George Washington Bridge Replacement of Upper Level Orthotropic Deck

A Maintenance of Traffic Case Study

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Some History…

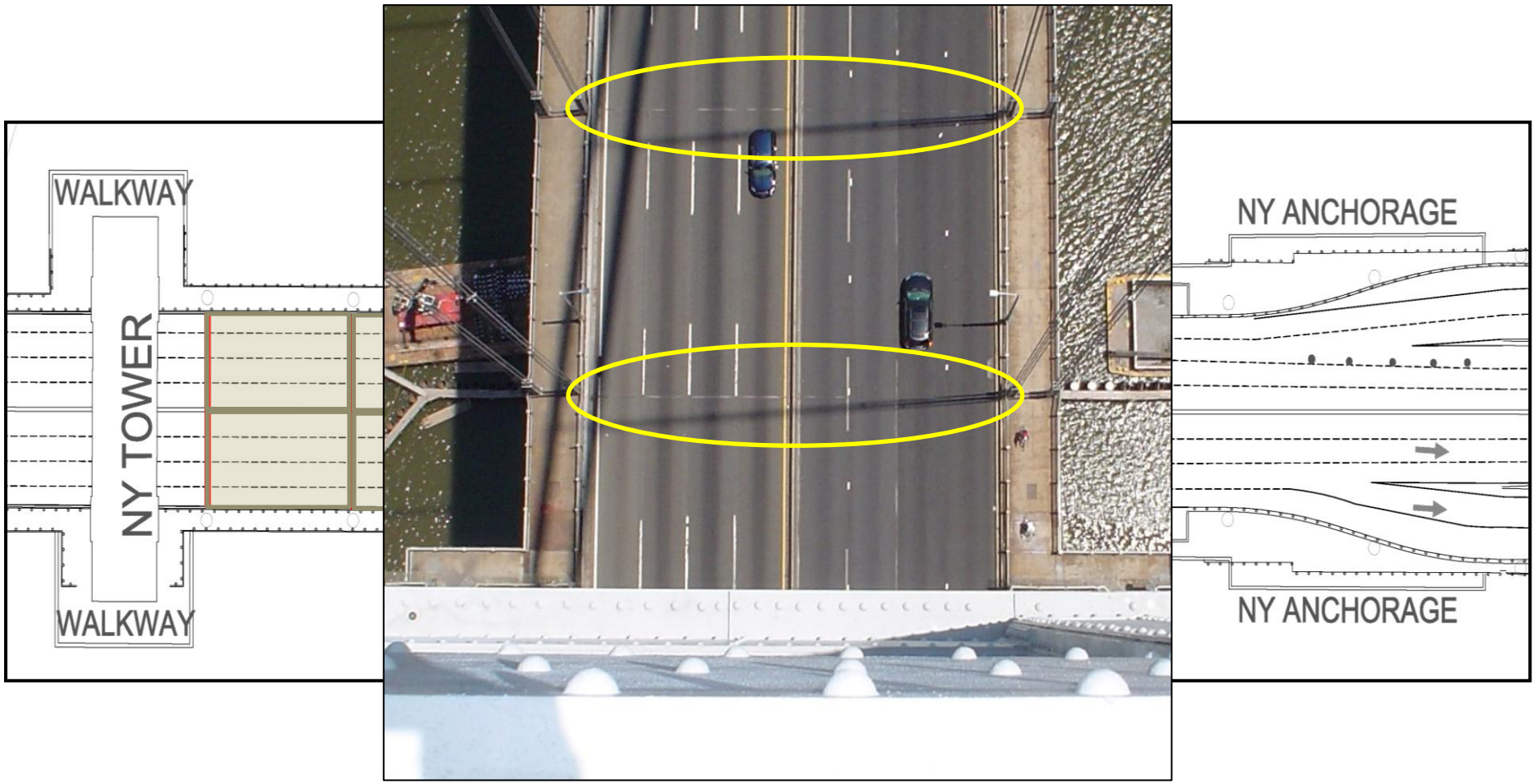
- ✓ Upper Level opened to traffic in 1931.
- ✓ Lower Level opened to traffic in 1962.
- ✓ Considered part of the I-95 corridor.
- ✓ The world's only 14 lane suspension bridge, with 4 lanes on the upper level and 3 lanes on the lower level in each direction.
- ✓ Connects the neighborhood of Washington Heights in Manhattan with Fort Lee in New Jersey.
- ✓ Access on the east side of Manhattan via the FDR / Harlem River Drive and on the west side via the Henry Hudson Parkway & Riverside Drive.
- ✓ Trucks are prohibited from using the lower level.

- ✓ Carried 106 million vehicles last year
  - – 30 million more than the Lincoln and Holland Tunnels **combined**.

What is an Orthotropic Deck?

An **orthotropic bridge** or **orthotropic deck** is one whose deck typically comprises a structural steel deck plate stiffened either longitudinally or transversely, or in both directions. This allows the deck both to directly bear vehicular loads and to contribute to the bridge structure's overall load-bearing behavior. The orthotropic deck may be integral with or supported on a grid of deck framing members such as floor beams and girders.

