DEPARTMENT OF THE AIR FORCE
HEADQUARTERS AIR FORCE CIVIL ENGINEER SUPPORT AGENCY

APR 29 2004

FROM: AFCESA/CES
139 Barnes Drive, Suite 1
Tyndall AFB, FL 32403-5319

SUBJECT: **Engineering Technical Letter (ETL) 04-9: Pavement Engineering Assessment (EA) Standards**

1. Purpose. This ETL supersedes ETL 02-13, *Pavement Engineering Assessment Standards*, 5 September 2002. This ETL provides standard procedures for:

- Determining or validating airfield pavement assessments and prioritizing and rating airfield pavement projects. It can be used to manage Air Force pavements at the base, major command (MAJCOM), or HQ USAF level. The primary product is an Engineering Assessment (EA), determined using the Pavement Condition Index (PCI), Friction Index (runway pavements only), Structural Index, and Foreign Object Damage (FOD) Index (optional).
- Determining or validating assessments of road and vehicular parking area pavements, and prioritizing associated pavement projects, based on the PCI.

Note: The use of the name or mark of any specific manufacturer, commercial product, commodity, or service in this ETL does not imply endorsement by the Air Force.

2. Application: All Air Force organizations conducting assessments for prioritizing and rating pavement projects.

2.1. Authority: Air Force Policy Directive (AFPD) 32-10, *Installations and Facilities,* and Air Force Instruction (AFI) 32-1041, *Airfield Pavement Evaluation Program*.

2.2. Effective Date: Immediately.

2.3. Intended Users: Base civil engineers (BCE) and MAJCOM engineers conducting facility assessments of pavement systems.

2.4. Coordination: Air Force MAJCOM pavement engineers, the Naval Facilities Engineering Service Center (NFESC), and the U.S. Army Corps of Engineers (USACE) Transportation Systems Center (TSC).

3. Referenced Publications.

3.1. Air Force:

- AFPD 32-10, *Installations and Facilities*, available at http://www.e-publishing.af.mil/afpubs.asp

- AFI 32-1032, *Planning and Programming Appropriated Funded Maintenance, Repair, and Construction Projects*, available at http://www.e-publishing.af.mil/afpubs.asp
- AFI 32-1041, *Airfield Pavement Evaluation Program*, available at http://www.e-publishing.af.mil/afpubs.asp
- ETL 97-14, *Procedures for Airfield Pavement Condition Index Surveys*, available at http://www.afcesa.af.mil/library/index.asp
- *Aircraft Characteristics for Airfield Pavement Design and Evaluation* (To obtain a copy, see paragraph 10 for contact information.)

3.2. Army:

- ETL 1110-3-394, *Engineering and Design - Aircraft Characteristics for Airfield-Heliport Design and Evaluation*, available at http://www.usace.army.mil/inet/usace-docs/eng-tech-ltrs/etl1110-3-394/toc.htm

3.3. Joint:

- Micro PAVER, pavement maintenance management system, http://www.cecer.army.mil/paver/Paver.htm
- Pavement-Transportation Computer Assisted Structural Engineering (PCASE), http://www.pcase.com/go.html
- Unified Facilities Criteria (UFC) 3-260-16FA, *Design: Airfield Pavement Condition Survey Procedures*, available at http://65.204.17.188//report/doc_ufc.html

3.4. Federal Aviation Administration (FAA):

- FAA Advisory Circular (AC) No: 150/5320-12C, *Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces*, 18 March 1997
- FAA Advisory Circular (AC) No: 150/5335-5, *Standardized Method of Reporting Airport Pavement Strength PCN*, 15 June 1983, available at http://www.faa.gov/arp/150acs.cfm

3.5. American Society for Testing and Materials (ASTM):

- ASTM D5340-03, *Standard Test Method for Airport Pavement Condition Index Surveys*, available at http://www.astm.org
- ASTM D6433-03, *Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys*, available at http://www.astm.org
- ASTM E274-97, *Standard Test Method for Skid Resistance of Paved Surfaces Using a Full-Scale Tire*, available at http://www.astm.org
- ASTM E503/E503M-88(2000), *Standard Test Methods for Measurement of Skid Resistance on Paved Surfaces Using a Passenger Vehicle Diagonal Braking Technique*, available at http://www.astm.org
- ASTM E524-88(2000), *Standard Specification for Standard Smooth Tire for Pavement Skid-Resistance Tests*, available at http://www.astm.org

4. Acronyms and Terms.

AC	– Advisory Circular
ACC	– asphalt cement concrete
ACN	– Aircraft Classification Number
AFI	– Air Force Instruction
AFJMAN	– Air Force Joint Manual
AFPD	– Air Force Policy Directive
ASTM	– American Society for Testing and Materials
BCE	– base civil engineer
EA	– Engineering Assessment
ETL	– Engineering Technical Letter
FAA	– Federal Aviation Administration
FIM	– Facility Investment Metric
FOD	– foreign object damage/debris
ft	– foot
ft^2	– square foot
ICAO	– International Civil Aviation Organization
IMA	– Individual Mobilization Augmentee
IMAG	– Instrument de Mesure Automatique de Glissance
JBI	– James Brake Index
kPa	– kilopascal
kph	– kilometers per hour
m	– meter
m^2	– square meter
MAJCOM	– major command
mph	– miles per hour
NFESC	– Naval Facilities Engineering Service Center
PCASE	– Pavement-Transportation Computer Assisted Structural Engineering
PCC	– Portland cement concrete
PCI	– Pavement Condition Index
PCN	– Pavement Classification Number
PIARC	– World Road Association (formerly Permanent International Association of Road Congresses)
psi	– pound per square inch
RCR	– runway condition rating
TSC	– Transportation Systems Center
USACE	– U.S. Army Corps of Engineers
USAF	– United States Air Force

5. Airfield Pavements.

5.1. Engineering Assessment (EA). This ETL can be used to determine an EA associated with the Facility Investment Metric (FIM) as outlined in AFI 32-1032, *Planning and Programming Appropriated Funded Maintenance, Repair, and Construction Projects*. The FIM has a rating system consisting of three ratings:

Essential, Degraded, or Critical. This ETL uses EA ratings of Adequate, Degraded, and Unsatisfactory, which may be used to support FIM ratings. It should be noted that FIM ratings identify a requirement's current effect on the overall installation/tenant mission.

5.1.1. EA Criteria. Apply the criteria in paragraph 6 to determine or validate a feature/facility rating of Adequate, Degraded, or Unsatisfactory.

