Gaining a Better Understanding of FAA and Military Airport Pavement Specifications

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American Concrete Pavement Association
Our Objective

- Advance quality construction.
- Educate:
  - Contractor
  - Engineer
  - Inspector – Construction Manager
- Awareness.
- Minimize costly mistakes
Not your typical highway pavement

- Non channelized traffic
- Heavy load
- Heat
- Mission based
- No detours
What Issues are Facing Airfields?

- Inconsistent construction and inspection
- Procurement/contracting limitations
- High costs of:
  - Shutdowns
  - Aircraft
- Increasing sensitivity to:
  - Operational readiness
  - Safety
What’s the Goal?

- Avoid Problems that Reduce Pavement Performance
- Reduce Variability of Construction
- Improve Decision-Making in Field (and Office!)
- Improve Knowledge of Constructors and Inspectors
What Problems Are We Trying to Minimize?

- **Cracking** – corner, longitudinal, transverse, material related.
- **Joint problems** – spalling, pumping, joint seal damage.
- **Surface defects** – scaling, popouts, map cracking.
- **Damage from Repairs** – lift-out chipping, coring, loose materials
D-Cracking
Weakened Surface
Joint Spalling
Bug Holes
What Minimizes the Risk of Distress?

Sound Design Principles

- Thickness Design
- Foundation Support
- Joint Layout
- Concrete Mixture Design
What Minimizes the Risk of Distress?

Sound Construction Principles

- Stockpiling & Mixing
- Placing & Consolidating
- Finishing & Curing
- Jointing & Sealing
Where Design and Construction Come Together...
Specifications don’t always say what they mean.

Current specifications rely on tests that are only surrogates for quality:
- Strength
- Thickness
- Air content
- Smoothness

The construction team needs to understand the balances among these sometimes competing factors.
Conformance to the Specifications

Despite the challenge... assessing quality in construction equates to how well construction conforms to specification requirements.

So it is vital that requirements are:

- Reasonable (target the average bidder)
- Meaningful (not arbitrary)
- Measurable (by testing)
- Well defined (account for test variability)
- Hold true (do not conflict w/ other requirements)
Concrete Pavement for Heavy Duty Airfields

High quality, durable concrete – no FOD
Same thing right?

Fruit
Bidders need to understand the requirements
Aggregates

**FAA**

- Reactivity
  - ASTM C1260 – 0.10% @ 28 days
  - ASTM C1567 – combined material test; 0.10% @ 28 days
  - LiN – COE CRD-C 662

- Gradations
  - Engineer can specify
  - #4s & 67s **OR** #57s
  - Option for CF and WF
  - ASTM C33

- Testing

**Corps**

- Reactivity
  - ASTM C1260 – 0.08% @ 28 days
  - ASTM C1567 – 0.08% @ 28 days
  - LiN – COE CRD-C 662

- Gradations
  - #4s and 67s, **AND**
  - CF and WF
  - May require a 3rd aggregate
  - ASTM C33 sand (FM 2.5 – 3.40)

