RoadTalk
Ontario's Transportation Technology Transfer Digest
Ministry of Transportation
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Baudette - Rainy River International Bridge recognized with an ACEC Engineering Excellence Grand Award

MTO, Stantec Consulting, and the Minnesota Department of Transportation are recognized for the first international border crossing project between the jurisdictions in over 50 years

The Ministry of Transportation Ontario (MTO), jointly with the Minnesota Department of Transportation (MnDOT) and Stantec Consulting Services, was presented the Engineering Excellence Grand Award from the American Council of Engineering Companies (ACEC), at the 2022 Engineering Excellence awards ceremony recognizing the joint efforts for Minnesota's first international border crossing project in over 50 years – the Baudette - Rainy River Bridge replacement.

Replacing the border bridge involved MnDOT and MTO mutual coordination for the construction of a replacement bridge on a new alignment, reconstructing the US and Canadian roadway approaches, and the decommissioning and removal of the existing bridge.

This international border crossing has supported the local communities of Rainy River, Ontario and Baudette, Minnesota, since its original construction in 1958. The bridge hosts 400-500 daily vehicles crossings.

Baudette - Rainy River Bridge Replacement

In 2011, after a scheduled bi-annual structural inspection of the Baudette - Rainy River Bridge, the structure was determined to be approaching the end of its service life.

MnDOT and MTO, whose governments jointly own the bridge, began collaborating, and signed the official "State of Minnesota - Ontario Cooperative Agreement for Replacement of the International Bridge Between Baudette, MN and Rainy River, Ontario", in July 2013.

The Award won jointly by MTO, the Minnesota Department of Transportation, and Stantec Consulting Services.

Project Collaboration

While MTO worked on the Cultural and Heritage assessment for the existing structure, MnDOT conducted a Rehabilitation Study, and their own Heritage Assessment for the bridge. All resulting study and assessment data supported the Heritage Bridge Committee decision to proceed with full bridge replacement. Planning for the new bridge was completed between 2011 and 2014.

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MnDOT was the lead agency on the project, however, decisions regarding design and specification requirements were decided mutually, as the final design was required to meet the codes and standards of both jurisdictions.
Portal development

Invaluable ministry stakeholder input was considered during Stantec led the preliminary design for the project starting in March 2015. Thus, commenced monthly technical advisory and design progress meetings with staff from Stantec, their sub-consultant HNTB Corporation, US Customs and Border Protection (CBP), Canada Border Services Agency (CBSA), MTO's Northwest Regional office, MTO Foundation Office, and MnDOT's District & Bridge Offices.

Preliminary design for the project was completed by March 2017, and included:

- development of alignment alternatives
- bridge-type study
- preliminary bridge plans
- construction delivery method
- environmental review and permitting,
- and geometric site layout.

The new Baudette - Rainy River Bridge detail design started in April 2017, with Stantec continuing with overall project management and highway design for the roadway approaches, and Parsons Corporation joining the project to complete structural design of the bridge. Detail Design was completed in December 2017, followed by construction advertisement via MnDOT, for a six-week period, and award to the low bid contractor Lunda Construction Co.

Key staff involved in the project stand six feet apart across the new international bridge.

Joe McKinnon (Project Manager, MnDOT) and Kevin Saunders (Senior Project Manager, MTO) shaking hands across the international border marker.

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Site Constraints

There were many existing facilities and features, particularly on the Minnesota side of the bridge, that were taken into consideration during the design and construction of the new border bridge, and during removal of the existing bridge.

Ontario Side

- Existing CBSA facility and equipment

Minnesota Side

- Existing CBP facility and detection equipment
- Baudette Regional Airport
- Baudette Water Treatment Ponds
- Adjacent Canada National Railway (CNRR) Bridge
- Sensitive wetlands along embankment
- Unmarked gravesites next to the port
- Peace Park (owned by City of Baudette) adjacent to the port
- Convergence of the Baudette River with the Rainy River immediately upstream of the bridge
- MnDOT requirement that all stormwater to be collected and treated

The new Baudette - Rainy River Bridge under construction, and the decommissioned 1958 Bridges, side by side.

