Types of Specifications

- METHOD
- END RESULT
- QC/QA – Statistically Based
- PERFORMANCE
  - Warranty
  - Performance Related
QUALITY CONTROL

- Activities that have to do with making the Quality of a product what it should be
QUALITY ASSURANCE

- Activities that have to do with making sure that the Quality of a product is what it should be
Quality Control

- **Materials**
- Personnel Qualifications
- Quality Control Plans
- Trial Batch
Materials - PCCP

- Approved Materials List
  - Materials
  - Sources
- Material Certifications
- Verification Samples
Cement

- Approved list
  - Quality Control Plan
  - Monthly summary of mill test data
- Verification Testing
Cement

- Approved List
- Shall be stored and protected against dampness
- Different kinds or brands, or cement of the same brand from different mills shall not be mixed
Cement

- Blended cements may only be used between April 1 and October 15 of the same calendar year.
- Time period restriction does not apply if traffic is not anticipated.
- If Type IP, Type IS or Type IS-A are used, the minimum portland cement content is increased to 500 lb/ yd$^3$. 

[Image of Portland Cement Type I]
Mineral Admixtures

- Ground Granulated Blast Furnace Slag
- Fly Ash
Ground Granulated Blast Furnace Slag

- Developed in a molten condition simultaneously with iron in a blast furnace
  - Increases long-term strength
  - Lowers permeability
  - Improves sulfate resistance
  - Lowers heat of hydration
  - Reduces potential alkali-silica reaction
  - Improves workability
GGBFS

- Minimum portland cement/GGBFS ratio = 2.3 by weight
- May only be used between April 1 and October 15 of the same calendar year
- May not be used when blended portland cements are used
Fly Ash

- Finely divided residue that results from combustion of ground or powdered coal
  - Enhances workability
  - Lowers permeability
  - Lowers water demand
  - Slightly enhances long term strength
  - Reduces the heat of hydration
  - Retards setting time
  - Delays strength gain
Fly Ash

- Approved List
- Class C and Class F
- Different sources or types may not be mixed or used alternately unless approved in writing
Fly Ash

- Minimum portland cement/fly ash ratio = 3.2 by weight
- May only be used between April 1 and October 15 of the same calendar year
- May not be used when blended portland cements are used
Chemical Admixtures

- Air Entraining Admixtures
- Water Reducing Admixtures
- Retarding Admixtures
- Accelerating Admixtures
Chemical Admixtures

- Approved List
  - Material Certification indicating compliance to required specification
  - Annual Certificate of Compliance
  - One verification sample per year per manufacturer
Aggregates

- Class AP aggregate
- Natural sand
- Coarse Aggregate
  - Limestone or Dolomite
  - Blast Furnace Slag
  - Gravel
Coarse Aggregates

- Size No. 8
- Quality Assurance size
- 100% passing 1 in. sieve
Certified Aggregate Producer Program

- Replaced Stockpile Approval
- Stockpiles Accepted based on Producer’s Tests
- INDOT Audits
Stockpiling
Loading Out
Loading Out
In-Line Sampling
Testing

- Production
  - Gradation
  - CAA
  - Deleterious
- Load - Out
  - Gradation
  - Decant
- Control Charts
Control Charts

SOURCE #2001 - #8 STANDARD SPEC.

1/2 in. CRITICAL SIEVE

TEST VALUE

55.2 52.6 56.2 59.2 53.2 54.6 48.6 51.6 49.5 44.2 45.7

05/22 05/27 05/27 05/27 05/28 05/29 06/01 06/02 06/02

SAMPLE DATE
Fine Aggregates

- Fine Sand – No. 50 and No. 100
  - Workability
  - Surface Texture
  - Bleeding
  - Fineness Modulus
  - Higher the Number the Coarser the Aggregate
Coarse Aggregates

- Size No. 8 or QA
- Coarser
  - Less water
  - Less cement
- Angularity
  - Surface area – water
  - Interlock – strength
- Surface Texture
  - Rough – stronger bond for the cement
Class AP Coarse Aggregates
ITM 210
Class AP Aggregates
Reinforcing Bar and Dowel Bar Certification Program – ITM 301

