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Airport Engineering

ATR-037

**PG Binder Test Section
Calgary International Airport
Second Year Technical Analysis**

R&D PROJECT

PG Binders for Canadian Airport Pavements
Calgary Field Trial

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EBA Engineering Consultants Ltd.

**PG BINDER TEST SECTION
CALGARY INTERNATIONAL AIRPORT
SECOND YEAR TECHNICAL ANALYSIS**

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1.0 INTRODUCTION

Public Works and Government Services Canada (PWGSC) has initiated a review of the applicability of Superpave Performance Graded (PG) Binders for the construction of Canadian airport pavements. This work has been coordinated by PWGSC as a joint research effort involving Transport Canada, the U.S. Federal Aviation Administration and the Calgary Airport Authority.

Initial work was conducted in 1997/1998 examining the original basis of the Superpave PG Binder specification and its applicability to Canadian Airport pavements. Subsequent work undertaken in 1998/1999 developed guidelines for selecting PG binders for Canadian Airport pavements with consideration for the type of aircraft using the facility.

Test sections have since been constructed at several airports to provide performance information relative to the performance of HMAC (Hot Mix Asphalt Concrete) constructed using Superpave PG binder grades compared to conventional CGSB asphalt grades. In 1998, the extension of Taxiway 'J' at the Calgary International Airport was constructed with a PG Binder Test Section utilizing PG 58-34 binder; the Control Section utilized CGSB 150-200A binder (equivalent to PG58-28). Within the PG Binder Test Section, thermocouples were installed in the pavement structure to allow for the analysis of pavement temperatures versus air temperatures. The analysis of these data is being undertaken as a separate study.

This report provides a second year review of the performance of the Calgary International Airport PG Binder Test Site pavements. The scope of work reported herein includes the following:

- Review of first year condition report.
- Pavement condition rating of the Calgary Test Section and Control Section after two years performance,
- Preparation of technical report; this technical report also includes a summary of the first year condition observations

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2.0 TEST SITE LAYOUT

Figure 1 shows the site layout. The Superpave PG 58-34 Binder Test Section is located from Station 2+000 to west of the intersection with Taxiway Alpha at Station 2+120.

The Control Section (CGSB 150-200A) HMAC is located from Station 1+690 to Station 1+810.

Areas encompassing 20m east of each of the Test Section and the Control Section have previously been identified for sampling purposes. These areas are outside of the actual portion of the Test and Control Sections being monitored and will not influence the performance of the monitored Sections.

3.0 PAVEMENT CONDITION SURVEY

The condition surveys were undertaken in accordance with the procedures developed by the U.S. Army Corps of Engineers for determining a Pavement Condition Index (PCI).

The PCI for air fields has been published as an ASTM test method¹. The PCI is a numerical index ranging from 0 for a failed pavement to 100 for a pavement in perfect condition. The PCI was developed to provide an index of the pavement's structural integrity and surface operational condition.

Both the PG binder 120 m Test Section and the CGSB asphalt 120 m Control Section were surveyed in their entirety. The procedure requires the extent and severity of 16 different distresses be recorded. The field data sheet used to undertake the survey are included in the Appendix.

3.1 1999 Pavement Condition Survey

A pavement condition survey was undertaken by Chuck McMillan, M.Sc., P.Eng. on September 17, 1999. The weather conditions at the time of the survey were sunny and the pavement surface was dry and clear. Representative photos are presented in Appendix A.

¹ ASTM D5340-93 Standard Test Method for Airport Pavement Condition Index Surveys

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Control Section – CGSB 150-200A

The CGSB Control Section (HMAC utilizing CGSB 150-200A asphalt) was exhibiting low severity weathering of about one half of the total area. This weathering was manifested by the loss of fine sand-size aggregate from the pavement surface and did not count as distress for the purpose of the PCI determination. As well, one small fuel/oil spill blemish was noted but was not considered significant in terms of the PCI.

