AC 150-5370-10H
P501 Rigid Pavement

P501 Cement Concrete Pavement

Presented to: ACPA Airport Workshop
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Date: October 24, 2019
This specification is to be used for the surface course for airfield rigid pavements subject to aircraft loadings.

The use of materials that meet state highway department specifications for airfield pavements subject to aircraft loading by aircraft greater than 30,000 pounds and less than 60,000 pounds requires a modification to standards in accordance with FAA Order 5300.1, Modifications to Agency Airport Design, Construction, and Equipment Standards.

State highway department material specifications may be used for access roads, perimeter roads, and other pavements subject to aircraft loading less than or equal to 30,000 pounds.

When state highway material specifications are used, include all applicable/approved state specifications in the contract documents. State specifications must include the material requirements of paragraph 501-2.1 for reactivity.

For aircraft loadings less than 30,000 pounds, the use of materials that meet state highway department specifications does not require a modification to standards.
P-501 When to Use

Rigid Pavement subject to Aircraft Load

- Surface Courses
- > 30,000 lbs gross load

Non Aircraft Loads and < 30,000 lbs

- State Highway Material Specifications
P-501 Organization

- Description
- Materials
- Mix
- Construction Methods
- Quality Control
- Material Acceptance
  - QA & Measurement & Payment
Materials

Aggregates

- Reactivity
- Deleterious Material
- Combined Aggregate Gradation
Reactivity

- Coarse & Fine Separate
  - ASTM C1260 < .01% @ 28 day
  - No action just report
- Combined Coarse & Fine + SCM
  - ASTM C1567 < .01% @ 28 day
### Fine Aggregate Material Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Requirements</th>
<th>ASTM Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate</td>
<td>Loss after 5 cycles: 10% maximum using Sodium sulfate - or - 15% maximum using magnesium sulfate</td>
<td>ASTM C88</td>
</tr>
<tr>
<td>Sand Equivalent</td>
<td>45 minimum</td>
<td>ASTM D2419</td>
</tr>
<tr>
<td>Fineness Modulus (FM)</td>
<td>2.50 ≤ FM ≤ 3.40</td>
<td>ASTM C136</td>
</tr>
</tbody>
</table>

### Limits for Deleterious Substances in Fine Aggregate for Concrete

<table>
<thead>
<tr>
<th>Deleterious Substance</th>
<th>Limits</th>
<th>ASTM Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay lumps and friable particles</td>
<td>1.0% maximum</td>
<td>ASTM C142</td>
</tr>
<tr>
<td>Coal and lignite</td>
<td>0.5% using a medium with a density of Sp. Gr. of 2.0</td>
<td>ASTM C123</td>
</tr>
<tr>
<td>Total Deleterious Material</td>
<td>1.0% maximum</td>
<td></td>
</tr>
</tbody>
</table>
Maximum Size

- Designer sets Maximum Aggregate Size
- Contractor chooses gradation
<table>
<thead>
<tr>
<th>Material Test</th>
<th>Requirement</th>
<th>Standard</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance to Degradation</td>
<td>Loss: 40% maximum</td>
<td>ASTM C131</td>
</tr>
<tr>
<td>Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate</td>
<td>Loss after 5 cycles: 12% maximum using Sodium sulfate - or - 18% maximum using magnesium sulfate</td>
<td>ASTM C88</td>
</tr>
<tr>
<td>Flat, Elongated, or Flat and Elongated Particles</td>
<td>8% maximum, by weight, of flat, elongated, or flat and elongated particles at 5:1 for any size group coarser than 3/8 (9.5 mm) sieve</td>
<td>ASTM D4791</td>
</tr>
<tr>
<td>Bulk density of slag</td>
<td>Weigh not less than 70 pounds per cubic foot (1.12 Mg/cubic meter)</td>
<td>ASTM C29</td>
</tr>
<tr>
<td>[ D-cracking (Freeze-Thaw)]^3</td>
<td>Durability factor ≥ 95</td>
<td>ASTM C666</td>
</tr>
</tbody>
</table>
## Limits for Deleterious Substances in Coarse Aggregate

<table>
<thead>
<tr>
<th>Deleterious material</th>
<th>ASTM</th>
<th>Percentage by Mass</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clay Lumps and friable particles</td>
<td>ASTM C142</td>
<td>1.0</td>
</tr>
<tr>
<td>Material finer than No. 200 sieve (75 μm)</td>
<td>ASTM C117</td>
<td>1.0&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Lightweight particles</td>
<td>ASTM C123 using a medium with a density of Sp. Gr. of 2.0</td>
<td>0.5</td>
</tr>
</tbody>
</table>
| Chert<sup>2</sup> (less than 2.40 Sp Gr.)                 | ASTM C123 using a medium with a density of Sp. Gr. of 2.40 | \[
|                                                          | [ 1.0 ]<sup>3</sup>                   |                    |
|                                                          | [ 0.1 ]<sup>3</sup>                   |                    |
| Total of all deleterious Material                         |                                       | 3.0<sup>1</sup>    |

1. The limit for material finer than 75-μm is allowed to be increased to 1.5% for crushed aggregates consisting of dust of fracture that is essentially free from clay or shale. Test results supporting acceptance of increasing limit to 1.5% with statement indicating material is dust of fracture must be submitted with Concrete mix. Acceptable techniques to characterizing these fines include methylene blue adsorption or X-ray diffraction analysis. The total of all deleterious materials increases up to 3.5%.