- Coater - Concrete Reinforcing Steel Institute (CRSI) Certified
- Manufacturer
  - Compliance to specification requirements for heats
  - Satisfactory testing with INDOT
  - Satisfactory verification testing
Reinforcing Bar and Dowel Bar Certification Program – ITM 301

- Acceptance – Bars
  - Type B Certification provided by manufacturer
- Acceptance – Coating
  - Type A Certification for coating thickness and adhesion tests
  - Type C Certification to identify coating material and state that the coating is from the Approved List of Epoxy Coatings for Steel
Central Mix Plant

- Plant Inspection - ITM 405
- Procedures for storage and sampling of aggregates, cement, pozzolans, and admixtures
- Inspection of scales and meters
Certified Ready Mixed Concrete Plant Program

- NRMCA Plant Certification
- 2 Year cycle for inspection of plant
- Voluntary program
- More frequent scale calibrations
- INDOT still does inspection
Certified Ready Mixed Concrete Plant Program

- Delivery trucks included
- 14 month cycle for inspection
Approved Materials Lists

- Materials
- Sources

INDOT - Approved Materials List

If you have any questions or require additional information about an item on any list below, please e-mail them by selecting the author. Questions or additional information about the contents of this page, please e-mail Kenny Anderson, Materials Services Engineer or call 317-610-7251 ext. 203.

