Louisiana's Longest Steel Girder Double Leaf Bascule Bridge

Presentation by

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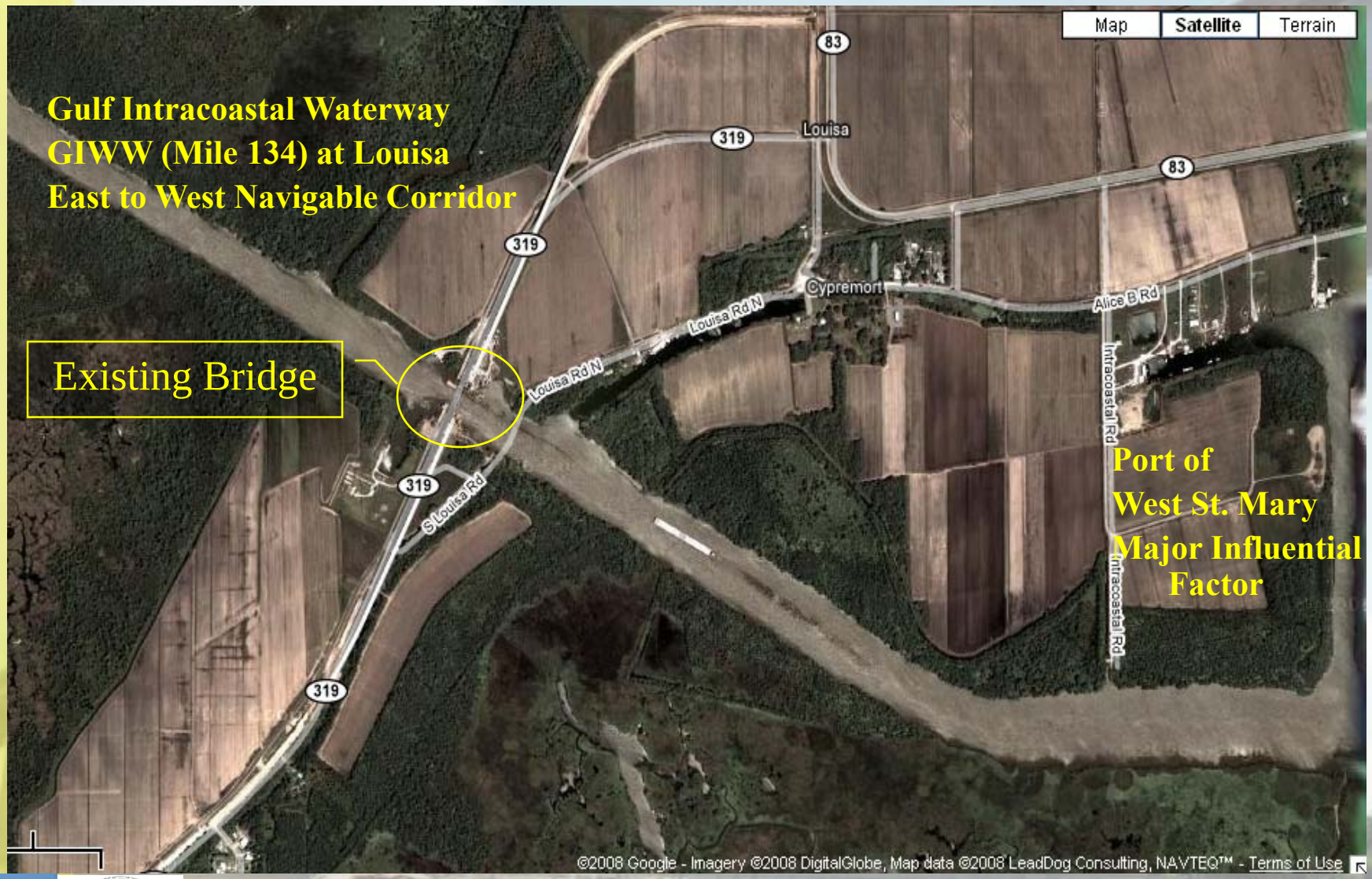
2008 Louisiana Structures Conference Louisa Bridge

Louisiana

Project Location

Existing Bridge



Existing Bridge

Existing Bridge

Average Daily Traffic ➔1,200 Vehicles

Unequal Arm (Bobtail) Swing Span

Long Arm at 160 Ft and Short Arm at 80 Ft

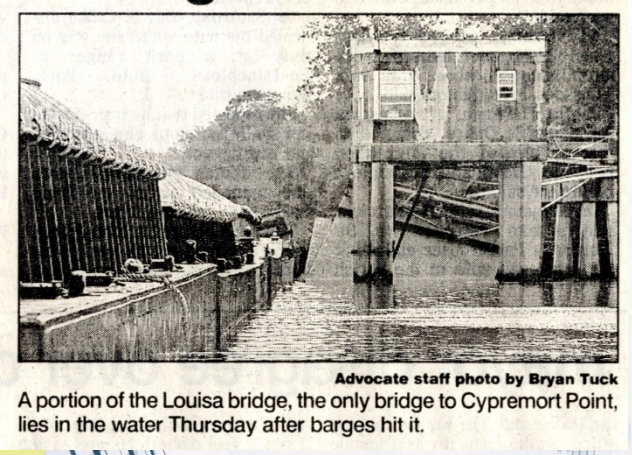
125 Ft Horizontal Clearance When Opened

6 Ft of Vertical Clearance When Closed

Number of Openings ➔ 1,050 / Month (35 / Day)

Structurally Deficient 20 Ton Limit

Existing Bridge



Advocate staff photo by Bryan Tuck

A portion of the Louisa bridge, the only bridge to Cypremort Point, lies in the water Thursday after barges hit it.

