Super-Slab® Precast Pavement System

OTEC 2016 – Session 38
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The Fort Miller Co., Inc.
Dan E. Moellman, P.E.
The Fort Miller Co., Inc.

• Located in *upstate* New York
• Transportation products
  – Highway barrier
  – Precast retaining walls
  – Bridges
  – Precast pavement slabs
• Specializing in accelerated bridge construction
• Developer of the Super-Slab® Precast Pavement System
Precast Concrete Pavement Slabs = Overnight Repairs

145,000 ADT
I-287, Tarrytown, NY

200,000 ADT
I-15, Ontario, CA

180,000 ADT
I-66, Fairfax, VA
What Does High ADT’s Mean For Pavement Repair & Maintenance?

• Heavily-deteriorated pavement
  – Too much traffic for long-term durable repairs
  – Often repaired with fast-setting non-durable materials

• Very short work windows
  – 8 – 5 hour night work windows
  – 55 hour weekend closures

• Real need for durable repairs

• **Summary - Premium pavement required - overnight!**
Precast Pavement Emulates Cast in Place

- Full Bedding Support
- Load transfer Dowels
- Slab Surface Geometry

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**Super-Slab® System – Bottom Slots**

- Simple slab-on-grade system
- Standard dowels and tie bars (JRCP)
- Built-in bedding grout distribution
- Precision grading equipment
- Warped and planar surfaces
- 25,000+ slabs & 2,800,000+ SF INSTALLED
- Industry leading experience

100+ projects, 43 lane-miles completed in 17 States + ON & QC, 29 Owner Agencies
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43+ Lane Miles, 2.7+ Million Sq Ft, 25,000+ Slabs
100+ projects in 17 States and 2 Provinces, 29 Agencies

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Does Precast Compete With Cast-in-Place Concrete Pavement?

- Precast pavement will never compete on an initial cost basis vs. CIP – need LCCA, user delay costs, etc.
  - Precast more expensive - must be cast, stored and shipped before installation
- Precast is that “special tool” for heavily traveled locations
  - impossible to stage or detour
- **Precast pavement** - a material and a method for rapidly and durably repairing concrete pavement
Achieving Full and Complete Bedding
A Two - Step Process

Precisely-Graded (to ± 1/8”)
and Compacted Fine Aggregate Material

Grade control rails placed to survey marks

Chorded Slab Surface

Grout Distribution Channel
Foam Gaskets

Bedding Grout Fills Any Voids

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Super-Slab®
Load Transfer Dowel System

- Dowels engage slots in adjacent slab
- Pump dowel grout into ports
  - Grout reaches 2500 psi in about 2 hours
- Fill slots and joint between slabs
- Dove-tail slot resists bar pop out
Two Types of Slabs

Slab shape depends on geometry of pavement surface

**Single Plane**
- Slopes of opposite sides are equal

**Warped Plane**
- Slopes of opposite sides are un-equal
Small Scale Grading
Rail Supported and Hand Operated

Auger H.O.G.

Hand Operated Grader (H.O.G.)

Mini-H.O.G

Shutter Screed
Automated Grading Equipment:

The “Wave of the Future” That’s Here Right Now

- For large scale grading
- Grades single and warped planes
- Crawler skid-steer controlled by robotic total station

Uses same surface model as FM HOG
I-78 Interchange 14C Toll Plaza – NJTA
Jersey City, NJ – Baker / GPI
Drilling for Dowels

Use Correct Template

16 holes – 12 minutes

Drilling and Setting Rail
Placing Slabs

- Slabs delivered in adjacent lane
- One man in each corner
- Set slabs to panel point mark
- Check for match (the Super-Slab Shuffle)
- Average setting rate – 10 slabs per hour
Installing Dowel Grout

Fill Dowel Slots and Joints
Contractor-Designed Joint Dam
Indicators for Long Life - Full scale load testing in California

Test results show no cracks or distress

Falling Weight Deflectometer

Heavy vehicle simulator

143 Million ESALs (100 KN Load)
4.3 Million Cycles
Controlled Fabrication Conditions

Accurate Forms

Roller Screed - Accurate Top Surface

Accurate Piece Drawings

Ideal Finishing (and curing) Conditions
Intermittent Repairs

I- 90
Albany, NY

I-676 Vine St Expressway
Philadelphia, PA

I-15 Salt Lake City, Utah

I-95, New Rochelle, NY

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Continuous -
Tappan Zee Bridge Toll Plaza

