December 16, 2021
Meeting Minutes – Concrete Pavement Technical Committee

Location: Zoom Meeting

Date: December 16, 2021

Time: 9:00 am to 12:00 pm

Attendance

Committee Members:

WisDOT Members –

Bureau of Technical Services (BTS):

☐ Scott Lawry – BTS Director
☒ Barry Paye – Chief Materials Engineer
☒ Jim Parry – Quality Assurance Supervisor
☒ Leslie Ashauer – Concrete Quality Assurance Engineer
☒ Debra Bischoff – QMP Engineer
☒ Peter Kemp – Pavement Unit Supervisor
☒ Ali Arabzadeh – Pavement Policy and Research Engineer
☐ Adam Johnson – Independent Assurance Program Coordinator
☒ Mark Finnell – Concrete Engineer Consultant (Behnke Materials)
☐ Signe Reichelt – Test Procedure Manual Consultant (Behnke Materials)

Bureau of Project Development (BPD):

☐ Michael Hall – Construction Standards Engineer
☒ Craig Pringle – Construction Oversight Engineer
☐ Chad Hayes – Construction Oversight Engineer

Regional Representatives:

☒ Alan Rommel – NE Region TSS Chief – Management Liaison
☒ Travis Mikshowsky – SW TSS Supervisor – TSS Liaison
☐ *Vacant* – SW Region Soils & Materials Engineer
☐ Matt Smith – SW Region Independent Assurance
☒ Kurt Flierl – SE Region Construction Project Manager
☐ *Vacant* – SE Freeways Design/Construction Interface Engineer
☒ Brent Ferguson – NC Region Independent Assurance
☒ Devin Harings – NW Region Pavement Engineer
☒ Matt Bertucci – NE Region Materials Engineer

Bureau of Aeronautics (BOA):

☐ *Vacant* – Airport Construction Standards Chief

FHWA Members –

☒ James Pforr – Pavement & Materials/Asset Management Engineer

Industry Members –

- ☐ *Vacant* – American Council of Engineering Companies Liaison
- ☒ Ed Anastas – A.W. Oakes
- ☐ Barry Bohman – Chippewa Concrete Services
- ☒ David Meyer - Continental Cement Company
- ☐ Brian Borowski – Lafarge/Holcim
- ☐ Mark LaLonde – LaLonde Contractors
- ☐ John McConahy – Mapei
- ☒ Scott Grams – Michels Paving
- ☐ Tom Ptaschinski – Ptaschinski Construction Company
- ☐ David McKewin – Sommers Construction Company
- ☒ James Palmer – St. Mary's Cement Company
- ☐ Mark Pichler – Stark Paving
- ☐ Mike Hammitt – Trierweiler Construction Company
- ☐ Heath Schopf – Vinton Construction Company
- ☒ Jackie Spoor – Wisconsin Concrete Pavement Association
- ☒ Kevin McMullen – Wisconsin Concrete Pavement Association
- ☐ Matt Grove – Wisconsin Transportation Builders Association
- ☐ Tony Zignego – Zignego Company

Resource Members (as needed)–

- ☒ Erik Lyngdal – BTS Concrete Lab Supervisor - Aggregate Tech Committee Chair
- ☒ Adam Albers – Concrete Materials Lab Coordinator
- ☐ Ryan Ramthun – Michels Paving
- ☒ Andrea Breen – Zignego Ready Mix

Agenda Items

1. Welcome and Introductions – L. Ashauer (~5 min)
    a. Review etiquette during virtual meting
    b. Recording of Meeting
2. Review & Approval of September 16, 2021 Minutes – L. Ashauer (~10 min)
    a. #9 Tie Bars: Reviewing the drawings and suggesting edits.
    L Ashauer to update the minutes and send out the revised minutes.
3. Tech Team Updates (~40 min)
    a. Fast Track – M. Finnell
        i. Material requirements are not the challenging part of this TF. Therefore, we will be working to understand the traffic parameters first and then work with materials and training for designers.
    b. Sidewalk Staking – L. Ashauer
        i. Having internal discussions on the best way to implement the sidewalk staking item. STSP vs. Std Spec. Once determined language will be crafted.

c. Curb Shear – L. Ashauer
    i. Reaching out to regional maintenance to see how widespread this is occurring. The TF is working on determining the parameters as to when solutions need to be applied. The two options that are favored currently are:
        1. Increasing the curb head width from 6” to 12”
        2. Proving expansion in large islands.
d. SAM – M. Finnell
    i. Meeting every other month.
    ii. In process of gathering concerns, issues, practicality etc. of implementation into specification requirements.

4. Action Item Updates (~25 min)
    a. Curb Head Details – Pete Kemp (September 2021) Merged into Curb Shear TF
    b. 4 x 4 Concrete Beam Task Force – M. Finnell (August 2021) ON HOLD till WHRP Report Complete
    c. Driveway Tie Bar Locations & Type A Curb & Gutter – P. Kemp (November 2021)
        i. The NE Region is taking out the tie bar in SDD 8d18 “Driveway and Sidewalk Ramps Types X & Y” and replacing with felt/expansion material. Industry would like to see this applied statewide.
        ii. Concern of water sitting in the area from the driveway to curb if felt is added. Suggest using plastic vs. felt.
        iii. What are other industry practices?
        iv. Concern of settlement if the driveway is not tied to the C&G. The settlement would likely occur in the driveway since they are not constructed to the same standards. Consensus to keep driveway concerns stay separate from pavement concerns.
        v. Consensus that tie bar will be taken out in SDD 8d18.
        vi. Power point presentation (attached)
    d. Concrete Pavement Approach Detail – A. Arabzadeh (December 2021 Update)
        i. Power point presentation (attached)
5. 2022 Specification Webinar – K. McMullen (~5 min)
    a. Recording on WCPA Website: http://www.wisconcrete.org/events-2/
6. WCPA Conference Preview – J. Spoor (~20 min)
    a. February 10 & 11, 2022 – Ingleside (Pewaukee, WI)
    b. Secretary Thompson and FHWA Rep Glenn Fulkerson will be presenting
    c. Colorado presenting on Concrete Overlays
    d. Presentation on UWP new Major – Construction Management (Horizontal Construction)

e. PavementDesigner.org
f. E-Ticketing Possible
g. Sign up at: http://www.wisconcrete.org/events-2/ (Open by 12/20/2021)
h. Hotel block available until January 17, 2022
    i. MAIN WCPA BLOCK: Rate $139+tax
    ii. Direct Booking Link – No login/attendee code needed https://reservations.travelclick.com/17743?groupID=3368315

7. Portland IL Cements – K. McMullen / J. Parry (~10 min)
    a. Acceptance on projects prior to 2022 Spec
        i. No change orders are needed if the company is running at a 10% replacement. This is allowed by specification.
        ii. Trial batching IS required for carryover mix designs that have not started placing concrete.
        iii. Refer to Type IL cement memo that will be available by the beginning of January.
    b. Contracts LET under 2022 Spec
        i. Trial batching IS required for mix designs for use under 2022 spec.
    c. Buzzi Unicem, LaFarge & St. Mary's are already producing IL cements.
    d. Continental will start producing in Jan 2022.
    e. Currently no company is using a percentage greater than 10%.
8. HES & SHES Concrete – M Finnell (~10 min)
    a. SCM Requirement
        i. 2022 Spec requires a minimum SCM requirement. It includes HES and SHES.
        ii. New construction benefits from having the SCM's.
        iii. Department will be looking at 2023 spec to address the oversight.
            1. Fast Track TF will also investigate areas of possible exemption.
        iv. If there is a question, bring it up during the bid letting. BPD will consult BTS on the answer for all, to ensure fair bidding.
        v. List of Exemptions brought up for consideration (attached)
            1. Internal review by department is needed on potential exemptions.
9. Concrete Barrier Pay Equation – M. Finnell (~15 min)
    a. Pay equation
        i. Concrete barrier is tracked by CY. Concrete barrier is paid by LF. There are a plethora of cross sectional areas in the barrier details. Applying incentive by LF is not an easy conversion. Since construction tracks by CY for testing, the incentive amount will change to a $ / CY.

ii. Using the most common barriers from the previous 2-year window (2019-2020), a standard unit cost per CY has been derived off the weighted average. The standard unit cost will be reevaluated each year using the most common barrier types for the 2-year window. (IE: 2024 spec will be updated using the 2-year window of 2021 & 2022 construction)
iii. Standard unit cost for 2023 is $285/CY.
iv. FDM guidance will be provided for designers for how to estimate the new incentive amounts for the LET's.

b. 2022 Contracts
i. Std CCO provided by BTS to individual projects.

10. DT Forms – M. Finnell (~25 min)
a. DT 2220 Approval – Approved
b. DT 2221 Approval – Approved
c. Spreadsheets will be provided to CPTC.
11. Manual of Test Procedures (MoTP) – L. Ashauer (~10 min)
a. Power point presentation (attached)

Action Items

Old Items:

1. Driveway Tie Bar Locations & Type A Curb & Gutter – P. Kemp (November 2021)
   a. Remove Driveway to Curb Tie Bars from SDD 8d18 and add isolation/expansion joint. – P. Kemp (January 2022)
2. Concrete Pavement Approach Detail – P. Kemp (December 2021 Update)
   b. Have BTS & regions review. (February 2022 Update)

New Items:

3. Concrete Barrier CMJ/CCO – L. Ashauer (January 2022)
4. Industry practice for constructing Driveway to curb. Address if expansion/bond breaker is needed. – K. McMullen (February 2022)
5. Research alternatives to asphalt fiberboard expansion material. – Send to Curb Shear TF.
6. Guidance to all Regions on Trial Batching requirements for IL Cements – M. Finnell / L. Ashauer (January 2022)

Action Items – Long Term

1. 4 x 4 Concrete Beam Task Force – M. Finnell (August 2021): ON HOLD until WHRP Study Complete

Other Notes

Upcoming Meetings

2021		
December 16, 2021	9:00 am to 12:00 pm	CPTC
December 17, 2021	8:00 am to 10:00 am	TF: Fast Track - CANCELLED
2022		
January 9-13, 2022	multi day	TRB
January 14, 2022	8:00 am to 10:00 am	TF: Fast Track
January 19, 2022	2:00 pm to 3:30 pm	TF: Sidewalk Staking
January 20-21, 2022	multi day	WTBA Contractor-Engineer Conference
January 24, 2022	9:00 am to 11:00 am	TF: Curb Shear
February 3-4, 2022	multi day	WRMCA
February 9-11, 2022	multi day	WCPA Annual Conference
February 17, 2022	9:00 am to 12:00 pm	CPTC
February 18, 2022	8:00 am to 10:00 am	TF: Fast Track
February 28, 2022	9:00 am to 11:00 am	TF: Curb Shear
March 2022	multi day	ACEC
April 4-8, 2022	multi day	National Concrete Consortium
June 16, 2022	9:00 am to 12:00 pm	CPTC
August 11, 2022	9:00 am to 12:00 pm	CPTC
November 17, 2022	9:00 am to 12:00 pm	CPTC

