Full Depth Reclamation Process In North Carolina
Part 1 - Investigation

43rd Annual Southeastern Transportation Geotechnical Engineering Conference (STGEC)

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Mohammed A. Mulla, P.E., CPM, MCE

Assistant State Geotechnical Engineer

Geotechnical Engineering Unit

North Carolina Department of Transportation

Presentation Outline

- NCDOT Full Depth Reclamation (FDR) History
- What is the basic FDR process
- FDR Selection and Design Criteria
- Step By Step Investigation - Pictures
- Laboratory Testing
- Recommendation

NCDOT FDR History

- Started in July 2003
- Have performed 80 FDR investigations in 11 of 14 N.C. Divisions

- Have investigated 319+ miles, while having actually performed FDR on over 107 miles (30 FDR)
- Project sizes range from ½ mile to 9 miles in length

What is Full Depth Reclamation (FDR)?

FDR is a process whereby both the existing asphalt pavement and underlying materials (predetermined mix-design depth) are **first pulverized, then mixed with cement, and compacted (recycled in-place)**, into a new base course, ready for paving. Design strength gain is achieved by the measured addition of Portland Cement during the mixing of these materials.

What is Full Depth Reclamation (FDR)?

FDR is also a Green Process: Asphaltic roadway materials are not removed from the project, thereby saving money, time, and landfill space, and not causing further damage to adjacent rural roadways. Asphalt areas, which are too thick due to repeated patching or overlaying, can be milled off and reused for widening of shoulders.

When Should FDR Be Considered?

When a roadway is in such poor condition that it may be more economical over the long term to make a new base course out of it than to continually patch and/or overlay it.

