Fort Street Bascule Bridge

DESIGN

Overview
History
Geotech/Substructures
Superstructure
Aesthetics

CONSTRUCTION

Steel and Machinery Fabrication
Existing Bridge Removal
Road Reconstruction
Bridge Replacement
Leaf Launch

QUESTIONS/LESSONS LEARNED
Rouge River

- Ford River Rouge Plant
- Navigation Channel
- Fort Street Bridge
- Dix Road Bridge
- Rouge River
- Fort Street
- Zug Island
- Detroit River
- Jefferson Bridge
- Short Cut Navigation Channel
Fort Street Bascule Bridge

Overview

Existing Bridge, 90 Years Old
Extensive Deterioration
End of Useful Life
Fort Street Bascule Bridge

History

Rouge River enlarged in 1920-22 for Ford River Rouge Plant
Dredged 2X Depth & 2X Width
Destabilized Bridge Subpiers
Fort Street Bascule Bridge – 1922

Double-Leaf Bascule

4 Lanes of Traffic
2 Trolley Lines
8’-6” Sidewalks
164 Feet Betw. Trunnions
278 Feet Overall
125 Foot Wide Channel,
  Reduced to 118 Feet
Fort Street Bascule Bridge – 1922

1920-22 Dredging

Bascule Piers
- 88’-4” Wide
- 46’-6” Long
- 26 Feet below Water Line

Abutments
- Timber Piles
- 75 Feet Long or “fetch up on hard pan”
- 118-foot Channel
Fort Street Bascule Bridge

Construction Challenges

Utility Tunnels
- 10’-0” Michcon Gas Tunnel
- 7’-6” Detroit Edison Tunnel
Fort Street Bascule Bridge – 1922

Pier Foundations

Four 12-Foot Square Caissons
Intent – 1 Foot Into Hardpan
Terminated above Hardpan or Rock
No Documentation of:
  Hydrogen Sulfide Gas
  Artesian Water
Fort Street Bascule Bridge – 1922

Things To Consider:
Effects of Large Fill Areas
Major Dredging
Appropriate Geotechnical Investigation
Fort Street Bascule Bridge

New Bridge Requirements

Provide 135-ft navigation Channel
Accomodate 5 traffic Lanes & 2 Pedestrian/Bikeways
Minimize ROW Impacts
Avoid Tunnels and Existing Subpiers
Provide a Striking Visual Enhancement to the Community

Result:

An 88-ft Wide, 176-ft Rolling-Lift Bascule with an Overhead Counterweight
Alignment Option 1

Realign Fort Street

Pros:
Fort is Primary Movement
At Oakwood Intersection

Cons:
Very High ROW Costs
Alignment Option 2

Retain Existing Alignment

Pros:
Minimal ROW Costs

Cons:
Oakwood is Primary Movement
At Oakwood Intersection
Accommodate Tunnels and
Existing Subpiers
Global Stability Factor of Safety = 0.85 to 1 (Assuming No Resisting Force from Bridge)
Fort Street Bascule Bridge – 2012

Geotechnical Investigation

Use Pile Supported Concrete Slab to Support Fill, Road, Live Load

87 Ft. Wide by 64 Ft. Long by 3 Ft. Thick

Supported by 43 Steel Piles HP 12 X 74
Fort Street Bascule Bridge

New Single-Leaf Rolling-Lift Bascule

176-Ft Span (135-Ft Channel)  Half-Filled Steel Grid Deck with 2-Inch Overpour
88-Ft Wide  Stringers at about 6’-3” Centers
13-Ft Deep Half-Through Trusses  Floorbeams at 17’-3” Centers
Five 12-Ft Traffic Lanes  Total Leaf Weight is 8 Million lbs
Two 8-Ft Sidewalks  

Rolling Dead Load  - 8,000 Kips
Total Dead Load  - 18,500 Kips
Rolling Moment  -132,000 Ft-Kips to +118,000 Ft-Kips
Wind Moment  -56,000 Ft-Kips to +56,000 Ft-Kips
Fort Street Bascule Bridge

Bascule Pier Foundation

Options

Large Diameter Drilled Shafts
- Limited Locations
- Artesian Water
- High Costs

Steel Piles Driven to Rock
  - HP 18 X 204
- Minimal Individual Footprints
- Large Capacity Per Pile
- Cost Effective
Fort Street Bascule Bridge

Steel Piles
HP 18 x 204
Fort Street Bascule Bridge

Bascule Pier Foundation

Piles:
HP 18 x 204

Fenders:
HP 16 x 88

Fender Whaler:
W 36 X 232
Fort Street Bascule Bridge

Deck

Steel Grid with 115 pcf Lightweight Concrete Half-fill and 2” over-fill
Fort Street Bascule Bridge

Walkway Deck
Steel Plate with Thermal Spray Slip Resistant Surface, Galvanized
Fort Street Bascule Bridge

Superstructure

Single-Leaf Bascule

Rolling-Lift, Most Efficient

Shortest Span for Channel
Reduced Area for Wind & Ice
Reduced Friction During Operation
Fort Street Bascule Bridge

Two Steel Pony Trusses

13 Feet Deep
176 Feet Long
Fort Street Bascule Bridge

**Chords:**
15” x 20”
Welded Boxes

**Web Members:**
W-Shapes &
3-Plate Weldments
Fort Street Bascule Bridge

Segmental Girders

Web: 3” x 96”
Top Flange: 3” x 32”
Bottom Flange: 3 ½” x 32”
Yield Strength: 70 ksi
Fort Street Bascule Bridge

Tread & Track Castings

High Strength I-Shape Steel Castings 30” Wide x 16” Deep
Yield Strength: 115 ksi
Shear Lugs: 4 5/8” x 14”
Tread Radius: 24’-7 1/2”
Length of Travel: 31’-3”
Fort Street Bascule Bridge

Track Castings

Shear Lugs spaced at 25” Center-to-Center
10” Thick Web
Fort Street Bascule Bridge

Concrete Counterweight

Supported by Steel Trusses
Encased in the Concrete
6,000,000 Pounds
Fort Street Bascule Bridge

Electrical Equipment

Electrical Room

Two 150 HP Motors
Fort Street Bascule Bridge

Machinery

Bull Gear

Rack & Pinion 1

Bull Gear & Pinion 2

Rack

Pinion P1

Pinion P2
Fort Street Bascule Bridge

Aesthetics

Public Involvement
Shape of Bridge Towers
Color Scheme

Stainless Steel Cladding

Unique Special Pattern
Railing
Fort Street Bascule Bridge
Structural Steel and Machinery Fabrication
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Bridge Replacement

MDOT
Michigan Department of Transportation
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QUESTIONS?

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