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Memorandum

To: Chris Haines, P.Eng., Dillon Consulting Limited

From: F. Michael Bartlett, P.Eng.

Re: Historical engineering perspective on five bridges in the Rouge National Urban Park

Date: 27 September 2021

This memorandum summarizes thoughts about the historical engineering significance of five road bridges in Rouge National Urban Park and possible preservation initiatives. A brief statement of qualifications is attached.

Sewell's Road Bridge (1912)

Frank Barber designed the Sewell's Road suspension bridge and Lewis Construction was the contractor for the original construction.

James Franklin Barber (1875-1935) was a very prominent and active bridge designer in Ontario. Born in Milton, he was educated at Mount Allison University and the School of Practical Science (Civil Engineering), which became the Faculty of Applied Science and Engineering at the University of Toronto in 1901. He apprenticed under James McDougall, York County Engineer, and subsequently served as Engineer for the counties of York and Haldimand and for the townships of York, Vaughan, Etobicoke, King and Bruce. His entry in *Who's Who and Why 1921* indicates that he had "supervised over 200 bridges in Canada in the period 1908-1920". He was an illustrious bridge engineer, designing major concrete arch bridges including the Hunter Street (Ashburnham) Bridge in Peterborough, at 235 ft (71.6 m) the longest concrete span in Canada at the time of its completion, and, with C. R. Young, the Middle Road Bridge, the first reinforced concrete arch-truss bridge in Canada.

Cuming (1985 – *Discovering Heritage Bridges on Ontario Roads*, pg. 48) says that Barber "...built three suspension bridges between 1909 and 1915. These were not large bridges, but simple spans designed to be erected in a minimum amount of time and with the minimum labour and cost of materials. Only one now remains" (i.e., Sewell's Road Bridge).

Barber published a short paper (1911 – "Stiffened suspension bridge, applied to a short span") that describes one of his other short suspension bridges, a 90 ft. (27 m) span across the Don

River. The cost, exclusive of abutment fill, for this 14 ft. (4.3 m) wide structure with a 15 ton live load capacity is stated to be less than \$1000. The concrete Middle Road Bridge was opened in 1909 with an 80 ft (24 m) span, 16 ft (5 m) wide, with a 10 ton live load capacity: it cost \$3,190. So the claim in the paper that “the suspension bridge is much cheaper than any other form of bridge for this situation” seems justifiable. Savings were realized because it was constructed by farmhands “during slack times on the farm”.

The paper also talks about reduced floorbeam spacing for the suspension bridge that makes the stringers markedly more economical compared to conventional through trusses. The hangers for the bridge over the Don are at 10 ft (3 m) centres. At Sewell’s Road Bridge, they’re 5 ft (1.5 m) centres, so the stringers are even more economical.

The bridge is designated under the Ontario Heritage Act. The heritage designation documentation describes it as the “only remaining suspension bridge on a public road in Ontario”, a dubious claim given several major international suspension bridge crossings exist, including the Ambassador Bridge, the longest span in the world when it opened in 1929, the Thousand Islands (1938), the Three Nations Crossing (1958), and the Ogdensburg-Prescott (1960) bridges. Sewell’s Road Bridge was constructed before these other structures and is interesting because, with a main span length of only 30 m and a total length of 49 m, it is uncommonly short for a suspension bridge. Subsequent investigations suggest that the heritage designation should read the “only remaining single lane suspension bridge on a public road in Ontario”.

Not much of the original structure remains. Drawings describing a major rehabilitation completed in 1981 indicate that the main cable, tower bent, thrust blocks, abutment cap, pier cap, concrete abutments, and stiffening trusses were replaced. The original floor beams, main cable clamps and 25 mm diameter hangers were specified to be blast cleaned, painted and re-used.

U-bolts have been installed on the main suspension cables. These are likely intended to prevent the tops of the hangers from slipping down the main cables, and to prevent cable from slipping on the tower saddles. It is difficult to assess whether slip has taken place, as the 1981 rehabilitation drawings do not specify the profile of the main cable. It would perhaps be prudent to verify that the hangers in their current configuration are indeed vertical, and to document any out-of-plumbness for future reference.

Further significant repairs were made circa 2013 including replacing stiffening truss diagonals and verticals, top chord gusset plates, and deteriorated hanger-truss-floorbeam connections.

One is reminded of the story of Grandfather’s axe – it has had two heads and six handles but it is still Grandfather’s axe! Although much of its historic integrity has been lost, Sewell’s Road Bridge is clearly celebrated by the local community as indicated by a commemorative plaque installed at the time of the 1981 rehabilitation.

In summary, Sewell’s Road Bridge is the last remaining example of a very unusual bridge type, a single-lane short-span suspension bridge, with links to a prolific bridge designer, J. Frank Barber. It should be preserved if possible.

Should it eventually be replaced, the current structure might be reconstructed as a pedestrian crossing. Pedestrian loadings are heavy, often in the order of 100 pounds per square foot (4.8 kPa), so it might also be necessary to control the loading by reducing the deck area. This could be accomplished through reducing the bridge width by shortening the floorbeams and the bracing between the tower legs.

Milne Bailey Bridge (1988)

In October 1954, a Bailey Bridge was erected in a week at this site after the previous bridge was washed out by rainfall from Hurricane Hazel. It was replaced in 1988 by a similar-looking but stronger Bailey Bridge – the 1954 structure had two lines of panels in each truss and the present structure has three. The public may believe that the present bridge is the 1954 structure – virtually every reference to the structure on the internet, for example, erroneously indicates that the present bridge is the 1954 structure. In fact, only the centre pier – which is not particularly noteworthy from a historical perspective - dates from 1954.