Typical Upper Level Panel Layout

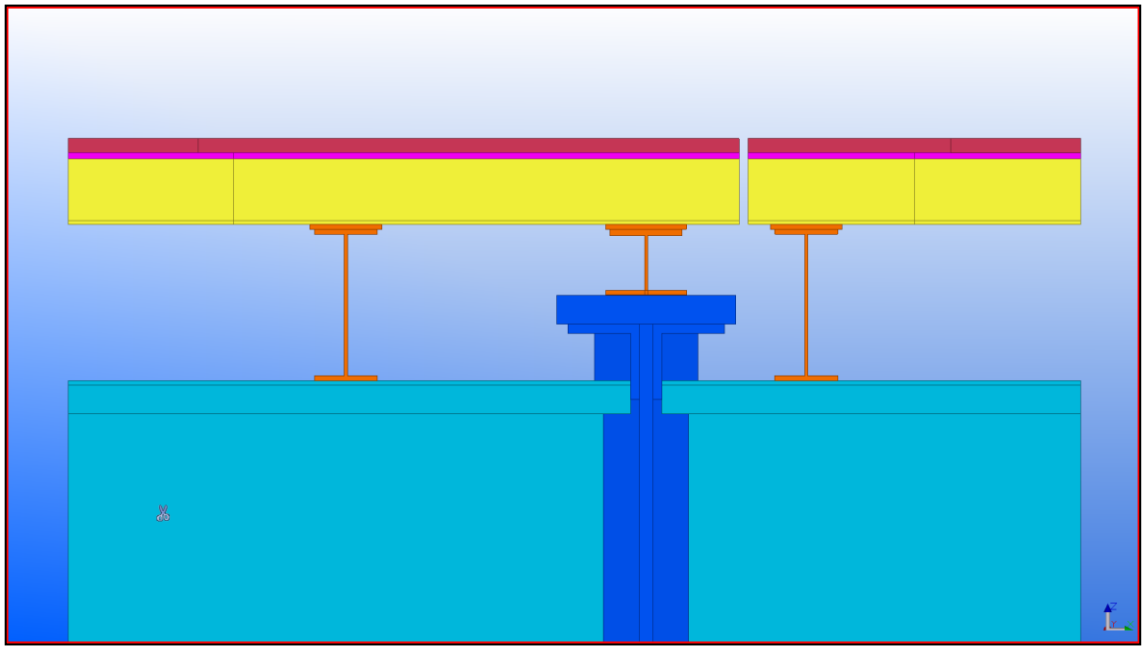


What's the Problem?

Since 2001, the cyclic loading of trucks – a large percentage of which are overweight – has resulted in 90% of all stresses experienced on the deck occurring at the main floor beams.

Existing deck support beam is directly on main floor beam

- *Concentrated load path creating fatigue on main beams*
- *Location of joint creates water penetration over floor beam*
- *Inadequate access for proper repairs*

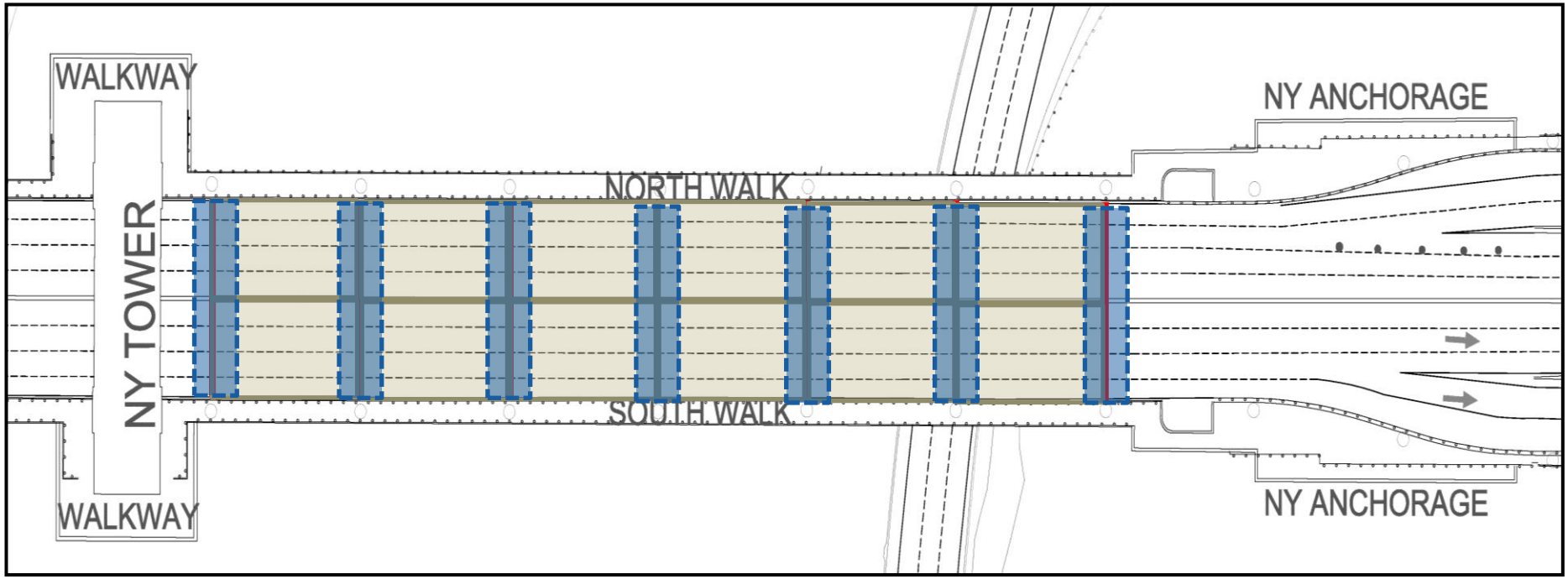


What's Included in the Contract?

