodology & Background

- LPA's Process
  - Initial Investigation
    - Identify Pavement Usage
    - Pavement Characteristics



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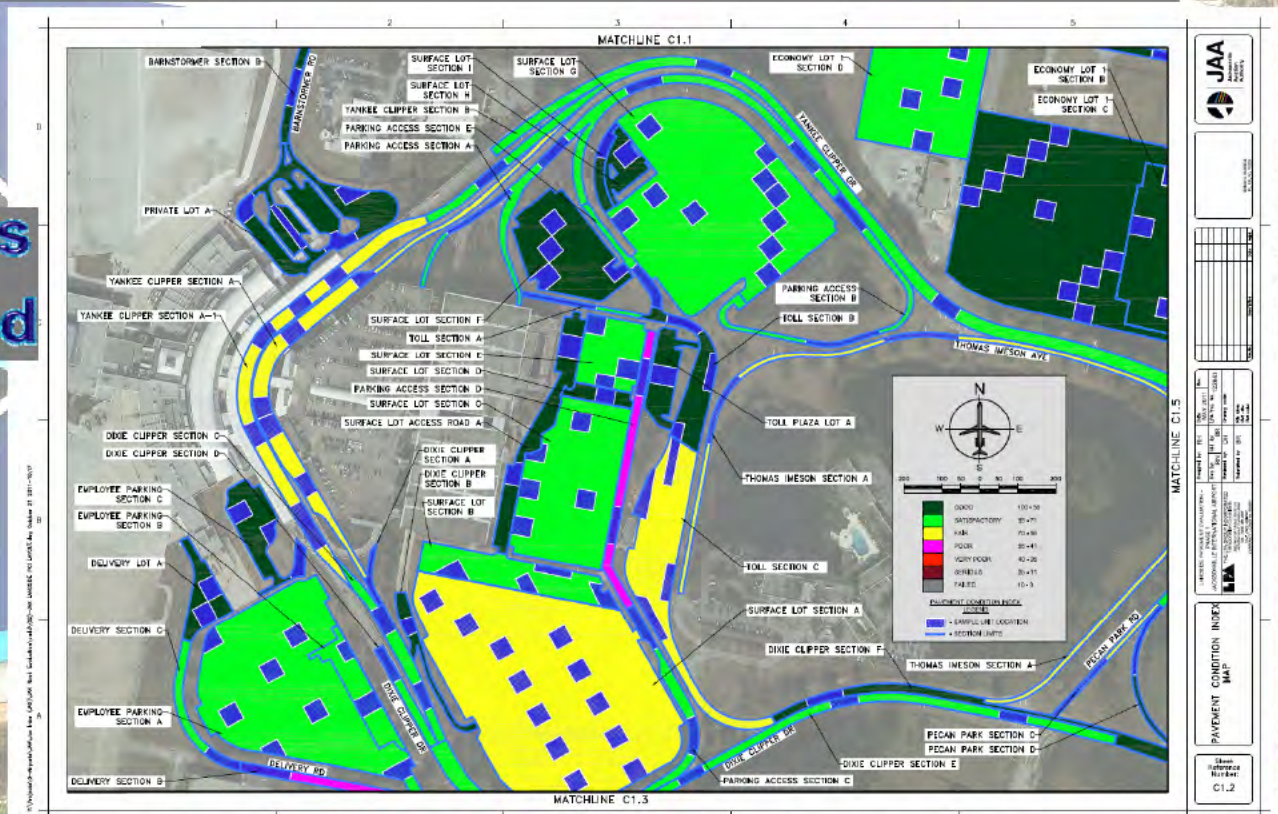
Section 1 – Methodology & Background

- Layout in CAD & GIS
  - Branches
  - Sections
  - Sample Units
  - 10% Sampled



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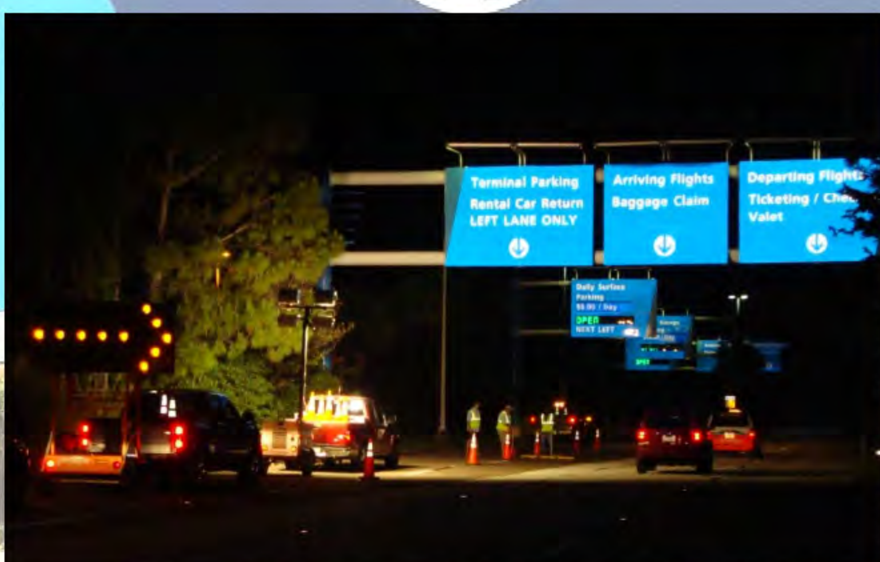
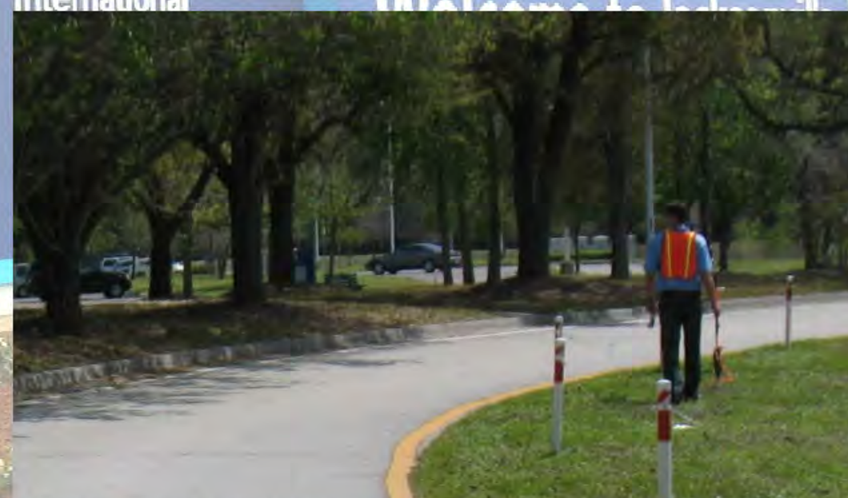
Section 1 – Methodology & Background

- **Field Inspection**
  - **Roadways, Surface Lots, Loading Facilities**
  - **Visual classification and measurement of failure in accordance with ASTM 6433-03 "Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys"**
  - **Logging pavement damage with GPS enabled tablet**
  - **Day and night operations**





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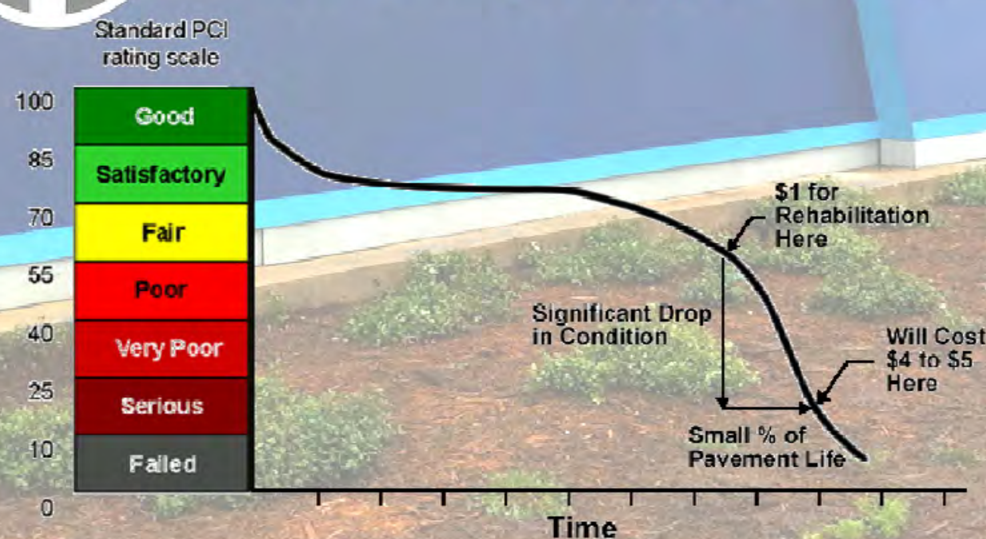
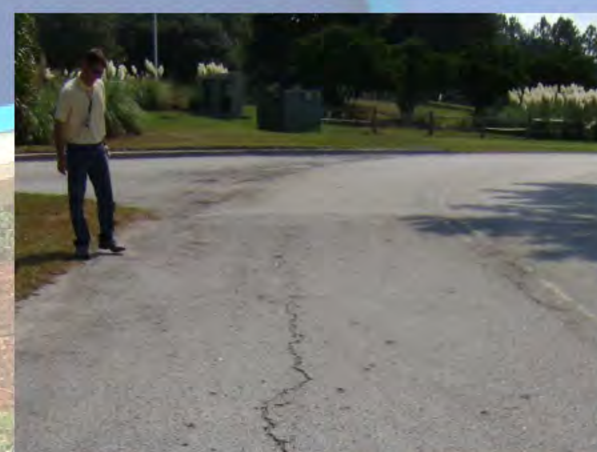
Section 1 – Methodology & Background

- **Data Analysis**
  - Survey Forms Entered into MicroPaver v6.5
  - Paver setup to allow for future Pavement Management System (PMS)
  - Pavement Condition Index (PCI) Assigned through complex analysis
  - Minor Rehabilitation vs Major Repair = $$$



Section 1 – Methodology & Background

- **Quality Control Review**
  - Checking of recorded notes
  - Visual Inspection by independent staff of actual field conditions
  - Deficiencies for areas of concern documented and analyzed in greater detail for repair recommendations.



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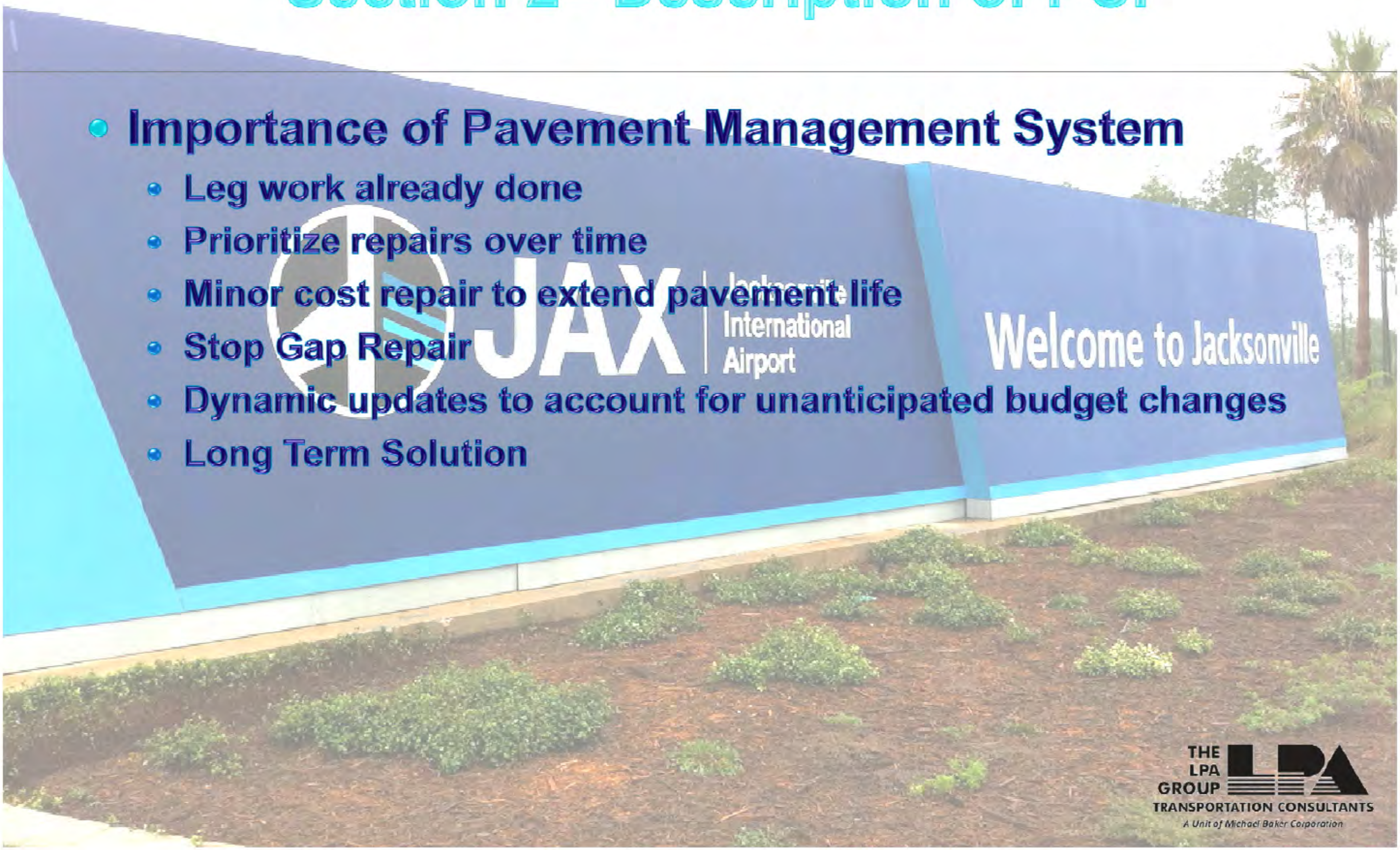
Section 2– Description of PCI

- **Importance of Pavement Management System**
  - Leg work already done
  - Prioritize repairs over time
  - Minor cost repair to extend pavement life
  - Stop Gap Repair
  - Dynamic updates to account for unanticipated budget changes
  - Long Term Solution



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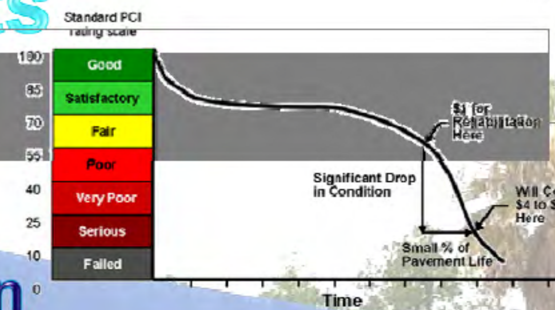
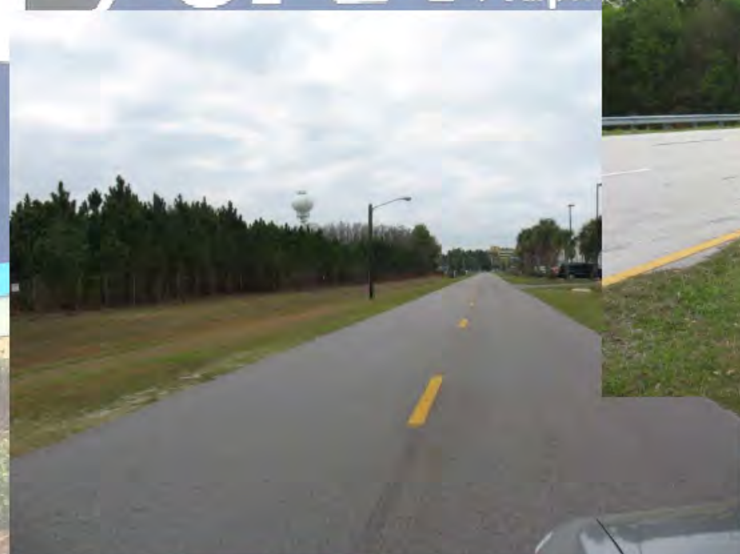
Section 3– Results



- Landside Roadways
  - Generally in "Satisfactory" condition
  - Some areas require localized repairs to return to "Satisfactory" condition



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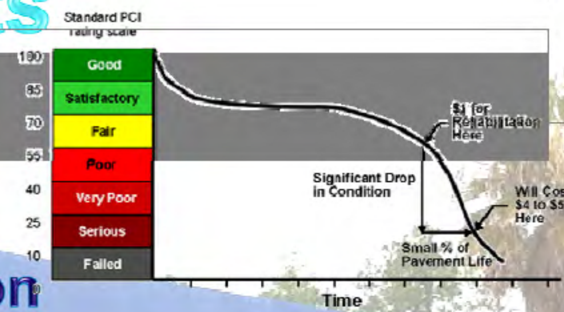
Section 3– Results



- Parking Areas
  - Also in typically "Satisfactory" condition
  - Some areas require localized repairs, sealing, and pavement rejuvenator or other asphalt emulsion coating

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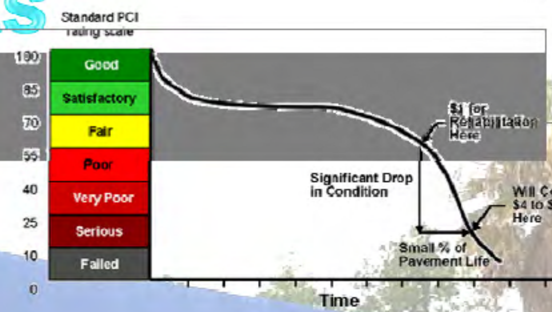
Section 3– Results



- Cargo & Loading Areas
  - Bottom of the "Fair" condition
  - Some areas in critical zone of rapid deterioration
  - Major and minor repairs required

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Section 3– Results

	Branch ID	Section ID	Surface	Use	PCI	PCI Map Location
Below Critical Value (55)	P-CARGO (AIR CARGO LOT)	A	AC	LOADING	52.00	C1.3
	P-COLE (COLE FLYER LOT)	A	AC	PARKING	26.00	C1.3
	P-COLE (COLE FLYER LOT)	B	AC	PARKING	54.00	C1.3
	R-DELI (DELIVERY ROAD)	B	AC	ROADWAY	46.00	C1.2 & C1.3
	R-DIXIE (DIXIE CLIPPER ROAD)	A	AC	ROADWAY	7.00	C1.2
	R-PARK (PARKING ACCESS ROADS)	D	AC	ROADWAY	48.00	C1.2
	R-PECAN (PECAN PARK ROAD)	A	AC	ROADWAY	14.00	C1.5
Critical Range (65 - 55)	R-PECAN (PECAN PARK ROAD)	C	AC	ROADWAY	57.00	C1.2
	R-THOMAS (THOMAS IMESON AVENUE)	A	AC	ROADWAY	66.00	C1.2 & C1.5
	R-YANKEE (YANKEE CLIPPER ROAD)	A	AC	ROADWAY	64.00	C1.2
	R-YANKEE (YANKEE CLIPPER ROAD)	A1	AC	ROADWAY	63.00	C1.2
70> PCI >65	P-SURF (SURFACE PARKING LOTS)	A	AC	PARKING	69.00	C1.2 & C1.3
	R-TOLL (TOLL PLAZA ACCESS ROADS)	C	AC	ROADWAY	68.00.	C1.2

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Section 4 – Recommendations

- **Air Cargo Lot A**
  - **PCI 52 (Below Critical)**
  - **Significant Weathering, Cracking, and Erosion of Asphalt Binder from Oil Drippings.**
  - **Severe Failure of pavement and subgrade around inlets**
  - **Cars and trucks scraping on failed sections**

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Section 4 – Recommendations

- **Air Cargo Lot A**
- **Long Term Fix – $295,080**
  - **Mill & Resurface**
  - **Full Depth Repair of Pavements**
  - **Repair of Pipes and Inlets**
- **Short Term Fix - $145,560**
  - **Seal Pavement & Cracks**
  - **Repair Around Inlets**
  - **Repair Inlets & Pipes as needed**
  - **Full Depth Repair of Load Failures only**

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Section 4 – Recommendations

- **Cole Flyer Lot A & B**
  - PCI 26 & 54 (Below Critical)
  - Adjacent to Vacant Hangar (Embraer)
  - Shallow Cracking similar to Alligator Cracking
  - Two distinctly different pavement areas

- **Recommended Fix - $40,128**
  - Pavement cores to verify cracking does not penetrate the full depth of pavements.
  - Apply surface seal (Fog) coat
  - Minor grading to correct ponding issues

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Section 4 – Recommendations

- **Delivery Road B**
  - **PCI 46 (Below Critical)**
  - **Primarily used by delivery trucks to land side terminal**
  - **Weathering, Alligator Cracking, Rutting.**
  - **Poorly Bonded Overlay resulting in potholes.**
- **Recommended Fix - $36,456**
  - **Mill & Resurface (Select Areas Only)**

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Section 4 – Recommendations

- Dixie Clipper Road A
  - PCI 14 (Below Critical)
  - Near parking garage exit by passenger pickup area
  - Heavy traffic and constant start/stop conditions generating point loads
  - Severe Rutting and Alligator Cracking
  - Past patching attempts have failed

- Recommended Fix - $40,224
  - Remove damaged AC pavements and replace with concrete.

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Section 4 – Recommendations

- Parking Access Road D
  - PCI 48 (Below Critical)
  - Long Term Surface Lot
  - Numerous Utility Patches
  - Isolated areas of distress causing poor ride quality
- Recommended Fix - $60,740
  - Isolated Full Depth Repairs
  - Mill and Resurface

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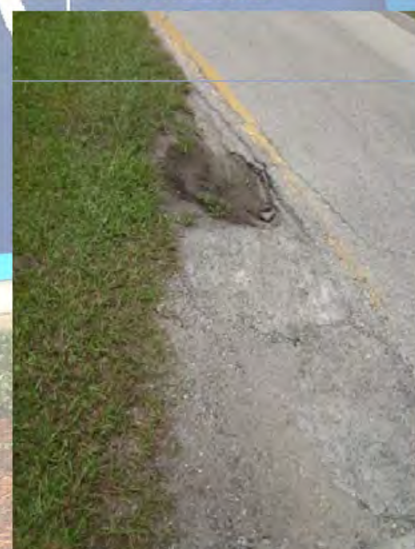
Section 4 – Recommendations

- Pecan Park A
  - PCI 14 (Below Critical)
  - Connects Pecan Park to Yankee Clipper
  - Poorly bonded overlay
  - Failing Patches
  - Alligator Cracking
  - Rutting where vehicles leave pavement



- Recommended Fix - $52,500
  - Widen and add Curb & Gutter
  - Mill and Resurface

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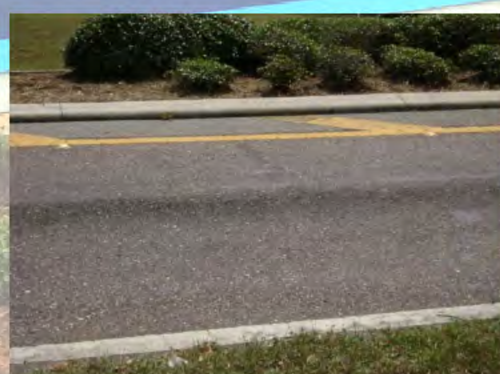
Section 4 – Recommendations

- **Pecan Park C**
  - PCI 57 (Critical Range)
  - Straight stretch to Dixie Clipper Dr.
  - Small section of rutting and failing patches
- **Recommended Fix - $24,000**
  - Reconstruct 90'x15' area
  - Possibly shift markings 1' southeast to eliminate drivers from leaving roadway.



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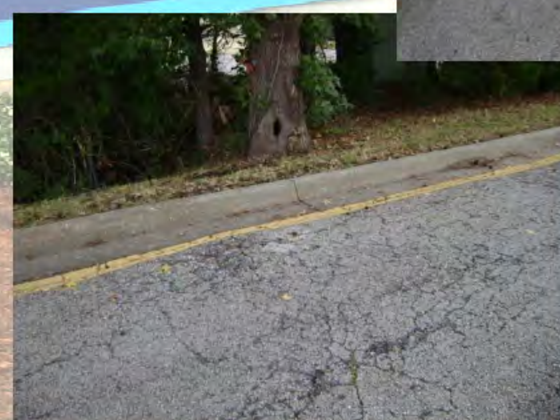
Section 4 – Recommendations

- Thomas Imeson Ave A
  - PCI 66 (Critical Range)
  - Entrance to Clarion Hotel
  - Isolated areas of Severe Distress
  - Roots coming up through pavement
  - Very poor ride quality in areas

- Recommended Fix - $52,080
  - Isolated Full Depth Repairs to 40'x12' and 50'x12' areas
  - Remove Large Tree with roots in pavement.
    - Tree has significant rot



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Section 4 – Recommendations

- Yankee Clipper Rd A
  - PCI 64 (Critical Range)
  - Bus and Taxi Lane in front of passenger pickup at terminal
  - Standing water, damage to C&G, failing patches, rutting, cracking, pavement scars from removal of markings and reflectors.
- Recommended Fix - $198,360
  - Isolated full depth repairs
  - Mill and resurface
  - Reconstruct exit area with concrete where there is severe rutting and failings patches





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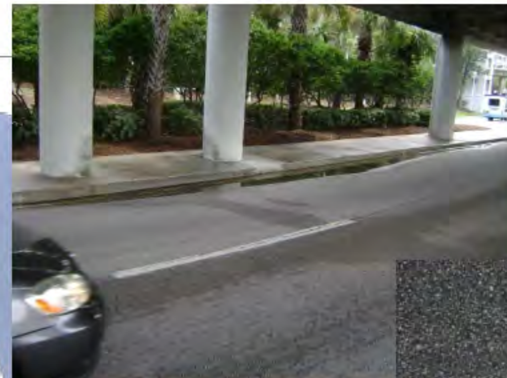
Section 4 – Recommendations

- Yankee Clipper Rd A-1
  - PCI 63 (Critical Range)
  - Passenger pickup lanes at terminal
  - Not adequately designed to handle heavy rainfall
  - Observed areas of standing water and distress caused by standing water
  - Downspout & standpipes for bridge severely leaking & need to be replaced or repaired prior to rehab
  - Ranked high on priority list due to location and usage

- Recommended Fix - $309,528
  - Replace downspout system
  - Mill & resurface
  - Grade adjustments & levelling to facilitate drainage



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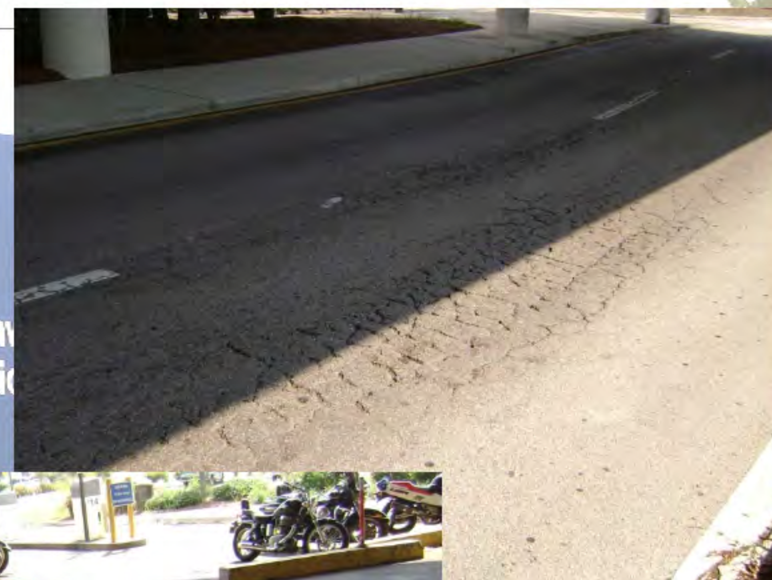
Section 4 – Recommendations

- Yankee Clipper Rd A-1



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Section 4 – Recommendations

- ***Surface Parking Lot A***
  - **PCI 69 (Approaching Critical Range)**
  - **Majority of southern surface lot**
  - **Good structural condition**
  - **Most distress related to weathering and age**
  - **Weeds growing through pavement.**
  - **Some signs & lighting pole bases allowing infiltration of water.**

- **Recommended Fix - $263,400**
  - **Apply Herbicide**
  - **Seal large cracks**
  - **Isolated repairs around light poles**
  - **Apply pavement rejuvenator**

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Section 4 – Recommendations

- **Toll Plaza C**
  - **PCI 68 (Approaching Critical Range)**
  - **Aging pavement**
  - **L&T Cracking, rutting, block cracking**
  - **Rutting at end of toll plaza**

- **Recommended Fix - $96,960**
  - **Apply rejuvenator**
  - **Provide thickened AC pavement section at toll plazas near concrete**

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Section 4 – Recommendations

- **Future Inspections**
  - Critical Pavements with a PCI of 65 or lower should be inspected annually
  - Pavements above PCI 65 should be inspected every two years
- **Pavement Management System**
  - All data and input already collected can be used
  - All future inspections can easily be updated in database created for this project

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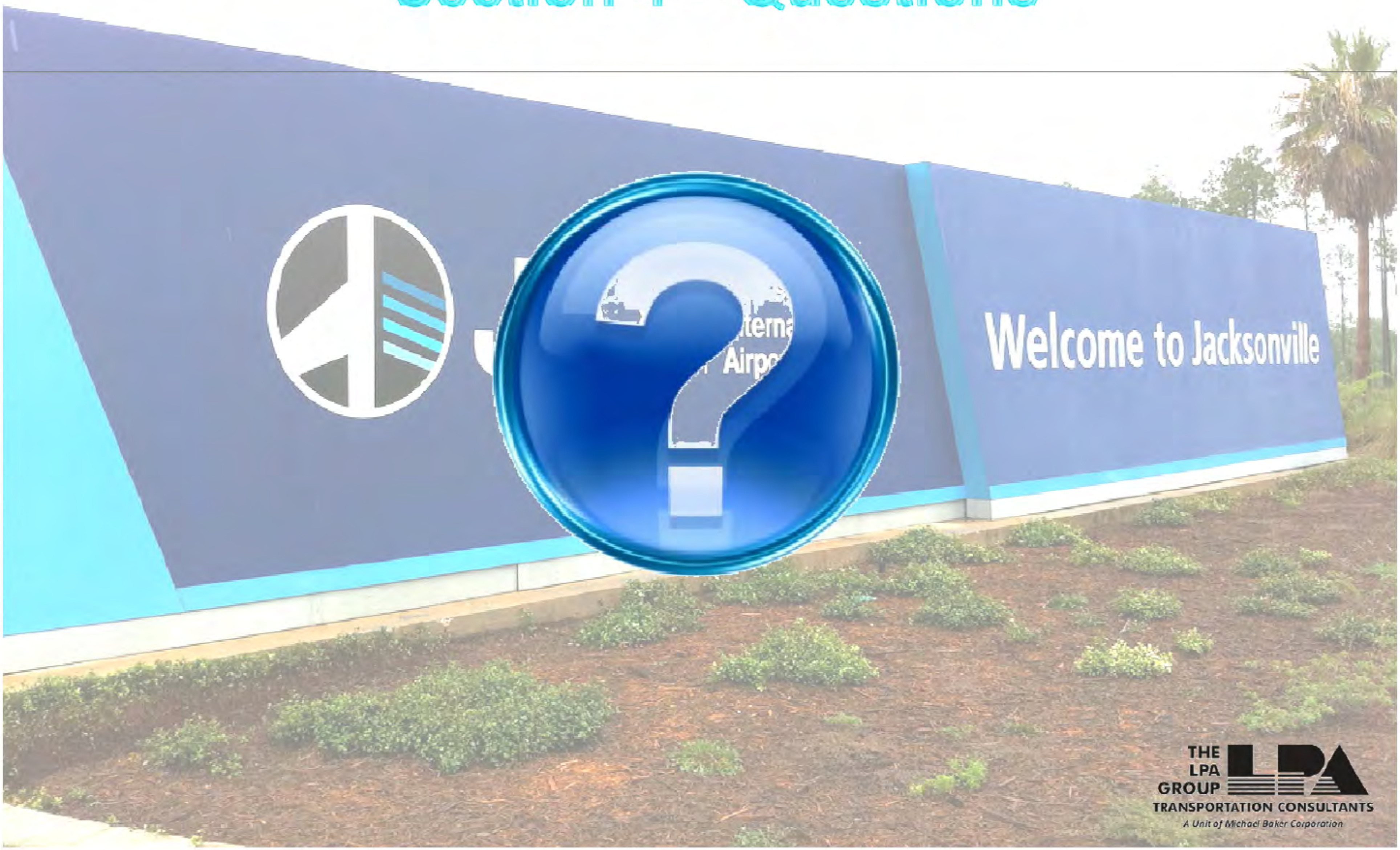
Section 4 – Questions



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STANDARD PRACTICE FOR ROADS AND PARKING LOTS PAVEMENT CONDITION INDEX SURVEYS

ASTM D 6433 - 03

Designation: D 6433 – 03

Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys[1]

This standard is issued under the fixed designation D 6433; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the determination of roads and parking lots pavement condition through visual surveys using the Pavement Condition Index (PCI) method of quantifying pavement condition.

