Appendix A

PAVEMENT CONDITION SUMMARY

Colorado Springs Airport

Prepared by:

Applied Pavement Technology, Inc.

Date:

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COLORADO SPRINGS AIRPORT

Pavement Condition Summary

Introduction

As part of the Colorado Division of Aeronautics' (CDOA) continuing pavement management activities, Applied Pavement Technology, Inc. (APTech) conducted an evaluation of the condition of the pavements at Colorado Springs Airport in August 2009. The results of this evaluation are presented in this document.

Pavement Inventory

Colorado Springs Airport has approximately 16,632,000 square feet of pavement. Figure 1 shows the area of the pavement system broken out by pavement use (runway, taxiway, and apron). This figure also shows the area-weighted age of the pavements, as measured from the last time major rehabilitation or reconstruction was performed on the pavements.

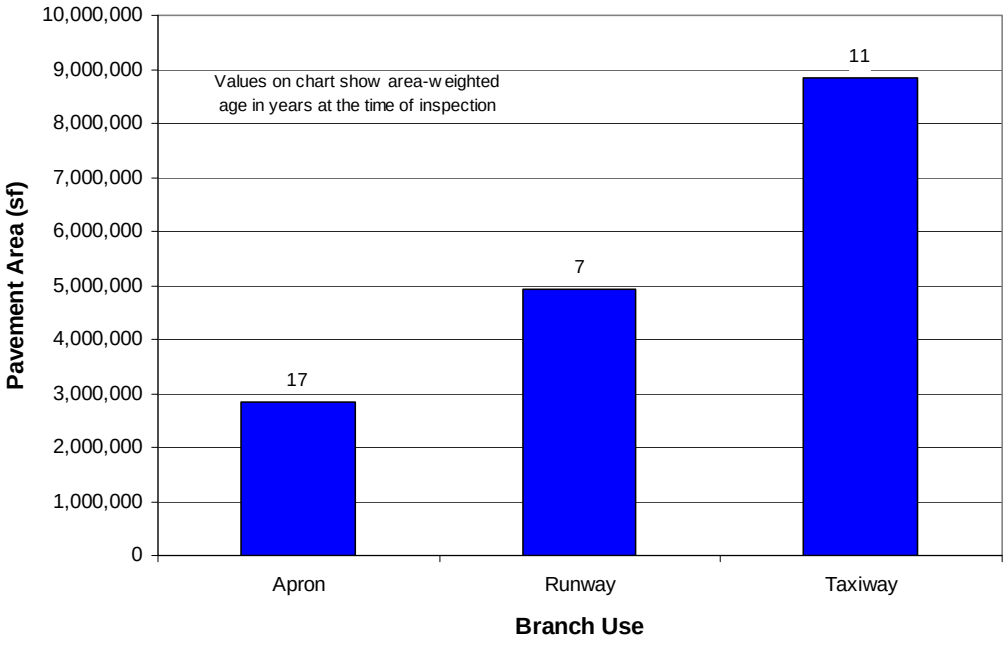


Figure 1. Pavement inventory.

Figure 2 summarizes the area of the pavement system broken out by pavement surface type. The surface types identified at Colorado Springs Airport are defined as follows:

AC: Asphalt concrete pavements.

AAC: AC pavements with one or more AC overlays.

PCC: Portland cement concrete pavements.

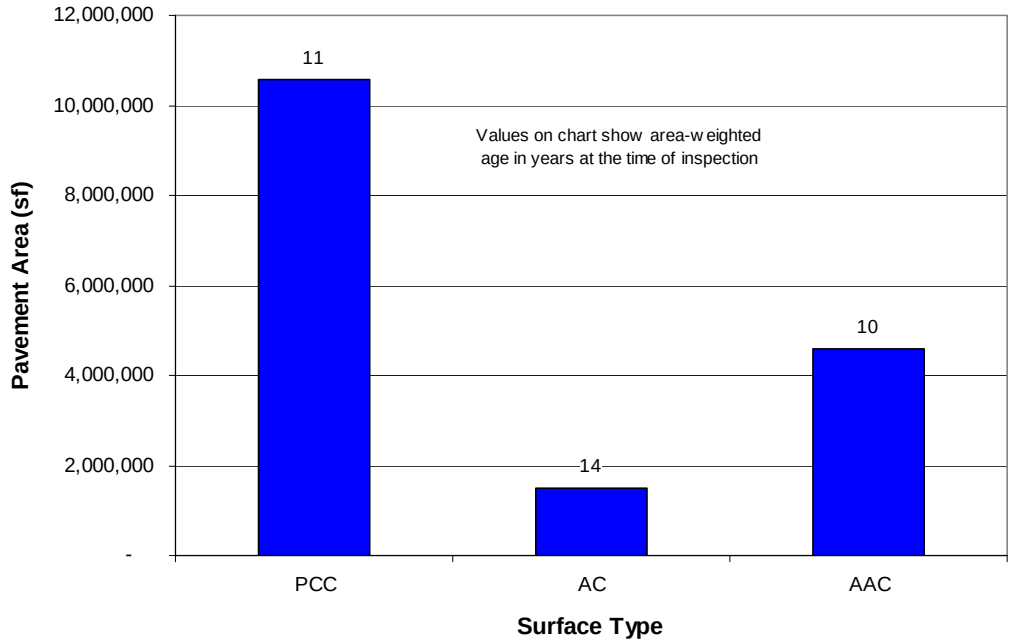


Figure 2. Pavement inventory by surface type.

Pavement Condition Inspections

Detailed pavement condition inspections were conducted at Colorado Springs Airport during August 2009. The runway, taxiway, and apron sections that are maintained by the Airport were inspected. The Pavement Condition Index (PCI) procedure is the standard used by the aviation industry to visually assess pavement condition. An APTech engineer, trained and experienced in the conduct of PCI surveys, led the inspections and was assisted by CDOA personnel.

Pavement Condition Index Procedure

The PCI procedure is used to identify distress types and to rate severity levels. The PCI procedure provides a consistent and systematic methodology to identify and rate distresses on the pavement surface and to report pavement condition. The 2009 PCI inspection was conducted following the procedure documented in the following publications:

> The U.S. Federal Aviation Administration's (FAA's) Advisory Circular 150/5380-6B, *Guidelines and Procedures for Maintenance of Airport Pavements.*
>
> The American Society for Testing and Material's (ASTM's) Standard D5340-04e1, *Standard Test Method for Airport Pavement Condition Index Surveys*.

In accordance with the PCI procedure, the network of pavements is defined by several branches, subdivided into sections, and further defined by sample units. In an airport setting, each branch (or facility) consists of a distinct pavement area, such as a runway, taxiway, or apron. Each branch may be further divided into sections, defined as parts of the facility that share common attributes, such as cross section, construction history, traffic, and performance. The third

subdivision or level is called a sample unit. Sample units are randomly selected for inspection to obtain representative conditions for each pavement section.

The PCI procedure was developed to provide a numerical indication of overall pavement condition. During a PCI survey, visible signs of deterioration within a selected sample unit are recorded and analyzed. Distress type, severity, and quantity are all identified and recorded. This information is then used to develop a composite index (PCI number) that represents the overall condition of the pavement in numerical terms, ranging from 0 (failed) to 100 (excellent).

In general terms, pavements above a PCI of 65 that are not exhibiting significant load-related distress will benefit from preventive maintenance actions, such as crack sealing and surface treatments. Pavements with a PCI of 40 to 65 may require major rehabilitation, such as an overlay. Often, when the PCI is less than 40, reconstruction is the only viable alternative due to the substantial damage to the pavement structure. This concept, along with the PCI rating scale, is illustrated in figure 4.

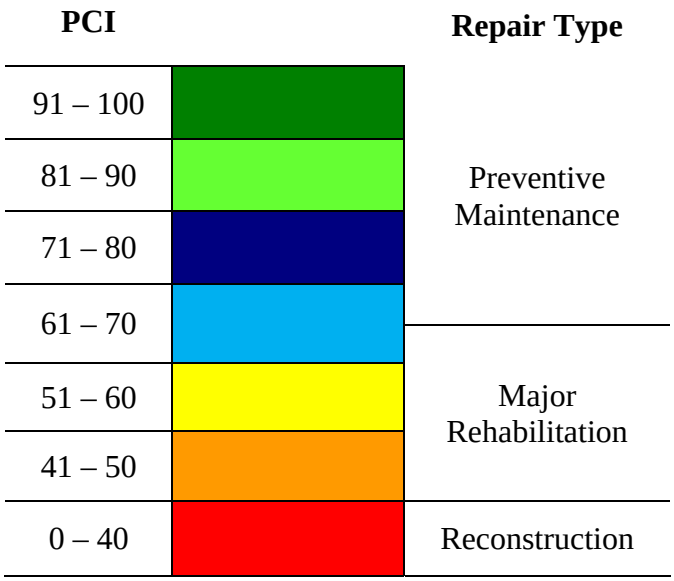


Figure 4. PCI rating scale and recommended repair action.

The types of distress identified during the PCI inspection provide insight into the cause of pavement deterioration. PCI distress types are characterized as load-related, climate/durability-related, and other (distress types that cannot be attributed solely to load or climate/durability). Each of the distress types and their associated primary cause of distress are identified in table 1. By knowing the causes of the pavement deterioration, more appropriate repair and rehabilitation alternatives can be identified. Tables 2 and 3 provide additional information on the likely cause of each distress type and feasible maintenance strategies for addressing each distress type for AC and PCC pavements.

