2021 Aggregates Updates

Matt Beeson, P.E.
Director, Division of Materials and Tests

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2021 Aggregate Updates

- Name change!
- ITM Changes
- Changes to Sum Qual
- PRA Lab Testing
- CAPP School
- Pea Gravel
- Optimized Concrete Aggregate (Tarantula)
  - Background
  - Spec Change
  - ITM 226
  - Remaining Tasks

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OMM → M&T

- Office of Materials Management
- Does this say what we do?
- Stolen from Ohio anyway.
- All the signs say Division of Materials and Tests already……

- Will be updating documents throughout the year

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ITM Changes

- ITM 902
  - 2021: Added ¼" sieve
  - 2020: Allowed the use of go-no go gauge.
    - Insert procedures in QCP
- Upcoming proposed changes to ITM 203 and ITM 211 on inactive status

17.5.1 The Producer shall submit a statement to the Manager, Office of Materials Management requesting Inactive Status.

17.5.1 A Producer may request to be placed on Inactive Status to temporarily suspend meeting the requirements of a Certified Producer by submitting a statement to the Manager, Division of Materials and Tests requesting Inactive Status. If for a duration of three years, a Producer has not produced or shipped any material which would require production or loadout testing under the CAPP, the Division of Materials and Tests may notify and place the source in Inactive Status.

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Sum Quals

- Old format required transferring data from test reports to form to be typed out
- We had fallen behind for various reasons
- New format
  - Help us get the letters out more quickly
  - Reduce transposition errors
  - Cover Letter, with test reports attached directly from SiteManager
- Internal metric: Have the letter out within 3 weeks of completion of all test results from that source

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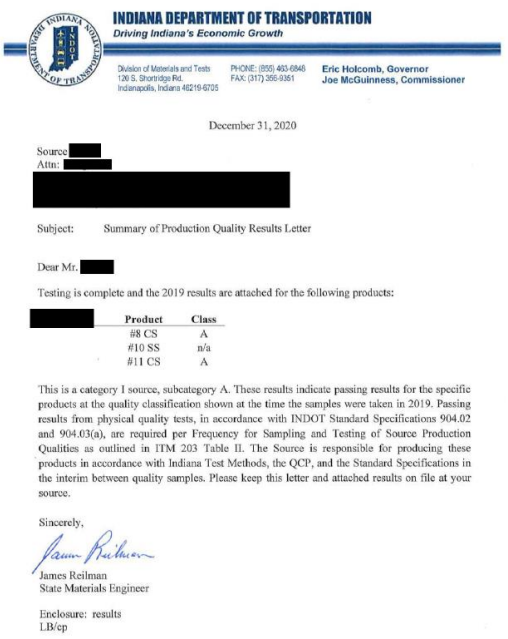
Sum Quals



INDIANA DEPARTMENT OF TRANSPORTATION
Driving Indiana's Economic Growth

Division of Materials and Tests
126 S. Shortridge Rd.
Indianapolis, Indiana 46219-6705

PHONE: (855) 463-6848
FAX: (317) 356-9351

Eric Holcomb, Governor
Joe McGuinness, Commissioner

December 31, 2020

Source [redacted]
Attn: [redacted]
[redacted]

Subject: Summary of Production Quality Results Letter

Dear Mr. [redacted]

Testing is complete and the 2019 results are attached for the following products:

[redacted]	Product	Class
	#8 CS	A
	#10 SS	n/a
	#11 CS	A

This is a category I source, subcategory A. These results indicate passing results for the specific products at the quality classification shown at the time the samples were taken in 2019. Passing results from physical quality tests, in accordance with INDOT Standard Specifications 904.02 and 904.03(a), are required per Frequency for Sampling and Testing of Source Production Qualities as outlined in ITM 203 Table II. The Source is responsible for producing these products in accordance with Indiana Test Methods, the QCP, and the Standard Specifications in the interim between quality samples. Please keep this letter and attached results on file at your source.