- Testing – pay attention to sample size (200 pounds)
<table>
<thead>
<tr>
<th>Deleterious Material</th>
<th>Test Standard</th>
<th>USAF/ Army Maximum %</th>
<th>Navy Maximum %</th>
<th>FAA Maximum %</th>
<th>ASTM Maximum %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay lumps and friable particles</td>
<td>ASTM C 142</td>
<td>0.2</td>
<td>1.0</td>
<td>1.0</td>
<td>3.0</td>
</tr>
<tr>
<td>shale</td>
<td>ASTM C 295</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material finer than 0.075 mm (No. 200 sieve)</td>
<td>ASTM C 117</td>
<td>0.5</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
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<tr>
<td>Lightweight particles (SG &lt; 2.0)</td>
<td>ASTM C 123</td>
<td>0.2</td>
<td>1.0</td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Clay ironstone</td>
<td>ASTM C 295</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chert and cherty stone</td>
<td>ASTM C 123/C 295</td>
<td>0.1</td>
<td>1.0</td>
<td>5.0</td>
<td></td>
</tr>
<tr>
<td>Claystone, mudstone, siltstone</td>
<td>ASTM C 295</td>
<td>0.1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shaly and argillaceous limestone</td>
<td>ASTM C 295</td>
<td>0.2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other soft particles</td>
<td>COE CRD-C 130</td>
<td>0.1</td>
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</tr>
<tr>
<td>Coal and lignite</td>
<td>ASTM C 123/C 295</td>
<td>0.1</td>
<td></td>
<td>0.5</td>
<td></td>
</tr>
<tr>
<td>Total deleterious substances exclusive of material finer than 0.0075 mm</td>
<td></td>
<td>1.0</td>
<td>3.0</td>
<td>3.0</td>
<td></td>
</tr>
<tr>
<td>Sum of clay lumps, friable particles, and chert</td>
<td></td>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Qualification Testing

Weeks - By the Book - 5 3/4 Months (175 Days)

1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24  25

- ASTM C 666
- Freeze Thaw
- Durability
- 8 Weeks

- Deleterious
- ASTM C 295
- Petrographic
- Examination
- 4 Weeks

- ASR ASTM C 1260
- 1N NaOH Individual
- Aggregates
- 5 Weeks

- ASR ASTM C 1567
- 1N NaOH Individual
- Aggregates
- 5 Weeks

Review
Approval
4 Weeks
Mix Design

- Similar but in general, Corps is more stringent
- Corps requires optimization
- Corps requires 3 trial mixes to establish curve
- Corps requires uniformity testing
- Submittal requirements
Concrete Mixture Submittals

The submitted mix design shall be stamped or sealed by the responsible professional Engineer of the laboratory and shall include the following items as a minimum:

a. Coarse, fine, and combined aggregate gradations and plots including fineness modulus of the fine aggregate.
b. Reactivity Test Results.
c. Coarse aggregate quality test results, including deleterious materials.
d. Fine aggregate quality test results, including deleterious materials.
e. Mill certificates for cement and supplemental cementitious materials.
f. Certified test results for all admixtures, including Lithium Nitrate if applicable.
g. Specified flexural strength, slump, and air content.
h. Recommended proportions/volumes for proposed mixture and trial water-cementitious materials ratio, including actual slump and air content.
i. Flexural and compressive strength summaries and plots, including all individual beam and cylinder breaks.
j. Correlation ratios for acceptance testing and Contractor Quality Control testing, when applicable.
k. Historical record of test results documenting production standard deviation, when applicable.

Corps

a. Coarse and fine aggregate gradations and plots.
c. Coarse aggregate quality test results, include deleterious materials.
d. Fine aggregate quality test results.
e. Mill certificates for cement and supplemental cementitious materials.
f. Certified test results for air entraining, water reducing, retarding, non-chloride accelerating[, and Lithium Nitrate] admixtures.
g. Specified flexural strength, slump, and air content.
h. Documentation of required average CQC flexural strength, Ra.
i. Recommended proportions/volumes for proposed mixture and each of three trial water-cementitious materials ratios.
k. Flexural [and compressive] strength summaries and plots.
l. Correlation ratios for acceptance testing and CQC testing.
m. Historical record of test results, documenting production standard deviation (if available).
Water Cement Ratio & slump

- Maximum w/cm = 0.45 (minimum 0.38)
- Maximum slump = 2 inches (forms and hand pours)
- Maximum slump = 1 ¾ inches for slip-form

2.12.2.1 Water-Cement Ratio
At least three different water-cement ratios, which will produce a range of strength encompassing that required on the project, shall be used. The maximum allowable water-cement ratio required in paragraph: Specified Flexural Strength, above will be the equivalent water-cement ratio. Laboratory trial mixtures shall be proportioned for maximum permitted slump and air content.
The Engineer may specify the use of a central plant mixer if deemed necessary for a particular project.

