Tack Coat Effect on Field Performance

December 2, 2014

Wisconsin Asphalt Paving Association

Madison, WI

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You might have a bonding problem if …

You definitely have a bonding problem if …

You might have a bonding problem if …

- Longitudinal cracking near the wheel path

Why do pavements debond?

- Lack of tack coat
- Non-uniform application of tack
- No adjustment in rate for surface type or condition
- Dirt, debris and dust contamination of surface

Why do pavements debond?

- Construction practices necessitate driving on the tack coat to place the mix
- Tracking of the tack from the surface may result

Tack Coat - Constructability vs Performance

- Traditional distributor placed tack coat construction dictates:
  - Low application rates
    - Curing of the tack
    - Traction for paving equipment
  - Use of non-tacky hard binders to reduce tracking

Tack Coat Paradigms

Heavy application of tack coat may -

- create a slip plane
- flush to the surface of the new overlay

What options are available to place tack uniformly without disturbing during construction?

- Modify the process to keep all construction equipment and trucks off the tack during construction
- Spray paver

What is a Spray Paver?

Spray Paver = Paver + Distributor in one machine

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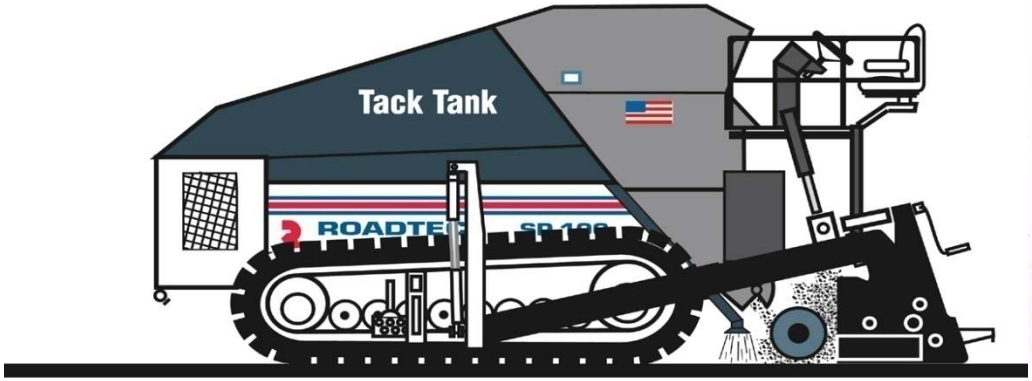
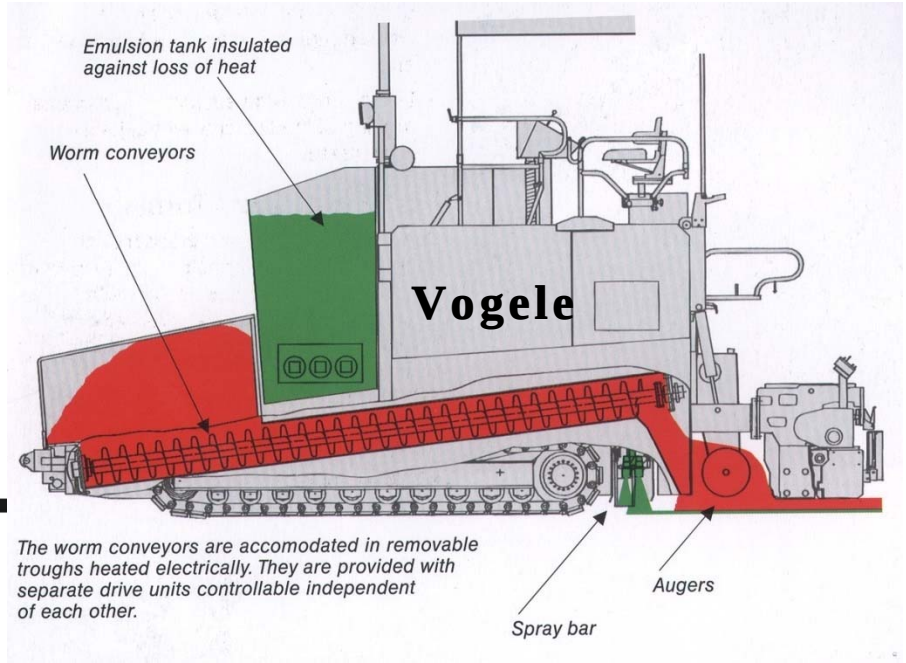
Spray Pavers

- Due to the distributor plus paver in one,
  - **Different types of emulsion can be used**
  - **Dilution of emulsion is not required**
  - **Application rates are not limited by construction**



ROADTEC STEALTH PAVER WITH TACK TANK



Spray Paver Experimentation (Field)

- What happens if significantly higher application rates are used?
- What forms of distress will appear or possibly be delayed?
- What effect does significantly different types of tack have on performance?
- Surface type effect on application rates (PCC, AC, milled)?

2008

2012

Field Performance Data

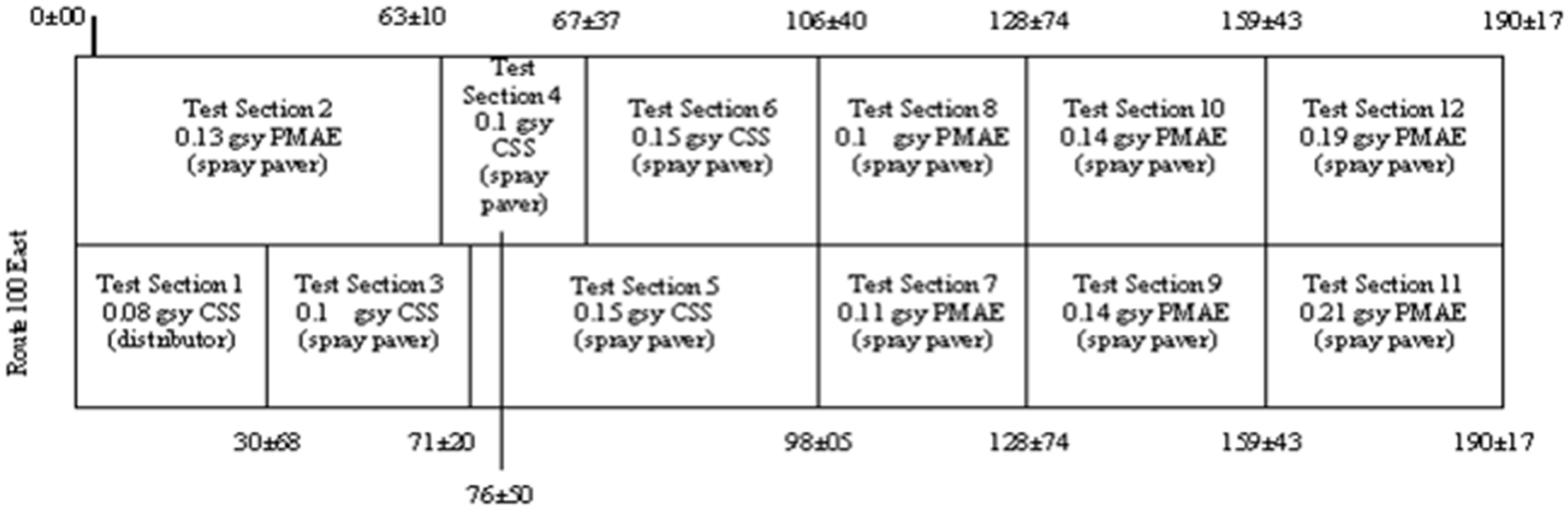
Route T, Franklin County, MO

- Constructed: October 2008
- Contractor: N.B. West
- Project length: 3.5 miles (test sections)
- Surface: Composite, HMA over PCC
- Mix: 1 ¾" Bonded BP-1 HMA w/ PG64-22
- Tack:
  - Test sections at 0.1, 0.15, and 0.2 gal/yd2 PMAE at 65% AC
  - Test sections at 0.1 gal/yd^2 thru distributor and 0.1 and 0.15 gal/yd^2 CSS-1h thru SP-200
- Equipment: RoadTec SP-200 spray paver