Sincerely,

James Reilman
State Materials Engineer

Enclosure: results
LB/ep

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Sum Quals

INDIANA
Department of Transportation
Test Results

SAMPLE ID: [redacted] **SAMPLE DATE:** 12/27/2019
MATERIAL: 904M05570 CA, CS, Production Quality
PRODUCER: [redacted]
PRODUCT NAME:
LOT/SUBLOT: Ledge[redacted] stockpile
QUANTITY: 8.000 Z **SAMPLED FROM:**
STATION: **OFFSET:** **REFERENCE:**
CONTROL TYPE: **BEGINNING NUMBER:** **ENDING**
STANDARD SAMPLE REMARKS: Testing is complete and material meets specification.
AUTHORIZED 06/18/2020 **AUTHORIZED BY:** [redacted] **JOB MIX FORMULA #:**
REMARKS:

SAMPLE ID: [redacted] **SAMPLE DATE:** 12/27/2019
CONTRACT ID:

TEST METHOD: SM9035-v2 Structurally Weak Material for Coarse Aggregate
SAMPLE TEST NUMBER: 1

FIELD LABEL	RESULTS	UNITS
Percent of Structurally Weak M	0.8	%

TEST METHOD: T103-v2 Soundness of Aggregates by Freeze & Thaw
SAMPLE TEST NUMBER: J1

FIELD LABEL	RESULTS	UNITS
Total Fine Agg % Loss	0	%
Total Coarse Agg % Loss	0.3	%

TEST METHOD: T112-v1 Clay Lumps & Friable Particles
SAMPLE TEST NUMBER: 1

FIELD LABEL	RESULTS	UNITS
% Clay Lumps/Friable Particles	0.05	%

TEST METHOD: T113TC-v2 Field Total Chert in Aggregate
SAMPLE TEST NUMBER: 1

FIELD LABEL	RESULTS	UNITS
Percent Total Chert	0	%

TEST METHOD: T11NP-v2 Material Finer Than 200 Sieve By Washing (For Non-PCC)
SAMPLE TEST NUMBER: 1

FIELD LABEL	RESULTS	UNITS

Page 1 of 2 Report Date: 12/31/2020

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Changes to ITM 214/PRA Program

- ITM 214
  - British Polishing testing
  - 2 year (or more) test strip
- Time consuming and costly
- ITM 221 was developed to validate friction too!
  - Three-wheel polisher, Dynamic Friction Tester
  - Ayesha Shah had a great presentation on this on Wednesday
- Let's utilize this method to replace ITM 214 system

NextLevel INDIANA

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Changes to ITM 214/PRA Program

- What else do we need?
- Data!
- We are piloting a set of samples with US Aggregates and Milestone Contractors
- One missing piece of data:
  - How does a highly polishing aggregate do on the test?
  - We had yet to do this
  - Is being done as part of US Aggregates samples
- Will follow up on some long-term friction data locations
- Hope to have this fully in place for 2022 season

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CAPP School

- Was held virtually in December 2020
- Many challenges overcome
- Thank you to all who were involved!
- We ended up delivering the exam virtually as well.
- Will need to rewrite some test questions
- One did not take exam, one did not pass re-take

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CAPP Technicians

- The list is now online!
- Indication of Qualified status
- Recertification procedure the same as last year – attend the Regional/Kickoff Meeting
- Shooting for first week of April – will have date nailed down soon

