

SWIFT 2022

# Assessment of Gravel Runways



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# What are we looking for?



# AGENDA

References for  
Unpaved Runway  
Surfaces



Unpaved Surface  
Assessment  
Methodology

Unpaved Surface  
Distresses



CYOC Old Crow Airport  
Assessment Case  
Study



Questions





## REFERENCES FOR UNPAVED RUNWAY SURFACES

- Transport Canada Advisory Circulars
  - AC 300-004 Unpaved Runway Surfaces
  - AC 300-021 Thin Bituminous Surface Runways
  - AC 700-011 Operations on Runways with Unpaved Surfaces
- Transport Canada Engineering Reference Documents
  - ERD 121 Guidelines Respecting Airport Pavement Structural Condition Surveys





# AC 300-004 – Unpaved Runway Surfaces

Frost Effects on  
Gravel Pavements

Soil Properties –  
Effect on Surface  
Shear Strength

Strength  
Measurement and  
Reporting

Condition Inspection  
of Gravel Surfaces

Maintenance and  
Repair of Gravel  
Surfaces

Maintenance and  
Repair of Turf  
Landing Strips

# AC 300-004 – Unpaved Runway Surfaces



**Frost Effects on  
Gravel Pavements**

Soil Properties –  
Effect on Surface  
Shear Strength

Strength  
Measurement and  
Reporting



**Condition  
Inspection of  
Gravel Surfaces**



**Maintenance and  
Repair of Gravel  
Surfaces**

Maintenance and  
Repair of Turf  
Landing Strips



# AC 300-021 – Thin Bituminous Surface Runways

Soil Properties and  
Frost Effects on  
Pavements

Strength  
Measurement and  
Reporting

Friction  
Measurement

Slope Gradients

Maintenance and  
Repair of Thin  
Bituminous Surfaces

Condition Inspection  
of Thin Bituminous  
Surfaces

# AC 300-021 – Thin Bituminous Surface Runways



**Soil Properties and  
Frost Effects on  
Pavements**

**Strength  
Measurement and  
Reporting**

**Friction  
Measurement**



**Slope Gradients**



**Maintenance and  
Repair of Thin  
Bituminous  
Surfaces**



**Condition  
Inspection of Thin  
Bituminous  
Surfaces**



# AC 700-011 – Operations on Runways with Unpaved Surfaces

Climatic and Wear Effects

Effects on Aeroplane Performance and Handling

Frozen Unpaved Runways

Minimum Required Surface Strength

Measurement of Surface Strength