2. Chert and aggregates with less than 2.4 specific gravity.

3. The limit for chert may be limited to 0.1 percent by mass in areas subject to severe freeze and thaw.
e. Contractors combined aggregate gradation. The contractor shall submit their combined aggregate gradation using the following format:

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>Contractor’s Concrete mix Gradation (Percent passing by weight)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 inch (50 mm)</td>
<td>*</td>
</tr>
<tr>
<td>1-1/2 inch (37.5 mm)</td>
<td>*</td>
</tr>
<tr>
<td>1 inch (25.0 mm)</td>
<td>*</td>
</tr>
<tr>
<td>3/4 inch (19.0 mm)</td>
<td>*</td>
</tr>
<tr>
<td>1/2 inch (12.5 mm)</td>
<td>*</td>
</tr>
<tr>
<td>3/8 inch (9.5 mm)</td>
<td>*</td>
</tr>
<tr>
<td>No. 4 (4.75 mm)</td>
<td>*</td>
</tr>
<tr>
<td>No. 8 (2.36 mm)</td>
<td>*</td>
</tr>
<tr>
<td>No. 16 (1.18 mm)</td>
<td>*</td>
</tr>
<tr>
<td>No. 30 (600 μm)</td>
<td>*</td>
</tr>
<tr>
<td>No. 50 (300 μm)</td>
<td>*</td>
</tr>
<tr>
<td>No. 100 (150 μm)</td>
<td>*</td>
</tr>
</tbody>
</table>
Materials Cementitious

**Fly Ash**

- ASTM C-618
  - LOI < 6%
  - CaO < 15%

**Slag**

- ASTM C989
  - 25-55%
Materials Dowel & Tie Bar

❑ Dowel Bars
  • Epoxy Coated

❑ Tie Bars
  • Plain or Epoxy
- FAA **not aware** of any joint failures due to corrosion of dowel or tie bar

- FAA **is aware** of joint failures due to misalignment of dowel or tie bars
Materials Bond Breaker

- Required over lean concrete
- Choke Stone is most effective
  - No 89 stone – one rock layer
Concrete Mix

- Maximum Aggregate Size
- Combined Aggregate Gradation
  - Note Production Gradation set after control strip
  - 2 or 3 aggregate sizes
  - More bins – better
  - Contractor decision
Construction Methods

Control Strip

- Next Joint after 250’ of each type (slip pilot, slip fill in, fixed form)
- Most projects will require all three
- Nothing new, contractor always uses start up to fine tune production and placement
- Now we just call it control strip
Construction Methods

- Purpose: Establish that Materials, Equipment and Personal Produce acceptable Pavement
  - Establish Production Mix – may require modifications to admixtures, proportions etc
  - Equipment Set up and Operation
  - Personnel
Construction Methods

- Fixed Form ‘Honeycomb’
  - Honeycomb areas < 1” deep repair
    - > 1” deep remove and replace
      (501-4.14)
  - Materials, placement and consolidation must be reviewed and appropriate adjustments made
Repair, Removal or Replacement

- Shrinkage Cracks (501-4.19 a)
  - < 1/3 slab depth
  - High molecular weight methacrylate (super glue)
  - Epoxy Resign Type IV pressure injected
  - > 1/3 Remove and replace
Repair, Removal or Replacement

- Cracks > 6” from joint (501-4.19c)
  - REMOVE and REPLACE

- Cracks < 6” from Joint
  - Full depth and Joint not cracked
    - Fill joint with epoxy resin
    - Random crack saw on crack to create joint seal reservoir, seal crack
Repair, Removal or Replacement

- Cracks < 6” from Joint
  - Full depth and Joint cracked
  REMOVE AND REPLACE
Repair, Removal or Replacement

- Spalls
  - < 1” wide, < depth less than joint reservoir….Fill with Joint sealant material
  - > 1” or > depth of joint reservoir
    - Partial depth repair
  - > ½ slab depth or > 25% of joint...
    REMOVE AND REPLACE
Quality Control

- Production and Placement of pavement is a manufacturing process
- Quality Control = Production Control of materials and methods
Quality Control

- CQCP in accordance with C-100
  - Key is corrective action plans
  - Advance planning of how to keep production under control and what to do when it gets out
  - Control charts (all materials and mix)
Quality Control

- QC Testing Plan
  - Gradation
  - Moisture
  - Deleterious Materials
  - Mix Consistency – Slump, Air, Unit Weight, Temperature, Strength
  - Smoothness - Daily
  - Grade – Before & After Placement

Should already have been checked on all layers below
Quality Assurance

- QA is verification that material meets specification requirements
- Payment for acceptable material
Lot Size

- Divide into equal sublots with individual sublots between 400-600 sy
- Lot generally one day's production not to exceed 2,000 cy
- Partial lots combine with previous or next day when less than 2 sublots
Measurement & Payment

- Strength
- Thickness
- Grade
  - Payment reduced by 5% when 25% of sublots does not meet grade criteria
- [Profilograph Roughness]
  - Meets no bonus
Measurement & Payment

- **Adjustment for Repair**
  Sublots with spall repairs, crack repairs or partial panel replacement limited to 95% payment

- **Adjustment for Grinding**
  Sublots with grinding over 25% of sublot payment reduced by 5%
Questions?