1.2 The PCI for roads and parking lots was developed by the U.S. Army Corps of Engineers (**1, 2**).[2] It is further verified and adopted by DOD and APWA.

1.3 The values stated in inch-pound units are to be regarded as the standard. The SI units given in parentheses are for information only.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* Specific precautionary statements are given in Section 6.

2. Terminology

2.1 *Definitions of Terms Specific to This Standard:*

2.1.1 *additional sample*—a sample unit inspected in addition to the random sample units to include nonrepresentative sample units in the determination of the pavement condition. This includes very poor or excellent samples that are not typical of the section and sample units, which contain an unusual distress such as a utility cut. If a sample unit containing an unusual distress is chosen at random it should be counted as an additional sample unit and another random sample unit should be chosen. If every sample unit is surveyed, then there are no additional sample units.

2.1.2 *asphalt concrete (AC) surface*—aggregate mixture with an asphalt cement binder. This term also refers to surfaces constructed of coal tars and natural tars for purposes of this practice.

2.1.3 *pavement branch*—a branch is an identifiable part of the pavement network that is a single entity and has a distinct function. For example, each roadway or parking area is a separate branch.

2.1.4 *pavement condition index (PCI)*—a numerical rating of the pavement condition that ranges from 0 to 100 with 0 being the worst possible condition and 100 being the best possible condition.

2.1.5 *pavement condition rating*—a verbal description of pavement condition as a function of the PCI value that varies from "failed" to "excellent" as shown in Fig. 1.

2.1.6 *pavement distress*—external indicators of pavement deterioration caused by loading, environmental factors, construction deficiencies, or a combination thereof. Typical distresses are cracks, rutting, and weathering of the pavement surface. Distress types and severity levels detailed in Appendix X1 for AC, and Appendix X2 for PCC pavements must be used to obtain an accurate PCI value.

2.1.7 *pavement sample unit*—a subdivision of a pavement section that has a standard size range: 20 contiguous slabs (±8 slabs if the total number of slabs in the section is not evenly divided by 20 or to accommodate specific field condition) for PCC pavement, and 2500 contiguous square feet, ± 1000 ft^2 (225 ± 90 m^2), if the pavement is not evenly divided by 2500 or to accommodate specific field condition, for AC pavement.

2.1.8 *pavement section*—a contiguous pavement area having uniform construction, maintenance, usage history, and condition. A section should have the same traffic volume and load intensity.

2.1.9 *portland cement concrete (PCC) pavement*—aggregate mixture with portland cement binder including nonreinforced and reinforced jointed pavement.

2.1.10 *random sample*—a sample unit of the pavement section selected for inspection by random sampling techniques, such as a random number table or systematic random procedure.

3. Summary of Practice

3.1 The pavement is divided into branches that are divided into sections. Each section is divided into sample units. The type and severity of pavement distress is assessed by visual

[1] This practice is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.39 on Nondestructive Testing of Pavement Structures.

Current edition approved Dec. 1, 2003. Published January 2004. Originally approved in 1999. Last previous edition approved in 1999 as D 6433 – 99.

[2] The boldface numbers in parentheses refer to the list of references at the end of this standard.

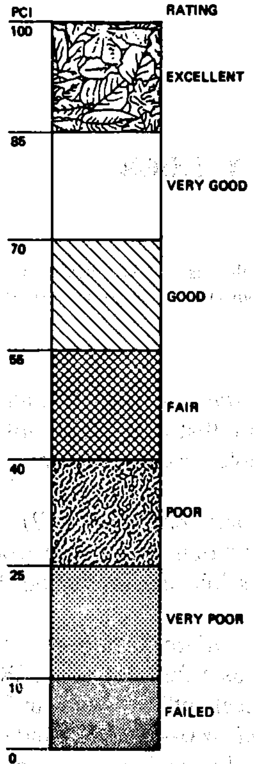


FIG. 1 Pavement Condition Index (PCI) and Rating Scale

inspection of the pavement sample units. The quantity of the distress is measured as described in Appendix X1 and Appendix X2. The distress data are used to calculate the PCI for each sample unit. The PCI of the pavement section is determined based on the PCI of the inspected sample units within the section.

4. Significance and Use

4.1 The PCI is a numerical indicator that rates the surface condition of the pavement. The PCI provides a measure of the present condition of the pavement based on the distress observed on the surface of the pavement, which also indicates the structural integrity and surface operational condition (localized roughness and safety). The PCI cannot measure structural capacity nor does it provide direct measurement of skid resistance or roughness. It provides an objective and rational basis for determining maintenance and repair needs and priorities. Continuous monitoring of the PCI is used to establish the rate of pavement deterioration, which permits early identification of major rehabilitation needs. The PCI provides feedback on pavement performance for validation or improvement of current pavement design and maintenance procedures.

5. Apparatus

5.1 *Data Sheets*, or other field recording instruments that record at a minimum the following information: date, location, branch, section, sample unit size, slab number and size, distress types, severity levels, quantities, and names of surveyors. Example data sheets for AC and PCC pavements are shown in Figs. 2 and 3.

5.2 *Hand Odometer Wheel*, that reads to the nearest 0.1 ft (30 mm).

5.3 *Straightedge or String Line*, (AC only), 10 ft (3 m).

5.4 *Scale*, 12 in. (300 mm) that reads to ⅛ in. (3 mm) or better. Additional 12-in. (300 mm) ruler or straightedge is needed to measure faulting in PCC pavements.

5.5 *Layout Plan*, for network to be inspected.

6. Hazards

6.1 Traffic is a hazard as inspectors may walk on the pavement to perform the condition survey.

7. Sampling and Sample Units

7.1 Identify branches of the pavement with different uses such as roadways and parking on the network layout plan.

7.2 Divide each branch into sections based on the pavements design, construction history, traffic, and condition.

7.3 Divide the pavement sections into sample units. If the pavement slabs in PCC have joint spacing greater than 25 ft (8 m) subdivide each slab into imaginary slabs. The imaginary slabs all should be less than or equal to 25 ft (8 m) in length, and the imaginary joints dividing the slabs are assumed to be in perfect condition. This is needed because the deduct values developed for jointed concrete slabs are less than or equal to 25 ft (8 m).

7.4 Individual sample units to be inspected should be marked or identified in a manner to allow inspectors and quality control personnel to easily locate them on the pavement surface. Paint marks along the edge and sketches with locations connected to physical pavement features are acceptable. It is necessary to be able to accurately relocate the sample units to allow verification of current distress data, to examine changes in condition with time of a particular sample unit, and to enable future inspections of the same sample unit if desired.

7.5 Select the sample units to be inspected. The number of sample units to be inspected may vary from the following: all of the sample units in the section, a number of sample units that provides a 95 % confidence level, or a lesser number.

7.5.1 All sample units in the section may be inspected to determine the average PCI of the section. This is usually precluded for routine management purposes by available manpower, funds, and time. Total sampling, however, is desirable for project analysis to help estimate maintenance and repair quantities.

7.5.2 The minimum number of sample units (n) that must be surveyed within a given section to obtain a statistically adequate estimate (95 % confidence) of the PCI of the section is calculated using the following formula and rounding n to the next highest whole number (see Eq 1).

ASPHALT SURFACED ROADS AND PARKING LOTS CONDITION SURVEY DATA SHEET FOR SAMPLE UNIT

SKETCH:

BRANCH__________ SECTION__________ SAMPLE UNIT__________
SURVEYED BY__________ DATE__________ SAMPLE AREA__________

1. Alligator Cracking
2. Bleeding
3. Block Cracking
4. Bumps and Sags
5. Corrugation
6. Depression
7. Edge Cracking
8. Jt. Reflection Cracking
9. Lane/Shoulder Drop Off
10. Long & Trans Cracking
11. Patching & Util Cut Patching
12. Polished Aggregate
13. Potholes
14. Railroad Crossing
15. Rutting
16. Shoving
17. Slippage Cracking
18. Swell
19. Weathering/Raveling

DISTRESS SEVERITY	QUANTITY									TOTAL	DENSITY %	DEDUCT VALUE

FIG. 2 Flexible Pavement Condition Survey Data Sheet for Sample Unit

CONCRETE SURFACED ROADS AND PARKING LOTS
CONDITION SURVEY DATA SHEET FOR SAMPLE UNIT

BRANCH__________ SECTION__________ SAMPLE UNIT__________
SURVEYED BY__________ DATE__________ SAMPLE AREA__________

Distress Types

21. Blow up/Buckling	31. Polished Aggregate
22. Corner Break	32. Popouts
23. Divided Slab	33. Pumping
24. Durability Crack	34. Punchout
25. Faulting	35. Railroad Crossing
26. Joint Seal	36. Scaling
27. Lane/Shoulder	37. Shrinkage
28. Linear Cracking	38. Spalling Corner
29. Patching (Large)	39. Spalling Joint
30. Patching (Small)	

DIST TYPE	SEV	NO. SLABS	DENSITY %	DEDUCT VALUE

SKETCH:

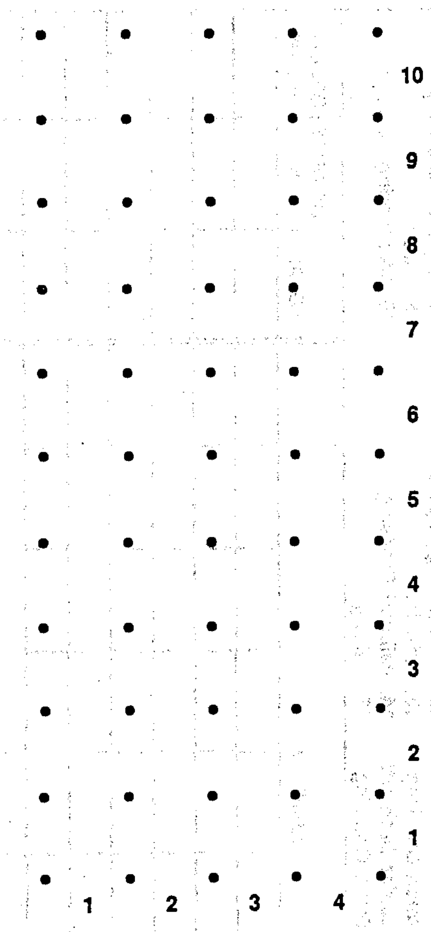


FIG. 3 Joint Rigid Pavement Condition Survey Data Sheet for Sample Unit

$$n = Ns^2/((e^2/4)(N-1) + s^2) \quad (1)$$

where:

e = acceptable error in estimating the section PCI; commonly, $e = \pm 5$ PCI points;

s = standard deviation of the PCI from one sample unit to another within the section. When performing the initial inspection the standard deviation is assumed to be ten for AC pavements and 15 for PCC pavements. This assumption should be checked as described below after PCI values are determined. For subsequent inspections, the standard deviation from the preceding inspection should be used to determine n; and,

N = total number of sample units in the section.

7.5.2.1 If obtaining the 95 % confidence level is critical, the adequacy of the number of sample units surveyed must be confirmed. The number of sample units was estimated based on an assumed standard deviation. Calculate the actual standard deviation (s) as follows (see Eq 2):

$$s = \left(\sum_{i=1}^{n}(PCI_i - PCI_s)^2/(n-1)\right)^{1/2} \quad (2)$$

where:

PCI_i = PCI of surveyed sample units i,

PCI_s = PCI of section (mean PCI of surveyed sample units), and

n = total number of sample units surveyed.

7.5.2.2 Calculate the revised minimum number of sample units (Eq 1) to be surveyed using the calculated standard deviation (Eq 2). If the revised number of sample units to be surveyed is greater than the number of sample units already surveyed, select and survey additional random sample units.

These sample units should be spaced evenly across the section. Repeat the process of checking the revised number of sample units and surveying additional random sample units until the total number of sample units surveyed equals or exceeds the minimum required sample units (n) in Eq 1, using the actual total sample standard deviation.

7.5.3 Once the number of sample units to be inspected has been determined, compute the spacing interval of the units using systematic random sampling. Samples are spaced equally throughout the section with the first sample selected at random. The spacing interval (i) of the units to be sampled is calculated by the following formula rounded to the next lowest whole number:

$$i = N/n \tag{3}$$

where:

N = total number of sample units in the section, and
n = number of sample units to be inspected.

The first sample unit to be inspected is selected at random from sample units 1 through i. The sample units within a section that are successive increments of the interval i after the first randomly selected unit also are inspected.

7.6 A lessor sampling rate than the above mentioned 95 % confidence level can be used based on the condition survey objective. As an example, one agency uses the following table for selecting the number of sample units to be inspected for other than project analysis:

Given	Survey
1 to 5 sample units	1 sample unit
6 to 10 sample units	2 sample units
11 to 15 sample units	3 sample units
16 to 40 sample units	4 sample units
over 40 sample units	10 %

7.7 Additional sample units only are to be inspected when nonrepresentative distresses are observed as defined in 2.1.1. These sample units are selected by the user.

8. Inspection Procedure

8.1 The definitions and guidelines for quantifying distresses for PCI determination are given in Appendix X1 for AC pavements. Using this test method, inspectors should identify distress types accurately 95 % of the time. Linear measurements should be considered accurate when they are within 10 % if remeasured, and area measurements should be considered accurate when they are within 20 % if remeasured. Distress severities that one determines based on ride quality are considered subjective.

8.2 *Asphalt Concrete (AC) Surfaced Pavement*—Individually inspect each sample unit chosen. Sketch the sample unit, including orientation. Record the branch and section number and the number and type of the sample unit (random or additional). Record the sample unit size measured with the hand odometer. Conduct the distress inspection by walking over the sidewalk/shoulder of the sample unit being surveyed, measuring the quantity of each severity level of every distress type present, and recording the data. Each distress must correspond in type and severity to that described in Appendix X1. The method of measurement is included with each distress description. Repeat this procedure for each sample unit to be inspected. A copy of a Blank Flexible Pavement Condition Survey Data Sheet for Sample Unit is included in Fig. 2.

8.3 *PCC Pavements*—Individually inspect each sample unit chosen. Sketch the sample unit showing the location of the slabs. Record the sample unit size, branch and section number, and number and type of the sample unit (random or additional), the number of slabs in the sample unit and the slab size measured with the hand odometer. Perform the inspection by walking over the sidewalk/shoulder of the sample unit being surveyed and recording all distress existing in the slab along with their severity level. Each distress type and severity must correspond with that described in Appendix X2. Summarize the distress types, their severity levels and the number of slabs in the sample unit containing each type and severity level. Repeat this procedure for each sample unit to be inspected. A copy of a Blank Jointed Rigid Pavement Condition Survey Data Sheet for Sample Unit is included in Fig. 3.

9. Calculation of PCI for Asphalt Concrete (AC) Pavement

9.1 Add up the total quantity of each distress type at each severity level, and record them in the "Total Severities" section. For example, Fig. 4 shows five entries for the Distress Type 1, "Alligator Cracking": 5L, 4L, 4L, 8H, and 6H. The distress at each severity level is summed and entered in the "Total Severity" section as 13 ft^2 (1.2 m^2) of low severity and 14 ft^2 (1.3 m^2) of medium severity. The units for the quantities may be either in square feet (square meters), linear feet (meters), or number of occurrences, depending on the distress type.

9.2 Divide the total quantity of each distress type at each severity level from 9.1 by the total area of the sample unit and multiply by 100 to obtain the percent density of each distress type and severity.

9.3 Determine the deduct value (DV) for each distress type and severity level combination from the distress deduct value curves in Appendix X3.

9.4 Determine the maximum corrected deduct value (CDV). The procedure for determining maximum CDV from individual DVs is identical for both AC and PCC pavement types.

9.5 The following procedure must be used to determine the maximum CDV.

9.5.1 If none or only one individual deduct value is greater than two, the total value is used in place of the maximum CDV in determining the PCI; otherwise, maximum CDV must be determined using the procedure described in 9.5.2-9.5.5.

9.5.2 List the individual deduct values in descending order. For example, in Fig. 4 this will be 25.1, 23.4, 17.9, 11.2, 7.9, 7.5, 6.9, and 5.3.

9.5.3 Determine the allowable number of deducts, m, from Fig. 5, or using the following formula (see Eq 4):

$$m = 1 + (9/98)(100\text{–HDV}) \leq 10 \tag{4}$$

where:

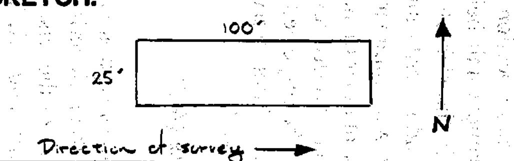
m = allowable number of deducts including fractions (must be less than or equal to ten), and
HDV = highest individual deduct value.

(For the example in Fig. 4, $m = 1 + (9/98)(100\text{-}25.1) = 7.9$).

ASPHALT SURFACED ROADS AND PARKING LOTS CONDITION SURVEY DATA SHEET FOR SAMPLE UNIT

BRANCH SPRINGFIELD SECTION 001 SAMPLE UNIT 1
SURVEYED BY KAK DATE 10 Jul 93 SAMPLE AREA 2500 sf

SKETCH:



1. Alligator Cracking
2. Bleeding
3. Block Cracking
4. Bumps and Sags
5. Corrugation
6. Depression
7. Edge Cracking
8. Jt. Reflection Cracking
9. Lane/Shoulder Drop Off
10. Long & Trans Cracking
11. Patching & Util Cut Patching
12. Polished Aggregate
13. Potholes
14. Railroad Crossing
15. Rutting
16. Shoving
17. Slippage Cracking
18. Swell
19. Weathering/Raveling

DISTRESS SEVERITY	QUANTITY									TOTAL	DENSITY %	DEDUCT VALUE
1L	1×5	1×4	1×4							13	0.52	7.9
1H	1×8	1×6								14	0.56	23.4
7L	32	15	18	24	41					130	5.20	7.5
8M	20	15	35	27	23	10	13			143	5.72	25.1
11H	3×4	2×5								22	0.88	17.9
13L	1									1	0.04	11.2
15L	4	9	8							21	0.84	6.9
19L	250									250	10.0	5.3

FIG. 4 Example of a Flexible Pavement Condition Survey Data Sheet

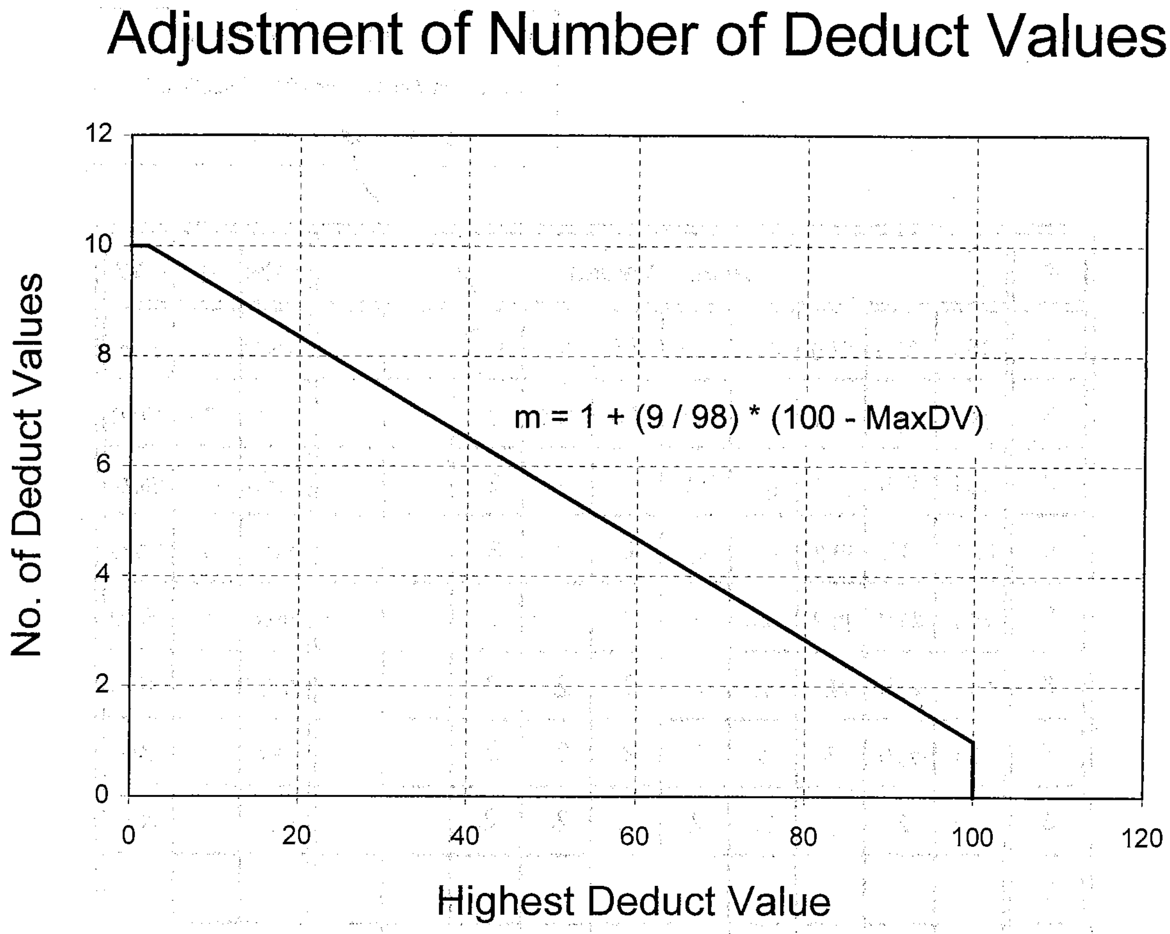


FIG. 5 Adjustment of Number of Deduct Values

9.5.4 The number of individual deduct values is reduced to the m largest deduct values, including the fractional part. For the example in Fig. 6, the values are 25.1, 23.4, 17.9, 11.2, 7.9, 7.5, 6.9, and 4.8 (the 4.8 is obtained by multiplying 5.3 by (7.9 – 7 = 0.9)). If less than m deduct values are available, all of the deduct values are used.

9.5.5 Determine maximum CDV iteratively, as shown in Fig. 6.

9.5.5.1 Determine total deduct value by summing individual deduct values. The total deduct value is obtained by adding the individual deduct values in 9.5.4, that is, 104.7.

9.5.5.2 Determine q as the number of deducts with a value greater than 2.0. For example, in Fig. 6, $q = 8$.

9.5.5.3 Determine the CDV from total deduct value and q by looking up the appropriate correction curve for AC pavements in Fig. X4.15 in Appendix X3.

9.5.5.4 Reduce the smallest individual deduct value greater than 2.0 to 2.0 and repeat 9.5.5.1-9.5.5.3 until $q = 1$.

9.5.5.5 Maximum CDV is the largest of the CDVs.

9.6 Calculate PCI by subtracting the maximum CDV from 100: PCI = 100-max CDV.

9.7 Fig. 6 shows a summary of PCI calculation for the example AC pavement data in Fig. 4. A blank PCI calculation form is included in Fig. 2.

10. Calculation of PCI for Portland Cement Concrete (PCC) Pavement

10.1 For each unique combination of distress type and severity level, add up the total number of slabs in which they occur. For the example in Fig. 7, there are two slabs containing low-severity corner break (Distress 22L).

10.2 Divide the number of slabs from 10.1 by the total number of slabs in the sample unit and multiply by 100 to obtain the percent density of each distress type and severity combination.

10.3 Determine the deduct values for each distress type severity level combination using the corresponding deduct curve in Appendix X4.

10.4 Determine PCI by following the procedures in 9.5 and 9.6, using the correction curve for PCC pavements (see Fig. X4.20 in Appendix X4) in place of the correction curve for AC pavements.

10.5 Fig. 7 shows a summary of PCI calculation for the example PCC pavement distress data in Fig. 8.

11. Determination of Section PCI

11.1 If all surveyed sample units are selected randomly, then the PCI of the section (PCI_s) is calculated as the area weighted PCI of the randomly surveyed sample units ($\overline{PCI_r}$) using equation 5:

m = 1 + (9/98) (100 - 25.1) = 7.9 $<$ 8

Use highest 7 deducts and 0.9 of eighth deduct.

0.9 x 5.3 = 4.8

#	Deduct Values										Total	q	CDV
1	25.1	23.4	17.9	11.2	7.9	7.5	6.9	(4.8)			104.7	8	51.0
2	25.1	23.4	17.9	11.2	7.9	7.5	6.9	2			101.9	7	50.0
3	25.1	23.4	17.9	11.2	7.9	7.5	2	2			96.0	6	46.0
4	25.1	23.4	17.9	11.2	7.9	2	2	2			90.5	5	47.0
5	25.1	23.4	17.9	11.2	2	2	2	2			84.6	4	48.0
6	25.1	23.4	17.9	2	2	2	2	2			75.4	3	48.0
7	25.1	23.4	2	2	2	2	2	2			59.5	2	44.0
8	25.1	2	2	2	2	2	2	2			38.1	1	38.0
9													
10													

Max CDV = 51

PCI = 100 - Max CDV = 49

Rating = FAIR

FIG. 6 Calculation of Corrected PCI Value—Flexible Pavement

$$PCI_S = \overline{PCI_r} = \frac{\sum_{i=1}^{n} (PCI_{ri} \cdot A_{ri})}{\sum_{i=1}^{n} A_{ri}} \quad (5)$$

where:

$\overline{PCI_r}$ = area weighted PCI of randomly surveyed sample units,
PCI_{ri} = PCI of random sample unit *i*,
A_{ri} = area of random sample unit *i*,
n = number of random sample units surveyed.

If additional sample units, as defined in 2.1.1, are surveyed, the area weighted PCI of the surveyed additional units ($\overline{PCI_a}$) is calculated using equation 6. The PCI of the pavement section is calculated using equation 7.

$$\overline{PCI_a} = \frac{\sum_{i=1}^{m} (PCI_{ai} \cdot A_{ai})}{\sum_{i=1}^{m} A_{ai}} \quad (6)$$

$$PCI_s = \frac{\overline{PCI_r}(A - \sum_{i=1}^{m} A_{ai}) + \overline{PCI_a}(\sum_{i=1}^{m} A_{ai})}{A} \quad (7)$$

CONCRETE SURFACED ROADS AND PARKING LOTS
CONDITION SURVEY DATA SHEET FOR SAMPLE UNIT

BRANCH SECOND SECTION 001 SAMPLE UNIT 1
SURVEYED BY KAK DATE 10 JUL 93 SAMPLE AREA 20 slabs

Distress Types

21. Blow up/Buckling
22. Corner Break
23. Divided Slab
24. Durability Crack
25. Faulting
26. Joint Seal
27. Lane/Shoulder
28. Linear Cracking
29. Patching (Large)
30. Patching (Small)
31. Polished Aggregate
32. Popouts
33. Pumping
34. Punchout
35. Railroad Crossing
36. Scaling
37. Shrinkage
38. Spalling Corner
39. Spalling Joint

DIST TYPE	SEV	NO. SLABS	DENSITY %	DEDUCT VALUE
26	H	—	100	8.0
22	L	3	15	12.6
22	M	1	5	7.7
23	M	3	15	30.5
30	M	4	20	4.4
34	M	2	10	25.1
38	L	6	30	5.8
39	H	1	5	9.0

SKETCH:

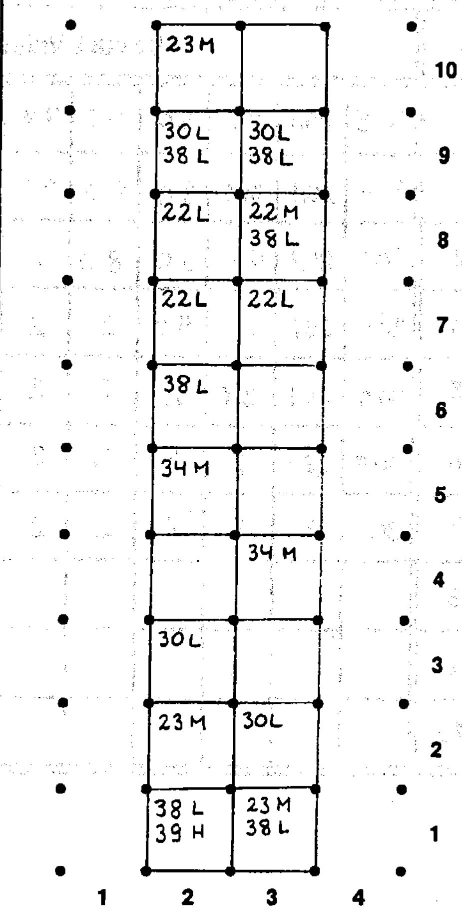


FIG. 7 Example of a Jointed Rigid Pavement Condition Survey Data Sheet

$\overline{PCI_a}$ = area weighted PCI of additional sample units,
PCI_{ai} = PCI of additional sample unit i,
A_{ai} = area of additional sample unit i,
A = area of section,
m = number of additional sample units surveyed, and
PCI_s = area weighted PCI of the pavement section.

