HERITAGE ACT ASSESSMENT OF THE

CALEDONIA

ARGYLE STREET BRID

ONTARIO CONSOLIDATED REPORT MARCH 2008 (REVISED MAY 2009)

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Prepared for: Morrison Hershfield Limited And Ontario Ministry of Transportation

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Heritage Impact Assessment of the Argyle Street Bridge Caledonia, Ontario

Consolidated Report

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EXECUTIVE SUMMARY

The Argyle Street Bridge – a nine-span, concrete bowstring truss – carries Argyle Street over the Grand River at Caledonia. The bridge has been listed in the *Ontario Heritage Bridge Program* as a structure of historic significance. The Ministry of Transportation (hereafter MTO) owns the bridge, but Argyle Street and the bridge approaches were transferred to Haldimand County following completion of the Highway 6 By-pass in 1997.

MTO initiated a Class Environmental Assessment (hereafter EA), in accordance with the requirements for Group 'B' projects under the Class Environmental Assessment for Provincial Transportation Facilities (2000), of the Argyle Street Bridge in 2002. It retained Morrison Hershfield Limited to undertake a "Preliminary Design and Environmental Assessment of the Argyle Street Bridge." The purpose of the study was to investigate and propose a solution for the rehabilitation or replacement of the bridge, as well as traffic management during construction. During this phase of the project, Archaeological Services Inc. (ASI) was retained by Morrison Hershfield Limited to undertake a cultural heritage assessment of the structure. ASI conducted two studies in this regard: *Heritage Bridge Impact Assessment Caledonia (Argyle Street) Bridge* (July 2005)1 and *Argyle Street Bridge Caledonia, Haldimand-Norfolk Cultural Landscape Study* (January, 2006).

In 2007 MTO decided to continue the EA study in order to address recent amendments to the *Ontario Heritage Act* that could affect the heritage significance of the bridge within the Class EA process. Morrison Hershfield hired ASI to undertake the additional necessary heritage assessment of the bridge.

This report addresses the cultural heritage value of the Argyle Street Bridge and then presents the evaluation of effects of new mitigation options, in order to determine the overall net effects of either rehabilitating or replacing the Argyle Street Bridge. Specifically, Part A of this report presents the cultural heritage evaluation of the Argyle Street Bridge. It addresses the background history of the bridge crossing and bridge construction (Section 2.0), provides an inventory of the structure and surrounding resources (Section 3.0), presents a statement of cultural heritage value (Section 4.0), and identifies the structure's heritage attributes (Section 5.0). Part B of this report presents the proposed undertaking (Section 6.0), evaluates the net effects of the undertaking on the structure's heritage values (Section 7.0), and provides recommendations and mitigation options (Section 8.0). This report also functions as a consolidation of the two previous studies conducted by ASI. Finally, Volume 2 of this report presents the heritage impacts of a new mitigation option that would twin the existing bridge.



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PART A

ARGYLE STREET BRIDGE CULTURAL HERITAGE EVALUATION



1.0 INTRODUCTION

1.1 Study Purpose

The Argyle Street Bridge – a nine-span, concrete bowstring truss – carries Argyle Street over the Grand River at Caledonia. The bridge has been listed in the Ontario Heritage Bridge Program as a structure of historic significance. This program was established in 1982 jointly by the Ministry of Transportation (hereafter MTO) and the Ministry of Culture (hereafter MCL) to provide a framework for the consistent and considered decisions in allocating funds for the conservation of heritage road bridges. This Program also acknowledges that MTO has an interest in conserving historic provincial bridges.

In 1994, the Grand River was declared a Canadian Heritage River. A contributing factor towards its designation was the character of the bridges over the Grand River, of which the Argyle Street Bridge is a major structure. The objectives of the Canadian Heritage Rivers System are to give national recognition to the important rivers of Canada and to ensure their future management such that:¹

- the natural heritage which they represent is conserved and interpreted;
- the human heritage which they represent is conserved and interpreted; and
- the opportunities they possess for recreation and heritage appreciation are realized by residents of and visitors to Canada.

The MTO owns the bridge but Argyle Street and the bridge approaches were transferred to Haldimand County following completion of the Highway 6 By-pass in 1997. MTO has identified structural deficiencies in the bridge that will require either a major rehabilitation of the bridge or its replacement.

MTO initiated a Class Environmental Assessment (hereafter EA), in accordance with the requirements for Group 'B' projects under the Class Environmental Assessment for Provincial Transportation Facilities (2000), of the Argyle Street Bridge in 2002. It retained Morrison Hershfield Limited to undertake a "Preliminary Design and Environmental Assessment of the Argyle Street Bridge." The purpose of the study was to investigate and propose a solution for the rehabilitation or replacement of the bridge, as well as traffic management during construction.

The requirement for the EA to consider cultural environment is defined in the Environmental Assessment Act subsection 1(c) to include: *Cultural conditions that influence the life of man or a community* as well as, *any building, structure, machine or other device or thing made by man.*

The *Planning Act* and related Provincial Policy Statements do not pertain directly to the requirements of *Environmental Assessment Act*. However, the Policy Statements for heritage reiterate the importance that the province attaches to heritage conservation. One of these provincial interests is directly concerned with:

(d) The conservation of features of significant architectural, cultural, historical, archaeological or scientific interest.

Subsection 2.6, *Cultural Heritage and Archaeological Resources*, makes the following provisions:

2.6.1 Significant built heritage resources and cultural heritage landscapes shall be conserved.

¹ The Canadian Heritage Rivers System: *Objectives, Principles and Procedures*, 3



In 2007 MTO decided to continue the EA study in order to address recent amendments to the *Ontario Heritage Act* that could affect the heritage significance of the bridge within the Class EA process. Morrison Hershfield hired Archaeological Services Inc. (hereafter ASI) to undertake the additional necessary heritage assessment of the bridge.

This Heritage Impact Assessment of the Argyle Street Bridge, Caledonia – Consolidated Report (hereafter Report) was undertaken to complete three tasks. First, it is a consolidation of two previous studies completed by ASI of the bridge: Heritage Bridge Impact Assessment Caledonia (Argyle Street) Bridge (July 2005), and Argyle Street Bridge Caledonia, Haldimand-Norfolk Cultural Landscape Study (January, 2006).

Second, an additional study of the heritage impacts of a new mitigation option that would twin the existing bridge had to be undertaken. This report, *Heritage Impact Assessment of a Proposal to Twin the Argyle Street Bridge, Caledonia*, was completed in September 2007 and has been consolidated in this *Report.*

Third, the effects of the new mitigation options had to be evaluated in conjunction with other environmental factors to determine the overall net effects of either rehabilitating or replacing the Argyle Street Bridge. The evaluation had to be consistent with the earlier EA methodology. The net effects of the heritage factors have also been integrated into this *Report*.

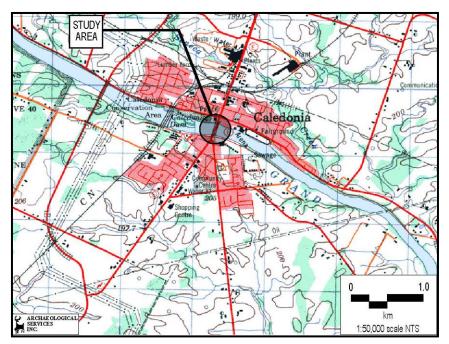


Figure 1: Location of the Caledonia Bridge, Caledonia, Town of Haldimand-Norfolk.

1.2 Study Method

The study area was defined by MTO in 2002 to include the Grand River for a distance of approximately 200 m upstream and downstream of the bridge. The study area also included Argyle Street from Caithness Street, north of the Bridge to just south of the junction of Argyle Street and Wigton Street south of the



bridge. In addition, the areas of potential impact by construction activities for the proposed rehabilitation/replacement of the existing bridge were included. The cultural landscape study area consisted of viewsheds along the river to the bridge and viewsheds of the Grand River and its shorelines from the bridge.

The consolidation of the two previous ASI reports – *Heritage Bridge Impact Assessment Caledonia* (*Argyle Street*) *Bridge* (July 2005), and *Argyle Street Bridge Caledonia, Haldimand-Norfolk Cultural Landscape Study* (January, 2006) – needed to be reorganized to reflect organization changes required by MTO. Specifically, MTO requested chapters titled "Statement of Heritage Values" and "Heritage Attributes." Some new additional background information on the historical context of concrete bowstring bridges was added as a result of research conducted for the new bridge rehabilitation option of twinning the bridge.

The *Heritage Impact Assessment of a Proposal to Twin the Argyle Street Bridge* followed the same methodology used in the previous two ASI reports. This report examined both the built and landscape heritage impacts of the proposed mitigation. The buildings along Argyle Street north and south of the river were evaluated in more detail than in the previous studies due to the potential impact of road widening associated with the proposed twinning.

The study method used in all three reports that have been consolidated into this document followed the same approach. First, a background history of the Argyle Street Bridge (Section 2.0) was researched to provide data to identify potential historic resources (Section 3.0) and to evaluate the historical significance of these resources (Sections 4.0 and 5.0). Imperial measurements have been given when describing the historic bridge. Since the structure was designed in these units, it is easier to recognize patterns and standardized construction dimensions than if the units were converted to metric.

Second, built heritage features and cultural landscapes within the study area were inventoried following guidelines established by MCL (Section 3.0). The primary reference documents were *Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments* (1992) and *Guidelines on the Man-Made Heritage Component of Environmental Assessments* (1980). As well, the United States Department of the Interior's *National Register Bulletin 30: Guidelines for Evaluating and Documenting Rural Historic Landscapes* was used to guide the landscape assessment.

The evaluation of cultural values for both the bridge and associated landscape were determined using the *Ontario Heritage Bridge Program* criteria (Sections 4.0 and 5.0). Other guiding documents included the Ontario Realty Corporation's *Cultural Heritage Protocol Process for Cultural Landscapes* and Parks Canada's *Standards and Guidelines for the Conservation of Historic Places in Canada*.

The possible alternative that could be used in the rehabilitation or replacement of the Argyle Street Bridge are then addressed (Section 6.0). Following, the Net Effects assessment (Section 7) of the proposed twinning of the bridge was undertaken in three workshops held in Caledonia in September and October 2007. The method followed the MTO process used in the previous evaluation of the EA rehabilitation/replacement alternatives.

1.3 Definitions

Built Heritage Resource:

One or more significant buildings, structures, monuments, installations or remains associated with architectural, cultural, social, political, economic or military history and identified as being important to a community. These resources may be identified through designation or



	heritage conservation easement under the Ontario Heritage Act, or listed by local, provincial or federal jurisdictions. (Source: <i>Ontario Provincial Policy Statement</i>)
Cultural Resource:	A human work or a place which gives evidence of human activity or has spiritual or cultural meaning, and which has been determined to have historic value. (Source: Parks Canada <i>Guiding Principles and Operational Policies</i>)
Cultural Heritage Landscape:	A defined geographical area of heritage significance which has been modified by human activities and is valued by a community. It involves a grouping(s) of individual heritage features such as structures, spaces, archaeological sites and natural elements, which together form a significant type of heritage form, distinctive from that of its constituent elements or parts. Examples may include, but are not limited to, heritage conservation districts designated under the <i>Ontario</i> <i>Heritage Act</i> ; and villages, parks, gardens, battlefields, main streets and neighbourhoods, cemeteries, trailways and industrial complexes of cultural heritage value. (Source: <i>Ontario Provincial Policy Statement</i>)
Cultural Landscape:	Any geographical area that has been modified, influenced, or given special cultural meaning by people. (Source: <i>Parks Canada Guiding Principles and Operational Policies</i>)
Heritage Attributes:	 The principal features, characteristics, context and appearance that contribute to the cultural heritage significance of a protected heritage property. (Source: <i>Ontario Provincial Policy Statement</i>) In relation to real property, and to the buildings and structures on the real property, the attributes of the property, buildings and structures that contribute to their cultural heritage value or interest. (Source: <i>Ontario Heritage Act</i>)
Historic Value:	A value assigned by Parks Canada to a resource, whereby it is recognized as a cultural resource. All resources have historical value; only those which are considered to have importance over and above the historical, have historic value. (Source: Parks Canada <i>Guiding Principles and Operational Policies</i>)

Furthermore, a property may be designated under section 29 of the *Ontario Heritage Act* if it meets one or more of the following criteria for determining whether it is of cultural heritage value or interest: (Source: *Ontario Heritage Act*, Regulation 9/06: *Criteria for determining cultural heritage value or interest*)

Design Value/Physical Value	Design	Value/Physical	Value
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- i. is a rare, unique, representative or early example of a style, type, expression, material or construction method;
- ii. displays a high degree of craftsmanship or artistic merit; or
- iii. demonstrates a high degree of technical or scientific achievement.

Historical Value/Associative Value	 i. has direct associations with a theme, event, belief, person, activity, organization or institution that is significant to a community; ii. yields, or has the potential to yield, information that contributes to an understanding of a community or culture; or iii. demonstrates or reflects the work or ideas of an architect, artist, builder, designer or theorist who is significant to a community.
Contextual Value	i. is important in defining, maintaining or supporting the character of an area;ii. is physically, functionally, visually or historically linked to its surroundings; oriii. is a landmark.

2.0 BACKGROUND HISTORY

2.1 History of Bridge Crossing

2.1.1 Physiographic Description

The study area is situated within the Haldimand Clay Plain physiographic region of southern Ontario.² The Haldimand Clay Plain, which includes all of the Niagara Peninsula south of the Niagara Escarpment, is a large, predominantly flat region of glacial lake sediment deposits. The majority of the surface material is lacustrine clay, although sand deposits do occur in places, and there are areas where glacial till protrudes above or is interbedded with the clay.

