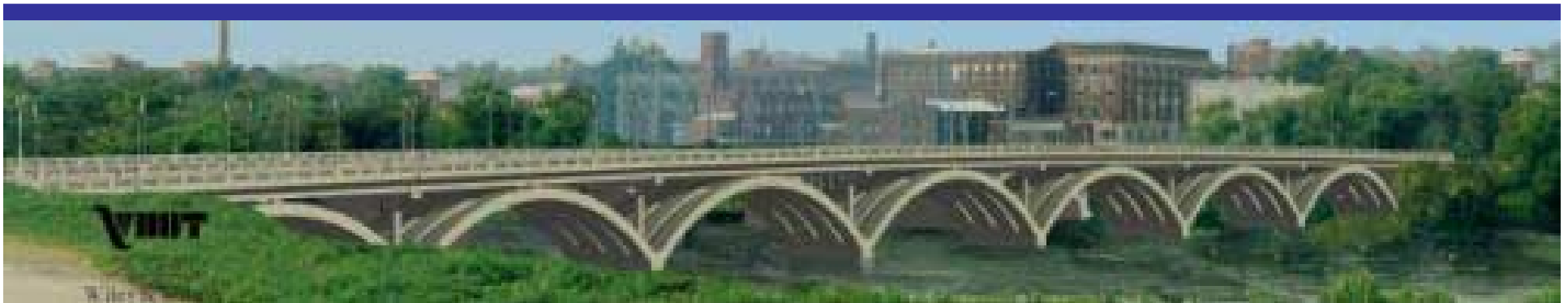


Virginia Concrete Conference
March, 2006



*Open Spandrel Concrete Arches
New and Old*

Wiley & Wilson
Employee-Owned



Introduction

- William M. (Bill) Davidge IV, P.E.
- Vice President - Wiley & Wilson, Inc.
- Education
 - B.S. Civil Engineering - 1973
University of Virginia
 - M.S. Structural Engineering - 1977
George Washington University
- Professional Registration
 - Professional Engineer
 - VA, MD, CA, NC
- Professional Organizations
 - American Society of Civil Engineers
 - National Society of Professional Engineers
 - Virginia Society of Professional Engineers
 - Joint ASCE/ACI Committee on Concrete Bridge Design
 - Virginia Section - Institute of Transportation Engineers



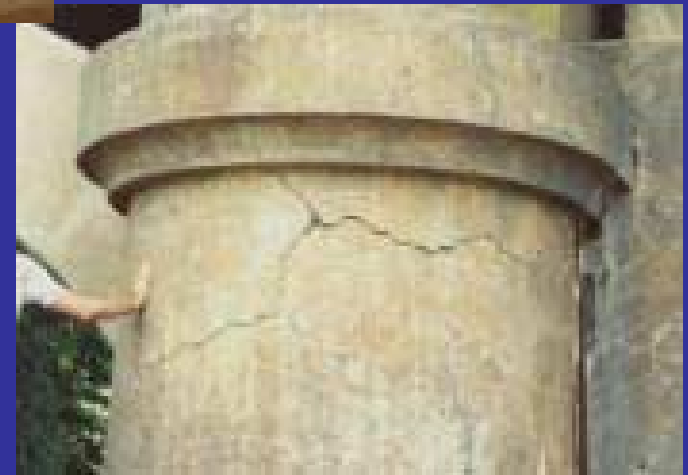
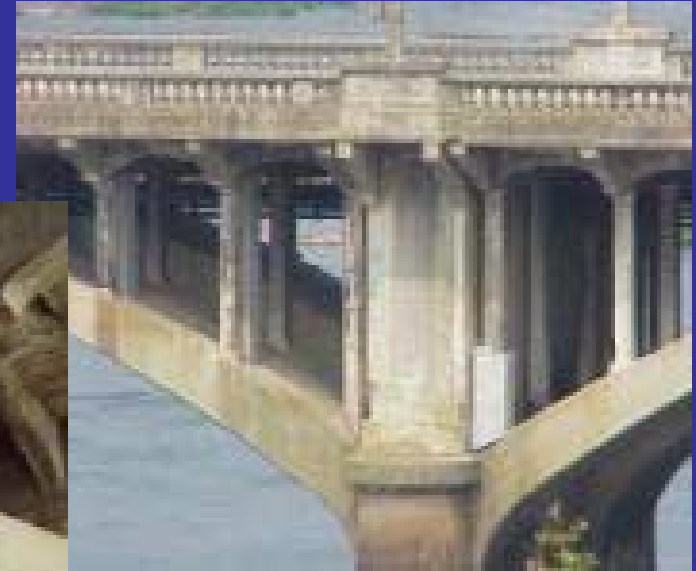
Agenda

- Purpose & Need
- Project Constraints
- The Original Luten Bridge
- The General Design Solution
- The Bridge Design Solution
- Aesthetics
- Project Status/Conclusion
- Questions and Answers