Driveway to Curb Tie Bars

Peter Kemp

BTS Pavement Unit Supervisor

Concrete Pavement Technical Committee
Zoom Meeting

December 15, 2021

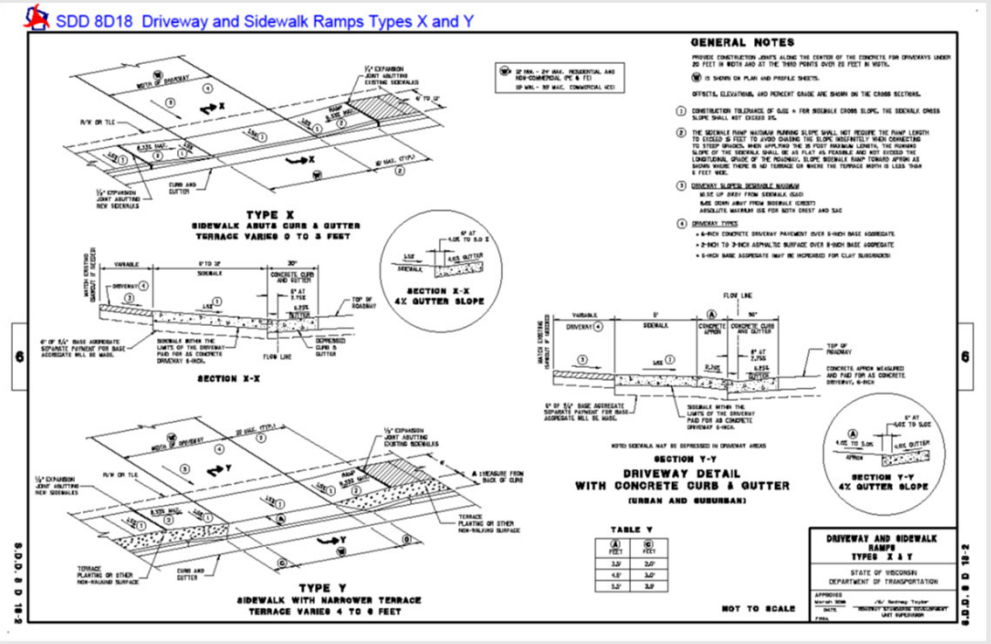
Driveway to Curb Tie Bars

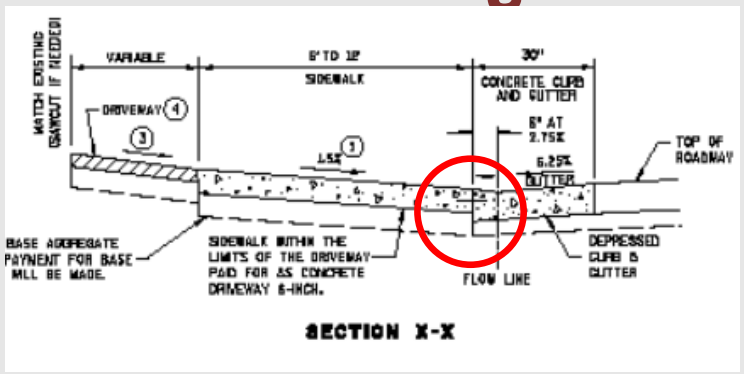
September 16, 2021
Meeting Minutes – Concrete Pavement Technical Committee

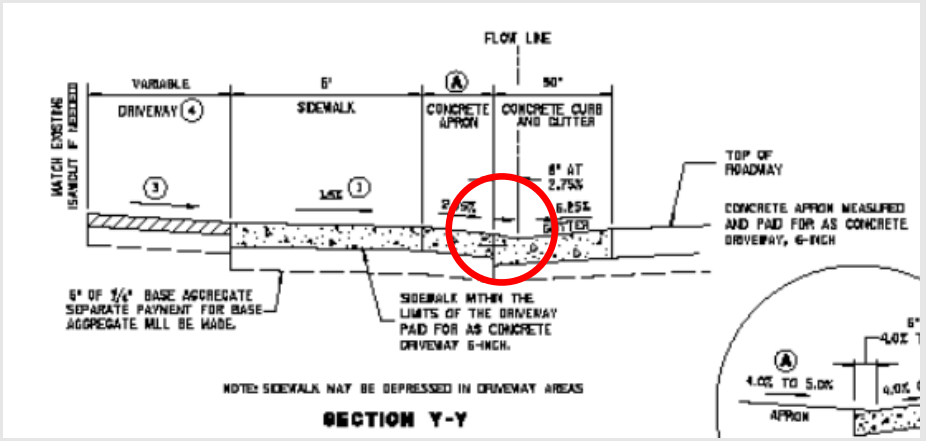
9. Driveway Tie Bar Locations – K. McMullen (~15 min)
    - Recent revision includes a tie bar that causes constructability issues. Suggested revision is to remove the tie bar. Pete Kemp with Rodney Taylor and revise the drawings with the suggested edits.

Driveway to Curb Tie Bars

Current Standard Detail Drawing

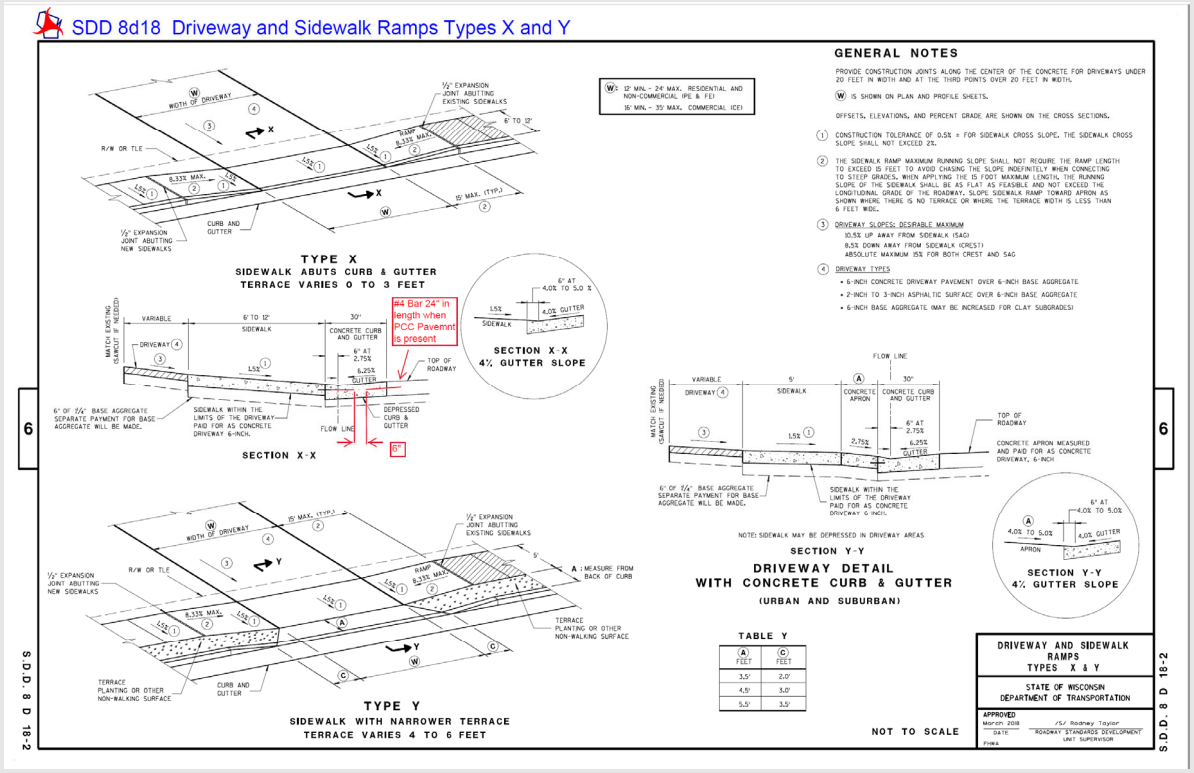


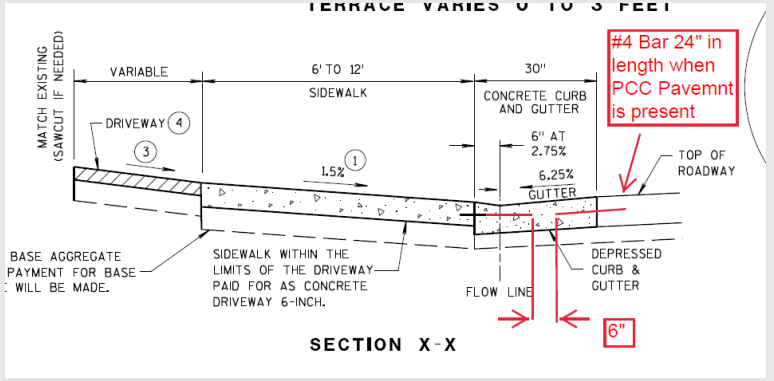




Driveway to Curb Tie Bars

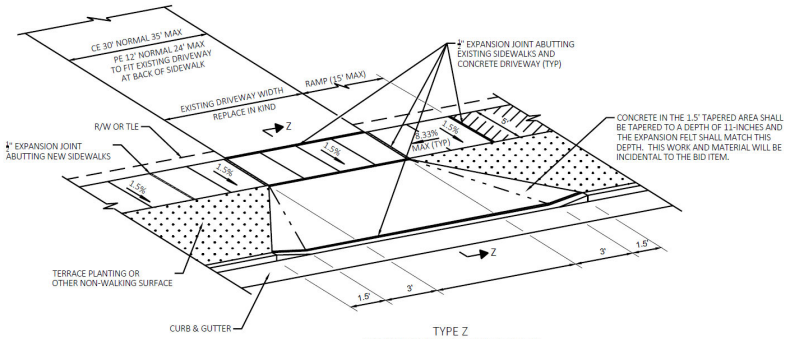
Proposed Revision Detail Drawing



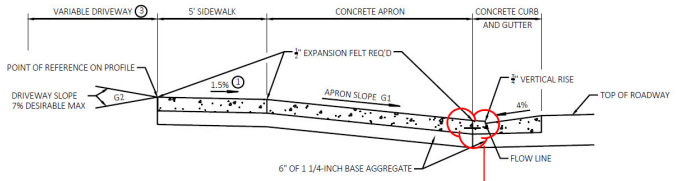


Driveway to Curb Tie Bars

Northeast Region Alternate Detail Drawing



TYPE Z
SIDEWALK WITH WIDER TERRACE
TERRACE VARIES 3 TO 8 FEET



SECTION Z-Z

Remove Tie Bar GTV 7/29/2021

SEE PLAN FOR ADDITIONAL INFORMATION

THE SIDEWALK RAMP MAXIMUM RUNNING SLOPE SHALL NOT REQUIRE THE RAMP LENGTH TO EXCEED 15 FEET TO AVOID CHASING THE SLOPE INDEFINITELY WHEN CONNECTING TO STEEP GRADES. WHEN APPLYING THE 15 FOOT MAXIMUM LENGTH, THE RUNNING SLOPE OF THE SIDEWALK SHALL BE AS FLAT AS FEASIBLE AND NOT EXCEED THE LONGITUDINAL GRADE OF THE ROADWAY.

454

DRIVEWAY ENTRANCE DETAIL WITH SIDEWALK, CURB & GUTTER

GENERAL NOTES

CONSTRUCTION TOLERANCE OF +/- 0.5% FOR SIDEWALK CROSS SLOPE. THE SIDEWALK CROSS SLOPE SHALL NOT EXCEED 2%.

12' MAXIMUM SPACING FOR CONTRACTION JOINTS IN DRIVEWAY APPROACHES.

OFFSETS, ELEVATIONS, AND PERCENT GRADE ARE SHOWN IN THE PLAN.

SIDEWALK AND APRON WITHIN THE LIMITS OF THE DRIVEWAY PAID FOR AS CONCRETE DRIVEWAY, 6-INCH.

USE 4% GUTTER CROSS SLOPE UNLESS OTHERWISE NOTED IN PLANS.

DRIVEWAY TYPES

- 6-INCH CONCRETE DRIVEWAY PAVEMENT OVER 6" BASE AGGREGATE DENSE 1 1/4-INCH.
- 3-INCH ASPHALTIC SURFACE OVER 6" BASE AGGREGATE DENSE 1 1/4-INCH.
- 6-INCH BASE AGGREGATE DENSE 3/4-INCH.

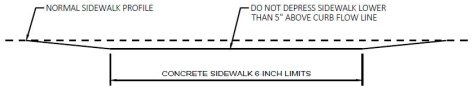
TERRACE WIDTH	APRON SLOPE G1		
	MIN %	DESIRABLE %	MAXIMUM %
3 FT	7.0	8.5	10.0
4 FT	5.0	7.0	10.0
5 FT	4.0	7.0	10.0
6 FT	4.0	7.0	10.0
7 FT	3.5	7.0	10.0
8 FT	3.0	7.0	10.0

NOTE:

ALGEBRAIC DIFFERENCE BETWEEN TANGENT GRADES G1 & G2 NOT TO EXCEED 10% DESIRABLE MAXIMUM.