5.1.2. Project Priorities. Apply the criteria in paragraph 7 to set priorities for projects on features/facilities within each rating category.

5.1.3. Numerical Rating System. The criteria in paragraph 8 can be used to establish a numerical rating for pavement systems or entire airfields to allow comparison throughout a MAJCOM and to assess the potential impact of projects.

5.2. Rating Factors. The factors used to determine EAs or ratings in this ETL are the PCI, Friction Index (runway pavements only), Structural Index, and FOD Index (optional).

5.2.1. PCI. The PCI is a numerical rating (on a scale of 0 to 100) determined by a visual pavement survey, based on procedures in ASTM D5340-03, *Standard Test Method for Airport Pavement Condition Index Surveys*, UFC 3-260-16FA, *Design: Airfield Pavement Condition Survey Procedures*, and ETL 97-14, *Procedures for Airfield Pavement Condition Index Surveys*. MAJCOMs are responsible for conducting condition surveys to determine the PCI of a pavement. In accordance with AFI 32-1041, surveys should be accomplished every five years. Currently, the surveys are accomplished in-house, or by contract, Individual Mobilization Augmentees (IMA), or Guard and Reserve units. AFI 32-1032 requires a PCI for projects submitted to MAJCOMs for approval. This ETL establishes a standard color code for the seven condition codes described in ASTM D5340-03 and also for a corresponding simplified PCI Rating system, used when performing EAs, of Good (PCI = 71 to 100), Fair (PCI = 56 to 70), and Poor (PCI = 0 to 55), as depicted in Figure 1. To facilitate their presentation, the results from the PCI and PCI Rating can be displayed on color-coded airfield layout maps.

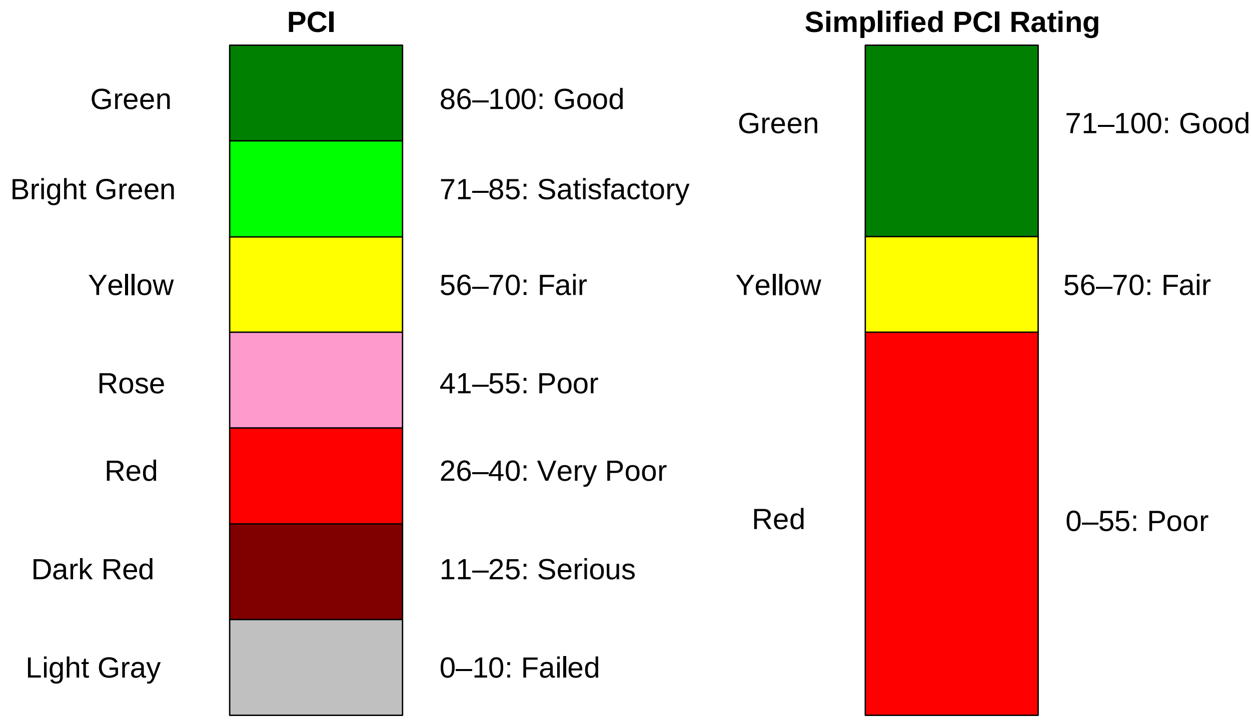

Figure 1. PCI and Simplified PCI Rating Scales

Table 1 provides a more detailed description of the PCI rating categories and their associated distress levels and probable maintenance requirements.

Table 1. Definition of PCI Ratings

Rating	Definition
86–100	GOOD: Pavement has minor or no distresses and should require only routine maintenance.
71–85	SATISFACTORY: Pavement has scattered low-severity distresses that should require only routine maintenance.
56–70	FAIR: Pavement has a combination of generally low- and medium-severity distresses. Near-term maintenance and repair needs may range from routine to major.
41–55	POOR: Pavement has low-, medium-, and high-severity distresses that probably cause some operational problems. Near-term maintenance and repair needs may range from routine up to a requirement for reconstruction.
26–40	VERY POOR: Pavement has predominantly medium- and high-severity distresses that cause considerable maintenance and operational problems. Near-term maintenance and repair needs will be intensive in nature.
11–25	SERIOUS: Pavement has mainly high-severity distresses that cause operational restrictions; immediate repairs are needed.
0–10	FAILED: Pavement deterioration has progressed to the point that safe aircraft operations are no longer possible; complete reconstruction is required.

