

Balanced Asphalt Mix Design Performance Engineered Designs Implementation and Efforts

ATS

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Louisiana's Balanced Asphalt Mixture Design: Contractor's Experience

Barry L Nunez

Formerly of Diamond B Const.

Barry L Nunez LLC

bnunezLLC@outlook.com | (225) 772 – 2753

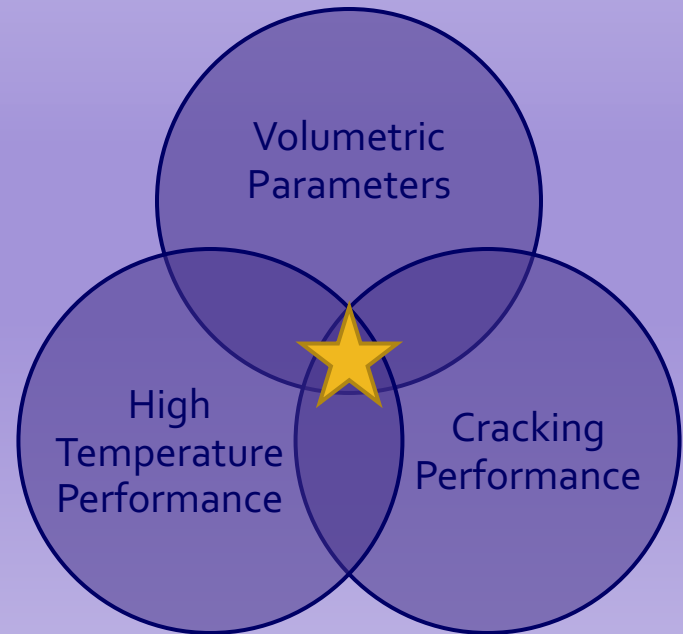
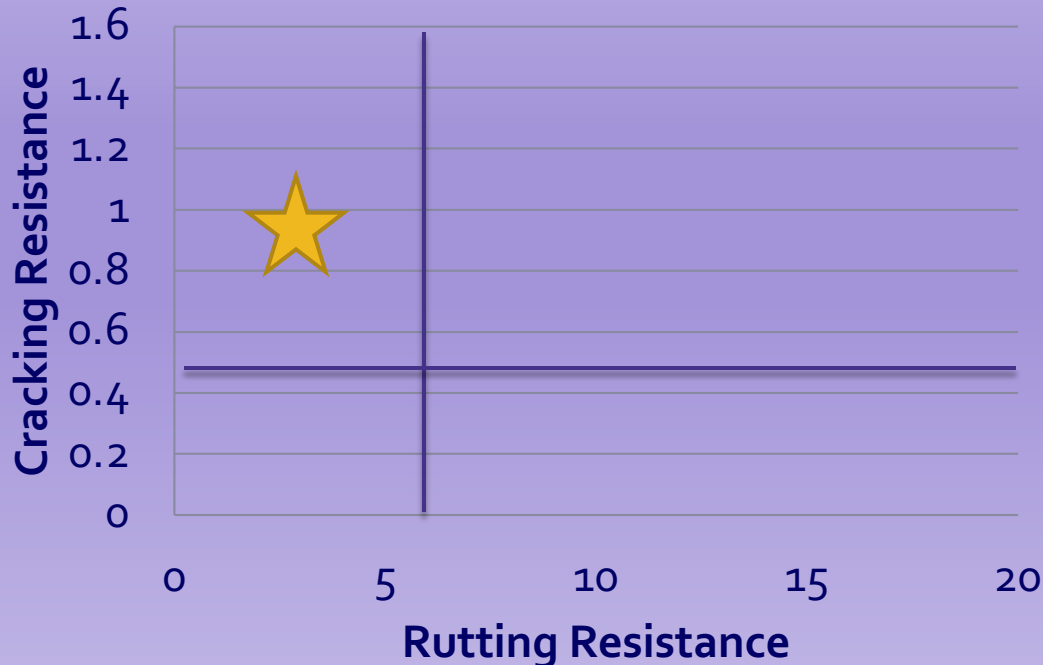
Thank You ATS!!!

