# Louisiana Case Study:
# Implementation of CRM Binder in PG specs


**Sutainable Materials for Pavement Infrastructure:**
**Use of Waste Tires in Asphalt Mixtures**
**Baton Rouge, September 5, 2012**

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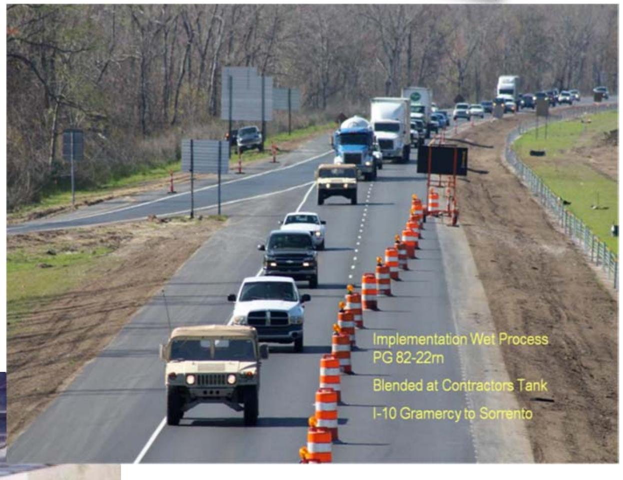
**LADOTD Materials Engineer Administrator**

# *My Story*

- **Background**
- **Approach**
  - – **Phase I**
    - **Evaluation: Field Performance**
  - – **Phase II**
    - **Evaluation: APT**
- **Summary**




# *Sustainability Materials/Technology*

## Recycled Materials

### Waste Tires

# Waste Tires

- 1991 – Intermodal Surface Transportation Efficiency Act (ISTEA)
  - specified that all asphalt pavement project funded by federal agencies must use certain percentages of scrap tires
    - 5% in 1994
    - 20% by 1997
- Mandate was later suspended from the ISTEA legislation,
  - encouraged the research and application of CRM asphalt in HMA pavement.

# Phase I Evaluation -- 1994

- Crumb-rubber modified asphalt pavements in Louisiana
  - Evaluate field performance
- LADOTD sponsored research project
  - evaluate different procedures of CRM applications
  - monitor long-term pavement performance
    - Five different CRM applications
  - compare to companion control sections
    - conventional asphalt mixtures

# Phase I
# CRM Technology/Product

**Wet Process**

- Arizona / International Surfacing Inc. (ISI)
  - 16-mesh CRM
- Rouse
  - 80 mesh
- Neste Wright

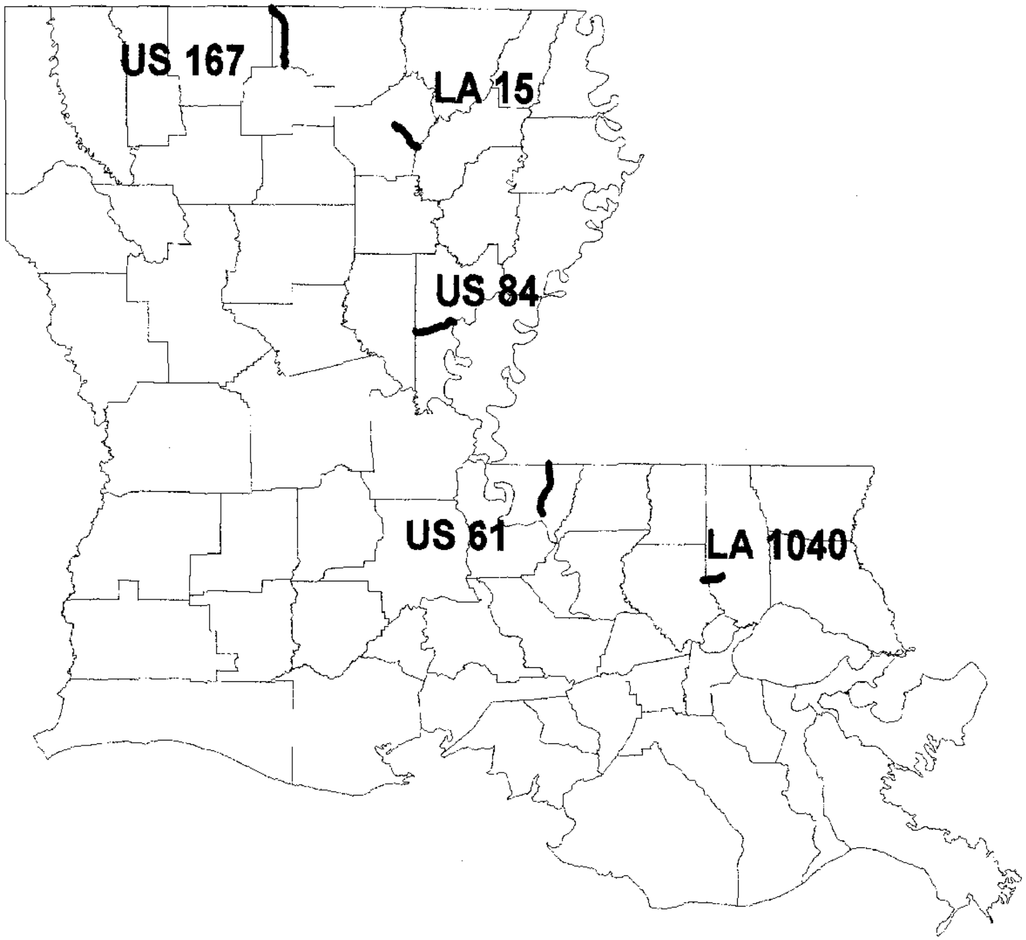
**Dry Process**

- PlusRide™
- generic crumb rubber
  - 16-mesh
- Rouse
  - 80 mesh

# Phase I Evaluation

- **Processes of applying crumb-rubber in asphalt mixtures**
  - **Wet Process**
    - **Asphalt binder is pre-blended with the rubber**
      - **at high temperature**
        - » **177 – 210C**
      - **specific blending conditions**
      - **Arizona (ISI), McDonald, Ecoflex, and Rouse continuous blending**
  - **Dry Process**
    - **added to the aggregate before the asphalt binder is charged into the mixture**
    - **PlusRide™, chunk rubber, and generic dry**

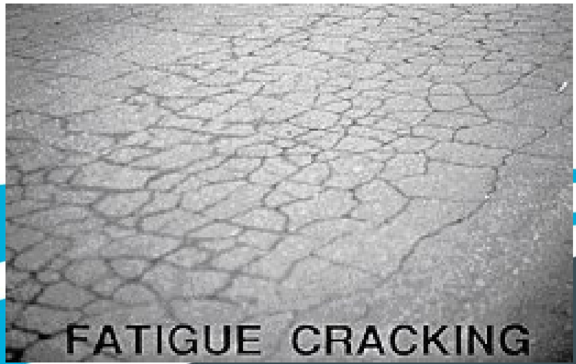
# Phase I Field Projects




- **Five Field Projects**
- **Eight test section**
- **Six CRM Products**
  - **Arizona wet process incorporated into a gap-graded mixture; (US 61, LA 15)**
  - **Arizona wet process incorporated into a stress absorbing membrane interlayer (SAMI); (US 61)**
  - **Arizona wet process incorporated into an open-graded friction course (OGFC); (US 61)**
  - **PlusRide™ dry process utilizing a gap-graded aggregate structure; (LA 1040)**
  - **Rouse powdered rubber wet process incorporated into a typical dense-graded mixture; (LA 15)**
  - **A terminal-blended material formulated by Neste Wright in a dense-graded mixture; (US 84)**
  - **Rouse dry-powdered rubber process blended into a dense-graded aggregate structure; (US 167)**
  - **Generic dry process incorporated into a gap-graded mixture. (US 167)**

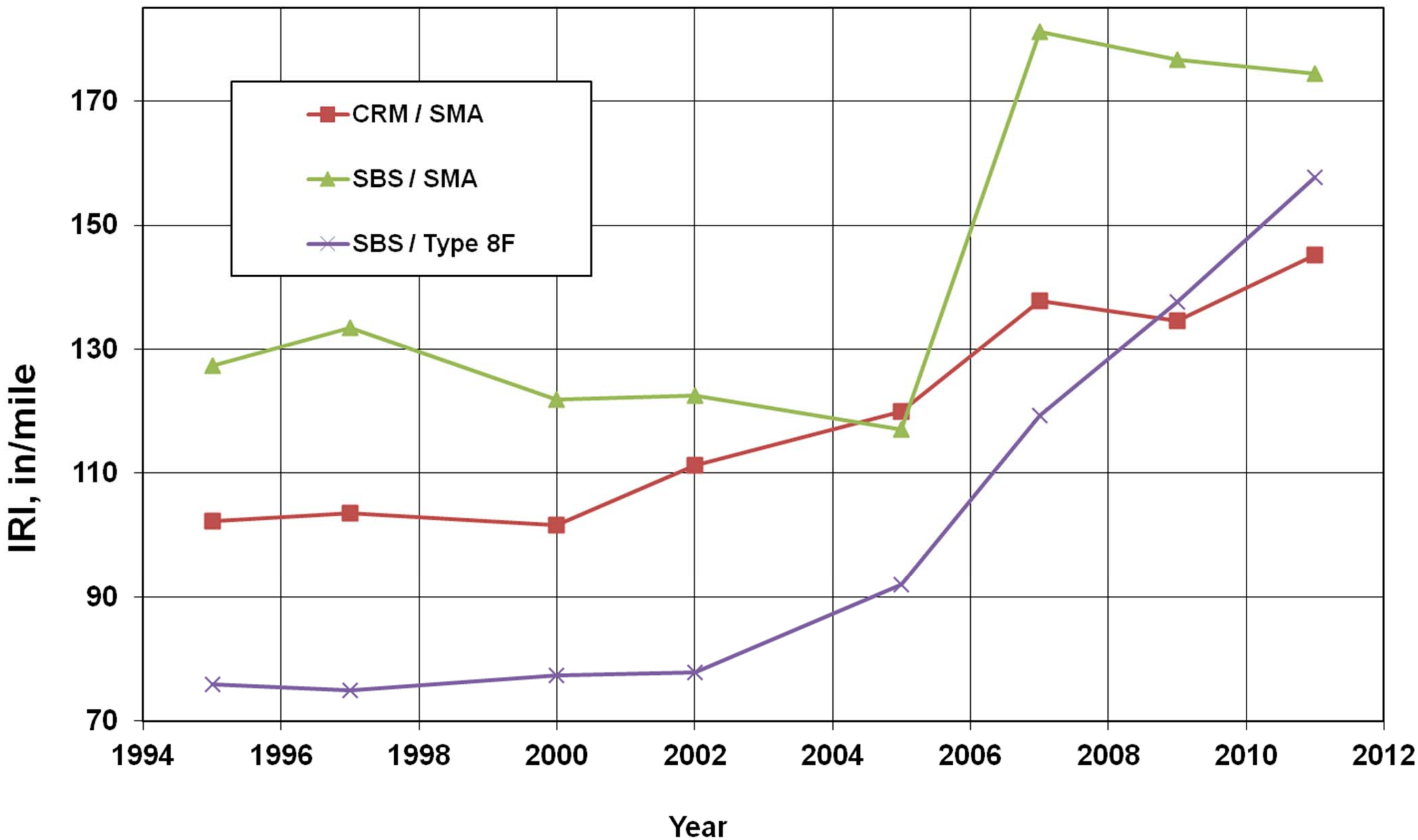
# Phase I

- **Ten years field pavement performance**
  - **Conventional & CRM Sections**
  - **roadway core density,**
  - **International Roughness Index (IRI),**
  - **Rutting**
  - **fatigue cracking.**