Table 1. Distress types and primary distress categories for AC and PCC pavements.

Pavement Type	**Pavement Distress Category**		
	Load-Related	**Climate-Related**	**Other**
AC-Surfaced Pavements	Fatigue (Alligator) Cracking Rutting*	Block Cracking Joint Reflection Cracking Longitudinal and Transverse Cracking Patching Raveling and Weathering	Bleeding Corrugation Depression Jet Blast Oil Spillage Polished Aggregate Shoving Slippage Swelling
PCC Pavements	Corner Break Linear Cracking Shattered Slab	Blow-up Durability Cracking Joint Seal Damage	Small/Large Patch Popouts Pumping Scaling, Map Cracking, and Crazing Faulting/Settlement Shrinkage Cracking Spalling, Joint/Corner

Table 2. Likely cause(s) of AC pavement distresses and feasible maintenance strategies.

Distress Type	Probable Cause of Distress	Feasible Maintenance Strategies
Alligator Cracking	Fatigue failure of the asphalt concrete surface under repeated traffic loading	If localized, partial- or full-depth asphalt patch. If extensive, major rehabilitation needed.
Bleeding	Excessive amounts of asphalt cement or tars in the mix and/or low air void content	Spread heated sand, roll, and sweep. Another option is to plane excess asphalt. Or, remove and replace.
Block Cracking	Shrinkage of the asphalt concrete and daily temperature cycling; it is not load associated	At low severity levels, crack seal and/or surface treatment. At higher severities, consider overlay.
Corrugation	Traffic action combined with an unstable pavement layer	If localized, mill. If extensive, remove and replace.
Depression	Settlement of the foundation soil or can be "built up" during construction	Patch.
Jet Blast	Bituminous binder has been burned or carbonized	Patch.
Joint Reflection	Movement of the concrete slab beneath the asphalt concrete surface because of thermal and moisture changes	At low and medium severities, crack seal. At higher severities, especially if extensive, consider overlay.
Longitudinal and Transverse Cracking	Cracks may be caused by 1) poorly constructed paving lane joint, 2) shrinkage of the AC surface due to low temperatures or hardening of the asphalt, or 3) reflective crack caused by cracks in an underlying PCC[1] slab	At low and medium severity levels, crack seal. At higher severities, especially if extensive, consider overlay options.
Oil Spillage	Deterioration or softening of the pavement surface caused by the spilling of oil, fuel, or other solvents	Patch.
Patching	N/A	Replace patch if deteriorated.
Polished Aggregate	Repeated traffic applications	Aggregate seal coat is one option. Could also groove or mill. Overlay is another option.
Raveling and Weathering	Asphalt binder may have hardened significantly	Patch if isolated. If low-severity, consider surface treatment if extensive. At medium and high severity levels, consider major rehabilitation if extensive.
Rutting	Usually caused by consolidation or lateral movement of the materials due to traffic loads	Patch medium and high severity levels if localized. If extensive, consider major rehabilitation.
Shoving	Where PCC pavements adjoin flexible pavements, PCC "growth" may shove the asphalt pavement	Mill and patch as needed.
Slippage Cracking	Low strength surface mix or poor bond between the surface and next layer of pavement structure	Partial- or full-depth patch.
Swelling	Usually caused by frost action or by swelling soil	Patch if localized. Major rehabilitation if extensive.

Table 3. Likely cause(s) of PCC pavement distresses and feasible maintenance strategies.

Distress Type	Probable Cause of Distress	Feasible Maintenance Strategies
Blow-Up	Incompressibles in joints	Partial- or full-depth patch. Slab replacement.
Corner Break	Load repetition combined with loss of support and curling stresses	Seal cracks at low severity. Full-depth patch.
Cracks	Combination of load repetition, curling stresses, and shrinkage stresses	Seal cracks. At high severity, may need full-depth patch or slab replacement.
Durability Cracking	Concrete's inability to withstand environmental factors such as freeze-thaw cycles	Full-depth patch if present on small amount of slab. At higher severity levels, once it has appeared on most of slab, slab replacement.
Joint Seal Damage	Stripping of joint sealant, extrusion of joint sealant, weed growth, hardening of the filler (oxidation, loss of bond to the slab edges, or absence of sealant in joint	Replace joint seal.
Patching (Small and Large)	N/A	Replace patches if deteriorated.
Popouts	Freeze-thaw action in combination with expansive aggregates	Monitor.
Pumping	Poor drainage, poor joint sealant	Seal cracks and joints. Underseal is an option if voids have developed. Establish good drainage.
Map Cracking/ Scaling	Overfinishing of concrete, deicing salts, improper construction, freeze-thaw cycles, poor aggregate, and alkali-silica reactivity	At low severity levels, do nothing. At medium and high severity levels, partial-depth patches or slab replacement.
Settlement	Upheaval or consolidation	At higher severity levels, leveling patch or grind to restore smooth ride.
Shattered Slab	Load repetition	Replace slab.
Shrinkage	Setting and curing of the concrete	Monitor.
Spalling (Joint and Corner)	Excessive stresses at the joint caused by infiltration of incompressible materials or traffic loads; weak concrete at joint combined with traffic loads	Partial-depth patch.

The loss in PCI over time (i.e., the pavement's rate of deterioration) is another factor that is of interest in evaluating the performance of a pavement. Pavements that are exhibiting high deterioration rates should be closely examined to determine the reason for such high deterioration rates.

Although the PCI results give a general indication of the overall condition of the pavement, the specific maintenance or rehabilitation needs of a pavement are often obscured by such an index. For example, while the PCI results may indicate load-related deterioration, the actual structural improvement required is not determined by the procedure.

During the condition surveys, the survey crew also took photographs of distresses observed on the pavement, both to record typical conditions and to highlight areas of concern. Some of these photographs are provided in Appendix A of this report.

Pavement Condition Index Results

The 2009 overall area-weighted PCI for Colorado Springs Airport is 82, with conditions ranging from 7 to 100. Figure 5 provides a summary of the overall condition of the pavements by area at Colorado Springs Airport. Figures 6 and 7 summarize the area-weighted conditions by pavement use and surface type, respectively. The results of the PCI survey, along with percent deduct values for each section, are presented in table 4, which also presents a detailed list of the distress types and severities present in each section. PCI results are also summarized in figure 8.

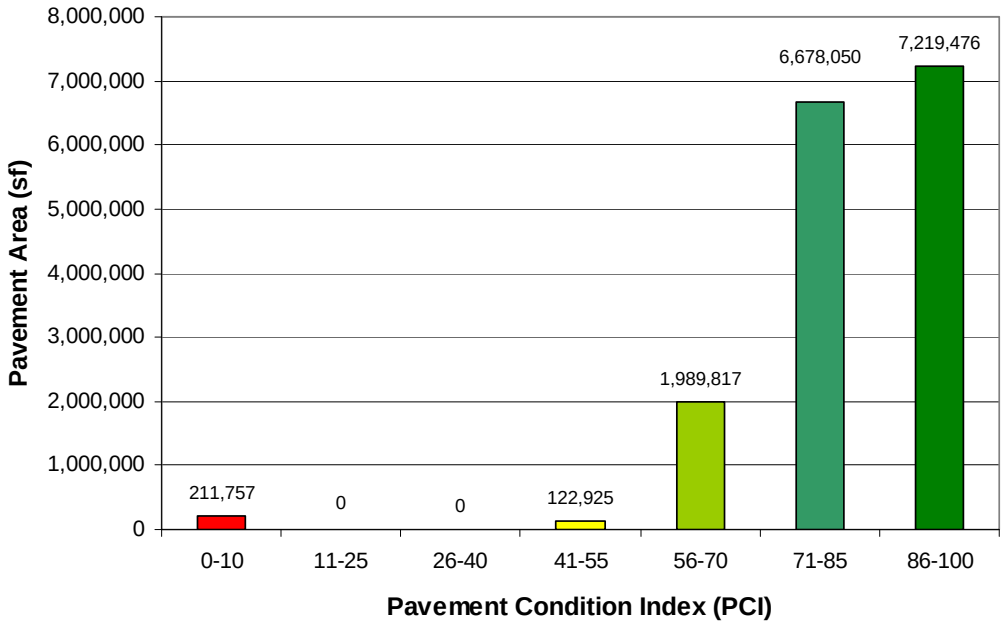


Figure 5. Condition distribution.

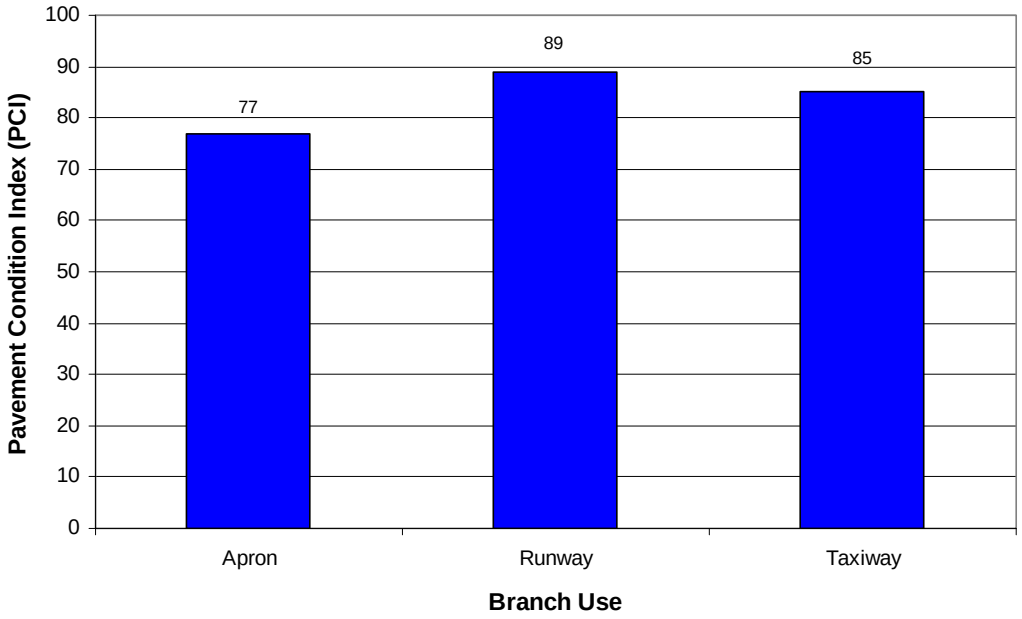


Figure 6. Condition by use.

