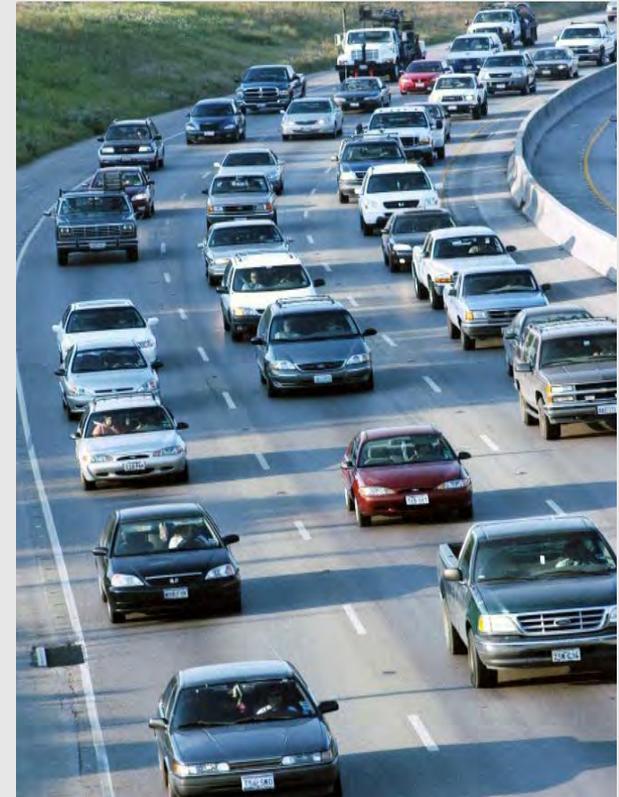




RELEASE STRENGTHS

Prestressed Girder Deterioration



ASR and DEF

- In the 1990's TxDOT discovered several instances in prestressed girders.
- This resulted in several research projects that ultimately led to:
 - Bridge Division's 1997 Memo 6,500psi release / 8,500psi design Max
 - Concrete Mix Design Options 1-8 with max internal temperature limits
 - Total cementitious was also limited to 700 lbs per yard.



Alkali-Silica Reaction (ASR) and Delayed Ettringite Formation (DEF)



Total Cementitious Content

- The 700 total cementitious limit was unrealistic with materials at that time for the prestressed girder industry production needs.
- Therefore, in the 2000's TxDOT funded research 4086 and 5197
 - increased the allowable compressive strength limit [0.60 → 0.65]
 - lowered required released strengths
 - Worked with admixture and prestressed industries to get higher early strengths by other means



TxDOT and PCMA Agreement

- 2010 Agreement with Precast Concrete Manufacturers Association (PCMA)
 - TxDOT target release strength maximum of 5,500psi.
 - under extreme circumstances where span length or beam spacing cannot be reduced for reasons of practicality release strengths should not ever exceed 6,000psi
 - changed to 6,000psi hard limit for Designers in 2013.
 - PCMA will begin lowering total cementitious content
- This will take several years to incorporate since fabricators have multi-year backlogs of girders that exceed 6,000psi release strength.

Important to Adhere to Agreement

- Important to not exceed max release and design strengths
 - Threats of litigation for not allowing Design-Build projects to exceed max when TxDOT has allowed for other projects
 - Recent incidents of ASR have caused TxDOT to revisit mix designs and attainable concrete strengths
 - Lowered to 750 lb total cementitious content for precast
 - Changing fly ash chemistry and availability
 - Lower strength gains
 - Thermal and restrained cracking
 - Federal Highway administration is looking closer to see that TxDOT is not exceeding own design criteria when federal dollars are involved

Presently

High cementitious content also leads to other problems other than premature concrete deterioration including greater autogenous and drying shrinkage all ultimately leading to cracked concrete.

Current random members cracking in about 12-24 months that are not ASR or DEF related. Believe it is related to high cementitious content and changing material characteristics.



Two Research Projects Funded to Investigate



Two Research Projects Funded to Investigate



Two Research Projects Funded to Investigate

- *Project 0-6813: Evaluation of ASTM C 494 Procedures for Polycarboxylate Admixtures Used in Precast Concrete Elements*
 - *Recommendations:*
 - “lower their cementitious content, to the lowest extent possible without compromising strength”
 - “using the highest w/cm ratio that provides adequate durability and strength”
 - “re-evaluating concreting procedures to mitigate surface self-desiccation (e.g., better curing) and shrinkage (e.g., chemical shrinkage)”

- *Project 0-6922: Evaluation Long-term Durability and Performance of Prestressed Concrete Beam with Extensive Surface Cracking*
 - *Currently ongoing but early indications are the cracks are still growing*

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