Precast Pavement Construction Using The Super-Slab System ®

October 31, 2013

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 and promulgator of the Super-Slab® Precast Pavement System**

The Fort Miller Co., Inc.

Precast Concrete Pavement Slabs = Overnight Repairs

145,000 ADT

I-287, Tarrytown, NY

180,000 ADT

Cross Bronx Exp.

162,000 ADT

Brooklyn-Queens Exp.

The Fort Miller Co., Inc.

Overnight repairs for Failed Interstate Pavement!

Shattered Slabs

Pasadena, CA

Failed Rapid Set Patches

Hollywood, CA

Heavily Faulted Slabs

Pasadena, CA

210 Freeway, Pasadena, CA

The Fort Miller Co., Inc.

Urban Arterial & Intersection Pavement in Poor Condition

50 Year Old Pavement

Poor Surface Drainage

Many Utilities

Shoved Black Top

The Fort Miller Co., Inc.

Precast Pavement BASICS

Precast Slabs

\+ Uniform Support

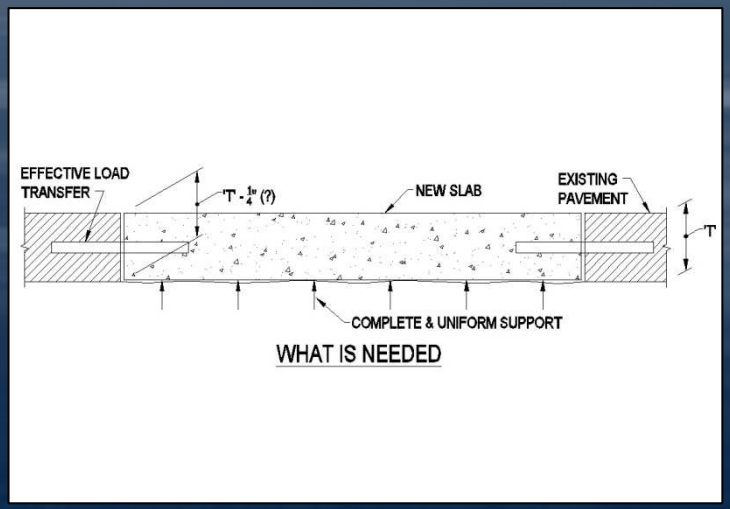
\+ Match Road Surface

\+ Effective Load Transfer Between Slabs

Successful Long-term Repair

The Fort Miller Co., Inc.

Precast Pavement Emulates Cast in Place



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

Overview of 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"

The Fort Miller Co., Inc.

Grade-Supported, Bottom-Slot Super-Slab® System

- Simple slab-on-grade system
- Standard dowels and tie bars (JRCP)
- Built-in bedding grout distribution
- Precision grading equipment
- Warped and planar surfaces
- 15,000 + slabs = 1,575,000 SF INSTALLED

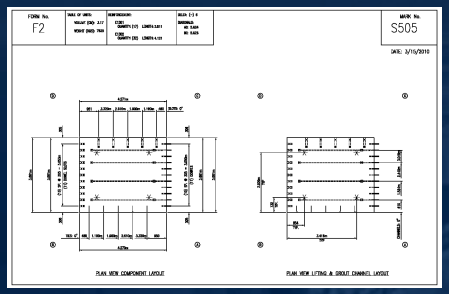
(78 projects, 27 lane-miles completed in 13 States + ONT & QUE)

The Fort Miller Co., Inc.

Controlled Fabrication Conditions

Accurate Forms

Roller Screed - Accurate Top Surface



Accurate Piece Drawings

Ideal Finishing (and curing) Conditions

The Fort Miller Co., Inc.

Grade Control & Slab Support – A Two - Step Process

Primary Bedding

Grade control rails placed to survey marks

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

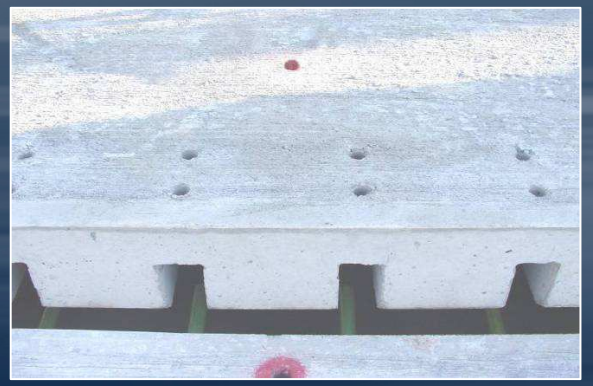
Secondary Bedding

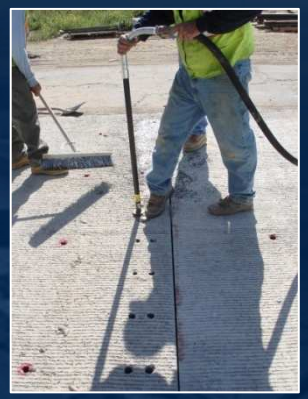
Bedding Grout Fills Any Voids

The Fort Miller Co., Inc.

Super-Slab®
Load Transfer Dowel System

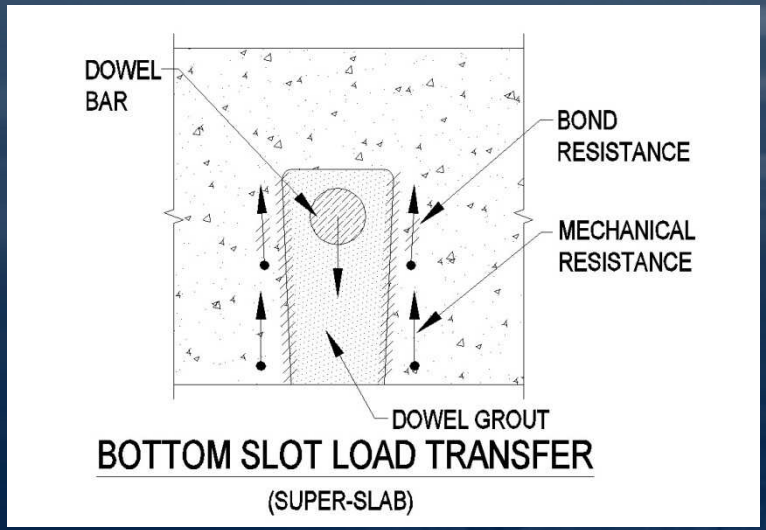
- Dowels engage slots in adjacent slab
- Pump dowel group into ports
  - Grout reaches 2500 psi in about 2 hours
- Fill slots and joint between slabs
- Dove-tail slot resists bar pop out





Dove-tail-shaped slot

Load Transfer Mechanisms –Bottom-Slot Super-Slab®



- "CLEAN" TOP OF SLAB
- STRONG CONNECTION
- FAST – SLOTS CAST IN

(proprietary detail)

The Fort Miller Co., Inc.

