US Army Airfield Pavement Assessment Program

Geotechnical and Structures Laboratory
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Background

• Initiated in May 1982 by the Department of the Army
• Requested by FORSCOM, TRADOC, and AMC
• Army Airfields (AAFs) last evaluated in the 1960s
• Pavements designed for WWII and Korean War era aircrafts
• Now required to support heavier and larger aircraft
1941-1993 AAF Mission Aircraft

1941
B-17, 65,000 lb

1943
B-29, 105,000 lb

1964
C-141, 323,000 lb

1993
C-17, 580,000 lb

1955
C-130, 155,000 lb

1969
C-5A, 837,000 lb

US Army Corps of Engineers
Significance

- Determines the overall mission readiness of the AAFs in support of the Army’s force projection mission
- Provides technical data required to quantify airfield pavement maintenance, construction, and repair needs
- Data assists in optimal use of available funding for maintenance and repair (M&R)
- Provides information for establishing work plans necessary to reach and maintain AR 420-72 facility condition requirements
- Provides data for runway-bearing strengths
Why ERDC?

- Leadership in pavement design, evaluation, and research
- Expertise
- Military and security issues
- Database expansion and research validation
- Consistency
- Equipment
  - Dynatest heavy weight deflectometer (HWD)
  - 2 Dynatest falling weight deflectometers (FWDs)
  - Dynamic cone penetrometer (DCP)
- State of the art equipment implementation
  - Ground-penetrating radar (GPR)
  - Portable seismic pavement analyzer (PSPA)
Inspection Intervals

- Critical Category I airfields
  - structural evaluation including nondestructive testing (NDT) every 5 years
  - pavement condition survey to determine the pavement condition index (PCI) every 5 years

- Category I airfields and instrumented heliports
  - structural evaluation including NDT every 8 years
  - pavement condition survey to determine the PCI every 4 years
Objectives

- Structural evaluation
  - determines allowable aircraft loads and design traffic
    - FWD/HWD
    - DCP
- Visual evaluation
  - pavement condition survey
  - identify M&R
- Test new technologies
  - PSPA
  - GPR
FWD/HWD

- Trailer mounted, nondestructive, impact load device
- Dynamic force applied to the pavement
  - drop height of 0-15.7 in
  - 0-50,000 lbs
  - 25-30 ms duration
- Applied force and pavement deflections are measured
DCP

- Determines strength (CBR) of underlying soil layers
- Thickness is delineated from changes in strength
- 4 main components
  - cone, rod, anvil, hammer
- Procedure:
  - 1-in drilled hole
  - drop hammer until penetration depth is 20-30 mm
  - record number of blows and depth
  - penetration/mm is correlated to CBR
PSPA

- Measures seismic modulus of concrete pavements
- Quick, simple, nondestructive
- Measurements taken from near surface pavements
GPR

- GPR is used to non-invasively determine thickness of pavements.
- Two radar antennas are usually used:
  - 1 GHz – penetrates pavements up to 3 ft
  - 500 MHz – penetrates pavements up to 6 ft
- Depth of penetration is dependent on the material type and the dielectric constants.
Pavement Condition Survey

- Visual inspection to determine present surface condition
  - types of distress
  - severity of distress
  - quantity of distress
- Airfield broken into features and sample units
- Estimated quantities and severity of distresses are used to compute the PCI for each feature
Micro PAVER

- Developed by USACE, Champaign, IL
- Aids pavement managers in:
  - developing and organizing the pavement inventory
  - assessing the current conditions of pavements
  - developing models to predict future conditions
  - reporting on past and future pavement performance
  - developing scenarios for pavement M&R based on budget or condition requirements
NDT Analysis

- Pre-evaluation
  - climatological data
  - traffic data (critical aircraft and maximum number of passes)
- Load-carrying capacity
  - strength of the pavement
  - gross weight of the aircraft
  - number of applications of the load
- ACN/PCN method is used to report pavement load-carrying capacity
  - ACN – structural effect of an aircraft (single wheel load)
  - PCN – load-carrying capacity in terms (single wheel load)
  - ACN/PCN ratio
    - should be < 1
    - pavement life is greater than the design life
PCASE

- Developed by USACE, Vicksburg, MS
- Aids in the design and evaluation of transportation systems
- Some capabilities:
  - generate ACN curves for any vehicle
  - analyze DCP data with DCP module
  - generate a design curve for any aircraft
  - determine the load-carrying capacity for any airfield using modulus values
  - backcalculate the modulus using the FWD/HWD data
  - percent-life curves can tell how much damage an aircraft will do to an airfield
  - use the NDT module to analyze deflection data
Determination of M&R Recommendations

STEP 1
INSPECT PAVEMENT: DETERMINE DENSITY AND SEVERITY OF VARIOUS DISTRESS TYPES

STEP 2
COMPUTE PCI (0 - 100)

STEP 3
DETERMINE CONDITION RATING

STEP 4
NDT METHOD OF DETERMINING LOAD-CARRYING CAPACITY (PCN)

STEP 5
DETERMINE M&R ALTERNATIVES BASED ON RESULTS OF 3&4

STEP 6
PERFORM LIFE CYCLE COST ANALYSIS AND IMPLEMENT THE MOST FEASIBLE M&R ALTERNATIVE
Airfield Evaluation Summary

- Review previous reports
- Brief installation personnel
- Get necessary data
- Drive over and identify overall visual condition
- Mark features and sample units
- Survey, NDT
- Review PCI sheets and NDT data
- Enter all information into PAVER, PCASE
- Analyze data
- Generate report
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