

# Material QA Procedures for Concrete Mix Production

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MDOT Metro Region C&T

## Topics of Discussion

- Material Transparency
- Adherence to QC Plan/Stockpile Management plan
- Tracking of Aggregate Quantities
- Sampling & Testing
- Corrective Action

## Job Mix Formula

- Submit JMF 10 days prior to production
- Pre-qualified Aggregates and Certified Cements
- Qualified Admixtures
- Materials must represent JMF
- Re-submit mix design if different materials to be used at any time

## Adherence to QC Plan

- Aggregate & cement tickets available upon request
- QC aggregate reports available for any days production
- Proper Stockpile Management
- Corrective Action

**STONECO** SOUTH KENT GRAVEL MDOT Pit # 03-093  
3700 PATTERSON RD.  
MIDDLEVILLE, MI 49333  
(269) 216-7944

Ticket #: **77004243**

**Signed Statement** → I hereby certify that Aggregate as delivered meets specification requirements for stated Michigan series and class in quantity stated:  
*[Signature]*

Date: 8/10/2017 Time In: 6:58 am Time Out: 7:17 am  
Location: SOUTH KENT GRAVEL MDOT Pit # 03-093  
Customer: 15185 L & D CAREY & SONS TRUCKING, CO.  
Order: Q298923 P17 M-66 SHERIDAN AND STANTON (1707-040)  
P.O.: MDOT# 59051-200264-2  
Product: 2121 MDOT 21AA 53.26 TON Weighmaster: JWS Clerk  
Today: 53.26 Loads: 1

|       | Pounds | Tons  | Metric |
|-------|--------|-------|--------|
| Gross | 158680 | 79.34 | 71.98  |
| Tare  | 52180  | 26.08 | 23.66  |
| Net   | 106520 | 53.26 | 48.32  |

1707-040

- Aggregate tickets must be signed if prequalified
- Aggregate tickets not signed are not considered to be prequalified
- Cement delivery tickets must state that they are certified and meet specification

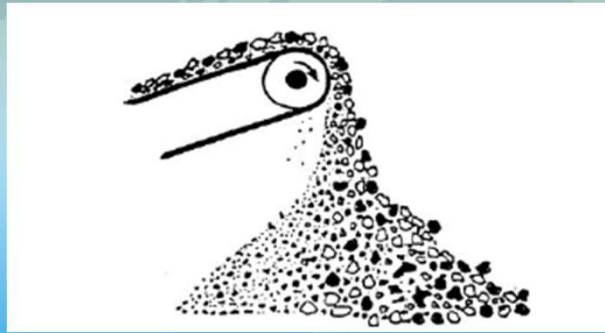
## Stockpile Management

- Materials Separated and Clearly Identified
- Cross Pile Segregation/Contamination
- Aggregates preconditioned (Min SSD)
- Well defined shipping/loading face