11.2 Determine the overall condition rating of the section by using the section PCI and the condition rating scale in Fig. 1.

12. Report

12.1 Develop a summary report for each section. The summary lists section location, size, total number of sample units, the sample units inspected, the PCIs obtained, the average PCI for the section, and the section condition rating.

m = 1 + (9/98) (100 - 30.5) = 7.4 < 8

Use highest 7 deducts and 0.4 of eighth deduct.

0.4 x 4.4 = 1.76

#	Deduct Values										Total	q	CDV
1	30.5	25.1	12.6	9.0	8.0	7.7	5.8	1.76			100.5	7	50.0
2	30.5	25.1	12.6	9.0	8.0	7.7	2	1.76			96.7	6	49.5
3	30.5	25.1	12.6	9.0	8.0	2	2	1.76			91.0	5	51.0
4	30.5	25.1	12.6	9.0	2	2	2	1.76			85.0	4	49.0
5	30.5	25.1	12.6	2	2	2	2	1.76			78.0	3	50.0
6	30.5	25.1	2	2	2	2	2	1.76			67.4	2	50.0
7	30.5	2	2	2	2	2	2	1.76			44.3	1	44.3
8													
9													
10													

Max CDV = 51

PCI = 100 - Max CDV = 49

Rating = FAIR

FIG. 8 Calculation of Corrected PCI Value—Jointed Rigid Pavement

APPENDIXES

(Nonmandatory Information)

X1. Distress in Asphalt Pavements

X1.1 During the field condition surveys and validation of the PCI, several questions are commonly asked about the identification and measurement of some of the distresses. The answers to these questions for each distress are included under the heading "How to Measure." For convenience, however, the most frequently raised issues are addressed below:

X1.1.1 If alligator cracking and rutting occur in the same area, each is recorded separately at its respective severity level.

X1.1.2 If bleeding is counted, polished aggregate is not counted in the same area.

X1.1.3 Spalling as used herein is the further breaking of pavement or loss of materials around cracks or joints.

X1.1.4 If a crack does not have the same severity level along its entire length, each portion of the crack having a different severity level should be recorded separately. If, however, the different levels of severity in a portion of a crack cannot be easily divided, that portion should be rated at the highest severity level present.

X1.1.5 If any distress, including cracking and potholes, is found in a patched area, it is not recorded; its effect on the patch, however, is considered in determining the severity level of the patch.

X1.1.6 A significant amount of polished aggregate should be present before it is counted.

X1.1.7 A distress is said to be raveled if the area surrounding the distress is broken (sometimes to the extent that pieces are removed).

X1.2 The reader should note that the items above are general issues and do not stand alone as inspection criteria. To properly measure each distress type, the inspector must be familiar with its individual measurement criteria.

X1.3 Nineteen distress types for asphalt-surfaced pavements are listed alphabetically in this manual.

RIDE QUALITY

X1.4 Ride quality must be evaluated in order to establish a severity level for the following distress types:

X1.4.1 Bumps.

X1.4.2 Corrugation.

X1.4.3 Railroad crossings.

X1.4.4 Shoving.

X1.4.5 Swells.

X1.4.6 To determine the effect these distresses have on ride quality, the inspector should drive at the normal operating speed and use the following severity-level definitions of ride quality:

X1.4.6.1 **L**—Low. Vehicle vibrations, for example, from corrugation, are noticeable, but no reduction in speed is necessary for comfort or safety. Individual bumps or settlements, or both, cause the vehicle to bounce slightly, but create little discomfort.

X1.4.6.2 **M**—Medium. Vehicle vibrations are significant and some reduction in speed is necessary for safety and comfort. Individual bumps or settlements, or both, cause the vehicle to bounce significantly, creating some discomfort.

X1.4.6.3 **H**—High. Vehicle vibrations are so excessive that speed must be reduced considerably for safety and comfort. Individual bumps or settlements, or both, cause the vehicle to bounce excessively, creating substantial discomfort, safety hazard, or high potential vehicle damage.

X1.4.7 The inspector should drive at the posted speed in a sedan that is representative of cars typically seen in local traffic. Pavement sections near stop signs should be rated at a deceleration speed appropriate for the intersection.

ALLIGATOR CRACKING (FATIGUE)

X1.5 *Description*—Alligator or fatigue cracking is a series of interconnecting cracks caused by fatigue failure of the asphalt concrete surface under repeated traffic loading. Cracking begins at the bottom of the asphalt surface, or stabilized base, where tensile stress and strain are highest under a wheel load. The cracks propagate to the surface initially as a series of parallel longitudinal cracks. After repeated traffic loading, the cracks connect, forming many sided, sharp-angled pieces that develop a pattern resembling chicken wire or the skin of an alligator. The pieces are generally less than 0.5 m (1.5 ft) on the longest side. Alligator cracking occurs only in areas subjected to repeated traffic loading, such as wheel paths. Pattern-type cracking that occurs over an entire area not subjected to loading is called "block cracking," which is not a load-associated distress.

X1.5.1 *Severity Levels*:

X1.5.1.1 **L**—Fine, longitudinal hairline cracks running parallel to each other with no, or only a few interconnecting cracks. The cracks are not spalled (Fig. X1.1).

X1.5.1.2 **M**—Further development of light alligator cracks into a pattern or network of cracks that may be lightly spalled (Fig. X1.2).

X1.5.1.3 **H**—Network or pattern cracking has progressed so that the pieces are well defined and spalled at the edges. Some of the pieces may rock under traffic (Fig. X1.3).

X1.5.2 *How to Measure*—Alligator cracking is measured in square meters (square feet) of surface area. The major difficulty in measuring this type of distress is that two or three levels of severity often exist within one distressed area. If these portions can be easily distinguished from each other, they should be measured and recorded separately; however, if the different levels of severity cannot be divided easily, the entire area should be rated at the highest severity present. If alligator cracking and rutting occur in the same area, each is recorded separately as its respective severity level.

BLEEDING

X1.6 *Description*—Bleeding is a film of bituminous material on the pavement surface that creates a shiny, glasslike, reflecting surface that usually becomes quite sticky. Bleeding is caused by excessive amounts of asphaltic cement or tars in the mix, excess application of a bituminous sealant, or low air void content, or a combination thereof. It occurs when asphalt fills the voids of the mix during hot weather and then expands onto the pavement surface. Since the bleeding process in not reversible during cold weather, asphalt or tar will accumulate on the surface.

FIG. X1.1 Low-Severity Alligator Cracking

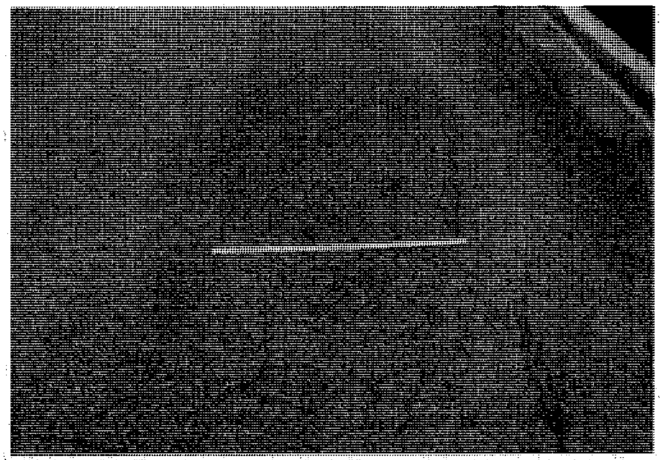


FIG. X1.2 Medium-Severity Alligator Cracking

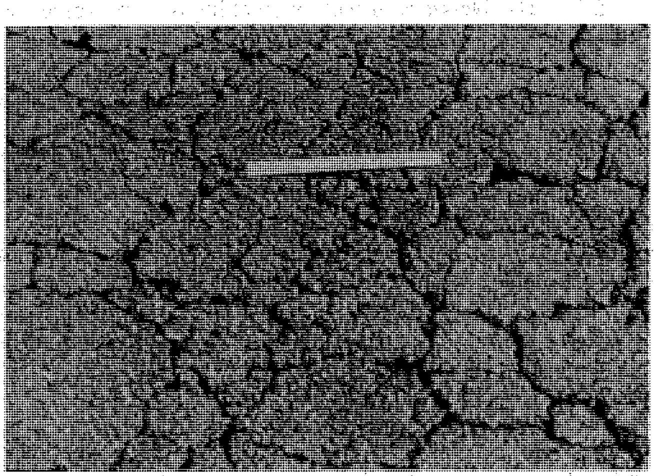


FIG. X1.3 High-Severity Alligator Cracking

X1.6.1 *Severity Levels*:

X1.6.1.1 **L**—Bleeding only has occurred to a very slight degree and is noticeable only during a few days of the year. Asphalt does not stick to shoes or vehicles (Fig. X1.4).

X1.6.1.2 **M**—Bleeding has occurred to the extent that asphalt sticks to shoes and vehicles during only a few weeks of the year (Fig. X1.5).

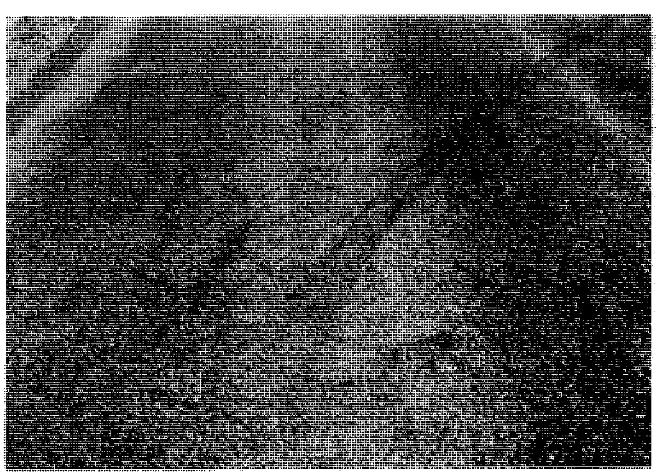


FIG. X1.4 Low-Severity Bleeding

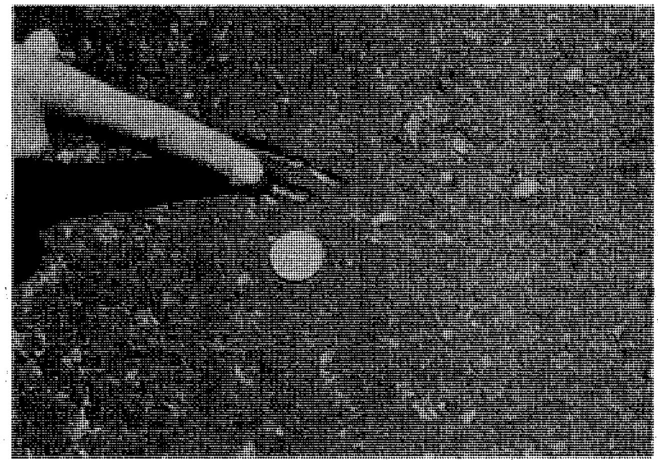


FIG. X1.5 Medium-Severity Bleeding

X1.6.1.3 **H**—Bleeding has occurred extensively and considerable asphalt sticks to shoes and vehicles during at least several weeks of the year (Fig. X1.6).

X1.6.2 *How to Measure*—Bleeding is measured in square meters (square feet) of surface area. If bleeding is counted, polished aggregate should not be counted.

BLOCK CRACKING

X1.7 *Description*—Block cracks are interconnected cracks that divide the pavement into approximately rectangular pieces. The blocks may range in size from approximately 0.3 by 0.3 m (1 by 1 ft) to 3 by 3 m (10 by 10 ft). Block cracking is caused mainly by shrinkage of the asphalt concrete and daily temperature cycling, which results in daily stress/strain cycling. It is not load-associated. Block cracking usually indicates that the asphalt has hardened significantly. Block cracking normally occurs over a large portion of the pavement area,

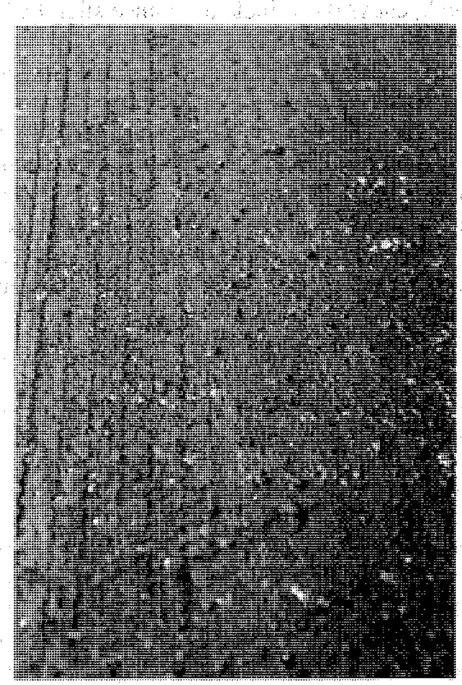


FIG. X1.6 High-Severity Bleeding

but sometimes will occur only in nontraffic areas. This type of distress differs from alligator cracking in that alligator cracks form smaller, many-sided pieces with sharp angles. Also, unlike block, alligator cracks are caused by repeated traffic loadings, and therefore, are found only in traffic areas, that is, wheel paths.

X1.7.1 *Severity Levels*:

X1.7.1.1 **L**—Blocks are defined by low-severity[3] cracks (Fig. X1.7).

X1.7.1.2 **M**—Blocks are defined by medium-severity[3] cracks (Fig. X1.8).

X1.7.1.3 **H**—Blocks are defined by high-severity[3] cracks (Fig. X1.9).

X1.7.2 *How to Measure*—Block cracking is measured in m^2 (ft^2) of surface area. It usually occurs at one severity level in a given pavement section; however, if areas of different severity levels can be distinguished easily from one another, they should be measured and recorded separately.

BUMPS AND SAGS

X1.8 *Description*:

X1.8.1 Bumps are small, localized, upward displacements of the pavement surface. They are different from shoves in that shoves are caused by unstable pavement. Bumps, on the other hand, can be caused by several factors, including:

X1.8.1.1 Buckling or bulging of underlying PCC slabs in AC overlay over PCC pavement.

X1.8.1.2 Frost heave (ice, lens growth).

X1.8.1.3 Infiltration and buildup of material in a crack in combination with traffic loading (sometimes called "tenting").

X1.8.1.4 Sags are small, abrupt, downward displacements of the pavement surface. If bumps appear in a pattern perpendicular to traffic flow and are spaced at less than 3 m (10 ft), the distress is called corrugation. Distortion and displacement that occur over large areas of the pavement surface, causing large or long dips, or both, in the pavement should be recorded as" swelling."

[3] See definitions of longitudinal transverse cracking within Appendix X2.10.

FIG. X1.7 Low-Severity Block Cracking

FIG. X1.8 Medium-Severity Block Cracking

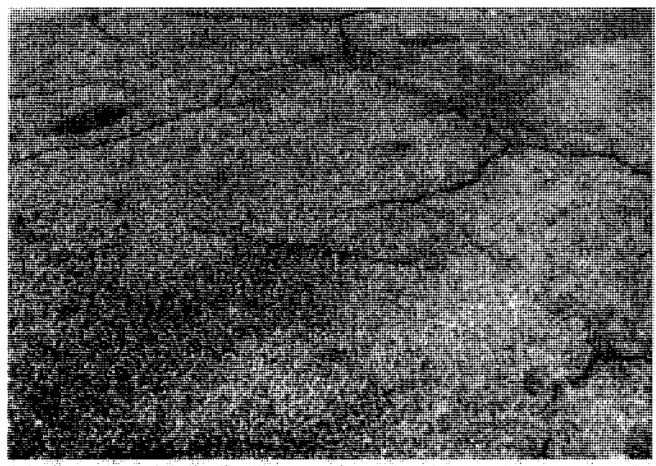


FIG. X1.9 High-Severity Block Cracking

X1.8.2 *Severity Levels*:

X1.8.2.1 **L**—Bump or sag causes low-severity ride quality (Fig. X1.10).

X1.8.2.2 **M**—Bump or sag causes medium-severity ride quality (Fig. X1.11).

X1.8.2.3 **H**—Bump or sag causes high-severity ride quality (Fig. X1.12).

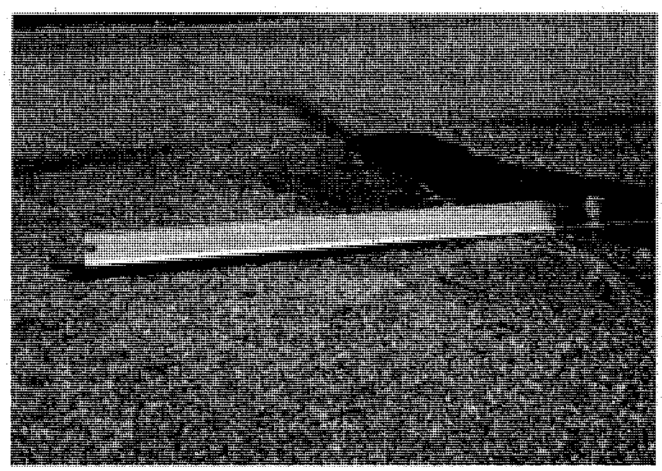


FIG. X1.10 Low-Severity Bumps and Sags

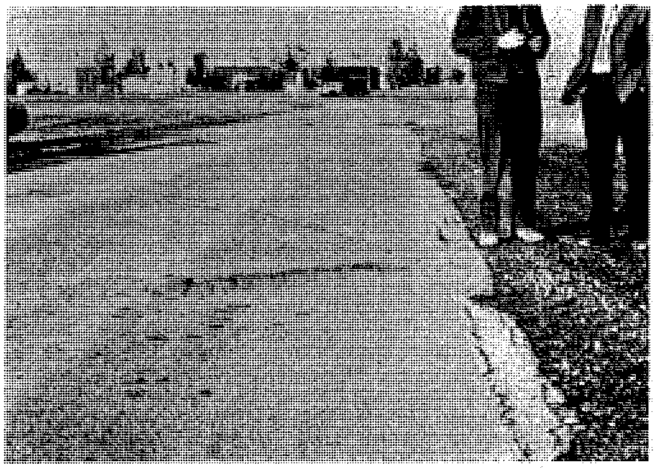


FIG. X1.11 Medium-Severity Bumps and Sags

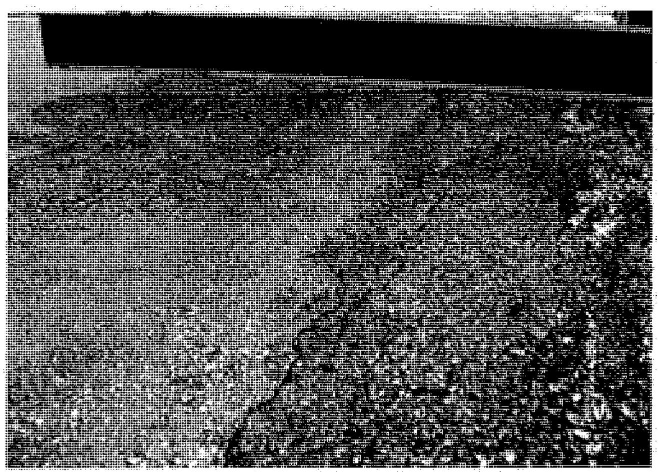


FIG. X1.12 High-Severity Bumps and Sags

X1.8.3 *How to Measure*—Bumps or sags are measured in linear meters (feet). If the bump occurs in combination with a crack, the crack also is recorded.

CORRUGATION

X1.9 *Description*—Corrugation, also known as "wash-boarding", is a series of closely spaced ridges and valleys (ripples) occurring at fairly regular intervals, usually less than 3 m (10 ft) along the pavement. The ridges are perpendicular to the traffic direction. This type of distress usually is caused by traffic action combined with an unstable pavement surface or base.

X1.9.1 *Severity Levels*:

X1.9.1.1 **L**—Corrugation produces low-severity ride quality (Fig. X1.13).

X1.9.1.2 **M**—Corrugation produces medium-severity ride quality (Fig. X1.14).

X1.9.1.3 **H**—Corrugation produces high-severity ride quality (Fig. X1.15).

X1.9.2 *How to Measure*—Corrugation is measured in square meters (square feet) of surface area.

DEPRESSION

X1.10 *Description*—Depressions are localized pavement surface areas with elevations slightly lower than those of the surrounding pavement. In many instances, light depressions are not noticeable until after a rain, when ponding water creates a "birdbath" area; on dry pavement, depressions can be spotted by looking for stains caused by ponding water. Depressions are created by settlement of the foundation soil or are a result of

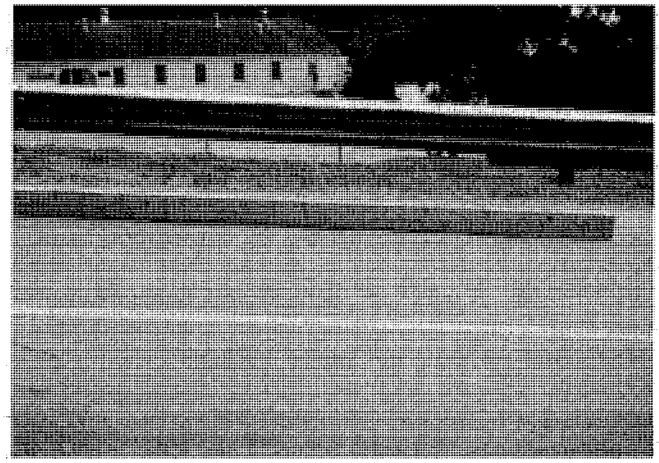


FIG. X1.13 Low-Severity Corrugation

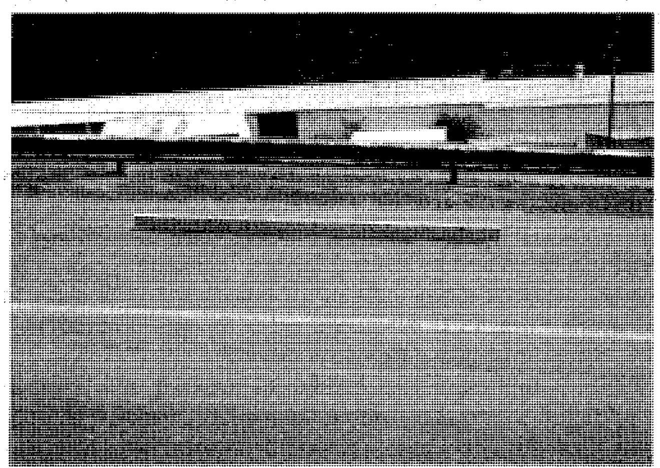


FIG. X1.14 Medium-Severity Corrugation

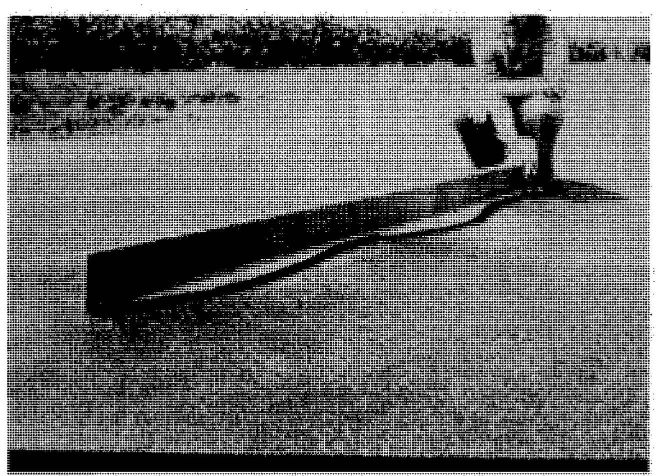


FIG. X1.15 High-Severity Corrugation

improper construction. Depressions cause some roughness, and when deep enough or filled with water, can cause hydroplaning.

X1.10.1 *Severity Levels (Maximum Depth of Depression)*:

X1.10.1.1 **L**–13 to 25 mm (½ to 1 in.) (Fig. X1.16).

X1.10.1.2 **M**–25 to 50 mm (1 to 2 in.) (Fig. X1.17).

X1.10.1.3 **H**—More than 50 mm (2 in.) (Fig. X1.18).

X1.10.2 *How to Measure*—Depressions are measured in square meters (square feet) of surface area.

EDGE CRACKING

X1.11 *Description*—Edge cracks are parallel to and usually within 0.3 to 0.5 m (1 to 1.5 ft) of the outer edge of the pavement. This distress is accelerated by traffic loading and can be caused by frost-weakened base or subgrade near the edge of the pavement. The area between the crack and pavement edge is classified as raveled if it is broken up (sometimes to the extent that pieces are removed).

X1.11.1 *Severity Levels*:

X1.11.1.1 **L**—Low or medium cracking with no breakup or raveling (Fig. X1.19).

X1.11.1.2 **M**—Medium cracks with some breakup and raveling (Fig. X1.20).

X1.11.1.3 **H**—Considerable breakup or raveling along the edge (Fig. X1.21).

X1.11.2 *How to Measure*—Edge cracking is measure in linear meters (feet).

JOINT REFLECTION CRACKING (From Longitudinal and Transverse PCC Slabs)

X1.12 *Description*—This distress occurs only on asphalt-surfaced pavements that have been laid over a PCC slab. It does not include reflection cracks from any other type of base, that is, cement- or lime-stabilized; these cracks are caused mainly by thermal- or moisture-induced movement of the PCC slab beneath the AC surface. This distress is not load-related; however, traffic loading may cause a breakdown of the AC surface near the crack. If the pavement is fragmented along a

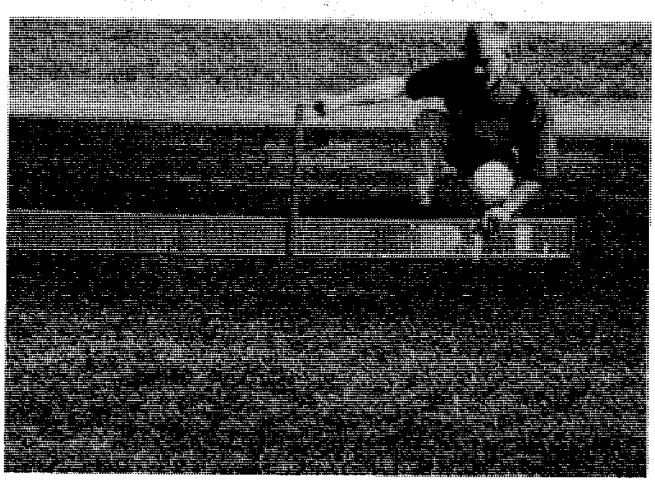


FIG. X1.16 Low-Severity Depression

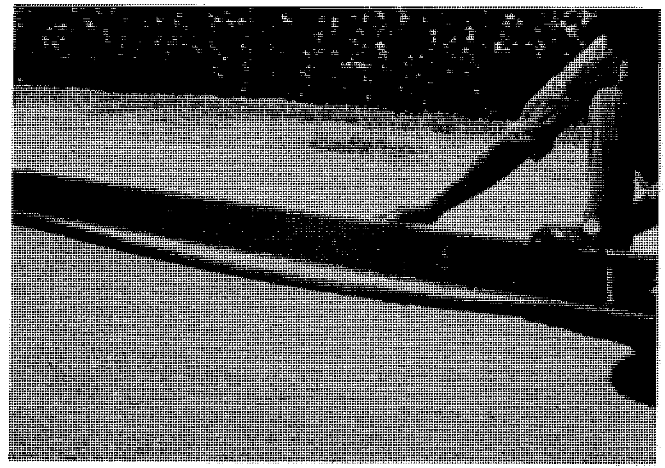


FIG. X1.17 Medium-Severity Depression

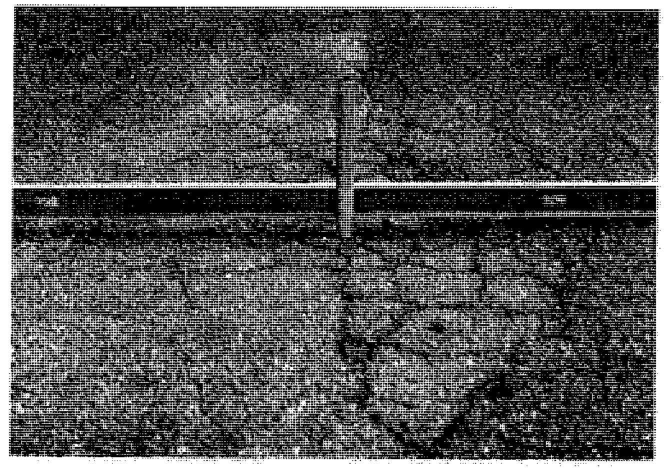


FIG. X1.18 High-Severity Depression

FIG. X1.19 Low-Severity Edge Cracking

crack, the crack is said to be spalled. A knowledge of slab dimension beneath the AC surface will help to identify these distresses.

