ROLLER COMPACTED CONCRETE

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88th Annual Transportation Short Course
Materials II – Roller Compacted Concrete
Roller compacted concrete pavement is...

**Like conventional concrete pavement**
- Same basic ingredients
- Similar mechanical properties
- Curing is critical!

**Like asphalt pavement**
- Similar aggregategradation
- Similar placement and compaction

**RCC Pavement**
- Stiffer than zero-slump concrete
- Plant mixed and transported in dump trucks
- Placed with an asphalt type paver
- Rolled to compaction
- Cured with water or compound
### Differences between conventional concrete and RCC

#### Material Proportions (% by weight)

<table>
<thead>
<tr>
<th>Material</th>
<th>Conventional Concrete</th>
<th>RCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>~7%</td>
<td>~5%</td>
</tr>
<tr>
<td>Cement</td>
<td>~15%</td>
<td>~12%</td>
</tr>
<tr>
<td>Fine Aggregate</td>
<td>~30%</td>
<td>~45</td>
</tr>
<tr>
<td>Coarse Aggregate</td>
<td>~50%</td>
<td>~35%</td>
</tr>
</tbody>
</table>

#### Workability, Paving, and Consolidation

- Conventional concrete for slip-form paving is:
  - Plastic and flowable
  - But stiff enough to maintain shape
  - Consolidated with internal and surface vibrators
  - Completed in one pass
- Roller compacted concrete:
  - Has the consistency of damp dirt
  - Is very stiff but fluid enough to distribute paste under vibratory rollers
  - Is laid in multiple lifts when total pavement thickness is greater than ~10 in.

#### Reinforcement

- Conventional concrete pavement:
  - Always has some kind of reinforcement
- RCC pavement:
  - NONE

#### Finishing

- Conventional concrete pavement:
  - Tining
  - Carpet drag
- Roller compacted concrete pavement:
  - No finishing
  - Rolled surface is the riding surface
Advantages of RCC Pavements

- Durability benefit of concrete
- Faster construction
- (Potential) cost savings
- Higher solar reflectance
Where can you use RCC?

- Large open areas for easy construction
  - Ports
  - Industrial facilities
  - Parking lots
  - Equipment storage

Example: The Port of Houston
- 3 different pavement designs
  - Thickness ranged from 14”-18”
- Port estimates RCC shortened construction by 4 months
- 7-day compressive: 4400 psi
- 7-day flexural: 570 psi
Where can you use RCC?

- **Slow(er) speed traffic**
  - Arterial and local streets
  - Shoulders

- **Example: San Angelo, TX**
  - Re-constructed a number of streets with RCC pavement
  - Diamond ground surface for smoothness

- **Example: Georgia DOT**
  - I-285 shoulder replacement
  - 6”-8” thickness
  - Rumble strips ground in to RCC
Pugmill or Central rotary drum mixer

Asphalt type paver
  - Capable of attaining 90% compaction

Testing
  - Density measured by Tex-451-A
  - Compressive strength cylinders (ASTM C 1435)

Two standard combined aggregate gradations

Mixture proportioning is a little different

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**Table 1**

<table>
<thead>
<tr>
<th>Sieve Size</th>
<th>RCC Surface Course - Percent Passing by Weight</th>
<th>RCC Base/Subbase Course - Percent Passing by Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 inch</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>¾ inch</td>
<td>100</td>
<td>90-100</td>
</tr>
<tr>
<td>½ inch</td>
<td>70-90</td>
<td>70-90</td>
</tr>
<tr>
<td>3/8 inch</td>
<td>60-85</td>
<td>60-85</td>
</tr>
<tr>
<td>#4</td>
<td>40-60</td>
<td>40-60</td>
</tr>
<tr>
<td>#16</td>
<td>20-40</td>
<td>20-40</td>
</tr>
<tr>
<td>#100</td>
<td>6-18</td>
<td>0-10</td>
</tr>
<tr>
<td>#200</td>
<td>2-8</td>
<td>--</td>
</tr>
</tbody>
</table>

allowed. Limit recycled crushed concrete fine aggregate to a maximum of 20% of the fine aggregate.

1-14

3258
08-12
TxDOT’s first RCC project started earlier this year

- IH-20 Safety Rest Area in Eastland Co.
  - 12” RCC on cement stabilized base
  - Parking lot and ramps
**Construction of Roller-Compacted Concrete Pavement in the Fayetteville Shale Play Area, Arkansas**

Stacy G. Williams

In 2012, roller-compacted concrete (RCC) pavement was used to rehabilitate a 1-mile section of roadway in the Fayetteville Shale Play Area (FSPA), Arkansas, to the most recent heavy-duty truck traffic related to natural gas exploration efforts in the region. However, experience with significant pavement distress and atypical maintenance activities suggested that RCC pavement was selected as a potential solution to repeat failure problems in this area because RCC pavement could be constructed more quickly than conventional cement concrete. Rehabilitation of the selected roadway sections was completed in a manner that minimizes the impact of RCC pavement on surrounding natural areas. The first step was to spread a coarse noncohesive base course, followed by a second course of 2 in., finished as a 1-in. overlay. The RCC overlay contained a central, maximum aggregate size of 7 in., and was designed to meet a minimum, 20-day compressive strength of 1,000 psi. Although some difficulties were encountered during the construction, the RCC overlay met all specified requirements. The intent of the overlay was to provide an additional layer of strength to the pavement in order to sustain the imposed loads of heavy truck traffic. The overlay was constructed using a combination of the strength and fatigue properties of RCC, which are oriented toward high-strength concrete requirements.

**BACKGROUND**

A number of states have reported successful use of RCC pavements. Recently, RCC has been used for sections of State Route 519 in Tennessee, for the 2012 Olympic Games in London, England, and for the 2014 Winter Olympics in Sochi, Russia. In 2012, the U.S. Department of Transportation’s Transportation Research Board (TRB) sponsored a series of field observations related to the project. These observations included the use of RCC in various applications, including roads, luxurious, and heavy-duty truck traffic. The construction and maintenance of RCC pavements were conducted in a manner that allows for efficient and sustainable management of the existing roadway infrastructure.

**Why isn’t RCC everywhere?**

- **Currently available RCC design guides and software are not applicable for our projected volumes or speeds.**

- **How will RCC pavements hold up under heavy truck traffic at relatively high speeds?**
Summary

- RCC pavement:
  - Provides the long-term durability of conventional concrete
  - Can be constructed relatively fast

- Successful and proven applications include:
  - Heavy industrial areas
  - Arterial streets
  - Local streets
  - Shoulders

- TxDOT has a Special Spec for RCC pavements

- Need more RCC data for heavy, repetitive loads
QUESTIONS?

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