

HISTORIC CONCRETE ARCH BRIDGE - REHABILITATION

Amanda H. Porath, PE
Northwest Design Group, Inc.



MACKINAC TRAIL OVER CARP RIVER

Mackinac County Road Commission

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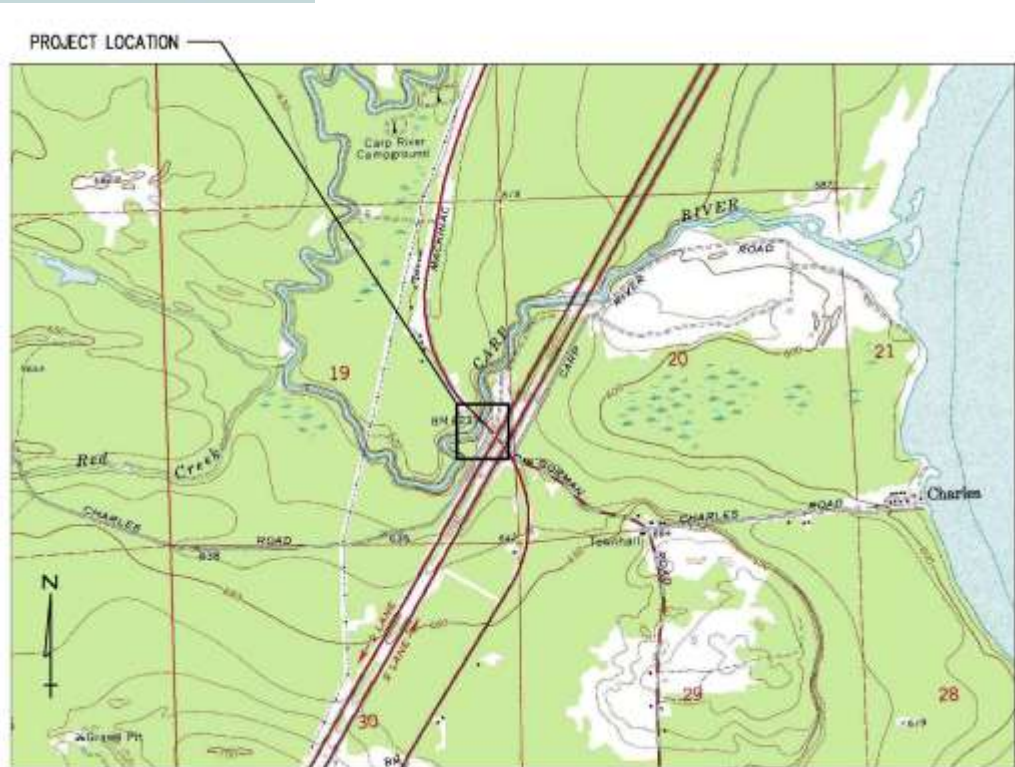
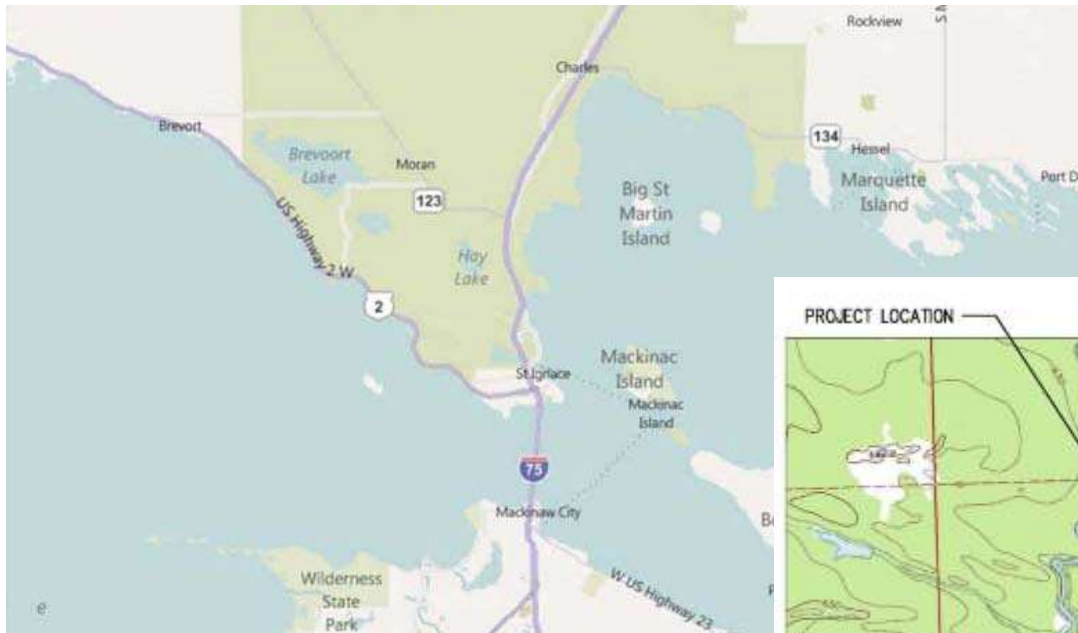
ARCH BRIDGE REHABILITATION