INDOT Certified Aggregate Producer Program (CAPP)
Certified Technician List

Updated: December 1, 2020

Last Name	First Name	Company / Organization	IA Qualified
Adams	Steve	Calcar Quarries	
Allen	Paul	Barrett Paving Materials, Inc.	•
Alsman	Mike	Barrett Paving Materials, Inc.	•
Anderson	Courtney	Phoenix Services, LLC	
Anstey	Ryan	Michiana Aggregate, Inc.	•
Arroyo	Alejandra	Lehigh Hanson Inc.	•
Badding	Lauren	INDOT - OMM	
Bailey	Elena	Hanson Aggregates	•
Bales	Andrew	Irving Materials, Inc.	•
Barkley	Greg	Martin Marietta	•
Barnard	Kristen	INDOT - Crawfordsville	•
Barnes	Brian	Mulzer Crushed Stone, Inc.	•
Barnstable	Daniel	Vulcan Materials Co.	
Barthel Jr.	John	Hanson Material Service Corp.	•
Bassett	John	Meuth Concrete	
Beer	Ryan	Elkhart County Gravel, Inc.	•
Beers	Todd	Hanson Aggregates	•
Begle	Landon	Calcar Paving, Inc.	•
Beitman	Richard	Irving Materials, Inc.	•
Berker	Tyler	INDOT	•
Blackwell	Michael	Fritz Enterprises, Inc	•
Blackwell	David	South Lake Stone, LLC	•
Blaker	Mike	Rogers Group, Inc.	
Boots	David	Irving Materials, Inc.	•
Borodkin	Oleg	Phend & Brown, Inc.	
Bottorff	Richard	INDOT	•

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Pea Gravel

- Previously no defined material classified as pea gravel
- Impact Attenuator specs

Barrels used in impact attenuators shall be yellow with black lids. The *coarse* aggregate used in the barrels shall be ~~uncrushed gravel~~*size 93PG*, class F or higher, in accordance with 904 ~~and the following gradation requirements~~.

~~Sieve Size~~	~~% Passing~~
~~1/2 in. (12.5 mm)~~	~~100~~
~~No. 50 (300 µm)~~	~~0 – 5~~
~~No. 100 (150 µm)~~	~~0 – 2~~

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Pea Gravel

- Created size 93PG

Sieve Sizes	Coarse Aggregate Sizes (Percent Passing)									
	Coarse Graded									
	2	5	8	9	11, SC 11[5]	12, SC 12[5]	SC 16[5]	43[1]	91	*93PG[6]*
4 in. (100 mm)										
3 1/2 in. (90 mm)										
2 1/2 in. (63 mm)	100									
2 in. (50 mm)	80 - 100									
1 1/2 in. (37.5 mm)		100						100		
1 in. (25 mm)	0 - 25	85 - 98	100					70 - 90	100	
3/4 in. (19 mm)	0 - 10	60 - 85	75 - 95	100				50 - 70		
1/2 in. (12.5 mm)	0 - 7	30 - 60	40 - 70	60 - 85	100	100	100	35 - 50		*98 - 100*
3/8 in. (9.5 mm)		15 - 45	20 - 50	30 - 60	75 - 95	95 - 100	94 - 100			*75 - 100*
No. 4 (4.75 mm)		0 - 15	0 - 15	0 - 15	10 - 30	50 - 80	15 - 45	20 - 40		*10 – 60*
No. 8 (2.36 mm)		0 - 10	0 - 10	0 - 10	0 - 10	0 - 35		15 - 35		*0 – 15*
No. 16 (1.18 mm)							0 - 4			
No. 30 (600 µm)						0 - 4		5 - 20		*0 – 5*
No. 200 (75 µm)[2]								0 - 6.0		
Decant (PCC)[3]		0 - 1.5	0 - 1.5	0 - 1.5	0 - 1.5	0 - 1.5			0 - 1.5	
Decant (Non-PCC)	0 - 2.5	0 - 2.5	0 - 3.0	0 - 2.5	0 - 2.5	0 - 2.0			0 - 2.5	*0 – 2.0*
Decant (SC)					0 - 1.5	0 - 1.5	0 - 1.5			

