

## Quick guide to review a mix design:

This guide is meant to be a quick reference however if any of the information required to be submitted (see MT-100), including the MDT-MAT-008 form, is missing or incorrect, the mix design submittal will not be accepted and will be returned to the contractor or supplier for correction and resubmittal.

### Background information you will need:

Locate Bid Letting date, you can use this portion of our website:

<https://app.mdt.mt.gov/project-search/project/search>

Locate the appropriate standard and supplemental specifications, you can use this portion of our website:

[https://www.mdt.mt.gov/business/contracting/standard\\_specs.shtml](https://www.mdt.mt.gov/business/contracting/standard_specs.shtml)

Locate the project specific requirements in Special Provisions

<ftp://ftp.mdt.mt.gov/contract/Awarded-bid-packages/>

The mix design submittal form (MDT-MAT-008) can be found at this location:

[https://www.mdt.mt.gov/publications/forms/const\\_forms.shtml](https://www.mdt.mt.gov/publications/forms/const_forms.shtml)

### Review submittal form cover sheet (**Submittal Worksheet**)

- Ensure Correct concrete class is shown
- Ensure Contractor and supplier are listed
- Ensure Mix Designer, ACI Tech, and PE are listed
- Ensure the project information is present and correct
- Ensure EPM/DMS are appropriately identified
- Ensure the AASHTOWare Mix Design ID is identified

### **Contractor Mix Design Tab/Sheet**

Reviewing from Top to Bottom:

Is the aggregate source appropriately identified? Is the source code correct? Is the aggregate from an approved source? The District or Area laboratory supervisor can provide the source code.

Are the specific gravity and absorption values provided and feasible? (you know your sources best, approximately 2.65 Sp. Gr. and 1-2.2% abs. seems reasonable for most). The absorption value is critical in calculation of water/cementitious ratio.

Check the cementitious materials and admixtures to ensure that they are properly identified and that they are listed on the QPL.

<https://app.mdt.mt.gov/QPL/QPL/search>

Next ensure that the total cementitious content and W/C ratio meet the Class Specific requirements in Standard Specifications Table 551-2.

Check to ensure the gradation type (conventional or combined) has been chosen.

Check to ensure the Air Content and Target Slump meet the Class Specific Criteria in Table 551-2.

Check the volume. Is it between 26.7 and 27.3? If not, this is not a balanced mix and will under yield or over yield respectively. Depending on the severity it may be worthwhile to contact the supplier and ask about this.

Ensure the mix design is stamped by the PE indicated on the Submittal Form.

### **Aggregate Charts Tab**

If conventional aggregate was selected as the aggregate acceptance method, compare the supplied gradations for coarse and fine aggregate to our standard specifications: Table 701-2 Fine Aggregate for Concrete, 701-4 Coarse Aggregate for Concrete.

If optimized aggregate (combined gradation) was selected for the aggregate acceptance method, compare the Coarseness Factor Chart (top chart in right portion of Aggregate Data Tab or second page of gradations in a pdf) to the requirements in MT-122. The current requirements are:

For Class Pave concrete, the coarseness factor and workability factor must plot within the workability box defined as follows:

- coarseness factor must not be greater than 68 or less than 52
- workability factor must not be greater than 38 or less than 34 when the coarse factor is 52
- workability factor must not be greater than 36 or less than 32 when the coarseness factor is 68.

For other classes of concrete, the Workability Factor must plot within Zone II. Aggregate blends that plot in Zone III may be considered for approval of a mix design if a ¾-inch nominal maximum or smaller size aggregate is utilized.

Make sure blend percentage adds up to 100%. (99.9% or 100.1% are ok and is likely due to rounding in Excel).

### **Trial Batch Data Tab**

Determine what the specified compressive strength is for the class of concrete you are reviewing on the project it was submitted for.

Look through special provisions and plan sheets to determine if there are special circumstances for the concrete used on the project.

Compare supplied compressive strengths from the trial batch with the project or standard requirements for the class of concrete in question.

For Class Pave ensure the flexural strength (modulus of rupture) meets the standard requirements. See note in Table 551-2.

For other Classes of concrete ensure that the submitted information meets the requirements in 551.03.2 specific to that class of concrete. Classes Deck, Overlay SF, and Drilled Shaft have additional requirements. (SEE: Class Specific Highlights on subsequent pages in section 551.03.2.)

### **Aggregate Data Tab**

Ensure that results are submitted for each of the fields that are applicable and that the supplied results meet the requirements in section 701.

### **Some Class Specific highlights**

#### **Class CLSM**

- CLSM has fewer requirements than some other classes of concrete so for this class of concrete review 551.03.2 (E) and determine if the required material for the project is excavatable or non-excavatable.
- The gradation requirements are different for CLSM, check the appropriate supplemental specification for current requirements.
- A plasticity index for the aggregate used to produce this class of concrete is required.
- There are products used for CLSM that are not on our QPL as they are neither admixtures nor cementitious materials. These are products called “high air generators” or “foaming agents”. Some of the product names are Sika® Lightcrete Liquid or Powder, Rheocell, Rheofill etc. We have allowed the use of these products.
- Problems usually arise with the unit weight and air content not meeting requirements.

### Class Deck and Overlay SF

- requires 3-5% silica fume along with a supplementary cementitious material (fly ash, slag, etc.) in proportions meeting the requirement of 551.03.2(A)(5)
- requires Surface Resistivity or RCP meeting the requirements in 551.03.2 (C) [check the applicable supplemental specification]
- requires a batching sequence (this is for ongoing research to try and help MDT/industry understand what works and what doesn't as far as when the silica fume is incorporated). Please don't let this be a deal breaker but do request the information and get it at some point.
- Check the W/C ratio, we changed our requirements in 2017 from a maximum of 0.42 to a range of 0.42 to 0.45.

### Class Drilled Shaft

- Target Slump is no lower than 8 inches.
- The estimated time from producing the 1<sup>st</sup> load to completion of the shaft placement needs to be identified, also, results from trial batch testing need to be submitted verifying that the slump is maintained at least 2 hours after this time period. Delvo® and Stasis are some of the products we see that are used to accomplish this.