June 2009

MoDOT Route T Project – Oct 2008

1 ¾” BP-1 overlay over <u>composite pavement</u>



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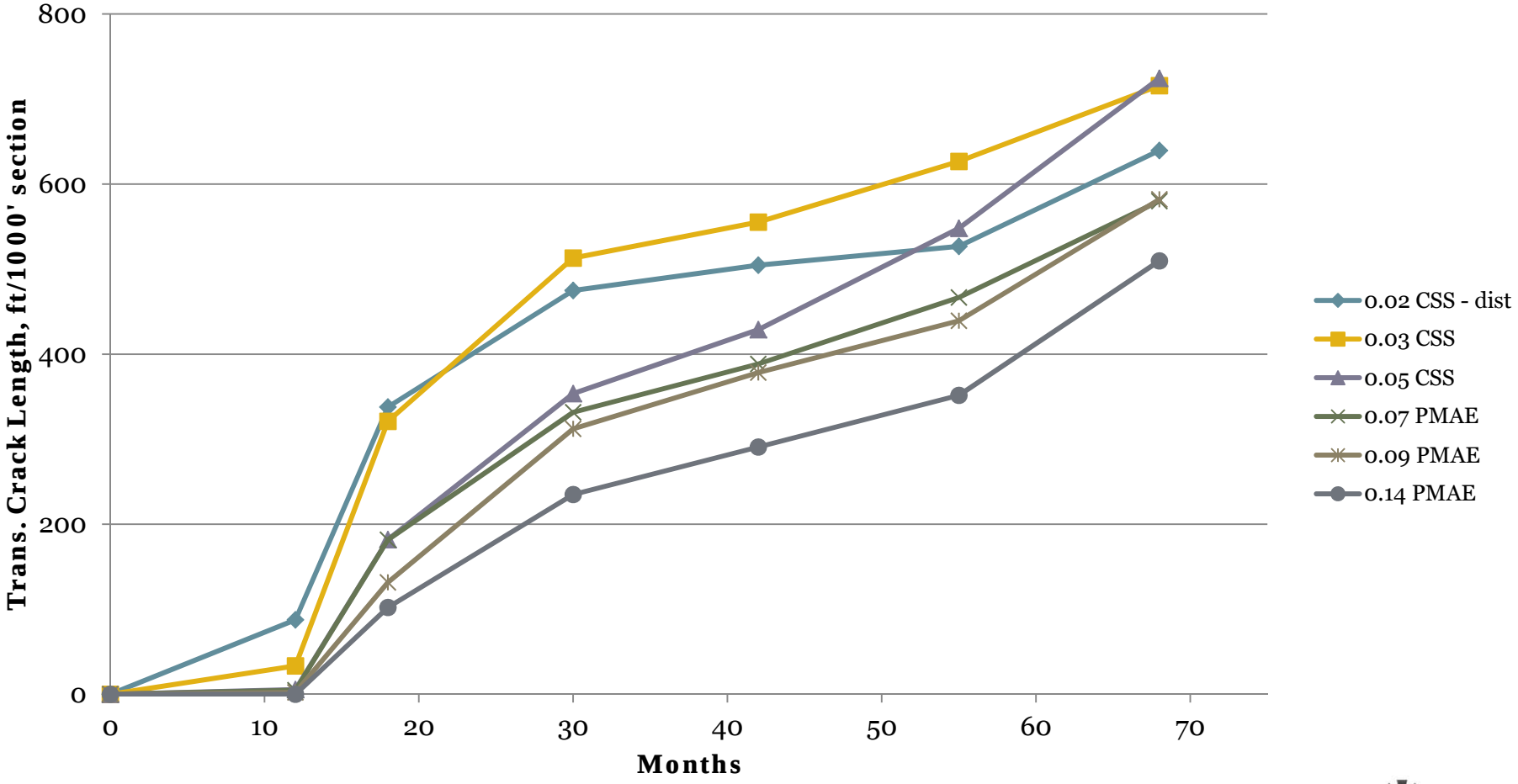
MoDOT Route T 2008 @ 68 months
1 ¾" BP-1 over HMA/PCC Composite
Tranverse Crack Length/1000' vs Time
West Bound Lane



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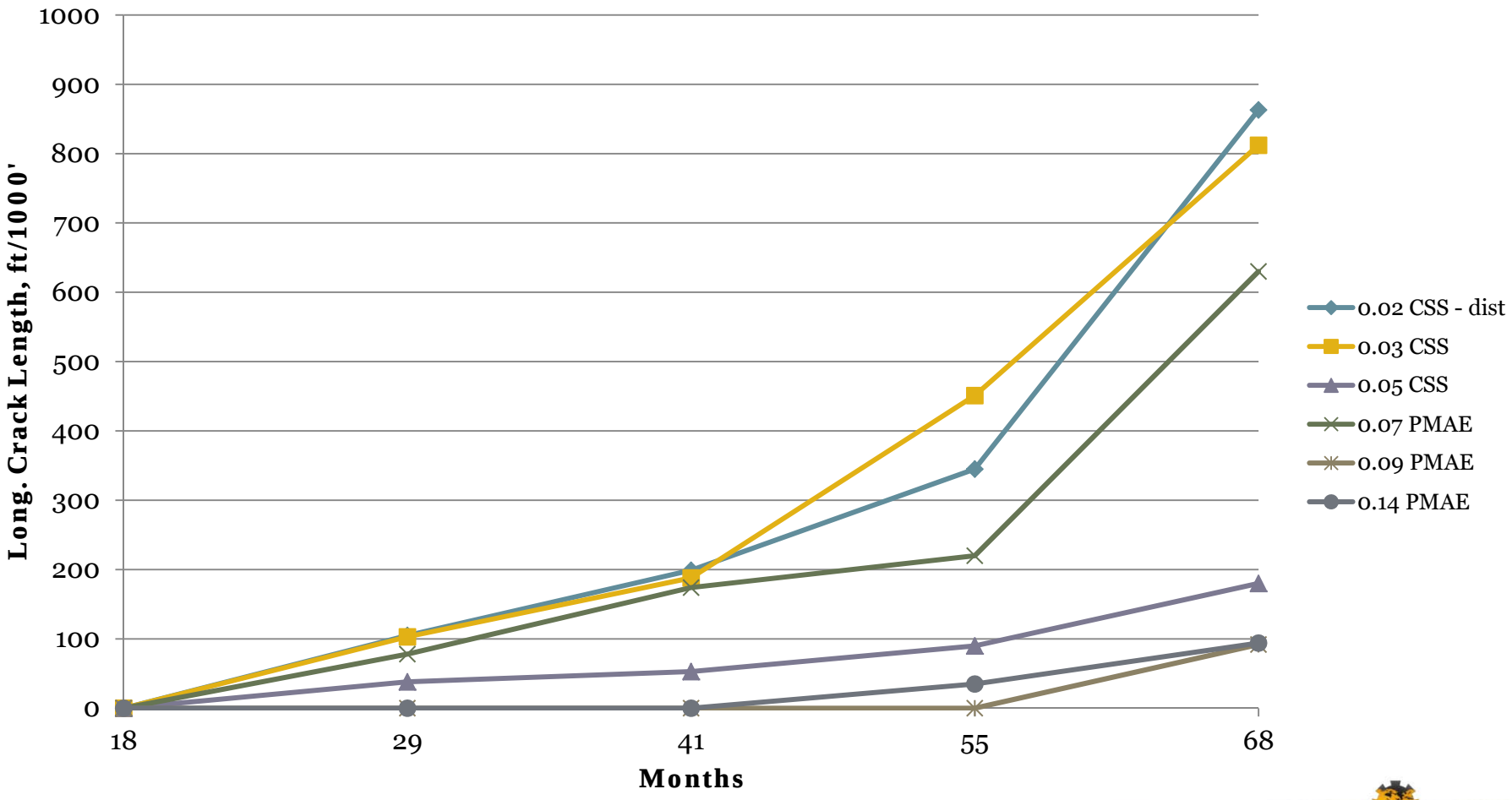
MoDOT Route T 2008 @ 68 months
1¾" BP-1 over HMA/PCC Composite
Longitudinal Crack Length/1000' vs Time
West Bound Lane



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Route T Franklin Co Test Sections 11/12 Pre-paving and 4 years later

2008 2012

0.21 gal/yd2 (0.14 res) PMAE Tack

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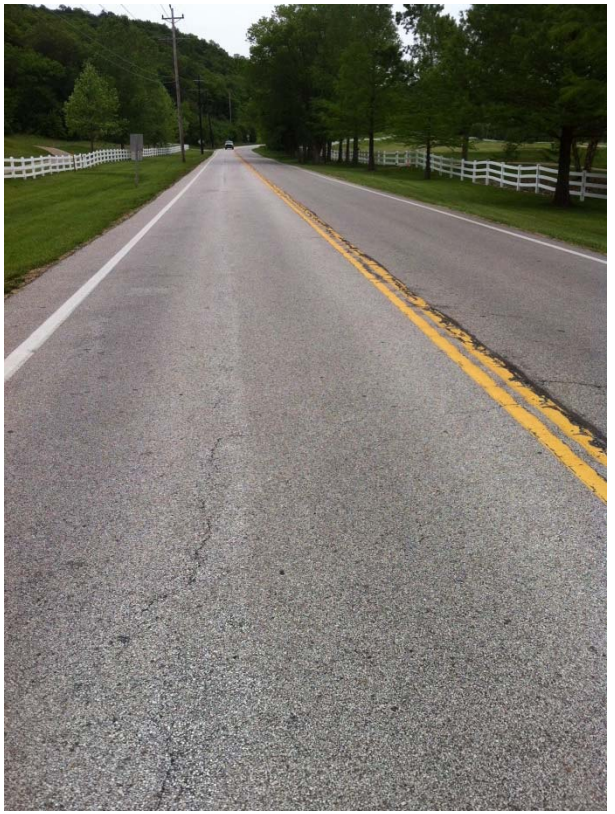
Route T Franklin Co Test Sections 11/12 Pre-paving and 6 years later