Closed

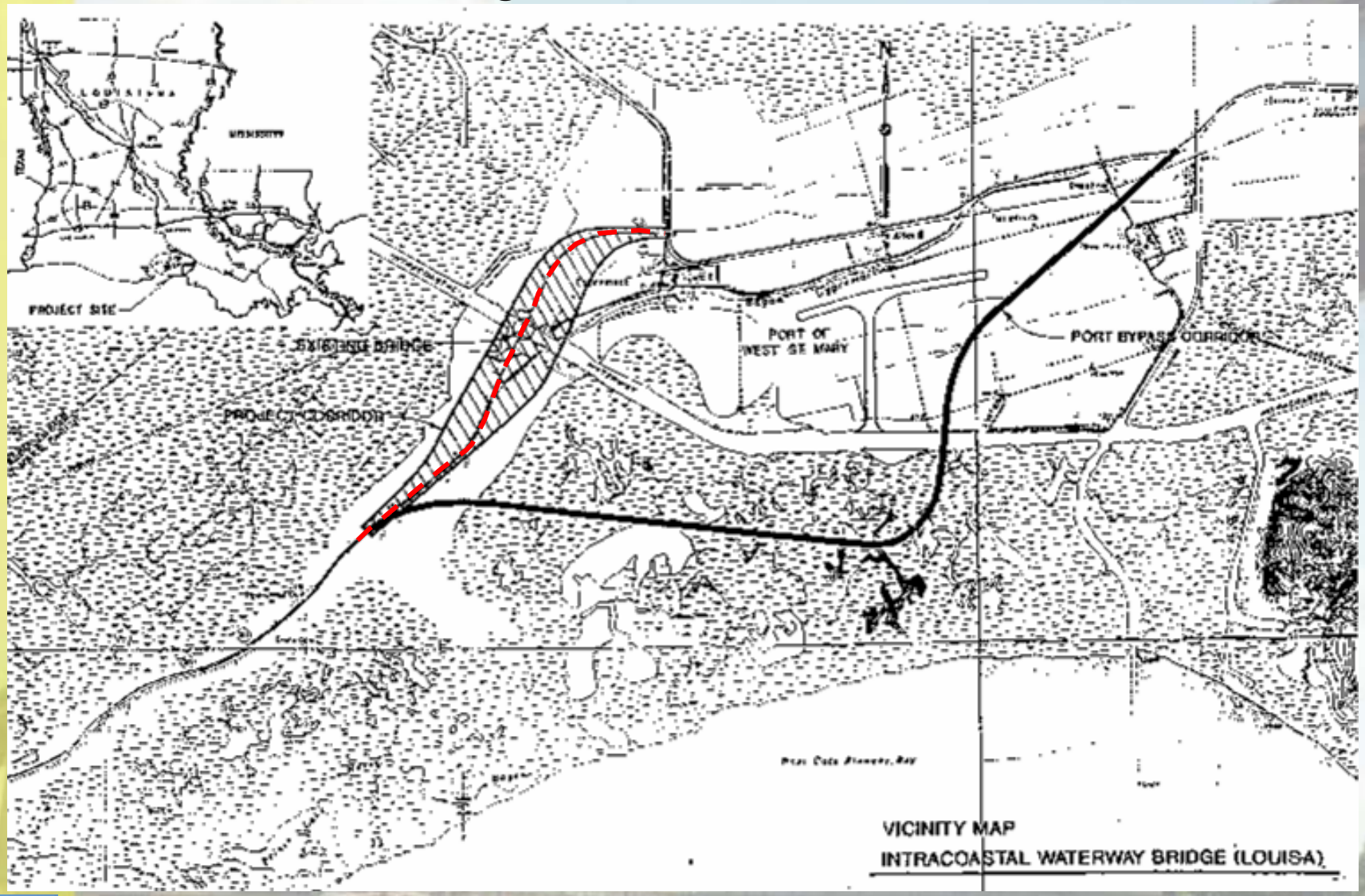
Opening

Opened

Existing Bridge

Existing Bridge

Project Corridors



Alignment Study

Alternate 1

250 m (800 Ft) East of Existing Bridge

Additional 24 Acres of ROW

Alternate 2

198 m (600 Ft) West of Existing Bridge

Additional 28 Acres of ROW

Alternate 1A

30 m (100 Ft) East and Adjacent To Existing Bridge

Additional 24 Acres of ROW

Port Bypass

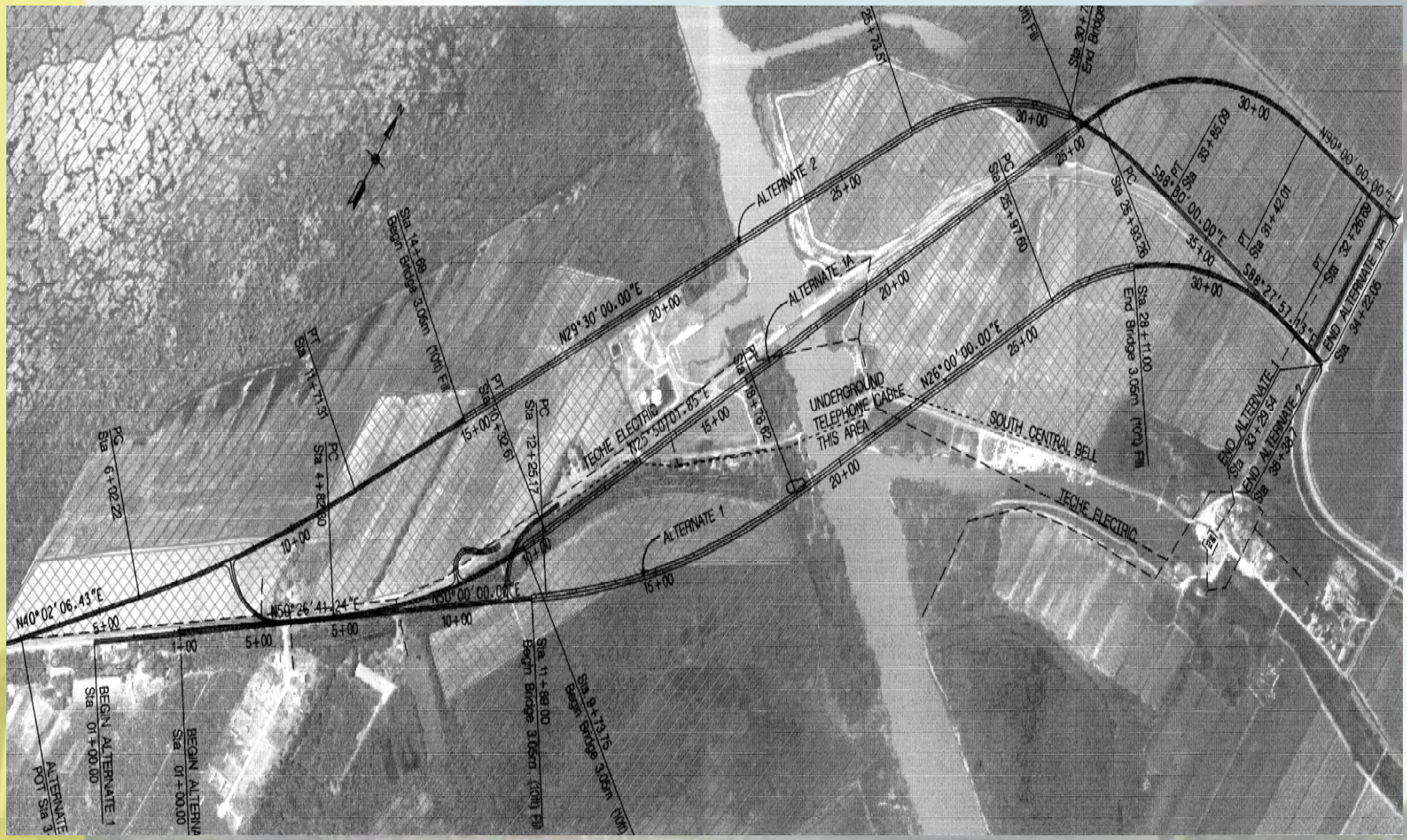
Ships Enter Port Without Passing Bridge

Discounted Because of Environmental Impact & Roadway Cost

Additional 70 Acres of ROW

Alignment Study

Alternate 1, 2, 1A



Navigation Study

Intracoastal Waterway - Sabine River To Houma

5 Major Bridges (3 High Level Fixed, 2 Movable)

High Levels Have 22 m (73 Ft) of Vertical Clearance

Existing Swing Span Averages 1,050 Openings/Month

Close Proximity To Port of West St. Mary

1500 Acre Complex With Total Intermodal Operations

Import/Export Business for International Trade

Constructed and Shipped the Largest Offshore Drilling Deck

Navigation Study

Majority Barge/Tug Vessels