## Good Stockpile Management



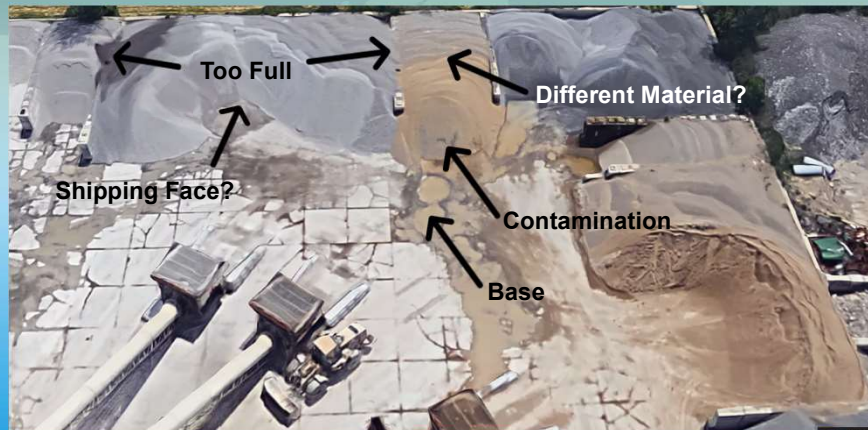
## Segregation

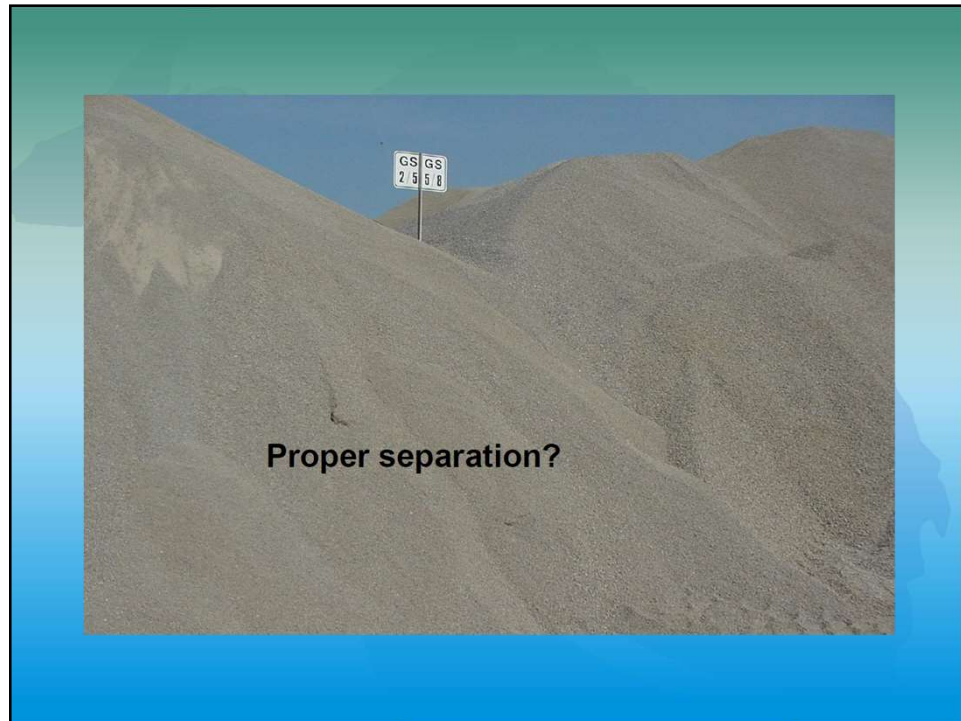


## Good Stockpile Management



## Good Stockpile Management?





- Handling
  - Plant & Loader Operator should be able to identify material when requested
  - Proper training to Loader Operator
    - Keep bucket low but don't scrape base
  - Contamination
    - Oversized aggregate
    - Clay or sand from ground
    - Other foreign material tracked into stockpile

# Sampling

- Mini Stockpile
  - Preferred method
  - 3 locations across shipping face
  - Mix and back blade

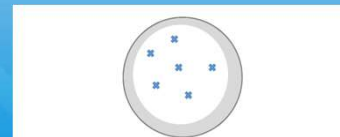
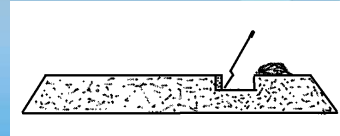
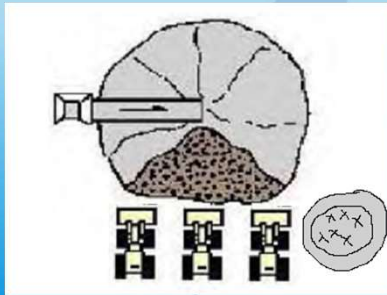


Figure 8: Top View Sample Pattern "Mini" Stockpile after Back Blading

## SAMPLING TOOLS

Some common field sampling tools are:



Figure 2: Canvas Bags, Plastic or Steel Pails capable of holding approximately 60 pounds



Figure 3: Square Point Shovels (Round Point Shovels are not allowed)



Figure 4: Square Nosed Scoops

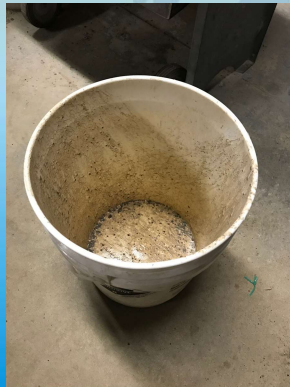


Figure 5: A Sample Thief made from 1 1/2 to 2 inch diameter by approximately 30 inches long thin wall electrical conduit to sample fine aggregates (sand) only



Figure 6: 5 foot T-handle Bucket Auger made from thick walled galvanized iron pipe with blades welded on either a 3 or 4 inch outside diameter foot long thin walled pipe

- Canvas bags preferred container
  - Aggregate must be in SSD or slightly below for testing
  - Variations in L.B.W.