Indicators for Long Life
Full scale load testing in California

Falling Weight Deflectometer

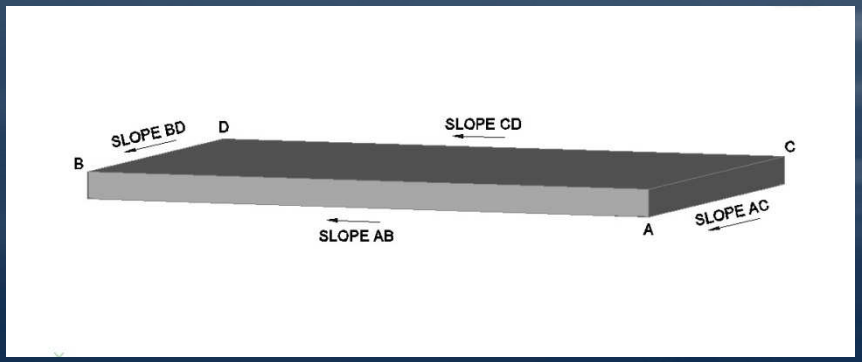
Test results show no cracks or distress

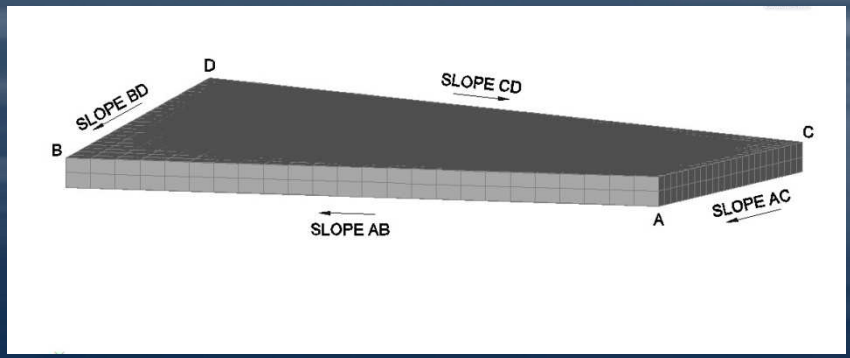
Heavy vehicle simulator

143 Million ESALs (100 KN Load)

4.3 Million Cycles

Slab Surface Geometry





Single Plane

- Slopes of opposite sides are equal

Warped Plane

- Slopes of opposite sides are un-equal

At the Site

- Lay out slab locations and limits
- Cut and remove existing slabs
  - May be a single or a multiple of single slabs
- Install load transfer dowels and tie bars
- Place, grade and compact bedding material
  - Mainline or ramps
- Place slabs
  - At specified locations
- Install dowel and bedding grout
- Grind (if necessary) to achieve smoothness requirements

The Fort Miller Co., Inc.

Saw Cutting and Removal

Cuts - Full Depth
- Accurate

Slab crab bucket

Trucks - right size
- right number

The Fort Miller Co., Inc.

Drilling for Dowels

Mark Out (accurately)

to Match Dovetail Slots

16 holes – 12 minutes

Precision Grading is the Key!

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

- **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

The Fort Miller Co., Inc.

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

Three Steps

(12 minutes)

First Pass (high)

Compaction

Last Pass (done)

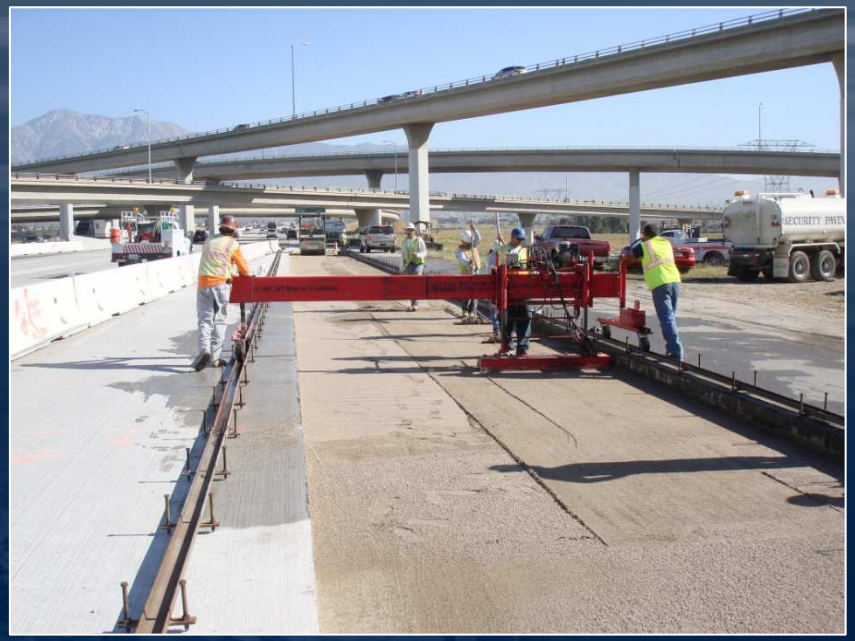
The Fort Miller Co., Inc.

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)

The Fort Miller Co., Inc.

Drilling for Dowels

Mark Out (accurately)

to Match Dovetail Slots

16 holes – 12 minutes

Shipping and Placing

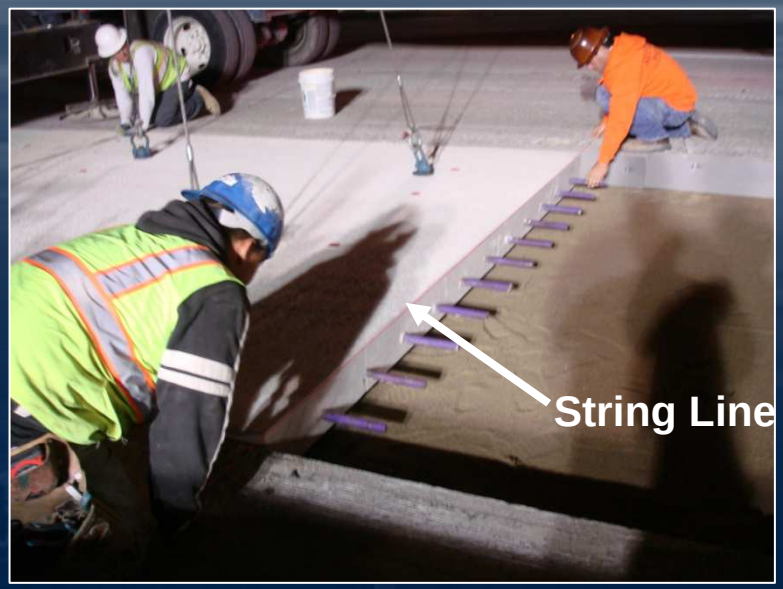
- Size slabs for shipping
  - 12’ Max. width
  - Special permits
- Ship in order – by mark number
- Provide unloading lane / shoulder

The Fort Miller Co., Inc.