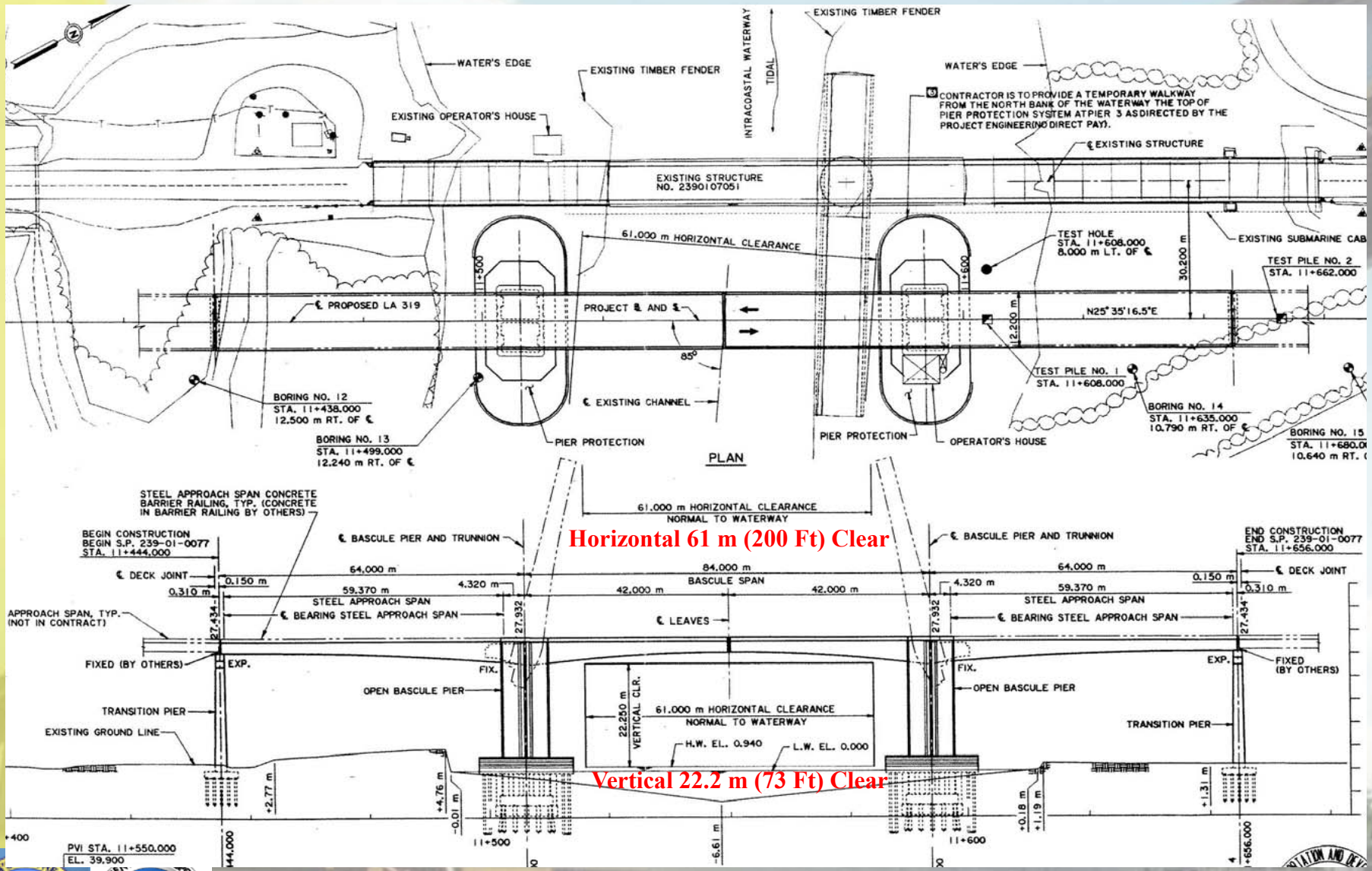
Some Shallow Draft Ships

Drilling Platforms

Navigation Study

Existing Swing Span Average Number of Openings Per Month (1993 – 1994)						
No. of Vessels	No. of Openings	0′ – 40′	41′ – 50 ′	51′ – 60′	61′ – 73′	Over 73′
1,714	1,050	872	132	33	6	7

Navigation Study



Geotechnical

Borings To 39.6 m (130 Ft)

9.1 m (30 Ft) Soft Clay Over Stiff Clay

Bascule Pier Foundations

50 Steel Pipe Piles

762 mm (30 inch) Diameter x 42.7 m (140 Ft) Long

50 Ton Design Capacity

Reinforced Concrete Footing / Seal

Adjacent Approach Pier Foundations

33 PPC Piles

450 mm (18 inch) Square x 25 m (82 Ft) Long

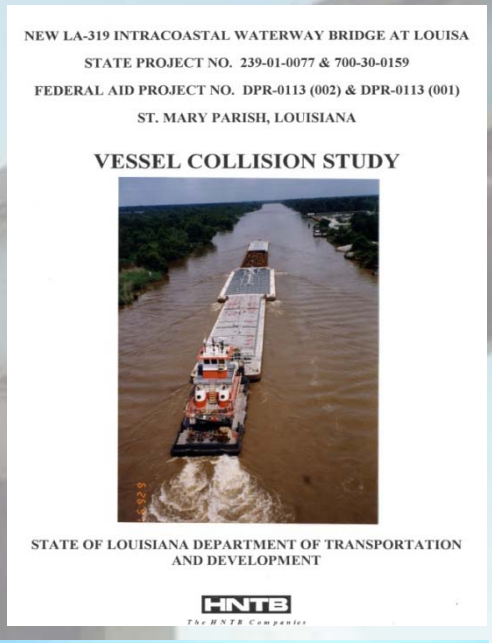
50 Ton Design Capacity

Reinforced Concrete Footing

Pier Protection System

AASHTO Vessel Collision Design

- Design 4 Barges with 1 Towboat (LOA = 1200 Ft)
- Flow Is Tidal with Water EL 0.0 To 3.0 Ft
- 1967-1995 Vessel Collisions to Existing Bridge (26 Barge Tows) 3 Barge Collisions In 2001
- Classification - Critical
- Vessel Impact Speed = 6 MPH (4 to 6 MPH recorded)
- Method II (Method I) Force = 3,800 (4,100) Kips



