



## Airport Management Conference of Ontario (AMCO)

Annual Conference (Sudbury)

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Wawa Municipal Airport



## 2008 Airfield Pavement Condition Survey for Municipal Airports

- This pavement survey was **funded** in part by each of the following organizations:
- Ministry of Transportation (MTO)
- Ministry of Northern Development and Mines (MNDM)
- Ministry of Economic Development and Trade (MEDT)
- Ministry of Tourism (MTOUR)

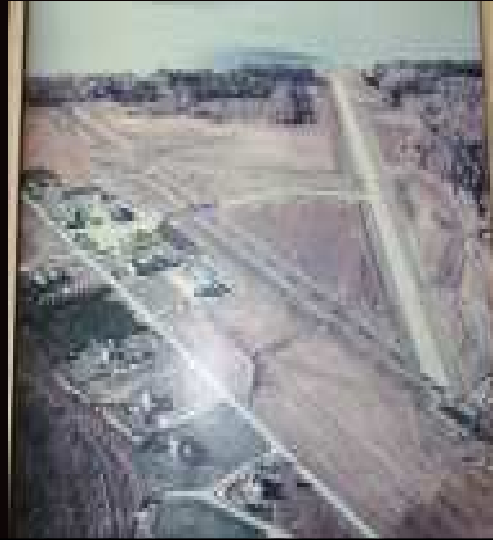
Atikokan Municipal Airport

## 2008 Airfield Pavement Condition Survey for Municipal Airports



### Scope of Work

- Pavement History
- Condition Survey For Airfields in Northern and Southern Ontario
  - Northern Ontario (18 airports)
  - Southern Ontario (23 airports)  
Plus  
Additional (5 airports) Southern Ontario done by others.
- Pavement Rehabilitation Strategies and Costing



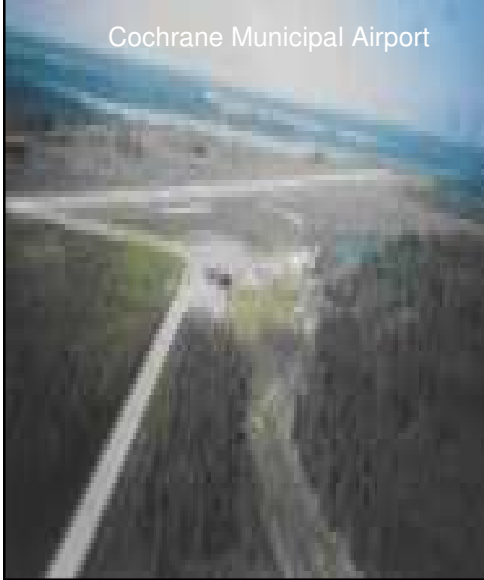
### Northern Ontario (18 airports):



