# Precast Pavement Construction Using The Super-Slab System ®


TTCC/ National Concrete Consortium

April 2, 2013

The Fort Miller Co., Inc.

Dan E. Moellman, P.E.

# Precast Concrete Pavement Slabs = Overnight Repairs

145,000 ADT

I-287, Tarrytown, NY

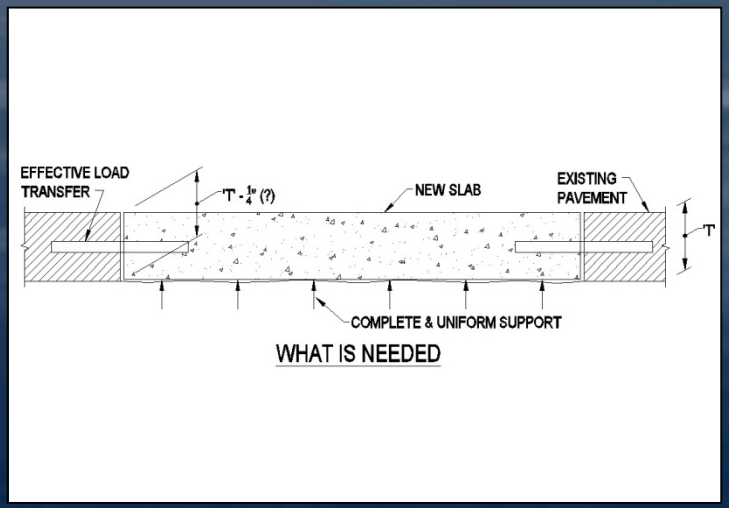
200,000 ADT

I-15, Ontario, CA

180,000 ADT

I-66, Fairfax, VA

# Precast Pavement Emulates Cast in Place




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

# Current Precast Systems

- Precast Prestressed Concrete Pavement (PPCP)
  - Pre & post tensioned ( 250'± assembly)
  - Developed by FHWA (non-proprietary)
- Top-Slot Jointed Systems (Michigan Method)
  - Jointed – slab lengths 16' ± long
  - Developed by FHWA (non-proprietary)
  - Flowable fill or urethane foam support
- Bottom-Slot Jointed System (Super-Slab®)
  - Jointed – slabs 6' to16'
  - Grade supported
- Other systems are "appearing"

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# Bottom-Slot Super-Slab® System (Proprietary)


- Simple slab-on-grade system
- Standard dowels and tie bars (JRCP)
- Built-in bedding grout distribution
- Precision grading equipment
- Warped and planar surfaces
- 15,017 slabs = 1,574,280 SF INSTALLED

**(75 projects, 25 lane-miles completed in 11 States + ONT & QUE)**

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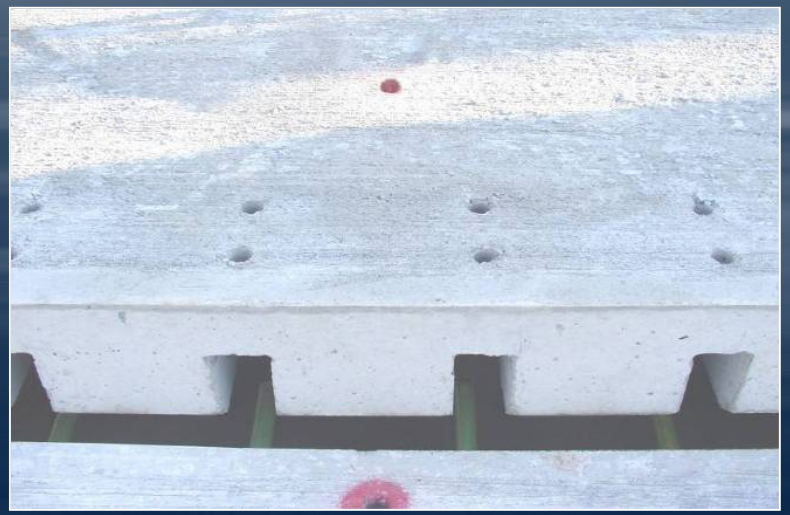
# Super-Slab®
# Load Transfer Dowel System

- 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



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# Indicators for Long Life - Full scale load testing in California

Falling Weight Deflectometer

Test results show no cracks or distress

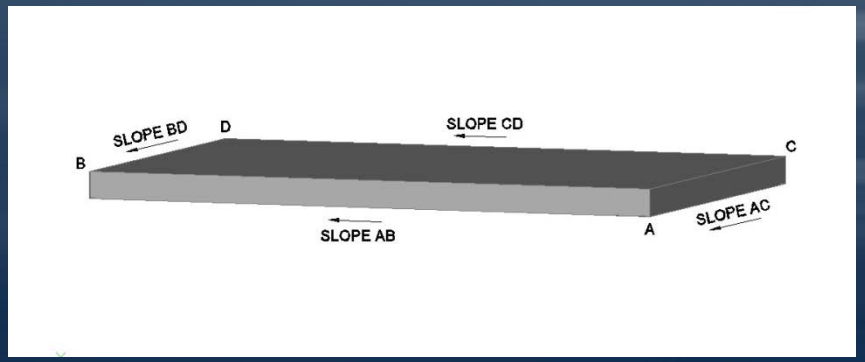
Heavy vehicle simulator

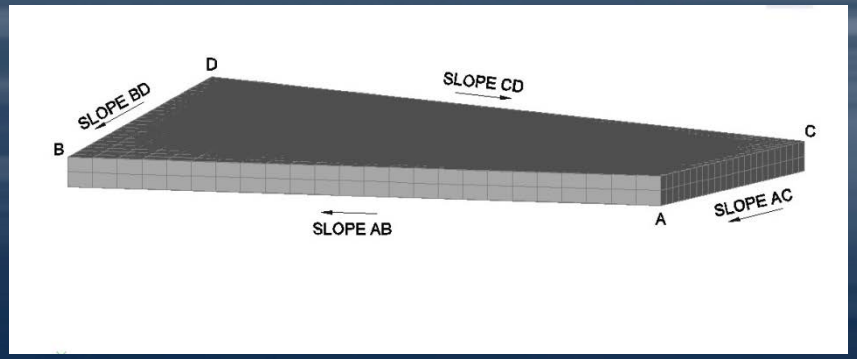
143 Million ESALs (100 KN Load)