DEPRESS SIDEWALK PROFILE IF DRIVEWAY APRON EXCEEDS MAXIMUM SLOPE.

SEPARATE PAYMENT FOR BASE AGGREGATE WILL BE MADE.



DEPRESSED SIDEWALK PROFILE DETAIL

Driveway to Curb Tie Bars

NOTES

- The consensus of the meeting was to remove the ties to focus on performance of the pavement and curb.
- To place an expansion joint at the curb and both sides of the sidewalk.
- Incorporate into the SDD

Conditions of Barrier Wall/Parapet with Alternate Approach Slab SDD

Ali Arabzadeh

Pavement Engineer

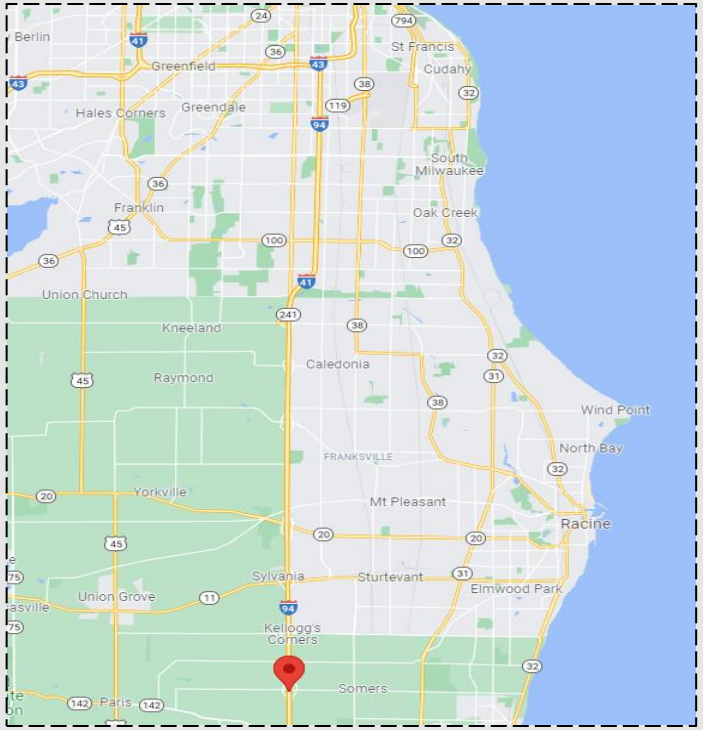
Concrete Pavement Technical Committee: Meeting 4
Online

December 16, 2021

The bridges were evaluated using PathWeb and Google Maps

26 bridges were on I-40 and 1 was on Elm Rd.

- The approach slab of 18 bridges had problems
  - Joint sealer failure
  - Faulting/settlement
  - Spalling/delamination
  - Cracking
  - Lack of construction joint



Spalling

- Spalling was observed at two different locations
  - Pavement surfaces adjacent to the joints
  - On the barrier walls

Spalling at the barrier walls

- B-51-137
- B-30-112

Spalling at the barrier walls

- B-51-137

https://trust.dot.state.wi.us/

Spalling at the barrier walls

- B-51-137

https://pathweb.pathwayservices.com/

Spalling at the barrier walls

- B-51-137

https://pathweb.pathwayservices.com/

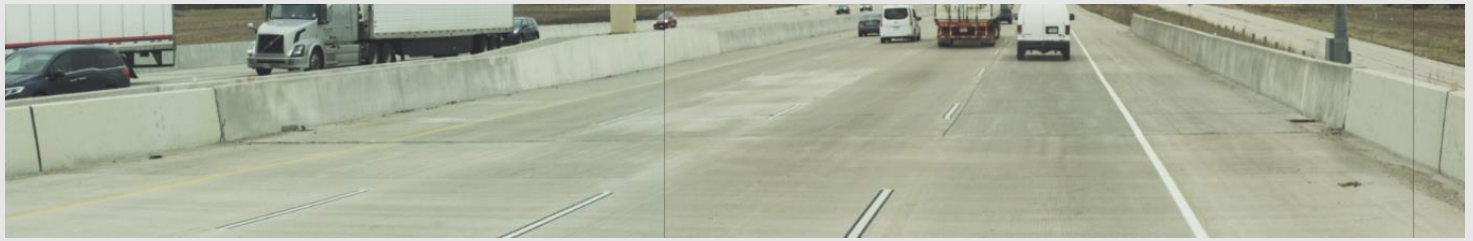
Spalling at the barrier walls

- B-30-112

https://trust.dot.state.wi.us/

Spalling at the barrier walls

- B-30-112



https://pathweb.pathwayservices.com/

Spalling at the barrier walls

- B-30-112

https://pathweb.pathwayservices.com/

Thank you!

Exceptions to the Use of SCMs

1. Small quantities.
2. Loss of source/supply
3. Source quoted not able to supply
4. Trucking cost is prohibitive from alternative source
5. Trucking issues, unavailable
6. Power Plant shutdown or ash goes out of specification
7. Central mix plant breakdown
8. Alternative plant does not have SCM available.
9. End of project/emptying pigs
10. Weather – cold weather
11. Weather – Rain imminent/forecasted
12. Traffic staging requires fast strength
13. Opening to service requires fast strength
14.

DT 2220:
Concrete Mixture Design
Combined Aggregate Gradation

CONCRETE MIXTURE DESIGN - COMBINED AGGREGATE GRADATION

DT2220: 12/2021

Wisconsin Department of Transportation

GENERAL INSTRUCTIONS PRIOR TO USING THIS SPREADSHEET
1) Upon downloading and opening the spreadsheet select Enable Editing if you get a protected view warning.
2) If you do not have the Excel Solver Add-in active on your machine you will need to enable it by selecting: file, options, Add-ins and enable the Solver Add-in.
3) Save the spreadsheet on your local computer.
4) Close the spreadsheet
5) Reopen the saved spreadsheet.

Version 1.0

This is the Official version to be used on Wisconsin DOT projects when seeking approval for combined aggregate gradation and combined mixtures.

GENERAL INSTRUCTIONS ON ENTERING DATA

NOTES

Inputs ONLY go in cells that are CANARY YELLOW

Computation cells are locked

SHEETS

1 Certification

This form can be filled out and submitted to WisDOT for your project

This certification sheet is required to be submitted for all WisDOT Mixture Designs

Ensure Worksheets 2-4 are complete and are error free

SCM Exemption Signature Field

MIXTURE DESIGNERS/CONTRACTORS: Only checkmark the SCM Exemption Request Checkbox if there are **KNOWN** logistical issues of supplying a SCM(s) for the project. Work with WisDOT staff if SCM supplies for the project are a foreseeable issue. Leave this checkbox unmarked if the project will have a steady and relaible source of SCM(s).

WisDOT STAFF ONLY: A Regional Materials Engineer is the only signature allowed in the signature field. Digital and/or physical. Any signature other than the WisDOT Regional Materials Engineer will void the proposed mixture design.

2 Aggregate System

Enter the desired aggregate information listed: Source Name, Source ID, Test #, SG, Absorption, etc.

Enter the desired individual aggregate gradations in terms of % Passing

Enter the nominal maximum sizes

3 Paste Quality

Enter info listed in Cementitious material: Manufacturer, Source, Type/Class/Grade, and SG.

SG can be found on the Mill Certification from the manufacturer.

If the 'Other' cells are filled out in the 'Cementitious Materials Information' table, fill out the 'Other Information' Table with the appropriate information

The purpose of this section is to cover SCMs that are NOT fly-ash, slag or silica fume. These include a variety of ASCMs or blended SCMs that may be allowed under the active Standard Specification

Select the desired Concrete Grade and Classification to determine allowable w/cm and total cementitious content

Enter water cementitious ratio (w/cm) that complies with Concrete Grade and Classification. A 'Pass' or 'Fail' will appear if the improper amount is typed in

Enter the desired total cementitious content the complies with the Concrete Grade and Classification. A 'Pass' or 'Fail' will appear if the improper amount is typed in

Enter the target air content of the mixture (Air %) and SAM #

Enter the percentages of Supplementary Cementitious Materials (SCMs): Fly-ash, Slag, Silica Fume, etc. The maximum total SCM replacement amount is 30%. If the input is greater than 30%, then an error message will be present

Enter Water Source

Enter Admixture information

Look up the ASTM C494 Type on the admixture product sheet

For air entrainers, type in AE

4 Mix Design **WARNING THIS WORKSHEET IS UNLOCKED AND CONTAINS SENSITIVE CALCULATIONS. ONLY MODIFY CANARY YELLOW CELLS AND G27**

Ensure Paste Quality Sheet is completely filled and the TOTAL cementitious content is greater than or equal what is required from the Grade of Concrete and Classification of Concrete. An error message will be displayed in key cells if the total cementitious content is below Spec cementitious content.

Select the total number of COARSE AGGREGATES PRESENT in the mixture in the Table called 'COMBINED AGGREGATE GRADATION LIMIT SELECTION (HOW MANY COARSE AGGREGATES)'.

For No. 2 and No. 1 Stone mixes or mixes containing 2 or more coarse aggregates: select 'Standard' from drop down menu

For No. 1 Stone only mixes: select '100% Passing 1-inch' from the drop down menu.

Not selecting the proper curve will result in an error.

Input the desired SSD aggregate weights for the mixture. If starting a new mixture design, use a target TOTAL AGGREGATE WEIGHT between 3000-4000 lbs./cy. Multiply the total aggregate weight by the desired percentage to get the weight for each aggregate.

Solve for your mix. Data → Solver → Solve → Ok

Set Objective to the TOTAL ABS. VOLUME cell: G27

Input 27.2 in the 'To:' field in Solver

Select the desired cell or cells with the aggregate weight to be changed in the 'By Changing Variable Cells' field in Solver

Press solve to get a result

Check to ensure the mixture design is within the Combined Aggregate Gradation Limits.

Check to ensure the TOTAL ABS. VOLUME equals 27.20 $ft.^3$ using standard rounding rules (Cell G27)

There is an allowable tolerance of +/- .05 $ft.^3$ from the 27.2 $ft.^3$ requirement

Data_Charts

Various visual data representations of the blended aggregates

The charts located on this sheet are FOR INFORMATIONAL PURPOSES only! It is not meant to be used for mixture design acceptance.

DT2220: CONCRETE MIXTURE DESIGN CERTIFICATION - COMBINED AGGREGATE GRADATION

SECTION A - Project Information

Construction Project ID(s)	Contract ID	Highway	County
1002-12-71	**20021210005**	**USH 18**	**Dane**

Project Title	Project Limits
Beltline	**Stoughton Rd. to Fish Hatchery Rd.**
Prime Contractor	Project Engineer / Company
Concrete Company	**Jane Doe**

SECTION B - Concrete Contractor Information

Concrete Paving Company			Telephone Number
Paving Company			**(608) 579-8368**
Main Address	City	State	Zip Code
944 Somewhere Way	**Dane**	**WI**	**54304**

SECTION C - Concrete Supplier Information

Concrete Supplier Company			Telephone Number
Concrete Company			**(608) 123-4567**
Main Address	City	State	Zip Code
1234 Out There Ave.	**Madison**	**WI**	**53532**

SECTION D - Concrete Mix Information

Contractor Mix ID	Mix Grade	MRS Mix # (132 Prefix)	Design Date
108 A	**A**	**132 -1234-2022**	**1/21/2021**

Mix to be used on following bid items:

Bid Item No.	Description
256.3211	**Concrete Pavment 8"**
602.3256	**srfafgadf**
625.2130	**sdf**
352.3216	**adf**

Concrete Plant Name / Location		Plant Type	
Redi Concrete		**Batch**	
Address	City	State	Zip Code
Fly Ash St.	**Appleton**	**WI**	**56782**

SECTION E - Mix Design Certification

I certify that this mix design meets WisDOT specification requirements. The design is based on the documented material sources, types and proportions documented during the trial batching process and is only valid for these constituents and proportions. Any change in a constituent type or source will require reevaluation of the mix design by a certified mix designer.
****Disclaimer: This mix design is to be used by the parties indicated on this certification for construction purposes. This mix design does not guarantee the results in the field due to the variability of construction operations.**

Mix Designer Name (Print)	Signature (Wet or Digital)	HTCP #	Date
Jane Doe		**123456**	**11/12/2021**

Company Name	Email	Telephone Number	
Redi Concrete	jane.doe@rediconcrete.com	**(580) 987-6543**	
Address	City	State	Zip Code
Fly Ash St.	**Appleton**	**WI**	**56782**

SECTION F - Project Staff Review

I certify that I have reviewed the mix design. All the sources listed in this mix design are approved per WisDOT specifications or written approval of the department. I have confirmed the sources in this mix design are accurate with the Contractor's submitted Quality Control Plan. I acknowledge that any source change from this mix design requires reevaluation by a certified mix designer.