5.2.2. Friction Index. HQ AFCESA conducts tests to determine the friction characteristics of runways and compiles the results in a runway friction characteristics report for a given base. The friction values measured by approved friction testing equipment (see FAA AC No: 150/5320-12C, *Measurement, Construction, and Maintenance of Skid-Resistant Airport Pavement Surfaces*) will be used to determine Friction Indices. This ETL assumes all U.S. Air Force friction tests are conducted with either a GripTester or a Mu-Meter (three-wheeled trailer devices used for pavement surface friction testing). To determine Friction Indices, the runway should first be divided into 152-meter (500-foot) long segments. The Friction Index for each segment is equal to the average friction value measured by GripTester or Mu-Meter tests conducted at 64 kilometers per hour (kph) (40 miles per hour [mph]). The average for a segment can be taken as the average of the results from test runs conducted on each side of the runway centerline. Do not include friction values measured along the runway edges, which would be outside the expected aircraft wheel path area. The Friction Index for a feature is equal to the Friction Index of the segment comprising the feature. If the feature is composed of more than one segment, assign the lowest of the segment Friction Indices to the feature. Based upon the Friction Index assigned to the feature, a corresponding Friction Rating can be assigned using Table 2, which correlates Friction Indices from different friction-measuring equipment to Friction Ratings. As with PCI Ratings, Friction Ratings can be displayed on a color-coded airfield layout map, using green for the corresponding rating of Good, yellow for Fair, and red for Poor. Because rubber deposits can lower the measured friction values, the truest measure of a pavement's friction characteristics will be obtained if testing is accomplished shortly after completion of rubber removal. Therefore, it is recommended that, to the maximum extent possible, friction testing be scheduled as soon as possible following completion of a rubber removal project.

Table 2. Friction Index and Friction Rating Scales

Friction Rating	Friction Index 65 kph (40 mph) Nominal Test Speed, Unless Noted [10]										
	RCR[1]	GripTester[2]	JBI[3]	Mu-Meter	Surface Friction Tester[4]	Runway Friction Tester[5]	Bv-11 Skiddo-Meter[4]	Decel Meters[6]	Locked Wheel Devices[7]	IMAG[8]	ICAO Index[9]
Good	>17	>0.49	>0.58	>0.50	>0.54	>0.51	>0.59	>0.53	>0.51	>0.53	5
Fair	12-17	0.34–0.49	0.40–0.58	0.35–0.50	0.38–0.54	0.35–0.51	0.42–0.59	0.37–0.53	0.37–0.51	0.40–0.53	3–4
Poor	≤11	≤0.33	≤0.39	≤0.34	≤0.37	≤0.34	≤0.41	≤0.36	≤0.36	≤0.40	1–2

Notes:

1. RCR (runway condition rating): Decelerometer reading x 32 obtained at 40 kph (25 mph)
2. Measurements obtained with smooth ASTM tire inflated to 140 kPa (20 psi)
3. JBI: James Brake Index obtained at 40 kph (25 mph)
4. Measurements obtained with grooved aero tire inflated to 690 kPa (100 psi)
5. Measurements obtained with smooth ASTM 4 in x 8.0 in tire inflated to 210 kPa (30 psi)
6. Decelerometers include Tapley, Bowmonk, and electronic recording decelerometer at 40 kph (25 mph)
7. ASTM E-274 skid trailer and E-503 diagonal-brake vehicle equipped with ASTM E-524 smooth test tires inflated to 170 kPa (24 psi)
8. IMAG: Trailer device (manufactured in France) operated at 15% slip; grooved PIARC tire inflated to 690 kPa (100 psi)
9. ICAO: International Civil Aviation Organization index of friction characteristics
10. A wet runway produces a drop in friction with an increase in speed. If the runway has good texture, allowing the water to escape beneath the tire, then friction values will be less affected by speed. Conversely, a poorly textured surface will produce a larger drop in friction with an increase in speed. Friction characteristics can be further reduced by poor drainage due to inadequate slopes or depressions in the runway surface.

5.2.3. Structural Index. The Structural Index is a ratio of Aircraft Classification Number to Pavement Classification Number (ACN/PCN) for a feature. The ACN represents the impact a particular aircraft will have on the pavement. The PCN represents the capability of the pavement to support an aircraft. HQ AFCESA conducts structural evaluations for Air Force bases and publishes an airfield pavement evaluation report that contains the PCN for each pavement feature. The airfield pavement evaluation report also contains ACN data on certain aircraft (i.e., critical aircraft from each of the standard Aircraft Group Indices as defined in AFI 32-1041). Additional ACN data are available from HQ AFCESA's *Aircraft Characteristics for Airfield Pavement Design and Evaluation* report; USACE ETL 1110-3-394, *Aircraft Characteristics for Airfield-Heliport Design and Evaluation*; Federal Aviation Administration (FAA) Advisory Circular (AC) 150/5335-5, *Standardized Method of Reporting Airport Pavement Strength PCN*; and the Pavement-Transportation Computer Assisted Structural Engineering (PCASE) computer program (see paragraph 3.3). Data from the latest HQ AFCESA report can be used to determine the Structural Index and corresponding Structural Rating for each pavement feature. It is possible that different aircraft will be used to determine the ACN for different features, based upon a base's mission and traffic patterns. An ACN/PCN ratio < 1.10 is considered Good, a ratio between 1.10 and 1.40 is considered Fair, and a ratio > 1.4 is considered Poor. The Structural Ratings of each feature can be displayed on a color-coded airfield layout map, using green for the corresponding rating of Good, yellow for Fair, and red for Poor.

Note: Some airfield pavement evaluation reports contain two sets of PCN values, one for normal conditions and one for the frost-melt or thaw-weakening period. In such instances, the Structural Index determination should be based upon the reported PCN values for normal conditions.

5.2.4. FOD Index. This factor is optional, as FOD is not a primary concern for some MAJCOMs. At certain locations, however, FOD potential is one of the primary factors for determining the serviceability of a pavement area. A FOD Index can be determined using the PCI survey data. The FOD Index is determined from the PCI calculated by considering only the distresses/severity levels capable of producing FOD as presented in boldface type in Tables 3 and 4. In calculating the PCI for determining the FOD Index, note that a multiplier, or modification factor, of 0.6 is applied to the deduct value for alligator cracking and a multiplier, or modification factor, of 4.0 is applied to the deduct value for joint seal damage. The FOD Index = (100 – PCI_{FOD}) and can be calculated using Micro PAVER software (see paragraph 3.3).

Table 3. Distress List for ACC Pavements

Distress Type	Severity Levels (L = Low, M = Medium, H = High)
Alligator Cracking (modification factor: 0.6)	**L, M, H**
Bleeding	n/a
Block Cracking	**L, M, H**
Corrugation	L, M, H
Depression	L, M, H
Jet Blast Erosion	**n/a**
Joint Reflection Cracking	**L, M, H**
Longitudinal and Transverse Cracking	**L, M, H**
Oil Spillage	**n/a**
Patching	L, **M, H**
Polished Aggregate	n/a
Raveling and Weathering	**L, M, H**
Rutting	L, M, H
Shoving	L, **M, H**
Slippage Cracking	**n/a**
Swelling	L, M, H

Note: FOD-producing distresses/severity levels are shown above in boldface type.