X1.12.1 *Severity Levels*:

X1.12.1.1 **L**—One of the following conditions exists (Fig. X1.22): Nonfilled crack width is less than 10 mm (⅜ in.), or filled crack of any width (filler in satisfactory condition).

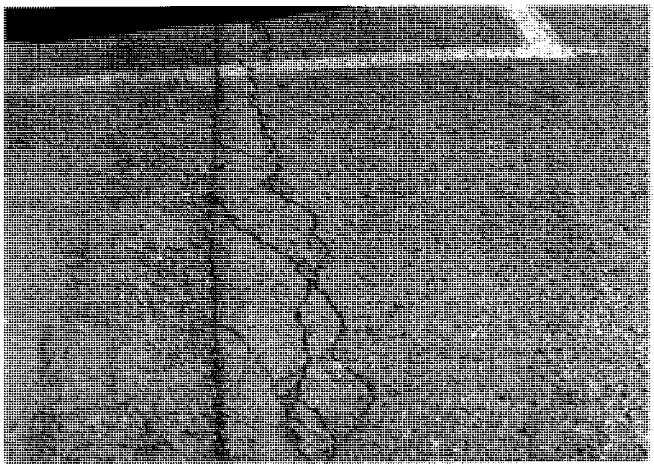


FIG. X1.20 Medium-Severity Edge Cracking

FIG. X1.21 High-Severity Edge Cracking

FIG. X1.22 Low-Severity Joint Reflection Cracking

X1.12.1.2 **M**—One of the following conditions exists (Fig. X1.23): Nonfilled crack width is greater than or equal to 10 mm (⅜ in.) and less than 75 mm (3 in.); nonfilled crack less than or equal to 75 mm (3 in.) surrounded by light secondary cracking; or, filled crack of any width surrounded by light secondary cracking.

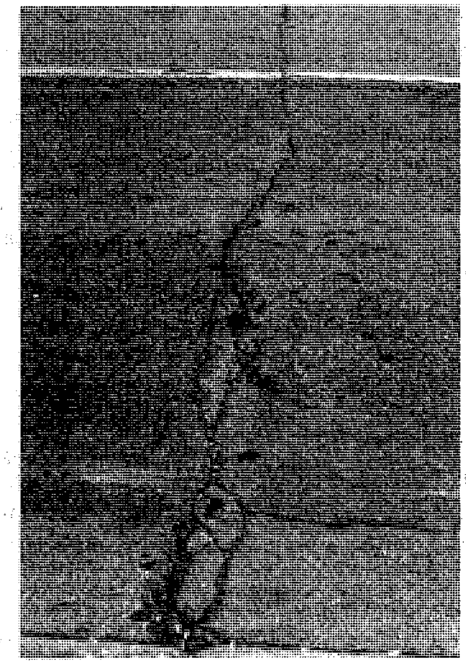


FIG. X1.23 Medium-Severity Joint Reflection Cracking

X1.12.1.3 **H**—One of the following conditions exists (Fig. X1.24): Any crack filled or nonfilled surrounded by medium- or high-severity secondary cracking; nonfilled cracks greater than 75 mm (3 in.); or, a crack of any width where approximately 100 mm (4 in.) of pavement around the crack are severely raveled or broken.

X1.12.2 *How to Measure*—Joint reflection cracking is measured in linear meters (feet). The length and severity level of each crack should be identified and recorded separately. For example, a crack that is 15 m (50 ft) long may have 3 m (10 ft)

FIG. X1.24 High-Severity Joint Reflection Cracking of high severity cracks, which are all recorded separately. If a bump occurs at the reflection crack, it is recorded also.

LANE/SHOULDER DROP-OFF

X1.13 *Description*—Lane/shoulder drop-off is a difference in elevation between the pavement edge and the shoulder. This distress is caused by shoulder erosion, shoulder settlement, or by building up the roadway without adjusting the shoulder level.

X1.13.1 *Severity Levels*:

X1.13.1.1 **L**—The difference in elevation between the pavement edge and shoulder is > 25 mm (1 in.) and< 50 mm (2 in.) (Fig. X1.25).

X1.13.1.2 **M**—The difference in elevation is > 50 mm (2 in.) and < 100 mm (4 in.) (Fig. X1.26).

X1.13.1.3 **H**—The difference in elevation is > 100 mm (4 in.) (Fig. X1.27).

X1.13.2 *How to Measure*—Lane/shoulder drop-off is measured in linear meters (feet).

LONGITUDINAL AND TRANSVERSE CRACKING (Non-PCC Slab Joint Reflective)

X1.14 *Description*:

X1.14.1 Longitudinal cracks are parallel to the pavement's centerline or laydown direction. They may be caused by:

X1.14.1.1 A poorly constructed paving lane joint.

X1.14.1.2 Shrinkage of the AC surface due to low temperatures or hardening of the asphalt, or daily temperature cycling, or both.

X1.14.1.3 A reflective crack caused by cracking beneath the surface course, including cracks in PCC slabs, but not PCC joints.

X1.14.1.4 Transverse cracks extend across the pavement at approximately right angles to the pavement centerline or direction of laydown. These types of cracks are not usually load-associated.

X1.14.2 *Severity Levels*:

X1.14.2.1 **L**—One of the following conditions exists (Fig. X1.28): nonfilled crack width is less than 10 mm (3⁄8 in.), or filled crack of any width (filler in satisfactory condition).

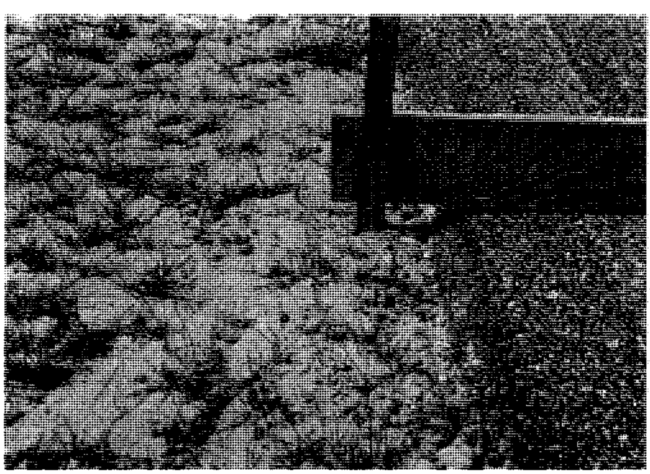


FIG. X1.25 Low-Severity Lane/Shoulder Drop-Off

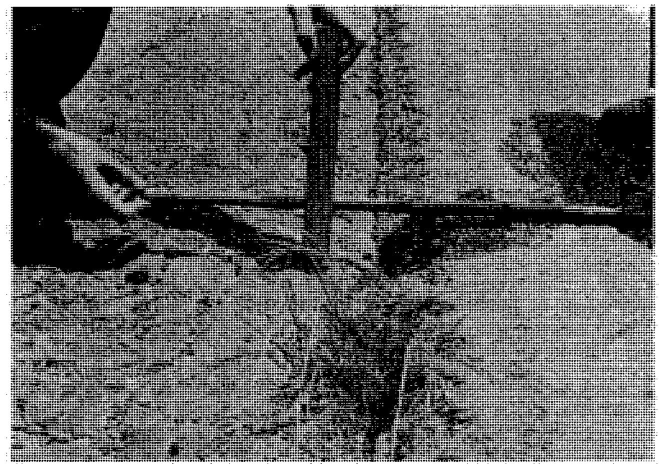


FIG. X1.26 Medium-Severity Lane/Shoulder Drop-Off

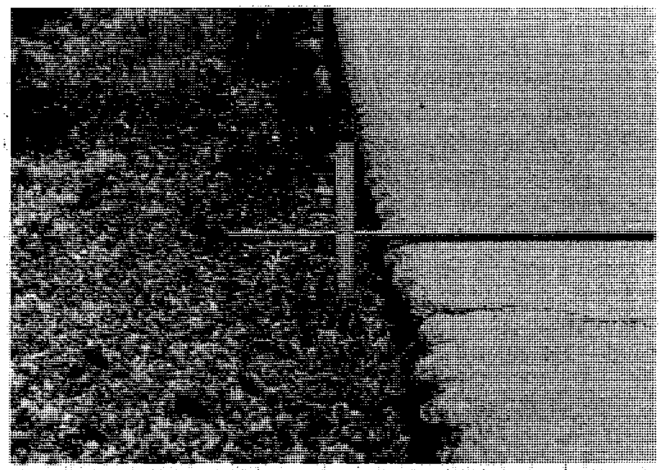


FIG. X1.27 High-Severity Lane/Shoulder Drop-Off

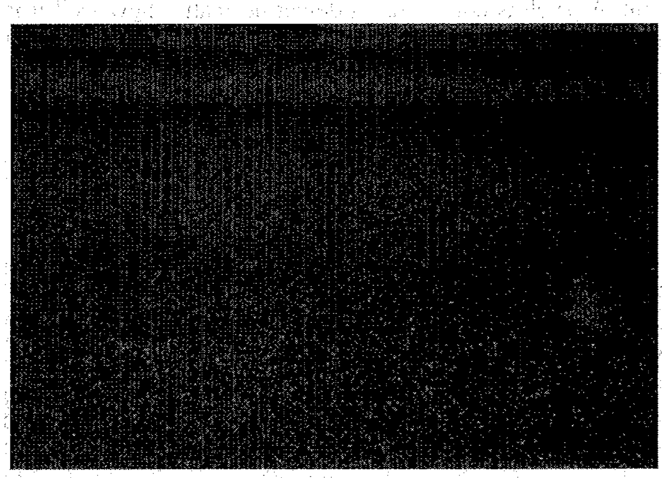


FIG. X1.28 Low-Severity Longitudinal and Transverse Cracking

X1.14.2.2 **M**—One of the following conditions exists (Fig. X1.29): nonfilled crack width is greater than or equal to 10 mm and less than 75 mm (3⁄8 to 3 in.); nonfilled crack is less than or equal to 75 mm (3 in.) surrounded by light and random cracking; or, filled crack is of any width surrounded by light random cracking.

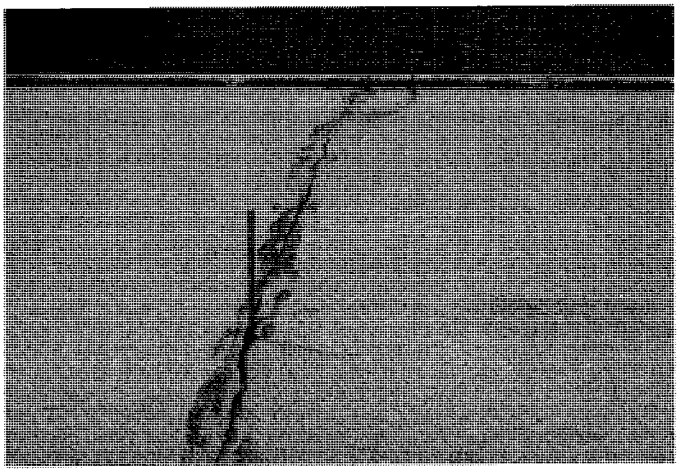


FIG. X1.29 Medium-Severity Longitudinal and Transverse Cracking

X1.14.2.3 **H**—One of the following conditions exists (Fig. X1.30): any crack filled or nonfilled surrounded by medium- or high-severity random cracking; nonfilled crack greater than 75 m (3 in.); or, a crack of any width where approximately 100 mm (4 in.) of pavement around the crack is severely broken.

X1.14.3 *How to Measure*—Longitudinal and transverse cracks are measured in linear meters (feet). The length and severity of each crack should be recorded. If the crack does not have the same severity level along its entire length, each portion of the crack having a different severity level should be recorded separately.

PATCHING AND UTILITY CUT PATCHING

X1.15 *Description*—A patch is an area of pavement that has been replaced with new material to repair the existing pavement. A patch is considered a defect no matter how well it is performing (a patched area or adjacent area usually does not perform as well as an original pavement section). Generally, some roughness is associated with this distress.

X1.15.1 *Severity Levels*:

X1.15.1.1 **L**—Patch is in good condition and satisfactory. Ride quality is rated as low severity or better (Fig. X1.31).

FIG. X1.30 High-Severity Longitudinal and Transverse Cracking

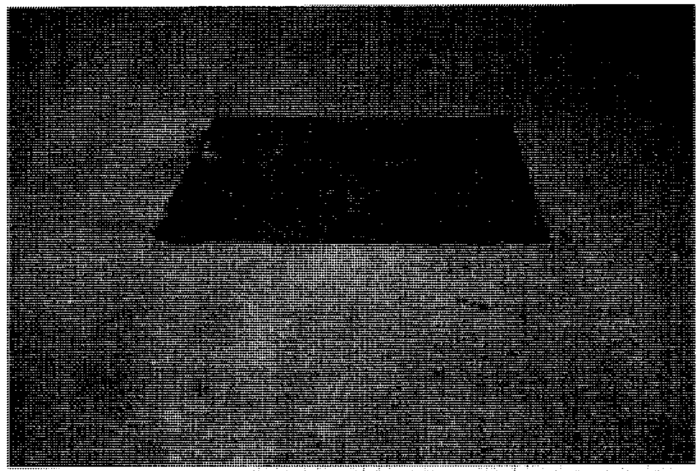


FIG. X1.31 Low-Severity Patching and Utility Cut Patching

X1.15.1.2 **M**—Patch is moderately deteriorated, or ride quality is rated as medium severity, or both (Fig. X1.32).

X1.15.1.3 **H**—Patch is badly deteriorated, or ride quality is rated as high severity, or both; needs replacement soon (Fig. X1.33).

X1.15.2 *How to Measure*—Patching is rated in ft^2 of surface area; however, if a single patch has areas of differing severity, these areas should be measured and recorded separately. For example, a 2.5 m^2 (27.0 ft^2) patch may have 1 m^2 (11 ft^2) of medium severity and 1.5 m^2 (16 ft^2) of low severity. These areas would be recorded separately. Any distress found in a patched area will not be recorded; however, its effect on the patch will be considered when determining the patch's severity level. No other distresses, for example, are recorded within a patch. Even if the patch material is shoving or cracking, the area is rated only as a patch. If a large amount of pavement has been replaced, it should not be recorded as a patch but considered as new pavement, for example, replacement of a complete intersection.

POLISHED AGGREGATE

X1.16 *Description*—This distress is caused by repeated traffic applications. Polished aggregate is present when close

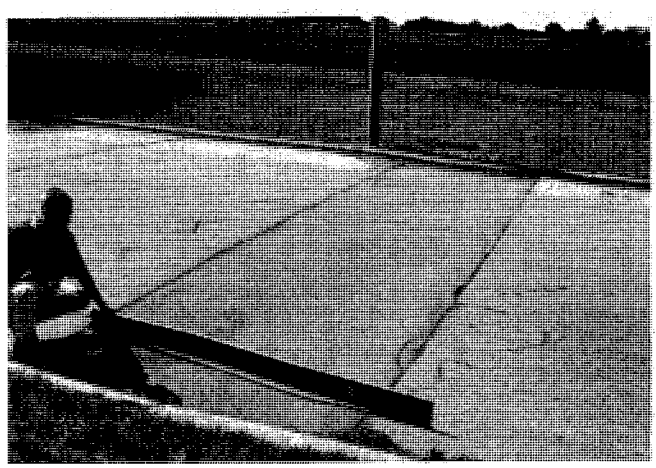


FIG. X1.32 Medium-Severity Patching and Utility Cut Patching

FIG. X1.33 High-Severity Patching and Utility Cut Patching

examination of a pavement reveals that the portion of aggregate extending above the asphalt is either very small, or there are no rough or angular aggregate particles to provide good skid resistance. When the aggregate in the surface becomes smooth to the touch, adhesion with vehicle tires is considerably reduced. When the portion of aggregate extending above the surface is small, the pavement texture does not significantly contribute to reducing vehicle speed. Polished aggregate should be counted when close examination reveals that the aggregate extending above the asphalt is negligible, and the surface aggregate is smooth to the touch. This type of distress is indicated when the number on a skid resistance test is low or has dropped significantly from a previous rating.

X1.16.1 *Severity Levels*—No degrees of severity are defined; however, the degree of polishing should be clearly evident in the sample unit in that the aggregate surface should be smooth to the touch (Fig. X1.34).

X1.16.2 *How to Measure*—Polished aggregate is measured in square meters (square feet) of surface area. If bleeding is counted, polished aggregate should not be counted.

POTHOLES

X1.17 *Description*—Potholes are small—usually less than 750 mm (30 in.) in diameter—bowl-shaped depressions in the pavement surface. They generally have sharp edges and vertical sides near the top of the hole. When holes are created by high-severity alligator cracking, they should be identified as potholes, not as weathering.

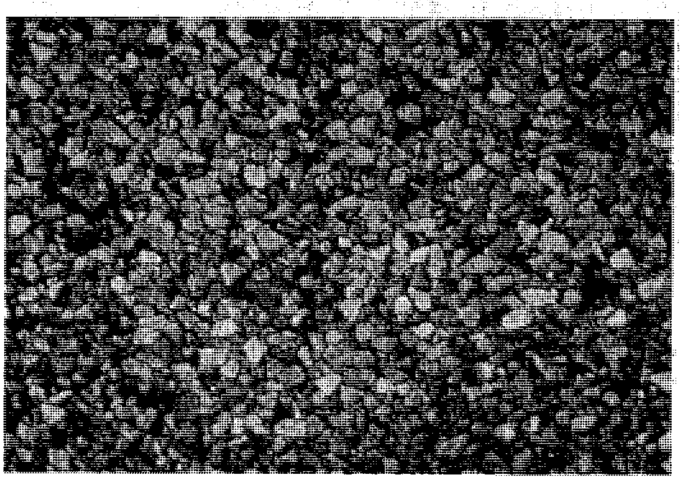


FIG. X1.34 Polished Aggregate

X1.17.1 *Severity Levels*:

X1.17.1.1 The levels of severity for potholes less than 750 mm (30 in.) in diameter are based on both the diameter and the depth of the pothole, according to Table X1.1.

X1.17.1.2 If the pothole is more than 750 mm (30 in.) in diameter, the area should be determined in square feet and divided by 0.5 m^2 (5.5 ft^2) find the equivalent number of holes. If the depth is 25 mm (1 in.) or less, the holes are considered medium-severity. If the depth is more than 25 mm (1 in.), they are considered high-severity (Figs. X1.35-X1.37).

X1.17.2 *How to Measure*—Potholes are measured by counting the number that are low-, medium-, and high-severity and recording them separately.

RAILROAD CROSSING

X1.18 *Description*—Railroad crossing defects are depressions or bumps around, or between tracks, or both.

X1.18.1 *Severity Levels*:

X1.18.1.1 **L**—Railroad crossing causes low-severity ride quality (Fig. X1.38).

X1.18.1.2 **M**—Railroad crossing causes medium-severity ride quality (Fig. X1.39).

X1.18.1.3 **H**—Railroad crossing causes high-severity ride quality (Fig. X1.40).

X1.18.2 *How to Measure*—The area of the crossing is measured in square meters (square feet) of surface area. If the crossing does not affect ride quality, it should not be counted. Any large bump created by the tracks should be counted as part of the crossing.

RUTTING

X1.19 *Description*—A rut is a surface depression in the wheel paths. Pavement uplift may occur along the sides of the rut, but, in many instances, ruts are noticeable only after a rainfall when the paths are filled with water. Rutting stems from a permanent deformation in any of the pavement layers or subgrades, usually caused by consolidated or lateral movement of the materials due to traffic load.

X1.19.1 *Severity Levels (Mean Rut Depth)*:

X1.19.1.1 **L**—6 to 13 mm (¼ to ½ in.) (Fig. X1.41).

X1.19.1.2 **M**—>13 to 25 mm (>½ to 1 in.) (Fig. X1.42).

TABLE X1.1 Levels of Severity for Potholes

Maximum Depth of Pothole	Average Diameter (mm) (in.) 100 to 200 mm (4 to 8 in.)	200 to 450 mm (8 to 18 in.)	450 to 750 mm (18 to 30 in.)
13 to ≤25 mm (½ to 1 in.)	L	L	M
>25 and ≤50 mm (1 to 2 in.)	L	M	H
>50 mm (2 in.)	M	M	H

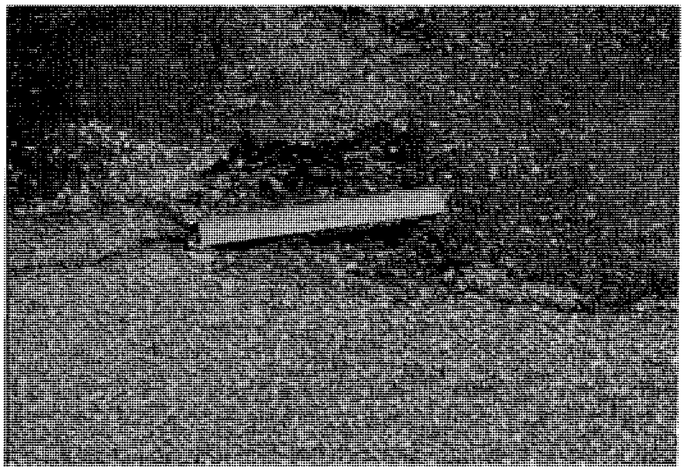


FIG. X1.35 Low-Severity Pothole

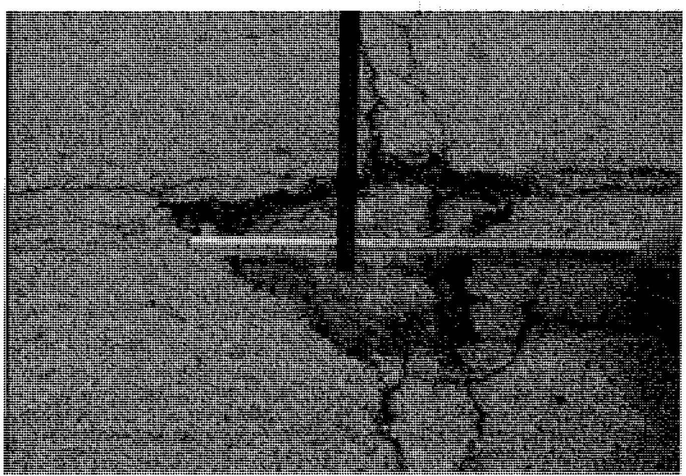


FIG. X1.36 Medium-Severity Pothole

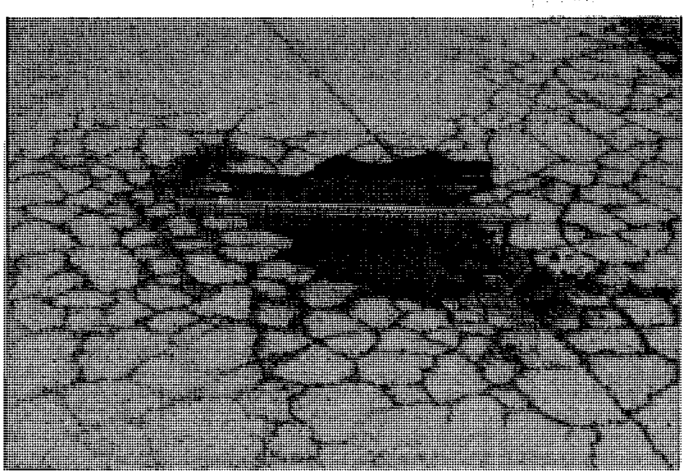


FIG. X1.37 High-Severity Pothole

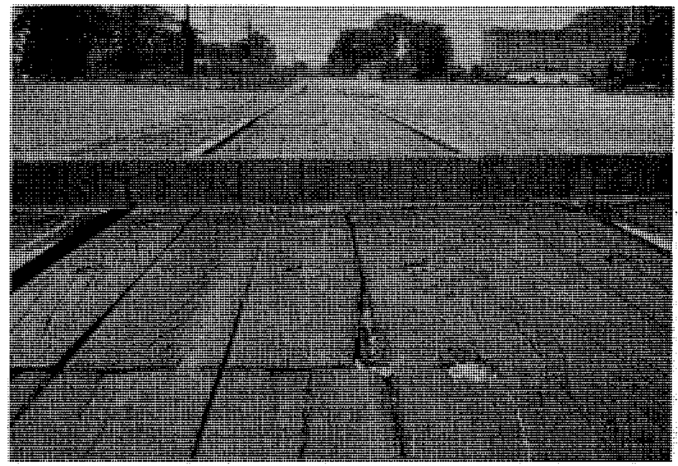


FIG. X1.38 Low-Severity Railroad Crossing

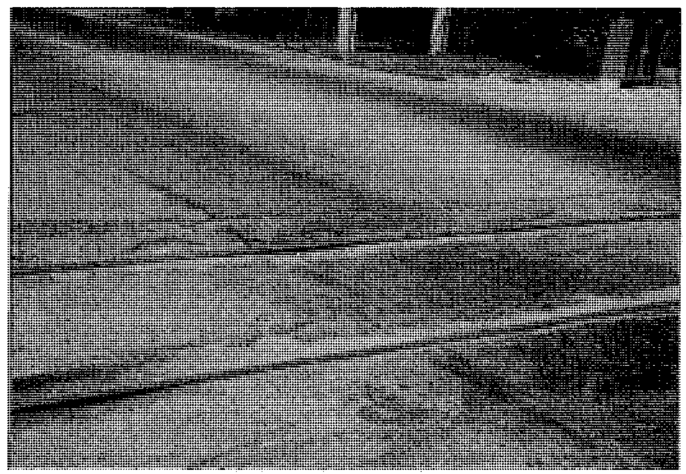


FIG. X1.39 Medium-Severity Railroad Crossing

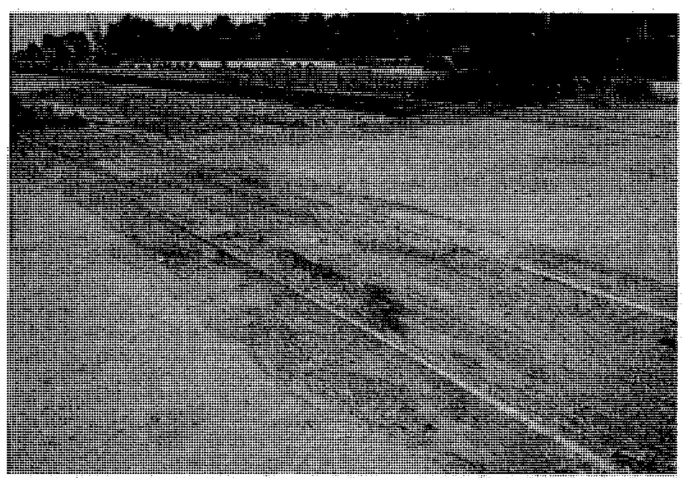


FIG. X1.40 High-Severity Railroad Crossing

X1.19.1.3 **H**—>25 mm (>1 in.) (Fig. X1.43).

X1.19.2 *How to Measure*—Rutting is measured in square meters (square feet) of surface area, and its severity is determined by the mean depth of the rut (see X1.19.1.1-X1.19.1.3). The mean rut depth is calculated by laying a straight edge across the rut, measuring its depth, then using measurements taken along the length of the rut to compute its mean depth in millimeters.

SHOVING

X1.20 *Description*:

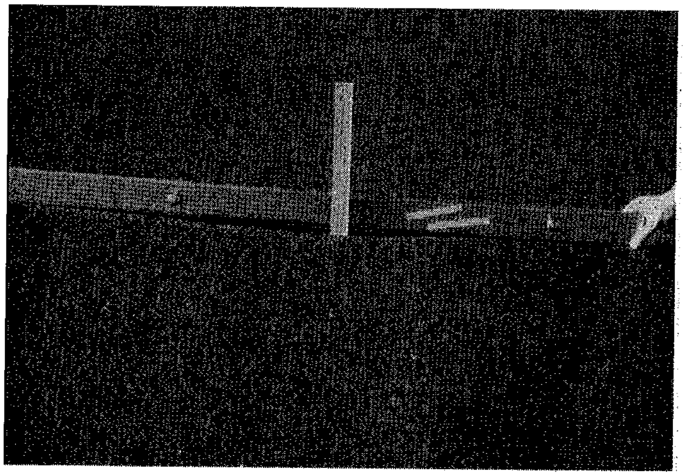


FIG. X1.41 Low-Severity Rutting

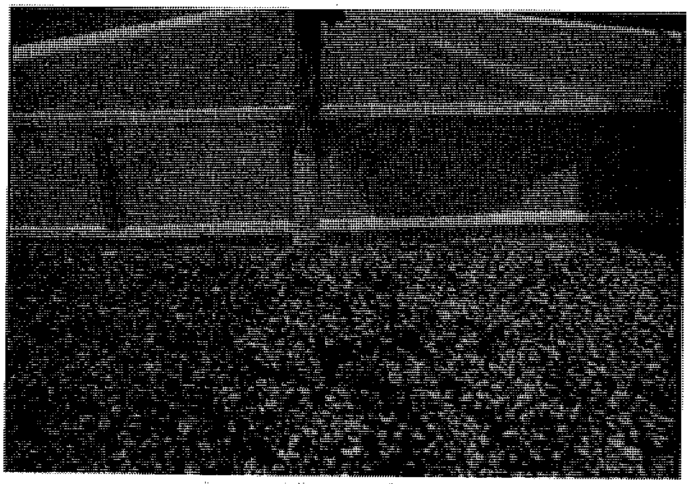


FIG. X1.42 Medium-Severity Rutting

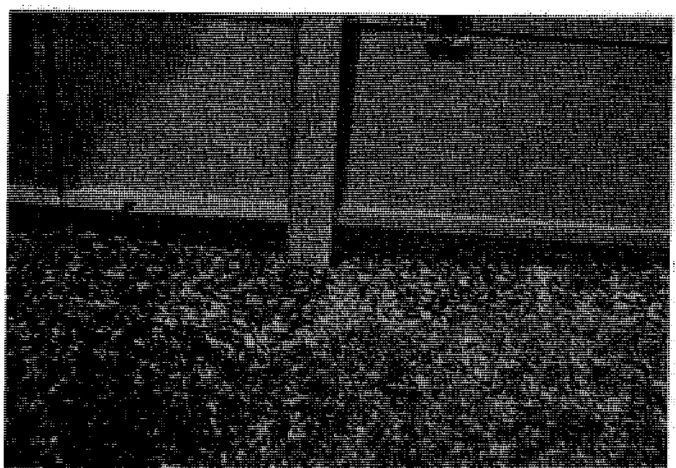


FIG. X1.43 High-Severity Rutting

X1.20.1 Shoving is a permanent, longitudinal displacement of a localized area of the pavement surface caused by traffic loading. When traffic pushes against the pavement, it produces a short, abrupt wave in the pavement surface. This distress normally occurs only in unstable liquid asphalt mix (cutback or emulsion) pavements.