4.3 Million Cycles

# Two Types of Slabs

*Slab shape depends on geometry of pavement surface*




## Single Plane

- Slopes of opposite sides are equal

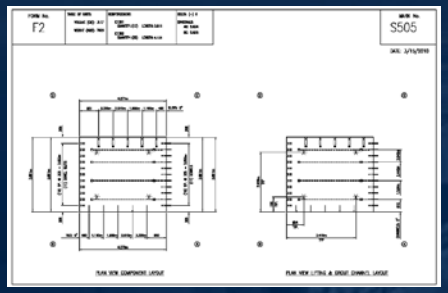
## Warped Plane

- Slopes of opposite sides are un-equal

# Controlled Fabrication Conditions

Accurate Forms

Roller Screed - Accurate Top Surface

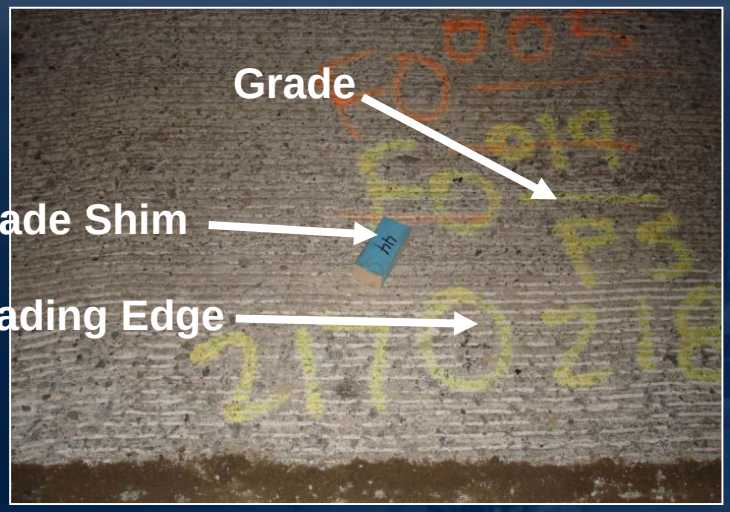



Accurate Piece Drawings

Ideal Finishing (and curing) Conditions

# Slab Layout

Use Template




Panel Point & Grade (“x”, “y”, “z”)

Panel Point - New Location

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# Saw Cutting and Removal

Cuts - Full Depth
- Accurate

Slab crab bucket

Trucks - right size
- right number

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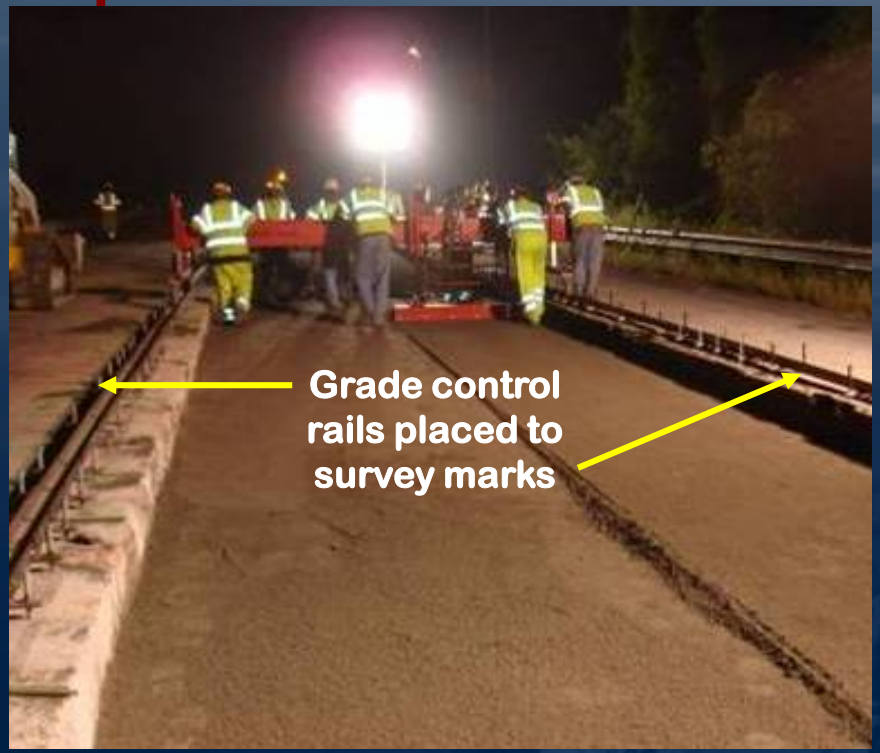
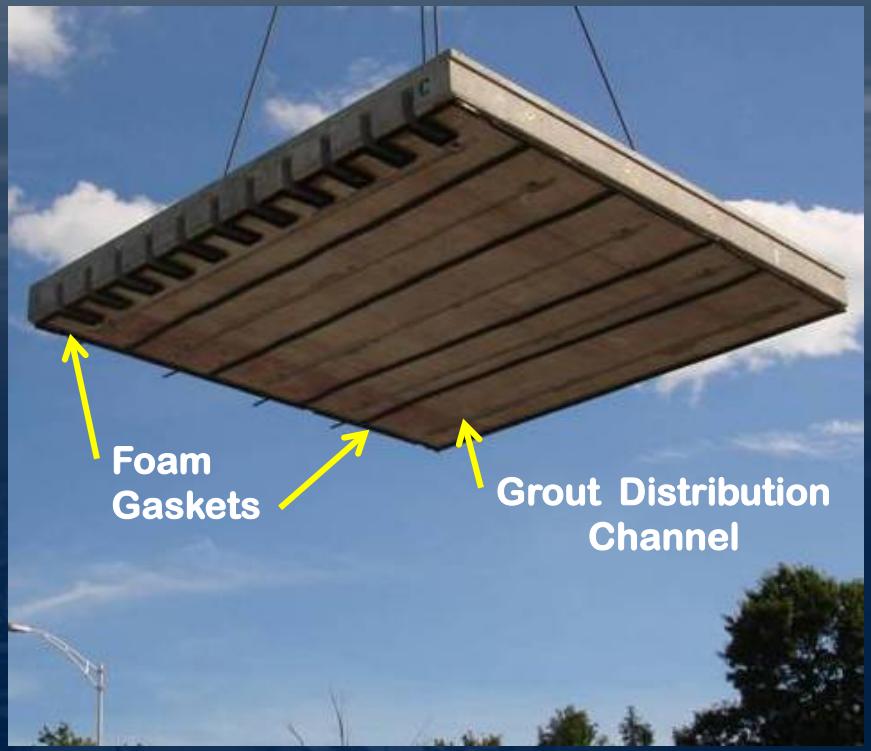
# Full and Complete Bedding
# A Two-Step Process