<table>
<thead>
<tr>
<th>List Name</th>
<th>Specification/ITM</th>
<th>Contact Person</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-Adhesive Materials</td>
<td>409.03(b)</td>
<td>Harley Phillips</td>
</tr>
<tr>
<td>Cable Barrier Systems</td>
<td>SP 627-R-546</td>
<td>Yudu Shah</td>
</tr>
<tr>
<td>Cellular Concrete Fill Concentrate Manufacturers</td>
<td>216</td>
<td>Nayar Siddiki</td>
</tr>
<tr>
<td>Cement Sources</td>
<td>901.01(b)2d</td>
<td>Tony Zander</td>
</tr>
<tr>
<td>Certified Aggregate Producers</td>
<td>917 &amp; ITM 211</td>
<td>Robert Rees</td>
</tr>
<tr>
<td>Certified Guardrail Suppliers</td>
<td>910.12</td>
<td>Kenny Anderson</td>
</tr>
<tr>
<td>Certified Hot Mix Asphalt Producers</td>
<td>ITM 583</td>
<td>Mike Prather</td>
</tr>
<tr>
<td>Certified Precast Concrete Producers</td>
<td>ITM 813</td>
<td>Tony Zander</td>
</tr>
<tr>
<td>Certified Ready Mixed Concrete Plants</td>
<td>ITM406</td>
<td>Tony Zander</td>
</tr>
<tr>
<td>Certified Reinforcing Bar Epoxy Coaters</td>
<td>910.01(b)9 &amp; ITM 301</td>
<td>Kenny Anderson</td>
</tr>
<tr>
<td>Certified Uncoated Reinforcing Bar Manufacturers</td>
<td>910.01 &amp; ITM 301</td>
<td>Kenny Anderson</td>
</tr>
<tr>
<td>Chemical Anchor Systems</td>
<td>901.05</td>
<td>Tony Zander</td>
</tr>
<tr>
<td>Coating Formulations</td>
<td>909.02</td>
<td>Todd Tracy</td>
</tr>
<tr>
<td>Delineators</td>
<td>926.02(a) &amp; (c)</td>
<td>Ting Nahrwold</td>
</tr>
<tr>
<td>Detectable Warning Elements</td>
<td>905.05</td>
<td>Tony Zander</td>
</tr>
<tr>
<td>Epoxy Coating for Steel</td>
<td>910.01(b)9 &amp; 915.01(d)</td>
<td>Kenny Anderson</td>
</tr>
<tr>
<td>Geogrids</td>
<td>913.21</td>
<td>Som Hiremath</td>
</tr>
<tr>
<td>Geotextiles Used With Riprap And Underdrains</td>
<td>913.18 &amp; 913.19</td>
<td>Som Hiremath</td>
</tr>
<tr>
<td>Guardrail End Treatments</td>
<td>601.07</td>
<td>Yudu Shah</td>
</tr>
<tr>
<td>Impact Attenuators</td>
<td>601.07.1</td>
<td>Yudu Shah</td>
</tr>
<tr>
<td>Joint Sealants</td>
<td>906.02(a)1</td>
<td>Tony Zander</td>
</tr>
<tr>
<td>Latex Modifiers</td>
<td>912.04</td>
<td>Tony Zander</td>
</tr>
<tr>
<td>Manhole Steps</td>
<td>907.04</td>
<td>Tony Zander</td>
</tr>
<tr>
<td>Non-Vapor Barrier Type Bonding Agents</td>
<td>506.02</td>
<td>Tony Zander</td>
</tr>
<tr>
<td>PCC Admixtures and Admixture Systems</td>
<td>912.03</td>
<td>Tony Zander</td>
</tr>
<tr>
<td>PCC Curing-Sealing Materials</td>
<td>702.22 &amp; 912.02</td>
<td>Tony Zander</td>
</tr>
<tr>
<td>PCC Sealer/Healers</td>
<td>722.10</td>
<td>Tony Zander</td>
</tr>
<tr>
<td>Performance-Graded Asphalt Binder Suppliers</td>
<td>902.01(a) &amp; ITM 581</td>
<td>Mike Prather</td>
</tr>
<tr>
<td>Plastic Delineator Posts</td>
<td>926.01</td>
<td>Ting Nahrwold</td>
</tr>
<tr>
<td>Plastic Pipe and Pipe Liner Sources</td>
<td>907.16 thru 907.25</td>
<td>Kenny Anderson</td>
</tr>
<tr>
<td>Polish Resistant Aggregate Sources</td>
<td>904.03(b) &amp; ITM 214</td>
<td>Robert Rees</td>
</tr>
<tr>
<td>Pozzolan Sources</td>
<td>901.02, 901.03, &amp; 901.04</td>
<td>Tony Zander</td>
</tr>
<tr>
<td>Proprietary Portland Cement Concrete Sealers</td>
<td>909.10</td>
<td>Tony Zander</td>
</tr>
<tr>
<td>Rapid Setting Patch Materials</td>
<td>901.07</td>
<td>Tony Zander</td>
</tr>
<tr>
<td>Recycled Foundry Sand</td>
<td>SP200-R-401</td>
<td>Nayar Siddiki</td>
</tr>
</tbody>
</table>
Approved Materials Lists

- **Materials**
  - Class AP Aggregates
  - Joint Sealants
  - PCC Admixtures and Admixture Systems
  - Chemical Anchor Systems

- **Sources**
  - Cement
  - Reinforcing Bar Epoxy Coaters
  - Uncoated Reinforcing Bar
  - Ready Mixed Concrete Plants
  - Certified Aggregate Producers
Material Certifications - 916

- **Type A**
  - Manufacturer
  - Copy of lab report
  - Certify materials meet specifications

- **Type B**
  - Manufacturer
  - Applicable specifications
  - Indicate limits of test values
  - Certify materials meet specifications

- **Type C**
  - Manufacturer
  - Applicable specifications
  - Certify materials meet specifications

INDIANA DEPARTMENT OF TRANSPORTATION
TYPE A CERTIFICATION OF COMPLIANCE

CONTRACTOR NUMBER

PROJECT NUMBER

CONTRACTOR’S NAME

MANUFACTURER’S NAME

B/L or INVOICE NUMBER

MATERIAL DESTINATION

This is to certify that for the contract described above, the materials supplied are as follows:

<table>
<thead>
<tr>
<th>Material Name</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Material Name**

<table>
<thead>
<tr>
<th><strong>Conform to:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

The materials listed above comply with the following Test Methods and are within the acceptable limits of said Test Methods:

