Lake Champlain Bridge Project

Public Meeting
On New Bridge Design Concepts
and Commemorating the Old Bridge

January 4, 2010
Public Meeting Agenda

1. Welcome
2. What is the purpose of this meeting?
3. Summary of project status
4. New bridge criteria and concepts
5. Ways to commemorate the historic bridge
6. Your input
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Public Meeting Purpose

1. To share information about bridge features and design criteria and to illustrate and explain **six** bridge concepts that would work for the Lake Champlain crossing.

2. To share some ideas about commemoration of the old bridge for future generations.

3. To get **YOUR** input about both of these actions.
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Why do this so quickly and in December & January?

• Normally public meetings are never held during late December or early January, but this project is a “horse of a different color”
• Getting a new bridge built and open-to-traffic is a top priority of both states
• The design team cannot begin bridge design until a concept is decided upon
• Both states desire, and the approval process requires, that the public be consulted
Project Status Changes

Before October 16:

- Project scoping process
- Multiple alternatives
- Environmental Impact Statement
- Five+ year process to completion

.........but the bridge had other ideas....
Project Status Changes

After completion of engineering assessment and significant public input:

- Bridge cannot be repaired or rehabilitated
- Local input has been clear that only a bridge in the same location can meet local needs
- Only one alternative remains:
  - Demolish existing bridge, and
  - Replace with new bridge on existing alignment
Project status changes

• National Environmental Policy Act (NEPA) is a requirement
• 3 options of increasing complexity
  – Categorical Exclusion (CE)
  – Environmental Assessment (EA)
  – Environmental Impact Statement (EIS)
• Original project was to be an EIS
• Project is now a Documented CE (DCE)
• DCE process considerably shorter and less complex
Project Status Changes

• All processes will be accelerated as quickly as possible
  – Section 106 consultation
  – Other regulatory compliance
  – Permitting

• Agencies that need to be consulted have been alerted to the urgency of this project

• Agencies have pledged speedy response

• Goal is to open the new bridge to traffic by summer of 2011
Four separate concurrent processes

1. Construction of new ferry facilities
2. Demolition of existing bridge
3. New bridge design/construction
4. Commemoration of the old bridge

………this meeting is about the new bridge and commemoration of the old bridge
New Ferry Facility Construction (NY)

Roadway paving complete

Piles to support docks being installed
New Ferry Facility Construction (VT)

Piles to support docks being installed

Bracing added to create pier that will support dock
Removal
What we would like from you today

Please:

- **Listen to** our presentation
- **Read** our handout and survey form
- **Complete** the survey form and return to us today
Following public input

• New bridge
  – Decision by NY and VT on bridge concept
  – Detailed design begins immediately

• Commemorating the old bridge
  – Consultation on ways to commemorate the old bridge (to mitigate the impact of losing this historic resource)
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Designer Charles M. Spofford

- Co-Founder Fay, Spofford and Thorndike
  - “significantly influenced future continuous truss highway bridge design in the areas of technology, aesthetics, and construction methods.”¹
- Author - *Theory of Continuous Structures and Arches* (1937)
- Early Pioneer of Continuous Truss Design

Bridge Design Innovations

• Early Example of Continuous Truss
  – 1st Long Span Continuous Bridge for Highway Traffic

• Unique & Iconic Form
  – “The layout of the Lake Champlain Bridge is most ingenious.”\(^1\)
  – “A significant advancement in the technology and aesthetics of continuous highway bridge design …It was a highly innovative and aesthetic design…”\(^2\)

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\(^1\)Abbett, Robert W., “Discussion of Lake Champlain Bridge”, *Transactions of the American Society of Civil Engineers*, 1933, p. 654.

Unusual Aspects of the LCB

• Unreinforced concrete piers
  – Slender proportions
• No protection against ice abrasion
• Iron-ore tailings used in concrete
• Caisson concreting without tremie
  – Patented drop-bottom bucket
Why Bridge Replacement?

• Pier Deterioration
  – Pier freeze / thaw damage
  – Strength degradation
  – Pier cracking below waterline
  – Rapid increase in last 4 years
Why Bridge Replacement?

• Ice / Wind / Thermal Loading
  – Ice Thrust
• Restrained Thermal Movement
  – Frozen Bearings
**Design Requirements**

- **The Replacement Bridge:**
  - Meet Modern Design Codes
  - Ensure Load Redundancy
    - Avoid Progressive Collapse
    - Reduced Maintenance & Inspection
  - Enhanced Service Life
    - All Key Elements Replaceable
  - Be **SAFER** than the original
Design Requirements

• To meet or exceed the existing structure functionality
  – 2 vehicle lanes, 12’-0” lane width
  – 2 wider shoulders
  – Aesthetically pleasing structure

• Meet current loading and clearance requirements
  – Over 17’-0” vertical vehicular clearance
  – 75’-0” vertical navigational clearance
    • Exceeds Rouse’s Point vertical clearance

• Minimum 75-year service life
Additional Bridge Considerations

- **Community Input:**
  - Bicycle and Pedestrian Facilities
    - Sidewalks
    - Observation Area
  - Feature Lighting
  - Bridge Aesthetics
    - Form & Scale
    - Important Viewsheds
    - Character
Shoulder & Sidewalk Transition
Conceptual Bridge Types