## QA Sampling Frequencies

- Non-Optimized (pre-qualified)
  - Once per material every 10,000 tons
- Optimized for On-Site Batch Plant
  - Once per 5000 tons based on coarse aggregate
- Optimized for Commercial Batch Plant
  - Every 2000 cyd of concrete mix produced
  - Tracked by weekly submittal of 1155
- Non-prequalified
  - Once per 1000 tons prior to use

Michigan Department of Transportation  
1105 (12/17)

**WEEKLY SUMMARY OF CERTIFIED CONCRETE FROM  
COMMERCIAL CENTRAL MIX AND TRANSIT MIX PLANTS** FILE #004

\* If other than MODOT design is used, supply adequate information so that the actual mix design used can be found.  
For an analysis report to the Region Office, attention Region Materials Supervisor, on the Monday of the week following the production week covered by this report. The RMS will forward a copy to the Construction Engineer.

PROJECT: ABC Concrete  
LOCATION: 38414 Mount Road  
REPORT NO: Z-103  
DATE: 07/01/18 TO: 07/07/18  
PAGE: 1 OF 1

| MONTH<br>DAY | CONTROL SECTION<br>JOB NO. | PROJECT ENGINEER | GRADE OF<br>CONCRETE | CURB<br>THICKNESS | COMB<br>TYPE | * MODOT<br>MIX DESIGN NO. |
|--------------|----------------------------|------------------|----------------------|-------------------|--------------|---------------------------|
| 7/2/18       | 63112-116372               | C. Smith         | P1M                  | 18                | 1            | PCCP1005                  |
| 7/2/18       | 63114-60319                | B. Baker         | S2M                  | 30                | 1            | PCCS2006                  |
| 7/3/18       | 63115-116372               | C. Smith         | P1M                  | 95                | 1            | PCCP1005                  |
| 7/3/18       | 63114-60319                | B. Baker         | S2M                  | 40                | 1            | PCCS2006                  |

| MATERIALS      |        |            | TYPE OF ACCEPTANCE<br>(Certified Source of Tested Material) |  |           |
|----------------|--------|------------|-------------------------------------------------------------|--|-----------|
| TYPE           | SOURCE |            |                                                             |  |           |
| CEMENT         | I      | St. Mary's |                                                             |  | Certified |
| FLY ASH        | F      | Roadworks  |                                                             |  | Certified |
| SLAG<br>CEMENT |        |            |                                                             |  |           |

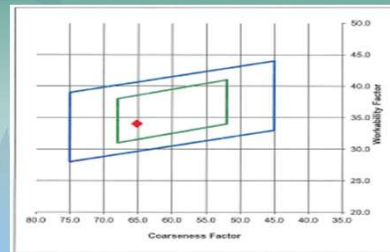
| AGG.   | CLASS | SOURCE       | PIT NO. | TYPE OF MATERIAL ACCEPTANCE |      |                |
|--------|-------|--------------|---------|-----------------------------|------|----------------|
|        |       |              |         | TESTED                      | USED | REMAINING QTY. |
| COARSE | 6AA   | Prosser Isle | 71-47   |                             |      |                |
| COARSE | 6AA   | Lyny         | 83-19   |                             |      |                |
| COARSE |       |              |         |                             |      |                |
| FINE   | 2N5   | Orange Hill  | 63-092  |                             |      |                |

It is hereby certified that the above listed concrete meets the specification requirements of the Michigan Department of Transportation and that all materials used in the mixture were from approved sources, tested and/or certified for use in accordance with MODOT procedures and conform to specification requirements.

