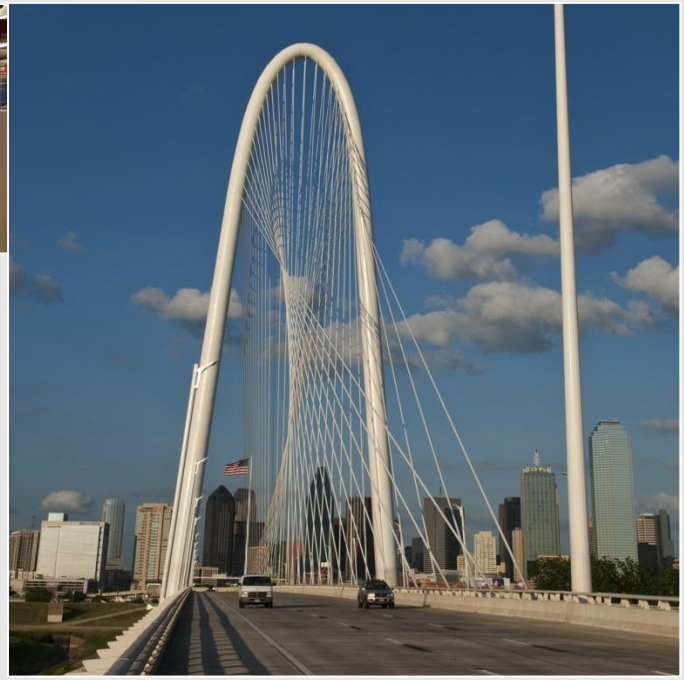
TEXAS DEPARTMENT OF TRANSPORTATION



BALANCED MIX DESIGN APPROACH

Travis Patton, P.E.

Flexible Pavements

Initial Thoughts

Dry mixes are prevalent in our industry.

Restrictive specifications and general notes are not long term solutions.

Lowering N-design and raising lab molded densities will only help so much.

Continuing to increase binder replacement without addressing mix performance is not sustainable.

We need to increase our understanding of the factors which drive mix performance to help us better optimize our mixes

Current State of Affairs

- We prescribe material qualities and characteristics, but don't always get the performance we are after

"Recipe" driven **volumetric designs** are based on history and what we think works

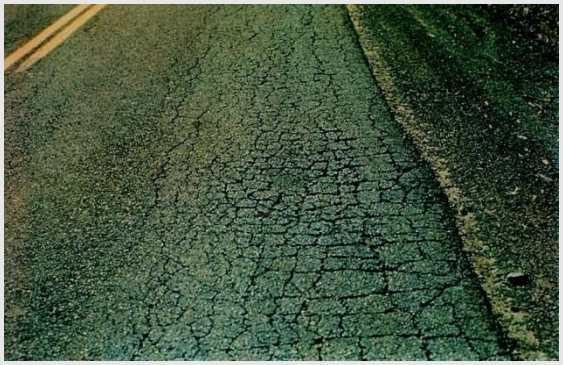
- What constitutes a good cake? Is it the individual steps to make it, or is it the end product?

- What defines a good cake? **It Tastes Good**
- What defines a good mix? **Lasting Performance**

LET'S STOP USING THE RECIPE TO DETERMINE IF THE CAKE IS GOOD

Current State of Affairs

1. What's more important; cracking resistance or rutting resistance?
2. Can I have both?
3. Economics or performance?
4. Have we placed too many restrictions trying to prescribe what "good hot mix" should look like on paper?
5. Why not specify performance?



Eliminate the restrictions and focus on

PERFORMANCE

What is a Balanced Mix Design?

Optimize

- Make the best or most effective use of (a situation, opportunity, or resource)