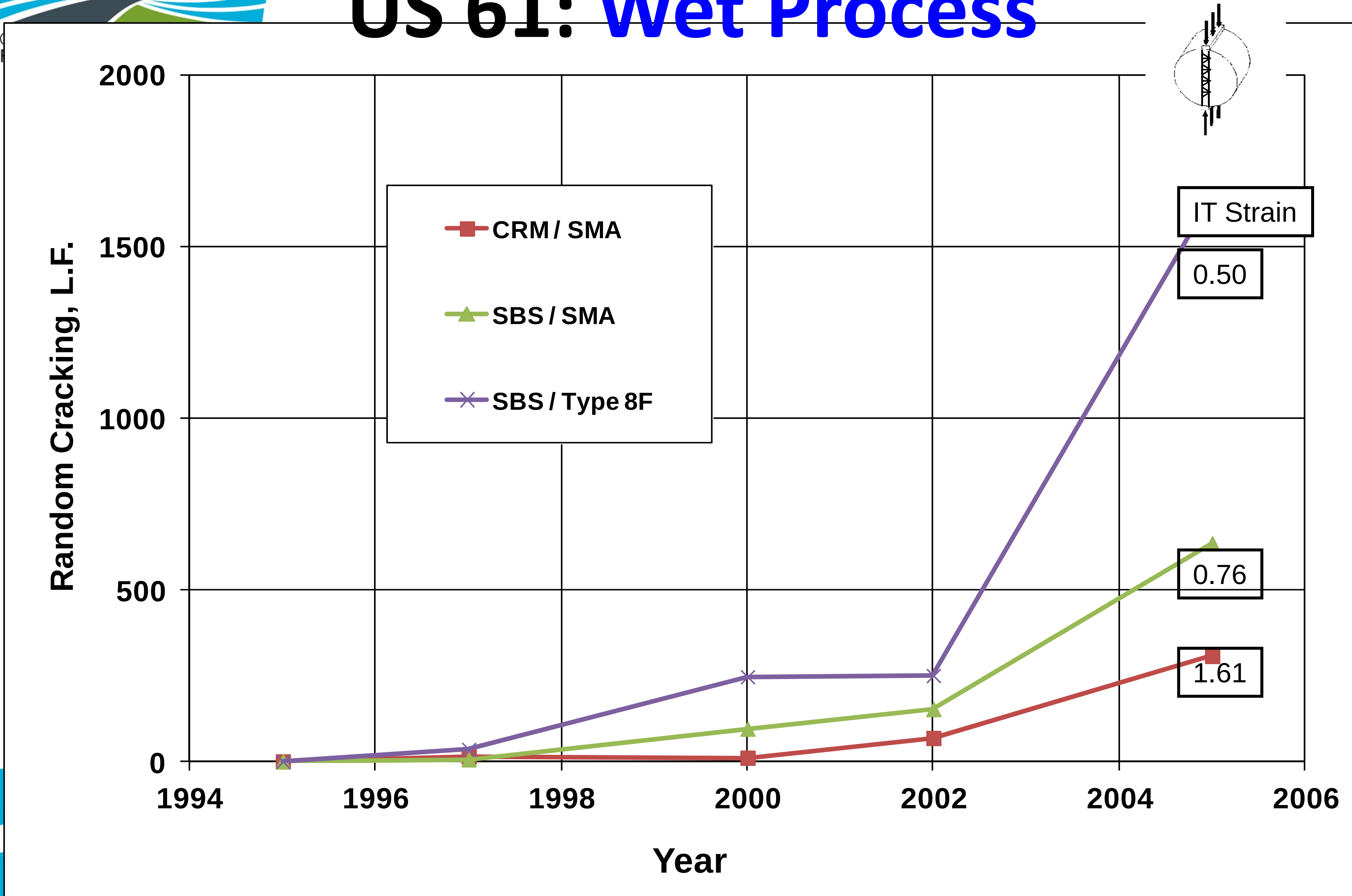


# Phase I
# US 61: wet Arizona Process

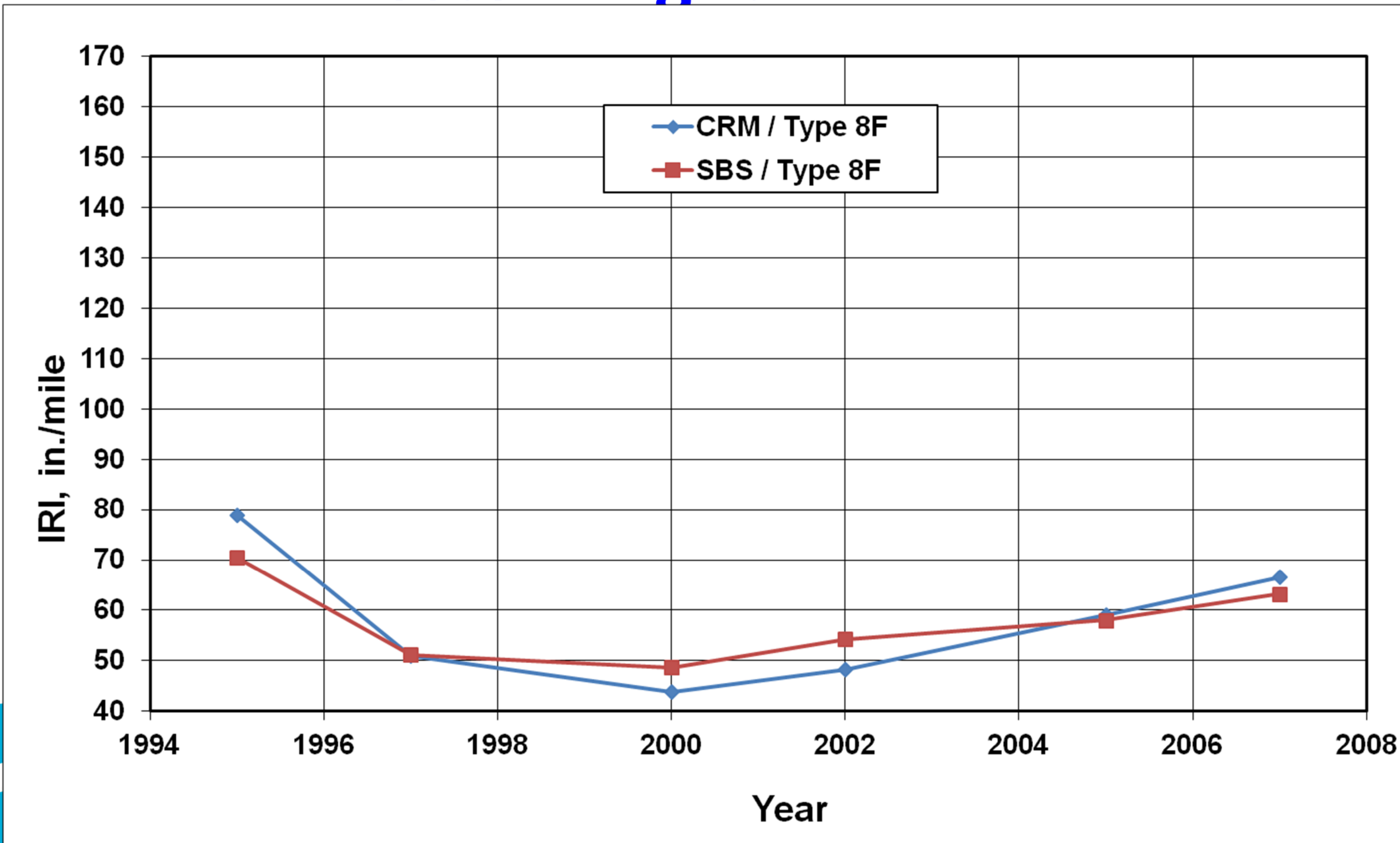


# Phase I

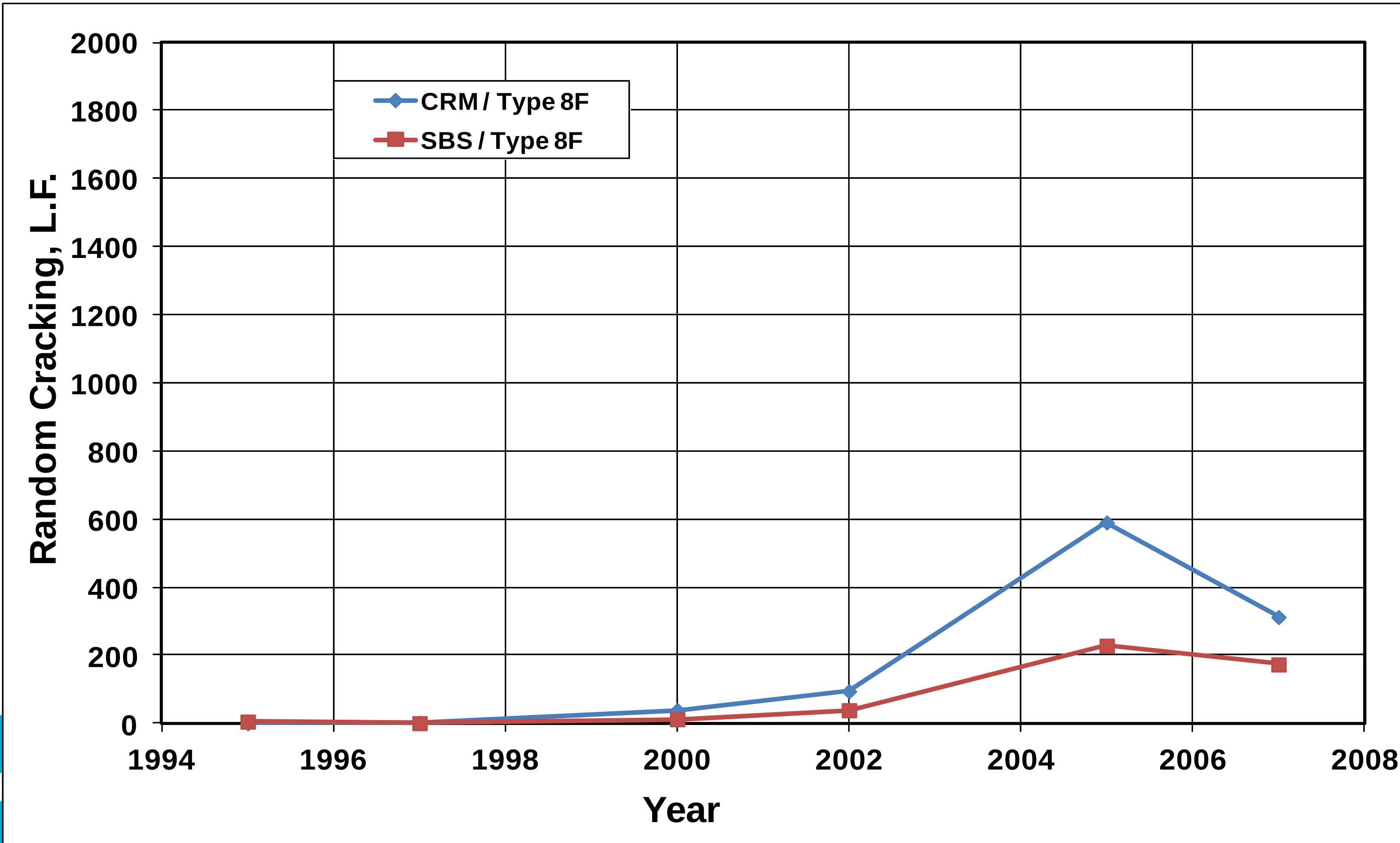
# US 61: Wet Process



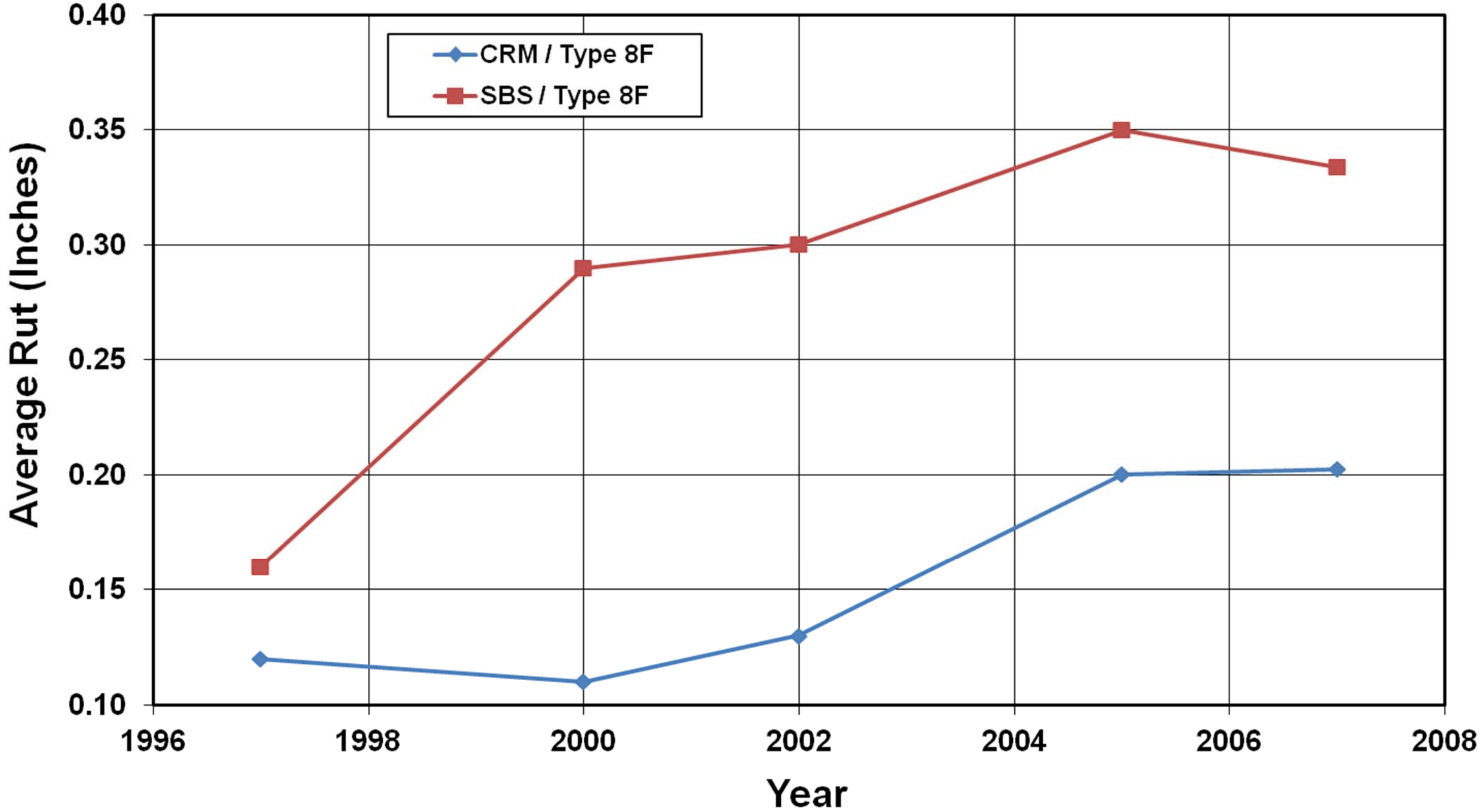
# Phase I-US 84: Terminal Blended
## Neste Wright



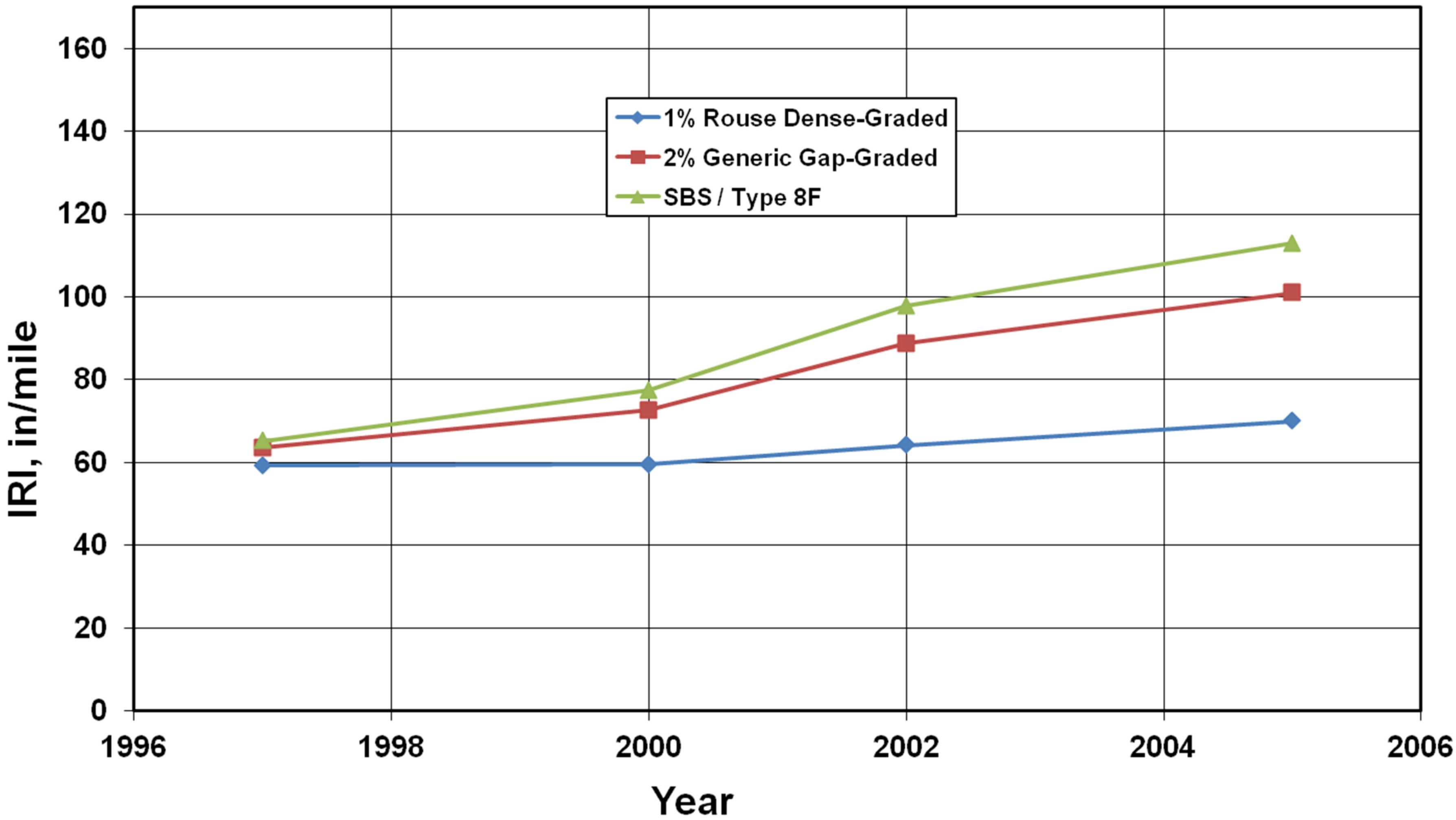