The bridge is not designated under the Ontario Heritage Act, but has been listed on the City of Toronto Heritage Register. Bailey bridges are becoming rare in Ontario, there's a vehicular bridge at Jordan Valley, 21st Street over 20 Mile Creek (see GPS Co-ordinates 43.1520064, -79.3744661), a pedestrian bridge at Strathroy (42.959180, -81.626820), and a bridge exhibited on the ground of the Royal Military College in Kingston (44.235970, -76.465100). The form is historically significant given the success of Bailey Bridges in the Second World War, which eventually caused the designer, Donald Bailey of the British War Office, to be knighted.

Current thinking is to replace it with a modern deeper, stronger panel-type structure – perhaps preserving the tradition of having the Canadian military erect it. Given the history of the use of Bailey Bridges at this location, it would seem appropriate to use a similar form of structure, as proposed.

Maxwell's Bridge (1927)

Maxwell's Bridge is a reinforced concrete tied-arch ("rainbow") bridge with a 60 ft (18 m) span.

It is designated under the Ontario Heritage Act. The heritage designation documentation says "few of these bridge types remain in Ontario today" – a recent survey of the website HistoricBridges.com suggests that 34 remain in Ontario. However, many rainbow bridges in Ontario have been replaced – of the seven Wellington County concrete bowstrings listed by Cuming (1985 – *Discovering Heritage Bridges on Ontario Roads*, pg. 70), for example, only two remain. The documentation says the bridge is "one of the last of its type to be constructed in the province" – roughly one-third of these remaining 34 bridges were constructed after 1927 with the most recent, two reinforced concrete rainbow bridges in Essex County, constructed in 1937 and 1938.

Cuming (1985 – *Discovering Heritage Bridges on Ontario Roads*, pg. 69) notes:

“The single-lane concrete bowstring trusses of Wellington County are excellent examples [of a form of bridge that has become particularly popular in a region]. Unique in the province because of their age, style and concentration in numbers, they are certainly worth a visit. Built primarily in the period 1915 to 1925, these single lane, at best one-and-a-half lane, structures reflect the transition from horse-drawn vehicles to the new motorized age. Whereas timber could withstand, within reasonable limits, the occasional encounter with the wheels of a buggy or wagon, the new juggernauts of the late nineteenth and early twentieth century – threshing machines and road rollers – proved more than a match for many a span. The introduction of the bowstring truss reflects the need to provide a safe and durable structure, capable of withstanding frequent use, heavy loads, and the inevitable scrape or two.”

Maxwell’s Bridge has undergone very sympathetic rehabilitation in 1997, when the deck was replaced and minor repairs were carried out, and in 2013, when deteriorated concrete was removed and repaired. It is an excellent example of the century-old reinforced concrete “rainbow” arch form and should continue to be preserved.

Stotts (1915) and Hillside (1917) Bridges

The Stotts and Hillside Bridges can be considered together because they share many similarities. Both are Warren half-through (i.e., pony) trusses constructed during the First World War: Stotts Bridge has five panels and a 75 ft (23 m) span, and Hillside Bridge has six panels and a 82 ft (25 m) span.

Both are designated under the Ontario Heritage Act, primarily, it would seem, for their age. The overall historic integrity of both structures is good: there have been repairs, but the essential load carrying members are original. The Warren truss form has been extensively used in Ontario, across Canada and the United States: both the Stotts and Hillside Bridges are therefore not examples of a rare truss form.

Both are likely candidates for replacement: Stotts Bridge was closed for emergency repairs in the fall of 2020 and the Hillside Bridge was also closed for strengthening that summer. The superstructures of both bridges have the potential to be relocated and repurposed as pedestrian/cyclist bridges, with some rehabilitation. This would likely involve shortening the floorbeams to reduce the bridge width and thereby control the maximum loading.

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Education

2020: Master of Arts in Public History, Western University.
1994: Ph.D. in Civil Engineering, University of Alberta.
1982: M.A.Sc. in Structural Engineering, University of Waterloo.
1979: B.Sc. (Hons.) in Civil Engineering, Queen's University at Kingston.

Recent Work Experience

2020 – 21: Consultant, Rouge National Urban Park (RNUP) Transportation Master Plan (Dillon Consulting Ltd.) Advised on conservation strategies for five heritage bridges in RNUP.
2020 – present: Volunteer, Collections Team, Fanshawe Pioneer Village.
2019 – 20: Research Assistant, Fanshawe Pioneer Village. Cleaned, researched and catalogued objects using PastPerfect. Researched and wrote *Database of London Industries*, a 79,000 word-searchable database of London industries 1820-1920.
1995 – 2019: Assistant Professor (to 2000), Associate Professor (to 2006), Professor of Civil & Environmental Engineering, Western University. Graduate and undergraduate teaching and course development, supervision of 7 PhD, 28 MEng and 8 MSc students, NSERC Discovery Grant Funding 1995-2023.
2013 – 18: Associate Dean (Undergraduate), Faculty of Engineering, Western University. Curriculum review and revision, scholastic discipline and appeal resolution, student recruitment, extensive committee work.

Synergistic Activities

2018 – present: Chair, National History Committee of the Canadian Society for Civil Engineering (CSCE) (Member, 2008 to present):

- 2020: Led initiative to revise [online descriptions of 78 CSCE Historic Civil Engineering Sites](#). Revised descriptions comprise 55,000 words, 450 images, 240 links to online documentation.
- 2020 – present: wrote *This Week in Canadian Civil Engineering History* blurbs for the CSCE weekly [eBulletin](#).
- 2020 – present: initiated and chaired the Historic Bridge Task Group of the CSCE National History Committee, which has developed and implemented criteria for selecting bridges to list on the CSCE's Inventory of Historic Civil Engineering Sites.
- 2016 – 21: participated in the designation and plaque unveiling of six Historic Civil Engineering Sites.