Table 4. Distress List for PCC Pavements

Distress Type	Severity Levels (L = Low, M = Medium, H = High)
Blow Up	**L, M, H**
Corner Break	**L, M, H**
Durability Cracking	L, **M, H**
Linear Cracking	**L, M, H**
Joint Seal Damage (modification factor: 4.0)	**L, M, H**
Small Patching	**L, M, H**
Large Patching	**L, M, H**
Popouts	**n/a**
Pumping	**n/a**
Scaling	**L, M, H**
Settlement	L, M, H
Shattered Slab	**L, M, H**
Shrinkage Cracking	n/a
Joint Spalling	**L, M, H**
Corner Spalling	**L, M, H**

Note: FOD-producing distresses/severity levels are shown above in boldface type.

5.2.4.1. A FOD Potential Rating scale, ranging from 0 to 100, can be used to indicate the potential for FOD problems. Figure 2 shows a numerical FOD Potential Rating scale and corresponding descriptive categorizations.

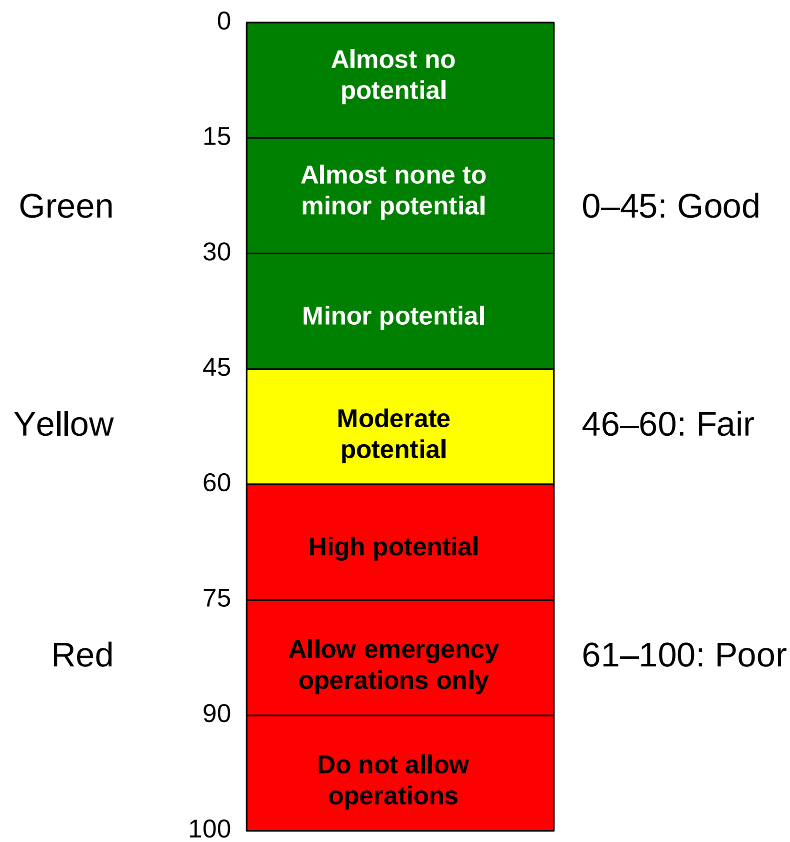

Figure 2. FOD Potential Rating Scale

5.2.4.2. The FOD Potential Rating is dependent upon the type of aircraft using the pavement, the type of pavement surface (asphalt or concrete), and the FOD Index. The FOD Index and FOD Potential Rating should be determined from the most current pavement condition survey. Relationships between FOD Indices and FOD Potential Ratings have been developed for F-16, KC-135, and C-17 aircraft; Figures 3 and 4 show these relationships. These three aircraft were selected as a representative cross-section in regards to engine height above the pavement surface and engine susceptibility to FOD (e.g., engine type, size, air flow, thrust). Table 5 shows the FOD Index ranges corresponding to the FOD Potential Ratings of Good, Fair, and Poor, as determined from Figures 3 and 4. Table 6 provides recommendations on which standard aircraft curve (i.e., F-16, KC-135, or C-17) to use when determining the FOD Potential Ratings for other aircraft. It is possible that different aircraft curves will be used to determine the FOD Potential Ratings for different features, based upon a base's mission and traffic patterns. The FOD Potential Ratings can be displayed on a color-coded airfield layout map, using green for the corresponding rating of Good, yellow for Fair, and red for Poor.

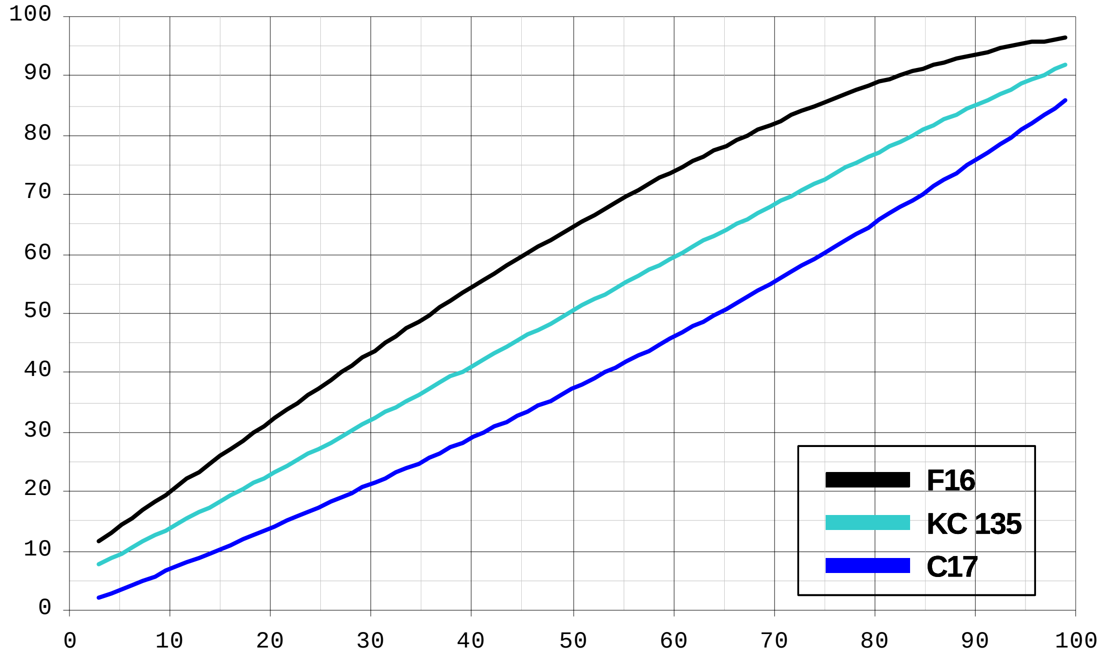

Figure 3. Relationships Between FOD Index and FOD Potential Rating for Asphalt Pavements

