



expanding the realm of  
**POSSIBILITY**

# BERMUDA PAVER IMPLEMENTATION

**CAPTG Workshop 2019 – Shila Khanal, P.Eng.**

With grateful acknowledgement to Moe Kamleh, Bermuda Skyport



# PRESENTATION OUTLINE

- Introduction
- Paver Implementation
- Next Steps



# INTRODUCTION

- L.F. Wade International Airport (BDA)
- Located on the St. David's Island
- Operated by Bermuda Skyport Corporation Limited since 2017
- Average temperature – 23 degree centigrade



# EXISTING INFRASTRUCTURE

- One Runway
- Taxiways
- Aprons
- Perimeter roads and access roads
- Landside, roads and parking lots
- Terminal building, general aviation facilities, cargo terminal, aircraft hangar, and other ancillary facilities

# AIRSIDE INFRASTRUCTURE

- Runway 12-30
  - 2,959 m X 45 m
- Taxiway
  - One primary taxiway A
  - 12 connecting taxiways B,C,E,F,G,H,J,Q,T,U,V,W
- Aprons
  - Six aprons (A, B, C, D, F, G)
- Perimeter roads: North and South

# IMPLEMENTATION OUTLINE

- Network Definition
- Visual Airfield Condition Survey
- Paver Customization
- Capital Improvement Plan
- Interactive Airview GIS Application

# PREPARATION IS KEY!

- Getting organized before field inspections can start
  - Dividing the airfield into manageable units
  - Statistically valid sample units
  - Inspection tools/equipment
  - Safety considerations

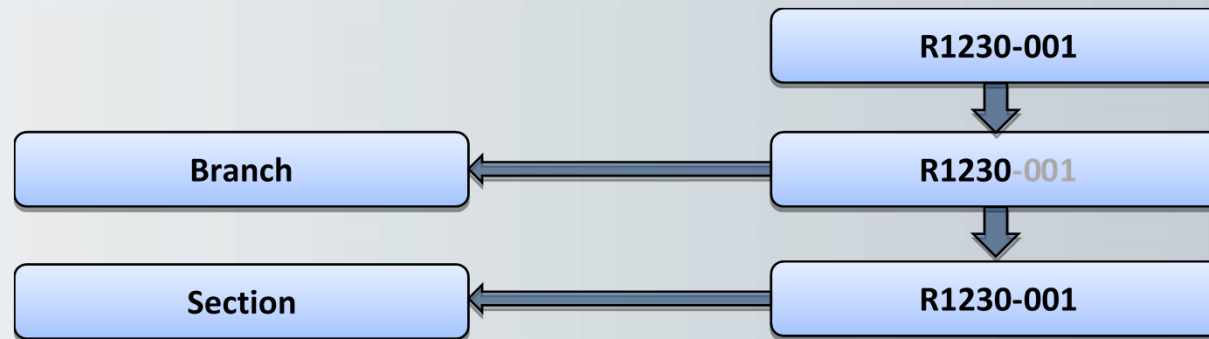
# PAVEMENT INVENTORY DEFINITION

- Network
  - Group of related pavements
  - Entire airfield
- Branch
  - Readily identifiable piece of pavement
  - Usually referred to by name
    - "Runway 12-30"
    - "Taxiway A"



# PAVEMENT INVENTORY DEFINITION

- Section
  - Pavement with identical history, structure and traffic
  - Contiguous



# SAMPLE UNITS

- Networks are divided into branches and sections based on pavement type, usage, construction history, etc.
- Sections are divided into sample units to facilitate inspection
- Sample unit size is based on ASTM guidelines

