FAA Standard Specifications For Construction

What are they and how are they updated?

Presented to: CP Tech Center Tech Tuesday Webinar

By: Harold Honey P.E. PMP
Design and Construction Branch (AAS-110)

Date: April 25, 2023

Federal Aviation Administration

About the Presenter

- **Harold Honey, P.E., PMP** is a Senior Airfield Pavement Engineer in the Design and Construction Branch at FAA Headquarters in Washington, D.C.
- He is responsible for engineering standards for design, construction, evaluation and maintenance of airfield pavement at civil airports.
- Harold has over 18 years of engineering experience including as a active duty Air Force officer, consultant and federal employee.
- He holds a BSCE degree from Syracuse University, a MSCE degree from the University of Illinois at Urbana-Champaign and a MBA from Robert Morris University.
- Harold is a registered professional engineer in Ohio and Pennsylvania and a certified Project Management Professional. He resides in Beaver, PA with his wife and two sons.

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Today's Learning Objectives

- Describe when FAA standard specifications must be used and how products are approved for use on airfield construction projects.
- Identify the publication that contains FAA construction standard specifications and where to locate the document.
- Discuss the triggers that may lead to an update in FAA design and construction publications.
- Explain the five phases of update a FAA publication undergoes.
- Understand the background of EB-106 and how to incorporate the revised language into FAA specifications.

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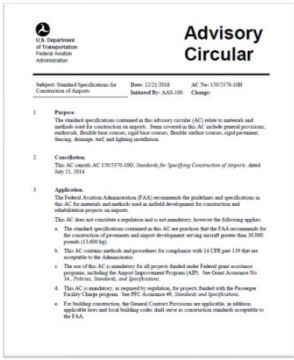
FAA Airport Design & Construction Publications

- **Advisory Circulars**
- **Engineering Briefs**
- **FAA Orders**
- **Engineering Policy Memos**

More than publications:
Tools, software, and videos



U.S. Department of Transportation
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Advisory Circular

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When do you have to use FAA Standards?

- **When you use the FAA's $$$$$$**
  - AIP Grant Funded Project
  - Other Grant Funded Project (i.e. BIL grants)
  - When using Passenger Facility Charges (PFC)
- **Locally Funded work does not have to follow FAA Standards**
  - Most Maintenance and Repair projects are locally funded
  - FAA funded projects can have ineligible line items that FAA does not fund
  - Other funding sources (i.e. aircraft operators, DoD) don't need to follow FAA standards
- **While FAA standards are not always required, they can be used at any time**
- **Modifications of FAA standards can be approved using FAA MOS process**

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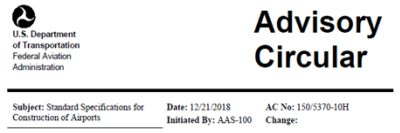
AC 150/5370-10H *Standard Specifications for Construction of Airports*

- **Released 12/21/2018**
- **Last Errata Issued 8/19/2020**
  - Note that errata does not change date on AC
  - Make sure you are using the latest version with every project
  - https://www.faa.gov/airports/resources/advisory_circulars/index.cfm/go/document.information/documentID/1035128


U.S. Department of Transportation
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Advisory Circular

Subject: Standard Specifications for Construction of Airports | **Date:** 12/21/2018 | **AC No:** 150/5370-10H
Initiated By: AAS-100 | **Change:**

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Reminder!!!!

- **The FAA DOES NOT approve construction materials**
  - If somebody is claiming their product is "FAA approved" don't believe them
- **FAA specifications establish the standard that materials need to meet**
  - Acceptable for a product to say "meets FAA P-501"
  - Just because their marketing material says it meets doesn't mean it does
- **Airport Sponsor approves materials for a project based on whether or not it meets specification**
  - The FAA does not track submittals that have been approved for projects
  - Just because a product was approved on previous project does not mean it meets the FAA specification

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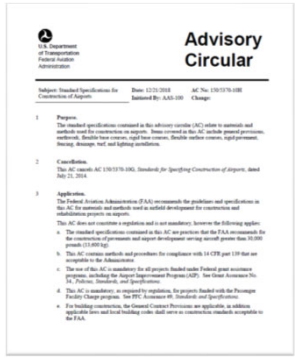
When, How, What, triggers AC updates

- **Changes in Aircraft performance/characteristics;**
- **Progress in technology (AI/Machine Learning);**
- **Research performed by / at the Tech Center (ATR);**
- **Feedback received from:**
  - Part 139 ACSIs & State Agencies
  - Region/ADOs
  - Industry (MOS, AC comments etc)
- **Can it be addressed in:**
  - Errata;
  - Change Set i.e. change 1; or
  - Engineering Brief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AAS Publication Review

