Concrete Paving Practices: Common Issues and How to Address Them

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The purpose of this presentation is NOT to enable you to design or construct concrete pavements, but....... In order to understand troubleshooting for both design and construction operations, it is necessary to cover some of the key elements of both and how they relate. This presentation is based on recent or ongoing construction projects in several locations. You will find that the same issues arise on many paving or overlay projects.
What Do We Want?

- Good ride quality
- Economical
- Non-Deforming Surface (for safety)
- Adequate Structure (for performance)
- Adequate Friction (for safety)
- Provide for Renewal and Recycling (whenever possible)
- Provide Foundation with Uniformity of Support (for longevity)
- Design Must be Constructible
Presentation Topics

- Plans.
- Specifications.
- Project layout.
- Foundation.
- Concrete materials.
- Placement and consolidation.
- Texturing.
- Jointing.
- Curing.
- Sawing.
- Ride Quality.
- Miscellaneous.
Plans
Plans

- Plans for a typical new construction project can be several hundred sheets of highly detailed information.
- Plans for an overlay project are significantly different than for new construction and are generally less involved.
- Alignment is obviously important. How do you verify it, especially with stringless operations.
- Grade control issues are of concern and should have been addressed in the planning phase. Again, how and when do you verify?
Plans – What to be Aware of

• First and most importantly, can the project be constructed the way it is shown on the plans?
• Quantity take-offs for new construction is “easy,” or is it?
• When dealing with overlays, simple quantity take offs are rarely valid because of differences in existing pavement thicknesses, type and amount of pre-overlay repairs (if required) and other unknowns.
Specifications
Specifications

- Specifications are highly variable depending on the owner and project type. Wouldn’t standardization benefit all parties?
- I recently finished a general specification for concrete on concrete bonded overlays that was 24 pages, I have seen similar documents that were less than 10 pages, what is the difference?
- Read the “fine print.”
- Specifications regarding placement conditions, material uniformity, thickness tolerances, surface texturing, etc. are of particular importance as compliance is sometimes difficult to achieve.
Projects can experience significant deviations from the plans (and specifications).

For example, when dealing with overlays and in the most extreme case, the type of overlay might require a change, i.e. from a bonded concrete overlay to an unbonded concrete overlay.

Due diligence on the part of the design team should minimize these occurrences. However, keep in mind that it can and does happen.
Making Changes “On-the-fly”

- It is advantageous to have a knowledgeable owners representative that is able to approve changes as required.
- These changes might be as simple as jointing details around in-pavement structures or as significant as changing intersection details.
- These types of issues should be discussed at the pre-construction meeting.....make sure EVERYONE is on the same page. You might want to re-evaluate the situation after the project is underway.
Project Layout
How Do You Verify This?
How About This?
Foundation
Stability and Uniformity are Key
Regardless of Slipform or Fixed Form Paving Operations
Concrete Materials
Rock Type, Gradation, Moisture, etc. – Optimization?
What is Important?
Initial 300 Foot Run
Placement and Consolidation
Details – Who is Checking?
Check for Obstructions
Paver Configuration, Adjustments
Texturing
Uniformity, Depth?
Does it Pass?
Uniformity of Concrete Issue?
Jointing
Lots of Structures, Are the Jointing Details Correct?
One of a Number of Options
Sometimes it Looks Better in the Office
A Better Plan?
Curing
After Evaporation Retarder and Curing Application
Internal Curing

**ACI:** Internal Curing: “supplying water throughout a freshly placed cementitious mixture using reservoirs, via pre-wetted lightweight aggregates, that readily release water as needed for hydration or to replace moisture lost through evaporation or self-desiccation [1]”
Internal Curing
Improved Hydration

Degree of hydration of cement @ 90 days, cured @ 50% RH

Espinoza-Hajazin (2010)
Less Shrinkage; Less Cracking

<table>
<thead>
<tr>
<th>Type</th>
<th>Crack Width</th>
<th>Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plain 0.30 Concrete</td>
<td>0.6 mm</td>
<td>12</td>
</tr>
<tr>
<td>IC 0.30 Concrete</td>
<td>0.4 mm</td>
<td>43</td>
</tr>
</tbody>
</table>

Schlitter (2010)
Sawing
Ideal, Maybe a Little Deep
Not so Ideal – Why?
Ride Quality
Visualization
Roughness

![Graph showing roughness over station intervals from 507+00 to 511+00. The x-axis represents station intervals, and the y-axis represents roughness in inches per mile. The graph fluctuates significantly between the stations.]
Soft Trackline
Stringline Swap
Everything You Always Wanted To Know About Smoothness

- SHRP2 Project Ro-6E report is currently available at: http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2prepubRo6E.pdf
Miscellaneous
Conclusions

- We have gone through a lot of material in a very short time.
- The key point is that there seems to be only a limited number of construction operations that are directly related to design.
- In reality, they all are.
- They may be influential in different ways and to different extents. The only way to know for sure is to study the design in detail.
Thank you!

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