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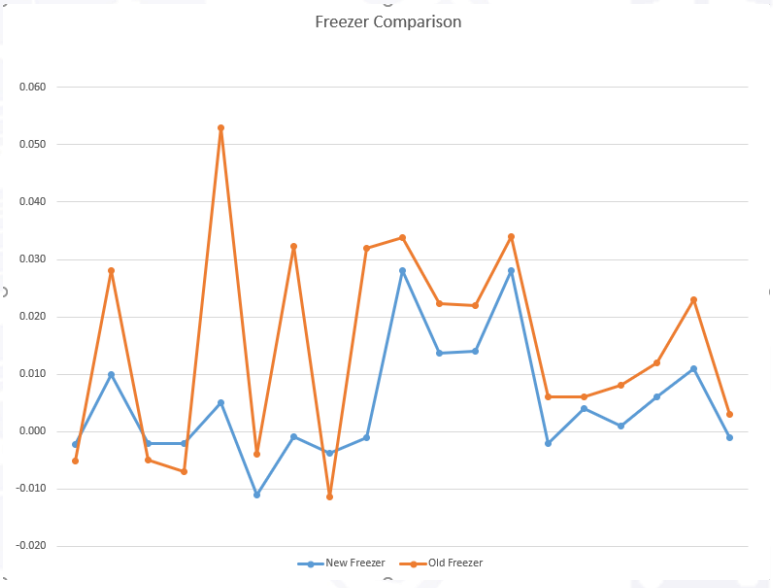
Freezer Comparison

- New Freezer is fully operational
- Old Freezer had timing issue which was corrected halfway across the graph



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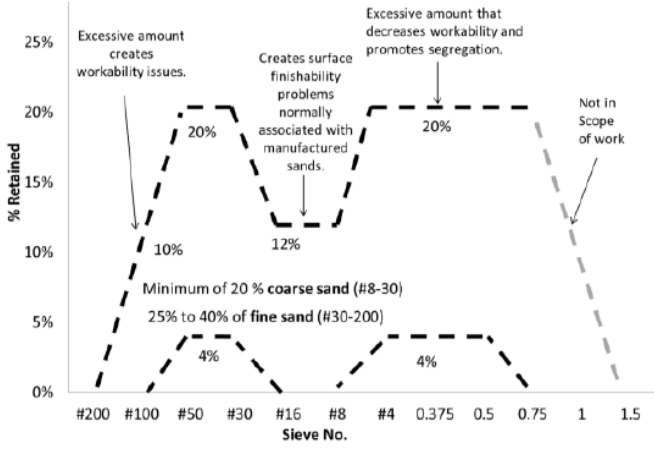
Optimized Concrete Aggregate

- What are we trying to do?
  - Improve concrete performance
- "Tarantula Curve"



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Optimized Concrete Aggregate

- Tarantula Curve
- Developed by researchers at Oklahoma State
- Aggregate proportioning method to improve workability
- Goal of minimizing paste content

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Optimized Concrete Aggregate

- Issues prior to set
- Poor Workability
  - Difficult to Place and Finish

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Optimized Concrete Aggregate

- Issues prior to set
- Poor Workability
  - Surface won't close behind paver
  - Poor consolidation
  - Segregation
  - Mix is "sticky" or harsh and/or stiff

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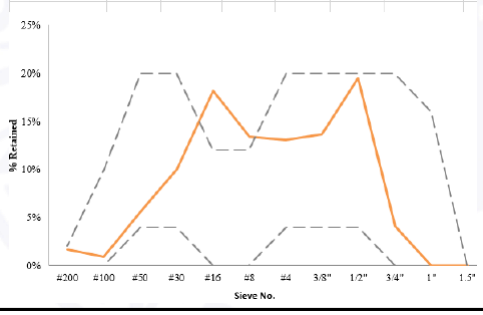
Optimized Concrete Aggregate

- Issues prior to set
- Poor Workability
  - Surface won't close behind paver
  - Poor consolidation
  - Segregation
  - Mix is "sticky" or harsh and/or stiff



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Optimized Concrete Aggregate

- Issues prior to set
- Poor Workability
  - Surface won't close behind paver
  - Poor consolidation
  - Segregation
  - Mix is "sticky" or harsh and/or stiff

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Optimized Concrete Aggregate

- Issues soon after placement/long term
- Low Strength
- Drying shrinkage cracking
- Scaling

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Optimized Concrete Aggregate

- Is the concrete we're getting "bad?"
  - No, but we could be better!
  - Pavement *and* Structural
- So how do we get there?
  - That's been the hard part

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Optimized Concrete Aggregate

- In 2017, INDOT proposed requiring tarantula gradation for all concrete pavement
- This kicked off much "discussion"
  - How will Industry deliver this?
  - Whose responsibility?