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




SECONDARY - Grout Fills Any Voids

# Precision Grading is the Key!

**Super-Grading = fully-compacted to 1/8th inch ±**

- Thin layer (1/2”) fine bedding material
- Grade – Compact - Grade
- Provides “near complete” subgrade support without grout
- Slabs can be opened to traffic before grouting

# Small Scale Grading

## Rail Supported and Hand Operated

Auger H.O.G.

Hand Operated Grader (H.O.G.)

Mini-H.O.G.

Shutter Screed

# Grading Patches With Hand-Operated Grader (H.O.G.)

## Three Steps

## (12 minutes)

First Pass (high)

Compaction

Last Pass (done)

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# Continuous Grading With Hand Operated Grader H.O.G.

First Pass (1/4” high)

Compaction

## Three Steps

Last Pass (done)

(over 500 LF per night possible)

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# Drilling for Dowels

Mark Out (accurately)

to Match Dovetail Slots

16 holes – 12 minutes

# Shipping and Placing

- Size slabs for shipping
  - 12’ Max. width
  - Special permits
- Ship in order – by mark number
- Provide unloading lane / shoulder

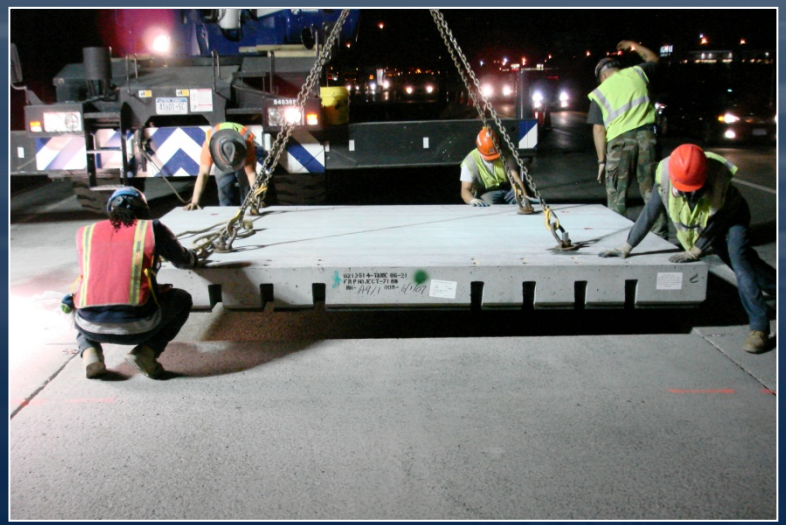
# Placing Slabs – Continuous

Crane Occupies New Slabs

12’ Lane & 10’ Shoulder (min.)