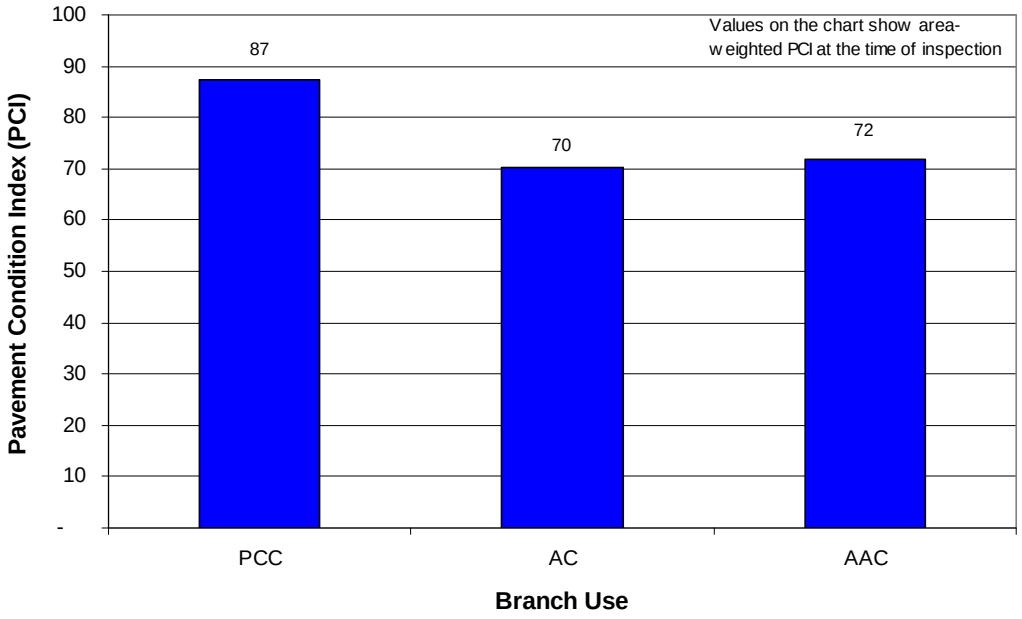
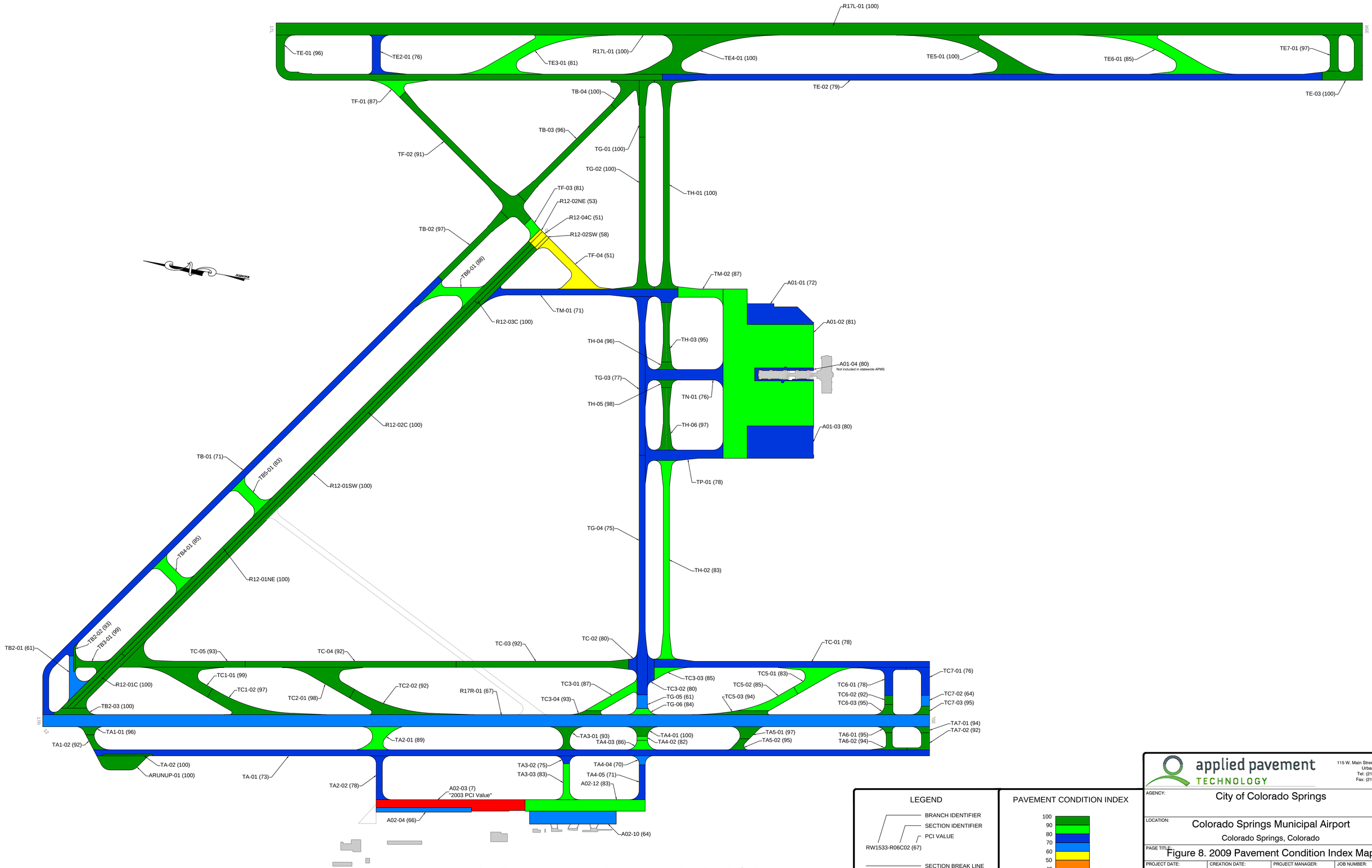


Figure 7. Condition by surface type.



Note: This map was obtained from the 2009 Colorado Statewide Airport Pavement Maintenance System Update.

LEGEND

BRANCH IDENTIFIER
SECTION IDENTIFIER
PCI VALUE
RW1533-R06C02 (67)
SECTION BREAK LINE

PAVEMENT CONDITION INDEX

100
90
80
70
60
50
40
0

applied pavement TECHNOLOGY
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Urbana, IL 61801
Tel: (217) 398-3977
Fax: (217) 398-4027

AGENCY: City of Colorado Springs

LOCATION: Colorado Springs Municipal Airport
Colorado Springs, Colorado

PAGE TITLE: Figure 8. 2009 Pavement Condition Index Map

PROJECT DATE:	CREATION DATE:	PROJECT MANAGER:	JOB NUMBER:
Oct 2010	May 2003	JB	
DRAWING SCALE:	LAST MODIFIED DATE:	REVISED BY:	DRAWN BY:
1:500	Nov 2010	CVT	KAC
FILENAME:		LAYOUT NAME/NUMBER:	PAGE NUMBER:
Colorado Springs.dwg		PCI	9

Table 4. Summary of 2009 PCI results.

Branch ID	Section ID	Surface Type	Section Area, SF	LCD	Inspection Date	PCI	Percent Deducts Due To:			Distress Types (Severity)
							Load	Climate	Other	
A01CS	1	PCC	174,282.00	12/1/1996	8/19/2009	72	4	61	35	Corner Spalling (M,H), Small Patch (M), D-Cracking (M), Joint Spalling (L,H), Corner Break (M), Large Patch/Utility Cut (L), Popouts, Joint Seal Damage (M), Shrinkage Cracking
A01CS	2	PCC	1,553,447.00	5/1/1993	8/18/2009	81	7	47	46	LTD Cracking (M), D-Cracking (M), Corner Break (L,H), Corner Spalling (L,M), Joint Spalling (L), Map Cracking/Scaling/Crazing (M), Large Patch/Utility Cut (L), Small Patch (M), Shrinkage Cracking, Joint Seal Damage (L,M,H), Pumping, Faulting/Settlement (L,H)
A01CS	3	PCC	330,480.00	7/1/1995	8/17/2009	80	6	35	59	Joint Spalling (H), Shrinkage Cracking, Pumping, Popouts, Large Patch/Utility Cut (L), D-Cracking (L), Small Patch (M), Corner Spalling (L,H), Joint Seal Damage (M,H), LTD Cracking (L,M)

Table 4 (continued). Summary of 2009 PCI results.

