


# Materials & Tests Breakout



**Materials and Tests Unit**

Jack Cowser  
Randy Pace

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**Contact Information**

- General
  - Local Contacts: Section Materials Specialists and Regional Laboratory Managers
  - Appendix with Contact Names and Numbers

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**Contacts**

- Structural Members
  - Structural Steel, Prestressed Concrete, Signs/Structures, Grates and Frames
- Asphalt Laboratory
  - Asphalt Mix Designs, Asphalt Coring & Investigations, Aggregate Testing

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**Contacts**

- **Chemical Testing Laboratory**
  - Coatings, Liquid Asphalt, Fencing Materials, Chemical Analysis on Metals, Cement, Water and various other materials, MSE Wall Corrosion Monitoring
  - Manage the contracts for Environmental testing on water and soils

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**Contacts**

- **Soils Laboratory**
  - Soils, Aggregates, Recycled Asphalt/Concrete
  - Conventional and Nuclear Density Questions/Problems
- **Physical Testing Laboratory**
  - Concrete, Reinforcing Steel, Aggregates, Cement, Epoxies, Grouts, and other destructive tests.

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**Certifications**

- **Existing Programs**
  - Concrete, Aggregates, Density, Asphalt, Nuclear, ABC (See Handout on Certification Contacts)
- **New Certification Programs**
  - Coatings Certification
  - Welder Certification
  - Structural Steel (inspection course)

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# Materials & Tests Breakout



## On-Line Documents

- **AASHTO**
  - The Materials Book
  - Other AASHTO Documents
- **ASTM**
  - All Standards (Historical, Redline)
- **Other Entity Documents**
  - Contact M&T

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## On-Line Standards

- **What Can I Do With Standards?**
  - Print
  - Save
  - Give to other DOT employees
- **Limitations of Agreement**
  - For DOT employees ONLY

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## Security Tag

4.2. Fine aggregate from different sources of supply shall not be mixed or stored in the same pile.

5. **GRADING**

5.1. Fine aggregate, when tested by means of laboratory sieves, shall conform to the requirements of Table 1, except as provided in Sections 5.2 and 5.3:

**Table 1—Grading Requirements**

Sieve	Min.	Max.
9.5 mm (No. 20)	100	
4.75 mm (No. 40)	95 to 100	
2.50 mm (No. 60)	80 to 100	
1.18 mm (No. 150)	50 to 85	
600 µm (No. 300)	25 to 60	
300 µm (No. 600)	10 to 30	
150 µm (No. 1000)	2 to 10	

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## Coatings Certification



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## Coatings Certification

- BRIDGE COATING - LEVEL 1
- Contractor Certification (SSPC)
- QC/QA requirement

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## Coatings Certification

- Safety/PPE
- Ambient Conditions
- Surface Preparation
- Coating Application
- Testing
- Lead Abatement

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## Field Welder Certification



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## Current Program

- Test by independent testing agency (submitted to M&T)
- Name and SSN entered into HICAMS
- Confirm validity in HICAMS for Field Welding
- Certification Limitations Not Shown
- Certification valid for 3 years

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## New Program

- M&T tests welder in person
- On-site testing
- Certification level (limitations) shown on picture ID card



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# Materials & Tests Breakout



**KEY DATES**

- **JANUARY 1 TO JULY 1 2006**
  - Both Certification Programs Accepted
- **AFTER JULY 1 2006**
  - All Welders to be Tested and Approved by Materials and Tests

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**M&T Provides:**

- **Welding equipment, test plates, and all tools needed to take test**
  - No PPE provided
- **Testing of coupons**
- **Picture ID certification card**
  - Welder must provide valid picture ID for identification
- **Technician number assigned in HiCAMS**

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**Certification Details**

- **Fees charged based on certification desired**
- **Reciprocal agreements with other states**

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## Certification Duration

- Certification valid for 5 years
  - If welder's ability in question; retest will be required
- Period of Effectiveness (POE) Card
  - Signed by RE or Inspector (min 1/year)

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## Certification Levels

- SIP Form Welder
- Bridge Welder
- Pipe Welder

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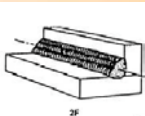
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## SIP Form Welder

