Prefabricated Grid Reinforced Concrete Bridge Deck Replacement

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BGFMA

REHABILITATION = PRESERVATION

- Partial or complete deck replacement is considered rehabilitation.
- In many cases, deck replacement can extend service life of structure and save significant future costs.
- Per FHWA, "…these projects typically require significant engineering resources for design and a **lengthy completion schedule**…
- …Or do they?

GDOT DECK REHAB APPROACH

- Bonded concrete overlays

  Never for Interstates, Rarely for High Volume

- Hydro and concrete overlay

  Bread and butter. Dep. on existing condition.

- Conventional CIP repl. w/ high early concrete

  Hydro is not an option. 7-10 day lane closures.

- Pre-fabricated deck systems

  When costs associated with impact to traffic (accidents, lost revenue, etc.) outweigh material costs.

Source: ***The Georgia Engineer***, June/July 2006

WHY GRID REINFORCED CONCRETE?

- Grid reinforced concrete decks are specified for three primary reasons:
  - Durability/Longevity
  - High strength to weight ratio
  - Speed of installation
- **Durability/Longevity:**

  Several decks have 50+ years of service:

  ✓ South 10th St. Bridge (PADOT) 1932-…

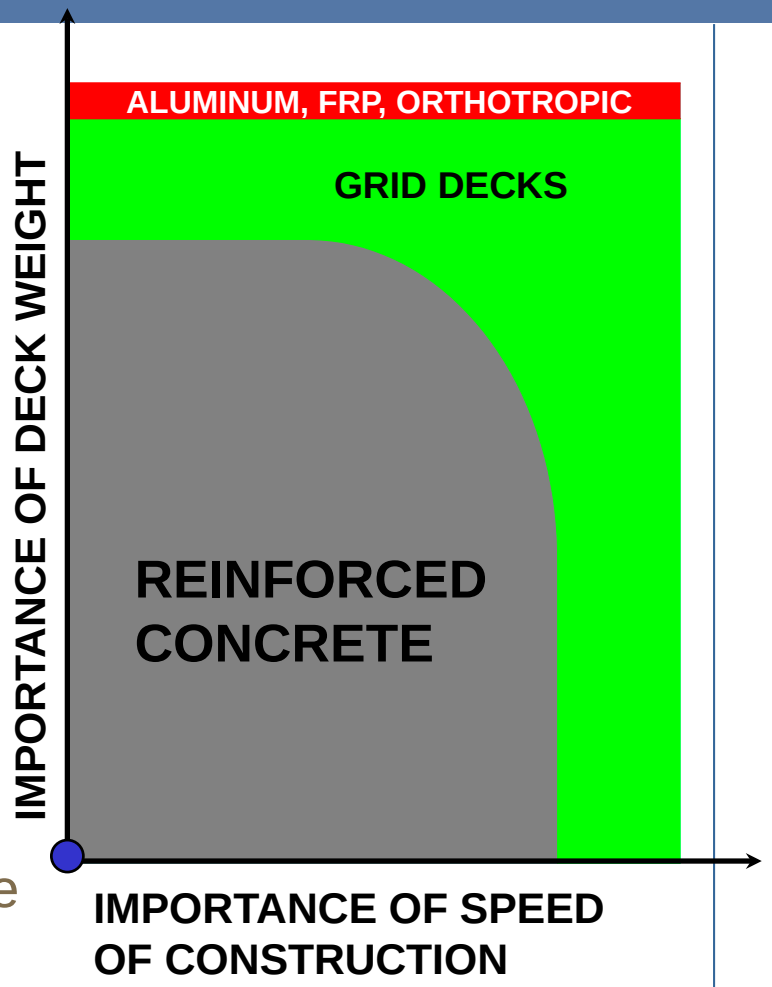
  ✓ Walt Whitman (Del River Port Auth) 1956-2013