c. Finishing Equipment. The standard method of constructing concrete pavements on FAA projects shall be with an approved slip-form paving equipment designed to spread, consolidate, screed, and float-finish the freshly placed concrete in one complete pass of the machine so a dense and homogeneous pavement is achieved with a minimum of hand finishing. The paver-finisher shall be a heavy duty, self-propelled machine designed specifically for paving and finishing high quality concrete pavements. It shall weigh at least 2200 lbs. per foot of paving lane width and powered by an engine having at least 6.0 horsepower per foot of lane width. On projects requiring less than 500 square yards of cement concrete pavement or requiring individual placement areas of less than 500 square yards, or irregular areas at locations inaccessible to slip-form paving equipment, cement concrete pavement may be placed with approved placement and finishing equipment utilizing stationary side forms. Hand screeding and float finishing may only be utilized on small irregular areas as allowed by the Engineer.

d. Vibrators. Vibrator shall be the internal type. Operating frequency for internal vibrators shall be between 8,000 and 12,000 vibrations per minute. Average amplitude for internal vibrators shall be 0.025-0.05 inches (0.06-0.13 cm). The number, spacing, and frequency shall be as necessary to provide a dense and homogeneous pavement and meet the recommendations of ACI 309, Guide for Consolidation of Concrete. Adequate power to operate all vibrators shall be available on the paver. The vibrators shall be automatically controlled so that they shall be stopped as forward motion ceases. The contractor shall provide an electronic or mechanical means to monitor vibrator status. The checks on vibrator status shall occur a minimum of two times per day or when requested by the Engineer. Hand held vibrators may be used in irregular areas only, but shall meet the recommendations of ACI 309, Guide for Consolidation of Concrete.

3.5.5 Fixed Form Paving

NOTE: Fixed-form paving should always be included as an option or mandatory item as appropriate. Edit bracketed items in subparagraph a. Keys are only permitted for roads and streets with a thickness of 230 mm (9 inches) or greater. Do not permit keys for airfield pavements.
**P-501: 4-11 Finishing**

**b. Machine finishing with fixed forms.** The machine shall be designed to straddle the forms and shall be operated to screed and consolidate the concrete. Machines that cause displacement of the forms shall be replaced. The machine shall make only one pass over each area of pavement. If the equipment and procedures do not produce a surface of uniform texture, true to grade, in one pass, the operation shall be immediately stopped and the equipment, mixture, and procedures adjusted as necessary.

**c. Other types of finishing equipment.** Clary screeds, other rotating tube floats, or bridge deck finishers are not allowed on mainline paving, but may be allowed on irregular or odd-shaped slabs, and near buildings or trench drains, subject to the Engineer’s approval.

Bridge deck finishers shall have a minimum operating weight of 7500 pounds (3400 kg) and shall have a transversely operating carriage containing a knock-down auger and a minimum of two immersion vibrators. Vibrating screeds or pans shall be used only for isolated slabs where hand finishing is permitted as specified, and only where specifically approved.
What is the intent? Slip form as standard?
Then why is side forms described in section f?
Paragraph 501.4.8 Placing Concrete gives the option – side or slip form
  Note to the engineer gives the engineer the choice
  Needs to be consistent with the intent in 4.1?
What about Section 501-4.11 - Finishing?
Leads to confusion
Test Section

- P-501 does not require a test section
- 32 13 11 Section 1.5.6 – Test Section
  - 400 feet pilot lane
  - 400 feet fill in lane
  - Must meet all specification requirements to leave in place
  - Must use equipment and procedure subsequently
Edge Slump

- Important issue
- If there is a problem needs to be resolved immediately
  - Concrete consistency
  - Mixture compatibility with placement methods
  - Paver adjustment
  - Excessive finishing
  - Segregation on belt placer
Edge Slump