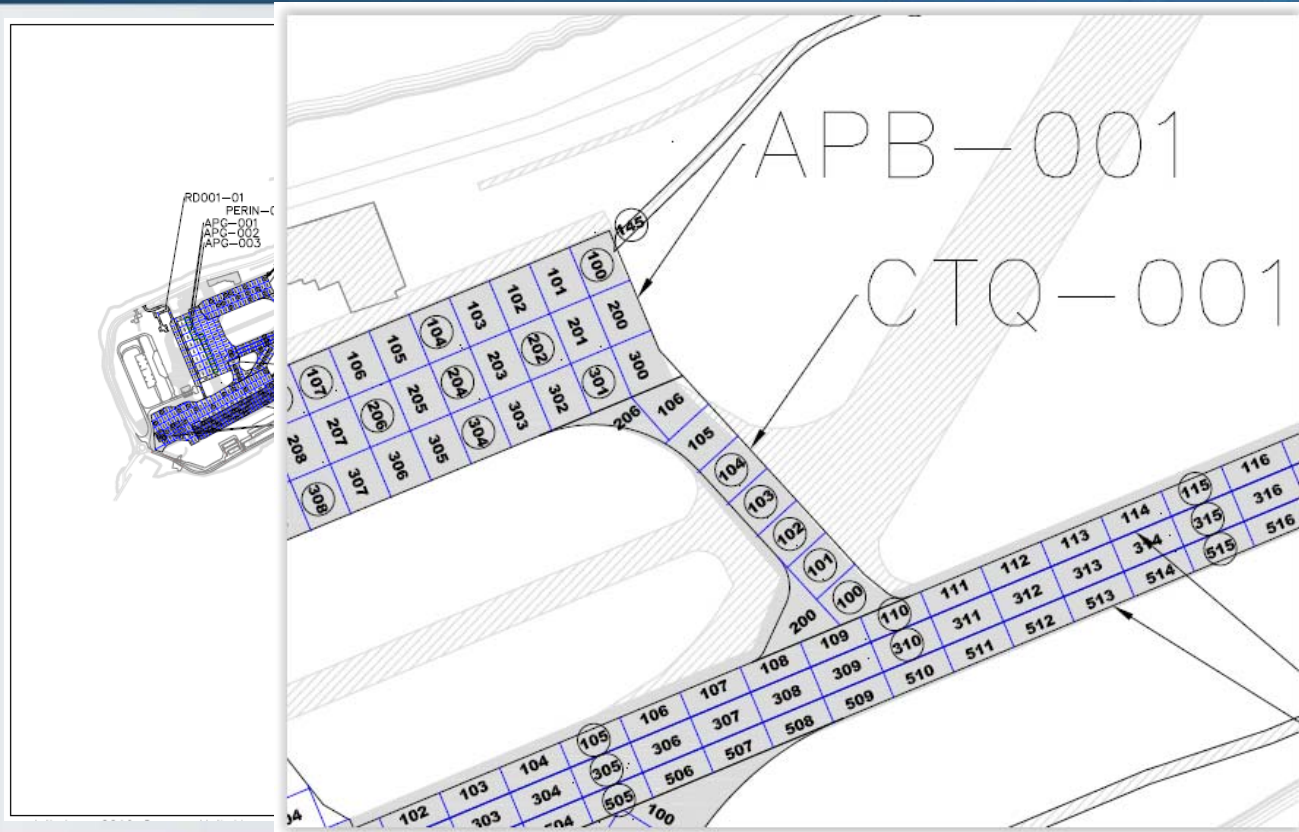
# STATISTICAL SAMPLING

- Inspection of the entire network would require a considerable amounts of time and money
- Statistical sampling techniques can be used to reduce data collection costs
- Statistical methods are used to determine the number of sample units to be inspected to provide a 95% confidence level

# INSPECTION DENSITY

Total Number of Sample Units	Number of Sample Units Surveyed
1-4	ALL
5-7	5
8-10	6
11-13	7
14-16	8
17-21	9
22-28	10
29-28	11
39-53	12
54-80	13
81-100	14
> 100	15%

