The New I-35W Bridge
Context Sensitive Solutions

CSS National Dialogue Workshop
St. Paul, Minnesota
April 22, 2010

Linda Figg
President/CEO

Creating Bridges as Art®
The Partnership

Mn/DOT

FHWA

Flatiron • Manson, J.V. with FIGG

Extensive community involvement

November 2007

Selected as #1 bridge of 2008 by Roads & Bridges Magazine
Understand Contexts

Demonstrate a comprehensive understanding of contexts.
Project Challenges

- Sensitive emergency recovery, removal, investigative and clean-up operations
- Severe topography and limited right of way
- Roadway approaches did not meet capacity or design standards
- Presence of historic properties and districts
- Multiple Parkways, Trails and Scenic Byway in project area
- Large contaminated areas including a superfund site
- Six Railroads passing under bridge along with major utilities
- Citizen group and stakeholders' views of how design should be approached
- Presence of historic properties and districts
I-35W Context of the Site
Create A Vision

Strive towards a shared stakeholder vision to provide a basis for decisions.
Construction Schedule

2007

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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</thead>
<tbody>
<tr>
<td>10/15/07</td>
<td>Groundbreaking</td>
</tr>
<tr>
<td>October 24, 2007</td>
<td>Design Charette</td>
</tr>
<tr>
<td></td>
<td>Design/Site Preparation</td>
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<tr>
<td></td>
<td>Foundation Construction</td>
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<td></td>
<td>Pier Construction</td>
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<td></td>
<td>Segment Casting</td>
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<td></td>
<td>Superstructure Construction</td>
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<td></td>
<td>Segment Erection (Center Span)</td>
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<td></td>
<td>Finishing Work</td>
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2008

<table>
<thead>
<tr>
<th>Date</th>
<th>Event Description</th>
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<tbody>
<tr>
<td>September 18, 2008</td>
<td>Ribbon Cutting/Open To Traffic</td>
</tr>
</tbody>
</table>

PROPOSED
ACTUAL
Visual Quality Team

David Hall  Mn/DOT Bridge Office
Kevin Western  Mn/DOT Bridge Office
Amber Blanchard  Mn/DOT Bridge Office
Kristen Zschomler  Mn/DOT Cultural Resources Unit
Scott Bradley  Mn/DOT Landscape Architecture Unit
David Larson  Mn/DOT Landscape Architecture Unit
Steve Johnson  National Park Service
Paul Labovitz  National Park Service
Jack Yuzna  City of Minneapolis Public Works
Ann Calvert  City of Minneapolis Community Planning & Economic Development
Carol Ahlgren  City of Minneapolis Community Planning & Economic Development
Nick Eoloff  Minneapolis Parks & Recreation Board
Judd Rietkerk  Minneapolis Parks & Recreation Board
Irene Jones  Friends of the Mississippi River
Whitney Clark  Friends of the Mississippi River
Dennis Gimmestad  Minnesota State Historic Preservation Office
Britta Bloomberg  Minnesota State Historic Preservation Office
Romeo Garcia  Federal Highway Administration
## 17 Visual Quality Meetings

<table>
<thead>
<tr>
<th>Date</th>
<th>Event</th>
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<tbody>
<tr>
<td>October 10, 2007</td>
<td>Community Design Charette - determined items for selection</td>
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<tr>
<td>October 17, 2007</td>
<td>Community Design Charette (full day)</td>
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<tr>
<td>October 24, 2007</td>
<td>Design team presented details for review</td>
</tr>
<tr>
<td>November 1, 2007</td>
<td>Landscaping</td>
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<td>November 8, 2007</td>
<td>Lighting</td>
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<td>November 15, 2007</td>
<td>Signage</td>
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<td>November 29, 2007</td>
<td>2nd Street Overpass</td>
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<td>December 6, 2007</td>
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<td>December 20, 2007</td>
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<tr>
<td>January 10, 2008</td>
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<td>February 6, 2008</td>
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<td>February 21, 2008</td>
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<td>February 28, 2008</td>
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<tr>
<td>March 6, 2008</td>
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<td>March 20, 2008</td>
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<td>March 27, 2008</td>
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<td>April 25, 2008</td>
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<td>May 30, 2008</td>
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</tbody>
</table>
Participants Create Bridge Aesthetics
512 letters inviting people to attend
FIGG Bridge Design Charette™

October 24, 2007
7:30 AM – 5:00 PM

88 People
Residents, Businesses,
Cultural/Arts,
University of Minnesota,
Government Officials

Voted on Bridge Features
Arches • Water • Reflection

Project Theme
Stone Arch Bridge

Opened in 1883 - 50’ spans
Third Avenue Bridge
Opened in 1918
Concrete Arch Bridge
211’ spans
10th Avenue Bridge

Opened in 1929
Concrete Arch Bridge
266’ spans
The project centerpiece, water, is framed as a point of interest in this National Park.
Simple Elegance