  ✓ Mackinac (Mackinac Bridge Authority) 1957-…

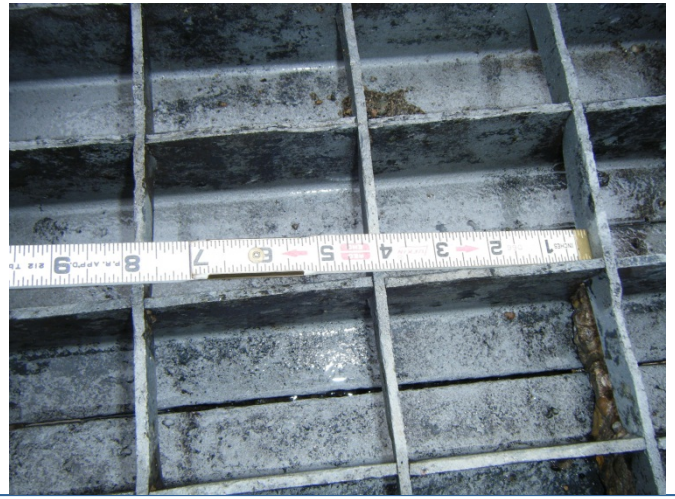
  ✓ Homestead Grays (High Level) Bridge (Allegheny County) 1936-…

  In some mixed applications, the grid deck has outlived the standard concrete deck x2 or more

- **Deck Weight**
  - ✓ Save 30%-50%
  - ✓ Reduction in deck DL provides an increase in LL capacity
  - ✓ Further weight reduction can be achieved using lightweight concrete
- **Speed of Installation**
  - ✓ Public impatient with bridge construction congestion
  - ✓ Focus of FHWA: “Get In, Get Out, Stay Out”
  - ✓ Nighttime, Weekend or other MPT
  - ✓ Indirect cost savings



SOUTH 10th ST. BRIDGE, PITTSBURGH, PA



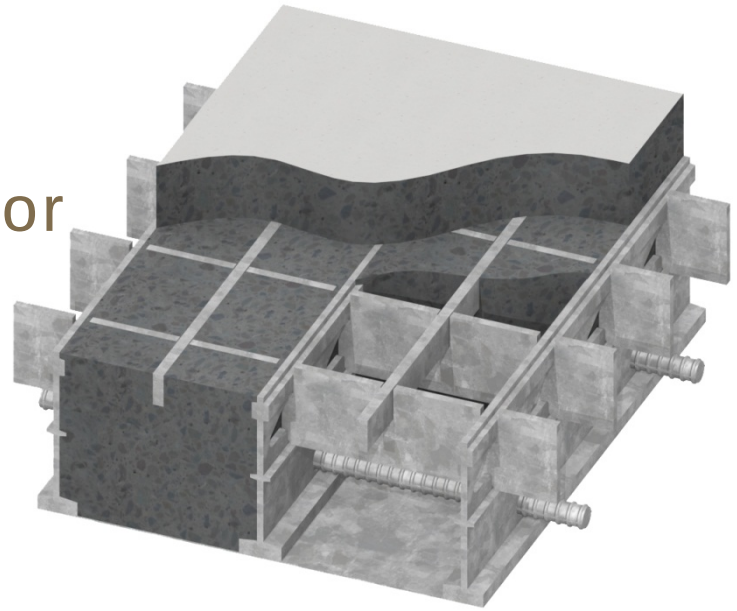
Hydro-removal of concrete reveals the steel grid in exceptional condition - even after over 85 years in service!

Approved for historical structures such as Eads Bridge over the Mississippi – required a strong, lightweight system (Originally opened to traffic in 1874)

Commonly used for lightweight deck on moveable bridges such as 17th St. Causeway Bridge in Ft. Lauderdale, FL (spanning floorbeams spaced @ 14.4 ft with no stringers)

FILLED GRID SYSTEMS

- In 1930's, full-depth grid introduced by engineers for **high strength / weight ratio** and to **speed up construction** on large bridge projects

