Dowel Basket Standardization Update & New Considerations

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Recap: Dowel Basket Standardization

- In 2009 John Staton asked me if I would speak about Variables in Dowel Basket Manufacturing at the NC2 meeting in San Antonio, TX.

- The purpose was to provide an overview to all the DOT Concrete Pavement Materials Engineers in attendance, and raise an awareness that with so many different variables between each States’ basket designs, that there was definitely an opportunity to take costs out of the channel with standardization. And this action could reduce lead times during the peak of the season.

- This was not the 1st attempt to get a consensus for some level of Dowel Basket Standardization by NC2.

- We reviewed the major variables and wanted to incorporate some aspects of standardization that would be acceptable to a number of DOT’s even if it was on a regional basis because of climatic conditions.
Recap: Dowel Basket Standardization
What we looked at…and where we are at now

• Dia of Dowels: ¼” or 1/8” increments  Most States use ¼” increments
• Dowel Length:  All but 1 State uses 18”
• Steel Spec & Grade:  Most States use ASTM A615 grade or a dual grade
• Coating Type:  Most States use Epoxy Powder Coating
• Coating Specs:  More now Using new ASTM A775 Spec
• Frame Wire Size:  Most use either .362 or .306
• Type of Legs in Frame:  “J” Style Legs or “A” & “U” Style legs
• Dowel Dia versus Pavement Thickness:  Varies greatly between States
• Mil Coating Thickness:  Now 7-16 mils or 5-9 mils (+8 other thicknesses)
DOT Epoxy Coating Mil Thickness Variations

- In 2009 we had 14 different Epoxy Coating Mil thicknesses from the 36 States surveyed
- In 2017 we have 8 different Epoxy Coating Mil thicknesses from the 36 States surveyed
- 15 States use 7-16 mil
- 13 States use 5-9 mil
We Made Some Progress but there is still more we can do

• The 2 greatest variables are:
  Dowel Diameter versus Pavement Thickness
  Epoxy Coating Thickness
Besides Standardization of existing manufacturing
We need to evaluate new developments

• We were focused on standardizing the existing processes for dowel basket manufacturing

• We were looking back, and where we were, but not forward as far as what could we do to improve dowel baskets in the future

• Since then an awareness of 2 new issues has gained momentum impacting dowel basket manufacturing
  • Dowel Bar Alignment
  • High Performance Long Life Dowels

• We need to consider these new developments in our efforts for Standardization for Dowel Baskets to ensure we are incorporating the latest technology that will result in the best performance in the field
Dowel Bar Alignment
Leg style makes a huge difference

• “A” legs versus “J” legs

• This is a no brainer: in a 12 dowel basket you get 24 more welds with a “A” leg design basket than you do with a “J” leg baskets

• You also get approximately 12’ more of wire

• “J” leg style basket has approximately 10 lbs of wire in the frame

• We’re asking an awful lot from 10 lbs of wire during the concrete paving process. We have a chance to mitigate some alignment issues by using “A” style legs that provide more stabilization
Dowel Bar Alignment

“J” Style Legs

“A” Style Legs
Shipping Wires: To cut or not to cut, is that the question? What does that do for alignment?

- By NOT cutting the shipping wires, you are increasing the stability of the basket frame significantly during the concrete placing operations.

- The shipping wires are very thin, usually .177 wire and will not lock up a transverse joint if they are not cut.

- If you are going to perform a MIT Scan 2 testing of the joints, Check with the MIT Scan Rep as to whether or not the shipping wires need to be cut.

- Don’t cut the shipping wires if you don’t have to.
Shipping Wires: To cut or not to cut, is that the question?

Cut shipping wires makes the basket less stable during paving.

Uncut shipping wires add greatly to the stability of the basket.
New Innovation: A visual guide for alignment

• Marking the mid-point on the dowel bars at the manufacturing plant adds a visual guide for placing the basket on the center of the transverse joints on grade

• This alignment guide will also facilitates inspection in the field
Alignment Issue:
Dowels moving in un-stabilized basket frames during concrete placement in thick pavement sections

1\textsuperscript{st} & 3\textsuperscript{rd} Dowels, the welded end is away from paver

2\textsuperscript{nd} Dowel free end away from paver
Stabilized Dowel Basket frames for dowel bar alignment in thick Pavement Sections

Stabilizer inside Side Frame

Stabilizer Deployed
MIT Scan 2 Has redefined Dowel Bar Alignment

MIT SCAN 2

- These two signal intensity plots illustrate how easily an engineer can use MIT Scan-2 to see the difference between properly aligned dowel bars (A) and severely misaligned bars (B). A good alignment is characterized by uniformity and symmetry in the intensity of the magnetic signal. A poor alignment shows an asymmetrical magnetic signal, which is a telltale sign that the dowel basket was pulled apart and the alternating ends of successive bars were dropped. Source: ARA
Alignment Issue: Dowels falling out of baskets while placing on grade or Concrete Paving Operations

• Traditionally when the Epoxy Coated Dowels are welded into the frame, the welding process burns through the epoxy coating creating soot that makes it hard to determine if a good weld was achieved. This is the most common cause of dowel bars falling out of the basket frame in the field.

• By preparing the epoxy coated dowel for welding, dowels falling out of the baskets are all but eliminated.
Dowel Bar Alignment Solution:
Preparing the dowel bars for welding

Burning through the epoxy coating to weld the dowels

Preparing the dowel bars for welding
High Performance Dowels for Long Life Concrete Pavements

• Solid Stainless Steel and Stainless Steel Options
• Rolled Zinc Alloy Solid or Tubular Bars
• Low – Carbon, Chromium Alloy Steel
• Solid GFRP Dowels and GFRP Coated Steel Bars
• Dual Epoxy Coating - Corrosion Resistant Basecoat with an Abrasion Resistant Overcoat (ARO) Carbon Steel Dowels
High Performance Dowels for Long Life Concrete Pavements

- There are many different types of High Performance Dowels
- At many different price points
- It ranges from a high end of Solid Stainless Steel dowels welded in a stainless steel wire frames to an affordable option slightly higher than a standard DOT Basket
- With so many choices it is important that the high performance dowel selection matches the project life expectancy, one doesn’t want to put a 40 year dowel in a patching project when the pavement will be replaced in 10 years
- It is also important for a welded rigid frame to ensure dowels stay in the frame and aligned
What Standardization can we achieve right now?

“A” Style Basket Legs

- Who wouldn’t want 24 more welds in their basket frame?
- Plus 12 additional feet of wire?
- You can go back to your office and make this happen with the stroke of a pen!

We ask a lot of 12 lbs of wire
Give alignment a fighting chance
The End… Thank You
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