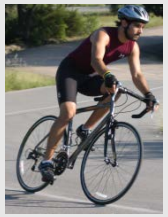
TEXAS DEPARTMENT OF TRANSPORTATION



CEMENT TREATMENT (ROAD-MIXED)

TxDOT Specification Item 275
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TTI
2018 TxDOT Short Course

October 16, 2018

Table of Contents

Basics of Full Depth Reclamation Process

- Assembling Background Information
- NDT Evaluation and Section Breakdown
  - GPR
  - FWD
- Verifying Pavement Structure and Sampling
  - Auger
  - Verification of problem location
  - DCP on shoulder for widening
- Laboratory Mix Design
  - Guidelines on selecting stabilizer type and amount
  - RAP content max 50%
- Pavement Design
  - Special Considerations
    - Need to Establish Foundation layer
    - Handling Variability
    - How to handle traffic
    - Need for widening
    - Avoid cutting into subgrade (add rock requirement)
  - FPS + Triaxial Design
- Special Considerations
  - Ensuring Surface bonding
  - Microcracking
- Construction Quality Assurance
  - Distribution of stabilizers
  - Immediate strength testing
  - Final Quality Assurance testing

TxDOT Specification, Item 275, “Cement Treatment – Road Mixed”

- TxDOT Item 275, “Cement Treatment (Road-Mixed)
  - Mix and compact cement, water, and subgrade or base (with or without asphalt concrete pavement) in the roadway.
  - Materials
    - Cement
    - Existing
      - Subgrade
      - Pavement
        - » Maximum of 50% RAP
    - Flexible Base (furnish new base)
    - Water
    - Asphalt (may be permitted for curing purposes)

TxDOT Specification, Item 275, “Cement Treatment – Road Mixed”

- Mix Design
  - Tex-120-E
    - Compressive Strength Test
    - 6x8 in mold
    - Tex-113-E to determine

      Optimum moisture and density

  - Reference - TxDOT research 0-6271
    - Investigating small sample 2x4in
    - Moisture susceptibility test

TxDOT Specification, Item 275, “Cement Treatment – Road Mixed”

- Equipment
  - Cement distribution
    - Slurry equipment
    - Dry distribution equipment
  - Pulverization Equipment
  - Compaction Equipment
  - Finishing Equipment
    - Motor Grader

TxDOT Specification, Item 275, "Cement Treatment – Road Mixed"

- Microcracking
  - TxDOT research project 0-4502
    - Minimum 12 ton vibratory roller
      - Typically the same roller used in compaction
    - Usual timing to perform microcracking 2- 3 days after compacting
      - unless the average ambient temperature is <60^F, then increase to 4 days
    - 2 mph
    - 2 – 4 passes (down and back)
      - Can test with FWD before and after. Look for 50% reduction in Backcalculated modulus before stop rolling
- Curing – 3 days
  - Moist cure
  - Asphalt cure
  - Additional 2 days, after microcracking

