

# ***Pavement Evaluation Considerations for PCR***

***ICAO ACR/PCR Workshop***

***Presented by: Harold Muniz***  
***Airfield Pavement Engineer***  
***FAA Headquarter, AAS-110***



# *What information do I need compute PCR?*

- *Aircraft mix utilizing the airport or runway*
  - *Annual departures*
  - *Aircraft weights*
- ***Pavement Properties***
  - ***Layer Types, Thickness, and Strength***
  - ***There may be multiple pavement sections on a Runway***
    - ***Must evaluate all pavement section***
    - ***Generally, report the most restrictive***



# Airfield Pavement Information Needed

- **Rigid Pavement**

- Thicknesses of all layers
- Soil Strength (Modulus,  $k$ )
  - All layers including subgrade
- Concrete Flexural Strength



- **Flexible Pavement**

- Thicknesses of all layers
- Soil Strength (Modulus, CBR)
  - All layers including subgrade



# *Do I need to go out and test?*

- **Largely dependent on the amount of information available**
- **It can be a table-top exercise if sufficient information is available**
  - Pavement Condition Inspection (PCI)
  - Structural Evaluations
  - Design Reports
- **On site testing may be required if little or not information exist**



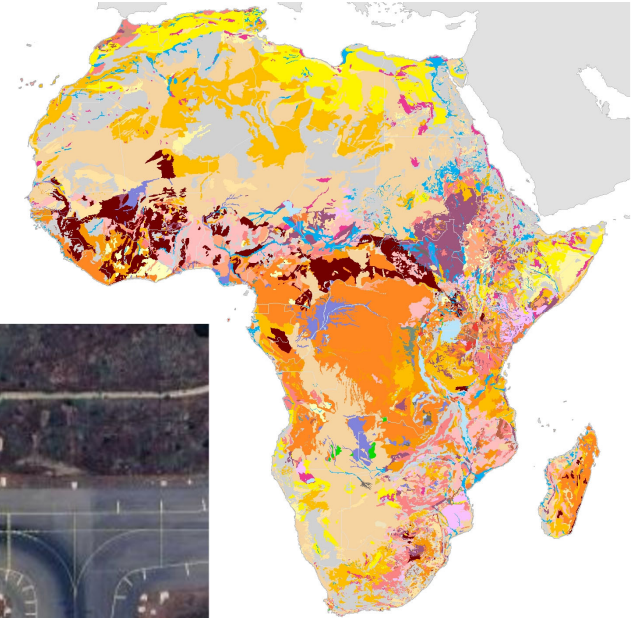
# *PCR Evaluation Process*

- *Records Review*
- *Site Inspection*
- *Sampling & Testing*
  - *Direct Sampling*
  - *Nondestructive Testing*
- *Pavement Condition Assessment*
- *Interviews with Airport Personnel*
- *Evaluation*
- *Reporting*



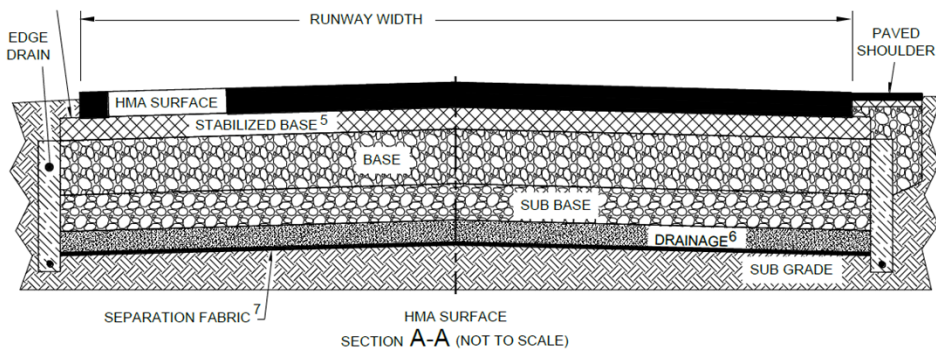
# PCR Evaluation Process

- **Records Review**
  - Aerial Imagery
  - Soil Maps
  - Design drawing
  - As-builts
  - Construction History