Placing Slabs – Continuous

Crane Occupies New Slabs

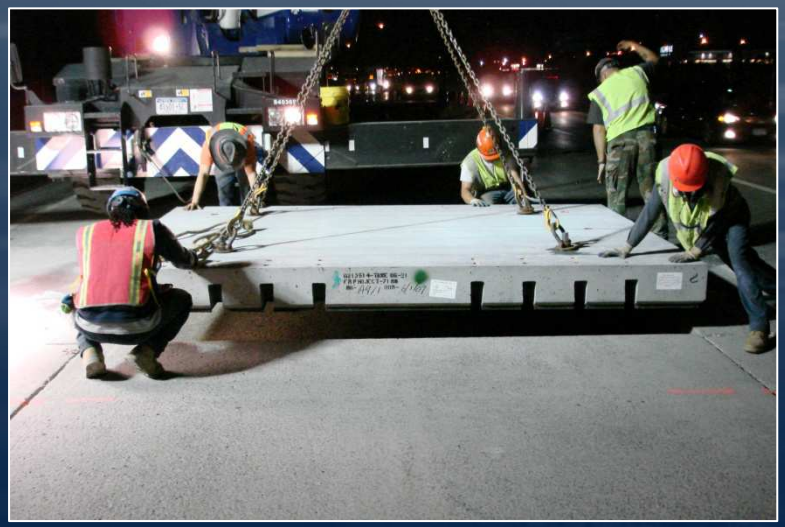
12’ Lane & 10’ Shoulder (min.)



Set Slab to String

The Fort Miller Co., Inc.

Placing Slabs – Intermittent

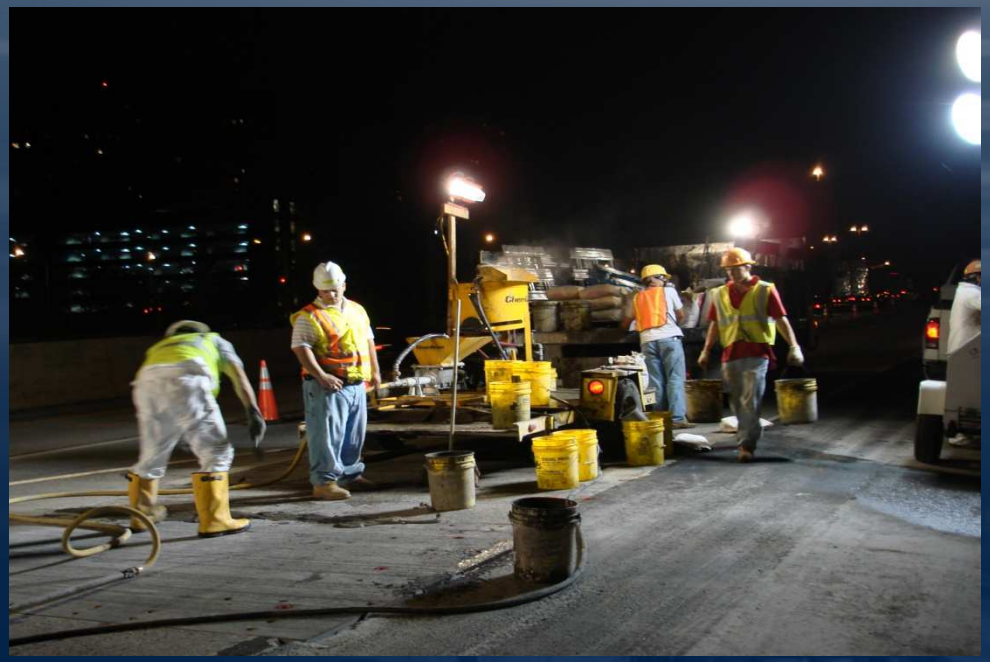


Center Slab in Hole

(Single Slab Holes)

Crane Occupies New Slab

Grouting



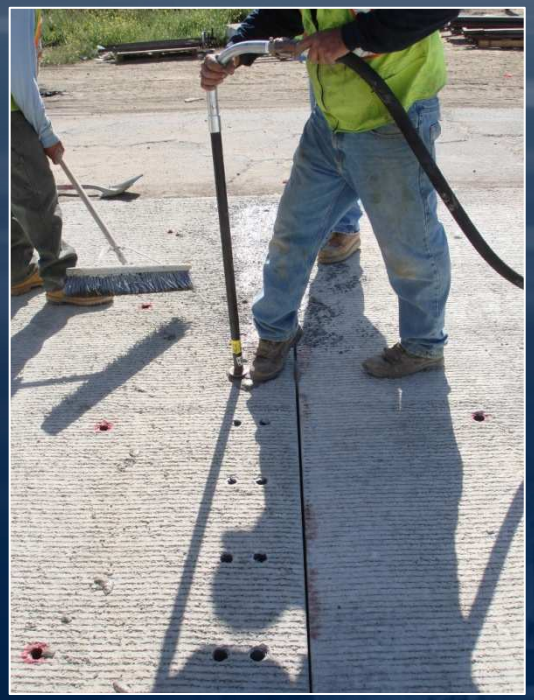
- Truck (grout material & water)
- Trailer (grout mixer/pump)
- Short hose & nozzle
- Pails (for water measuring)
- Barrels (for waste)

