FULL DEPTH RECLAMATION IN CHAMBERS COUNTY
Summary of the County’s Infrastructure

Paved Road Miles: 435 Miles

Dirt Road Miles: 326 Miles

Federally Regulated Bridge Structures: 145

Caution Lights: 2

Traffic Signals: 3

Interchange Lighting: 2 Exits
UNFORTUNATELY, WE HAVE A LOT OF ROADS THAT ARE SIMILAR TO THIS....

ORIGINALLY BUILT IN THE 1950’S, ONLY MAINTENANCE HAS BEEN POT HOLE PATCHING, CLIPPING, AND MOWING
<table>
<thead>
<tr>
<th>COUNTY ROAD NUMBER</th>
<th>YEAR</th>
<th>FUNDING SOURCE</th>
<th>LENGTH, MI</th>
<th>COST</th>
<th>BASE MATERIAL</th>
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</thead>
<tbody>
<tr>
<td>1011</td>
<td>1997</td>
<td>FEDERAL</td>
<td>8.40</td>
<td>$760,729.56</td>
<td>AGGREGATE</td>
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<tr>
<td>1123</td>
<td>1998</td>
<td>FEDERAL</td>
<td>3.50</td>
<td>$431,687.61</td>
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<td>1177</td>
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<td>3.09</td>
<td>$427,022.70</td>
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<tr>
<td>1389</td>
<td>2008</td>
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<td>4.46</td>
<td>$517,622.21</td>
<td>CEMENT</td>
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<tr>
<td>1267</td>
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<td>LOCAL</td>
<td>1.78</td>
<td>$159,385.00</td>
<td>CEMENT</td>
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<tr>
<td>1022</td>
<td>2010</td>
<td>LOCAL</td>
<td>2.30</td>
<td>$201,270.00</td>
<td>CEMENT</td>
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<tr>
<td>1044 A</td>
<td>2010</td>
<td>LOCAL</td>
<td>1.52</td>
<td>$137,153.83</td>
<td>CEMENT</td>
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<tr>
<td>1044 B</td>
<td>2011</td>
<td>LOCAL</td>
<td>3.21</td>
<td>$315,724.65</td>
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<tr>
<td>1045</td>
<td>2011</td>
<td>LOCAL</td>
<td>0.52</td>
<td>$45,383.93</td>
<td>CEMENT</td>
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<tr>
<td>1519</td>
<td>2011</td>
<td>LOCAL</td>
<td>0.59</td>
<td>$76,748.50</td>
<td>CEMENT</td>
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<tr>
<td>1028</td>
<td>2011</td>
<td>FEDERAL</td>
<td>5.69</td>
<td>$663,909.87</td>
<td>CEMENT</td>
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<tr>
<td>1186</td>
<td>2013</td>
<td>FEDERAL</td>
<td>2.73</td>
<td>$527,210.64</td>
<td>CEMENT</td>
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<tr>
<td>1104</td>
<td>2013</td>
<td>FEDERAL</td>
<td>2.36</td>
<td>$325,426.04</td>
<td>CEMENT</td>
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<tr>
<td>1053</td>
<td>2014</td>
<td>FEDERAL</td>
<td>3.19</td>
<td>$445,537.11</td>
<td>CEMENT</td>
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<tr>
<td>1258</td>
<td>2014</td>
<td>FEDERAL</td>
<td>3.79</td>
<td>$475,144.49</td>
<td>CEMENT</td>
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<tr>
<td>1210</td>
<td>2015</td>
<td>FEDERAL</td>
<td>3.41</td>
<td>$611,162.99</td>
<td>CEMENT</td>
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<tr>
<td>1289/1222</td>
<td>2015</td>
<td>FEDERAL</td>
<td>8.97</td>
<td>$1,594,679.61</td>
<td>CEMENT</td>
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<tr>
<td>1222</td>
<td>2015</td>
<td>FEDERAL</td>
<td>4.21</td>
<td>$720,455.05</td>
<td>CEMENT</td>
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</tbody>
</table>

**COUNTY TOTALS:** 69.29 $9,064,985.30

**AVERAGE:** per mile $130,834.30
CEMENT STABILIZATION
Increases Rigidity/Spreads Loads

Unstabilized Granular Base

Cement-Stabilized Base

100 psi

15 psi

2"

8"

6"

4 psi
Maintains Strength During....

