TEXAS DEPARTMENT OF TRANSPORTATION

CURRENT FLEXIBLE PAVEMENT DESIGN ISSUES

2014 Construction Conference

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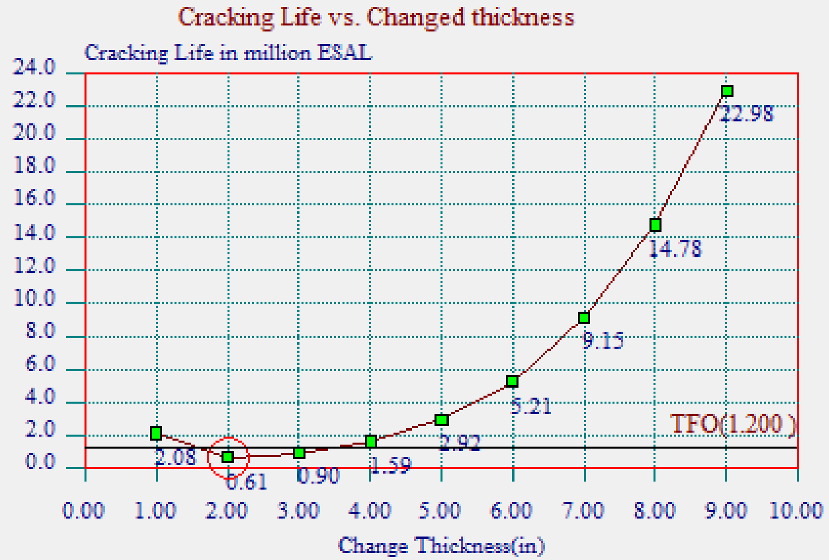
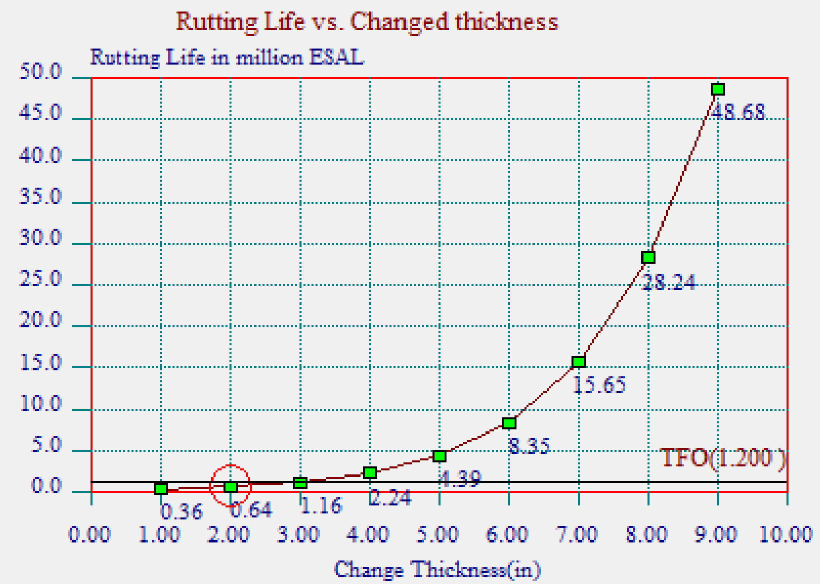
Current FPS Functionality Issues

- Use of Lower Reliability Levels often gives incredible "*performance*", making TTC check more critical.
  - 2009 recommendations for highway with < 5M ESALs
    - < 1M use 80% (A)
    - 1M to < 5M use 90% (B)
- Can't adjust traffic in ME checks to a reasonable time to 1st OL
  - Works well for 95% reliability – time to 1st OL is typically reasonable
  - Problems with lower reliability where time to 1st OL is commonly 20 years or more
- Suitability issues of FPS design for energy sector development areas
  - Traffic predictions
  - 18-kip ESAL assumption
  - Environmental Impact
  - Materials Characterization
- Others?