Requires Grout Rig

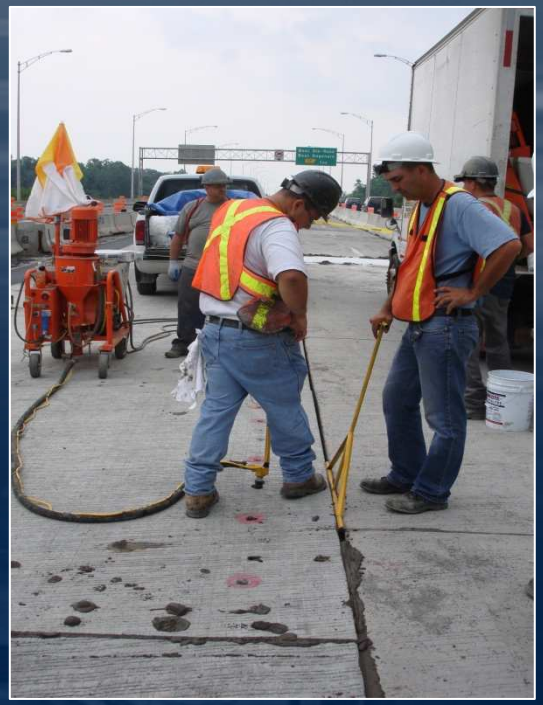
(Typically completed subsequent nights)

The Fort Miller Co., Inc.

Installing Dowel Grout



Fill Dowel Slots and Joints First



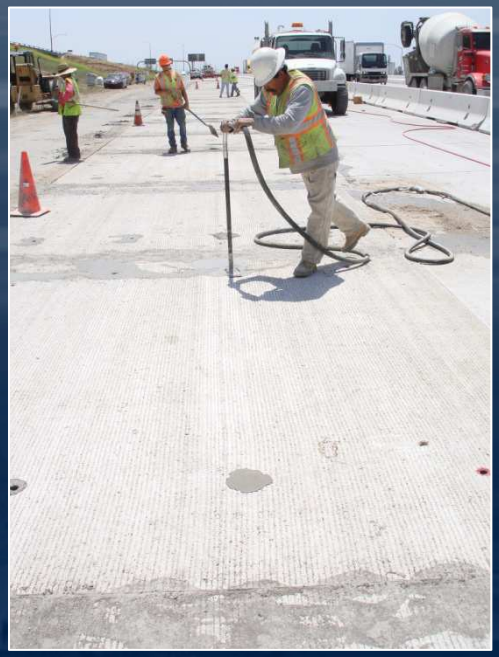
Contractor-Designed Joint Dam

The Fort Miller Co., Inc.

Installing Bedding Grout

Pre-bagged Bedding Grout

(Recommended)



Flow Rate

15 - 20 Seconds Max.

Keep Ports Full by "topping off"

NJDOT & NYSDOT Specifications

NJDOT Sec 453 – Full Depth Concrete Pavement Repair, Precast

NYSDOT 704 -15 Precast Concrete Pavement Slab Systems

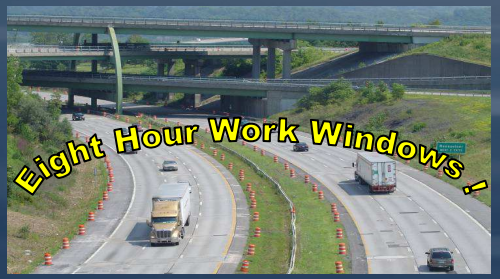
- Fabrication Standard Drawings, Install Instructions, Trial Installation
- Approved List

NYSDOT EI 05-043 Precast Concrete Pavement Slab Systems – Design Guidance

NYSDOT 502.15PF—18, Precast Concrete Pavement Slabs

The Fort Miller Co., Inc.

Intermittent Repairs (CPR)



I- 90

Albany, NY

I-676 Vine St Expressway

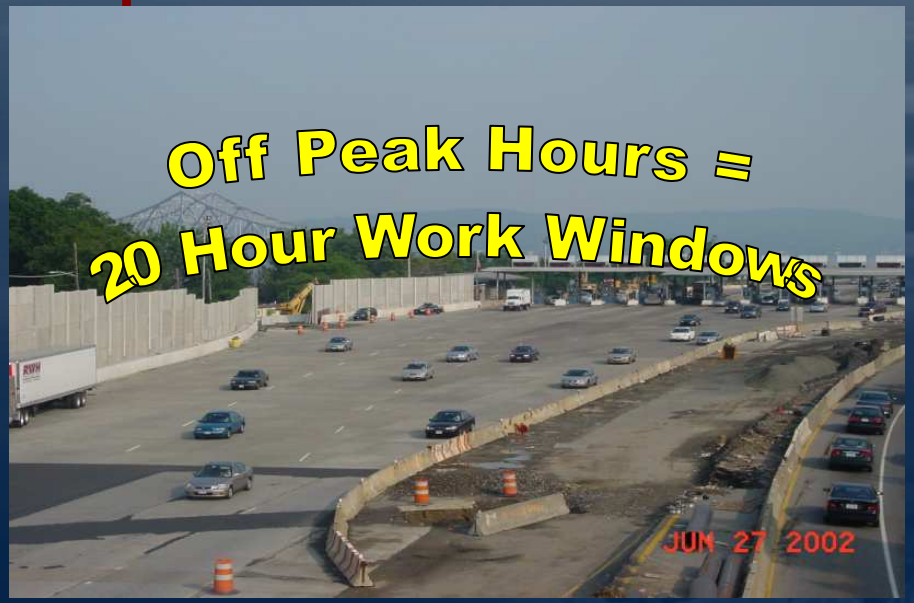
Philadelphia, PA

I-15 Salt Lake City, Utah

I-95, New Rochelle, NY

The Fort Miller Co., Inc.

Continuous - Tappan Zee Bridge Toll Plaza



3,000 SF / 8 Hour Shift

(Within ± 1/8")

2001 - 2002

Open for Rush Hour

(135,000 ADT)

The Fort Miller Co., Inc.

Continuous - Mainline Placement

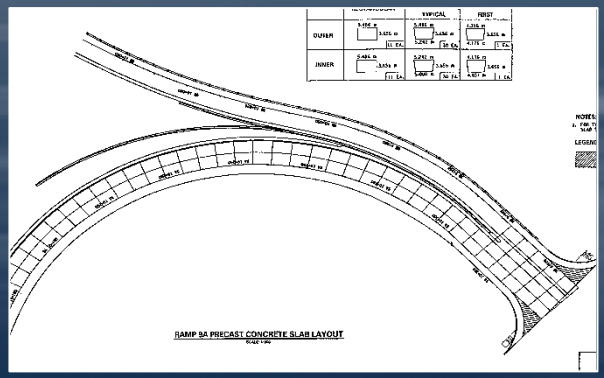
Mainline I-15, Ontario, CA

(200,000 VPD)

The Fort Miller Co., Inc.