# AC 700-011 – Operations on Runways with Unpaved Surfaces



**Climatic and Wear Effects**

Effects on Aeroplane Performance and Handling



**Frozen Unpaved Runways**

Minimum Required Surface Strength

Measurement of Surface Strength



# ERD 121 Guidelines Respecting Airport Pavement Structural Condition Surveys

Pavement Quality  
Characteristics

Pavement Structural  
Condition

Objectives

Pavement Surface  
Defects and  
Distresses

Pavement Structural  
Condition Ratings

Pavement Condition  
Survey, Analysis,  
and Reporting  
Procedures

Survey Scheduling

Gravel Surface  
Defects and Rating  
Guidelines

# ERD 121 Guidelines Respecting Airport Pavement Structural Condition Surveys

Pavement Quality Characteristics

Pavement Structural Condition

Objectives

Pavement Surface Defects and Distresses



Pavement Structural Condition Ratings



Pavement Condition Survey, Analysis, and Reporting Procedures



Survey Scheduling








Gravel Surface Defects and Rating Guidelines

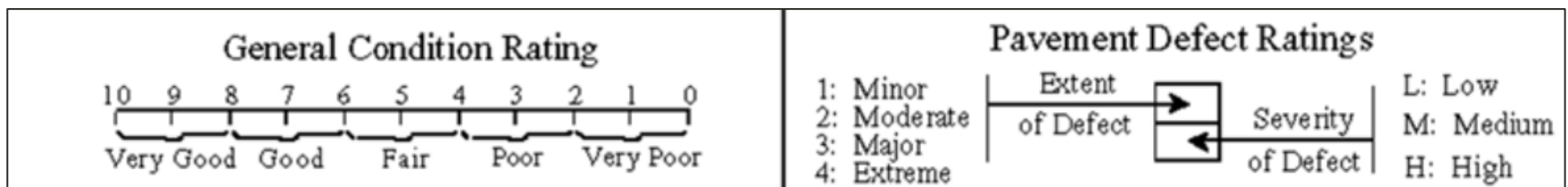


# ERD 121 Guidelines Respecting Airport Pavement Structural Condition Surveys

## General Condition Rating

	Very Poor [ $\leq 2$ ]
	Poor [ $>2$ to $\leq 4$ ]
	Fair [ $>4$ to $\leq 6$ ]
	Good [ $>6$ to $\leq 8$ ]
	Very Good [ $>8$ ]

- General Condition Rating assigned to each pavement section based on the extent and severity of the distresses and defects observed
- Condition Rating Legend for a Gravel Runway Assessment



# UNPAVED SURFACE ASSESSMENT METHODOLOGY

- Gather Airport Background Information
- Airport Operator and Staff Interviews
- Surface Condition Assessment and Technology



# Airport Background Information

## Construction History and Attributes



- Subgrade
- Structure Composition
- Critical Aircraft and Tire Pressure
- Last Regravelling Date
- Thickness of Gravel at Last Regravelling
- Surface Treatments



# Airport Operator and Staff Interviews

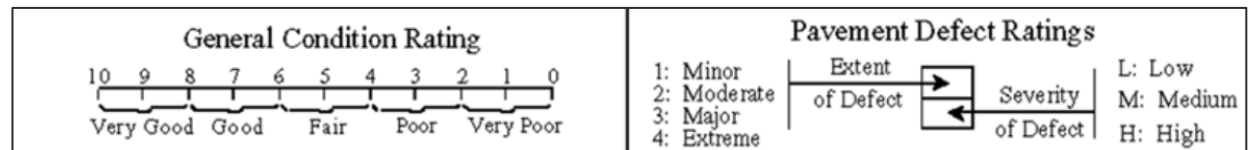
- Equipment Available
- Last Graded Date
- Granular Material Availability
- Seasonal Timing for Maintenance
- Surface and Subsurface Drainage Characteristics
- Complaints from Pilots
- Areas of Concern