FPS Example – Confidence Level ‘B’ – 1.2M ESALs





Design Parameters

Thick.	Modulus	v	Material Name
2.00	500.0	0.35	ASPH CONC PVMT
12.00	50.0	0.35	FLEXIBLE BASE
200.00	12.0	0.40	SUBGRADE(200)

Pavement Life

Based on design period: 20.0 years the traffic to first overlay is (million) 1.200

HMA Tensile Strain	269.0	Crack Life (million)	0.61
Subgrade Compressive Strain	-529.0	Rut Life (million)	0.64

Check Result The Design is Failed by Ruting and Cracking for the period:1which is 20.0 years

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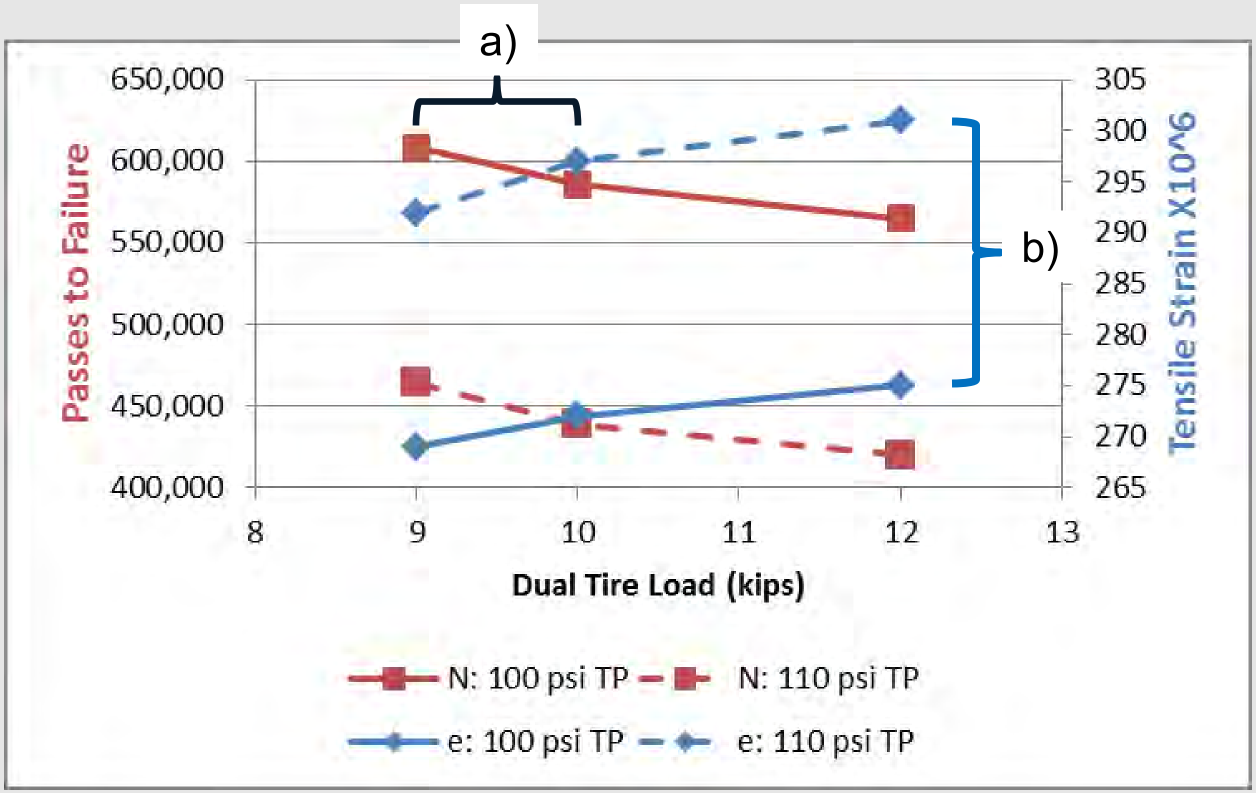
Exit

Energy Sector - Traffic Predictions

- % Trucks in traffic stream often much > TPP forecast
- General belief that average loads are higher than “typical” forecast