Project Engineer Name (Print)	Signature (Wet or Digital)	Date	
John Doe		**1/25/2021**	

Company Name	Email	Telephone Number	
Concrete Company	johndoe@concretecompany.com	**(918) 520-1478**	
Address	City	State	Zip Code
945 Somewhere Way	**Madison**	**WI**	**53532**

DT2220: CONCRETE MIXTURE DESIGN CERTIFICATION - COMBINED AGGREGATE GRADATION

Project Information

Construction Project ID	Contract ID	Highway	County
1002-12-71	**20021210005**	**USH 18**	**Dane**

Project Title	Project Limits
Beltline	**Stoughton Rd. to Fish Hatchery Rd.**

Prime Contractor	Project Engineer / Company
Concrete Company	**Jane Doe**

Concrete Mix Information

AGGREGATE INFORMATION

Type	Source Name / Source ID	Test #
Coarse A	Stones Throw Quarry / 55-51-006-QRY	0-225-81-2021
Coarse B	Stones Throw Quarry / 55-51-006-QRY	0-225-81-2021
Coarse C	-	-
Fine A	Sandy Pit / 12-56-009-PIT	0-223-21-2021
Fine B	-	-
AGGREGATE CORRECTION FACTOR (%)		0.3

CHEMICAL ADMIXTURE INFORMATION

Name	ASTM/AASHTO Type (AE, A,B,C,D,…)	Dosage (oz./cwt)
Good AE	AE	2
Liquid Concrete	D	0.5
-	-	-
-	-	-

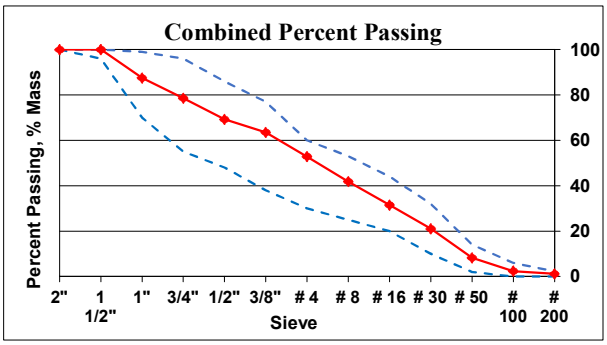
CEMENTITIOUS MATERIALS

Type	Manufacturer	Source	Type/Class/Grade
Cement	Cement Company	Dust	IL
Fly Ash	Fly Ash Company	Coal	C
Slag	-	-	-
Silica Fume	-	-	-
Other	-	-	-

Water Source

Source	Test Number
City of Madison	-

☐ Met Combined Gradation



COMBINED AGGREGATE GRADATION RESULTS

Sieve Size	Spec Defined Limits (% Pass)	Combined % Passing	Results
2"	100-100	100.0	**Pass**
1 1/2"	100-96	100.0	**Pass**
1"	99-70	87.5	**Pass**
3/4"	96-55	78.6	**Pass**
1/2"	86-48	69.3	**Pass**
3/8"	77-38	63.5	**Pass**
# 4	60-30	52.8	**Pass**
# 8	53-25	41.9	**Pass**
# 16	44-20	31.5	**Pass**
# 30	32-10	21.0	**Pass**
# 50	14-2	8.2	**Pass**
# 100	6-0	2.4	**Pass**
# 200	2.3-0	1.2	**Pass**

MIXTURE PROPORTIONS

Material	**SSD Wts. (lbs./cy)**	**Volume (ft^3)**
Coarse A	700	4.2
Coarse B	980	5.8
Coarse C	-	-
Fine A	1725	10.4
Fine B	-	-
Cement	396	2.0
Fly-Ash	170	1.0
Slag	-	-
Silica Fume	-	-
Other	-	-
Water	237	3.8
Target Air Content (%)	6.0	0.0
Target w/cm		0.42
Tot. Vol. (ft^3)		27.2

☐ SAM Number ☐ Concrete Grade ☐ Concrete Classification

☐ Mix Designer's Request for SCM exemption (501.3.2.2.2)

	Concrete Grade	Concrete Classification
0.20	**A**	**Class I: Barrier**

X _____

TO THE ENGINEER: ONLY SIGN AFTER DISCUSSING THE REASON FOR SCM EXEMPTION

DT2220: CONCRETE MIXTURE DESIGN - COMBINED AGGREGATE GRADATION			Design Date	01/21/21
Project Information				
Construction Project ID **1002-12-71**	Contract ID **20021210005**	Highway **USH 18**	County **Dane**	
Project Title **Beltline**		Project Limits **Stoughton Rd. to Fish Hatchery Rd.**		
Prime Contractor **Concrete Company**		Project Engineer / Company **Jane Doe**		

Version 1.0

AGGREGATE SOURCES AND INFORMATION						
Type	Source Name	Source ID #	Test #	S.G. (OD)	Absorp (%)	S.G. (SSD)
Coarse A	**Stones Throw Quarry**	**55-51-006-QRY**	**0-225-81-2021**	**2.646**	**1.913**	2.697
Coarse B	**Stones Throw Quarry**	**55-51-006-QRY**	**0-225-81-2021**	**2.646**	**1.913**	2.697
Coarse C						0.000
Fine A	**Sandy Pit**	**12-56-009-PIT**	**0-223-21-2021**	**2.622**	**1.502**	2.661
Fine B						0.000

AGGREGATE CORRECTION FACTOR	0.3

SIEVE ANALYSIS DATA					
Aggregate Type	Coarse A	Coarse B	Coarse C	Fine A	Fine B
Source Name	Stones Throw Quarry	Stones Throw Quarry		Sandy Pit	
Sieve:	% Pass	% Pass	% Pass	% Pass	% Pass
2"	**100.0**	**100.0**		**100.0**	
1 1/2"	**100.0**	**100.0**		**100.0**	
1"	**39.3**	**100.0**		**100.0**	
3/4"	**3.0**	**95.0**		**100.0**	
1/2"	**2.0**	**63.3**		**100.0**	
3/8"	**1.5**	**43.7**		**100.0**	
# 4	**1.1**	**6.8**		**100.0**	
# 8	**0.8**	**3.0**		**80.6**	
# 16	**0.7**	**1.9**		**60.8**	
# 30	**0.6**	**1.2**		**40.6**	
# 50	**0.5**	**0.7**		**15.6**	
# 100	**0.3**	**0.4**		**4.3**	
# 200	**0.1**	**0.3**		**2.1**	
Max Nominal Aggregate Size (in.)	**1 1/2"**	**3/4"**			

Fineness Modulus of Fine A	2.98
Fineness Modulus of Fine B	0.00

DT2220: CONCRETE MIXTURE DESIGN - COMBINED AGGREGATE GRADATION			Design Date	01/21/21
Project Information				
Construction Project ID **1002-12-71**	Contract ID **20021210005**	Highway **USH 18**	County **Dane**	
Project Title **Beltline**		Project Limits **Stoughton Rd. to Fish Hatchery Rd.**		
Prime Contractor **Concrete Company**		Project Engineer / Company **Jane Doe**		

CEMENTITIOUS MATERIAL INFORMATION				
	Manufacturer	Source	Type/Class/Grade:	Specific Gravity (S.G.)
Cement	**Cement Company**	**Dust**	**IL**	3.150
Fly Ash	**Fly Ash Company**	**Coal**	**C**	**2.70**
Slag				
Silica Fume				
Other				

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OTHER INFORMATION (FILL OUT IF 'OTHER' CELL IS FILLED)			
Material Name	Material Type (Blended SCM, ASCM)	ASTM/AASHTO	Liquid/Powder

501.3.2.3 ,710.4 & 715.2.2 MIXTURE DESIGN REQUIREMENTS	
CONCRETE GRADE	**A**
CONCRETE CLASSIFICATION	**Class I: Barrier**
MIN. CEMENTITIOUS CONTENT (LBS./CY)	**565**
MAX. W/CM	**0.42**

CONCRETE MATERIAL PROPERTIES		
Total Cementitious (lbs./cy)	**565**	**PASS**
Target w/cm	**0.42**	**PASS**
Target Volume of Air (%)	**6.0**	**PASS**
SAM #	**0.20**	during trial batching
SCM REPLACEMENT AMOUNTS		
Fly Ash	**30**	% Rep. by Wt. Cem.
Slag		% Rep. by Wt. Cem.
Silica Fume		% Rep. by Wt. Cem.
Other		% Rep. by Wt. Cem.
Total SCM Rep.	**30**	% Rep. by Wt. Cem.

AGGREGATE SOURCES				
	Source Name	Source ID #	S.G. (OD)	S.G. (SSD)
Coarse A	Stones Throw Quarry	55-51-006-QRY	2.65	2.70
Coarse B	Stones Throw Quarry	55-51-006-QRY	2.65	2.70
Coarse C				0.00
Fine A	Sandy Pit	12-56-009-PIT	2.62	2.66
Fine B				0.00

WATER				
	Gal	Source	Test Number	SG
Water	**28.45**	**City of Madison**		1.00

ADMIXTURE			
	Name	ASTM/AASHTO Type (AE,A,B,C,D,..)	Dosage (oz/cwt)
1	**Good AE**	**AE**	**2**
2	**Liquid Concrete**	**D**	**0.5**
3			
4			

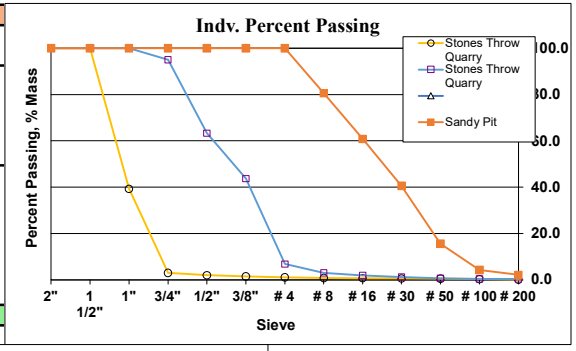
DT2220: CONCRETE MIXTURE DESIGN - COMBINED AGGREGATE GRADATION			Design Date	01/21/21
Project Information				
Construction Project ID	Contract ID	Highway	County	
1002-12-71	**20021210005**	**USH 18**	Dane	
Project Title		Project Limits		
Beltline		**Stoughton Rd. to Fish Hatchery Rd.**		
Prime Contractor		Project Engineer / Company		
Concrete Company		**Jane Doe**		

Version 1.0

COMBINED AGGREGATE GRADATION LIMIT SELECTION (STANDARD OR 100% PASSING 1 INCH SIEVE)	Standard

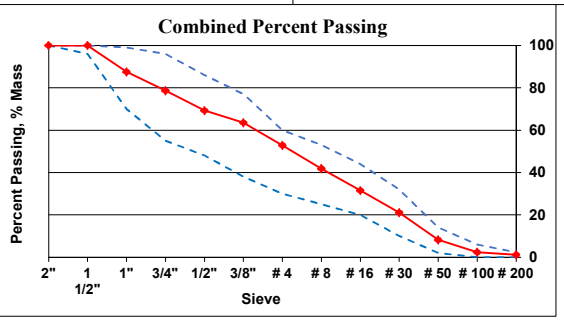
MIXTURE PROPORTIONS

Material	Source Name/Manufacturer	SSD Weight (lbs./cy)	Agg. % Mass	S.G. (SSD)	Abs. Volume (ft^3)
Coarse A	Stones Throw Quarry	700	20.6	2.697	4.2
Coarse B	Stones Throw Quarry	980	28.8	2.697	5.8
Coarse C			0.0	0.000	-
Fine A	Sandy Pit	1725	50.7	2.661	10.4
Fine B			0.0	0.000	-
Cement	Cement Company	395		3.15	2.0
Fly Ash	Fly Ash Company	170		2.70	1.0
Slag		0		0.00	0.0
Silica Fume		0		0.00	0.0
Other		0		0.00	0.0
Water		237		1.00	3.8
Target Air %		6.0			0.0
	TOTAL	4207			**27.2**