# PCR Record Review Process

## • Example of Pavement Profile Data



DEPTH (FT)	SAMPLE NO./ TYPE/CORE RUN	BLOWS/0.5 FT. ON SAMPLER	RECOVERY (FL)	RECOVERY(%)	ROD (%)	POCKET PENIT/ TORVANE (TSF)	USCS	AASHTO	H <sub>2</sub> O CONTENT	DESCRIPTION	REMARKS	
												NOT ENCOUNTERED <input type="checkbox"/>
21.0	S-14	4	1.5'	-	2.8				M	GRAVELLY CLAY WITH SAND, dark gray, dark brown, tan, very moist to moist, medium stiff, +PL, -LL, heterogeneous. gravel is claystone and limestone fragments. (FILL)		
		6										
22.5	S-15	2	1.0'	-	1.8				M TO W			
		2										
24.0	S-16	2	1.0'	-	2.0				M TO W			
		3										
25.5	S-17	14	1.5'	-					W TO M	24.5	1112.5	
		21										
27.0	S-18	22	1.5'	-					M TO D	SILTY TO CLAYEY GRAVEL, trace sand, tan, brown, orange-brown to gray, moist to dry, dense to very dense, NP, gravel is blocky siltstone fragments. (RESIDUAL)		
		28										
28.5	S-19	18	1.5'	-					M TO D			
		20										
29.3	S-20	24	0.5'	-					D	29.3	1107.7	
		50/0.3										
										END OF BORING AT 29.3 FEET		

# PCR Record Review Process

- **Example of Pavement Profile Data**

FEAT	IDENT	AREA sq ft	COND	OVERLAY PAVEMENT			PAVEMENT			BASE			SUBBASE			SUBGRADE	
				THICK (in)	DESC	FLEX (psi)	THICK (in)	DESC	FLEX (psi)	THICK (in)	DESC	K/CBR	THICK (in)	DESC	K/CBR	DESC	K/CBR
R03C1	01 APPROACH END OF RUNWAY 01/19	90,600	GOOD	-	-	-	9.00	AC	-	2.50	SOIL CEMENT	$\frac{80}{-}$	18.00	CLAYEY SAND WITH GRAVEL (SC)	$\frac{60}{-}$	CLAYEY SAND (SC)	-
R03C2	01 APPROACH END OF RUNWAY 01/19	90,600	GOOD	-	-	-	8.50	AC	-	2.50	SOIL CEMENT	$\frac{80}{-}$	18.00	CLAYEY SAND WITH GRAVEL (SC)	$\frac{60}{-}$	CLAYEY SAND (SC)	-
R04C1	RUNWAY 01/19	52,775	GOOD	-	-	-	18.00	AC	-	20.00	SAND (SM)*	$\frac{60}{-}$	-	-	-	CLAY (CL)*	$\frac{15}{-}$
R04C2	RUNWAY 01/19	224,925	GOOD	-	-	-	20.00	AC	-	4.00	SOIL CEMENT	$\frac{80}{-}$	8.00	POORLY GRADED SAND WITH CLAY AND GRAVEL (SP-SC)	$\frac{40}{-}$	CLAY (CL)*	$\frac{20}{-}$





# PCR Evaluation Process Site Inspection

- **Site Inspection**

- **Cursory Inspection of Pavement**

- **Consider PASER manuals** (AC 150/5320-17A)
    - *Focused on obtaining overall condition of pavement*
    - *Should highlight any areas with signs of structural distress*
      - *Shattered Slabs, L/T Cracking*
      - *Rutting, Alligator Cracking*
    - *Drainage conditions*
    - *Pavement markings*
      - *Load bearing areas clearly delineated*

- **Pavement sectioning should be accomplished or confirmed**



# *Pavement Inventory Hierarchy*

- **Pavement Network**- a logical unit for organizing pavements into a structure for the purpose of pavement management. A network will consist of one or more pavement branches. Highest level of the hierarchy.
  - Examples: DCA (Reagan) Airfield Pavement, DCA Landside Pavement
- **Pavement Branch** - a readily identifiable part of the pavement network with a distinct function.
  - Examples: Taxiway Kilo, Runway 15/33, GA Parking Apron
- **Pavement Section** - is a subset of a branch and is an area of pavement having a consistent or uniform pavement type, thickness, and condition, as well as the same pavement use.