NCDOT Selection Criteria

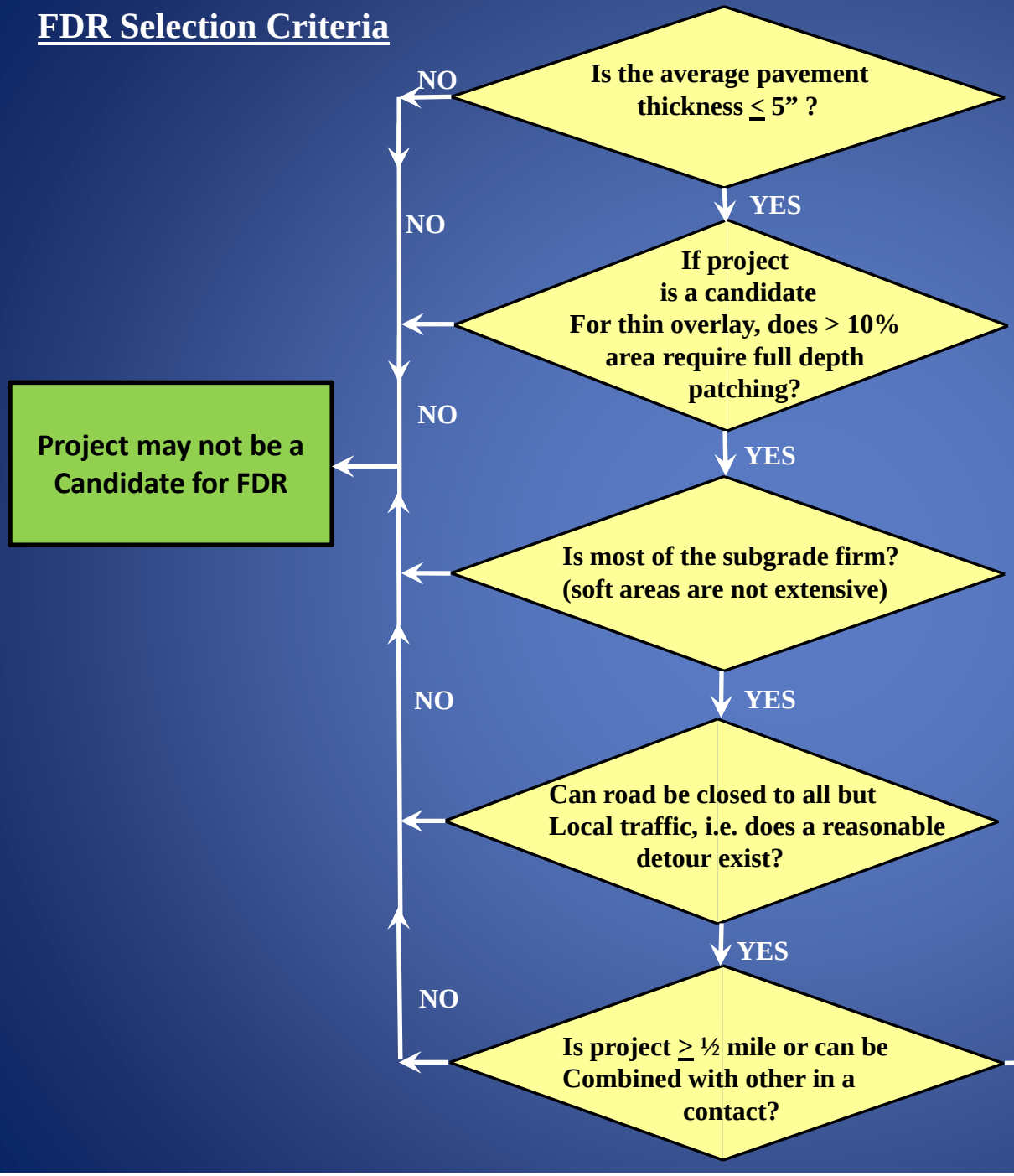
Potential FDR

Potential FDR

FDR

Step By Step Investigation
(FDR) Full Depth Reclamation

FDR Selection Criteria



Other Data Required for Selection

Approximate Length of Project: _____

ADT: _____

% of Trucks: _____

Anticipated Widening: Yes ____ NO ____

Anticipated Width of Widening: _____

Extensive Utilities: Yes ____ NO ____

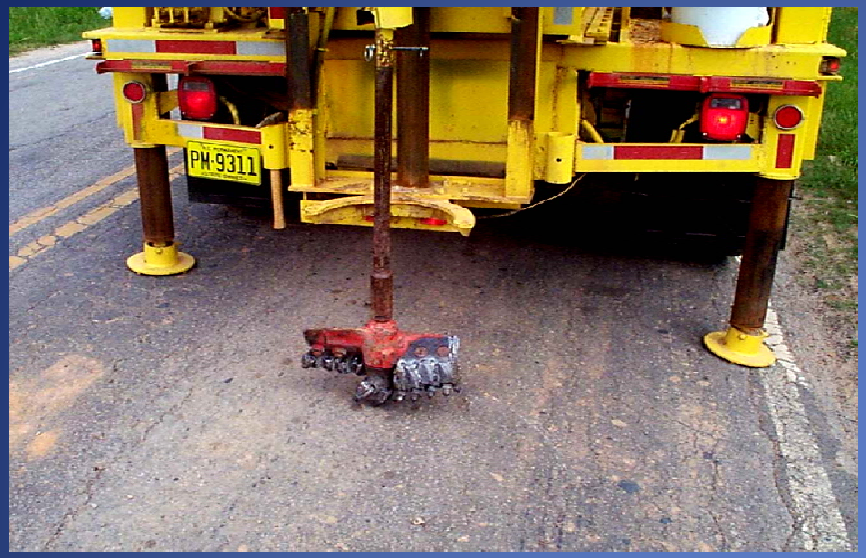
Utilities Present: _____

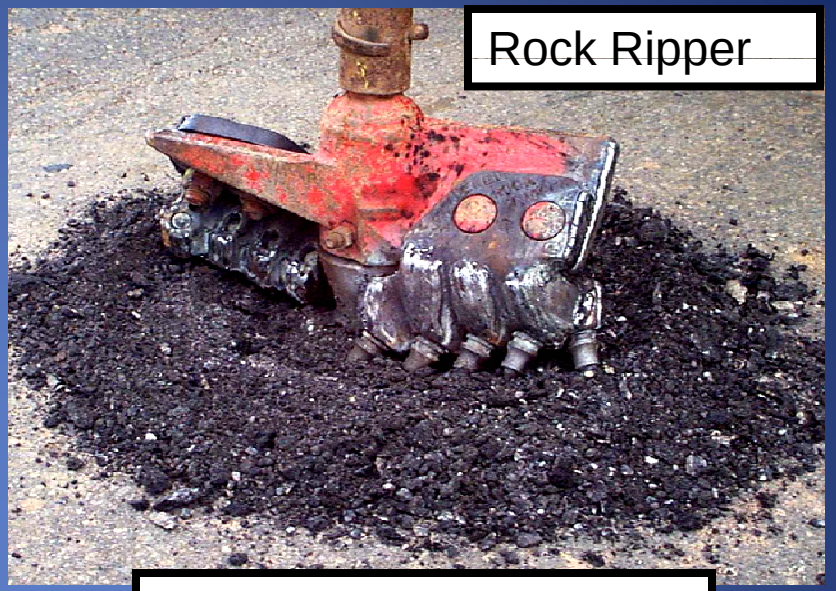
Are Ditches Open and Functioning: Yes ____ NO ____