# Phase I: US 84
# Terminal Blended Neste Wright



# Phase I - US 84:
# Terminal Blended Neste Wright



# Phase I US 167: Dry Process Rouse and Generic



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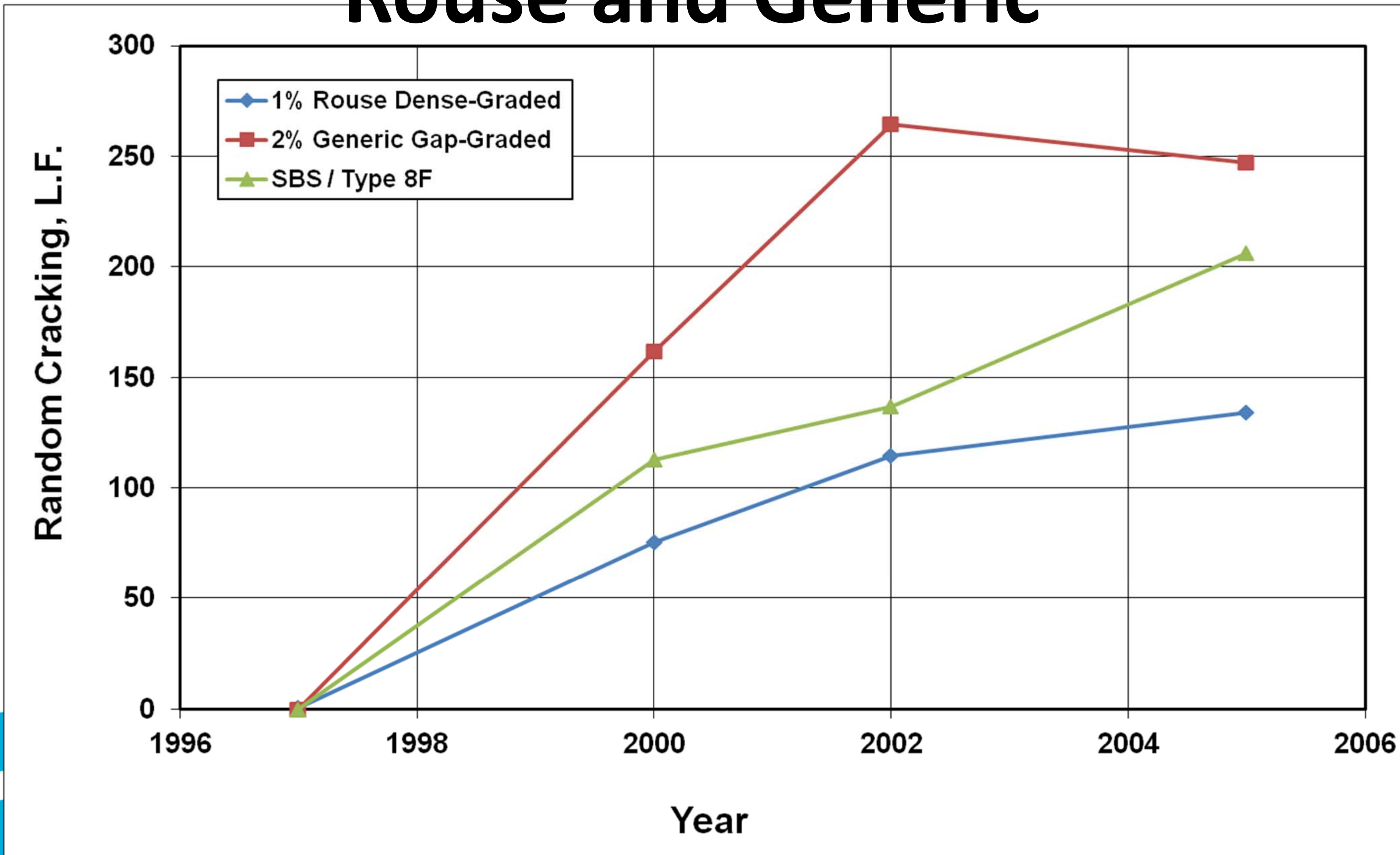