Within this part of the Haldimand Clay Plain, a number of environmental subregions have been defined, and the study area falls within the Lower Grand River Valley physiographic subregion.³ The distribution and character of these subregions, and the specific environmental features they contain, have influenced land use in the region throughout history and prehistory.

The Lower Grand River Valley is characterized by well-developed riparian landforms such as floodplains, terraces, meander scars and channels, bluffs, banks, shoals, rapids, alluvial islands, levees, and tributary valleys. The biota of the subregion is diverse in the manner of most riparian systems, and includes many western and southern plant species in addition to common wetland taxa.⁴ The natural environment of the area has been drastically altered over the last 150 years. Clearance of the sloped floodplain forests, agricultural development of the floodplain, dam construction, and community development along the banks of the river in places such as Caledonia have created a landscape that bears little resemblance to that which existed prior to Euro-Canadian settlement.

2.1.2 Early History

The site of Caledonia was laid out in the 1840s and became the more important community when the Hamilton and Port Dover Plank Road and a bridge over the Grand River (present day Argyle Street, old



² Chapman and Putnam 1984:156-9

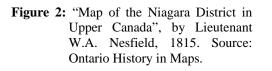
³ MacDonald 1980

⁴ MacDonald 1980:17.

Highway 6) were completed in 1842. The community was incorporated as a village in 1853, though its name was not changed to Caledonia until 1880.

Caledonia's early growth was directly linked to its location, including its position on the Grand River and its place along an important transportation route. Prior to European settlement, the future Hamilton and Port Dover Plank Road had already been carved into the landscape by native travellers following a portage route from the Head of the Lake (Ontario) to the Grand River. Figure 2 indicates the general extent of trail development in and around the area and shows a clearly demarcated system of trails and roads. The 1815 map illustrates a number of trails converging on top of the escarpment. Two lead west, one to Ancaster and another to the Grand River and native settlements, and two strike southeast and east: the former to Pelham and Thorold townships, and the latter "A road cut by Governor Simcoe," parallels the escarpment in an effort to avoid swampy lands below. The trail to the Grand River follows the present day route alignment of former Highway 6 through Glanford. The track, formerly called the Caledonia Stage Road and the Hamilton to Port Dover Road, was lined with at least 15 taverns from Hamilton to Caledonia on the Grand, and it was planked to Mount Hope as early as 1837. By 1850, a





well developed system of roads, including the Hamilton to Port Dover Plank road (and bridge) passed through Caledonia (Figures 3 and 4).

Caledonia's early settlement history can be traced to the years just after the American Revolution. On October 25, 1784, the British Crown gave Mohawk Chief Joseph Brant and his Six Nations Confederacy six miles of land on either side of the Grand River from its mouth at Lake Erie to its source in present-day Dufferin County. This land grant was given in payment for the loyalty of the Six Nations to the Crown during the war and in restitution for lands lost to the United States. The grant was completed by Sir Frederick Haldimand, Governor-in-Chief of Canada.

In 1832, a bill was passed by the provincial government authorizing a company to make the Grand River, or Ouse River, as it was first called by European travellers, navigable from Lake Erie to Brantford. The Grand River Navigation Company built locks and dams. The first section opened in 1835, but the final link into Brantford was not finished until 1848.⁵ Since few steamers operated on the river, a tow path was necessary so that horses could haul the boats. The need of a tow-path on the shore of the Grand River would ultimately have an impact on the landscape value of the Argyle Street Bridge.

The company also laid out small villages on the north and south banks of the Grand. The village of Seneca was located on the north bank at Dam Four, while the village of South Seneca was on the south bank. By 1834, Jacob Turner, the contractor for Dam Four, was operating a sawmill at Seneca Village. By 1833, Dams One, Two and Three were completed at Indiana, York and Sims Locks. Dam Four, just east of present day Caledonia at Seneca, was constructed by 1834.

⁵ Colin Duquemin, *A Guide to the Grand River Canal*, St. Catharines, Ont.: 1980.



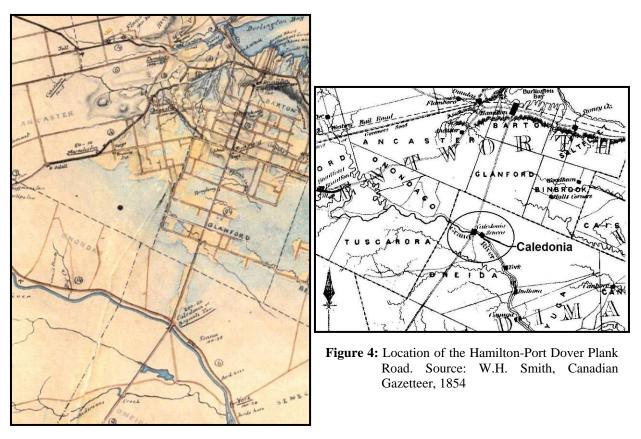


Figure 3: "Map of the Principal Communications in Canada West Compiled from the most authentic sources, actual Surveys, District maps etc., etc. by Major Baron de Rottenberg, 1850. Source: Ontario History in Maps.

Ronald MacKinnon, the first village reeve, was a central figure in the Caledonia's early development. McKinnon was hired as a contractor for the construction of Dam Five for the Grand River Navigation Company at Oneida. When McKinnon first came to the area, Caledonia (between Seneca and Oneida) was known as Bryant's Corners. It comprised of a hamlet with two log houses and a tavern owned by Mr. Bryant. In 1836, McKinnon built a sawmill and a store, and, in 1844, he erected a gristmill, followed by a woollen factory in 1848. A number of hotels and stores were also constructed during this early period, and they serviced the surrounding community and plank road travellers.

William H. Smith's 1846 Canadian Gazetteer provides the following description of the growing village:

CALEDONIA.: A flourishing Village on the banks of the Grand River, twenty miles from Brantford, fourteen from Hamilton, and twenty-three from Port Dover; principally situated in the township of Seneca, with a small portion on the opposite side of the river, in the township of Oneida. The two portions of the village are connected by means of a handsome swing bridge across the river. Caledonia was laid out as a village by the Crown, about two years since, and the village of Seneca was included in the town plot. The plank road from Hamilton to Port Dover passes through the village. Stages run daily



to Hamilton and Port Dover, and a mail runs three times a week to Dunnville, and from thence to St. Catharines. A settlement called "Little Caledonia," where is a grist mill, and a saw mill with two saws), is situated about a quarter of a mile distant.

Population, including Little Caledonia, about 300.

Post Office (in Oneida), post daily.

Professions and Trades—One physician and surgeon, five stores, three taverns, two groceries, one saddler, two wagon makers, two cabinet makers, three blacksmiths, three shoemakers, three tailor, two bakers.

The 1846 list of professions, trades and services clearly indicates that Caledonia largely existed to serve travellers. Of course, permanent settlers needed community services as well, and a frame building housed both church and school until 1848, when the Anglicans and the Presbyterians both erected churches. Sometime prior to 1856, Thomas Messenger began publishing a newspaper which he called the *Advertiser*. That year, he changed the name to the *Grand River Sachem*, and it is still published under that name today.

Due to its enviable hub position, Caledonia also became a supply centre for the surrounding agricultural area. Substantial community buildings were constructed in the 1860s and 1870s, including a Town Hall in 1860, attesting to the local prosperity, and, by the mid-1870s, a well-developed pattern of village lots existed.

2.1.3 Previous Bridges at Caledonia

The first bridge over the Grand River at Caledonia was erected in 1843 (Figure 5). It was on the plank road between Hamilton and Port Dover, built by the provincial government and finally completed in 1846. It was a toll road with seven toll gates. In 1851, the Commissioners of Public Works gave up control of the road and bridge and leased out their operation. The road, including the bridge, was sold to Z.B. Choate and Samuel Kern in 1865⁶

The Caledonia bridge was 638 feet long and 16 feet wide and consisted of six fixed spans and one moveable span on the east bank. The moveable bridge was for the passage of barges and vessels on the Grand River Navigation Canal.⁷

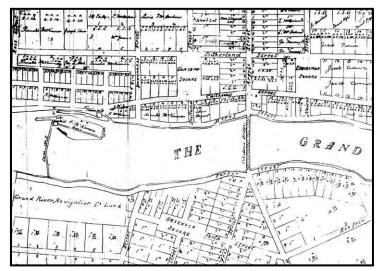


Figure 5: "Caledonia c.1850" showing 1843 bridge. Plan reproduced from the Caledonia Tweedsmuir History.

⁷ Canada. Commissioner of Public Works. *General Report, 1867.* 191, 321; W.H. Smith Canada Past Present & Future, vol 1 164



⁶ Canada. Commissioner of Public Works. *General Report of the Commissioner of Public Works*, 1867. 172.

The bridge was described as an arch and truss frame structure, suggesting that it may have been built with the Burr Truss. This design was widely used for long span timber bridges as it could be built up to 175 feet long (Figure 6). Assuming that all seven spans were the same length, each span would have been about 91 feet. Since the movable span was probably significantly shorter, the six main spans were probably about 100 feet long.

The Caledonia bridge was destroyed during a flood in the spring of 1861. A ferry was used until the bridge was rebuilt in 1865 by the lessees of the road. Figure 7 illustrates part of

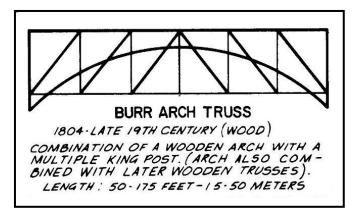


Figure 6: Burr Truss.

the bridge as it existed in 1863. The bridge is depicted on the left side of the illustration. It seems to consist of short spans resting on large timber cribs. The detail is too hazy to determine the type of span. This appears to be the earliest image of the bridge. This may be the standing remains of the bridge or indicate that the replacement had been built earlier. In any case, two spans of this new bridge were destroyed in 1870 and subsequently replaced. Finally, in the mid-1870s, the County of Haldimand made funding available for a substantial metal bridge.⁸

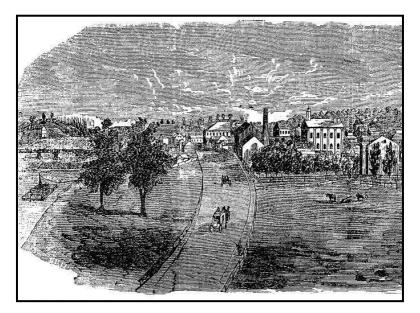


Figure 7: Approaching Caledonia C.W. from the East, Canadian Illustrated News, Oct.24, 1863. Source: deVolpi, The Niagara Peninsula – A Pictorial Record, 1966.

⁸ Canada. Commissioner of Public Works. *General Report 1867.* 321; Anne Corlis, *Caledonia and District*, 33; Barbara Martindale. *Caledonia -- Along the Grand River*, 75.



In 1875, a six-span iron bridge replaced the 1865 structure (Plate 1 and Figure 8). By then, navigation on the Grand River in this area had virtually ended. Thus, the County of Haldimand was able to build a new bridge without the swing span for vessels.

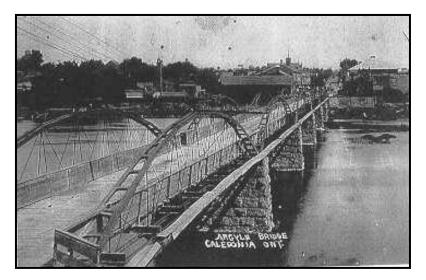


Plate 1: The 1875 six-span iron bowstring arch bridge, Caledonia

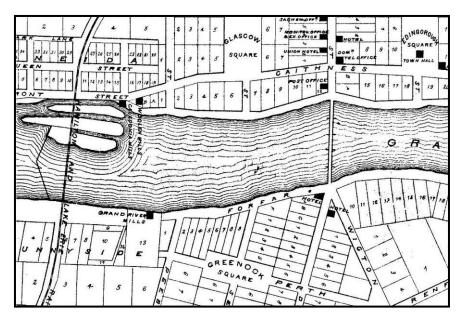


Figure 8: This map seems to show four piers in the river, indicating a five span iron bridge rather than the six spans as built. Source: Illustrated Atlas of the County of Haldimand, 1877

Each span of the new bridge was 105 feet (32 m) long. The bowstring truss was made of wrought iron and fabricated at the Scott Foundry in Caledonia. It had a wood deck and a six-foot wide wooden sidewalk along the west side. The trusses were supported on masonry piers and abutments. The piers were constructed of large blocks of limestone placed on a footing of large pine timbers. The upstream face of



these piers was protected from ice and debris by sheet iron.⁹ The design was typical of the era. A similar bridge still stands in London, Ontario.

A gate and a toll keeper cottage were erected at the north end of the bridge at the same time. The red and buff brick Gothic revival house exists today (see Plates 18 and 19 in Section 3.2). Tolls were collected until about 1890 to help defray the cost of the bridge.

In August 1925, a truck carrying a load of stone caused one of the spans to collapse (Figure 9). The span was replaced with a temporary trestle. The following year, the Ontario Department of Highways assumed responsibility for the road from Hamilton to Port Dover, and it became known as Highway 6. The Department of Highways also assumed the obligation to rebuild the bridge.¹⁰

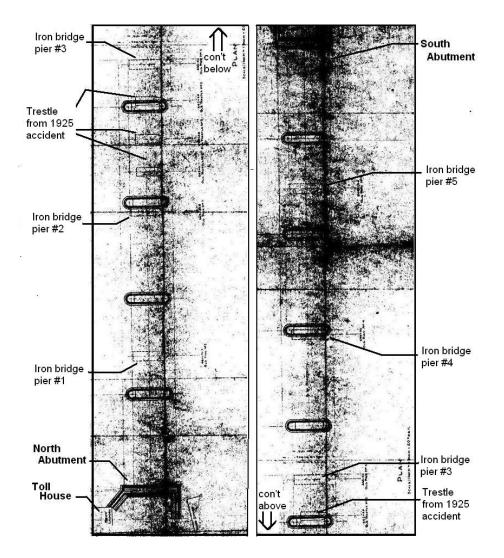


Figure 9: Pier placement showing location of 1875 iron bridge piers and the span destroyed in the 1925 truck accident. Source: MTO drawing 1927



⁹ Canadian Engineer, Dec. 20, 1927

2.1.4 Present Bridge

The currently extant Argyle Street Bridge was designed by A. B. Crealock, bridge engineer for the Department of Highways (Plate 2). The contractor was Randolph MacDonald Co. Ltd. of Toronto. Demolition of the iron bridge and the completion of the new bridge were undertaken in the 1927 construction season. Highway traffic was carried by a temporary trestle structure built beside the bridge.