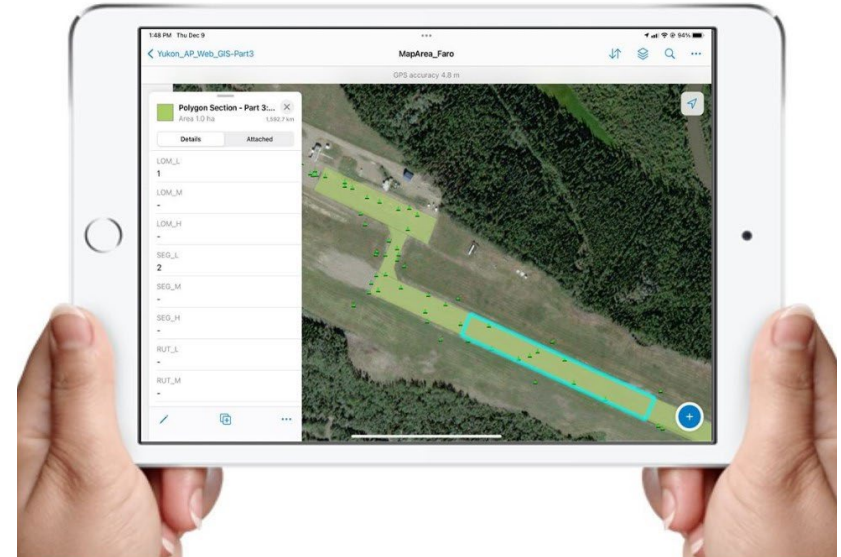
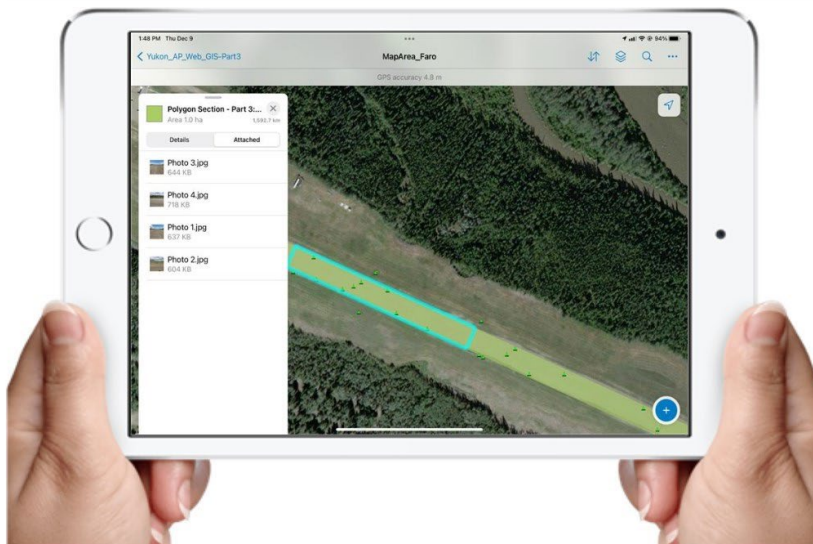
# Surface Condition Assessment



- Prepare Site Plans
- Coordinate Operational Impacts
- Record Surface Defects and Distresses
- Assign General Condition Rating



# Surface Condition Assessment Technology



- Arc-GIS Based
- Digital Site Plans
- Geolocation



- Photos
- Data Collection
- Ease of Use



# UNPAVED SURFACE DISTRESSES

- Loss of Material
- Segregation
- Rutting
- Surface Drainage
- Sub-Drainage
- Frost Action
- Runway Roughness
- Vegetation
- Dust Generation





# Loss of Material





# Segregation





# Rutting





# Surface Drainage



# Sub-Drainage



- Soft areas with rutting and shoving during spring thaw or wet conditions and frost heave during winter are indications of poor subsurface drainage
- Similar to rutting, but caused by high moisture content instead of inadequate structure

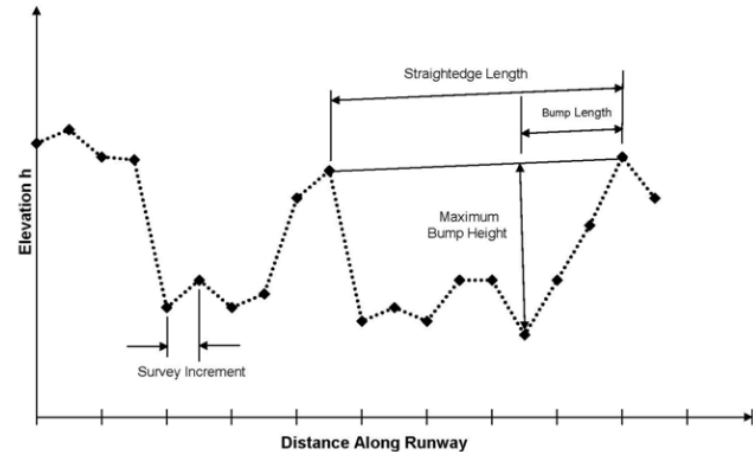


# Frost Action



# Runway Roughness

Figure 2 – Bump Height Measurement



- Isolated bumps and depressions in the runway profile where an excessive change in elevation occurs in relation to the base length of the bump or depression