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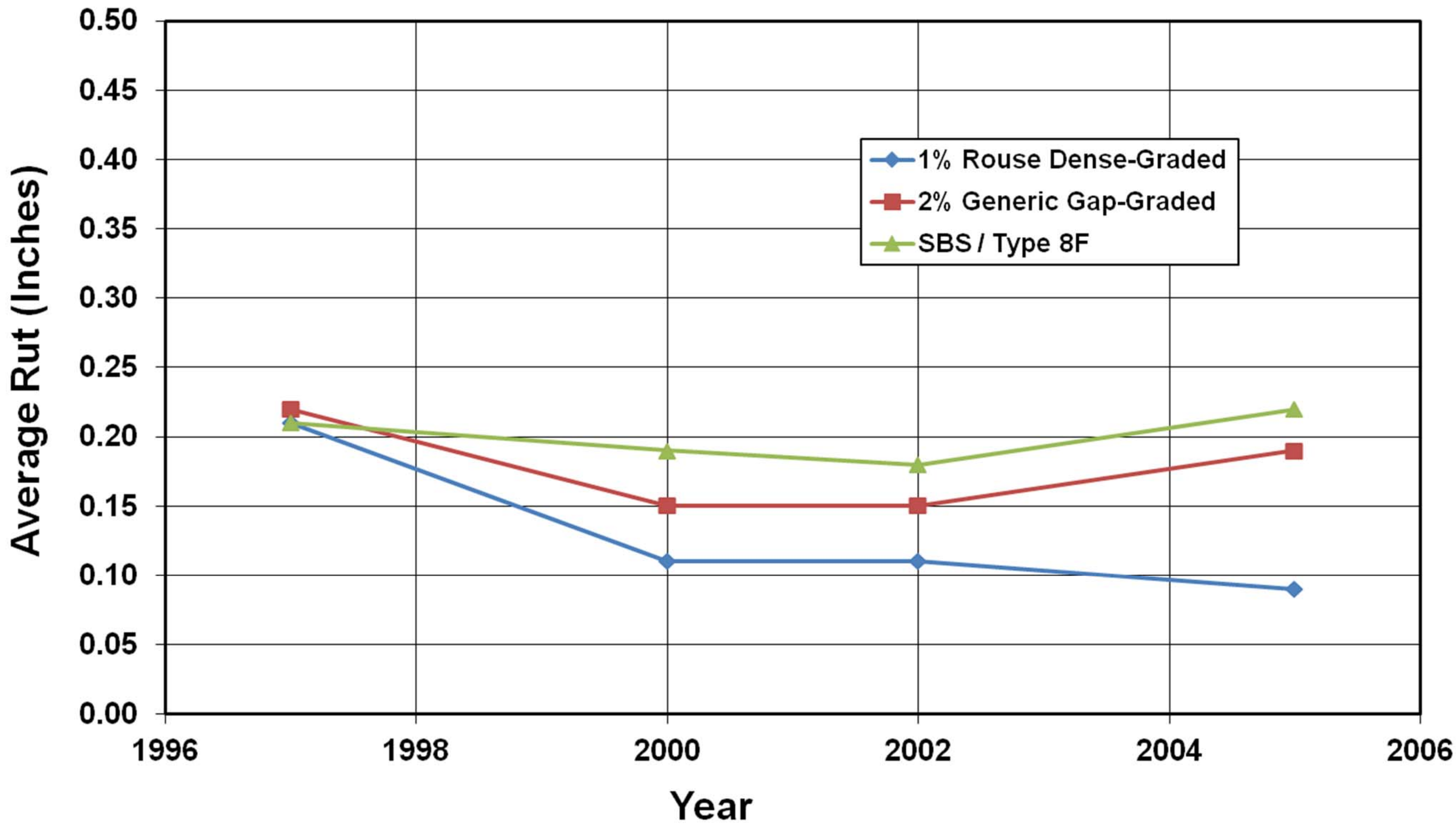
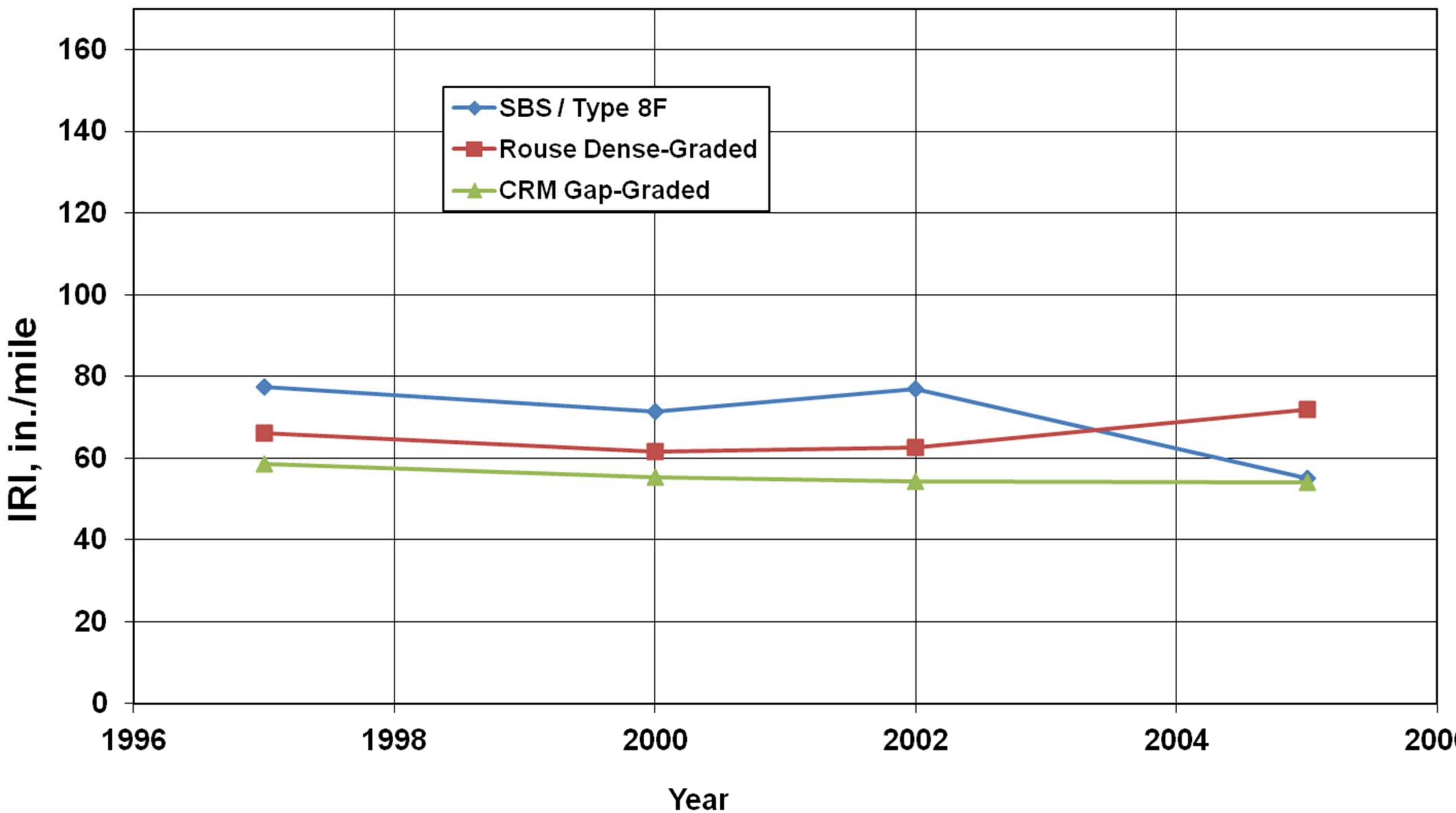
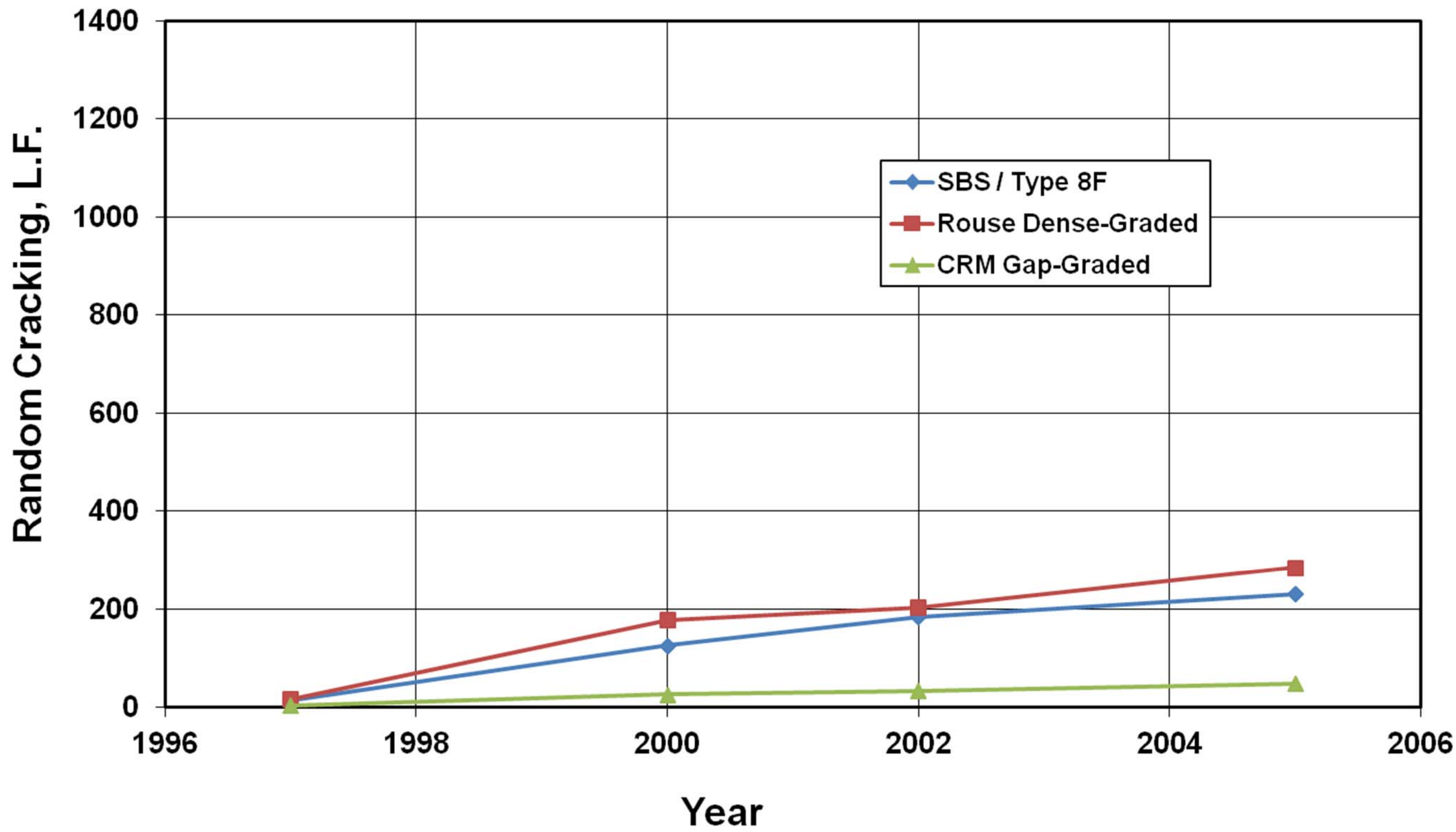