Branch ID	Section ID	Surface Type	Section Area, SF	LCD	Inspection Date	PCI	Percent Deducts Due To:			Distress Types (Severity)
							Load	Climate	Other	
A01CS	4	PCC	40,421.00	1/1/1995	8/17/2009	80	59	29	12	LTD Cracking (M), Joint Seal Damage (L,M), D-Cracking (L), Large Patch/Utility Cut (L), Map Cracking/Scaling/Crazing (L), Shrinkage Cracking, Corner Spalling (L)
A02CS	3	AC	211,757.00	6/1/1967	8/13/2003	7	47	53	0	Alligator Cracking (L,M), Rutting (M), Block Cracking (M), L&T Cracking (L,M), Weathering and Raveling (L,M,H)
A02CS	4	AAC	65,036.00	6/1/2003	8/3/2009	66	52	48	0	L&T Cracking (L,M), Alligator Cracking (M)
A02CS	10	PCC	172,320.00	6/1/1986	8/3/2009	64	3	47	50	Corner Spalling (H), Large Patch/Utility Cut (H), Small Patch (M), D-Cracking (M,H), LTD Cracking (L), Joint Spalling (M), Pumping, Shrinkage Cracking, Joint Seal Damage (H), Corner Break (L,H)
A02CS	12	AAC	213,483.00	6/1/1999	8/3/2009	83	0	100	0	L&T Cracking (L)
ARUNUPCS	1	AC	87,716.00	6/1/2004	8/3/2009	100	0	0	0	No Distresses
R12CS	01C	AAC	46,865.00	6/1/1993	7/18/2006	56	69	31	0	L&T Cracking (L,M), Alligator Cracking (L,M)
R12CS	01NE	AAC	409,452.00	6/1/1993	7/18/2006	76	0	100	0	L&T Cracking (L,M)
R12CS	01SW	AAC	409,510.00	6/1/1993	7/18/2006	77	0	100	0	L&T Cracking (L,M)
R12CS	02C	AAC	310,000.00	6/1/1993	7/18/2006	44	68	32	0	Alligator Cracking (M), Weathering and Raveling (H), L&T Cracking (L,M)

Table 4 (continued). Summary of 2009 PCI results.

Branch ID	Section ID	Surface Type	Section Area, SF	LCD	Inspection Date	PCI	Percent Deducts Due To:			Distress Types (Severity)
							Load	Climate	Other	
R12CS	02NE	PCC	7,734.00	6/1/1992	8/4/2009	53	14	68	18	LTD Cracking (L), Joint Spalling (M), D-Cracking (L), Small Patch (L), Corner Spalling (L,M), Corner Break (L)
R12CS	02SW	PCC	7,734.00	6/1/1992	8/4/2009	58	0	72	28	D-Cracking (M), Small Patch (L,M), Joint Spalling (L,H)
R12CS	03C	AAC	50,000.00	6/1/1993	7/18/2006	58	54	46	0	L&T Cracking (M), Alligator Cracking (L,M), Weathering and Raveling (L,M)
R12CS	04C	PCC	15,469.00	6/1/1992	8/4/2009	51	0	88	12	D-Cracking (L), Small Patch (L,M), Corner Spalling (L), Joint Seal Damage (L)
R17LCS	1	PCC	2,025,000.00	9/1/2006	8/3/2009	100	0	0	0	No Distresses
R17RCS	1	AAC	1,653,150.00	6/1/2002	8/3/2009	67	56	44	0	Alligator Cracking (L), L&T Cracking (L,M)
TA1CS	1	AAC	16,493.00	6/1/2002	8/3/2009	96	0	100	0	L&T Cracking (L)
TA1CS	2	AC	18,452.00	6/1/1997	8/3/2009	91	0	100	0	L&T Cracking (L)
TA2CS	1	AAC	68,342.00	6/1/2002	8/3/2009	89	0	100	0	L&T Cracking (L,M)
TA2CS	2	AAC	48,649.00	6/1/1998	8/3/2009	78	22	78	0	Alligator Cracking (L), L&T Cracking (L,M)
TA3CS	1	AAC	40,944.00	6/1/2002	8/3/2009	93	0	100	0	L&T Cracking (L,M)
TA3CS	2	AAC	12,062.00	6/1/1998	8/3/2009	75	21	79	0	L&T Cracking (M), Alligator Cracking (L)
TA3CS	3	AAC	40,590.00	6/1/1998	8/3/2009	83	0	100	0	L&T Cracking (L,M)
TA4CS	1	AAC	22,814.00	6/1/2002	8/3/2009	100	0	0	0	No Distresses
TA4CS	2	AC	6,546.00	6/1/1992	8/3/2009	82	0	100	0	L&T Cracking (L,M)
TA4CS	3	AAC	22,187.00	6/1/1998	8/3/2009	87	0	100	0	L&T Cracking (L,M)

Table 4 (continued). Summary of 2009 PCI results.

Branch ID	Section ID	Surface Type	Section Area, SF	LCD	Inspection Date	PCI	Percent Deducts Due To:			Distress Types (Severity)
							Load	Climate	Other	
TA4CS	4	AAC	12,692.00	6/1/1998	8/3/2009	70	54	46	0	Bleeding, L&T Cracking (L,M), Alligator Cracking (L)
TA4CS	5	AAC	35,324.00	6/1/1998	8/3/2009	71	26	74	0	Alligator Cracking (L), L&T Cracking (L,M)
TA5CS	1	AAC	31,468.00	6/1/2002	8/3/2009	97	0	100	0	L&T Cracking (L)
TA5CS	2	AC	18,277.00	6/1/1998	8/3/2009	95	0	100	0	L&T Cracking (L)
TA6CS	1	AAC	9,344.00	6/1/2002	8/3/2009	95	0	100	0	L&T Cracking (L)
TA6CS	2	AC	18,791.00	6/1/1998	8/3/2009	94	0	100	0	L&T Cracking (L)
TA7CS	1	AAC	10,682.00	6/1/2002	8/3/2009	94	0	100	0	L&T Cracking (L)
TA7CS	2	AAC	22,682.00	6/1/1998	8/3/2009	92	0	100	0	L&T Cracking (L,M)
TACS	1	AC	765,231.00	6/1/1997	8/3/2009	73	33	67	0	Alligator Cracking (L), L&T Cracking (L,M), Patching (L)
TACS	2	AC	12,450.00	6/1/2004	8/3/2009	100	0	0	0	No Distresses
TB2CS	1	AAC	50,069.00	6/1/1993	8/3/2009	61	0	100	0	Patching (M), L&T Cracking (L,M), Block Cracking (L)
TB2CS	2	AAC	7,518.00	1/1/2004	8/3/2009	93	0	100	0	L&T Cracking (L)
TB2CS	3	AAC	32,146.00	6/1/2002	7/19/2006	98	0	100	0	L&T Cracking (L)
TB3CS	1	AC	35,994.00	6/1/2004	8/3/2009	99	0	100	0	L&T Cracking (L)
TB4CS	1	AAC	64,983.00	6/1/2000	8/3/2009	85	0	100	0	L&T Cracking (L,M)
TB5CS	1	AAC	64,062.00	6/1/2000	8/3/2009	83	0	100	0	L&T Cracking (M), Patching (L,M)
TB6CS	1	AAC	82,818.00	6/1/2000	8/3/2009	89	59	41	0	L&T Cracking (L), Alligator Cracking (L,M), Rutting (L)
TBCS	1	AAC	567,983.00	6/1/2000	8/3/2009	71	51	49	0	Bleeding, Alligator Cracking (M), L&T Cracking (L), Weathering and Raveling (L,M)

Table 4 (continued). Summary of 2009 PCI results.

Branch ID	Section ID	Surface Type	Section Area, SF	LCD	Inspection Date	PCI	Percent Deducts Due To:			Distress Types (Severity)
							Load	Climate	Other	
TBCS	2	PCC	91,717.00	6/1/2000	8/4/2009	97	0	65	35	Joint Seal Damage (L), Shrinkage Cracking, Small Patch (L), Map Cracking/Scaling (L), D-Cracking (L)
TBCS	3	PCC	145,538.00	6/1/2000	8/4/2009	96	0	61	39	Small Patch (L), Joint Seal Damage (L), Joint Spalling (L), D-Cracking (L), Shrinkage Cracking
TBCS	4	PCC	98,901.00	3/1/2009	3/1/2009	100	0	0	0	No Distresses
TC1CS	1	PCC	113,259.00	6/1/2005	8/4/2009	99	0	0	100	Corner Spalling (L), Joint Spalling (L), Small Patch (L), Shrinkage Cracking
TC1CS	2	AC	103,912.00	6/1/2005	8/3/2009	97	0	100	0	L&T Cracking (L)
TC2CS	1	PCC	116,276.00	6/1/2003	8/4/2009	98	0	0	100	Shrinkage Cracking, Small Patch (L), Joint Spalling (L,M)
TC2CS	2	AC	102,521.00	6/1/2002	8/3/2009	92	0	100	0	L&T Cracking (L)
TC3CS	1	AAC	64,147.00	7/1/2002	8/3/2009	87	0	100	0	L&T Cracking (L)
TC3CS	2	PCC	25,866.00	6/1/1997	8/4/2009	80	0	99	1	D-Cracking (L), Joint Seal Damage (L), Small Patch (L)
TC3CS	3	PCC	24,604.00	6/1/1997	8/4/2009	85	0	96	4	D-Cracking (L), Joint Seal Damage (M), Shrinkage Cracking
TC3CS	4	AAC	13,022.00	6/1/2002	8/3/2009	93	0	100	0	L&T Cracking (L)
TC5CS	1	PCC	93,550.00	6/1/1997	8/4/2009	83	0	91	9	Small Patch (L), Map Cracking/Scaling/Crazing (L), Joint Seal Damage (L), D-Cracking (L)

Table 4 (continued). Summary of 2009 PCI results.

