Portage Lake Bridge

ASCE Historic Civil Engineering Landmark

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Outline

• The ASCE Historic Civil Engineering Landmark
• History of the Portage Lake crossing
• History of the current bridge
  • Critical people
• Unique features
  o Civil engineering perspective
  o Social and economic perspective
• Conclusions
Goals

- Get the lift bridge on the ASCE National Historic Civil Engineering Landmark list - **SUCCESS**
  - Through the process of contacting ASCE MI, they requested the bridge be submitted for the *State* Historic Landmark award - **SUCCESS**
  - Historic Landmark Award process required a package with information on:
    - Historic significance
    - Unique features and comparable projects
    - Contribution to the civil engineering profession
    - Contribution to the nation or large region
    - Supplementary documents
History of the region

• The nation’s first mining boom
  o Copper in the mid-1840s

• Rapid Growth
  o 1848 – Keweenaw produced 1 million lbs. (92% of all U.S. copper production)

• Keweenaw led production in US, peaking in late-1800s

• The early 1900s saw many ups and downs in production
  o Still leader in quality of ore

• Mined into 1970s
History of the Portage Lake crossing

• Early crossings:
  o Ferry service – 1850
  o Floating Bridge – 1873
  o Wooden swing bridge
    ▪ Single deck, carried animal carts and pedestrians – 1875
    ▪ Adapted to double deck for rail – 1892

• Steel swing bridge
  o Steel bridge with wooden swing span – 1895
  o Wooden swing replaced with steel – 1898
Portage Lake crossing – Steel Swing Bridge

• Accommodated 4 modes of transportation
  o Why replace?
• Structurally deficient
  o Failing foundation
  o Rotting members
  o Falling concrete
• Geometrically deficient
  o Narrow lanes
  o Opened for all boats
  o Narrow openings – 107 and 118 ft
• Increases in all modes of traffic
When did the current Portage Lake (lift) Bridge open to traffic?

a. 1925  
b. 1940  
c. 1959  
d. 1972
History of the Portage Lake Bridge

• 1940s – Carl Winkler spearheads investigations

• Different bridge solutions proposed by others
  o Different location – east of swing bridge
  o Different types:
    ▪ Fixed bridge – wouldn’t gain enough clearance
    ▪ Bascule – too long of a span
    ▪ Swing bridge – proven ineffective

• 1953 – Once a design was chosen, funding needed to be secured
  • Required to be “unreasonably obstruct the free navigation” of the waterway
    o Lake Carriers Association carried weight in classifying this

• 1956 – Hazelet & Erdal hired to design new lift bridge
History of the Portage Lake Bridge

• Dec 18, 1957 – Construction began

• Winter 1957 to winter 1958 – Caisson and pier construction
  o Built sand island
  o Sink caisson by excavating underneath
    ▪ Mechanical buckets first, then people
  o Piers built on top

• Feb, 1959 – Steel components arrive and steel erection begins
  o Field rivets
  o Lift span and structure built separate to allow full operation of swing bridge
History of the Portage Lake Bridge

• Sept 9, 1959 – Lift span floated into place
  o Closed waterway for day
  o Immediately lifted to highest position for most of finishing construction

• 3 months of equipment testing

• 8:00am Dec. 20, 1959 – Lift bridge opens to traffic

• Dec. 21, 1959 – Demolition of swing bridge begins
  o Automobile approaches first removed
  o Feb 16 – Rail switched to lift bridge
  o Swing span removed following spring
History of the Portage Lake Bridge

- June 25, 1960 - Ribbon cutting ceremony
- Completed lift bridge
  - Triple car capacity
  - Shorter and fewer delays
    - Intermediate position
  - More than double canal width clearance
  - Full rail and pedestrian access
- Sept. 28, 1982 - Last train
  - Used for snowmobiles now
- June, 2009 - 50 years old
- 2015 to 2016 - First major rehabilitation
  - 50 year fix on structure
  - 20 year fix on electrical and painting
The People who made it happen

Carl Winkler – Houghton Co. Commissioner

Tom D’Arcy – design engineer at Hazelet & Erdal

John Michaels – MDOT

And so many more...
How heavy is the lift span?

a. 250,000 lbs.
b. 1.5 million lbs.
c. 4.5 million lbs.
d. 10 million lbs.
Unique features

- Double-deck vertical lift bridge
  - Only one of its type in Michigan
  - Uncommon nationwide
  - Well-maintained

- High level of use in comparison to other notable Michigan bridges:
  - Portage Lake Bridge AADT – 30,600
  - Mackinac Bridge AADT – 8,120
  - Blue Water Bridge AADT – 13,550
  - International Bridge AADT – 4,850

- Heaviest lift span in the world at the time of construction – 4,584,000 lbs.
Unique Features

- Accommodates many modes of transportation
  - Vehicles, watercraft, pedestrians, snowmobiles and formerly rail
  - Did this using the double deck and intermediate position

- **Fully closed position**
  - Upper deck open for vehicles
  - Lower deck open for rail
  - Waterway closed

- **Intermediate position**
  - Upper deck open for vehicles
  - Lower deck closed
  - Waterway open for small craft

- **Open position**
  - Upper and lower decks closed
  - Waterway open for all marine traffic
Civil engineering significance

- First of its kind intermediate position
  - Lift span is partially raised so the bottom deck functions as part of the upper roadway
  - Reduced the number of bridge openings by 63% in comparison to the previous swing bridge
Civil engineering significance

• Intermediate position required additional innovations to function:
  o Lower lift span deck had to be useable by rail and automobiles
  o Movable intermediate bridge seats
How long did it take for the lift span to be installed?

a. 1 day  
b. 1 week  
c. 1 month  
d. 1 year
Civil engineering significance

- Early example of a “bridge slide”
  - Needed to use the swing bridge during construction
  - Floated the lift span into place on barges
  - Only had 4 inches of clearance on each end of the 260 foot lift span
Social and economic significance

• Copper and lumber to nation
  o Crucial to the development of country

• Much more efficient crossing at a transportation bottleneck
  o Auto – copper, logging, people, tourism
  o Waterway – copper industry and iron industry in western Superior
    ▪ Shortcut and harbor of refuge
  o Pedestrian – social between two important towns
  o Rail – copper, people

• Today
  o Tourism
    ▪ Historic/industrial
    ▪ Nature/activity focused
Conclusions

- The Portage Lake Bridge is a unique double-deck vertical lift bridge
- Replaced an aging and deficient steel swing bridge in 1959
- Had the heaviest lift span in the world at the time of its construction
- Revolutionary intermediate position increased its efficiency
- Played a key role in connecting the Keweenaw Peninsula’s local industries to the rest of the nation
- Recognized as a ASCE Michigan Historic Civil Engineering Landmark and accepted as a National ASCE Landmark
Questions?