2014 TXDOT CONCRETE SPECIFICATIONS - A WORK IN PROGRESS

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§ DISCLAIMER: The process is still underway. No guarantees!

§ TACA Specification Committee has been submitting suggestions/issues for several months

§ Rigid Pavements Branch has drafted first draft (incorporating as many TACA member suggestions as possible – some still up for consideration) submitted this weekend for internal TxDOT review

§ After TxDOT Specification Committee reviews, will be sent to AGC

§ AGC/Industry/TxDOT working meetings will commence
Item 421 Hydraulic Cement Concrete

- Changes Being Considered:
  - Format
  - Content
Item 421 Hydraulic Cement Concrete

Format

- Will use ASTM/AASHTO format of numbered sections
- Concrete Production/Material Quality perhaps being separated from Delivery and Placement (?)
- Representing information in tabular format where possible
- Re-ordering some content to make specification more sequential
More Information in Tabular Format

Table 5
Concrete Classes

<table>
<thead>
<tr>
<th>Class of Concrete</th>
<th>Design Strength, Min. 28-day $f'_c$ (psi)</th>
<th>Maximum w/c Ratio$^1$</th>
<th>Coarse Aggregate Grades $^2,3$</th>
<th>Cement Types</th>
<th>Mix Design Options</th>
<th>Exceptions to Mix Design Options</th>
<th>General Usage$^4$</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>3,000</td>
<td>0.60</td>
<td>1–4, 8</td>
<td>I, I/II, IL, IP, IS, V</td>
<td>1, 2, 4, &amp; 7</td>
<td>• Class C fly ash may be used in lieu of Class F fly ash if the cementitious content is &lt;520 lb/cy</td>
<td>Inlets, manholes, curb, gutter, curb &amp; gutter, conc. retards, sidewalks, driveways, back-up walls, anchors, non-reinforced drilled shafts</td>
</tr>
<tr>
<td>B</td>
<td>2,000</td>
<td>0.60</td>
<td>2–7</td>
<td></td>
<td></td>
<td></td>
<td>Riprap, small roadside signs, and anchors</td>
</tr>
</tbody>
</table>
Item 421 Hydraulic Cement Concrete

Draft Content

- Minor gradation changes to Gr. 1-3 coarse aggregate (0-10% passing No. 4).
- Decant definition & max. limits change (3% non-pavement, 5% for pavement)
- Blending of hard man. sands for skid applications
- 6-mo. admixture dispensing check
- Removal of Strength Over Design Requirements
Item 421 Hydraulic Cement Concrete

Draft Content (continued)

- External sulfate attack prevention reverts to 1993 Specification (use of sulfate resistant cement OR use of pozzolan, not both)
- Inclusion of IL cements (limited or full?)
- Minimum w/c for all classes of concrete: 0.30
- Increase w/c of Class P concrete to 0.50
- Mix Design Option 8 is getting revamped to require additional testing
- SCC for precast and drilled shaft concrete
Draft Content (continued)

- Optimized Agg Gradation concrete included and individual stockpile gradations waived (max. nominal defined)
- More reliance on uniformity testing, less on number of revolutions, etc.
- Moving evaluation of low strength concrete from Item 420 into 421 (does not apply to Item 360/361)
Item 421 Hydraulic Cement Concrete

Draft Content (continued)

- Time on the truck (360/420/422) similar to 1993 Specifications
  - Based on Concrete Temperature
  - Use of retarder (chemical, working on mineral)
- Entrained Air: either only when specified on the plans or AEA dosage based, depending on region/usage
CoTE Update for Use in CRCP

- CoTE max. 5.5 microstrain/degF
- CRCP 2013 standard will have regular concrete and low CoTE (<4.0) concrete in same standard
  - 1-mat std. for 7.0”-13.0”
  - 2-mat std. for 14” & 15”
- ~80% of sources <5.5 microstrain/degF
- ~25% of sources <4.0 microstrain/degF
Soon to release revised test method adding alternative testing in addition to “reference” method

3 complete rounds of CoTE testing for every source (~130) since December 2011

Mitigation options being investigated by UT-Austin/TxDOT lab
Future of Concrete Pavements In Texas

- CRCP
- CPCD
- Roller Compacted Concrete
  - TxDOT’s first RCC project started last month, RCC paving months away from starting
- Thin White-topping
- Bonded Overlays