X1.20.2 Shoves also occur where asphalt pavements abut PCC pavements. The PCC pavements increase in length and push the asphalt pavement, causing the shoving.

X1.20.3 *Severity Levels*:

X1.20.3.1 **L**—Shove causes low-severity ride quality (Fig. X1.44).

X1.20.3.2 **M**—Shove causes medium-severity ride quality (Fig. X1.45).

X1.20.3.3 **H**—Shove causes high-severity ride quality (Fig. X1.46).

X1.20.4 *How to Measure*—Shoves are measured in square meters (feet) of surface area. Shoves occurring in patches are considered in rating the patch, not as a separate distress.

SLIPPAGE CRACKING

X1.21 *Description*—Slippage cracks are crescent or half-moon shaped cracks, usually transverse to the direction of travel. They are produced when braking or turning wheels cause the pavement surface to slide or deform. This distress usually occurs in overlaps when there is a poor bond between the surface and the next layer of the pavement structure.

X1.21.1 *Severity Level*:

X1.21.1.1 **L**—Average crack width is < 10 mm (⅜ in.) (Fig. X1.47).

X1.21.1.2 **M**—One of the following conditions exists (Fig. X1.48): average crack width is ≥ 10 and < 40 mm (≥ ⅜ and< 1-½ in.); or the area around the crack is moderately spalled, or surrounded with secondary cracks.

X1.21.1.3 **H**—One of the following conditions exists (Fig. X1.49): the average crack width is > 40 mm (1-½ in.) or the area around the crack is broken into easily removed pieces.

X1.21.2 *How to Measure*—The area associated with a given slippage crack is measured in square meters (square feet) and rated according to the highest level of severity in the area.

SWELL

X1.22 *Description*—Swell is characterized by an upward bulge in the pavement's surface, a long, gradual wave more

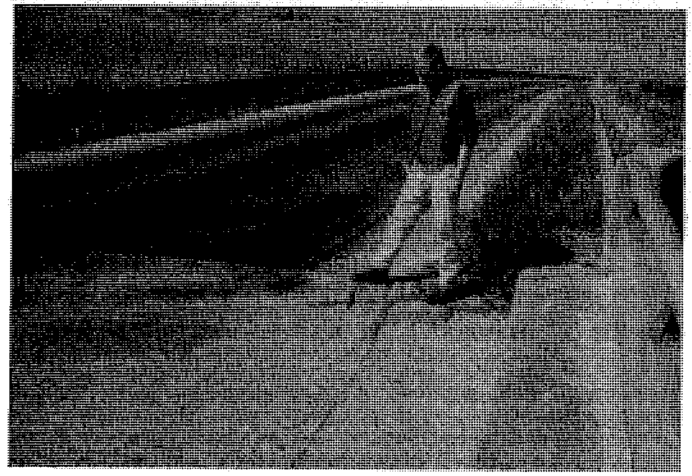


FIG. X1.44 Low-Severity Shoving

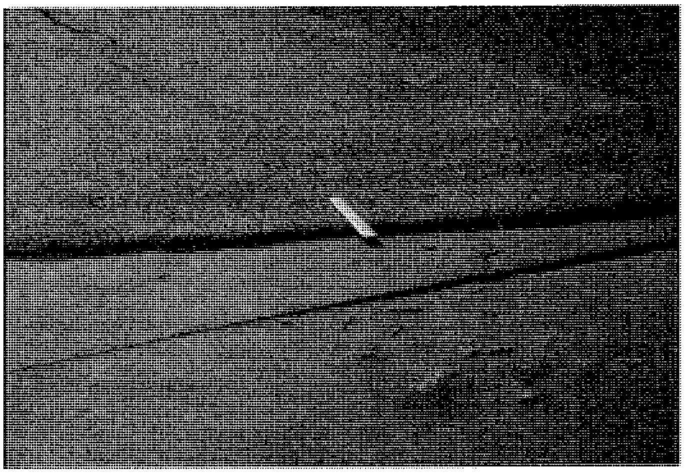


FIG. X1.45 Medium-Severity Shoving

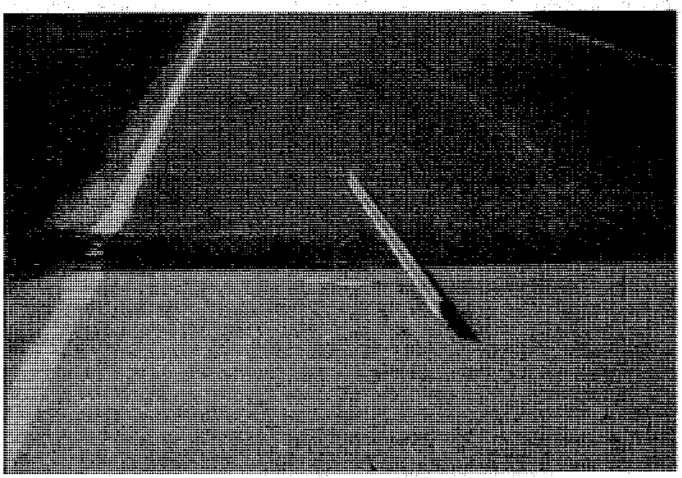


FIG. X1.46 High-Severity Shoving

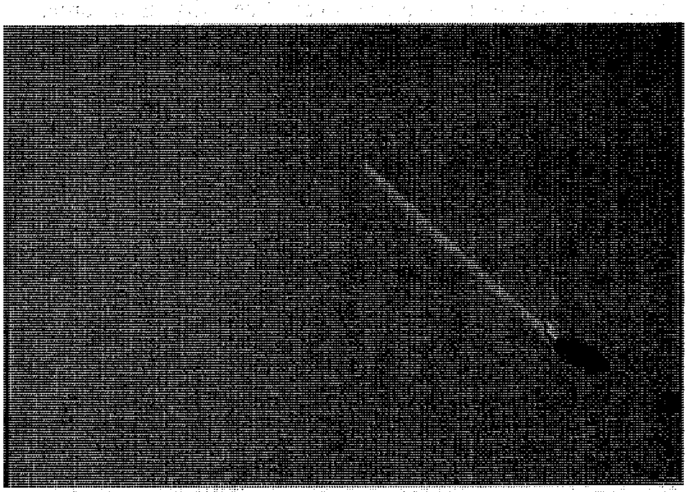


FIG. X1.47 Low-Severity Slippage Cracking

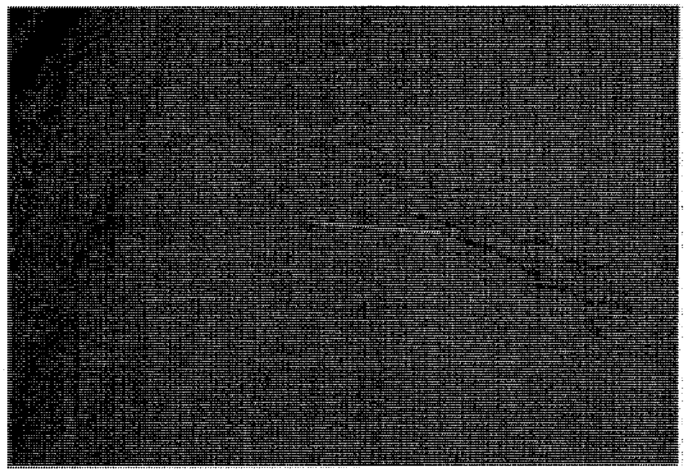


FIG. X1.48 Medium-Severity Slippage Cracking

FIG. X1.49 High-Severity Slippage Cracking

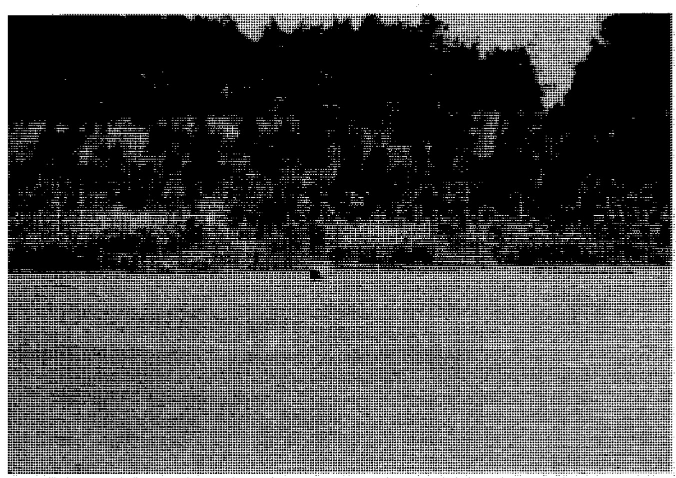


FIG. X1.50 Example Swell. Severity level is based on ride quality criteria.

than 3 m (10 ft) long (Fig. X1.50). Swelling can be accompanied by surface cracking. This distress usually is caused by frost action in the subgrade or by swelling soil.

X1.22.1 *Severity Level*:

X1.22.1.1 **L**—Swell causes low-severity ride quality. Low-severity swells are not always easy to see but can be detected by driving at the speed limit over the pavement section. An upward motion will occur at the swell if it is present.

X1.22.1.2 **M**—Swell causes medium-severity ride quality.

X1.22.1.3 **H**—Swell causes high-severity ride quality.

X1.22.2 *How to Measure*—The surface area of the swell is measured in square meters (square feet).

WEATHERING AND RAVELING

X1.23 *Description*—Weathering and raveling are the wearing away of the pavement surface due to a loss of asphalt or tar binder and dislodged aggregate particles. These distresses indicate that either the asphalt binder has hardened appreciably or that a poor-quality mixture is present. In addition, raveling may be caused by certain types of traffic, for example, tracked vehicles. Softening of the surface and dislodging of the aggregates due to oil spillage also are included under raveling.

X1.23.1 *Severity Levels*:

X1.23.1.1 **L**—Aggregate or binder has started to wear away. In some areas, the surface is starting to pit (Fig. X1.51). In the case of oil spillage, the oil stain can be seen, but the surface is hard and cannot be penetrated with a coin.

X1.23.1.2 **M**—Aggregate or binder has worn away. The surface texture is moderately rough and pitted (Fig. X1.52). In the case of oil spillage, the surface is soft and can be penetrated with a coin.

X1.23.1.3 **H**—Aggregate or binder has been worn away considerably. The surface texture is very rough and severely pitted. The pitted areas are less than 10 mm (4 in.) in diameter and less than 13 mm (½ in.) deep (Fig. X1.53); pitted areas larger than this are counted as potholes. In the case of oil spillage, the asphalt binder has lost its binding effect and the aggregate has become loose.

X1.23.2 *How to Measure*—Weathering and raveling are measured in square meters (square feet) of surface area.

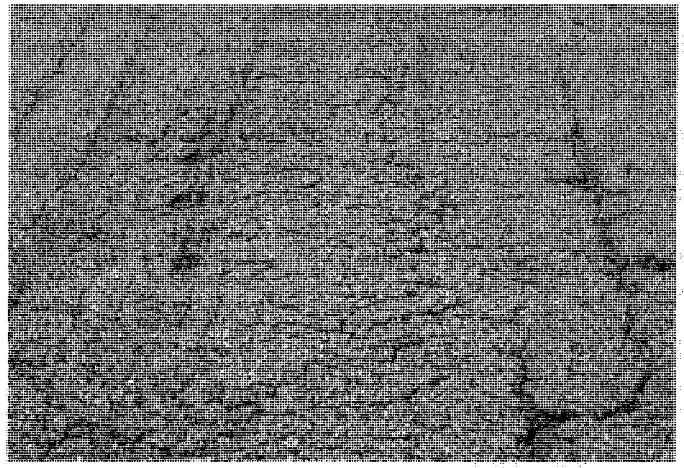


FIG. X1.52 Medium-Severity Weathering and Raveling

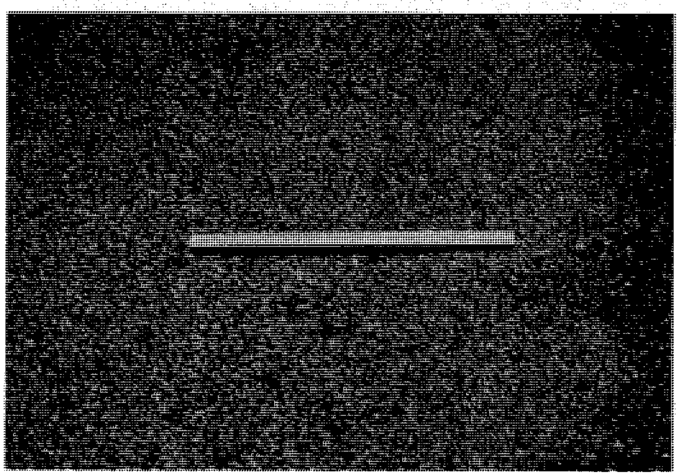


FIG. X1.51 Low-Severity Weathering and Raveling

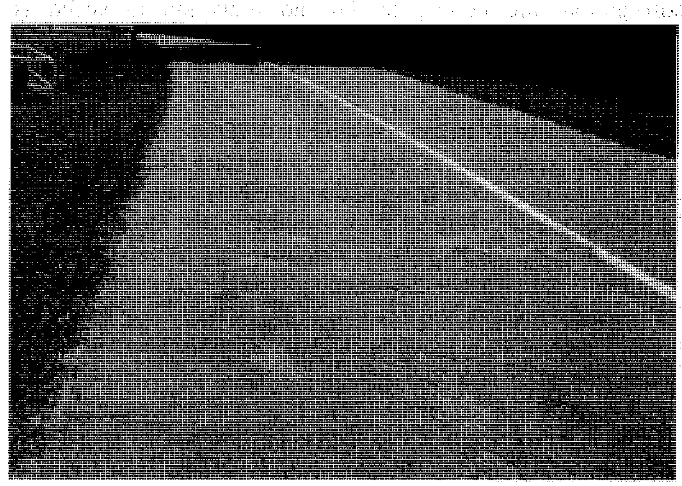


FIG. X1.53 High-Severity Weathering and Raveling

X2. DISTRESS IN JOINTED CONCRETE PAVEMENTS

X2.1 This Appendix lists alphabetically 19 distress types for jointed concrete pavements. Distress definitions apply to both plain and reinforced jointed concrete pavements, with the exception of linear cracking distress, which is defined separately for plain and reinforced jointed concrete.

X2.1.1 During the field condition surveys and validation of the PCI, several questions often are asked about the identification and counted method of some of the distresses. Answers to these questions are included under the heading "How to Count." For convenience, however, the most frequently raised issues are addressed below.

X2.1.1.1 Faulting is counted only at joints. Faulting associated with cracks is not counted separately since it is incorporated into the severity-level definitions of cracks. Crack definitions are also used in defining corner breaks and divided slabs.

X2.1.1.2 Joint seal damage is not counted on a slab-by-slab basis. Instead, a severity level is assigned based on the overall condition of the joint seal in the area.

X2.1.1.3 Cracks in reinforced concrete slabs that are less than ⅛ in. wide are counted as shrinkage cracks. Shrinkage cracks should not be counted to determine if the slab is broken into four or more pieces.

X2.1.1.4 Low-severity scaling, that is, crazing, should only be counted if there is evidence that future scaling is likely to occur.

X2.1.2 The user should note that the items above are general issues and do not stand alone as inspection criteria. To measure each distress type properly, the inspector must be familiar with the individual distress criteria.

X2.2 *Ride Quality*:

X2.2.1 Ride quality must be evaluated in order to establish a severity level for the following distress types:

X2.2.1.1 Blowup/buckling.

X2.2.1.2 Railroad crossings.

X2.2.2 To determine the effect these distresses have on ride quality, the inspector should drive at the normal operating speed and use the following severity-level definitions of ride quality:

X2.2.2.1 **L**—Low. Vehicle vibrations, for example, from corrugation, are noticeable, but no reduction in speed is necessary for comfort or safety, or individual bumps or settlements, or both, cause the vehicle to bounce slightly but create little discomfort.

X2.2.2.2 **M**—Medium. Vehicle vibrations are significant and some reduction in speed is necessary for safety and comfort, or individual bumps or settlements cause the vehicle to bounce significantly, or both, creating some discomfort.

X2.2.2.3 **H**—High. Vehicle vibrations are so excessive that speed must be reduced considerably for safety and comfort, or individual bumps or settlements, or both, cause the vehicle to bounce excessively, creating substantial discomfort, a safety hazard, or high potential vehicle damage, or a combination thereof.

X2.2.3 The inspector should drive at the posted speed in a sedan that is representative of cars typically seen in local traffic. Pavement sections near stop signs should be rated at a deceleration speed appropriate for the intersection.

BLOWUP/BUCKLING

X2.3 *Description*—Blowups or buckles occur in hot weather, usually at a transverse crack or joint that is not wide enough to permit slab expansion. The insufficient width usually is caused by infiltration of incompressible materials into the joint space. When expansion cannot relieve enough pressure, a localized upward movement of the slab edges (buckling) or shattering will occur in the vicinity of the joint. Blowups also can occur at utility cuts and drainage inlets.

X2.3.1 *Severity Levels*:

X2.3.1.1 **L**—Buckling or shattering causes low-severity ride quality (Fig. X2.1).

X2.3.1.2 **M**—Buckling or shattering causes medium-severity ride quality (Fig. X2.2).

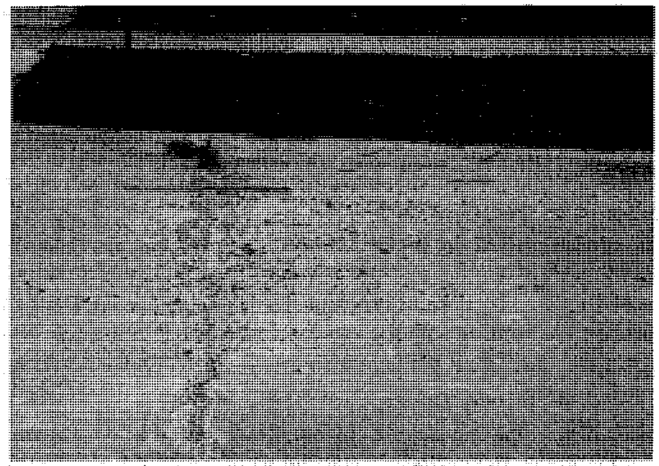


FIG. X2.1 Low Severity Blowup/Buckling

FIG. X2.2 Medium Severity Blowup/Buckling

X2.3.1.3 **H**—Buckling or shattering causes high-severity ride quality (Fig. X2.3).

X2.3.2 *How to Count*—At a crack, a blowup is counted as being in one slab; however, if the blowup occurs at a joint and affects two slabs, the distress should be recorded as occurring

FIG. X2.3 High-Severity Blowup/Buckling

in two slabs. When a blowup renders the pavement impassable, it should be repaired immediately.

CORNER BREAK

X2.4 *Description*—A corner break is a crack that intersects the joints at a distance less than or equal to one-half the slab length on both sides, measured from the corner of the slab. For example, a slab measuring 3.5 by 6.0 m (11.5 by 20.0 ft) that has a crack 1.5 m (5 ft) on one side and 3.5 m (11.5 ft) on the other side is not considered a corner break; it is a diagonal crack. However, a crack that intersects 0.5 m (4 ft) on one side and 2.5 m (8 ft) on the other is considered a corner break. A corner break differs from a corner spall in that the crack extends vertically through the entire slab thickness, whereas a corner spall intersects the joint at an angle. Load repetition combined with loss of support and curling stresses usually cause corner breaks.

X2.4.1 *Severity Levels*—

X2.4.1.1 **L**—Break is defined by a low-severity[4] crack. A low severity crack is < 13 mm (½ in.), cracks of any width with satisfactory filler; no faulting. The area between the break and the joints is not cracked or may be lightly cracked (Fig. X2.4).

X2.4.1.2 **M**—Break is defined by a medium-severity[4] crack, or the area between the break and the joints, or both, has a medium crack. A medium severity crack is a nonfilled crack > 13 mm and < 50 mm (>½ in. and < 2 in.), a nonfilled crack ≤ 50 mm (2 in.) with faulting < 10 mm (⅜ in.), or a any filled crack with faulting < 10 mm (⅜ in.) (Fig. X2.5).

[4] The above crack severity definitions are for nonreinforced slabs. For reinforced slabs, see *linear cracking*.

FIG. X2.4 Low-Severity Corner Break

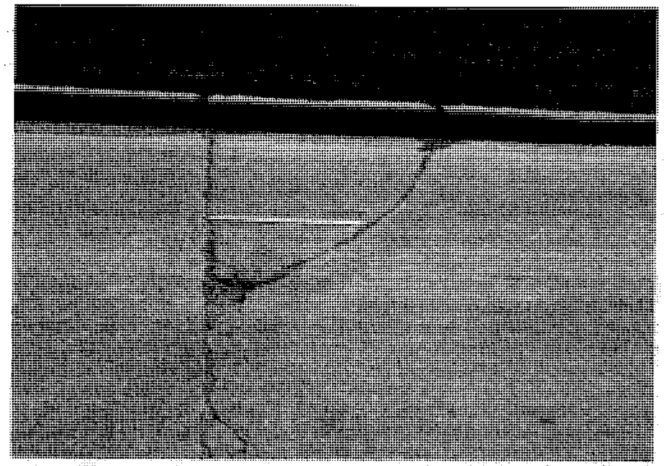


FIG. X2.5 Medium-Severity Corner Break

X2.4.1.3 **H**—Break is defined by a high-severity[4] crack, or the area between the break and the joints, or both, is highly cracked. A high severity crack is a nonfilled crack >50 mm (2 in.) wide, or any filled or nonfilled crack with faulting >10 mm (⅜ in.) (Fig. X2.6).

X2.4.2 *How to Count*—Distressed slab is recorded as one slab if it:

X2.4.2.1 A single corner break.

X2.4.2.2 More than one break of a particular severity.

X2.4.2.3 Two or more breaks of different severities. For two or more breaks, the highest level of severity should be recorded. For example, a slab containing both low- and medium-severity corner breaks should be counted as one slab with a medium corner break.

DIVIDED SLAB

X2.5 *Description*—Slab is divided by cracks into four or more pieces due to overloading, or inadequate support, or both. If all pieces or cracks are contained within a corner break, the distress is categorized as a severe corner break.

X2.5.1 *Severity Levels*—Table X2.1 lists severity levels for divided slabs. Examples are shown in Figs. X2.7-X2.9.

FIG. X2.6 High-Severity Corner Break

TABLE X2.1 Levels of Severity for Faulting

Severity Level	Difference of Elevation
L	>3 and <10 mm (>1⁄8 and <3⁄8 in.)
M	>10 and <20 mm (>3⁄8 and <3⁄4 in.)
H	>20 mm (>3⁄4 in.)

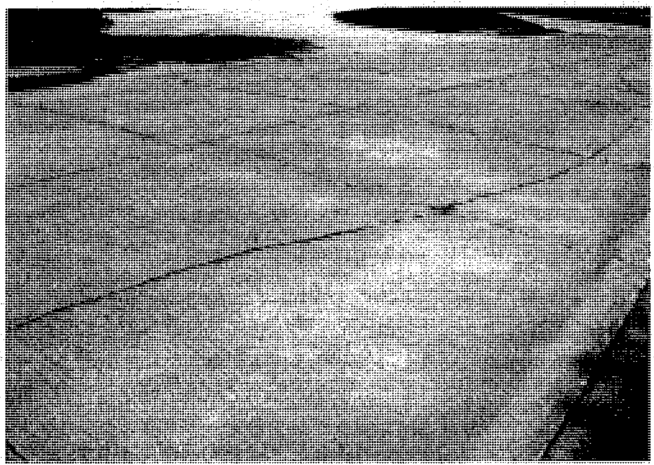


FIG. X2.7 Low-Severity Divided Slab

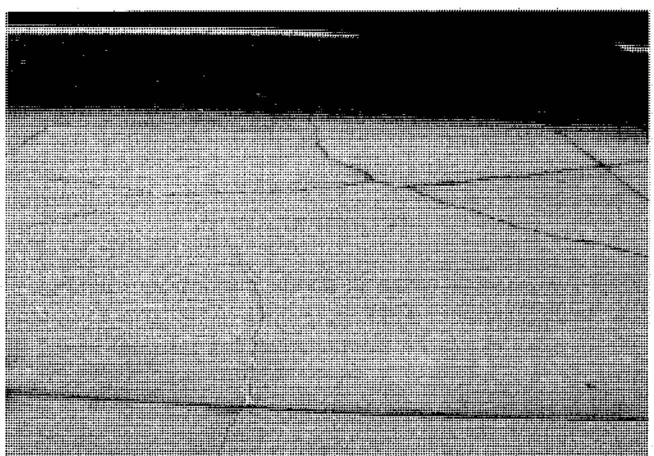


FIG. X2.8 Medium-Severity Divided Slab

X2.5.2 *How to Count*—If the divided slab is medium- or high-severity, no other distress is counted for that slab.

DURABILITY ("D") CRACKING

X2.6 *Description*—"D" cracking is caused by freeze-thaw expansion of the large aggregate, which, over time, gradually breaks down the concrete. This distress usually appears as a pattern of cracks running parallel and close to a joint or linear crack. Since the concrete becomes saturated near joints and cracks, a dark-colored deposit can usually be found around fine" D" cracks. This type of distress may eventually lead to disintegration of the entire slab.

X2.6.1 *Severity Levels*:

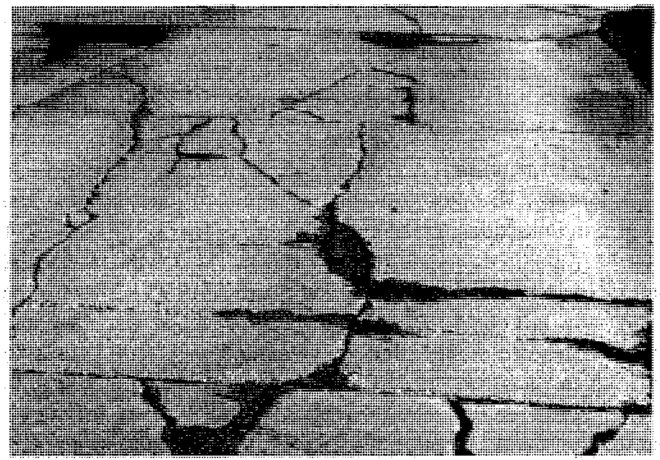


FIG. X2.9 High-Severity Divided Slab

X2.6.1.1 *L*—"D" cracks cover less than 15 % of slab area. Most of the cracks are tight, but a few pieces may be loose and or missing (Fig. X2.10).

X2.6.1.2 M—One of the following conditions exists (Fig. X2.11): "D" cracks cover less than 15 % of the area and most of the pieces are loose and or missing, or "D" cracks cover more than 15 % of the area. Most of the cracks are tight, but a few pieces may be loose and or missing.

X2.6.1.3 *H*—"D" cracks cover more than 15 % of the area and most of the pieces have come out or could be removed easily (Fig. X2.12).

X2.6.2 *How to Count*—When the distress is located and rated at one severity, it is counted as one slab. If more than one severity level exists, the slab is counted as having the higher severity distress. For example, if low and medium "D" cracking are on the same slab, the slab is counted as medium-severity cracking only.

FAULTING

X2.7 *Description*:

X2.7.1 Faulting is the difference in elevation across a joint. Some common causes of faulting are as follows:

X2.7.1.1 Settlement because of soft foundation.

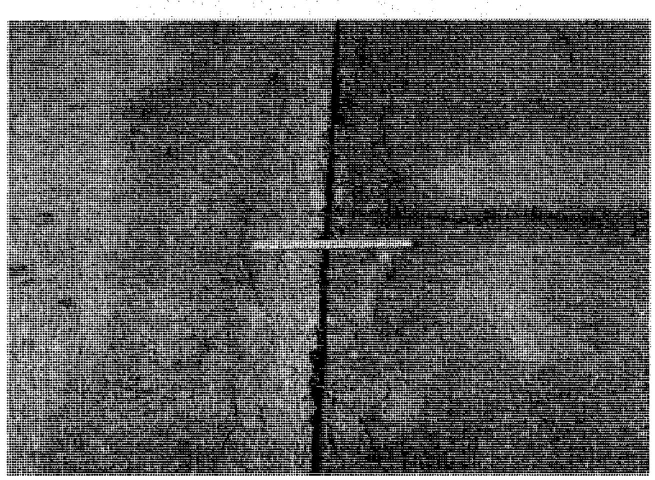


FIG. X2.10 Low-Severity Durability Cracking

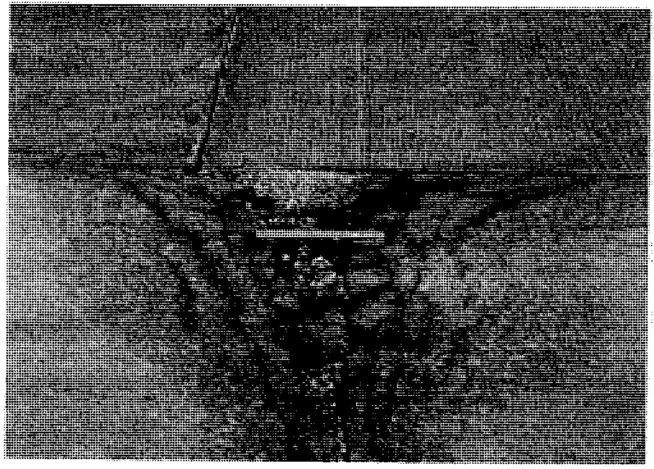


FIG. X2.11 Medium-Severity Durability Cracking

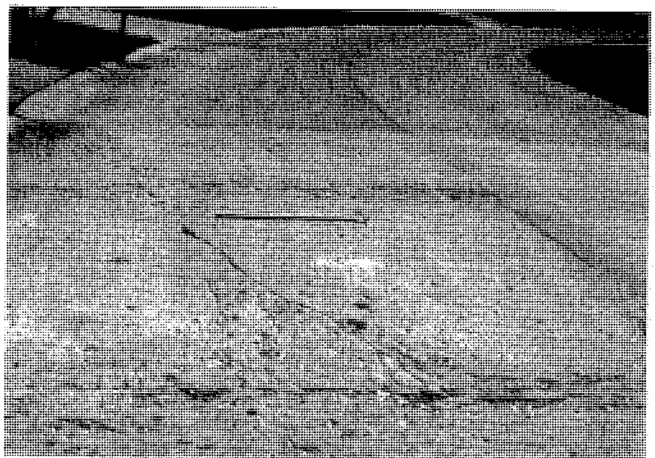


FIG. X2.12 High-Severity Durability Cracking

X2.7.1.2 Pumping or eroding of material from under the slab.