**Northern Ontario (18 airports):**

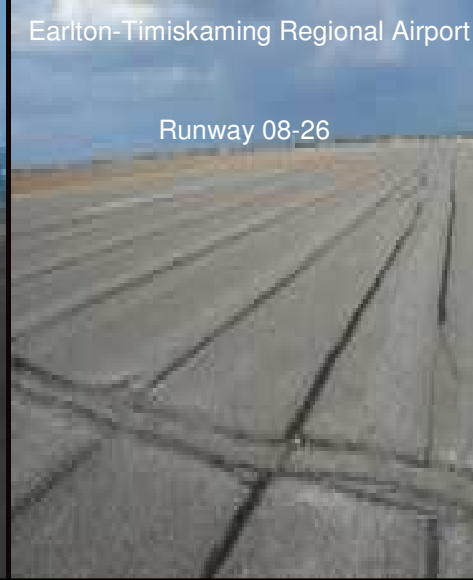


Cochrane Municipal Airport



Earlton-Timiskaming Regional Airport

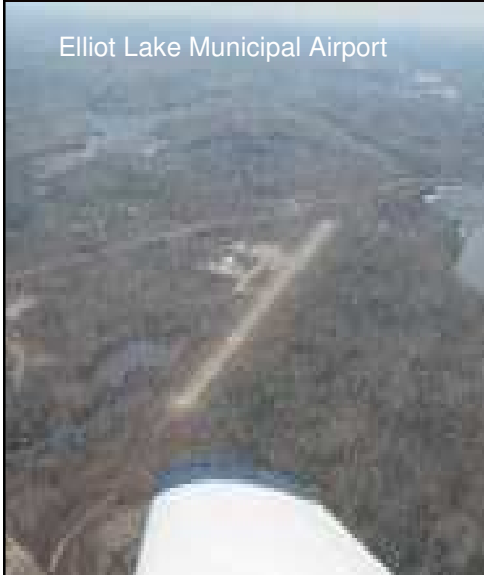
Runway 08-26



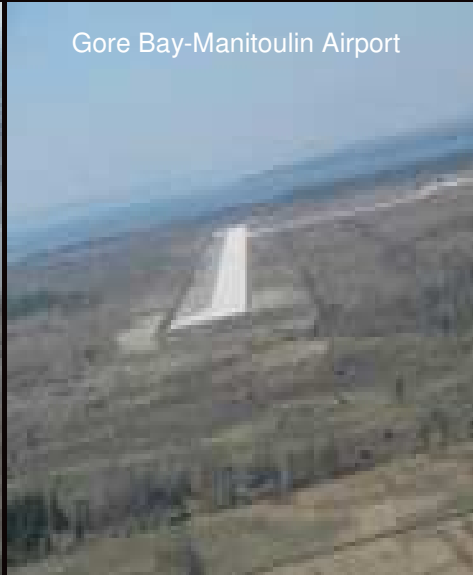
**Northern Ontario (18 airports):**



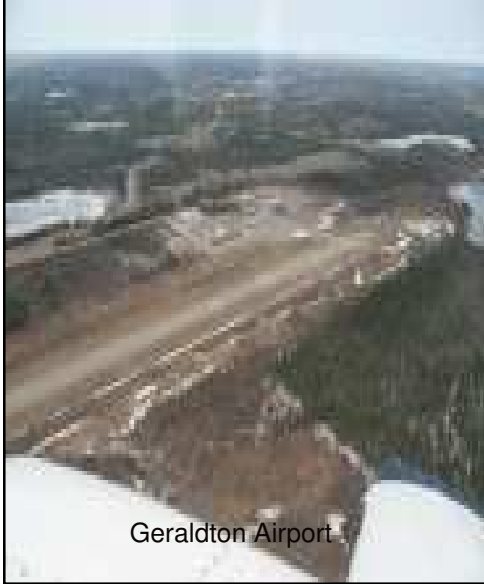
Elliot Lake Municipal Airport



Gore Bay-Manitoulin Airport



Northern Ontario (18 airports):



Geraldton Airport



Hornepayne Municipal Airport

Northern Ontario (18 airports):



Ignace Municipal Airport



Iroquois Falls Municipal Airport

**Northern Ontario (18 airports):**



Killarney Municipal Airport



Kirkland Lake Municipal Airport



**Northern Ontario (18 airports):**



Manitoulin East Municipal Airport



Manitouwadge Municipal Airport



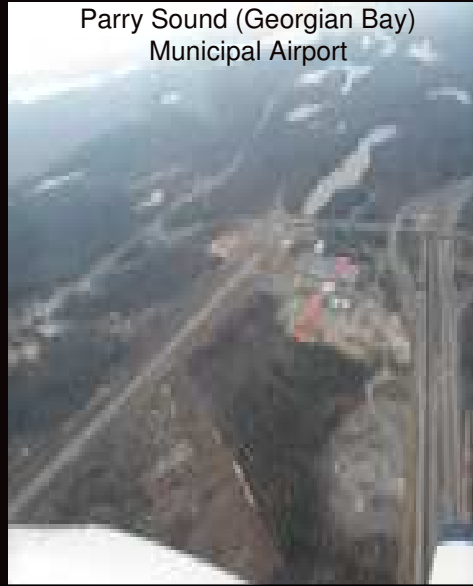
Northern Ontario (18 airports):



Marathon Municipal Airport



Parry Sound (Georgian Bay) Municipal Airport



Northern Ontario (18 airports):



Hearst (Rene Fontaine) Municipal Airport



Wawa Municipal Airport



**Southern Ontario (23 airports):**



Runway 10-28



Arnprior Municipal Airport

Runway 05-23

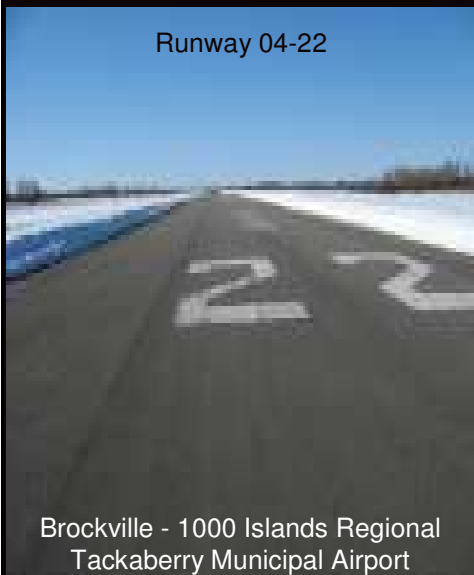


Brantford Municipal Airport

**Southern Ontario (23 airports):**



Runway 04-22



Brockville - 1000 Islands Regional  
Tackaberry Municipal Airport

Runway 10-28



Carp Municipal Airport

Southern Ontario (23 airports):



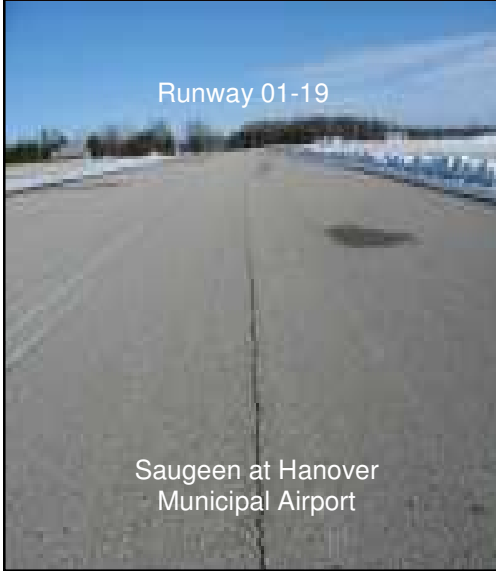
Southern Ontario (23 airports):