Approximate Depth of Water Table: _____

Light Weight Deflectometer (LWD) PRIMA100

Investigation and Sampling Procedure

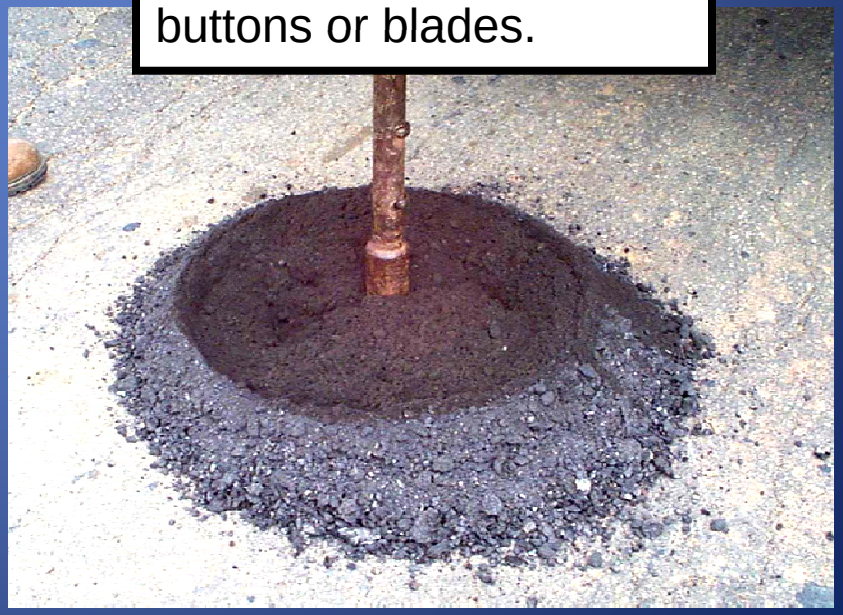


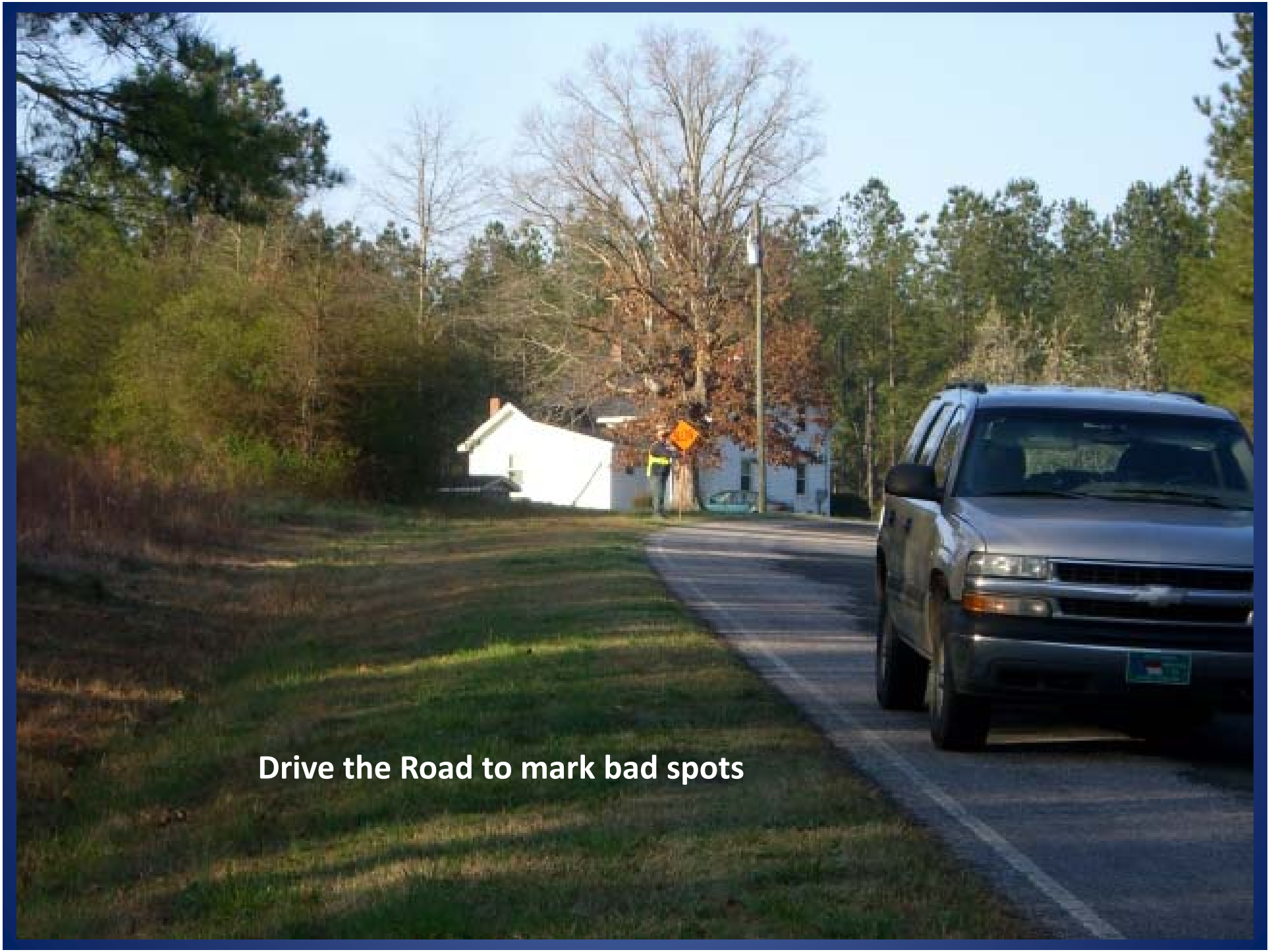


- **Pavement Layer Thickness:** 4” Core
- **Subgrade Strength:** DCP
- **Subgrade Investigation:**

  Dead Stem Auguring to 5’

Teeth are carbide-tipped buttons or blades.