- Big deal for airports
- Ponding water in the joints—joint deterioration
- Often leads to spalling because of working the edges
- Indication something is wrong with the mixture
- < 15% of free edge with ¼ inch; none > 3/8 inch
b. Joint Face Deformation: In addition to the edge slump limits specified above, the vertical joint face shall have a surface within the maximum limits shown below:

<table>
<thead>
<tr>
<th>Offset from Straightedge Applied Logitudinally to Pavement Surface</th>
<th>Offset from Straightedge Applied Longitudinally to Vertical Face</th>
<th>Offset from Straightedge Applied Top to Bottom Against the Joint Face</th>
<th>Abrupt Offset in Any Direction</th>
<th>Offset of Joint Face from True Vertical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airfield Pavement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 mm/8 inch</td>
<td>6 mm/4 inch</td>
<td>9 mm3/8 inch</td>
<td>3 mm/8 inch</td>
<td>8 mm/100 mm1 inch/12 inches</td>
</tr>
<tr>
<td>All Other Pavement</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 mm/4 inch</td>
<td>All other items same as airfield pavement</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Smoothness
Smoothness Criteria
(New Pavement Acceptance)

- FAA AC 150/5370-10G – 12-Foot Straight Edge
- UFGC 32 13 11 – 12-Foot Straight Edge
- California Profilograph
- These Methods Will Produce Smooth Pavement when Combined with Grade Control (.5-inch to Established Grade Elevation)
a. Straightedge Testing: The finished surfaces of the pavements shall have no abrupt change of 6 mm 1/4 inch or more, and all pavements shall be within the limits specified when checked with an approved 4 m 12 foot straightedge. [Runways and taxiways shall have a variation from the specified straight edge not greater than 3 mm 1/8 inch in the longitudinal direction and not greater than 6 mm 1/4 inch in the transverse direction. Runway pavement within 60 m 200 feet on both the approach and departure sides of an aircraft arresting gear shall have a variation in the longitudinal direction from the specified straightedge not more than plus or minus 3 mm 1/8 inch.] All other airfield areas shall have a variation from a straight edge not greater than 6 mm 1/4 inch in either the longitudinal or transverse direction. [Roads, streets, tank hardstands, vehicular parking areas, and open storage areas shall have a variation from the specified straight edge not greater than 6 mm 1/4 inch in either the longitudinal or transverse direction.]

b. Profilograph Testing: The finished surfaces of the pavements shall have no abrupt change of 6 mm 1/4 inch or more, and each 0.1 km 0.1 mile segment of each pavement lot shall have a Profile Index not greater than specified when tested with an approved California-type profilograph. [Runways and taxiways shall have a Profile index not greater than 110 mm per km 7 inches per mile in the longitudinal direction. Runway and taxiway transverse smoothness shall be measured with the straight edge method and the straight edge requirements shall apply. All other airfield areas shall have a Profile Index not greater than 140 mm per km 9 inches per mile in the longitudinal direction.] [Roads, streets, tank hardstands, vehicular parking areas and open storage areas shall have a Profile index not greater than 140 mm per km 9 inches per mile in the longitudinal direction.]
(3) Smoothness. As soon as the concrete has hardened sufficiently, but not later than 48 hours after placement, the surface of each lot shall be tested in both longitudinal and transverse directions for smoothness to reveal all surface irregularities exceeding the tolerances specified. The Contractor shall furnish paving equipment and employ methods that produce a surface for each section of pavement having an average profile index meeting the requirements of paragraph 501-8.1c when evaluated with a profilograph; and the finished surface of the pavement shall not vary more than 1/4 inch (6mm) when evaluated with a 12-foot (3.7m) straightedge. When the surface smoothness exceeds specification tolerances which cannot be corrected by diamond grinding of the pavement, full depth removal and replacement of pavement shall be to the limit of the longitudinal placement. Corrections involving diamond grinding will be subject to the final pavement thickness tolerances specified.

