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ICMPA9 • International Conference on Managing Pavement Assets

Precast Panels for Temporary Military Airfield Pavement Repairs

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Problem Statement

Expedient military repair methods are required for concrete airfield pavements

- **Emergency repair operations do not allow for long closures**
- **Traditional PCC requires time to gain strength**
- **Proprietary repair materials are costly and a logistical burden**

Solution: precast PCC technology?

Objective

Develop expedient precast panel repair system for military repair teams

Possible Damage Spectrum

System Design Challenges

The system must:

- Support 3,000 C-17 passes
- Be completed within 4-6 hr
- Enable local material use
- Allow various repair sizes
- Require limited specialty equipment
- Rely upon simplified techniques/procedures
- Require minimal training
- Be readily deployable

Previous Investigations

- Periodic investigations for past 50-80 years
  - Pre-2000s
    - Initially focused on airfield pavements
    - Many concepts evaluated worldwide
    - Primarily focused on highway investigations
    - Many technical feasibility studies
  - Recent investigations
    - Renewed precast panel research and interest
    - Primarily focused on highway applications
    - State, national, and international studies
    - Limited commercial airfield usage
    - Limited performance documentation

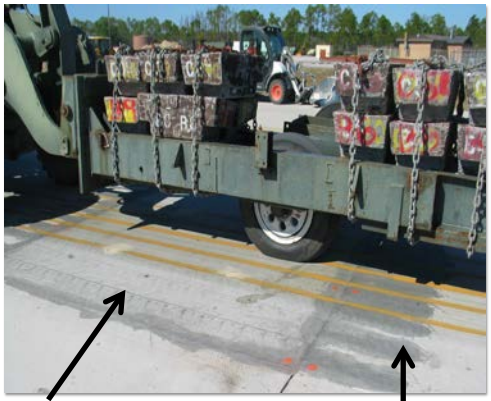
Selected Precast System

Air Force Method Prototype

- Designed for airfield use
- Supported simulated F-15 traffic
- Similar to other generic systems in load transfer mechanisms
- Cost similar to proprietary repair matls.
- Cost similar to other precast systems

