Part II Update: Overlay Design and Construction
OVERVIEW

- What Is SCAPA?
- Part 1: Pavement Design Guide
- Part 2: Overlay Design
- Wrap Up/Moving Forward
Show of hands:
Have You Heard of SCAPA?
What is SCAPA?

- The South Carolina Asphalt Pavement Association
- Its membership is comprised of asphalt pavement producers and companies affiliated with the asphalt pavement industry in South Carolina.
- 50 Years Old!
For your Next Paving Project, Contact One of These
QUALIFIED CONTRACTORS & SCAPA MEMBERS

Ashmore Bros., Inc.
P.O. Box 529
Greer, SC 29652
864-879-7311
www.ashmorebros.com

Banks Construction Company
4902 Banco Rd.
Charleston, SC 29415
843-744-8261
www.banksconstruction.com

CR Jackson, Inc.
100 Independence Blvd.
Columbia, SC 29202
803-750-6070
www.cri.jackson.com

Granite Contracting, LLC
18606 Northline Dr.
Cornelius, NC 28031
704-892-0341
www.GraniteContracting.com

King Asphalt, Inc.
2127 Greenville Hwy.
P.O. Box 179
Liberty, SC 29657
864-855-0338
www.kingaspaltinc.com

Lane Construction Corp.
P.O. Box 3846
3176 Charleston Hwy
West Columbia, SC 29171
803-791-1295

Palmetto Corp.
3873 Hwy. 701 North
P.O. Box 346
Conway, SC 29526
843-365-2156
www.palmettocorp.net

Preferred Materials, Inc.
Asphalt Division
47 Telfair Place
Savannah, GA 31402
912-443-3400
www.preferredmaterials.com

Sandrs Brothers Construction Company
1990 Harley St.
P.O. Box 60969
North Charleston, SC 29406
843-744-4261
www.sandersbrothers.com

Satterfield Construction Company, Inc.
2111 Laurens Highway
P.O. Box 279
Greenwood, SC 29648
864-223-8601
www.satterfieldconstruction.org

Sloan Construction,
a division of Reeves Construction Company
250 Plemons Rd.
Duncan, SC 29334
864-416-0200
www.Sloan-Construction.com

Please refer to the SCAPA website
(www.scasphalt.org)
to find a plant location near you.

South Carolina Asphalt Pavement Association
Office Location: 1331 Elmwood Ave. Suite 160 • Columbia, SC, 29201
Mailing Address: P.O. Box 11448 • Columbia, SC 29211
www.scasphalt.org • 803-252-2522
FOCUS ON EDUCATION

- Asphalt Pavement Design Guide for Low Volumes and Parking Lots (released in 2014)
- Hired Technical Director
- Lunch and Learns
- Curriculum
  - Road Rehab Strategies
  - Asphalt Topics

The Asphalt Resource For South Carolina!
SCAPA Asphalt Pavement Design Guide
Asphalt Pavement Alliance Publications
SCDOT/SCAPA Best Practices Documents
SC Asphalt Index
PaveXpress
Conference Materials & Presentations
Paving The Way:
SCAPA’s E-Newsletter

- News and Events
- Industry News
- Asphalt Resources
  - NCAT Reports
  - NAPA Publications
- Calendar of Events
- Asphalt Facts
SCAPA SOCIAL MEDIA

- Facebook, Twitter, LinkedIn
- Articles, Reports, Industry News, Construction Pictures
SAVE THE DATE – WEDNESDAY, APRIL 13TH

- PaveXpress Seminar
- Sandhill REC Lakehouse, Columbia, SC
- George White, Pavia Systems

http://www.scltap.org/event/pavexpress-seminar/
ASPHALT PAVEMENT DESIGN GUIDE
FOR LOW-VOLUME ROADS AND PARKING LOTS

“Together we know more”
A resource…here to help
www.scasphalt.org
DESIGN GUIDE SEMINARS

- Columbia
- Greenville
- Rock Hill
- Charleston
- Myrtle Beach
- Florence
PART 1 OBJECTIVES

By the end of this phase, you should be able to:

– Explain how an asphalt pavement behaves.