Changes in Specifications and Testing Techniques

- ▣ Brief History of Mix Design (Full Circle)
- ▣ Balanced Mix Design
- ▣ Louisiana Specification Changes (When will it ever happen?)
- ▣ Implementation of the Louisiana SCB
- ▣ Modified Liquid Asphalt Effects and Ductility
- ▣ Increase in Rap or Not?
- ▣ Structure? LWT=yes SCB?
- ▣ You want me to add how much Asphalt????!!!!

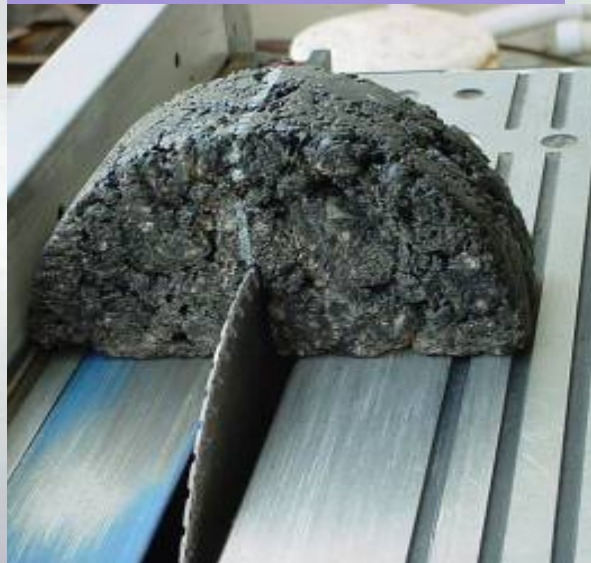
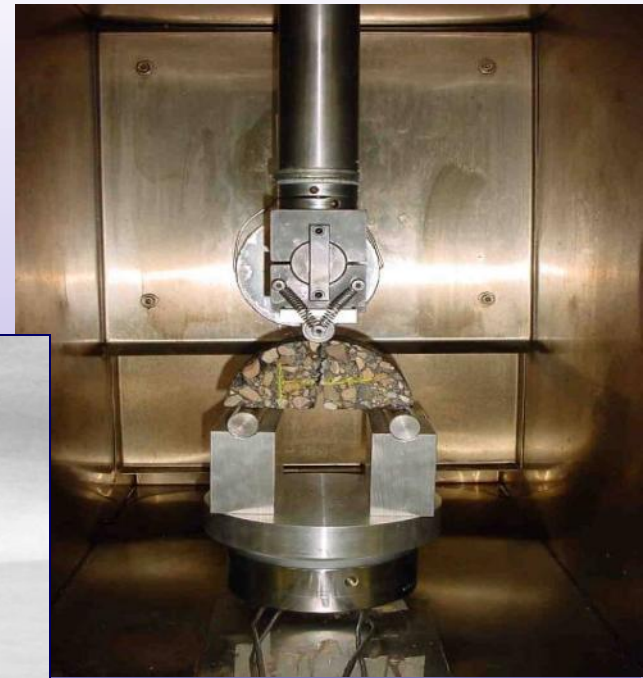
How?

- What is a balanced mixture design?
 - ▣ Process to ensure adequate resistance to both rutting and cracking distresses
- Laboratory testing:
 - ▣ Rutting and Cracking