2008



2014

0.21 gal/yd2 (0.14 res) PMAE Tack

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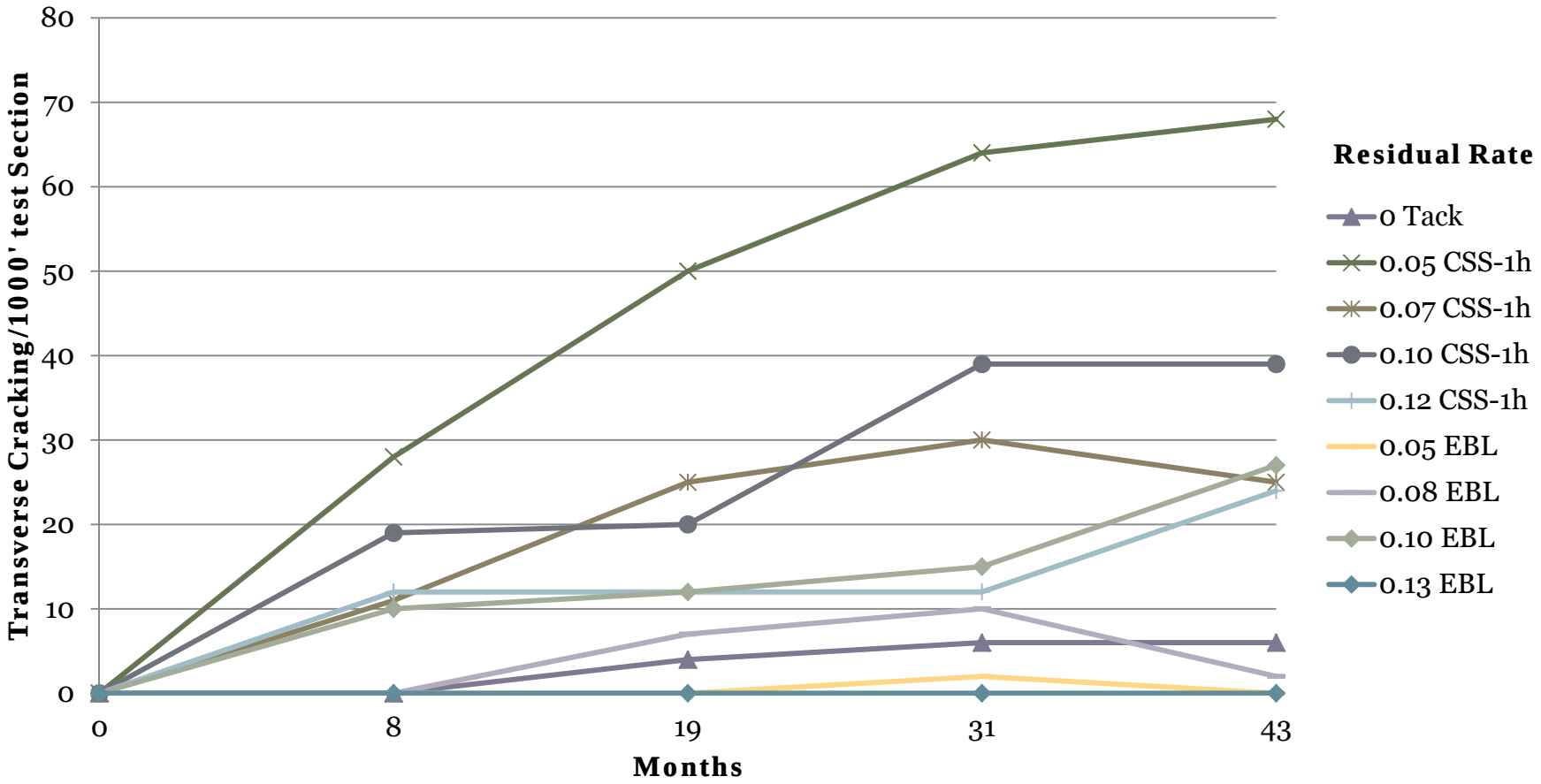
KDOT US 36 Washington Co. Project – Sept 2009

1 ½" SR-12.5A over a Milled Surface

Test Section 11 40% RAP 0.35 gal/yd2 EBL	**Test Section 10** 40% RAP 0.25 gal/yd2 EBL	**Test Section 9** 25% RAP 0.12 gal/yd2 EBL	**Test Section 7** 25% RAP 0.20 gal/yd2 EBL	**Test Section 5** 25% RAP 0.16 gal/yd2 EBL	**Test Section 3** 25% RAP 0.08 gal/yd2 EBL	**Test Section 1** 25% RAP No Tack
		Test Section 8 25% RAP 0.12 gal/yd2 CSS-1h	**Test Section 6** 25% RAP 0.20 gal/yd2 CSS-1h	**Test Section 4** 25% RAP 0.16 gal/yd2 CSS-1h	**Test Section 2** 25% RAP 0.08 gal/yd2 CSS-1h	

KDOT US 36 Washington Co 2009 at 43 months
½ Mill, 1 ½" SR12.5A, PG58-28
Transverse Cracking/1000' section vs Time



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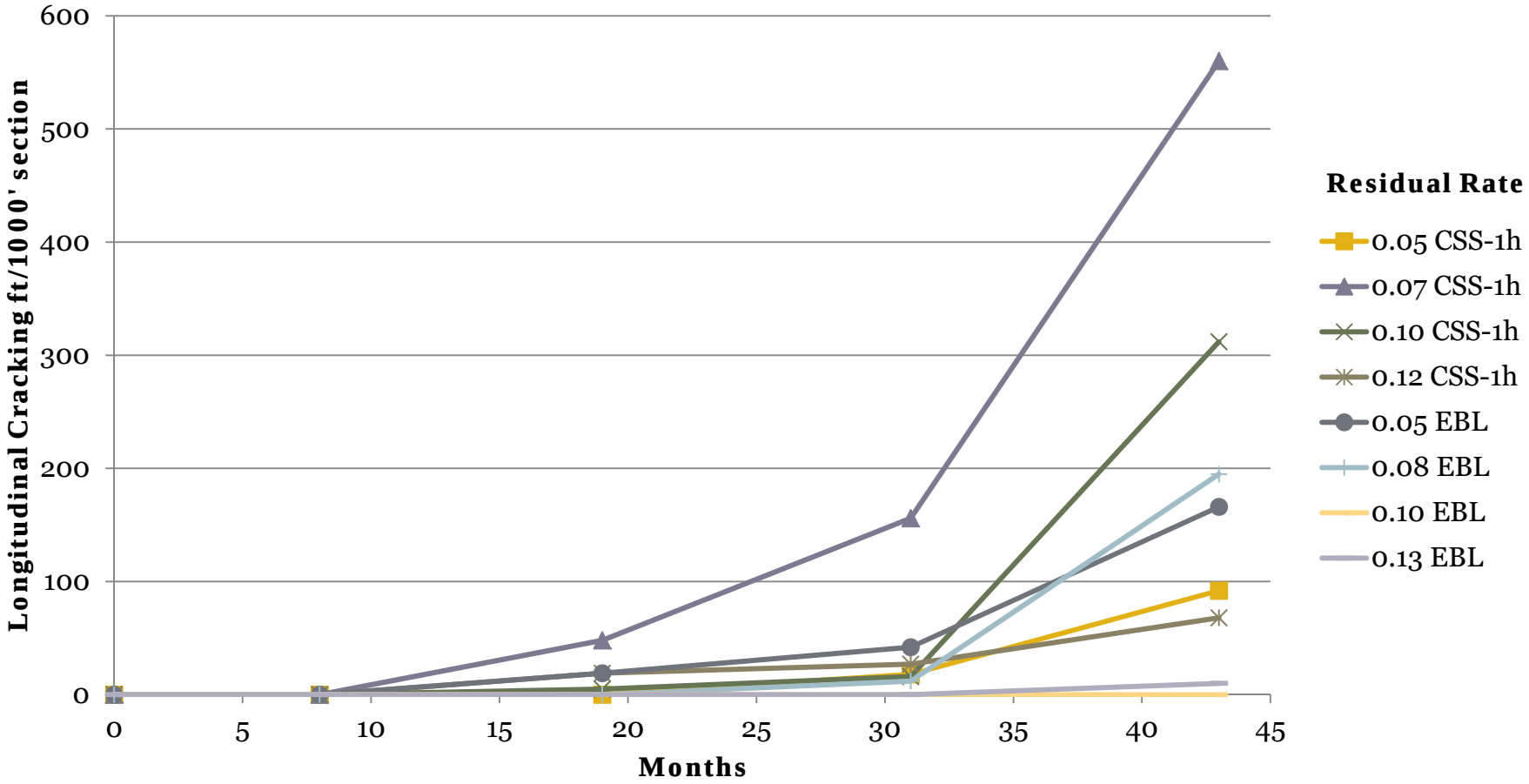
KDOT US 36 Washington Co. at 43 months
½" Mill, 1 ½" SR12.5A, PG58-28
Longitudinal Cracking/1000' section vs Time