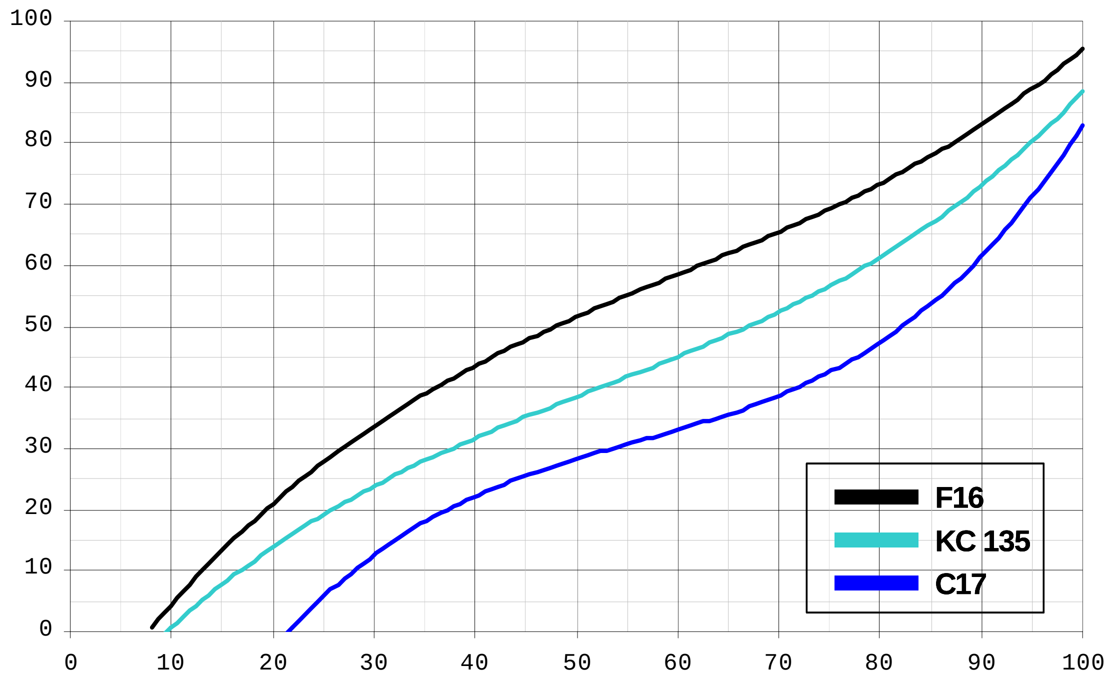

Figure 4. Relationships Between FOD Index and FOD Potential Rating for Concrete Pavements

Table 5. FOD Index and FOD Potential Rating Scales

FOD Potential Rating	FOD Index					
	F-16		KC-135		C-17	
	ACC	PCC	ACC	PCC	ACC	PCC
Good: 0–45	0–32	0–41	0–44	0–60	0–59	0–77
Fair: 46–60	33–45	42–62	45–60	61–78	60–75	78–89
Poor: 61–100	46–100	63–100	61–100	79–100	76–100	90–100

Table 6. Recommended FOD Curve Applicability for Various Aircraft

Standard Aircraft	Use FOD Index/FOD Potential Rating Relationship Curve for Standard Aircraft for Aircraft Listed Below in the Same Row
F-16	A-37, F-4, F-15, F-22, F-117, C-38, T-37, T-38, U-2
KC-135	A-300, A-310, AN-124, B-1, B-2, B-52, B-707, B-737, B-747, B-757, B-767, C-21, C-32, C-38, C-40, C-135, C-141, DC-8, DC-10, E-3, E-4, E-8, EC-18, EC-135, IL-76, KC-10, L-1011, T-1A, T-43, VC-25, VC-137
C-17	A-10, B-727, C-5, C-9, C-12*, C-20, C-22, C-23*, C-130*, DC-9, OV-10*, T-6*, V-22*

Note: * denotes turboprop or turbo-shaft equipped aircraft

6. Determining the EA. This section describes a procedure for determining the EA for any airfield pavement feature or facility (i.e., runway, apron, or taxiway) based on four factors: PCI, Friction Index (runway pavements only), Structural Index, and FOD Index (optional).

6.1. Step One: Determine indices. Determine the appropriate PCI, Friction Index (runway pavements only), Structural Index, and FOD Index (optional) for each pavement feature.

6.1.1. PCI. Review the most recent airfield pavement condition survey report and determine the PCI for each pavement feature. Conduct PCI surveys if the current condition is not accurately reflected in the latest airfield pavement condition survey report. Rate the feature in accordance with Figure 1 and the instructions in paragraph 5.2.1.

6.1.2. Friction Index. Review the most recent HQ AFCESA runway friction characteristics report for the base to determine the skid/hydroplaning potential of runway pavements. Divide the runway into 152-meter (500-foot) long segments and determine the Friction Index of each segment. Correlate the segments to pavement features and determine the Friction Index for each feature. Rate the feature in accordance with Table 2 and the instructions in paragraph 5.2.2.

6.1.3. Structural Index. Review the latest HQ AFCESA airfield pavement evaluation report for the base and determine the Structural Index of each feature. Use an ACN for the most critical mission aircraft on a given feature, at its maximum takeoff weight, when performing ACN/PCN calculations. (Note: Different aircraft may be used in the calculation for different features, such as when a particular feature is only used by fighter aircraft, while other features receive a mix of traffic that includes heavier aircraft.) Rate the feature in accordance with the instructions in paragraph 5.2.3.

6.1.4. FOD Index (Optional). Determine the FOD Index using the PCI survey data. The FOD Index is determined from the PCI calculated by considering only the distresses/severity levels capable of producing FOD. Determine the FOD Potential Rating for each pavement feature, based on the appropriate aircraft, in accordance with Figures 3 and 4, Table 5, and the instructions in paragraph 5.2.4. (Note: Different aircraft may be used in determining the FOD Potential Ratings for different features, such as when a particular feature is only used for parking transport aircraft, while other features receive fighter aircraft.)