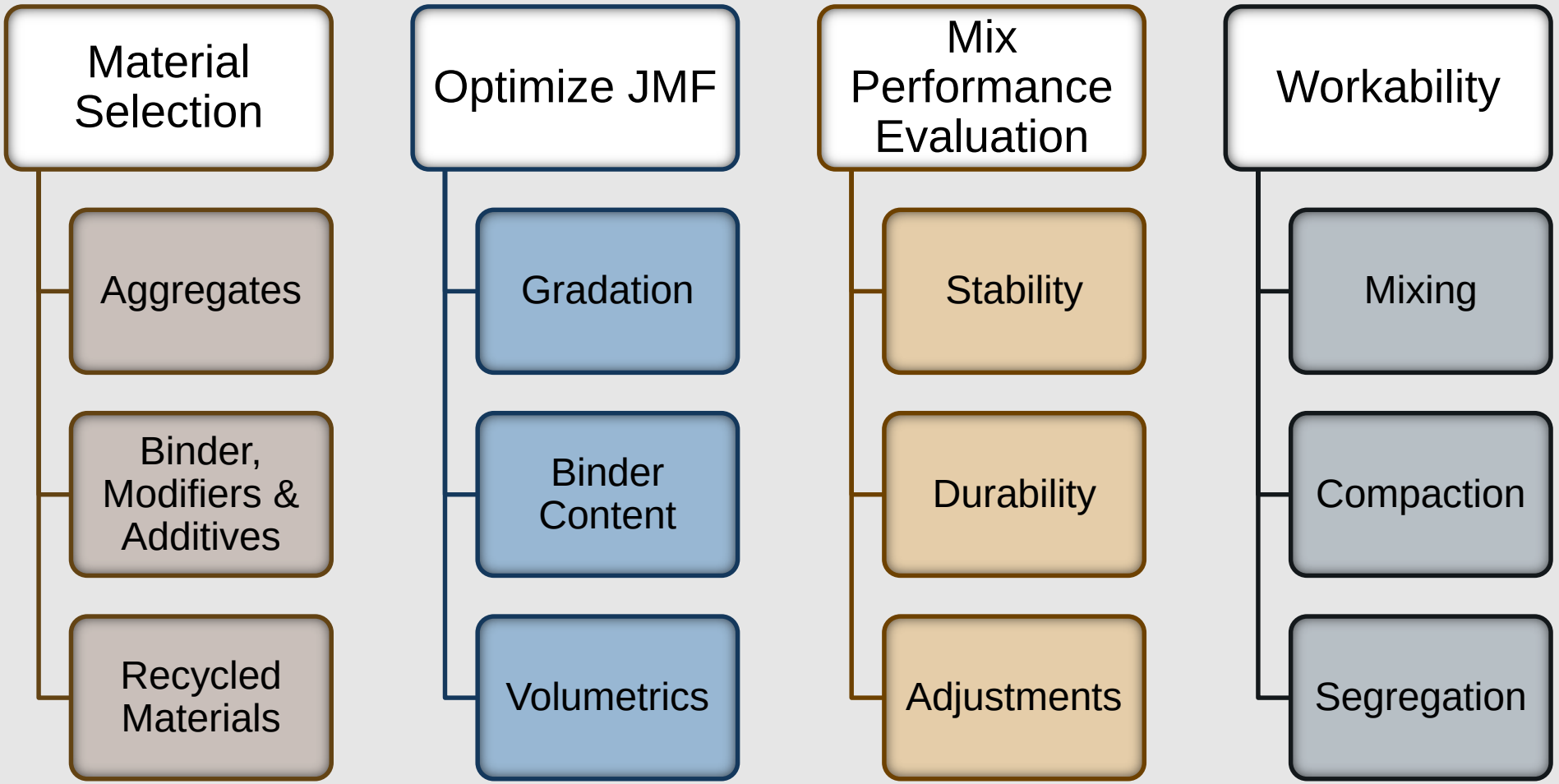
Balance

- Being in proper arrangement or adjustment, proportion

Balanced Mix Design

- *Optimize the mix to provide needed performance and balance between stability and durability.*