Several transverse marks attributed to the paver screed were noted within the Control Section; these marks were limited to the southern and northern most mats; no screed marks were observed in the center two mats. At the time of the survey, these screed marks did not contribute to the PCI.

The observed distresses are mapped in Figure 2.

Several QA core locations were identified within the Control Section. (The Control Section was not identified until after construction and therefore coring for Quality Control purposes had not been restricted).

A PCI value of 100 was determined for the Control Section.

Test Section – PG 58-34

The PG Test Section (HMAC utilizing PG 58-34 asphalt) was exhibiting low severity weathering of the entire wearing surface. As with the Control Section, this weathering was manifested by the loss of fine sand-size aggregate from the pavement surface. Additional raveling/weathering was measured along longitudinal joints which was considered as a distress for the purpose of the PCI determination. As for the Control Section, screed marks which appear as transverse lines were somewhat common, though irregularly spaced. Some aggregate loss was observed at these marks.

The observed distresses are mapped in Figure 2.

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The ravelling/weathering along the longitudinal joint and two slight depressions were recorded for the purpose of determining a PCI. The Test Section had a calculated PCI of 91.5. The data sheet and field notes are included in Appendix B.

3.2 2000 Pavement Condition Survey

A pavement condition survey was undertaken by Dave Palsat, M.Sc., P.Eng. on September 17, 2000. The weather conditions at the time of the survey were sunny and the pavement surface was dry and clear. Representative photos are presented in Appendix A.

Control Section - CGSB 150-200A

The CGSB Control Section (HMAC utilizing CGSB 150-200A asphalt) was exhibiting very minor ravelling/weathering over the total area (Photo 14). This weathering, which was considered normal for a two year old pavement, was manifested by the loss of fine sand-size aggregate from the pavement surface and did not count as a distress for the purposes of PCI determination.

Longitudinal cracking was observed along the longitudinal construction joint down the centre of the taxiway (Photo 15). The crack was hairline in width (Photo 10) and discontinuous and was recorded as low severity.

At isolated locations some minor bleeding at the crack was observed (Photo 8 and Photo 14). The bleeding observed was not extensive enough to cause a reduction in skid resistance and did not count as a distress for the purpose of PCI determination.

Transverse marks were attributed to the paver screed on all mats (Photo 7). These screed marks, observed in 1999, were less discernible in 2000 and were considered a blemish and did not count as a distress for the purpose of PCI determination.

Some surface marks that could have been caused by brooming operations (Photo 13) were observed. These marks were considered blemishes and did not count as a distress for the purpose of PCI determination.

Overall the Control Section was considered in very good condition with a PCI value of 96.

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Test Section - PG58-34

The PG Test Section (HMAC Utilizing PG58-34) was exhibiting very minor ravelling/weathering over the total area (Photo 10). As with the Control Section, this weathering was manifested by the loss of fine sand-size aggregate from the pavement surface.

Additional ravelling was measured along the longitudinal joint between mats two and three which was considered as a distress for the purpose of the PCI determination (Photo 5) and was recorded as low severity. The width of ravelling was estimated at about 0.5 m which was less than the 1.5 m estimated in 1999; this is considered due to the overall general surface weathering.

Longitudinal cracking was observed along the longitudinal construction joint between mats two and three (Photo 4). The crack was hairline in width (Photo 10) and discontinuous and was recorded as low severity.

At isolated locations some minor bleeding was observed (Photo 8 and Photo 14). This was not extensive enough to cause a reduction in skid resistance and was not counted as a distress.

Transverse marks were attributed to the paver screed which did not count as a distress (Photo 7).

A depression was measured at one location along a longitudinal construction joint (Photo 6). This depression was less than 3 mm and was not visible without very close scrutiny. This depression was considered to be related to construction. It did not count as a distress for the purpose of PCI determination.

Overall the Test Section was considered in very good condition with a PCI value of 91.

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4.0 SUMMARY

The PCIs for 1999 and 2000 for both the Control and Test Sections are summarized in the following table.