Smoothness measurement should be taken within 48 hours of paving
Both Specifications contain penalties

c. Basis of adjusted payment for smoothness. Price adjustment for pavement smoothness will apply to the total area of concrete within a section of pavement and shall be applied in accordance the following equation and schedule:

\[(\text{Square yard in section}) \times (\text{original unit price per square yard}) \times P_{\text{Fm}} = \text{reduction in payment for area within section}\]

<table>
<thead>
<tr>
<th>Average Profile Index (Inches Per Mile)</th>
<th>Pavement Strength Rating</th>
<th>Contract Unit Price Adjustment (P_{\text{Fm}})</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over 30,000 lb</td>
<td>30,000 lb or Less</td>
<td>Short Sections</td>
</tr>
<tr>
<td>0 - 7</td>
<td>0 - 10</td>
<td>0 - 15</td>
</tr>
<tr>
<td>7.1 - 9</td>
<td>10.1 - 11</td>
<td>15.1 - 16</td>
</tr>
<tr>
<td>9.1 - 11</td>
<td>11.1 - 12</td>
<td>16.1 - 17</td>
</tr>
<tr>
<td>11.1 - 13</td>
<td>12.1 - 13</td>
<td>17.1 - 18</td>
</tr>
<tr>
<td>13.1 - 14</td>
<td>13.1 - 14</td>
<td>18.1 - 20</td>
</tr>
<tr>
<td>15.1 and up</td>
<td>15.1 and up</td>
<td>22.1 and up</td>
</tr>
</tbody>
</table>

Not intended for Aprons
Not appropriate for all projects (e.g. widening, keel replacement, etc.)
Straightedge Measurements

- 12 feet straightedge
- Threshold of Acceptability – $\frac{1}{4}$ inch measured [between high points] along the length of the straightedge
- No criteria for long wavelength profile of a pavement feature
- Therefore no criteria exist for smoothness of an entire pavement feature
Airfield Pavement Smoothness

Criteria
- 0.25-Inch in 12 Feet or PI of 5-7 (in/mile)
- 0.5-Inch Max Deviation from Established Grade

Difficult to Meet 100% of the Time
Conservative from Aircraft Response Perspective
Causes Unnecessary Disputes Regarding Pavement Acceptance
Unnecessary Grinding
Evolution of Airport Pavement Smoothness Assessment California Profilograph

PI of 5-7 Inches/Mile is Conservative
Misapplication and Misinterpretation of the Profilograph Specification

- Low PI = smooth
- Requiring low PI (e.g. 4” per mile)
- Low PI apron—phased project
- Short Sections
- Tying to existing pavement
- Using existing is measurements
- Effects of speed
What About Grade Control?

(4) Grade. An evaluation of the surface grade shall be made by the Engineer for compliance to the tolerances contained below. The finish grade will be determined by running levels at intervals of 50 feet (15 m) or less longitudinally and all breaks in grade transversely (not to exceed 50 feet (15 m)) to determine the elevation of the completed pavement. The Contractor shall pay the costs of surveying the level runs, and this work shall be performed by a licensed surveyor. The documentation, stamped and signed by a licensed surveyor, shall be provided by the Contractor to the Engineer.

(a) Lateral deviation. Lateral deviation from established alignment of the pavement edge shall not exceed ±0.10 feet (3 mm) in any lane.

(b) Vertical deviation. Vertical deviation from established grade shall not exceed ±0.04 feet (12 mm) at any point.