Prototype Panel

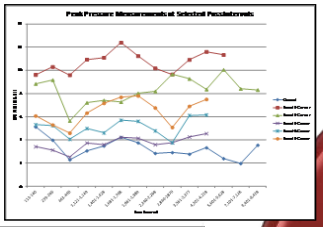
F-15 Load Cart

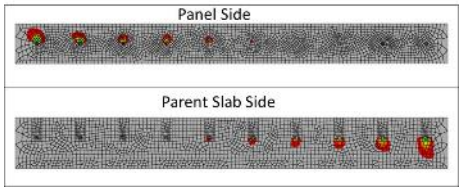


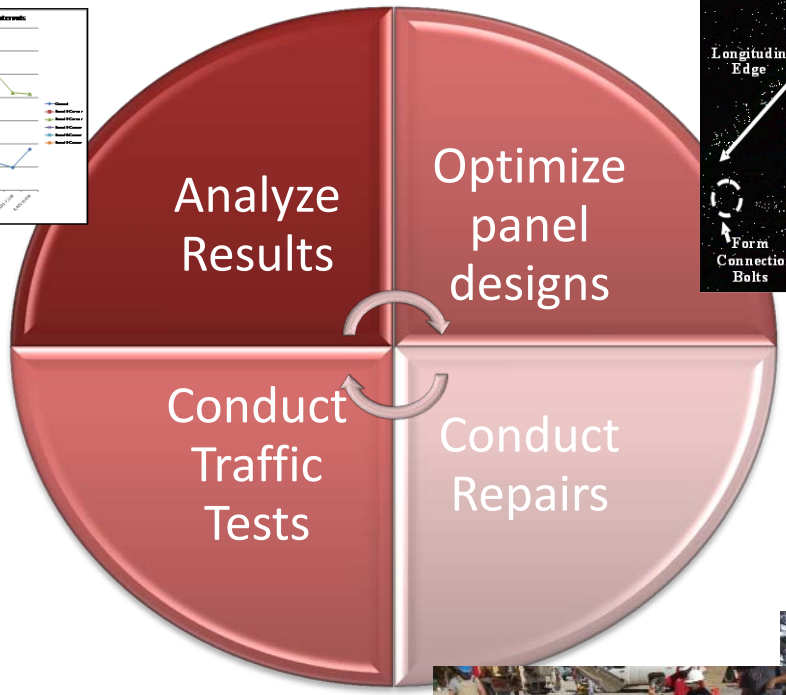
Drawbacks to the Selected System

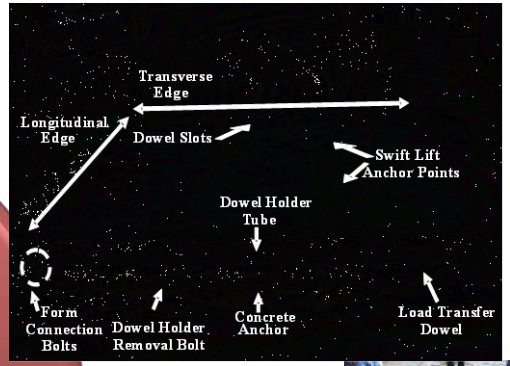
- Small precast panel size (10 ft x 10 ft repair)
- Inability to connect panels
- No minimum panel lifting capabilities
- No documentation for reinforcement design
- Lack of repair timing data/work tasks
- Lack of performance data under aircraft traffic