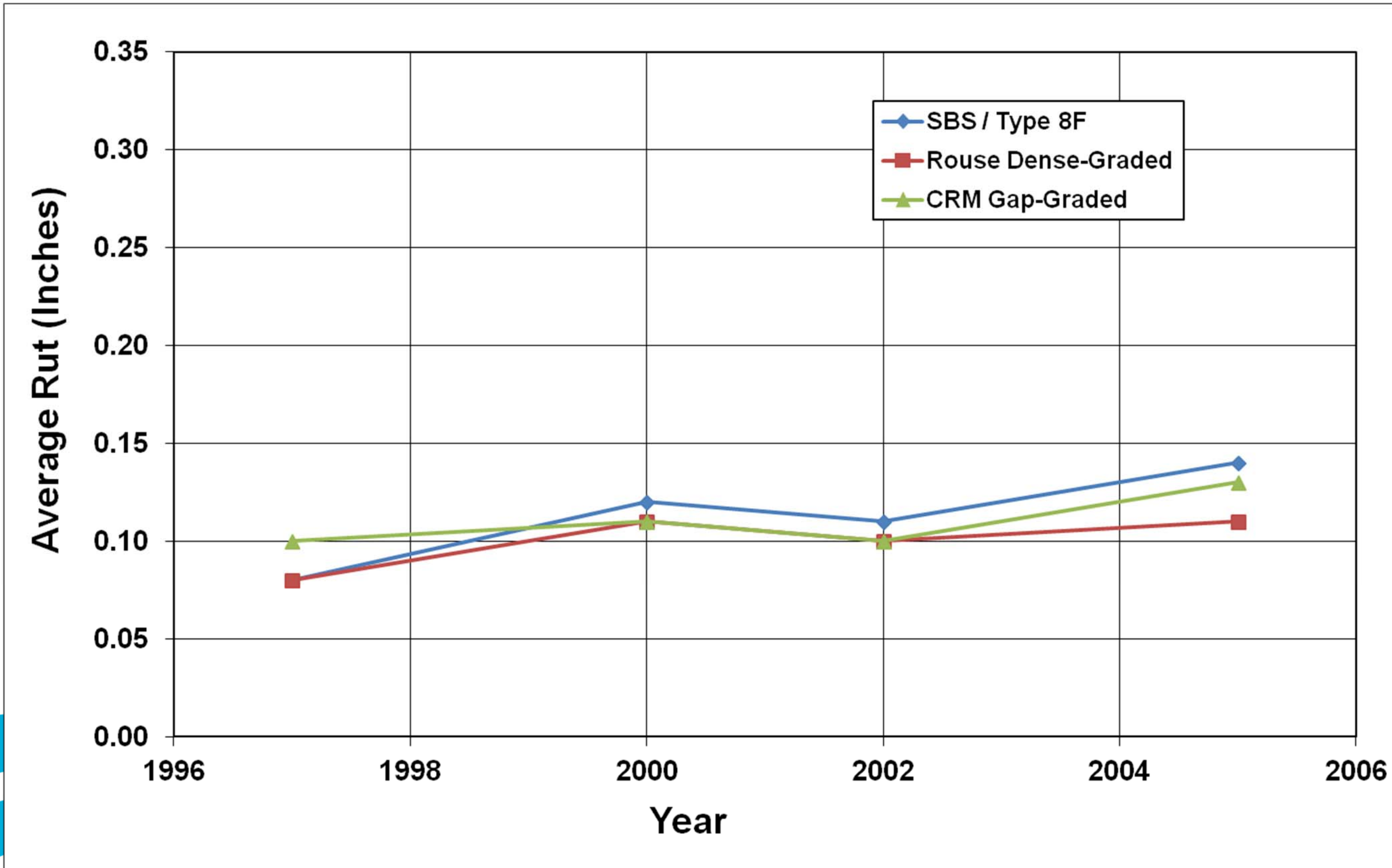
# Phase I LA 15: 40 Mesh Rouse Dense and Arizona SMA



# Phase I -- LA 15: Rouse and Arizona



# Phase I -- LA 15: Rouse and Arizona



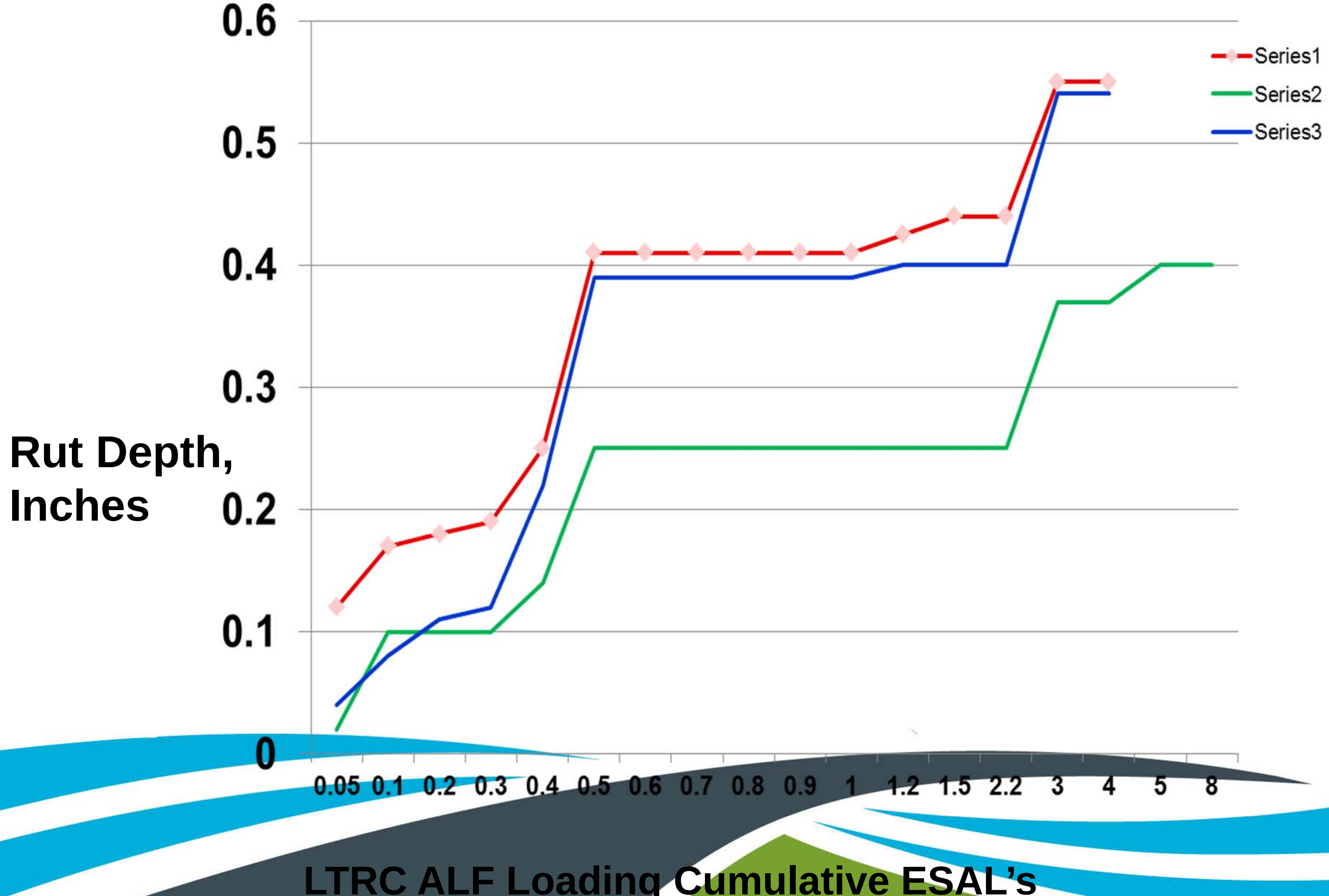
# Phase II Evaluation
# Accelerated Pavement Testing (APT)

- Build test sections using conventional construction equipment
- Compress 20 years of loading into 9-12 months

# Phase II Evaluation
## APT Test Lanes

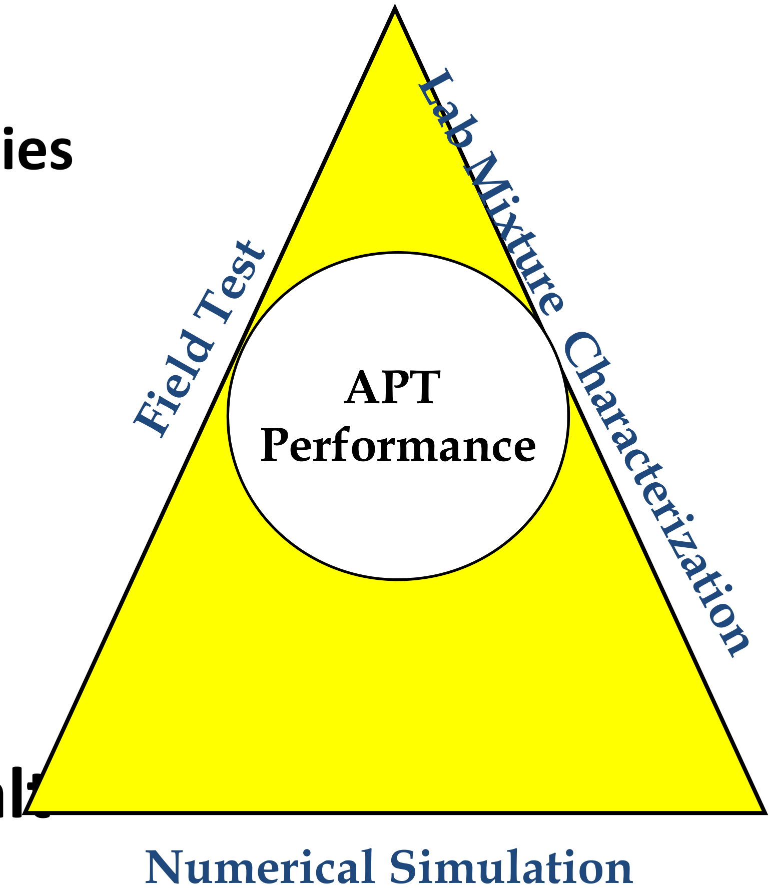
| Thickness | Lane 1 | Lane 2 | Lane 3 |
|---|---|---|---|
| WC-38.1 mm (1.5 inch) | CRM-HMA | SBS modified ~PG76-22 | SBS modified ~PG76-22 |
| BC-50.8 mm (2.0 inch) | SBS modified ~PG76-22 w/20% RAP | SBS modified ~PG76-22 w/20% RAP | SBS modified ~PG76-22 w/20% RAP |
| Base-88.9 mm (3.5 inch) | ~PG 64-22 Base | CRM-HMA | ~PG64-22 Base |
| 215.9 mm (8”) | Crushed Stone | | |
| 254 mm (10”) | Cement Treated Embankment | | |