Centerpiece is the River
Bridge Reflects Series of Modern Arch Forms

Elegant Simplicity
Four-span bridge approximately 1,214’ Long
Bridge Description

Two parallel bridges, each with two box girders

Striped for 5 lanes each direction (10 total) with 13’ and 14’ shoulders
Bridge Description

Future configuration of 4 lanes each direction plus light rail line or bus transit lane
A Sculptural Bridge: Arches • Water • Reflections

CURVED PIER OPTION A

CURVED PIER OPTION B
Visualizations

Examine Bridge in context with the site
Visualizations

Helps Community understand scale and features of the structure
Community Chose

Option A
Native Stone
Community Chose Native Kasota Stone
Native Kasota Stone  Vetterstone
Option 1

Fully Open Rail

Driver's perspective southbound towards city center
Option 1 - Fully Open Rail

View from Driver’s Eye Level
(Approx. 4’-6” above roadway surface)
View from north shore near St. Anthony Falls

Blue Lighting on Bridge
Aesthetic Lighting

LED’s
Bridge Color

White - Modern or
Sandstone - Color from local rock

View from north shore near St. Anthony Falls
Community Chose Color “Snowbound”
Achieve Consensus

Foster continuing communication and collaboration to achieve consensus.
Construction
Minnesota Workers Built This Bridge

The bridge design relied heavily on Minnesota workers and resources

Equivalent of 400 full-time employees (vast majority local)

Local subcontractors, local materials

Union employees from the building trades
A Strategy for Safety and Speed

2-3 shifts day and night, including all holidays except Christmas Day

Zero lost time incidents
Form for the footing at Pier 3 north side of River

January 8, 2008
Pouring footing at Pier 3 on the north side

January 14-15, 2008
1330 cu. yds.
2 pumps - 13 hours
Segmental box girder casting yard

Bohemian Flats storage area

Main span cantilever construction

Cast-in-place spans over land
“Construction As A Spectator Sport”

NY Times June 8, 2008
Pier 2 forms (foreground) and Pier 3 (across the river)  
February 4, 2008
Cast-In-Place spans 1 and 3
Casting yard on south approach roadway

January 27, 2008
Elevation of Long-Line Precasting System
Precast Segments

Weighed up to 200 tons each
45’ wide
Up to 25’ tall - Up to 16’ long
Long Line Precasting

Warming house maintains constant temperature for curing
Casting yard on south approach roadway

1st Segment Cast January 30, 2008
Last Segment Cast June 6, 2008
Long Line Precasting

Lift segment using straddle carrier
Erect Cantilevered Main-Span
Three dimensional integrated drawings
Main Span Pier Segment - 25’ deep
The Art of Segmental Design

Approximately one million pounds of force were applied to each tendon, pulling the box girder segments together.
Erect Cantilevered Main-Span
Precast Segment Erection

Up to 4 segments/day
Bridging the Mississippi
J uly 8, 2008
504’ Main Span

120 segments placed in 47 days

NTP to close of main span was 9 months
## Schedule
(Days from NTP - October 15)

<table>
<thead>
<tr>
<th>Task</th>
<th>Day</th>
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</thead>
<tbody>
<tr>
<td>First Drilled Shafts</td>
<td>50</td>
</tr>
<tr>
<td>Footings</td>
<td>92</td>
</tr>
<tr>
<td>Piers</td>
<td>100</td>
</tr>
<tr>
<td>Precasting</td>
<td>107</td>
</tr>
<tr>
<td>CIP Span</td>
<td>170</td>
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<tr>
<td>Precast Erection</td>
<td>223</td>
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<tr>
<td>Erection Completed</td>
<td>269</td>
</tr>
<tr>
<td>Opening (Sept. 18)</td>
<td>339</td>
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</tbody>
</table>

Completed in 11 months
Sidewalk Superintendent Talks Every Saturday

Project Manager Peter Sanderson, and Representatives from Mn/DOT, FIGG gave tours
Sidewalk Superintendent Talks
Every Saturday

Jon Chiglo, Project Manager
Mn/DOT gave tours to the community
Sidewalk Superintendent Talks Every Saturday
Sidewalk Superintendent Talks Every Saturday

Peak attendance occurred Saturday, July 5, 2008, when more than 800 people watched the final north bound segments being placed.
Community Information

4 Signs mounted on 10th Avenue Bridge for self-guided tours
Community Information

Signs were updated as the project progressed
Exercise flexibility and creativity to shape effective transportation solutions, while preserving and enhancing community and natural environments.
Sustainable Design
Sustainable Design

High quality materials built to last

Sand  Water

Cement  Gravel
High Performance Concrete

Design strengths up to 6,500 psi
(10,000 achieved)

Fly ash (waste product from coal) replaces some cement for lower permeability

Saved 3.5 tons of CO2 per truckload
Eco-Friendly Concrete

A new self-cleaning and pollution-eating cement was used to create two 30-foot-tall gateway sculptures.