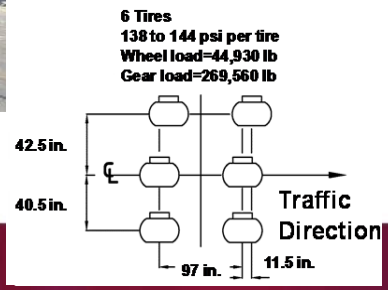
Research Approach



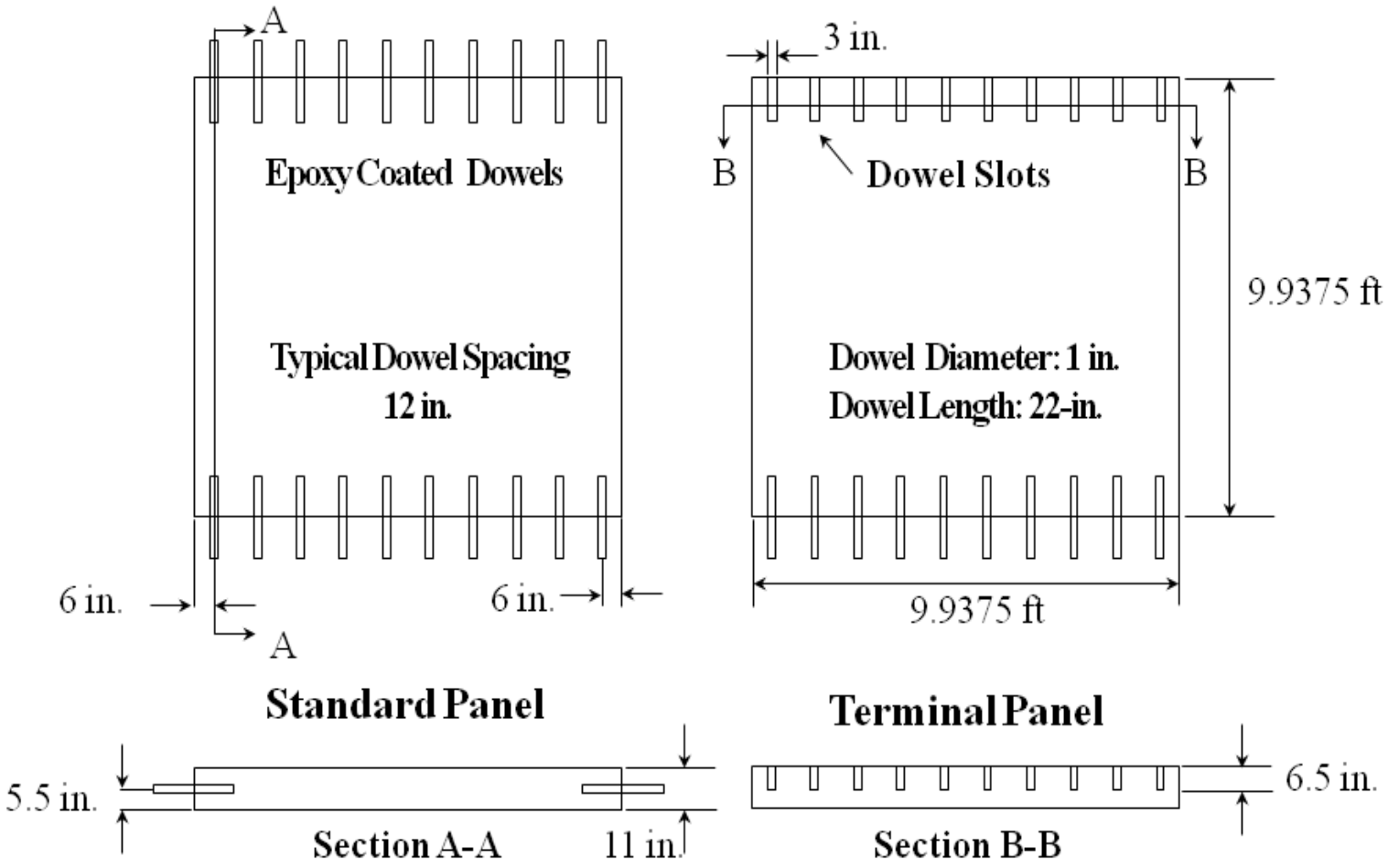






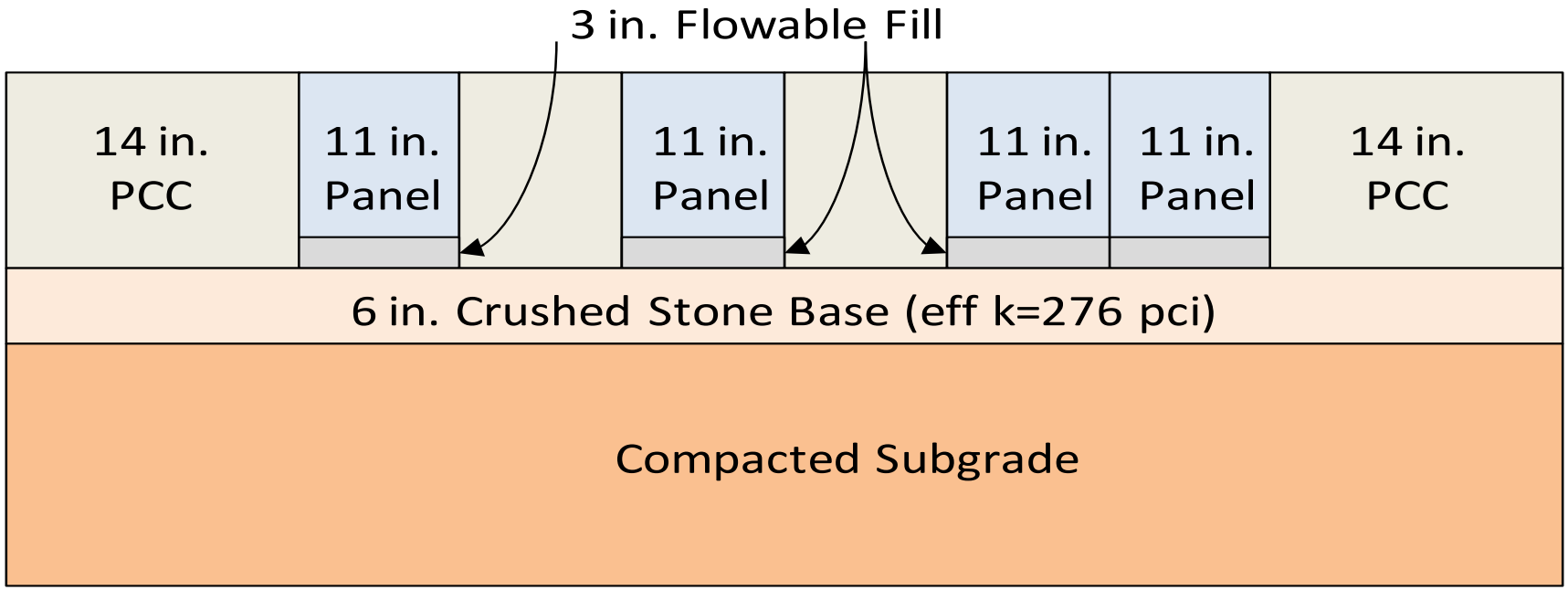


New Panel Designs

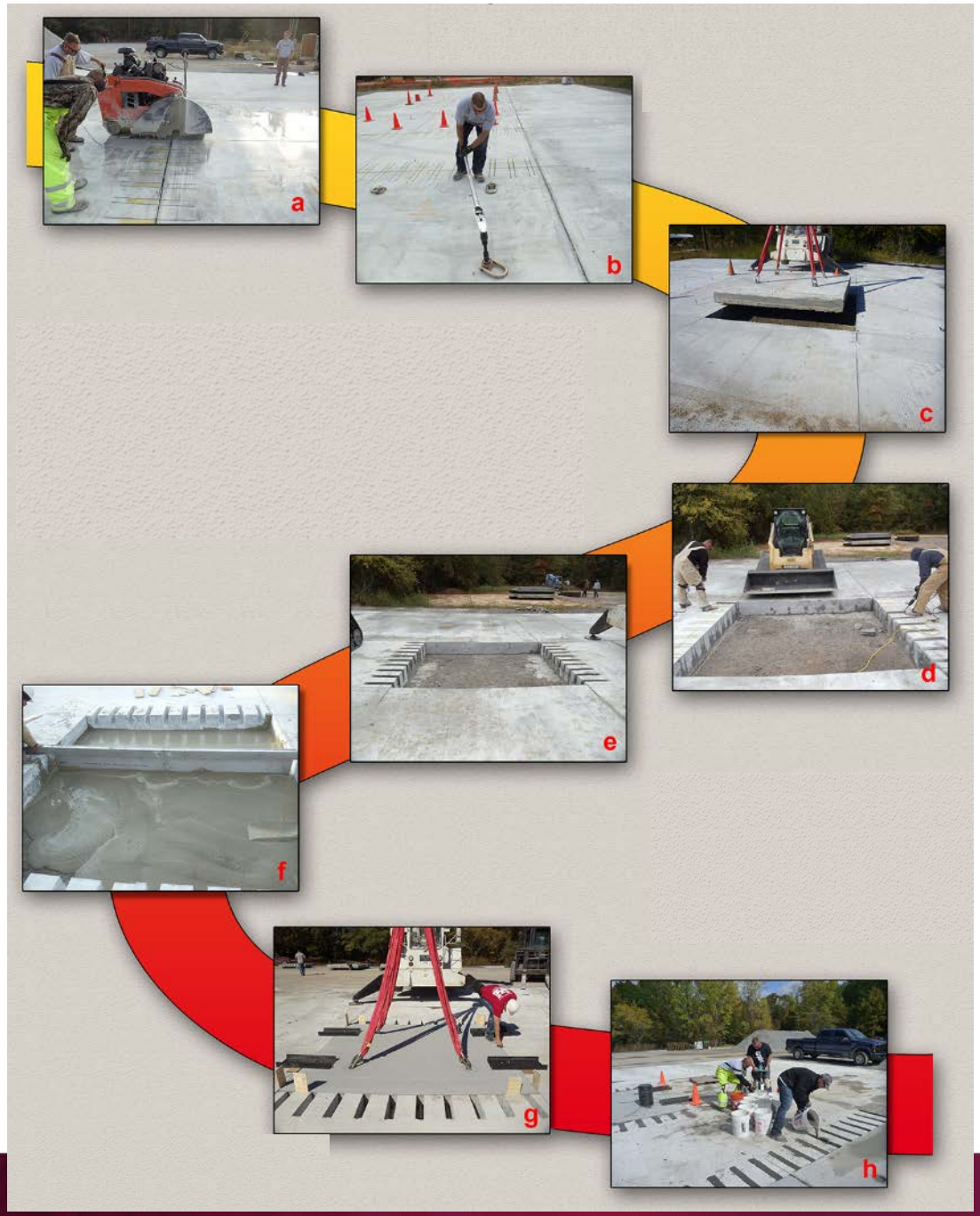


Note: Same panel dimensions and thicknesses

Test Section Cross Section



- Pavement designed to support 50,000 C-17 passes at 580,000 lb (PCASE)
- Subgrade soil classification of CL; base course classification of GW
- 1% (1 ft) longitudinal slope and 0.5% (0.3 ft) cross slope for drainage
- Test Section PCC UCS 7,240 psi (ASTM C39)
- Precast PCC UCS 5,710 psi (ASTM C39)