Basic Steps – Preparing the Area

Basic Steps – Spreading Cement

Basic Steps – Adding Moisture

Basic Steps - Mixing

Basic Steps – Mixing and Compacting

Basic Steps - Compacting

Basic Steps – Compacting and Finishing

Basic Steps – Testing for Density

SH 47

Original failure very wet subgrade

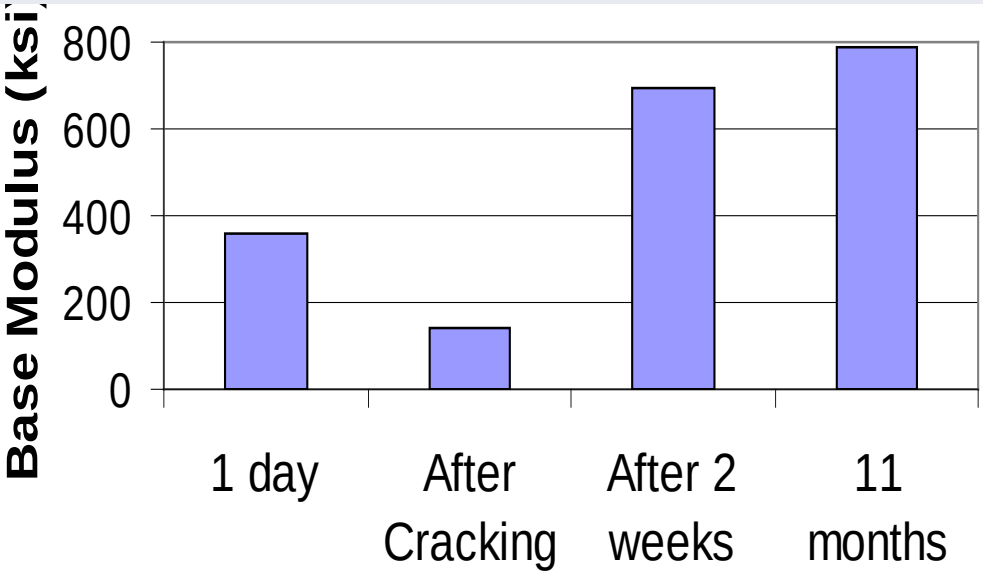
Lab design recommended 3% cement

FDR recycling top 14 1/2 inches

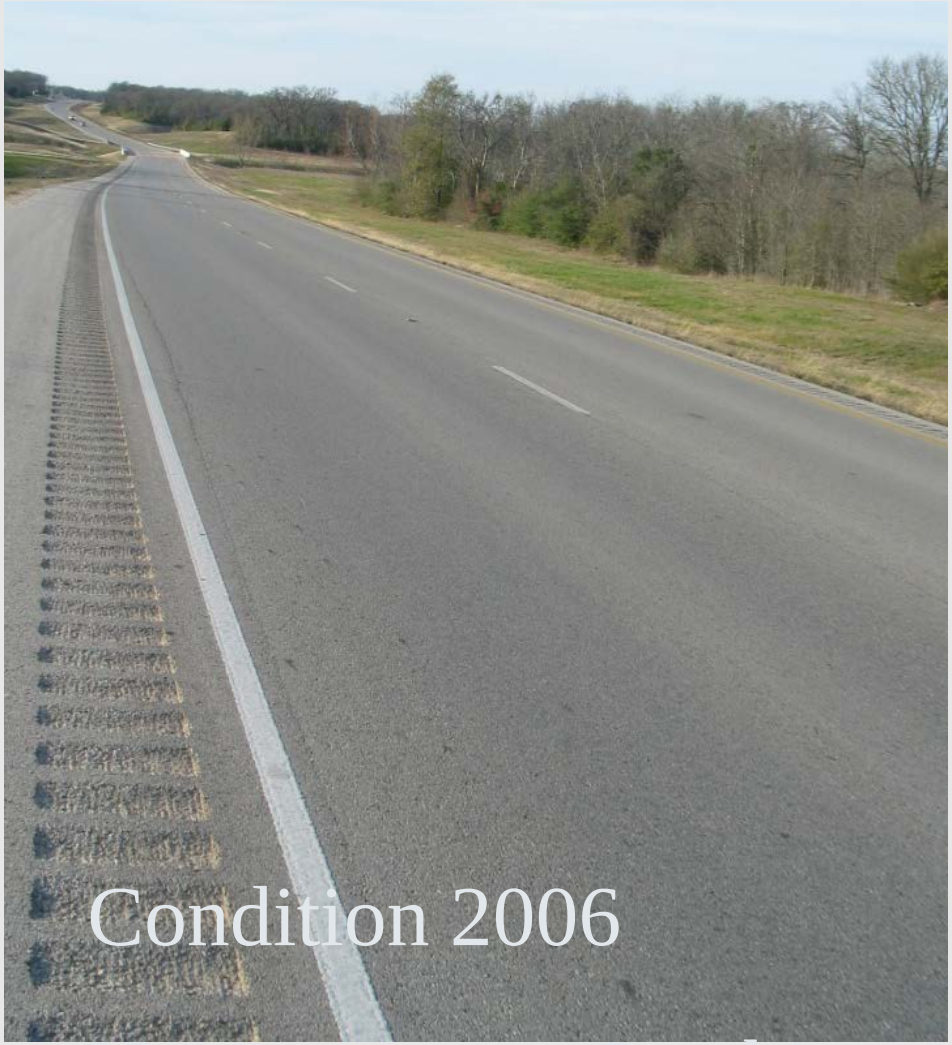
Microcracking between 1 and 3 days after treating