SCB Sample Preparation

150mm x 57mm

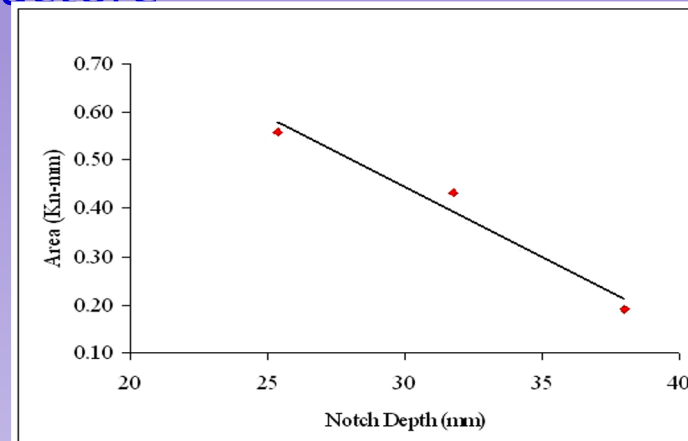


Intermediate Temperature Cracking: SCB Test ASTM D8044

- Performance Indicator
Resistance to Crack Propagation
- Test Protocol
TR 330
- Temperature
25°C
- Loading
0.5 mm/min vertical deformation
- The Critical Value of Fracture Resistance,

$$J_c = -\left(\frac{1}{b}\right) \frac{dU}{da}$$

b = sample thickness,
a = notch depth,
U = strain energy to failure



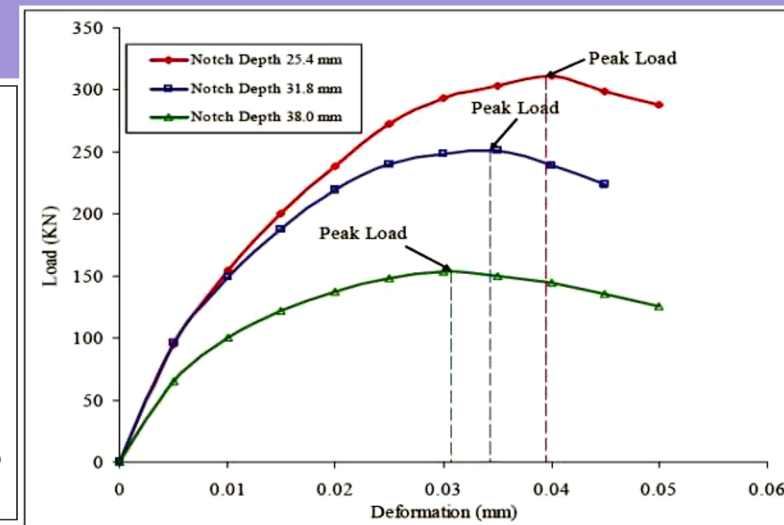
1. SCOPE

- 1.1. This test method covers procedures for the preparation, testing, and measurement of fracture failure of semi-circular asphalt mixtures of specimens loaded monotonically.
- 1.2. This standard may involve hazardous material, operations, and equipment. This standard does not purport to address all safety problems associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.