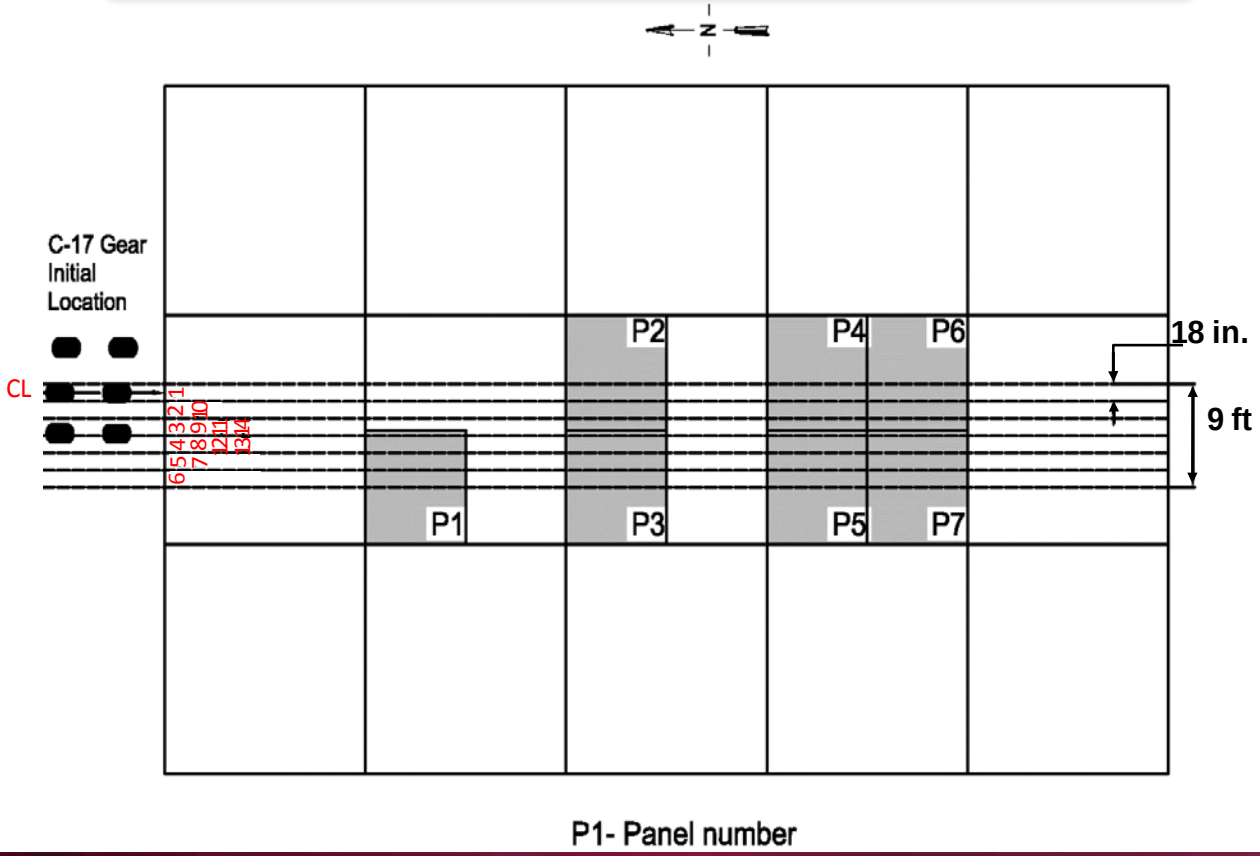
Repair Process

a. Sawcut repair area and dowel slots
b. Install expansion anchors and lifting eyes
c. Remove PCC
d. Prepare dowel slots
e. Inspect prepared area
f. Place flowable fill
g. Place panel
h. Grout dowel slots
i. Allow flowable fill and dowel grout to cure to minimum strength