Seal Coat & 2 1/2 inch HMA surface

No cracks after 18 months

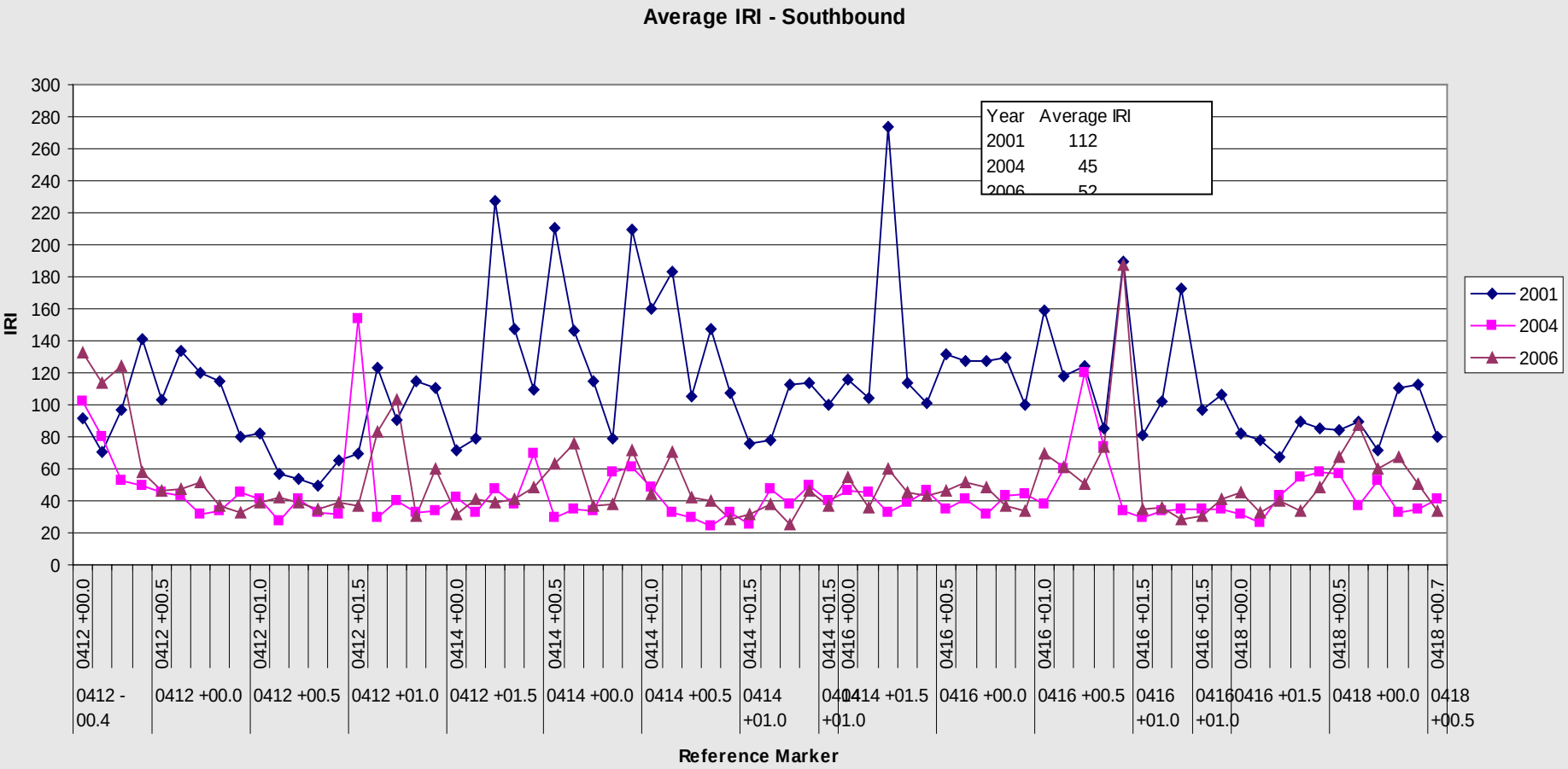


Minor Longitudinal

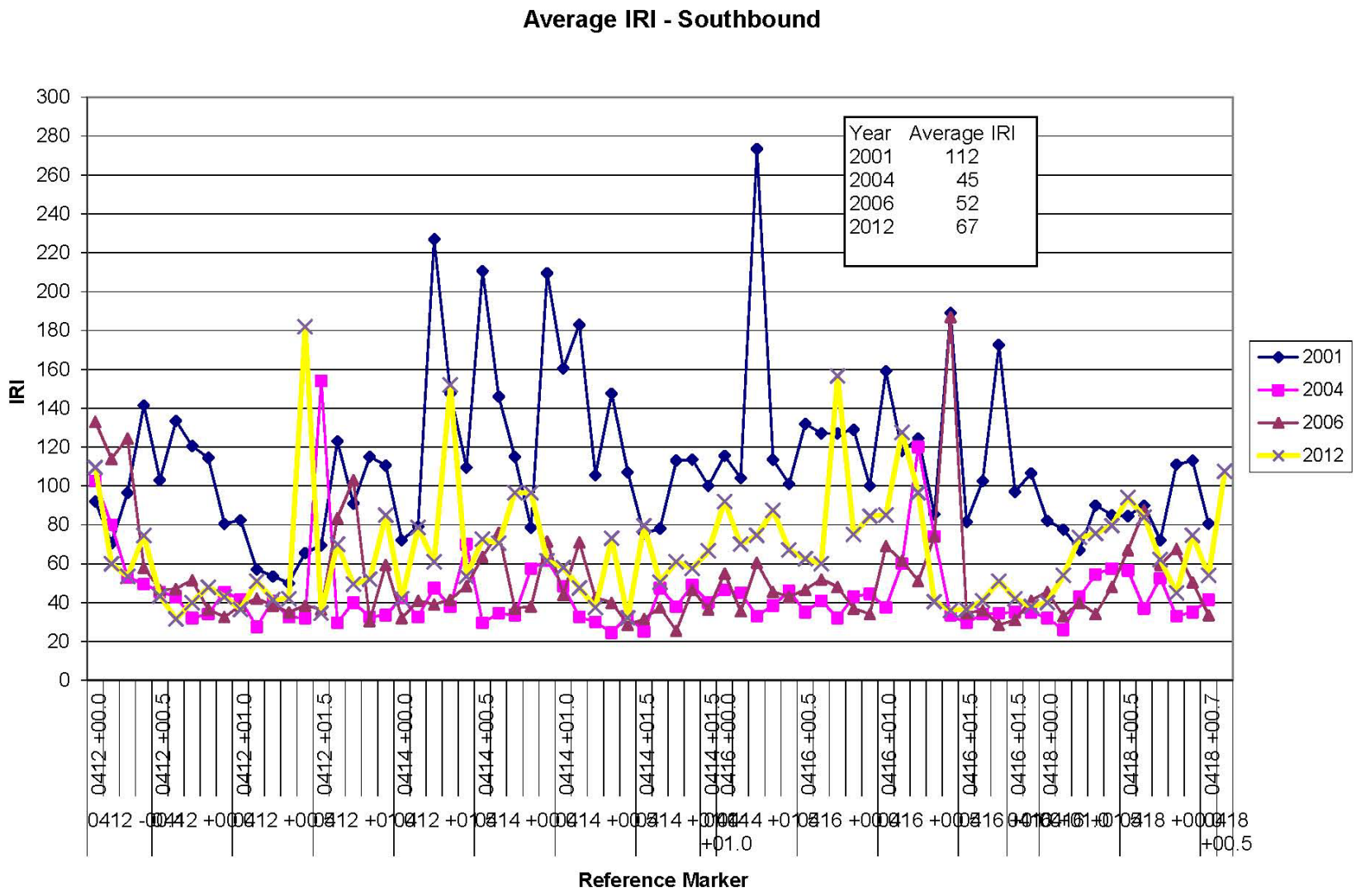


No transverse cracking

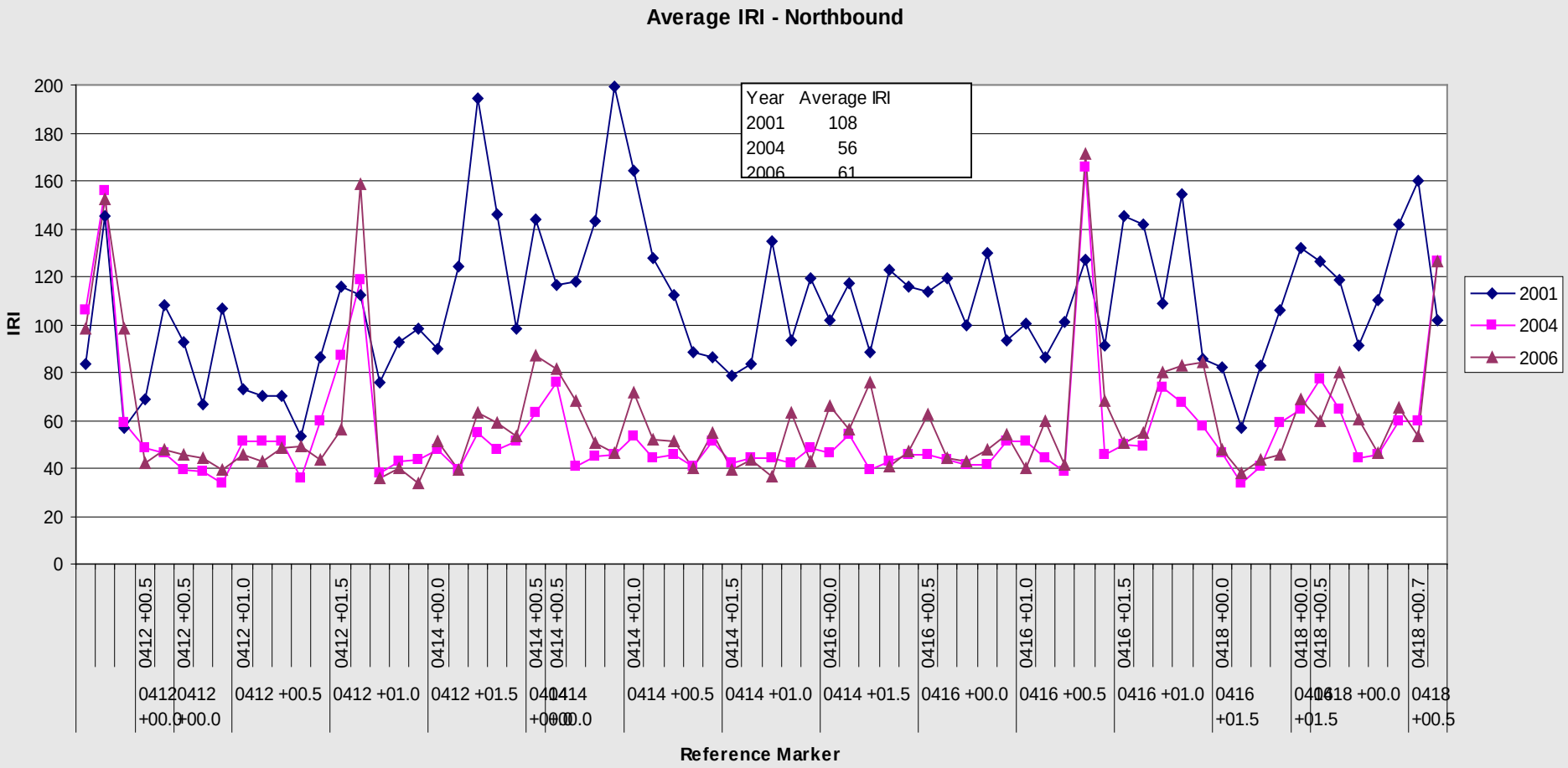