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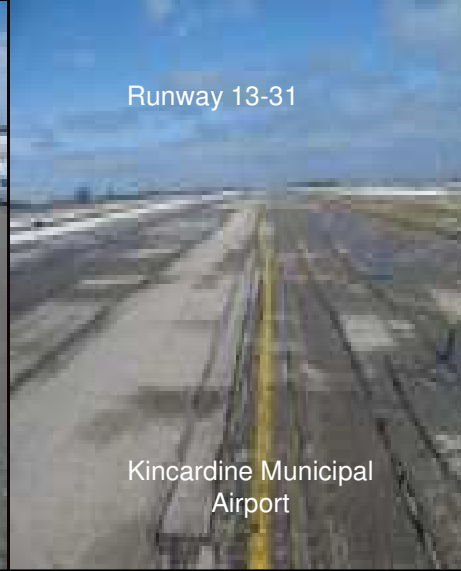


Runway 01-19



Saugeen at Hanover  
Municipal Airport

Runway 13-31

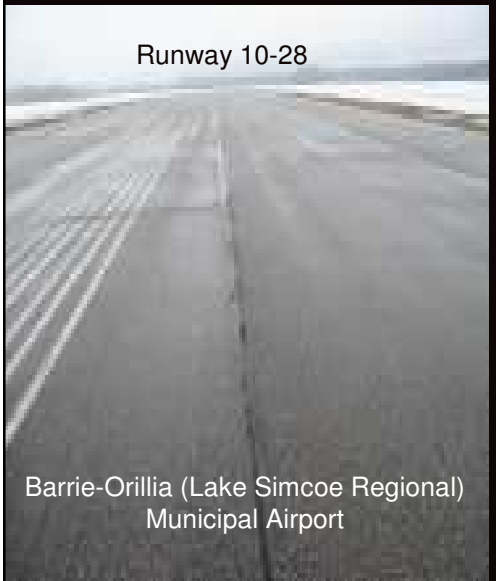


Kincardine Municipal  
Airport

Southern Ontario (23 airports):

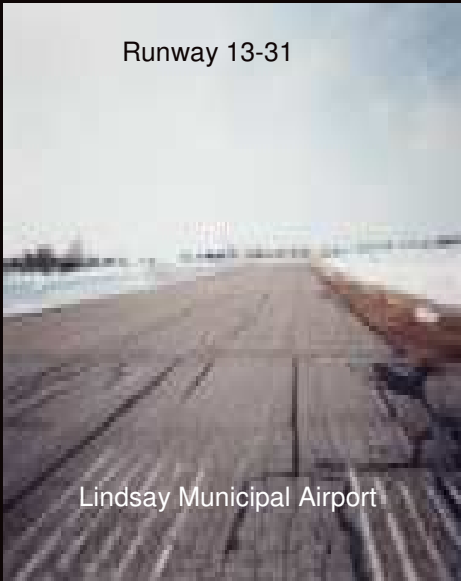


Runway 10-28



Barrie-Orillia (Lake Simcoe Regional)  
Municipal Airport

Runway 13-31



Lindsay Municipal Airport

**Southern Ontario (23 airports):**



Runway 18-36



Muskoka Municipal Airport

Runway 05-23



Welland-Port Colborne (Niagara Central) Municipal Airport

**Southern Ontario (23 airports):**



Runway 06 - 24



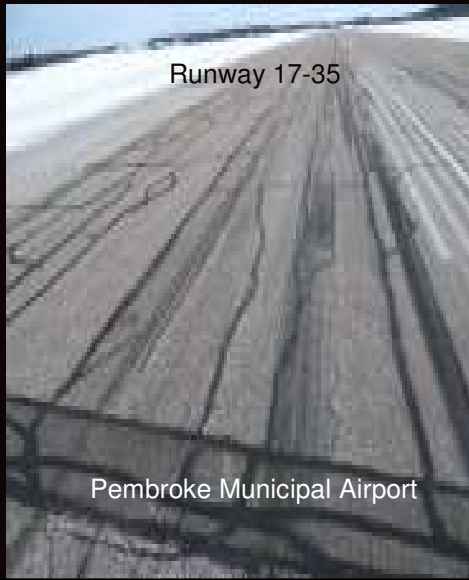
Niagara District (St. Catharines) Airport

Runway 12-30



Oshawa Municipal Airport

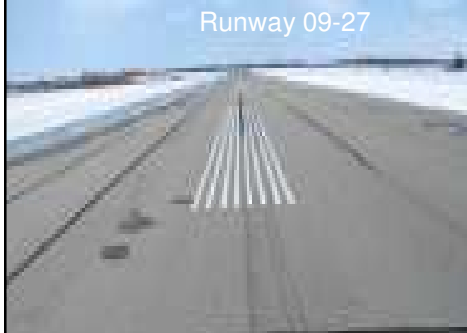
Southern Ontario (23 airports):



Southern Ontario (23 airports):



Southern Ontario (23 airports):