Replacement Structure

Construction began in June 2018, and the new alignment for the bridge was placed immediately upstream of the existing bridge, to the south, tying into existing port of entry plazas on both ends.

The new 411.5 metre (1,350 feet) long, 14.7 metre (48.2 feet) wide, 5-span bridge opened to traffic In October 2020. It also features:

- four steel welded plate haunched I-girders (2.032 to 3.556m depth) (exterior faces coated)
- cast in place 254mm thick concrete deck
- exposed concrete pavement wear surface
- two 3.50m traffic lanes
- a pedestrian sidewalk,
- 2.438m shoulders, to safely accommodate bicycle traffic.
- Aluminum Arch Border Feature
  - Since the bridge is so important to the history and identity of the towns, MTO and MnDOT agreed to include a visual feature at the location of the bridge where the actual border is located.
  - After consultation with the Public Advisory Committee (PAC) the selected feature included two aluminum arches (76 feet long and 23 feet high each) and flag poles for US and Canadian flags.

Concrete for the bridge deck is placed using concrete pumps.

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Due to site soil conditions, the bridge substructure features large diameter (2.438m/8-foot diameter) reinforced concrete caissons to support the concrete piers and driven steel h-pile foundations to support the concrete abutments. MTO has experience using smaller diameter (e.g., 2 foot) caissons on bridge projects, but these were the largest used on an Ontario bridge, a first for Ontario.

The contractor levelling concrete for the new cast-in-place bridge deck using a Bidwell screed machine.

The Ontario Experience – A dozen lessons

Agency Cooperation

1. Establish one written agreement between both governments addressing the full spectrum of the project including preliminary design, detail design, construction, and maintenance. Two separate agreements were used for the Baudette - Rainy River Bridge project which added additional time to the schedule for agreement approvals and signatures. Written agreements between governments take considerable time as they are considered treaties that require legal and Federal government review.
2. Be flexible and collaborate. The bridge design had to meet both the Canadian Highway Bridge Design Code (CHBDC) and the American Association of State Highway and Transportation Officials Load and Resistance Factor Design (AASHTO LRFD). Where there were discrepancies between agency preferences and agency design standards, the more restrictive requirement was followed; however, to promote cooperation and a good relationship, it is important to be willing to negotiate and collaborate where you can. For example, discussion and collaboration were required to determine the permissible grades of stainless-steel reinforcement for the bridge deck on this project.

View of the narrow separation between the old bridge on the left and new bridge on the right.

Engagement

Since the border crossing is integral to the two adjacent communities, and to ensure that community input was provided to the design team, MTO and MnDOT created a Public Advisory Committee (PAC) whose membership consisted of MTO staff, MnDOT staff, Canadian Border Services and US Customs & Border Protection staff, the mayors of both towns, representatives of the chambers of commerce from both towns, and representatives from the Lakehead Region Conservation Authority. PAC meetings were held four times through the design and the PAC provided input on bridge aesthetics for

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the border feature, the pier shape, and steel & concrete coating colours.

Also, public consultation involved additional stakeholders than a typical MTO project, since it was subject to US Federal & State and Canadian Federal and Provincial jurisdictions. To ensure all issues and concerns were identified and addressed, MTO and MnDOT held four Agency webinars and invited representatives from all stakeholder groups to attend and provide feedback and ask questions. This allowed any potential schedule roadblocks or slowdowns with required permits to be addressed in advance of permit application submissions for approval to the various agencies.

To identify concerns or questions from potential contractors, a Contractor Pre-Bid meeting was held and was attended by representatives from both border services agencies. The border services staff were able to answer questions related to import and export of materials, requirements for workers to work on both sides of the border, site security, and taxation. This allowed contractors to have additional information when preparing their bids.