Drive the Road to mark bad spots


Traffic Control
PL-5735

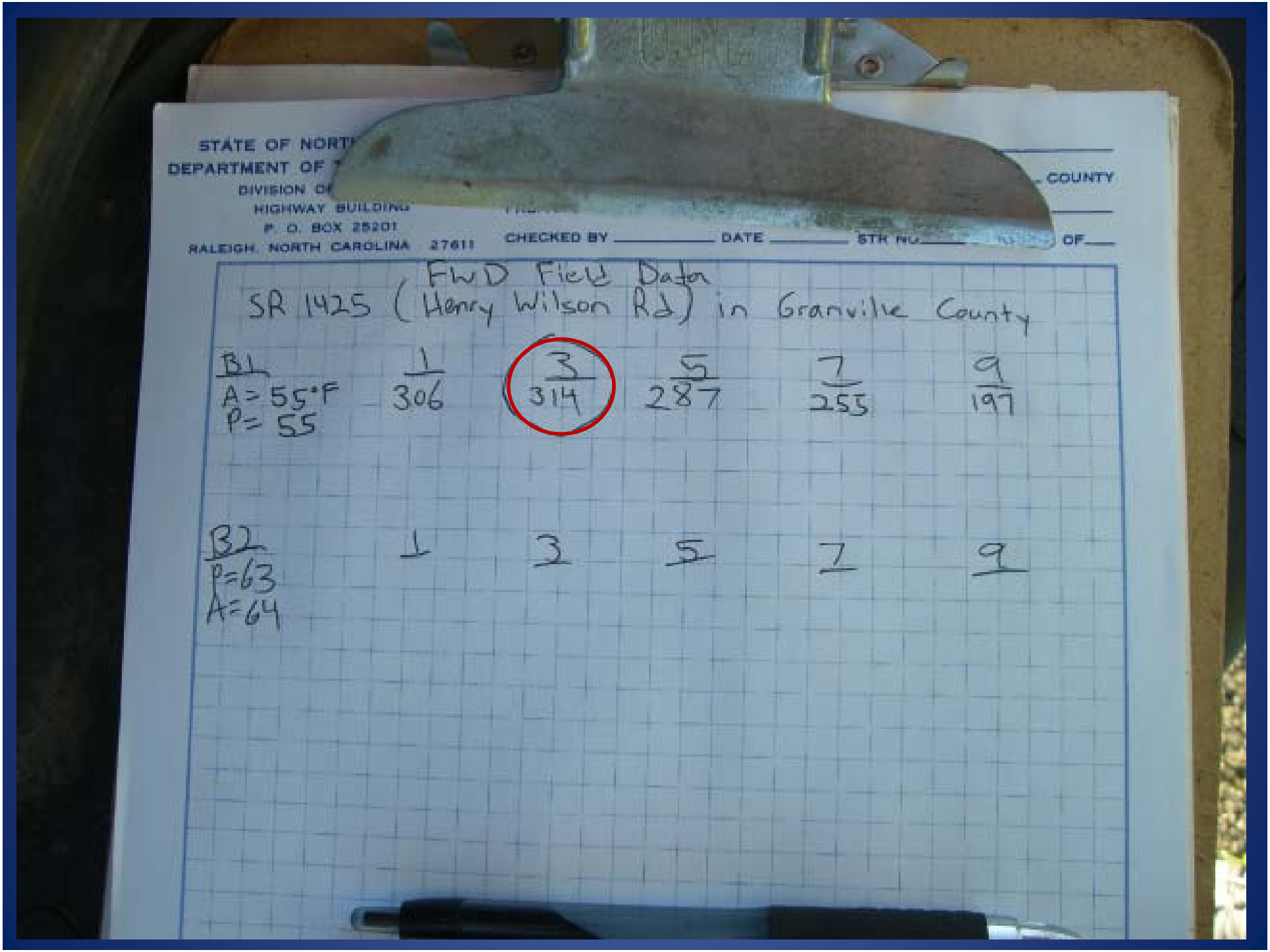
Air and Pavement Temperatures

Mark 1, 3, 5, 7 and 9 foot
1’ from edge of pavement


DEPARTMENT OF
DIVISION O
HIGHWAY
P. O. BOX 25201
RALEIGH, NORTH CAROLINA 27611
CHECKED BY
DATE
COUNTY
FWD Field Data
SR 1425 (Henry Wilson Rd) in Granville County
BL
A=
P=
1
3
5
7
9