- Steel Girder
- Segmental Box
- Steel Cable Stayed
- Extradosed
- Network Arch
- Modified Network Arch
**Conceptual Bridge Types - Dismissed**

**Conventional Truss**
- Majority of main members fracture critical
- High life cycle costs – Inspection & Maintenance
- Vulnerable to progressive collapse

**Lattice Truss**
- See also Conventional Truss
- True arch configuration – Large lateral loads in poor soil
- Difficult to Construct

**Concrete Arch**
- Large lateral loads in poor soil at anchorage
- Long construction schedule
- Complex construction that requires significant temporary works

**Fin Back**
- Similar to cable-stayed bridge, no distinct advantages
- Requires center tower configuration and segmental box construction
- Significant structure depth steep approach angles
- Additional width inefficient, median barrier not required
- Very high initial cost

**Suspension**
- Inefficient for short spans – high cost of cable erection and anchorage construction
- Large lateral loads in poor soil at anchorages
- Long construction schedule
- High risk for schedule delays
- Very high initial cost
## Conceptual Bridge Type – Steel Girder

<table>
<thead>
<tr>
<th>Pros</th>
<th>Cons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest initial cost</td>
<td>Less visually pleasing</td>
</tr>
<tr>
<td>Shortest construction time, familiarity</td>
<td>Difficult to make 75' vertical clearance</td>
</tr>
<tr>
<td>High degree of redundancy</td>
<td>Deep structure depth</td>
</tr>
<tr>
<td>Min. cold weather construction impact</td>
<td></td>
</tr>
<tr>
<td>Replaceable deck</td>
<td></td>
</tr>
<tr>
<td>Lighter structure, smaller foundations</td>
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Conceptual Bridge Type – Steel Girder
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Conceptual Bridge Type – Steel Girder

- Steel plate or steel box girder with concrete deck
### Conceptual Bridge Type – Concrete Segmental

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<tr>
<th><strong>Pros</strong></th>
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<tr>
<td>High quality precast segmental construction</td>
<td>Heaviest structure, largest foundations</td>
</tr>
<tr>
<td></td>
<td>Cold weather schedule impacts to construction</td>
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<tr>
<td></td>
<td>Non-replaceable deck</td>
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<tr>
<td></td>
<td>Maintenance costs (overlays)</td>
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- Cast-in-place or precast concrete box girder
Conceptual Bridge Type – Cable-Stayed

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<tr>
<td>Visually pleasing</td>
<td>High initial cost</td>
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<tr>
<td>Light weight superstructure</td>
<td>Maintenance costs (overlays)</td>
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<tr>
<td>Efficient use of materials</td>
<td>Non-replaceable deck</td>
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<tr>
<td></td>
<td>Less efficient for spans under 600’</td>
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Conceptual Bridge Type – Cable-Stayed

PROPOSED ELEVATION - STEEL COMPOSITE CABLE STAYED

TOP OF DECK
MUD LINE
ROCK LINE

W:W = 99.8
Conceptual Bridge Type – Cable-Stayed
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Conceptual Bridge Type – Cable-Stayed

- One or more towers with cables supporting the bridge deck
## Conceptual Bridge Type – Concrete Extradosed

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<td>Less efficient for spans under 600’</td>
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<td>Longest construction time</td>
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Conceptual Bridge Type – Concrete Extradosed

PROPOSED ELEVATION - CONCRETE EXTRADOSED

TOP OF DECK

MUD LINE

ROCK LINE

WHW = 99.8
Conceptual Bridge Type – Concrete Extradosed
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- One or more towers with cables supporting the bridge deck
## Conceptual Bridge Type – Network Tied Arch

![Bridge Image]

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<td>Complex arch fabrication</td>
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<td>Efficient use of steel</td>
<td></td>
</tr>
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<td>Float in construction for arch</td>
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Conceptual Bridge Type – Network Tied Arch

PROPOSED ELEVATION - NETWORK TIED ARCH
Conceptual Bridge Type – Network Tied Arch
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Conceptual Bridge Type – Network Tied Arch

• Tied arch with inclined hangers
## Conceptual Bridge Type – Modified Network Tied Arch

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Conceptual Bridge Type – Modified Network Tied Arch
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Fremont Bridge Erection
Conceptual Bridge Type – Innovation

• **Cable Stayed / Extradosed**
  – Balanced cantilever construction
  – Highly efficient use of steel
  – Enhanced design redundancy

• **Network Tied Arch**
  – Innovative structural form
    • Efficient use of steel
  – Modern version of the truss
  – All cables are replaceable
  – Enhanced design redundancy
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Commemorating the bridge for future generations

- Historic American Engineering Record documentation
- Permanent local museum display? (where?)
- Oral and written memories by residents
- Documentary on the bridge?
- Interpretive roadside display near Crown Point or Chimney Point historic sites?
- Development of “popular history” document to be distributed to local schools and libraries?
- Development of permanent historic website?
- Salvage and display pieces of the bridge?
- Other ideas???
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Survey says…….

Lake Champlain Bridge Concept Survey Results

- Steel Girder
- Segmental Concrete
- Cable Stayed
- Concrete Extradosed
- Network Tied Arch
- Modified Network Tied Arch

Percent of Responses

Data collected between 12/12/2009, 9:30 AM and 12/15/2009, 12:00 PM.
Your turn

• Question/comments
• Please return the survey form from your handout