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Optimized Concrete Aggregate

- Mid-2019
- Indiana 8s gradation
  - Doesn't typically meet tarantula gradation when blended with average 23 sand
  - So why do we actually want 8s?
  - What do I mean?
    - Aggregate suppliers – Make 8s = great!
    - Concrete producers – Don't use 8s! Those mixes aren't optimized!
- What now?

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Optimized Concrete Aggregate

- Propose a new gradation to replace Indiana 8s
- INDOT asked Concrete Industry to propose a new gradation
  - Intent was to provide a single gradation that would ensure all concrete produced in Indiana would be optimized
- Proposed new gradation was submitted to INDOT and IMAA in October 2019
- Numerous meetings and discussions ensued

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Optimized Concrete Aggregate

- Single gradation was too restrictive
- What now?
  - Change nothing on aggregate specs?
  - Wouldn't solve anything!
  - Still need to "start from a better place"
- "Alternate" option
- Instead of one standardized gradation,
- Each source submits "QA" gradation for approval
- Similar to ITM 225 for drainage layers

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Optimized Concrete Aggregate

- Because of the knowledge of how this will improve concrete across INDOT projects, we are moving forward with implementation to take effect with contracts let after 9/1/2021
  - "8s" replaced in spec with "Concrete Coarse Aggregate" per ITM 226
  - Will require optimized mixes for all concrete
  - Updated CMDS

702.03 Materials

Materials shall be in accordance with the following:

Admixtures for Use in Concrete	912.03
Castings	910.05
Concrete Coarse Aggregate	
For exposed concrete, Class A or Higher, ~~Size No. 8~~	*ITM 226,* 904
For non-exposed concrete, Class B or Higher, ~~Size No. 8~~	*ITM 226,* 904

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Optimized Concrete Aggregate

- ITM 226
- Producers submit a candidate gradation to Materials and Tests
- Gradation will be evaluated for compliance with tarantula curve
  - Two fine aggregate gradations
  - Two "blend percentages", 40% fine aggregate/60% coarse, and 45%/55%
  - Total of four curves
- Also, for comparison to coarse and fine sand limits
  - Coarse sand = material retained on #8, #16, and #30
  - Fine sand = material retained on #30, #50, #100, and #200 sieves

Sieve Size	Percent Passing
1 1/2 in. (37.5 mm)	100
3/4 in. (19.0 mm)	90 max.
Decant (Stone and Slag)	0-2.5
Decant (All Others)	0-1.5

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Optimized Concrete Aggregate

- Fine Aggregate Gradations
- Review of 76 sands in July 2020
- "Fine" sand and "coarse" sand chosen by choosing 15th and 85th percentile of percent passing

	% passing (by mass)	
Sieve	"Fine" FA	"Coarse" FA
2" (50 mm)	100	100
1.5" (37.5mm)	100	100
1" (25mm)	100	100
3/4" (19mm)	100	100
1/2" (12.5mm)	100	100
3/8" (9.5mm)	100	100
#4 (4.75mm)	100	98
#8 (2.36mm)	93	83
#16 (1.18mm)	75	63
#30 (600um)	52	37
#50 (300um)	21	11
#100 (150um)	4	1
#200 (75um)	1.7	0.4
Fineness Mod.	2.55	3.07

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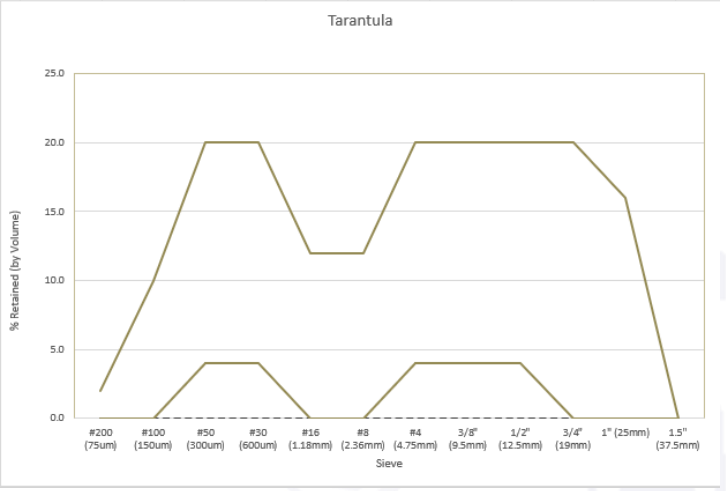
Optimized Concrete Aggregate