Optimized Mix Design Approach – Framework



Optimized Mix Design Approach – Framework

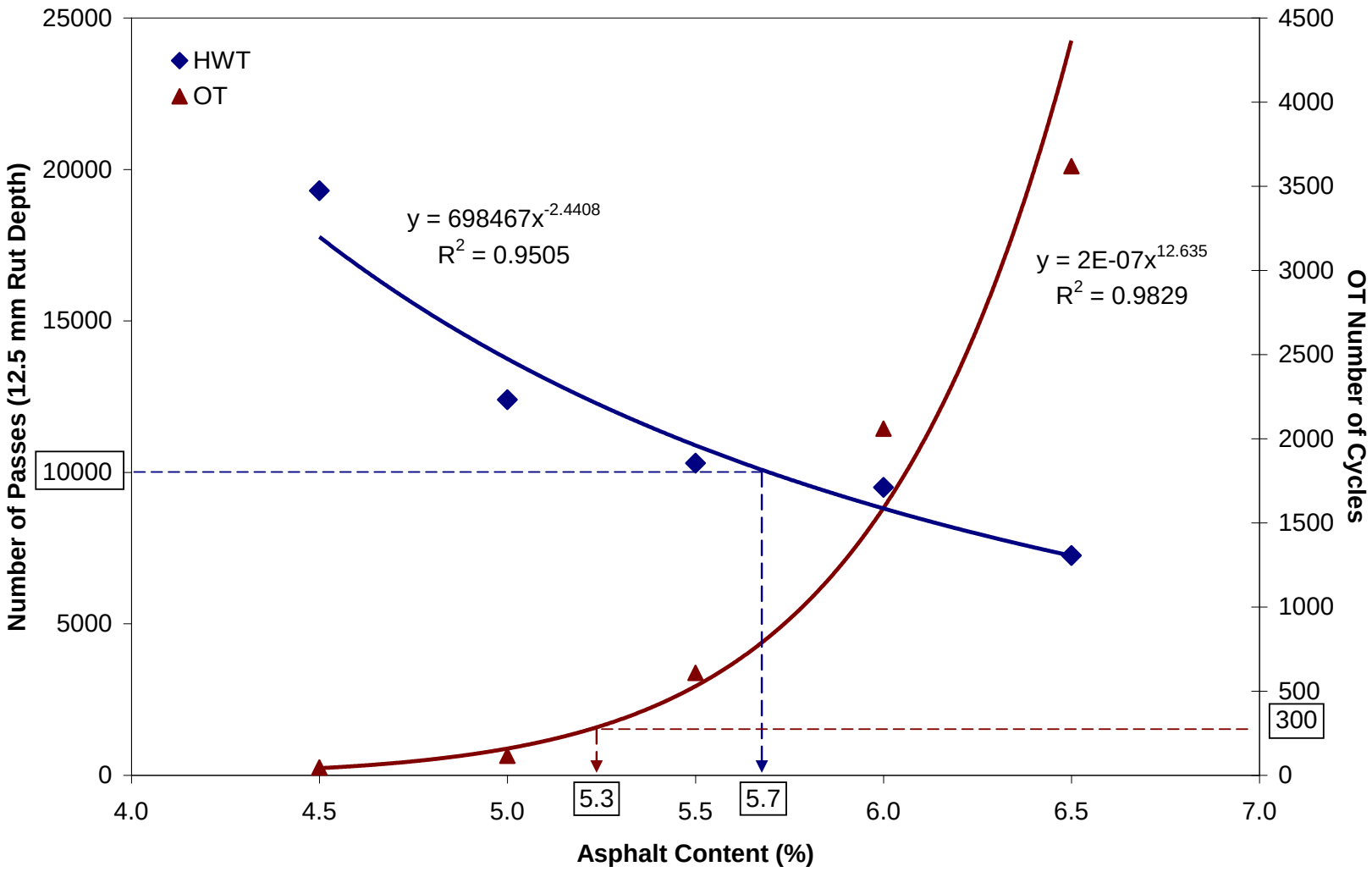
Indicator of cracking resistance

Mix Performance Evaluation