Branch ID	Section ID	Surface Type	Section Area, SF	LCD	Inspection Date	PCI	Percent Deducts Due To:			Distress Types (Severity)
							Load	Climate	Other	
TC5CS	2	AC	60,412.00	7/1/1997	8/3/2009	85	0	100	0	L&T Cracking (L)
TC5CS	3	AAC	28,657.00	6/1/2002	8/3/2009	94	0	100	0	L&T Cracking (L)
TC6CS	1	PCC	48,514.00	6/1/1997	8/4/2009	78	0	95	5	Joint Seal Damage (L), Shrinkage Cracking, D-Cracking (L,M), Small Patch (L)
TC6CS	2	AC	11,788.00	6/1/1997	8/3/2009	92	0	100	0	L&T Cracking (L)
TC6CS	3	AAC	16,702.00	6/1/2002	8/3/2009	95	0	100	0	L&T Cracking (L)
TC7CS	1	PCC	42,313.00	6/1/1997	8/4/2009	76	0	82	18	Corner Spalling (L), Joint Spalling (M), Shrinkage Cracking, Map Cracking/Scaling/Crazing (L), Joint Seal Damage (L,M), D-Cracking (L)
TC7CS	2	AC	13,848.00	6/1/1997	8/3/2009	64	52	48	0	L&T Cracking (L), Alligator Cracking (L,M)
TC7CS	3	AAC	14,105.00	6/1/2002	8/3/2009	95	0	100	0	L&T Cracking (L)
TCCS	1	PCC	267,611.00	6/1/1997	8/4/2009	78	0	86	14	Joint Seal Damage (L), Large Patch/Utility Cut (L), D-Cracking (L), Small Patch (L,M)
TCCS	2	PCC	16,702.00	6/1/1997	8/4/2009	80	0	100	0	Joint Seal Damage (L), D-Cracking (L)
TCCS	3	PCC	166,155.00	6/1/2001	8/4/2009	92	0	25	75	Shrinkage Cracking, Map Cracking/Scaling/Crazing (L), Joint Seal Damage (L)
TCCS	4	PCC	196,598.00	6/1/2003	8/4/2009	92	0	25	75	Joint Seal Damage (L), Shrinkage Cracking

Table 4 (continued). Summary of 2009 PCI results.

Branch ID	Section ID	Surface Type	Section Area, SF	LCD	Inspection Date	PCI	Percent Deducts Due To: Load	Climate	Other	Distress Types (Severity)
TCCS	5	PCC	147,281.00	6/1/2005	8/4/2009	93	0	44	56	Shrinkage Cracking, D-Cracking (L), Joint Seal Damage (L), Small Patch (L), Map Cracking/Scaling/Crazing (L)
TE2CS	1	PCC	61,959.00	6/1/1991	8/3/2009	76	0	90	10	Shrinkage Cracking, Small Patch (L), Joint Seal Damage (L), Joint Spalling (L), D-Cracking (L,M)
TE3CS	1	PCC	191,344.00	6/1/1991	8/3/2009	81	0	88	12	Joint Seal Damage (L), Small Patch (L,M), D-Cracking (L), Joint Spalling (M), Large Patch/Utility Cut (L)
TE4CS	1	PCC	244,269.00	9/1/2009	9/1/2009	100	0	0	0	No Distresses
TE5CS	1	PCC	191,611.00	9/1/2009	9/1/2009	100	0	0	0	No Distresses
TE6CS	1	PCC	191,611.00	6/1/1991	8/3/2009	85	0	79	21	Small Patch (L), D-Cracking (L), Corner Spalling (M), Joint Spalling (L,M), Shrinkage Cracking, Joint Seal Damage (L)
TE7CS	1	PCC	51,428.00	9/1/2006	8/3/2009	97	0	0	100	Small Patch (L), Shrinkage Cracking
TECS	1	PCC	30,314.00	3/1/2009	3/1/2009	100	0	0	0	No Distresses
TECS	2	PCC	1,000,827.00	6/1/1991	8/3/2009	79	0	88	12	Shrinkage Cracking, Corner Spalling (M), Joint Seal Damage (L), Small Patch (M), D-Cracking (L,M)

Table 4 (continued). Summary of 2009 PCI results.

Branch ID	Section ID	Surface Type	Section Area, SF	LCD	Inspection Date	PCI	Percent Deducts Due To:			Distress Types (Severity)
							Load	Climate	Other	
TECS	3	PCC	105,293.00	9/1/2006	8/3/2009	96	0	0	100	Shrinkage Cracking, Small Patch (L), Joint Spalling (L)
TFCS	1	PCC	46,428.00	6/1/1992	8/4/2009	87	0	61	39	Joint Seal Damage (L), Large Patch/Utility Cut (L), Small Patch (M), Shrinkage Cracking, D-Cracking (L,M), Joint Spalling (L)
TFCS	2	PCC	227,337.00	6/1/1992	8/4/2009	91	0	79	21	D-Cracking (L), Joint Spalling (L), Joint Seal Damage (L), Small Patch (L)
TFCS	3	PCC	22,881.00	6/1/1992	8/4/2009	81	0	97	3	Joint Seal Damage (M), Small Patch (L), Corner Spalling (L), D-Cracking (L,M)
TFCS	4	PCC	122,925.00	6/1/1992	8/4/2009	51	0	99	1	D-Cracking (M), Joint Seal Damage (L), Small Patch (L)
TGCS	1	PCC	98,901.00	4/1/2009	4/1/2009	100	0	0	0	No Distresses
TGCS	2	PCC	259,383.00	9/1/2009	9/1/2009	100	0	0	0	No Distresses
TGCS	3	PCC	163,275.00	6/1/1992	8/4/2009	77	0	88	12	Large Patch/Utility Cut (L), Joint Seal Damage (L), Small Patch (L,M), Joint Spalling (L,M), D-Cracking (L,M), Corner Spalling (M)
TGCS	4	PCC	258,653.00	6/1/1992	8/4/2009	75	0	88	12	Corner Spalling (M), Small Patch (L), D-Cracking (L,M), Joint Seal Damage (L,M,H), Shrinkage Cracking

Table 4 (continued). Summary of 2009 PCI results.

Branch ID	Section ID	Surface Type	Section Area, SF	LCD	Inspection Date	PCI	Percent Deducts Due To:			Distress Types (Severity)
							Load	Climate	Other	
TGCS	5	AC	22,702.00	6/1/1992	8/3/2009	61	64	36	0	Alligator Cracking (L,M), L&T Cracking (L,M)
TGCS	6	AAC	16,114.00	6/1/2002	8/3/2009	84	29	71	0	L&T Cracking (L), Alligator Cracking (L,M)
THCS	1	PCC	239,122.00	9/1/2009	9/1/2009	100	0	0	0	No Distresses
THCS	2	PCC	214,760.00	6/1/1992	8/4/2009	83	0	93	7	Small Patch (L), D-Cracking (L,M), Corner Spalling (L), Joint Seal Damage (L)
THCS	3	PCC	84,436.00	6/1/2005	8/4/2009	95	0	0	100	Shrinkage Cracking, Small Patch (L)
THCS	4	PCC	98,901.00	6/1/1992	8/4/2009	96	0	50	50	D-Cracking (L), Shrinkage Cracking, Small Patch (L)
THCS	5	PCC	98,901.00	6/1/1992	8/4/2009	98	0	63	37	D-Cracking (L), Small Patch (L)
THCS	6	PCC	94,861.00	6/1/2005	8/4/2009	97	0	0	100	Shrinkage Cracking, Small Patch (L)
TMCS	1	PCC	205,244.00	6/1/1992	8/4/2009	71	0	92	8	Joint Seal Damage (L,H), Small Patch (L), D-Cracking (L,M), Shrinkage Cracking, Corner Spalling (L,M)
TMCS	2	PCC	64,114.00	6/1/1992	8/4/2009	87	0	84	16	Small Patch (M), D-Cracking (L), Joint Spalling (M), Joint Seal Damage (L)
TNCS	1	PCC	147,158.00	6/1/1992	8/4/2009	76	0	100	0	D-Cracking (L,M)
TPCS	1	PCC	130,310.00	6/1/1991	8/4/2009	78	0	75	25	Large Patch/Utility Cut (M), Small Patch (L,M), Joint Seal Damage (L), D-Cracking (L), Corner Spalling (M,H)

Data obtained from 2009 Colorado statewide APMS update.

Additional Inspection Comments

Several sections on the airfield were not inspected in 2009, either due to poor condition or pending construction:

> Runway 12-30 was expected to be resurfaced in 2009, so it was not inspected during the 2009 inspections. Additionally, the section of Taxiway B2 adjacent to the runway (Section 3) was not inspected because it was expected to be resurfaced with the runway.
>
> Two of the high-speed taxiway connectors to Runway 17L-35R, Taxiways E4 and E5, were not inspected because of planned reconstruction.
>
> Taxiway G, section 1 not inspected because of planned reconstruction.
>
> Taxiway H, section 1, was not inspected because of planned reconstruction.
>
> Section 3 of the General Aviation Apron (Apron 2) was not inspected (per the DOT's request) in 2009 (or 2006) because of its extremely poor condition. This section had a PCI of 7 in 2003, has not been inspected since then, and has not received any maintenance or rehabilitation work in many years.

