HISTORICAL PERSPECTIVES OF TXDOT MATERIALS
WHAT HAS CHANGED OVER THE LAST 40 YEARS
Construction Materials and Technology
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The 1972 and 1982 Specification Books had:

- Item 340, Hot Mix Asphalt Concrete Pavement
  (TxDOT’s conventional dense-graded hot mix, which was a method specification.)

2014 Specifications have:

- Item 340, Dense Graded Hot-Mix Asphalt (Small Quantity)
- Item 341, Dense Graded Hot-Mix Asphalt
- Item 342, Permeable Friction Course
- Item 344, Superpave Mixtures
- Item 346, Stone Matrix Asphalt
- Item 347, Thin Overlay Mixtures
- Item 348, Thin Bonded Friction Courses
Testing Hot Mix Asphalt Then and Now

The 1972 and 1982 Design used:

Texas Gyratory Compactor
Hveem Stabilometer
Centrifuge Solvent Extractor.

2014 Specifications use:

Superpave Compactor
Hamburg Wheel Test
Ignition Oven
Overlay Tester
Indirect Tensile Test
Then

Texas Gyratory Compactor
Then

Hveem Stabilometer
Then

Centrifuge Solvent Extractor
Now

Superpave Gyratory Compactor
Hamburg Wheel Test
Now

Hamburg Wheel Test
Now

Asphalt Ignition Oven
Now

Texas Overlay Tester
Now

Indirect Tensile Test
Hot Mix Asphalt

In FY 2014, we tested enough asphalt and chip seal rock to pave a 2-lane road from Austin to Melbourne Australia.
Testing Asphalt Binders Then and Now

The 1972 and 1982 Design used:

Penetration
Viscosity

2014 Specifications use:

Dynamic Shear Rheometer
Bending Beam Rheometer
Pressure Aging Vessel
Then

Penetrometer
Then

Absolute Viscosity
Now

Dynamic Shear Rheometer

Not Pictured is:
Bending Beam Rheometer
Pressure Aging Vessel
Tested asphalt binder equivalent to:
• Filling 350 Olympic-size Swimming Pools, or
• Floating 15 Battleship Texas’, or
• Providing 10 kegs of beer to 30,700 Super Bowl parties in each of the 50 states.
Concrete, Cement, Aggregates, and Steel

The 1972 Specification Books used:
Concrete Class A, B, C, D, E, F, H
Cement Type I, II, III
Reinforcing Steel: Standard “Black Bar”
Admixtures: air entraining, set retarding, water reducing.

2014 Specifications use:
Concrete Class A, B, C, E, F, H, S, P, CO, LMC, SS, K, HES, X-HPC, X-SRC
Hydraulic Cement Type I, IP, IL, IS, IT II, I/II, III, IIIIP, V,
Reinforcing Steel: Standard “Black Bar”, Epoxy Coated, Stainless, Low Carbon/Chromium, Dual Coated (stainless clad), Glass Fiber Reinforced Polymer, and Carbon Fiber (not specifically listed)
Aggregates: Meet CoTE limit for CRCP.
Admixtures: air entraining, set retarding, set accelerating, water reducing (280+)
Fibers
Concrete Material Components

Then
In FY 2014, we tested cement and fly ash samples representing 2-million cubic yards of concrete; enough to fill half of Cowboy stadium.
Then

Blaine
Fineness
Particle Size Analyzer
Now

Coefficient of Thermal Expansion (CoTE)
Now

CoTE Specimen
Now X-Ray Diffraction
Now

X-Ray Fluorescence
Now

Thermogravimetric Analyzer
Now

Scanning Electron Microscope
Other Significant Changes

- Advances in Sign Sheeting performance and how to measure it
- Advances in Structural Forensics
- Advances in Project Level Sulfate detection.
Now Dark Room Goniometer
Now

Dark Room

Goniometer
Now

Phased Array Acoustic Analysis
Now

Veris Conductivity Detector
Construction Methods Using Materials

- New Designs with High Performance Concrete
- New Methods to Speed Construction
  - Precast elements
  - Precast Pavement
  - Roller Compacted Concrete
Now

Spliced Prestressed Concrete Girders
Post-Tensioned together to complete spans in excess of 200 feet, historically only possible with steel.
Now

Erection of Spliced Prestressed Concrete Girders
Now

Spliced Curved Concrete Girders
Now

Bridge using Spliced Curved Concrete Girders (Colorado)
Now

Precast Bridge Bent Caps
In FY 2014, we inspected enough prestressed bridge beams, which if laid end to end, would stretch from Austin to Houston.
Other Technology Changes in Materials and Materials Testing

- Glass Beads
- Weathering and Durability
- Soils and Base Material Specimen Uniformity
- Other Testing Abilities
Then

Glass Bead Round-o-meter
Then

Glass Bead Sieve Analysis
Now

Glass Bead Digital Image Analyzer
In FY 2014 we tested enough striping material to apply a continuous stripe from the North Pole to the South Pole.
Now Inside a Weatherometer
Now

Soil Compaction Analyzer (SCA)
In FY 2014, we tested base material to represent a stockpile the size of the Great Pyramid of Giza in Egypt (built about 2500 BC and for 3800 years was the tallest man-made structure in the world).
Now

Gas Chromatograph
Now

High Pressure Liquid Chromatograph
Now

Ion Chromatograph
What has Changed in the last 40 year?

- Materials have changed
- There are new materials to address new environments or to better address old environments
- The ability to develop sensors to measure things we used to not be able to measure has drastically changed the way we can test materials.
- The use of computers to control testing, monitor sensors, and crunch data has allowed us to test materials in ways we could not have in the past.

- Is the materials and testing environment a symbiotic relationship? Have Materials Changed because we can better measure their characteristics and performance?
Thank You