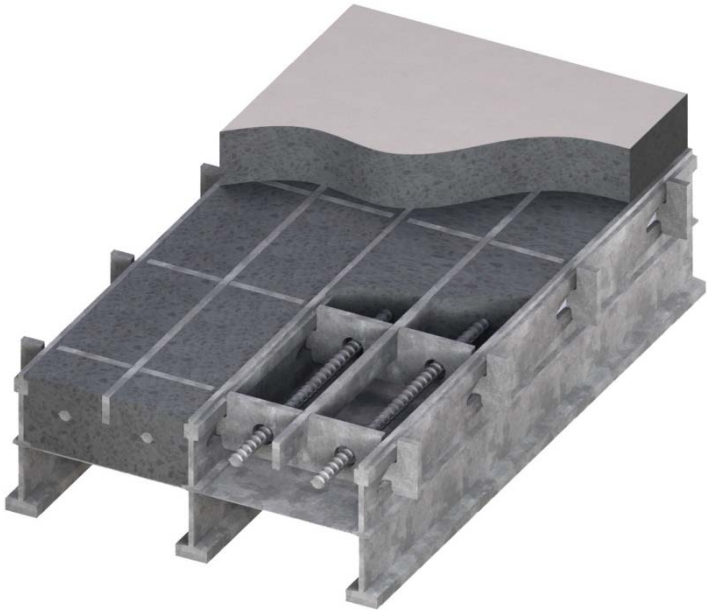


FULL-DEPTH CONCRETE FILLED GRID

- Can be precast or cast-in-place for very quick installation; **high performance to cost ratio**
- High durability and longevity are demonstrated by the **great service history**

FILLED GRID SYSTEMS

- Partially filled grid - first used in the 1950's to further **reduce weight** by eliminating concrete in bottom tension zone

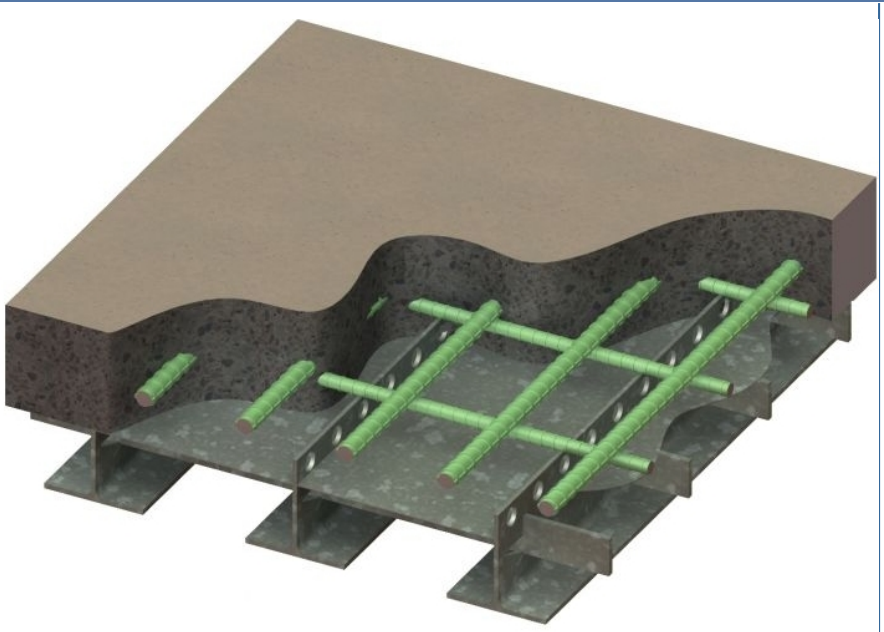


PARTIAL-DEPTH CONCRETE FILLED GRID

- Can be precast or cast-in-place offering rapid construction; very **good strength to weight ratio**
- Proven performance, this LW system offers **similar span capabilities to Full-Depth**

EXODERMIC® DECK

- Developed in the early 1980's – evolved from traditional concrete filled grid decks
- AASHTO defines as "unfilled steel grid deck composite with a reinforced concrete slab"
- Through optimizing the material properties where they best fit, Exodermic® decks have the **best strength to weight ratio**