COUNTY: ABC Concrete  
CUSTOMER REPRESENTATIVE (Signature): Vince D'Amore  
ADDRESS: 38414 Mount Road, Sterling Heights, MI  
PHONE NO: (586) 619-0334  
DATE: 07/07/18

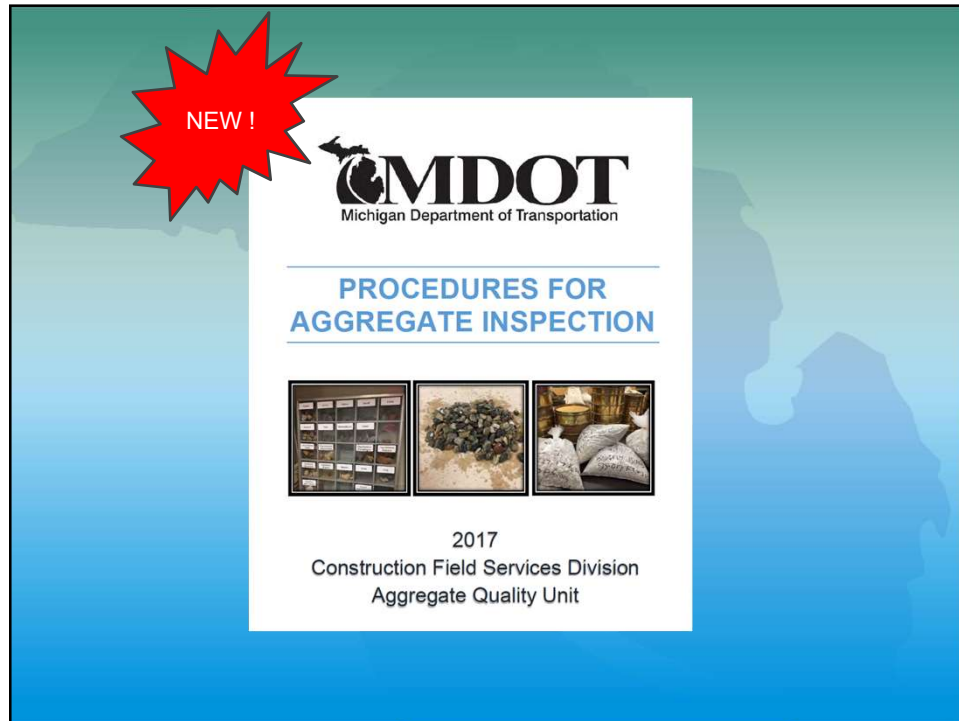
## Acceptance Criteria

- For Optimized Mix Gradations
  - Verify Loss by Wash
  - Verify the ability for the aggregates to be optimized
- Non-Optimized
  - Loss by wash
  - Gradation requirements based on specification class