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- Owner's Needs
- Design Challenges
- Construction Solutions
- Rehabilitation

LOCATION

4



ORIGINAL CONDITION

5



REPLACEMENT BRIDGE CONSIDERED

6

- Concrete Box Beam Structure
- 100' Span
- Width to meet AASHTO and MCRC requirements
- \$1.4 Million Estimated Construction Cost
- Local Agency Bridge Program Funding
- Construction 2013+

OWNER'S NEEDS

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- General: Improve Condition of Crossing
- Widened Crossing
- Strength to Support Today's Design Loads
- Within Allocated Funding Amount
- Timely Construction

IDEA TO REHABILITATE

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- Width
 - ▣ Existing 22' clear roadway
 - ▣ MCRC required 26' clear
- Strength
 - ▣ Analyze for current design loads
- \$850,00 Estimated Construction Cost
- Construction 2011 due to Available Funding
- MCRC Quickly Decided to Rehabilitate

DESIGN CHALLENGES

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- Width
 - ▣ Arch is approximately 20' wide
- Environmental
 - ▣ MDNRE Permit Easier to Obtain with Rehabilitation
 - ▣ USFS Section 7 Review, Wild & Scenic River
 - NDG wrote review for Forest Service Approval to accelerate process
- Strength
 - ▣ Original Design approximately 1920
 - ▣ Finite Element Analysis Performed





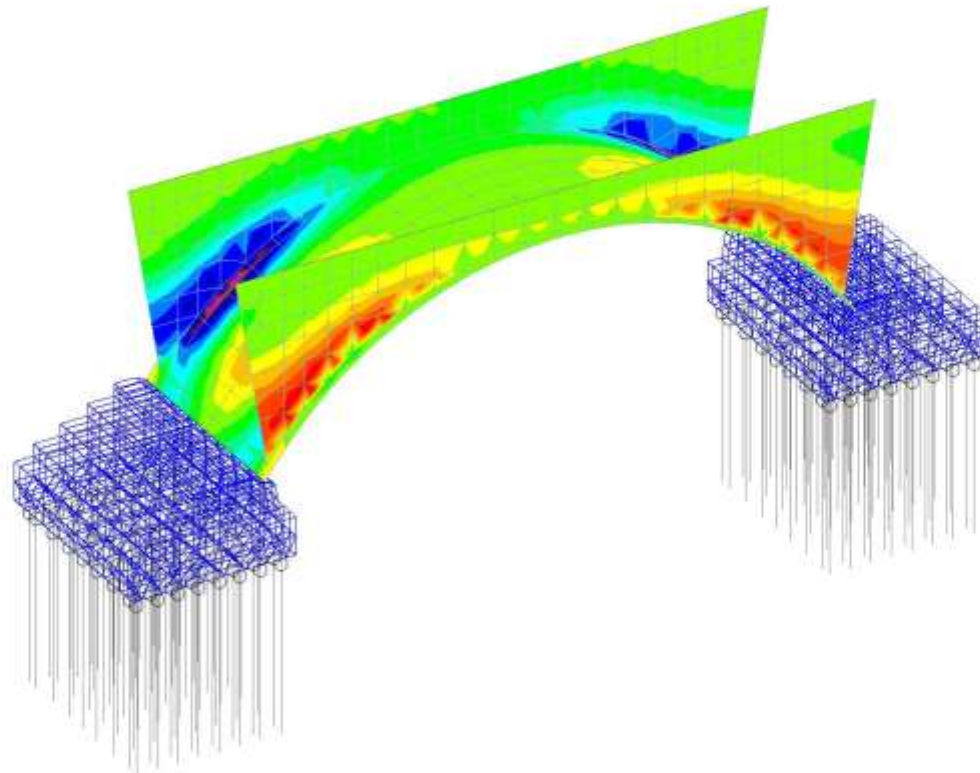
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Job No	Sheet No 1	Rev
Part		
Ref		
By	Date: 28-Sep-09	Chd
Client	File: Mackinac Trail Bridge ove	Date/Time: 23-Oct-2009 09:24