Moisture infiltrates base
- Through high water table
- Capillary action
- Causing softening, lower strength, and reduced modulus

Cement stabilization:
- *Reduces permeability*
- Helps keep moisture out
- Maintains high level of strength and stiffness even when saturated
MOST RECENT BID PRICES (FEDERAL PROJECTS)

Letting Date: February 2014

**Price:** $14.55/SY or $179,226.68/Mi

**Scope of Work:**
- FDR 8” Deep and 22’ Wide
- Cement Stabilization @ 42 lbs/sy
- Prime 22’ Wide
- G Treatment 21’ Wide
- 145-155 lbs/sy of ½” MASM, 21’ Wide

Letting Date: March 2015

**Price:** $12.88/SY or $158,623.23/Mi

**Scope of Work:**
- FDR 8” Deep and 22’ Wide
- Cement Stabilization @ 32 lbs/sy
- Prime 22’ Wide
- JG Treatment 21’ Wide
WHEN A CANDIDATE PROJECT IS IDENTIFIED, WHAT’S NEXT...

PRELIMINARY TESTING

ATTERBERG LIMITS – Liquid limit, Plastic limit, Plasticity Index.

SOIL CLASSIFICATION

MOST OF OUR ROADS HAVE A SANDY/TOP SOIL TYPE BASE, MAKING THEM EXCELLENT CANDIDATES FOR FDR W/ CEMENT STABILIZATION

2008/05/20
<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Well-graded gravel</th>
<th>Poorly graded gravel</th>
<th>Silty gravel</th>
<th>Clayey gravel</th>
<th>Well-graded sand*</th>
<th>Poorly graded sand</th>
<th>Silty sand</th>
<th>Clayey sand</th>
<th>Silt, Silt with sand</th>
<th>Lean clay</th>
<th>Organic silt / organic lean clay</th>
<th>Elastic silt</th>
<th>Fat clay, fat clay with sand</th>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>USCS</td>
<td>GW</td>
<td>GP</td>
<td>GM</td>
<td>GC</td>
<td>SW</td>
<td>SP</td>
<td>SM</td>
<td>SC</td>
<td>ML</td>
<td>CL</td>
<td>OL</td>
<td>MH</td>
<td>CH</td>
<td>Project / material selection, engineered mix design/emulsion, same day return to traffic, quick overlay</td>
<td>Can not handle high clay content</td>
</tr>
<tr>
<td>AASHTO</td>
<td>A-1-a</td>
<td>A-1-a</td>
<td>A-1-b</td>
<td>A-1-b</td>
<td>A-1-b or A-2-6</td>
<td>A-1-b or A-1-b</td>
<td>A-2-4 or A-2-5</td>
<td>A-2-6 or A-2-7</td>
<td>A-4 or A-5</td>
<td>A-6</td>
<td>A-4</td>
<td>A-5 or A-7-5</td>
<td>A-7-6</td>
<td>Same day return to traffic, quick overlay</td>
<td>Safety, may require cement / lime, gradation sensitive, maintain high asphalt temperature</td>
</tr>
<tr>
<td>Fortress® FDR / GBS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Quick set, high strength, compatible with many soils</td>
<td>Prime &amp; sand req’d for traffic, dust, early cracking, little overlay bonding</td>
</tr>
<tr>
<td>Portland cement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Quick set, high strength (with clay-containing soils)</td>
<td>Dust, early cracking, potential sulfate heave</td>
</tr>
<tr>
<td>Lime</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Same as lime</td>
<td>Same as lime</td>
</tr>
</tbody>
</table>

*Some projects that do not meet these material recommendations have been successfully built.
NOT EVERY FDR PROJECT IS PERFECT FOR CEMENT...

BUT CAN STILL BECOME A SUCCESSFUL PROJECT
CHALLENGES...