Concrete for the piers was first poured on July 8. Pouring the trusses began on August 16, and the last span was completed in early October. The bridge was opened on November 19, two weeks before the scheduled completion of November 30. The structure had been built in 140 working days. The superintendent for the contractor Randolph Macdonald Co. Ltd. enthused that "this is a record for this type of bridge and the contractors deserve credit for speedy construction and excellent workmanship."¹¹

Construction material comprised of 2,400 yd³ of concrete, of which 1,200 yd³ were reinforced by 176 tons of steel. The steel requirements were shared between two Hamilton companies. Reinforcing steel for the floors and



Plate 2: A. B. Crealock. Source: Canadian Engineer June 7, 1932

sidewalk was furnished by Burlington Steel Co. Ltd. while that for the arches and bottom cords came from the Steel Company of Canada Ltd.¹²

The spans rested on two abutments and eight piers. The pier foundations were excavated from four to five feet below the bed of the river, in order to obtain solid bedrock. Coffer dams were constructed for each pier. Pumping was a costly item because of leakage caused by the fractured nature of the surface rock.¹³ As it turned out, over time water leached out gypsum deposits in the rock. A detailed foundation investigation undertaken in the 1990s determined that the bedrock under the piers had become highly weathered and fractured due to the dissolved gypsum layers which created voids under the piers.

A gala two day event was held to celebrate the completion of the bridge, including a dance sponsored by the fire brigade. On Saturday a crowd gathered to hear the speeches of provincial officials (which were continued later in the Opera House), and a procession led by the Caledonia Citizen Band was the first to cross the new bridge, while the first car carried the wife of the contractor.¹⁴

The original structure was built without any deck lighting. Lights were added at a later date. A series of extensive repairs were completed in 1984. The expansion bearings were replaced. A new deck and drains were installed. Expansion joints were built into the concrete handrails. Deteriorated concrete was replaced throughout the structure. New "heritage" light standards were installed.

A subsequent "bridge deck condition survey" determined that much of the concrete installed had begun to delaminate and spall. Problems were identified in the hangers, tie-girder (bottom cord) deck, and, to a lesser extent, in the abutments, piers, and wing walls. A foundation investigation determined that the bedrock under the piers had become highly weathered and fractured. Finally, a structural analysis indicated the most parts of the trusses were overstressed under modern loadings. It was the identification



¹⁰ Barbara Martindale. *Caledonia – Along the Grand River*.

¹¹ DHO Annual Report 1927-28; Canadian Engineer Dec 20, 1927

¹² Canadian Engineer Dec 20, 1927.

¹³ Canadian Engineer Dec 20, 1927.

¹⁴ Barbara Martindale, *Caledonia -- Along the Grand River* (1995).

of these conditions that lead, in part to the detailed study of the future of the bridge. Due to the deteriorating bridge condition, MTO posted a load restriction in February 2002.

2.2 Historical Context of Concrete Bowstring Truss Bridges

2.2.1 Bridge Building in Ontario

Construction of the Argyle Street Bridge fits within the most recent era of a general three-phase chronology of bridge building in Ontario. The first phase, up to 1870-1880, was the "pioneer" era typified by the use of timber in relatively simple structures that could adequately handle the small wagon loads of the era. The first Caledonia bridge was an example of a long timber structure of this era. Most bridges were considerably smaller and less sophisticated in design (see Figure 6).¹⁵

The second era of bridge building consisted of composite wood and iron, or all-iron (later steel), trusses. The ability to build these bridges was indicative of cost reductions in iron and steel by the end of the century. Iron bridges were more permanent than timber structures and could be designed for longer spans and heavier loads. This era extended from about 1880 to the First World War. The 1875 iron bridge at Caledonia was a typical example of the early use of wrought iron construction (see Figure 8).

The third phase, and one that we are still in, was driven by the immense impact of the automobile on bridge demands. By the 1920s, motor vehicle traffic had become an important part of Ontario's transportation infrastructure. Vehicles had become affordable and offered considerable benefit in moving people and goods. Motor vehicles were placed significantly heavier stresses on roads and bridges. They were heavier – especially loaded trucks – than horse-hauled wagons.

The public demand for better bridges, and roads, actually predated the rise of the motor vehicle. By the 1890s, shippers were looking for alternative methods to the monopoly of railways. A new fad in bicycling drew public attention to the abysmal state of roads outside of urban areas. In 1894, a *Goods Road Association* was established in Ontario, and, in 1896, the first provincial highway commissioner was appointed within the Department of Agriculture.

Thus, when motor vehicles entered the picture, the groundwork was set for a new era of bridge construction. Many of the new bridges required where steel trusses. However, concrete was becoming a viable alternative.

2.2.2 Concrete Bowstring Truss

In any truss design, whether wood, steel or concrete, the truss contains a combination of compression forces (the tendency to crush) and tension forces (the tendency to rip apart). Each material has characteristics that have to be taken into account in order to make an efficient structure. Concrete is a very good material in compression and not in tension. Steel performed well with both forces.

Since structural concrete was a new material at the beginning of the 20th century, new designs had to be developed to utilize the material. The first design was the simple arch; a design that had been used in stone for millennia (Figure 10). An arch when restrained by the abutments is in compression and hence concrete was an appropriate building material. The first reinforced concrete deck-arch bridge in Ontario

¹⁵ See David Cuming *Discovering Heritage Bridges on Ontario Roads* for more details on these three bridge eras.

was completed in 1906. This bridge, still in existence, is 92 feet long and spans the Aux Sables River at Massey.

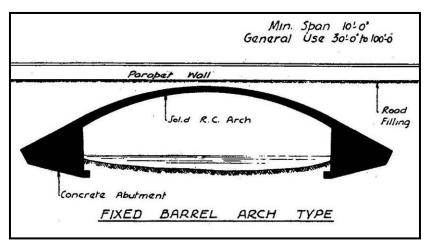


Figure 10: Generic design of a concrete deck arch. Source: Legatt, Design and construction of Reinforced Concrete Bridges (1948).

A subsequent development was the concrete bowstring arch (Figure 11). The challenge in designing a bowstring truss was that the bottom cord was in tension (like the string of a bow) which is unsuitable for concrete. To over come this tendency, the deck structure is heavily reinforced with steel. Over time it has been known by a variety of names: Concrete Tied-arch; Rainbow arch (in the United States); Concrete Bowstring girder; Concrete Bowstring truss; and Concrete truss.

The main advantage of the bowstring arch was in comparison to the concrete deck arch. A deck arch requires a relatively high crown in relation to the span. As the span becomes longer, the arch becomes taller. Thus the road surface of a long-span, deck arch over a river, railway or road would be unnecessarily (and expensively) high. The bowstring placed the arch over the deck and hence could be as low as necessary to the obstacle being crossed.

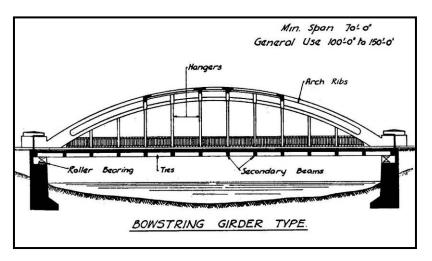


Figure 11: Generic design of a bowstring truss. Source: Legatt, Design and construction of Reinforced Concrete Bridges (1948).



The bowstring arch had a similar advantage over concrete beams which had also been developed about the same time (Figure 12). As the beam span became longer, the depth of the beam also increased. In the case of a bowstring, the arch is "tied" in tension by the bottom cord beam. This beam could be thin because reinforcing steel contained the tensile forces.

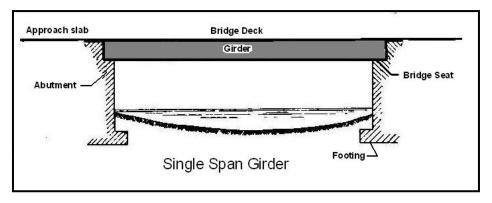


Figure 12: Generic design of a girder span. Source: Legatt, Design and construction of Reinforced Concrete Bridges (1948)

The first concrete bowstring arch was built in France by the engineer M.A. Considère, in 1904. The first in North America was at Nashville Tennessee in 1908. This was a hybrid structure in which the bridge approaches were the concrete truss, while the actual span over the river was a steel truss.

The first concrete bowstring in Canada – and possibly the first true use of the design in North America – was completed in 1909 on the Middle Road over Etobicoke Creek in what is now Mississauga (Plate 3). The structure has a 79-foot span and a 16-foot roadway. Remarkably, it survives today.



Plate 3: Canadian prototype of the concrete bowstring, Barber and Young, 1909. Source: Andreae, 2006.



The bowstring arch was less popular in North America than in Europe, primarily due to cheaper European labour costs. Building the formwork, installing the steel reinforcing bars, and placing concrete in bowstrings were labour intensive activities. American engineers were also more cautious of the design because of the tensile forces contained in the bottom cord. The issues were summed up in one paragraph by the well-known, American bridge engineer, George Hool in 1928:¹⁶

Many engineers have considered the trussed- or bowstring-girder type in reinforced concrete to be a somewhat questionable type of construction, on account of the greater difficulty in constructing the forms, in depositing the concrete, and in making connections in the reinforcement; and also because some members are subjected to direct tensile stress. Notwithstanding these disadvantages, however, there are many cases where such types are more economical than solid webbed girders, and many fine examples of successful applications of these types are found throughout Europe. They, of course, are never preferred to the arch, and their use is limited to those cases where conditions make arch construction impracticable on account of limited under-clearance over waterways, highways, or railways; or where unstable foundation conditions exist.

Thus, while the concrete bowstring design had a relatively short era of popularity in the 1920s in North America, Europeans continued to use the design well into the 1930s.¹⁷

Actually, the design continued to be used in North America into the 1930s, specifically because it was so labour intensive. The 1937 Borden Bridge across the North Saskatchewan River, was completed as a Depression-era, make-work project. It consisted of two 205-foot spans, and a centre 213.5-foot span.

In Ontario, the history of the bowstring arch immediately after Barber and Young's 1909 bridge is unknown. The design was used for the major river crossings on the Toronto-Hamilton Highway at the end of the First World War. The longest were the 119-foot Twelve Mile Creek (Bronte) and the Etobicoke Creek Bridges completed in 1919.¹⁸

Despite the greater cost of bowstring arches over other designs, some were built by municipalities. Wellington County is unique in the province due to the large number of such bridges; at least 12 and possibly up to 20 were built. They are relatively short – few were more that 80-90 feet long – and built from about 1915 to the mid-1930s.¹⁹

The Ontario Department of Highways was late to adopt the design and then used it for only a few years. The reason for this is not clear, but it may be that A. B. Crealock, the Department's bridge engineer, held the conservative views expressed in Hool's quote, above. The Department's first bowstring bridge was completed over the Grand River, at Freeport, in 1926. The structure was 502 feet 4 inches and consisted of seven 72-foot spans (Plate 4). The following year three were built at Caledonia – the subject of this report – a 104 feet 8 inch span at Delhi, and two spans of 119 feet each at Plantagenet. These structures were designed under the direction of A. B. Crealock.²⁰

²⁰ DOH *Annual Report*, 1927-27, 1928-29; after leaving the provincial government, Crealock continued to work as a consulting engineer. Among his later work was a 1932 two-span concrete bowstring arch over the Grand River at Galt. A.B. Crealock "Reinforced Concrete Bridge at Galt, Ont." *Canadian Engineer* June 7, 1932



¹⁶ George Hool, *Reinforced Concrete Construction, Vol II Bridges and Culverts*. New York: McGraw-Hill, 1928. p633-35.

¹⁷ A.W. Legatt, *Design and construction of Reinforced Concrete Bridges*. London: Concrete Publications Limited: 1948 p.511

¹⁸ "Canada's Longest Reinforced Concrete Trusses," Canadian *Engineer* April 3, 1919.

¹⁹ Cuming, D.; *Discovering Heritage Bridges on Ontario's Roads*, Boston Mills Press, 1983.



Plate 4: Freeport Bridge, Kitchener, Nov. 2007. Source; Andreae

When Crealock retired in 1927, he was replaced by Arthur Sedgwick.²¹ Sedgwick continued to build bowstring bridges, and, during 1928-29, the Department constructed 11, most in the 50-60 foot range. But these seem to have been the last ones built by the Department of Highways.²²

The design's demise was partly due to an overall slowdown in bridge construction during the Depression. Although the Department used highway construction in general for relief work, it did not use labour intensive bowstring arches.

Sedgwick introduced the use of the rigid-frame structure into the Department in 1931 when the first such bridge was completed. It was seen as replacing primarily concrete beam bridges up to 60 feet. But as the ability to design longer spans improved, it could also replace bowstring arches.²³

As noted earlier, the concrete bowstring arch did have significant shortcomings. Labour costs of erection were more than for other designs. Equally damming was that the bowstring arch was a through-truss. The deck could not be widened to meet increased traffic needs. By contrast, a rigid-frame bridge, being a deck structure, could be readily widened. Even in the 1930s, the growth of automobile traffic was such that the Department of Highways bridge engineer had to anticipate that structures on major roads would have to be widened long-before the bridge was structurally obsolete.