Time of Survey	Pavememtn Condition Index	
	Control Section CGSB 150-200A	Test Section PG 58-34
September 1999	100	92
September 2000	96	91

Overall in 2000, the pavements for both the Control and the Test Section were in very good condition. Both pavements are exhibiting very slight weathering which is considered normal for a two year old pavement.

A higher frequency of screed marks was observed in 2000 than 1999; however the observed severity has reduced to what can be considered a blemish.

The only significant difference in condition observed from 1999 is the manifestation of a discontinuous hairline crack at the location of one longitudinal construction joint at or near the centre of the taxiway in both the Control and Test Sections.

The difference in PCI between the PG Test Section and Control Section is only due to the low severity ravelling/weathering along one longitudinal joint.

All distresses observed are considered to have resulted from workmanship or construction and are not attributable to the asphalt binders used.

5.0 CLOSURE

The testing and evaluation undertaken following the second year in-service has provided an update on the first year baseline observations. The performance of the Test Section and Control Section are, as would be expected for a two year old pavement. Continued monitoring should be undertaken on an annual basis. These condition surveys should continue to be carried out each September to maintain consistency.

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Figures

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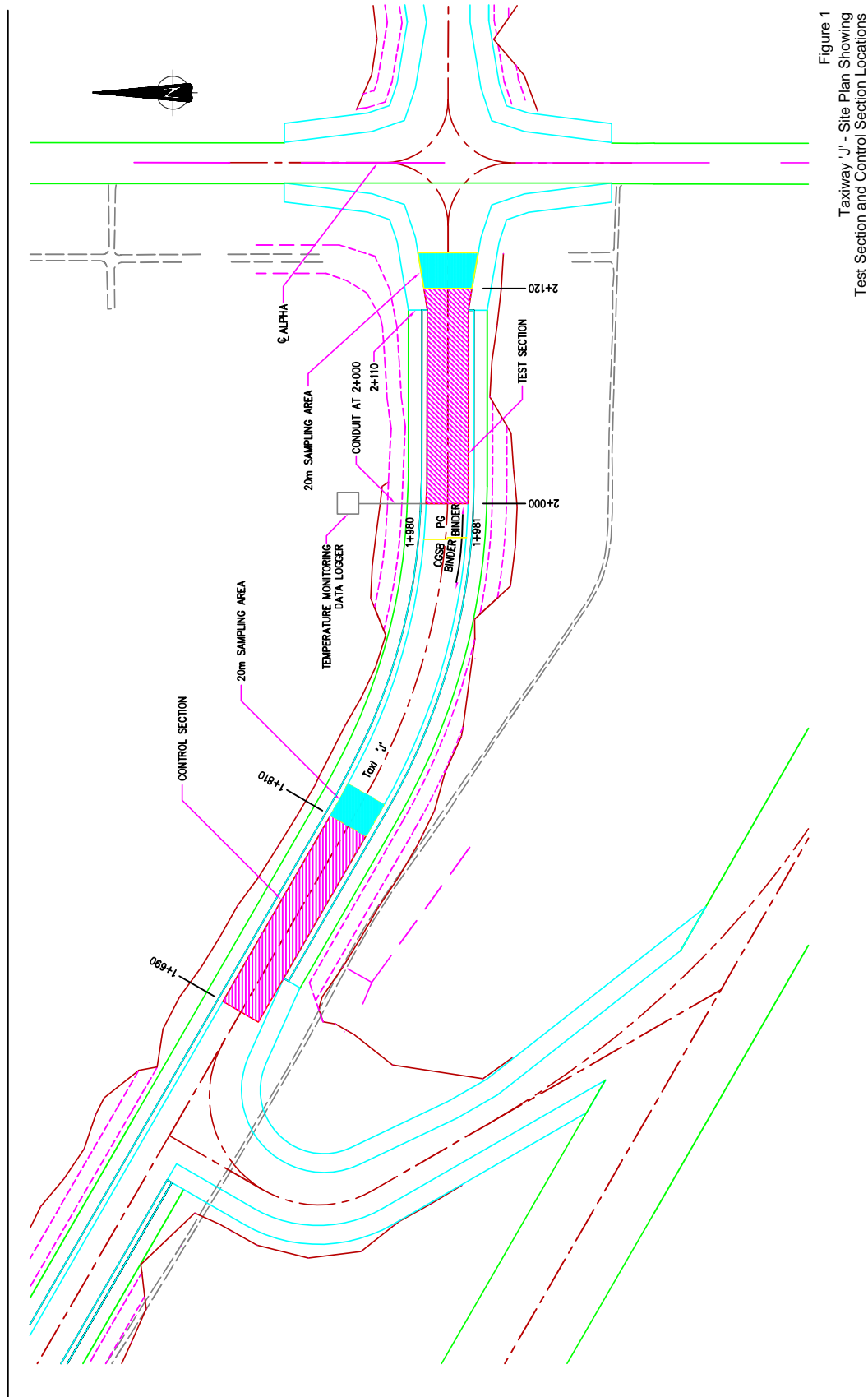
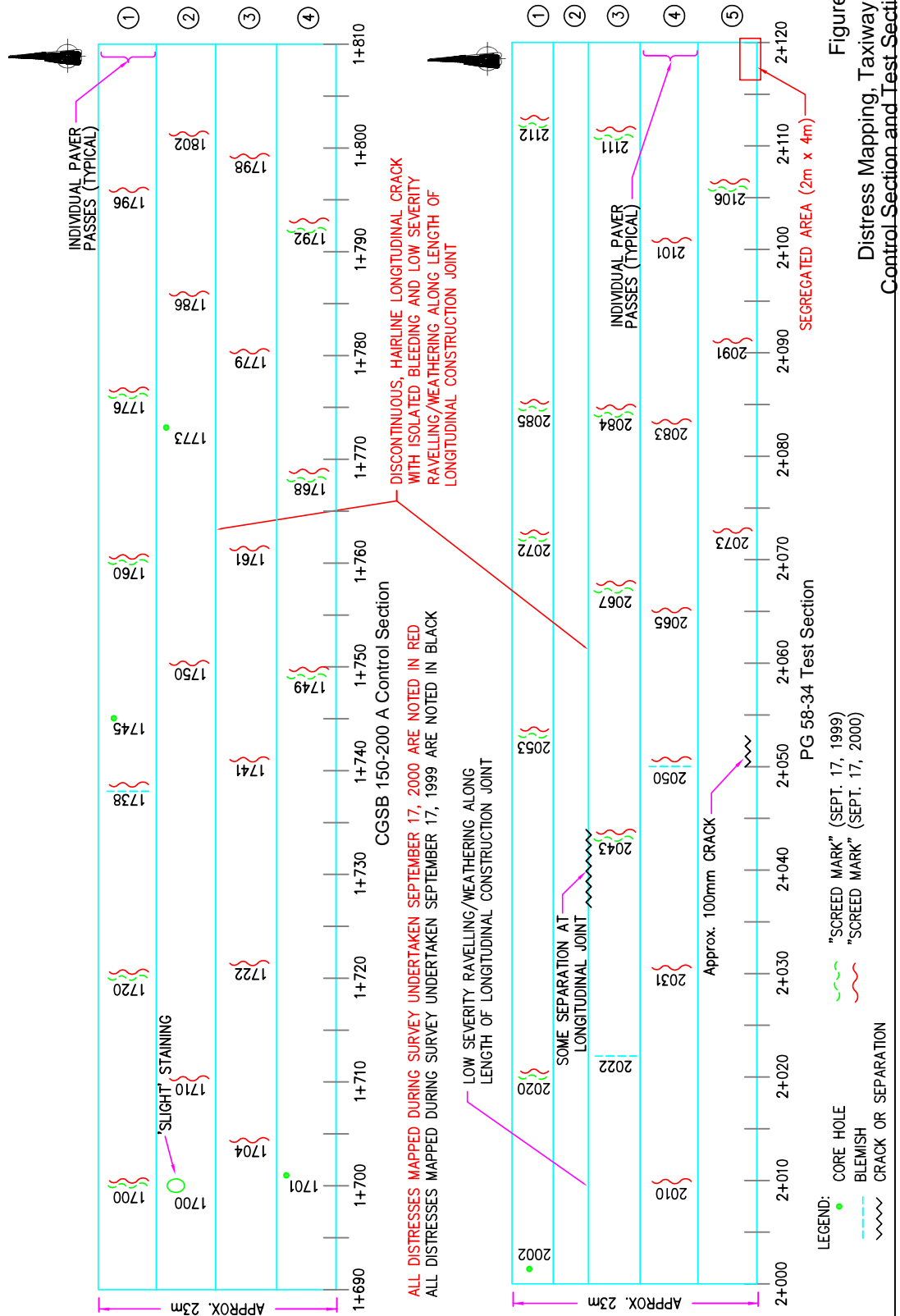