A project-level inspection was performed on the Terminal Apron (Apron 1) during August 2009. The project-level evaluation included a PCI inspection of 100 percent of the apron pavement. These results are used in the pavement condition summary (as opposed to network-level survey results). The project-level inspection also involved mapping the observed distresses and conducting a materials-related distress (MRD) survey.

The MRD procedure was developed to help identify where MRD issues are affecting performance and future maintenance and rehabilitation needs before those needs become evident from a PCI survey. The MRD rating (MRDR) generated during this evaluation can also be used to monitor performance of the apron over time. In particular, the MRD procedure will help to differentiate the performance of areas that are exhibiting signs of deterioration due to materials problems. Different MRDRs will help to determine the extent and severity of this problem.

Within the procedure, the MRDR weighting factors have been calibrated to assist with controlling possible FOD risk: MRDR values below 25 are not critical, but warrant monitoring. A point of 25 is set for the initiation of maintenance activities to preserve the pavement in a low FOD risk condition, and a value of 100 has been established to indicate that significant action, such as major rehabilitation or reconstruction, is needed because of the increased risk from FOD (IPRF 2009). These two points are illustrated in figure 8, which also shows a typical PCI performance curve and the traditional PCI decision point.

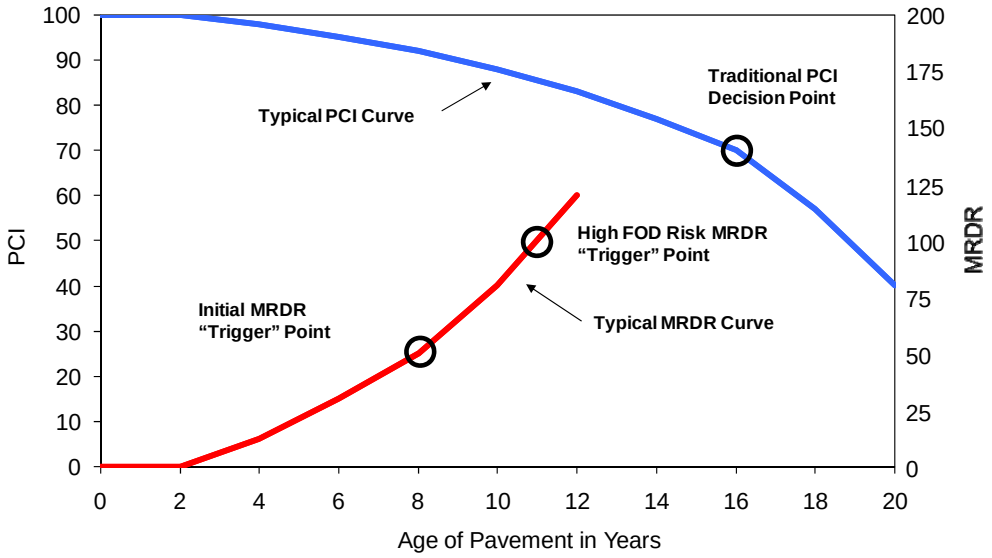

Figure 8. Conceptualization of relationship between PCI and MRDR (IPRF 2009).

The average MRDR for the Terminal Apron are summarized in table 3. Section 2 is subdivided into three sections (north, east, and west) because the northern portion of the apron was much worse than the east and west portions of the section.

Table 3. Summary of 2009 MRDR.

Pavement Section	MRDR
A01-01	88
A01-02 – north	135
A01-02 – east	52
A01-02 – west	83
A01-03	54

The MRD results indicate the northern portion of the apron has passed the threshold for major rehabilitation, while the west portion of Section 2 and the east expansion of the apron (Section 1) are approaching that threshold. Distresses similar to those observed on the Terminal Apron are present on other PCC pavements around the airport. Additionally, Runway 17L-35R was recently reconstructed, with MRD of the original pavement an underlying reason.

Summary

This document presents the results of the pavement condition evaluations conducted at Colorado Springs Airport. During visual inspections of the pavements in August 2009, it was found that the overall area-weighted PCI of the pavement network is 82, with section PCIs ranging from 7 to 100. Additional project-level evaluations conducted at the airport indicate that MRD is occuring in some of the PCC pavements and needs to be considered in addition to PCI results in determining pavement repair needs.

APPENDIX A. PHOTOGRAPHS

Figure 1. A01CS-01 Joint Spall

Figure 2. A01CS-01 Overview

Figure 3. A01CS-02 Overview

Figure 4. A01CS-03 Joint Spall

Figure 5. A01CS-03 Overview

Figure 6. A02CS-04 Alligator Cracking

Figure 7. A02CS-04 Overview

Figure 8. A02CS-10 Joint Seal Damage

Figure 9. A02CS-10 Overview

Figure 10. A02CS-10 Small Patch

Figure 11. A02CS-12 Overview

Figure 12. ARUNUPCS-01 Overview

Figure 13. R12CS-02NE Overview

Figure 14. R12CS-02SW Overview

Figure 15. R12CS-04C Overview

Figure 16. R17LCS-01 Overview

Figure 17. R17RCS-01 Alligator Cracking

Figure 18. R17RCS-01 Overview

Figure 19. TA1CS-01 Overview

Figure 20. TA1CS-02 Overview

Figure 21. TA2CS-01 Overview

Figure 22. TA2CS-02 Overview

Figure 23. TA3CS-01 Overview

Figure 24. TA3CS-02 Overview

Figure 25. TA3CS-03 Overview

Figure 26. TA4CS-01 Overview

Figure 27. TA4CS-02 Overview

Figure 28. TA4CS-03 Overview

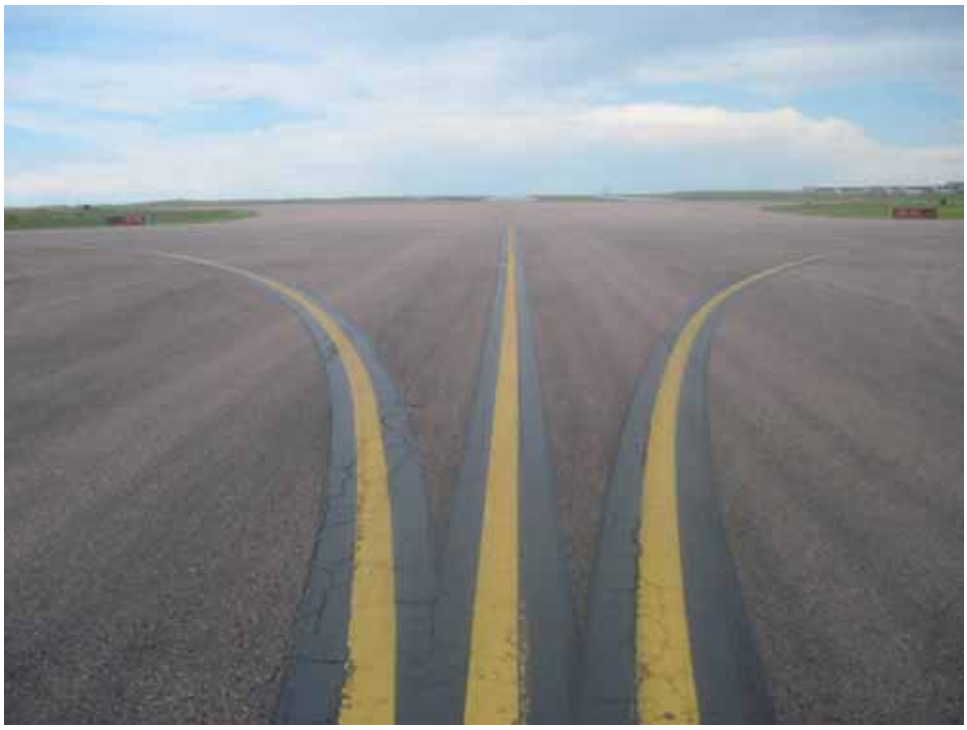

Figure 29. TA4CS-04 Overview

Figure 30. TA4CS-05 Overview

Figure 31. TA5CS-01 Overview

Figure 32. TA5CS-02 Overview

Figure 33. TA6CS-01 Overview

Figure 34. TA6CS-02 Overview

Figure 35. TA7CS-01 Overview

Figure 36. TA7CS-02 Overview

Figure 37. TACS-01 Alligator Cracking

Figure 38. TACS-01 Overview

Figure 39. TACS-02 Overview

Figure 40. TB2CS-01 Overview

Figure 41. TB2CS-02 Overview

Figure 42. TB3CS-01 Overview (1)

Figure 43. TB3CS-01 Overview (2)

