

## **JANUARY 21, 2004 - TxDOT's Approach to Address Premature Concrete Deterioration**

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### **PRESENTATION SUMMARY**

Mr. Won, manager of the rigid pavements and concrete materials branch in the Texas Department of Transportation in Austin spoke to an audience of 40 about about the current philosophy by Texas Department of Transportation in addressing premature concrete deterioration of their pavements and bridge structures. Mr. Won is a licensed professional engineer with a BSCE degree from Seoul National University along with MSCE and Ph.D. degrees from the University of Texas in Austin.

Mr. Won said TxDOT now does their forensic investigations internally and as a result have changed the way they order concrete. TxDOT is mainly concerned with the following types of premature deterioration in their concrete:

- Plastic Shrinkage Cracks
- Thermal Cracking
- Alkali Silica Reaction (ASR)

TxDOT now controls plastic shrinkage cracking by watching the delivered concrete temperature more closely. Their current philosophy is to reject trucks carrying concrete warmer than 95 deg F. In addition, they also pay more attention to reducing water loss during curing. To control thermal cracking, TxDOT now specifies more fly ash in the mix.

ASR is a difficult problem to detect early on. It typically happens ten or more years later but the cracking is quite severe when it happens, often forcing a complete replacement. When it begins happening, it can destroy the concrete's integrity in a matter of weeks.

TxDOT's research has shown that most of the aggregate supplied in Texas is prone to cause ASR. Now, unless their contractors test per ASTM 1260 to prove their mix is not prone to causing ASR, TxDOT requires one of various options for their concrete mix. The favorite mixes by TxDOT to prevent ASR (as well as Thermal cracking) is to require 20-35 percent Class F (Silica Fume) Fly Ash or 35-50 percent GGBFS (slag) in the mix, or a combination thereof.

Mr. Won said that the fly ash "is like a ball bearing" at the microscopic level, and provides added slippage of the mix particles so less water is needed for similar workability. The only drawback of using fly ash is it takes longer to cure. However, it attains a higher strength later than does Portland cement concrete. Other advantages of using fly ash is it reduces heat of hydration (meaning, less shrinkage cracks) and it reduces permeability of the final concrete.

When asked the mix he would use for his home's foundation, Mr. Won said he would specify 30 percent Type F fly ash with a more flexible aggregate (i.e., not granite). He also said he would keep the concrete wet during the initial cure and make sure the concrete temperature is less than 95 degrees F as it comes out of the truck.

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