- Replacement of 6' X 44' strips of existing orthotropic deck, using pre-paved 6' X 11' panels, at each of the 79 panel points in each direction.
- Installation of new scuppers and improved drainage piping at more frequent locations.
- Paving of the upper level westbound
- Rehabilitation of the finger joints
- Ultrasonic peening of welds for improved strength and longevity
- Miscellaneous steel repairs – 18 different repair types at 2800 locations.

Total Contract Cost – Approximately $80 Million

Typical Upper Level Panel Replacement Plan

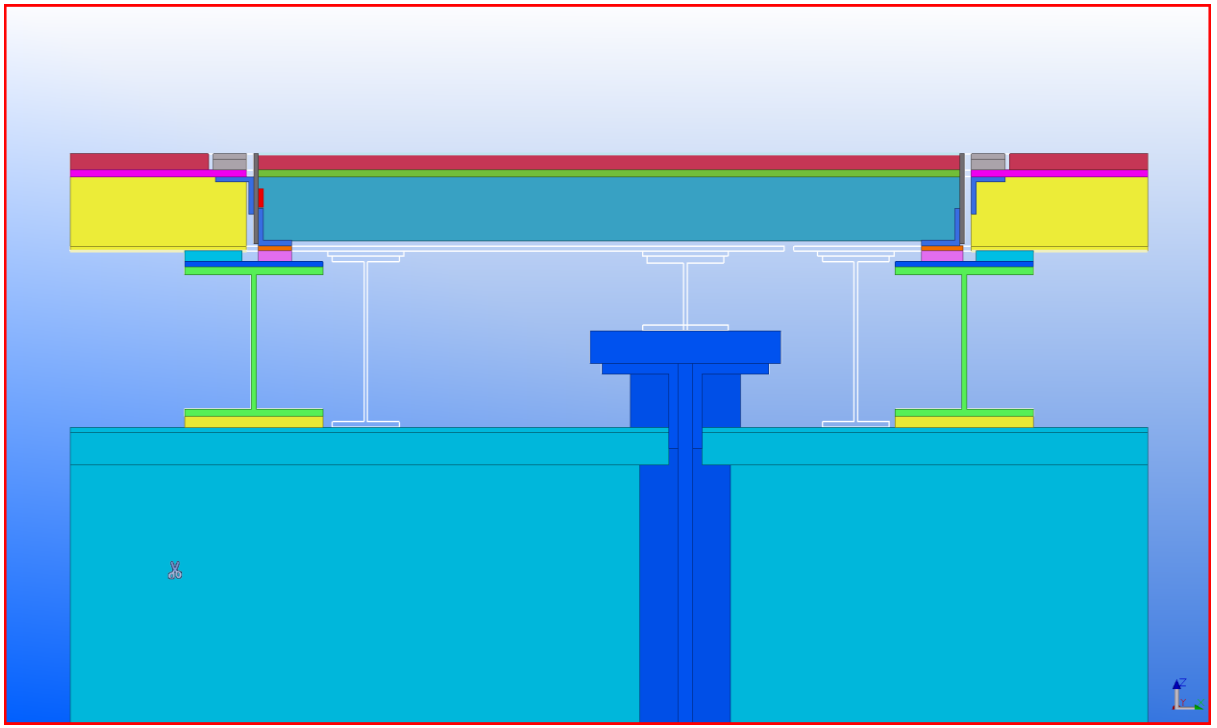


The overall objective of this effort is to extend the useful service life of the deck by 10 to 15 years.