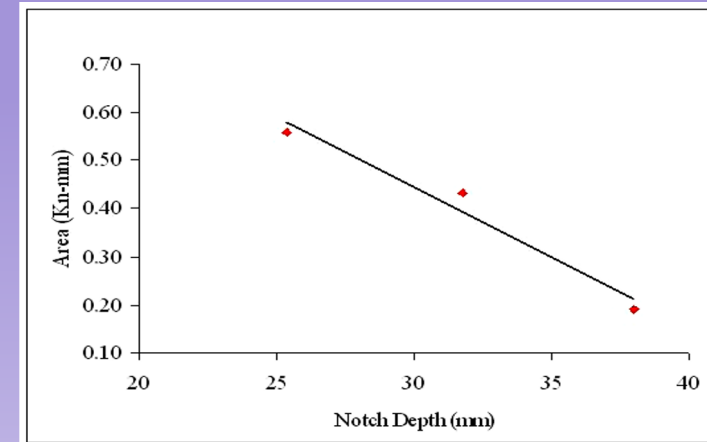
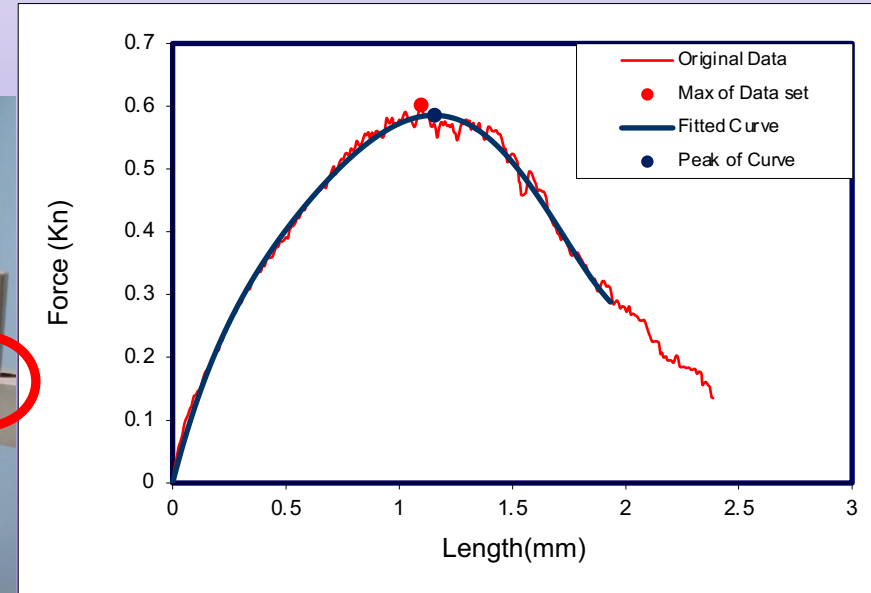
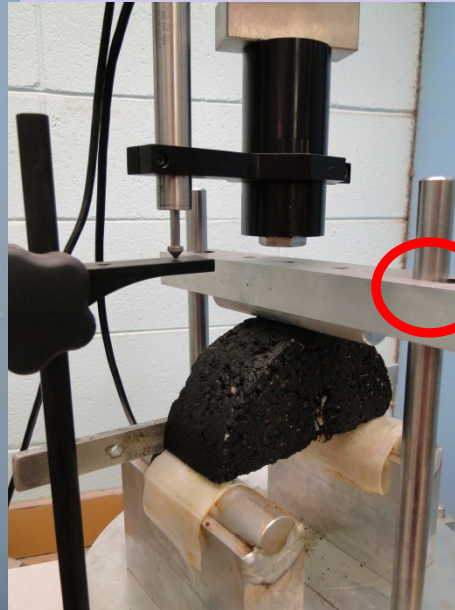
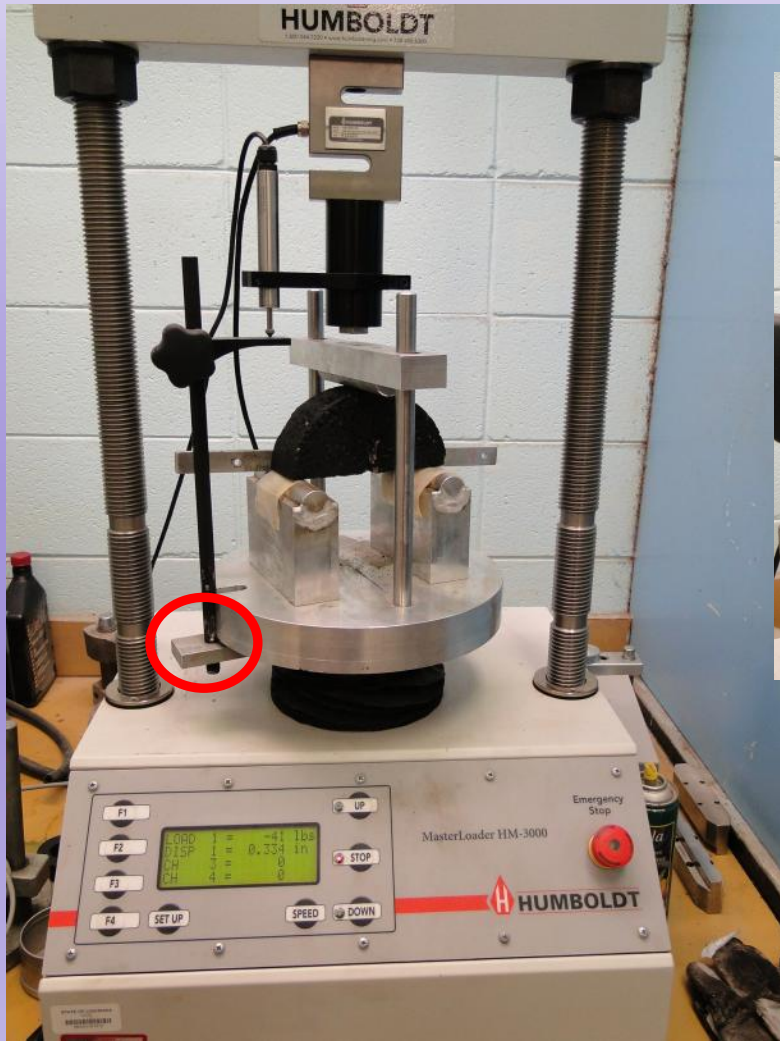
2. REFERENCED DOCUMENTS