- **First draft is prepared and submitted for internal coordination and discussion (HQ, RO, ADO, and other LOBs)**
- **2nd Draft is posted on the FAA website for Industry Review and Comments**
- **Updated 3rd Draft (QA/QC Review) is submitted to AGC (Legal)**
  - They are looking for no over-reaching regulatory authority.
  - "Must" versus "should"
  - "Requirement" versus" recommended", or even" best practice"
- **Final "Final" Sr. Management discussion: presented to (AAS-1 & AAS-2) and sometimes to ARP-1 & ARP-2**
- **Final Version/Package is prepared for AAS-1 signature, website publication and industry notification.**

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AC 150/5370-10J (draft)

- **The update process has started**
- **Overall Updates**
  - New format for specs being discussed to make more agile for future updates
  - General Provisions updates to incorporate new legislation allowing early completion incentives
  - General Provisions updates to address sustainability and EPDs
  - Incorporate EBs 66 (P-215 rubblization), 102 (P-407 ATPB) and 106 (cement)
  - New specification for Construction Safety and Traffic Control
  - Comprehensive update to P-207 (FDR)
  - New Specification for PCMO (old EB-62)
  - Extensive reviews and updates to many other specifications

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P-501 Updates

- **Incorporate EB-106 for alkali loading and blended cements**
- **Improve guidance on reactivity testing (source vs. product)**
- **Improve guidance on opening of pavement to traffic (construction and aircraft)**
- **Address concerns with QC vs. QA strength testing**
  - May lead to update to EB-34a (referee testing)
- **Improve language on PWLs**
  - What deducts are taken for other things (grade, repairs, grinding)
  - When are deducts applied?
  - When can a "bonus" payment from one lot be applied to a deduct for another lot?

***Unfortunately we will likely not get results from ACPTP research into this update**

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Timeline for Update

- **FAA Internal Draft:** **June 2024**
- **Industry Review Draft:** **February 2025**
- **Legal Review Draft:** **September 2025**
- **Publication:** **February 2026**

****These dates are all preliminary and definitely will change****

Federal Aviation Administration

FAA Airports Safety & Standards
Airports Engineering Division
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Cement (501-2.2)

501-2.2 Cement. Cement shall conform to the requirements of ASTM [___] Type [___].

The Engineer shall specify all of the following that are acceptable for use on the project:

ASTM C150 - Type I, II, or V.

ASTM C595 - Type IP, IS, IL.

ASTM C1157 – Types GU, HS, MH.

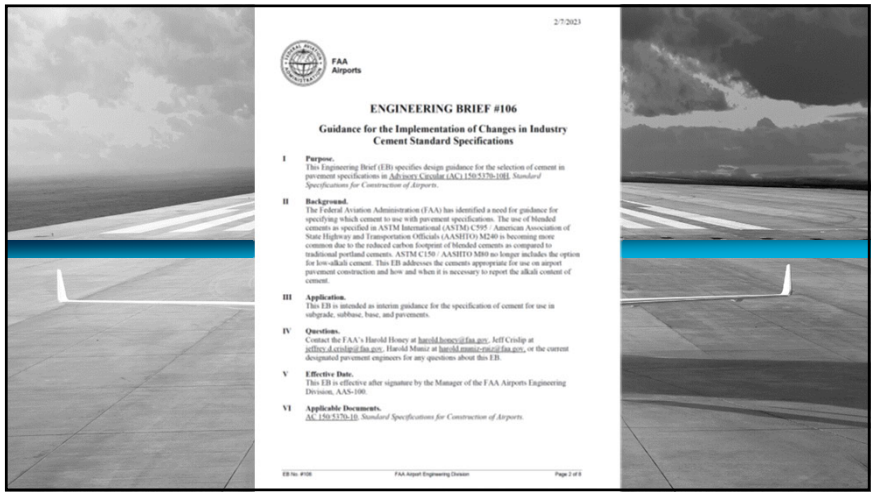
Other cements may be specified with concurrence of the FAA.

Low alkali cements (less than 0.6% equivalent alkali, the low reactivity option in ASTM C595, or Option R in ASTM C1157) shall be specified.

Is this the appropriate Cement Specification?

Cement Issues

- Industry is changing quickly to address carbon footprint
- ASTM C595/AASHTO M240 Blended cements becoming common
- FAA Recognizes need for guidance
- Low-alkali cement no longer included in ASTM C150
- Engineering Brief 106 provides guidance



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FAA Airports

ENGINEERING BRIEF #106

Guidance for the Implementation of Changes in Industry Cement Standard Specifications

I **Purpose.**
This Engineering Brief (EB) specifies design guidance for the selection of cement in pavement specifications in Advisory Circular (AC) 150/5370-10H, *Standard Specifications for Construction of Airports*.