<table>
<thead>
<tr>
<th>TEST METHOD</th>
<th>LIMITS OF TEST VALUE</th>
<th>ACTUAL TEST RESULTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Date

Company of Manufacture

*Signature of Company Official/Title

* This Certification shall be prepared by the manufacturer of the material being supplied for this contract.
** Identifying information such as Alloy, Grade, Type, Class, or other similar designation shall also be shown when appropriate.
*** Applicable material specification reference shall be listed.
Verification Samples

- Frequency Manual
  - Cement
  - Fly Ash
  - Concrete Admixtures
  - Curing Materials
  - Reinforcing Steel
  - Hydrated lime
  - Geotextiles
Quality Control

- Materials
- Personnel Qualifications
- Quality Control Plans
- Trial Batch
Personnel Qualifications

- Qualified Technicians
  - Soils
  - Aggregates
  - Concrete

- Aggregate Producers
  - Certified Aggregate Technicians

- Contractor Personnel
  - ACI Certified Concrete Field Testing Technician, Level 1
  - Certified PCCP Field Supervisor
Qualified Technicians

- **Requirements**
  - Written examination on test procedure
  - Proficiency by Independent Assurance Technician
  - Proficiency required once per year
  - If no proficiency within three years, the written exam is required again
Qualified Technicians - Soils

- AASHTO T 191 – Density by Sand Cone
- AASHTO T 255 – Moisture Content of Aggregate
- AASHTO T 310 – Density by Nuclear Gauge
- ASTM D 6951 – Stiffness by DCP
- ITM 506 – Field Moisture Content
- ITM 508 – Stiffness by LWD
Qualified Technicians - PCCP

- AASHTO T 23 – Making and Curing Test Specimens in the Field
- AASHTO T 97 – Flexural Strength
- AASHTO T 119 – Slump
- AASHTO T 152 – Air Content by Pressure Method
- ASTM C 173 – Air Content by Volumetric
- ITM 403 – W/C Ratio
Qualified Technicians - Smoothness

- ITM 912 -- Profilographs
Certified PCCP Field Supervisor

- Contractor Paving Superintendents
  - QCP Field Manager (ITM 803) - responsible for execution of the QCP and liaison with Engineer

- May be Field Manager for multiple contracts
Quality Control

- Materials
- Personnel Qualifications
- Quality Control Plans
- Trial Batch
QUALITY CONTROL PLANS

- QCP – A detailed description of the type and frequency of inspection, sampling, and testing deemed necessary to measure and control the various properties of the material
General Requirements

- QCP shall be site specific
- Shall state how the Contractor proposes to control the materials, equipment, and operations on the contract
- Shall be signed and dated by Contractor’s representative at time of submittal (15 days prior to PCCP paving operations)
- Department reviews, signs and dates the QCP
General Requirements

- QCP shall be maintained to reflect current status of operations
- Revisions provided in writing prior to initiating change
Quality Control Plan

- Sampling Methods
- Testing Methods
- Calibration of Equipment
- Construction Control
- Monitoring of Quality
- Anticipated Frequencies of Quality Control
Testing Facility

- Location
- Controlled Curing Environment – AASHTO T 23
- Sufficient Storage Tanks w/curing solution for production control and acceptance test beams
Testing Equipment

- List of testing equipment
- Test methods
- Frequency of testing
- In accordance with applicable AASHTO requirements
- Spud vibrator
## Testing Equipment Calibration/Verification

<table>
<thead>
<tr>
<th>Equipment</th>
<th>Requirement</th>
<th>Minimum Frequency</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Air Meter</td>
<td>Calibration</td>
<td>3 months</td>
<td>AASHTO T 152 or ASTM C 173</td>
</tr>
<tr>
<td>Balances</td>
<td>Verification</td>
<td>12 months</td>
<td>ITM 910</td>
</tr>
<tr>
<td>Sieves</td>
<td>Check Physical Condition</td>
<td>6 months</td>
<td>ITM 902</td>
</tr>
<tr>
<td>Slump Cones</td>
<td>Verify Dimensions</td>
<td>12 months</td>
<td>ITM 911</td>
</tr>
<tr>
<td>Thermometers</td>
<td>Verification</td>
<td>6 months</td>
<td>ITM 909</td>
</tr>
<tr>
<td>Unit Weight Measure</td>
<td>Calibration</td>
<td>12 months</td>
<td>AASHTO T 121</td>
</tr>
</tbody>
</table>
Materials – Source, transportation, handling, and storage procedures