Ramps

Chicago, Il



Plan View Tarrytown

Brooklyn, NY

Tarrytown, NY

The Fort Miller Co., Inc.

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

New & Old

Complex Geometry

Undercuts

Replaced in 17 Nights!

NY 7 Crosstown Connection

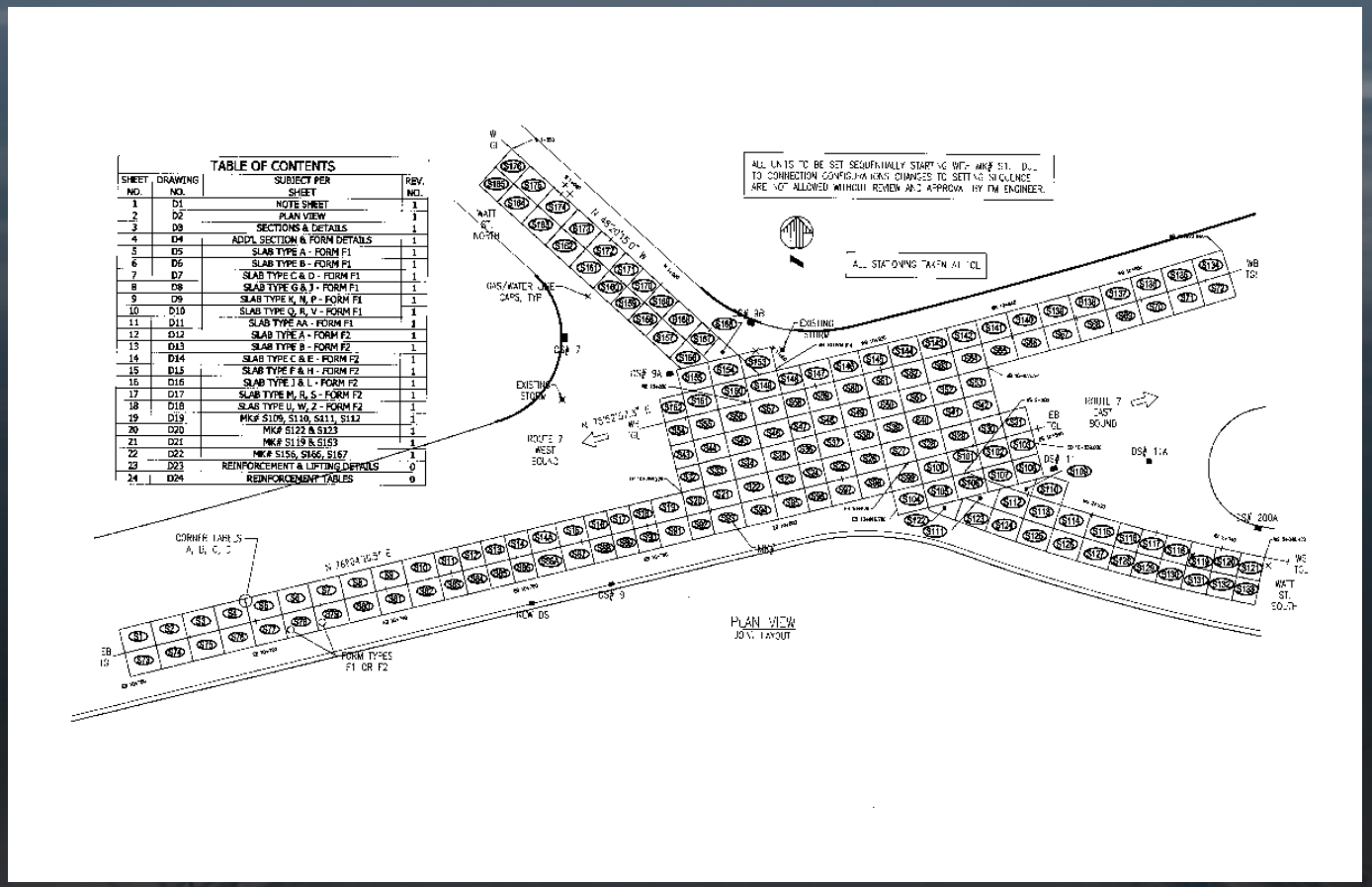


TABLE OF CONTENTS

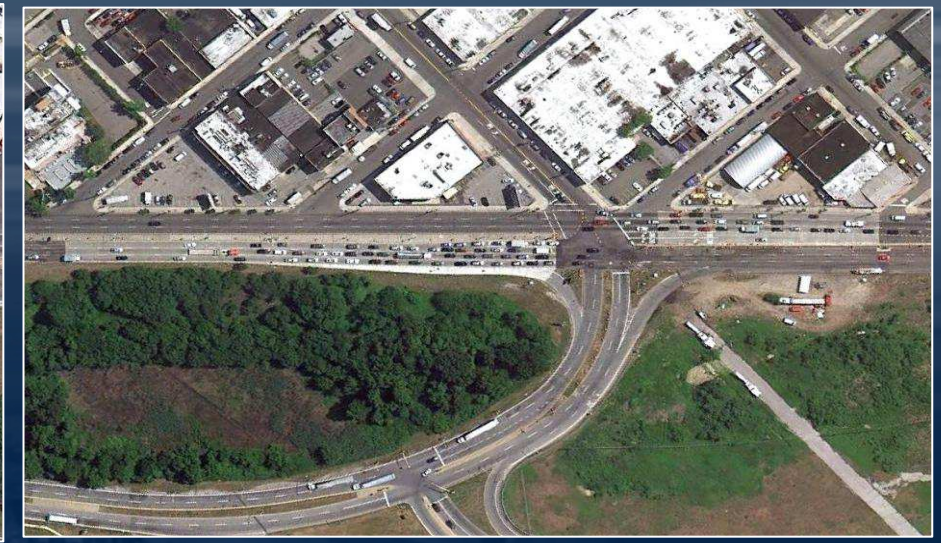
SHEET NO.	DRAWING NO.	SUBJECT PER SHEET	REV. NO.
1	D1	NOTE SHEET	1
2	D2	PLAN VIEW	1
3	D3	SECTIONS & DETAILS	1
4	D4	ADD'L SECTION & FORM DETAILS	1
5	D5	SLAB TYPE A - FORM F1	1
6	D6	SLAB TYPE B - FORM F1	1
7	D7	SLAB TYPE C & D - FORM F1	1
8	D8	SLAB TYPE G & J - FORM F1	1
9	D9	SLAB TYPE K, N, P - FORM F1	1
10	D10	SLAB TYPE Q, R, V - FORM F1	1
11	D11	SLAB TYPE AA - FORM F1	1
12	D12	SLAB TYPE A - FORM F2	1
13	D13	SLAB TYPE B - FORM F2	1
14	D14	SLAB TYPE C & E - FORM F2	1
15	D15	SLAB TYPE F & H - FORM F2	1
16	D16	SLAB TYPE J & L - FORM F2	1
17	D17	SLAB TYPE M, R, S - FORM F2	1
18	D18	SLAB TYPE U, W, Z - FORM F2	1
19	D19	MK# S109, S110, S111, S112	1
20	D20	MK# S122 & S123	1
21	D21	MK# S119 & S163	1
22	D22	MK# S156, S166, S167	1
23	D23	REINFORCEMENT & LIFTING DETAILS	0
24	D24	REINFORCEMENT TABLES	0