First test area

Video


STATE OF NORTH
DEPARTMENT OF
DIVISION OF
HIGHWAY BUILDING
P. O. BOX 25201
RALEIGH, NORTH CAROLINA 27611

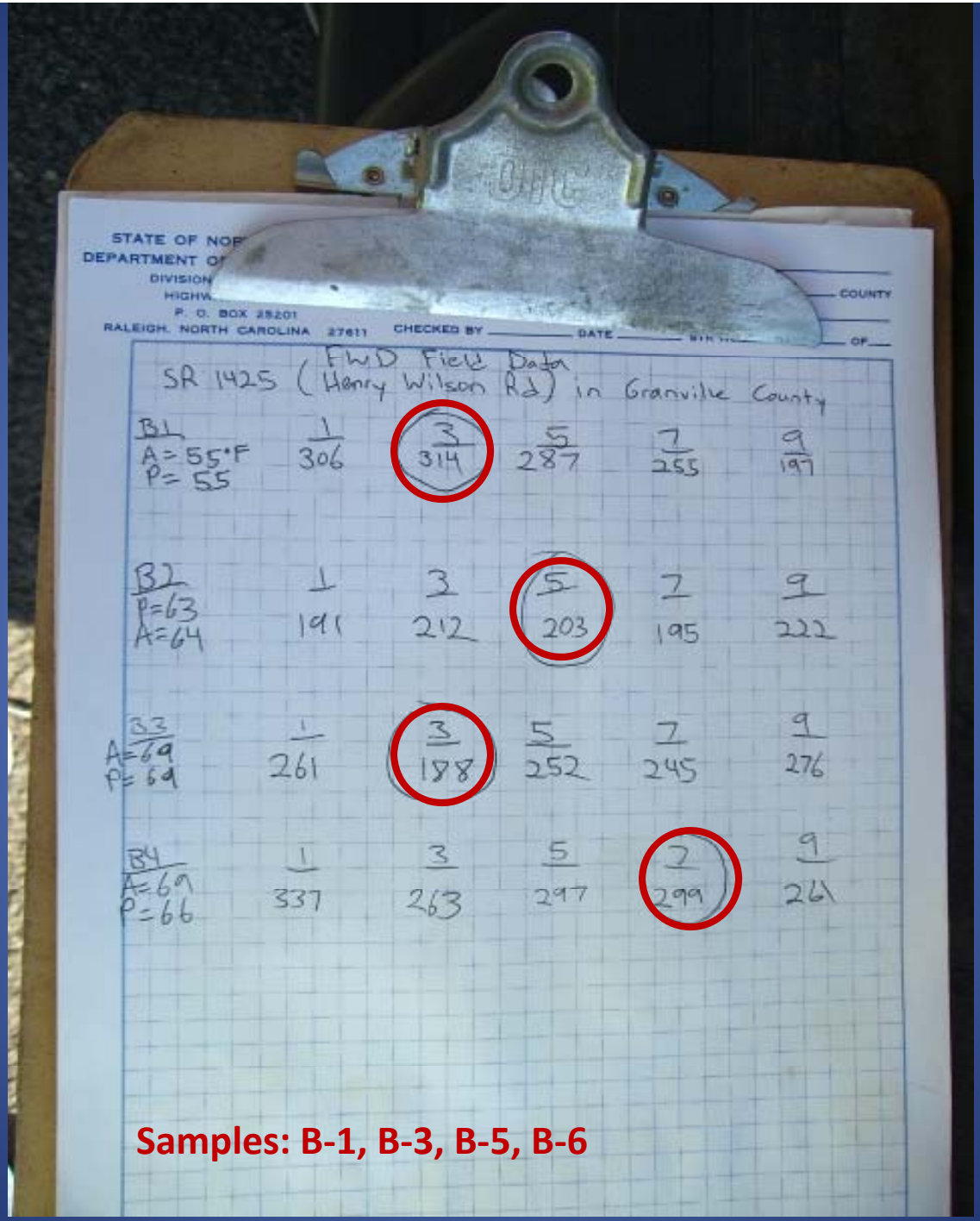
COUNTY

CHECKED BY _____ DATE _____ STR NO. _____ OF _____

FWD Field Data

SR 1425 (Henry Wilson Rd) in Granville County

B1 A = 55°F P = 55	1 306	3 314	5 287	7 255	9 197
B2 P = 63 A = 64	1	3	5	7	9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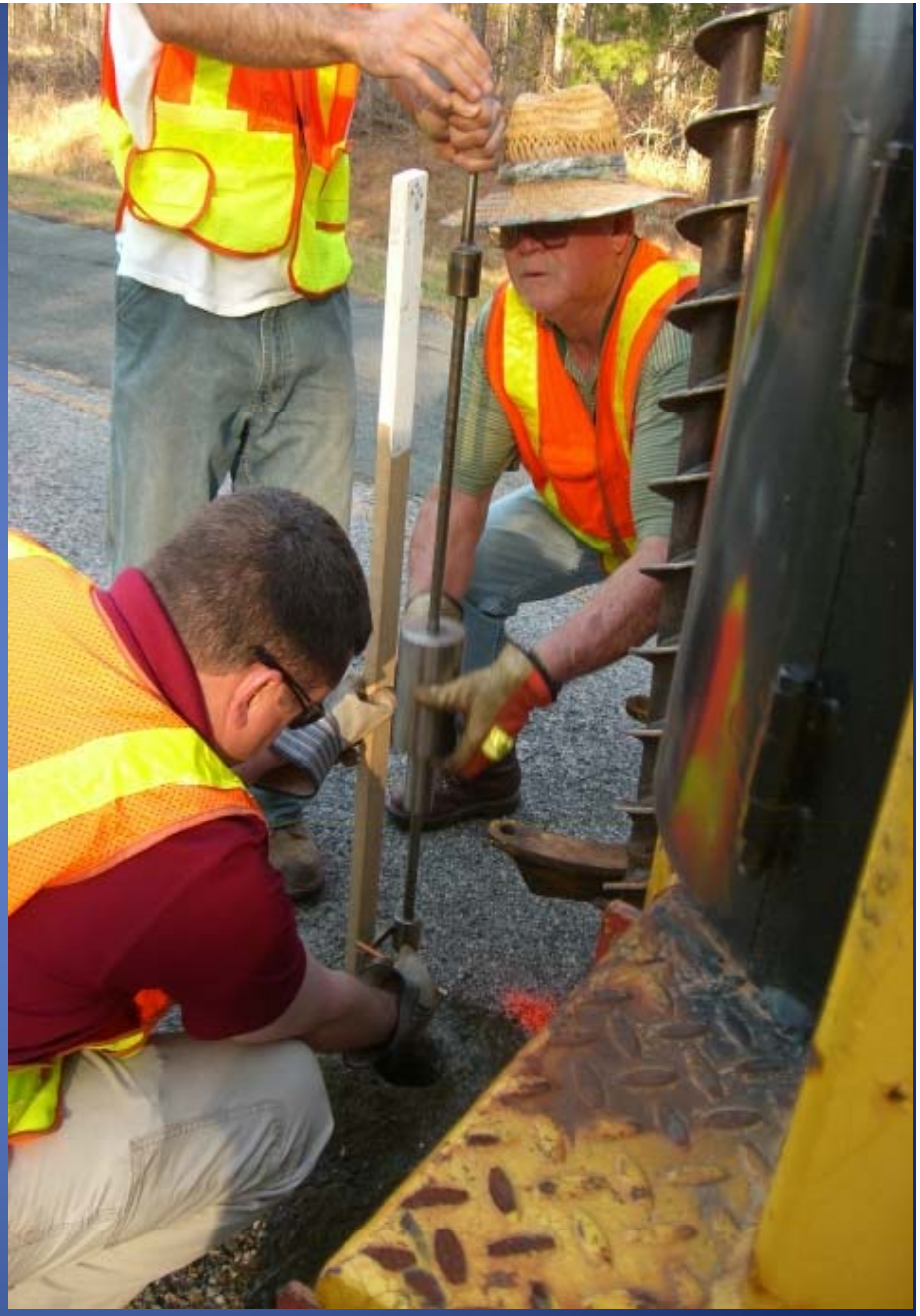
FWD Field Data
SR 1425 (Henry Wilson Rd) in Granville County
B1
A=55°F
P=55
1 306
3 314
5 287
7 255
9 197
B2
P=63
A=64
1 191
3 212
5 203
7 195
9 222
B3
A=69
P=69
1 261
3 188
5 252
7 245
9 276
B4
A=69
P=66
1 337
3 263
5 297
7 299
9 261
Samples: B-1, B-3, B-5, B-6

Video

Auger borings

Pavement Layer Thickness:


Subgrade Strength: DCP
Video DCP



Video Augur Boring


PJ-1877


Video Material Depths

Video
Mix

Cold Patch both holes

Samples: B-1, B-3, B-5, B-6

Samples for Lab Testing:

Classification, Gradation, and Unconfined Compressive Strength with 4%, 6%, and 8% Cement added.