Two Bascule Piers In Navigable Waterway

Pier Protection Alternates

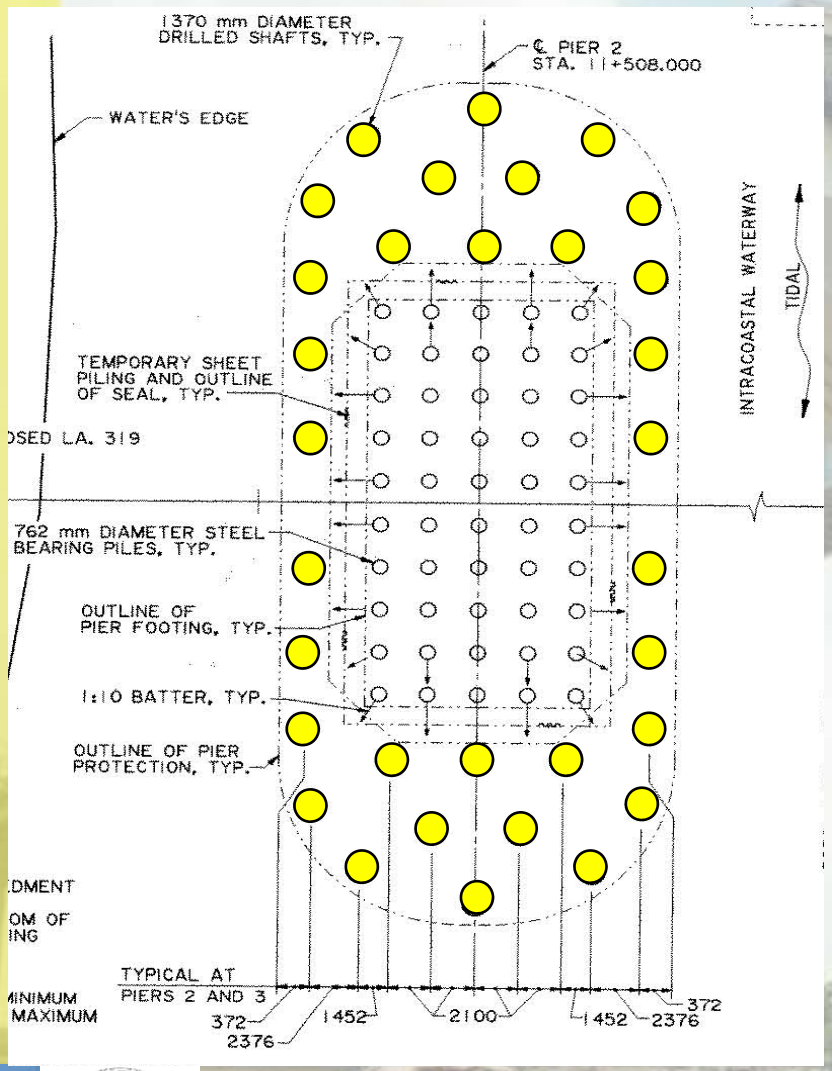
- Drilled Shaft ➔ Elastic/Not Destroyed
- Guide Wall ➔ Plastic/Partial Breakup
- Dolphin System ➔ Plastic/Partial or Complete Breakup