PLAN VIEW

The Fort Miller Co., Inc.

Intersection Approaches – Replacing Full Depth Ashpalt, Rockaway Blvd., Queens, NY – 2010

Farmers Blvd

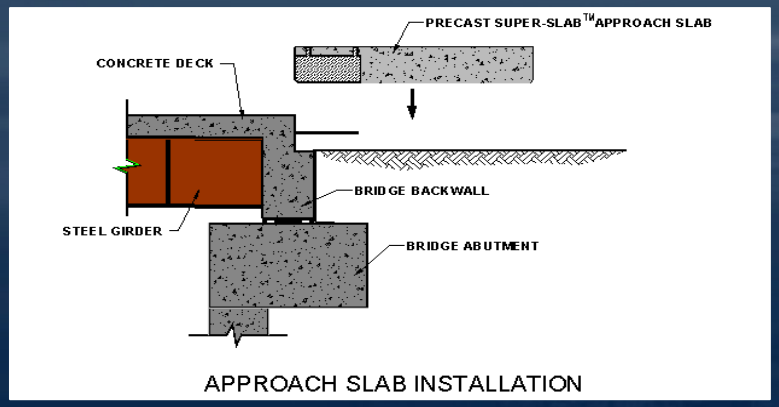


Guy R. Brewer Blvd.

Intersection Approaches Only

The Fort Miller Co., Inc.

Bridge Approach Slabs (Existing Bridges)



Cross Section at Abutment

Binghamton, NY (2009)

NY State DOT

The Fort Miller Co., Inc.

Bridge and Approach Slab Total 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

Bridge Units

Skewed Approach Slabs

The Fort Miller Co., Inc.

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

Grading

Placing

Last Slab

Finished, Next Day

The Fort Miller Co., Inc.

Industrial Driveways
City of Mamaroneck, NY

Continuous Access During Construction

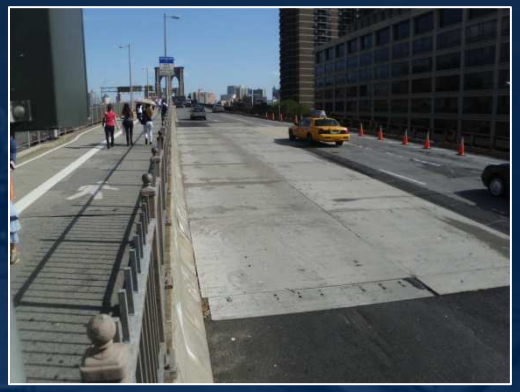
The Fort Miller Co., Inc.

Brooklyn Bridge Approaches 2010 – 2013

Grading

Placing

Looking Towards Manhattan



Looking Towards Brooklyn

The Fort Miller Co., Inc.

Alexander Hamilton Bridge West Approach, 2011 – 2013

Lower Level

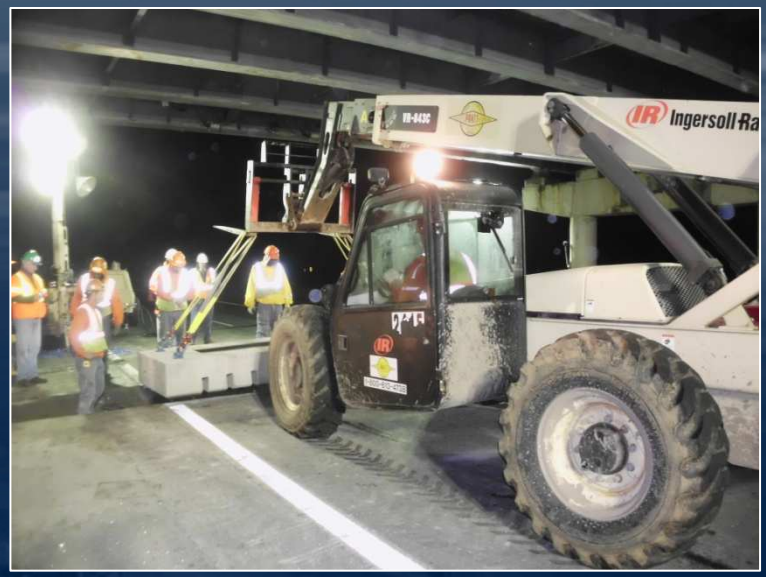
Contractor Gets One Lane To Replace The Same Lane

Grading

Placing, June 2012

Other Places for Fast-Track Precast Pavement

- Under Bridges
- Instrumented pavement
  - Toll booth treadles
- Weigh and Motion Stations
- Round-Abouts
- Utility corridors



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

The Fort Miller Co., Inc.

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

The Fort Miller Co., Inc.

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

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

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

The Fort Miller Co., Inc.

Compare with Conventional Fast-Track Concrete Actual Bid Prices (NY State)

Item No.	Description	(SY)
502.2001	Saw Cutting	$ 23.33
502.3101	Lift Out Removal	$ 13.33
502.3301	Tie Bars	$ 30.00
502.3201	D & A Dowels	$ 30.00
502.3603	PCC Placement	$ 175 - $ 238
Total		$ 272 - $ 335

The Fort Miller Co., Inc.