Table 1 - Runway Roughness Criteria for Isolated Bumps

Surface irregularity (bump)	Length of irregularity (m)								
	3	6	9	12	15	20	30	45	60
Acceptable surface irregularity height (cm)	2.9	3.8	4.5	5	5.4	5.9	6.5	8.5	10
Tolerable surface irregularity height (cm)	3.9	5.5	6.8	7.8	8.6	9.6	11	13.6	16
Excessive surface irregularity height (cm)	5.8	7.6	9.1	10	10.8	11.9	13.9	17	20

AC 302-023 – Measurement and Evaluation of Runway Roughness



# Vegetation



# Dust Generation





# CYOC OLD CROW AIRPORT ASSESSMENT CASE STUDY

- Airfield Location
- Surface Distresses Identified
- General Condition Rating





# CYOC Old Crow Airport



Runway 04-22  
5,020 ft



# Runway 04-22



**Well Graded with  
Recent 40mm Thick  
Overlay**

**Tight, Compact  
Surface with Minimal  
Segregation**



**Tire Impressions in Top  
10mm of Fines**

- Condition Rating: GOOD (8)





# Taxiway A



**Transverse Slopes  
Draining Surface**

**Patches of EK35 Dust  
Suppressant**



**Low Severity Rutting /  
Tire Impressions**



- Condition Rating: GOOD (8)

# Apron



**Loss of Material and Segregation**

**Shallow Depressions  
between EK35 Dust  
Suppressant Patches**



**Surface Drainage  
Concerns**

- Condition Rating: FAIR (6)





# General Surface Condition Rating





# THANK YOU!



# QUESTIONS?

## APPENDICES

- Gravel Replacement Material Specifications
- Condition Rating Form for Gravel Surfaces



# Gravel Replacement Material Specifications

AC 300-004

## APPENDIX A — TABLE 1

**Table 1: Gravel Replacement Material Specifications**

Gravel Replacement Material Gradation or Mixture	
Sieve Size (mm)	Percentage by Weight Passing Sieves
25	100
19	70-100
2.00	40-70
0.425	20-45
0.075	10-20

# Condition Rating Form for Gravel Surfaces

Figure 2: Condition Rating Form for Gravel Surfaces

AC 300-004

Condition Rating Form for Gravel Surfaces

Airport:																								
Date:																								
Inspector:																								
Critical Aircraft:																								
Tire Pressure:																								
Facility	Chainage		Last Regravelling (Month / Year)	Thickness of Gravel at Last Regravelling (mm)	Present Gravel Thickness (mm)	Last Graded (Date)	Next Regravelling Required (Year)	Surface Condition Rating								General Condition Rating								
	From	To						Loss of Material	Segregation	Rutting	Surface Drainage	Sub-Drainage	Frost Action	Runway Roughness	Vegetation									
Comments:																								
<div style="display: flex; justify-content: space-between;"> <div> <p><b>General Condition Rating</b></p> <p>10 9 8 7 6 5 4 3 2 1 0</p> <p>Very Good Good Fair Poor Very Poor</p> </div> <div> <p><b>Pavement Defect Ratings</b></p> <table border="0"> <tr> <td>1: Minor</td> <td rowspan="4"> <div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="width: 50%; height: 10px; background-color: black;"></div> </div> </td> <td>L: Low</td> </tr> <tr> <td>2: Moderate</td> <td>M: Medium</td> </tr> <tr> <td>3: Major</td> <td>H: High</td> </tr> <tr> <td>4: Extremes</td> <td></td> </tr> </table> </div> </div>																1: Minor	<div style="border: 1px solid black; padding: 2px; display: inline-block;"> <div style="width: 50%; height: 10px; background-color: black;"></div> </div>	L: Low	2: Moderate	M: Medium	3: Major	H: High	4: Extremes	
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