A curious feature of the Caledonia bridge was it seemingly conservative use of nine, short, 72'7"-foot spans. By then, spans of up to 119 feet had been used in Ontario. Even the previous iron bridge at Caledonia had used 105-foot spans.

 ²³ Arthur Sedgwick, "Design of Reinforced Concrete Highway Bridges in Ontario," *Canadian Engineer* March 10, 1936.



²¹ After leaving the provincial government, Crealock continued to work as a consulting engineer. Among his later work was a 1932 two-span concrete bowstring arch over the Grand River at Galt. A.B. Crealock "Reinforced Concrete Bridge at Galt, Ont." *Canadian Engineer* June 7, 1932

²² DOH Annual Report, 1928-29

Shorter spans required more piers and, in the case of a concrete bowstring, more costly formwork. The new concrete bridge at Caledonia required eight piers compared to the five in the iron bridge. The use of short multiple spans suggest a conservative design philosophy. The Department's Freeport and Bridgeport bridges near Kitchener also employed a similar design.

One explanation for using short, multiple spans can be offered by the longest, multiple-span, concrete bowstring truss bridge in North America (Plate 5). The 11-span 1,100 foot bridge over the South Platte River at Fort Morgan, Colorado was completed in 1923. One reason for using multiple, 100-foot spans was that the bridge could be more readily repaired if the flood-prone river knocked out one (or more) of the spans.²⁴ The Grand River was also a noted for its floods.

The Fort Morgan bridge was also built to demonstrate the versatility of concrete in Colorado. This was hardly a necessary reason in Ontario. But the bridge was also designed, in part, because of the aesthetics of the design. Here too, the Caledonia bridge seems to have been conservatively designed.

The form of an arch is generally perceived as a pleasing shape. The bowstring arch has an inherent attractiveness lacking in, say a concrete beam. The arch height to span length ratio was a variable that could be adjusted to suit the designer's preference. It is probably for this reason that the bridge contractor congratulated Crealock in 1927 for his "rare genius in being able to weave in the beautiful and picturesque, at the same not losing sight and strength and permanence."²⁵ Crealock used a low ratio for his truss design. Other bridges by contrast, could be relatively tall in relationship to length (compare Plate 6 to Plate 8).

Plate 5: Eleven-span Rainbow Arch Bridge, over the South Platte River, Fort Morgan, Colorado. The bridge has been used since 1995 as a pedestrian bridge. Source: <bridgehunter.com>

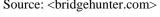




Plate 6: Piercey's Bridge (1933), Wellington County. Source: Andreae, 2005.

The plastic nature of concrete prior to

hardening lends itself very well to architectural treatment. Panels, chamfers, and rosettes were among the designs often moulded into bridge components. In this area, the Caledonia bridge is very plain (compare Plate 7 to Plate 17).



²⁴ Correspondence with curator, Fort Morgan Museum, September 12, 2007.

²⁵ Canadian Engineer Dec 20, 1927.



Plate 7: Decorative panels and concrete detailing on Piercey's Bridge. Source: Andreae, 2005.



3.0 INVENTORY OF RESOURCES

3.1 Argyle Street Bridge (Plate 8)



Plate 8: Looking north east toward the Argyle Street Bridge, 2007, showing seven of the nine spans.

3.1.1 Abutments

The bridge abutments are at right angles to the bridge structure. They are essentially all identical in design. The top of the abutments are about a metre above the flood plain. On the south side, the approach road has been filled so that there is no perceptible slope at the bridge. However, on the north side, there is a steep grade from the bridge down to the level of the flood plain and main commercial section of Argyle Street.

The wing walls are at right angles to the south bank abutment. The abutment has been armoured in recent years with large concrete blocks. A pedestrian underpass has been built under the deck, adjacent to the abutment wall. The wing wall on the west side of the north abutment has also been built at right angles to the abutment. The east wing wall was constructed at an angle to connect with the curb and sidewalk on Argyle Street (Plate 9).

3.1.2 Piers

Eight identical concrete piers were built. The bridge trusses rest on pier caps, or seats, on the top of the piers. This design provided a gap under the floor beams for the installation of utilities. The pier foundations are set on bed rock. Stable rock was found about $1-1\frac{1}{2}$ m below the river bed. Both the upstream and downstream end of the piers were rounded and built with a slight batter (Plate 10).





Plate 9: Abutment, south side.



Plate 10: Pier detail with spread footing just visible below the surface.

3.1.3 Trusses

Each span is 72' 7" (21.1 m) long and constructed of two concrete, bowstring trusses. Ten hangers connect the top, arch beam, or cord, with the bottom cord (Plate 11 and Figure 13).

The arch appears to be segment of an ellipse rather than a circle. The arch has a low height to length ratio which gives the appearance of a low, flat arch. The beam is heavy with a width of two feet and a depth of 2' 4". The bottom cord is cast as an integral component of the deck, floor beams and arch. The bottom cord is relatively less massive than the arch cord because the tensile strength of the beam is carried by reinforcing steel.

The hanger locations and support posts of the pedestrian railings line up with the floor beams. These beams cast as an integral part of truss. They are cantilevered outside the trusses to support the sidewalks (Plates 12 to 14).

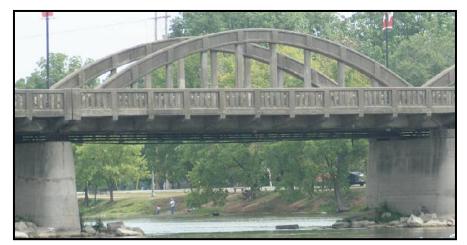


Plate 11: Noth elevation of truss and piers.



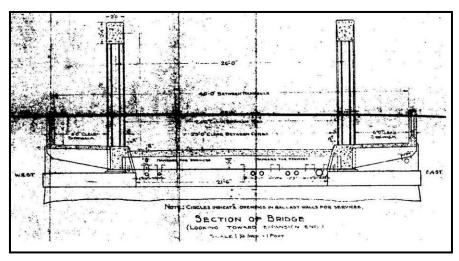


Figure 13: Cross section of bridge, 1927 drawing.



Plate 12: Bottom cord with floor beams under deck and cantilevered under sidewalk. A modern utility tray is on the right. Old utility hangers in floor beam on left.



Plate 13: Cantilevered sidewalk and railing. Showing also modern bridge lighting. West side of bridge, looking north.

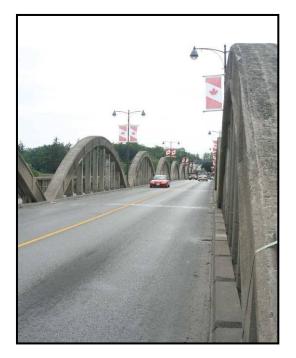


Plate 14: Sidewalk cantilevered outside the truss.



3.1.4 Deck Structure

The two lane roadway is 23 feet (7.1 m) wide and the two sidewalks are each six feet (1.8 m) wide. The overall width of bridge, taking into account the thickness of the trusses and railing is 41'8" feet (12.7 m). The deck slab is cast on top of floor beam connecting the two trusses. The sidewalk hand-rail is four feet (1.2 m) high (Plate 15).

3.1.5 Bearings and Expansion

The spans were constructed as independent structures. Expansion joints were installed between each span (Plate 16). The trusses were supported on bearings of unknown construction.

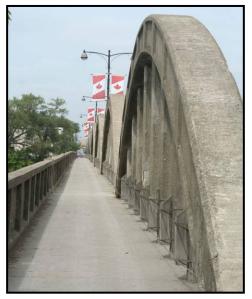


Plate 15: Bridge deck, showing visual gateway and effect of concrete arches in a through-truss design.

3.1.6 Lights and Utilities

Light standards are mounted on bases for every other arch (Plate 16). These bases alternate on each side of the bridge. The concrete light pads do not appear to be original but added at a later date. The existing light standards were erected in 1984

Originally hangers were cast into the floor beams to support utilities under the bridge. At some recent date, the utilities were relocated to a trough.

3.1.7 Miscellaneous

The concrete detailing on the bridge is very plain. On the trusses, the only detail was to cast recessed panels between the points of intersection of the hangers. The pedestrian railings were devoid of any ornamentation (Plate 17).

3.1.8 Condition

Visually, from a cultural heritage perspective, the bridge appears to be in good condition. Spalling of the surface concrete does not affect the heritage value of the deck. No significant features of the original 1927 design have been



Plate 16: Truss detail with light base and expansion joints.



Plate 17: Concrete detailing of arch and hangers.



removed. At some later date, bridge lighting was added.

3.2 Adjacent Structures

3.2.1 Toll Keeper's House

The former 1875 toll keeper's house is located at the southeast abutment of the bridge (Plates 18 and 19). The building was designated under Part IV of the *Ontario Heritage Act* in 1988.

Due to close proximity to existing bridge and association with previous bridge, it is a distinct part of the built form of the bridge. The location of the building provides a tangible link to the previous iron bridge. The toll house is located at the grade level of the bridge and not at the flood plain level of Argyle Street. It is a red and buff brick Ontario Gothic revival structure with decorative elements including buff brick quoins and voussoirs and substantial twin chimneys.



Plate 18: Toll House from Argyle Street



Plate 19: Toll House from River. Note also the angled wing wall.

3.2.2 Argyle Street

Argyle Street North between the bridge and the intersection with Caithness Street is a largely unbroken stretch of 19th and early 20th century commercial buildings (Figures 14 and 15; Plate 20).

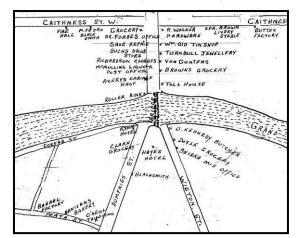


Figure 14: Map of Caledonia, c. 1880-1890. Source copied from Caledonia Tweedsmuir History.

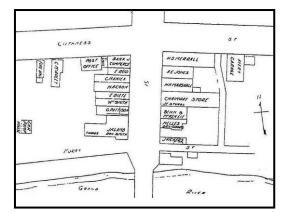


Figure 15: Plan of commercial district in Caledonia, c.1950. Source: Alex Areell, A Short History of Caledonia. Caledonia, Ont.:





Plate 20: Argyle Street North lookng south to the bridge.

The architectural character of the east and west sides of Argyle Street North are noticeably different. The east side includes the former bridge toll-house and no building is newer than 1927 (Plates 21 to 28).



Plate 21: #4 Argyle Street North (1875).



Plate 22: #8 Argyle Street North (1900/10)



Plate 23: #12 Argyle Street North (1870/80s)



Plate 24: #14 Argyle Street North (1860/70s).





Plate 25: #20 Argyle Street North (1927)



Plate 27: #26 Argyle Street North (?)



Plate 26: #22 Argyle Street North (c.1890/1910?)



Plate 28: Argyle Street North (1870/80s)

The west side contains four remaining early 20th and 19th century commercial buildings (Plates 29 to 34). Two modern (post-1960) bank buildings now have long facades on Argyle Street. The Bank of Commerce occupied a smaller building on the corner in 1950. When the present building was constructed (Plate 34), the adjacent shop to the south was also demolished and the site used for the new bank. The Scotia Bank (Figure 29) replaced two older buildings. A gap in the façade between the bridge and the Scotia Bank Building, which is now used as a driveway access to a parking lot, once contained a building. The structure built in 1880 and once used as a roller rink, collapsed under a snow load in 1940.²⁶



²⁶ Corlis, *Caledonia*, 20.



Plate 29: #11 Argyle Street North (modern)



Plate 30: #15 Argyle Street North (1880/90s)



Plate 31: #17 Argyle Street North (1880/90s)

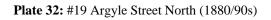




Plate 33: #21 Argyle Street North (1990s)



Plate 34: Argyle Street at Caithness (1870/80s)



The buildings along Argyle Street are architecturally and functionally distinctly different at the north and south approaches to the bridge. Whereas north of the bridge is commercial, Argyle Street South, at the bridge, is lined with a few late-19th and early-20th century residences (Plates 35 to 37).



Plate 35: #11 Argyle Street South (1890s?)



Plate 36: #15 Argyle Street South (1860/70s)



Plate 37: #17 Argyle Street South (1920s)

3.3 Cultural Landscape

3.3.1 Land Use Activity and Settlement Clusters

There are three visually distinct land uses adjacent to the bridge. On the north side, commercial activity is present along Argyle Street. On the south bank the land use is residential. The third activity is recreational, consisting of walking paths on both banks of the river and small parks at each end of the bridge (Plates 38 to 41).





Plate 38: Argyle Street South looking north to bridge. #11 Argyle Street South is on the right.



Plate 39: Kinsman's Park, north end.



Plate 40: Memorial Park, south end.



Plate 41: Flood dyke on north bank, looking east to toll house in background.

3.3.2 Patterns of Spatial Organization

The 1844 survey of the Caledonia town plot laid out roads along both banks of the Grand River. The trail on the north bank was used as a tow path for barges using the Grand River Navigation Company's canal. This type of river road is relatively uncommon in southern Ontario. As a result, the banks of the Grand are publicly accessible. The bridge is highly visible from these routes.

The former tow path on the north side has been raised and converted into a flood protection dyke. The top of the dyke is a pedestrian walkway. The trail on the south side has become both a pedestrian trail and a separate roadway. This trail is known as Ramsey Walk upstream of the bridge and the Patterson Riverwalk downstream. The two trails are connected with a pedestrian underpass below the bridge.

The town of Caledonia began on the north side of the river after the Hamilton-Port Dover Plank Road was completed. The north side remained the commercially important side of the river until well into the 20th century.



3.3.3 Response to Natural Environment

The Grand River is very wide at Caledonia. The flow of water was a source of power and stimulated the industrial growth of the community. The river is subject to large variations in flow. In summer, low water can make the river almost crossable on foot. In flood conditions, the water rises almost to the height of the bridge deck.