| Table 902.1<br>Grading Requirements for Coarse Aggregates, Dense-Graded Aggregates, and Open-Graded Aggregates |        |                                                   |                                                     |        |           |       |         |         |                                       |        |                                     |         |
|----------------------------------------------------------------------------------------------------------------|--------|---------------------------------------------------|-----------------------------------------------------|--------|-----------|-------|---------|---------|---------------------------------------|--------|-------------------------------------|---------|
| Material Type                                                                                                  | Class  | Item of Work by<br>Section Number<br>(Sequential) | Sieve Analysis, ASTM 100, Total Percent Passing (a) |        |           |       |         |         | Limits by<br>Washing<br>(b), (c), (d) |        | Loss by<br>Washing<br>(e), (f), (g) |         |
|                                                                                                                |        |                                                   | 2 1/2 in.                                           | 2 in.  | 1 1/2 in. | 1 in. | 3/4 in. | 3/8 in. | No. 4                                 | No. 10 |                                     | No. 200 |
| Coarse Aggregates                                                                                              | 4 A    | 802                                               | 100                                                 | 90-100 | 40-60     | 5-12  | —       | —       | —                                     | —      | 42.0                                |         |
|                                                                                                                | 4 A A  | 802                                               | —                                                   | 100    | 90-100    | 50-60 | 5-8     | —       | —                                     | —      | 41.0 (g)                            |         |
|                                                                                                                | 6 A    | 801, 802, 906                                     | —                                                   | 100    | 95-100    | 30-40 | —       | 5-8     | —                                     | —      | 41.0 (g)                            |         |
|                                                                                                                | 6 A A  | 801, 802, 906, 901                                | —                                                   | 100    | 95-100    | 30-40 | —       | 5-8     | —                                     | —      | 41.0 (g)                            |         |
|                                                                                                                | 17 A   | 801, 802, 906, 906                                | —                                                   | 100    | 90-100    | 50-75 | —       | 5-8     | —                                     | —      | 41.0 (g)                            |         |
|                                                                                                                | 28 A   | 806, 912                                          | —                                                   | 100    | 95-100    | 50-60 | 5-30    | 5-12    | —                                     | —      | 43.0                                |         |
| Dense-Graded Aggregates                                                                                        | 28 A A | 806, 912                                          | —                                                   | 100    | 95-100    | 50-60 | 5-30    | 5-12    | —                                     | —      | 43.0                                |         |
|                                                                                                                | 29 A   | 802, 904, 906, 906                                | —                                                   | 100    | 85-100    | 50-75 | —       | 5-8     | —                                     | —      | 41.0 (g)                            |         |
|                                                                                                                | 21 A   | 802, 906, 906, 907                                | —                                                   | 100    | 85-100    | 50-75 | —       | 5-8     | —                                     | —      | 41.0 (g)                            |         |
|                                                                                                                | 21 A A | 802, 906, 906, 907                                | —                                                   | 100    | 85-100    | 50-75 | —       | 5-8     | —                                     | —      | 41.0 (g)                            |         |
|                                                                                                                | 23 A   | 802, 906                                          | —                                                   | 100    | 85-100    | 50-75 | —       | 5-8     | —                                     | —      | 41.0 (g)                            |         |
|                                                                                                                | 14 A   | 802                                               | —                                                   | 100    | 85-100    | 50-75 | —       | 5-8     | —                                     | —      | 41.0 (g)                            |         |
| Open-Graded Aggregates                                                                                         | 14 A A | 802, 906                                          | —                                                   | 100    | 85-100    | 50-75 | —       | 5-8     | —                                     | —      | 41.0 (g)                            |         |
|                                                                                                                | 14 A   | 802, 906                                          | —                                                   | 100    | 85-100    | 50-75 | —       | 5-8     | —                                     | —      | 41.0 (g)                            |         |

a. Based on dry weights.  
b. Class BMA will be used exclusively for all ramp and concrete pavement when the directional commercial ACT is greater than or equal to 5,000 vehicles per day.  
c. Loss by Washing will not exceed 2.0 percent for material produced entirely by crushing rock, boulders, cobbles, slag, or concrete.  
d. Loss by Washing will not exceed 2.0 percent for material produced entirely by crushing rock, boulders, cobbles, slag, or concrete, the maximum limit for Loss by Washing must not exceed 10 percent.  
e. The limits for Loss by Washing of dense-graded aggregates are significant to the nearest whole percent.  
f. For aggregates produced from sources located in Berrien County, the Loss by Washing must not exceed 8 percent and the sum of Loss by Washing and other particles must not exceed 10 percent.  
g. Reference contract documents.



## Failing Material

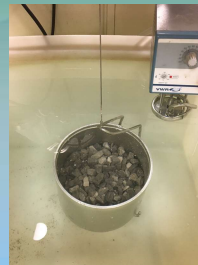
- Initial test failure will require 2 re-samples.
  - Must avg. and meet independently
- Re-samples fail
  - Corrective action implemented

## Corrective Action

- QC Plan should indicate procedure
- Examples:
  - Remove and separate material from stockpile
  - Wash aggregate to reduce L.B.W.
  - Switch sources (New J.M.F.)

## *Testing Criteria Cont.*

- Verification of Specific Gravities
  - Coarse Agg -0.04 of F.T. Specific Gravity
- Fineness Modulus of Fine Aggregate
  - 0.20 +/- of base F.M.





## *Questions?*

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