X2.7.1.3 Curling of the slab edges due to temperature and moisture changes.

X2.7.2 *Severity Levels*—Severity levels are defined by the difference in elevation across the joint as indicated in Table X2.2. Figs. X2.13-X2.15 show examples of the different severity levels.

X2.7.3 *How to Count*—Faulting across a joint is counted as one slab. Only affected slabs are counted. Faults across a crack are not counted as distress but are considered when defining crack severity.

JOINT SEAL DAMAGE

X2.8 *Description:*

TABLE X2.2 Levels of Severity for Punchouts

Severity of the Majority of Cracks	Number of Pieces 2 to 3	4 to 5	>5
L	L	L	M
M	L	M	H
H	M	H	H

FIG. X2.13 Low-Severity Faulting

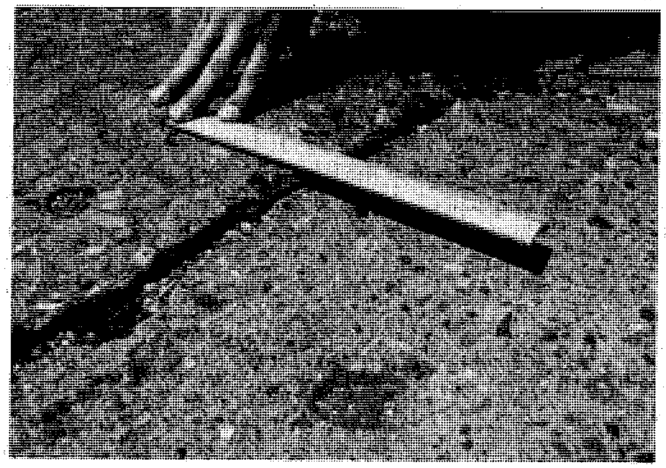


FIG. X2.14 Medium-Severity Faulting

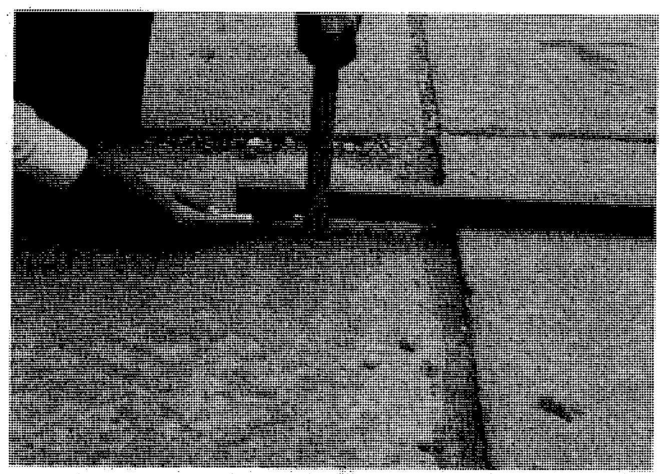


FIG. X2.15 High-Severity Faulting

X2.8.1 Joint seal damage is any condition that enables soil or rocks to accumulate in the joints or allows significant water infiltration. Accumulation of incompressible materials prevents the slab from expanding and may result in buckling, shattering, or spalling. A pliable joint filler bonded to the edges of the slabs protects the joints from material accumulation and prevents water from seeping down and softening the foundation supporting the slab. Typical types of joint seal damage are as follows:

X2.8.1.1 Stripping of joint sealant.

X2.8.1.2 Extrusion of joint sealant.

X2.8.1.3 Weed growth.

X2.8.1.4 Hardening of the filler (oxidation).

X2.8.1.5 Loss of bond to the slab edges.

X2.8.1.6 Lack or absence of sealant in the joint.

X2.8.2 *Severity Levels*:

X2.8.2.1 **L**—Joint sealant is in generally good condition throughout section (Fig. X2.16). Sealant is performing well, with only minor damage (see X2.8.1.1-X2.8.1.6). Joint seal damage is at low severity if a few of the joints have sealer, which has debonded from, but is still in contact with, the joint edge. This condition exists if a knife blade can be inserted between sealer and joint face without resistance.

X2.8.2.2 **M**—Joint sealant is in generally fair condition over the entire section, with one or more of the above types of damage occurring to a moderate degree. Sealant needs replacement within two years (Fig. X2.17). Joint seal damage is at medium severity if a few of the joints have any of the following conditions: joint sealer is in place, but water access is possible through visible openings no more than 3 mm (⅛ in.) wide. If a knife blade cannot be inserted easily between sealer and joint face, this condition does not exist; pumping debris are evident at the joint; joint sealer is oxidized and "lifeless" but pliable (like a rope), and generally fills the joint opening; or, vegetation in the joint is obvious but does not obscure the joint opening.

X2.8.2.3 **H**—Joint sealant is in generally poor condition over the entire section, with one or more of the above types of damage occurring to a severe degree. Sealant needs immediate replacement (Fig. X2.18). Joint seal damage is at high severity if 10 % or more of the joint sealer exceeds limiting criteria listed above or if 10 % or more of sealer is missing.

X2.8.3 *How to Count*—Joint seal damage is not counted on a slab-by-slab basis but is rated based on the overall condition of the sealant over the entire area.

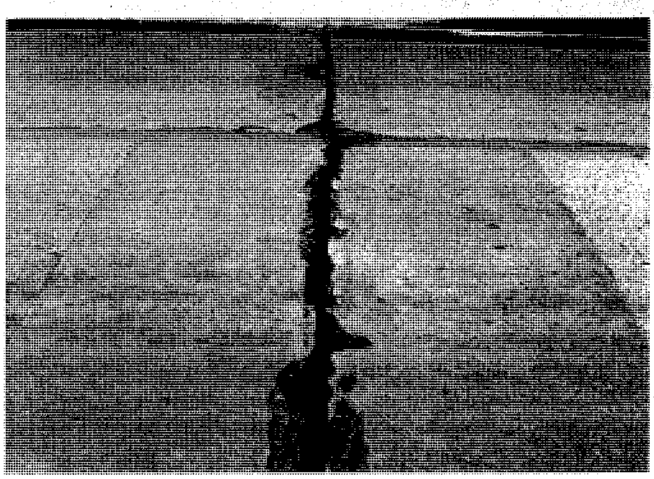


FIG. X2.16 Low-Severity Joint Seal Damage

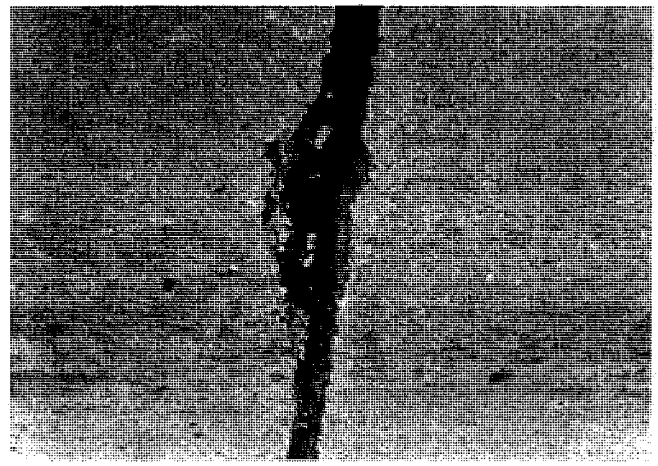


FIG. X2.17 Medium-Severity Joint Seal Damage

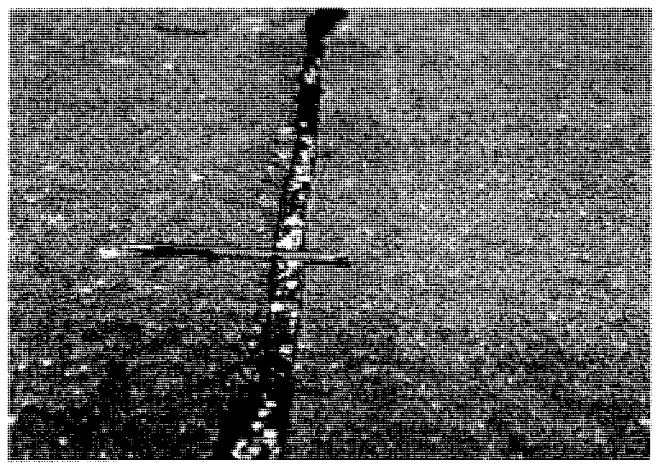


FIG. X2.18 High-Severity Joint Seal Damage

LANE/SHOULDER DROP-OFF

X2.9 *Description*—Lane/shoulder drop-off is the difference between the settlement or erosion of the shoulder and the pavement travel-lane edge. The elevation difference can be a safety hazard, and it also can cause increased water infiltration.

X2.9.1 *Severity Levels*:

X2.9.1.1 **L**—The difference between the pavement edge and shoulder is >25 and ≤50 mm (>1 and ≤2 in.) (Fig. X2.19).

X2.9.1.2 **M**—The difference in elevation is >50 and ≤100 mm (>2 and ≤4 in.) (Fig. X2.20).

X2.9.1.3 **H**—The difference in elevation is >100 mm (>4 in.) (Fig. X2.21).

X2.9.2 *How to Count*—The mean lane/shoulder drop-off is computed by averaging the maximum and minimum drop along the slab. Each slab exhibiting distress is measured separately and counted as one slab with the appropriate severity level.

LINEAR CRACKING
(Longitudinal, Transverse, and Diagonal Cracks)

X2.10 *Description*—These cracks, which divide the slab into two or three pieces, usually are caused by a combination

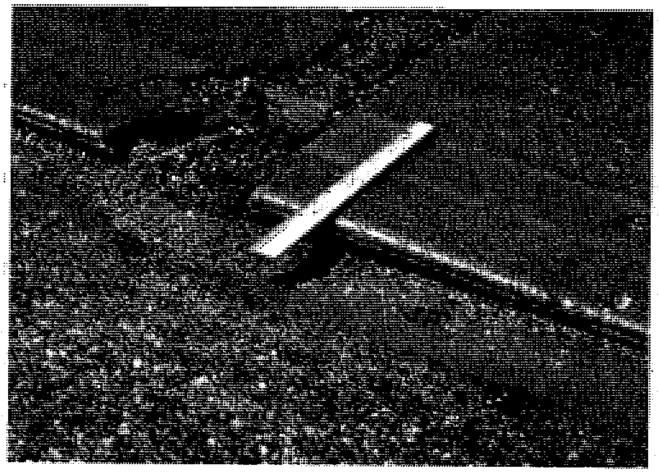


FIG. X2.19 Low-Severity Lane/Shoulder Drop-Off

FIG. X2.20 Medium-Severity Lane/Shoulder Drop-Off

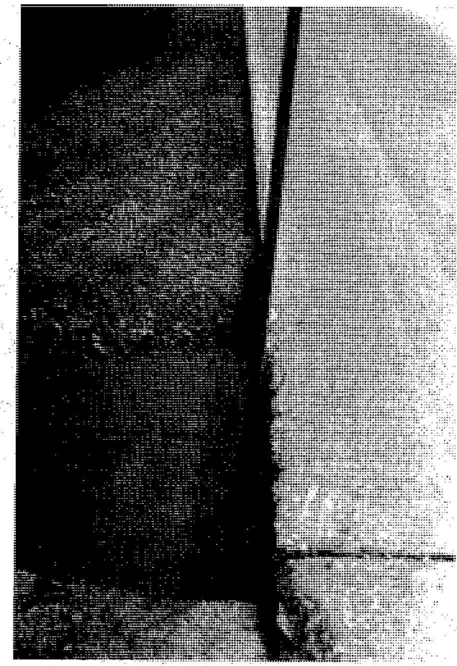


FIG. X2.21 High-Severity Lane/Shoulder Drop-Off

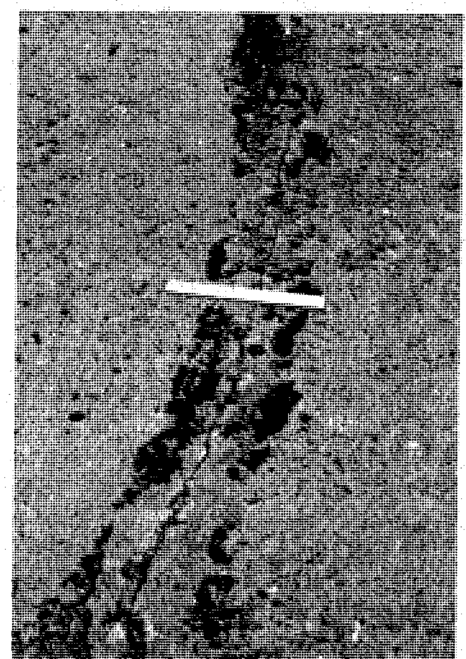


FIG. X2.22 Low-Severity Linear Cracking

of repeated traffic loading, thermal gradient curling, and repeated moisture loading. (Slabs divided into four or more pieces are counted as divided slabs.) Hairline cracks that are only a few feet long and do not extend across the entire slab, are counted as shrinkage cracks.

X2.10.1 *Severity Levels (Nonreinforced Slabs)*:

X2.10.1.1 **L**—Nonfilled[4] cracks ≤ 13 mm (≤ ½ in.) or filled cracks of any width with the filler in satisfactory condition. No faulting exists (Fig. X2.22).

X2.10.1.2 **M**—One of the following conditions exists: nonfilled crack with a width >13 and ≤50 mm (>½ and ≤ 2 in.); nonfilled crack of any width ≤ 50 mm (2 in.) with faulting of <10 mm (⅜ in.), or filled crack of any width with faulting <10 mm (⅜ in.) (Fig. X2.23).

X2.10.1.3 **H**—One of the following conditions exists: nonfilled crack with a width >50 mm (2 in.), or filled or nonfilled crack of any width with faulting >10 mm (⅜ in.) (Fig. X2.24).

X2.10.2 *Reinforced Slabs*:

X2.10.2.1 **L**—Nonfilled cracks ≥ 3 and < 25 mm (≥ ⅛ to < 1 in.) wide; filled crack of any width with the filler in satisfactory condition. No faulting exists.

X2.10.2.2 **M**—One of the following conditions exists: nonfilled cracks with a width ≥ 25 and < 75 mm (≥ 1 and < 3 in.)

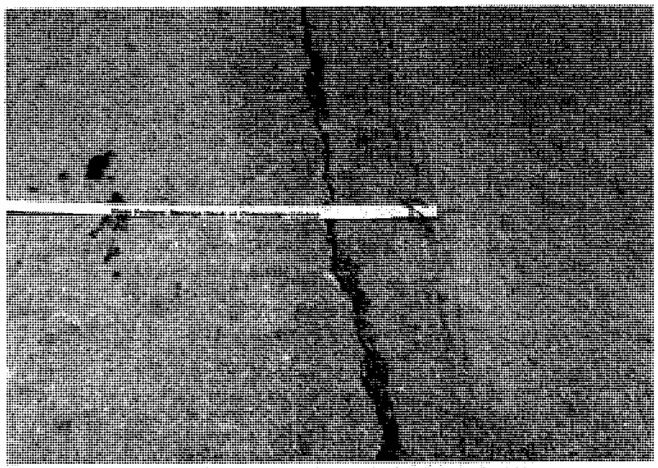


FIG. X2.23 Medium-Severity Linear Cracking

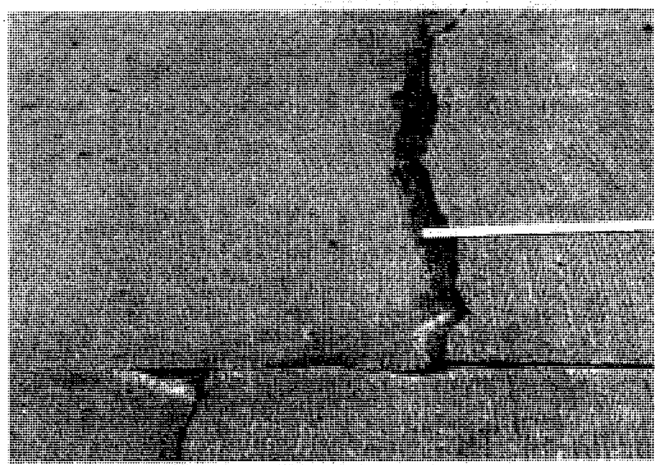


FIG. X2.24 High-Severity Linear Cracking

and no faulting; nonfilled crack of any width ≤ 75 mm (3 in.) with ≤ 10 mm (3⁄8 in.) of faulting, or filled crack of any width with ≤ 10 mm (3⁄8 in.) faulting.

X2.10.2.3 **H**—Once of the following conditions exists: nonfilled crack >75 mm (3 in.) wide, or filled or nonfilled crack of any width with faulting >10 mm (3⁄8 in.).

X2.10.3 *How to Count*—One the severity has been identified, the distress is recorded as one slab. If two medium severity cracks are within one slab, the slab is counted as having one high-severity crack. Slabs divided into four or more pieces are counted as divided slabs. In reinforced slabs, cracks <3 mm (1⁄8 in.) wide are counted as shrinkage cracks. Slabs longer than 9 m (29.5 ft) are divided into approximately equal length" slabs" having imaginary joints assumed to be in perfect condition.

PATCHING, LARGE (MORE THAN 0.5 M^2 [5.5 FT^2]) AND UTILITY CUTS

X2.11 *Description*—A patch is an area where the original pavement has been removed and replaced by filler material. A utility cut is a patch that has replaced the original pavement to allow the installation or maintenance of underground utilities. The severity levels of a utility cut are assessed according to the same criteria as large patching.

X2.11.1 *Severity Levels*:

X2.11.1.1 **L**—Patch is functioning well, with little or no deterioration (Fig. X2.25).

X2.11.1.2 **M**—Patch is moderately deteriorated, or moderate spalling can be seen around the edges, or both. Patch material can be dislodged with considerable effort (Fig. X2.26).

X2.11.1.3 **H**—Patch is badly deteriorated. The extent of the deterioration warrants replacement (Fig. X2.27).

X2.11.2 *How to Count*—If a single slab has one or more patches with the same severity level, it is counted as one slab containing that distress. If a single slab has more than one severity level, it is counted as one slab with the higher severity level.

PATCHING, SMALL (LESS THAN 0.5 M^2 [5.5 FT^2])

X2.12 *Description*—A patch is an area where the original pavement has been removed and replaced by a filler material.

X2.12.1 *Severity Levels*:

X2.12.1.1 **L**—Patch is functioning well with little or no deterioration (Fig. X2.28).

X2.12.1.2 **M**—Patch is moderately deteriorated. Patch material can be dislodged with considerable effort (Fig. X2.29).

X2.12.1.3 **H**—Patch is badly deteriorated. The extent of deterioration warrants replacement (Fig. X2.30).

X2.12.2 *How to Count*—If a single slab has one or more patches with the same severity level, it is counted as one slab containing that distress. If a single slab has more than one severity level, it is counted as one slab with the higher severity level.

POLISHED AGGREGATE

X2.13 *Description*—This distress is caused by repeated traffic applications. Polished aggregate is present when close examination of a pavement reveals that the portion of aggregate extending above the asphalt is either very small, or there are no rough or angular aggregate particles to provide good skid resistance.

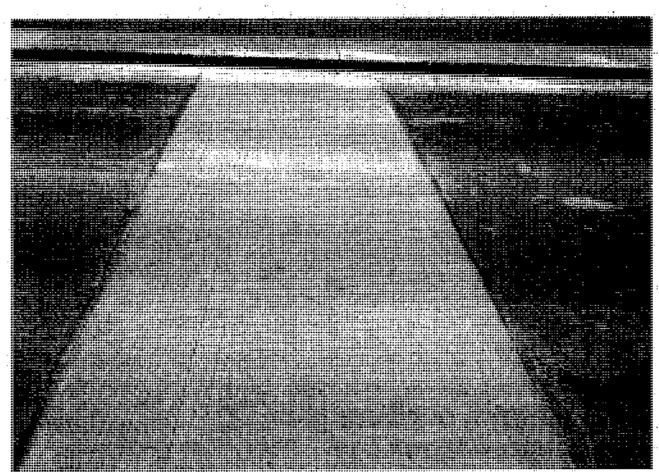


FIG. X2.25 Low-Severity Patching, Large and Utility Cuts

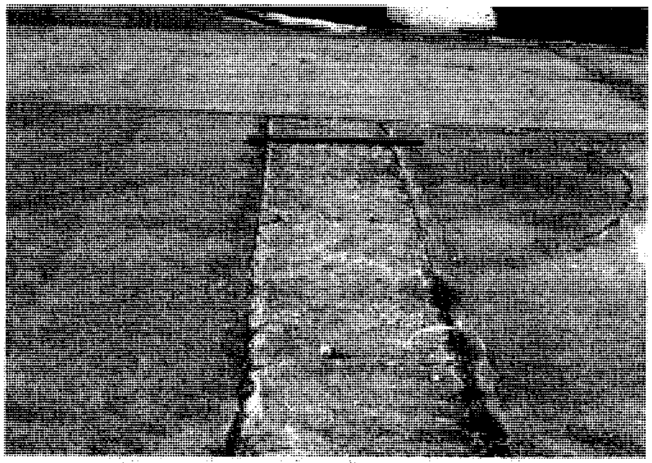


FIG. X2.26 Medium-Severity Patching, Large and Utility Cuts

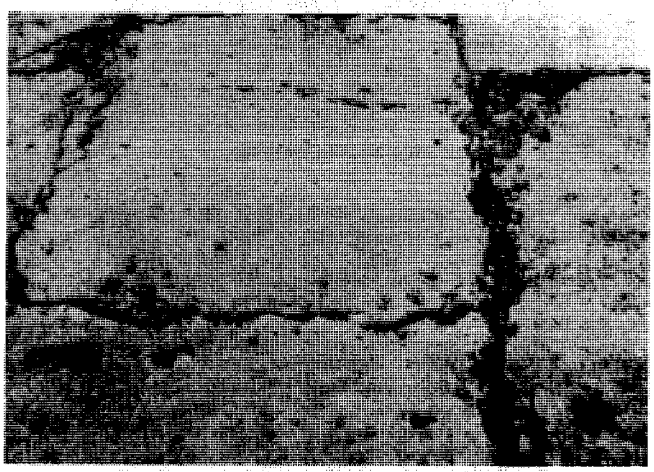


FIG. X2.27 High-Severity Patching, Large and Utility Cuts

FIG. X2.28 Low-Severity Patching, Small

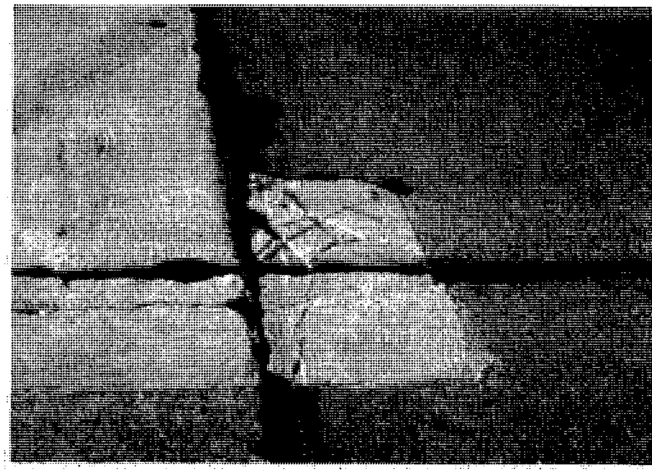


FIG. X2.29 Medium-Severity Patching, Small

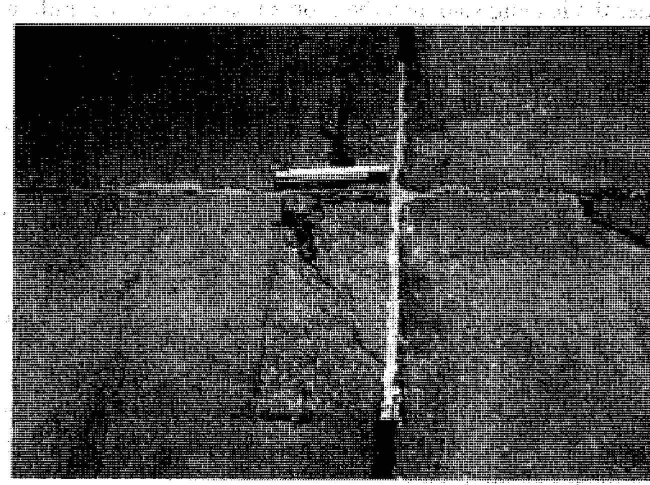


FIG. X2.30 High-Severity Patching, Small

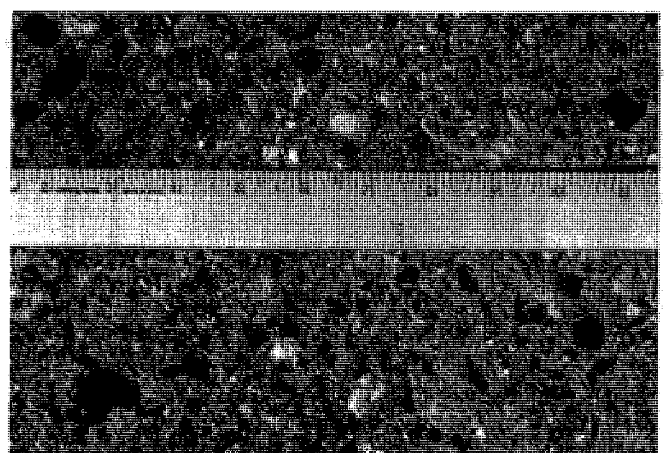


FIG. X2.31 Polished Aggregate

X2.13.1 *Severity Levels*—No degrees of severity are defined; however, the degree of polishing should be significant before it is included in the condition survey and rated as a defect (Fig. X2.31).

X2.13.2 *How to Count*—A slab with polished aggregate is counted as one slab.

POPOUTS

X2.14 *Description*—A popout is a small piece of pavement that breaks loose from the surface due to freeze-thaw action, combined with expansive aggregates. Popouts usually range in diameter from approximately 25 to 100 mm (1 to 4 in.) and in depth from 13 to 50 mm (½ to 2 in.).

X2.14.1 *Severity Levels*—No degrees of severity are defined for popouts; however, popouts must be extensive before they are counted as a distress. Average popout density must exceed approximately three popouts/m^2 over the entire slab area (Fig. X2.32).

X2.14.2 *How to Count*—The density of the distress must be measured. If there is any doubt that the average is greater than three popouts per square yard, at least three random 1 m^2 (11 ft^2) areas should be checked. When the average is greater than this density, the slab should be counted.

PUMPING

X2.15 *Description*—Pumping is the ejection of material from the slab foundation through joints or cracks. This is caused by deflection of the slab with passing loads. As a load moves across the joint between the slabs, water is first forced under the leading slab, and then forced back under the trailing slab. This action erodes and eventually removes soil particles resulting in progressive loss of pavement support. Pumping can be identified by surface stains and evidence of base or subgrade material on the pavement close to joints or cracks. Pumping near joints is caused by poor joint sealer and indicates loss of support; repeated loading eventually will produce cracks. Pumping also can occur along the slab edge causing loss of support.

X2.15.1 *Severity Levels*—No degrees of severity are defined. It is enough to indicate that pumping exists (Fig. X2.33 and Fig. X2.34).

X2.15.2 *How to Count*—One pumping joint between two slabs is counted as two slabs; however, if the remaining joints around the slab are also pumping, one slab is added per additional pumping joint.

PUNCHOUT

X2.16 *Description*—This distress is a localized area of the slab that is broken into pieces. The punchout can take many different shapes and forms, but it is usually defined by a crack and a joint. The distance between the join and the crack or two closely spaced cracks is ≤ 1.5 m (5 ft) wide. This distress is caused by heavy repeated loads, inadequate slab thickness, loss

FIG. X2.32 Popouts

FIG. X2.33 Pumping

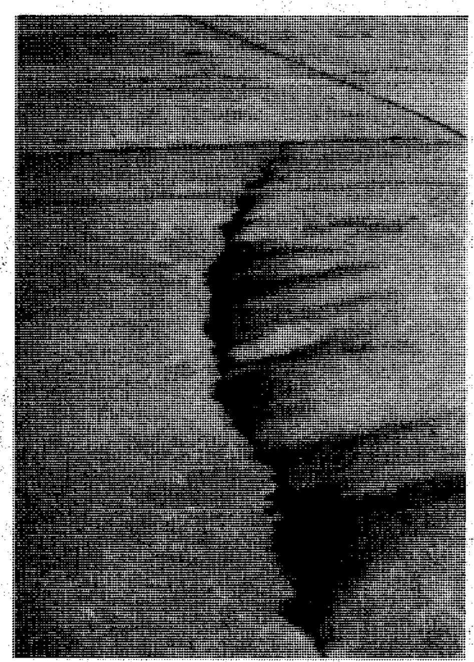


FIG. X2.34 Pumping

of foundation support, or a localized concrete construction deficiency, for example, honeycombing.

X2.16.1 *Severity Levels*—Table X2.2 lists the severity levels for punchouts, and Figs. X2.35-X2.37 show examples.

X2.16.2 *How to Count*—If a slab contains more than one punchout or a punchout and a crack, it is counted as shattered.

