Hampton Roads Bridge-Tunnel Expansion

2019 Virginia Concrete Conference

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Virginia Department of Transportation
Project Scope

- Settlers Landing in Hampton to I-564 in Norfolk (10 miles)

- I-64 improvements include 6 lanes of highway and construction of 4 lane bridge/tunnel

- New HRBT tunnel will serve Eastbound traffic

- 2 existing HRBT tunnels will serve Westbound traffic
Project Components

• Tunnel crossing
  ~ 8000 ft. across Hampton Roads waterway
• Island improvements
• Marine bridges
  ~ 9000 ft. across Hampton Roads waterway
  ~ 5000 ft. across Willoughby Bay
• Landside highway widening
  ~ 1 mile in Hampton
  ~ 4 miles in Norfolk
HRBT Conceptual Quantity Estimate

- **Marine bridges**
  - 160,000 LF of precast girders
  - 175,000 LF of precast piles
  - 85,000 CY of CIP concrete

- **Landside bridges and structures**
  - 70,000 LF of precast girders
  - 180,000 LF of precast piles
  - 25,000 CY of CIP concrete
  - 75,000 LF of parapet and median barrier
  - ...in addition to precast pipe, temporary barriers, sound walls

- **Bored tunnel**
  - 120,000 CY of precast liner segments
  - 75,000 CY of walls and slabs on islands
  - 20,000 CY of CIP walls and walkways in tunnel
  - ...in addition to tunnel ballast and operations buildings
HRBT Bored Tunnel Concept Design

- Two parallel 2-lane tunnels, each ~ 8,000 ft. long
- Interior diameter 41'-6"
- Deeper than immersed tube tunnel because more cover is needed for buoyancy control – therefore tunnel is longer
- 5% roadway grades require island expansion lengthwise
- Over 1 million cubic yards excavated tunnel material
- Ground improvement at islands to support weight of tunnel boring machine
Tunnel Boring Machine (TBM)

- Rotating cutter head
- The machine is operated from the control room
- Excavated earth removed by conveyor belt
- Hydraulic rams push against newly-placed concrete segments to drive machine forwards
- Pressure is maintained in the cutting chamber
- Rotating arm adds pre-cast concrete tunnel segments to form a ring
- Pre-cast concrete segments delivered to rotating arm

http://www.crossrail.co.uk
Steel Forms for Precast Liners
Stripping
Mock-Up of Rings for Testing
Transport from Laydown Area to Shaft
In this picture, TBM cutterhead is advancing toward left

Thrust jacks are pushing against completed precast rings at right to propel TBM into ground to be excavated

Precast ring segments typically use 7500 to 8000 psi concrete to resist construction stresses
Segments in Place (Seattle Tunnel)
Segments in Place (Seattle Tunnel)
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<td>September 2018</td>
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