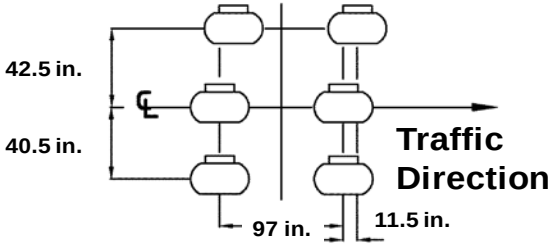
Completed Repairs

Accelerated Pavement Testing

Objective: 5,000 C-17 passes
Threshold: 3,700 C-17 passes



6 Tires
138 to 144 psi per tire
Wheel load=44,930 lb
Gear load=269,560 lb



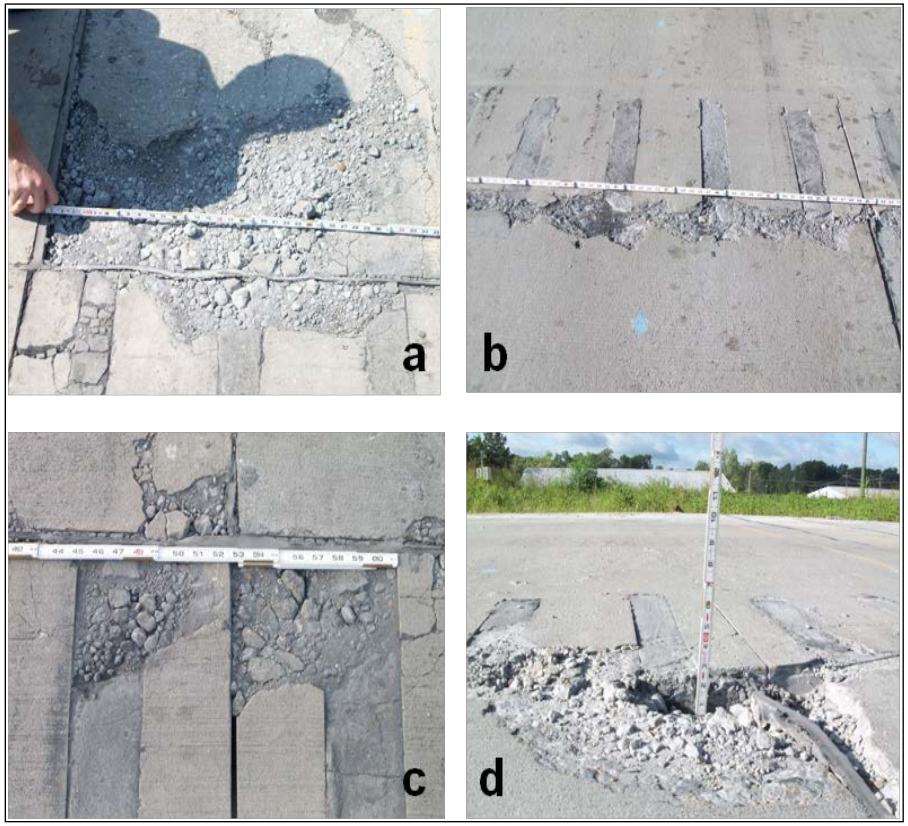
Failure Criteria

- Joint or corner spalls >3 in. deep or >15 in. wide
- Shattered slabs with high-severity cracks
- Settlement/faulting > 3 in.
- Any distress posing high tire damage potential or foreign object damage potential

These failure criteria were based on contingency C-17 operations

Key Findings of Accelerated Pavement Testing

- All repairs withstood objective and threshold pass levels
  - 5,000-10,000 passes
  - Severe joint spalling
- Failure and HWD tests indicated load transfer problems
- Dowel grout in joints may have contributed to failure



Typical Failures: Panel 1 N joint, (b) Panel 2 S joint, (c) Panels 2 and 3 N joints, (d) Panels 6 and 7 S joints

Summary

- Air Force Method of repair was selected for refinement
  - Several drawbacks were identified requiring modifications
  - Redesigned to allow both single- and multiple-panel repairs
- Only the single panel repair could be completed within 6 hr
- Failure modes under C-17 simulated traffic were identified
  - All repairs supported >3,000 passes
  - Panels supported 5,000-10,000 passes
  - Panels failed primarily due to doweled edge spalling
  - The dowel size should be increased to reduce spalling

Research Partners

US Army Engineer Research and Development Center
US Air Force Civil Engineer Center
Applied Research Associates

Questions