- Fillet weld test only
- Horizontal position (2F)
- Stop and start near middle



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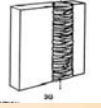
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## Bridge Welder

- Groove weld test
  - Vertical (3G) and Overhead (4G)
- Fillet weld test
  - Vertical (3F)



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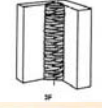

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## Pipe Welder

- Groove weld test on 6 inch, sch. 80 pipe
  - 45 Degree position (6G)
- Fillet weld test
  - Vertical (3F)



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## Welder Cert. Summary

- Provides greater assurance of the qualifications of field welders
- Reduces work load and training requirements for Project Inspectors
- Program details posted on M&T web page (“Training Schedules”)

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**Structural Steel  
Inspection Course**

- Field Welding Applications
  - What to Look For
  - NCDOT Welding Symbols
  - Weld Discontinuities
  - Special Considerations

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**Structural Steel  
Inspection Course**

- Use of High Strength Bolts
  - Approved by M&T
  - DTI verification
  - Proper Storage

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**Contact Information**

- Steve Walton  
Metals Engineer
  - Office 336-993-2300
  - Mobile 336-406-6502

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# Materials & Tests Breakout



## New Technologies

- Intelligent Compaction
- ME Pavement Design
  - Soil Mr
  - Asphalt E\*
- Self Consolidating Concrete
- MIT2 SCAN
- AVA
- Maturity Meters

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## Intelligent Compaction (IC)

- Real Time Measurement of Stiffness
- On-the-fly Adjustment to Machine Parameters
- 100 % Documentation/Reporting of Stiffness (GPS)

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## Old vs. New

Traditional



Intelligent



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## Old vs. New

**Conventional**



**Intelligent**



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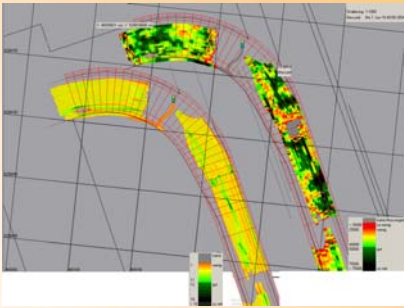
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## Real Time Measurement and Reporting



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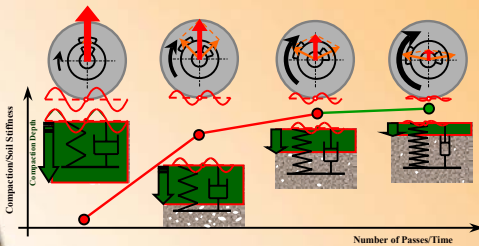
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## On-the-Fly Adjustment

- Compaction with adjustment of Amplitude, Frequency, Speed



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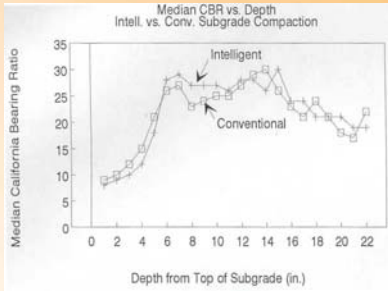
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# Materials & Tests Breakout

## Real Data

US-421 Bypass, Sanford October 2004



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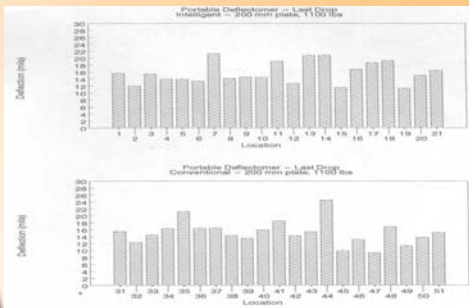
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## More Real Data



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## Possible Benefits

- More consistency in performance related properties
- Measurement and documentation
- Reduce QA tests (Nuclear Testing)
- Performance related specification (Warranties)

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**Challenges**

- Changing mindset from “density” to “modulus”
- How to measure stiffness (QA tests)
- Determining target values
- Revising specification
- Buy in from Contractors