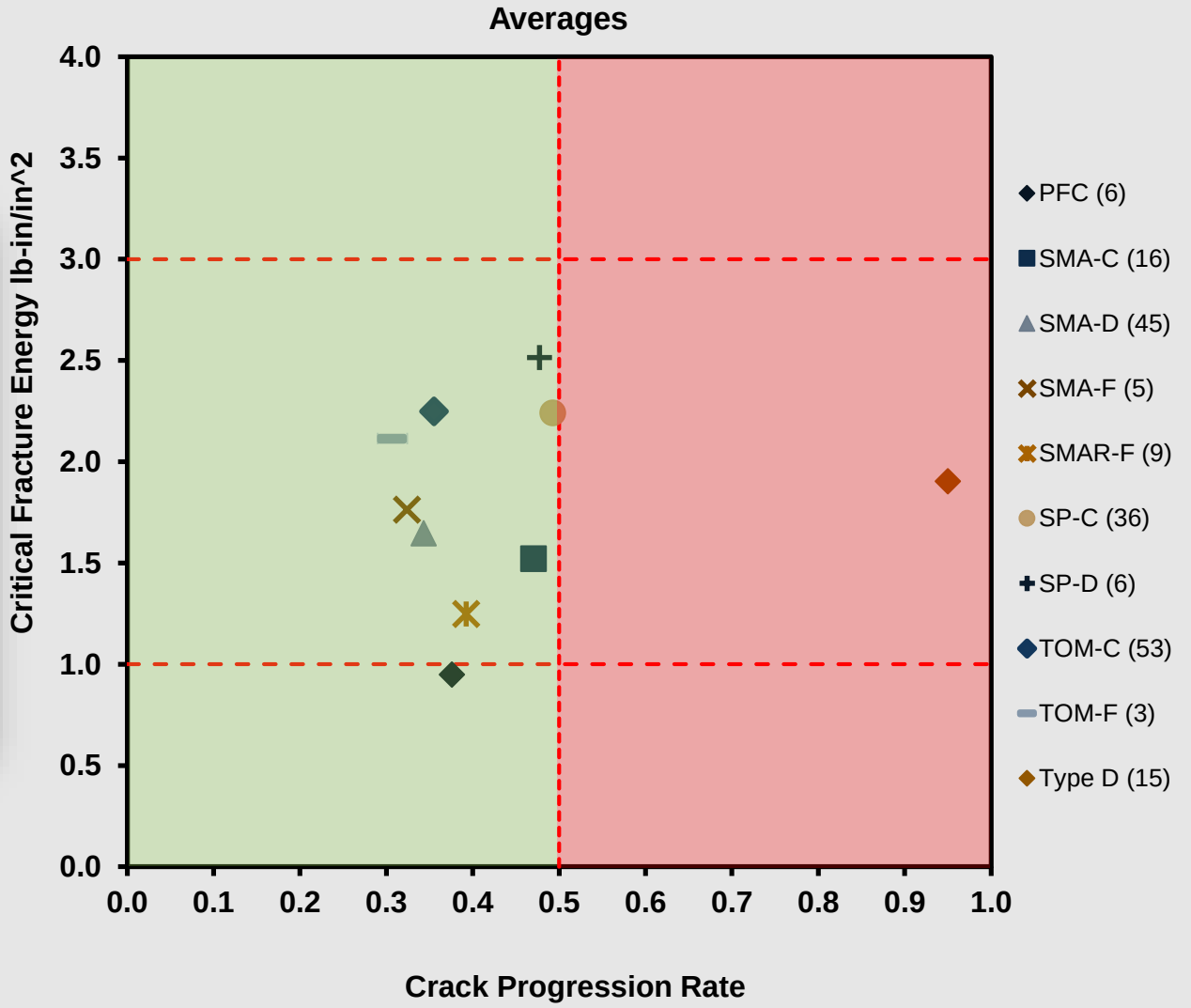
- Stability
- Durability

Indicator of rutting resistance

Balanced Mix Design Approach - PG 64-22

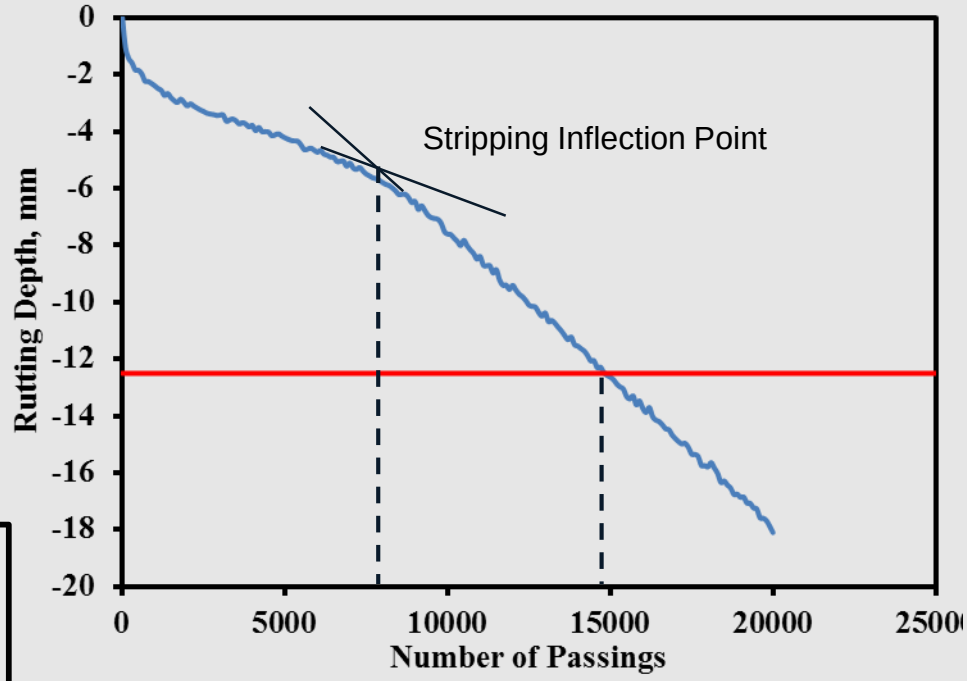


