



Gamebridge Bridge Replacement

2019 ACEC CCE Engineering Excellence Awards | Category B | Transportation

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Overhead view from east

Project summary



The Regional Municipality of Durham and County of Simcoe retained GHD Ltd. to perform an environmental assessment of the Gamebridge Bridge that provides vehicle and pedestrian access to community residents. The purpose was to identify a solution to address its deteriorating structure, along with related access issues. Built in 1920, **the bridge is an intact example of a concrete bowstring arch bridge. Preserving its cultural heritage was an important aspect of the project.**

Innovation

In 2017, the Regional Municipality, Durham (Durham Region) and the County of Simcoe initiated the Gamebridge Bridge (Gamebridge) Schedule 'B' Class Environmental Assessment. The purpose of the assessment was to identify an appropriate solution to address the structural, safety, and access issues, associated with the 87-year-old Bowstring Arch Bridge on Regional Road 51 between Talbot Road to the south, and Ramara Road 51 to the north. The 88-year-old Gamebridge is a concrete bowstring arch bridge spanning 22.6 meters with a roadway width of 7.45 meters. Its structural integrity is deteriorating, resulting in increased concern for the safety of bridge users.

Our aging and historical structures bridge team performed a structural assessment of the severely deteriorating bridge. The results of the assessment determined that to maintain Gamebridge's historical integrity, the structure needed replacement.

Due to punching failures in the concrete deck, the northbound lane was closed. As a result, only the southbound lane was open to vehicular traffic. The structure was posted with a five-tonne load limit based on visual assessment and deteriorating conditions. This project provided an opportunity to improve the structural integrity of the Gamebridge and maintain and improve the connection along Regional Road 51 right-of-way.



GHD operated drone

Innovation

The use of UAV (unmanned aerial vehicle) technology provided the project team and our client with high-quality images and video:

- Drones were used to survey and capture a full 360-degree view of the existing bridge, then saved in video format. This method demonstrated an efficient way to survey and inspect hard to reach or dangerous locations.
- Drones were used to capture aspects of the bridge's demolition and reconstruction, which will be used to produce a time-lapse video at the project's completion.

Design optimization

- GHD designed economical pre-stressed, precast concrete University of Nebraska girders system for longer girder spans as an alternative to steel plate girders, without the need to increase the superstructure depth; the result is a simplified design with reduced approach works and costs.
- 3-D analysis was completed by optimizing the concrete girders in order to minimize the superstructure depth. This resulted in minimizing both the impacts of a grade raise which would affect the adjacent cemetery, as well as holding the existing soffit elevation allowing the design flow for the 50-year return period, all while still improving the overall horizontal and vertical geometrics required for the roadway.



Erection of Girders

Complexity

This project provided an opportunity to address the structural deterioration of the bridge while considering transportation, cultural heritage, natural environmental, social environment, and economic infrastructure needs. Some extraordinary conditions that the team overcame are included below. Ultimately, **GHD provided the client with an innovative structure with a design life of over seventy-five years with minimal maintenance costs, while addressing heritage requirements in a manner satisfactory to all stakeholders.**

Safety Concerns

Due to the advanced state of disrepair of the Gamebridge, there was a significant risk to users of this bridge. Multiple punching failures in the deck had already restricted use and triggered additional monitoring.

Heritage Preservation

Built in 1920, and having no previous major rehabilitation or repair work, the Gamebridge is considered an intact example of a concrete bowstring arch bridge, commonly constructed across Ontario in the early 20th Century.

Maintaining Access/ Connectivity

The Gamebridge provides vehicle and pedestrian access to people in Gamebridge and to the Knox Presbyterian Church. In addition, Regional Road 51 can be used as a bypass to Highway 12.

Site Constraints

A cemetery located in the northeast corner of the site made the grade raise a significant challenge. The proposed structure depth needed management to maintain conveyance of the regional flood event, while addressing ponding, poor alignment, with the fixed cemetery restriction.