MIXTURE VOLUMETRICS AND WEIGHTS

Cementitious	**565**	lbs./cy
Total Agg. Vol.	20.4	ft^3
Total Agg. Wt.	3405	lbs.
% Vol. of Coarse Agg.	36.7	%
% Vol. of Fine Agg.	38.2	%
% Vol. of paste	25.1	%
% Vol. of aggs	74.9	%
w/cm	0.42	



COMBINED AGGREGATE GRADATION RESULTS

Source Name	Aggregate Proportions: Coarse A Stones Throw Quarry	Coarse B Stones Throw Quarry	Coarse C	Fine A Sandy Pit	Fine B	Combined by Mass %: Spec Defined Limits (% Pass) UL	LL	Combined % Passing	Results
% Mass	20.6	28.8	0.0	50.7	0.0				
Sieve:	% Passing								
2"	20.6	28.8	-	50.7	-	100	100	100.0	Pass
1 1/2"	20.6	28.8	-	50.7	-	100	96	100.0	Pass
1"	8.1	28.8	-	50.7	-	99	70	87.5	Pass
3/4"	0.6	27.3	-	50.7	-	96	55	78.6	Pass
1/2"	0.4	18.2	-	50.7	-	86	48	69.3	Pass
3/8"	0.3	12.6	-	50.7	-	77	38	63.5	Pass
# 4	0.2	2.0	-	50.7	-	60	30	52.8	Pass
# 8	0.2	0.9	-	40.8	-	53	25	41.9	Pass
# 16	0.1	0.5	-	30.8	-	44	20	31.5	Pass
# 30	0.1	0.3	-	20.6	-	32	10	21.0	Pass
# 50	0.1	0.2	-	7.9	-	14	2	8.2	Pass
# 100	0.1	0.1	-	2.2	-	6	0	2.4	Pass
# 200	0.0	0.1	-	1.1	-	2.3	0	1.2	Pass
		Composite FA Fineness Modulus			2.98				

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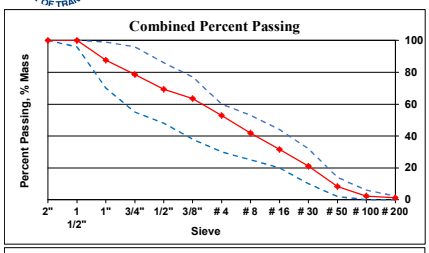
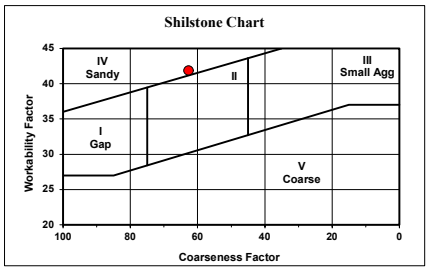
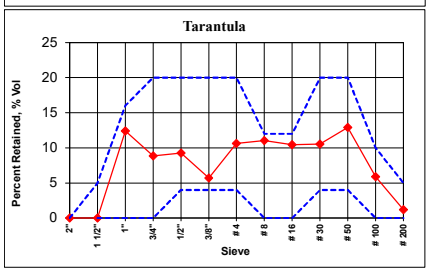
INFORMATIONAL PURPOSES ONLY

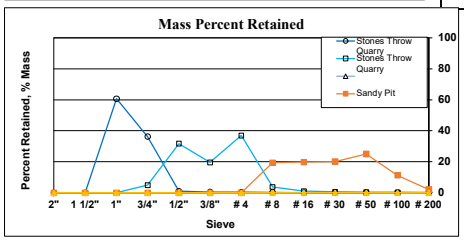
Shilstone Chart Data	
Coarseness Factor	62.70
Workability Factor	41.86
Adjustments	0.00
Adjusted Workability Factor	41.86





Shilstone Chart			Aggregate Proportions	
Sieve:	Combined by Mass %		Source Name	Agg. % Mass
	% Passing	Cum. % Ret.	Stones Throw Quarry	20.6
			Stones Throw Quarry	28.8
				0.0
2"	100.0	0.0	Sandy Pit	50.7
1 1/2"	100.0	0.0		0.0
1"	87.5	12.5		
3/4"	78.6	21.4		
1/2"	69.3	30.7		
3/8"	63.5	36.5		
# 4	52.8	47.2		
# 8	41.9	58.1		
# 16	31.5	68.5		
# 30	21.0	79.0		
# 50	8.2	91.8		
# 100	2.4	97.6		
# 200	1.2	98.8		





OPTIMIZED AGGREGATE GRADATION RESULTS			
Sieve Size	Spec Defined % Retained	% Retained Volumetric	Results
2"	0	0.0	Pass
1 1/2"	≤5	0.0	Pass
1"	≤16	12.4	Pass
3/4"	≤20	8.8	Pass
1/2"	4-20	9.3	Pass
3/8"	4-20	5.7	Pass
# 4	4-20	10.6	Pass
# 8	≤12	11.0	Pass
# 16	≤12	10.4	Pass
# 30	4-20	10.5	Pass
# 50	4-20	12.9	Pass
# 100	≤10	5.9	Pass
# 200	≤5.0	1.2	Pass

TARANTULA RESULTS: FINE AGGREGATE LIMITS (From Table 501-4 in the Standard Specification)

Placement Method	Description	Sieves Retained on	Limit	Mix Retained (%)	Results
Slip-form	Fine	#30 - #200	Slip-form: 24%-34%	30.5	Pass
			Pumping, Hand Placement or Other: 24%-40%		
	Coarse	#8, #16, and #30	>15%	32.0	Pass

DT 2221:
Concrete Mixture Design
Optimized Aggregate Gradation

GENERAL INSTRUCTIONS PRIOR TO USING THIS SPREADSHEET	
1)	Upon downloading and opening the spreadsheet select Enable Editing if you get a protected view warning.
2)	If you do not have the Excel Solver Add-in active on your machine you will need to enable it by selecting: file, options, Add-ins and enable the Solver Add-in.
3)	Save the spreadsheet on your local computer.
4)	Close the spreadsheet
5)	Reopen the saved spreadsheet.

Version 1.0

This is the Official version to be used on Wisconsin DOT projects when seeking approval for optimized gradation and optimized mixtures.

GENERAL INSTRUCTIONS ON ENTERING DATA

NOTES

Inputs ONLY go in cells that are CANARY YELLOW

Computation cells are locked

SHEETS

1 Certification

This form can be filled out and submitted to WisDOT for your project

This certification sheet is required to be submitted for all WisDOT Mixture Designs

Ensure Worksheets 2-4 are complete and are error free

SCM Exemption Signature Field

MIXTURE DESIGNERS/CONTRACTORS: Only checkmark the SCM Exemption Request Checkbox if there are **KNOWN** logistical issues of supplying a SCM(s) for the project. Work with WisDOT staff if SCM supplies for the project are a foreseeable issue. Leave this checkbox unmarked if the project will have a steady and relaible source of SCM(s).

WisDOT STAFF ONLY: A Regional Materials Engineer is the only signature allowed in the signature field. Digital and/or physical. Any signature other than the WisDOT Regional Materials Engineer will void the proposed mixture design.

2 Aggregate System **WARNING Computation Cells not locked for SOLVER to work - Input Data Only**

Enter the desired aggregate information listed: Source Name, Source ID, Test #, SG, Absorption, etc.

Enter the desired individual aggregate gradations in terms of % Passing

Enter the nominal maximum sizes

3 Paste Quality

Enter info listed in Cementitious material: Manufacturer, Source, Type/Class/Grade, and SG.

SG can be found on the Mill Certification from the manufacturer.

If the 'Other' cells are filled out in the 'Cementitious Materials Information' table, fill out the 'Other Information' Table with the appropriate information

The purpose of this section is to cover SCMs that are NOT fly-ash, slag or silica fume. These include a variety of ASCMs or blended SCMs that may

Select from the drop-down menu the Concrete Classification for the maximum w/cm ratio allowed per 715.2.2

Enter the desired TOTAL cementitious content as lbs./cy. The lowest allowed total cementitious is 500 lbs./cy for Optimized Aggregate Mixtures (OAG)

Enter a water cementitious ratio (w/cm) lower than the max w/cm ratio allowed.

Enter the target air content of the mixture (Air %) and SAM Number

If the mixture is a slip-form mixture: Enter the Box Test Results

Enter the percentages of Supplementary Cementitious Materials (SCMs): Fly-ash, Slag, Silica Fume, etc. The maximum total SCM replacement amount is 30%. If the input is greater than 30%, then an error message will be present. See 501.2.4.2.4 for restrictions on silica fume

Enter the measured aggregate void results using ASTM C 29

Enter Water Source information and testing

Enter Admixture information

Look up the ASTM C494 Type on the admixture product sheet

For air entrainers, type in AE

4 Mix Design **WARNING THIS WORKSHEET IS UNLOCKED AND CONTAINS SENSITIVE CALCULATIONS. ONLY MODIFY CANARY YELLOW CELLS AND F25**

Ensure Paste Quality Sheet is completely filled and error free. An error message will be displayed in key cells if there are violations/errors on the 2 previous sheets.

Input the desired aggregate weights for the mixture. If starting a new mixture design, use a target TOTAL AGGREGATE WEIGHT between 3000-4000 lbs./cy. Multiply the total aggregate weight by the desired percentage to get the weight for each aggregate.

Select the concrete placement method from the drop down menu in the 'TARANTULA RESULTS: FINE AGGREGATE LIMITS' at the bottom of the worksheet

Solve for your mix. Data → Solver → Solve → Ok

Set Objective to the TOTAL ABS. VOLUME cell: F25

Input 27.2 in the 'To:' field in Solver

Select the desired cell or cells with the aggregate weight to be changed in the 'By Changing Variable Cells' field in Solver

Press solve to get a result

Check to ensure the mixture design is within the Tarantula Curve Limits

Check to ensure the TOTAL ABS. VOLUME equals 27.20 $ft.^3$ using standard rounding rules (Cell F25)

There is an allowable tolerance of +/- .05 $ft.^3$ from the 27.2 $ft.^3$ requirement

Check the volume of paste/volume of voids (vp/vv) ratio so it is above 1.25.

Check the fine aggregate limits and make sure the desired placement method is selected. If the placement method is not selected from the drop down menu, an error message will be present in the Fine Aggregate Limits Section.

Data_Charts

Various visual data representations of the blended aggregates

The charts located on this sheet are FOR INFORMATIONAL PURPOSES only!

Unit Wt_Voids in Agg

Use this sheet to determine voids in aggregate

Calculating unit weight voids in aggregate is a required input for sheet 2. Th Unit Wt_Voids in Agg sheet is provided for your convenience and ease of calculating.