- Admixtures
- Aggregates
- Curing materials
- Dowel bars
- Dowel bar assemblies
- Fly ash
- GGBFS

- Joint fillers
- Joint materials
- Portland cement
- Reinforcing steel
- Water- if non-potable, sampling and testing procedures
Process Control of Aggregates

- Plan for control of gradation and moisture in aggregate stockpiles
Process Control of Concrete

- Procedures for sampling and testing concrete for flexural strength, air content, unit weight, and w/c ratio
Stockpile Identification
Stockpile Construction
Loading Procedures
Gradation Control Band

USL

Permissible Range For Gradation

LSL

Tolerances on each sieve of aggregates not in accordance with 904
Gradation Control

- Gradation tests for each aggregate size conducted daily when paving operations exceed 200 yd$^2$ per day
- Procedure for determining combined gradation included
Process Control of Aggregates

- Procedure for determining water absorption
- Minimum frequency is required to be two tests for each aggregate size used during paving operations
Trial Batch Demonstration

- Procedures, location and type of equipment
- Identification and intended use of each mixture
Concrete Batching

- Techniques and controls of batching operations
Plant Description

- Capacity
- Batch size
- Methods and sequence by which plant produces a batch
- Minimum mixing time
Equipment Checks

- Mixers
- Scales
- Water meters
- Admixture dispensers
- Frequencies of meter checks
- Methods to monitor ingredients
- Record of each batch
Quality Control Technicians
PCCP

- Quality control tests
  - Gradation of aggregates
  - Flexural strength
  - Air content
  - Unit Weight
  - W/C ratio
  - Surface smoothness
  - Control charts
Lots and Sublots - PCCP

- Lots -- 7200 syd
- Sublots -- 2400 syd
Flexural Strength

- One set of beams for each subplot
Air Content

- One air content determination for each subplot
Process Control of Concrete

- One unit weight determination for each sublot
Water/Cementitious Ratio

- One w/c determination per week or one for every 5 sublots, whichever is more restrictive by frequency

<table>
<thead>
<tr>
<th>Row</th>
<th>Procedure</th>
<th>Method</th>
<th>1</th>
<th>2</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Weight (max.) original sample &amp; pan, lbs (kg)</td>
<td>Weigh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Weight (max.) dry sample &amp; pan, lbs (kg)</td>
<td>Weigh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Weight (max.) of water in sample, lbs (kg)</td>
<td>A-B</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Weight (max.) of pan, lbs (kg)</td>
<td>Weigh</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Weight (max.) of dry sample, lbs (kg)</td>
<td>B-D</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Percent moisture (%)</td>
<td>(C/E) 100</td>
<td></td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>Percent absorption (%)</td>
<td>CMD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>H</td>
<td>Weight (max.) wet aggregate in batch, lbs (kg)</td>
<td>Batch Ticket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>I</td>
<td>Weight (max.) dry aggregate in batch, lbs (kg)</td>
<td>H/(L.0+P/100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>Weight (max.) water in aggregate in batch, lbs (kg)</td>
<td>H-I</td>
<td></td>
<td></td>
</tr>
<tr>
<td>K</td>
<td>Weight (max.) water absorption in batch, lbs (kg)</td>
<td>I(G/100)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>L</td>
<td>Total weight (max.) water in aggregate, lbs (kg)</td>
<td>J1+J2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>Total weight (max.) water absorbed, lbs (kg)</td>
<td>K1+</td>
<td></td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>Total water added to batch, lbs (kg)</td>
<td>Batch Ticket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O</td>
<td>Total free water in batch, lbs (kg)</td>
<td>N+L-M</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P</td>
<td>Weight (max.) cement in batch, lbs (kg)</td>
<td>Batch ticket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q</td>
<td>Total weight (max.) pozzolanic in batch, lbs (kg)</td>
<td>Batch ticket</td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>Total weight (max.) cementitious in batch, lbs (kg)</td>
<td>P+Q</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S</td>
<td>Water-cementitious ratio</td>
<td>O/R</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Concrete Discharge (Effective 09/01/11)