- ITM 226
- Tarantula Curve

	Individual Percent Retained by Volume (%)	
Sieve size	Min	Max
1.5" (37.5mm)	0	0
1" (25mm)	0	16
3/4" (19mm)	0	20
1/2" (12.5mm)	4	20
3/8" (9.5mm)	4	20
#4 (4.75mm)	4	20
#8 (2.36mm)	0	12
#16 (1.18mm)	0	12
#30 (600um)	4	20
#50 (300um)	4	20
#100 (150um)	0	10
#200 (75um)	0	2



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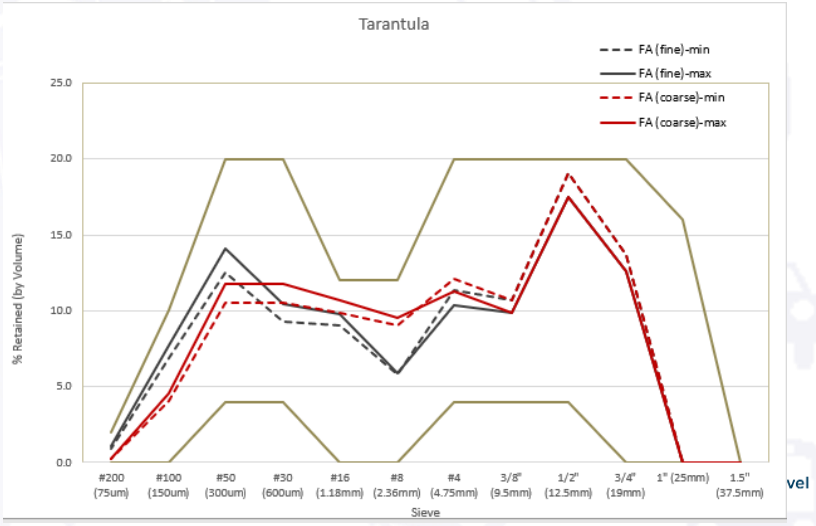
Optimized Concrete Aggregate

- ITM 226
- Tarantula Curve

Sieve size	Proposed CA (% passing)	FA (fine) (% passing)	FA (coarse) (% passing)
2" (50 mm)	100	100	100
1.5" (37.5mm)	100	100	100
1" (25mm)	100	100	100
3/4" (19mm)	77	100	100
1/2" (12.5mm)	45	100	100
3/8" (9.5mm)	27	100	100
#4 (4.75mm)	8	100	98
#8 (2.36mm)	3	93	83
#16 (1.18mm)	0	75	63
#30 (600um)	0	52	37
#50 (300um)	0	21	11
#100 (150um)	0	4	1
#200 (75um)	0	1.7	0.4
Fineness Modulus	6.85	2.55	3.07



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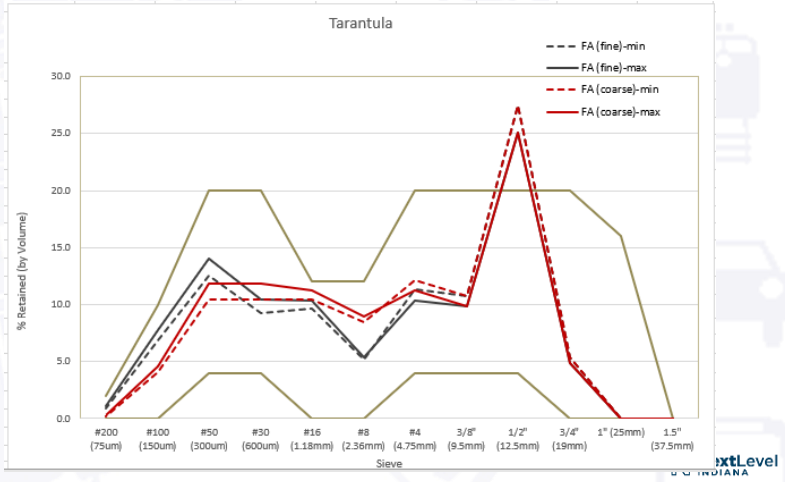
Optimized Concrete Aggregate