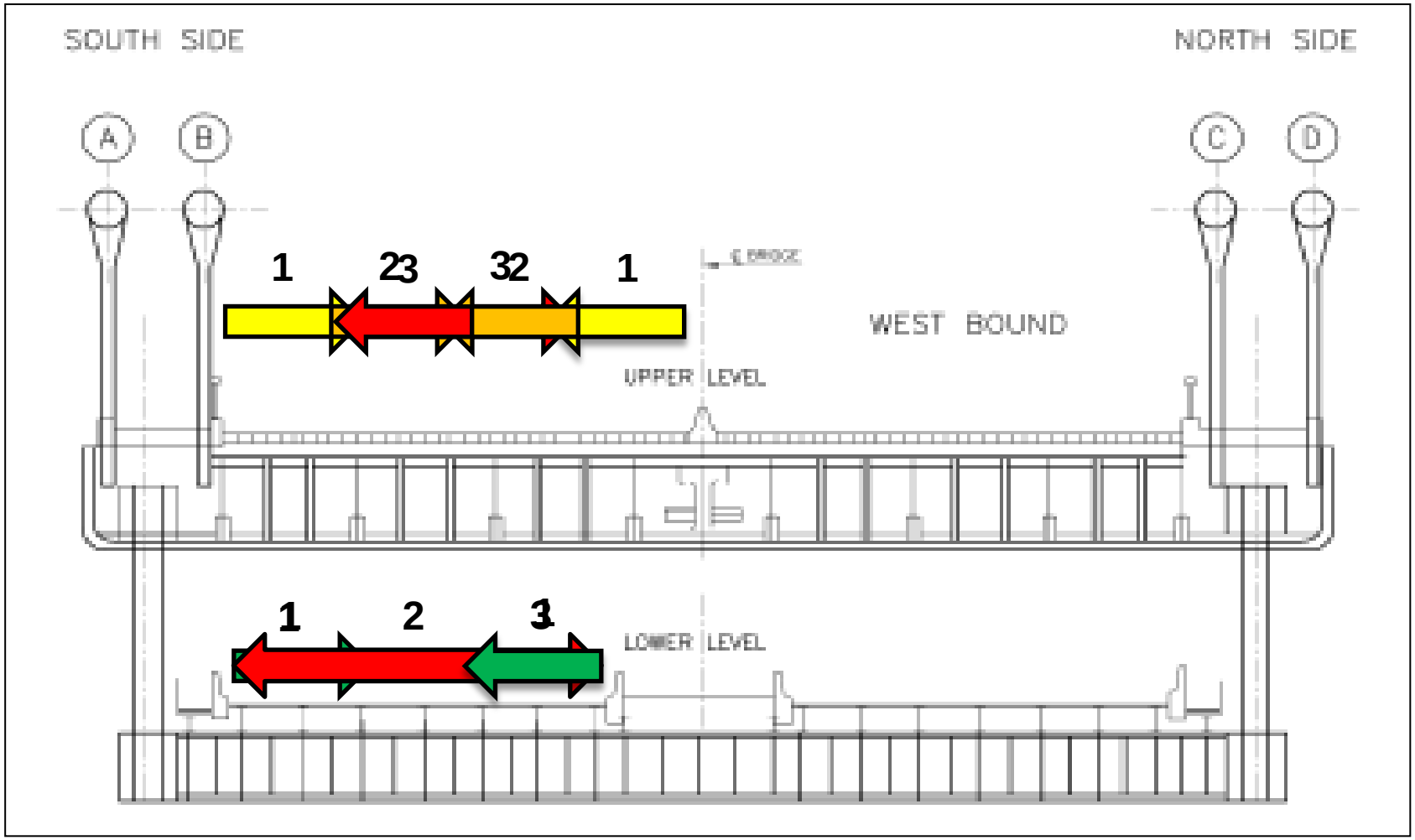
How will the Deck be Repaired?

New deck section will span over the main floor beam

- Improved load path reduces excess stress on main beams
- Joints moved away from floor beam, reducing water damage to critical structural components.
- Improved accessibility for future maintenance



What Lane Closures are Permitted?



General Conditions & Precautions

- Provisions in place to restrict construction on holidays, religious observances, Yankee home games, events at the Meadowlands Complex, and winter months.

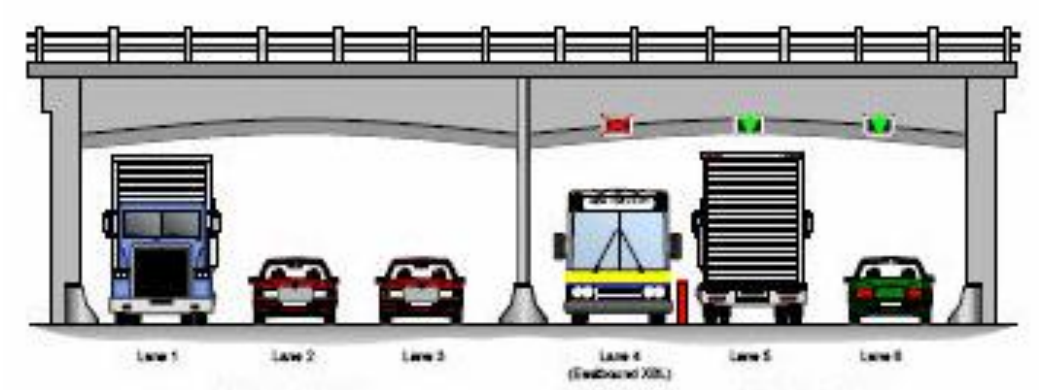
- Typical Lane Closure Schedule
  - Single Lane – Mostly Daytime Hours
  - Multiple Lanes – Nighttime Hours Only

- Approximately six hours are required for panel replacement, not including mobilization time.

A Value Engineering (VE) study proposed a contraflow scheme and discussed a corresponding time and cost savings.

What is Contraflow?

An abnormal state of a road or motorway where the traffic temporarily travels in the opposite direction to normal, usually as a result of repair work, an evacuation, or a major accident.



The Lincoln Tunnel XBL, although a more specialized operation, is a contraflow operation.

