Hwy 101/61 Flood Mitigation
Past, Present, and Future

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Minnesota DOT
Area of Concern: SW Metro
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5 River Crossings over the Minnesota River between Belle Plaine and Bloomington

Only Hwy 25 & Hwy 169 are above the 100-yr flood elevation
SW Metro Flooding Snapshot

• 50,000+ vehicle per day detoured. 20,000 commuters.
• Regional and local impact.
• Significant economic impact.
• Emergency response time compromised.
TH101 & TH41
MnDOT Flood Impact Study
Project Background
Study Components

• Analysis of historical flooding
• Development and Evaluation of alternatives
• River modeling
• Agency involvement
  – USFWS
  – DNR
  – MPCA
  – USACE
  – Watershed Management Organization
Flooding History – TH41

TH 41 Crossing Historical River Elevations

10 Events exceed closure elevation
Spring 2011 Flood – TH41
Looking North Towards Chaska
Flooding History – TH101

10 Events exceed closure elevation
Spring 2011 Flood – TH101
Looking North Towards Chanhassen
Hydraulic Modeling Objectives

• Assess Water Surface Elevation for Existing Conditions
  – Existing Conditions Model - Approx. 35 miles
  – From Carver to confluence with Mississippi River
  – HEC-RAS 4.1.0

• Develop a Calibrated 2-D Model
  – Finite-Element Surface-Water Modeling System (FESWMS by Baird)

• Assess Impact of Design Alternatives
  – Reduce Road Closure Frequency & Duration
Hydraulic Models

• HEC-RAS (1D) vs. FESWMS (2D)
  – HEC-RAS
    • Basic model used to evaluate alternatives
    • Regulatory model - Calibrated by USACE
  – FESWMS
    • Detailed data set (river cross sections, USACE hydrographic survey, LiDAR data, and USDA/NRCS National Elevation Data)
    • More accurately evaluates velocities
  – D/S boundary condition: USGS Gage at Ft. Snelling
  – Flow values: USGS Gage near Jordan
Finite Element Grid Near TH101
2-D Model Calibration

- Hydrodynamic Modeling using FESWMS
  - Calibrated Using Field Data
    - March 28, 2011 Event
    - Approximate 30-yr Event
    - Compared Flooded Inundation Area from Model to Actual Flood Photos
    - Measured Flow, Water Surface Elevation, and Velocity
2011 Flood Event – TH101
Flow at Bridge 10012, TH41
Why Not Just Raise The Road

• Raising the road would cause impacts upstream as the flow is restricted due to a higher embankment

• Floodplain regulations do not allow fill in the floodway that will cause the river to rise

• Need “no-rise” solution
Design Alternatives

- **Filling to Raise Road Profile**
  - Modeling Showed Surcharge (Rise) in 100-Yr Floodway WSE
  - Culverts Could Not Mitigate Surcharge

- **Use of Upstream Storage**
  - Not Feasible Due to Flat River Profile

- **LOMR to Allow for Some Stage Increase**
  - Not Practical Due to Length of Upstream Impact (30+miles)

- **Land Bridge / Bridge**
Land Bridge Design

• Iterative Process which Involved Varying:
  – Road Elevation
  – Bridge Length
  – Pier Width
  – Pier Spacing
  – Bridge Deck Depth
TH41 Preferred Concept

Concept Subject to Change

Remove Existing Bridge 70041

Proposed Roadway/Bridge Low Elevation = 722.5'
Proposed Closure Elevation = 719.6'
Existing Closure Elevation = 714.6'

Fill

1350' Land Bridge

716.9'

EXCAVATION
Road Closure Frequency – TH41

TH 41 Crossing Historical River Elevations

- Proposed Closure Elevation (719.6')
- Current Closure Elevation (714.6')

Key Dates:
Road Closure Duration – TH41

TH 41 Crossing, Summer 1993

Proposed Closure Elevation (719.6')

Current Closure Elevation (714.6')

4 Days

11 Days
TH101 Preferred Concept

Concept Subject to Change

LEGEND
- Proposed Bridges
- Proposed Right of Way
- Proposed Shoulder, Paved
torridine Trails
- Existing Right of Way
- Construction Limits