- Will use increase/decrease/stay constant?
Oil and Gas Production: Impacts on Highways

Source: Trailblazer Pilot Car
R.S. 0-6404
Overweight Permits by Hwy Designation

Source: R.S. 0-6404
Case Study: Dimmitt County

Source: R.S. 0-6404

IH-35 Weigh In Motion Location South of Cotulla

Dimmitt County

Source: R.S. 0-6404
Energy Sector impacts

- Energy sector growth is driving our economy
- Placing demand on state's road network
  - One gas well production = 8 million cars
  - Maintaining one well = 2 million cars/year
- In LAR requesting:
  - $400 million in FY 14 to repair current damage
  - $600 million each year of biennium to proactively reinforce existing roads
2007: Overweight Single Axles @ WIM Station South of Cotulla

![Graph showing the number of single axles by weight in kips for 2007.](image)

Courtesy: Tom Scullion
2011: Overweight Single Axles @ WIM Station South of Cotulla

![Graph showing the number of single axles vs the weight of the single axle in kips.](image_url)
2007: Overweight Tandem Axles @ WIM Station South of Cotulla

Weight on Tandem axle in Kips

Number of Tandem axle

Coverage: Tom Scullion
2011: Overweight Tandem Axles @ WIM Station South of Cotulla

[Bar chart showing the number of tandem axles by weight in kips, with a focus on the weight range 65 to 77 kips.]
Growth in Heaviest Overloaded Trucks at WIM Station South of Cotulla

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Trucks with tandem axles more than twice legal load limit (&gt; 68 kips)</th>
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</thead>
<tbody>
<tr>
<td>2007</td>
<td>2</td>
</tr>
<tr>
<td>2008</td>
<td>4</td>
</tr>
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<td>2010</td>
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Courtesy: Tom Scullion
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Courtesy: Tom Scullion
Well Permits by Year Cumulative

2002-2010

Source: Texas Railroad Commission
CRCP Ideal Pavement Choice For Heavy Loading

- Over the past decade Texas has made great strides in the area of CRCP design, construction and materials economy.
- The recently published low-CoTE CRCP standards allow for measurable savings of the most expensive component (steel) with no drop-off in pavement performance.
- Upcoming changes to pavement design practices using the results of numerous recent research projects will better account for support conditions.
- Historical performance of CRCP exceeds design expectations on average.
- Ride quality continues to improve in new construction, which will continue throughout the life of the CRCP.
Other Recent Concrete Successes: Cost Savings

- The use of fibers as a substitute for conventional reinforcement for miscellaneous concrete applications (mow strips, sidewalks, rip-rap, curb and gutter) has been saving time and money for several yeas now.
- Relaxed air-entrainment and soundness requirements for regions of the state with little-to-no freeze/thaw concerns has resulted in more cost-efficient concrete production by using more of our local materials and having fewer rejected trucks.
- Work to allow aggregate production savings associated with washing by raising decantation limits has been on-going in the laboratory and with one large test case project has already saved TxDOT $1M with much more to come.
- TxDOT has used crushed concrete aggregate since the mid-1990’s.
- TxDOT uses more fly ash than any other DOT at significant cost savings.
- TxDOT is one of the top DOTs in cement specification innovations.
There have been no cases of delayed ettringite formation (DEF) since the 2004 Specifications were enacted.

Alkali-silica reaction (ASR) has been controlled in cast-in-place concrete and issues with pre-cast concrete are diminishing greatly since TxDOT adopted positive mitigation strategies in 2000.

Curing compounds are being screened tested more rigorously for their effectiveness in dry/windy climates.

Repair materials are being specified by properties most needed based on the nature of the repair.
Ongoing funding challenges.

While concrete material prices have held steady, steel prices have been more volatile.

Funding for new roadways or expansions will remain largely dependent on PPP, sale of remaining bonds, collaboration with local governments and other innovative approaches.

Heavy truck traffic tied to economic growth but wearing out pavements.

Future supply concerns on the availability and quality of fly ash – the single biggest impact to concrete economy and concrete durability.

Design concrete pavement for variable subgrade conditions.

Education, education, education.
Conclusions

- TxDOT’s partnership with the cement, aggregate, concrete and concrete paving industry has allowed us to make great strides.
- CRCP continues to be the premiere pavement, particularly in urban areas and locations with high truck traffic and high vehicular weights.
- We have made great progress but challenges remain.
Questions?