- ITM 226
- Tarantula Curve

Sieve size	Proposed CA (% passing)	FA (fine) (% passing)	FA (coarse) (% passing)
2" (50 mm)	100	100	100
1.5" (37.5mm)	100	100	100
1" (25mm)	100	100	100
3/4" (19mm)	91	100	100
1/2" (12.5mm)	45	100	100
3/8" (9.5mm)	27	100	100
#4 (4.75mm)	8	100	98
#8 (2.36mm)	4	93	83
#16 (1.18mm)	0	75	63
#30 (600um)	0	52	37
#50 (300um)	0	21	11
#100 (150um)	0	4	1
#200 (75um)	0	1.7	0.4
Fineness Modulus	6.7	2.55	3.07



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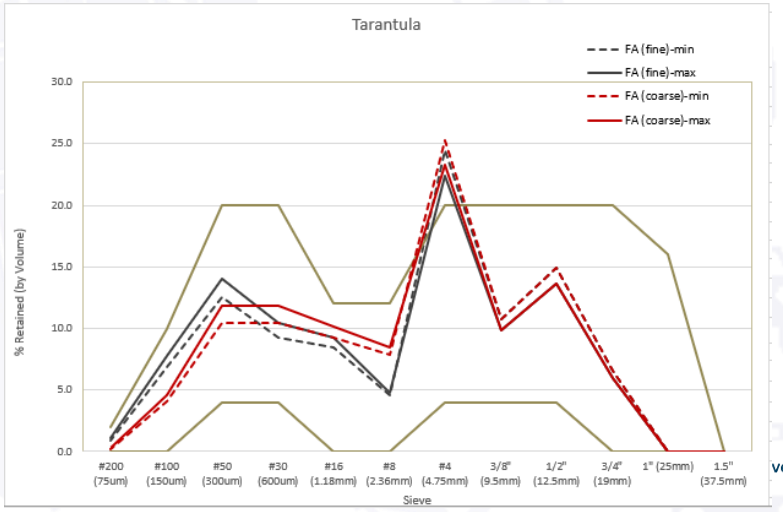
Optimized Concrete Aggregate

- ITM 226
- Tarantula Curve

Sieve size	Proposed CA (% passing)	FA (fine) (% passing)	FA (coarse) (% passing)
2" (50 mm)	100	100	100
1.5" (37.5mm)	100	100	100
1" (25mm)	100	100	100
3/4" (19mm)	89	100	100
1/2" (12.5mm)	64	100	100
3/8" (9.5mm)	46	100	100
#4 (4.75mm)	5	100	98
#8 (2.36mm)	2	93	83
#16 (1.18mm)	0	75	63
#30 (600um)	0	52	37
#50 (300um)	0	21	11
#100 (150um)	0	4	1
#200 (75um)	0	1.7	0.4
Fineness Modulus	6.58	2.55	3.07



