Super-Slab® Precast Pavement System

Joint Transportation Research Project
Precast Concrete Pavement Forum
Indianapolis, Indiana
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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
Jointed Precast Pavement in the US

- Full-scale implementation began in 2001 with introduction of the Super-Slab® System
- Can be installed rapidly – overnight
- Versatile
  - Intermittent repair, full lane replacement, bridge approach slabs, ramps, intersections
- Proven
  - Numerous FWD tests
  - Accelerated load (HVS) tests in 2005 – 2006
- Cost effective – compared to fast-track concrete repairs
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

100+ projects, 43 lane-miles completed in 17 States + ON & QC, 29 Owner Agencies
Cumulative Super-Slab Installations

(107 projects, 43 lane-miles in 17 States + ONT & QUE, 29 Agencies)
(25,000 Slabs +/- = 311,000 SY +/-)
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Super-Slab® Installations

43 Lane Miles, 2.8+ Million Sq Ft, 25,000+ Slabs
100+ projects in 17 States and 2 Provinces, 29 Agencies
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 Slab Types

Single Plane

- Slopes of opposite sides are equal

Warped Plane

- Slopes of opposite sides are not equal
Controlled Fabrication Conditions

Accurate Forms

Roller Screed - Accurate Top Surface

Accurate Piece Drawings

Ideal Finishing (and curing) Conditions
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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Small Scale Grading
Rail Supported and Hand Operated

Auger H.O.G.

Hand Operated Grader (H.O.G.)

Mini-H.O.G

Shutter Screed
Large Equipment Precision Grading Laser/Robotic Controlled Planar and Non-Planar Slabs
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

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Shipping and Placing

- Size slabs for shipping
  - 12’ Max. width
  - Special permits
- 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

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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
Result - 38 year life expectancy
Intermittent Repairs (CPR)

I-90
Albany, NY

I-676 Vine St Expressway
Philadelphia, PA

I-15 Salt Lake City, Utah

I-95, New Rochelle, NY
I-295 Pav’t Repair, Burlington Co., NJ
NJDOT 2007 to date: 14 jobs = 4500+ slabs
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)
Continuous - Mainline Placement

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

Oak Brook, IL

Brooklyn, NY

Tarrytown, NY

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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
Brooklyn Bridge Approaches
2010 – 2013
URS & Weidlinger

Grading

Placing

Looking toward Manhattan

Looking toward Brooklyn
Alexander Hamilton Bridge

Contractor Gets One Lane
To Replace The Same Lane
I-94 MDOT Low-Clearance Bridges, Kalamazoo, MI

Installation

Two Lanes

New Panels (before Grinding)
Bus Pad, Hollywood & Santa Monica Blvd.
North Hollywood, CA

Grading

Placing

Last Slab

Finished, Next Day

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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”
PennDOT District 6-0     85 slabs
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
Goals

- Up-grade subgrade and subgrade drainage
- Install long-lasting durable concrete pavement materials (concrete)
- Maintain traffic during the process
- Use a modular pavement system or materials that are easily removed and replaced to maintain utilities below
- If concrete, to use dowels for load transfer
- Be able to restore pavement to original (equivalent or better) condition after a utility repair event
  - In appearance and functionality
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
• Slabs may be (relatively) light weight
  – For ease of handling
  – To keep disturbed footprint to a minimum
• Vertically-removable (and replaceable) units
• Full load transfer between slabs
Two Approaches to Servicing Underlying Utilities

Cut, Remove and Replace Randomly

Size Slabs to Access Utilities Below – Cut at Joints for Access Below
Replacing Pavement

Asphalt Repair

Precast Pavement
– a Better Repair
Case Studies of Urban Arterials Replaced with Precast Pavement

• NYSDOT Route 7 – Nott Street Intersection, Crosstown Connection, Rotterdam, NY - 2006
• Nassau-Queens Expressway, Rockaway Boulevard, Jamaica, NY - 2009
• GDOT Broad Street, Winder GA – 2013
• Kansas DOT Route 73, Leavenworth, KS – 2015
NY 7 Crosstown Connection
Nott Street Intersection

Precast Pavement – Center Part of Intersection Only
Undercut and Replace with Dense Aggregate Base

Undercut 1’ – Backfill with Dense Aggregate Base

Geofabric Separation Layer
Grading Bedding Material and Placing Slabs

Grade Controlled by Rails
Each Slab Set To a Mark
Maintenance of Traffic

Undercuts Traffic Never Stopped Replaced in 17 Nights
Finished Street View

Completed in 17 Nights
158 Slabs – 28,500 SF

The Fort Miller Co., Inc.
Rockaway Blvd., Jamaica - Queens, NY
2009 – 2010 Installation

• 2390 slabs

• 29,000 SY

• Replaced full-depth asphalt

• 300 lane-ft in 8-hour shift
Intersection Approaches

Farmers Blvd.