1.3.3 Plan Grade

Within 5 days after paving of each lot, the finished surface of the pavement area shall be tested, by running lines of levels at intervals corresponding with every longitudinal and transverse joint to determine the elevation at each joint intersection. The results of this survey shall be recorded and a copy given to the Government at the completion of the survey of each lot. The finished surfaces of airfield runway, taxiway, and apron pavements shall vary not more than 13 mm 1/2 inch above or below the plan grade line or elevation indicated. The surfaces of other pavements shall vary not more than 19 mm 3/4 inch. The above deviations from the approved grade line and elevation will not be permitted in areas where closer conformance with the planned grade and elevation is required for the proper functioning of appurtenant structures. The finished surfaces of new abutting pavements shall coincide at their juncture.
Smoothness testing indicated in the above paragraphs except paragraph (iii) shall be performed within 48 hours of placement of material. Smoothness testing indicated in paragraph (iii) shall be performed within 48 hours final paving completion. The primary purpose of smoothness testing is to identify areas that may be prone to ponding of water which could lead to hydroplaning of aircraft. If the contractor’s machines and/or methods are producing significant areas that need corrective actions then production should be stopped until corrective measures can be implemented. If corrective measures are not implemented and when directed by the Engineer, production shall be stopped until corrective measures can be implemented.
What is the goal for smoothness?

FAA Advisory Circular 150/5380-9
(Based on Boeing Bump Criteria)
Airport pavements are constructed to provide adequate support for the loads imposed by airplanes and to produce a firm, stable, smooth, all-year, all-weather surface free of debris or other particles that may be blown or picked up by propeller wash or jet blast. In order to satisfactorily fulfill these requirements, the pavement must be of such quality and thickness that it will not fail under the load imposed. In addition, it must possess sufficient inherent stability to withstand, without damage, the abrasive action of traffic, adverse weather conditions, and other deteriorating influences. To produce such pavements requires a coordination of many factors of design, construction, and inspection to assure the best possible combination of available materials and a high standard of workmanship.

FAA Advisory Circular 150/5320-6E, Airport Pavement Design and Evaluation
So...
What is the Designer’s or (Engineer of Record) Role

- Creates Detailed and Executable plans and specifications (to meet owners needs)
- Reviews Shop Drawings and Submittals
- Ensures Compliance with Specs
- Manages Liability
- Makes a little profit
And...

What is the Contractor’s Role

- Good Craftsmanship
- Needs Concrete that Satisfies Owner
  - Engineer (Technical)
  - Owner (Appearance???)
  - Crew (Place and Finish)
- Profitable
Generally, Everyone intends to do quality work

- Material Acceptance, testing and Quality Control
  - Suppose the contractor meets QC requirements
  - Suppose all materials meet testing requirements
  - Imperfect materials
  - Imperfect process
  - Imperfect people

- Should we always expect perfect?
- Things can still go wrong!
- Do we always – remove and replace?
What is reasonable?
Let’s look at the Specifications

- **Pay Items**
  - Strength
  - Thickness

- **Suspension of Work**
  - Slump
  - Air

- **Dowel Bar Alignment**
  - Horizontal
  - Vertical
1.5.7 Acceptability of Work – The material and the pavement itself will be accepted on the basis of the test made by the Contractor.

Strength acceptance based 14 day correlation

No Individual set of test are 25 psi or more below the equivalent specified flexural strength.

Strength cannot offset thickness
FAA P-501-5.2 Acceptance criteria.

- Flexural strength
- Thickness
- Smoothness
- Grade
- Edge slump
## P-501 Price Adjustment Schedule based on PWL

### Price Adjustment Schedule

<table>
<thead>
<tr>
<th>Percentage of Materials Within Specification (PWL)</th>
<th>Lot Pay Factor (Percent of Contract Unit Price)</th>
</tr>
</thead>
<tbody>
<tr>
<td>96 – 100</td>
<td>106</td>
</tr>
<tr>
<td>90 – 95</td>
<td>PWL + 10</td>
</tr>
<tr>
<td>75 – 90</td>
<td>0.5 PWL + 55</td>
</tr>
<tr>
<td>55 – 74</td>
<td>1.4 PWL – 12</td>
</tr>
<tr>
<td>Below 55</td>
<td>Reject²</td>
</tr>
</tbody>
</table>

1. Although it is theoretically possible to achieve a pay factor of 106% for each lot, actual payment in excess of 100% shall be subject to the total project payment limitation specified in paragraph 501-8.1.