Southbound IRI – SH 47



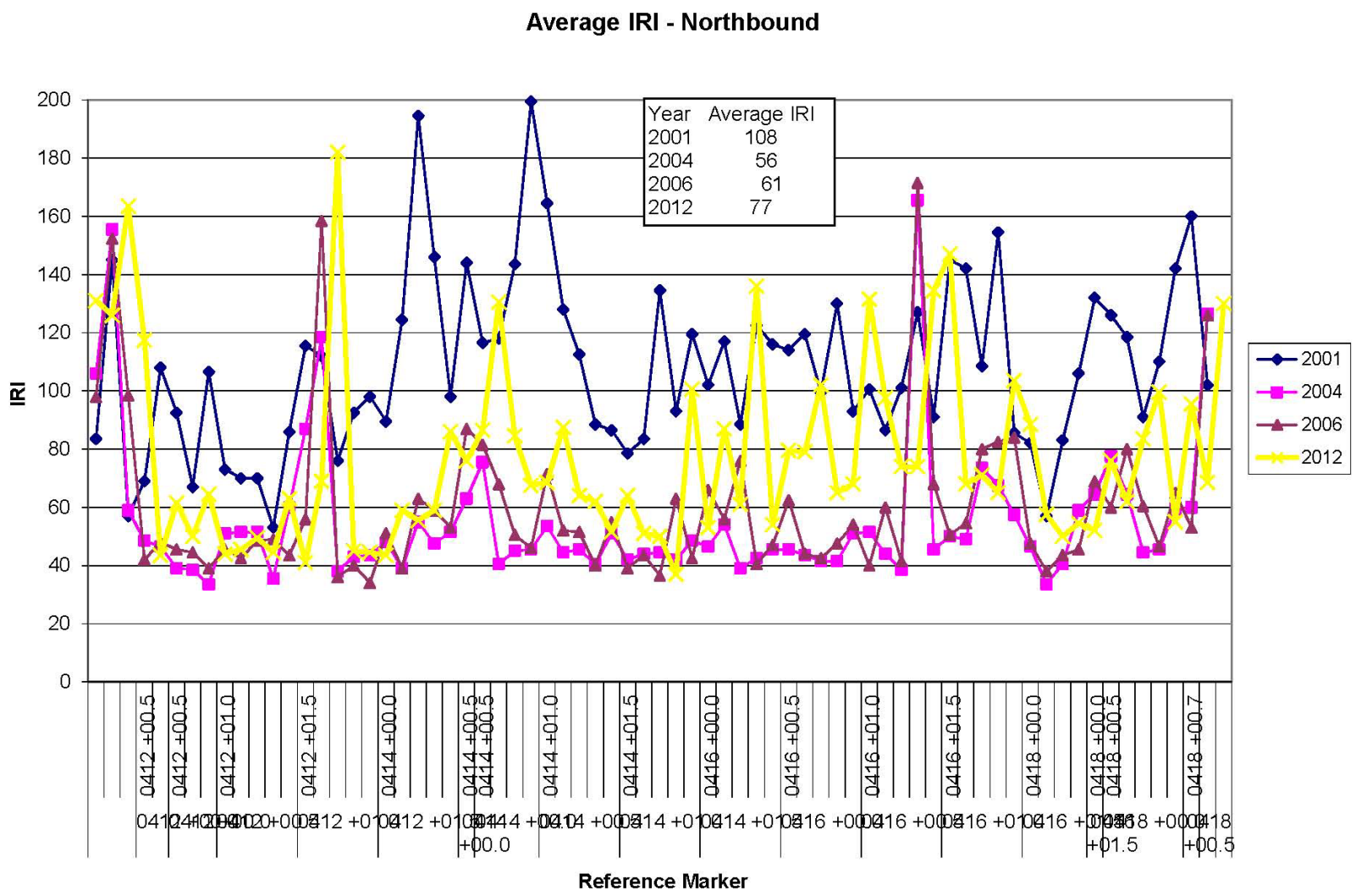
Southbound IRI – SH47



Northbound IRI – SH 47



Northbound IRI – SH 47



SH 288 Frontage Road Houston District

- Many patches
- New Failures
- Poor Drainage
- Existing HMA 2 – 4 inches
- Existing Base 4 to 8 inches (low quality PI 15 to 18)
- Moderate PI soils (23 to 33)
- Low traffic

Lab Testing for SH 288

- Proposed to add 4 inches new base prior to FDR, either
  - Crushed Concrete, or
  - Grade 2 base
- Design based on blend 50% RAP + 50% new base
- Standard Lab Tests
  - 7 day Strength
  - Seismic Modulus
  - TST
  - Retained strength

7 day UCS and retained strength

	2%	**3%**	4%
CC	271 (139%)	**305 (183%)**	427 (149%)
GR2	394 (141%)	**429 (160%)**	556 (183%)