Off Peak Hours =
20 Hour Work Windows

3,000 SF / 8 Hour Shift
(Within ± 1/8”)
2001 - 2002

Open for Rush Hour
(135,000 ADT)
Ramps

Oak Brook, IL

Brooklyn, NY

Tarrytown, NY

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Intersections – Replacing Composite Pavement, – Rotterdam, NY - 2006

New & Old

Complex Geometry

Undercuts

Replaced in 17 Nights
Continuous - Mainline Placement

Mainline I-15, Ontario, CA
(200,000 VPD)

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Bus Pad, Hollywood & Santa Monica Blvd. North Hollywood, CA

Grading

Placing

Last Slab

Finished, Next Day

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Accommodating Utilities

Curb Inlet

Water Valve – CIP Closure Pour

CIP Closure Pour

Drop Inlet CIP Closure Pour
Lincoln Tunnel – NJ Approach
The Port Authority of NY & NJ
VDOT I-66 WB Ramp to US 50 WB
FHWA Highways for LIFE - 2009

• 184,000 ADT, 5% Trucks

• (3) Repair Types:
  CIP, JPCP & PPCP

• Rt. Lane Super-Slab®
  224 Slabs:
  12’x16’x8.75”
Bridge Approach Slabs – NYSDOT Region 9 – Binghamton, NY

CONCRETE DECK
STEEL GIRDER
PRECAST SUPER-SLAB
APPROACH SLAB
BRIDGE BACKWALL
BRIDGE ABUTMENT
APPROACH SLAB INSTALLATION

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NJDOT Bridge & Approach Slabs
US 46 Over Broad St. - Clifton, NJ

• Bridge replaced over two weekends - April 2011

• Two-span (40.2’, 40.2’) continuous, 28.76° skew

• Precast Approach Slabs - tied to prefabricated bridge units
NYSDOT Region 11 – Nassau Expressway / Rockaway Blvd.

- 2390 slabs
- 29,000 SY
- Replaced full-depth asphalt
- 300 lane-ft in 8-hour shift
I-295 Pav’t Repair, Burlington Co., NJ
NJDOT 2007 to date: 14 jobs = 4500+ slabs
I-64/I-77 Exit 97 WV DOH
Charleston, WV - 2015
TAB 13-16 Buffalo Fisher Assoc.
NYC DOT – Brooklyn Bridge
Tappan Zee Ramp A – TZ Constructors HDR
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5% Grades, Horizontal Curves, Intersections, Widenings, Cross Slope Transitions

GDOT Broad Street, Winder, GA
FHWA HfL – 348 Slabs
I-94 MDOT Low-Clearance Bridges, Kalamazoo, MI

Installation

New Panels (before Grinding)
KDOT Reconstruction Metropolitan Ave. (US-73) Leavenworth, Kansas

7th Street Intersection

Slab Layout Drawing
I-676 Vine St. Expy. PennDOT #82705
Philadelphia, PA – Bulletin No. 15 Approval
PennDOT Project 87569 SR 80 – M21
Montour Co. Engineering District 3-0
Danville, PA

• Let 10-01-2015, installed May-June 2016
• CPR Project with CIP and Precast Repairs
• Existing SR 80:13” CP on 8” ATPBC
• 13” precast – specified Super-Slab on Cement-treated Concrete Sand Bedding
• 2,571 SY – 211 slabs
PennDOT 87569 SR 80 – M21
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PennDOT 87569 SR 80 – M21

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Intermittent - Installation Rates

- 8 hour work window
  - 12 – 15 slabs (12’ x 10’) per night
- 5 hour work windows
  - 7 – 9 slabs (12’ x 10’) per night
- Dependent on work window
Continuous - Installation Rates

- 8 hour night work windows
  - 10 – 30 slabs
  - Ontario, CA 30 slabs per night = 500 lane feet
- Weekend closures
  - 8 – 10 (12’ x 14’) slabs per hour
  - Chicago - 90 slabs per weekend (2013)
- Rates should improve
  - Contractors more familiar
  - Improved specialized equipment
Installed Cost – Bid Prices

