CONCRETE AGGREGATE UPDATE

2018 AGC-MoDOT Annual Co-op Meeting
Outline

1. Alkali-carbonate reaction (ACR) testing
2. Grade F Aggregate in the D-cracking zone
ACR Issues

- Opened up concrete aggregate specification
- MoDOT currently allowing new ledges and/or ledge combinations MoDOT previously would not have allowed
- Potential for alkali aggregate reactivity issues with newer sources
Chemical Testing

- Based on ratio of calcium oxide (CaO) to magnesium oxide (MgO) and aluminum oxide content (Al$_2$O$_3$)

- Reactive limits given in AASHTO R80 chart

- Potassium oxide (K2O) content greater than 0.3% correlates to expansive aggregates
  - Both in current and 1960’s MoDOT testing
Chemical Results so Far

[Diagram showing the relationship between CaO/MgO ratio, %K2O, and Al2O3 content for rock cylinder expansion and concrete prism expansion tests.]

- %K2O < 0.3%
- %K2O > 0.3%
Coarse Aggregate Expansion Results (using Meramec River sand)
Expansion vs. Durability Factor

- Tested all but 1 sample for freeze-thaw resistance

- Is there a correlation between ASTM C1105 expansion and T161 results?
ASTM C1105 Expansion vs. AASHTO T1611 Durability Factor
Expansion vs. Durability Factor

- High (>80) Durability Factor
  - ASTM C1105 results acceptable

- Low (<80) Durability Factor
  - ASTM C1105 results fail or have noticeable expansion

- Potential to accept/reject samples based on combination of chemical results and failing T161 results
Measurement Issues
Field Performance Issues

- Somewhere in Missouri…

- Concrete pavement showing severe deterioration
  - Possible combination of D-cracking and map cracking

- Cores taken, tested by Chemical lab
  - Tested by Sam Marshall
Street 1 Core 1
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0.69 % Al₂O₃
0.14 % K₂O