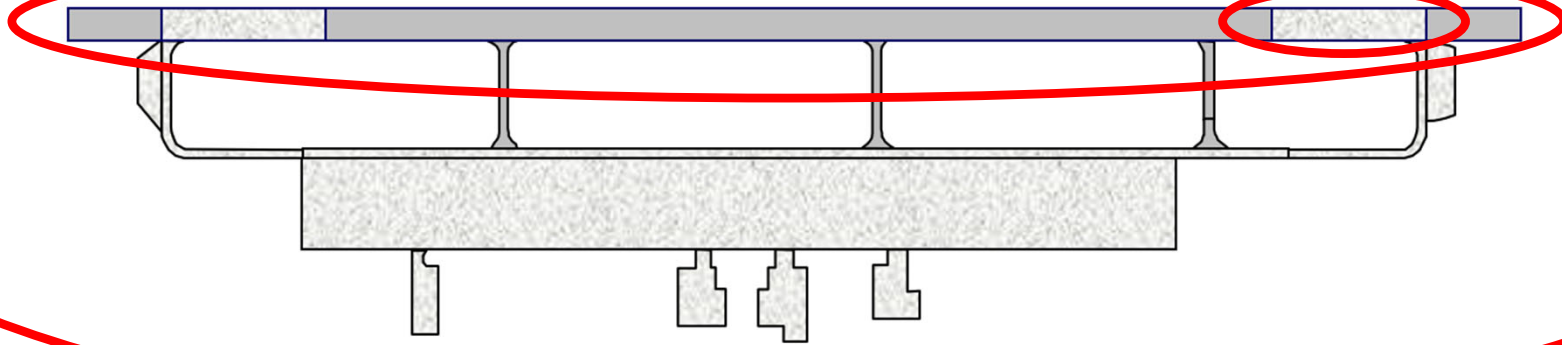


# Pavement Inventory Hierarchy

Airfield Network

Pavement Branch

Pavement Section



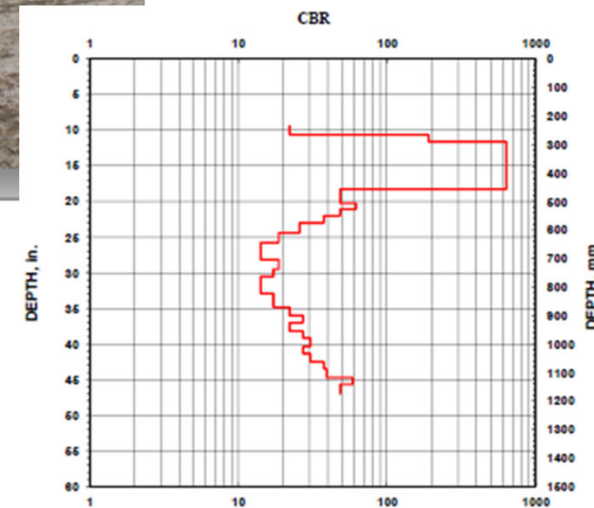
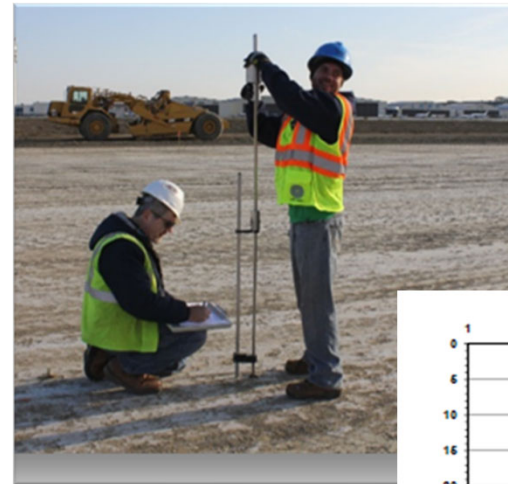
# PCR Evaluation Process- Testing

- **Sampling & Testing of Pavement Layer**
  - **Direct sampling consist of coring existing pavement material**
    - Determine pavement properties & allows access to subsurface layers
  - **Generally, 100-200mm core should suffice**
  - **Core should be visually inspected**
  - **Asphalt cores should be evaluated for soundness**
    - Asphalt lifts should be bonded
    - Check for stripping of the asphalt binder
  - **PCC cores should be inspected and tested**
    - Visually inspect core
    - Can be used to determine flexural strength via split tensile testing