II **Background.**
The Federal Aviation Administration (FAA) has identified a need for guidance for specifying which cement to use with pavement specifications. The use of blended cements as specified in ASTM International (ASTM) C595 / American Association of State Highway and Transportation Officials (AASHTO) M240 is becoming more common due to the reduced carbon footprint of blended cements as compared to traditional portland cements. ASTM C150 / AASHTO M80 no longer includes the option for low-alkali cement. This EB addresses the cements appropriate for use on airport pavement construction and how and when it is necessary to report the alkali content of cement.

III **Application.**
This EB is intended as interim guidance for the specification of cement for use in subgrade, subbase, base, and pavements.

IV **Questions.**
Contact the FAA's Harold Honey at harold.honey@faa.gov, Jeff Crislip at jeffrey.d.crislip@faa.gov, Harold Muniz at harold.muniz-ruiz@faa.gov, or the current designated pavement engineers for any questions about this EB.

V **Effective Date.**
This EB is effective after signature by the Manager of the FAA Airports Engineering Division, AAS-100.

VI **Applicable Documents.**
AC 150/5370-10, *Standard Specifications for Construction of Airports*.

EB No. #106 FAA Airport Engineering Division Page 2 of 8

Why Change?

3.3. Alkali Content.
For many years, based upon early research, the belief was that if the alkali content of the cement was below a certain level, that deleterious ASR reactions could be minimized. This was the basis for the adoption of the maximum alkali limit of "low alkali" cement as $Na_2Oeq < 0.6\%$.

However, a limit on the percent of equivalent alkalies in the cement alone did not address the total alkali loading of the concrete. The alkali loading of the concrete takes into consideration the cement content of the concrete and the alkali content of the cement. ASTM C150 no longer includes an option for low-alkali cement, but rather requires the cement manufacturer to report the equivalent alkali content of the cement on the mill test report. ASTM C595 also requires reporting of the equivalent alkali content of the portland cement component at the request of the purchaser.

- **P-501 States:**

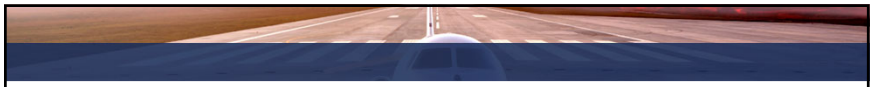
  Low alkali cements (less than 0.6% equivalent alkali, the low reactivity option in ASTM C595, or Option R in ASTM C1157) shall be specified.

- **Can't specify low alkali cement any more, it doesn't exist**

Alkali Loading of Concrete Mixtures

- **Equivalent Alkali Content (Na_2Oeq) = $Na_2O + 0.658K_2O$**
  - On mill test reports could be "alkalis", "Na_2Oeq", "equivalent alkalis", or "total alkalis"
- **Calculate Alkali loading of the concrete mixture**
  - Concrete alkali load (lb/yd^3) = cement content (lb/yd^3) x equivalent alkalis % Na_2Oeq x 1/100
- **When do we limit alkali in cement?**

When either the fine or coarse aggregate to be used in P-501 Cement Rigid Pavement or P-610 Concrete for miscellaneous structures, is potentially reactive, as determined by the ASTM C1260 test, the alkali loading of the cement component of the concrete mixture shall be less than 3 lb/cy [1.8 kg/m^3].



Aggregate Reactivity (501-2.1)

- **ASTM C1260 (extended to 28 days) is telling us "are the aggregates reactive?"**
  - Tested on coarse and fine aggregates separately
  - Is this a source test? Does it matter what gradation it is if it comes from the same source?
  - Test will be determining factor for if alkali loading limits are necessary
- **ASTM C1567 at 28 days is telling us if we have mitigated the reactive aggregates**
  - Tested on combined aggregate gradation
- **Mitigation Measures**
  - Fly Ash (Can you get fly ash? Does it meet ash requirements?)
  - Lithium Nitrate (Can you get it? What does it cost?)
  - Slag Cement (may cause more issues than it solves if not used right)
  - Other Pozzolans

Cementitious Materials (501-2.2)

a. Fly ash. Fly ash shall meet the requirements of ASTM C618, with the exception of loss of ignition, where the maximum shall be less than 6%. Fly ash shall have a Calcium Oxide (CaO) content of less than 15% and a total alkali content less than 3% per ASTM C311. The Contractor shall furnish the previous three most recent, consecutive ASTM C618 reports for each source of fly ash proposed in the concrete mix, and shall furnish each additional report as they become available during the project. The reports can be used for acceptance or the material may be tested independently by the Resident Project Representative (RPR).

b. Slag cement (ground granulated blast furnace (GGBF)). Slag cement shall conform to ASTM C989, Grade 100 or Grade 120. Slag cement shall be used only at a rate between 25% and 55% of the total cementitious material by mass.