SH 288 Pavement Design

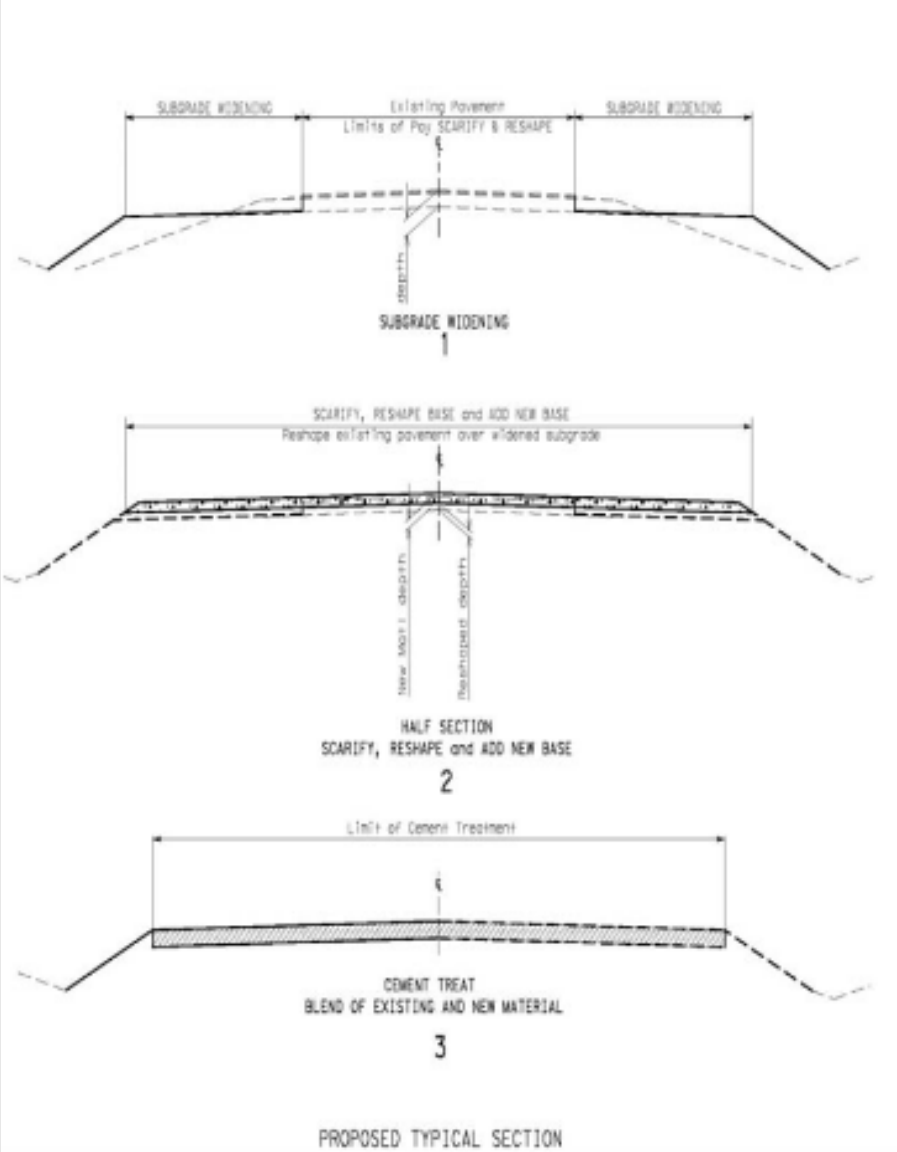


Table A1 - Design Method A

Parameter	Range	Usual Input FPS19w	Comments
Time to 1st Overlay (years)		10	may be lower for maintenance projects
Initial Serviceability Index (SI)	3.8-4.0	3.8	
Future Overlay – Initial SI	4.2-4.5	4.2	Future Overlays are not anticipated therefore use the conservative value
Minimum SI	2.0-2.5	2.5	
Design Confidence Level	A (85%) – B (90%)	B (90%)	
District Temperature Constant	30-31	30-31	Use default value in FPS program.
Selling Potential, PVR swelling rate	0-100%	0%	Do not use swelling potential as an input to FPS.
Detour (Road User Cost)	Posted speed and expected speed during overlay	Use same speed for all traffic speed entries and detour Model 3	Does not affect the pavement structure. Eliminates user costs associated with traffic delays for future overlays.
Material Cost per Cy		Use District Specific costs.	Monitor Bid Tabs and adjust accordingly

Material Description	Modulus Value	Poison's Ratio	Cohesiometer Value for MT check
Existing Material (including Subgrade)	Modulus Back-calculated from FWD data	0.35	na
Existing Pavement – Scarified, Reshaped and Compacted	Approximately 3 times the subgrade modulus	0.35	na
Stabilize Exist Pav/Subgrade a) mostly granular base (75% or more base) b) blend subgrade & base (50% to 75% base) c) mostly subgrade (<50% base)	a) 100 ksi b) 65 ksi c) 35 ksi	a) 0.3 b) 0.3 c) 0.35	a) 800 b) 650 c) 300
New Flexible Base	GR 2 = 50 ksi	0.35	na
Cement Treated Base UCS>210, with 85% retained strength	150 ksi	0.25	1000

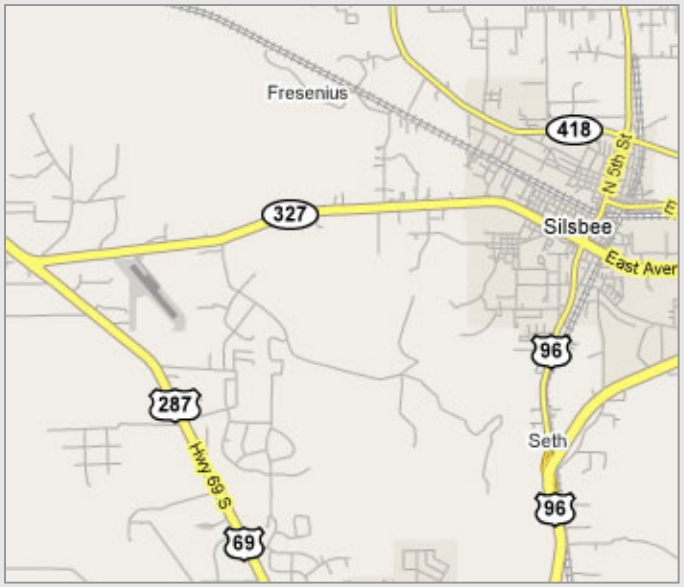
Construction of SH 288 FR

Completed highway 2010

Projects – SH 327 TxDOT's Beaumont District - 2008

Project Description:

- ~ 5" existing ACP blended w/5" existing base
- ACP pulverized w/milling machine then blended w/base by rotomill in October 2008
- Cement slurry application (4%) initiated in November 2008