Pier Protection System

Source: Vicksburg COE

Pier Protection System

32-1370 mm (54″) Diameter Drilled Shaft within a Concrete Cap System



Bascule Pier Alternates

Open Pier

Counterweight Under Approach Span

Counterweight Will Not Dip Into Water

Approach Spans Need To Be Two Girder Systems

Bascule Span Live Load Anchors Mounted On Approach Span

Approach Spans Mimic Bascule Haunch To Hide Counterweight

Enclosed Pier

Counterweight Enclosed

Simplified Approach Spans

Higher Pier Cost

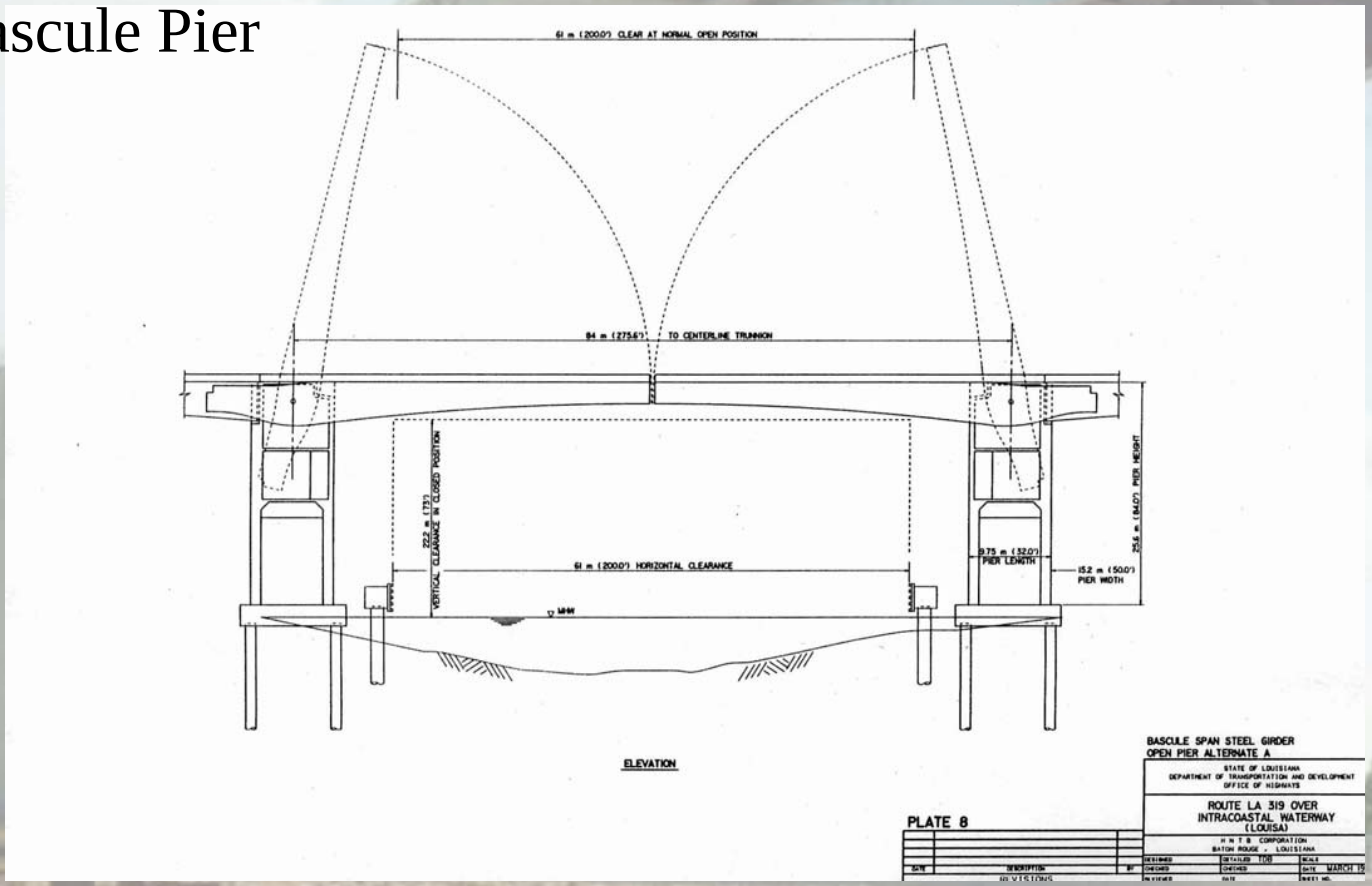
Bascule Superstructure Alternates

Alternate A

Double Leaf Trunnion Bascule

Two Steel Girder

Open Bascule Pier



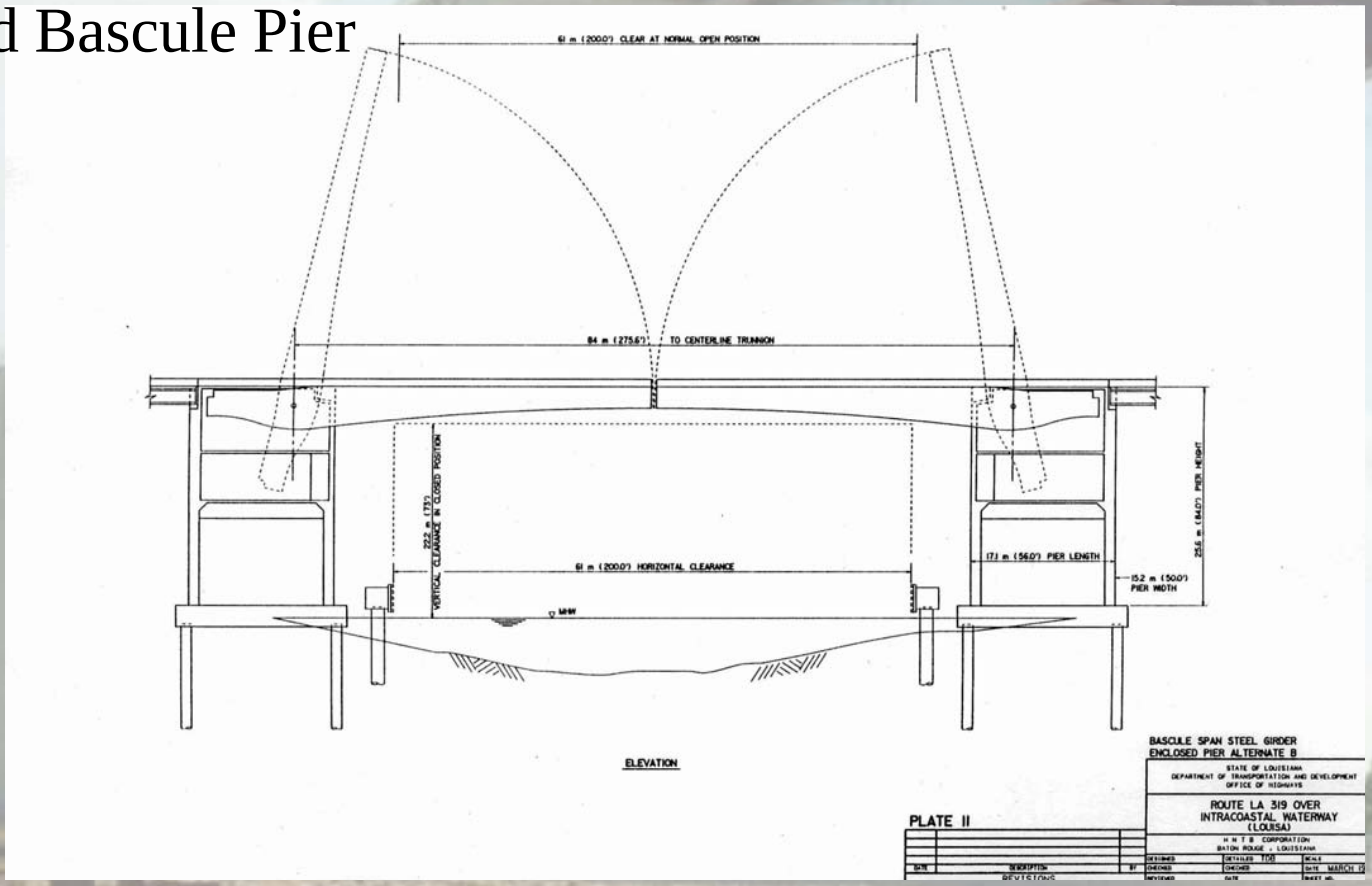
Bascule Superstructure Alternates

Alternate B