Set Slab to String

# Placing Slabs – Intermittent



Center Slab in Hole

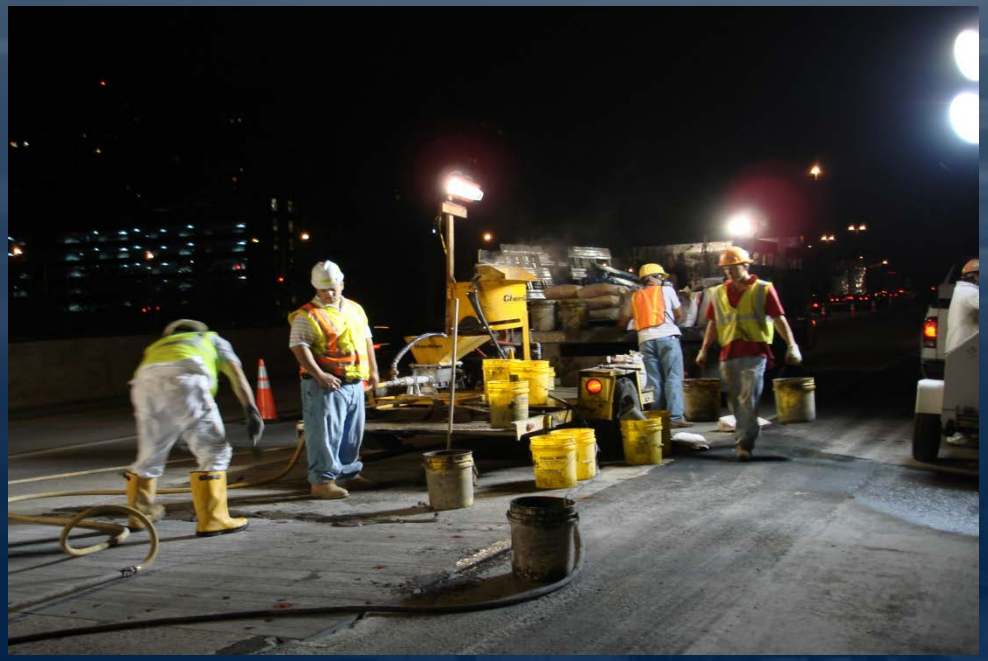
(Single Slab Holes)

Crane Occupies New Slab

# Checking for Match

## If Not - Pick Up & Re-Grade

# Grouting



- Truck (grout material & water)
- Trailer (grout mixer/pump)
- Short hose & nozzle
- Pails (for water measuring)
- Barrels (for waste)

**Requires Grout Rig**

**(Typically completed subsequent nights)**

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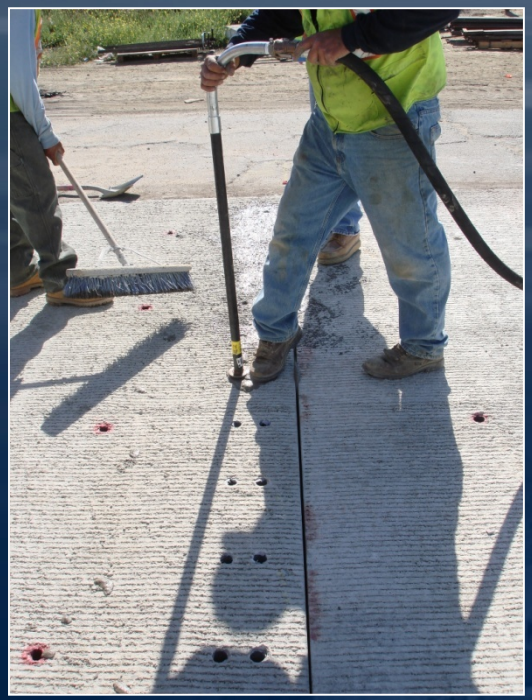
# Installing Dowel Grout



Fill Dowel Slots and Joints First

Contractor-Designed Joint Dam

# Installing Bedding Grout


**Pre-bagged Bedding Grout**

**(Recommended)**

**Flow Rate**

**15 - 20 Seconds Max.**

**Keep Ports Full by "topping off"**

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# Intermittent Repairs (CPR)


I- 90

Albany, NY

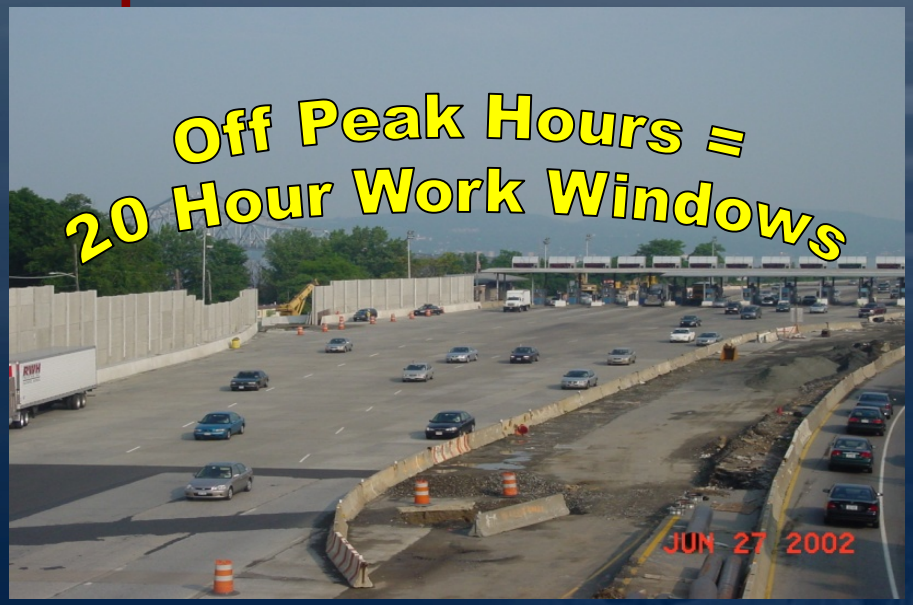

I-676 Vine St Expressway

Philadelphia, PA


I-15 Salt Lake City, Utah


I-95, New Rochelle, NY

# Continuous - Tappan Zee Bridge Toll Plaza




3,000 SF / 8 Hour Shift

(Within ± 1/8")