DT2221: CONCRETE MIXTURE DESIGN CERTIFICATION - OPTIMIZED AGGREGATE GRADATION

SECTION A - Project Information

Construction Project ID(s)	Contract ID	Highway	County
1002-12-71	**20021210005**	**USH 18**	**Dane**

Project Title	Project Limits
Beltline	**Stoughton Rd. to Fish Hatchery Rd.**
Prime Contractor	Project Engineer / Company
Concrete Company	**Jane Doe**

SECTION B - Concrete Contractor Information

Concrete Paving Company	Telephone Number		
Paving Company	**(608) 579-8368**		
Main Address	City	State	Zip Code
944 Somewhere Way	**Dane**	**WI**	**54304**

SECTION C - Concrete Supplier Information

Concrete Supplier Company	Telephone Number		
Concrete Company	**(608) 123-4567**		
Main Address	City	State	Zip Code
1234 Out There Ave.	**Madison**	**WI**	**53532**

SECTION D - Concrete Mix Information

Contractor Mix ID	Mix Grade	MRS Mix # (132 Prefix)	Design Date
108 OAG	**OAG**	**132-56789-2022**	**1/21/2021**

Mix to be used on following bid items:

Bid Item No.	Description
256.3211	**Concrete Pavment 8"**
602.3256	**srfafgadf**
625.2130	**sdf**
352.3216	**adf**

Concrete Plant Name / Location	Plant Type		
Redi Concrete	**Batch**		
Address	City	State	Zip Code
Fly Ash St.	**Appleton**	**WI**	**56782**

SECTION E - Mix Design Certification

I certify that this mix design meets WisDOT specification requirements. The design is based on the documented material sources, types and proportions documented during the trial batching process and is only valid for these constituents and proportions. Any change in a constituent type or source will require reevaluation of the mix design by a certified mix designer.
****Disclaimer: This mix design is to be used by the parties indicated on this certification for construction purposes. This mix design does not guarantee the results in the field due to the variability of construction operations.**

Mix Designer Name (Print)	Signature (Wet or Digital)	HTCP #	Date
Jane Doe		**123456**	**11/12/2021**
Company Name	Email	Telephone Number	
Redi Concrete	jane.doe@rediconcrete.com	**(580) 987-6543**	
Address	City	State	Zip Code
Fly Ash St.	**Appleton**	**WI**	**56782**

SECTION F - Project Staff Review

I certify that I have reviewed the mix design. All the sources listed in this mix design are approved per WisDOT specifications or written approval of the department. I have confirmed the sources in this mix design are accurate with the Contractor's submitted Quality Control Plan. I acknowledge that any source change from this mix design requires reevaluation by a certified mix designer.

Project Engineer Name (Print)	Signature (Wet or Digital)	Date	
John Doe		**1/25/2021**	
Company Name	Email	Telephone Number	
Concrete Company	johndoe@concretecompany.com	**(918) 520-1478**	
Address	City	State	Zip Code
945 Somewhere Way	**Madison**	**WI**	**53532**

DT2221: CONCRETE MIXTURE DESIGN CERTIFICATION - OPTIMIZED AGGREGATE GRADATION

Project Information

Construction Project ID	Contract ID	Highway	County
1002-12-71	**20021210005**	**USH 18**	**Dane**

Project Title	Project Limits
Beltline	**Stoughton Rd. to Fish Hatchery Rd.**

Prime Contractor	Project Engineer / Company
Concrete Company	**Jane Doe**

Concrete Mix Information

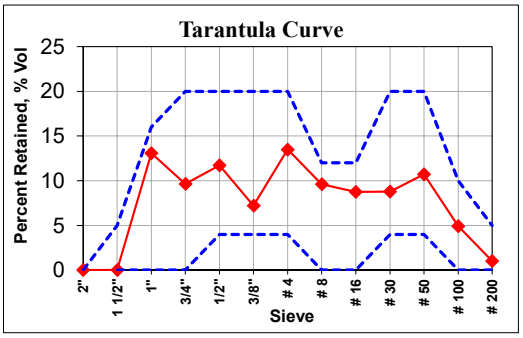
AGGREGATE INFORMATION		
Type	Source Name / Source ID	Test #
Coarse A	Stones Throw Quarry / 55-51-006-QRY	0-225-81-2021
Coarse B	Stones Throw Quarry / 55-51-006-QRY	0-225-81-2021
Coarse C	-	-
Fine A	Sandy Pit / 12-56-009-PIT	0-223-21-2021
Fine B	-	-
AGGREGATE CORRECTION FACTOR (%)		0.3

CHEMICAL ADMIXTURE INFORMATION		
Name	ASTM/AASHTO Type (AE,A,B,C,D,..)	Dosage (oz./cwt)
Good AE	AE	2
Liquid Concrete	D	0.5
-	-	-
-	-	-

CEMENTITIOUS MATERIALS			
Type	Manufacturer	Source	Type/Class/Grade
Cement	Cement Company	Dust	IL
Fly Ash	Fly Ash Company	Coal	C
Slag	-	-	-
Silica Fume	-	-	-
Other	-	-	-

WATER SOURCE	
Source	Test Number
City of Madison	-

☐ Met Optimized Gradation



TARANTULA RESULTS			
Sieve Size	**Spec Defined % Retained**	**Proposed Retained Volumetric**	**Results**
2"	0	0.0	**Pass**
1 1/2"	≤5	0.0	**Pass**
1"	≤16	13.1	**Pass**
3/4"	≤20	9.6	**Pass**
1/2"	4-20	11.7	**Pass**
3/8"	4-20	7.2	**Pass**
# 4	4-20	13.5	**Pass**
# 8	≤12	9.6	**Pass**
# 16	≤12	8.8	**Pass**
# 30	4-20	8.8	**Pass**
# 50	4-20	10.7	**Pass**
# 100	≤10	4.9	**Pass**
# 200	≤5.0	1.0	**Pass**

MIXTURE PROPORTIONS		
Material	**SSD Wts. (lbs./yd^3)**	**Volume (ft^3)**
Coarse A	700	4.2
Coarse B	1180	7.0
Coarse C	-	0.0
Fine A	1350	8.1
Fine B	-	0.0
Cement	360	1.8
Fly-Ash	155	0.9
Slag	-	0.0
Silica Fume	-	0.0
Other	-	0.0
Water	216	3.5
Air Content (%)	6.0	1.6
Target w/cm		0.42
Tot. Vol. (ft^3)		27.2

☐ Met Combined Sieves

Description	Sieves Retained on	Placement Method	Mix Retained (%)	Results
Fine	#30 - #200	Slip-form	25.4	Pass
Coarse	#8, #16, and #30		27.2	Pass
P200 Req.	Comb. % Passing Req.	Combined % Passing	Result	
	P200 ≤ 2.3%	1.0	Pass	

☐ Voids >= 1.25 **1.63**

☐ Box Test <=2 **1**

☐ SAM Number **0.20**

☐ Mix Designer's Request for SCM exemption (501.3.2.2.2)

X

WisDOT Regional Materials Engineer Signature

TO THE ENGINEER: ONLY SIGN AFTER DISCUSSING THE REASON FOR SCM EXEMPTION

DT2221: CONCRETE MIXTURE DESIGN - OPTIMIZED AGGREGATE GRADATION			Design Date	01/21/21
Project Information				
Construction Project ID **1002-12-71**	Contract ID **20021210005**	Highway **USH 18**	County **Dane**	
Project Title **Beltline**		Project Limits **Stoughton Rd. to Fish Hatchery Rd.**		
Prime Contractor **Concrete Company**		Project Engineer / Company **Jane Doe**		

Version 1.0

AGGREGATE SOURCES AND INFORMATION						
Type	Source Name	Source ID #	Test #	S.G. (OD)	Absorp (%)	S.G. (SSD)
Coarse A	**Stones Throw Quarry**	**55-51-006-QRY**	**0-225-81-2021**	**2.646**	**1.913**	2.697
Coarse B	**Stones Throw Quarry**	**55-51-006-QRY**	**0-225-81-2021**	**2.646**	**1.913**	2.697
Coarse C						0.000
Fine A	**Sandy Pit**	**12-56-009-PIT**	**0-223-21-2021**	**2.622**	**1.502**	2.661
Fine B						0.000

AGGREGATE CORRECTION FACTOR	0.3

SIEVE ANALYSIS DATA					
Aggregate Type	Coarse A	Coarse B	Coarse C	Fine A	Fine B
Source Name	Stones Throw Quarry	Stones Throw Quarry		Sandy Pit	
Sieve:	% Pass	% Pass	% Pass	% Pass	% Pass
2"	**100.0**	**100.0**		**100.0**	
1 1/2"	**100.0**	**100.0**		**100.0**	
1"	**39.3**	**100.0**		**100.0**	
3/4"	**3.0**	**95.0**		**100.0**	
1/2"	**2.0**	**63.3**		**100.0**	
3/8"	**1.5**	**43.7**		**100.0**	
# 4	**1.1**	**6.8**		**100.0**	
# 8	**0.8**	**3.0**		**80.6**	
# 16	**0.7**	**1.9**		**60.8**	
# 30	**0.6**	**1.2**		**40.6**	
# 50	**0.5**	**0.7**		**15.6**	
# 100	**0.3**	**0.4**		**4.3**	
# 200	**0.1**	**0.3**		**2.1**	
Max Nominal Aggregate Size (in.)	**1 1/2"**	**3/4"**			
Fineness Modulus of Fine A		2.98			
Fineness Modulus of Fine B		0.00			

DT2221: CONCRETE MIXTURE DESIGN - OPTIMIZED AGGREGATE GRADATION			Design Date	01/21/21
Project Information				
Construction Project ID **1002-12-71**	Contract ID **20021210005**	Highway **USH 18**	County **Dane**	
Project Title **Beltline**		Project Limits **Stoughton Rd. to Fish Hatchery Rd.**		
Prime Contractor **Concrete Company**		Project Engineer / Company **Jane Doe**		

CEMENTITIOUS MATERIAL INFORMATION				
	Manufacturer	Source	Type/Class/Grade:	Specific Gravity (S.G.)
Cement	**Cement Company**	**Dust**	**IL**	3.15
Fly Ash	**Fly Ash Company**	**Coal**	**C**	**2.70**
Slag				
Silica Fume				
Other				

Version 1.0

OTHER INFORMATION (FILL OUT IF 'OTHER' CELL IS FILLED)			
Material Name	Material Type (Blended SCM, ASCM)	ASTM/AASHTO	Liquid/Powder

501.3.2.3 & 715.2.2 MIXTURE DESIGN REQUIREMENTS	
CONCRETE CLASSIFICATION	**Class I: Pavement**
MAX. W/CM	**0.42**
MIN. TOTAL CEMENTITIOUS CONTENT (LBS./CY)	**500**

CONCRETE MATERIAL PROPERTIES		
Total Cementitious (lbs./cy)	**515**	**PASS**
Target w/cm	**0.42**	**PASS**
Volume of Air (%)	**6.0**	**PASS**
SAM #	**0.20**	during trial batching
Box Test Eval.	**1**	Rating # (if using)
Void Content (%)	**25.0**	**PASS**
SCM REPLACEMENT AMOUNTS		
Fly Ash	**30**	% Rep. by Wt. Cem.
Slag		% Rep. by Wt. Cem.
Silica Fume		% Rep. by Wt. Cem.
Other		% Rep. by Wt. Cem.
Total SCM Rep.	**30**	% Rep. by Wt. Cem.