# AIRSIDE SAMPLE INSPECTION MAP

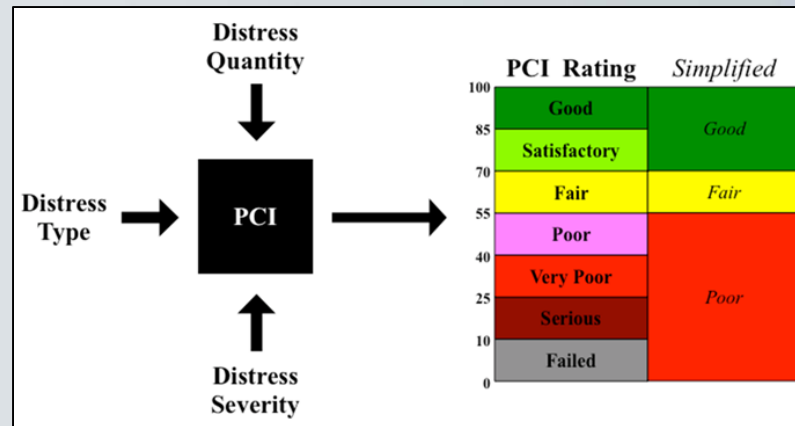


# VISUAL AIRFIELD CONDITION SURVEY

- What is Pavement Condition Index (PCI)?
  - PCI is a composite index of a pavement's structural integrity and operational condition
  - PCI is not a measure of structural capacity
- Standard test method: ASTM D5340 -12 *Standard Practice for Airport Pavement Condition Index Surveys*

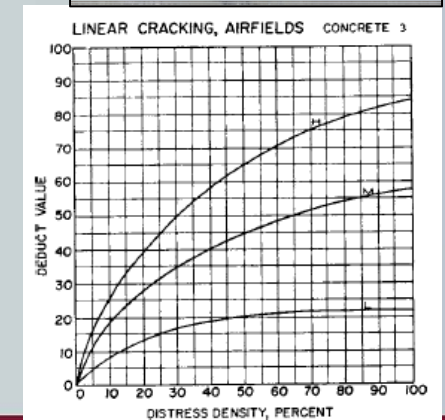
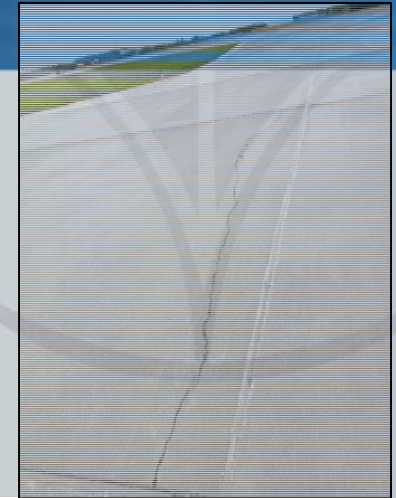
# VISUAL AIRFIELD CONDITION SURVEY

- PCI is a numerical index from 0 to 100
- Pavement condition ratings (from excellent to failed) are assigned to different levels based on PCI values
- PCI is repeatable to within 5 points



# HOW IS PCI DETERMINED?

- PCI is an objective measurement based on:
  - Distress type
  - Distress severity
  - Distress quantity
- Each distress has an associated deduct curve
- Reduced to a single number reflecting serviceability