3. Engage external agencies and stakeholders early and often. Four Agency Webinars were held over the course of preliminary design. Federal, Provincial, and State regulatory agencies were invited and attended, providing awareness of project progress, and to ask questions for clarification. At review and approval time for permits, agencies were already familiar with the project and any concerns were already addressed. There were also many individual tele-conferences with stakeholder agencies over the course of the project design.
4. Include staff from both border services at the start of the design phase. Have dedicated CBP and CBSA staff members attend all meetings; they oversee port operation and should contribute feedback during the design phase, regarding allowable changes to any existing plazas or equipment, security needs during construction, import/export logistics, and duty/taxes.
5. Engage the public often. Adjacent towns have a significant stake in the project since they are the end users. For example, due to the long and rich history of the existing bridge, the City of Baudette, MN used an image of the original bridge in the header of their city website.

The contractor completed much of the work using large barges.

Tyler McQuaker (MTO) visually inspecting some of the arch segments prior to installation.

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- Establish a Public Advisory Committee (PAC) at the beginning of the design process and included both local governments, their respective chambers of commerce, the regional Conservation Authority, and all agencies involved in the project. Public meetings allowed community representatives to provide input on bridge aesthetics, and to voice specific community needs about the project.
- Conduct Public Information Meetings to provide an opportunity for the public to learn and comment on various aspects and details of the project.
- Establish a project website for the public and keep it up-to-date regularly with new project information.
- Include public comment periods as part of the permitting process.

6. Engage Contractors during the design process so that they can ask questions, and to raise their awareness of the upcoming project.
   - Conduct Contractor Information Workshop and a pre-bid meeting to provide clarification and answer questions from Contractors who are interested in submitting bids.

Kevin Saunders (MTO) and Joe McKinnon (MnDOT) under one of the completed border arches.

Consultant Services

7. One agency should take the lead. To simplify the coordination of consultant agreements and invoicing, one agency should be considered the legal point of contact. In the case of this project, it was MnDOT.
8. Establish one consultant for preliminary and detail design process. This maintains continuity when dealing with external agencies and eliminates the time to onboard a new consultant between the preliminary and detail design phases. This consistency benefits both the owner agency as well as the stakeholder agencies.

Design

9. Learn from others; don't always try to reinvent the wheel. Two recent examples of border bridges replacements with shared Province and State ownership were completed by New Brunswick Ministry of Transportation and Maine DOT, who provided valuable lessons learned from their projects.
10. Establish a clear timeline of all environmental assessment activities and deliverables at the start of design so that the milestones for both agencies align and ensure that there are no surprises in the project schedule which could cause delays or duplicate work.
11. Establish a clear timeline of all foundation investigation and design activities and deliverables. For example, MTO learned during design that MnDOT foundation field investigations and borehole drilling are all completed during preliminary design, whereas MTO typically does both initial foundation investigations during preliminary design and then more extensive borehole drilling during detail design after the location of foundation elements are established. This difference in design philosophy required additional work by the foundation consultant to satisfy the requirements of both agencies.

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12. Establish detail design criteria during the preliminary design phase. It is important to establish detail design protocols because there can be differences in standards and preferences between agencies. Areas related to agency design practices and standards may include:
    - Deck design method of analysis
    - Plan stamping requirements
    - Units of measurement shown on plans
    - Materials (e.g., design concrete strength, structural steel grades, reinforcing steel grades, bridge deck wear course material)

Permits

Unique items of note related to permits for international water crossings include the US Coast Guard's authority over international waters, and Transport Canada's permit process related to the International Bridges and Tunnels Act, and Canadian Navigable Waters Act, and the International Joint Commission permit, related to any changes in water levels and hydraulics. Additional permits were also required from the International Boundary Commission, to allow construction work to occur adjacent to an international boundary and to remove/replace the international border marker plaques.

Also considered for this project were:

- Labour law requirements
- Import/export of goods used to construct the bridge
- Import/export equipment working at the border on each approach
- Taxation

Bridge Funding

The estimated cost for the new Baudette - Rainy River bridge was $47.7M CAD, split 50/50 for MnDOT & MTO. MnDOT was able to fund their half of the project entirely using State funds while MTO funding was 50 per cent Provincial and 50 per cent Federal, through the Build Canada Fund.