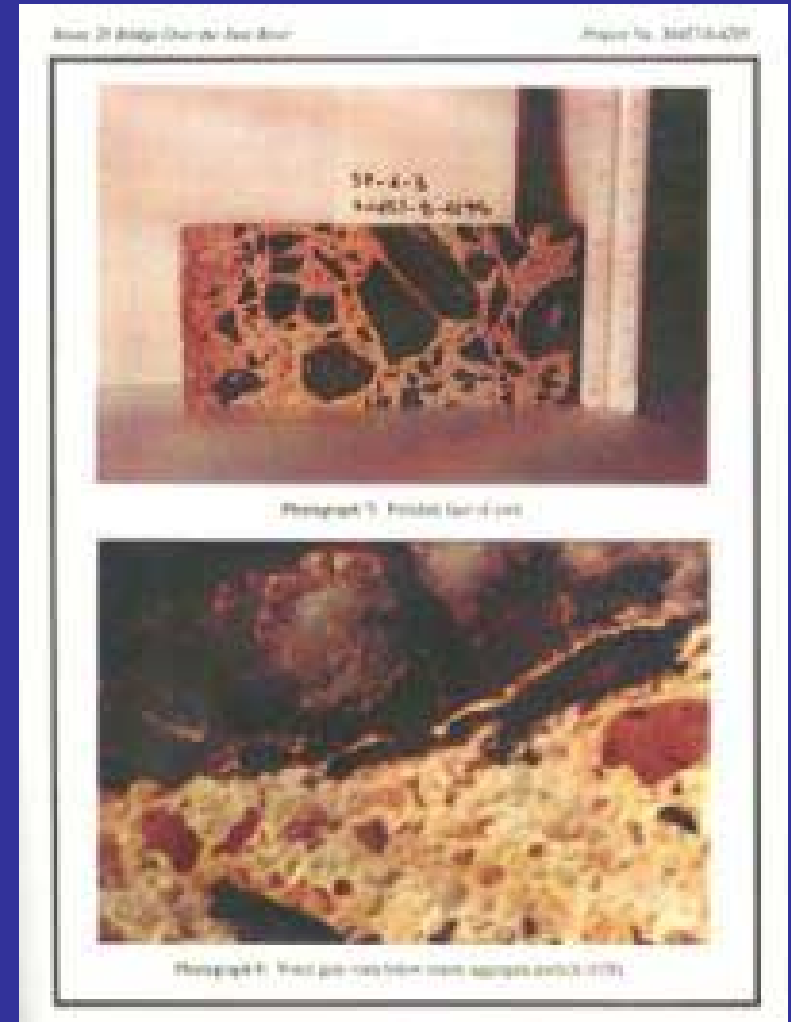
Project Purpose & Need

- Condition of Bridge Structure



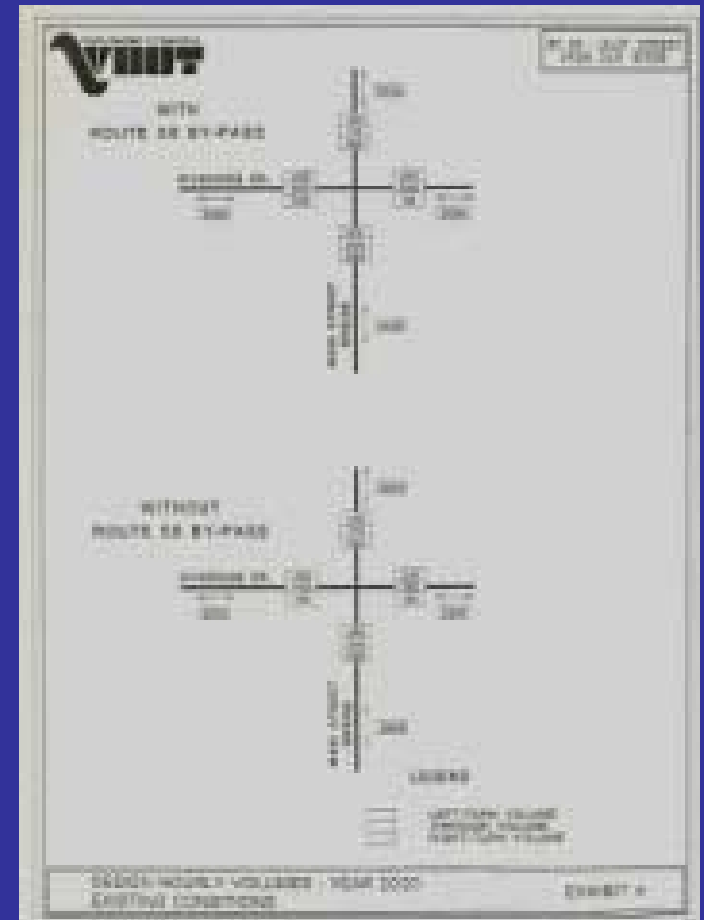
Project Purpose & Need

- Destructive Testing Program
 - 34 Compression Test Cores Taken in Arches & Piers
 - 6 Splitting Tensile Strength Tests for Arches & Piers
 - 54 Chloride Tests in Arches & Piers
 - Petrographic Analysis



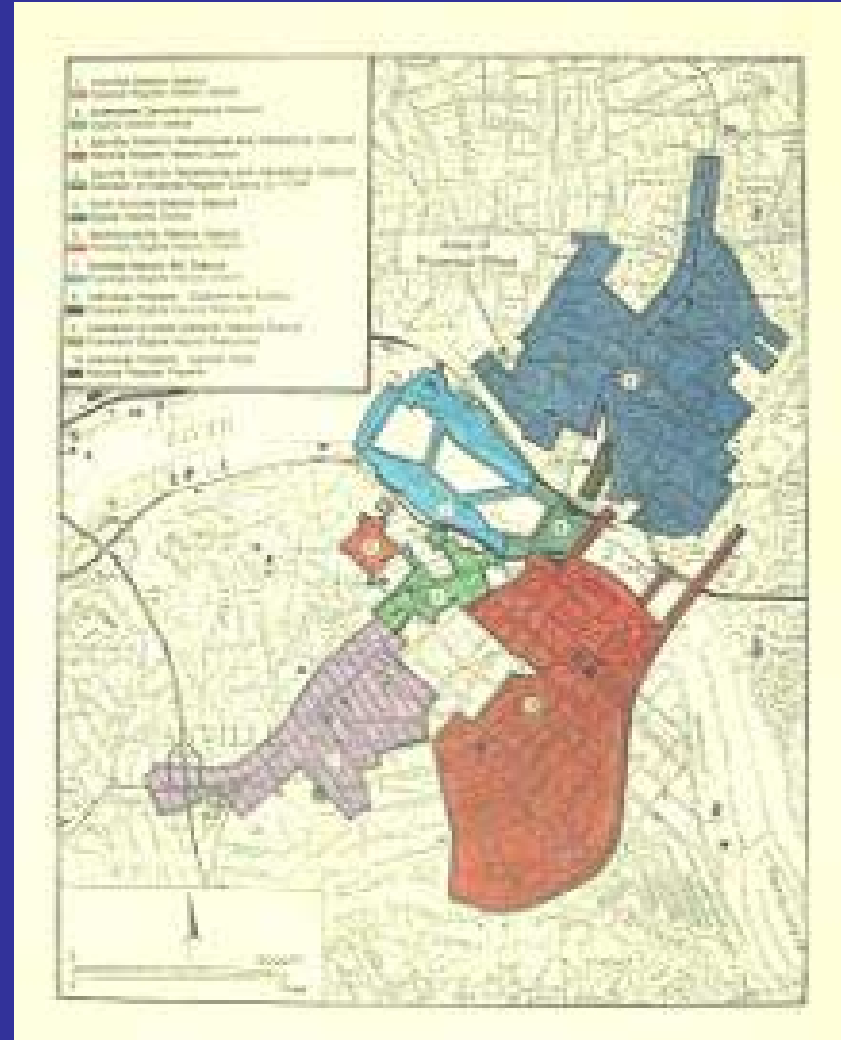
Project Purpose & Need

- Traffic
 - TRAFNETSIM Model
 - Main Street/Riverside Drive Intersection
 - Main St. Is Downtown Thoroughfare
 - Riverside Dr. (Rte. 58) Is Main East-West Corridor for Southside Virginia
 - Requires 2-Thru + Left and Right Turn Lanes on Each of 4 Legs



- Surrounding Historic Resources

Project Constraints



Project Constraints

- Existing Grid of City Streets



The Original Luten Bridge

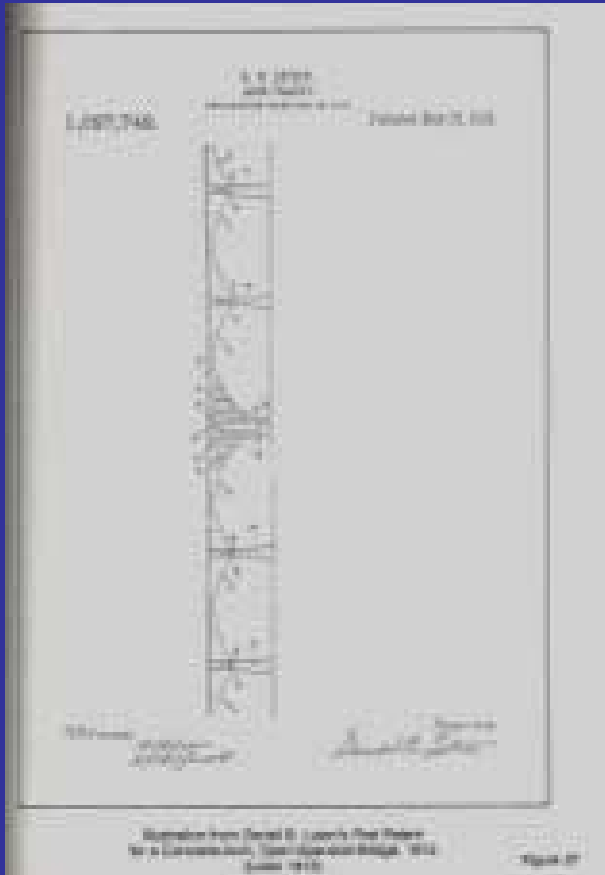


The Original Luten Bridge

- Backdrop of Historic Danville
 - Cotton Milling Industry
 - Began 1820's
 - 7 Mills Established Here in late 1800's
 - Mill Housing
 - Tail Races Here Served Other Businesses
 - Canals Here Used for Transport
- Other Bridges on this Site
 - Wood Covered Bridge Built 1851, Replaced 1887
 - Theodore Cooper "Iron" Truss (Fireproof) Built 1887, Burned 1927