Figure 44. TB4CS-01 Overview

Figure 45. TB5CS-01 Overview

Figure 46. TB6CS-01 Alligator Cracking

Figure 47. TB6CS-01 Overview

Figure 48. TBCS-01 Alligator Cracking

Figure 49. TBCS-01 Overview

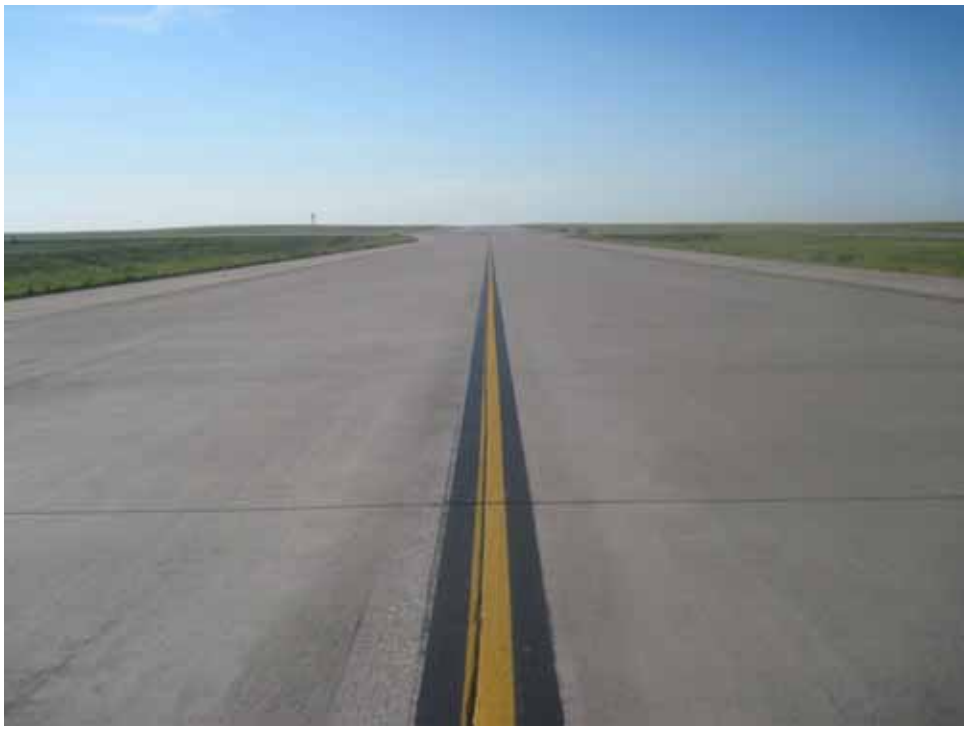

Figure 50. TBCS-02 Overview (1)

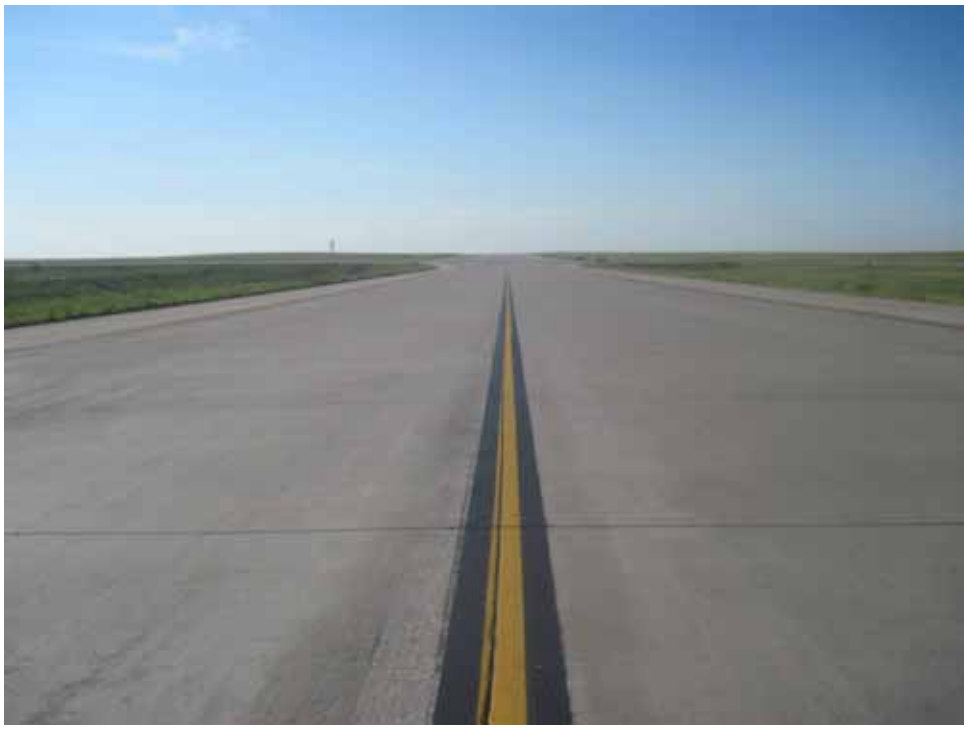

Figure 51. TBCS-02 Overview (2)

Figure 52. TBCS-03 Overview

Figure 53. TBCS-04 Overview

Figure 54. TC1CS-01 Overview

Figure 55. TC1CS-02 Overview

Figure 56. TC2CS-01 Overview

Figure 57. TC2CS-02 Overview

Figure 58. TC3CS-01 Overview

Figure 59. TC3CS-02 Durability Cracking

Figure 60. TC3CS-02 Overview

Figure 61. TC3CS-03 Overview

Figure 62. TC3CS-04 Overview

Figure 63. TC5CS-01 Durability Cracking

Figure 64. TC5CS-01 Overview

Figure 65. TC5CS-02 Overview

Figure 66. TC5CS-03 Overview

Figure 67. TC6CS-01 Durability Cracking

Figure 68. TC6CS-01 Overview

Figure 69. TC7CS-01 Durability Cracking

Figure 70. TC7CS-01 Overview

Figure 71. TC7CS-02 Alligator Cracking (1)

Figure 72. TC7CS-02 Alligator Cracking (2)

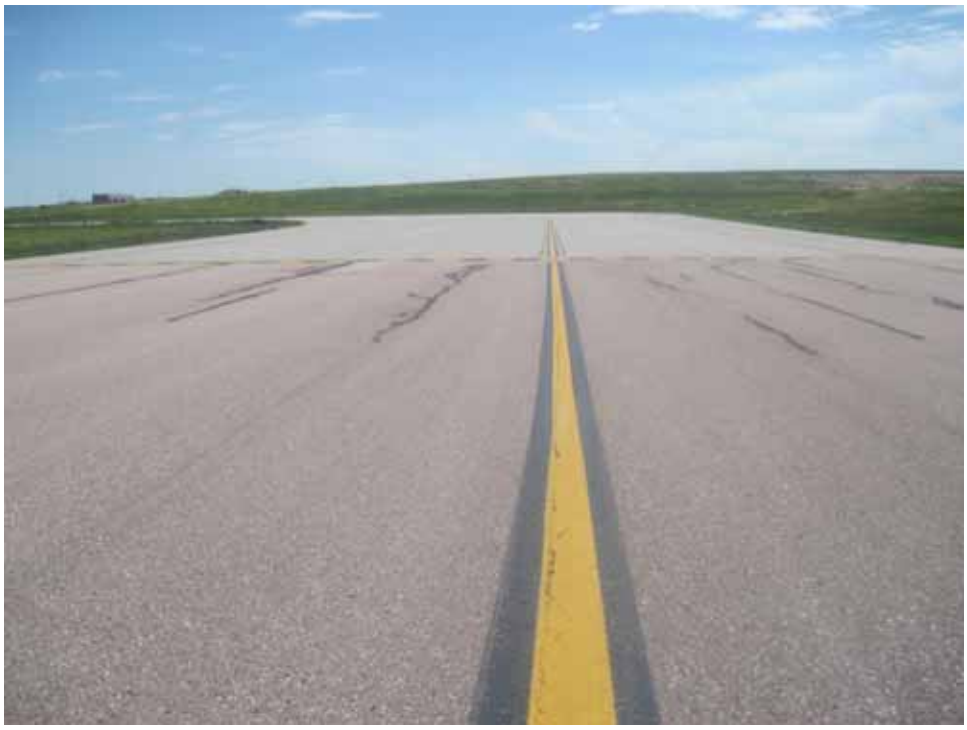

Figure 73. TC7CS-02 Overview

Figure 74. TCCS-01 Overview

Figure 75. TCCS-02 Overview

Figure 76. TCCS-03 Overview

Figure 77. TCCS-04 Overview

Figure 78. TCCS-05 Overview

Figure 79. TE2CS-01 Durability Cracking

Figure 80. TE2CS-01 Overview

Figure 81. TE3CS-01 Durability Cracking

Figure 82. TE3CS-01 Overview

Figure 83. TE6CS-01 Durability Cracking

Figure 84. TE6CS-01 Joint Spall

Figure 85. TE6CS-01 Overview

Figure 86. TE6CS-01 Repair

Figure 87. TE7CS-01 Overview

Figure 88. TECS-01 Overview

Figure 89. TECS-02 Durability Cracking

Figure 90. TECS-02 Overview

Figure 91. TECS-02 Small Patch

Figure 92. TECS-03 Overview

Figure 93. TFCS-01 Joint Spall (fraying)