2.1. AASHTO STANDARDS

- PP 2, Practice for Mixture conditioning of Hot Mix Asphalt (HMA)
- T 67, Standard Practices for Load Verification of Testing Machines
- T 166, Bulk Specific Gravity of Compacted Hot Mix Asphalt Using Saturated Surface-Dry Specimens
- T 168, Sampling Bituminous Paving Mixtures
- T 209, Theoretical Maximum Specific Gravity and Density of Hot Mix Asphalt (HMA)
- T 269, Percent Air Voids in Compacted Dense and Open Bituminous Paving Mixtures
- T 312, Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyrotray Compactor



Modified SCB Test



$$J_c = -\left(\frac{1}{b}\right) \frac{dU}{da}$$

*Temperature is controlled using an external environmental chamber

LADOTD Specification Changes

- Lowered Gyration (Level 1 and Level 2)

- ▣ L1: 55 Gyration N_d

- ▣ L2: 65 Gyration N_d

- VTM Remains

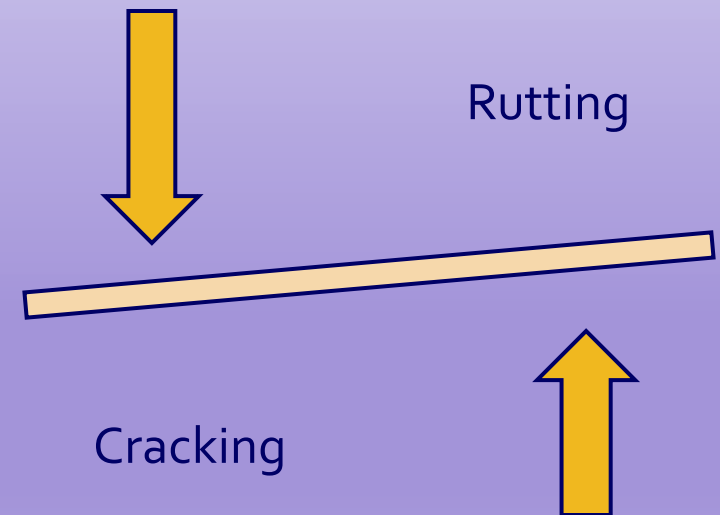
- ▣ 3.5%

- Raised design VFA

- ▣ 72%

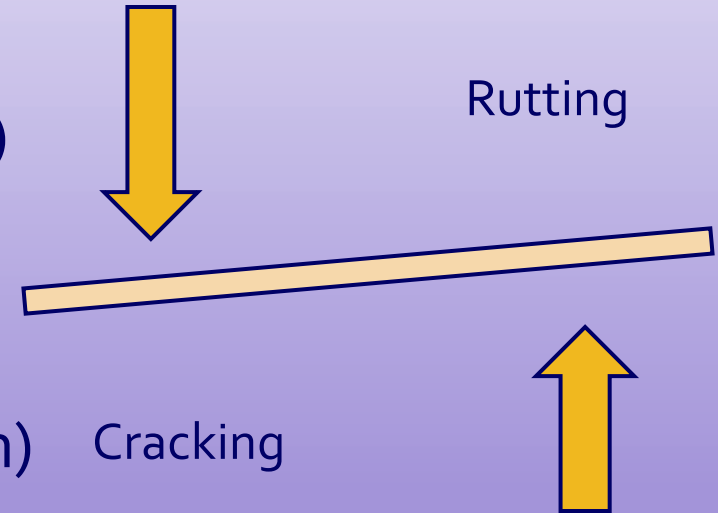
- Raised VMA

- ▣ 0.5% Increase for each NMAS



LADOTD Specification Changes

- LWT required for all mixtures
 - ▣ L1: 10mm @20K passes (maximum)
 - ▣ L2: 6mm @ 20K passes (maximum)
- SCB required for all mixtures
 - ▣ L1: PG 70-22m, 0.5 kJ/m² (minimum)
 - ▣ L2: PG 76-22m, 0.6 kJ/m² (minimum)
- Allow for 5% increase in RAP if “fractionated” -split on the 1”. (still must meet LWT and SCB for design)



Notch Depth	Area / Thick
25.4	0.01
31.8	0.01
38.0	0.00
Es	-0.0004
J1c	0.36
R ²	0.66

OMG It Failed?

- Call Sam Cooper- No Answer OMG!!
- Call Louay- OMG!! Add 0.5% MORE ASPHALT!?! Look at your design and see what you can change.
- Call Sam- More Asphalt! But, Maybe 0.5% is not needed
- Reasoning, Thinking, Theorizing