Figure 1
Taxiway 'J' - Site Plan Showing
Test Section and Control Section Locations

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Appendix A - Photos



Photo 1 Very minor crack in PG Binder Test Section (~2+050) - September 1999



Photo 2 Very minor crack in PG Binder Test Section (~2+050) - September 2000



**Photo 3 Low severity ravelling/weathering along longitudinal joint
in PG Test Section - September 1999**



**Photo 4 Low severity ravelling/weathering along longitudinal joint
in PG Test Section - Chalk highlights hairline crack at longitudinal joint
September 2000**



**Photo 5 Low severity ravelling/weathering along longitudinal joint
in PG Test Section - September 2000**



**Photo 6 Very minor depression along longitudinal joint with low
severity ravelling/weathering in PG Test Section - September 2000**



Photo 7 Example of screed mark in PG Test Section (also represents screed marks in Control Section) - September 2000



**Photo 8 Minor bleeding along longitudinal joint in PG Test Section
September 2000**



**Photo 9 Hairline crack at saw cut longitudinal joint in PG Test Section (~2+110)
(also represents Control Section) - September 2000**



**Photo 10 Close-up of hairline crack at saw cut longitudinal joint
in PG Test Section (~2+110) (also represents Control Section)
September 2000**



Photo 11 General condition of PG Test Section - September 2000



Photo 12 General condition of Control Section - September 2000



Photo 13 “Broom Marks” in Control Section - September 2000



**Photo 14 Minor bleeding at saw cut longitudinal joint in Control Section
September 2000**



**Photo 15 Chalk highlights hairline crack at longitudinal joint in Control Section
September 2000**

Appendix B

Airfield Asphalt Pavement Condition
Survey Data Sheets

AIRFIELD ASPHALT PAVEMENT CONDITION SURVEY DATA SHEET FOR SAMPLE UNIT					SKETCH: SEE FIGURE 2				
BRANCH		SECTION <i>Taxi J PG</i>			SAMPLE UNIT 1				
SURVEYED BY <i>CTM</i>		DATE Sept 17/99			SAMPLE AREA 120X33.5				
1 Alligator Cracking		5 Depression			9 Oil Spillage			13 Rutting	
2 Bleeding		6 Jet Blast			10 Patching			14 Shoving from PCC	
3 Block Cracking		7 Jt. Reflection (PCC)			11 Polished Aggregate			15 Slippage Cracking	
4 Corrugation		8 Long. & Trans. Cracking			12 Ravelling/Weathering			16 Swell	
Distress Severity	Quantity					Total	Density %	Deduct Value	
12 L	120m X 1.5m (Considered length of Test Section by 1.5m in width(along longitudinal joints))					180m2	6.40%	8	
5L	6	0.5				6.5m2	0.23%	0.5	
8L	0.08m2					0.08m2	0.00%	-	
100% of section is exhibiting minor fines loss.Fines loss along longitudinal joints considered low severity and included in PCI rating.									
Screed marks noted as shown in Figure 2.									