Job Title

Client

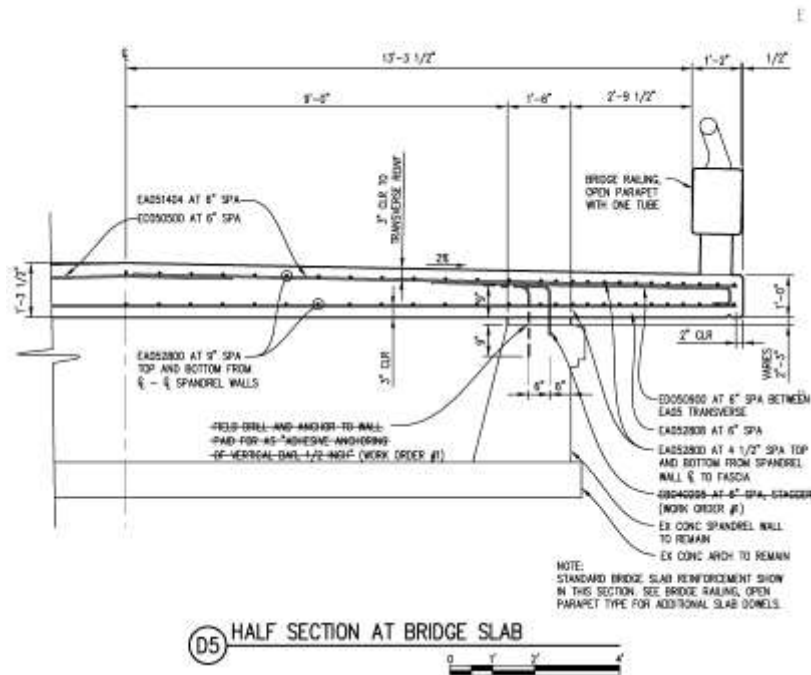
- MY (local)
lb-in/in
- <= -45.9 E3
 - 41.4 E3
 - 36.9 E3
 - 32.4 E3
 - 27.9 E3
 - 23.5 E3
 - 19 E3
 - 14.5 E3
 - 10 E3
 - 5552
 - 1073
 - 3407
 - 7686
 - 12.4 E3
 - 16.8 E3
 - 21.3 E3
 - >= 25.8 E3



CONSTRUCTION SOLUTIONS

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- Width
 - ▣ Approach Retaining Walls
 - ▣ Cantilevered Concrete Deck