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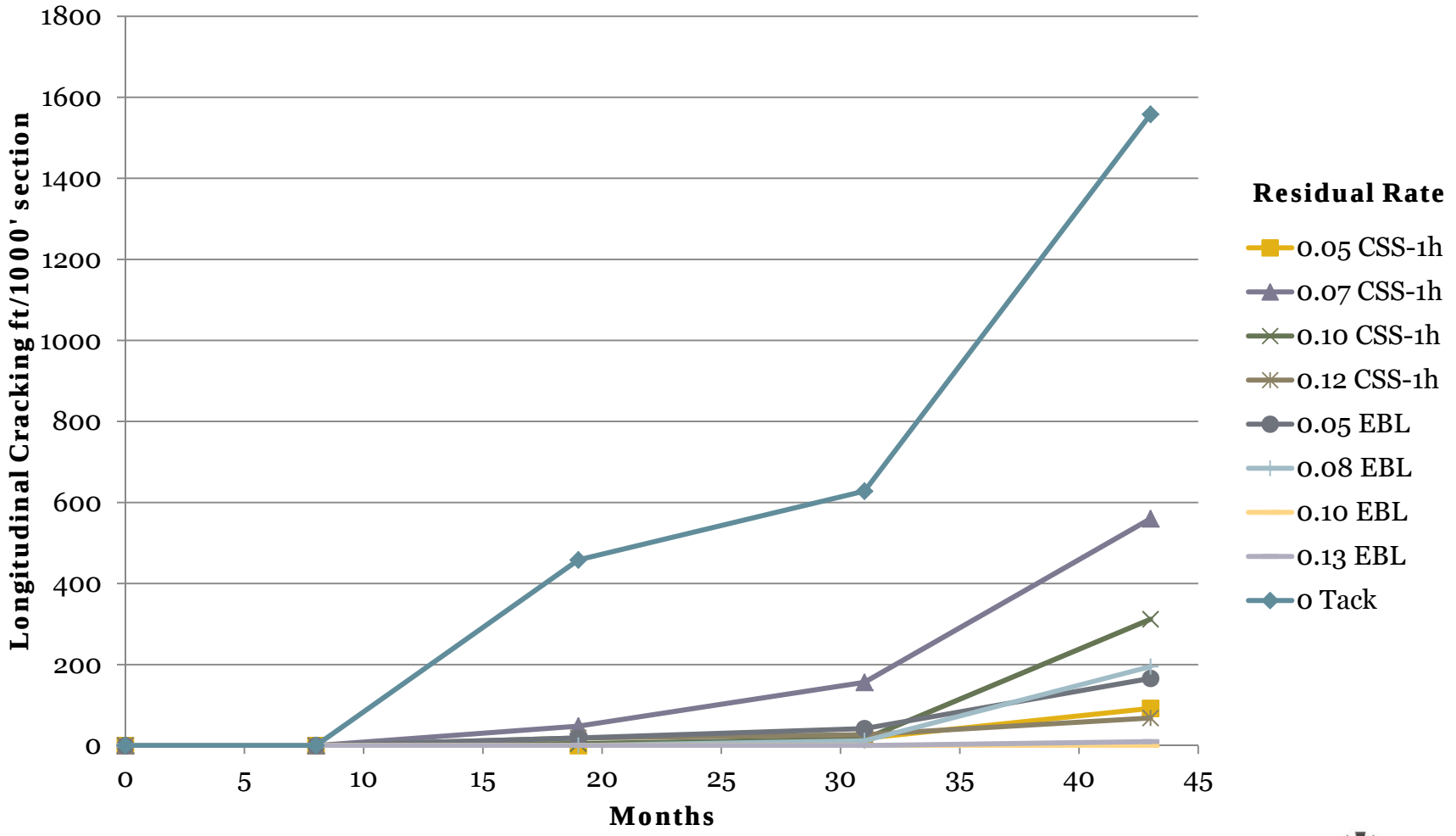

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No Tack over a Milled Asphalt Surface
US 36 Washington Co. KS 2009

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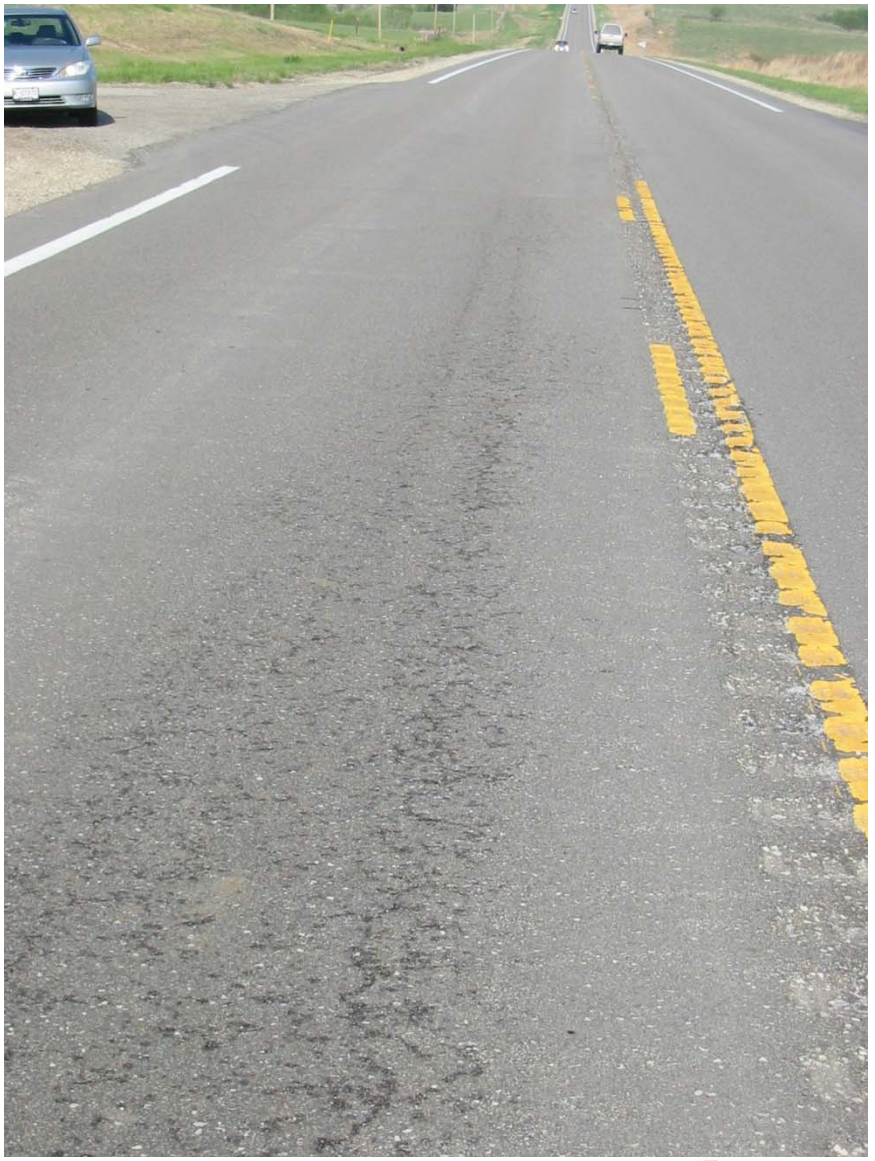
No tack over a milled surface – 2 years later

- US 36 Washington County, KS
- Fatigue cracking in the inside wheel path
- Effect of unbonded overlay