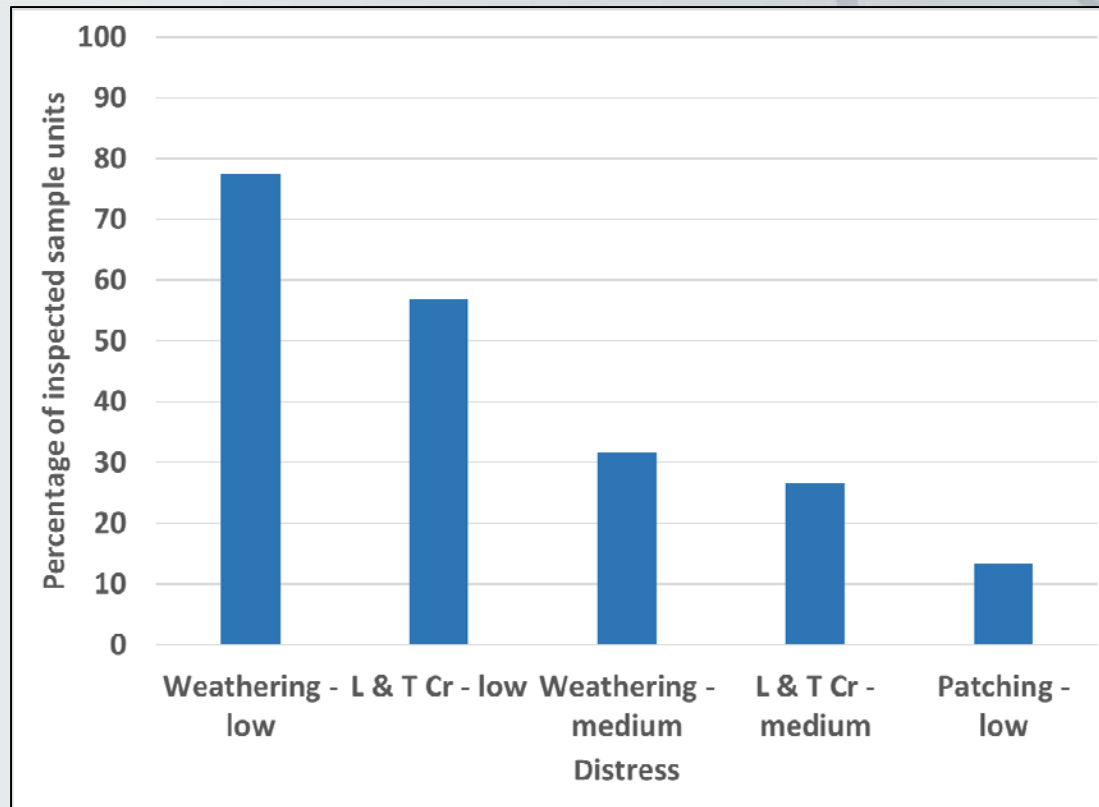




# PAVEMENT DISTRESSES

Asphalt Pavement	Rigid Pavement
Alligator cracking	Blow ups
Bleeding	Corner break
Block cracking	Linear cracking
Corrugation	Durability cracking
Depression	Joint seal damage
Jet blast	Small patch
Joint reflection cracking	Large patch
Longitudinal/transverse cracking	Popouts
Oil Spillage	Pumping
Patching	Scaling
Polished aggregate	Faulting
Ravelling	Shattered slab
Rutting	Shrinkage cracking
Shoving	Joint spalls
Slippage Cracking	Corner spalls
Swelling	Alkali Silica Reaction (ASR)
Weathering	