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**ME Pavement Design**

- Mechanistic/Empirical
- New Inputs / New Tests
  - Mr - Soil Resilient Modulus
  - E\* - Asphalt Complex Modulus

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**Soil Resilient Modulus**

- Is sand a good material to build roads with?
- Is Clay?
  - Confining Pressure
  - Moisture

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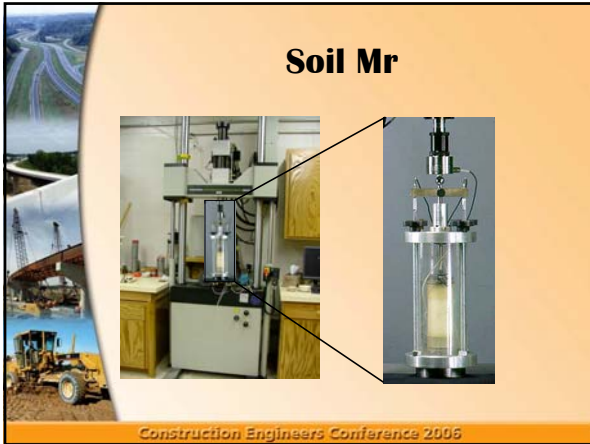
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**Soil Mr**



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**Asphalt Complex Modulus (E\*)**

- How hard is asphalt in the winter?
- How hard is it in the summer?
- Where do you see the most rutting?  
(high speed/low speed)



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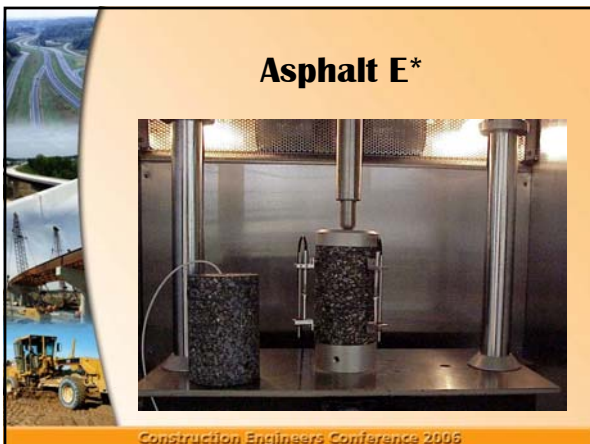
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**Asphalt E\***



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**Asphalt E\***



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**Self Consolidating Concrete (SCC)**

- VERY High Slump (Flow)
- Non-Segregating
- Fills Form Work / Reinforcement
- No Vibration Required
- Non-Standard Mix Proportions
- Viscosity Modifying Admixture

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**Slump Flow**



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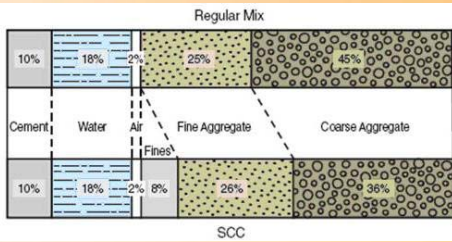
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# Materials & Tests Breakout

## SCC Mix Proportions



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## MIT2 SCAN



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## MIT SCAN

- MIT Scan-2—a nondestructive testing (NDT) device for evaluating dowel or tie bar placement
- The device can be used on fresh concrete and can measure up to 200 joints in an 8-hour shift.