6.2. Step Two: Determine EAs for each airfield feature. EAs of Adequate, Degraded, or Unsatisfactory are assigned to each airfield feature based on the criteria in Table 7. All rating factors must meet the criteria (i.e., if all factors do not meet the criteria, the feature rating is assigned based on the lowest factor rating).

Example: A runway feature would be rated Adequate only if:

- PCI is $\geq$ 71; <u>and</u>
- Friction Index is > 0.49; <u>and</u>
- Structural Index (ACN/PCN) is less than 1.1; <u>and</u>
- FOD Potential Rating is $\leq$ 45

Table 7. EA Criteria

Assessment/Rating Category	PCI	Friction Index (Runway Pavements Only)	Structural Index	FOD Potential Rating
Adequate	71–100	> 0.49*	< 1.10	0–45
Degraded	56–70	0.34–0.49*	1.10–1.40	46–60
Unsatisfactory	0–55	< 0.34*	> 1.40	61–100

*Applies to GripTester at 65 kph (40 mph) only. For other testing equipment, use the values corresponding to Good, Fair, and Poor in Table 2.

6.3. Step Three: Determine EA for the overall facility. Features may be grouped together as part of one facility or requirement. Determine the rating for the facility or requirement by computing the weighted average of PCI, Friction Index (runway pavements only), Structural Index, and FOD Potential Rating (optional), and comparing the values to the criteria in Table 7. An example of computing a weighted average is shown in paragraph 8. Table 8 shows an example of computing an EA or rating for a runway, where:

- Feature R01A is 45.7 meters by 304.8 meters (150 feet by 1000 feet)
- Feature R02C is 45.7 meters by 2438.4 meters (150 feet by 8000 feet)
- Feature R03A is 45.7 meters by 152.4 meters (150 feet by 500 feet)
- Feature R04A is 45.7 meters by 152.4 meters (150 feet by 500 feet)

Table 8. Engineering Assessment Example

	Feature	Area	PCI	Friction Index*	Structural Index	FOD Potential Rating	EA
	R01A	13,929 m^2 (150,000 ft^2)	78	0.55	0.88	35	Adequate
	R02C	111,435 m^2 (1,200,000 ft^2)	87	0.40	0.88	25	Degraded
	R03A	6,965 m^2 (75,000 ft^2)	76	0.40	1.25	39	Degraded
	R04A	6,965 m^2 (75,000 ft^2)	65	0.40	1.50	63	Unsatisfactory
Weighted Values			**85 (Adequate)**	**0.42 (Degraded)**	**0.93 (Adequate)**	**29 (Adequate)**	**Degraded**

*Applies to GripTester at 65 kph (40 mph).

Comparing the weighted values in Table 8 to the criteria in Table 7, the EA for the runway is **Degraded,** the lowest rating of the four factors**.**

6.4. Step Four: Report the EAs by feature and facility. It is also recommended the results be displayed on a color-coded airfield layout plan, with green indicating Adequate, yellow indicating Degraded, and red indicating Unsatisfactory features. An example airfield layout plan illustrating EAs by feature is shown in Figure 5, while EAs by facility (i.e., based on weighted feature values) are shown in Figure 6.

