BMD Roundtable

Sample Prep, Handling, Timeliness, Referee Presentation From Industry and MoDOT

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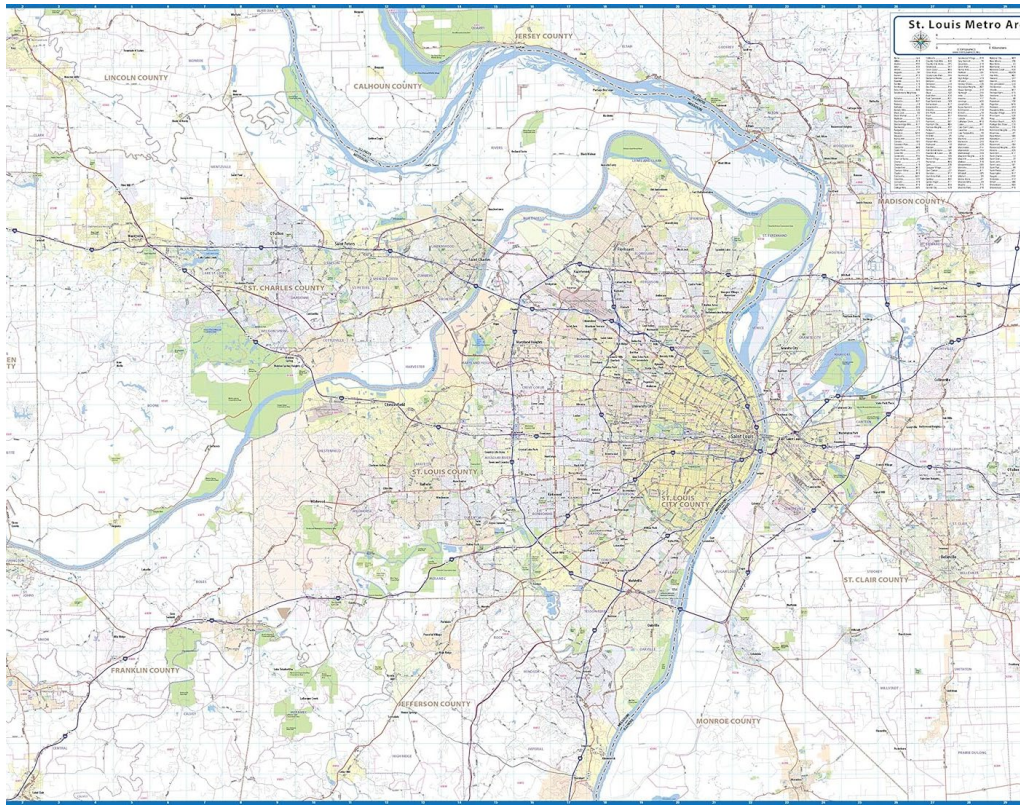
NEW FRONTIER MATERIALS

