WHAT TO LOOK FOR IN URBAN PAVING?

Iowa Concrete Paving Association
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Urban PCC Paving

• Staging
• Utilities
• Sidewalk ramps
• Delivery & placement
• Jointing
Staging

Challenges

• Lack of space
• Property owner access

How to Address?

• Engineer: Establish staging criteria

• Contractor: Figure out how to meet criteria

Engineer may discuss staging with contractor during design
Staging
Staging
Staging

Options for Access
Place rock
Temporary road

Emergency services access
Utilities

Challenges
- Timing
- Proper depths for subgrade prep

How to Address?
- Survey
- Proper identification during design
- Involve private utility companies early on
Utilities

Boxouts for Utility Access

Standard Detail PV-103
Utilities

Boxouts for Utility Access

Standard Detail PV-103
Utilities
Utilities

• Intake boxout SW-514
Sidewalk Ramps

Challenges

• Gutter needs to be flat but needs to drain

• Crosswalk cross slope

• Excessive slopes
Sidewalk Ramps

How to Address?

- Design Manual 12A-2
- Ramp beyond the turning space
Sidewalk Ramps

How to Address?

• Design Manual 12A-2

• Optional layouts
  ➢ Parallel ramp
  ➢ Perpendicular ramp
Sidewalk Ramps
Sidewalk Ramps

Accessibility Exceptions Certification (Form 517118)

➢ Structurally Impractical
➢ Technically Infeasible
Concrete Delivery

How long to deliver to the site?

• Ready-Mix Trucks
  Max. Delivery Time 90 minutes

Options

Retarding admixtures
Water reducing admixtures
C-SUD = Improved Durability

- Low w/cm ratio
  - Target = 0.40
  - Max = 0.42
- Consider adding intermediate aggregate for greater workability*
- Should add SCMs for enhanced freeze-thaw durability

*3 aggregate mixes should be proportioned to meet Zone 2 (IM 532, workability factor)
Urban Concrete Mix

Above mixture is based on Type I or Type II cements (Sp. G = 3.14). Mixes using blended cements (Type IP or IS) must be adjusted for cement gravities listed in IM 401. **These mixes require optimized aggregate proportioning in accordance with the specifications.**

### Proportion Table 4
**SUDAS Concrete Mixes**
**Using Article 4110 and 4115 Aggregates**
Basic Absolute Volumes of Materials Per Unit Volume of Concrete

<table>
<thead>
<tr>
<th>Mix No.</th>
<th>Cement</th>
<th>Water</th>
<th>Air</th>
<th>Fine</th>
<th>Coarse</th>
</tr>
</thead>
<tbody>
<tr>
<td>C-SUD</td>
<td>0.106</td>
<td>0.133</td>
<td>0.060</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Using Class V Aggregates (4117) Combined with Limestone
Basic Absolute Volumes of Materials Per Unit Volume of Concrete

<table>
<thead>
<tr>
<th>Mix No.</th>
<th>Cement</th>
<th>Water</th>
<th>Air</th>
<th>Class V.</th>
<th>Coarse Limestone</th>
</tr>
</thead>
<tbody>
<tr>
<td>CV-SUD</td>
<td>0.114</td>
<td>0.135</td>
<td>0.060</td>
<td>0.379</td>
<td>0.311</td>
</tr>
</tbody>
</table>

Above mixture is based on Type IP cements.
Urban Concrete Mix

• C-SUD Fly ash substitution rates
  Class C Max 35%
  Class F Max 25%
• Maximum combination rate is 20% Class C fly ash and 20% slag
Hydration (Creating C-S-H & CH)

- When calcium ions are super-saturated reactions kick off:
  - Calcium silicate hydrate (C-S-H, fiber-like particles)
  - Calcium hydroxide (CH, crystals)
- “Initial set” occurs when enough C-S-H forms to lock together.
Hydration (Creating C-S-H & CH)

Hydration is a series of irreversible chemical reactions between hydraulic cement and water.
How SCMs Work

Cement + Water → C-S-H

SCM + Water + CH → C-S-H
C-SUD Projects

Ankeny Reconstruction, 2017

- 0.40 w/cm ratio
- 44% coarse
- 15% intermediate (pea gravel)
- 41% fine
- 20% Class C Fly Ash
- Retarder
- Water reducer (handwork)
C-SUD Projects

Johnston, 2016

• QMC mix with limestone chip as third aggregate
  • Mix could have been specified as C-SUD – same mix requirements

• SCM replacement:
  • 20% Class C Fly Ash
  • 20% Slag
Monitor Added Water

- Ready-Mix trucks can add water at the grade
- Additional 30 revolutions recommended
- Document volume of water added
  ➢ Do not exceed max w/c ratio
  ➢ Know the specification for max w/cm ratio

Adding 1 gallon / cu. yd:
- Increases workability ~1”
- Lowers strength ~200 psi
- Increases drying shrinkage ~10%
- Increases permeability ~ 50%
Texture

SUDAS
Microtexture: Turf or Burlap Drag
Macrotexture: (when specified)

Iowa DOT
Microtexture: Turf or Burlap Drag
Macrotexture when speed limit is greater than 35 mph.
(Table 2301.03-1)

<table>
<thead>
<tr>
<th>Pavement/Placement Type</th>
<th>Macrotexture Orientation</th>
<th>Macrotexture Not Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainline - slip-form</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Mainline - handwork</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Turn lanes - slip-form</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Turn lanes - handwork</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Ramps - slip-form</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Ramps - handwork</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Gapped sections of mainline - slip-form</td>
<td>X</td>
<td>1</td>
</tr>
<tr>
<td>Gapped sections of mainline - handwork</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Radii</td>
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<td>X</td>
</tr>
<tr>
<td>Crossovers</td>
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<td>X</td>
</tr>
<tr>
<td>Paved Medians</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Shoulders</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Irregular Areas</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Bridge Approaches</td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

1. Transverse macrotexture permitted for placements less than 600 feet in length.
2. Transverse tiling required unless longitudinal grooving in concrete is specified in the contract documents.
The Rules of Jointing

**Things to Do**
- Match existing joints or cracks
- Place joints to meet in-pavement structures
- Remember max. spacing
- Place isolation joints where needed
- Field adjustments are allowed!

**Things to Avoid**
- Panels < 1 ft wide
- Panels > 15 ft wide
- Angles < 60° (~90° is best)
- Odd Shapes (keep slabs square)
The Rules of Jointing

ACPA Wikipave

Google: Wikipave Joint Layout

10-Step Method for Jointing Intersections

Step 1

Step 2

Step 3

Step 4
Boxouts - General

- Pavement width changes
  - Intake and manhole locations
  - Curb returns
  - Accesses

- Rock placed in boxout to prevent filling with concrete

- Check forms for stability
- Paver setup
- Subgrade checks
- Depth checks
- Air/slump
- Paving summary
- Texture
Resources

• Iowa DOT PCC Paving Field Inspection

• ACPA WikiPave

• SUDAS Section 7010

• Iowa DOT Section 2301

• CP Tech Center
Questions and Discussion

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