Runway 09-27



Runway 12-30

St. Thomas Municipal Airport

Tobermory Municipal Airport

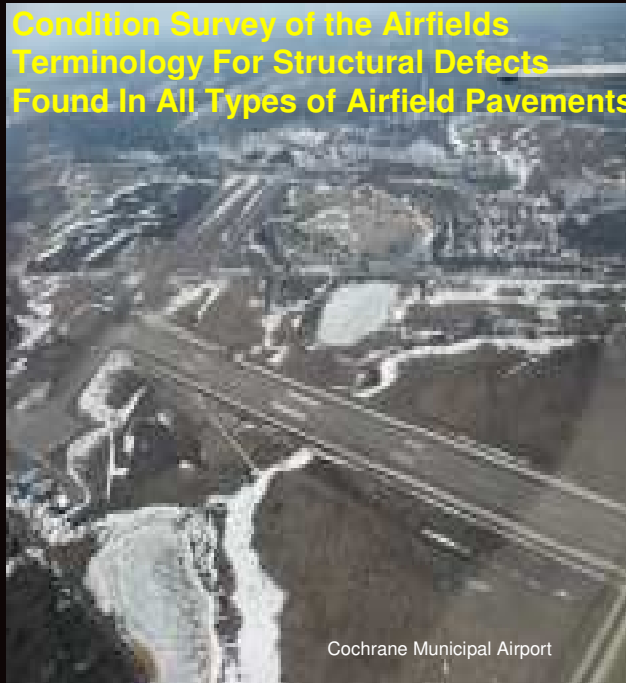
Southern Ontario (23 airports):



## Plus Additional Southern Ontario airports (5) - Done by Others

- Collingwood,
- Midland/Huronian,
- Stratford,
- Tillsonburg,
- Wiarton-Keppel

## Condition Survey of the Airfields Terminology For Structural Defects Found In All Types of Airfield Pavements



Cochrane Municipal Airport

## Alligator Cracking

- It is a **load-associated defect** normally found in the aircraft wheelpaths.
- It can cause Foreign Object Damage hazard.
- Spacing between cracks is usually 50 to 300 mm.



Problems: eventually results in potholes

## Map Cracking

- Cracks intersecting at a spacing of 500 mm to 2 m.
- Map cracking **occurs only in the wheelpaths** (load associated) - **otherwise the defect is block cracking.**
- Caused by excessive deflection of the pavement under load.



## Block Cracking

- Identified by intersecting transverse and longitudinal cracks forming blocks that may vary in size with a spacing of up to 3 X 3m.
- It is **not limited to wheelpath** locations (i.e. block cracking is **not load-related**) and will frequently occur throughout the entire pavement surface.



## Longitudinal Cracking

- Longitudinal cracks caused by repeated over-stressing of the wheelpath area by heavy aircraft traffic.
- Secondary cracking may eventually develop adjacent to the main crack which can lead to Foreign Object Damage (FOD) hazard for aircraft.



## Transverse Cracking

- Transverse, thermal cracks caused by cold temperature variation.



## Wheelpath Rutting

- Rutting is a **load-related depression found in the wheelpath area.**
- A visual check for rutting can be made by a straight-edge.
- Rut depths exceeding 40 mm are considered excessive.
- Ruts can cause problems with the directional control of aircraft should water accumulate in the ruts during rain and lead to hydroplaning problems.



**Possible causes: subgrade settlement resulting from inadequate compaction during construction**

## Ravelling

amec

- Ravelling is the disintegration and subsequent loss of the asphalt surface.
- It is evidenced by the pop-out of surface aggregates and/or the loss of surface fines from the asphalt mix.
- Severe cases representing a FOD hazard for aircraft.



## Bleeding

amec

- Bleeding is also accumulation of asphalt binder (cement) on the pavement surface - normally in the wheelpath areas.
- Bleeding can be caused by excess asphalt cement and/or insufficient voids in the asphalt mix, with the excess asphalt being flushed to the pavement surface by wheel loads during hot weather.
- Bleeding reduces friction required for aircraft braking and can become very slippery - especially when wet.



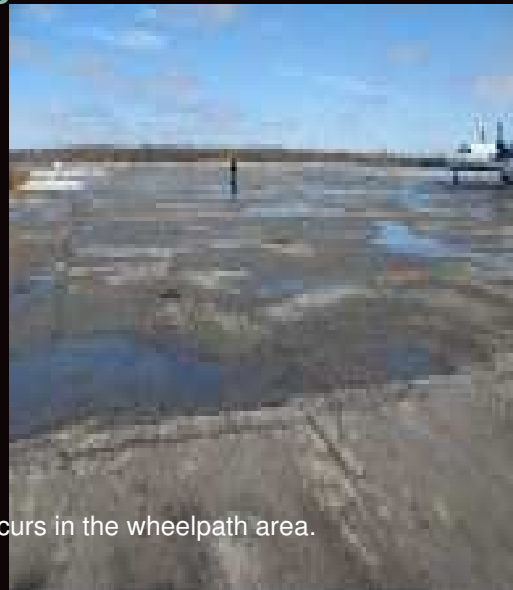
## Potholes

- The usual end result of structural deterioration is the pop-out of surface material which creates a FOD (Foreign Object Damage) hazard for aircraft.