Client
Chambers County Commission
Attn: Josh Harvill
PO Box 650
Lafayette, AL 36862

Project
CCP 00011 County Road 519
110 12th Street North
Birmingham, AL

Project Number E1111009

Material Information
Source of Material: 11-008
Proposed Use:

Sample Information
Sample Date: 02/04/11
Sampled By: Contractor
Sample Location: County Road 519

Sample Description: Mix of sandy gravel and clay with asphalt (11-008)

Laboratory Test Data
Test Procedure:
Test Method: Method A
Sample Preparation: Wet
Rammer Type: Mechanical
Maximum Dry Unit Weight (pcf): 120.9
Optimum Water Content (%): 12.4

<table>
<thead>
<tr>
<th>Liquid Limit</th>
<th>33</th>
<th>Specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plastic Limit</td>
<td>21</td>
<td></td>
</tr>
<tr>
<td>Plasticity Index</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>In-Place Moisture (%)</td>
<td></td>
<td></td>
</tr>
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</table>

USCS: CL

Zero Air Voids Curve for Assumed Specific Gravity 2.70

Water Content (%)
Soil-Cement Base Study
Chambers County Road 519
Gallet Project No. E1111009

\[ y = 47.35 + 36.83x \]
**CR 519 (Allan Hollis Subdivision)**

**Width**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing (Ft)</td>
<td>20</td>
</tr>
<tr>
<td>Proposed Pavement (FT)</td>
<td>21</td>
</tr>
<tr>
<td>FDR (Ft)</td>
<td>22</td>
</tr>
<tr>
<td>LENGTH (FT)</td>
<td>3128</td>
</tr>
<tr>
<td>LENGTH (MI)</td>
<td>0.59</td>
</tr>
<tr>
<td>Cul-D-Sac (SF)</td>
<td>4418</td>
</tr>
</tbody>
</table>

**BUILDUP** | **DESCRIPTION** | **QUANTITY** | **UNIT COST** | **COST**
---|------------------|--------------|---------------|---------------|
Limestone Crusher Run | 3” Depth, 22 Ft Wide, County Hauled | 1153 | $9.00 | $10,380.92 |
FDR | 22 feet wide & 8 inches deep | 8544 | $1.33 | $11,363.48 |
Cement | 35 lb/sy | 150 | $87.50 | $13,082.95 |
Prime & Sand | 22 feet | 8544 | $0.900 | $7,689.57 |
JG Treatment | 21 feet | 8179 | $3.240 | $26,500.07 |
STRIFFING & MARKINGS | Thermo CL with Stop Bars | 0.592 | $7,500.00 | $4,443.18 |
Asphalt Index (Prime & JG) | Plus $0.30 Per Gallon of Liquid | 8099 | $0.31 | $2,510.81 |

**FUND:**

**3-MIL or Public Bldg/Rd/Brdg**

**TOTAL COST (JG Treatment):** $75,970.97

**County’s 2010 Grade:** 51
CHALLENGES...

GRADATION?
WHAT HAVE WE LEARNED?

- An experienced motor grader operator is essential for this process. Inspectors should constantly check the roadway with a **16 foot straight edge** during construction to ensure that a smooth road surface is achieved.

- **The graded surface should be primed as soon as possible.** And, the final surface should also be placed as soon as possible. If the roadway is left “unprotected” for extended periods of time, the ride quality will go down.

- **Water and Cement introduction to the mix should be carefully monitored.** Too much or too little could be detrimental to the final product.

- Always sample your soil to ensure you are applying the correct amount of cement (or any other stabilization agent) and water.

- ALDOT has a Special Provision that thoroughly covers this operation.
KEYS TO A QUALITY PROJECT

(d) QUALITY CONTROL.

The Contractor shall provide and maintain a quality control system to provide assurance that the full depth reclamation is constructed in accordance with the contract requirements.

The Contractor shall submit six copies of a “Quality Control Plan for Full Depth Reclamation” to the Engineer for review prior to the preconstruction conference. This plan shall include:

- procedure, equipment, and frequency proposed for monitoring the amount of cement placement;
- procedure, equipment, and frequency proposed for monitoring the material characteristics of the reclaimed material;
- procedure, equipment, and frequency proposed for monitoring the amount of water, and depth of pulverization of the reclaimed material during mixing;
- procedure, equipment and frequency for monitoring the reclaimed material moisture requirements during production;
- procedure, equipment and frequency for monitoring the density and moisture content of the full depth reclamation in-place;
- any other information requested by the Engineer.