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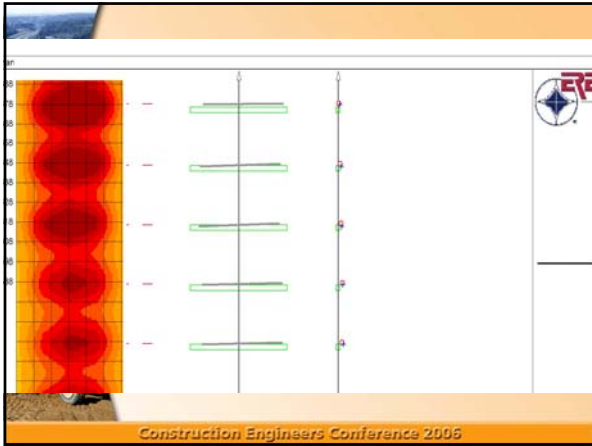
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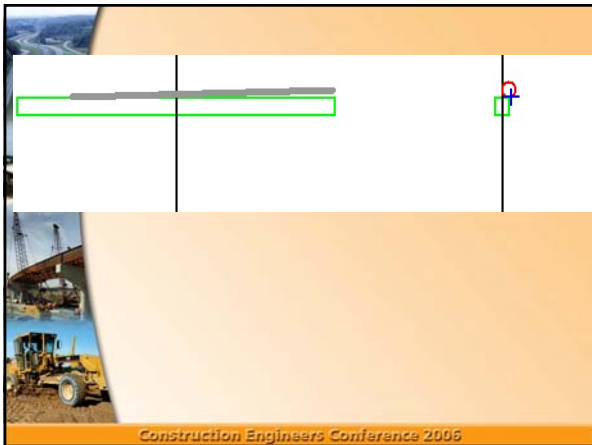
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**AVA**

- Air Void Analyzer

The image shows the Air Void Analyzer (AVA) equipment, which consists of a white base unit and a clear cylindrical test chamber. A close-up view of the test chamber shows a green liquid and a layer of air bubbles at the bottom. The background of the slide includes a photograph of a construction site with a yellow tractor.

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**AVA**

- Freeze-Thaw- leading cause of premature concrete deterioration
- Not confined to northern States
- Freeze-thaw damage may not be noticed until 10-15 years after construction
- Current pressure meter cannot characterize air void spacing

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**AVA**

- Provides timely results for on site adjustments
- Measures air void characteristics not just volume
- Needs a stable environment to run.

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**Maturity Meters**

- "The **STRENGTH** of a given concrete mixture, which has been properly placed, consolidated, and cured, is a function of its **AGE** and **TEMPERATURE** history." N.J. Carino, 1993



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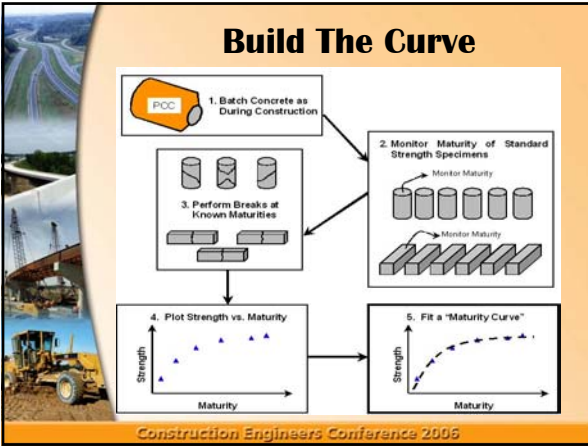
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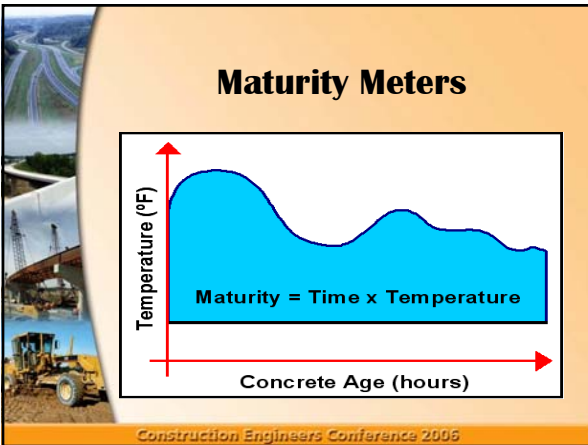
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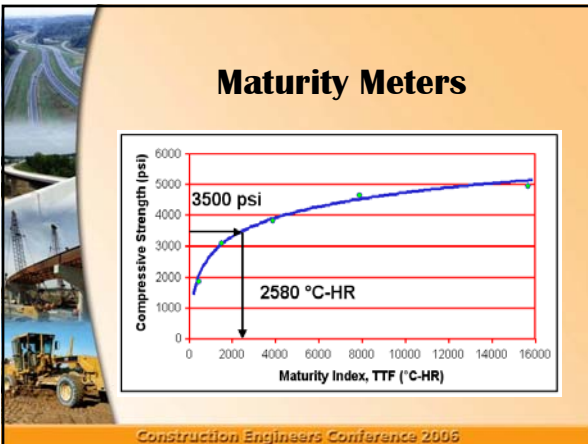
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## Maturity Meters

- IF:
  - Field concrete is the same (materials, mixing, slump, air content, consolidation) as that measured in the laboratory and
  - Adequate curing and moisture are available for hydration.