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Retaining Wall Construction

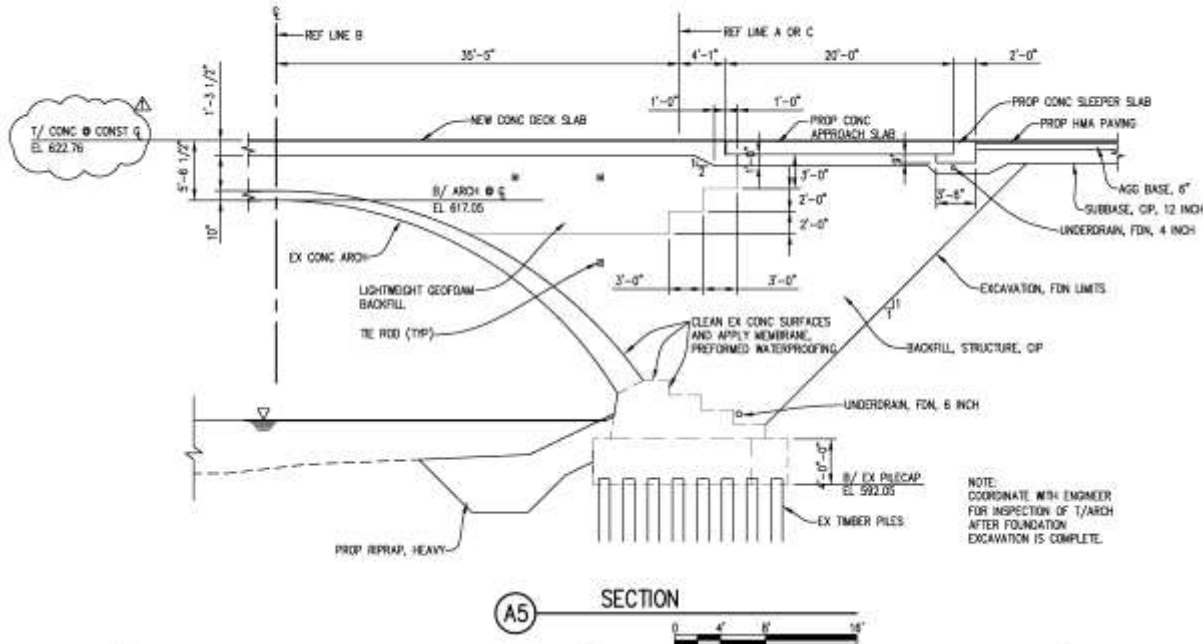
NDG

CONSTRUCTION SOLUTIONS

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Strength

- Tied Back Spandrel Walls
- Constructed Light Weight Fill over Arch





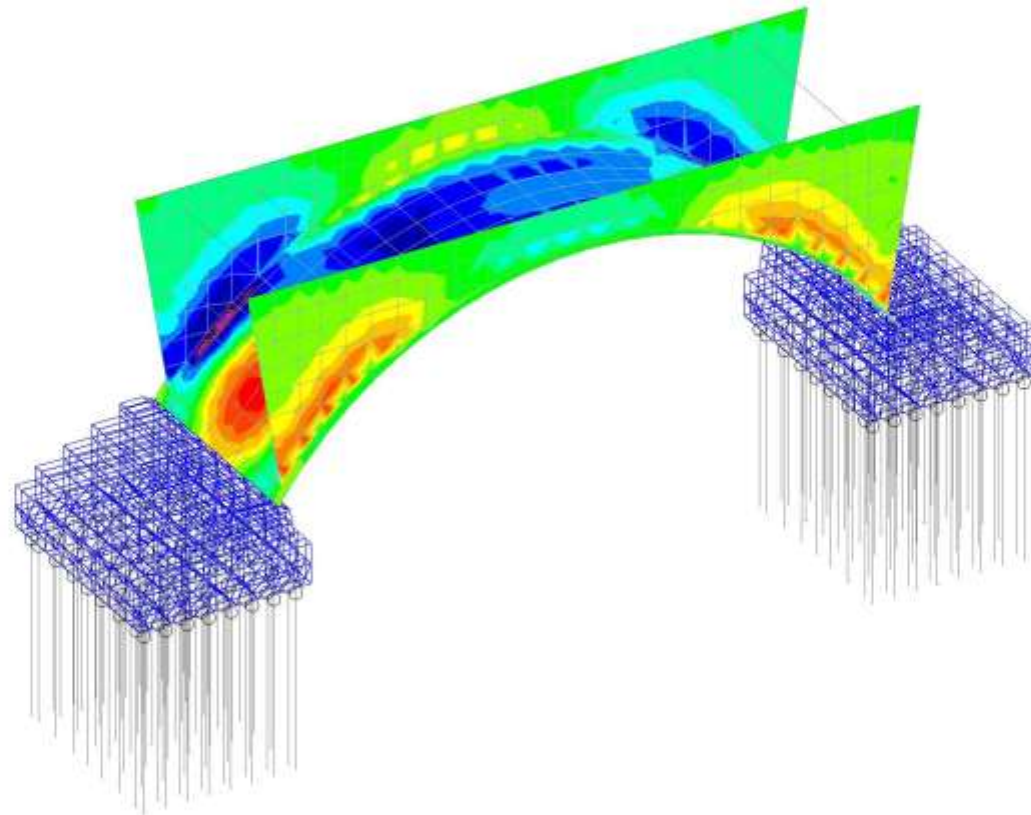
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Job No	Sheet No 1	Rev
Part		
Ref		
By	Date 21-Oct-09	Chd
Client	File Revised - Mackinac Trail I	Date/Time 23-Oct-2009 08:39

Job Title

Client

- MY (local)
lb-in/in
- <= -8207
 - 7334
 - 6462
 - 5589
 - 4716
 - 3843
 - 2971
 - 2098
 - 1225
 - 353
 - 520
 - 1393
 - 2265
 - 3138
 - 4011
 - 4884
 - >= 5756





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Light Weight (EPS) Fill & Tie Backs

NDG

REHABILITATION

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- Construction August - November 2010
 - ▣ Hand Chipping & Shotcrete
 - ▣ Foundation Excavation for Drains and Waterproofing
 - ▣ Retaining Walls
 - ▣ Bridge Slab
 - ▣ Railings
 - ▣ Paving
- Final Construction Cost Approximately \$850,000



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09/04/2010



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Salmon Fisherman



19

11/01/2010





21

11/18/2010



22

11/18/2010

23

THANK YOU

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