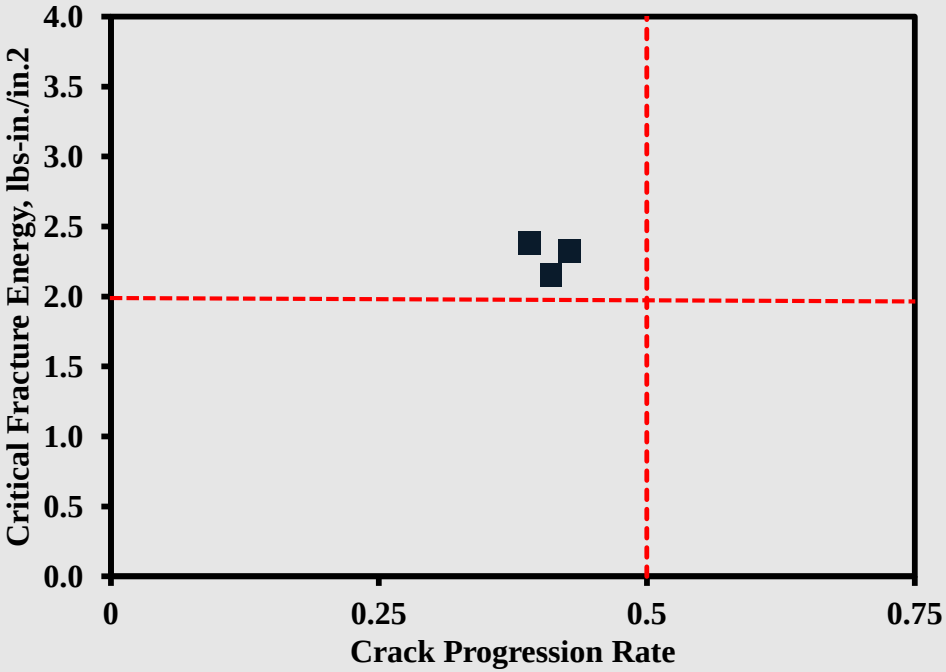
OT Data Analysis



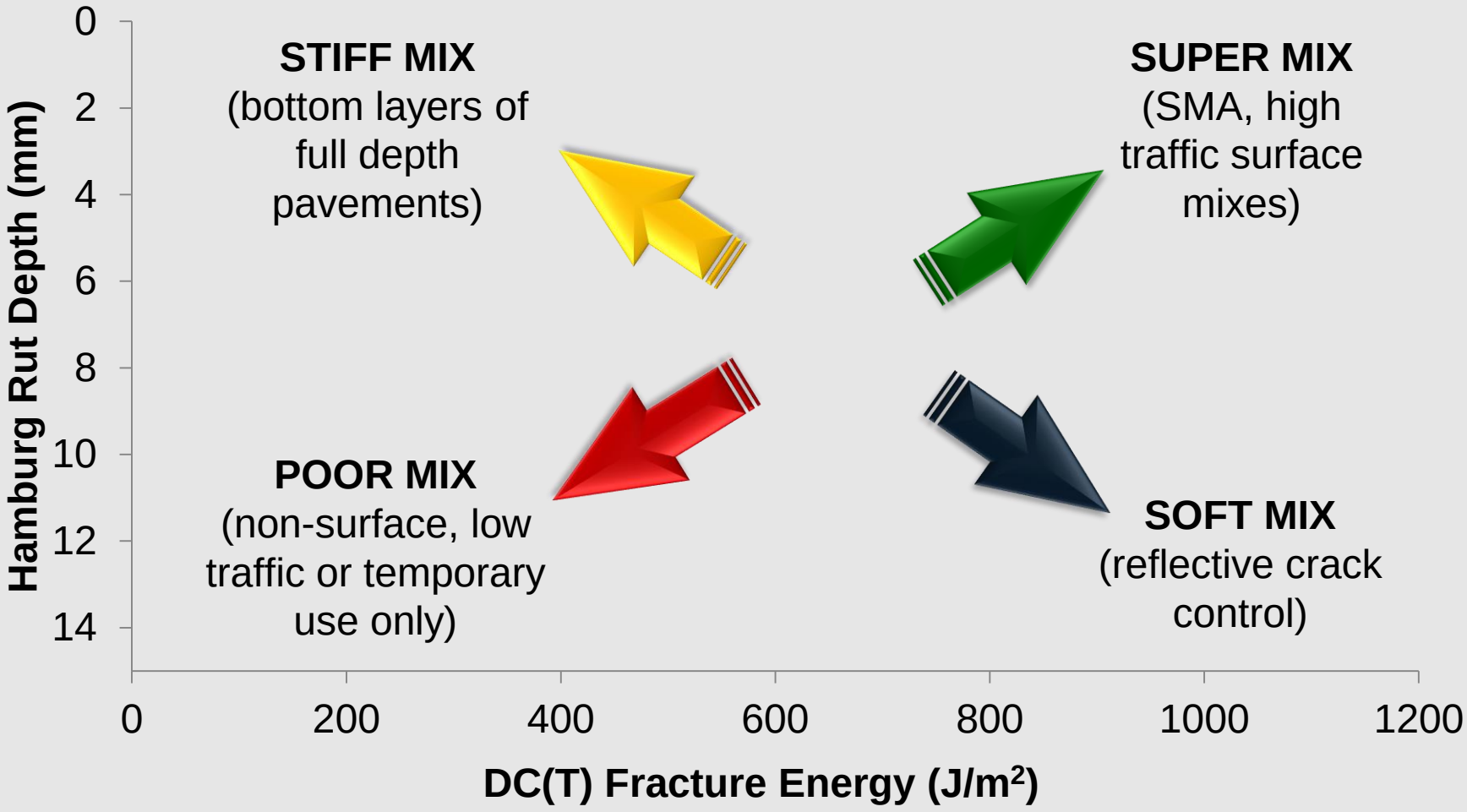
Example

- SuperPave Type D
- PG 70-22
- Limestone Aggregate SAC B



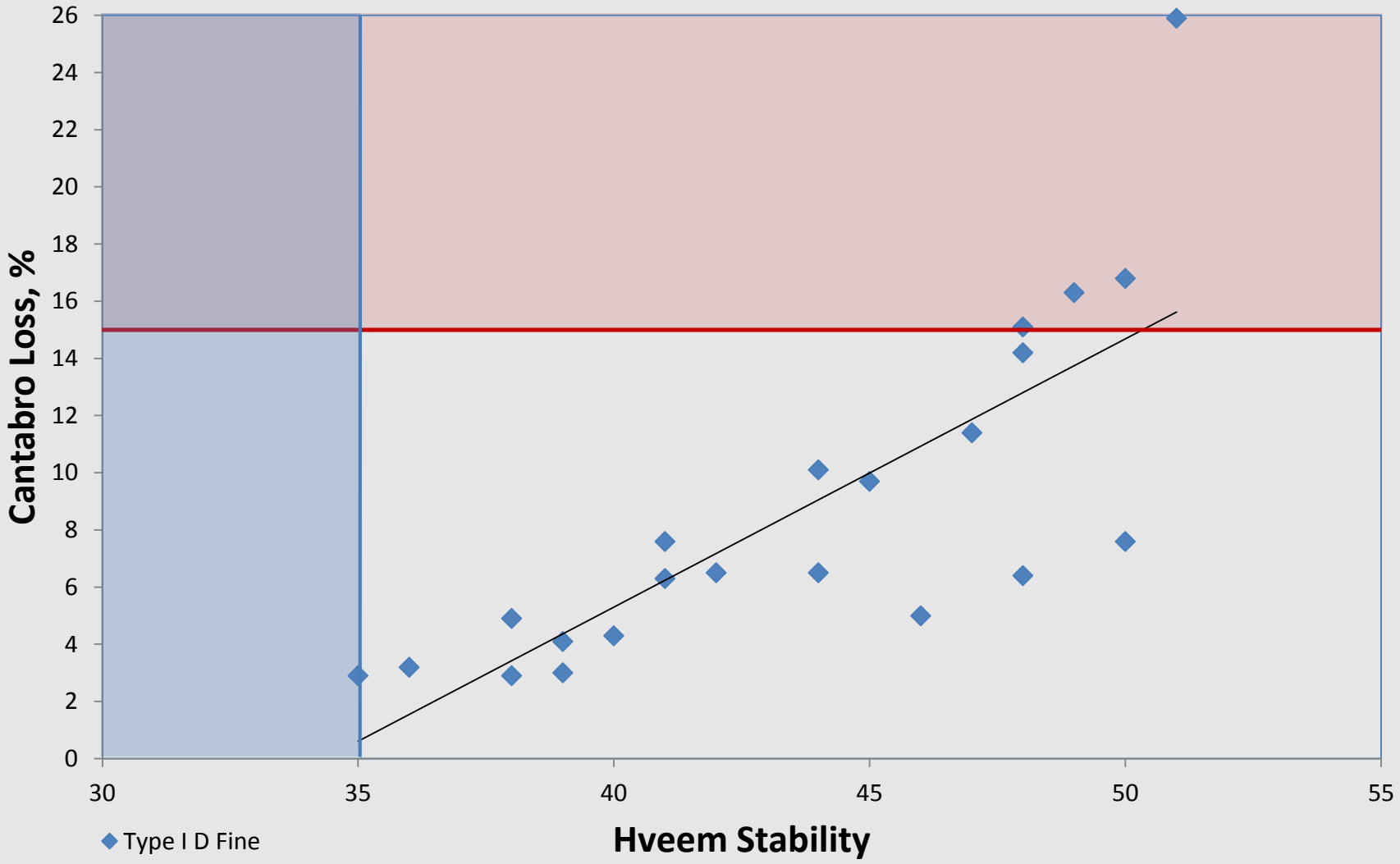