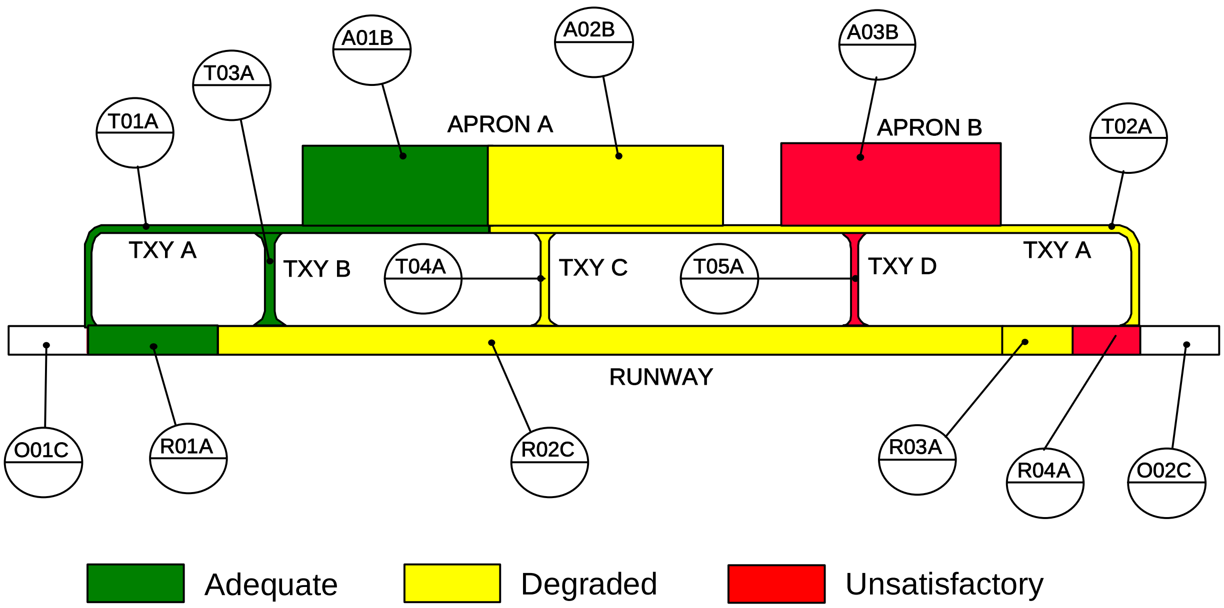

Figure 5. Sample Airfield Layout Plan Rated by Feature

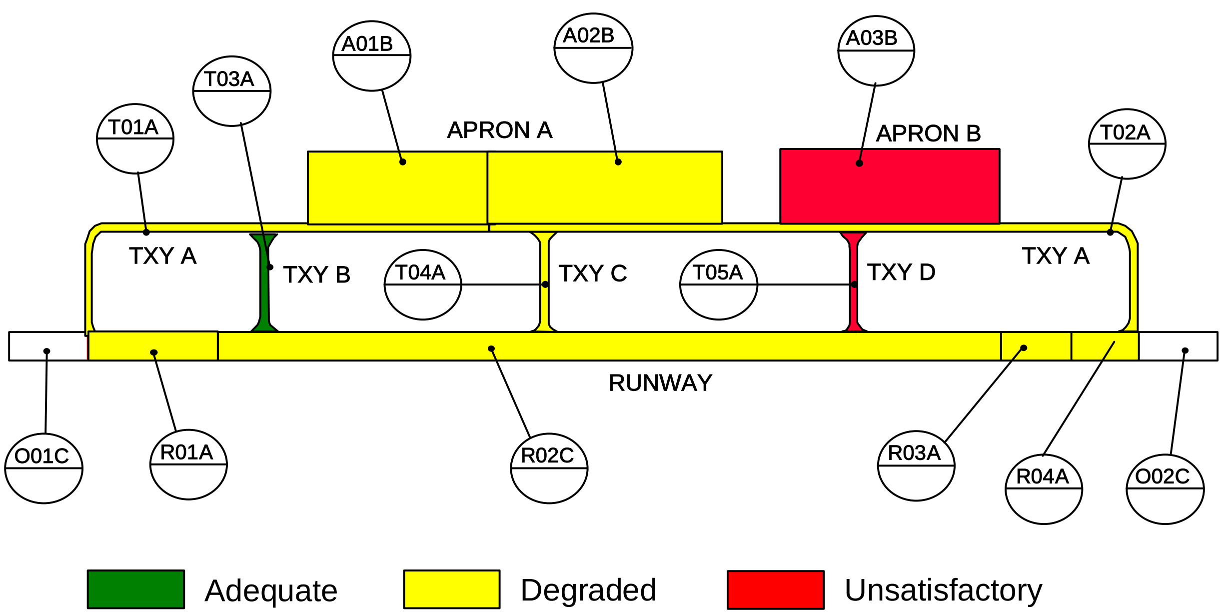

Figure 6. Sample Airfield Layout Plan Rated by Facility

7. Project Prioritization. Paragraphs 7.1 through 7.3 explain a method for objectively establishing priorities for projects that fall into the same assessment category (i.e., Adequate, Degraded, or Unsatisfactory).

7.1. Procedure. Determine the PCI, Friction Index, Structural Index, and FOD Potential Rating (optional) for the feature related to each project. Use Figure 7 to determine the "deduct values" for the Friction Index, Structural Index, and FOD Potential Rating (optional). Friction deduct charts are shown for both the Mu-Meter and the GripTester. These deduct values may be "capped" at a maximum value of 10 for data that falls outside the ranges of values depicted. Subtract each deduct value from the PCI to determine a priority order (lowest numerical result ranks first in priority).

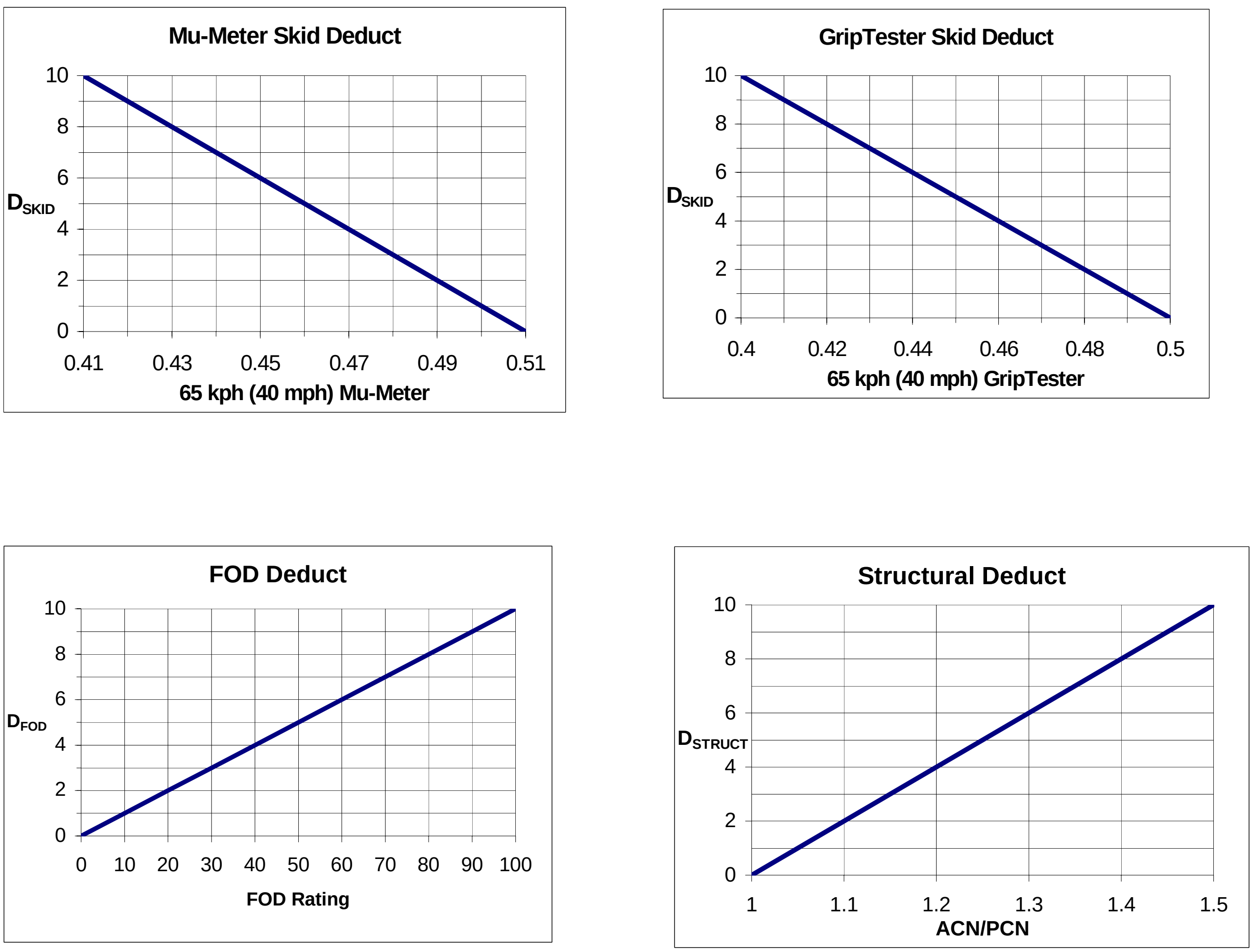

Figure 7. Deduct Values for Friction Index, Structural Index, and FOD Potential Rating

7.2. Example. Assume that three runway features fall within the Degraded category as determined by the criteria in Table 7. Pertinent information for then determining the feature project prioritization for this example is shown in Table 9.