KDOT US 36 Washington County

No Tack Section 2014

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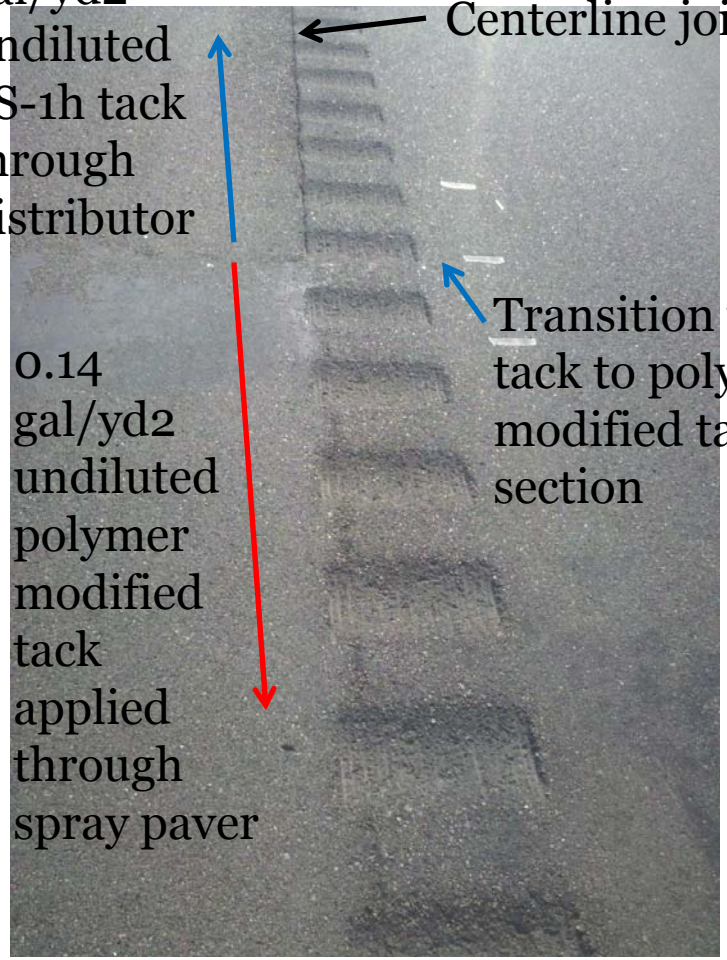
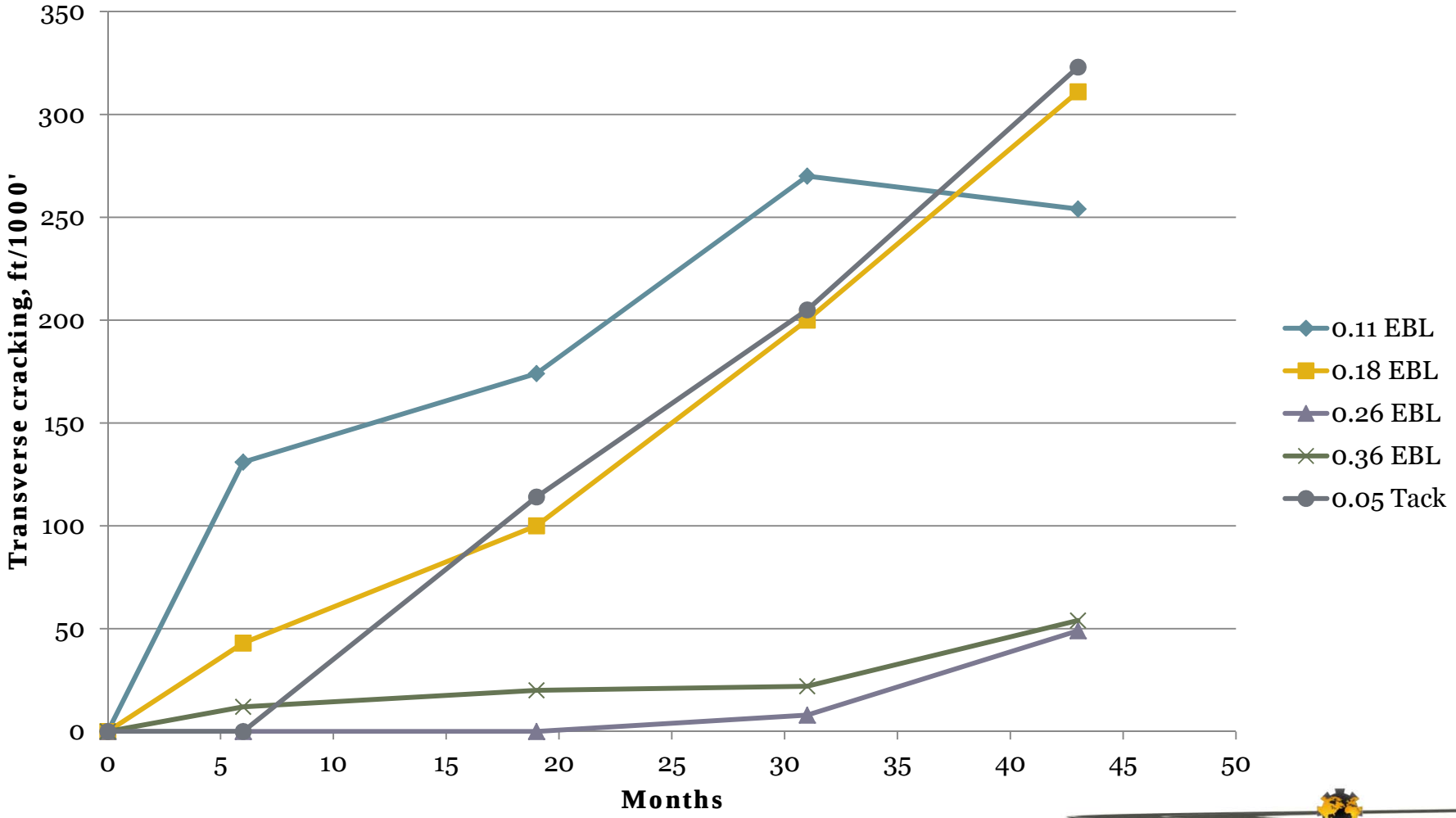
KDOT US 36 Marshall Co. (Const. 2010)



- 1” mill, 1” SR9.5A
- PG70-28 binder
- 5 test sections
  - 4 spray paver shot rates
    - 0.11 gal/yd2 EBL
    - 0.18 gal/yd2 EBL
    - 0.26 gal/yd2 EBL
    - 0.36 gal/yd2 EBL
  - 1 Distributor applied shot rate
    - 0.05 gal/yd2 SS-1h

KDOT US 36 Marshall Co. 2010
Transverse Cracking at 43 months
1" Mill, 1" SR9.5A, PG70-28



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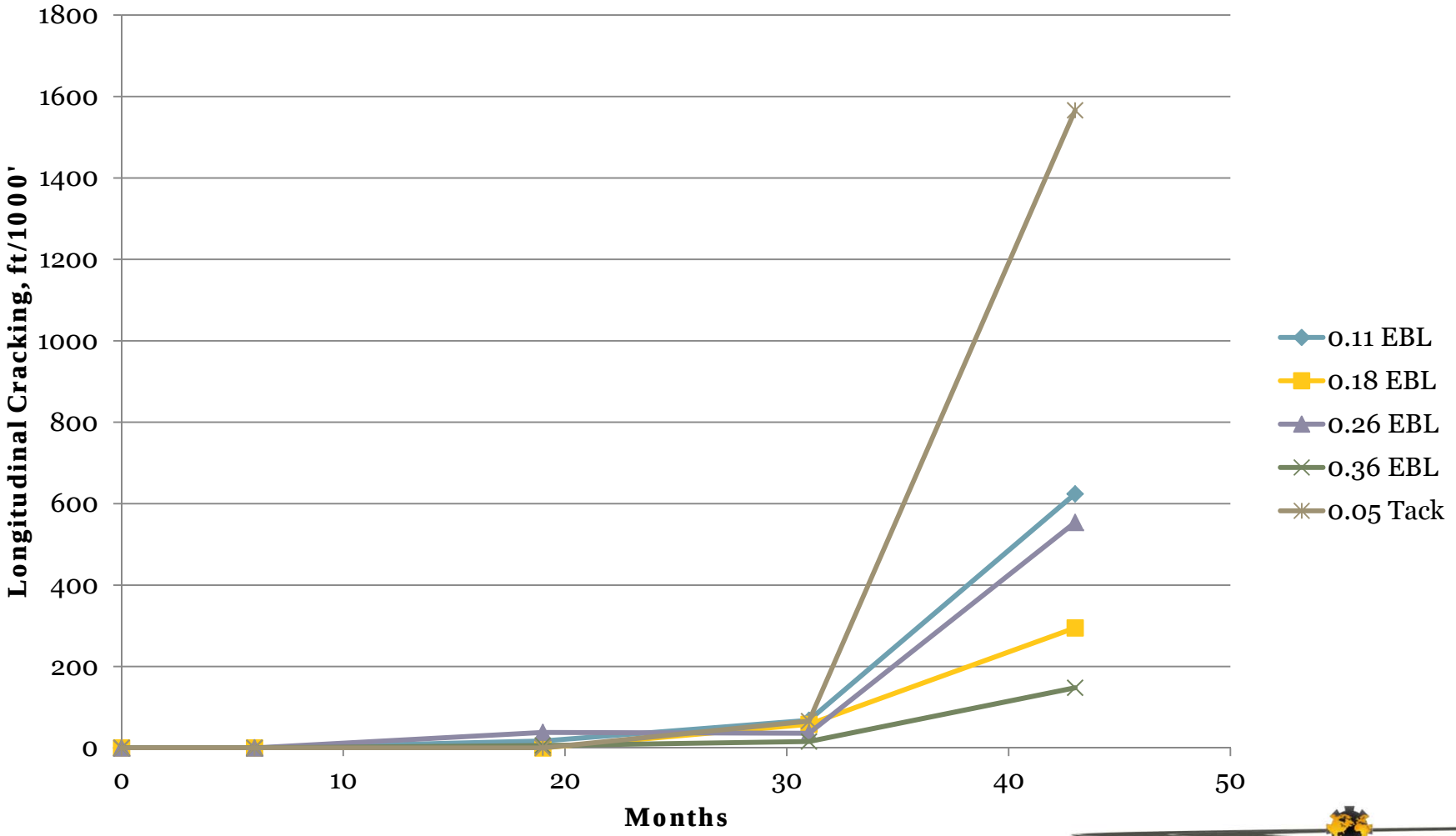
KDOT US 36 Marshall Co. 2010
Longitudinal Cracking at 43 months
1" Mill, 1" SR9.5A, PG70-28



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KDOT US 36 Nemaha County 2010