Mix Performance Space Diagram



From: Dr. Bill Buttlar, University of Illinois

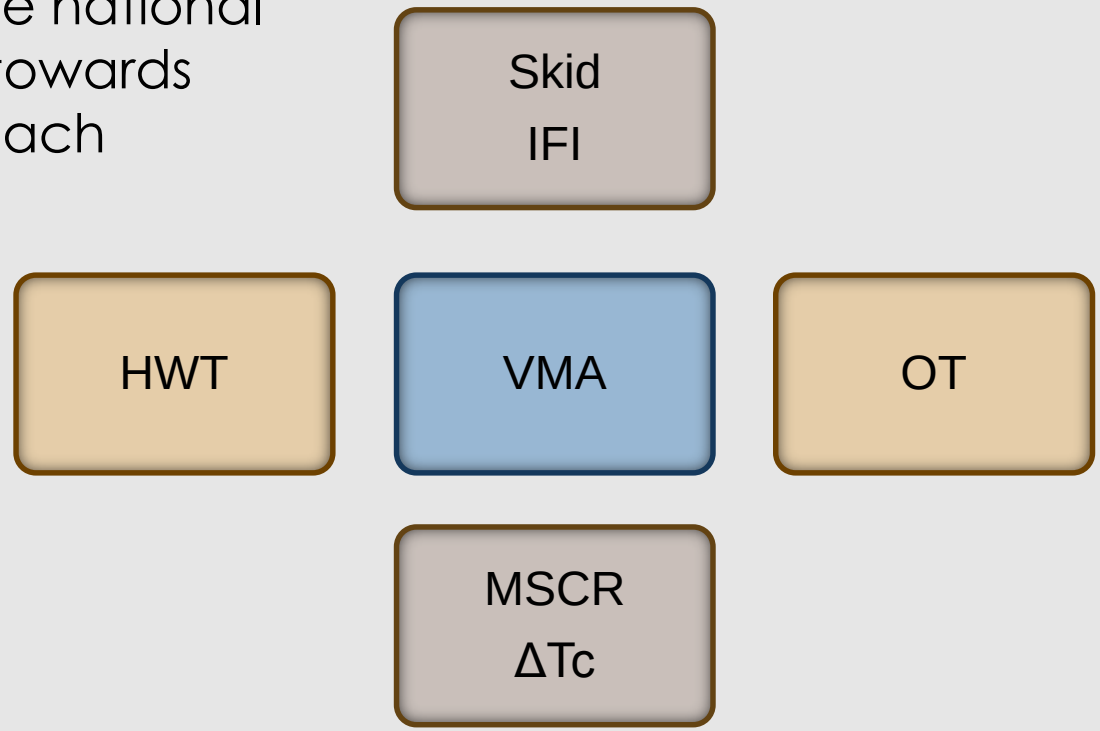
Balanced Mix Design Approach – Limestone Rock Asphalt