– Identify and interpret the inputs needed for asphalt pavement design.

– Differentiate between different materials used in asphalt pavement design.

– Design an asphalt pavement structure and select the appropriate materials.

– Explain how asphalt pavements are constructed.
Asphalt Pavement Loading

Contact Stress ($\sigma_o$) = Tire Pressure

$\sigma_i$ = Stress at Subgrade
DESIGN CONSIDERATIONS

- Traffic
- Subgrade
- Drainage
**Design Considerations [Traffic]**

<table>
<thead>
<tr>
<th>Class 1</th>
<th>Class 2</th>
<th>Class 3</th>
<th>Class 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>(≤ 50 cars/day)</td>
<td>(≤ 5 trucks/day)</td>
<td>(≤ 65 trucks/day)</td>
<td>(≤ 200 trucks/day)</td>
</tr>
<tr>
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</tr>
<tr>
<td>Seasonal recreation roads</td>
<td></td>
<td></td>
<td>Major service drives or entrances</td>
</tr>
</tbody>
</table>
Any structure is only as good as the foundation upon which it is built.
### DESIGN CONSIDERATIONS [Subgrade]

<table>
<thead>
<tr>
<th>Poor</th>
<th>Medium</th>
<th>Good</th>
</tr>
</thead>
</table>
| - Become soft and plastic when wet.  
- Clays and fine silts  
  - ≥ 50% passing No. 200  
- Coarse silts and sandy loams  
  - Deep frost penetration  
  - High water table  
  | - Retain a moderate degree of firmness under adverse moisture conditions.  
- Loams, silty sands, and sandy-gravels containing moderate amounts of clays and fine silts.  
| - Retain a substantial amount of their load-supporting capacity when wet.  
- Clean sands, sand-gravels, and those free of detrimental amounts of plastic fines.  
  - ≤ 10% passing No. 200  
- Relatively unaffected by moisture or frost.  
| - Typical Properties  
  CBR: 6 – 9  
  LL: 25 – 40  
  PI: 6 – 10  
  GI: 2 – 4  
| - Typical Properties  
  CBR < 6  
  LL > 40  
  PI > 10  
  GI > 4  
| - Typical Properties  
  CBR ≥ 10  
  LL < 25  
  PI < 6  
  GI < 2 |
DESIGN CONSIDERATIONS [DRAINAGE]

- Three keys to pavement design:
  - DRAINAGE, DRAINAGE, DRAINAGE

- Surface drainage
  - Safety
  - Prevent water from entering pavement surface

- Subsurface drainage
  - Areas with high water table
  - Areas where water accumulates in low areas
Drainage, Drainage, Drainage

OK, it was a broken water main, but still a water issue.
### Asphalt Surface Course

<table>
<thead>
<tr>
<th>Gradation (% passing)</th>
<th>SCDOT Surface Type B</th>
<th>SCDOT Surface Type C</th>
<th>SCDOT Surface Type D</th>
<th>SCDOT Surface Type E</th>
</tr>
</thead>
<tbody>
<tr>
<td>¾ in</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>—</td>
</tr>
<tr>
<td>½ in</td>
<td>97 - 100</td>
<td>97 - 100</td>
<td>97 - 100</td>
<td>—</td>
</tr>
<tr>
<td>⅜ in</td>
<td>76 - 100</td>
<td>83 - 100</td>
<td>90 - 100</td>
<td>100</td>
</tr>
<tr>
<td>No. 4</td>
<td>52 - 75</td>
<td>58 - 80</td>
<td>70 - 95</td>
<td>90 - 100</td>
</tr>
<tr>
<td>No. 8</td>
<td>36 - 56</td>
<td>42 - 62</td>
<td>50 - 82</td>
<td>70 - 100</td>
</tr>
<tr>
<td>No. 30</td>
<td>16 - 36</td>
<td>20 - 40</td>
<td>20 - 50</td>
<td>36 - 70</td>
</tr>
<tr>
<td>No. 100</td>
<td>5 - 18</td>
<td>5 - 20</td>
<td>6 - 20</td>
<td>4 - 28</td>
</tr>
<tr>
<td>No. 200</td>
<td>2 - 8</td>
<td>2 - 9</td>
<td>2 - 10</td>
<td>2 - 10</td>
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<table>
<thead>
<tr>
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<th>SCDOT Surface Type B</th>
<th>SCDOT Surface Type C</th>
<th>SCDOT Surface Type D</th>
<th>SCDOT Surface Type E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade</td>
<td>PG 64-22</td>
<td>PG 64-22</td>
<td>PG 64-22</td>
<td>PG 64-22</td>
</tr>
<tr>
<td>Content</td>
<td>4.8 - 6.0%</td>
<td>5.0 - 6.8%</td>
<td>5.0 - 6.8%</td>
<td>6.0 - 7.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>RAP Content (% aged binder)</th>
<th>SCDOT Surface Type B</th>
<th>SCDOT Surface Type C</th>
<th>SCDOT Surface Type D</th>
<th>SCDOT Surface Type E</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 25%</td>
<td></td>
<td></td>
<td>0 - 30%</td>
<td>0 - 30%</td>
</tr>
</tbody>
</table>