Double Leaf Trunnion Bascule

Three Steel Girder

Enclosed Bascule Pier



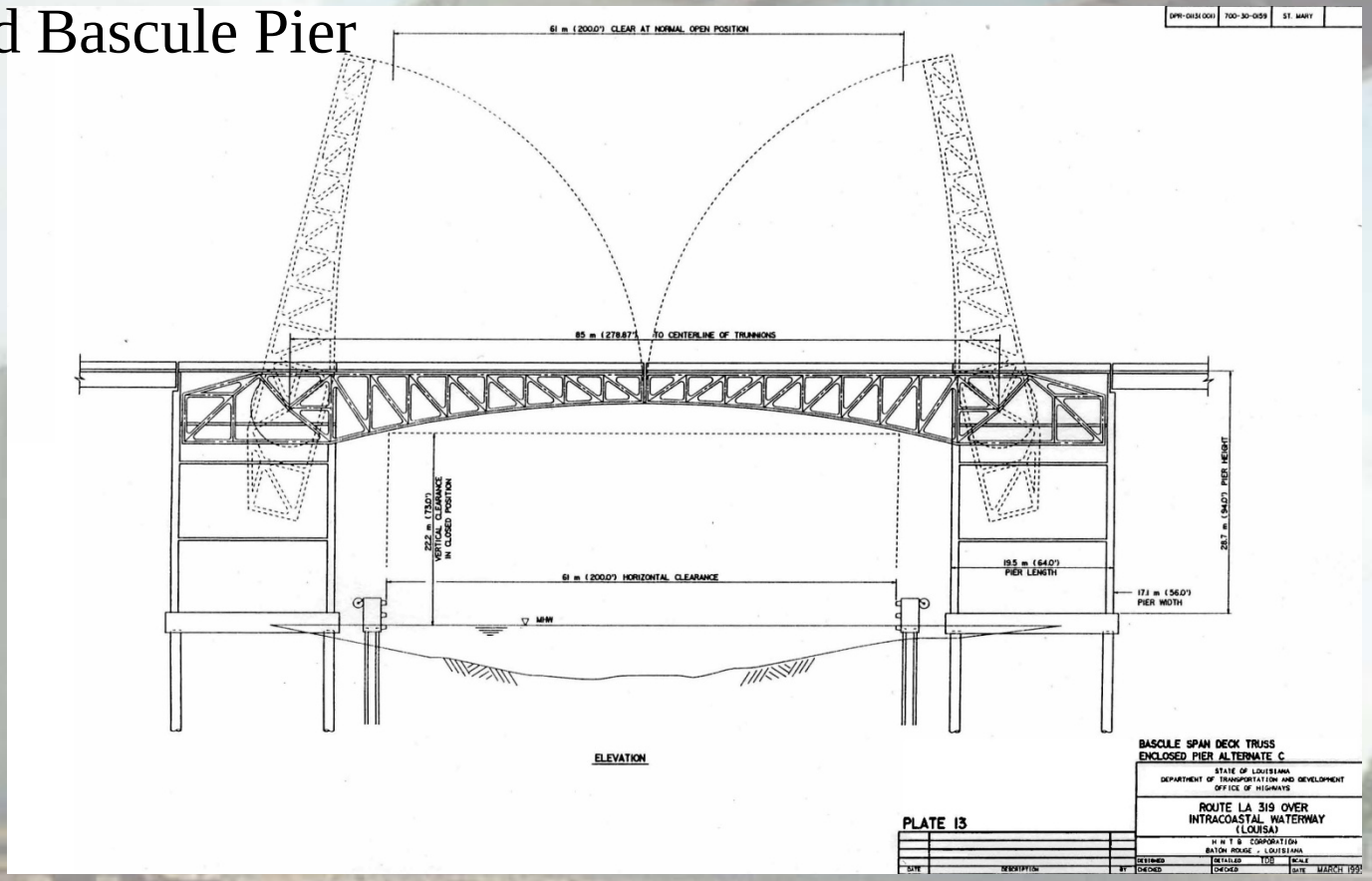
Bascule Superstructure Alternates

Alternate C

Double Leaf Trunnion Bascule

Two Steel Deck Truss

Enclosed Bascule Pier



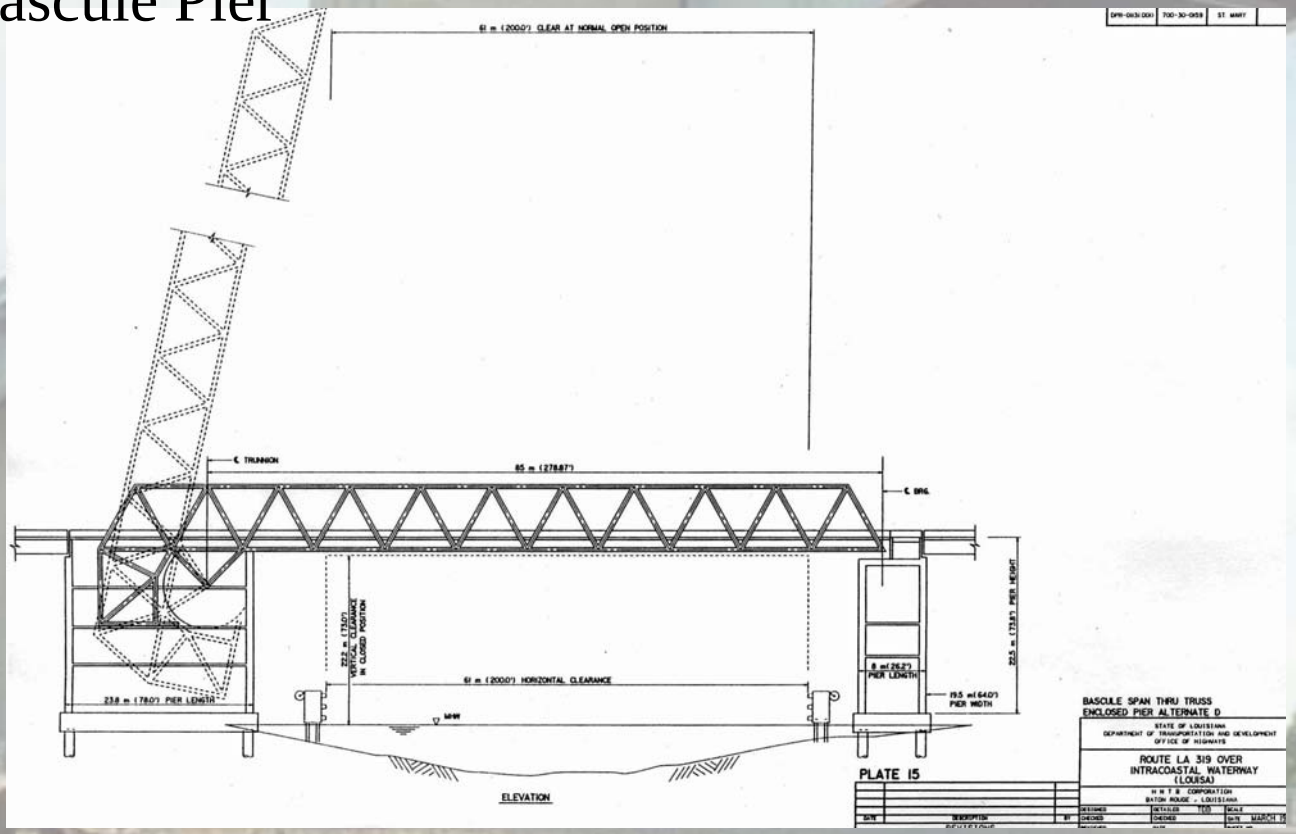
Bascule Superstructure Alternates

Alternate D

Single Leaf Trunnion Bascule

Two Steel Through Truss

Enclosed Bascule Pier



Bascule Superstructure Alternates

Preliminary Cost Estimate 1996 ($ millions)							
Alternate	Bascule Span		Pier Protection	Mechanical / Electrical	Approach Structure & Roadway	Mobilization / Contingencies	Total Cost
	Super	Sub				18%	
A	2.7	2.7	1.5	6.4	8.5	3.9	25.7
B	2.1	4.1	1.5	6.4	8.5	4.1	26.7
C	2.4	4.4	1.5	6.4	9.8	4.4	28.9
D	4.8	3.7	1.5	5.7	7.5	4.2	27.4