Take Samples to M&T Lab


DANGER

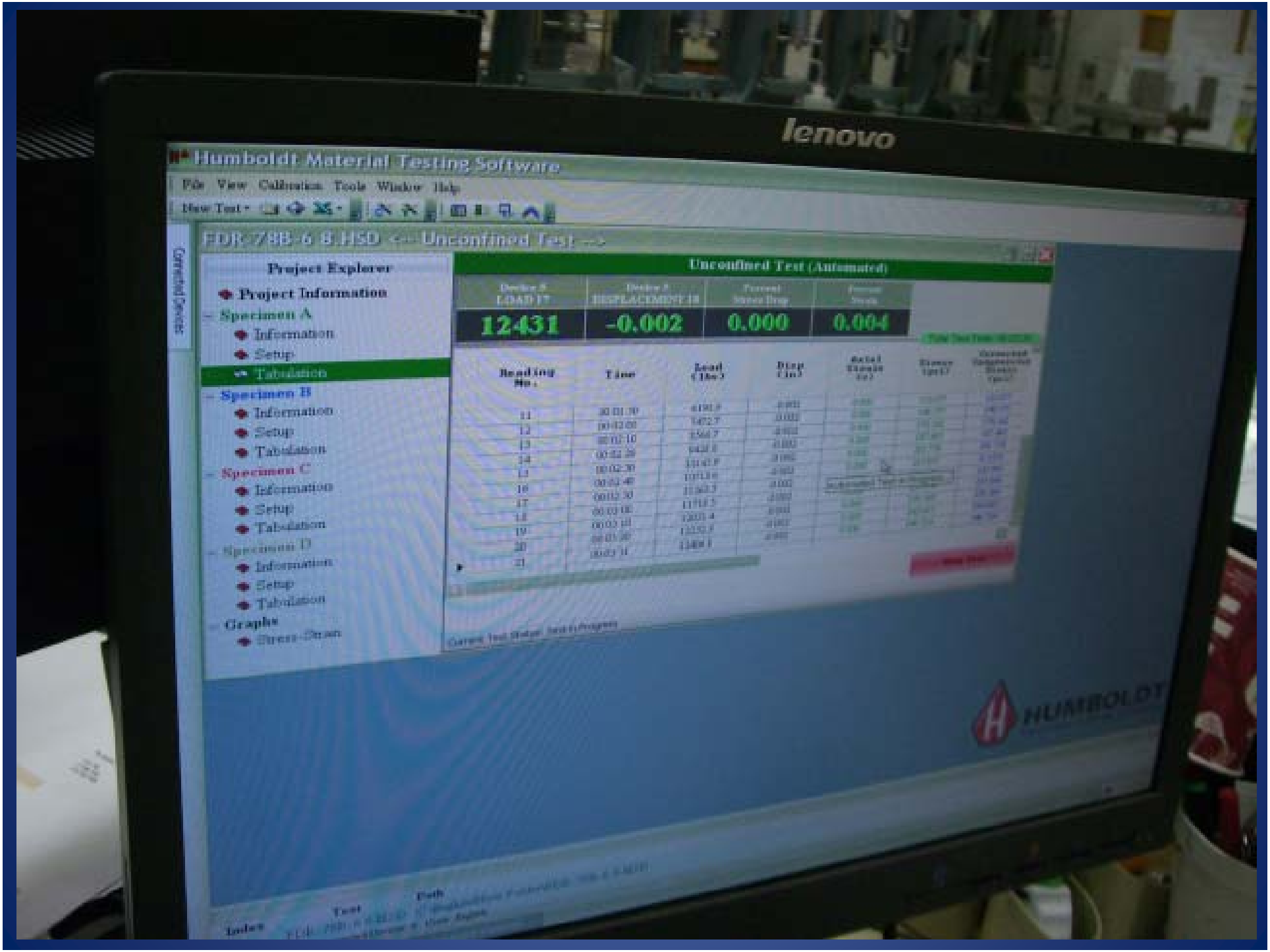

Add Cement


7 Days in Cure Room


4 Hours soaked in Water before testing


Ready for Unconfined Compressive Strength

Sample Failure


lenovo
Humboldt Material Testing Software
File View Calibration Tools Window Help
Project Explorer
Project Information
Specimen A
Information
Setup
Tabulation
Specimen B
Information
Setup
Tabulation
Specimen C
Information
Setup
Tabulation
Specimen D
Information
Setup
Tabulation
Graphs
Stress-Strain
Unconfined Test (Automated)
12431
-0.002
0.000
0.004
Reading No.
Time
Load (lbs)
Disp (in)
HUMBOLDT

RECOMMENDATIONS:

If FDR is chosen for the approximately 2.92 miles of roadway, the Geotechnical Engineering Unit recommends a CEMENT APPLICATION RATE OF 46 LBS PER SQUARE YARD AND A MIXING DEPTH OF 12 INCHES.

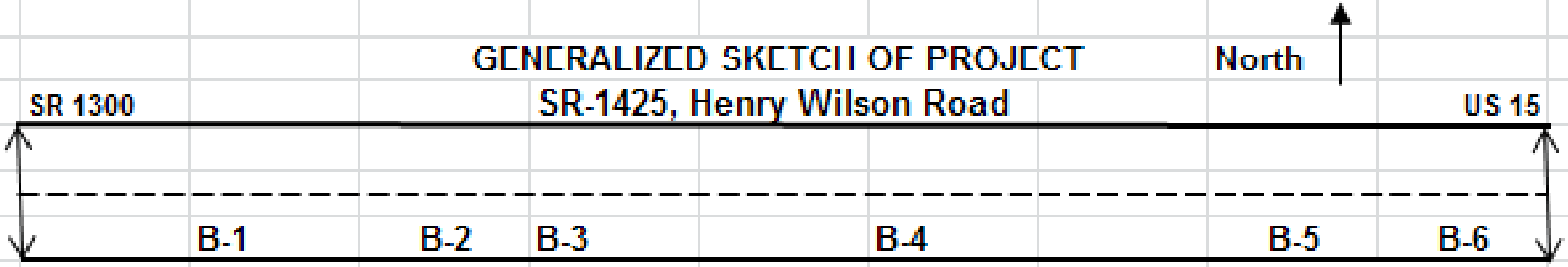
We do not recommend that a greater depth of reclamation be used unless the cement rate is increased. We highly recommend that the reclamation width be a minimum of two feet more (1 foot on each side of the roadway) than the final pavement width, including all widened areas.

The Pavement Management Unit recommends overlaying the 12 inches of FDR with 1.25" SF9.5A. Special attention is needed in any areas which are to be widened, to ensure that the base closely matches the composition of the mainline pavement.

RECOMMENDATIONS		
DEPTH IN INCHES	CEMENT PERCENT	CEMENT RATE: LBS/SY
12	3.5	46
Overlay with 1.25" SF9.5A		

GENERALIZED SKETCH OF PROJECT

SR-1425, Henry Wilson Road



B-1: 2" Asph, 5.5" ABC, Brn F Sd Cl Si w/ Pea Rx to 17", Brn F Sd Si Cl to 4'

B-2: 2" Asph, 10" ABC, Mottled Or Brn Sl F Sd Cl Si to 4'

B-3: 2" Asph, 13" ABC, Rd Brn Sl F Sd Si Cl to 4'