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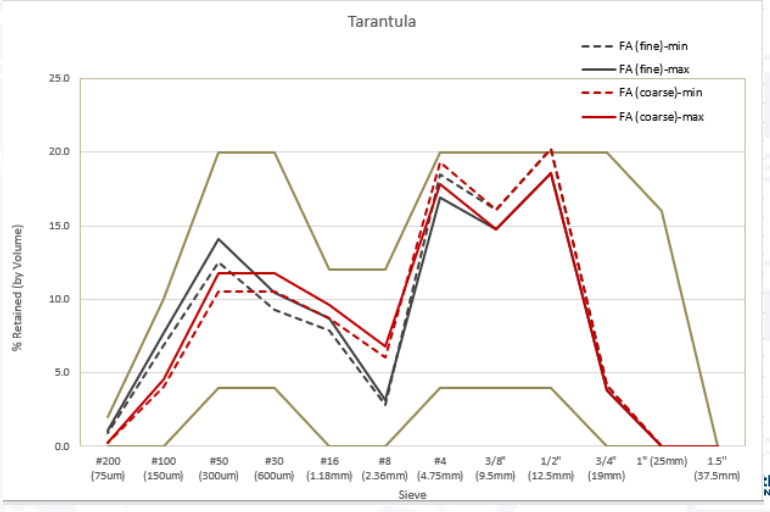
Optimized Concrete Aggregate

- ITM 226
- Tarantula Curve

Sieve size	Proposed CA (% passing)	FA (fine) (% passing)	FA (coarse) (% passing)
2" (50 mm)	100	100	100
1.5" (37.5mm)	100	100	100
1" (25mm)	100	100	100
3/4" (19mm)	89	100	100
1/2" (12.5mm)	64	100	100
3/8" (9.5mm)	46	100	100
#4 (4.75mm)	5	100	98
#8 (2.36mm)	2	93	83
#16 (1.18mm)	0	75	63
#30 (600um)	0	52	37
#50 (300um)	0	21	11
#100 (150um)	0	4	1
#200 (75um)	0	1.7	0.4
Fineness Modulus	6.58	2.55	3.07



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Optimized Concrete Aggregate

- ITM 226
- Producers submit a candidate gradation
- Once gradation is approved:

8.1 The gradation, as defined at the time of approval, shall be used as the established gradation for control as a Quality Assurance material in accordance with ITM 211, except the material shall be controlled on the following sieves:

8.1.1 1 ½" (37.5 mm)
8.1.2 1" (25.0 mm)
8.1.3 3/4" (19.0 mm)
8.1.4 1/2" (12.5 mm)
8.1.5 No. 4 (4.75 mm)
8.1.6 No. 8 (2.36 mm)
8.1.7 No. 200 (75 µm)

8.2 The following tolerances shall be used for gradation control:

8.2.1 Sieve size No. 4 (2.36 mm) and above = ± 10%
8.2.2 Sieve size No. 8 (600 µm) = ± 6%
8.2.3 Sieve size No. 200 (75 µm) = ± 2%

8.3 The Department will review the as-produced gradation of each approved Concrete Coarse Aggregate on an ongoing basis. The as-produced gradation will be verified per section 6.0 of this ITM. Multiple gradations that do not comply will be subject to corrective action, up to and including suspension of the product.

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Optimized Concrete Aggregate

- Concrete producers also required to demonstrate compliance to tarantula curve when submitting the mix design
- Could vary depending on sands used, changes in gradation, etc.

The aggregate blend submitted on the CMDS shall produce an optimized aggregate gradation in accordance with ITM 226 sections 6.2.1 and 6.3. The aggregate blend shall consist of, at a minimum, one concrete coarse aggregate and one fine aggregate, No. 23. One additional class A or higher for exposed or class B or higher for non-exposed intermediate-sized coarse aggregate may be included if approved by the Engineer.

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Optimized Concrete Aggregate

- Remaining Questions:
  - How does this affect AP testing?
    - No changes! ITM 210 uses a specific gradation, anyway.
    - We believe that a small amount of +1" material will not have an adverse effect.
  - How often do we update gradations for concrete producers to use?
  - How often does INDOT validate gradation?
  - How do we handle transition into 2022 with "carryover" projects?

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Future Topics

- B-Borrow/Structure Backfill "clean up"
- Point of Use program updates
- Audit Checklist updates for 2021 season
- Still working on alternate 53s proposal
  - INDOT will schedule small group meeting
- Concrete Aggregate friction
  - Fine aggregate micro-deval
- Ongoing Blast Furnace Slag Leachate research

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Thank you!

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