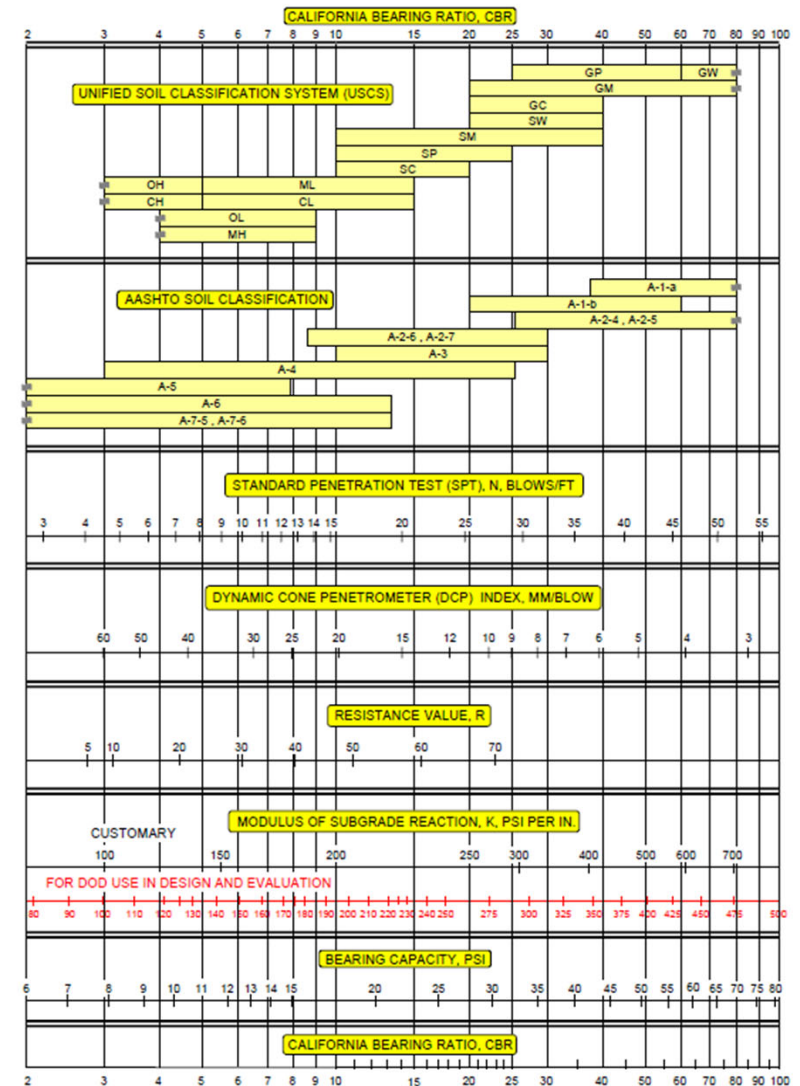
# PCR Evaluation Process- Testing

- Sampling & Testing of Soil Layers
  - Determine thickness and strengths of unbound materials and subgrade layer
    - Dynamic Cone Penetrometer
    - Standard Penetration Test
    - Field CBR



# PCR Evaluation Process

- Sampling & Testing of Soil Layers
  - Auger through material
    - Visually classify
    - Sample for laboratory classification
      - Unified Soil Classification System (USCS)



# PCR Evaluation Process- NDT Testing

- **Non-destructive alternatives to obtain pavement & soil characteristics can also be considered**
  - Results yield load carrying capability of the pavement
  - Approach may allow higher rate of sampling with minimal disturbance
- **FWD/HWD**
- **Ground Penetrating Radar (GPR)**
- **PSPA**
- **LWD**