25 = from Voids WS

AGGREGATE SOURCES				
	Source Name	Source ID #	S.G. (OD)	S.G. (SSD)
Coarse A	Stones Throw Quarry	55-51-006-QRY	2.646	2.697
Coarse B	Stones Throw Quarry	55-51-006-QRY	2.646	2.697
Coarse C				0.000
Fine A	Sandy Pit	12-56-009-PIT	2.622	2.661
Fine B				0.000

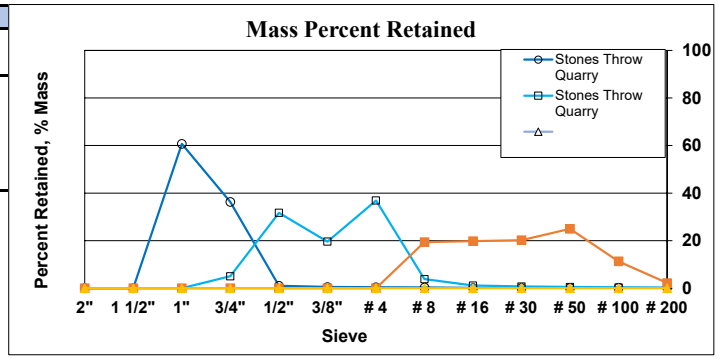
WATER				
	Gal	Source	Test Number	SG
Water	**25.94**	**City of Madison**		1.00

ADMIXTURE			
	Name	ASTM/AASHTO Type (AE,A,B,C,D,..)	Dosage (oz/cwt)
1	**Good AE**	**AE**	**2**
2	**Liquid Concrete**	**D**	**0.5**
3			
4			

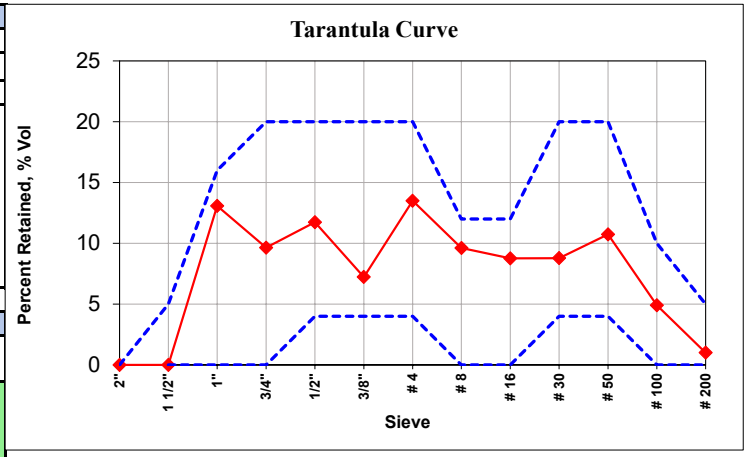
DT2221: CONCRETE MIXTURE DESIGN - OPTIMIZED AGGREGATE GRADATION			Design Date	01/21/21
Project Information				
Construction Project ID **1002-12-71**	Contract ID **20021210005**	Highway **USH 18**	County **Dane**	
Project Title **Beltline**		Project Limits **Stoughton Rd. to Fish Hatchery Rd.**		
Prime Contractor **Concrete Company**		Project Engineer / Company **Jane Doe**		

Version 1.0

MIXTURE PROPORTIONS						
Material	Source Name/Manufacturer	SSD Weight (lbs./yd^3)	S.G. (SSD)	Abs. Volume (ft^3)	Agg. % Volume	Agg. % Mass
Coarse A	Stones Throw Quarry	700	2.697	4.2	21.6	21.7
Coarse B	Stones Throw Quarry	1180	2.697	7.0	36.3	36.5
Coarse C			0.000	0.0	0.0	0.0
Fine A	Sandy Pit	1350	2.661	8.1	42.1	41.8
Fine B			0.000	0.0	0.0	0.0
Cement	Cement Company	361	3.15	1.8		
Fly Ash	Fly Ash Company	155	2.70	0.9		
Slag		0	0.00	0.0		
Silica Fume		0	0.00	0.0		
Other		0	0.00	0.0		
Water		216	1.00	3.5		
Air %		6.0		1.6		
	TOTAL	3961		**27.2**		



MIXTURE VOLUMETRICS AND WEIGHTS			
Cementitious		**515**	lbs./cy
Total Agg. Vol.		19.3	ft^3
Total Agg. Wt.		3230	lbs.
Vol. of Coarse Agg.		41.1	%
Vol. of Fine Agg.		29.9	%
Vol. of aggs		71.1	%
Vol. of paste		28.9	%
Vol. of voids		17.8	%
Voids Content		25.0	%
vp/vv	>1.25	1.63	
Target w/cm		0.42	



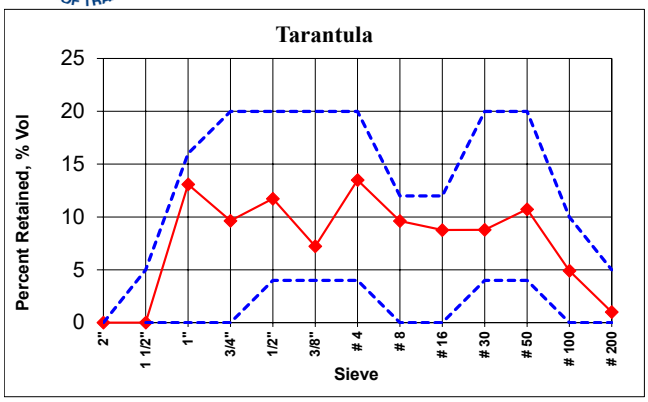
TARANTULA RESULTS			
Sieve Size	Spec Defined % Retained	% Retained Volumetric	Results
2"	0	0.0	Pass
1 1/2"	≤5	0.0	Pass
1"	≤16	13.1	Pass
3/4"	≤20	9.6	Pass
1/2"	4-20	11.7	Pass
3/8"	4-20	7.2	Pass
# 4	4-20	13.5	Pass
# 8	≤12	9.6	Pass
# 16	≤12	8.8	Pass
# 30	4-20	8.8	Pass
# 50	4-20	10.7	Pass
# 100	≤10	4.9	Pass
# 200	≤5.0	1.0	Pass
Composite FA Fineness Modulus		2.98	

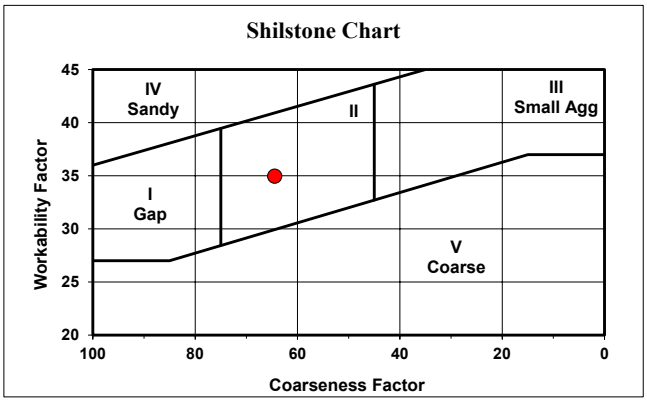
TARANTULA RESULTS: FINE AGGREGATE LIMITS (From Table 501-4 in the Standard Specification)					
Placement Method	Description	Sieves Retained on	Limit	Mix Retained (%)	Results
Slip-form	Fine	#30 - #200	Slip-form: 24%-34% Pumping, Hand Placement or Other: 24%-40%	25.4	Pass
	Coarse	#8, #16, and #30	>15%	27.2	Pass
			Combined P200: <2.3%	Mix % Passing 1.0	Pass

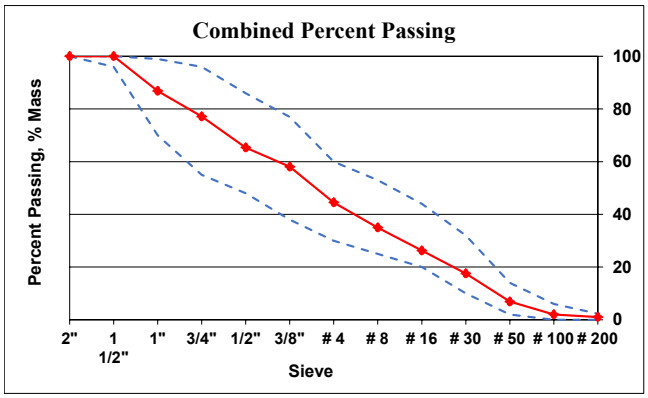
Version 1.0

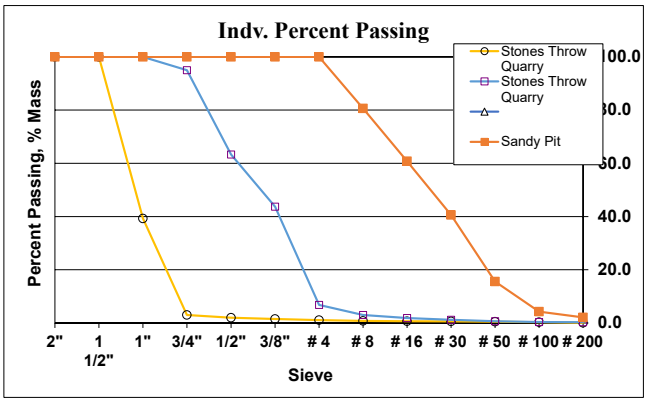
INFORMATIONAL PURPOSES ONLY

Shilstone Chart Data	
Coarseness Factor	64.44
Workability Factor	34.96
Adjustments	0.00
Adjusted Workability Factor	34.96









Shilstone Chart/Combined Aggregate Gradation							
	Mix % Passing					Combined by Mass %	
Sieve:	Coarse A	Coarse B	Coarse C	Fine A	Fine B	% Passing	Cum. % Ret.
Source Name	Stones Throw Quarry	Stones Throw Quarry		Sandy Pit			
% Mass	21.7	36.5	0.0	41.8	0.0		
2"	21.7	36.5	0.0	41.8	0.0	100.0	0.0
1 1/2"	21.7	36.5	0.0	41.8	0.0	100.0	0.0
1"	8.5	36.5	0.0	41.8	0.0	86.8	13.2
3/4"	0.7	34.7	0.0	41.8	0.0	77.2	22.8
1/2"	0.4	23.1	0.0	41.8	0.0	65.4	34.6
3/8"	0.3	16.0	0.0	41.8	0.0	58.1	41.9
# 4	0.2	2.5	0.0	41.8	0.0	44.5	55.5
# 8	0.2	1.1	0.0	33.7	0.0	35.0	65.0
# 16	0.2	0.7	0.0	25.4	0.0	26.3	73.7
# 30	0.1	0.4	0.0	17.0	0.0	17.5	82.5
# 50	0.1	0.3	0.0	6.5	0.0	6.9	93.1
# 100	0.1	0.1	0.0	1.8	0.0	2.0	98.0
# 200	0.0	0.1	0.0	0.9	0.0	1.0	99.0

UNIT WEIGHT/VOIDS IN AGGREGATE - AASHTO T19/ ASTM: C29			**Design Date**	**01/21/21**
Project Information				
Construction Project ID **1002-12-71**	Contract ID **20021210005**	Highway **USH 18**	County **Dane**	
Project Title **Beltline**	Project Limits **Stoughton Rd. to Fish Hatchery Rd.**			
Prime Contractor **Concrete Company**	Subcontractor (if applicable) **Jane Doe**			

Mix Type:	OAG
Maximum Nominal Aggregate Size:	1 1/2"
Unit Weight By :	Rodding
Moisture Condition at Time of Test:	Oven Dry

Version 1.0

NOTE: Must use all 3 to get the correct average and for this spreadsheet to work

	1	2	3	
Wt. of Sample and Container, lbs (A)	80.75	80.85	80.70	
Wt. Of Unit Weight Container, lbs (B)	18.80	18.80	18.80	
Weight of Sample, lbs (A-B)	61.95	62.05	61.90	
Container Volume, cf (C)	0.5000	0.5000	0.5000	Avg.
Dry Rodded Unit Weight, pcf (D)	123.9	124.1	123.8	123.9
Avg. Agg. Bulk Specific Gravity (E)	2.636	2.636	2.636	2.636
Void Content (%)	25	24	25	25

Dry Rodded Unit Weight (D) = $\frac{A-B}{C}$ *(nearest 0.1 pcf)*

Avg. Aggregate Specific Gravity (E)= $\frac{1}{\frac{P_{CA-A}}{100G_{CA-A}} + \frac{P_{FA-A}}{100G_{FA-A}} + \frac{P_n}{100G_n}}$ *(ASTM: C128/ AASHTO T85)*

Where:

$P_1, P_2, \ldots P_n$ = percentage of each aggregate in the mix

$G_1, G_2, \ldots G_n$ = appropriate Bulk SG of each aggregate in the mix

P_{CA-A} =	21.7
P_{CA-B} =	36.5
P_{CA-C} =	
P_{FA-A} =	41.8
P_{FA-B} =	
G_{CA-A} =	2.646
G_{CA-B} =	2.646
G_{CA-C} =	1.000
G_{FA-A} =	2.622
G_{FA-B} =	1.000

Avg. Aggregate Specific Gravity (E) = $\frac{1}{\frac{P_{CA-A}}{100G_{CA-A}} + \frac{P_{FA-A}}{100G_{FA-A}} + \frac{P_n}{100G_n}}$ = **2.636**
(ASTM: C128/ AASHTO T85)

Void Content = $\frac{100\,[(E \times 62.3) - D]}{E \times 62.3}$ = **25** *(nearest 1%)*

Manual of Test Procedures

...FOR WISCONSIN

Manual of Test Procedures (MOTP)

1. *Ensure all parties are testing the same.*
2. *One stop shop for modifications to AASHTO or ASTM (currently found in HTCP, CMM an/or Standard Spec)*
3. *Will be a place to add new procedures/methods in an organized manner.*

Where does the MOTP fit in?