Environmental Constraints

Natural environmental studies indicated species at risk including butternut trees, bats and barn swallows. Mitigation measures were incorporated in the final design to minimize impacts.

Social benefits



A third-party firm completed a Cultural Heritage Evaluation Report determining that the Gamebridge is of value from a design/physical, historical, associative and contextual perspective. A heritage impact assessment concluded that this project provided an opportunity to preserve the heritage features of the Gamebridge. **The community of Gamebridge benefits as their citizens take pride in its history and mutual concern for the protection of the historic bridge fabric.**

GHD's design team and the heritage consultant worked together to document and preserve the heritage features of the existing bridge.

A copy of the cultural heritage evaluation report, including a general arrangement drawing of the existing bridge that was created by the design team, can be found at various municipal offices and libraries in the area. A commemorative plaque will be installed at the site to commemorate the river crossings at this location from the 19th century to the present day, and the contributions made in the development of the Region and the settlement history in Gamebridge, within Durham Region and the County of Simcoe.

The community will remain connected by maintaining vehicle and pedestrian access to people in Gamebridge and to the Knox Presbyterian Church. In addition, Regional Road 51 can be used as a bypass to Highway 12. The bridge superstructure is now slender in profile with open railing for enhanced views of the river and its safety was vastly improved for all users. Maintenance is important as it will lower long-term costs to maintain.



Environmental benefits



In accordance with the broad definition of the environment in the Environmental Assessment Act, the inventory of the existing environment included the natural, social, and cultural environment. Natural environment investigations indicated the potential presence of species at risk such as butternut trees, bats and barn swallows. Seventeen wells were also located within five-hundred miles of the bridge. GHD's Natural Environment Team completed a Tree Inventory, Butternut Health Assessment, and Acoustic Monitoring Survey of bat species and field investigations. A Cultural Heritage investigation was also undertaken for the existing built structure. Based on the information gathered from the background research, elevated archaeological potential was established within the study area boundary.

Consultation with the public and government review agencies was carried out throughout the Class EA process in order to inform stakeholders of the project details and provide all interested parties an opportunity to contribute their input or comments. Stakeholders included the local conservation authority, First Nations, emergency services, Ontario Ministry of Natural Resources and Forestry, Ontario Ministry of Tourism, Culture and Sports, local school boards, utilities, municipalities and the public. An active church and cemetery was located immediately adjacent to the site. The assessment included a robust assessment of rehabilitation, replacement and removal alternatives.

The team was committed to protecting the terrestrial area by maintaining and preserving the ecosystem that is a strong pillar for our economies and societies. Over the long term, it will help in the adaptation to climate change and improve ecosystem resilience.





Meeting client's needs

The client's main goals were to:

- innovatively replace the structure with a design life of over seventy-five years and minimal maintenance costs, while addressing heritage requirements in a manner satisfactory to all stakeholders;
- present an accurate budget estimate and satisfactory tender package;
- perform impact mitigation and permitting; and
- deliver a full-service package with the capability to supply a full engineering concept and environmental assessment through to detailed design and construction administration and material testing.

Based on the problem and opportunities associated with the Gamebridge Bridge, the team identified six alternative solutions to address the deteriorating structural integrity of the bridge. Each of the key areas of consideration were evaluated (technical, natural environment, social environment, cultural environment, and financial) and the potential tradeoffs were weighed. **The community and stakeholders were consulted through a public meeting held at the local church.**

The team determined that the best option for the replacement of Gamebridge was a new two-lane bridge, which will maintain long-term transportation connectivity in the community while improving safety. The new bridge has two, three-meter-wide lanes and two-meter-wide shoulders. This wide paved platform accommodates both vehicular traffic and active transportation needs.



GHD Whitby bridge team



Looking south at bridge

“The client expressed their satisfaction with our high-quality design and services by awarding GHD the contract administration assignment in 2018 which we are currently still leading.



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