Specification Development

Some form of a balanced mix design framework is probably in our future

There is a lot of work at the national level already in progress towards utilizing this type of approach

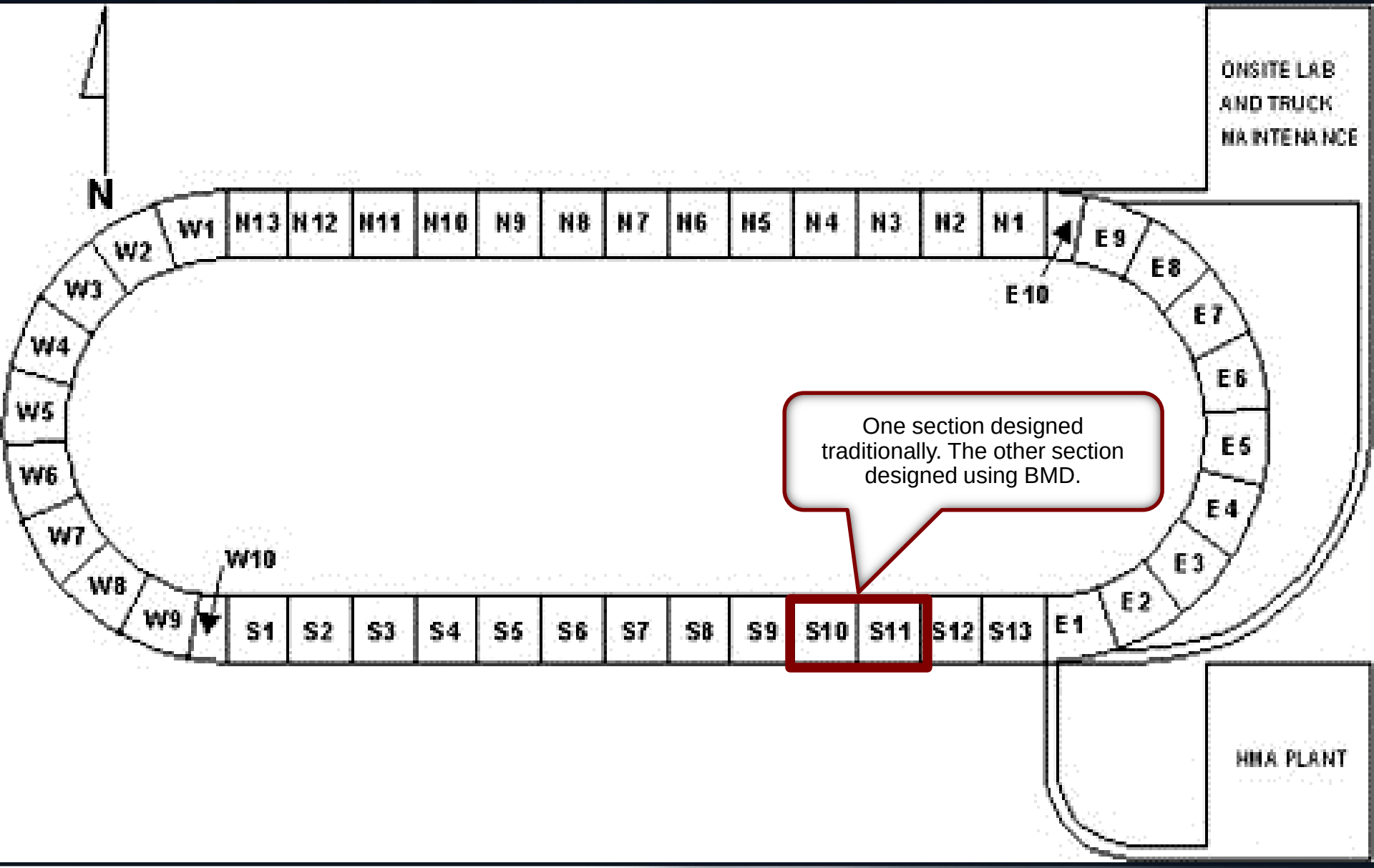
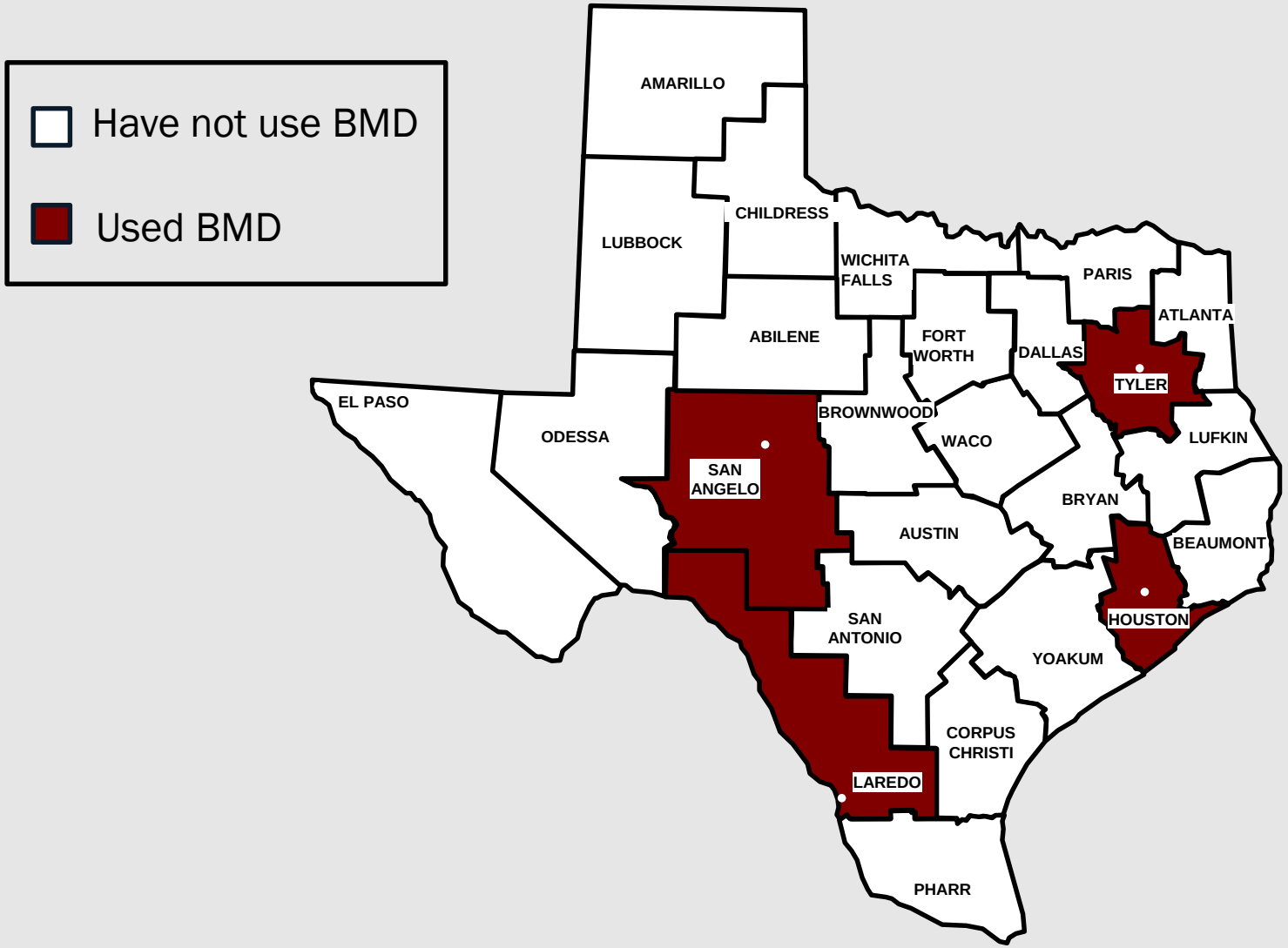


Specification Goals:

- Relax constraints
- Design by specifying end performance

NCAT Track

NCAT Track


N
ONSITE LAB
AND TRUCK
MAINTENANCE
W1
W2
W3
W4
W5
W6
W7
W8
W9
W10
N13
N12
N11
N10
N9
N8
N7
N6
N5
N4
N3
N2
N1
E10
E9
E8
E7
E6
E5
E4
E3
E2
E1
S1
S2
S3
S4
S5
S6
S7
S8
S9
S10
S11
S12
S13
One section designed traditionally. The other section designed using BMD.
HMA PLANT

District Implementation