# LTRC Report 374 – Accelerated Loading of Modified AC



# Phase II Evaluation Summary

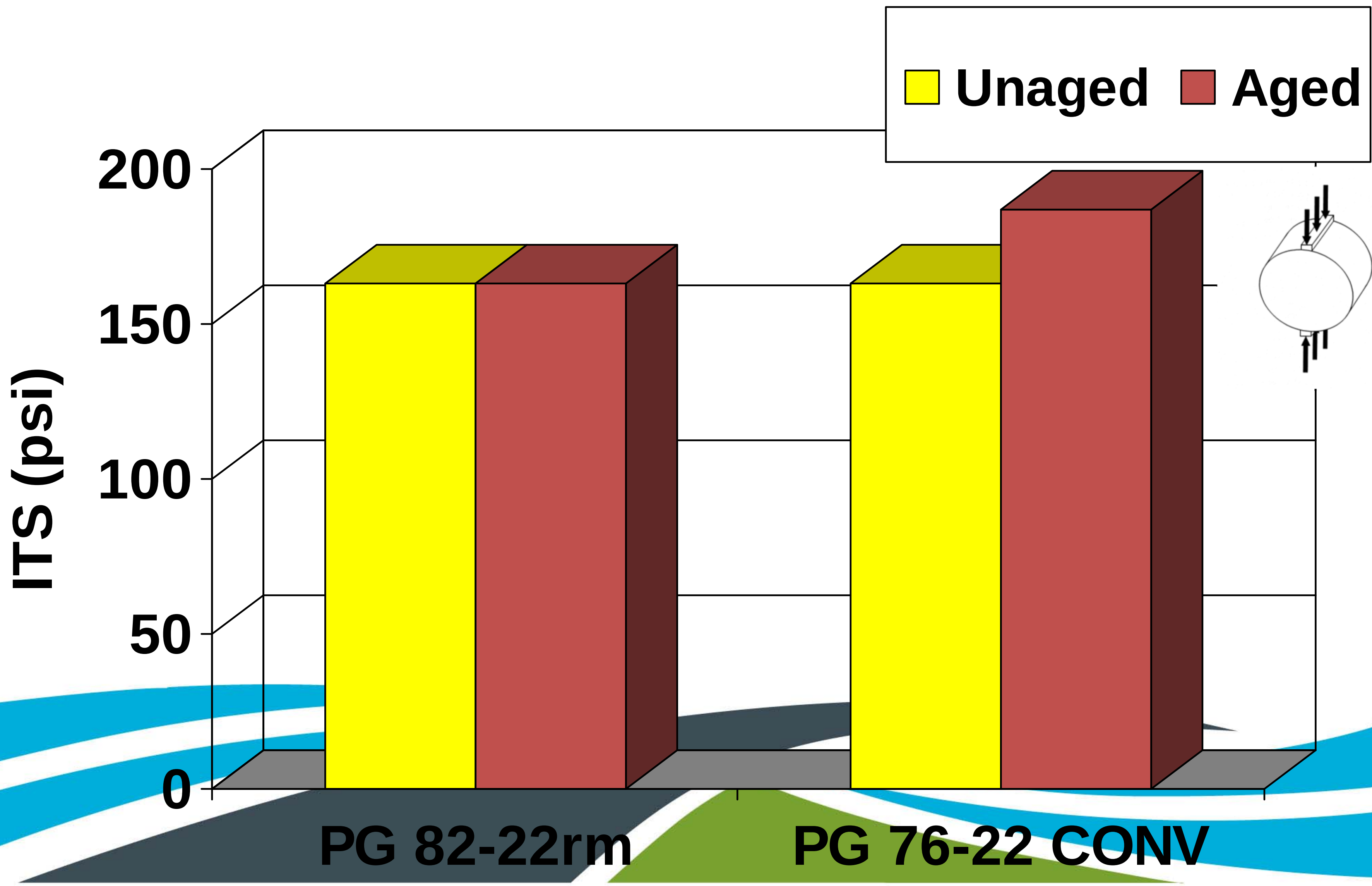
- **Wearing Course: CRM vs SBS**
  - showed similar laboratory properties
  - Similar rutting in lab and on ALF
- **Base Course: CRM vs PG64-22**
  - improved lab properties
  - Lower rutting in lab and on ALF
- **Final Report**
- **Comparative Performance of Rubber Modified Hot Mix Asphalt Under ALF Loading**
  - (www.LTRC.LSU.Edu, Report 374)



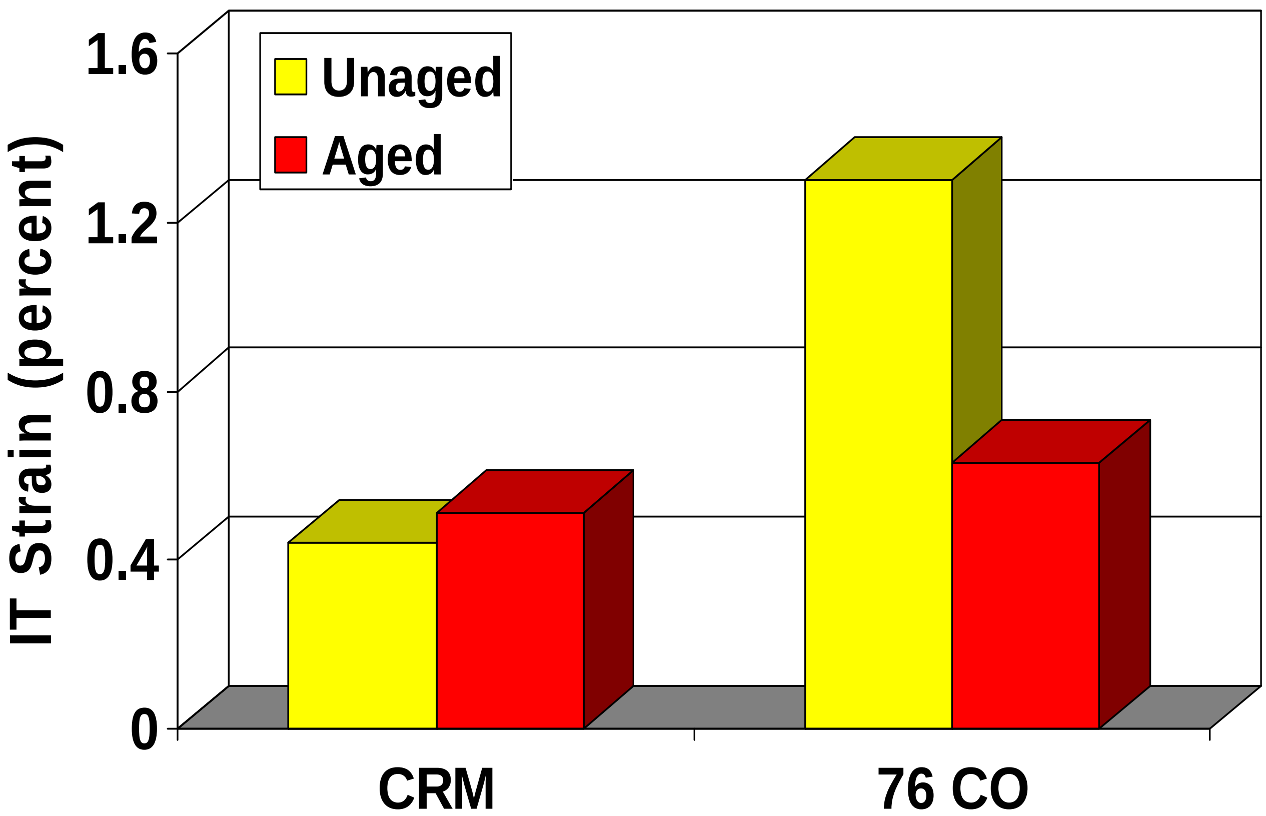
# Phase I & II Evaluation Outcome

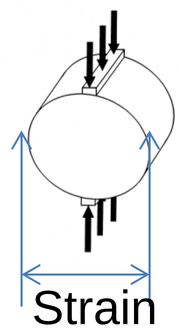
- **September 2007**
  - **Developed binder performance graded (PG) specification**
    - **Ground tire rubber**
    - **PG 82-22rm**
- **December 2007**
  - **Rubber Modified Binder Specification Meeting**
  - **Material supplier, Contractor, State, Academic**
    - **Challenges & opportunities**
- **April 2008**
  - **Binder PG 82-22rm was adopted in LDOTD specifications**

# Indirect Tensile Strength, 25°C

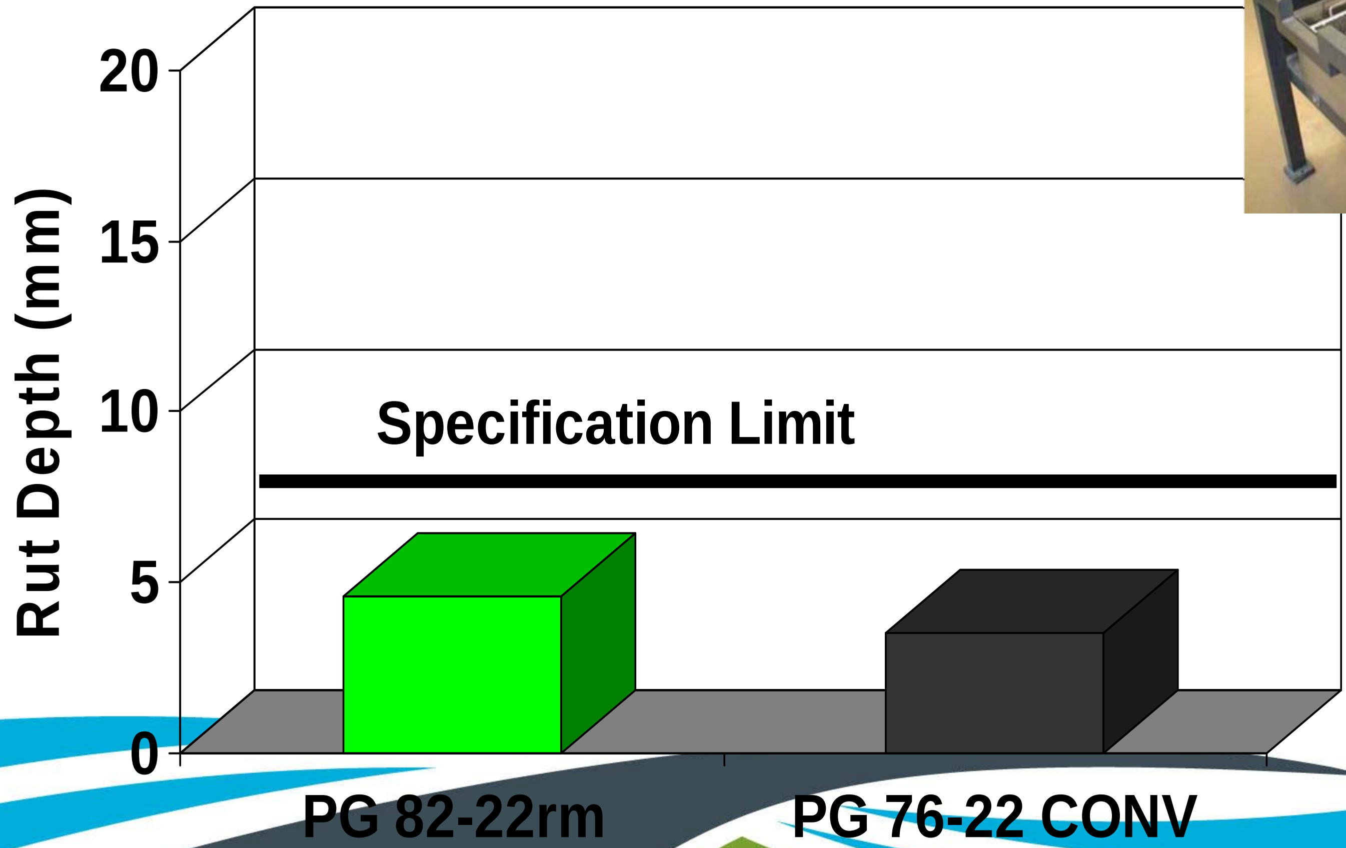


# Indirect Tensile Strain, 25°C



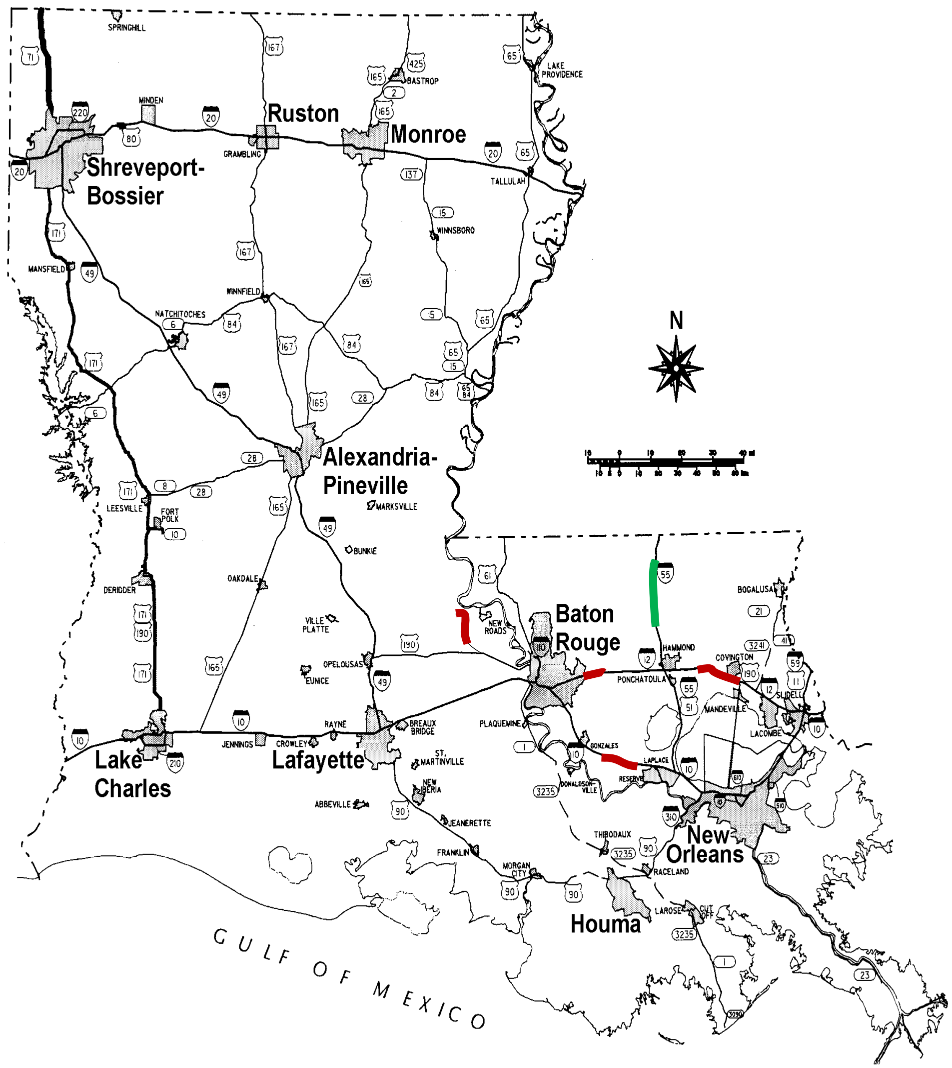
# Rutting:
# Loaded Wheel Track Test, 50°C