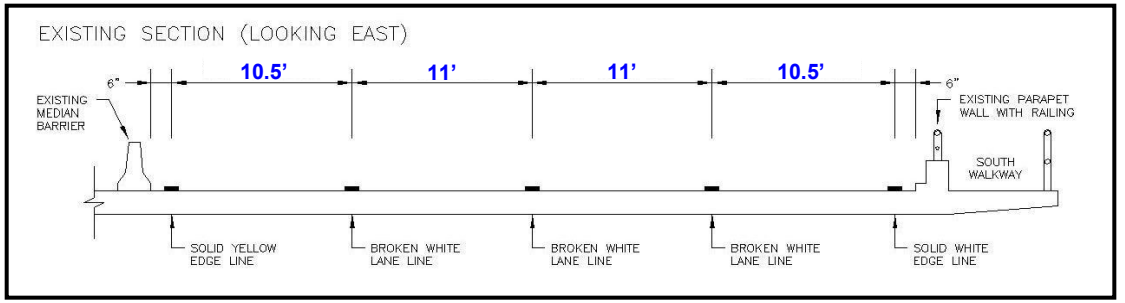
What Would be Required for Implementation?

- Restripe the upper level to accommodate a moveable median barrier system.
- Remove 1,100 linear feet of existing median barrier for crossovers.
- Restore pavement within limits of crossover locations.
- Procure four impact attenuators to protect exposed blunt ends at crossovers.
- Rent a moveable median barrier and transfer machine.