## Frost Heave Damage

- Frost heave is the vertical movement of the pavement surface during winter or early spring.
- Normally, only differential heaving is of concern.
- Frost heave is caused by ice lenses forming in a frost-susceptible subgrade soil when a source of subsurface water and freezing temperatures are present.
- Frost heaving is critical if it occurs in the wheelpath area.



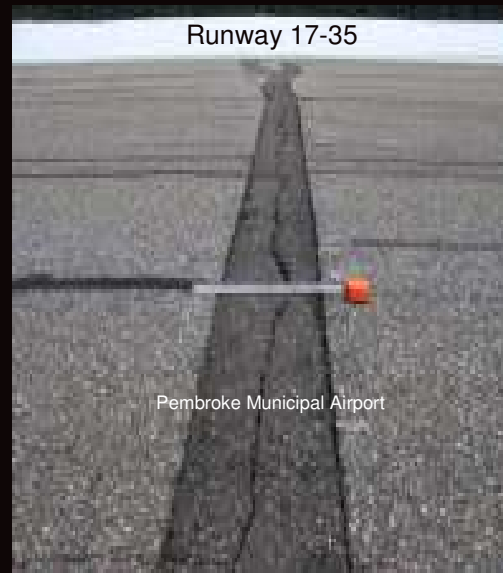
## Subgrade Settlement/Depression and Surface Ponding

- Subgrade settlement is a depression in the pavement surface, usually over a fairly extended area, and may occur anywhere in the pavement surface.
- Ponded water may represent a potential hydroplaning problem.



## Surface Patching

- Patching is localized area usually to correct a pavement structural defect or deficiency.





### Structural Distresses and Possible Contributing Factors\*

Types of Distresses	Functional Distress	Structure Distress	Traffic Distress		Environmental Distress		Materials Distress	Construction
			Pavement Design	Load	Water	Temp		
<b>Surface Defects</b>								
Ravelling & C. Agg. Loss	√		N	C	C	N	√	P
Flushing	√		N	C	N	C	√	P
<b>Surface Deformation</b>								
Rippling and shoving	√		N	C	N	N	√	P
Wheel Track Rutting	√		N	P√	N	C	C	C
Distortion/settlement		√	P	P√	C	N	C	P
<b>Cracking</b>								
<b>Longitudinal Wheel Track:</b> Alligator, Single & Multiple		√	P	P√	C	C	C	C
<b>Centreline Cracking:</b> Alligator, Single & Multiple		√	P	P√	C	C	C	P
<b>Random Cracking</b> Midlane Cracking		√	P	P√	C	N	C	N
<b>Pavement Edge Cracking:</b> Alligator, Single & Multiple		√	P	P√	C	N	C	C
<b>Transverse Cracking:</b> Half, Full and Multiple Cupping Alligator		√	N	N	P	P√	C	N

\* P= Prime factor, C= Contributing factor, N= Negligible factor



## Pavement Distress Evaluation

Pavement distresses was in accordance with the Transport Canada

	General Condition	Alligator Cracking	Map/Block Cracking	Transverse Cracking	Longitudinal Cracking	Rutting	Ravelling	Bleeding	Frost Heaving	Subgrade Settlement	Patching	Potholes	Smoothness
Runway 13-31	2	4/2	4/2	4/3	4/4	3/1			2/1	one		3	*
Runway 13-31	4	1/0		2/1	2/2	0/0			0/0	few		5	**
Taxiway Alpha	2	4/3	4/3	4/3	4/2	1/1			3/0	few		3	
Main Apron	2	4/3	4/3	4/2	4/3	3/1			1/1	few		3	

\* South (3000 ft long) paved Year 1980's

\*\* North (500 ft long), paved Year 1990's

#### General Condition Rating

Excellent (Rating 9-10)
Good (Rating 7-8)
Fair (Rating 5-6)
Poor (Rating 3-4)
V. Poor (Rating 1-2)

#### Severity/Density (Rating)

Severity of Distress					Density of Distress				
0	1	2	3	4	0	1	2	3	4
Very Slight/None	Slight/Minor	Moderate	Severe/Major	Very Severe/extreme	Few	Intermittent	Frequent	Extensive	Throughout
<2mm	2-12mm	13-19mm	20-25mm	>25mm	<10%	10-20%	20-50%	50-80%	80-100%

## Airfields Pavement Rehabilitation Strategies



Routine Maintenance  
Preventative Maintenance  
Rehabilitation  
Holding

Extends life of pavement i.e. adds more time



In general, there are several levels of treatment to correct pavement deterioration.

The holding strategy involves temporary repairs that "hold" the pavement until funding for full rehabilitation of a runway is acquired. Holding leads to a temporary yet effective repair while funding and asset planning efforts are diverted to other areas.

Routine maintenance (e.g., [filling cracks](#), [potholes](#)).