The Original Luten Bridge

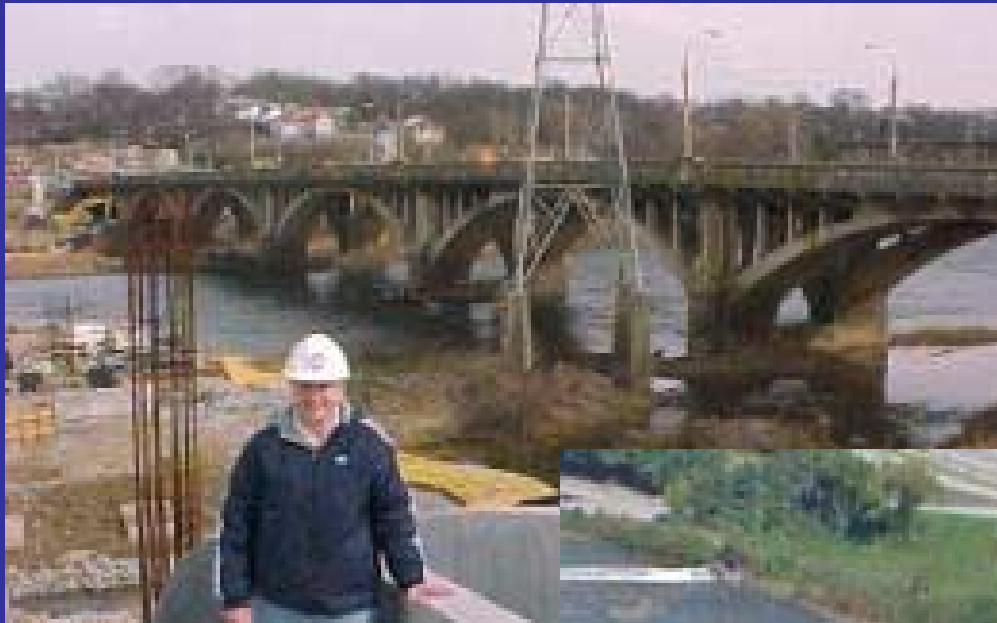


- Daniel B. Luten,
Bridge Designer
 - Indianapolis, Indiana
 - Prolific & Well Known Engineer
 - Held 50 Patents, First Dated 1912
 - Pioneered Open Spandrel Arch Construction
 - Marketed to Municipalities
 - Marketed to Replace Metal/Timber Structures (Fire, Wear & Flood Resistant)
 - Built Bridges in 45 States + Overseas

The Original Luten Bridge

- Construction of the Bridge
 - 1927
 - Concrete Steel Bridge Company
Clarksville, West Virginia
 - Concrete Design Selected for
Fire and Flood Resistance
 - High-Profile Designer Selected in
Line With Danville's Image
(Notable Others Included
Concrete Building Designers
Julius Kahn & Claude A.P.
Turner)





- 7 Spans
- 840 Feet Long



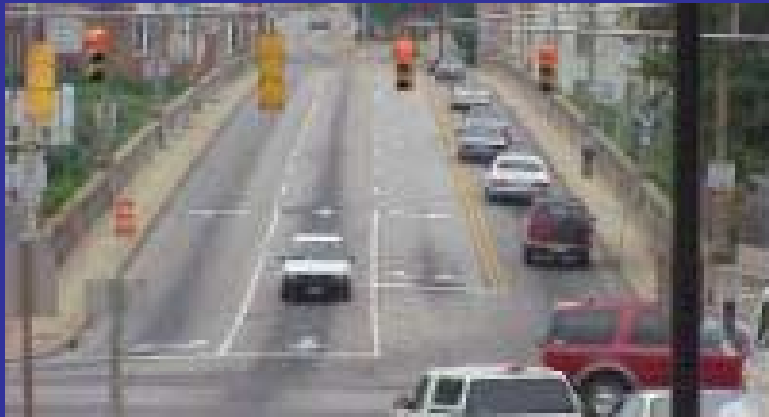
The Original Lutten Bridge



The Original Luten Bridge -Function

- Cross Section
 - 2 Arches
 - 4 Spandrel Columns
 - 44.5 Feet Curb-To-Curb
 - 2 – 5 Foot Sidewalks
 - Trolley Tracks