Strain Levels and Performance: 18-KIP VS Higher Loads

<u>FPS ME Checks: Alligator Cracking</u>



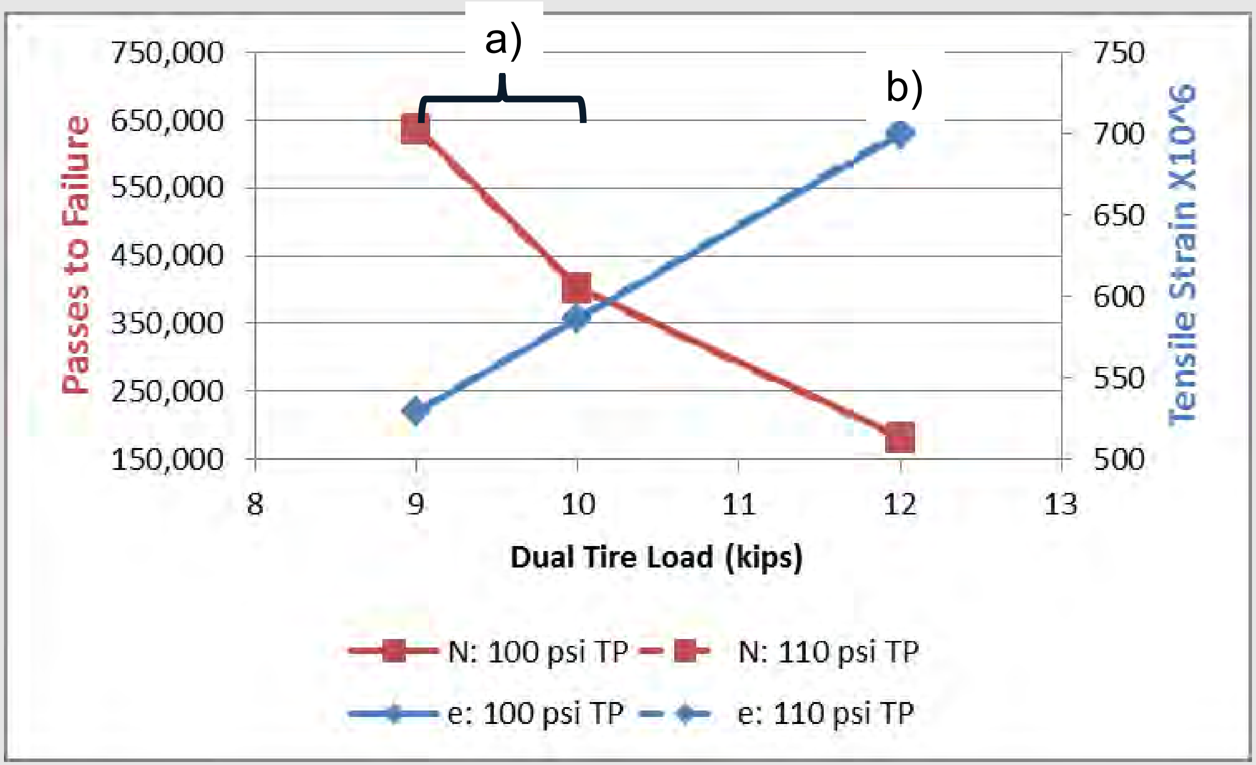
a) 11% increase in wheel load = 1.1% increase in tensile strain & 3.6% decrease in load passes

b) 10% increase in TP = 9.0% increase in strain & <u>25% decrease in load passes</u>

Assumed 2” HMA on 12” FB
12 ksi subgrade

Strain Levels and Performance: 18-KIP VS Higher Loads

<u>FPS ME Checks: Full-depth Rutting (Subgrade Failure)</u>



a) 11% increase in wheel load = 11% increase in compressive strain & <u>37% decrease in load passes</u>.

b) TP change inconsequential in deep rutting – curves virtually overlap.

Assumed 2" HMA on 12" FB
12 ksi subgrade

Environmental Impact

- FPS does not account for environmental effects on material properties
  - Modulus input values are “typical” for expected conditions
  - No accounting for temperature and moisture variations (seasons)

Materials Characterization

- FPS uses limited materials characterization.
  - Design modulus
  - Poisson's Ratio
- FPS is not capable of sufficiently differentiating effects of product attributes on performance of the structure.
  - Think recycled products
  - Binder content/grade
  - Flex base quality, etc.

Solutions

- Short term
  - Continue to use FPS, but decision makers must improve familiarity with performance characteristics of materials (including the subgrade) used in pavements
  - Lab Testing
  - NDT
- Longer term
  - Implement a more mechanistically-based pavement design system.
  - Benefits
    - Improved material characterization
    - Improved environmental influence considerations
    - Improved accounting of traffic loading variations.
    - Improved reliability modeling.

Questions?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