# PCR Evaluation Process- Reporting

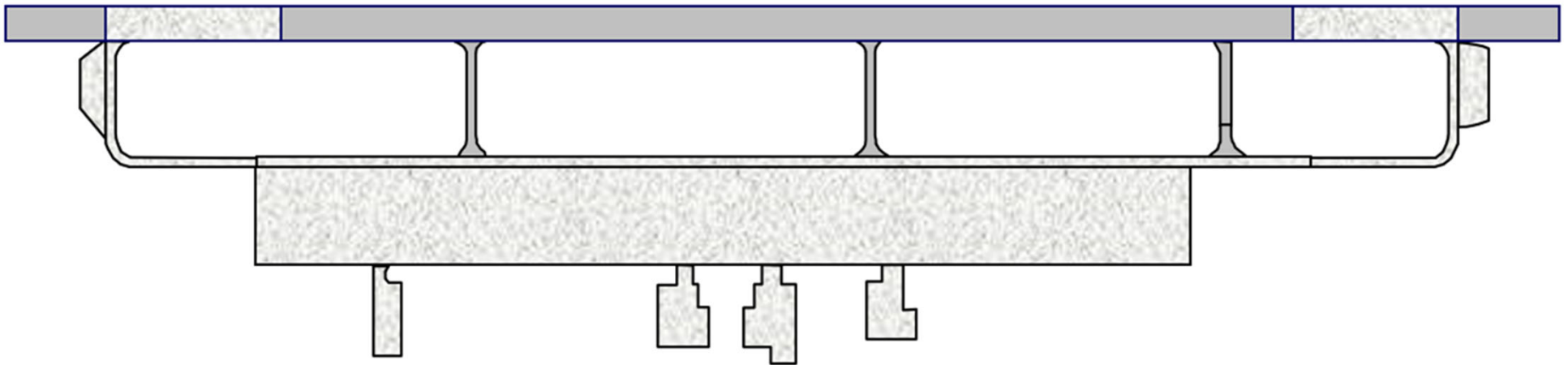
- The methodology use to compile the information and develop the pavement profiles should be well documented in the report
- Pavement profiles should be developed for all sections of pavement within a pavement branch
  - **Pavement Branch** - a readily identifiable part of the pavement network with a distinct function.
    - Examples: Taxiway Kilo, Runway 15/33, GA Parking Apron
  - **Pavement Section** - is a subset of a branch and is an area of pavement having a consistent or uniform pavement type, thickness, and condition, as well as the same pavement use.
- **Comprehensive report should be provided that recommends the reported PCR for each runway**





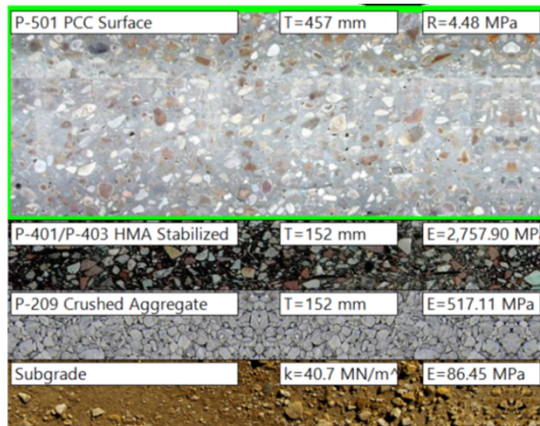
# PCR Evaluation Process- Reporting

- A runway may consist of multiple pavement sections with different profiles
- Each pavement section should be evaluated independently

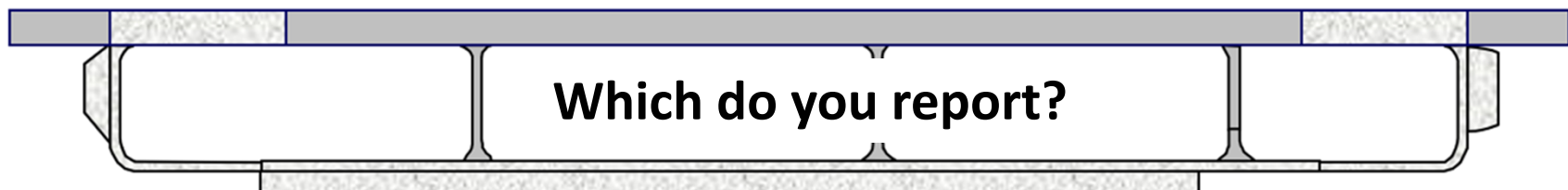
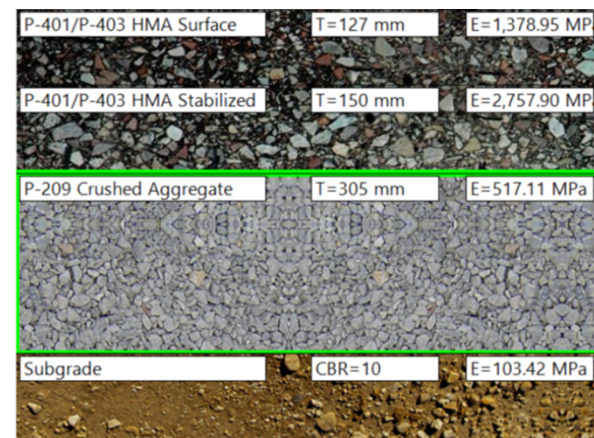