Inspired by the ancient symbol for water, the gateway design consists of three rippling forms that recall the river and the flow of life.
Local Manufacture
Local materials
Local labor
Recycled Materials

Existing roadway concrete crushed into aggregate
Landscape Elements

Kentucky Coffeetree planted around the bridge site
Observation platforms on both sides of the river create new places for the public to enjoy views of the Mississippi River.
Landscape Elements

Observation platforms connect to pedestrian pathways and bike trails along the Mississippi
Landscape Elements

Rip rap along trail blends with river environment
Energy Efficient Low Maintenance Lights

The bridge pioneered the first use of LED’s on major highway in U.S.
Provisions for the addition of a future pedestrian bridge, that can link both sides of the river, were made during design.
Integrated Bridge Sensor Monitoring System covering five areas:

- Support construction processes
- Control of the automated anti-icing system
- Intelligent Transportation System (ITS)
- Bridge security
- Record of structural behavior (Structure monitoring)

Mn/DOT, FHWA, University of Minnesota Partnership

Smart Bridge Technology 323 Sensors
Public Involvement

Design Charette to Select Bridge Aesthetics

Open Houses

Stakeholder Presentations

Sidewalk Talks

Website, Kiosks and Visuals

Student Education Program
Kiosk

Two touch-screen kiosks provided a new way to get information. In addition to bridge facts, photos, and other interactive features, the kiosks included animations of what the finished bridge will look like from a helicopter, a boat, and a car.

Locations included:

IDS Center
Mill City Museum
Minneapolis Airport
Shosten Training Center
MnDOT Booth at Minnesota State Fair
Kiosk

Open house at IDS Center on January 29, 2008
CASTING THE FUTURE
Sponsored by

MINNESOTA DEPARTMENT OF TRANSPORTATION

FLATIRON • MANSON

FIGG

FHWA

CEMSTONE

AMERICAN ENGINEERING TESTING, INC.

BULACH CUSTOM ROCK

UNIVERSITY OF MINNESOTA

NORTH CENTRAL STATES REGIONAL COUNCIL OF CARPENTERS
2nd Street Aesthetics

Walls: Recycled Glass - Blue, Yellow & Green
Casting the Future

Each day 60 students attended a 4-hour course and site tour.
I-35W St. Anthony Falls Bridge
BRAIN TEASER #1

Name ___________________________ School ___________________________

Below are 10 questions about the new I-35W Bridge. Take a few minutes and circle your answers before the presentation starts. If you’re not sure about the answer, just make your best guess. The answers will be given during the presentation today so you can check your answers. Don’t worry, this isn’t for a grade!

1. One of the bridge’s footings for the main piers (109 feet long x 34 feet wide x 13 feet tall) can fit inside this room.
   a) True   b) False

2. Tarvaris Jackson, the quarterback of the Minnesota Vikings, would have to throw the football how far to make it across the width (transversely) of the bridge including all 10 lanes of traffic and shoulders as shown in the diagram?
   (Hint: 1 yard = 3 feet)
   a) 20 yards   b) 40 yards   c) 55 yards   d) 65 yards

3. What is the definition of a “span”?
   a) Total length of bridge
   b) Distance across bridge
   c) Distance between piers
   d) Height of Piers

4. How far would Tiger Woods have to hit a golf ball to go the length (longitudinal) of the bridge?
   (Hint: he has not hit it this far yet!)
   a) 330’   b) 504’   c) 242’   d) 147’
Question 10:

How strong is the concrete used for the bridge superstructure? (psi = pounds per square inch of strength)

(a.) 6.5 psi
(b.) 65 psi
(c.) 650 psi
(d.) 6,500 psi
(d.) 6,500 psi!
The concrete in the bridge superstructure is strong enough for one square inch to hold 6,500 pounds. That means you could balance 3 elephants on top of a piece of concrete the size of a soda can and it wouldn’t break!
Building a Landmark Bridge Construction Team

400 full time local workers are building the new bridge
Casting the Future

1,800 students created a glass mosaic concrete tile
Students filled molds with concrete and recycled glass aggregate.
Casting the Future

Cleaning the tiles reveals the shiny glass mosaic.
Casting the Future

Students proudly display their works of art made of concrete and recycled glass.
“Last, I want to thank you for making Minnesota such a beautiful new bridge! I can’t wait until I get to show my family the tile I made! This was a once-in-a-lifetime chance.

“Tell all of the workers that they are doing a wonderful job and I can’t wait to see what the bridge looks like... I am so glad that our class was lucky enough to get to work on the bridge. I also feel so happy that I got to help my city.”

“The tour was also really cool. I loved watching the construction happen right before my eyes. How incredible!”

“It was the best thing I had ever done.”
Teachers were given a Bridge Basics Kit, created by FIGG and the National Building Museum.