To protect the bridge, the existing structure was built on tall piers designed to stand above the maximum flood level.

Dyke construction was undertaken at the end of the 20th century to protect the commercial section on the north side. The walking trail was paved on top in 1985 when lighting and benches were installed. No similar dyking was undertaken on the south bank.

3.3.4 Circulation Network

The remnant tow path at the bridge is an indication of the former commercial importance of water traffic. The dam upstream of the bridge was originally part of the canal project.

Construction of the Hamilton and Port Dover Plank Road was the actual stimulus to Caledonia's 19th century growth. In the late 20th century, motor vehicle traffic through the town was predicted to increase with the industrial development at Naticoke and the associated new town of Townsend. A highway bypass was constructed to the west of Caledonia redirecting traffic away from the town centre.

Completion of the Buffalo and Lake Huron Railway in 1856 and the Hamilton and Port Dover Railway in 1875 ensured



Plate 42: Canadian National Railway (former Port Dover & Lake Huron) bridge just upstream of the Argyle Street Bridge. The dam was source of power and water control to enable navigation. The former locks are located behind the trees on the right.

the continued growth of the community, and the ultimate demise of river navigation (Plate 42).

3.3.5 Boundary Demarcation

A variety of boundaries are visible in the vicinity of the bridge. The most pronounced are the Grand River's shorelines. Forfar Street and the pedestrian walkway on the south bank provide a boundary between the residential, institutional uses and the river. The dyke on the north shore provides a similar visual function.



3.3.6 Vegetation Related to Land Use

The river banks are lined with mature deciduous trees (Plate 43). These have regenerated naturally rather than having been planted with any design in mind. It appears that a deliberate tree planting program has been used on the south bank. The two parks at either end of the bridge have been planted with flowers.

3.3.7 Buildings, Structures and Objects

The Argyle Street Bridge is obviously the central built feature of the landscape. The second most important structure is the Toll Keeper's cottage. The contrasting commercial buildings on the north side with the residential development on the south side are key massings of structures. Other features, such as the Grand River Mill (Plate 44), dam and railway bridge are further removed from the focus of the landscape

3.3.8 Archaeological Sites

There are no known archaeological sites in the vicinity of the bridge. A Stage 1 archaeological assessment of lands immediately adjacent to the bridge, which was conducted by ASI in 2003, concluded that disturbances have been extensive and intensive throughout the study area, defined as the footprint of the existing bridge.

3.3.9 Small Scale Elements

Four commemorative plaques are installed on, or adjacent to the bridge. These plaques are evidence of the community focus of the bridge (Plates 45 to 48).

A set of stairs lead from the top of the flood dyke to the Grand River below the north bridge abutment. This seems to be an unfinished project of landscaping, because the steps do not terminate at a feature. The steps were built by the County of Haldimand (Plate 49).



Plate 43: Toll House from River and shoreline vegetation.

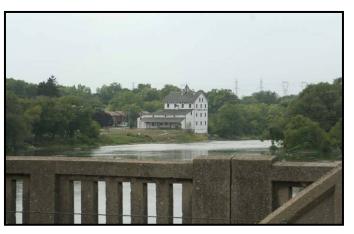


Plate 44: Grand River Mill just upstream of the Argyle Street Bridge on the south bank.

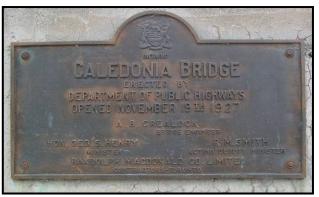


Plate 45: Plaque on north end of bridge commemorating its completion.





Plate 46: Commemorative plaque for the Toll House.



Plate 48: Commemorative plaque for the Patterson Brothers Riverwalk.



Plate 47: Commemorative plaque for the Kinsman Park.



Plate 49: Stairs leading from Kinsmen's Park to river at the north abutment.

3.4 Viewsheds

The most varied views *of* the bridge and *from* the bridge are on the west side. Views of the bridge are almost continuous on the north and south banks from Argyle Street upstream to the dam (Plates 50 and 51). The north bank views are roughly from the alignment of the 1830-40s tow path. On the south bank they are available from Forfar Street which rises up the river bank in the vicinity of the railway bridge (Plate 52).



Plate 51: View from dam upstream of the bridge.





Plate 52: View looking upstream from east end of Fair Ground. The river is publicly accessible from both sides of the river.

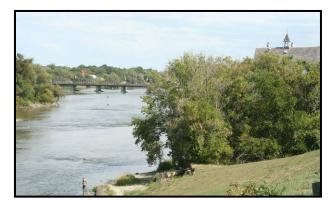


Plate 53: View of the bridge from Forfar Street near the railway bridge; with Caledonia Mill on the right.

3.4.1 Canadian Heritage Rivers System

The Grand River was declared a Canadian Heritage River in 1994. To be designated as a heritage river, the candidate river must meet one or more of the "Heritage Value Guidelines" (Natural Heritage Values, Human Heritage Values and Recreational Values). Human Heritage Values will be recognized when a river environment meets one or more "Integrity Guidelines". One guideline states that human heritage value will be recognized if a river environment:²⁷

• Contains historical or archaeological structures, works or sites which are unique, rare or of great antiquity

The Grand River Conservation Authority (GRCA) completed a management plan, *The Grand Strategy* in 1993 to establish boundaries of the river management area and set out policies and practices to be followed by the Authority. The Human Heritage Values of the Grand River included:

- the cultural mosaic or number of groups which have settled and retained their culture since the mid-nineteenth century through settlement patterns, buildings, arts, and events; and
- the significant concentration of nineteenth century factories, mills, foundries, dams, canals and other artifacts of industrial heritage.²⁸

The Caledonia bridge is associated with and represents both these themes. Additionally, *The Grand Strategy* identified several Central Goals and Guidelines for Action. One goal is: ²⁹

To strengthen, through shared responsibility, the knowledge, stewardship and enjoyment of the heritage and recreational resources of the Grand River watershed.

A complementary Guideline for Action is to:



²⁷ The Canadian Heritage Rivers System: Objectives, Principles and Procedures, 15

²⁸ The Grand Strategy, Appendix Supporting Information, 37.

²⁹ The Grand Strategy, Appendix Supporting Information, 27.

Acknowledge, promote and strengthen existing partnerships and programs which recognize, protect, and enhance heritage and recreational resources.

Considerations of alternatives should clearly have regard for the spirit and intent of the Canadian Heritage River Program as articulated in the GRCA *The Grand Strategy*.

4.0 STATEMENT OF HERITAGE VALUE

4.1 Ontario Heritage Bridge Program and the Ontario Heritage Act

The *Ontario Heritage Bridge Program* contains Heritage Bridge Evaluation Criteria (Table 1). The most recent revisions to the *Program* were undertaken in 1991. ASI scored the Argyle Street Bridge in 2005 as 80 out of a possible 100 points. Any bridge scoring more than 60 points is eligible for listing as a heritage bridge.

Table 1: Ontario Bridge	Table 1: Ontario Bridge Program, Heritage Bridge Evaluation Criteria				
Criteria		Numeric Score Max. ASI			
Documentation:	Builder	6	4		
	Age	14	6		
Technology	Materials	4	4		
	Design/Style	16	16		
	Prototype	10	0		
	Structural Integrity	10	10		
Bridge Aesthetics and	Visual appeal	12	12		
Environment	Integrity	4	4		
	Landmark	6	6		
	Gateway	4	4		
	Character	4	4		
	contribution				
Historical	Historical Association	10	10		
TOTAL SCORE		100	80		

In 2005, the *Ontario Heritage Act* was revised to provide municipalities and the province with enhanced powers to conserve Ontario's heritage. With regards to the evaluation of the Argyle Street Bridge, Part III.1, *Standards and Guidelines for Provincial Heritage Properties*, was added to the *Act*. This section permits MCL to prepare heritage standards and guidelines for provincially owned properties that are deemed to have cultural heritage value or interest. Regulation 9/06 was prepared to provide *criteria for determining cultural heritage value or interest* (Figure 16). The *Act* redefined the term *heritage attributes* and stated that an analysis of a property had to include a statement of heritage value and a description of its heritage attributes.

Since this EA is guided by both the *Ontario Heritage Bridge Program* and the revised *Ontario Heritage Act*, the criteria of the *Program* and *Act* have been integrated as follows:

• The *Program* criteria of <u>Documentation and Technology</u> have been combined into the *Act* criterion of <u>(1) Design Value or Physical Value</u> but the *Program* subheadings (Builder, Age Materials, etc) have been retained.



- The *Program* criteria of <u>Historical Association</u> is unchanged from that of the *Act* criterion of (2) <u>historical value or associative value.</u>
- The *Program* criteria of <u>Bridge Aesthetics and Environment</u> have been combined into the *Act* criterion of (3) contextual value but the *Program* subheadings (Visual Appeal, Integrity, etc) have been retained.

Cultural Heritage Values 1. (2) A property may be designated under section 29 of the [Ontario Heritage] Act if it meets one or more of the following criteria for determining whether it is of cultural heritage value or interest: The property has design value or physical value because it, 1. is a rare, unique, representative or early example of a style, type, i. expression, material or construction method, ii. displays a high degree of craftsmanship or artistic merit, or demonstrates a high degree of technical or scientific achievement. iii. 2. The property has historical value or associative value because it, has direct associations with a theme, event, belief, person, activity, i. organization or institution that is significant to a community, yields, or has the potential to yield, information that contributes to an ii. understanding of a community or culture, or demonstrates or reflects the work or ideas of an architect, artist, builder, iii. designer or theorist who is significant to a community. 3. The property has contextual value because it, is important in defining, maintaining or supporting the character of an area, i. ii. is physically, functionally, visually or historically linked to its surroundings, or iii. is a landmark.

Figure 16: Ontario Heritage Act - Regulation 9/06: Criteria for determining cultural heritage value or interest

4.2 Analysis of Cultural Heritage Values

4.2.1 Design or Physical Value

The Argyle Street Bridge has design or physical value because of:

Builder: Original design drawings exist and the construction of the bridge was described in technical literature. Both the bridge engineer, Ontario Department of Highways bridge engineer A. B. Crealock, and the contractor, Randolph MacDonald Co., are known.

Age: The construction date of 1927 coincided with the major era of concrete bowstring arch construction in Ontario.

Materials: Concrete was well understood as a bridge building material by the mid-1920s.



Little ornamentation was used in the bridge despite the ability of concrete to be easily cast.

Design/Style: The concrete bowstring truss reached its peak of popularity in Ontario during the 1920s. However, less that a dozen were built by the Department of Highways. The truss design used at the Argyle Street Bridge is representative of the era and type.

The bridge is one of the few remaining examples of concrete bowstring trusses in Ontario. The demolition of this design has accelerated in recent years as the structures reach the end of their useful life.

The design of the sidewalks, cantilevered beyond the bridge deck and outside the trusses, has increased in value over time. The separation of vehicle and pedestrian traffic by the trusses, makes walking on the bridge more comfortable.

Prototype: The Argyle Street Bridge is a rare example of using the bowstring truss as a series of multiple arches to produce a long bridge. Of the three known to have been built in Ontario, this bridge is the longest, at nine spans. The bridge is believed to be the longest such structure in Canada, but a longer one, with more spans, exists in Colorado.

The short-spans (72' 7") of the arches used in the Argyle Street Bridge, is essentially a very conservative design. Spans of over 100 feet had been built previously in Ontario. No documentation was found to indicate why a short-span, multiple arch design was selected for this crossing.

Structural Integrity: Apart from ongoing maintenance, the bridge is essentially unchanged since it was completed in 1927. The only identified later addition was the installation of street lighting.

4.2.2 Contextual Value

The Argyle Street Bridge has contextual value because of:

Visual Appeal:	The low span to height ratio of the arches and the use of multiple spans accentuates the length of bridge. The brown/grey earthy colour of the concrete blends in with the vegetation along the shore. The distinct, concrete bowstring arch design conveys a sense of age.
Integrity of Landscape:	The bridge is on the location of the earlier 1875 structure. The alignment of the 1842 plank road can be seen in the bend in Argyle Street at the south embankment.
	Alterations to the present bridge have been made sympathetically over time, and the shoreline and townscape have remained largely unchanged since the bridge's construction in 1927. In addition, the banks of the shore has have been designed within the last two decades to give greater pedestrian movement through the landscape and to aid in the appreciation of the view sheds.



Landmark:



Plate 54: Masthead of the Grand River Sachem.



Plate 55: Pedestrian bridge near the Caledonia Dam.



Plate 56: Entrance sign to Caledonia.

Gateway:

Character Contribution:

The Argyle Street Bridge is a landmark within Caledonia both because of its physical prominence in the landscape and because of the high public awareness of the structure.

- *Physical Prominence*: Access to views of bridge from the shore created by the original town survey and early use of navigation on the Grand which created public rights-of-way along each shore. As a result, the shoreline is highly accessible, and the bridge is quite visible from Forfar Street. The shoreline on both sides of the river has been enhanced in recent decades as linear parks. The old tow path, now covered with the flood prevention dyke and walkway, extends from the bridge to the Caledonia Dam.
- *Public Perception*: Small commemorative parks have been established at each end of the bridge. Although they were not built specifically to commemorate the bridge, their location at the bridge is an indicator of a public perception of the bridge as a focal point in the community.

The listing of the Argyle Street Bridge in the *Ontario Heritage Bridge Program*, the designation of the Toll House under the *Ontario Heritage Act*, and the designation of the Grand River as a *Canadian Heritage River* are indicative of public awareness of the bridge.

The Argyle Street Bridge – specifically the bowstring truss - has become a symbolic landmark for the town, with the image emblazoned on the masthead of the newspaper *Grand River Sachem*, on tourism literature, and on signs posted at the town's limits (Plates 54 to 56).