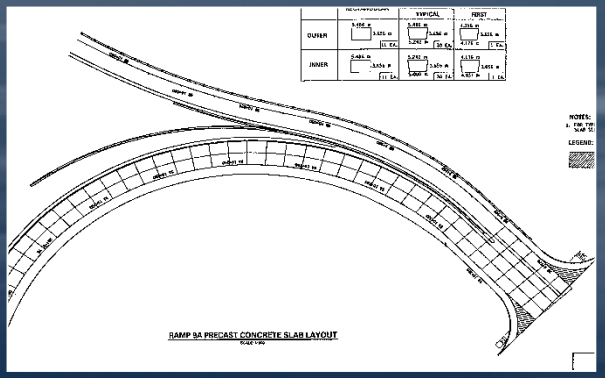
2001 - 2002

**Open for Rush Hour**

(135,000 ADT)

# Ramps

Oak Brook, IL

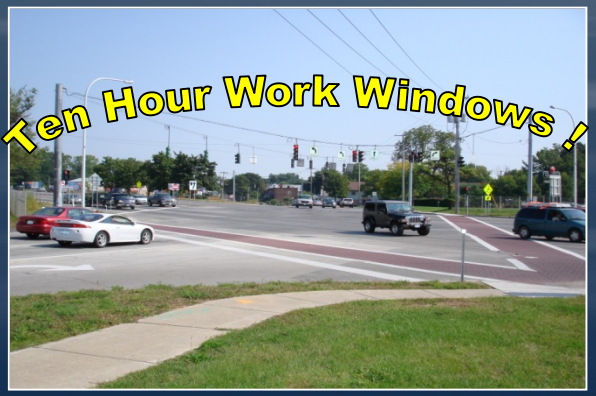



Plan View Tarrytown

Brooklyn, NY


Tarrytown, NY

# Intersections




Rotterdam, NY - 2006


Brooklyn, NY - 2009

Complex Geometry

Replacing Existing Full Depth Asphalt

# NY 7 Crosstown Connection

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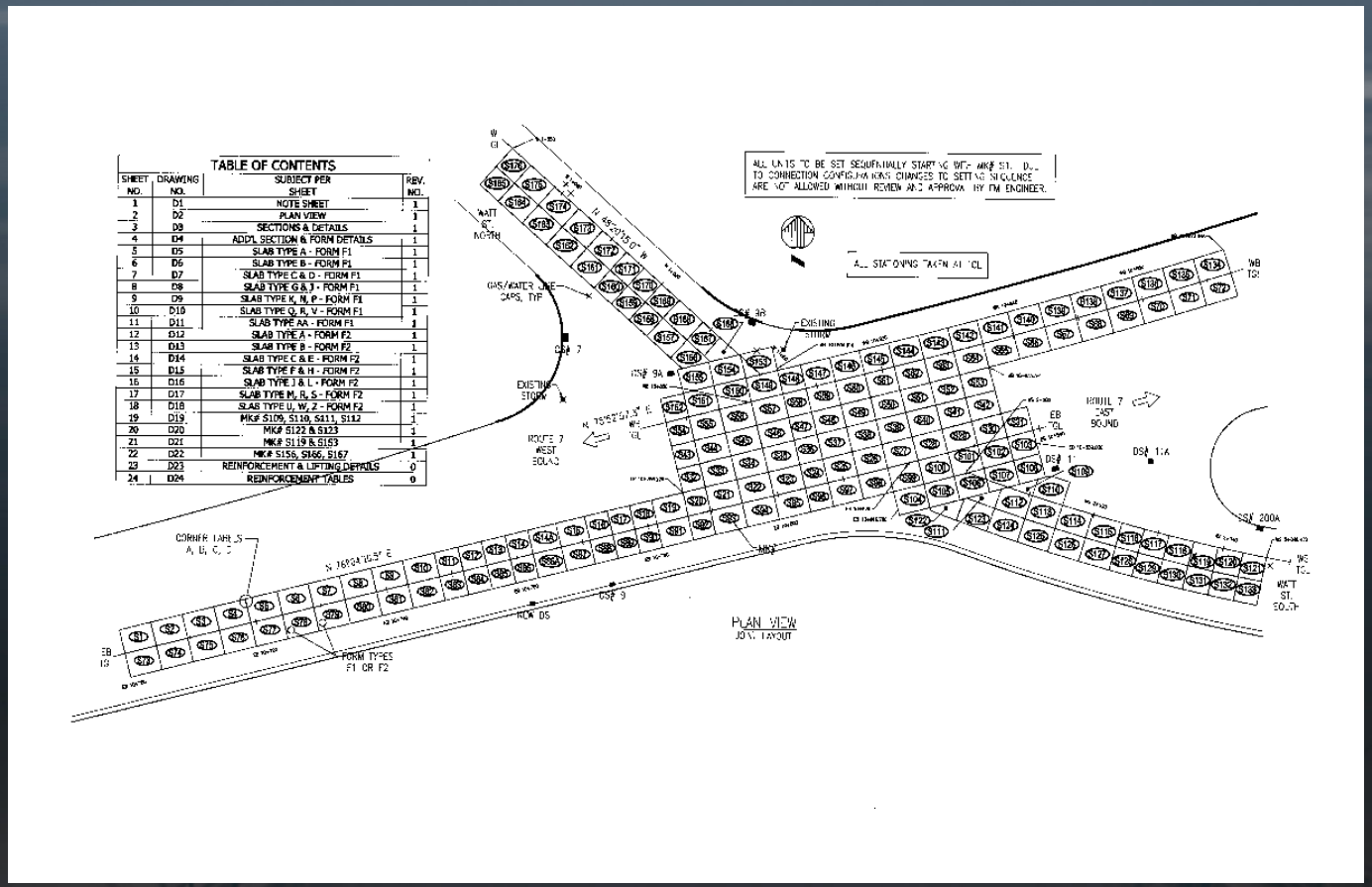