- 4” CIR with emulsion
- 1 ½” SR12.5A
- PG70-22 binder
- 4 Test sections
  - 3 spray paver shot rates
    - 0.11 gal/yd2 EBL
    - 0.22 gal/yd2 EBL
    - 0.34 gal/yd2 EBL
  - 1 distributor applied control section
    - 0.05 gal/yd2 CSS-1h

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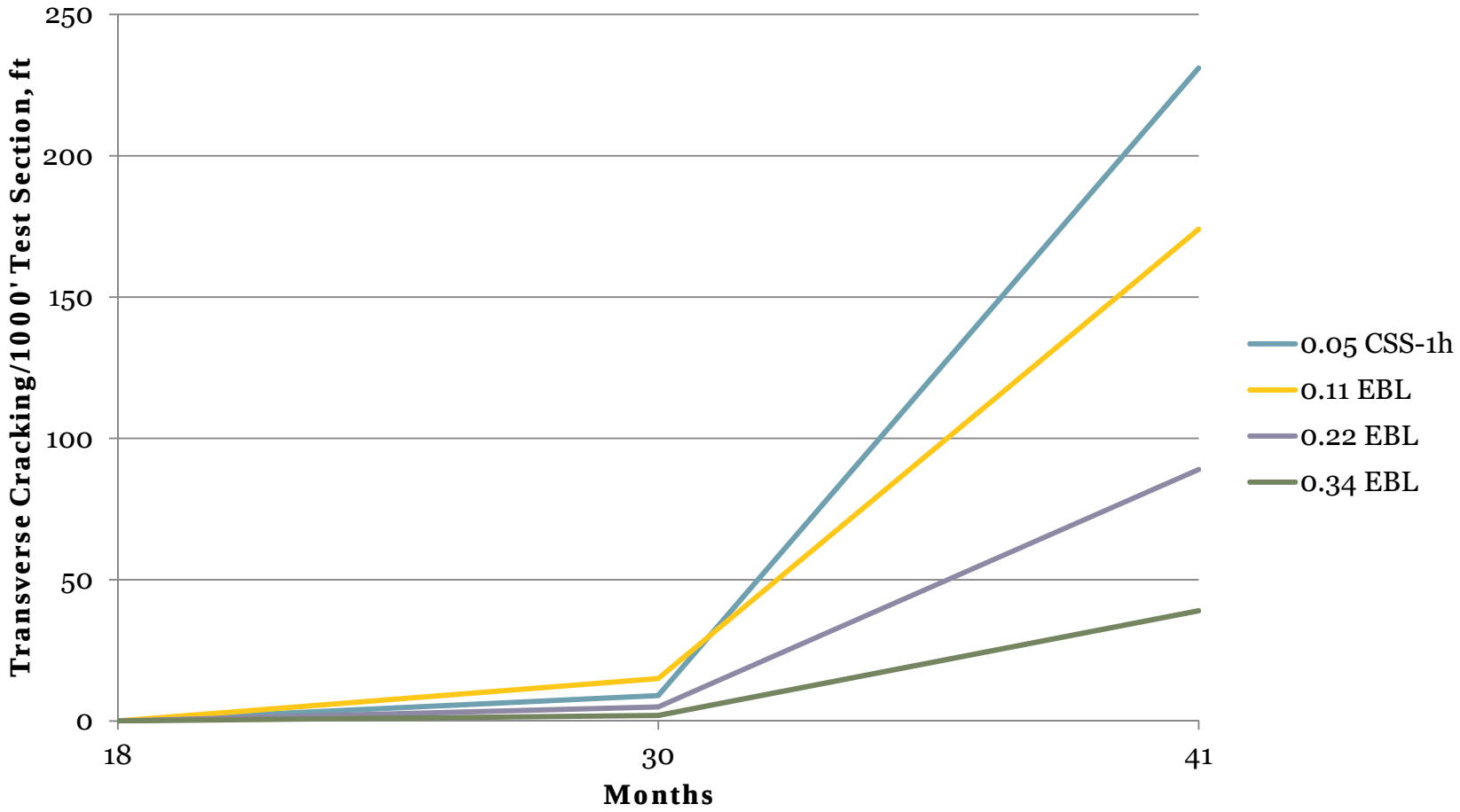
KDOT US 36 Nemaha Co. 2010
Transverse Cracking at 41 months
4" CIR w/ 1 ½" SR12.5A, PG70-22



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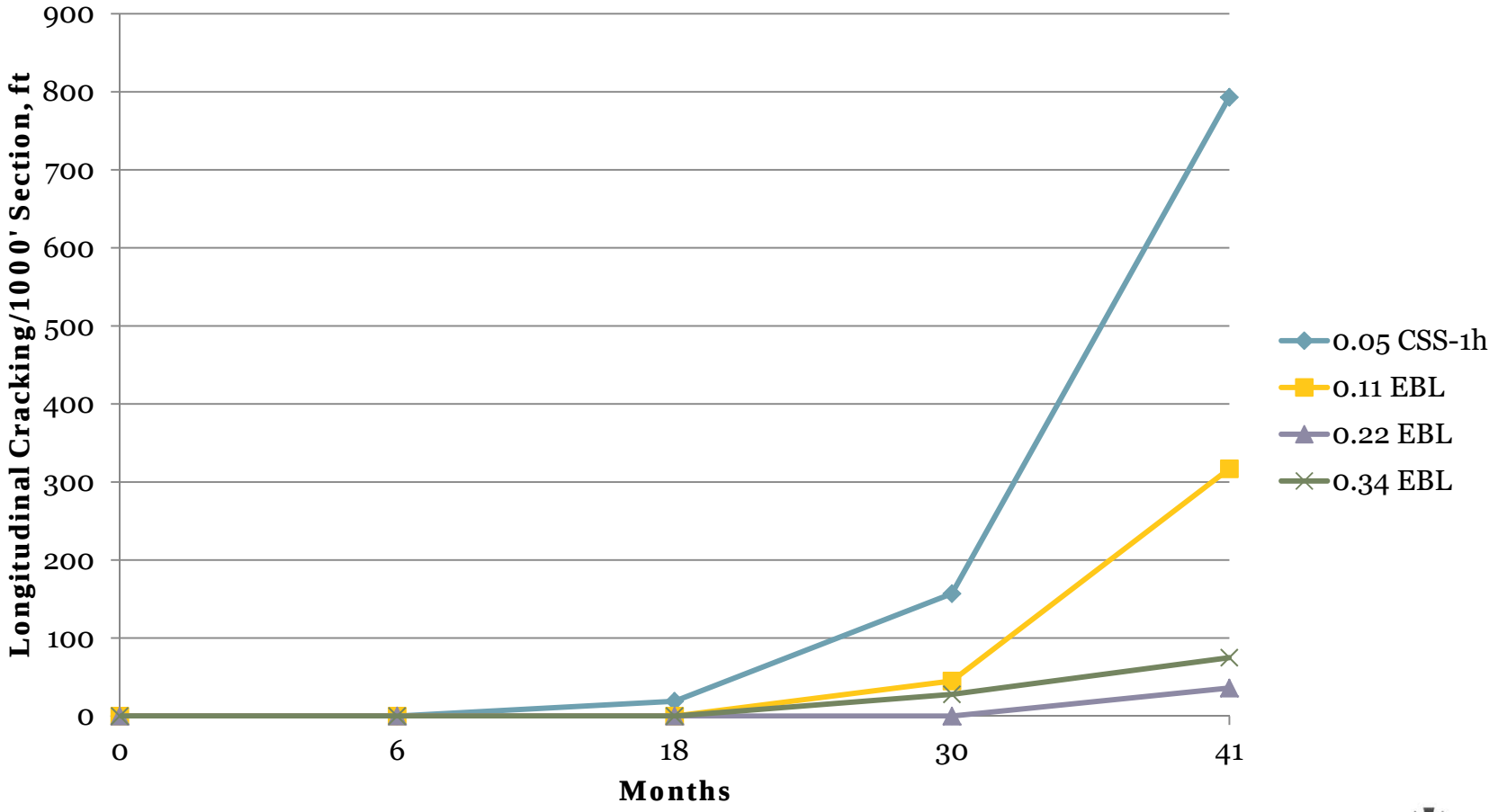
KDOT US 36 Nemaha Co. 2010
Longitudinal Cracking at 41 months
4" CIR w/ 1 ½" SR12.5A, PG70-22