# TOP 5 DISTRESSES IN AC PAVEMENT



# WEATHERING

Low Severity Weathering



Medium Severity Weathering



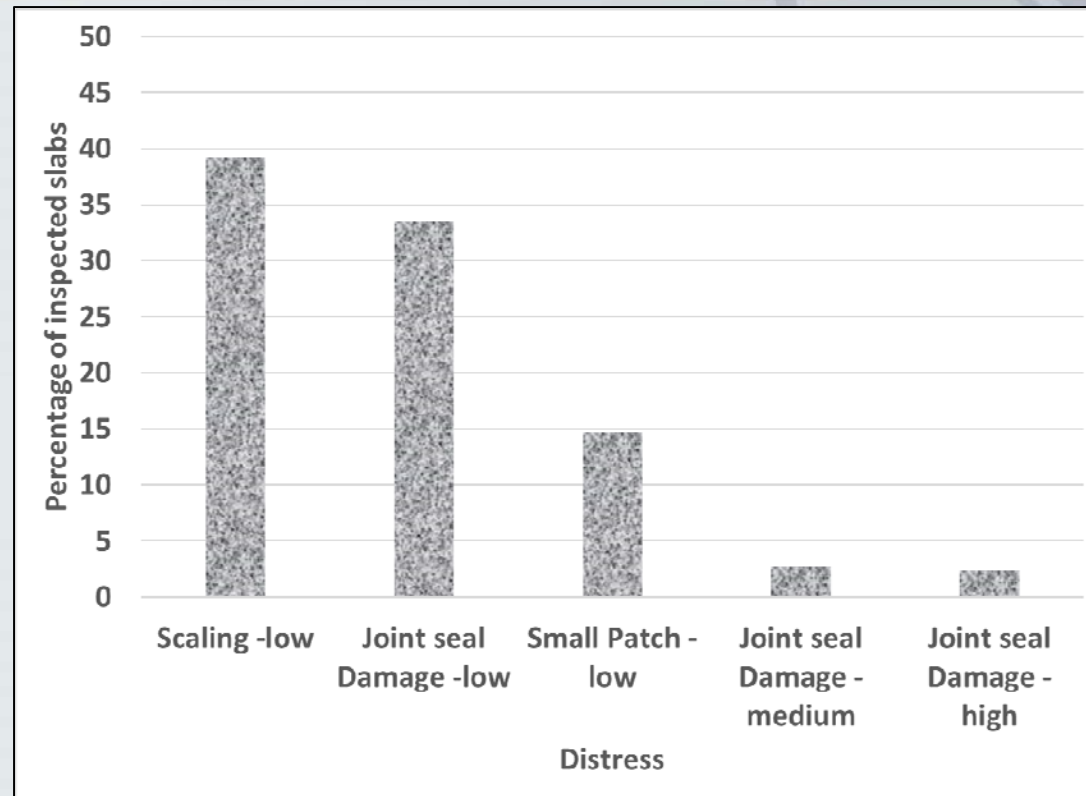
# LOW SEVERITY L&T CRACKING



# LOW SEVERITY PATCHING



# TOP 5 DISTRESSES IN PCC PAVEMENT



# LOW SEVERITY SCALING



# LOW SEVERITY JOINT SEAL DAMAGE





# MEDIUM SEVERITY PATCHING



# TYPICAL PHOTOS OF BDA



# TYPICAL PHOTOS OF BDA



Good PCC



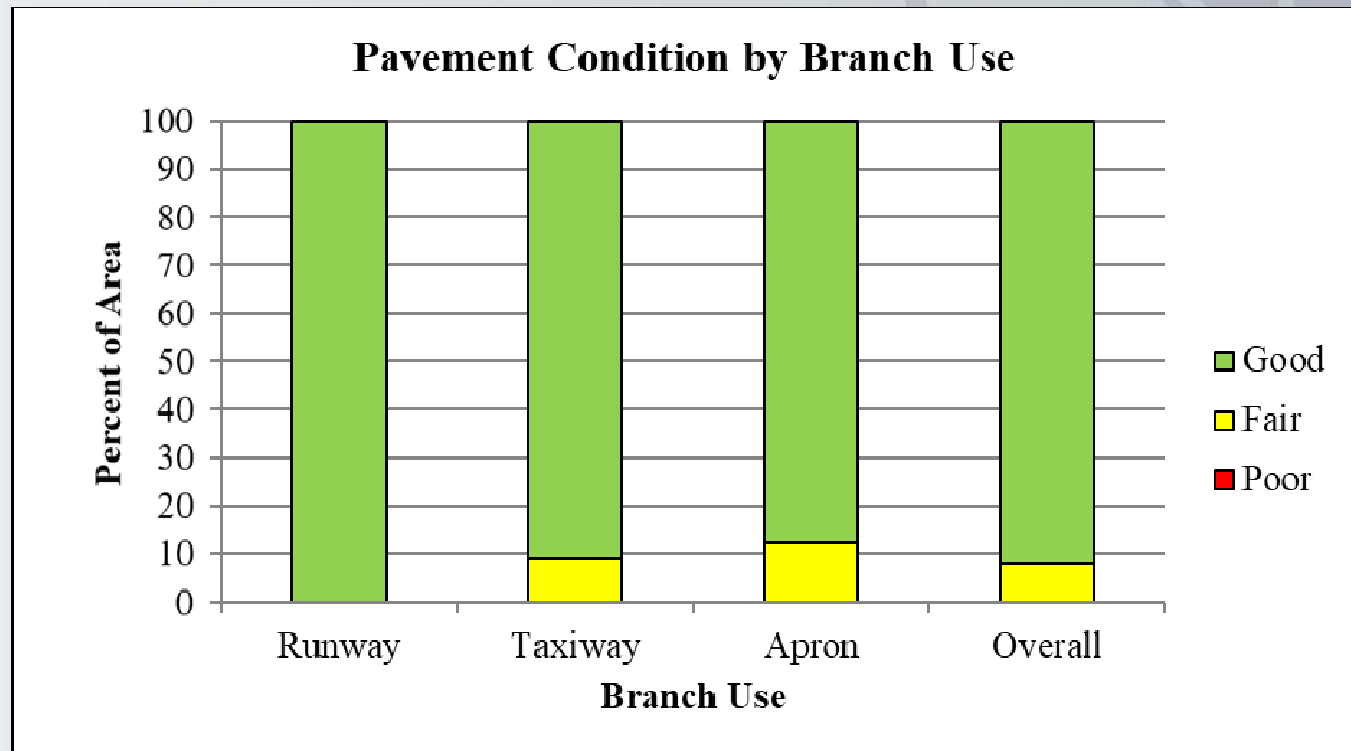
Good AC

# TYPICAL PHOTOS OF BDA



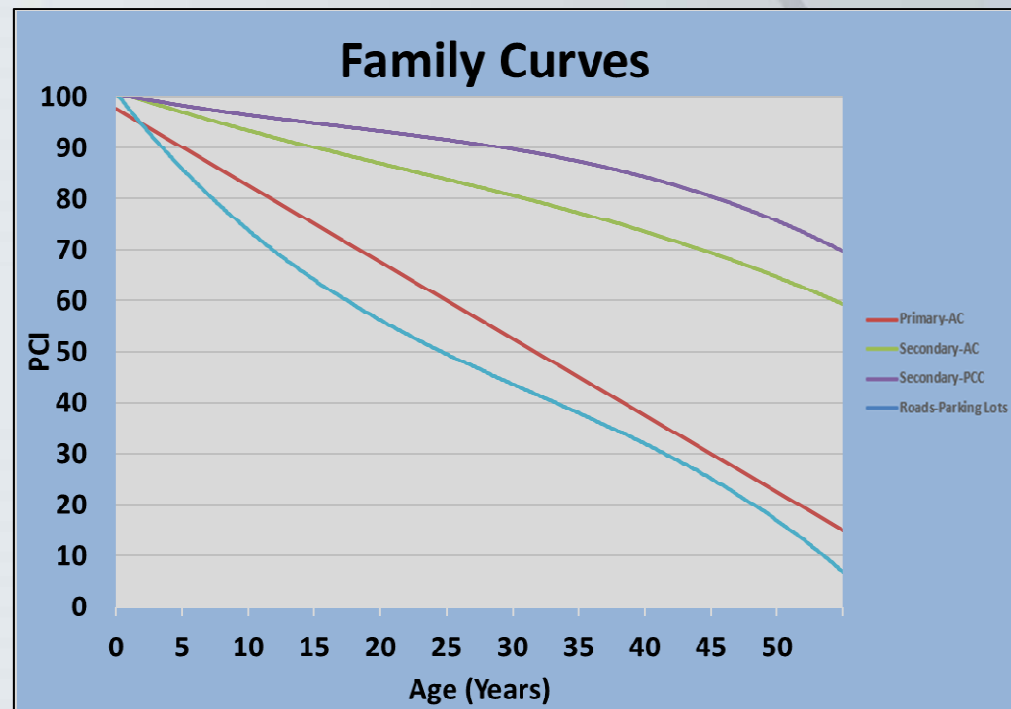
Fair AC

# AIRFIELD PAVEMENT CONDITION



# PAVER CUSTOMIZATION

- Family Curves



# PAVER CUSTOMIZATION

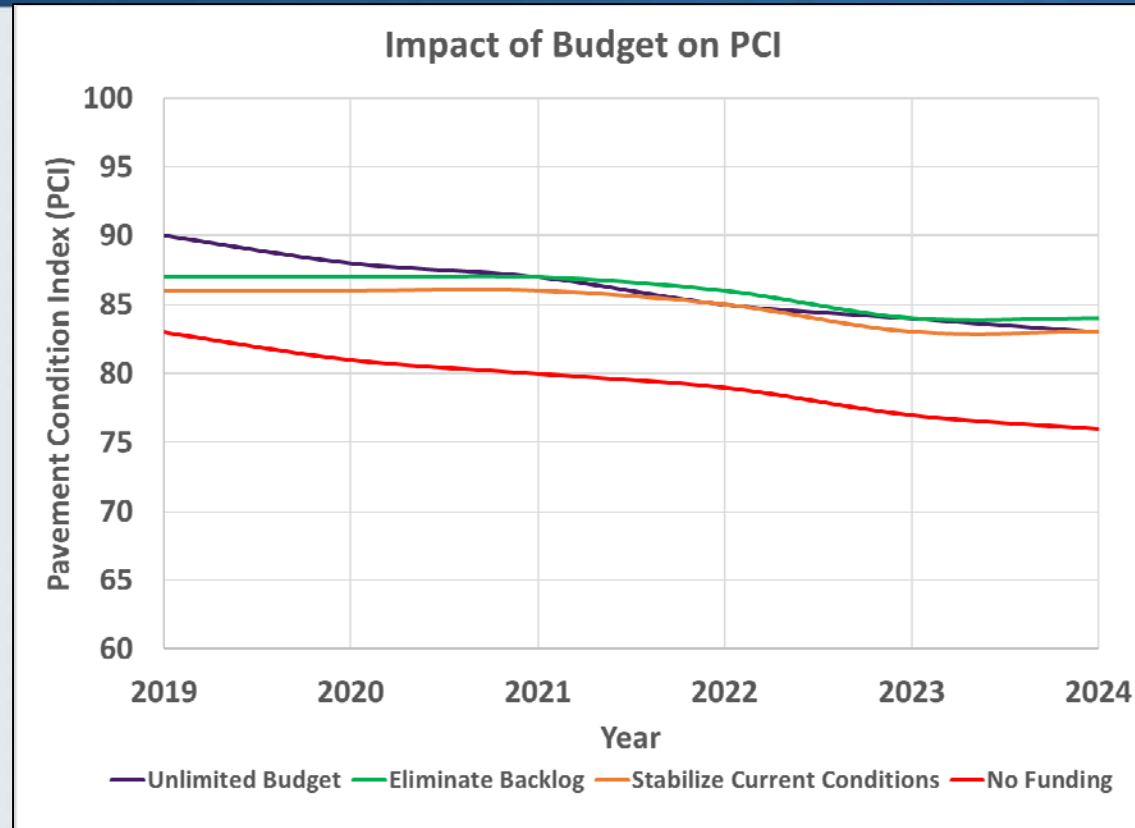
- Minimum Service Level (MSL)
  - Primary pavement (Runway/Taxiway) – 75
  - Secondary pavement (Aprons) – 65
- Maintenance Policies
  - Typical maintenance practices in Bermuda
- Unit Costs

# CAPITAL IMPROVEMENT PLANNING

- Budget Scenarios