- Watertight cover shall be used for truck agitator and non-agitating equipment
- Concrete shall be incorporated into paving equipment within 15 minutes
Concrete Discharge (Effective 09/01/11)

- Concrete temperature $\geq 90^\circ$F -- discharge from non-agitating equipment within 30 min. of mixing water, cement & aggregates
- Concrete temperature $< 90^\circ$F -- 45 min.
- Concrete temperature -- AASHTO T 309 at point of delivery
Process Control of Pavement

- Procedures for determining pavement depth, surface profile and surface smoothness
- Correcting profile non-compliance shall be included
Process Control of Pavement

- Procedures for measuring smoothness and correcting non-compliance
- Certification of profilograph included (ITM 901)
Control Charts

- Flexural strength, unit weight, and air content
- Process control limits, 100% payment limits, and have a legend
Response to Test Results

- Procedure for corrective action for results outside of satisfactory limits for each type of test
Response to Test Results

- Water absorption – Differs from mix design by more than 0.5%
- Production shall be discontinued when tolerance exceeded
Concrete Hauling

- Equipment and methods of delivery
- Plan drawing of traffic patterns in vicinity of plant and for delivery of concrete to site of work
Concrete Hauling

- Temporary adjustments to traffic control
- Transit mixers – procedures for adding water to concrete and required mixing time
Paving Plan

- General sequence of construction, widths and methods of placement for all areas
- Planned date for paving to begin and end for each phase
Cold Weather Paving

- Procedures used when ambient temperature < 35°F
- Protection of subgrade, treatment of concrete components, and protection of PCCP
- ACI 306 used for additional guidance
Night Paving

- Procedures for using artificial lighting to include number and type of units
Paving techniques for difficult locations such as joining existing pavement, gaps, headers, crossovers, approaches, or tapers.
Equipment

- Identification of equipment used in paving operations on each phase
Methods to control alignment and profile
Placement and Consolidation

- Methods of depositing concrete from hauling equipment to the grade
Placement and Consolidation

- Methods of spreading and consolidating concrete
Joints

- Type of sealant and manufacturer’s recommended installation procedure
- Measures to prevent flow of cementitious material into sawn joints
D-1 Contraction Joint

- Procedure for identifying contract conditions so that joints are continuous from edge of pavement to edge of pavement
- Methods of installation, alignment, timing of sawing, and protection
Longitudinal Joints

- Method of construction
- Details of how reinforcing steel is placed
- When joints are to be sawed
Transverse Construction

- Methods of construction
- Details of types of header and reinforcing used when paving is suspended
Longitudinal Construction

- Methods of construction
- Proposed spacing if other than shown on plans
Finishing Concrete

- Methods of finishing
- Equipment identified
Texturing Concrete

- Methods of texturing
- Equipment identified
Curing Concrete

- Methods of curing
- Equipment identified
Documentation

- Quality Control Tests – results for aggregate tests, mixture tests and the profile, smoothness and depth of pavement tests
- Maintained for three years by electronic or hard copy and accessible by INDOT
Quality Control

- Materials
- Personnel Qualifications
- Quality Control Plans
- Trial Batch
Purpose of Trial Batch

- Validate Concrete Properties
- Quality Control and Acceptance Testing Comparison
- Baseline Properties of Concrete Mix Design
- Confirm Targets for Unit Weight and W/C
- View Plant Process to Understand Quality Control Needs
Quality Assurance - CMDS
Concrete Trial Batch

- **Air Content** -- 5.0% - 10.0%
- **Plastic Unit weight** -- ± 3.0% of CMDS
- **W/C ratio** -- ± 0.030% of target value of CMDS and shall not exceed 0.450
- **Flexural strength** -- minimum of 570 psi