EXODERMIC® DECK

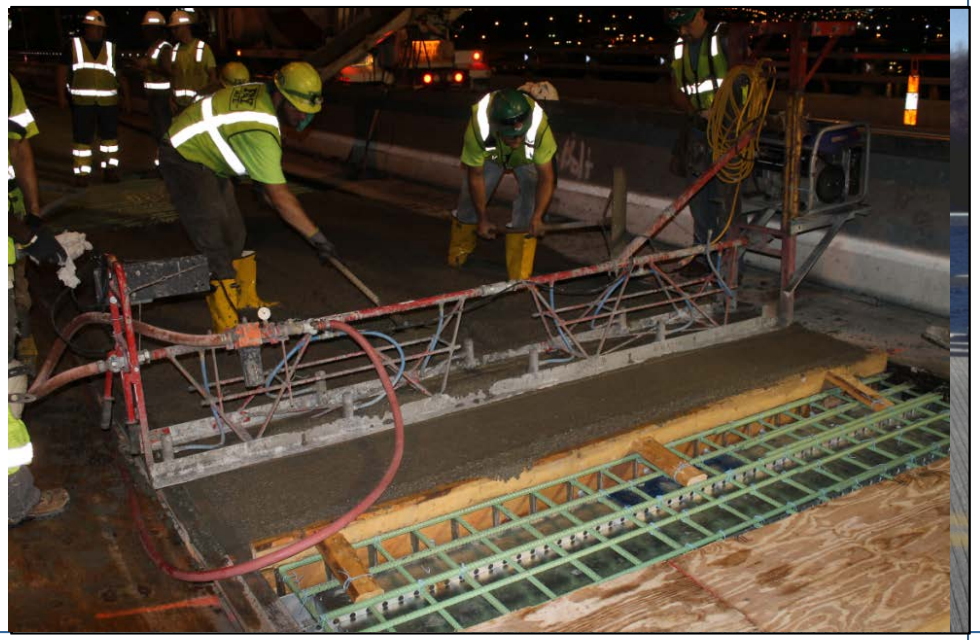
CAST-IN-PLACE CONSTRUCTION

- The grid arrives at the job site as a galvanized, "**pre-formed**" deck, with very little additional formwork required
  - ✓ Rapid installation (up to 1000 SF/day)
  - ✓ Allows staged construction

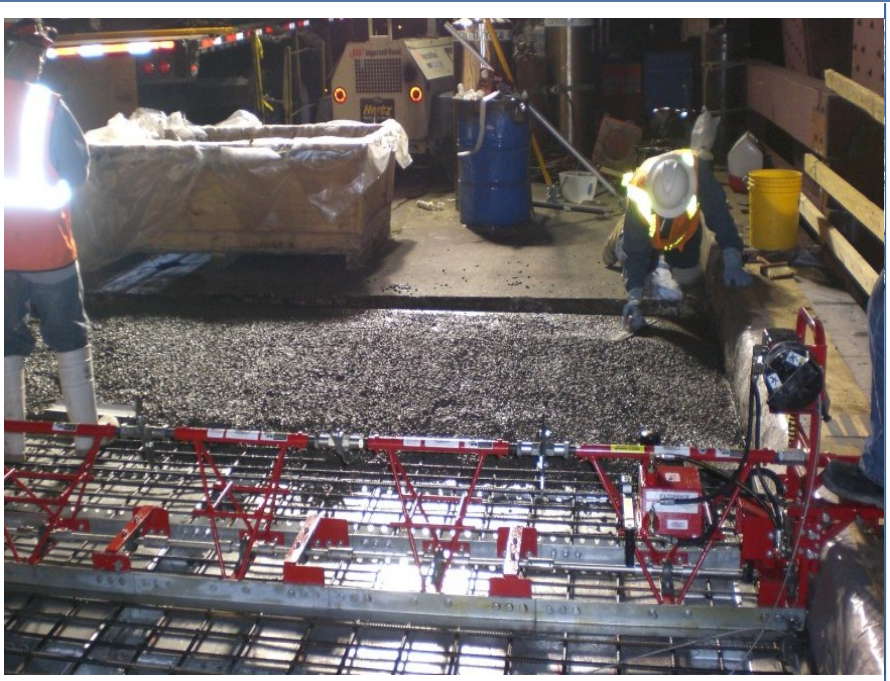
- Conventional concrete placement process