**AIRFIELD ASPHALT PAVEMENT
CONDITION SURVEY DATA SHEET
FOR SAMPLE UNIT**

SKETCH:

SEE FIGURE 2

BRANCH		SECTION <i>Taxi J CGSB</i>		SAMPLE UNIT <i>2</i>					
SURVEYED BY <i>CTM</i>		DATE <i>Sept 17/99</i>		SAMPLE AREA <i>120x22.9</i>					
1 Alligator Cracking		5 Depression		9 Oil Spillage		13 Rutting			
2 Bleeding		6 Jet Blast		10 Patching		14 Shoving from PCC			
3 Block Cracking		7 Jt. Reflection (PCC)		11 Polished Aggregate		15 Slippage Cracking			
4 Corrugation		8 Long. & Trans. Cracking		12 Ravelling/Weathering		16 Swell			
Distress Severity	Quantity					Total	Density %	Deduct Value	
12 L	About 50% of the section is exhibiting minor fines loss- however this was not considered to be a distress as required to contribute to PCI determination. Fines loss limited to mats 2 & 4 (from N.)					0	0%	0	
	Screed marks noted as shown in Figure 2.								

AIRFIELD ASPHALT PAVEMENT CONDITION SURVEY DATA SHEET FOR SAMPLE UNIT				SKETCH: SEE FIGURE 2		
BRANCH		SECTION <i>Taxi J PG</i>		SAMPLE UNIT 1		
SURVEYED BY <i>DPP</i>		DATE Sept 17/00		SAMPLE AREA 120X23.5		
1 Alligator Cracking		5 Depression		9 Oil Spillage		
2 Bleeding		6 Jet Blast		10 Patching		
3 Block Cracking		7 Jt. Reflection (PCC)		11 Polished Aggregate		
4 Corrugation		8 Long. & Trans. Cracking		12 Ravelling/Weathering		
				13 Rutting		
				14 Shoving from PCC		
				15 Slippage Cracking		
				16 Swell		

Distress Severity	Quantity	Total	Density %	Deduct Value
12 L	120m X 0.5m (Considered length of Test Section by 0.5m in width (along longitudinal joints))	60m ²	2.13%	5
8L	60m	60m	2.13%	4
		Total Deduct value		9
		<i>Max Corrected Deduct Value</i>		9
			PCI	91
	100% of section is exhibiting minor fines loss, which is considered normal weathering.			
	Fines loss along longitudinal joints between mats 2 and 3 is considered low severity			
	Screed marks noted as shown in Figure 2.			

AIRFIELD ASPHALT PAVEMENT CONDITION SURVEY DATA SHEET FOR SAMPLE UNIT				SKETCH: SEE FIGURE 2	
BRANCH		SECTION <i>Taxi J CGSB</i>		SAMPLE UNIT <i>2</i>	
SURVEYED BY <i>DPP</i>		DATE <i>Sept 17/00</i>		SAMPLE AREA <i>120X22.9</i>	
1 Alligator Cracking		5 Depression		9 Oil Spillage	
2 Bleeding		6 Jet Blast		10 Patching	
3 Block Cracking		7 Jt. Reflection (PCC)		11 Polished Aggregate	
4 Corrugation		8 Long. & Trans. Cracking		12 Ravelling/Weathering	
				13 Rutting	
				14 Shoving from PCC	
				15 Slippage Cracking	
				16 Swell	
Distress Severity	Quantity			Total	Density %
8 L	120m X 0.5m (Considered length of Test Section by 0.5m in width (along longitudinal joints))			60m	2.18%
				Total Deduct value	
				4	
				Max Corrected Deduct Value	
				4	
					PCI
					96
	100% of section is exhibiting minor fines loss, which is considered normal weathering.				
	Screed marks noted as shown in Figure 2.				