Periodic maintenance (e.g., [fog seals](#), [slurry seals](#), [Bituminous Surface Treatment \(BST\) applications](#) and [non-structural \(thin\) overlays](#))

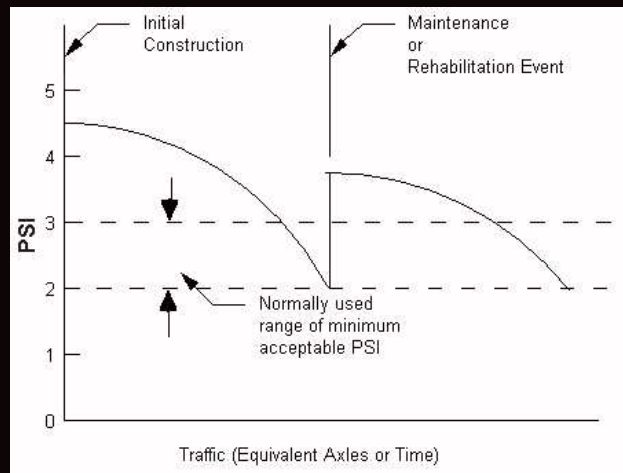
Rehabilitation (e.g., [structural overlays](#))

Reconstruction (e.g., design and construct an entire new Airport)  
Supplementary (leveling and spot repair, usually done with other treatments)

# Pavement Performance



The pavement deterioration is well explained by a deterioration curve as shown in the figure below.



# Rehabilitation Strategies

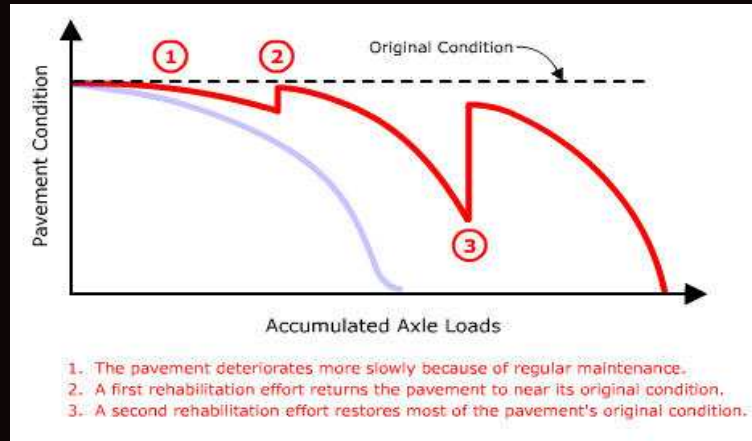


- The worst is waiting until pavement has deteriorated significantly over its service life before initiating more costly resurfacing / reconstruction alternatives. It is estimated that \$1 invested early in a pavement's life cycle can save in excess of \$5 in the future.
- Notice that for the first 75% of pavement life, the pavement condition drops by about 40%. However, it only takes another 17% of pavement life for the pavement condition to drop another 40 percent.

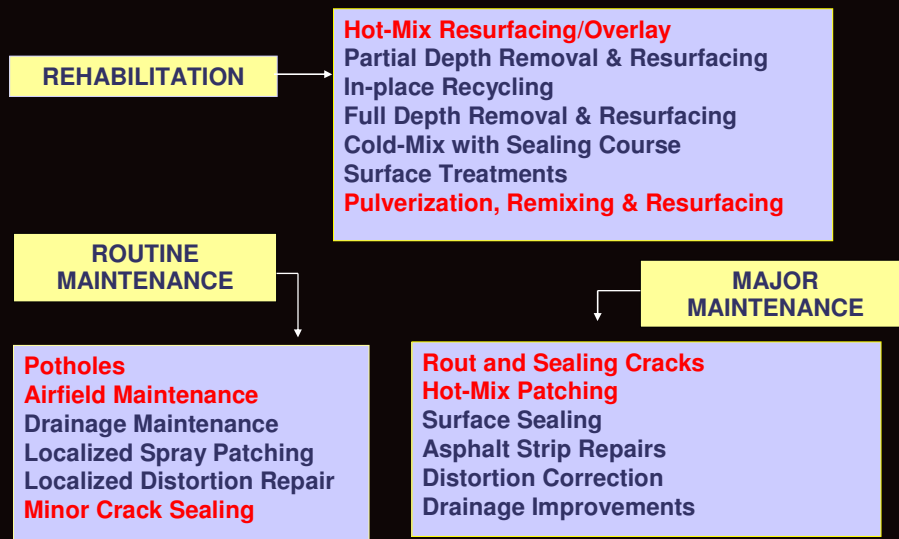


## Rehabilitation Strategies

- Timing of maintenance and rehabilitation actions can greatly influence their effectiveness and cost.



## Rehabilitation Strategies



## Rehabilitation Alternatives

### Option: Milling & Resurfacing

This option involves cold milling/grinding the existing asphalt surface to a depth of 100+ mm.

**Typical Milling Machine**  
Tracks, Vacuum, Cutter Drum, Conveyor Belts

The milled areas should be tack coated and should conform to OPSS 1103, Type SS1. The milled depth should be replaced with a minimum of 1 lift of 60 mm asphalt concrete binder course.

A new surface course of 40 mm hot mix should be placed over the new binder course.