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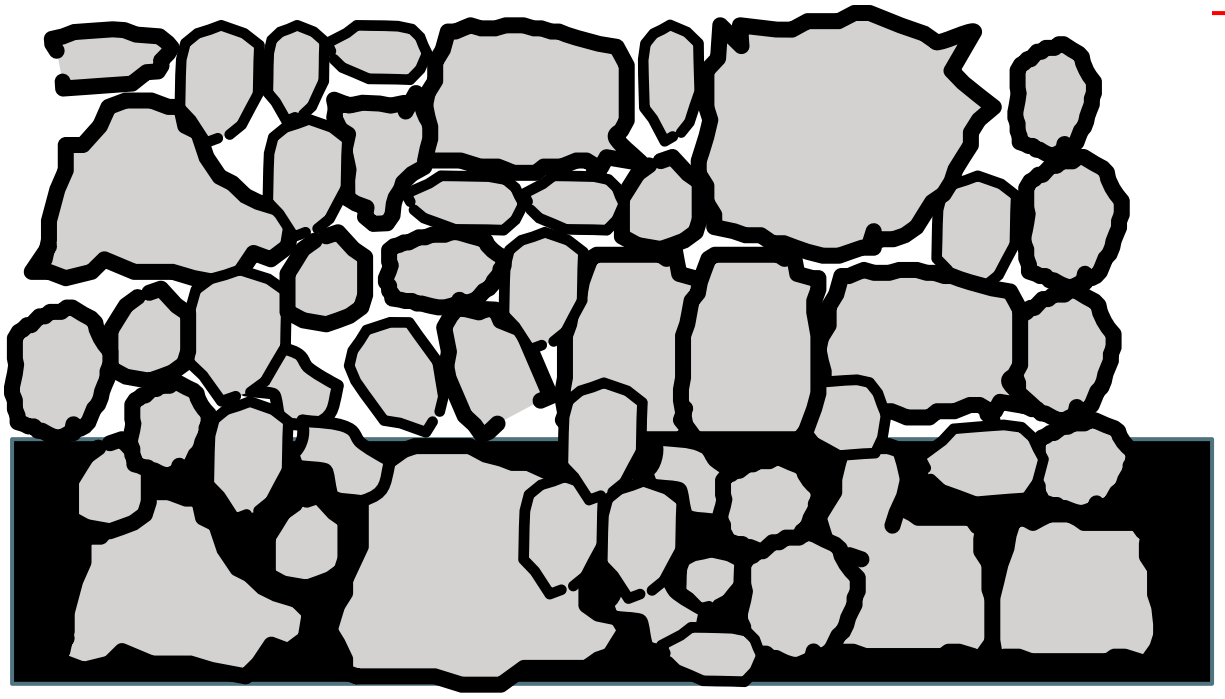
Saturation at Interface Creates Voidless Height in HMA

- Higher tack rate creates an asphalt rich interlayer at the interface with the existing pavement



HMA compacted height

Voidless height from tack residue

Bonded to existing pavement surface

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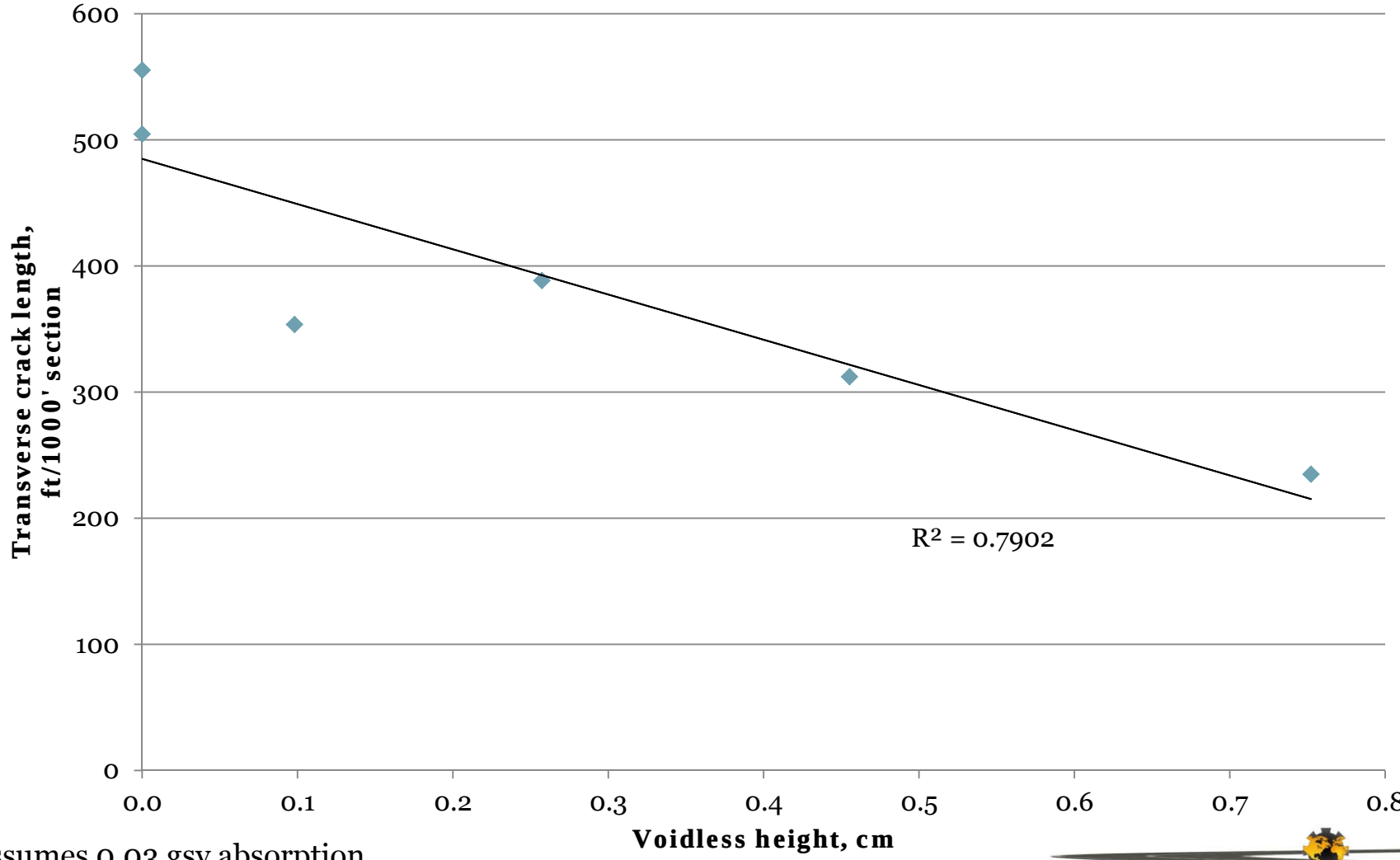
MoDOT Route T @ 41 months
Transverse Cracks vs Voidless Height



*Assumes 0.03 gsy absorption

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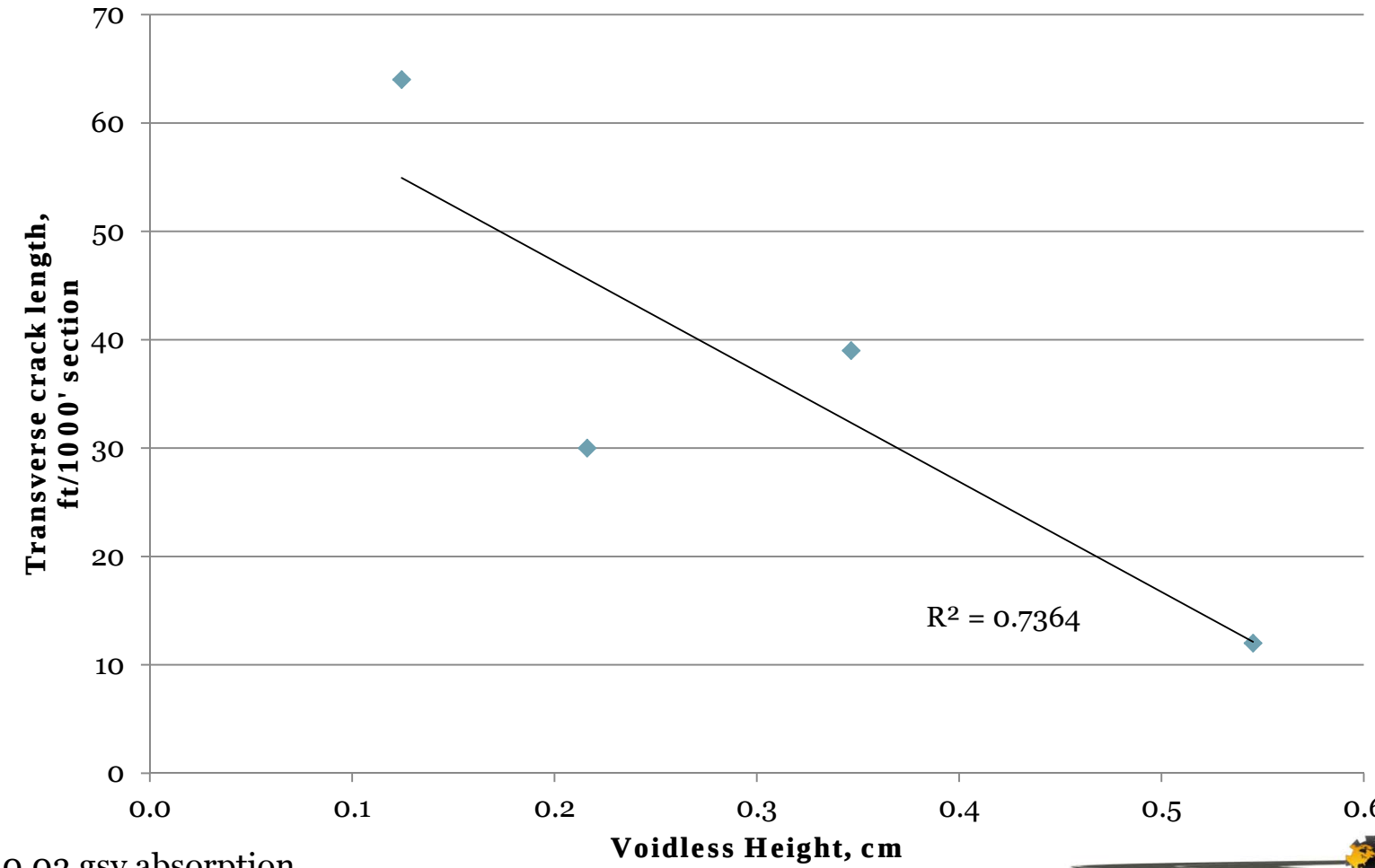
KDOT US 36 Washington Co at 31 months
Transverse Cracks vs Voidless Height
All CSS-1h sections