RAILROAD CROSSING

X2.17 *Description*—Railroad crossing distress is characterized by depressions or bumps around the tracks.

FIG. X2.35 Low-Severity Punchout

FIG. X2.36 Medium-Severity Punchout

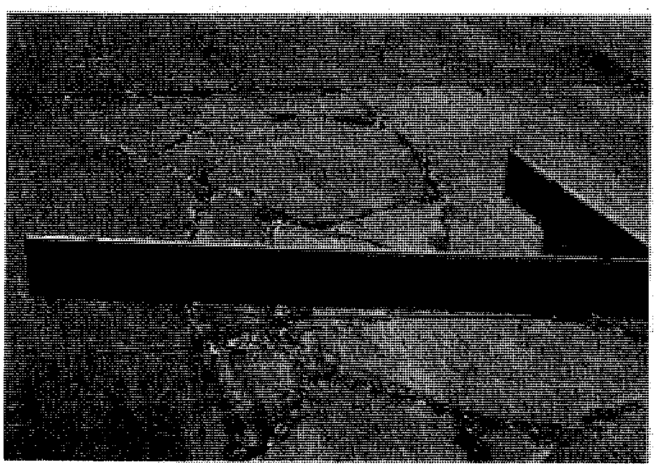


FIG. X2.37 High-Severity Punchout

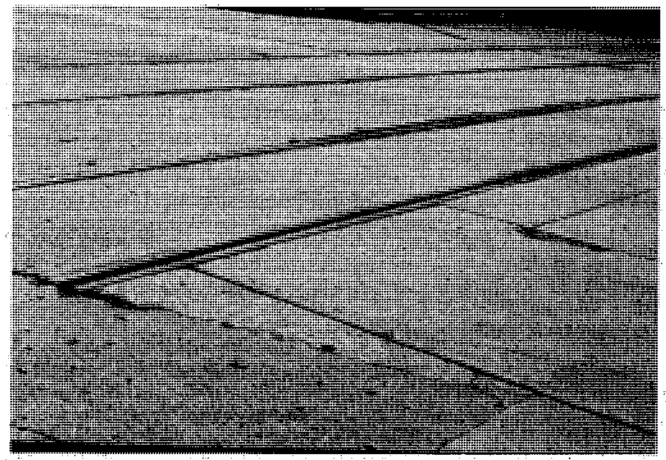


FIG. X2.38 Low-Severity Railroad Crossing

FIG. X2.39 Medium-Severity Railroad Crossing

FIG. X2.40 High-Severity Railroad Crossing

X2.17.1 *Severity Levels*:

X2.17.1.1 **L**—Railroad crossing causes low-severity ride quality (Fig. X2.38).

X2.17.1.2 **M**—Railroad crossing causes medium-severity ride quality (Fig. X2.39).

X2.17.1.3 **H**—Railroad crossing causes high-severity ride quality (Fig. X2.40).

X2.17.2 *How to Count*—The number of slabs crossed by the railroad tracks is counted. Any large bump created by the tracks should be counted as part of the crossing.

SCALING, MAP CRACKING, AND CRAZING

X2.18 *Description*—Map cracking or crazing refers to a network of shallow, fine, or hairline cracks that extend only through the upper surface of the concrete. The cracks tend to intersect at angles of 120°. Map cracking or crazing usually is caused by concrete over-finishing and may lead to surface scaling, which is the breakdown of the slab surface to a depth of approximately 6 to 13 mm (¼ to ½ in.). Scaling also may be caused by deicing salts, improper construction, freeze-thaw cycles and poor aggregate. The type of scaling defined here is not caused by "D" cracking. If scaling is caused by "D" cracking, it should be counted under that distress only.

X2.18.1 *Severity Levels*:

X2.18.1.1 **L**—Crazing or map cracking exists over most of the slab area; the surface is in good condition, with only minor scaling present (Fig. X2.41).

X2.18.1.2 **M**—Slab is scaled but less than 15 % of the slab is affected (Fig. X2.42).

X2.18.1.3 **H**—Slab is scaled over more than 15 % of its area (Fig. X2.43).

X2.18.2 *How to Count*—A scaled slab is counted as one slab. Low-severity crazing only should be counted if the potential for scaling appears to be imminent or a few small pieces come out.

SHRINKAGE CRACKS

X2.19 *Description*—Shrinkage cracks are hairline cracks that usually are less than 2-m long and do not extend across the entire slab. They are formed during the setting and curing of the concrete and usually do not extend through the depth of the slab.

X2.19.1 *Severity Levels*—No degrees of severity are defined. It is enough to indicate that shrinkage cracks are present (Fig. X2.44).

X2.19.2 *How to Count*—If any shrinkage cracks exist on a particular slab, the slab is counted as one slab with shrinkage cracks.

SPALLING, CORNER

X2.20 *Description*—Corner spalling is the breakdown of the slab within approximately 0.5 m (1.5 ft) of the corner. A corner spall differs from a corner break in that the spall usually angles downward to intersect the joint, whereas a break

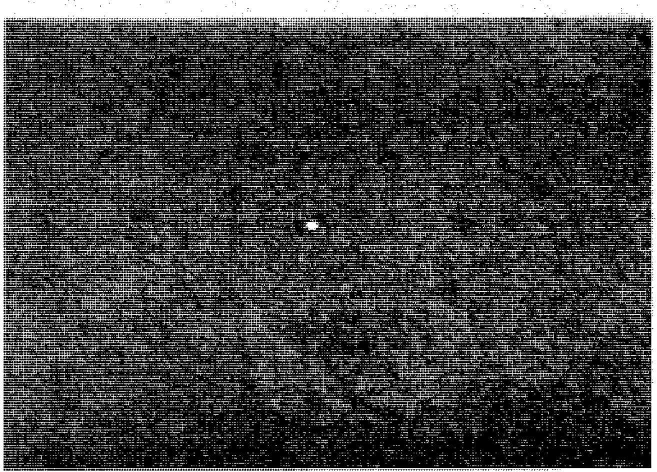


FIG. X2.41 Low-Severity Scaling, Map Cracking, and Crazing

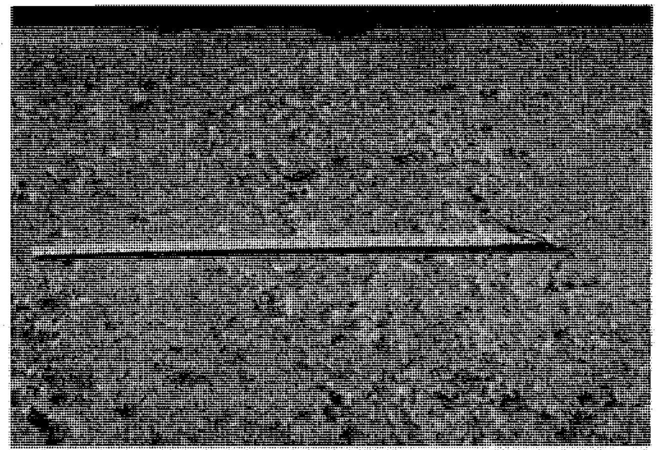


FIG. X2.42 Medium-Severity Scaling, Map Cracking, and Crazing

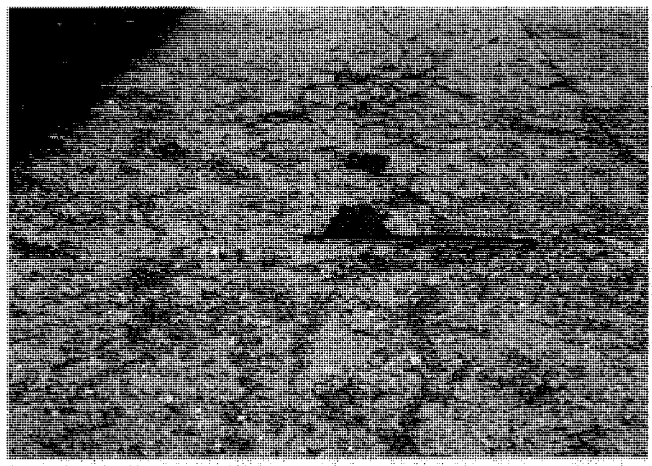


FIG. X2.43 High-Severity Scaling, Map Cracking, and Crazing

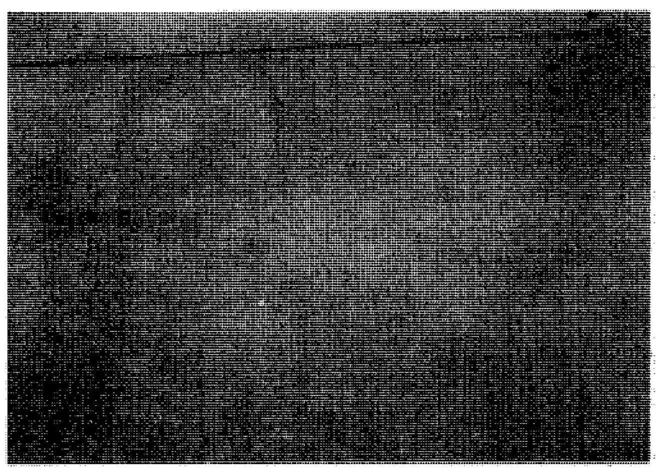


FIG. X2.44 Shrinkage Cracks

extends vertically through the slab corner. Spalls less than 130 mm (5 in.) from the crack to the corner on both sides should not be counted.

X2.20.1 *Severity Levels*—Table X2.3 lists the levels of severity for corner spalling. Figs. X2.45-X2.47 show examples. Corner spalling with an area of less than 650 cm (10 in.^{2}) from the crack to the corner on both sides should not be counted.

X2.20.2 *How to Count*—If one or more corner spalls with the same severity level are in a slab, the slab is counted as one slab with corner spalling. If more than one severity level occurs, it is counted as one slab with the higher severity level.

SPALLING, JOINT

X2.21 *Description*:

X2.21.1 Joint spalling is the breakdown of the slab edges within 0.5 m (1.5 ft) of the joint. A joint spall usually does not extend vertically through the slab, but intersects the joint at an angle. Spalling results from:

X2.21.1.1 Excessive stresses at the joint caused by traffic loading or by infiltration of incompressible materials.

X2.21.1.2 Weak concrete at the joint caused by overworking.

X2.21.1.3 Water accumulation in the joint and freeze-thaw action.

X2.21.2 *Severity Levels*—Table X2.4 and Figs. X2.48-X2.50 show the severity levels of joint spalling. A frayed joint where the concrete has been worn away along the entire joint is rated as low severity.

X2.21.3 *How to Count*—If spall is along the edge of one slab, it is counted as one slab with joint spalling. If spalling is on more than one edge of the same slab, the edge having the highest severity is counted and recorded as one slab. Joint spalling also can occur along the edges of two adjacent slabs. If this is the case, each slab is counted as having joint spalling.

TABLE X2.3 Levels of Severity for Corner Spalling

Depth of Spall	Dimensions of Sides of Spall 130 × 130 mm to 300 × 300 mm (5 × 5 in.) to (12 × 12 in.)	300 × 300 mm (>12 × 12 in.)
<25 mm (1 in.)	L	L
>25 to 50 mm (1 to 2 in.)	L	M
>50 mm (2 in.)	M	H

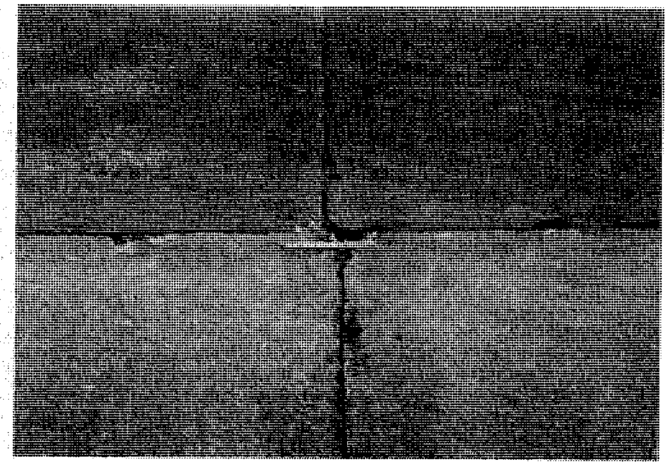


FIG. X2.45 Low-Severity Spalling, Corner

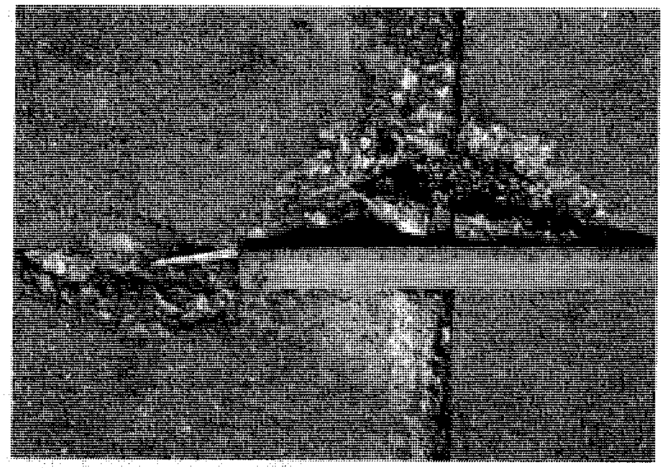


FIG. X2.46 Medium-Severity Spalling, Corner

FIG. X2.47 High-Severity Spalling, Corner

TABLE X2.4 Levels of Severity for Joint Spalling

Spall Pieces	Width of Spall	Length of Spall <0.5 m (1.5 ft)	Length of Spall >0.5 m (1.5 ft)
Tight—cannot be removed easily (maybe a few pieces missing.	<100 mm (4 in.)	**L**	**L**
	>100 mm	**L**	**L**
Loose—can be removed and some pieces are missing; if most or all pieces are missing, spall is shallow, less than 25 mm (1 in.).	<100 mm	**L**	**M**
	>100 mm	**L**	**M**
Missing—most or all pieces have been removed.	<100 mm	**L**	**M**
	>100 mm	**M**	**H**

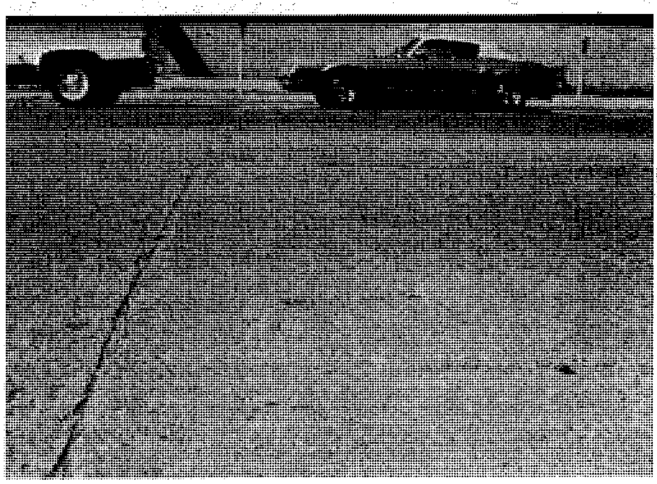


FIG. X2.48 Low-Severity Spalling, Joint

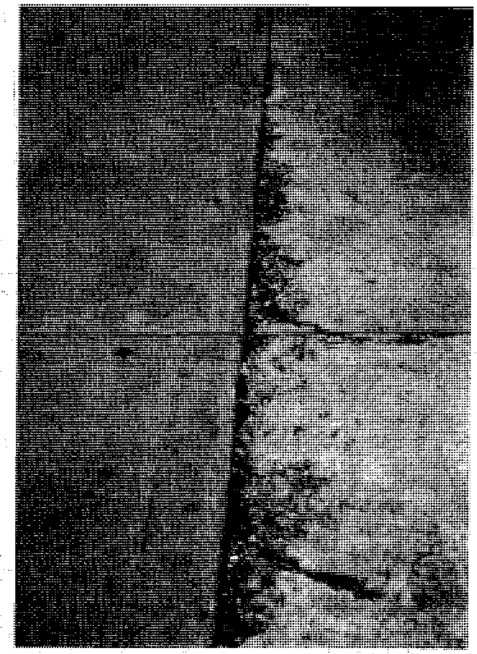


FIG. X2.49 Medium-Severity Spalling, Joint

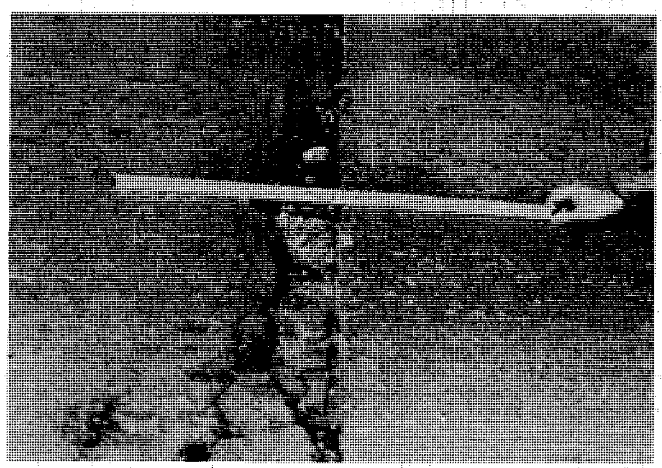


FIG. X2.50 High-Severity Spalling, Joint

X3. DEDUCT VALUE CURVES FOR ASPHALT

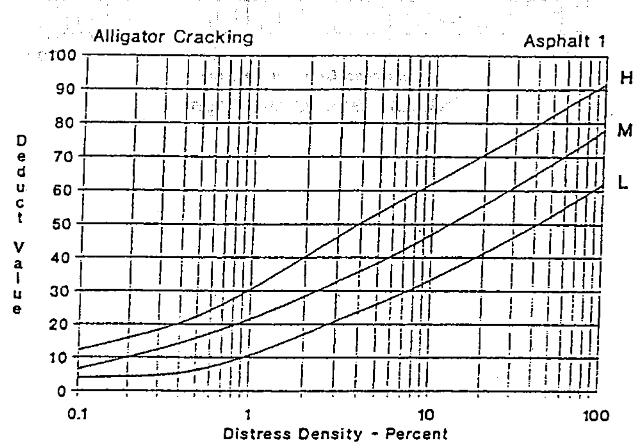


FIG. X3.1 Alligator Cracking

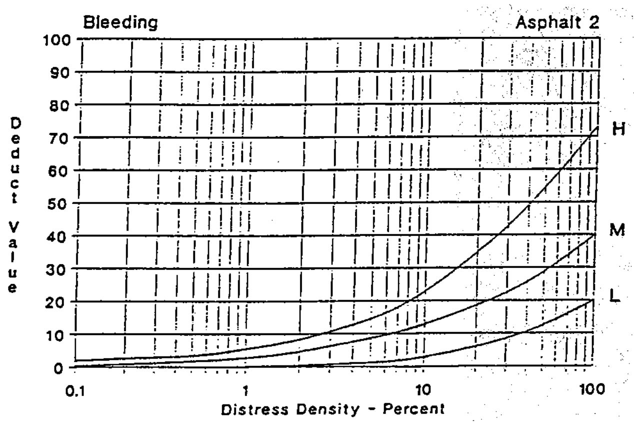


FIG. X3.2 Bleeding

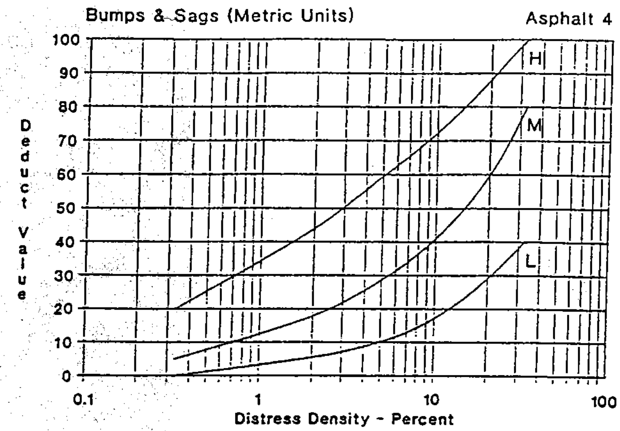


FIG. X3.5 Bumps and Sags (Metric units)

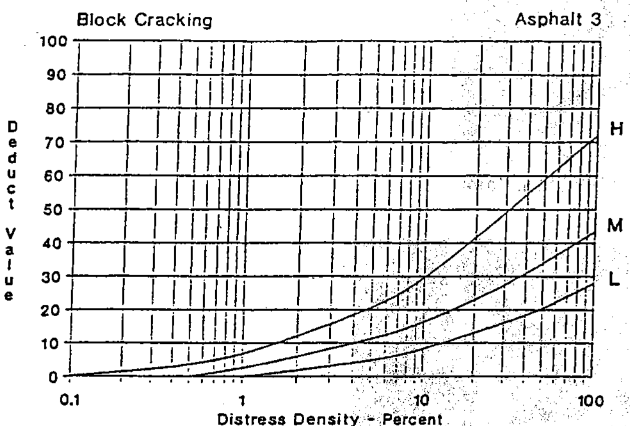


FIG. X3.3 Block Cracking

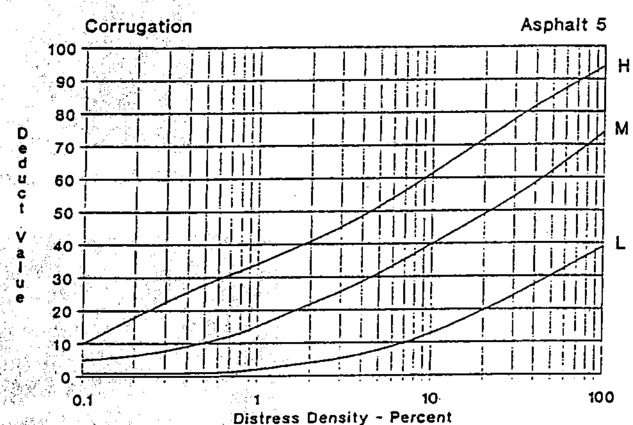


FIG. X3.6 Corrugation

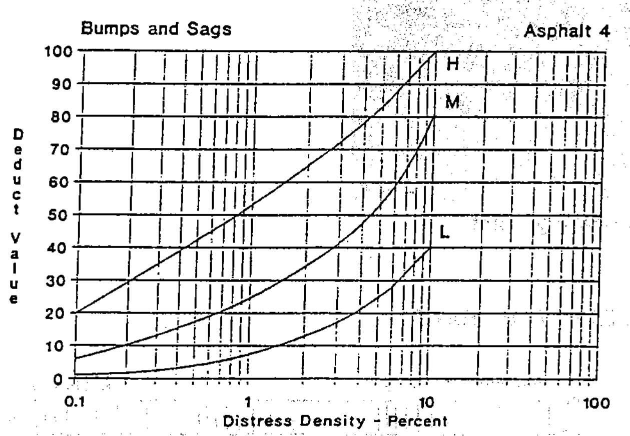


FIG. X3.4 Bumps and Sags

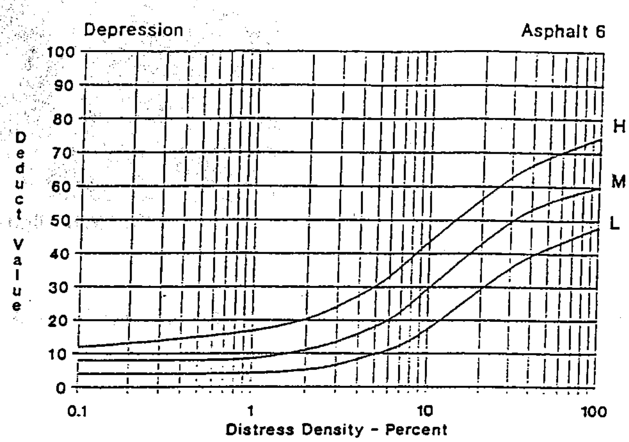


FIG. X3.7 Depression

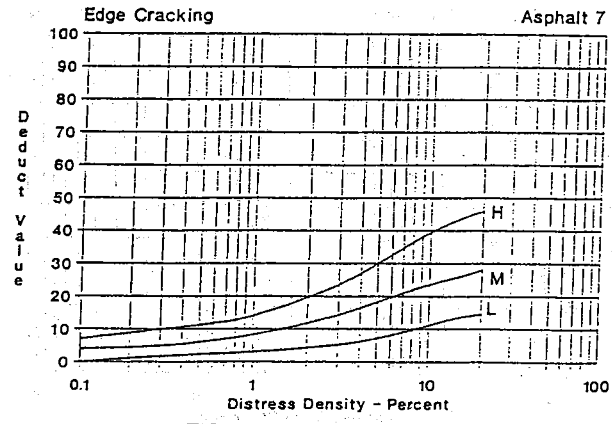


FIG. X3.8 Edge Cracking

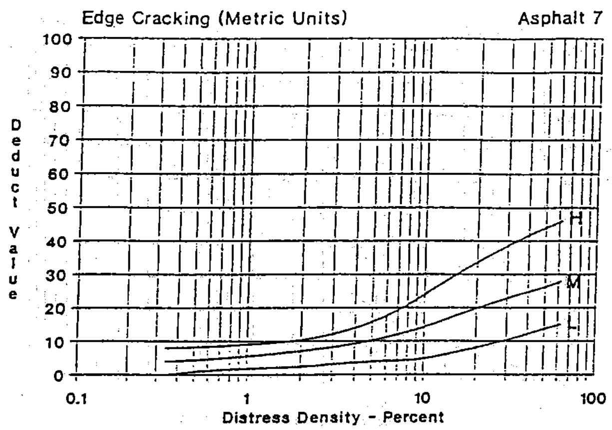


FIG. X3.9 Edge Cracking (metric units)

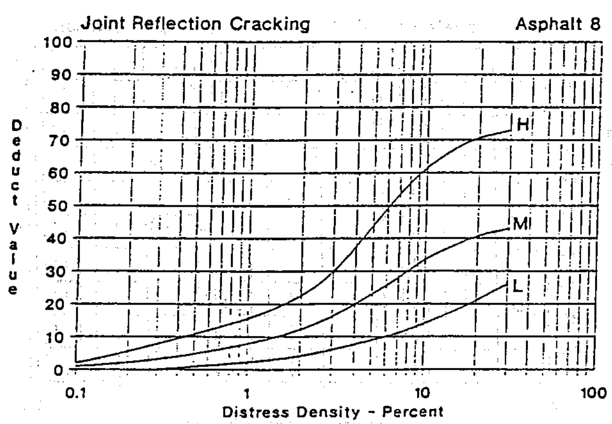


FIG. X3.10 Joint Reflection Cracking

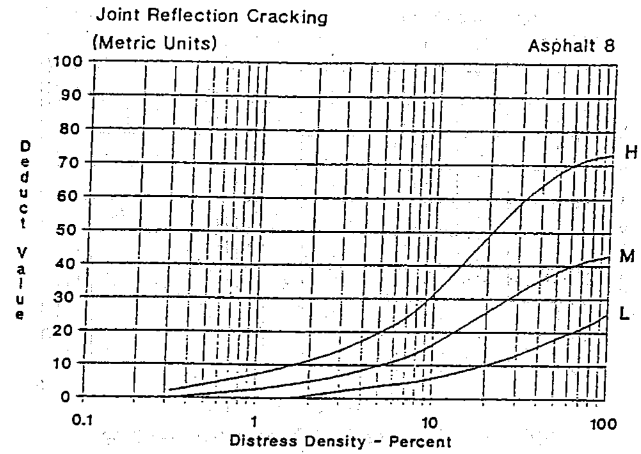


FIG. X3.11 Joint Reflection Cracking (metric units)

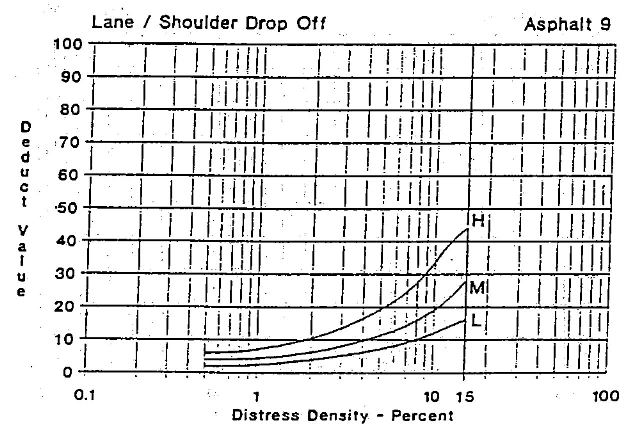


FIG. X3.12 Lane/Shoulder Drop-Off

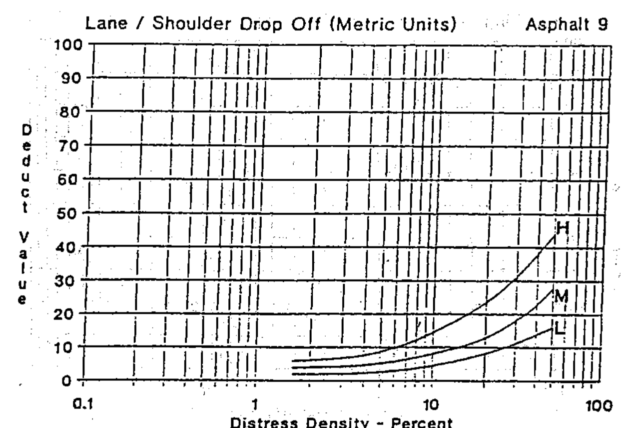


FIG. X3.13 Lane/Shoulder Drop-Off (metric units)