MAPA Black to Basics Spring Training

February 12-13, 2025

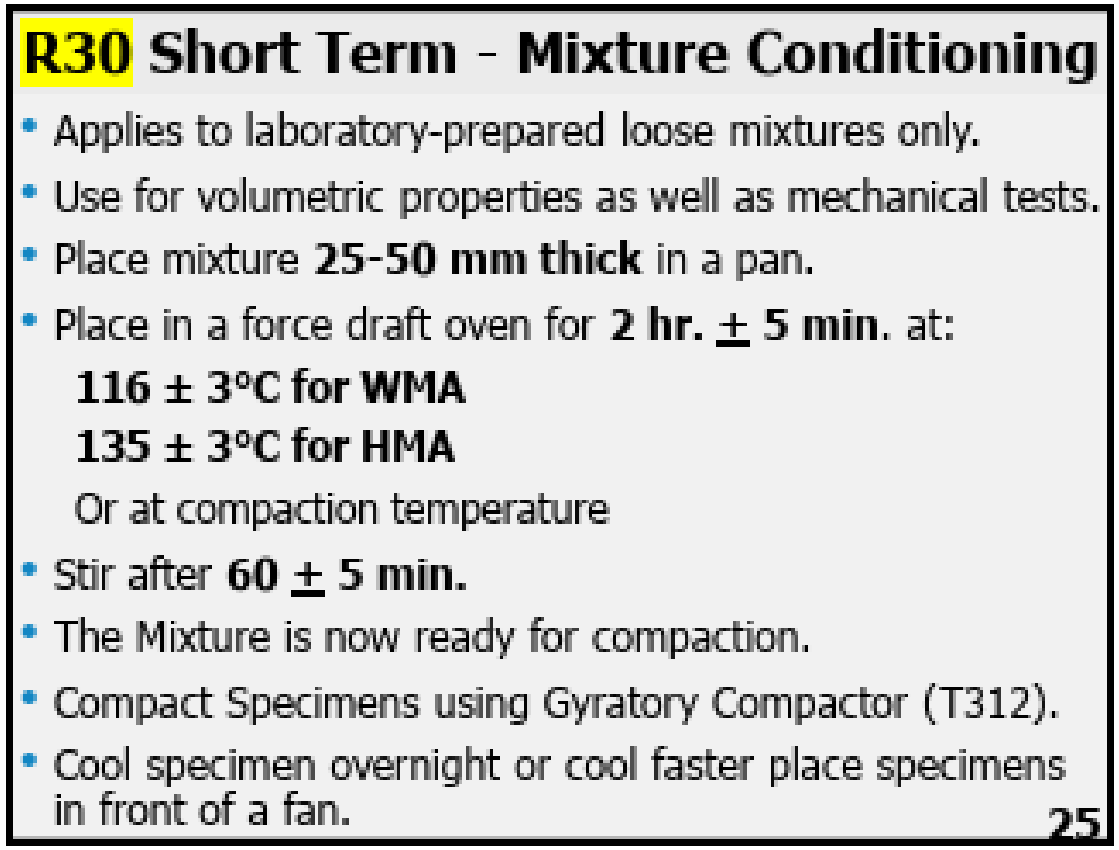
2024 Projects Background Information

- Four jobs with BMD requirements
  - J6I3568, I-44, St. Louis County
    - Options of 97%, 100%, 103% pay dependent on CT results and if HWT results are below 12.5 mm (NJSP-20-01C)
    - BMD mixes: SP095BSM, SP125CLGLP
  - J6S3281, Rte. 61, St. Louis County
    - Informational only. CT results must meet minimum requirements and HWT results below 12.5 mm (NJSP-21-08A)
    - BMD mix: SP095CLGLP
  - J6S3280, Rte. 67, St. Louis County
    - Informational only. CT results must meet minimum requirements and HWT results below 12.5 mm (NJSP-21-08A)
    - BMD mix: SP125CLGLP
  - J6P3570, Rte. 67, St. Charles/St. Louis County
    - Informational only. CT results must meet minimum requirements and HWT results below 12.5 mm (NJSP-21-08A)
    - BMD mix: SP125CLGLP



- QC PT frequency: 1/10,000 tons (random #)
- QA PT frequency: 1/20,000 tons (random #)

BMD Procedures During Mix Design



- Use NCAT's Trial Weight Estimating Spreadsheet for air void vs. weight trials at 62 mm
- Split out binder used for mix design points into quart cans
- Minimizes # of heating cycles to minimize any artificial aging of the binder

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Quality Control

Preparing Performance Testing (PT) Pucks in the Field

1. Switch gyratory compaction mode to "specified height" and set the height to 62 mm.
2. Set the number of gyrations high enough to allow gyratory to compact to specified height. A good starting point is 150 gyrations.
3. Set the oven temperature to the mix compaction temperature for the oven the PT puck samples will be in.
4. Obtain PT puck weight from our internal JMF sheet. This can be accessed by going to Quality Control -> Asphalt -> Project Designs -> select asphalt plant -> select year -> select mix's mix design excel sheet -> MoDOT JMF tab. Puck weight will be labeled "PT Weight". A good rule of thumb is to add ~5 g to PT weight to account for any loss.

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5. Obtain 4 buckets of mix from a truck according to the random number/tonnage given. 2 buckets will be used for testing and 2 buckets will be put into boxes for retained samples.
6. "No conditioning is required on plant mixed samples" so there is no time frame to wait before fabricating PT pucks after sampling.
7. Dump one of the buckets into the quartering pan, mix and quarter the sample in the quartering pan like normal Superpave procedure. Limiting mix segregation is crucial for PT puck preparation.
8. Weigh up 1st, 2nd and 3rd pucks into paper bags and place them in the oven for an initial cure. Then, after a couple minutes in the oven, run first puck in gyratory compactor to 62 mm height (this will be labeled "1"). All pucks should reach compaction temperature before fabricating.
9. Weigh up 4th, 5th and 6th puck into paper bags and place them in a cooler.
10. When 1st puck is done gyrating, take 2nd puck out of the oven and put into the gyratory to compact.
11. As a puck is taken out of the oven to compact, 1 puck should be moved from the cooler to the oven. There should always be 3 pucks in the oven and the rest in a cooler staying warm (pucks should be weighed, placed in the oven or cooler, compacted and labeled in numerical order).
12. After the 6th puck is weighed up from the 1st bucket of mix, discard the rest of mix from the quartering pan. It is most likely too cool and segregated now to make PT pucks with.
13. Dump the 2nd bucket of mix from a cooler into the quartering pan, repeat steps 7-11 to make 6 more pucks (~12 pucks total).

Notes:

- Before first set of PT pucks are made, a verification should be done to verify PT weight correlates to the target air void range at 62 mm. For the PT puck air void calculation, use the same sublot's random volumetric test Gmm to verify PT puck is in target air void range.
- All PT pucks are compacted to 62 mm height.
- SMA PT air void target range is 6.0 +/- 0.5. All other Superpave mixes' air void target range is 7.0 +/- 0.5.

