Chicago Lakefront Trail at Navy Pier and Chicago River

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AGENDA

- Phase I – Segment I & II (North of the Chicago River)
- Peer Review of Phase II – Segment I & II
- Conceptual – Segment III (Over Chicago River)
- Phase I – Segment III
- Phase II – Segment III
- Phase III – Segment III Construction Status
PROJECT LOCATION
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EXISTING CONDITIONS – AT NORTH END OF PROJECT AT JANE ADDAMS PARK
EXISTING CONDITIONS – AT GRAND AVE
EXISTING CONDITIONS – AT LOWER-LEVEL LSD
EXISTING CONDITIONS – AT LOWER-LEVEL LSD
EXISTING CONDITIONS – AT DUSABLE PARK
PROPOSED SOLUTION

CREATE SEPARATION BETWEEN PEDESTRIANS AND VEHICLES

ELIMINATE SHARED CROSSING POINTS

IMPROVE ACCESS TO NAVY PIER FACILITIES

REDUCE PEDESTRIANS CONGESTION AT JANE ADDAMS PARK

IMPROVE RIDING SURFACES, SIGNAGE AND PAVEMENT MARKINGS

DEVELOP ACCESSIBLE PARK

Source: CDOT Presentation
PROJECT AERIAL & ALIGNMENT
PROJECT RENDERING
Phase I Concepts
Phase I Concepts
Phase I Concepts
PROJECT DEVELOPMENT REPORT COVER

Computer Rendering of Flyover near Ohio St. Underpass
PHASE II ARCHITECTURAL CONCEPTS

CONCEPTION OF THE FORM – HOW, WHAT, WHY?
PHASE II FINAL SECTIONS

THE PIPE DOES IT ALL
Completed Segment 1
Completed Segment 1
Completed Segment 1
Completed Segment 1
LSD BRIDGE OVER THE CHICAGO RIVER
Existing Bridge and Its History

Original Construction

• Construction started in 1929 and finished in **1937**
• It was the longest bascule when constructed: **264-feet**
• It was the widest bascule when constructed: **108-feet**

East elevation of the Lake Shore Drive Bascule Bridge

CDOT BRIDGING THE DRIVE COMPETITION
The Need to Widen the Trail at the Bridge
Concept & Preliminary Design

Concept
How can the new widened hinged sidewalk improve on the proven 1980s solution?

Phase I Study
Can the end be supported or seated on the main bascule leaf?
Can it be fully or partially balanced?

Preliminary Design
Iterative design solutions
Introduction of locking mechanisms
EXISTING CONDITIONS – AT N. APPROACH
LSD BRIDGE
EXISTING CONDITIONS – AT N. APPROACH
LSD BRIDGE
EXISTING CONDITIONS – AT N. TOWER- LSD
EXISTING CONDITIONS – AT N. TOWER LOOKING NORTH – LSD BRIDGE
EXISTING CONDITIONS – AT N. TOWER LOOKING NORTH – LSD BRIDGE

Existing opening was ~8-ft at bridge houses
Additional >8' opening added in bridge houses

The Need to Widen the Trail at the Bridge More Work than a Trail Widening
EXISTING CONDITIONS – AT S. APPROACH
LSD BRIDGE
EXISTING CONDITIONS – AT S. APPROACH
LSD BRIDGE
EXISTING CONDITIONS – INSIDE S. TOWER OF LSD BRIDGE
Innovating on a Validated Solution
Existing Bridge and Its History

1980s Modification

- Cantilevered W12 support framing
- HSS 10x10 with 3” diameter pin into a pillow block bearing (each side)

1980s hinged sidewalk, closed position

1980s hinged sidewalk, fully-open position, ~75deg
Concept Design

Phase I Study

- Type, Size and Location
  Plans were approved in October 2013
- Phase I study completed in April 2014
- Concept for hinged sidewalk similar to existing with addition, but with the addition of counterweight at outer two girders
**Concept Design**

**Phase I Study**

A widened sidewalk (trail) will now clash with bridge house.

This section was added to moving piece.

1980s hinged sidewalk, fully open at NE Bridge House

Closer view of 1980s hinged sidewalk, fully open at NE Bridge House
Concept Design
Phase I Study

Railing would hit house at full open

Moving hinged sidewalk allows for navigation clearance to remain
Preliminary Design
Slider Crank Mechanism

Modifications:
1. Double Link Arm
2. Slider Rail
3. Link Arm Post Location
4. Truss Connection Point

(Image Source: https://ocw.metu.edu.tr/pluginfile.php/6885/mod_resource/content/1/ch7/7-2.htm)
Preliminary Design
Too Fast, Too Furious?

Bridge Operation: Solved

New Concerns:
- Maintenance
- Slider Rail Anchorage
- Performance
- Constructability

Decision Time:
- Add Linear Span Lock

Angle = 73.50°
Final Design
Tackling Eccentric Lift

Plan View of Hinged Sidewalk

SAP2000 Analytical Model (Fully Open Position)
Final Design
3D Modeling and Analysis

- At Truss (Pin Support)
- Center Lock (Gap Spring)
- Anchor Bracket Support (Gap Spring)
- Trunnion Shaft (Pin Supports)
Final Design
Details of the Final Solution

Final hinged sidewalk design detailing

Link Arm Post

Diaphragm Connection
Final Design
Details of the Final Solution

Bolted end-plate moment connection

Hinged Sidewalk Girder 2 with end plate moment connection (October 2020)
Final Design
Details of the Final Solution

Linkage limited to 7,000 lbs in operation

Locking mechanism goes above diaphragm
Building the New Bascule Structures for the Trail - Fabrication

- Steel fabrication was completed by Hillsdale Fabricators, in St. Louis, Missouri
  - 3D BIM software was used the new hinged sidewalk pieces
- Machined parts were completed by Lemke Industrial Machine, in Marathon, Wisconsin

Image from steel fabrication 3D model
Source: Hillsdale Fabricators
Building the New Bascule Structures for the Trail
Building the New Bascule Structures for the Trail - *Erection*

- Erection took place in September 2020 for the SE Hinged Sidewalk and October 2020 for the NE Hinged Sidewalk

SE Hinged Sidewalk (Girders 1 & 2) being erected

Source: TY Lin Intl.
Building the New Bascule Structures for the Trail

Erection took place in September 2020 for the SE Hinged Sidewalk and October 2020 for the NE Hinged Sidewalk.

SE Hinged Sidewalk (Girders 1 & 2) being erected

Source: TY Lin Intl.
Fire along Chicago River temporarily closes Lake Shore Drive Monday afternoon – October 7, 2019
Concluding Remarks
Lessons Learned

<table>
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<tr>
<th>WHY WAS PROJECT NEEDED?</th>
<th>WHAT LESSONS WERE LEARNED FROM THE PAST?</th>
<th>HOW WERE NEW TECHNOLOGIES USED?</th>
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<tr>
<td>• Trail safety and flow</td>
<td>• Look for simple solution</td>
<td>• Computer modeling with large displacement capabilities</td>
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<tr>
<td>• More economical than separate bridge, maintains historic entry to the City</td>
<td>• Include adjustments in the design</td>
<td>• 3D analysis is warranted on complex projects</td>
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Acknowledgements
Concluding Remarks
Acknowledgements

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