Guy R. Brewer Blvd.
Brookville Blvd. to Eastern Project Limit

½ Mile of Rockaway Blvd. - Full Depth Asphalt Replaced with Precast Concrete
Night Construction

Setting Grading Rails

Maintaining Traffic

DGB Compaction

8 hour (night) work windows
Rockaway Blvd. – Two Years Later (2011)

One-Half Mile Stretch - Two Lanes in Each Direction

Guy R. Brewer Intersection Approach
GDOT Reconstruction Broad Street
Winder, GA - 2013

Hills and Curves

Heavy Truck Traffic
Pavement Removal & Subbase Preparation

Removing Multiple Layers of Old Pavement

26 Inches
Installing Aggregate Subbase

Grading and Compacting
New Aggregate Subbase

Compaction Test
Installing & Super-Grading Bedding Material

Installing Bedding Material Over Aggregate Base (1” max. thickness)

Super-Grading With Hand Operated Grader (H.O.G.) to +/- 1/8” Accuracy

Key Operation!
Installing Slabs – At Night

Placing First Slab – Notice Gaskets on Bottom of Slab

Crane Occupies Previously Placed Slabs

(18’ wide x 11’-3” long x 8-1/2” thick)
GDOT Winder - Unique Challenges

Change In Grade – 5” lower on Right

Cross Slope Change & Horizontal Curve
Recipient of Several Awards

Ribbon Cutting 2014
Two Pavement Materials
GDOT Winder, GA
Georgia Engineer - Feb-Mar 2014

What do you do when main street needs major maintenance and it cannot be shut down to truck traffic or personnel of downtown businesses? Call an 'Super Slab.' That was the innovative call made by Georgia DOT to rebuild five blocks or about 1,600 feet of Broad Street through the heart of downtown Winder with precast concrete panels.

DOWNTOWN WINDER'S INNOVATIVE RENOVATION OF BROAD STREET

The Fort Miller Co., Inc.
Reconstruction Metropolitan Ave. (US-73) Leavenworth, Kansas

- 294 slabs
- 4,555 SY
- 8-hour night work windows
- Part of larger cast in place project

Two Intersections and One Bridge Approach
Re-Construction Metropolitan Ave. (US-73) Leavenworth, Kansas

4th Street Intersection

Slab Layout Drawing
Reconstruction Metropolitan Ave. (US-73) Leavenworth, Kansas

7th Street Intersection

Slab Layout Drawing
Reconstruction Metropolitan Ave. (US-73) Leavenworth, Kansas

Centennial Bridge Approach

Slab Layout Drawing
Installing Slabs – At Night

Removing Old Base, Placing New Cement-Treated Bedding Material

Grading Cement-Treated Bedding Material

294 Slabs – 24 Nights
The Super Paver System – a Removable and Reusable Urban Pavement (RUP) System
Demonstrating the RUP Concept Technology Work Shop – Nov. 9, 2011

Each Paver Set to a Mark

Independent Dowels Placed in Slots

Utility Blockout

Initial Placement
Intersection Quarter

Varying Cross Slopes
(Crosswalks of Any Texture – Also Removable)
Slab Removal

Remove Vertically

Grout Plug Removal

Use Pry Bar To Remove Grout Plug in Inverted Slab
Cleanup of Removed Slabs

Removing Original Bedding Grout

Slots restored

Extracting Half Dowel with Battery-Powered Drill
Extracting Half Dowels Left Behind
Removable/Replaceable Longitudinal Joint Tie
Removable/Replaceable Longitudinal Joint Tie

Core and Remove Coupler

Replace Coupler and Headed Tie
Installing Restored Slab

New Super-Dowels and Restored Longitudinal Joint Ties

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Accommodating Utilities

Curb Inlet

CIP Closure Pour

Water Valve – CIP Closure Pour

Drop Inlet CIP Closure Pour
Precast Crosswalk Slabs - Port Jefferson, NY

Two Methods - Block-outs for Manhole or Cast Manhole Frame in Slab

Casting in manhole frame logistically difficult

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NYSTA New England Thruway I-95
Yonkers Construction

WSP
Precast Pavement Add-ons – Smart Patching with Super-Dowels

Make The Most of Your Existing Concrete Pavement Assets
Broadway Junction, Brooklyn, NY

Van Sinderen Avenue Preliminary Slab Layout Drawing

167 Slabs – all removable and replaceable, 91 flat, 76 non-planar
Broadway Junction, Brooklyn, NY
Broadway Junction, Brooklyn, NY
Broadway Junction, Brooklyn, NY
Broadway Junction, Brooklyn, NY
Broadway Junction, Brooklyn, NY
INDOT US 40 Richmond
INDOT US 40 Richmond
Installed Costs (Bid Prices)

- **Installed Cost for Precast Repairs**
  - About $244 to $600 per SY
  - Similar to rapid-set concrete costs (in some states)
- **Varies greatly with**
  - Length of work window
  - Size of project
  - Local labor rates
- **Typically includes excavation, grading, slabs, dowels and tie bars and grout – all installed**
Bad Pavement Over Utility Cuts – Now Preventable

Fordham Rd., Bronx  I-87 Major Deegan Off Ramp - Bronx  Fordham Rd., Bronx
Benefits of Precast Pavement

Reduce construction-related traffic congestion

Longer lasting pavement repairs – Asset Preservation
  – 40+ years
  – Reduced (long-term) repair costs
  – “Get in, get out and stay out”
  – “Total Incremental Replacement” – now possible

Reduces field inspection time and cost
  – Precast slabs – plant inspected

Pre-engineered, pre-inspected slabs result in a superior finished pavement
Fort Miller Provides

- Design and engineering support
- Super Paver Specifications
- Standard and special slabs as required
- Specialized grading equipment
- On-site technical assistance
- Installation guidance
Presentation Take-A-Ways

- Long-life precast pavement can be installed overnight
- Drainage and subgrade can be upgraded in the process
- Precast pavement installation - minimum impact on traffic
- Precast pavement may be designed to be removable and replaceable to maintain utilities below
- Precast may be part of CIP project
  - Use precast in most critical areas
- Precast RUP allows restoration of original pavement after a utility repair event
  - Preserves appearance and functionality
  - May save cost in the long run
Keys to Success
(Still More to Learn)

Good engineering
Open minds
Real partnering
www.super-slab.com

SUPER-SLAB
Thank You

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