Performance Testing Trends

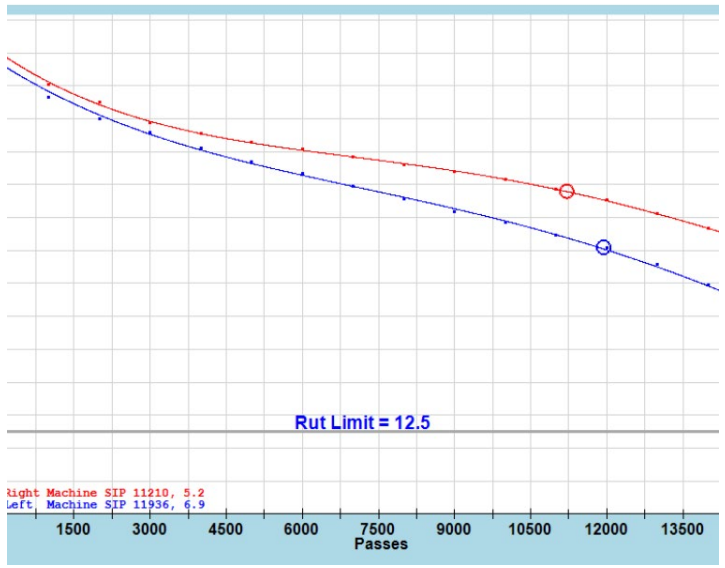
· The non SMA mixes had no problem passing the CT criteria during mix design and production

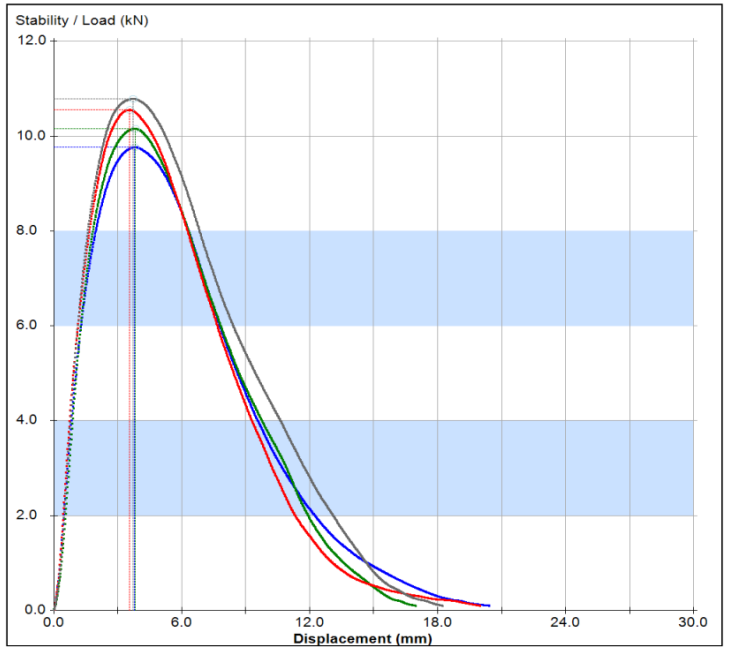
· Some issues with Hamburg results across all mixes during production

· Hamburg seems to be more sensitive to aggregate/AC/air void variation in the mix/pucks

· CT seems to be more sensitive to temperature aging of the mix

· No data on RT testing yet…





Lessons Learned In 2024

- During very early stages of a SMA BMD mix design, we had forgotten to drop the oven temperature and stir the mix after 60 min
- The mix was ‘mounded’ in the bowl (not flat)
- Did not follow AASHTO R30 (Short Term Mixture Conditioning)
- It took 999 gyrations to get the puck to 62 mm for PT testing
- Usually should take a little over half the number of N_{des} gyrations to get to 62 mm at the air void target
- During mix designs, SMA seemed to be very sensitive to proper short term aging procedures for Hamburg and CT tests

Lessons Learned In 2024 Continued…

- During production, would initially make ~12 PT pucks out of 1 bucket of mix (~65 lbs)
- Would send off the first 8 pucks made for Hamburg and CT testing and would run the last 4 pucks made in our own Hamburg machine
- Our Hamburg results were always much worse than what the 3rd party results were
- **Conclusion:** on the last 4 pucks made, the mix was too segregated in the quartering pan now to be representative. Just like volumetric testing, you shouldn't use all the mix in the quartering pan and should have ~ ⅓ - ½ of the sample leftover
- **Solution:** moved on to making ~6 pucks out of 1 bucket of mix then dumping the excess and made another 6 pucks out of a second bucket of mix

Next Steps To Improve

- Use open bowls/pans instead of brown paper bags when splitting out individual PT pucks
  - More consistent aging? (pans/bowls are ‘open’ in the oven)
  - Lower segregation when dumping mix into gyro molds using collar
- Problem is limited space in lab ovens for 7+ pucks to reach or stay at compaction temp
- Or weigh up individual pucks into bags then transfer them to pans/bowls when getting up to temp in the oven
- “Pour the mixture into the center of the mold to minimize air void variation between samples. Pouring material down the sides of the mold will result in lower air voids on that side of the mold.” (taken from MoDOT AMPT sample preparation)
- i.e. one side of Hamburg would be tracking along with the other side, then it would sharply drop off. Due to aggregate/AC/air void variation in molded pucks??