The Contractor shall present weekly documentation to the Engineer that the work is being monitored in accordance with the requirements given in the quality control plan.

The Engineer will not approve the Contractor’s “Quality Control Plan for Full Depth Reclamation” but will review it to determine if the information in the plan is complete. An incomplete plan will be returned to the Contractor for completion. Construction shall not begin until the Engineer returns one copy of the plan to the Contractor and informs the Contractor in writing that no further information will be required. The Engineer will stop the production if the Contractor does not perform the work in compliance with the plan.
KEYS TO A QUALITY PROJECT

(a) OFFSET REFERENCE FOR THE ESTABLISHMENT OF THE ROADWAY ALIGNMENT.
The Contractor shall establish offset reference points before beginning of construction so that the original alignment of the roadway (centerlines, edges of pavement, etc.) will be restored during construction.

(f) LENGTH OF ROADBED ALLOWED TO BE PROCESSED.
Except by written permission of the Engineer, the length of roadbed pulverized at any time shall not exceed the length that can be completely pulverized, mixed and compacted in the same working day.

(g) INITIAL PULVERIZING AND MIXING.
The width and depth of the required pulverizing and mixing will be shown on the plans. The depth of pulverizing shall be controlled to insure that the finished thickness will be within the required tolerance limits.
The pulverizing and mixing shall break up the existing roadbed to the extent that 100% by weight passes a 3 inch sieve, a minimum of 95% passes a 2 inch sieve and a minimum of 50% passes the No. 4 sieve. The moisture content shall be maintained within +/- 2% of the theoretical optimum moisture content unless approved otherwise by the Engineer.
The Engineer will check the gradation at least once for each 2000 linear feet or fraction thereof of each lane. Preliminary pulverization and mixing of the roadbed materials will be allowed prior to final pulverization and mixing of the roadbed materials and cement to ensure uniformity of the mixture. The Engineer will monitor the pulverization in accordance with BMT-80, “Rate of Spread and Pulverization of Cement Stabilized Soil”.
KEYS TO A QUALITY PROJECT

When the uncompacted mixture is made too wet by the addition of too much water, or by rain, and the moisture content exceeds the specified tolerance for compaction, the entire affected section shall be reconstructed at the Contractor’s expense.
4. SURFACE FINISH.

The Contractor shall be responsible for roadbed grade controls. The finished surface shall not vary more than 1/4 of an inch from a 16 foot straightedge placed anywhere on the surface parallel to the centerline of the roadbed.

The cross slope shall not vary by more than 0.50% from the required slope as shown on the plans. (If, for example a 2.0% cross slope is required, the measured slope shall not be greater than 2.5% or less than 1.5%.)

The surface finish shall be checked at intervals not to exceed 100 feet along the roadway. High spots in the finished surface may be corrected by motor grader or planer without additional compensation, provided the resulting thickness is within the allowable tolerances.
KEYS TO A QUALITY PROJECT

After the mixture has been compacted, the surface shall be shaped to the required lines, grades, and cross sections and within the required tolerances. During the shaping, light scarifying may be necessary to prevent the formation of compaction planes. Broom dragging or clipping of the surface may be required as a part of the process of shaping the surface during compaction. The surface material shall be maintained at the specified moisture content during finishing operations. At the end of the work day, the surface shall be covered to prevent drying.

(k) TESTING, TOLERANCE, AND DEFICIENCY CORRECTION.

1. GENERAL.

Areas of the full depth reclamation that are not within the required tolerances of thickness, density, and surface finish shall be reconstructed as directed by the Engineer without additional compensation. The amount of cement required for reconstruction will be in accordance with the approved Job Mix Design.
MAINTENANCE
QUESTIONS

JOSH HARVILL
CHAMBERS COUNTY ENGINEER
josh.harvill@chamberscountyal.gov
334-864-4377