ROLLER COMPACTED CONCRETE
Tuesday, March 25, 2008
94th Annual Purdue Road School
www.purdue.edu/jtrp · Purdue University

WHAT WE WILL DISCUSS
• Background of RCC
• What about local use?
• Ready Mixed Roller Compacted Concrete
• Questions

RCC BACKGROUND

Definition
“Roller-Compacted Concrete (RCC) is a no-slump concrete that is compacted by vibratory rollers.”

• Zero slump (consistency of DGA)
• No forms
• No reinforcing steel
• No finishing
• Consolidated with vibratory rollers

Concrete pavement placed in a different way!

Benefits of RCCP
• Economical
• High load carrying ability
• Eliminates rutting and spans weak subgrades
• Excellent freeze-thaw durability
• Simple, fast construction
• High production with minimum labor
• Light surface for better night time visibility

Intermodal Yards
Logging Yards

Distribution Centers
18 acre distribution center in Austin, TX
10 years after construction

Warehouse Facilities

Big Jobs…
• We know we can do big jobs
  – Pug Mill
  – High Density Asphalt Paver
• What about smaller jobs
  – Conventional paver
  – Ready Mix Plant

YOU HAVE GOT TO TRY…

UNION COUNTY
Clifton Rd
**Union County**

- Wanda Hartman & Southeast Cement Association RCC Seminar
- She believed it could be done with local equipment
- Teamed with IMI & Union County Crews

**Union County**

- Project was completed quickly.
- We did not have a proctor
- We did make some cylinders
- Wanda calls it “Black Cold Patch”

---

**Useful Information… But?**

Can we obtain enough compaction through a conventional county owned asphalt paver and roller?

**HENRY COUNTY**

- Chad Hayes of Busters Cement
- Joe Wiley Henry County Highway Administrator

**HENRY COUNTY**

- Perform a test pour at Buster’s landfill access road
- Do a full scale analysis of the system
Steps

- Buster’s determined their RCC mix design (confidential)
- Buster’s had engineering firm run a proctor on the mix design
- RCC batched into ready mix trucks and placed into county dump truck for transportation
- RCC placed with Henry County equipment
- Density tested via nuclear gauge

RCC Mix Design

- Buster’s proprietary design
- Cement
- Flyash
- Aggregates from readily available sources
- Nothing “special” or readily available from any ready mix producer
- No batch water

Proctor

Batching

- Buster’s older plant in New Castle
- Placed into ready mix truck
- Transported into Dump trucks

READY MIX TO DUMP TRUCK
DUMP TRUCK TO JOBSITE

CHECK DEPTH OUT OF THE PAVER

CALIBRATED TO PROCTOR

DENSITY OUT OF PAVER

ROLL WITHOUT AND WITH VIBRATOR ON
### DENSITY AFTER ROLLING

<table>
<thead>
<tr>
<th>Lift (in)</th>
<th>Wet Density (pcf)</th>
<th>Dry Density (pcf)</th>
<th>Moisture (%)</th>
<th>Proctor (%)</th>
<th>Roller (y/n)</th>
<th># Passes w/o Vibrator</th>
<th># Passes w/ Vibrator</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>144.9</td>
<td>136.5</td>
<td>6.2</td>
<td>92</td>
<td>Yes</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>148.8</td>
<td>138.8</td>
<td>7.3</td>
<td>94</td>
<td>Yes</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>147.4</td>
<td>137.8</td>
<td>7</td>
<td>Yes</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>8</td>
<td>161.9</td>
<td>151.3</td>
<td>7</td>
<td>102</td>
<td>Yes</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

* Tested at joint

### First Run

<table>
<thead>
<tr>
<th>Lift (in)</th>
<th>Wet Density (pcf)</th>
<th>Dry Density (pcf)</th>
<th>Moisture (%)</th>
<th>Proctor (%)</th>
<th>Roller (y/n)</th>
<th># Passes w/o Vibrator</th>
<th># Passes w/ Vibrator</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>117.8</td>
<td>109.7</td>
<td>7.4</td>
<td>74</td>
<td>No</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>116.1</td>
<td>109.4</td>
<td>6.2</td>
<td>74</td>
<td>No</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>144.9</td>
<td>136.5</td>
<td>6.2</td>
<td>92</td>
<td>Yes</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>148.8</td>
<td>138.8</td>
<td>7.3</td>
<td>94</td>
<td>Yes</td>
<td>2</td>
<td>0</td>
</tr>
</tbody>
</table>

### Second Run

<table>
<thead>
<tr>
<th>Lift (in)</th>
<th>Wet Density (pcf)</th>
<th>Dry Density (pcf)</th>
<th>Moisture (%)</th>
<th>Proctor (%)</th>
<th>Roller (y/n)</th>
<th># Passes w/o Vibrator</th>
<th># Passes w/ Vibrator</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>118.7</td>
<td>111.9</td>
<td>6</td>
<td>76</td>
<td>No</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>9</td>
<td>114.4</td>
<td>108.6</td>
<td>5.3</td>
<td>73</td>
<td>No</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>6</td>
<td>143.1</td>
<td>135.2</td>
<td>5.8</td>
<td>91</td>
<td>Yes</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>138.9</td>
<td>131.6</td>
<td>5.5</td>
<td>89</td>
<td>Yes</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>147.3</td>
<td>138.9</td>
<td>6</td>
<td>94</td>
<td>Yes</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>6</td>
<td>153.2</td>
<td>145.2</td>
<td>5.5</td>
<td>98</td>
<td>Yes</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>

### Made Cylinders for Compressive Split Tensile Comparison

### COMPRESSIVE STRENGTH

### SPLIT TENNSILE
**SPLIT TENSILE**

**GOOD RESULTS**

**Testing Data**

(96 day; 56 day; 28 day room)

<table>
<thead>
<tr>
<th></th>
<th>Compressive Load (lbs)</th>
<th>Stress (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1</td>
<td>251,500</td>
<td>8,900</td>
</tr>
<tr>
<td>Sample 2</td>
<td>231,380</td>
<td>8,180</td>
</tr>
<tr>
<td>Average</td>
<td>241,440</td>
<td>8,540</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Split Tensile Load (lbs)</th>
<th>Stress (psi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample 1</td>
<td>86,620</td>
<td>765</td>
</tr>
<tr>
<td>Sample 2</td>
<td>90,125</td>
<td>790</td>
</tr>
<tr>
<td>Average</td>
<td>88,373</td>
<td>778</td>
</tr>
</tbody>
</table>

**CONCLUSIONS**

1. Ready Mix Plants can produce quality roller compacted concrete
2. County highway asphalt pavers & rollers can provide enough energy to obtain 98% of the modified proctor
3. Split Tensile = 8.4 *√Compressive
4. This is a viable market

**QUESTIONS?**