- Light Bulb Moment

Light Bulb Moment!!!



What If ???!!!

- It is not Necessarily Just about More Total Asphalt
- It is Really about More Film Thickness
- It is Actually about More Free Asphalt
- Asphalt Not Absorbed
- Available Asphalt to Perform Outside of the Aggregates
- Hmmmm? A Little Less Fines
- Hmmmm? A Little More Large Aggregate or Maybe More Intermediate Aggregates
- Restructure the Gradation of the Mixture -Just a Tad
- Let's Try It!!!!

Material Name	Cold Feed	Cold Feed
	Original	Final
1x5/8CrGrv	19.0	20.0
	22.0	22.0
5/8x4CrGrv		
1/4x0CrGrv	45.0	46.0
Blended Sand	14.0	12.0
RAP	25.0	25.0

% Passing Composite Gradation		
<u>Sieve</u>	Original	Final
1"	100	100
3/4"	98	98
1/2"	85	84
3/8"	76	75
#4	52	51
#8	39	38
#16	29	28
#30	23	22
#50	15	14
#100	8	8
#200	5.9	5.3

Average Volumetrics

Gmm	2.381
%Gmm,Ni	90.0
%Gmm,Nd	96.6
%Gmm,Nmax	97.7
VMA	13.3
VFA	74
%Voids	3.4
%Desn.AC	4.8 ? 4.9

	Failing Ductility	Passing Ductility	1% Agg 0% AC	2%Agg 0.1% AC
J1c	0.19	0.36	0.47	0.60

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31.8	0.01
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Es	-0.0004
J1c	0.36
R ²	0.66

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25.4	0.01
31.8	0.01
38.0	0.00
Es	-0.0006
J1c	0.60
R ²	0.98

The Simple Key

Free Asphalt as Opposed to Absorbed Asphalt

A Passing SCB

Does NOT Always Have to Be

0.5% MORE ASPHALT

Examine The Whole Design

- Study Every Aspect
- Gradation and Structure
- Asphalt Type and Quality
- Modified and Unmodified
- Effective Asphalt Content
- Aged and Unaged Asphalt Combinations
- VMA
- VFA
- Do the Work and Do Not Settle

A Graduate in The SCB!!!!