- Existing Configuration



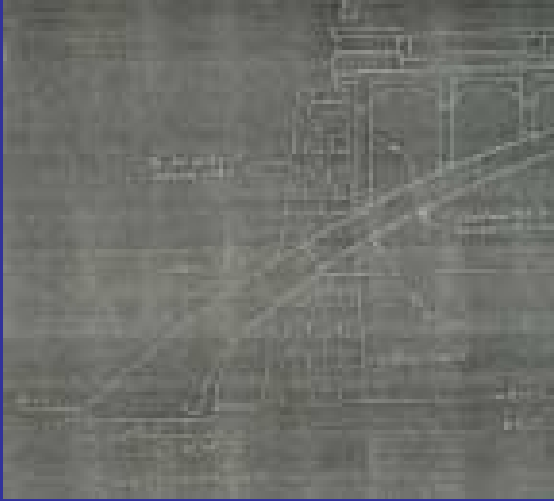
The Original Luten Bridge-Function



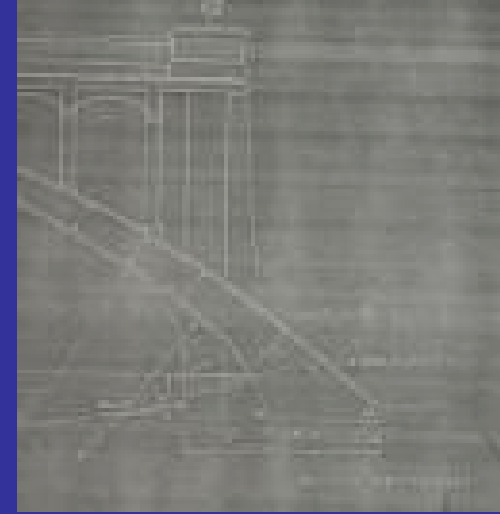
The Original Luten Bridge -Structure

- Piers & Foundations
 - Founded on Granite Bedrock





- Abutments
 - Incorporate Old Mill Race Walls

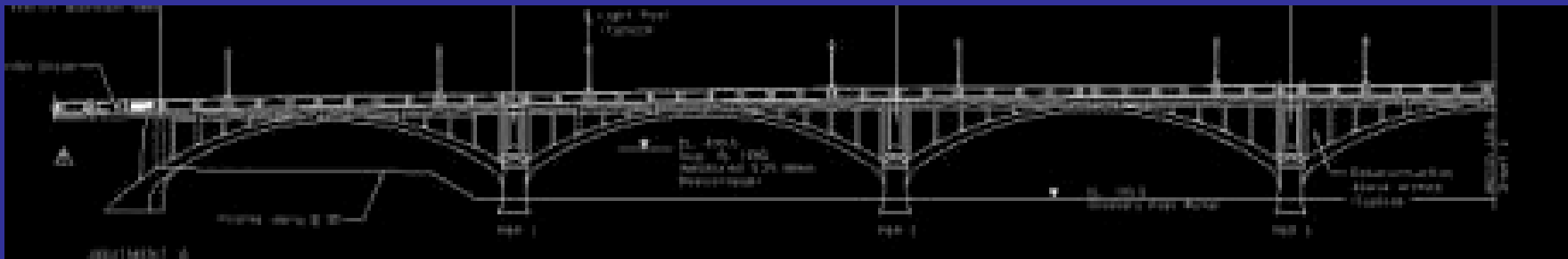


The Original Luten Bridge -Structure



The Original Luten Bridge -Structure

- Arches
– 3 Radii



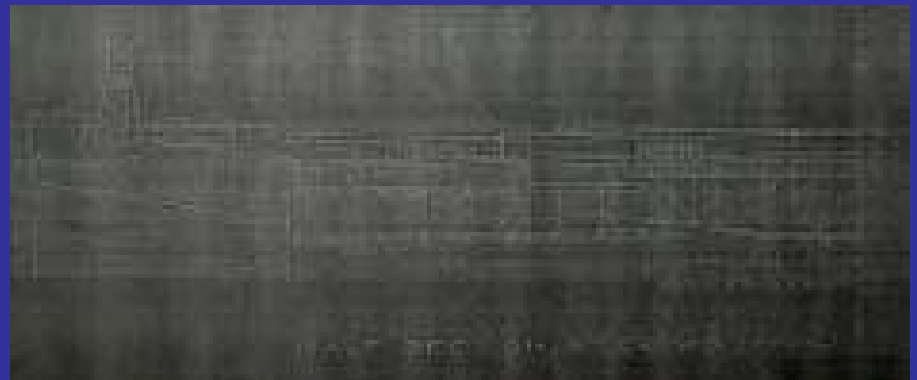
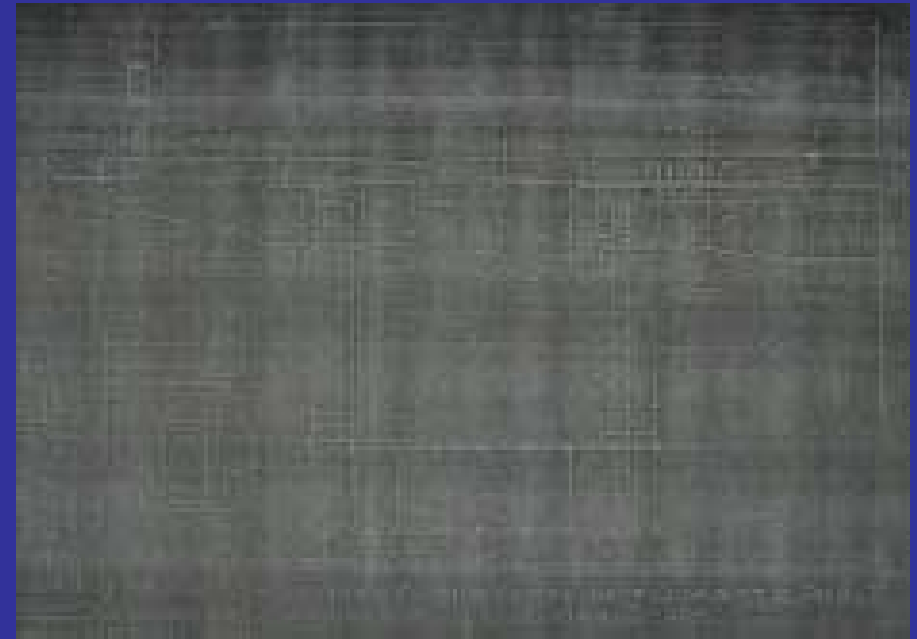
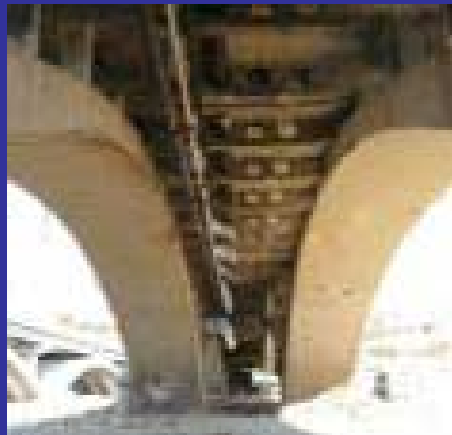
The Original Luten Bridge -Structure

- Arches
 - Pairs
 - Variable Thickness



The Original Luten Bridge -Structure

- Arches



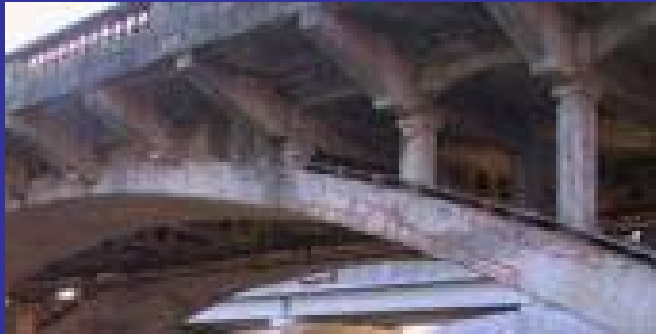
The Original Luten Bridge -Structure

- Spandrel Columns
12" X 18"



The Original Luten Bridge -Structure

- Floor Framing
 - Continuous, Cantilevered Cross-Beams
 - Deck Spanning Parallel to the Direction of Traffic