The bowstring arch design is a through-truss structure. The tall, heavy concrete arches of the Argyle Street Bridge create a literal gateway through which all traffic must travel. The bridge is the only connection between the north and south shore in Caledonia. Despite the Highway 6 bypass to the north, Argyle Street still carries through traffic as it has done since the Hamilton-Port Dover Plank Road was completed in the 1840s.

The commercial district at the north end of the bridge came into existence because of the historic bridge crossing. This connection between the bridge and business can be seen in the 19th century commercial architecture on Argyle Street between the bridge and Caithness Street.

The site is unique given its long association with traditional pathways, the history of various bridges at this location, and the central link that the bridge provides between two village halves. The dominant 19th century commercial streetscapes and related spaces remain to some degree intact on the north end of bridge approach, while the central



feature of the landscape is the bridge itself.

The waterscape and associated bridge form a unique community cultural landscape with the bridge at its visual and historic centre. The shoreline though has been organized with the bridge as its focal point, with viewing stands and benches angled toward crossing. The combination of the heritage character of the town and the heritage character of the bridge make this crossing unique.

Viewscapes: Traditional views of the bridge are from the main approaches to the bridge, from the shore of the river, and from the river itself. Pedestrian sidewalks on either side allow for excellent scenic viewing both up and down the river (see Plates 42 and 44).

Given the bridge's low profile, it is not possible to view the bridge at a great distance. In fact, when standing near the edge of the northern side of Caledonia, it is not possible to see the river crossing until one moves to within a block of the structure. This adds to the impact of the crossing. Similarly, when approaching from the south, a bend in the road hides the bridge until the viewer is within a block of it.

The Argyle Street Bridge and its associated cultural landscape is best viewed from the banks of the shore of the Grand River, and several rest and viewing benches have been placed along the river walks to aid in the visual appreciation of the landscape.

4.2.3 Historical/Associative Values

The Argyle Street Bridge has historical-associative values because of:

Associations with person or group:	None noted
Associations with an event:	1-Grand River navigation
	2-The bridge is representative of the proliferation of road related public works projects in the province in the 1920s.
Associations with a theme:	1-The bridge crossing made in the 1840s led to the establishment and growth of the town of Caledonia.
	2-In regards to bridge design, the curious feature of the bridge was its conservative use of multiple, short span arches.
Associations with former bridges:	1-The toll house was built for the predecessor, 1875 bridge.
	2-The ramp up to the bridge from Argyle Street North dates from at least the 1875 bridge and was necessary so that the deck could be built above the flood line.



4.3 Statement of Cultural Heritage Value

The Argyle Street Bridge has cultural heritage value because it is the longest concrete multiple-span, bowstring-truss in Ontario, and possibly Canada.³⁰ Within Ontario, concrete bowstring-truss bridges were built during a short transitional era of the 1920s and early 1930s. The bridge crossing of the existing and predecessor bridges was a critical factor in the commercial growth of the town of Caledonia. The bridge is a rare survivor of the concrete bowstring truss in Ontario.

The setting, or landscape, associated with the Argyle Street Bridge is of cultural heritage value because its design and accessibility make it a visual landmark with the community. As a result of its physical prominence and age, the bridge has a high public perception within the community. The design of the bridge creates a physical sense of gateway to people entering/leaving the community.

5.0 HERITAGE ATTRIBUTES

As defined by the Ontario Heritage Act, heritage attributes are those attributes of the property, buildings and structures that contribute to their cultural heritage value or interest. This section uses the background history, the inventory of tangible components, and the cultural heritage value analysis to identify those bridge components and its surroundings that physically contribute to the heritage value of the bridge.

- 1) Significant attributes of the Argyle Street Bridge that contribute to its **design value** are:
 - Ramp up on Argyle Street to the north entrance of the bridge;
 - Extreme length of bridge to cross river;
 - Short length of each of the nine spans;
 - Two road lanes and two sidewalks cantilevered outside of trusses; and
 - Concrete, bowstring, arch; large cross section of arch, relatively slender hangers; low height-tolength ratio of arches.
- 2) Significant attributes of the Argyle Street Bridge that contribute to its **contextual value** are:
 - Extreme length of bridge to cross river;
 - Short length of each of the nine spans;
 - Roadway passing between arches of through truss;
 - Concrete, bowstring arch with low height-to-length ratio of arches;
 - The visual accessibility of the bridge from the walkway along the flood dyke on the north bank and from Forfar Street and Riverwalk on the south bank of the Grand River;
 - Two sidewalks cantilevered outside of trusses;
 - Commercial main street of Argyle Street North between the bridge and Caithness Street;
 - Residential development and open space along Argyle Street South of the bridge;
 - Parks at each end; and
 - Toll house.
- 3) Significant attributes of the Argyle Street Bridge that contribute to its **value of historic association** are:
 - Ramp up on Argyle Street to the north entrance of bridge;
 - Toll house;
 - Westerly direction change in alignment of Argyle Street at south end of bridge.

³⁰ The 1937, three-span Borden Bridge across the North Saskatchewan River has a total length of 623 feet. The nine-span Argyle Street Bridge has a total length of 652.5 feet.

PART B

ARGYLE STREET BRIDGE HERITAGE IMPACT ASSESSMENT AND MITIGATION ALTERNATIVES



6.0 **PROPOSED UNDERTAKING**

6.1 **Proposed Preliminary Design Alternatives**

The EA has assessed two design alternatives – bridge rehabilitation and bridge replacement. Bridge rehabilitation includes three possible alternatives while bridge replacement consists of two. A do-nothing alternative is not viable as it does not address the structural deficiencies of the bridge.

Building a new bridge across the Grand River at a new location in Caledonia, so that the existing one could remain is not an alternative. MTO is responsible for only the current crossing and a structure in a new location would be a municipal responsibility.

The existing bridge is two lanes. In 2004, Haldimand County recommended that the structure be widened to three lanes to accommodate future traffic requirements in Caledonia. Two of the rehabilitation options assume the bridge will remain as two lanes. All others assume that it will be widened to three, or four, lanes.

For listed heritage road bridges, the MTO/MCL *Heritage Bridge Program* (1991) ranks eight conservation options that should be considered in any proposed work. Recommendations have also been developed if it becomes necessary to replace a historic structure with a new bridge. While not true conservation options, these may be useful in certain circumstances under the EA process to preserve cultural landscape values and/or design qualities of the demolished structure.

The eight conservation options can be grouped into four categories:

- Restore existing bridge for vehicular use;
- Retain bridge for non-vehicular use;
- Relocate bridge; or,
- Demolish bridge.

The *Restore Existing Bridge for Vehicular Use* is the guiding principle behind the Rehabilitation Option discussed in Section 6.2. *Demolition* is the guiding principle behind the Replacement Option discussed in Section 6.3.

The continued use of the bridge *in situ* for *Non-Vehicular Use* is not an option for the Argyle Street Bridge. A vehicular river crossing must be retained in the same location. Building a new vehicular bridge adjacent to a preserved Argyle Street pedestrian bridge would require considerable demolition to the old commercial core of the town. Even if this extreme measure was acceptable to the community, the destruction of the historic structures and landscapes would more than offset any benefit of preserving the bridge.

While Relocation of the bridge is technically feasible – and smaller, individual concrete bowstring trusses have been moved – the sheer size of the bridge would make this mitigation option exceptionally expensive. Due to the poor structural conditions of the bridge, it seems that individual spans could not be relocated without extensive rehabilitation. The preservation of a truss, or other components of the existing bridge are considered as part of the *Demolition* mitigation option.



6.2 Bridge Rehabilitation

The proposed Rehabilitation Alternatives One and Two (Section 6.2.1) addresses the first two conservation options of the *Ontario Heritage Bridge Program:*

- Retention of existing bridge with no major modifications: This is the most suitable and appropriate conservation alternative that would satisfy the intent of retaining all of the original spans without any significant intrusions into the heritage structure.
- Retention of existing bridge with sympathetic modifications: This is an appropriate conservation alternative that would satisfy the intent of retaining all the original spans without any significant intrusions into the heritage structure.

The proposed Rehabilitation Alternatives Three (Section 6.2.2) and Four (Section 6.2.3) addresses the third conservation option of the *Ontario Heritage Bridge Program*:

• Retention of existing bridge with sympathetically designed structure in proximity: This is an appropriate conservation alternative that would satisfy the intent of retaining all the original spans without any significant intrusions into the heritage structure as well as providing a third or fourth traffic lane.

6.2.1 Alternatives 1 and 2 (RH1, RH2)

These two alternatives are essentially identical. They both consist of the rehabilitation of the existing bridge to extend its useful life for an additional 50 years. The heritage attributes of the bridge would be retained, subject to the repairs necessary to ensure the safety of the bridge and its users.

The difference between the two alternatives is in the scheduling of the bridge work over a 50 year rehabilitation program. In the case of RH1, a 20-year rehabilitation work program would be followed by a 30-year rehabilitation program. For RH2, the timing is reversed, and the 30-year rehabilitation work would be undertaken initially, followed by the 20-year activities.

6.2.2 Alternative 3 (RH3)

The RH3 alternative provides for the rehabilitation of the existing bridge as described for the RH1 and RH2 alternatives. In addition, a new, independent, one-lane structure would be constructed span on the west side of the bridge to accommodate a third traffic lane (Figure 17)

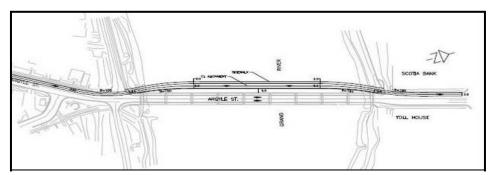


Figure 17: Rehabilitation Alternative 3; one-lane addition

6.2.3 Alternative 4 (RH4)

The RH4 alternative is similar to that of RH3 except that a two-lane structure would be constructed span on the west side of the bridge (Figure 18).

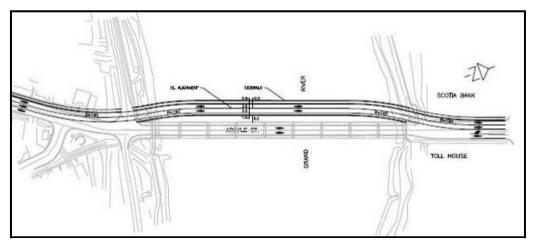


Figure 18: Rehabilitation Alternative 3; two-lane addition

6.3 Bridge Replacement

All four Replacement Alternatives (Section 6.3.1 - 6.3.4) involve the demolition of the historic bridge. The *Ontario Heritage Bridge Program* provides two guidelines when demolition is required:

• Salvage of elements/members of bridge for incorporation into new structure or for future conservation work or displays.

This option assumes that a listed bridge is not to be saved in its entirety. The existing light standards, for example, are modern. The original 1927 bridge plaque should be preserved and redisplayed in a public location (see Plate 45). Otherwise, there is little to salvage because the trusses in each span are integrated into the deck structure. Preservation of a single truss might have visual interest and potential interpretive value.

• Full recording and documentation of structure if it is to be demolished.

The most comprehensive standards for the documentation of historic bridges have been developed by the United States National Park Service *Historic American Engineering Record*. These, or equivalent, standards must be considered the minimal acceptable level of mitigation.

The design of a new bridge is not a conservation option according the existing *Ontario Heritage Bridge Program*. However the *Program* does note that under certain circumstances within the EA process, the replication or replacement with a signature bridge may be valuable to preserve cultural landscape values and/or design qualities of the demolished structure.

Replication assumes that of the appearance of the heritage bridge in the new bridge design, with allowances for the use of modern materials. This is the principle behind Replacement Option One.



Compatible new development, where a new bridge is given a design that is sympathetic to the design qualities of the original bridge is the principle behind Replacement Options Two and Three. This option would allow simplification of original design details, and the use of new technologies and materials.

Replacement Option Four is not a sympathetic design, but rather the replacement of the historic bridge with an MTO standard design. In this case, demolition is the only mitigating factor to be addressed.

6.3.1 Replacement Alternative 1 (RP1)

RP1 consists of a new, nine-span bridge with a silhouette similar to the existing bridge. The arches would be constructed of steel and have a smaller cross section than the existing concrete arches. The deck would consist of three lanes rather than the existing two lanes.

6.3.2 Replacement Alternatives 2 and 3 (RP2, RP3)

These two alternatives are identical and consist of five steel-arch spans and a three lane cross section (Figure 19). These alternatives differ in construction method. In RP2, one lane of traffic would be maintained during construction. In RP3, traffic would be diverted to a Bailey bridge during the course of construction.

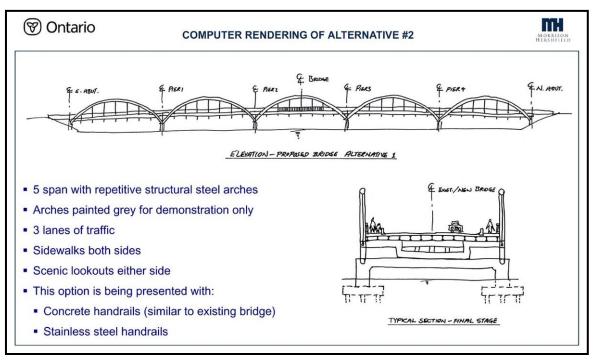


Figure 19: Bridge Replacement Alternative #2

6.3.3 Replacement Alternative 4 (RP4)

RP4 consists of a standard MTO bridge design suitable for the crossing. There would be no design features that would make this structure architecturally unique.