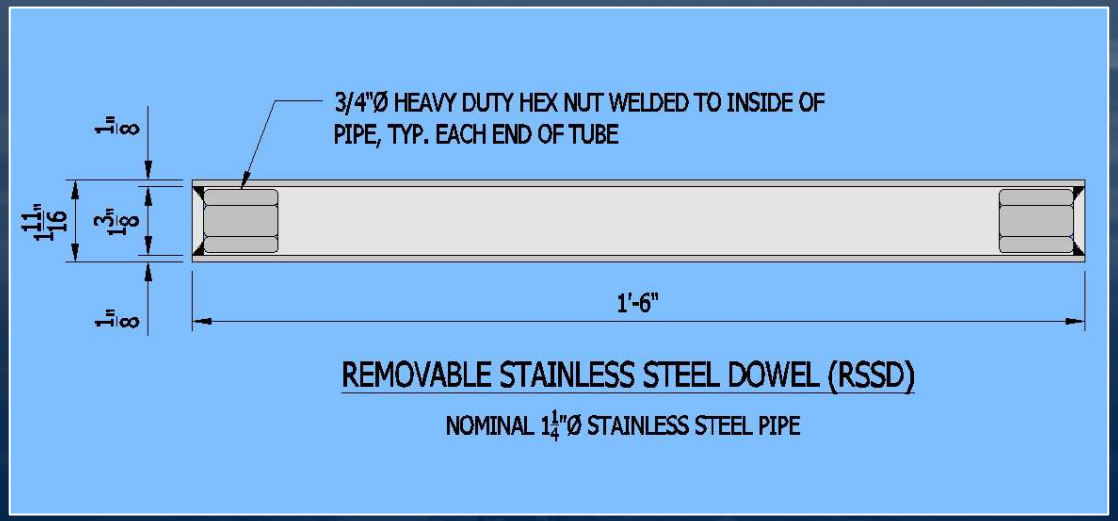
Pavement - Asset Management Strategies With Precast Available

- Use quality precast material every time
  - 40-year service life
- Use maintenance dollars for good 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

The Fort Miller Co., Inc.

New Developments in Super-Slab Precast Pavement

Super-Dowel (Pat. Pending)

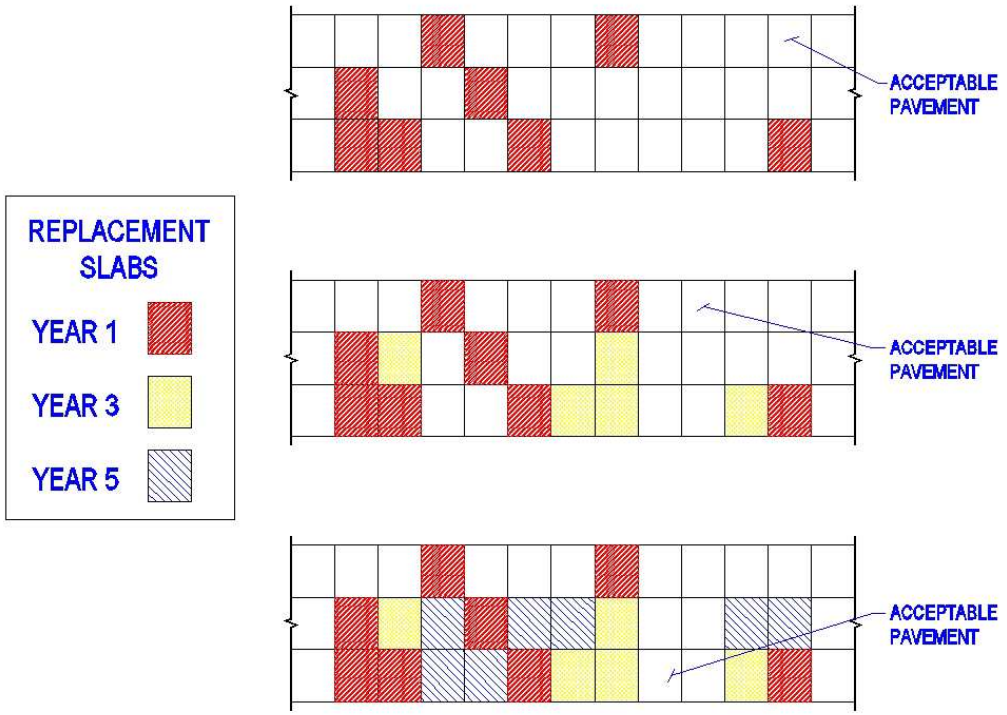


Removable & Replaceable

Enables Removable (& Replacable) Precast Pavement

The Fort Miller Co., Inc.

Incremental Total Replacement Using Super-Dowels



Makes The Most of Our Existing Concrete Pavement Asset

The Fort Miller Co., Inc.

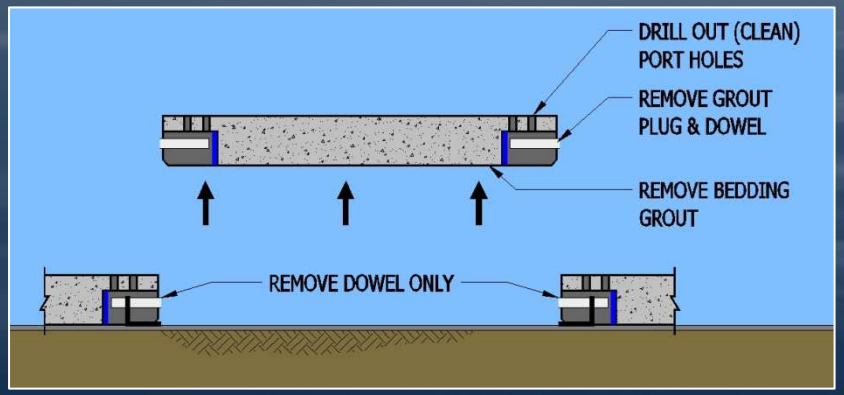
Super-Paver – A Re-usable Urban Pavement (RUP) System (Made Possible With Super-Dowels)

- 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**

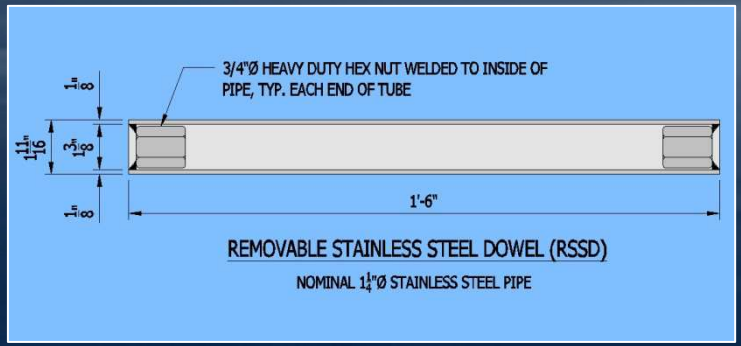
(Designed specifically for utility-intensive urban highways and intersections)

The Fort Miller Co., Inc.