The Original Luten Bridge -Structure

- Deck, Overlay & Sidewalk



The Original Luten Bridge -Structure

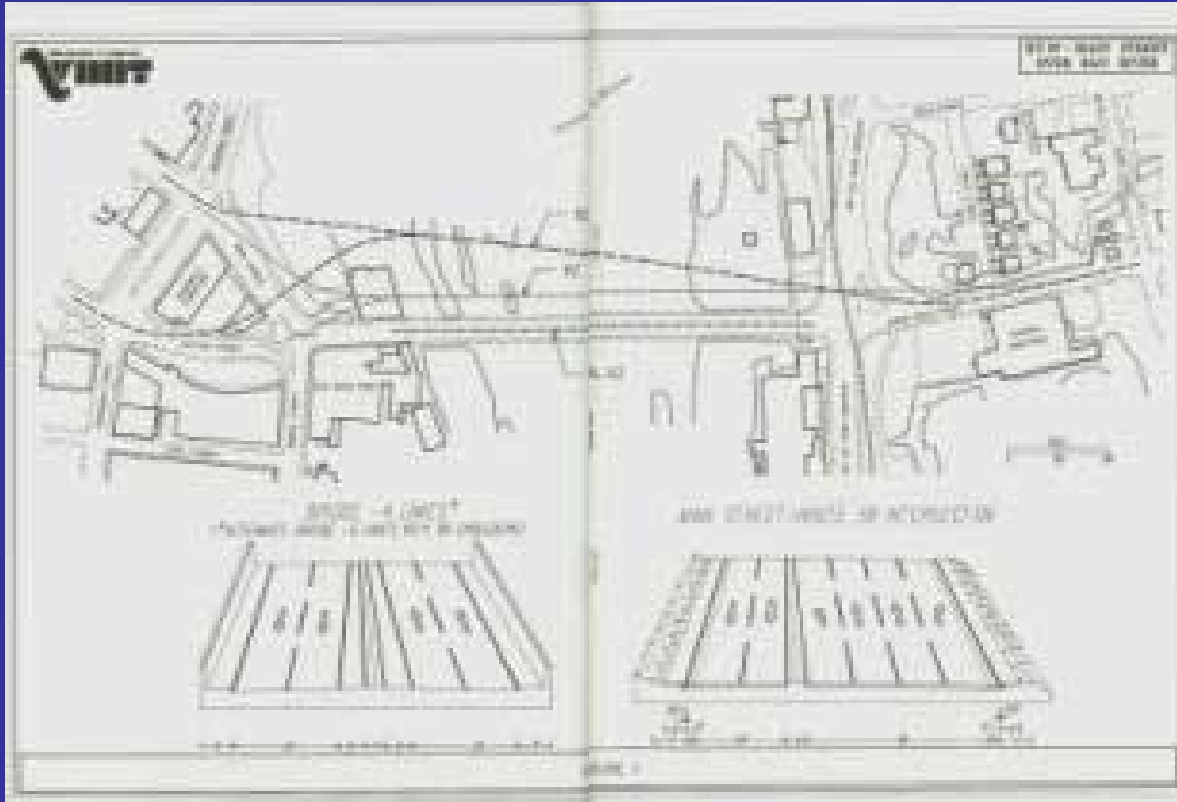
- Railings & Lighting



The Design Solution



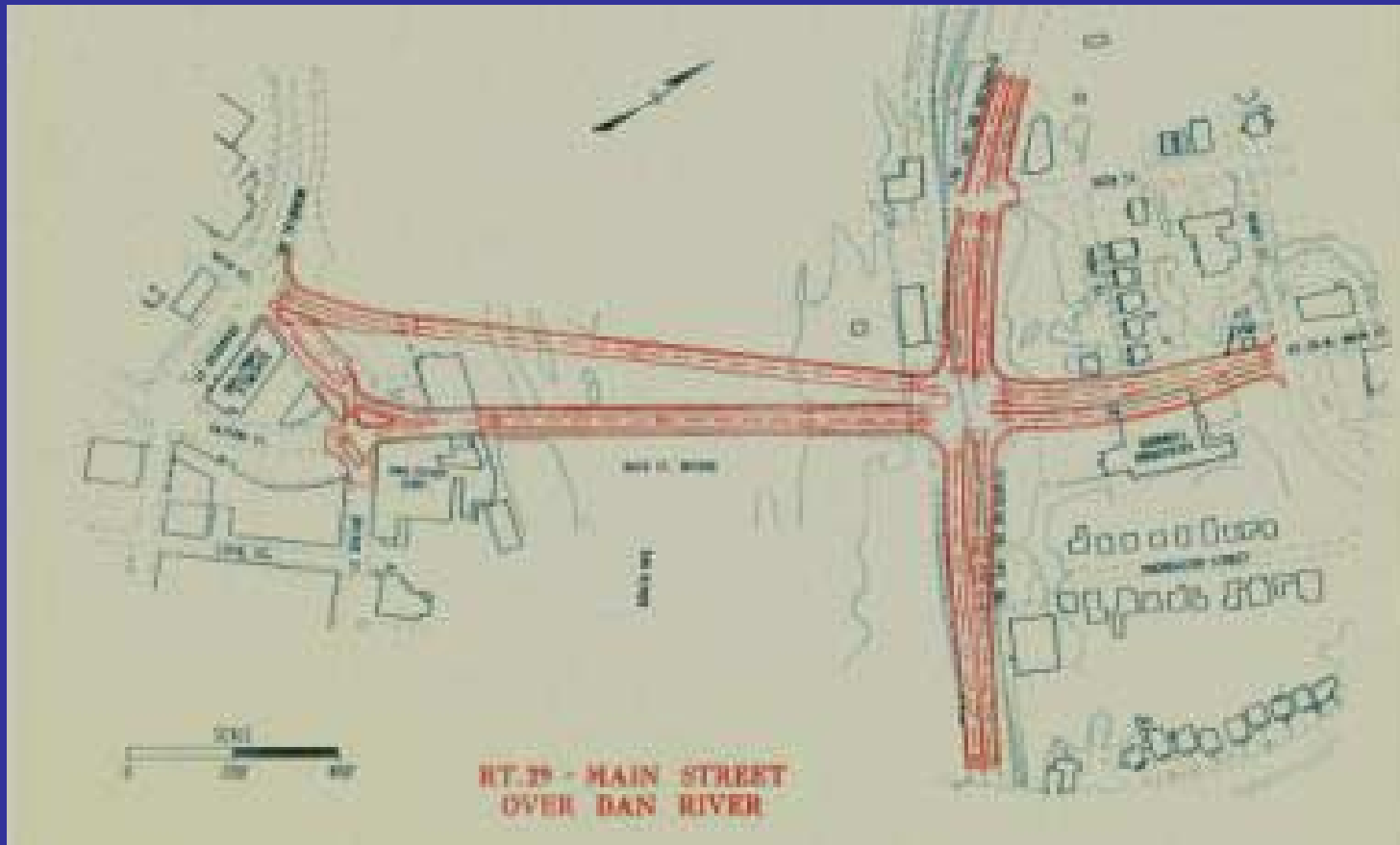
- Location Alternatives



The General Design Solution



- Design Configuration
- Maintenance of Traffic During Construction



The General Design Solution

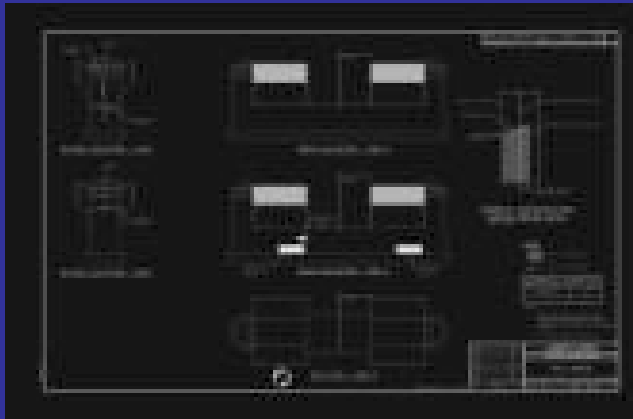


The Bridge Design Solution

-Renovation of the Original Bridge



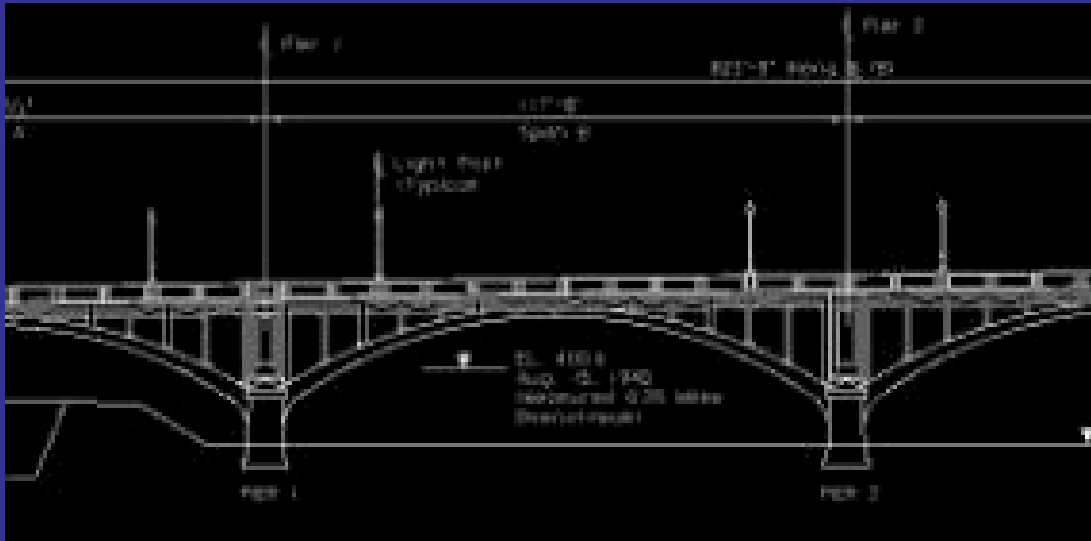
- Rehabilitation of Arches and Piers



The Bridge Design Solution
-Renovation of the Original Bridge



- Replacement Above Arches
 - Cast-In-Place Concrete

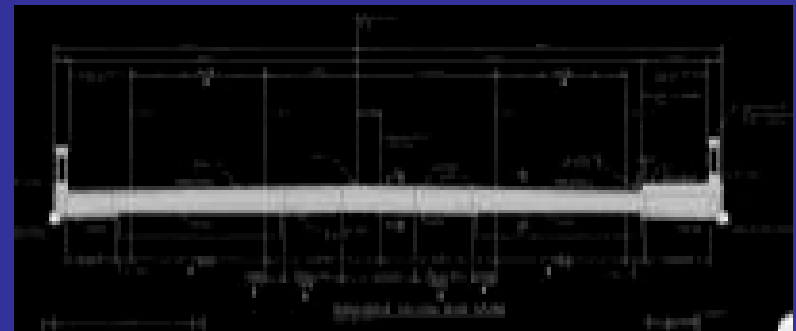
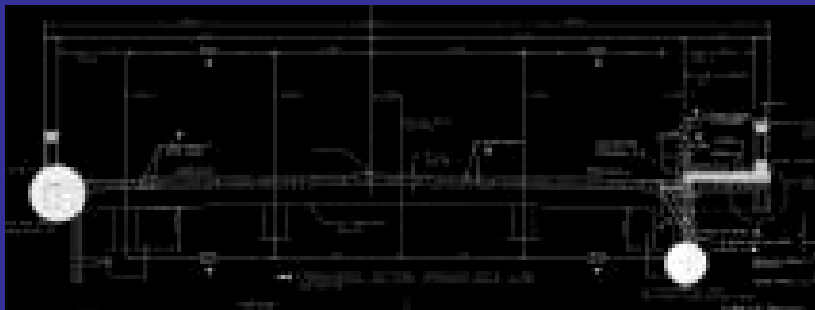