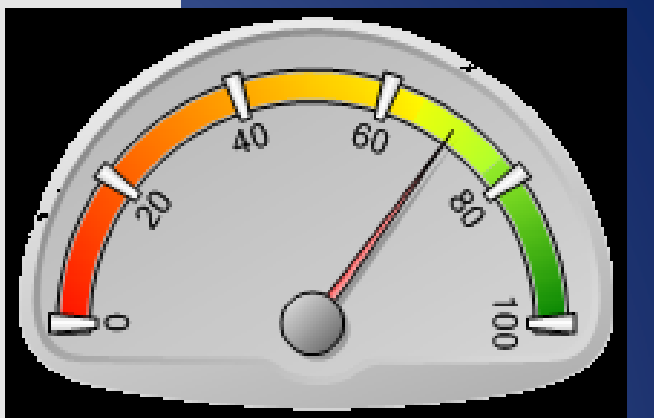
B-4: 1.5" Asph, 10" ABC, Brn Sl F Sd Si Cl to 4' w/ Rx to 26" (Moist)

B-5: 1.5" Asph, 9.5" ABC, Brn Cl Si VF Sd to 24", Brn Si V F Sd Cl to 35", White V F Sd Si to 4'

B-6: 1" Asph, 8" ABC, Or Brn Si V F Sd to 4'

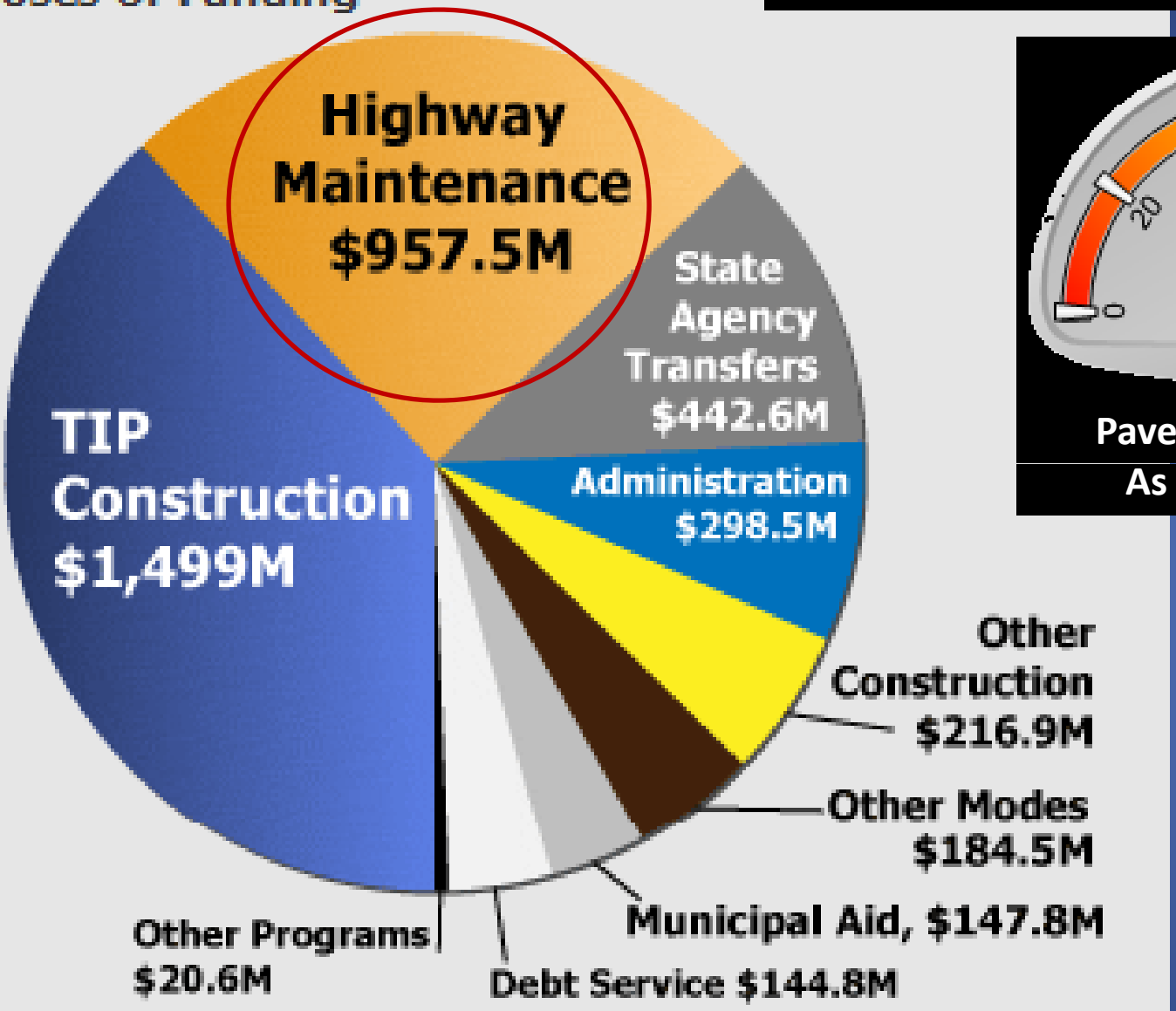
Uses of Funding

http://www.ncdot.gov/about/finance/



Pavement Health 70%

As of 10/23/2012/




Before FDR
Before FDR
After FDR
After FDR

Questions

Premix/Pulverize

Spread Cement

Mix/Blend:Dry/H_20

Compact

Grade

Pave