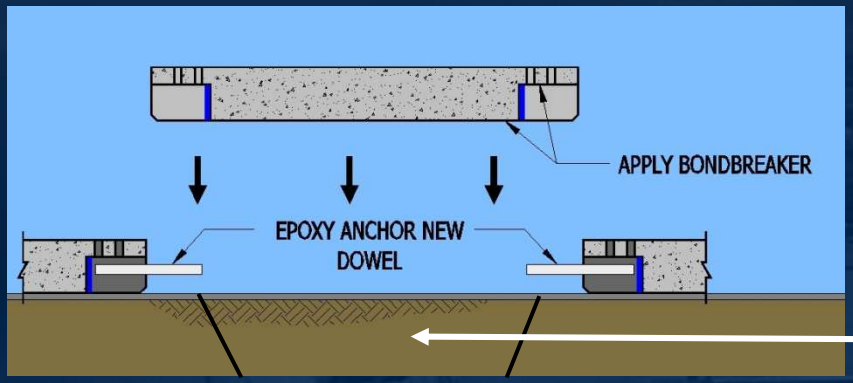
Slab Removal & Replacement



Remove Slab Vertically and Clean



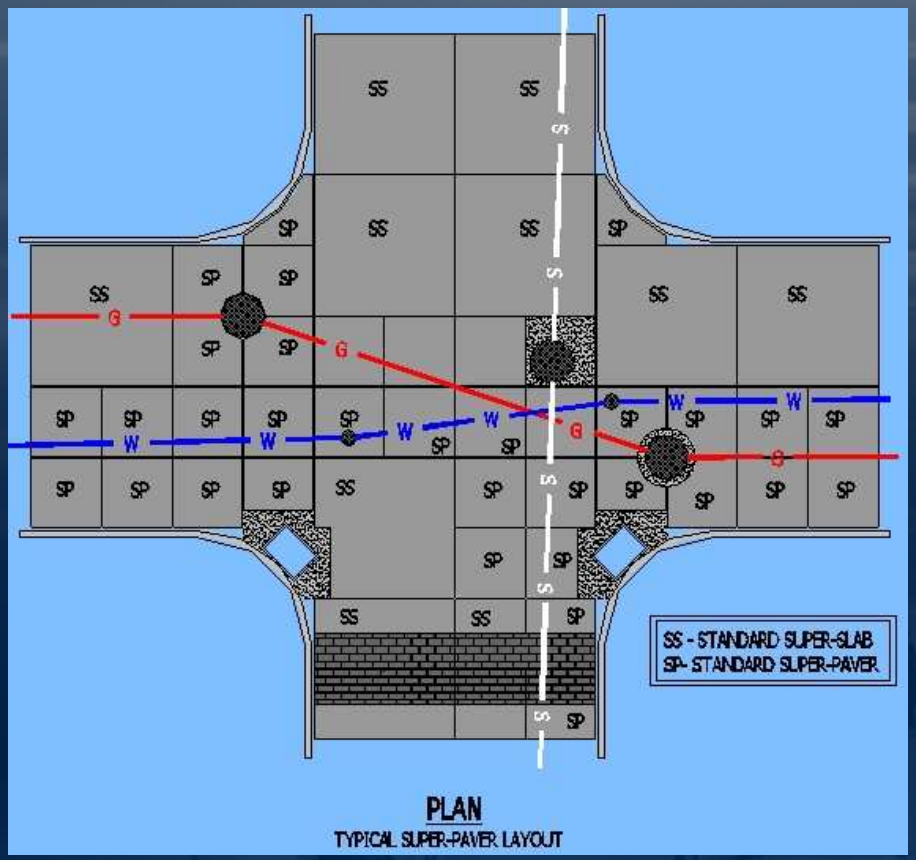
Super-Dowel



Utility Trench

Replacing Cleaned-up Slab Over New Dowels

Slab Layout Possibilities



- Remove slabs to work on utilities (Super-Dowels)
- Clean up and replace removed slabs
- Mix big and small Super-Pavers as needed

Super-Pavers Installed Over Utilities

NYC DOT – Broadway Junction
Van Sinderen Avenue

Reasons for Using Precast Pavement

- Heavy traffic
  - Requires most durable repair
  - Urban arterials most likely candidates
- Long term detours and staging not options
  - Access ramps, intersections prime candidates
- Traffic volumes require short work windows
  - If you have only 8 hrs., you need to strongly consider precast pavement
  - If you have only 5 hrs., precast likely your best option

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”
- “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

Benefits to Contractors

Eliminates design and submittal of fast-track concrete mix
- NYSDOT requires 45 Days for approval

Fewer risks in placement
- No finishing
- No curing time
- Immediately open to traffic
- Less weather sensitive – longer construction season

Material costs known at bid time

The Fort Miller Co., Inc.

Super-Slab® Pavement BASICS

Precast Slabs – Precision Engineered, Durable 40+ yr, Cost Effective

\+ Uniform Support – Super-Grading, Fully Compacted Subgrade

\+ Match Road Surface – Plane & Warped

\+ Effective Load Transfer Between Slabs - Dowels in Fully Grouted Dovetail Slots

---

Successful Long-term Overnight Repair

15,000 Slabs = 25+ lane-miles

Keys to Success
(Still More to Learn)

Good engineering

Open minds

Real partnering

FORT MILLER
THE FORT MILLER CO., INC.
Precast Concrete Solutions

Question #1:

What are the two types of concrete roadway repair made with Super-Slab® System?

Answer:

1) Intermittent or patch repair installations
2) Continuous repair installations

FORT MILLER
THE FORT MILLER CO., INC.
Precast Concrete Solutions

Question #2:

How does Super-Slab® System accommodate complex pavement surface geometry?

Answer:

Using a combination of planar and non-planar slabs on a matching precision graded subbase

FORT MILLER
THE FORT MILLER CO., INC.
Precast Concrete Solutions

Question #3:

What is the shortest work-window to be used with Super-Slab® System?

Answer:

5 Hours – 1:00 AM to 6:00 AM

NYS Thruway Authority – I-95 New Rochelle, NY


Thank You
The Fort Miller Co., Inc.