Field Construction

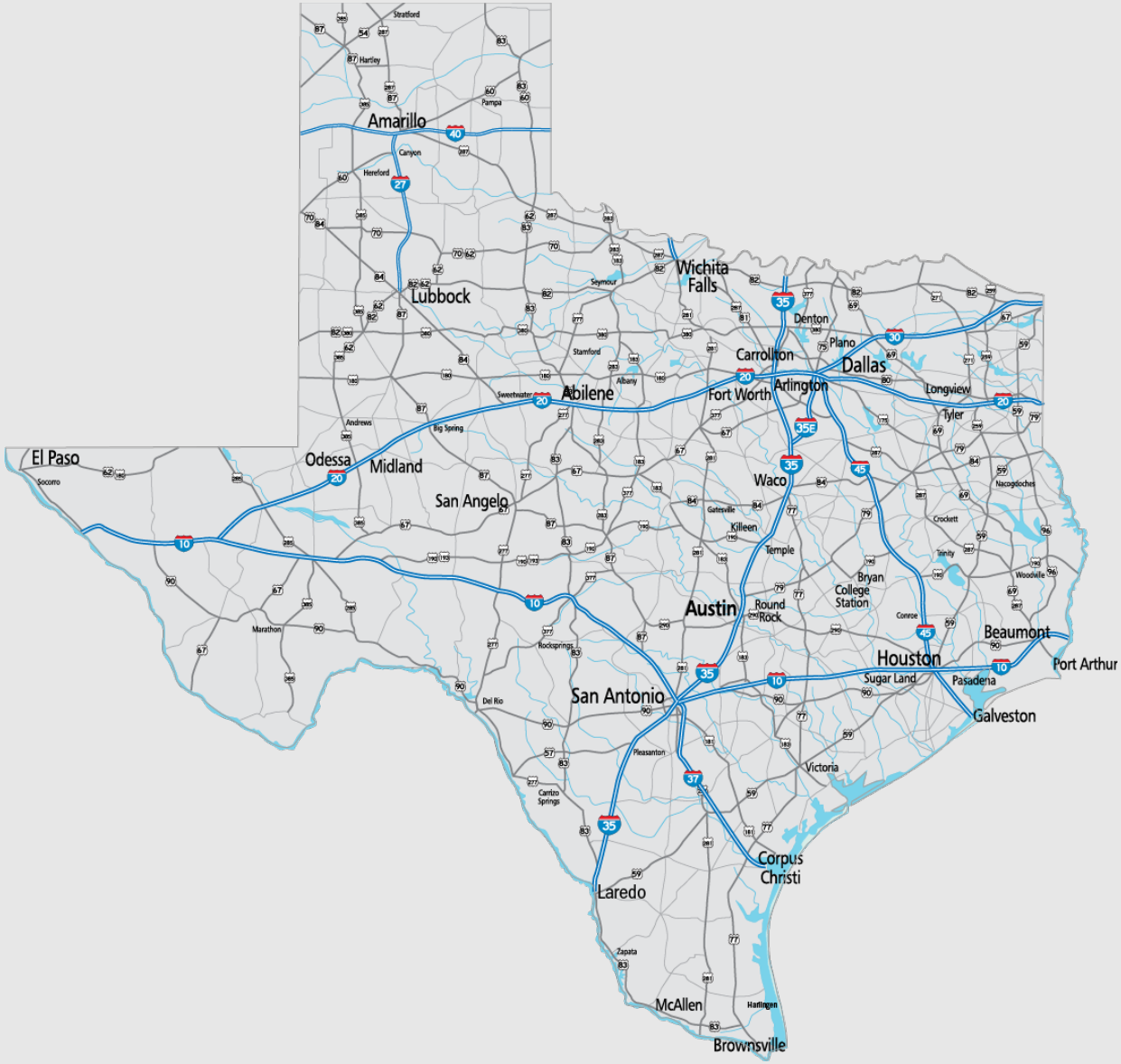
Application of Cement Slurry

- Produced by concrete plant and hauled in concrete trucks.
- Each truck spread in two batches with a custom spreader box over a length of ~ 211’
- Concerns with uniformity of cement application rate across transverse profile
  - Field-molded samples from wheelpath and center for 7-day UCS
  - PFWD on 2-day old section along both transverse and longitudinal profiles

Conclusions from SH 327

- Auger samples used for lab mix design matched well with field construction
- Cement slurry application, after “bugs” worked out, seemed to work reasonably well
  - No evidence of greater variability across lane width as compared to variability with longitudinal distance
- 3 passes with roller recommended for microcracking

Questions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