7.0 NET EFFECTS ASSESSMENT

7.1 **Process of Net Effects Assessment**

The previous section describes the possible alternatives that could be used in the replacement or the rehabilitation of the Argyle Street Bridge. Each alternative will have different impacts on the environment and on the engineering of the bridge. MTO identified three environmental factor groups and the engineering factor as the four factor groups which have to be considered under the provisions of the Ontario *Environmental Assessment Act:*

- Natural Environment
- Socio-Economic Environment
- Cultural Environment [Covered in this report]
- Transportation and Engineering

Each factor group was, in turn divided into sub-factors. Table 2 illustrates the Cultural Environment Factor Group, its three factors and seven sub-factors, and the criteria used to select these sub-factors.

Table 2: Breakdown of	Table 2: Breakdown of the Cultural Environment Factor Group				
Factor	Factor Sub-Factor Criteria				
 Heritage Bridge in the Nationally Designated Grand River Heritage Watershed 	1.1 Bridge listed on the Ontario Heritage Bridge List and the Grand River Heritage Bridge Inventory	Potential to maintain significant heritage bridge			
	1.2 Bridge Aesthetics - community landmark or gateway	Potential to maintain bridge aesthetics, community landmark, gateway			
 Cultural Heritage – Built Heritage and Cultural Landscapes 	2.1 Buildings, structures of resources of heritage value	Potential to affect buildings or standing sites of local, provincial or national interest			
	2.2 Cultural Heritage landscapes	Potential to affect cultural heritage landscapes; potential to affect drivers' and pedestrians view of landscape			
	2.3 Cultural Heritage Streetscapes	Potential to affect downtown heritage streetscapes			
3 Archaeology	3.1 Pre-historic and Historic First Nations Sites and Burial Sites	Potential to affect significant pre-historic and historic Aboriginal archaeological sites of extreme local, provincial or national interest			
	3.2 Historic Euro-Canadian Archaeological Sites	Potential to affect significant historic Euro-Canadian archaeological sites of extreme local, provincial or national interest			

By evaluating the cultural factors against the proposed bridge alternatives, it is possible to obtain a net effect for each alternative. This evaluation method is called a *reasoned argument method*. This method highlights the differences in net effects associated with the various alternatives. The rationale that favours the selection of one design alternative over all others is derived from other sources such as government legislation, policies and guidelines, issues raised during the EA process by agencies and interest groups, and by the project team expertise.

On the basis of the *reasoned argument method* as applied only to the Cultural Environment Factors Group, RH1 and RH2 are the preferred rehabilitation/replacement options. RP4 is considered



unacceptable as it provides no significant mitigation for the cultural characteristics of the bridge and its associated cultural landscape.

If the Cultural Heritage Factor Group was the only critical "environment" impacted by replacement/ rehabilitation of the Argyle Street Bridge, the *reasoned argument method* would have been sufficient to identify the preferred bridge rehabilitation/replacement option. However, four, diverse environmental and engineering factor groups had to be collectively evaluated in order to rank the overall net effects of each rehabilitation/replacement option.

In order to provide a meaningful comparison of the four factor groups, this EA applied an *arithmetic method* of evaluation. In this method, all factors and sub-factors for each of the four factor groups were quantified and weighted against each other based on their level of importance within the factor group. The weighted sub-factors were then scored relative to their impact on each of the rehabilitation/replacement alternatives.

The numeric scores for all four factor groups were calculated, and the rehabilitation/replacement option with the least negative net effects was identified. In order to substantiate the findings of the arithmetic method, the reasoned argument was then applied to the findings.

The weighting and scoring of the factor groups is not presented in this report. The arithmetic method has no significant analytical utility when applied specifically to the Cultural Environment Factor Group. The detailed methodology and the results of the arithmetic method as applied to the Argyle Street Bridge will be available in the MTO Transportation Environmental Study Report for the Argyle Street Bridge.

In the following matrix: RH is Rehabilitation Option RP is Replacement Option



7.2 Factor: Bridge in Designated Grand River Heritage Watershed

7.2.1 Sub-Factor: Bridge Listed on Ontario Heritage Bridge List/Grand River Heritage Bridge Inventory

RH3, RH4 Desi follow guida princ char exist follow guida relev caus herit bridg New of th New could appe	ehabilitation that is not according to ntario Heritage Bridge Program uidelines and relevant conservation inciples could cause major adverse hanges to the heritage attributes of the kisting bridge. esign: Rehabilitation that does not llow Ontario Heritage Bridge Program uidelines and that does not meet	Rehabilitation will be undertaken with no major modifications to heritage attributes (such as to form, material, and visual appearance), according to the <i>Ontario Heritage Bridge Program</i> guidelines and relevant conservation principles. Detailed design of rehabilitation will be guided by heritage consultant, heritage architect, and heritage engineer and based on additional documentation including photography, measured as-found drawings, additional research. Design : Rehabilitation will be undertaken with no	Historic structure is retained and well preserved; as per <i>Ontario Heritage Bridge</i> <i>Program</i> guidelines and relevant conservation principles and documentation. Historic structure is retained and well preserved, as per <i>Ontario Heritage Bridge</i> <i>Program</i> guidelines and relevant conservation principles. Some loss of the original fabric of bridge. Design : Historic structure is retained and
follov guide relev caus herit bridg New of th New could appe	llow Ontario Heritage Bridge Program	Design: Rehabilitation will be undertaken with no	Design: Historia structure is retained and
	levant conservation principles, could ause major adverse changes to the eritage attributes of the existing idge. ew bridge will partially block the view the west side of the heritage bridge. ew bridge, either one or two lanes build visually detract from the opearance of the heritage bridge. construction : Construction could ompromise the stability of the existing idge.	 major modifications to heritage attributes (such as to form, material, or visual appearance), according to the <i>Ontario Heritage Bridge Program</i> guidelines and relevant conservation principles. Detailed design of rehabilitation will be guided by heritage consultant, heritage architect, and heritage engineer and based on additional documentation including photography, measured as-found drawings, additional research Design of new bridge to incorporate appropriate choice of pier placement, railing design, materials/ colour/ texture to minimize visual distraction of the heritage bridge. Construction: Construction methodology to recognize the stability requirements. 	 Design. Instolic structure is retained and well preserved; as per <i>Ontario Heritage Bridge Program</i> guidelines and relevant conservation principles and documentation. Some loss of the original material in historic bridge. New bridge will obstruct view of the historic bridge from the west and no visual impact to east side of bridge New bridge will have minimal visual impact on the original bridge and clear visual distinction will be made between historic structure and new bridge. Construction: No destabilization of existing bridge
RP1, RP2, Origi RP3 RP4 Origi	riginal bridge would be demolished.	Documentation including photography, measured as- found drawings, additional research. Historic plaque erected and possible retention of arch(s) to be preserved and relocated. Replacement bridge, RP1, RP2, or RP3, is a signature bridge that references the historic qualities of the demolished bridge.	Historic bridge is demolished; record will be maintained; potential salvage of some elements. New replacement bridge will be a signature bridge with the future potential to be placed on the Ontario Heritage Bridge Program bridge list because of its design and contextual value. Replacement has no heritage value

7.2.2	Sub-Factor: Heritage Community Landmark/Gateway
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Design Alternative	Potential Effects	Mitigation:	Net Effects:
RH1, RH2	Heritage bridge continues to function as a landmark for the community	None Required	Heritage bridge continues to function as a landmark and a gateway for the community.
RH3, RH4	Heritage bridge continues to function as a landmark for the community. New bridge could detract from the landmark function of heritage bridge.	Rehabilitation will be undertaken with no major modifications to heritage attributes (such as form, material, or visual appearance), according to the <i>Ontario</i> <i>Heritage Bridge Program</i> guidelines and relevant conservation principles. Detailed design of rehabilitation will be guided by heritage consultant, heritage architect, and heritage engineer and based on additional documentation including photography, measured as-found drawings, additional research. Design of new bridge to incorporate appropriate choice of pier placement, railing design, materials/ colour/ texture to minimize visual distraction with the heritage bridge.	Historic structure continues to be a community landmark and gateway to and from the heritage downtown area. New bridge will somewhat obstruct view of the original bridge from the west.
RP 1, RP2, RP3	Loss of existing historic structure and community landmark/ gateway to and from the heritage downtown area. Bridge replacement alternatives RP1, RP2, or RP3 could fail to become a new landmark with high aesthetic value.	No mitigation possible for loss of historic structures/landmarks/gateway. None required because the new replacement bridge RP1, RP2, or RP3, will be designed to reflect the key heritage attributes of the historic bridge.	Loss of heritage landmark for all alternatives. RP1, RP2 or RP3 will continue to provide landmark recognition of site as historic crossing; five-span structure (RP2, RP3) will be more dramatic than nine-span structure (RP1) due to size of arches.
RP4	New bridge would fail to function as new community landmark/gateway.	Design of bridge to be aesthetically pleasing by means such as choice of materials and railings, and colour.	Provides no new landmark value.



7.3 Factor: Built Heritage and Cultural Landscapes

7.3.1 Sub-Factor: Buildings, Structures or Resources of Heritage Value

Design Alternative	Potential Effects	Mitigation:	Net Effects:
RH1, RH2	No buildings, structures or heritage resources will be impacted.	No mitigation is necessary.	No net effect.
RH3,	Streetscape on east side of Argyle Street is not impacted.	Prepare conservation plan for individually affected structures.	Relocation of one potential heritage building is required for a new one-lane bridge.
	On the west side of Argyle Street new one- lane bridge beside existing bridge will be extremely close to one potential heritage building; other potential heritage buildings may be in close proximity to the new alignment.		
RH4	Streetscape on east side of Argyle Street is not impacted. On the west side of Argyle Street new two- lane bridge beside existing bridge will be extremely close to one potential heritage building; other potential heritage buildings may be in close proximity to the new alignment.	Prepare conservation plan for individually affected structures.	Removal of one potential heritage building is required for a new two-lane bridge.
RP 1, RP2, RP3	No buildings, structures or heritage resources will be impacted.	No mitigation is necessary.	No net effect.
RP4	Possible wing wall to be placed in front of toll house, a designated heritage building.	No mitigation is possible.	Moderate impact due to wall located in front of toll house.
Construction of All Alternatives	Risk of vibration could damage buildings during construction.	Inspect "at risk" buildings such as the former Toll-keepers house before and after construction. Monitor during construction. Undertake repairs as necessary.	No net effect on adjacent heritage resources. Improvement of drainage in the vicinity of the designated heritage Toll House.

Design Alternative	Potential Effects	Mitigation:	Net Effects:
RH1, RH2	Rehabilitation could adversely impact the cultural heritage landscape.	Rehabilitation will be undertaken with no major modifications to the heritage attributes.	No impacts to the cultural heritage landscapes, and all existing viewsheds are maintained.
RH3,	Rehabilitation could adversely impact the cultural heritage landscape. The new bridge could be detrimental to the cultural heritage landscape.	Rehabilitation will be undertaken with no major modifications to heritage attributes according to the <i>Ontario Heritage Bridge Program</i> guidelines and conservation principles.	All existing view sheds to the east are maintained; view to the west compromised by new bridge. New bridge will have minimal visual impact on the cultural heritage landscape.
RH4	Increased footprint and the abutments of the new two-lane bridge would adversely impact the cultural heritage landscapes.	Design of new bridge to incorporate appropriate choice of pier placement, railing design, materials/ colour/ texture to minimize visual impact on cultural landscape.	All existing view sheds to the east are maintained; view to the west compromised by new bridge. New bridge will have moderate visual impact on the cultural heritage landscape that includes the original bridge.
RP 1, RP2, RP3	Cultural heritage landscape could be adversely impacted. A new bridge could be detrimental to the cultural heritage landscape. Signature bridge will fail to be a beneficial new addition to the cultural landscape.	RP1, RP2, or RP3 will be designed to harmonize with the cultural landscape through the use of colour, texture, railing design, etc. Outlooks on new bridge will be installed for viewing public.	Loss of significant landscape element through demolition of the bridge. RP1, RP2 or RP3 will be a signature bridge that adds to a new cultural landscape.
RP4	Viewing opportunities from the bridge could be compromised.	No viewing outlooks but mitigate through addition of features to harmonize with the cultural heritage landscape.	Loss of significant landscape element through demolition of the bridge. RP4 would provide views of the cultural heritage landscape from the bridge.

7.3.2 Sub-Factor: Cultural Heritage Landscapes



7.3.3 Sub-Factor: Cultural Heritage Streetscapes

Design Alternative	Potential Effects	Mitigation:	Net Effects:
RH1, RH2	Existing downtown streetscape is not affected	None required	No net effects
RH3,	 Streetscape on east side of Argyle Street is not impacted. On the west side of Argyle Street: A new one-lane bridge beside existing bridge will be extremely close to one potential heritage building; Other potential heritage buildings may be in close proximity to the new alignment. 	Prepare conservation plan for individually affected structures and parkettes.	Streetscape viewsheds of bridge will be maintained with minimal impacts. Relocation of one potential heritage building for new one-lane bridge
RH4	Streetscape on east side of Argyle Street is not impacted. On west side of Argyle , a new two-lane bridge beside the existing bridge will cause the removal of one potential heritage building Other potential heritage buildings may be in close proximity to the new alignment.		Streetscape viewsheds of bridge will be maintained with minimal impacts. Relocation of one potential heritage building for two-lane new bridge
RP1, RP2, RP3	A new bridge could create discontinuity between the historic downtown streetscape and a new structure.	Documentation including photography, measured as-found drawings, additional research, historic plaque and possible retention of arch(s) to be preserved and relocated. Historic plaque and possibly retention of arches to be preserved and relocated.	The transition from the historic downtown streetscape to the new bridge will be minimized.
RP4	Major grading changes between existing downtown streetscape and new bridge.	No mitigation possible.	Significant impact to the cultural heritage streetscape.