- Lightweight & durable

- Various barrier options can be easily incorporated

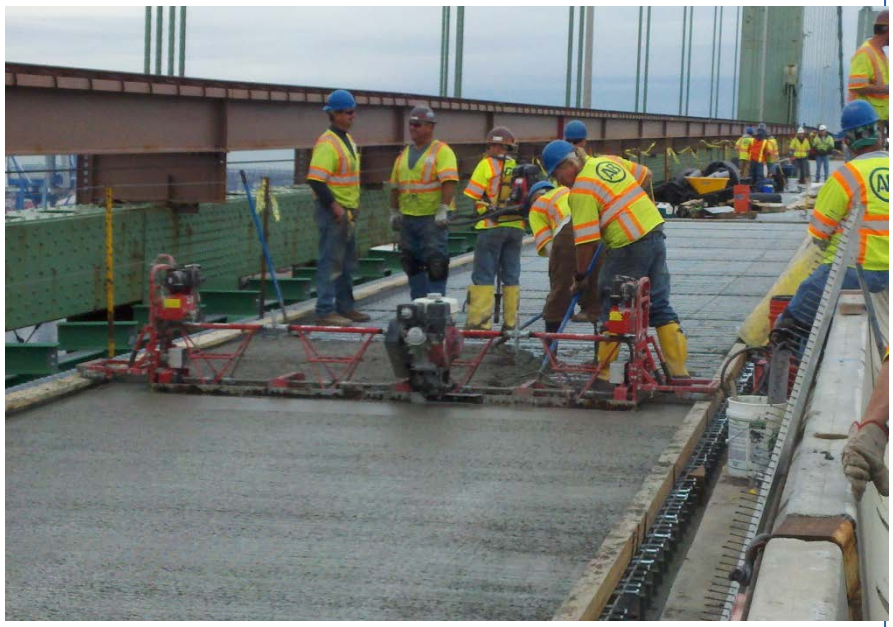


MATHEWS BRIDGE JACKSONVILLE (FDOT)



- Built 1952 w/ open grid
- ADT 75,000
- Deterioration of floor system/grid required 2007 rehab project
- FDOT required a closed-deck system for ride quality, durability, and to protect the steel floor system
- New **Exodermic® deck** w/ lightweight concrete weighs only 48.8-lbs/sf while maintaining 2” cover
- The project was **completed two weeks ahead** of 90 day window w/ installation rates averaging 400-500 SF/day

WALT WHITMAN BRIDGE PHILADELPHIA (DRPA)



- Built in 1956 with a partial depth grid deck
- Carries ADT of 120,000 over the Delaware River
- 270,000 SF of deck replaced in 7 single lane phases - two years
- New “floating deck” is a modern steel grid deck system partially filled with lightweight concrete – designed lighter than original 55 year old grid to reduce DL on cables

PRECAST CONSTRUCTION

- Heightened interest because of possibility for rapid installation (ABC)
- Installation rates beyond 2000 SF/day possible
- MPT criteria drives design and construction options:
  - ✓ Staged/phased construction
  - ✓ **Weekend** work (full or partial closure)
  - ✓ **Night time** work (full or partial closure)