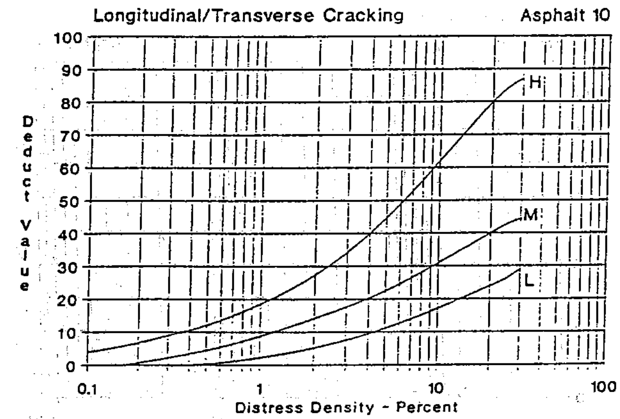


FIG. X3.14 Longitudinal/Transverse Cracking

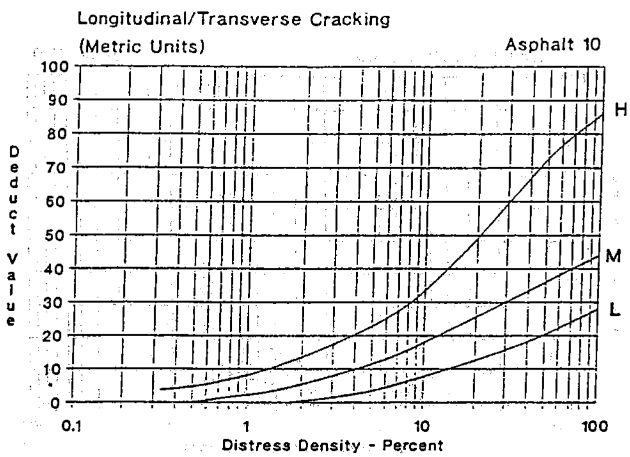


FIG. X3.15 Longitudinal/Transverse Cracking (metric units)

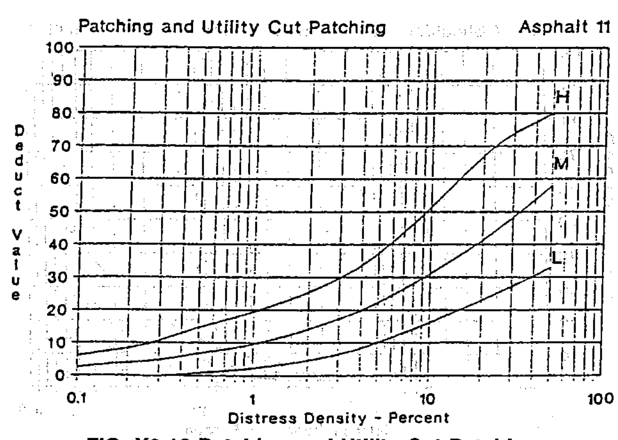


FIG. X3.16 Patching and Utility Cut Patching

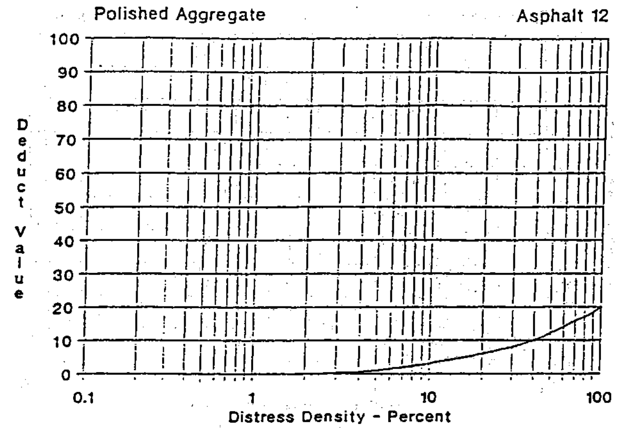


FIG. X3.17 Polished Aggregate

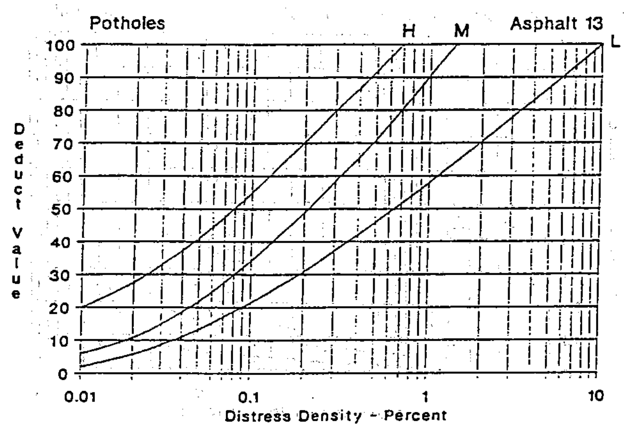


FIG. X3.18 Potholes

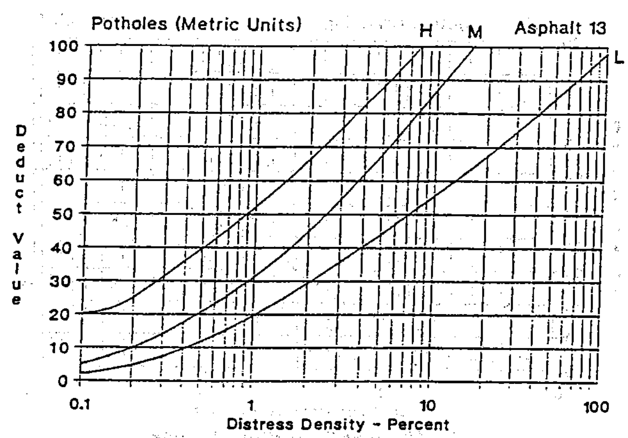


FIG. X3.19 Potholes (metric units)

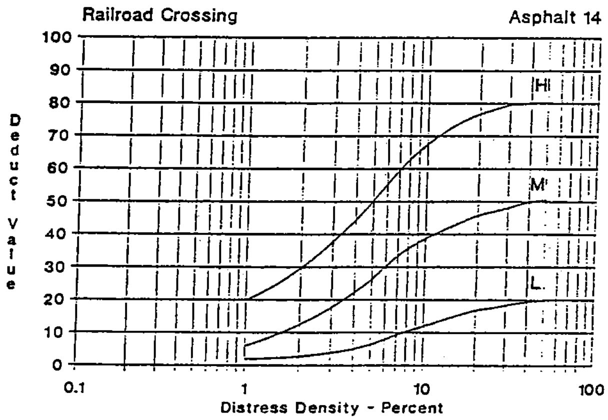


FIG. X3.20 Railroad Crossing

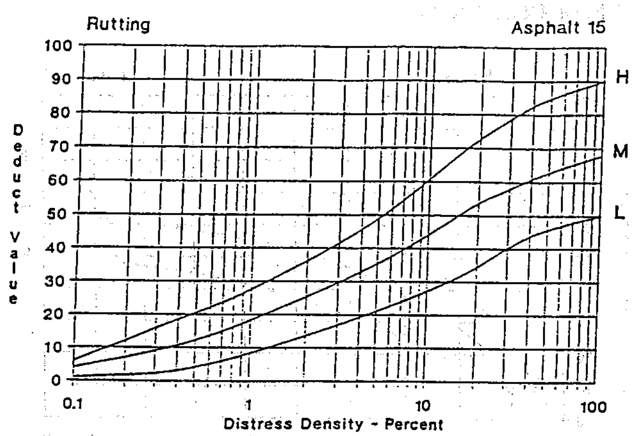


FIG. X3.21 Rutting

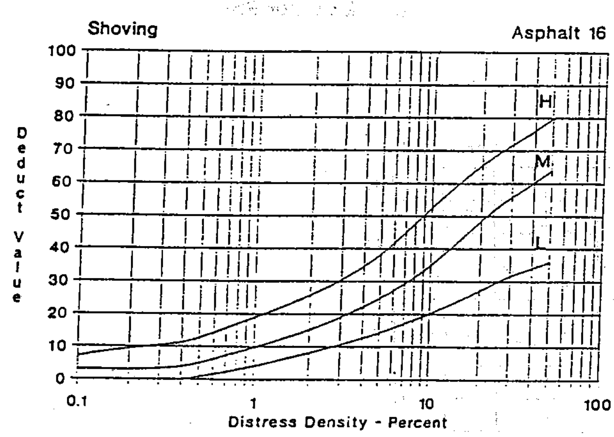


FIG. X3.22 Shoving

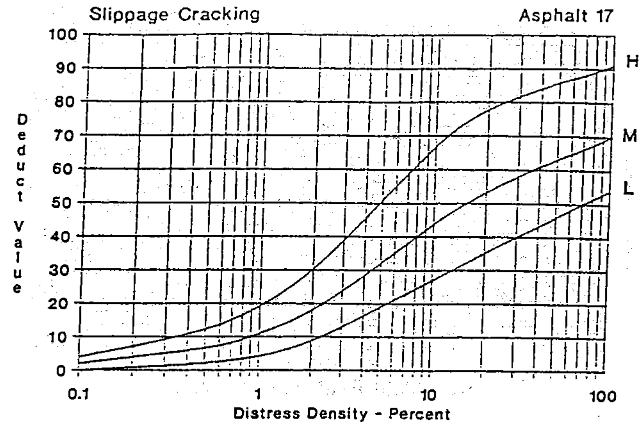


FIG. X3.23 Slippage Cracking

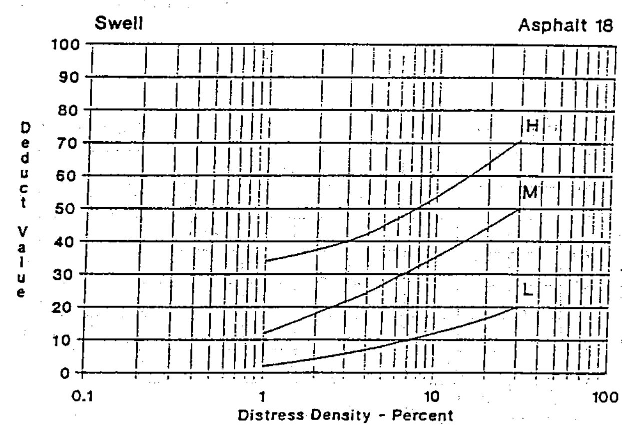


FIG. X3.24 Swell

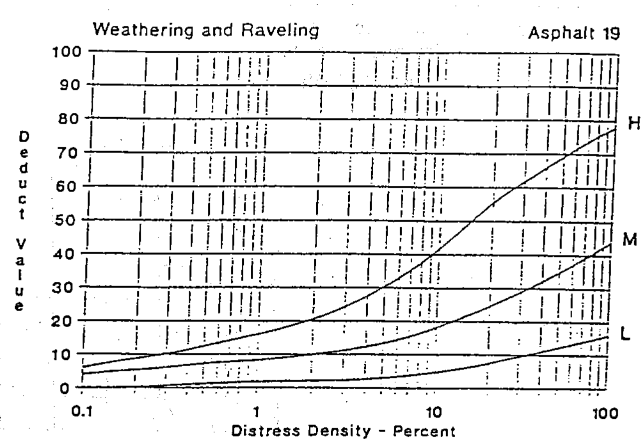


FIG. X3.25 Weathering and Raveling

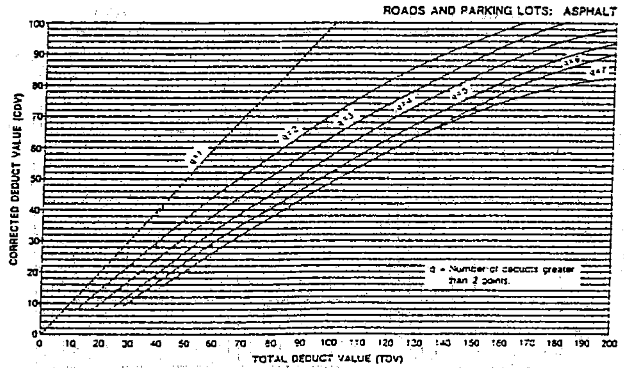


FIG. X3.26 Total Deduct Value

X4. DEDUCT VALUE CURVES FOR CONCRETE

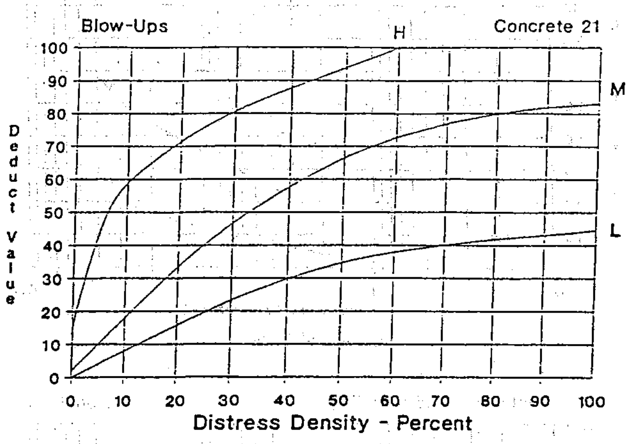


FIG. X4.1 Blowups

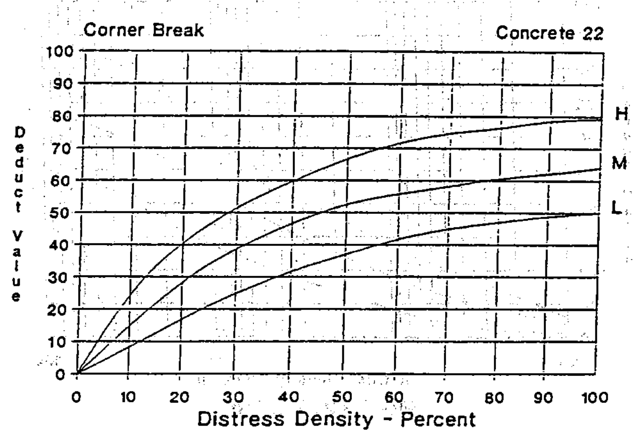


FIG. X4.2 Corner Break

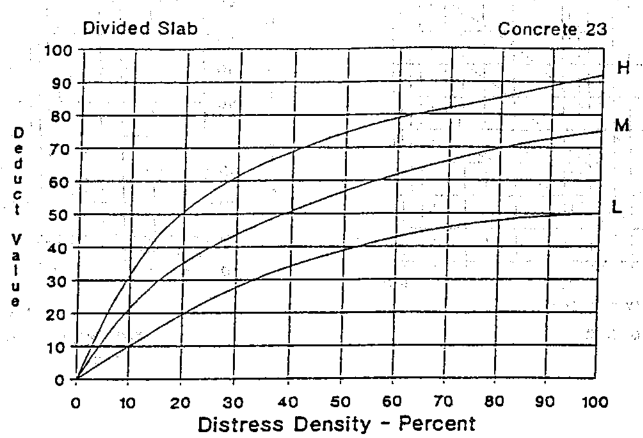


FIG. X4.3 Divided Slab

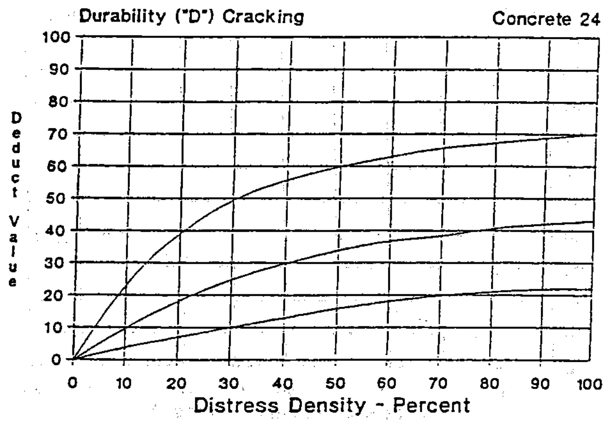


FIG. X4.4 Durability ("D") Cracking

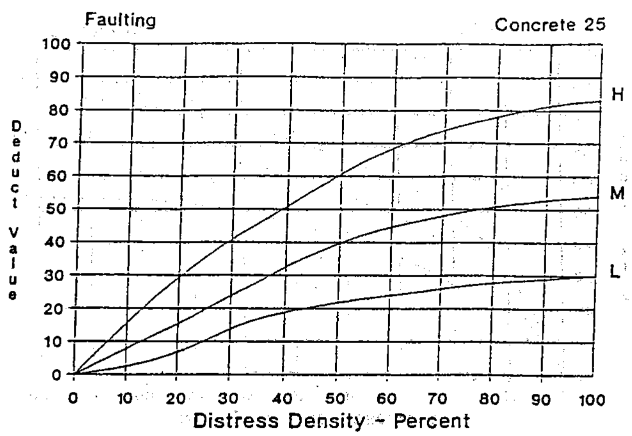


FIG. X4.5 Faulting

Joint Seal Damage Concrete 26

Joint seal damage is not rated by density. The severity of the distress is determined by the sealant's overall condition for a particular sample unit.

The deduct values for the three levels of severity are:

LOW	2 points
MEDIUM	4 points
HIGH	8 points

FIG. X4.6 Rigid Pavement Deduct Values, Distress 26, joint seal damage

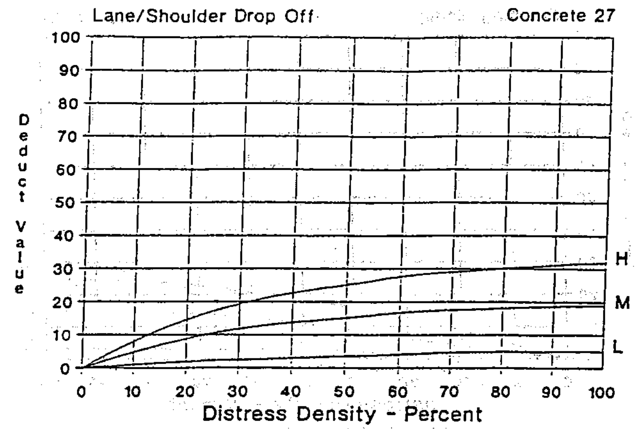


FIG. X4.7 Lane/Shoulder Drop-Off

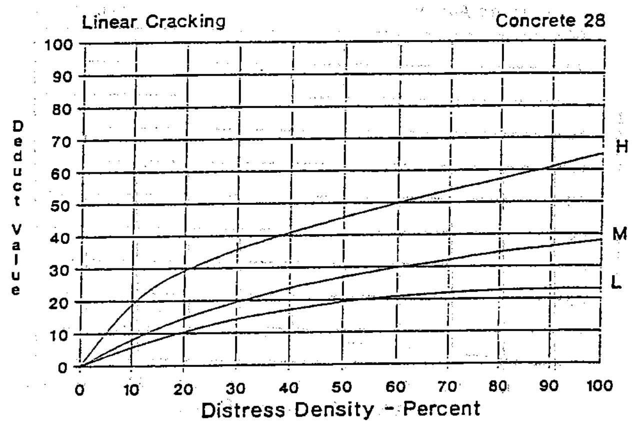


FIG. X4.8 Linear Cracking

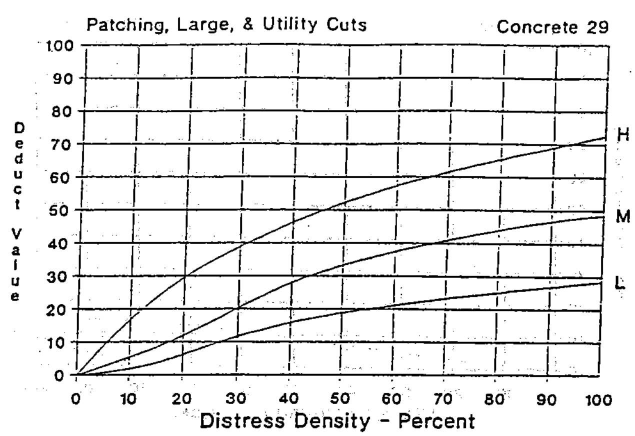


FIG. X4.9 Patching, Large, and Utility Cuts

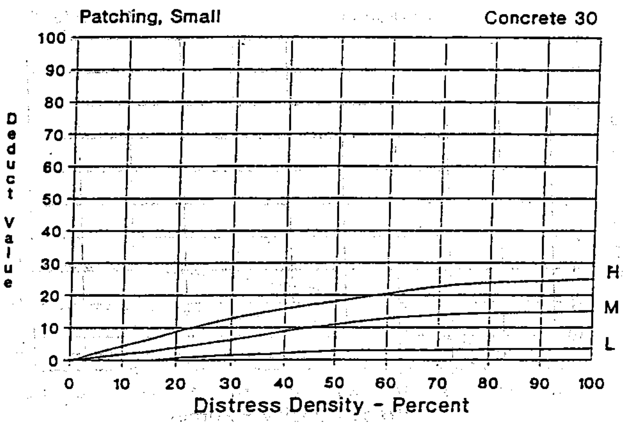


FIG. X4.10 Patching, Small

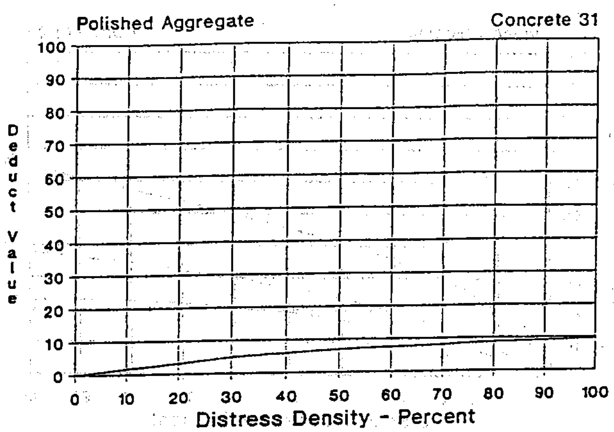


FIG. X4.11 Polished Aggregate

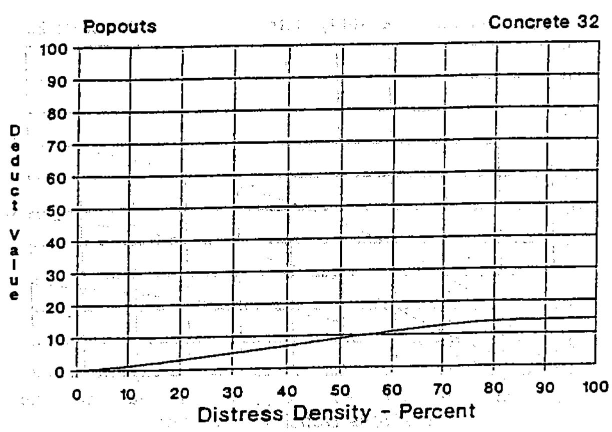


FIG. X4.12 Popouts

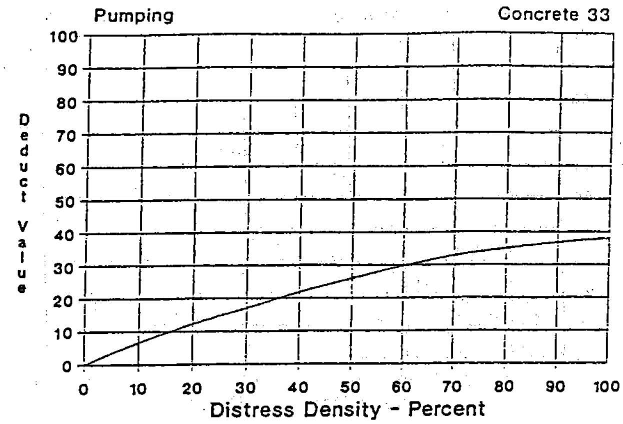


FIG. X4.13 Pumping

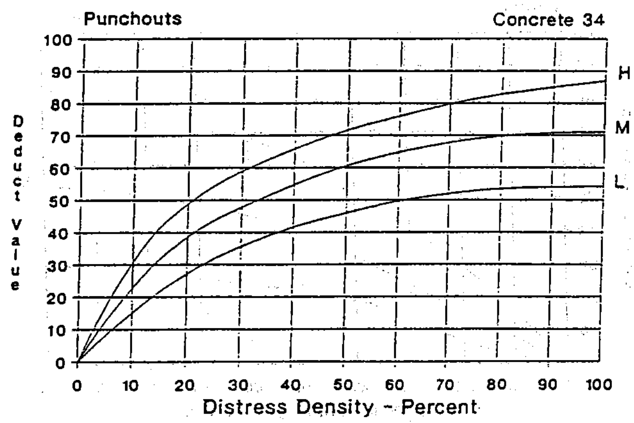


FIG. X4.14 Punchouts

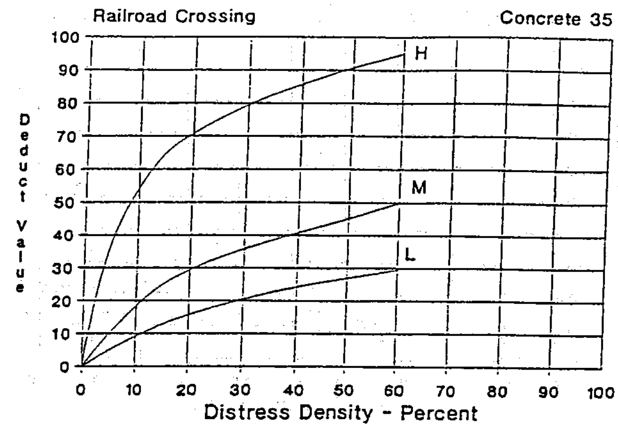


FIG. X4.15 Railroad Crossing

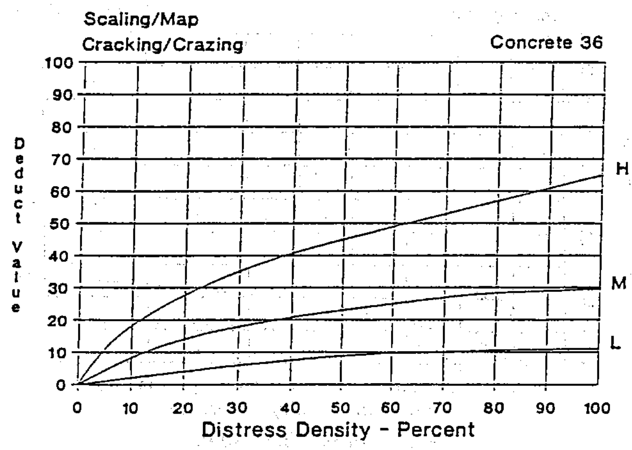


FIG. X4.16 Scaling/Map Cracking/Crazing

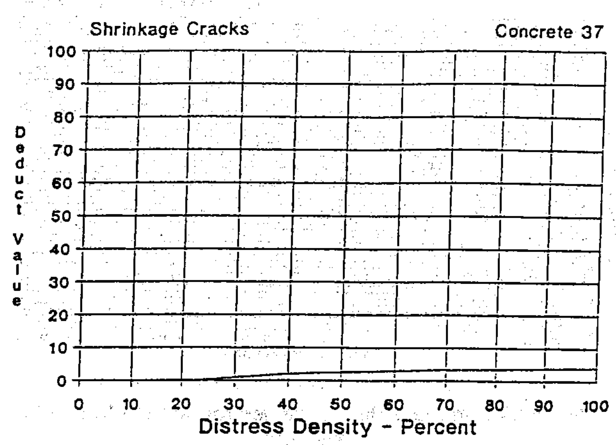


FIG. X4.17 Shrinkage Cracks

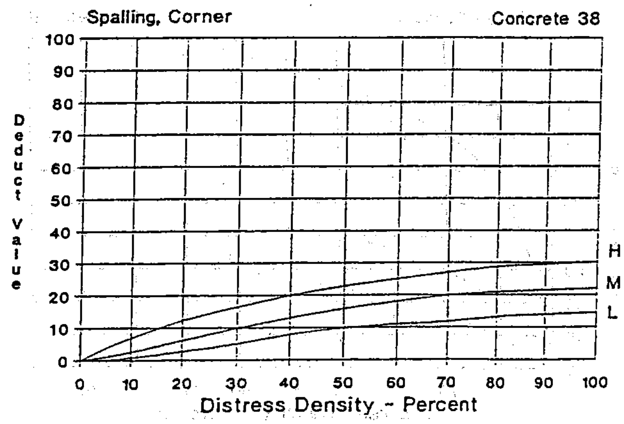


FIG. X4.18 Spalling, Corner

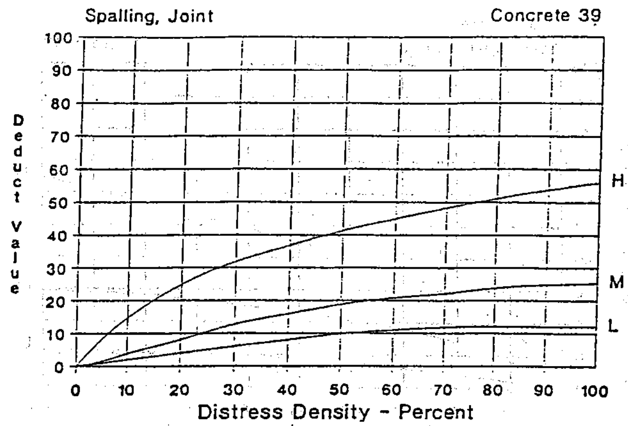
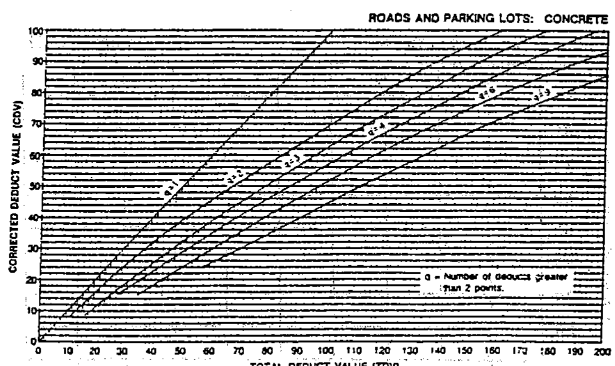


FIG. X4.19 Spalling, Joint



Corrected deduct values for jointed concrete pavement.

FIG. X4.20 Corrected Deduct Values for Jointed Concrete Pavement

REFERENCES

(1) *PAVER Asphalt Distress Manual*, US Army Construction Engineering Laboratories, TR 97/104, June 1997.

(2) *PAVER Asphalt Distress Manual*, US Army Construction Engineering Laboratories, TR 97/105, June 1997.

(3) Carey, W.N., Jr. and Irick, P.E., "The Pavement Serviceability-Performance Concept," *HRB Bulletin 250*, 1960.

(4) Sayers, M. W., Gillespie, T. D., and Queiroz, C. A. V., "The International Road Roughness Experiment: Establishing Correlation and a Calibration Standard for Measurements," World Bank Technical Paper No. 45, the International Bank for Reconstruction and Development/the World Bank, Washington, DC, 1986.