Alternate A Chosen

Environmental Assessment

Land Use - **Alignment 1A Smallest Impact**

Farmland Protection Policy Act (FPPA)

USDA Ranked **Alternate 1A As The Lowest Impact**

Air Quality – No Impact **Noise** – No Impact

Water Quality – Little Impact Chicot Aquifer (300 Foot Wells)

NEPA Permits - **Wetlands**

Much of It Prior Converted To Agriculture

Bypass Has The Highest Impact

Alignment 1A Is Second Highest

LADOTD Responsible For Mitigation

Floodplains – Project Lies In A 100 Year Floodplain

Endangered And Threatened Species - USFWS **No Effect**

Archeological/Historical

Visual Impact - Public Hearing - **Alignment 1A Preferred**

Environmental Assessment

Impacts To Wetland Habit

Impacts to Wetland Habitat						
Impact Categories	Alternate					
	1		2		1A	
Area (ac)	2.17		2.10		3.80	
	BHW[1]	FSWP[2]	BHW	FSWP	BHW	FSWP
AAHU's[3]	.5	.76	1.19	—	—	2.44

[1] Bottomland Hardwood; [2] Fresh Swamp; [3] Average Annual Habitat Units

FONSI Determined

Proposed Bridge Rendering

New Louisa Bridge

Construction Team

Louisiana DOTD / HNTB

Coastal Bridge Company – General Contractor

CEC/Huvall Associates – Bascule Span Erection

Steward Machine – Bascule Span Steel and Machinery

IKG Industries – Bascule Span Steel Grating

Carolina Steel – Approach Span Steel

Orleans Material – Bascule Pier Trunnion Support Steel

J.H Menge & Co. – Pier Protection Fendering

E. P. Breaux – Electrical

New Movable Span Bridge

2-Lanes 11.4 m (37 Ft) Wide Roadway/No Sidewalks

84 m (276 Ft) 2 Steel Girder Double Leaf Fixed Trunnion Bascule Span

Bascule is French for "Seesaw"
Trunnion is French for "Trunk" or "Stump"
Bascule Span Girders vary in depth 2.3 m to 5.3 m (7.5 to 17.3 Ft)

64 m (210 Ft) 2 Steel Girder Adjacent Span

Adjacent Span Girders vary in depth 2.5 m to 5.0 m (8.3 to 16.4 Ft)

Approach Spans

38 – 37 m (121 Ft) Spans (Typical Units are Two Span Continuous)