Upper Level Typical Sections

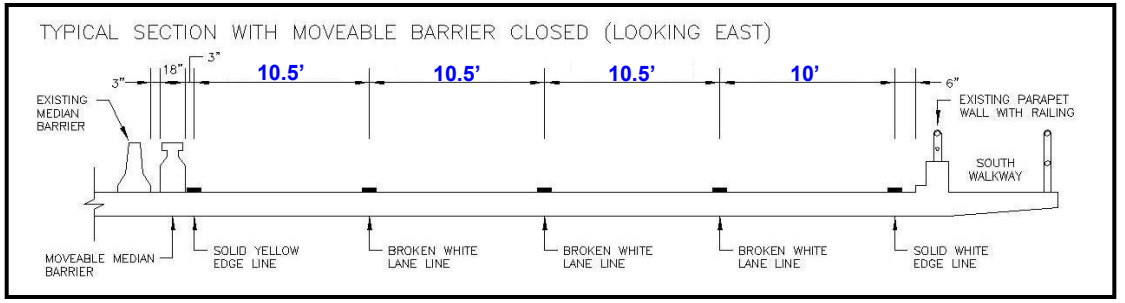
Existing Conditions

- 2 – 11’ lanes
- 2 – 10.5’ lanes



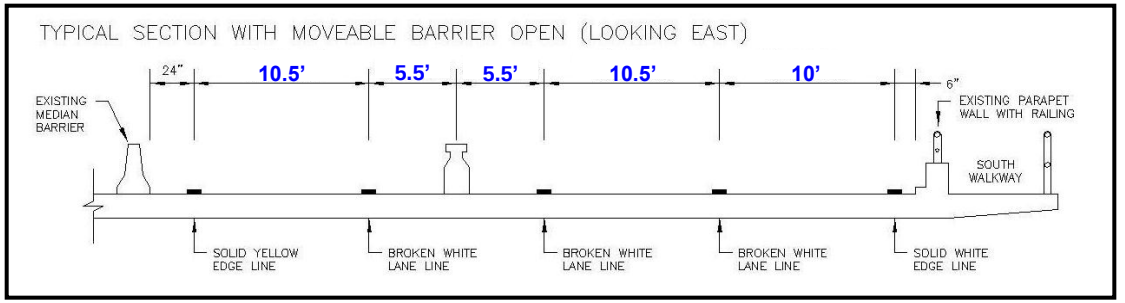
Non-Working Conditions

- 3 – 10.5’ lanes
- 1 – 10’ lane



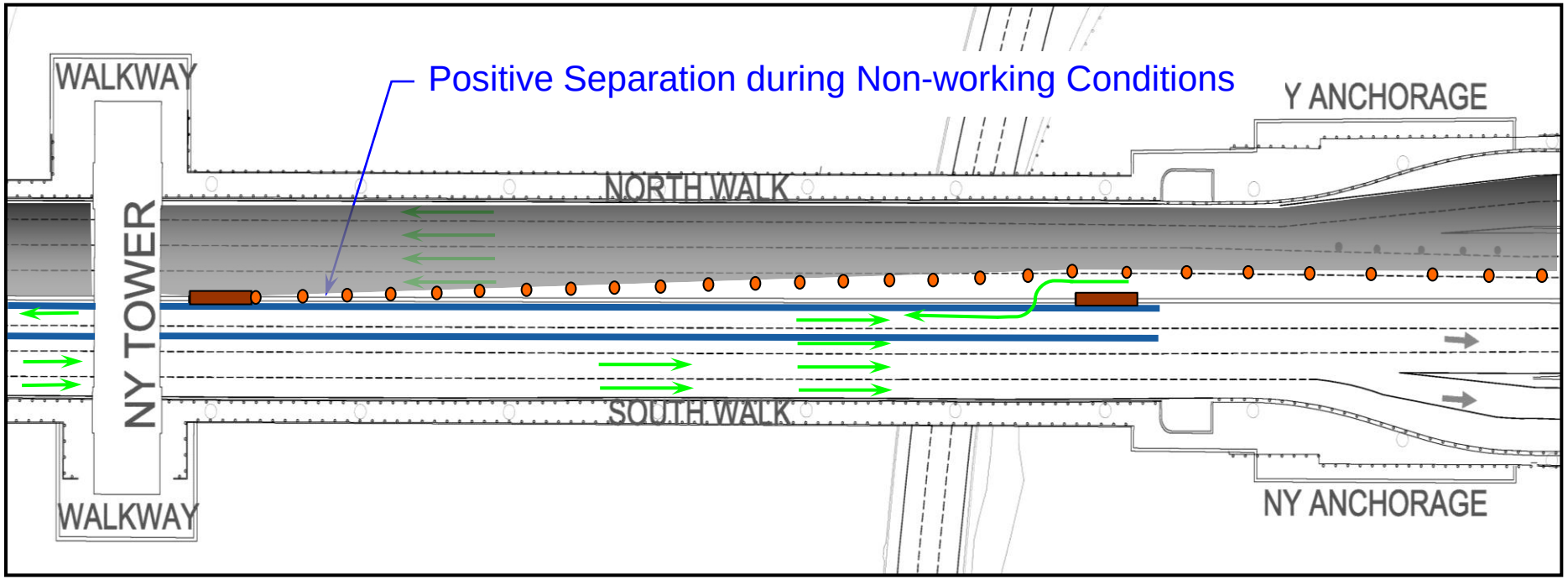
Construction Conditions

- 1 – 17’ contraflow lane
- 1 – 10.5’ lane
- 1 – 10’ lane



Upper Level Crossovers

Construction Conditions



Why Dismiss the Contraflow Alternative?

- **Negligible Time Savings**
  - The actual construction time showed only a marginal improvement compared to typical staged lane closures.

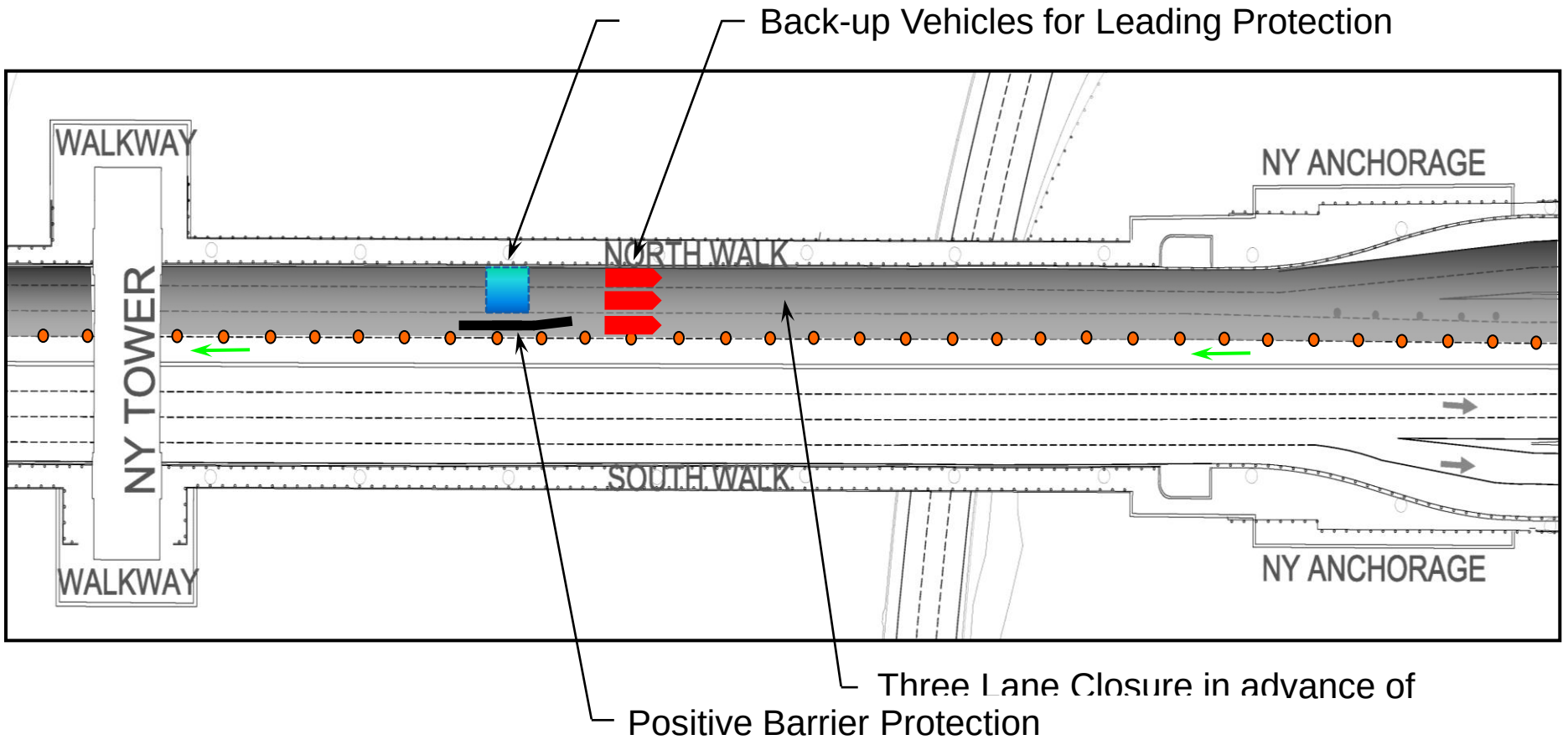
- **Cost**
  - The contraflow could cost approximately $2 million less than the conventional lane closures over the duration of the contract, but:
    - Additional staffing required for the lower level toll plaza
    - Procurement of “tunnel-type” wrecker

- **Construction Inflexibility**
  - Contraflow eliminates working on both upper and lower levels simultaneously.