### Option: In-Place Pulverization of Bituminous Pavement

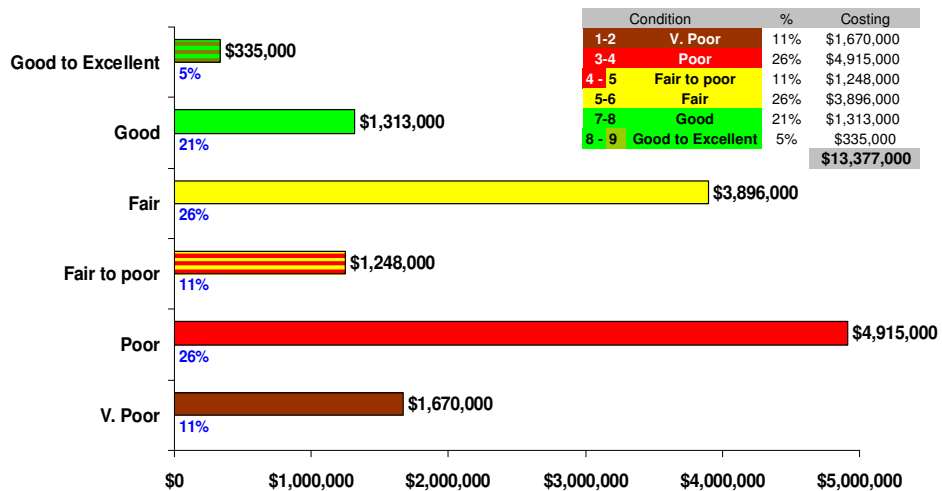
- In-Place Pulverization of Bituminous Pavement involves pulverization 100 mm+ of the asphalt thickness. The resulting mixture of asphalt concrete materials is then compacted and used as a base or subbase for the pavement structure.
- It should **eliminate surface defects and reflection cracking** and the reuse of the existing material efficiently. In-place pulverization improves the pavement structural capacity but it **does not provide a long-term treatment over distorted areas.**
- This method also raises the grade of the runway.