5 Girder BT Sections 1830 mm (72″)

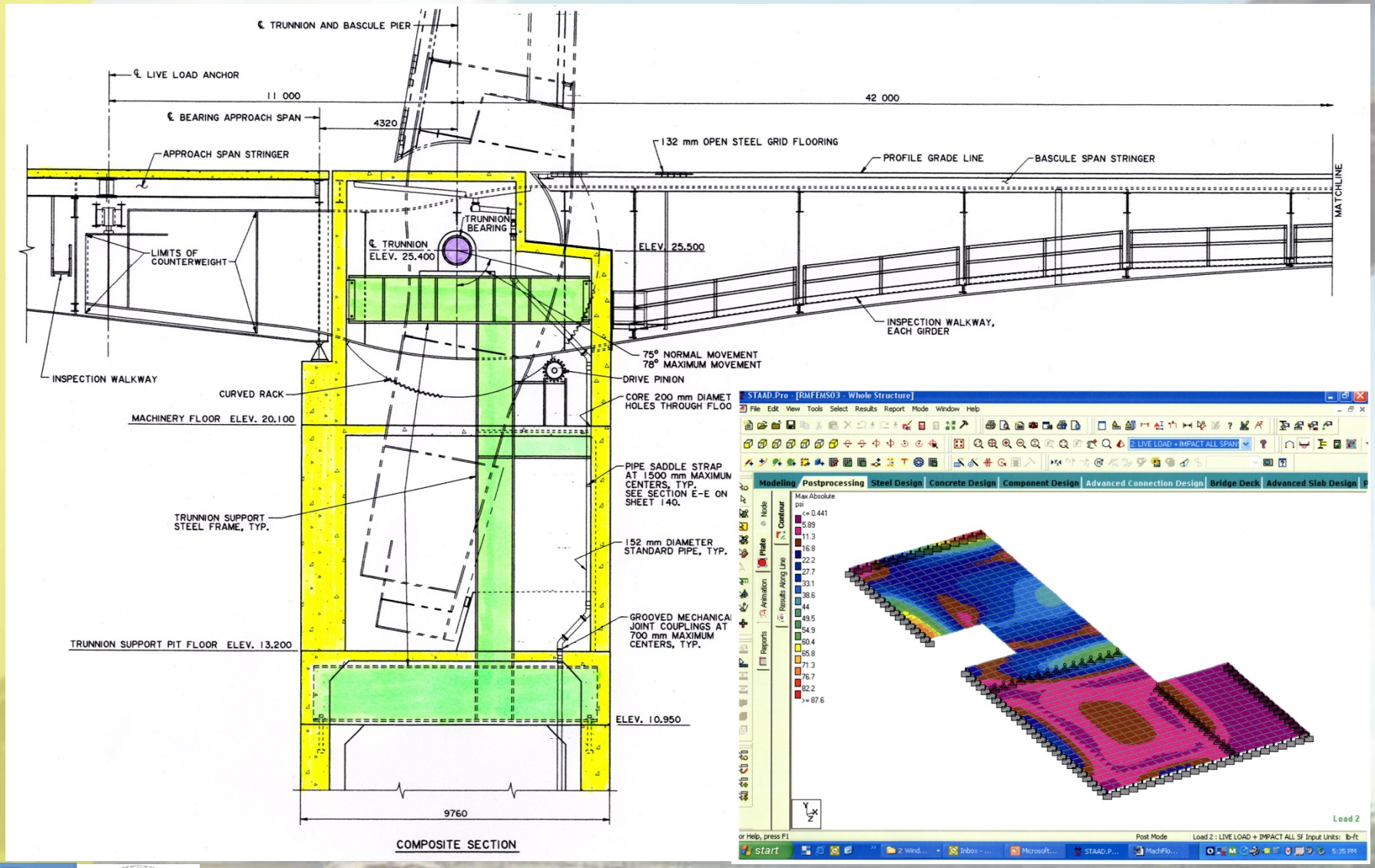
2 Column Reinforced Concrete Bents

Bascule Girders

Trunnion Inserted After LN2 Bath
Class 7 Fit with Trunnion Medium Drive Fit

Photos courtesy of Steward Machine Company

Bascule Piers



Bascule Piers

Steel Pipe Pile Foundation

Reinforced Cast In Place Concrete

Bascule Span Steel Support Structure

Pier Protection

Concrete Filled Steel Pile

Reinforced concrete cap

UHMW-PE

Ultra High Molecular Weight Polyethylene

Bascule Span Erection

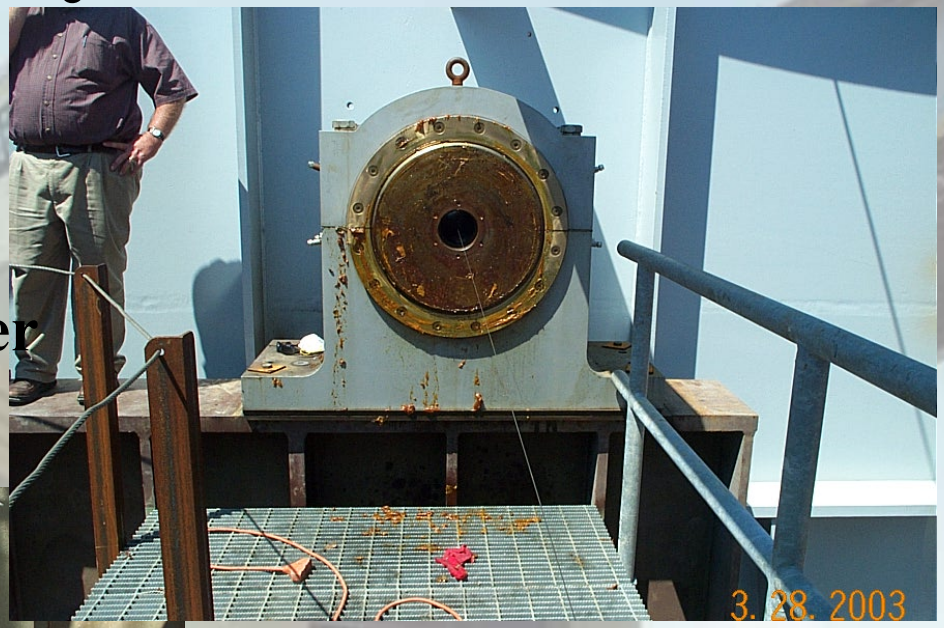
- Tail Erected
- Toe Added
- Deck Placed
- Steel and Concrete Filled Steel Box Counterweight

Machinery Erection

Trunnion Bearing

600 mm (24″) To 760 mm (30″)

Bronze Bushing



Rack Bolts To Bascule Girder Flange Plates

Drive Machinery

Simple Arrangement

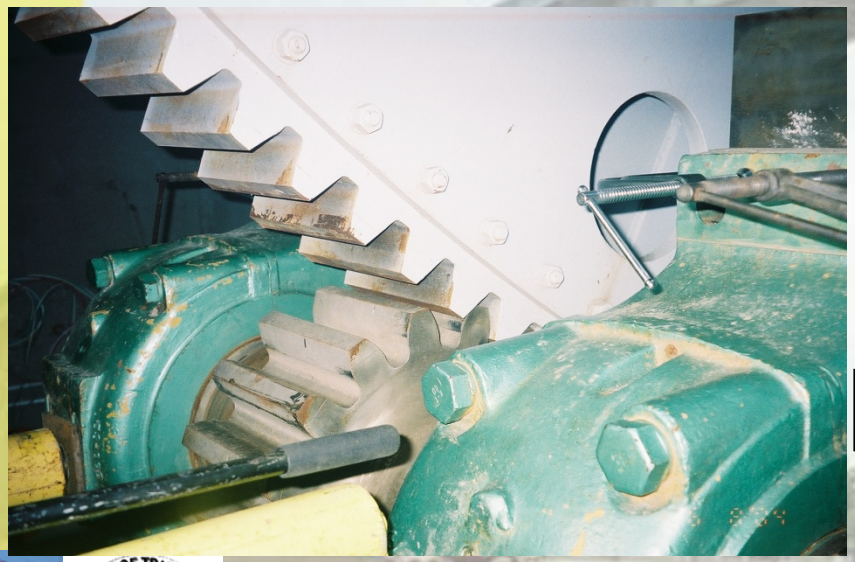
2 - 25 HP Two Speed AC Motors

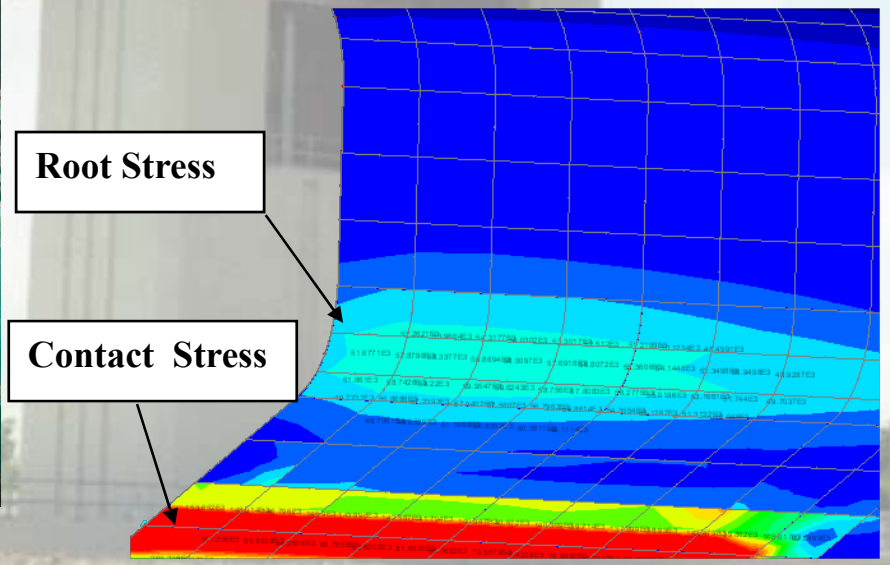
Single Central Reducer

Rack Alignment Analysis

Tooth Finite Element Analysis

Condition	Root Stress (ksi)	Loading Diagram
1 – Load Applied Full Width	14	
2 – Load Applied 20% Width	40	
3 – Load Applied 20% Width at end of tooth	60	





Finished Span 2005

Finished Span 2005

$12.7 M Approach

$22.2 M Bascule

$34.9 M Total

Intracoastal Waterway Bridge at Louisa

2007 Prize Bridge Award - Movable Span Category
Presented at the 2007 World Steel Bridge Symposium

HNTB