# Challenges

- **General Supplier modification preference is SBS**
  - **Material specifications**
  - **production and supplier issues**
    - **Proliferation of material types increases storage requirments**
    - **Storage stability,**
    - **Temperatures and time required to add rubber at the refinery or terminal.**
  - **Construction**
    - **ability for the contractor to compact the rubber modified mixture at normal compaction temperatures**
  - **Research, technical assistance, and training**
    - **focused on examining materials and methods that will improve performance of waste tire rubber.**

# Phase III
# PG82-22rm field projects




| Date | Route | Tonnage |
|---|---|---|
| 10/08 | I-12 | 15K |
| 02/09 | I-10 | 60K |
| 06/09 | LA 983 | 7K |
| 11/09 | I-12 | 100K |
| 03/10 -6/11 | I-55 | 200K |

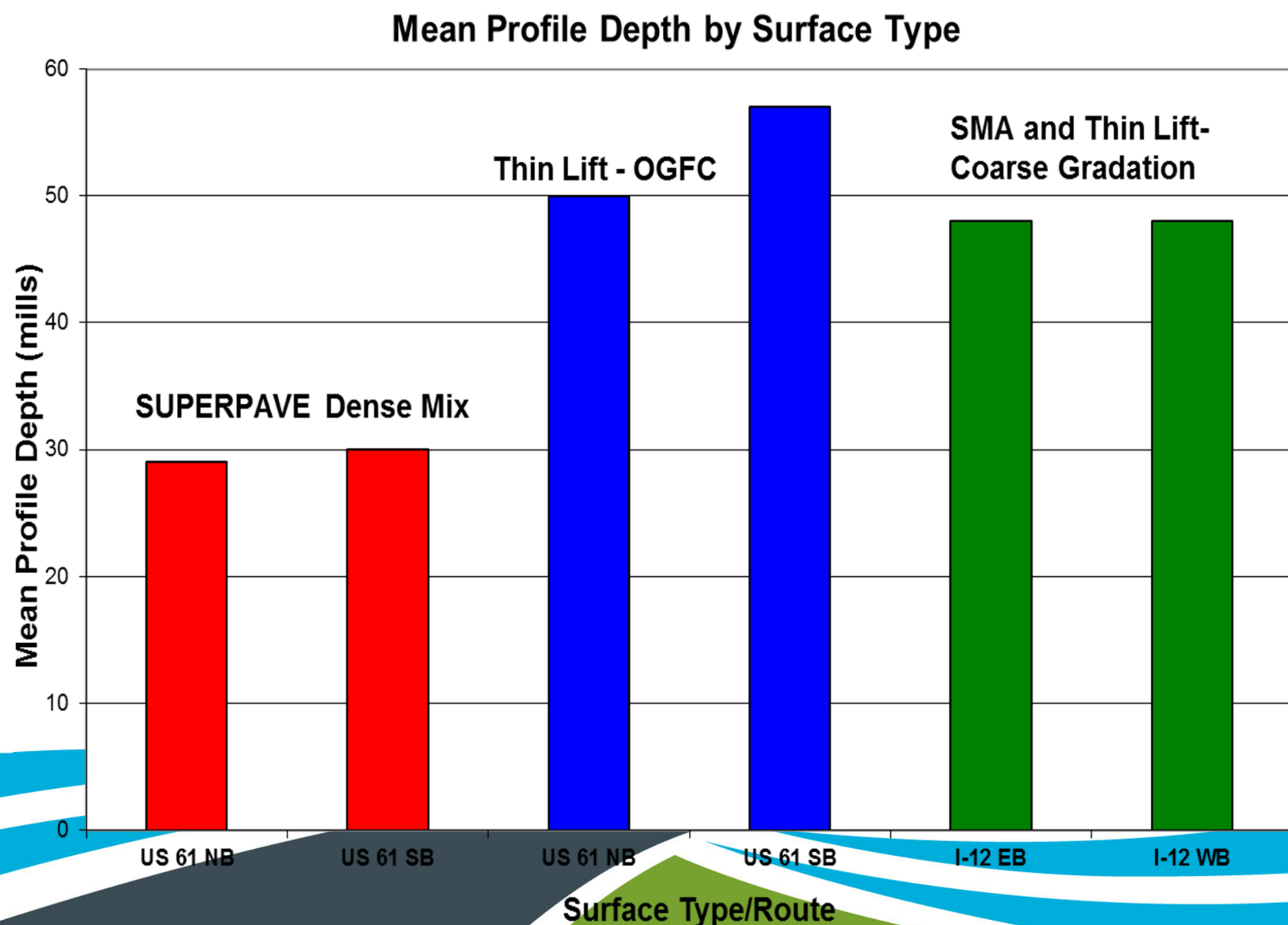

Implementation Wet Process
PG 82-22rn
Blended at Contractors Tank
I-10 Gramercy to Sorrento

# Plant blending facility

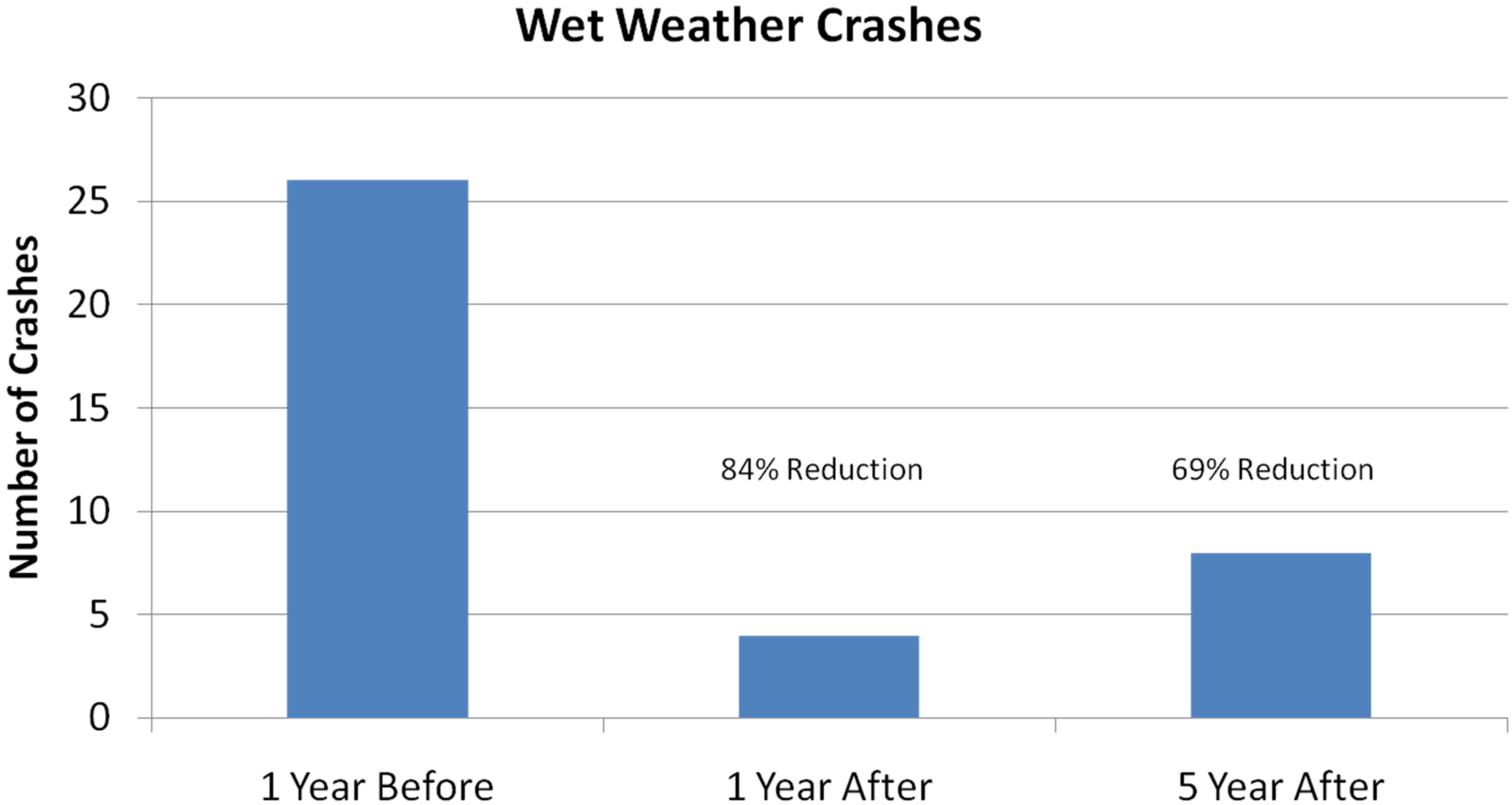
# LA’s experience with CRM modified OGFC and SMA

- Superior Rut resistance
- Superior Surface Texture
- Safest Surface for wet weather
- Superior Resistance to reflective cracking of transverse joints over composite pavements