| Single Lift Thickness    | Minimum: 2 in        | Minimum: 1½ in       | Minimum: 1 in        | Minimum: ½ in        |
|                          | Maximum: 2½ in       | Maximum: 2½ in       | Maximum: 1½ in       | Maximum: 1 in        |

**Recommended for Traffic Class**
- Minimum: 2 in
- Maximum: 2½ in

1. 4
2. 1, 2, 3, & 4
3. 1 & 2
4. 1, 2, & Preventive Maintenance
Pavement Materials

- Asphalt Surface Course

<table>
<thead>
<tr>
<th>Single Lift Thickness, in.</th>
<th>Traffic Classes 1 &amp; 2</th>
<th>Traffic Classes 1, 2, 3, &amp; 4</th>
<th>Traffic Class 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>0.5</td>
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<td></td>
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<tr>
<td>1.0</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

Surface Mix Type

- E
- D
- C
- B
Pavement Materials

- Asphalt Surface Course

Surface Type D  Surface Type C  Surface Type B

Finer  Coarser
THICKNESS DESIGN

- We need to know:
  - Traffic Class
  - Subgrade Quality

- Asphalt or aggregate base?
SAMPLE DESIGN CHART [MEDIUM SUBGRADE]
Equivalence
– 1 in. of Asphalt Base ≈ 2–3 in. of Aggregate Base
THICKNESS DESIGN

Figure 4-2: Recommended asphalt pavement thickness design options for different traffic classes on a Poor Subgrade.
Poor Subgrade

Traffic Class 1

Surface C
1 1/2 in
Subgrade

Surface C
1 1/2 in
Int. C
6 in

Notation
Surface C: Type C Asphalt Surface Course
Surface B: Type B Asphalt Surface Course
Int. C: Type C Asphalt Intermediate Course
Base B: Type B Asphalt Base Course
GAB: Graded Aggregate Base Course

Traffic Class 2

Surface C
2 in
Int. C
2 in

Surface C
2 in
Int. C
2 in

Traffic Class 4

Surface C/B
2 in
Int. C
2 in
Base B
3 1/2 in

Surface C/B
2 in
Int. C
2 in
Base B
3 in

Surface C/B
2 in
Int. C
2 in
Base B
3 in

Surface C/B
2 in
Int. C
2 in
Base B
3 in

Surface C/B
2 in
Int. C
2 in
Base B
3 in

Surface C/B
2 in
Int. C
2 in
Base B
3 in

Surface C/B
2 in
Int. C
2 in
Base B
3 in

Surface C/B
2 in
Int. C
2 in
Base B
3 in

GAB: Graded Aggregate Base Course
Subgrade
Asphalt Placement
Asphalt Compaction
Fix SC Roads — Contact your senator!
Users should know how to:

- Design a new pavement structure (from Part I).
- Evaluate pavement condition & existing structure.
- Determine why the overlay is needed.
- Determine the thickness of an asphalt overlay.
- Explain how asphalt overlays are constructed.
Section 1

**Asphalt Overlay Design Overview**
Contents of the Overlay Guide

- Introduction
- Design Considerations
- Pavement Evaluation
- Overlay Design
- Overlay Construction
- References
Typical Asphalt Pavement Section

Asphalt Base Course (Full-Depth Asphalt)

Aggregate Base Course

Asphalt Surface Course

Asphalt Intermediate Course

Asphalt Base Course

Aggregate Base Course

Subgrade
DESIGN CONSIDERATIONS

Section 2

DESIGN CONSIDERATIONS

When designing roadways, there are many factors that need to be taken into account to ensure the safety and efficiency of the roadway for all users. This includes considerations such as traffic volume, roadway geometry, and materials.