The Bridge Design Solution

-Renovation of the Original Bridge



- Floor System – Beams and Deck



The Bridge Design Solution

-Renovation of the Original Bridge



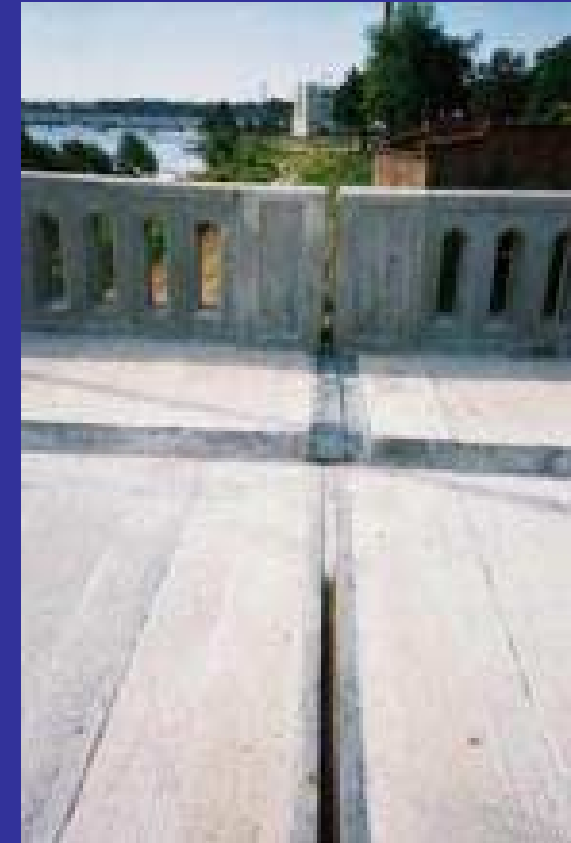
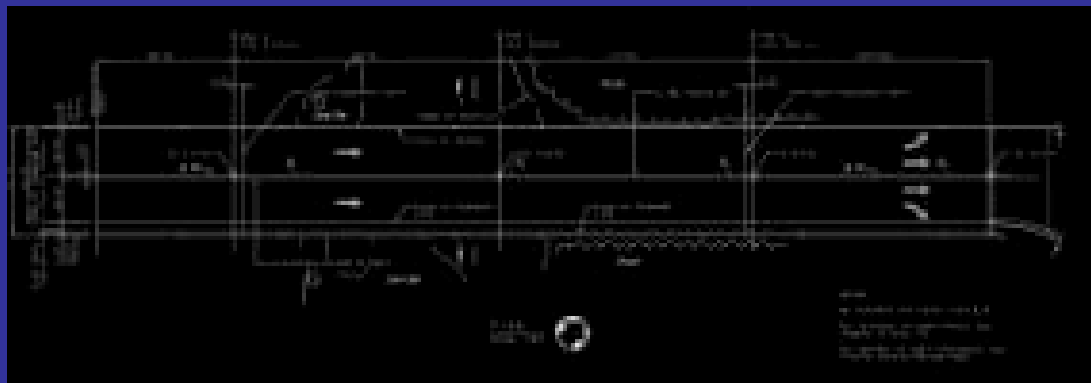
- Floor System – Concrete Formwork



The Bridge Design Solution
-Renovation of the Original Bridge



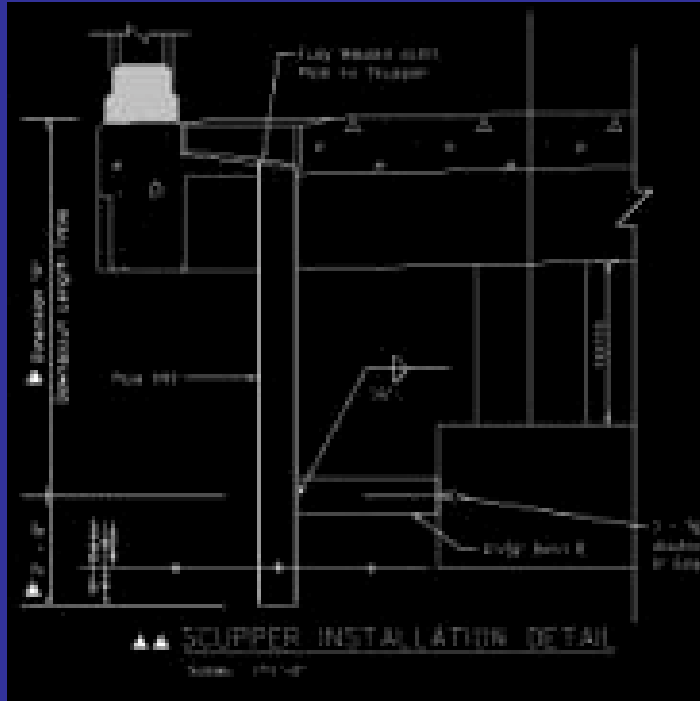
- Temperature Considerations/Deck Joints



The Bridge Design Solution
-Renovation of the Original Bridge



- Deck Drainage



The Bridge Design Solution
-Renovation of the Original Bridge

- Railings & Sidewalk
 - Texas Design With Alterations
 - Crash Tested

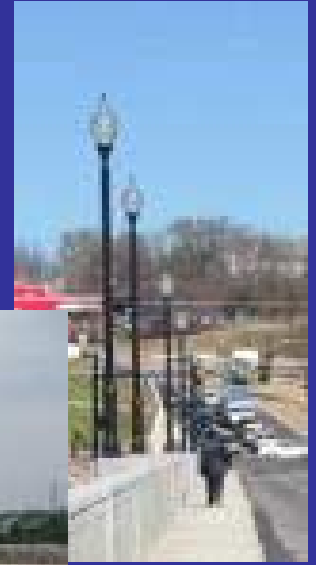


The Bridge Design Solution

-Renovation of the Original Bridge



- Lighting
 - Period Lighting Fixtures Consistent with City Standard



The Bridge Design Solution

-Renovation of the Original Bridge

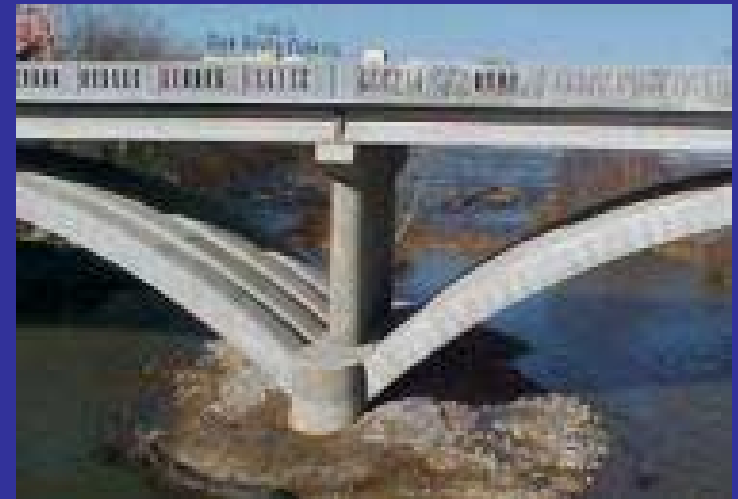


The Bridge Design Solution

-New Bridge



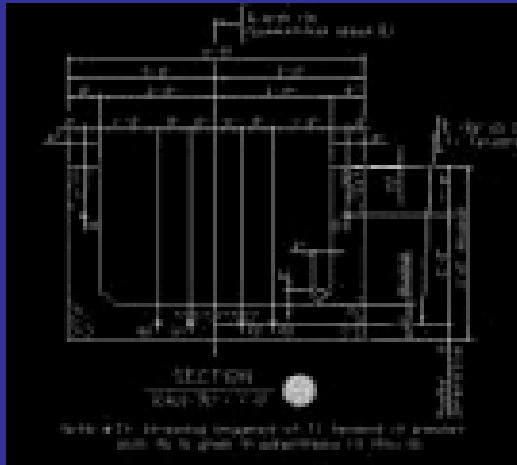
- Foundations & Substructure



The Bridge Design Solution
-New Bridge



- Arches
 - Uniform Radius
 - 2-Piece
 - Precast Channels
 - Post Tensioned at Crown