2. The lot shall be removed and replaced. However, the Engineer may decide to allow the rejected lot to remain. In that case, if the Engineer and Contractor agree in writing that the lot shall not be removed, it shall be paid for at 50% of the contract unit price and the total project payment limitation shall be reduced by the amount withheld for the rejected lot.

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![Standard Normal Probability Distribution](image-url)
Why PWL?

- Acceptance is based on a small sample of production
- Valid sample must be used for pay
- Risk is balanced
Section 50-02 – Conformity with plans and specifications

- Opens the door for “engineer’s opinion” on contract enforcement
- Consult with FAA on “reasonably close conformity”
- Doesn’t mean waive the contractor’s responsibility to meet the requirements of the contract, plans, & specs
- “reasonably close conformity” is not explicitly defined
General Provision

Problematic Language:

If the Engineer finds the materials furnished, work performed, or the finished product not within reasonably close conformity with the plans and specifications but that the portion of the work affected will, in his or her opinion, result in a finished product having a level of safety, economy, durability, and workmanship acceptable to the Owner, the Engineer will advise the Owner of his or her determination that the affected work be accepted and remain in place. In this event, the Engineer will document the determination and recommend to the Owner a basis of acceptance that will provide for an adjustment in the contract price for the affected portion of the work. The Engineer’s determination and recommended contract price adjustments will be based on sound engineering judgment and such tests or retests of the affected work as are, in the Engineer’s opinion, needed. Changes in the contract price shall be covered by contract change order or supplemental agreement as applicable.

If the Engineer finds the materials furnished, work performed, or the finished product are not in reasonably close conformity with the plans and specifications and have resulted in an unacceptable finished product, the affected work or materials shall be removed and replaced or otherwise corrected by and at the expense of the Contractor in accordance with the Engineer’s written orders.
3.9 REPAIR, REMOVAL AND REPLACEMENT OF NEWLY CONSTRUCTED SLABS

3.9.1 General Criteria
New pavement slabs that are broken, have spalled edges, or contain cracks shall be removed and replaced or repaired, as specified at no cost to the Government. Removal of partial slabs is not permitted. Not more than 15.0 percent of each slab's longitudinal joint edge shall be spalled. Prior to fill-in lane placement, pilot lane slabs with spalls exceeding this quantity, regardless of spall size, shall be sawn full depth to remove the spalled face. All other slabs shall be removed, as directed. The Contracting Officer will determine whether cracks extend full depth of the pavement and may require cores to be drilled on the crack to determine depth of cracking. Such cores shall be at least 150 mm 6 inch diameter, and shall be drilled and backfilled with an approved non-shrink concrete. Perform drilling of cores and refilling holes at no expense to the Government.

- If I cracks it comes out – in general
- Cracks < 2” may be repaired
- Up to 15% spalled edge can be repaired
- Repairs are prescriptive
Repair of weaken surfaces (< ¼ inch depth) by grinding - > ¼ inch remove and replace
- mortar-rich,
- rain-damaged,
- uncured
- containing exposed voids or deleterious materials.

Grinding not to exceed 10% of lot and ¼ inch depth

Repair of pilot lane vertical face
- Voids or honeycombed – saw cut full depth ??
- Edge slump – generally will require remove and replace
Pavement repair during construction (FAA P-501)

- Crack all way through thickness of slab – generally remove and replace
- Shrinkage cracks < 4 inch – epoxy repair
  - Debate for changing this…
- Crack adjacent to joints within 6 inches – depends…
- Spall repair – prescriptive
  - 25% maximum of joint
  - Engineer has the discretion of remove and Replace
Rained on surface
- Generally should be diamond ground unless really bad
- All grinding “should” be less than 10%

All repairs are prescriptive
In summary

- Airfield pavement construction is difficult
- Requirements are strict!
- Mistakes are difficult to resolve
- Many opportunities for conflicts or open interpretation
- Invest time and READ the specifications
- Use Pre-bid meeting to clarify and define
- Understand the intent – try to avoid surprises
- Communicate & Coordinate & Inform
Discussion...

Questions?

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