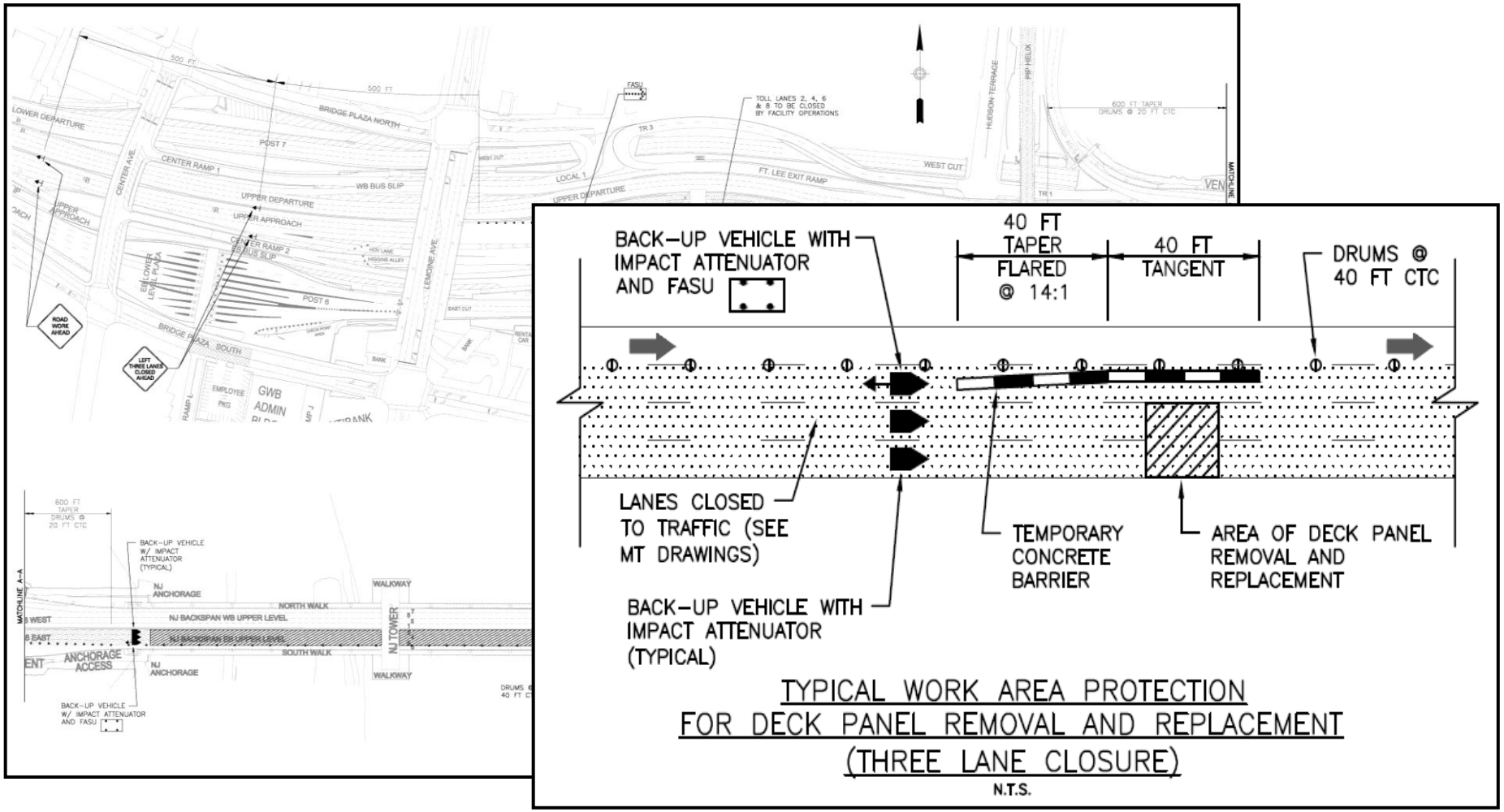
Why Dismiss the Contraflow Alternative?

- **Operational Risks**
  - Reduced lane widths across the span and the high percentage of heavy vehicles could lead to an increase in crashes on the upper level.
  - The moveable median barrier will deflect more than the existing pinned barrier if hit, although the product selected has lesser deflection compared to others available.
  - The contraflow lane presents a constrained operation, which will make it more difficult to respond to disabled vehicles and motor vehicle crashes.

How Do we Close the World's Busiest Bridge?