Option: In-Place Pulverization of Bituminous Pavement



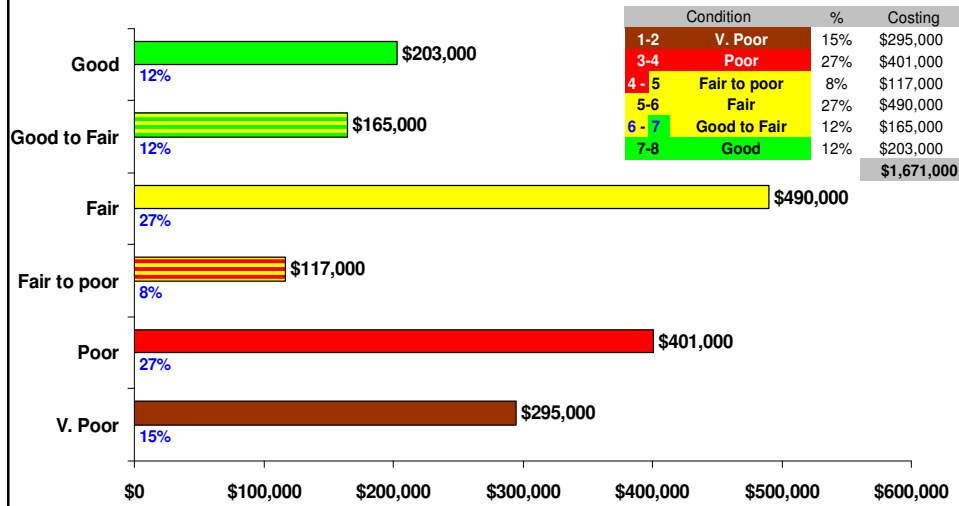
### Rehabilitation Costing

Condition Surveys for 19 Runways in Northern Ontario



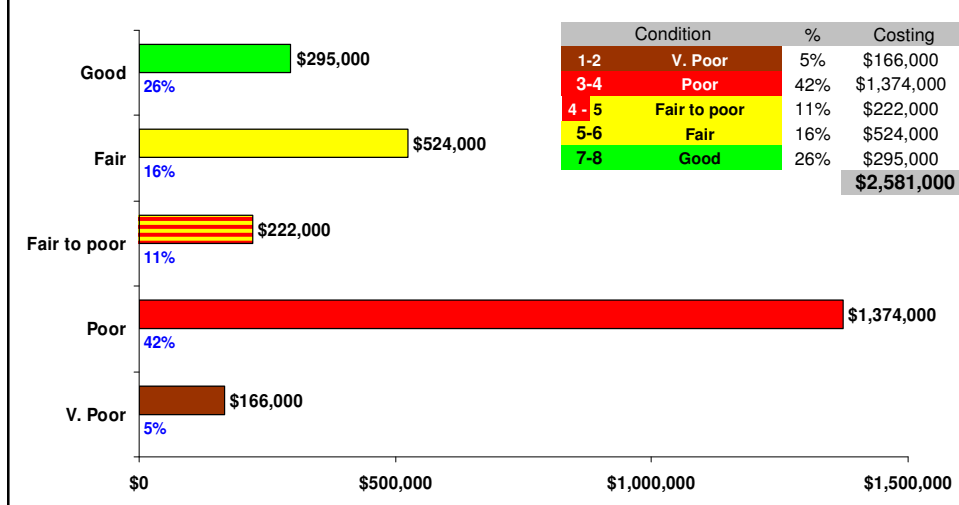
## Rehabilitation Costing

### Condition Surveys for 26 Taxiways in Northern Ontario



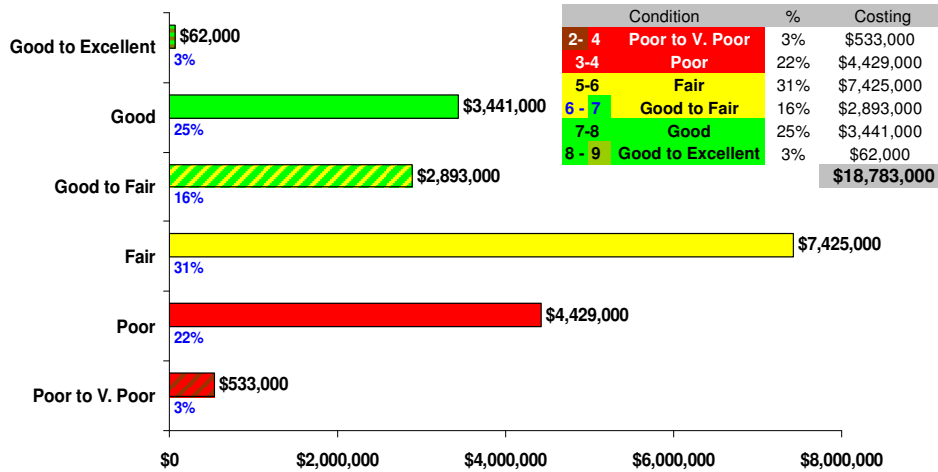
## Rehabilitation Costing

### Condition Surveys for 19 Aprons in Northern Ontario



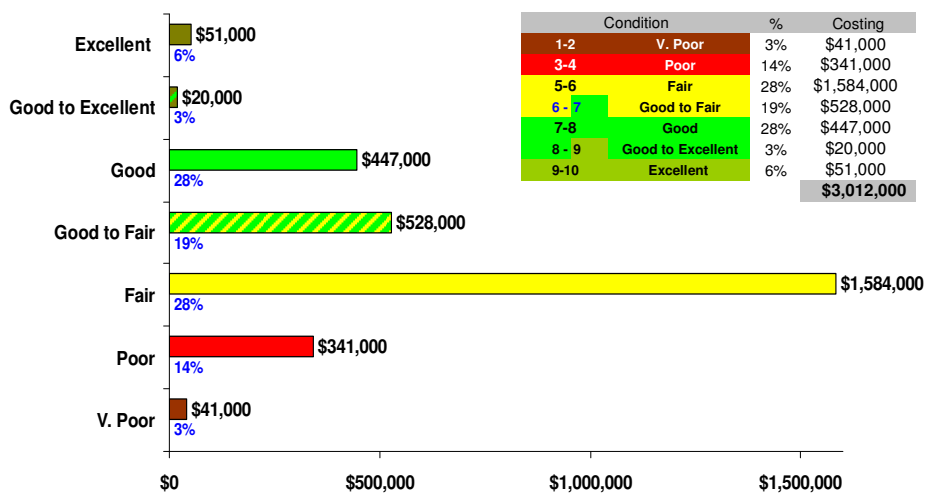
# Rehabilitation Costing

## Condition Surveys for 32 Runways in Southern Ontario



# Rehabilitation Costing

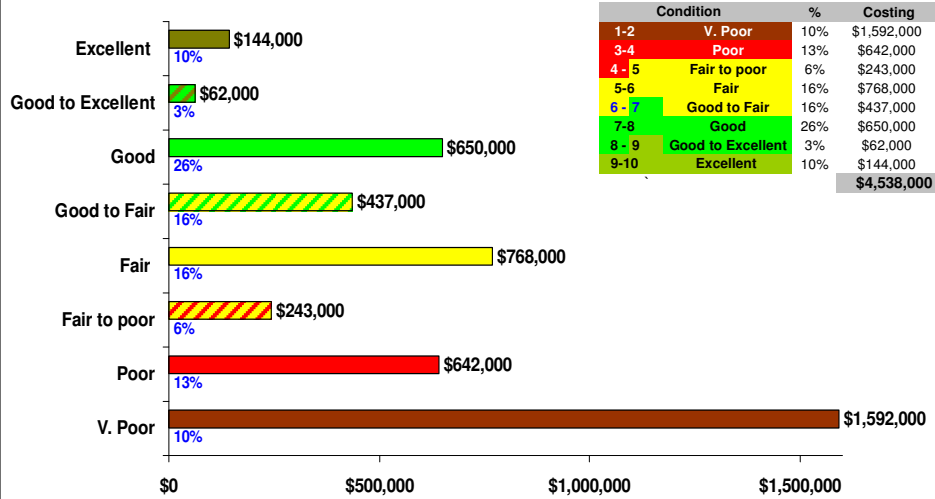
## Condition Surveys for 36 Taxiways in Southern Ontario



# Rehabilitation Costing



## Condition Surveys for 31 Aprons in Southern Ontario



## Questions?