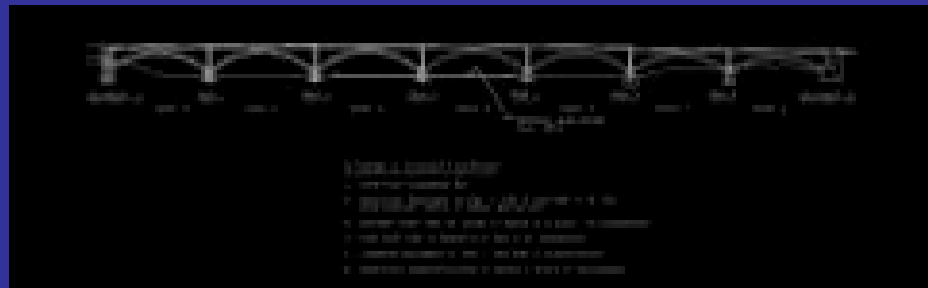


The Bridge Design Solution

-New Bridge



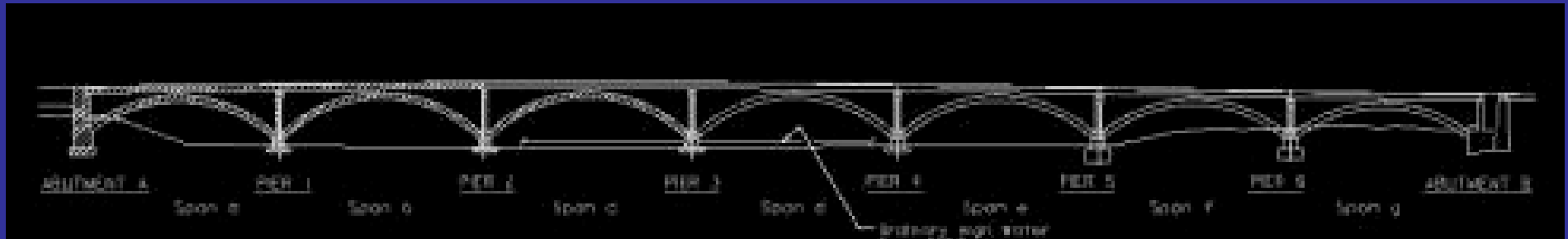
- Arches
 - Staged Construction



The Bridge Design Solution *-New Bridge*



- Arches - Staged Construction



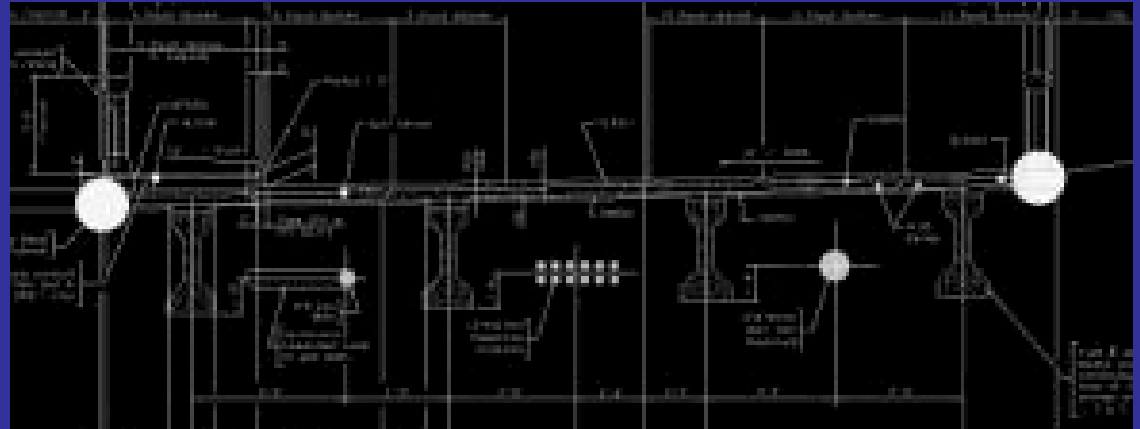
Stage I Construction

1. Construct Causeway A2.
2. Construct Abutment A, Pier 1, Pier 2 and Pier 3 to the construction joints, 2' below Spring line.
3. Connect arch ribs at crown in Spans a, b and c in succession.
4. Infill arch ribs in Spans a, b and c in succession.
5. Complete Abutment A, Pier 1 and Pier 2 construction.
6. Construct superstructure in Spans a and b in succession.