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## Maturity Can:

- Optimize Timing of Construction Operations
- Formwork/Shoring Removal
- Prestressing/Post-tensioning
- Sawcut Windows
- Opening to Traffic
- Backfilling
- Reduce Number of QC/QA Strength Tests
- Improve Overall QC/QA

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## Buy America Review

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- The Buy America Regulation is set forth in 23 CFR 635.410 and is applicable to all Federal-aid highway projects. The Regulation requires each State to certify the domesticity of steel and iron products permanently incorporated into highway or bridge projects.

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- January 2004 FHWA Division Personnel meet with SCE, Buy America identified for CAR
- Five contracts were selected at random. (4 Resident Engineers)
- Selection based on risk (progress, project cost and contractor)

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### Review Process

- Review of Records at Materials and Tests
  - Review of MRR's entered into HiCAMS
  - Review of Records for Prestested Materials
- Record Review at RE's Office
- Record Review at Contractor's Field Office
- Record Review of one Contractors Regional Office

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# Materials & Tests Breakout



**Review Process - Con't**

- **Items Reviewed**
  - Material Received Reports (MRR's)
  - Bills of Ladings (BOL's)
  - Certifications
  - Requests for Quotes
  - Sub-contract Agreements

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**Findings - Common To All Contracts**

- No formal process in the RE's office to monitor the material certifications for compliance
- RE's offices not correctly interpreting the special provisions
- Contractors not complying with the Project Standard Special Provision for record keeping.

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**Project Standard Special Provision**

- The Contractor and all affected subcontractors shall maintain a separate file for steel products permanently incorporated into this project so that verification of the Contractor's efforts to purchase "domestic" steel and iron products can readily be verified by an authorized representative of the Department or the Federal Highway Administration.

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# Materials & Tests Breakout



**Findings - Common To All Contracts**

- Wrong type of certifications on hand
- No "Statement of Origin" found in the RE's or the Contractor's office
- No step certification process in place to monitor the contract requirements.

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**Recommendations**

- 7 recommendations from 1994 Audit are still valid (See Appendix 1 in handout)
- Reiterate the Buy America requirements to Resident Engineers and Contractors
- Training on identification of certifications types
- Construction Manual Guidance
- Implement the "Step Certification" process
- Conduct routine office reviews \*\*
- Add Buy America to Project Certification Process

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**HiCAMS Issues**

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**HiCAMS Certification Issues**

- 4000 plus samples taken by uncertified technicians since January 1, 2004
- 550 Class B
- 810 Class A
- 754 Class AA
- 251 Drilled Pier
- 473 ABC

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**Represented Quantities**

- Some items are sampled per on a "lot" basis.
  - ABC
  - Class B Concrete
- Some items are sampled on a per placement basis
  - Class A, AA Concrete

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**Sample/FIR Failures**

- Notifications sent via HiCAMS and/or Materials Inspectors
- Need to have disposition comments completed by RE
- Quantities need to equal represented quantity

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# Materials & Tests Breakout



## Materials Payment

- Section 109-5 of Spec Book
- 109-5 A is for materials stored on the project
  - Accumulated costs >\$10,000
  - Inspected and Approved
- 105-5 B is for materials stored at off site location
  - Bulky, fabrication, durable, and represent a significant portion of the project cost

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## Materials Payment

- 109-5 C Documentation
  - Written Consent of Surety
  - Bill of Sale from Contractor to Department
  - Copy of invoice from supplier verifying cost of material

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## Project Certifications

- Start early
- Utilize “Contract Tracking - Audit Materials Report”
- SMS Office Reviews
- Training is Available

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