  - Unlimited budget
  - Stabilize current condition
  - Eliminate backlog
  - No funding



# SUMMARY OF BUDGET SCENARIOS



# INTERACTIVE AIRVIEW GIS APPLICATION

The screenshot displays the AIRVIEW GIS application interface. The browser address bar shows the URL [airview.i2bglobal.com/Default\\_details.aspx](http://airview.i2bglobal.com/Default_details.aspx). The application has a navigation menu with options: HOME, STATEWIDE, AIRPORT DETAILS (selected), and TECHNICAL REFERENCES. The main content area is divided into several sections:

- Left Panel:** Contains a list of airports under the heading "AIRPORT DETAILS". The list includes: Barnes Municipal Airport, Barnstable Municipal Airport-Boardman/Polando Field, Beverly Municipal Airport, Cape Cod Airport, Chatham Municipal Airport, Cranland Airport, Falmouth Airpark, Fitchburg Municipal Airport, Gardner Municipal Airport, and General Edward Lawrence Logan International Airport. Below this list is a small map of New Hampshire and Massachusetts.
- Top Left Panel:** Features a "Pavement" section with sub-sections for "Inspection" and "Rehabilitation". Under "Inspection", there are radio buttons for "PCI" (selected) and "Strength (PCN)". Under "Rehabilitation", there are radio buttons for "Smoothness" and "Friction". Below this are sections for "Pavement Marking", "Airfield Lighting", "Nav aids", and "Drainage".
- Main Map:** A satellite map of an airport area with various colored overlays (green, yellow, pink) and red circular markers. A white arrow points to a specific location on the map. An inset photo shows a runway with white markings.
- Right Panel:** Includes a "Map" section with "Map" and "Satellite" options, and a "Photos" section with a "Photos" button.

Thank you!

Questions ?