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PLAN VIEW

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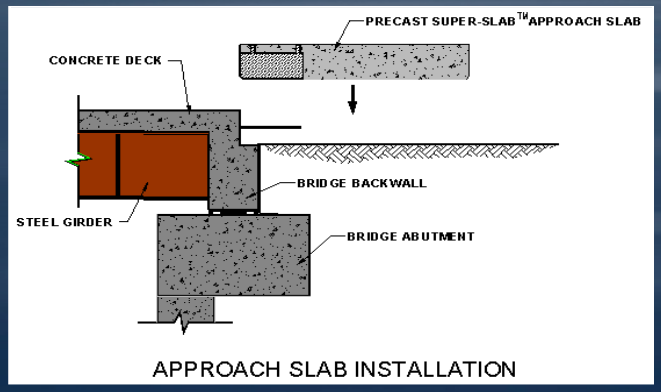
# Bridge Approach Slabs – NYSDOT Region 9 – Binghamton, NY



APPROACH SLAB INSTALLATION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# Bridge Replacement – 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

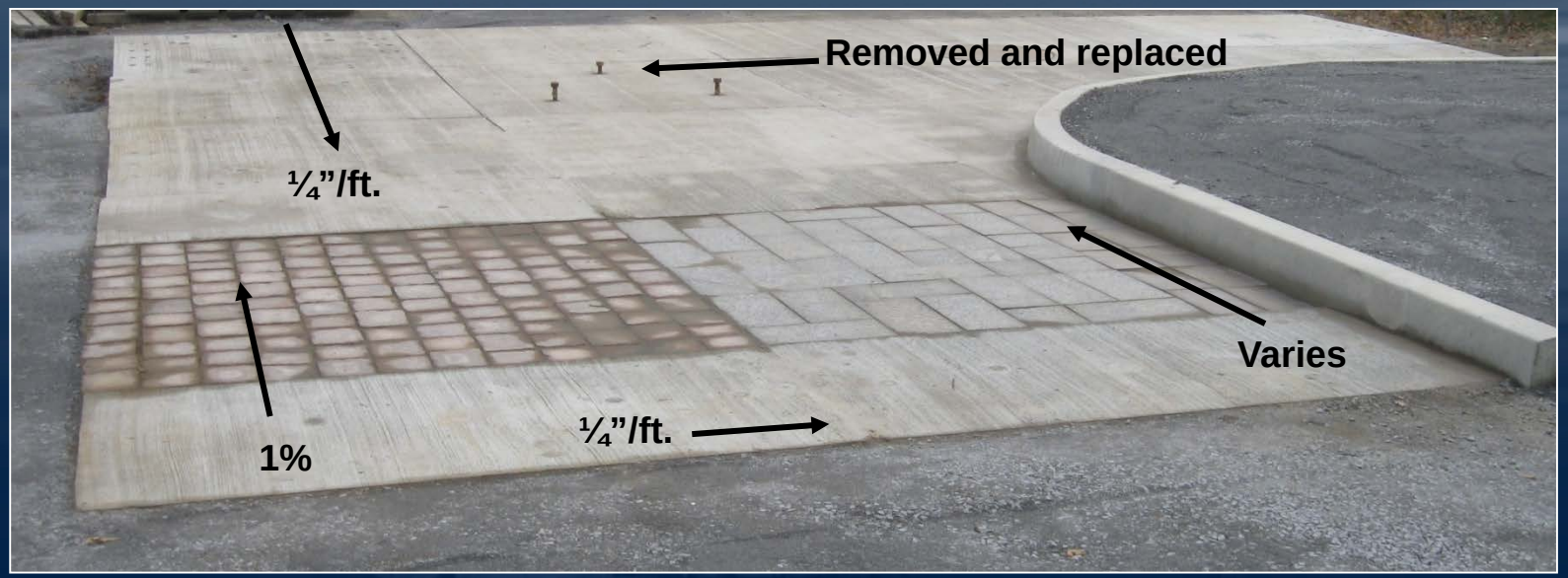
# Airport Taxiways


Dulles International Airport

October - 2002


Overnight Installation

# New Precast Concrete Pavement Technology Work Shop – Nov. 9, 2011




## Intersection "Quarter" With Varying Cross Slopes

(Cross Walks of Any Texture – Also Removable)

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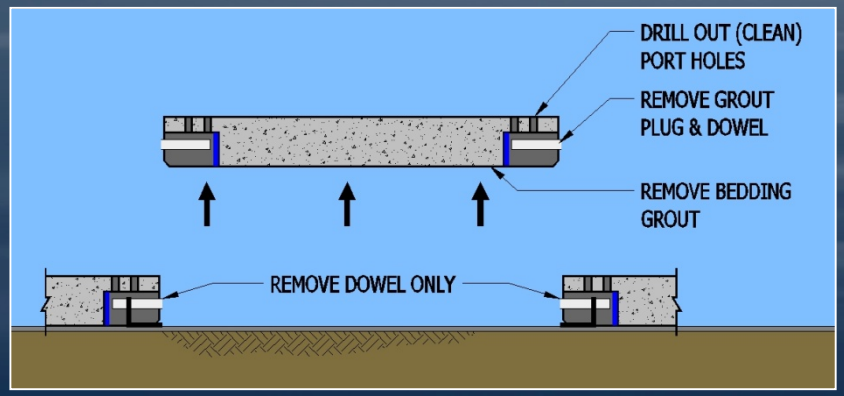
# Super-Paver – A Re-usable Urban Pavement (RUP) System