The Bridge Design Solution
-New Bridge



- Floor System
 - AASHTO Type III Girders
 - Utility Supports



The Bridge Design Solution

-New Bridge



- Above Deck Items

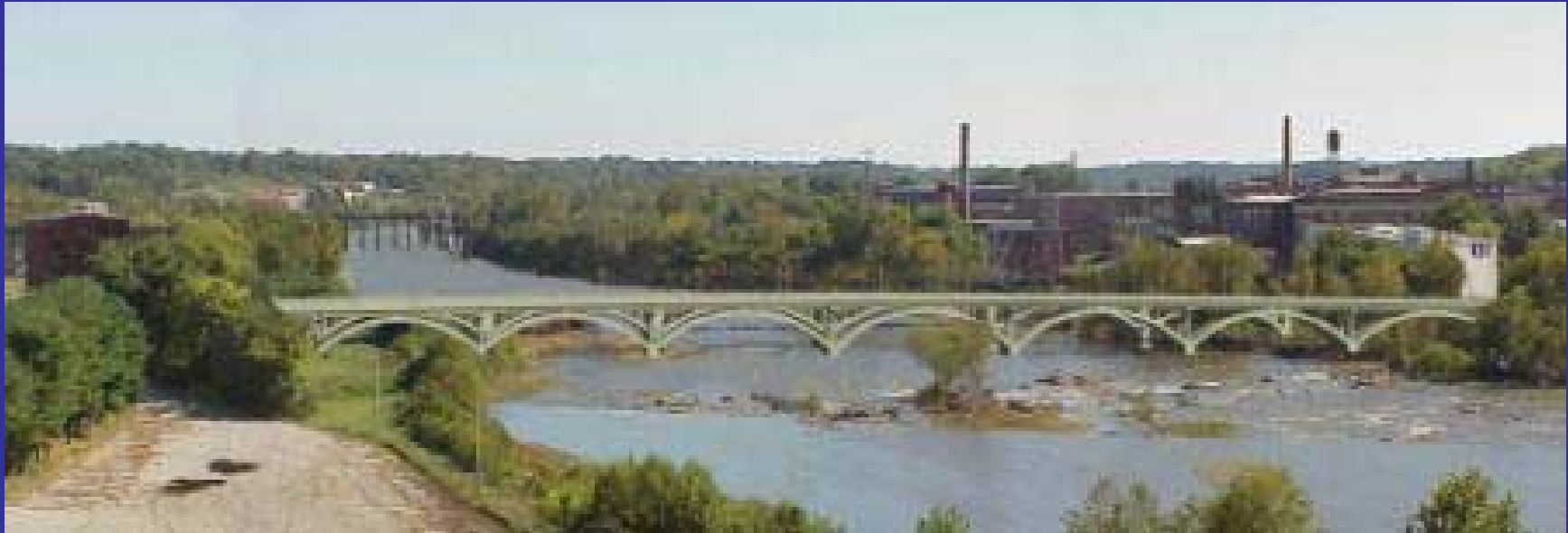


The Bridge Design Solution
-New Bridge



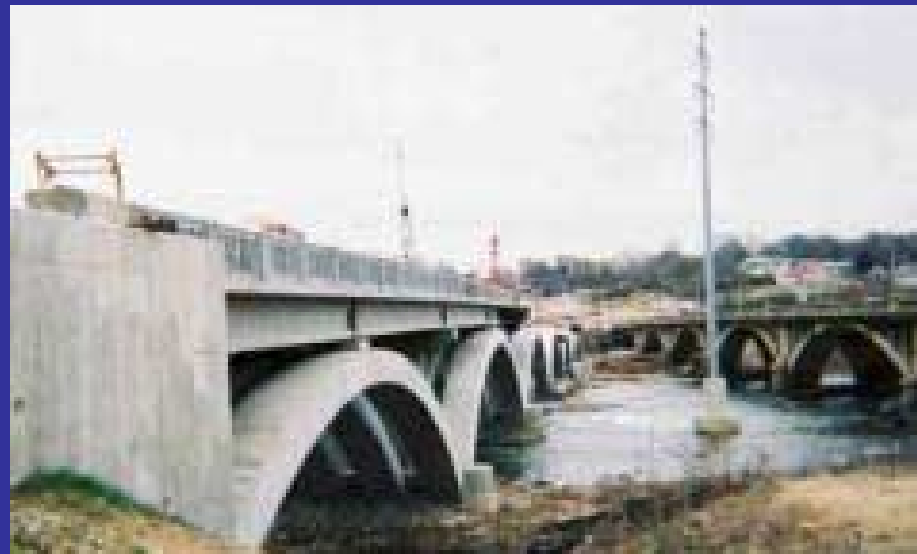
Aesthetics





Aesthetics *-Elements in Common*

- Arch Spans
- Span Arrangement



Aesthetics

-Elements in Common

- Railing
- Lighting

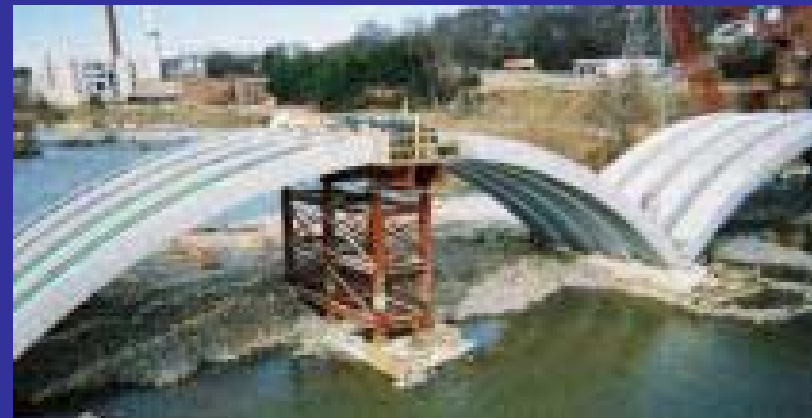




Aesthetics

-Elements in Contrast

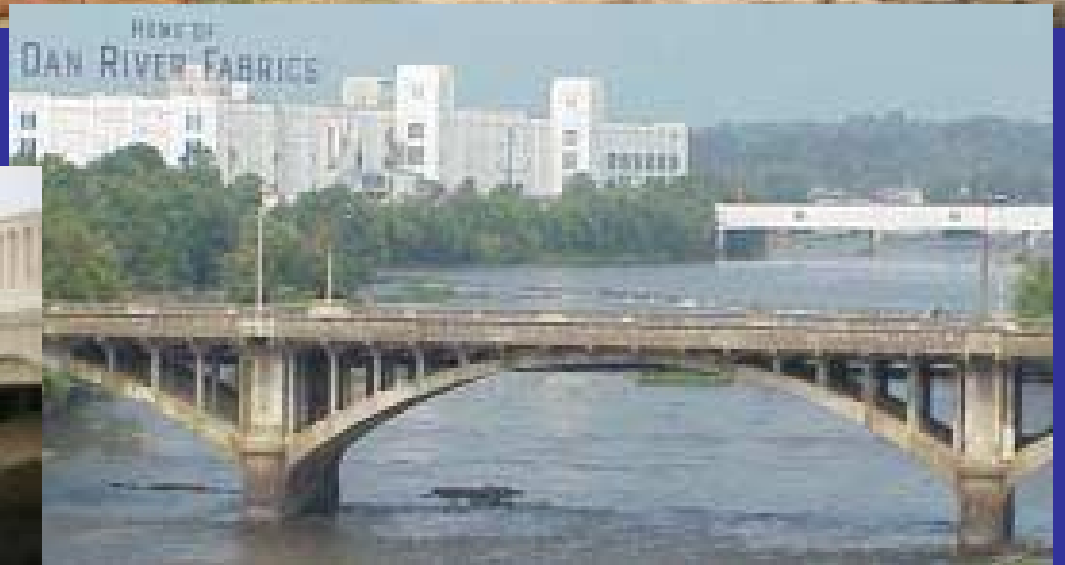
- Arch Shape



Aesthetics

-Elements in Contrast

- Spandrels



Aesthetics

-Elements in Contrast

- Concrete Color
 - Davis “Mesa Buff” Color No. 5447
 - Dosage Rate: 3/8# per Bag



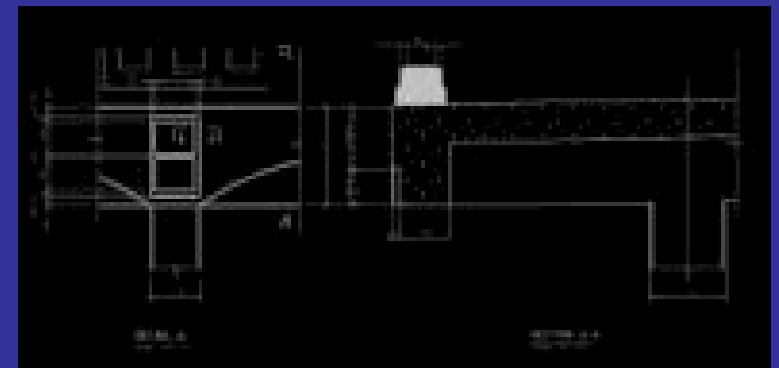
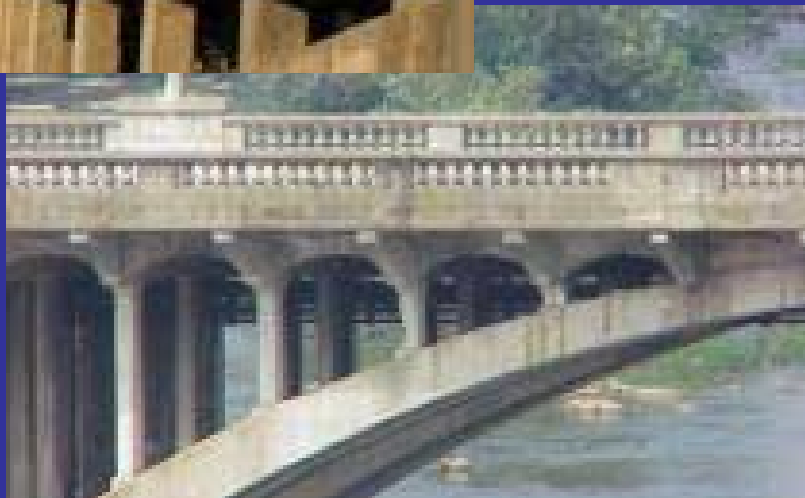
- Done in combination With Concrete Cleaning (No Chemicals, Limited Nozzle Velocity)



Aesthetics

-Elements in Contrast

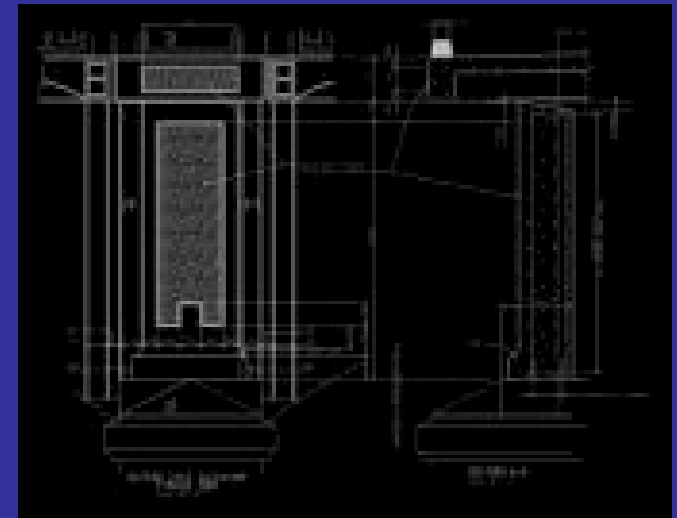
- Concrete Detailing
– Fascia



Aesthetics

-Elements in Contrast

- Concrete Detailing
 - Pier Faces





- Entire Project Opened to Traffic During Winter 2005/06

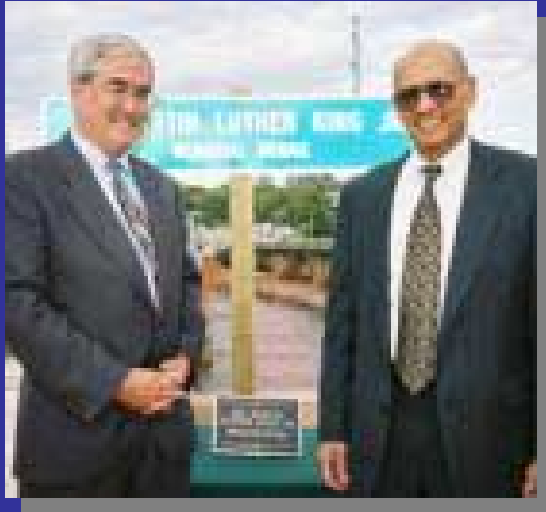
Project Status/ Conclusion



Acknowledgements

- June S. Baldwin, VDOT Overall Project Manager
- James M. Fariss, VDOT Bridge Project Manager
- S. Babu Nallamala, New Bridge Designer
- Karl Kratzer & Others from H. W. Lochner and JMA, Authors of the EA
- Claude Napier & Rudy Maruri, FHWA Bridge Engineers
- Les Daniel & Pettis Bond, Bridge Construction Engineers for VDOT
- A. L. Simpson & His VDOT/ Consultant Inspection Crew
- Jeff Beatty, Project Manager for GC Glade East
- Leonard Pharr, Superintendent for GC Glade East





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Questions & Answers