- **No longer specify Class F fly ash, most people don't realize this.**
- **Should be "total equivalent alkali" content less than 3%**
  - What should I do if my total equivalent alkalis are 3.04%?
  - What if I can't find a fly ash source that meets the standard?

Alkali Loading of Concrete Mixtures

- **Alkali loading is now a part of the concrete mix design and not a qualifier for cement.**
- **Example Calculations:**

3.6. How to Calculate Alkali Loading of Concrete Mixture.
The alkali loading of concrete (lb/yd^3) = portland cement fraction content (lb/yd^3) × equivalent alkalies % Na_2Oeq × 1/100. **Note:** In concrete that includes supplementary cementitious materials, only the alkali content of the portland cement fraction of the cementitious materials is included in the calculations of alkali loading.

For example, consider a concrete mix containing 575 lbs/yd^3 of ASTM C595 *Type IL* (15) cement which is 85% portland cement, 15% limestone. If the equivalent alkali content of the portland cement component is 0.63% Na_2Oeq, the alkali loading of concrete would be:
575 lbs/yd^3 × 85/100 × 0.63/100 = 3.1 lbs/yd^3. **(Note:** In this case the mix designer must reduce the cement content or use a different cement to get the alkali loading below 3.0 lb/cy.)

For another example, consider a concrete mix containing 600 lbs/yd^3 of ASTM C595 Type IP (20) cement which is 80% portland cement, 20% pozzolan. If the equivalent alkali content of the portland cement component is 0.59% Na_2Oeq, the alkali loading of concrete would be:
600 lbs/yd^3 × 80/100 × 0.59/100 = 2.8 lbs/yd^3.

What Cement Should be Specified?

- Multiple cements that will work for the project—options
- Generally, ASTM C595 Type IL Portland Limestone Cement
- Some locations may still have ASTM C150 Type I/II
- ASTM C595 Type IP or IS cements have been used—may need to switch to Type IT (the pozzolans must meet FAA Requirements)
- Engineers need to evaluate and leave options
- Industry is moving quickly at address carbon footprint
- Should not specify only ASTM C150 Type I/II

EB 106 Effects on AC 150/5370-10H

4.0 Modifications to AC 150/5370-10H.
This section provides modifications to AC 150/5370-10H for specifying cements to be used for subgrade, subbase, base, cement pavement, and miscellaneous concrete. Using the modifications included in this EB does not require submitting a formal request for a modification of standards (MOS). Replace the appropriate paragraph in AC 150/5370-10H with paragraphs 4.1 through 4.6.

4.1. P-153 Controlled Low-Strength Material (CLSM).
153-2.1a. Cement. Cement: ASTM C150, *Types I, II,* or *V*; ASTM C595, *Types IS, IP, IL,* or *IT.*

4.2. P-207 In-place, Full-Depth Reclamation (FDR) Recycled Asphalt Aggregate Base Course.
207-2.2b. Chemical Stabilization. Cement: ASTM C150, *Types I, II,* or *V*; ASTM C595, *Types IS, IP, IL,* or *IT.*

4.3. P-220 Cement Treated Soil Base Course.
220-2.1 Cement. Cement: ASTM C150, *Types I, II,* or *V*; ASTM C595, *Types IS, IP, IL,* or *IT.*

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4.4. P-307 Cement Treated Permeable Base Course (CTPB).
307-2.3. Cement. Cement: ASTM C150, *Types I, II,* or *V*; ASTM C595, *Types IS, IP, IL,* or *IT.*

4.5. P-501 Cement Concrete Pavement.
501-2.1 a. (1) Test course aggregate and fine aggregate separately, in accordance with ASTM C1260; however, extend the length of the test to 28 days (30 days from casting). Complete the tests within six months of the date of the concrete submittal. If expansion of either the course or fine aggregate exceeds 0.10% at 28 days, limit the alkali loading of the concrete to be less than or equal to 3.0 lb per cubic yard (1.8 kg per cubic meter), calculated in accordance with EB 106.

Note: Remaining parts of 501-2.1a remain as in AC 150/5370-10H.

501-2.2 Cement. Cement: [ASTM C150, *Types I, II,* or *V*; ASTM C595, *Types IS, IP, IL,* or *IT*; ASTM C1157 *Types GU, HS, MS, MH,* or *LH*]

The engineer should retain all cements appropriate for use on the project.
Note: ASTM C1157 cements are typically only used for repair projects.
Other cements may be specified with the concurrence of the FAA.

304-2.4 Cement. Cement shall conform to the requirements of ASTM [___].

The Engineer shall specify ASTM C150, [Type I][Type I or II] [Type II, low alkali] or ASTM C595 [Type IP][Type IL].


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