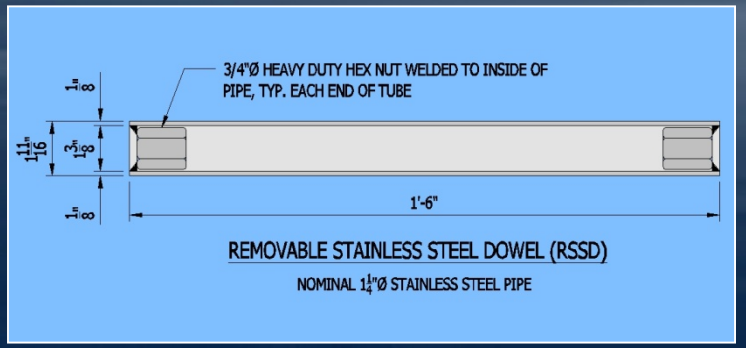

- Light weight
  - 6’ x 6’ weighs 2 T
- Vertically removable & replaceable
- Warped as required to fit any surface
  - Standard warps are in stock
- **Removable and reusable**

**(Designed specifically for utility-intensive urban highways and intersections)**

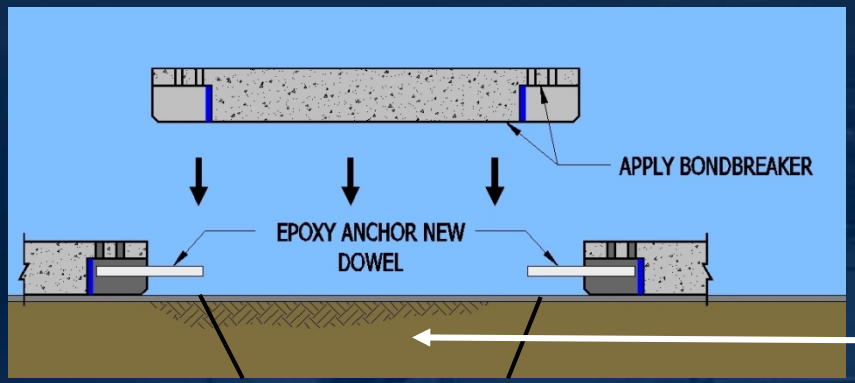
# Slab Removal & Replacement




Remove Slab Vertically and Clean

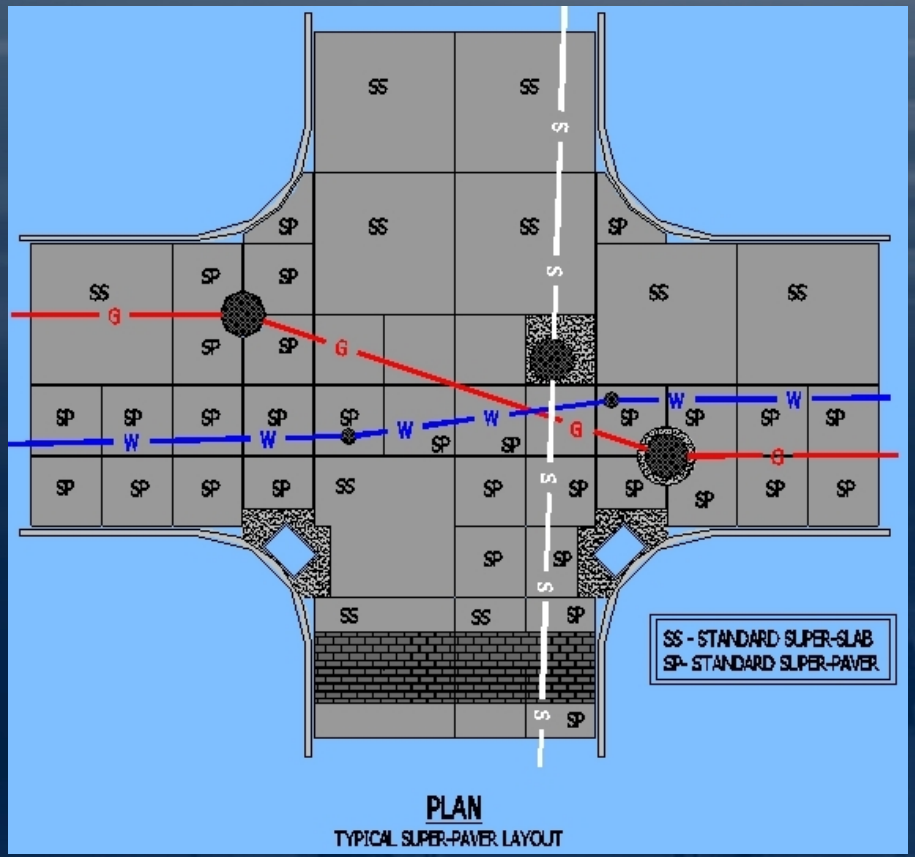



Super-Dowel




Replacing Cleaned-up Slab Over New Dowels

# Slab Layout Possibilities




- Intersection surfaces are heavily contoured
- Several standard warped slabs will accommodate almost any intersection
- Standard warped Super Paver slabs will be kept in stock

**Mix Big and Small Pavers As Needed**

# Other Possibilities

Cross Walks

Roundabouts

# I-15, Ontario, CA
# Continuous Placement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# NYSDOT Region 11 – Nassau Expressway / Rockaway Blvd.