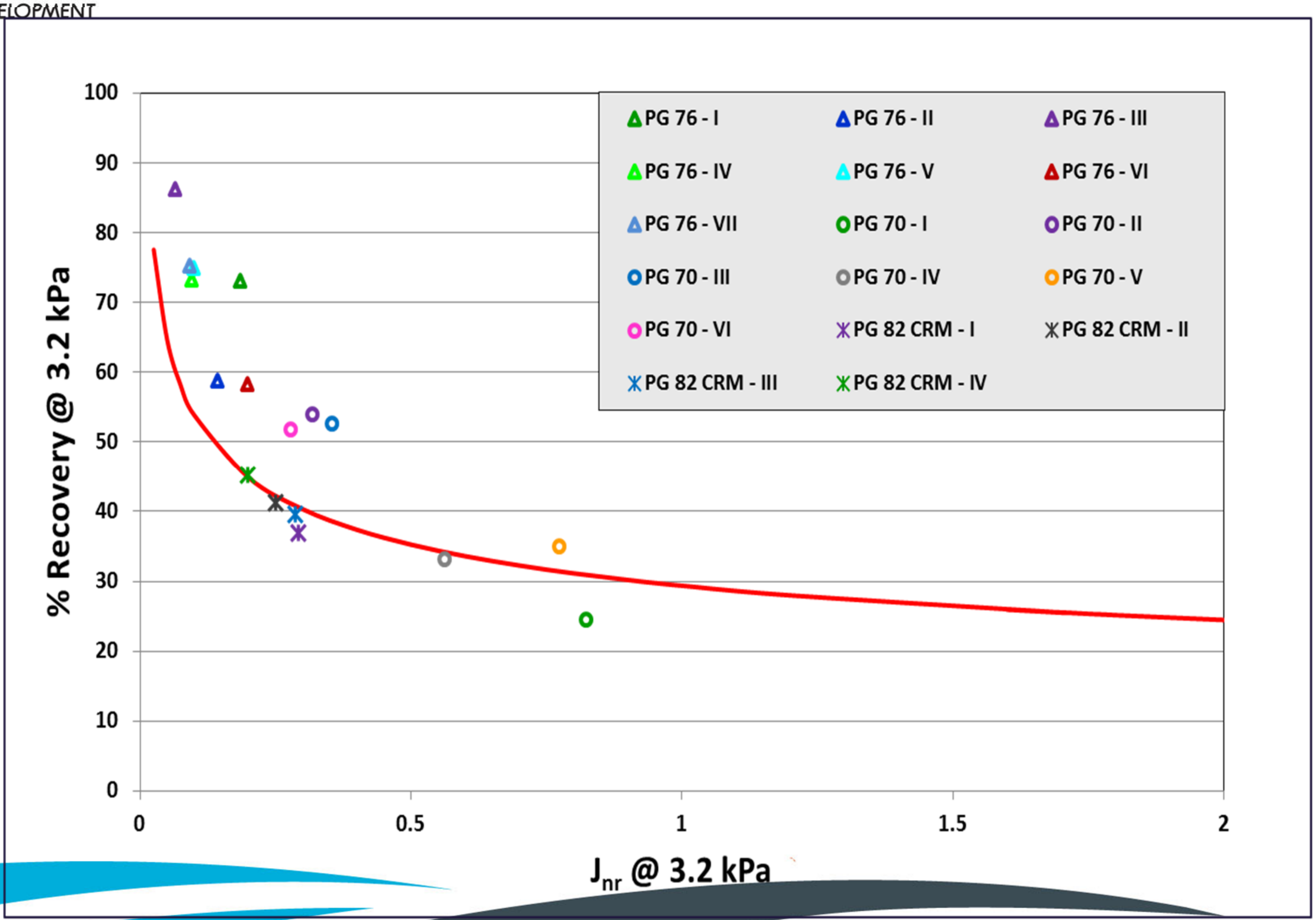
# Surface Texture
# LTRC report 485



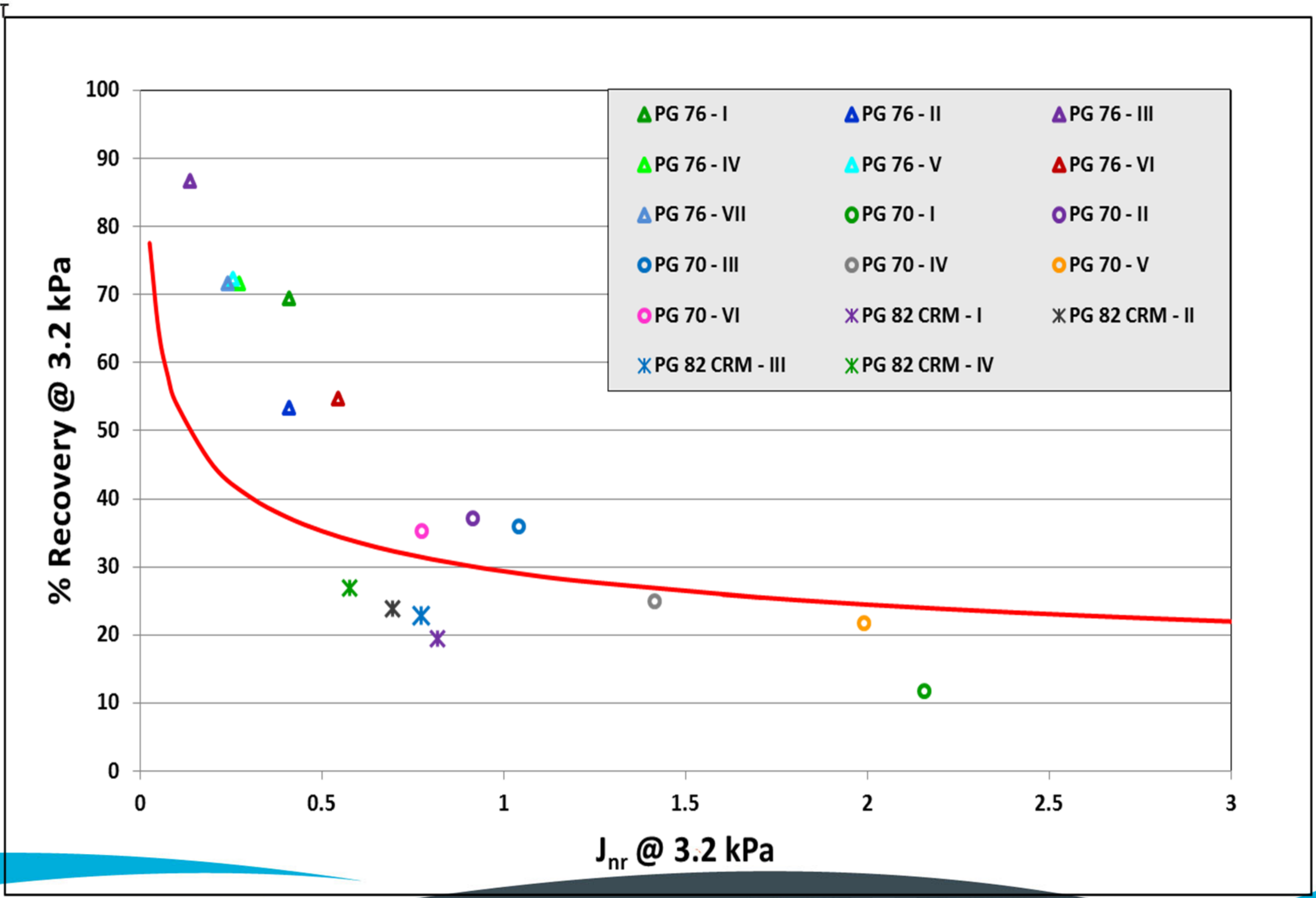
# I - 20
# Britton Road to Vancil Road



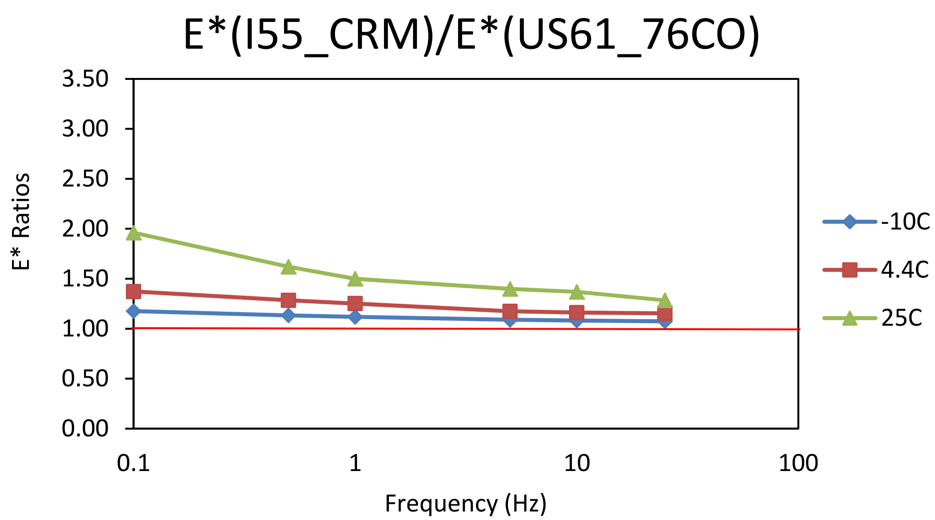
# MSCR Results @ 64ºC

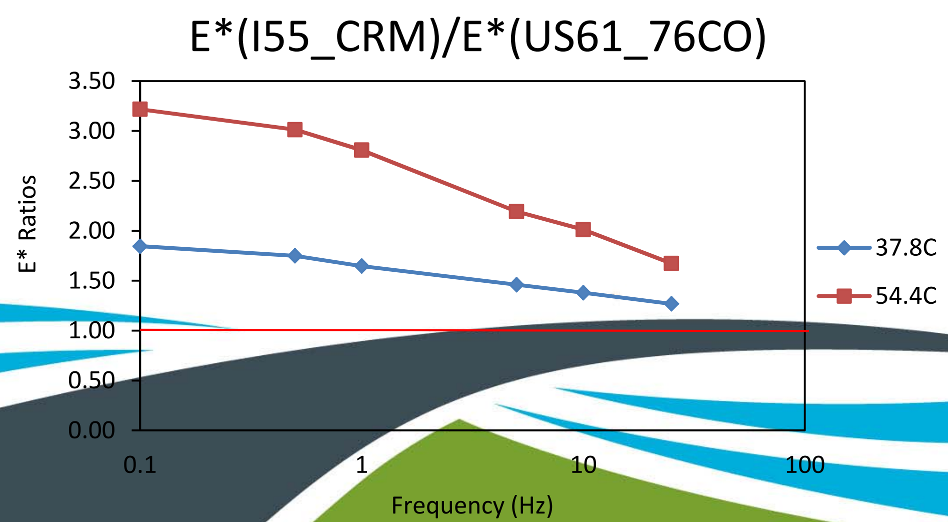


# MSCR Results @ 70ºC



# E* Comparisons:



**LOUISIANA SUPERPAVE BINDER SPECS**

| **PG 82-22RM** | **PG 76-22M** | **PG 70-22M** | **PG 64-22*** |
|---|---|---|---|
| High Volumn | High Volumn | Low Volumn | Base mix |

**ORIGNIAL BINDER**
FLASH POINT, **230 C Max.**,
ROTATIONAL VISCOSITY, **135 C, 3 Pa * S, Max**,
DSR, G*/Sin Delta @ Specified High Temp., **1KPa , Min.**
(1.3 K Pa for PG64 -22)

**RTFO aged;** (1% Max. Loss in RTFO)
DSR, G*/Sin Delta @ Specified High Temp., **2.2 KPa , Min.**

**PAV aged,** (uniform specs for all - 22 grades)
DSR **@ 25 C**, G* x Sin Delta, = **5000 KPa Max.**; (4000 max for 64-22)
BBR, @-12 C, **300 MPa** max stiffness and minimum slope of **0.300**.

*Note: **PG 58-28** required when 21-30% RAP is used in base course mixes.

# LOUISIANA SUPERPAVE BINDER SPECS, Modified Requirements

## Original Binder:

**Separation Test, 2 C max. difference on ring and ball**

**PG76-22m; Force Ratio @ 4 C, 30 cm: $F_2$ / $F_1$ = 0.3 Min.**

---Separation Test 2C max

**PG 70-22m; Force Ductility @ 4 C, 30 cm. = 0.5 Lb. Min**

-- Separation Test 2C max

## RTFO material:

**Elastic Recovery, Min. Recovery at 25 C,**

PG 82RM and **PG76m - 60% Min** **PG70m - 40% Min**

# Summary

- Crumb Rubber, PG82-22rm:
  - Provides a sustainable choice supporting the recycling of scrap tires
  - Provides similar or better lab mix performance to PG76-22 standard
  - In SMA and OGFC exhibits excellent performance in reducing traverse crack propagation in composite pavements
  - Improves actual pavement performance as measured by PMS.


# THANK YOU


I told you not to use bleach
Shut up!

LOUISIANA DEPARTMENT OF
TRANSPORTATION & DEVELOPMENT