- Intermittent Repairs
  - About $244 to $585 per SY
  - Similar to rapid-set concrete costs (in some states)

- Continuous Installations
  - About $244 to $550 per SY

- Varies greatly with
  - Length of work window
  - Size of project
  - Local labor rates
Pavement/Asset Management Strategies Available with Precast

- Use quality material (precast) every time
  - 40-year Service Life
- Use maintenance dollars for good permanent repairs, not temporary ones
- Consider life cycle rather than first costs
- Rather than patching, consider “intermittent total replacement” - keep adding on to good precast repair slabs
- Consider “re-usable” precast pavement in utility-intensive areas
Other Places for Fast-Track Precast Pavement

- Instrumented pavement
  - Toll booth treadles
- Weigh-In-Motion panels
- Precast pavement “addons” – Incremental Total Replacement
- Removable - re-usuable pavement panels over utilities (intersections)

Instrumented High Speed EZ Pass Slabs

Spring Valley, NY
Weigh-in-Motion Panels
I-95, Manhattan, NY
Challenge - Maintaining Quality Pavement on Heavily-Traveled Urban Streets and Arterials Over Multiple Utilities

First Avenue, New York City

Cross Bronx Expressway, NYC

Non-durable materials – no load transfer – poor workmanship
Removable Urban Pavements (RUP) - A New Tool For Consideration

• Pavement that can be removed and replaced rapidly
  – To original condition in appearance & functionality
• Durable concrete precast concrete pavement slabs
• Vertically-removable and replaceable units
• Full load transfer re-established between slabs
Two Approaches to Access Underground Utilities

Randomly Cut, Remove and Replace Pavement

Size Slabs and cut at Joints to Access Underground Utilities
Replacing Pavement

Asphalt Repair

Precast Pavement – a Better Repair
Slab Removal & Replacement

Replacing Cleaned-up Slab Over New Dowels

DRILL OUT (CLEAN) PORT HOLES
REMOVE GROUT PLUG & DOWEL
REMOVE BEDDING GROUT

REMOVE DOWEL ONLY

EPOXY ANCHOR NEW DOWEL

APPLY BONDBREAKER

3/4" X 3/8" HEAVY DUTY HEX NUT WELDED TO INSIDE OF PIPE, TYP. EACH END OF TUBE

REMOVABLE STAINLESS STEEL DOWEL (RSSD)
NOMINAL 1.18" STAINLESS STEEL PIPE

Super-Dowel

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Super-Dowel

- Pavement Add-ons: Incremental Total Replacement
- Removable & Re-usable Precast Pavement
Extracting Half Dowels Left Behind
Incremental Total Replacement Using Super-Dowels

Makes The Most of Our Existing Concrete Pavement Asset
NYSTA New England Thruway I-95 Yonkers Construction WSP
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Broadway Junction, Brooklyn, NY – STV, Inc.

Van Sinderen Avenue Preliminary Slab Layout Drawing

167 Slabs – all removable and replaceable, 91 flat, 76 non-planar

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Broadway Junction, Brooklyn, NY

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Broadway Junction, Brooklyn, NY
BQE Brooklyn-Queens Expressway
NYSDOT Region 11

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References

National Concrete Pavement Technology Center – Concrete Pavement Preservation Guide, 2nd Edition September 2014

7) FDR Using Precast Slabs

U.S. Department of Transportation Federal Highway Administration FHWA Publication No. FHWA-HIF-14-014

<table>
<thead>
<tr>
<th>Products (Project Number)</th>
<th>Impact on Practice</th>
<th>Product Status</th>
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<tbody>
<tr>
<td>MODULAR PAVEMENT TECHNOLOGY (R05)</td>
<td>Modular pavement technology use is rising, but little guidance has been available to make the most of these systems. This research provides guidance transportation agencies can use to design, fabricate, construct, and maintain PCP systems that can speed up roadway reconstruction without sacrificing quality and to reopen lanes sooner.</td>
<td>The guidelines, included in the research report, are available at <a href="http://www.trb.org/Main/Blurbs/167788.aspx">www.trb.org/Main/Blurbs/167788.aspx</a>. Model specifications are also available for download from that page.</td>
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Keys to Success
(Still More to Learn)

Good engineering
Open minds
Real partnering

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Thank You

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