- 2390 slabs
- 29,000 SY
- Replaced full-depth asphalt
- 300 lane-ft in 8-hour shift

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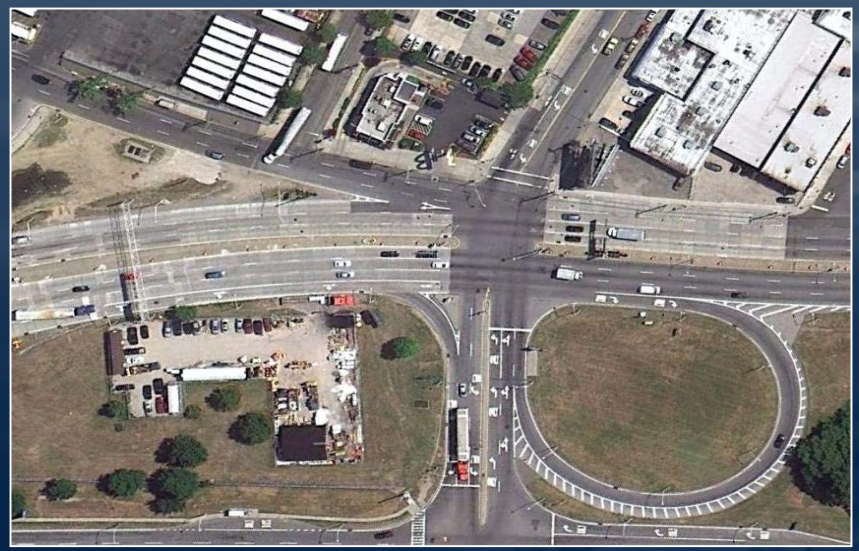
# Completed Intersection Approaches Rockaway Blvd., Queens, NY – 2010



Farmers Blvd

Guy R. Brewer Blvd.

**Intersection Approaches Only**

# New Pavement – Rockaway Blvd.


Farmers Blvd. – Before Grinding

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# I-95 Alexander Hamilton Bridge

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# NYC DOT – Brooklyn Bridge

# Bus Pads – Los Angeles, CA

# Bus Pads – Los Angeles, CA

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# VDOT I-66 WB to US 50
# FHWA Highways for LIFE Project

- 184,000 ADT, 5% Trucks
- (3) Repair Types:
  CIP, JPCP & PPCP
- Rt. Lane Super-Slab®
  224 Slabs: 12’x16’x8.75”

# I-95 Pavement Restoration
# TANE 06-21/D213514 New Rochelle, NY

# I-676 Vine St. Expressway
# PennDOT Project #82705
# Philadelphia, PA

# I-295 Pavement Repair
# Contract #041043470
# Burlington County, N J

# Autoroute 427 Rehabilitation
# Contract MTO 2008-2003
# Toronto, Ontario, Canada

# I-15 Rehabilitation
# Contract IM-15-7(221)332
# Layton to Clearfield, UT


# Somero S840 and 3-D Profiler

Somero Enterprises Inc.

Fort Myers, FL

www.somero.com

- Somero S840
- 3-D Profiler

# Somero Technology Matches Fort Miller's Warped Slab Requirements

No Forms

## Surface Details

- Panel points are stored in SMP's computer
- Finishes chorded surfaces – same a Super-Slab® warped form
- Cross slope varies linearly from one end to the other
- Surface accuracy of ± 1/8"

# I-78 Interchange 14C Toll Plaza
# NJ Turnpike Authority, Jersey City, NJ

# 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 length and spacing of repairs


# Continuous - Installation Rates

8 – 10 Slabs (1500 – 2000 SF) per Hour

- 12’ x 14’ slabs
- Average rate of over 6000 SF ( 500 Lane Ft.) per 8 hour shift – I-15, Ontario, CA
  - About one mile in two weeks

Rates should improve

- As Contractors become more familiar
- Improved specialized equipment

# Installed Costs (Bid Prices)

- Intermittent Repairs
  - About $ 238 to $ 450 per SY
  - Similar to rapid-set concrete costs (in some states)
- Continuous Installations
  - About $ 238 to $ 400 per SY
  - Up to 20% less than intermittent repair slabs
- Varies greatly with
  - Length of work window
  - Size of project
  - Local labor rates

# Smoothness

- Small differences are expected
  - Fabrication tolerance
  - Grading tolerance
- Super-Slab® finished surfaces ± 1/8”
  - May be acceptable for slow speed traffic
- Grind for best International Roughness Index
  - Diamond Grinding is an accepted and cost-effective practice

# Benefits to Owners

**Reduce construction-related traffic congestion**

**Longer lasting pavement repairs – Every Day Counts**

- **40+ years**
- **Reduced (long-term) repair costs**
- **“Get in, get out and stay out”**
- **“Incremental Total Replacement” – now possible**

**Reduces field inspection time and cost**

- **Precast slabs – plant inspected**

**Pre-engineered, pre-inspected slabs result in a superior finished pavement**

# Keys for Success

- Slab Design – Thickness & Size
  - Cast-in-place design criteria
  - Freight limitations
  - Base support
    - Cement treated base - special consideration
    - Existing concrete pavement below precast
  - Surface geometry
- Field Enforcement
  - Engineer in charge and inspectors
- Contractor aptitude and acceptance

# Places For Precast Construction

Philadelphia, PA

(2009)

I-95, New York City, NY

(2011 -2012– One Lane to Replace One Lane)

# Keys to Success
## (Still More to Learn)

Good engineering

Open minds

Real partnering


Thank You
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