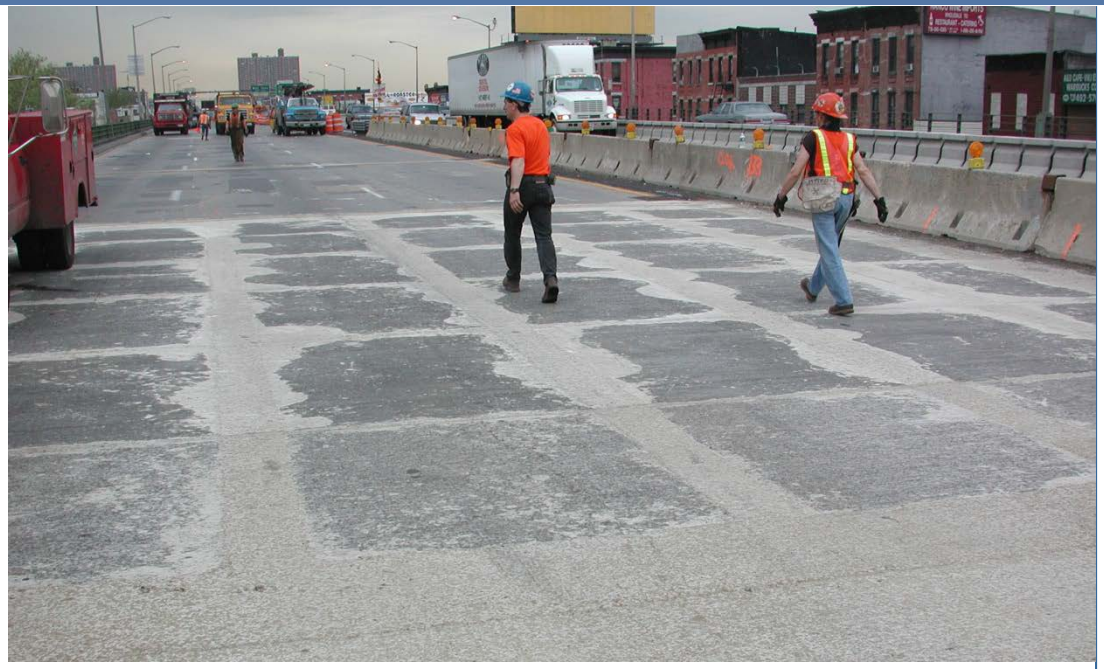
PRECAST DECK PANELS

SETTING AND LEVELING

CLOSURE POUR

- Mobile mixer is recommended for rapid-setting concrete
- Vibrators required to consolidate concrete in the shear keys and haunch areas

FINISHING



Commonly specified options for surface finishing after installation of precast panels:

- ✓ Diamond grind and seal
- ✓ Prepare surface and place an epoxy or PPC overlay
- ✓ Install a waterproofing membrane and an asphalt overlay

I-285 CORRIDOR ATLANTA

- Bridges over Cobb Pkwy & Buford Highway were built late 1950's & early 1960's
- Both previously widened, to carry nearly 300,000 ADT
- Precast full-depth grid deck was selected to span stringers at 6.5 & 7-ft w/ total depth of only 6.5"
- Weekend lane closures 9pm Friday to 5am Monday
- Completed 5 weeks ahead of 16 week allotted schedule
- Deck Area = 25,720 SF (Avg = 2340 SF/wknd)

GRAND ISLAND BRIDGES (NYSTA)

- I-190 gateway to Niagara Falls
- Peak traffic nearly 3,000 vehicles/hour
- Increased deck LL capacity to HS25

- Over 200K SF total new deck at rate up to 2000 SF/night (9PM to 6AM) with two crews
- $1000/minute liquidated damages for late opening up to $125,000/day

ROBERT C. BEACH MEMORIAL (WVDOT)

- 30 day calendar window
- Replace 5,400 SF of FRP with precast Exodermic™
- Completed 10 days early

PREFABRICATED GRID REINFORCED CONCRETE BRIDGE DECK PANELS

- Long successful history – continually outperformed other deck types for over 80 years now!
- Careful planning and communication between owner, design engineer & contractor is key to successful completion.
- Precast panels must be properly handled and stored to reduce chances of cracking.
- Durability of the system is affected by the number of cold joints and connection detail at these locations.
- Rapid setting closure pour material is a very important component of the system. Compromise between high-early strength and shrinkage.
- Specify BGFMA Certified Fabricators for Quality, Experience, Capacity and On-Time Delivery.

QUESTIONS?

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