STANDARD SPEC

- ✓ Material requirements
- ✓ Acceptance (QC/QV)
- ✓ Testing Frequencies
- ✓ Dispute Resolution
- ✓ Pay Items / Deductions / Incentives

MANUAL OF TEST PROCEDURES

- ✓ HOW TO TEST
- ✓ AASHTO/ASTM (WisDOT calibrated)
- ✓ Procedures Related to Testing
- ✓ Forms too?

Wisconsin Test Modification (WTM)

- References an existing AASHTO or ASTM
- Replaces, Deletes or Adds in verbiage where necessary
- Calibrates each AASHTO/ASTM for Wisconsin

WisDOT Modified AASHTO T113

Effective Date: 03/15/2022
Revised Date:

Follow AASHTO T113 ***Standard Method of Test for Lightweight Pieces in Aggregate*** with the following modifications:

AASHTO T113-18 Section	WisDOT Modification:
2.1	*Replace the AASHTO R76, R90, T27, T84, and T85 references with the following WisDOT Modified versions:* WisDOT Modified AASHTO R76 – Reducing Samples of Aggregate WisDOT Modified AASHTO R90 – Sampling of Aggregate WisDOT Modified AASHTO T27 – Sieve Analysis WisDOT Modified AASHTO T84 – Fine Aggregate Specific Gravity WisDOT Modified AASHTO T85 – Coarse Aggregate Specific Gravity
5.1.1	*Remove Section 5.1.1*
5.1.2	*Replace Section 5.1.2 with the following (keep Note 2):* A solution of zinc bromide in water. Mix the zinc bromide with water until a specific gravity of 2.45 is reached. NOTE: If reusing the solution, verify the specific gravity before each new test.
6.1	*Replace the table in Section 6.1 with the following:*

Nominal Maximum Aggregate Size	Minimum Weight of Sample, g
No. 4 (4.75 mm)	200
¾ in. (19.0 mm)	3,000
1.5 in. (37.5 mm)	5,000
3 in. (75 mm)	10,000

6.3	*Remove Section 6.3 – Fine Aggregates*
7.1	*Remove Section 7.1 – Fine Aggregates*
7.1.4.2 – 7.1.4.2.3	*Remove Sections 7.1.4.2 – 7.1.4.2.3 – Decanting*
7.1.5	*Replace Section 7.1.5 with the following:* Wash the lightweight particles over a sieve finer than a #4 (4.75mm) with water to remove the heavy liquid solution. Ensure the sample is thoroughly washed and all the heavy liquid solution is removed.

WisDOT Modified AASHTO T113
(WTM T113)

Effective Date: 03/15/2022

Revised Date:

Follow AASHTO T113 ***Standard Method of Test for Lightweight Pieces in Aggregate*** with the following modifications:

AASHTO T113-18

Section	WisDOT Modification:
2.1	*Replace the AASHTO R76, R90, T27, T84, and T85 references with the following WisDOT Modified versions:* WisDOT Modified AASHTO R76 – Reducing Samples of Aggregate WisDOT Modified AASHTO R90 – Sampling of Aggregate WisDOT Modified AASHTO T27 – Sieve Analysis WisDOT Modified AASHTO T84 – Fine Aggregate Specific Gravity WisDOT Modified AASHTO T85 – Coarse Aggregate Specific Gravity
5.1.1	*Remove Section 5.1.1*
5.1.2	*Replace Section 5.1.2 with the following (keep Note 2):* A solution of zinc bromide in water. Mix the zinc bromide with water until a specific gravity of 2.45 is reached. NOTE: If reusing the solution, verify the specific gravity before each new test.
6.1	*Replace the table in Section 6.1 with the following:*

Nominal Maximum Aggregate Size	Minimum Weight of Sample, g
No. 4 (4.75 mm)	200

SR **Signe Reichelt**
Removing zinc chlorine

SR **Signe Reichelt**
HTTP ATTS L-1
(with some changes)

SR **Signe Reichelt**
HTCP ATTS L-2

WTM vs AASHTO (example T113)

WTM T113

5.1.1	*Remove Section 5.1.1*
5.1.2	*Replace Section 5.1.2 with the following (keep Note 2):* A solution of zinc bromide in water. Mix the zinc bromide with water until a specific gravity of 2.45 is reached. NOTE: If reusing the solution, verify the specific gravity before each new test.

AASHTO T113

5. HEAVY LIQUID

5.1. The heavy liquid shall be able to achieve the required specific gravity and be readily removable from the sample. The heavy liquid shall consist of one of the following: (See Note 2.)

5.1.1. A solution of zinc chloride in water (for materials having a specific gravity less than 2.0).

5.1.2. A solution of zinc bromide in water (for materials having a specific gravity less than 2.6).

Note 2—Caution: There is no particular hazard from the fumes of zinc chloride solution (Section 5.1.1) or zinc bromide solution (Section 5.1.2), but goggles and gloves shall be worn to prevent contact with the eyes or skin. Use of a downdraft hood is recommended, especially while mixing the working solution.

Wisconsin Test Procedure (WTP)

- There is no existing AASHTO or ASTM
- Lists the procedure step-by step

WisDOT Test Procedure (WTP) C-001

Effective Date: 03/15/2022
Revised Date:

WisDOT Test Procedure for Concrete Mixing Water

This procedure is comprised of testing for Acidity, Alkalinity, Sulfate, Chloride and Total Solids & Inorganic Matter. A sample must have passing results for all five tests to be considered acceptable for use in concrete.

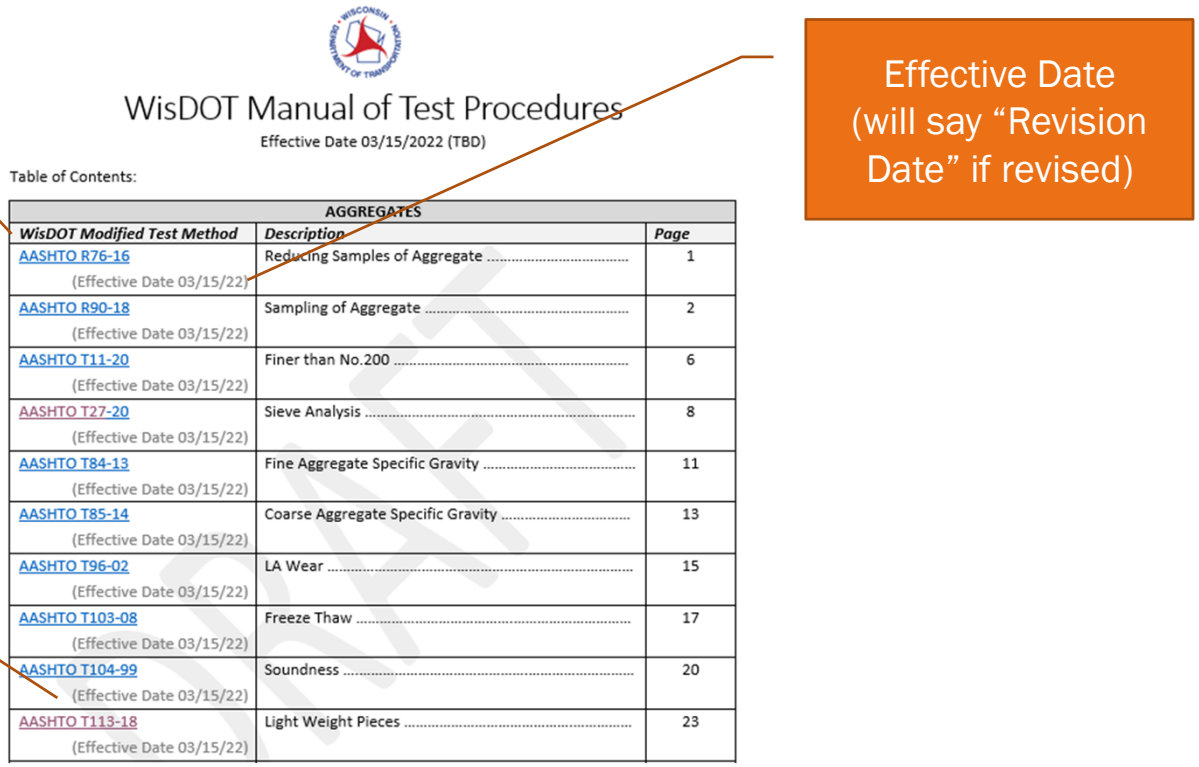
Section	WisDOT Procedure:		
1.	***Acidity Test***		
1.1	Pour 200 mL of sample water into a 400 mL beaker.		
1.2	Place the beaker on a stirring plate, place magnetic stirring rod, and start stirrer.		
1.3	Add several drops of bromocresol green indicator solution.		
1.4	Refer to Table 1 below for interpretation of bromocresol green test before proceeding.		
Table 1	Bromocresol Green Test Interpretation		
	Colorimetric Observation	pH	Interpretation
	Blue	>5.4	Solution is Alkaline. Record 0mL of NaOH and proceed to Alkalinity Test (Section 2.)
	Green	3.8<pH<5.4	Dispose of sample and proceed to methyl orange test (Section 1.5)
	Yellow	<3.8	
1.5	If the solution does not turn blue dispose of the solution and repeat Sections 1.1 and 1.2. Add 1.0 mL to 2.0 mL of methyl orange indicator solution to turn the sample orange. NOTE: Methyl orange solutions are yellow when they have a pH near 4.4 and are red when they have a pH near 3.1.		
1.6	Using a bottle top dispenser, add 0.005M NaOH to the sample, in 5 mL increments. Wait several seconds between pumps to observe a potential color change.		
1.7	Record the amount of 0.005M NaOH added to the sample when it turns yellow.		
1.8	If no more than 40 mL (8 pumps) of NaOH was used when the sample turned yellow, the sample is considered passing. Therefore, the sample is considered acidic, and record 0 mL for the alkaline test.		

MOTP Table of Contents:

Modified Test Method

Effective Date (will say “Revision Date” if revised)

Hyperlinks to Modifications to Test Methods



WisDOT Manual of Test Procedures

Effective Date 03/15/2022 (TBD)

Table of Contents:

AGGREGATES		
WisDOT Modified Test Method	***Description***	***Page***
AASHTO R76-16 (Effective Date 03/15/22)	Reducing Samples of Aggregate	1
AASHTO R90-18 (Effective Date 03/15/22)	Sampling of Aggregate	2
AASHTO T11-20 (Effective Date 03/15/22)	Finer than No.200	6
AASHTO T27-20 (Effective Date 03/15/22)	Sieve Analysis	8
AASHTO T84-13 (Effective Date 03/15/22)	Fine Aggregate Specific Gravity	11
AASHTO T85-14 (Effective Date 03/15/22)	Coarse Aggregate Specific Gravity	13
AASHTO T96-02 (Effective Date 03/15/22)	LA Wear	15
AASHTO T103-08 (Effective Date 03/15/22)	Freeze Thaw	17
AASHTO T104-99 (Effective Date 03/15/22)	Soundness	20
AASHTO T113-18 (Effective Date 03/15/22)	Light Weight Pieces	23

Expectations going forward

ROLL OUT

- ✓ **December 1** – send to WisDOT / FHWA
- ✓ **January 1** – comments back from WisDOT
- ✓ Review comments with WisDOT and make changes
- ✓ **January 15** – send to Industry
- ✓ **February 15** – comments back from Industry
- ✓ Review comments with WisDOT and make changes
- ✓ **GOAL: Effective with 2023 Spec**

AFTER ROLE OUT

- ✓ Work to update references in standard spec
- ✓ Continue to monitor needed changes
- ✓ Update annually with needed changes or new procedures

Testing is the foundation to success

...let's ensure everyone is doing it the same.