100 yr - 726.7 feet
50 yr - 712.6 feet
10 yr - 712.0 feet

100 + 00  95 + 00  90 + 00
110 + 00  105 + 00  100 + 00
115 + 00  110 + 00  105 + 00
120 + 00  115 + 00  110 + 00
125 + 00  120 + 00  115 + 00
130 + 00  125 + 00  120 + 00
135 + 00  130 + 00  125 + 00
140 + 00  135 + 00  130 + 00
145 + 00  140 + 00  135 + 00
150 + 00  145 + 00  140 + 00
155 + 00  150 + 00  145 + 00
160 + 00  155 + 00  150 + 00
165 + 00  160 + 00  155 + 00
170 + 00  165 + 00  160 + 00
175 + 00  170 + 00  165 + 00
180 + 00  175 + 00  170 + 00

Proposed Roadway Bridge Low Elevation = 724.0'
Proposed Closure Elevation = 722.0'
Existing Closure Elevation = 709.4'

Bridge 70002

3000' Land Bridge

Remove Existing Bridge 10007

Excavation

Fill

Existing Ground
TH 101 Crossing Historical River Elevations

- Proposed Closure Elevation (722.0')
- Current Closure Elevation (709.4')

Dates of Closure:
- 1951
- 1952
- 1969
- 1993
- 1997
- 2001
- 2010
- 2011

Dates:
- 11/7/1932
- 7/17/1946
- 3/25/1960
- 12/2/1973
- 8/11/1987
- 4/19/2001
- 12/27/2014
Modeling Results

- TH 41 and TH 101
  - No increase in stage (No Rise)

- TH 41
  - Velocity decreased for 10-Year event
  - Increased for larger events, yet less than maximum velocity for existing conditions

- TH 101
  - Velocity decreased for all events
Evaluation Criteria

- Construction Cost
- Benefit Cost
- Property Impacts and Costs
- Constructability
- Environmental Impacts/Opportunities
- Community Input
Comparison and Selection of Alternatives

• TH41 Preferred Concept
  – $22.4 Million to Design & Construct
  – Benefit/Cost = 3.06

• TH101 Preferred Concept
  – $33.3 Million to Design & Construct
  – Benefit/Cost = 3.81

• TH101 Selected
  – Carries more traffic
  – Reduced closure frequency and duration
Project Partners:
Hwy 101/61 Aerial Photo

Picture courtesy of Tony Wotzka, MnDOT
Hwy 101/61 Aerial View of Flooding

Photo courtesy of SRF, Inc
Project Background

- Flood Mitigation Study Completed in 2011
- Applied for Flood Mitigation Bonds in February 2012.
- March 2012: Awarded $20,000,000 for 2 lane bridge.
- Counties Requested 2012 Legislature to fund 4-lane.
- January 2013: Cooperative Project started
Combined Project

- 4226’ 4 lane Bridge – offset from existing 101 roadway.
- 4-lane CR 61 (Flying Cloud Drive) with Roundabouts.
- Signalized Intersection at 101N.
Floodplain Bridge
Floodplain Bridge Visualization
Engineering & Environmental Challenges

• Soil/foundation stability.
  – Organics 15’-90’ deep.

• Contaminated Soils.

• Bluff Creek Realignment.

• Water Quality Treatment.

• Cultural Resources.
Soil/Foundation stability

- Extended bridge ~1200ft to the north
- Pile bent pier design - lateral stability
- Other soil stability measures
  - Pile supported embankment
  - Geofoam
  - Significant Muck removal and granular fill
Bluff Creek Realignment

- Extended bridge ~1200ft to the north
  - Remove box culverts under Hwy 101
- Meandering channel pattern
Water Quality Treatment

- Overall Environmental Benefit
  - Removing Hwy 101 causeway, reconnecting floodplain

- Significant Resource Agency involvement
Cultural Resources - Archaeology

Phase 1 & 2 Study Areas

Phase 3 Recovery Site
Cultural Resources - Archaeology

Pictures courtesy of Frank Florin
Other Challenges

• Funding

• Schedule
  – MnDOT has committed to building bridge in 2014.
  – Risk with combining bridge and ‘Y’ projects.

• Construction Phasing

• Roles and Responsibilities

→ Outlined in Construction Agreement
Project Update

• Project Awarded on May 20, 2014 to Ames Construction.
  – Winning Bid was $49.3M
  – Engineers Estimate was $50.4M

• Project Groundbreaking on June 24, 2014

Photo courtesy of Fox 9 News
Project Update

• PROJECT START DELAYED DUE TO FLOODING!
• Actual project start in Late July 2014
• Anticipated completion in November 2015

Twitter: @SWReconnectProj

Facebook:
https://www.facebook.com/SouthwestReconnectionProject

http://www.dot.state.mn.us/metro/projects/hwy101river/
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