<table>
<thead>
<tr>
<th>Volume (ft³)</th>
<th>One yd³ Materials</th>
<th>Weight (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Air</td>
<td>I 0 O</td>
</tr>
<tr>
<td>B</td>
<td>Cement</td>
<td>J 507.6 P 508</td>
</tr>
<tr>
<td>C</td>
<td>Fly Ash</td>
<td>K 70.5 Q 71</td>
</tr>
<tr>
<td>D</td>
<td>Water</td>
<td>L 307.5 T(29gal)24</td>
</tr>
<tr>
<td>Paste (E)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aggregate (F)</td>
<td></td>
<td>17.282</td>
</tr>
<tr>
<td>G</td>
<td>Fine Aggregate</td>
<td>M 1073.6 R 1115</td>
</tr>
<tr>
<td>H</td>
<td>Coarse Aggregate</td>
<td>N 1785.2 S 1810</td>
</tr>
<tr>
<td>Total (E + F)</td>
<td></td>
<td>27.0</td>
</tr>
</tbody>
</table>
- Submitted to DTE upon completion of Trial Batch
- Minimum of 3 work days prior to production
- Production shall not start without approved CMDP

<table>
<thead>
<tr>
<th>Volume (ft³)</th>
<th>One yd³ Materials</th>
<th>Weight (lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SSD</td>
<td>Batch</td>
</tr>
<tr>
<td>A</td>
<td>1.755 Air</td>
<td>I 0 O</td>
</tr>
<tr>
<td>B</td>
<td>2.582 Cement</td>
<td>J 507.6 P 508</td>
</tr>
<tr>
<td>C</td>
<td>0.452 Fly Ash</td>
<td>K 70.5 Q 71</td>
</tr>
<tr>
<td>D</td>
<td>4.929 Water</td>
<td>L 307.5 T(29gal)24 2</td>
</tr>
<tr>
<td>Paste (E)</td>
<td>9.718</td>
<td></td>
</tr>
<tr>
<td>Aggregate (F)</td>
<td>17.282</td>
<td></td>
</tr>
<tr>
<td>G</td>
<td>6.567 Fine Aggregate</td>
<td>M 1073.6 R 1115</td>
</tr>
<tr>
<td>H</td>
<td>10.715 Coarse Aggregate</td>
<td>N 1785.2 S 1810</td>
</tr>
<tr>
<td>Total (E + F)</td>
<td>27.0</td>
<td></td>
</tr>
</tbody>
</table>
Intelligent Compaction - Soils

- Quality Control – optimize rolling patterns to reduce rollers
- Increase production rate
- Stiffness chart of entire lift rather than one random location
- Possibly reduce INDOT Acceptance testing
Dynamic Cone Penetrometer (DCP) RSP 203-R-562

- Continue to obtain data on different soils types
- JTRP Study – determine number of blows for each type soil and classify soils into 3 or 4 categories
Light Weight Deflectometer (LWD)

- Stiffness on compacted aggregate used as the separation layer instead of nuclear gauge and for chemically modified soils
Partial payment for delivered costs of dowel bar assemblies stored within project limits, at a storage facility adjacent to the project site, or at a location approved by the Engineer.
Dowel Bar Protection

- No time restriction for exposure of dowel bar assemblies. Sample may be obtained if there is suspect that there is ultraviolet damage.
- Shall be free of dirt, loose rust, or scale at time of placement.
- Tie wires are not required to be cut.
- Tie wires shall be size W 7.5 (7 mm) or smaller and there shall be a maximum of 5 tie wires for each assembly.
Recycled Concrete as Concrete (RCA)

Hydraulic Fracture Testing would be needed to shorten the required time for AP Testing
Recycled Concrete as Concrete (RCA)

- Project in 2012 that will incorporate 30 – 50 % RCA
Internally Cured Concrete

- Highly saturated lightweight fine aggregate
- Absorbed water provides internal moisture that is slowly released to hydrating cement
- Intended to inhibit shrinkage and early age cracking of bridge deck