*Assumes 0.03 gsy absorption

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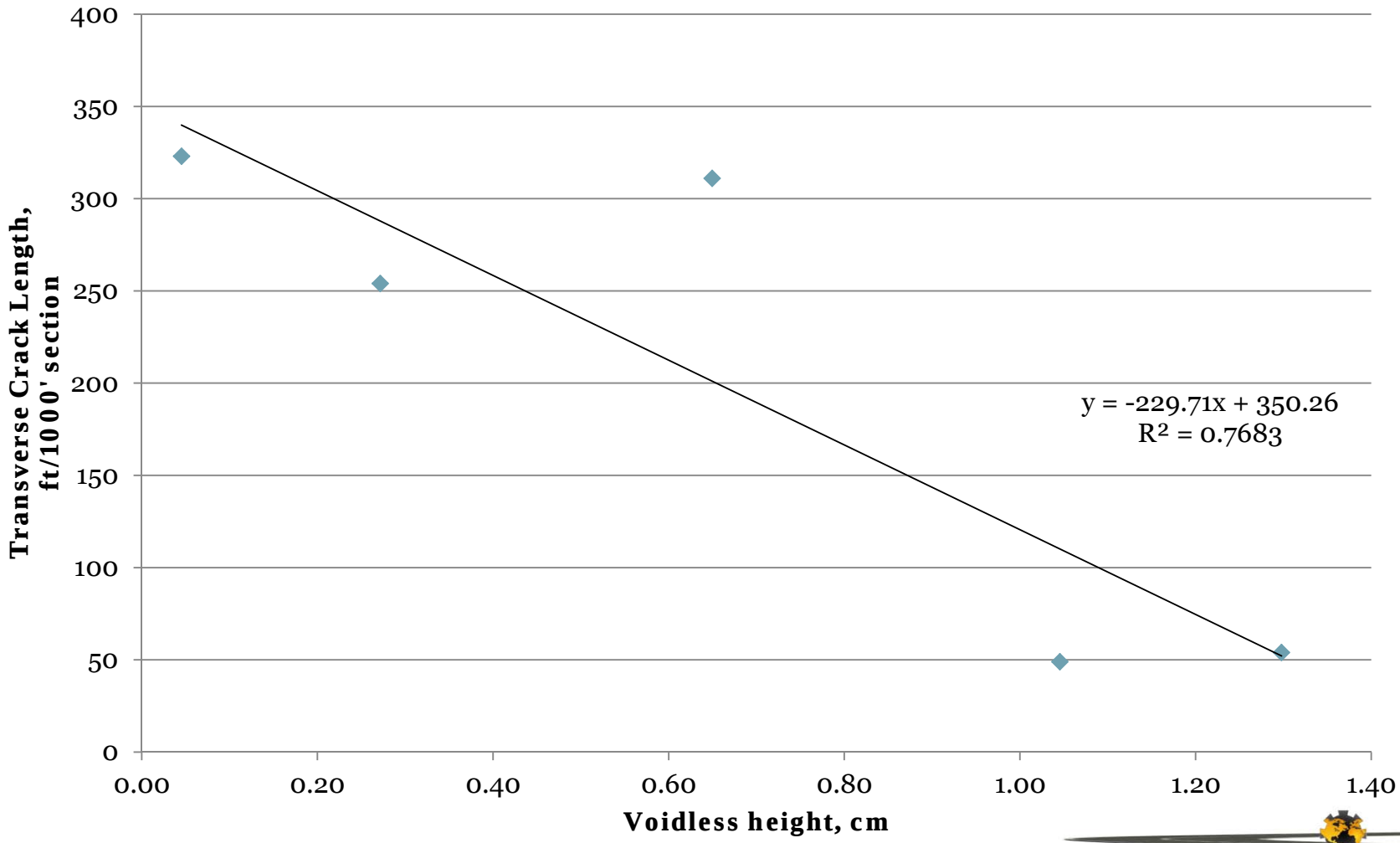
US 36 Marshall County, KS @ 43 months
Transverse Cracks vs Voidless Height



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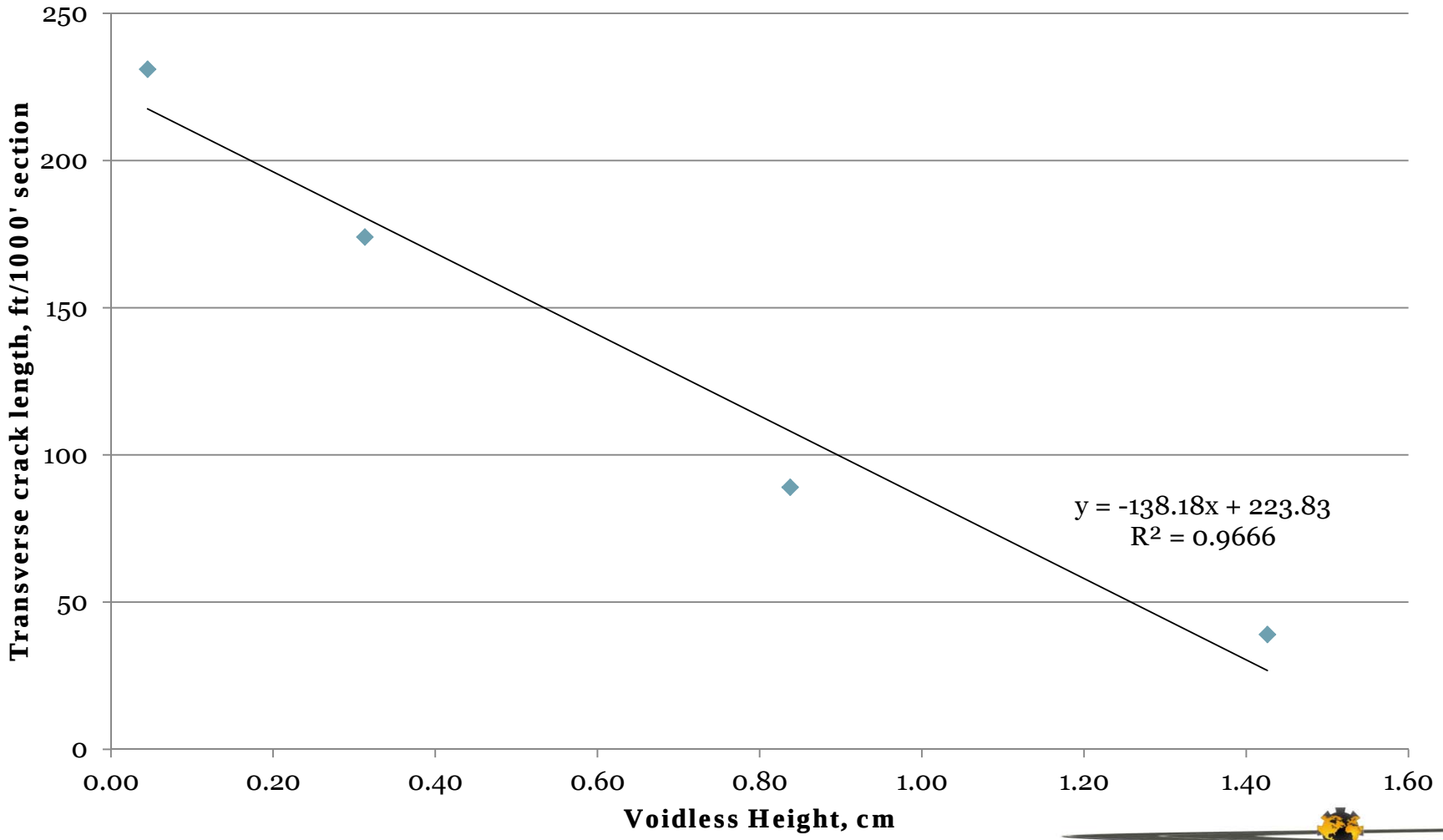
US 36 Nemaha County, KS @ 41 Months
Transverse Cracks vs Voidless Height



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Observations from Field Performance

- Based on field project data,
  - Correlation of bond energy to longitudinal cracking resistance exists
  - Correlation of voidless height to transverse cracking exists
  - General trends favor higher application rates (than standard tack rates) and polymer modified tack
    - Improved mix performance; more resistance to transverse and longitudinal cracking
  - Field data from more projects are being gathered

Questions?