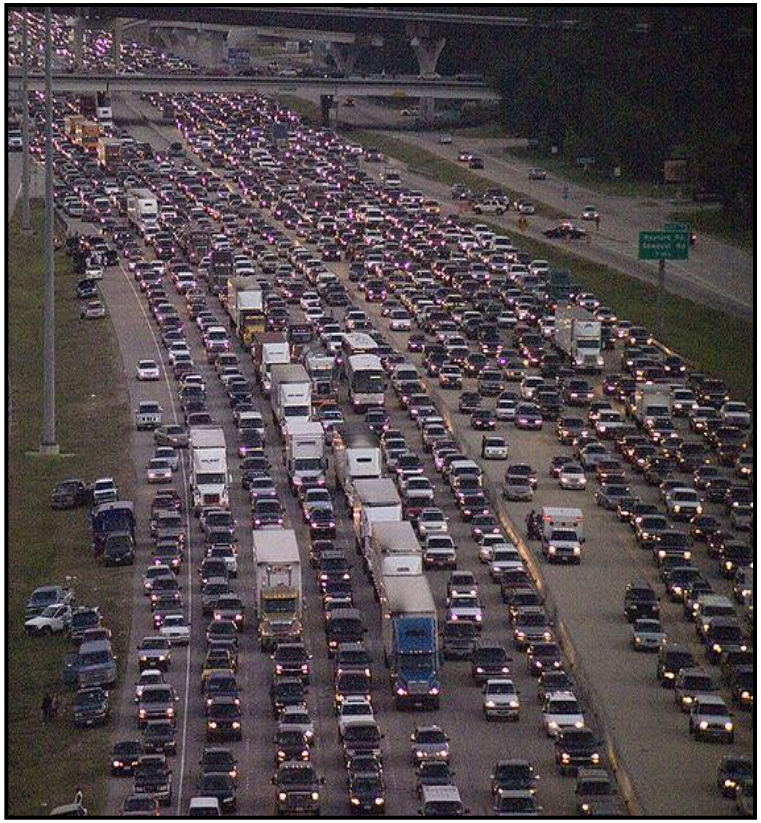


What was the Final Product?



What will be Done to Mitigate Expected Delays?

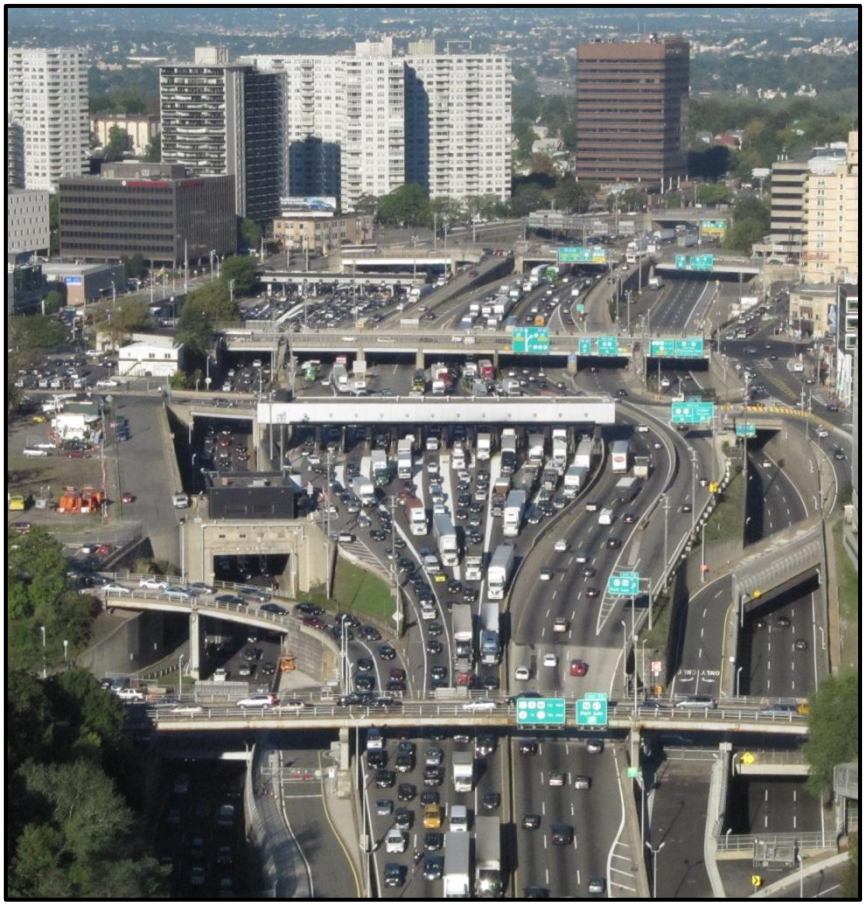
- Institute an extensive public information and awareness campaign, using radio, internet, and other media to issue travel advisories to our patrons.
- Use localized ITS capabilities – both permanent and portable – to maximize diversion of traffic to the lower level, thereby reducing congestion on the upper level.
- Hope for the “learning curve” regarding motorists, where they will learn from being delayed and choose alternate routes later.



We don’t want this!

Preliminary Construction Activity Schedule

- Erect eastbound & westbound shielding/temporary platforms
- Ultrasonic peening
- Install eastbound and westbound scuppers
- Perform eastbound and westbound routine/priority steel repairs
- Replace eastbound and westbound orthotropic deck panels
- Remove eastbound & westbound shielding/temporary platforms



The contract has a target completion date of late 2014.

Questions?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