Table 9. Determining Funding Priority

Feature	PCI	Friction Index (GripTester)	FOD Potential Rating	Structural Index
R11A	75	0.48	10	1.4
R12A	56	0.43	30	1.3
R13A	56	0.43	20	1.3

Rating for R11A = 75 – 2 – 1 – 8 = 64
Rating for R12A = 56 – 7 – 3 – 6 = 40
Rating for R13A = 56 – 7 – 2 – 6 = 41

Therefore, the priority for funding is R12A, then R13A, then R11A

7.3. Combining Features. When features are combined to form projects, use an area-weighted process for determining the rating. For instance, if Features R12A and R13A in Table 9 were included in a single project, the combined rating would be:

$$\text{Rating (Combined)} = \frac{\text{Rating R12A(Area R12A)} + \text{Rating R13A(Area R13A)}}{\text{Area R12A} + \text{Area R13A}}$$

8. Numerical Rating System. Some MAJCOMs may want to rate the general “health” of all facilities, including pavements, on a numerical rating scale. This section describes a procedure for calculating a pavement rating using a weighted PCI.

8.1. Procedure. A weighted PCI can be calculated manually or by using Micro PAVER (see paragraph 3.3). Assume a 3048- by 45.7-meter (10,000- by 150-foot) runway with the following features:

- R21A: 304.8 by 45.7 meters (1000 by 150 feet), PCI: 78
- R22C: 2438.4 by 45.7 meters (8000 by 150 feet), PCI: 70
- R23A: 152.4 by 45.7 meters (500 by 150 feet), PCI: 54
- R24A: 152.4 by 45.7 meters (500 by 150 feet), PCI: 52

The manual computation:

Weighted PCI =

$$\frac{\text{R21A PCI(R21A Area)} + \text{R22C PCI(R22C Area)} + \text{R23A PCI(R23A Area)} + \text{R24A PCI(R24A Area)}}{\text{R21A Area} + \text{R22C Area} + \text{R23A Area} + \text{R24A Area}}$$

Weighted PCI (metric system) =

$$\frac{78(304.8\text{m} \times 45.7\text{m}) + 70(2438.4\text{m} \times 45.7\text{m}) + 54(152.4\text{m} \times 45.7\text{m}) + 52(152.4\text{m} \times 45.7\text{m})}{(304.8\text{m} \times 45.7\text{m}) + (2438.4\text{m} \times 45.7\text{m}) + (152.4\text{m} \times 45.7\text{m}) + (152.4\text{m} \times 45.7\text{m})}$$

Weighted PCI (inch-pound system) =

$$\frac{78(1000' \times 150') + 70(8000' \times 150') + 54(500' \times 150') + 52(500 \times 150')}{(1000' \times 150') + (8000' \times 150') + (500' \times 150') + (500' \times 150')}$$

Weighted PCI = 69 = “Health” of Runway

8.2. Assessing Value Added. The procedure above can also be used to determine “value added” to a facility by a project. For example, assume a maintenance and repair project raises the PCI of R23A and R24A to 80 without affecting any of the other indices. The new rating for the runway would be 71.8; therefore, the project increased the “health “ of the runway by 2.8 points.

8.3. Rating Scales. A MAJCOM may want to use a different scale for rating facility “health.” For example, it may be desirable to use a range of 85 to 100 for the rating of Good. This can be accomplished by applying a proportioning operation to the weighted PCI (see Table 10).

Table 10. Proportioning Operation Applied to the Weighted PCI

Rating	Weighted PCI	Proportioning Operation	Numerical Rating
	100	→	100
Good		([PCI-71] x [15/30])+85	
	71	→	85
	70	→	84
Fair		(PCI-56)+70	
	56	→	70
	55	→	69
Poor		(PCI-70/55)	
	0	→	0

9. Roads and Parking Lots. The only factor used to determine the EA for roads and vehicular parking lots is the PCI as determined by ASTM D6433-03, *Standard Practice for Roads and Parking Lots Pavement Condition Index Surveys*. Criteria for determining the EA are shown in Table 11 and depicted in Figure 8; use these criteria to determine an EA for each feature.

Table 11. EA Criteria for Roads and Parking Lots

EA	PCI
Adequate	71–100
Degraded	56–70
Unsatisfactory	0–55

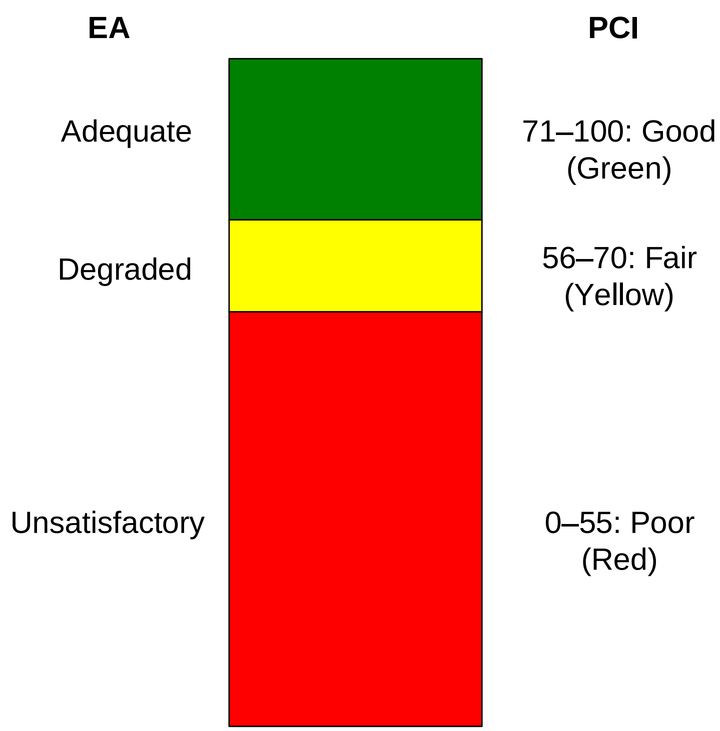

Figure 8. EAs for Roads & Parking Lots

9.1. Combining Features, Reporting, Numerical Rating System. Use the procedures outlined in paragraphs 6.3, 6.4, 7, and 8.

9.2. Project Prioritization. The PCI is used to establish the priority for projects that fall into the same assessment category (Adequate, Degraded, or Unsatisfactory); however, projects for primary roads should be ranked higher than those for parking lots and secondary roads.

10. Point of Contact. Recommendations for improvements to this ETL are encouraged and should be furnished to Mr. Jim Greene, HQ AFCESA/CESC, DSN 523-6334; commercial (850) 283-6334; FAX (850) 283-6219; Internet james.greene@tyndall.af.mil.

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