7.4 Factor: Archaeology

7.4.1 Sub-Factor: Pre-Historic and Historic First Nations Archaeological Sites and Burial Sites

Design Alternative	Potential Effects	Mitigation:	Net Effects:
All alternatives	All alternatives that result in a wider permanent or temporary footprint have the potential to impact a prehistoric and historic archaeological site.	 During design, conduct archaeological surveys and mitigation in the designated work area, as per <i>Ontario Heritage Act</i> and Ministry of Culture Regulations and guidelines and with involvement of the Six Nations of the Grand First Nation. During design, if any areas beyond existing survey areas are required, these areas will be surveyed (i.e. construction staging, storage, access roads etc.). During construction, archaeological monitoring will be undertaken by a licensed archaeologist and with the involvement of Six Nations of Grand First Nation. During construction, Six Nations will be notified if there are any archaeological finds. Archaeological finds will be salvaged where possible or otherwise mitigated during construction. 	The larger the construction footprint, the greater the potential to impact archaeological resources.

7.4.2 Sub-Factor: Historic Euro-Canadian Archaeological Sites

Design Alternative	Potential Effects	Mitigation:	Net Effects:
All alternatives	All alternatives that result in a wider permanent or temporary footprint have the potential to impact a Euro-Canadian archaeological site.	 During design, conduct archaeological surveys and mitigation in the designated work area, as per Ontario Heritage Act and Ministry of Culture Regulations and guidelines. During design, if any areas beyond existing survey areas are required, these areas will be surveyed (i.e. construction staging, storage, access roads etc.). During construction, archaeological monitoring will be undertaken by a licensed archaeologist. Protocols will be established to mitigate deeply buried archaeological features. During construction, if there are any archaeological finds they will be salvaged where possible or otherwise mitigated during construction. 	The larger the construction footprint, the greater the potential to impact archaeological resources. Net effects are anticipated to be the same for all alternatives, since areas are previously disturbed.



8.0 **RECOMMENDATIONS**

8.1 Rehabilitation Alternative

Rehabilitation Alternatives One or Two (RH1, RH2) are the preferred mitigation strategy for the bridge. Either alternative satisfies the *Ontario Heritage Bridge Program* preferred mitigation guidelines.

If RH1 or RH2 cannot be undertaken, then either RH3 or RH4 would be acceptable. For either of these alternatives, the design of the new, parallel span should minimize adverse visual impact to the existing bridge. The main variables would be the distance of the new span from the existing, pier placement, deck thickness, and colour. It is assumed that a beam structure would be preferable to a truss, arch or suspended span. All of these design variables should be explored in order to determine the appropriate design of the new structure.

8.2 Replacement Alternative

A new signature bridge, Alternatives One, Two, or Three (RP1, RP2, RP3) should only be considered if rehabilitation is not possible. The design of a signature bridge should take into consideration the historic place of the bridge within the town of Caledonia. The existing structure is a through-truss bridge, with massive concrete arches and hangers. The sidewalk is cantilevered outside the trusses. Two widely accepted guidelines for bridge proportions, and one that would affect the design of the Argyle Street Bridge, are:³¹

- Multiple span bridges should have an odd number of spans. This has been achieved by the nine spans of the existing bridge.
- The bridge deck could be projected beyond the fascia of the bridge supports to increase the visual effects of deck slenderness. This has been achieved by cantilevering the sidewalks beyond the trusses.

RP1 is less satisfactory an alternative than RP2 or RP3. The design attempts to replicate the existing bridge with the number spans and their proportion. However, the new span will be of steel and appear less massive than the original. This visual problem will be exacerbated by the need for a three-lane deck which will make the trusses further apart and even less massive. RP2 and RP3 are preferred to RP1.

The design of RP4 is not of a signature bridge and therefore not considered an appropriate form of mitigation.

8.3 Landscape Design

Given the design value of the landmark and gateway status of the Argyle Street Bridge, any changes to the adjacent landscape should be undertaken to conserve the heritage attributes of the site.

The landscaped parks at each end the bridge should be integrated into any future bridge rehabilitation or replacement option.

The north approach to the bridge should take into account the transition into the commercial section of Argyle Street. In particular the physical relationship of the toll keeper's house to the bridge should be

³¹ Legatt, *Reinforced Concrete Bridges*, 48-9; Melaragno, *Preliminary Design of Bridges*. 194-5.



considered. Presently a concrete railing provides a defined transition from the narrow bridge roadway to the wider edge of the Argyle Street sidewalk. Any change to the existing ramp up to the bridge approach should be considered as an impact on the historic resource and needs to be mitigated.

On the south approach, any change to the horizontal geometry of the intersection of Argyle Street South, Forfar Street, and Wigton Street, should be considered as an impact on the historic resource and needs to be mitigated.

8.4 **Documentation of Existing Bridge**

The extent (1927) drawings of the Argyle Street Bridge should be augmented with as-found annotations at the time of major rehabilitation or replacement intervention in the bridge and, as necessary, new measured drawings. This work should be done to the standards of the Historic American Engineering Record, or equivalent, and deposited in institutions listed in Recommendation 8.5 below.

8.5 Deposit Copies

Copies of the heritage reports prepared for this environmental assessment should be deposited in local community heritage organizations and archives along with copies of the original 1927 construction drawings and CD ROM copies of any associated photography.

At the very least, deposit copies should be given to the County of Haldimand Public Library System and to the Heritage and Culture Division of Haldimand County.

8.6 Interpretation

8.6.1 Plaques

Further mitigation should include the erection of a historic plaque or information kiosk on the shoreline near the bridge which outlines the history of the crossing and incorporates historic photographs of all previous bridges.

8.6.2 Preservation of Arch

The feasibility of preserving one or two of the existing concrete arches should be examined during detailed design. The arch or arches could be moved to a suitable location for viewing, along with a heritage information panel outlining the history of the 1927 bridge construction.



PART C

ARGYLE STREET BRIDGE PUBLIC CONSULTATION AND SOURCES



9.0 PUBLIC CONSULTATION

Various heritage groups and individuals in the County of Haldimand were contacted for additional information on the study area including (but not limited to):

Anne Unyi, Edinburgh Square Heritage & Cultural Centre Glen Brough, LACAC –Town of Haldimand Wendy Whitfield, Curator, Haldimand-Norfolk Museum Archives Jennifer Tigert, Haldimand County Museum and Archives Barbara Martindale, local historian and Executive Director of the Caledonia Regional Chamber of Commerce.

The following is a list of stakeholders that received project mailings and updates during the EA consultation process:

Grand River Conservation Authority	Mississaugas of the New Credit First Nation
Six Nations Council	Six Nations Eco Centre
Haudenosaunee Confederacy Council	Caledonia Region Chamber of Commerce
Caledonia Business Improvement Association	Caledonia Business Improvement Association
Tourism Caledonia	Edinburgh Square Heritage & Cultural Centre
Heritage Haldimand	Heritage Rivers Section - Parks Canada
Parks Canada	Ministry of Culture
Haldimand-Norfolk Museum Archives	Haldimand County, Planning and Economic
	Development Department
Haldimand County, Tourism Division	Grand River Advisory Committee
Ontario Ministry of Environment	Ministry of Natural Resources, Guelph District
Caledonia Regional Chamber of Commerce	Lower Grand River Land Trust
The Architectural Conservancy of Ontario	Ruthven Park National Historic Site:
Dunnville District Heritage Association	Heritage Mount Pleasant:
Caledonia Old Mill Corporation	Port Maitland Festival of History
York Historical Society, William Haartman	

A petition was initiated by local resident Ms. Alice MacKinnon to "Save Our Bridge." The petition was circulated to a few Caledonia business locations from the middle of July to September 6, 2002, and was signed by 822 people.

The local heritage community has continued to express strong feelings about the bridge and its importance as a heritage structure. Of the 40 respondents to the Public Information Centre questionnaire and Comment Sheet circulated on June 23, 2003:

- 33 individuals felt that the heritage value of the bridge should be rated at an evaluation factor of 3 or higher (1 being the lowest and 5 being the highest); and
- 25 of the 40 supported the replacement option as presented and, of these, the majority chose either of the 5 or 9 span concrete arch replacement design options.



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APPENDIX A



A Weekly Paper for Civil Engineers and Contractors

12 YO WHEN DO

Concrete Bridge at Caledonia, Ont.

Reinforced Concrete Arch Structure Built Across Grand River Consisting of Nine Spans Each 72 ft. 7 in. Long—Total Length 700 ft. and Overall Width 41 ft. 8 in. — Temporary Bridge Erected to Take Care of Traffic During Construction

By B. H. M. BALFOUR

Superintendent, Randolph Macdonald Co. Ltd., Toronto

CALEDONIA is a pretty little town situated on the Grand River about fourteen miles south of Hamilton, Ontario. The surrounding country was first settled by United Empire Loyalists and at the same time the Indian chief, General Brant, and his family, followed the flag from the State of Iowa to this district.

A DESCRIPTION OF THE PARTY OF

From that time to the present, the crossing of the Grand River at Caledonia has been a problem for many engineers

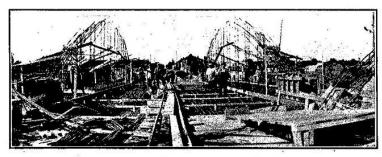
and contractors. At times, the water in this river is so shal-low that a child could walk across, but a day of rain causes a rapid rise in the water level. and a two days rain changes it into a raging torrent. During the spring freshet, the water rises from 10 to 12 ft. above the normal flow and the ice from the whole length of the river

built in 1873-74. It consisted of six spans of the bow string truss type supported on masonry piers and abutments. These piers were constructed of large blocks of limestone placed on large pine timbers. The upstream face of these piers had to be protected by sheet iron, as the ice rushing down in the Spring had begun to cause serious damage. This bridge carried the traffic for fifty years, but in 1924 a truck loaded with stone broke down one of the spans and it was time to

build another bridge suitable to carry the traffic of the present day.

In 1926 the Ontario Department of Public Highways took over this portion of the road, as it was part of the important highway from Hamilton to Port Dover.

The Hon. Geo. S. Henry, Minister of Public Highways, and R. M. Smith, the Acting Deputy Min-



CALEDONIA BRIDGE FROM THE SOUTH

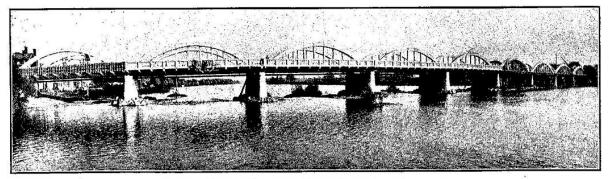
rushes towards Lake Erie. This sometimes causes serious blockades and damages structures along the river. Many improvements have been made along the river, in recent years, and the ice and flood danger is gradually being overcome.

There have been four bridges built across the river at Caledonia before the present structure was placed there.

The first two bridges of crib and frame construction were demolished by ice and floods. The third structure was ister and Chief Engineer, issued instructions to A. B. Crealock, bridge engineer, to prepare plans for a new bridge and the present structure is the result.

The bridge consists of nine spans of reinforced concrete, as shown in the accompanying illustrations.

Each span is 72 ft. 7 in. long, width of roadway 23 ft., with a 6-ft sidewalk on each side. The length from end to end of hand rails is 700 ft., the width is 41 ft. 8 in. overall. The hand rail is 4 ft. high and blends well with the arch



GENERAL VIEW OF CALEDONIA BRIDGE PRACTICALLY COMPLETED



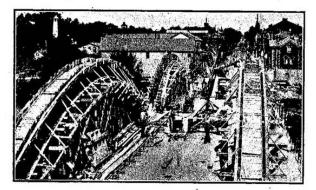
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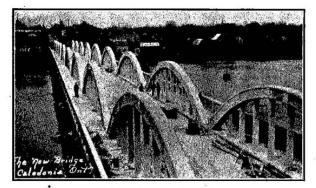
construction, giving the finishing touch to a very beautiful structure.

The spans rest on two abutments and eight piers, the foundations of which were excavated from 4 to 5 ft. below



SHOWING FORM WORK FOR ARCHES

the bed of the river, where good foundations were obtained. This necessitated the construction of a coffer dam for each pier and, owing to the fact that the surface rock was shat-

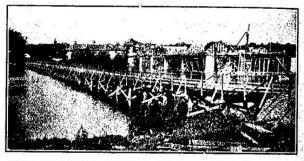


THE COMPLETED BRIDGE

tered and contained numerous seams, the pumping was a costly item; in some cases, two large pumps being required to handle the water. Work was commenced on the temporary trestle on June 11th, this structure being completed and open to traffic in two weeks.

The first concrete was poured for the substructure on July 8th, 1927, and the first span was poured August 16th, two other spans being poured by the end of this month. Five complete spans were poured in the month of September and the last span early in October. Even though a serious flood occurred on July 24th, which endangered the temporary trestle and the falsework for the new structure, causing serious delay and change in the construction program, the bridge was finished more than two weeks before November 30th, the date set for completion, and was opened for traffic November 19th.

This is a record for this type of bridge and the contractors deserve credit for speedy construction and excellent workmanship. The total time from start to completion, in-



TEMPORARY TRESTLE BRIDGE IN FRONT OF MAIN STRUCTURE

cluding the construction of the temporary trestle being only one hundred and forty working days.

The designer, A. B. Crealock, showed rare genius in being able to weave in the beautiful and picturesque, at the same time not losing sight of strength and permanence.

The contract for construction of this bridge was awarded to The Randolph Macdonald Co. Ltd., engineers and contractors, 1130 Bay Street, Toronto.

The stone was supplied by the Canada Crushed Stone Corporation Ltd., Hamilton, the sand by the Paris Sand & Gravel Co. Ltd. The reinforcing steel for the floors and sidewalk was furnished by the Burlington Steel Co. Ltd., Hamilton, and for the arches and main girders by the Steel Company of Canada Ltd., Hamilton. Cement supplied by the Canada Cement Co. Ltd. was used throughout the work. The writer was the superintendent in charge of the work for the contractors.