# PCR Reporting- Hypothetical Example

PCR= 1140/R/C/W/T



PCR= 410/F/C/X/T



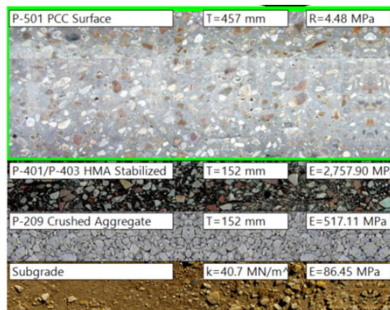
# PCR Evaluation Process- Reporting

**4.5.1 Numerical PCR Value.** The PCR numerical value indicates the load-carrying capacity of a pavement in terms of a standard single wheel load at a tire pressure of 218 psi (1.5 MPa). The PCR value should be reported in whole numbers, rounding off any fractional parts to the nearest whole number. For pavements of diverse strengths, the controlling PCR numerical value for the **weakest segment of the pavement should normally be reported** as the strength of the pavement. *Engineering judgment may be required if the weakest segment is not in the most heavily used part of the runway, then another representative segment may be more appropriate to determine PCR.*

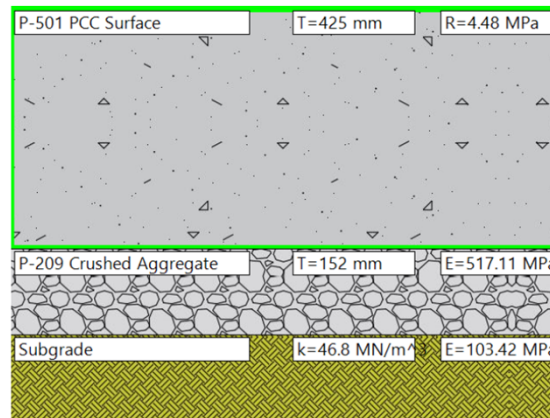


# PCR Reporting- Hypothetical Example

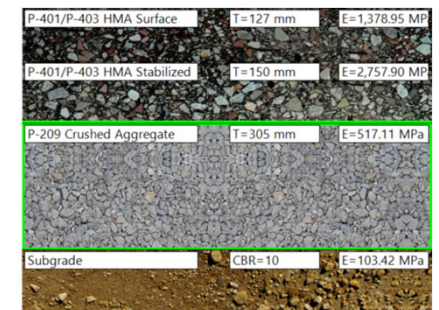
**PCR= 1140/R/C/W/T**



**PCR= 850/R/C/W/T**



**PCR= 410/F/C/X/T**



**Which could you report?**

# PCR Evaluation Process- Reporting

- **Should you compute PCR's for taxiways and aprons as well?**
- **Can you have multiple PCR's representing a pavement branch?**
- **Should you report more than one PCR for each runway?**



# *When should reevaluate a runway PCR?*

- **When pavement structure changes**
  - New Construction
  - Structural capacity increased (i.e. overlay)
  - Partial or full-depth reconstruction
- **When aircraft fleet mix changes**
  - New aircraft operations added ( regular operations)
  - Significant increase in operations by an aircraft
  - Change in aircraft variant ( i.e. 737-700, 737-8 MAX)
- **Periodically throughout pavement life**
  - Update as part of pavement management program
  - If premature structural distress observed



# QUESTIONS?

Harold Muniz, Airfield Engineer  
[harold.muniz-ruiz@faa.gov](mailto:harold.muniz-ruiz@faa.gov)  
(202) 267-5190