Figure 94. TFCS-01 Large Patch

Figure 95. TFCS-01 Overview

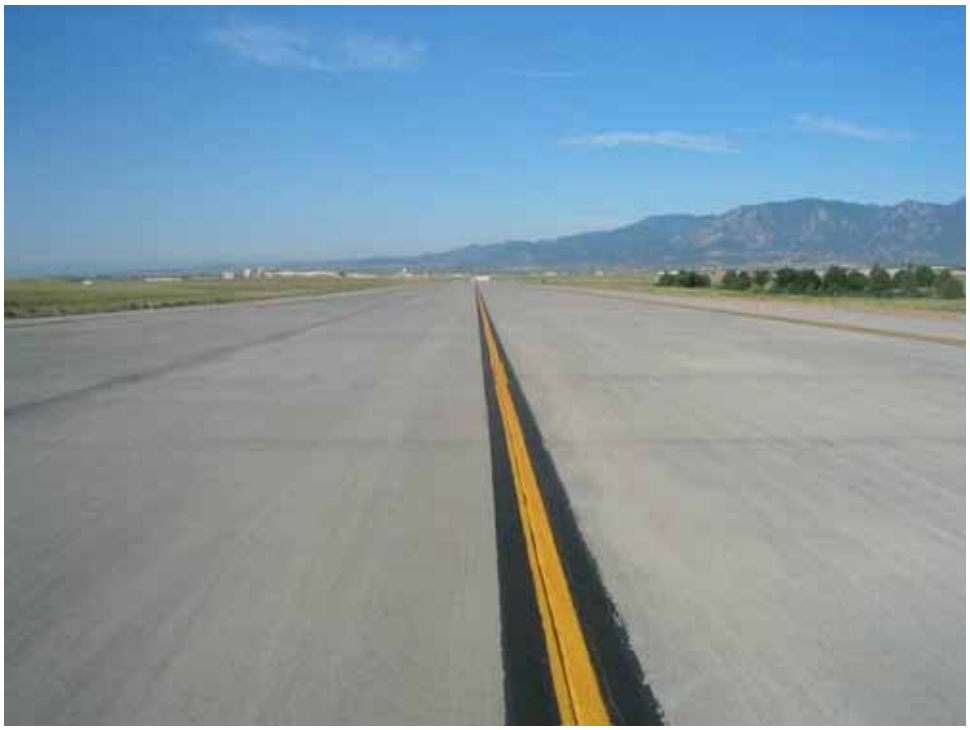

Figure 96. TFCS-02 Overview

Figure 97. TFCS-03 Durability Cracking

Figure 98. TFCS-03 Overview

Figure 99. TFCS-04 Durability Cracking

Figure 100. TFCS-04 Overview

Figure 101. TGCS-01 Overview

Figure 102. TGCS-02 To Be Rehabilitated

Figure 103. TGCS-03 Durability Cracking

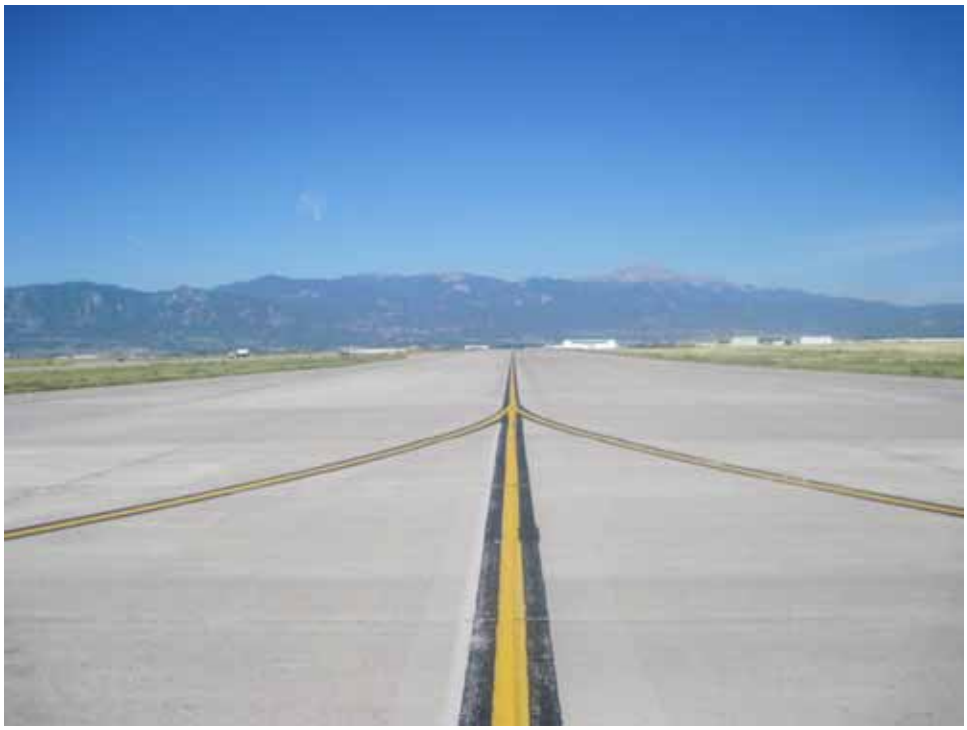

Figure 104. TGCS-03 Overview

Figure 105. TGCS-04 Overview

Figure 106. TGCS-05 Alligator Cracking

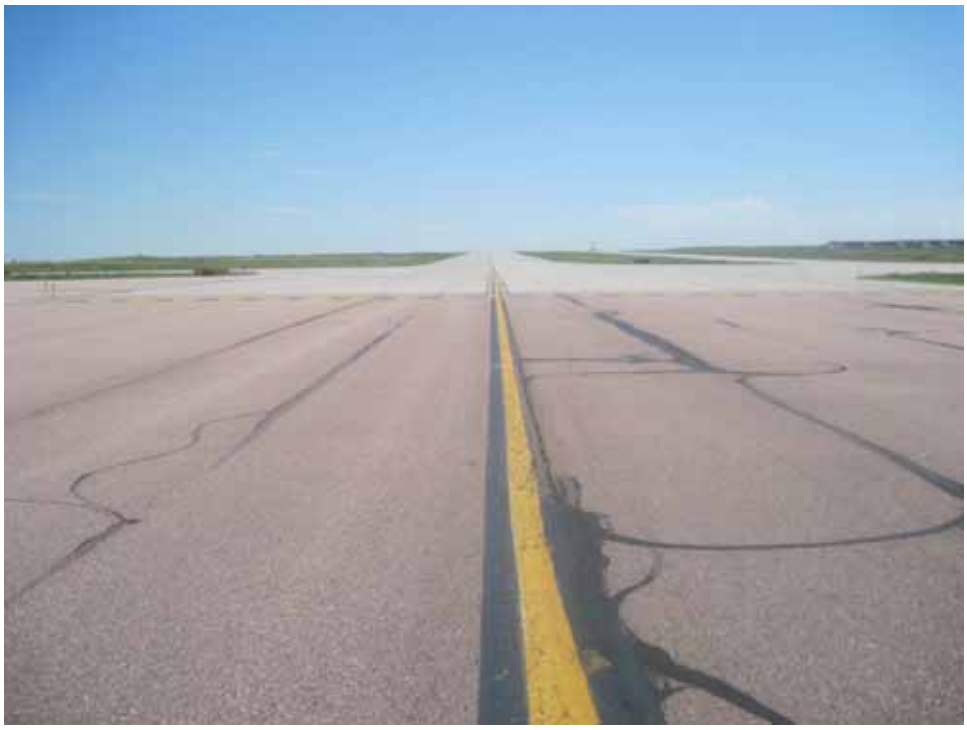

Figure 107. TGCS-05 Overview

Figure 108. TGCS-06 Overview

Figure 109. THCS-01 To Be Rehabilitated

Figure 110. THCS-02 Durability Cracking

Figure 111. THCS-02 Overview

Figure 112. THCS-03 Overview

Figure 113. THCS-04 Overview

Figure 114. THCS-05 Overview

Figure 115. THCS-06 Overview

Figure 116. TMCS-01 Durability Cracking

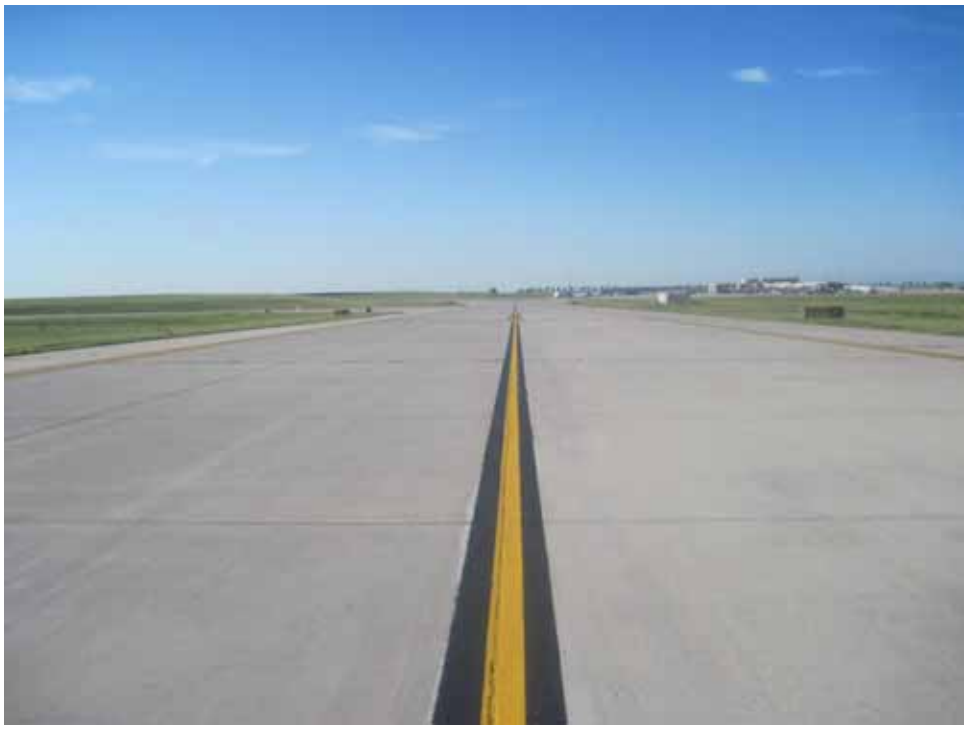

Figure 117. TMCS-01 Overview

Figure 118. TMCS-02 Overview

Figure 119. TNCS-01 Overview

Figure 120. TPCS-01 Overview