Traffic Volume

Traffic volume is an important factor in the design of a roadway. Higher traffic volumes require wider lanes and additional shoulders to accommodate the increased volume of vehicles. The volume of traffic also affects the frequency of maintenance and the need for additional capacity in the future. It is important to consider the projected traffic volumes in the design of a roadway to ensure that it can meet the needs of the community for years to come.

Roadway Geometry

The geometry of a roadway plays a significant role in its safety and efficiency. Curves, grades, and slopes must be designed to accommodate the speed and volume of traffic while minimizing the risk of accidents. The design of a roadway should also take into account the terrain and现有的 infrastructure. The length and severity of ramps must be considered to ensure that they are safe for both drivers and pedestrians.

Materials

The materials used in the construction of a roadway are also important considerations. The choice of materials can affect the durability, maintenance, and cost of the roadway. Asphalt, concrete, and gravel are common materials used in roadway construction. Each material has its own advantages and disadvantages, and the choice of material should be based on the specific needs of the roadway.

Asphalt.

SOUTH CAROLINA RIDES ON US
# Design Considerations [Traffic]

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| ▪ Coarse silts and sandy loams – Deep frost penetration – High water table | ▪ Typical Properties CBR: 6 – 9 
LL: 25 – 40 
PI: 6 – 10 
GI: 2 – 4 | ▪ Relatively unaffected by moisture or frost.                                                         |

**Typical Properties**

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<td>CBR &lt; 6</td>
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<tr>
<td>LL &gt; 40</td>
</tr>
<tr>
<td>PI &gt; 10</td>
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<td>GI &gt; 4</td>
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<td>CBR ≥ 10</td>
</tr>
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</tr>
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</tr>
<tr>
<td>GI &lt; 2</td>
</tr>
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</table>
Section 3

**EXISTING PAVEMENT CONDITION**
EXISTING PAVEMENT EVALUATION

- Condition assessment
  - Visual evaluation
  - Distress type, density, severity
  - Good, fair, or poor condition
  - Depth of cracking

- Pavement Evaluation Guide
  - Field manual
  - Reference photos
Existing Pavement Evaluation

- Existing Pavement Structure
  - Need to know the existing pavement structure
  - Take cores or refer to construction history
  - How deep are the cracks & are they top-down or full-depth?
Section 4

OVERLAY DESIGN
OVERLAY THICKNESS DESIGN

- We need to know:
  - Traffic (Class 1, 2, 3, 4)
  - Subgrade quality (Good, Medium, Poor)
  - Existing pavement structure
  - Condition of existing pavement structure
    - Good (Preservation)
    - Fair (Rehabilitation)
    - Poor
OVERLAY THICKNESS DESIGN

- **Preservation**
  - Thinlay
  - SCDOT Surface Type E

- **Rehabilitation and/or additional traffic**
  - Overlay
  - SCDOT Surface Type C or D
Overlay thickness based on:

- Effective structural value of existing pavement
  - Based on existing pavement layers & subgrade
  - Mill or not to mill?
  - Adjusted based on pavement condition

- Required structural value
  - Based on traffic

- Overlay Thickness Need = Required – Effective
Section 5

Asphalt Overlay Construction
Will milling be done?

Tend to distresses
- Leveling course to fill ruts
- Crack seal
- Full depth patching & subgrade repair where needed

Surface preparation & tack coat

Proper placement & compaction practices
Wrap-up
Wrap-Up

- Design Considerations
- Existing Pavement Condition
- Overlay Thickness Design
- Asphalt Overlay Construction
THANK YOU!
THANK YOU!