More Awards for Baudette - Rainy River Bridge

The bridge project has also received the 2020 ACG (Associated General Contractors of Minnesota) Bridge Construction Award, where the Lunda Construction Company won in the category for bridges over $5M. ●

For more information on the Baudette - Rainy River Bridge, please contact:

Kevin Saunders,
Senior Project Manager,
Transportation Infrastructure Management Division,
at 807-473-2109,
or Kevin.Saunders@ontario.ca

For more information about the project, visit this link: http://www.dot.state.mn.us/d2/projects/baudette-bridge/index.html

Road Talk publications can be found on the Ontario Ministry of Transportation website: https://www.ontario.ca/page/resources-transportation-planners#section-3

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Ontario's Centre for Excellence in Transportation Infrastructure

Learn more about MTO's state-of-the-art highway materials testing laboratories

The Ministry of Transportation's (MTO) state-of-the-art laboratories and highway materials testing equipment have moved to Ontario's Centre for Excellence in Transportation Infrastructure (CETI). MTO's materials testing, and applied research contribute to Ontario's Highway Standards.

The new CETI complex houses over 500 significant pieces of laboratory equipment to assess the quality of highway materials such as asphalt, concrete, steel, and other essential materials used in the construction and maintenance of Ontario's transportation infrastructure.

MTO's ongoing testing proficiency programs oversee labs that are performing quality assurance testing for MTO in external laboratories, and those working on other public infrastructure projects. The ministry's unique and specialized materials testing equipment also support Ontario's transportation innovation and applied research unique to Ontario's road-building industry. Some of the CETI lab equipment isn't available in any other consultant or university lab.

The CETI building replaces the ministry's testing labs in Downsview. Constructed in the 1950s, the former Downsview laboratories were no longer cost-effective to operate or maintain.

New ministry laboratories and technical laboratory staff are certified by the Canadian Council for Independent Laboratories (CCIL).

New Location

CETI is located on Arrow Road, in North York, Toronto, near the junction of Highways 400 and 407, just south of Finch Avenue. The location is already home to the ministry's COMPASS-Traffic Management Center (TMC), built in advance of Ontario's 2015 Pan Am/Parapan Am Games.

CETI
Centre for Excellence in Transportation Infrastructure
ONTARIO MINISTRY OF TRANSPORTATION

The CETI ministry's facility photographed showing the parking lot and flags flying.

In addition to the extensive single-storey laboratories, the complex includes a three-storey office tower as well as 12-bay garage. Ministry's specialized data collection vehicles are stored in the garage. A new warehouse at the complex is used to store MTO aggregate reference samples.

New Complex Construction - Silver Level LEED Certification

Leadership in Energy and Environmental Design® (LEED) is a rating system recognized as the international mark of excellence for environmentally friendly, or "green" construction, in over 160 countries. The approach helps lower carbon emissions, conserve resources and reduce operating costs.

Ontario's Centre for Excellence in Transportation Infrastructure

The new CETI complex incorporates specific LEED principles including:

- Maximizing open space and protecting and restoring habitat during site development
- Stormwater considerations during design
- A minimum energy-use performance
- Waste-management for construction materials, and
- Recycled materials use

For CETI, meeting the LEED principles resulted in:

- A green roof
- Eight electric vehicle charging stations
- Bicycle storage and change rooms
- Water efficient landscaping
- Reduced water use
- Low-emitting materials including adhesives, sealants, paint, and flooring systems, and
- Reduced light pollution

The new building features a modern laboratory ventilation system, and an efficient workflow configuration for a consolidated space that addressed workflow challenges identified at the former Downsview lab facility.

Installation of a green roof on the B-wing of the new CETI complex.

The concrete culvert headwall salvaged from a culvert on Highway 17.

One of the many historic ministry photos displayed in the new CETI complex. This photo features a 1950's laboratory technician conducting concrete testing.

The state-of-the art labs at CETI

At CETI, ministry staff focus on innovation, applied research and oversight pertaining to Ontario's highway infrastructure quality and durability. MTO's standards and specifications for materials, used for the construction of pavements and bridges on Ontario highways are developed based on the outcomes of the research work taking place at CETI.

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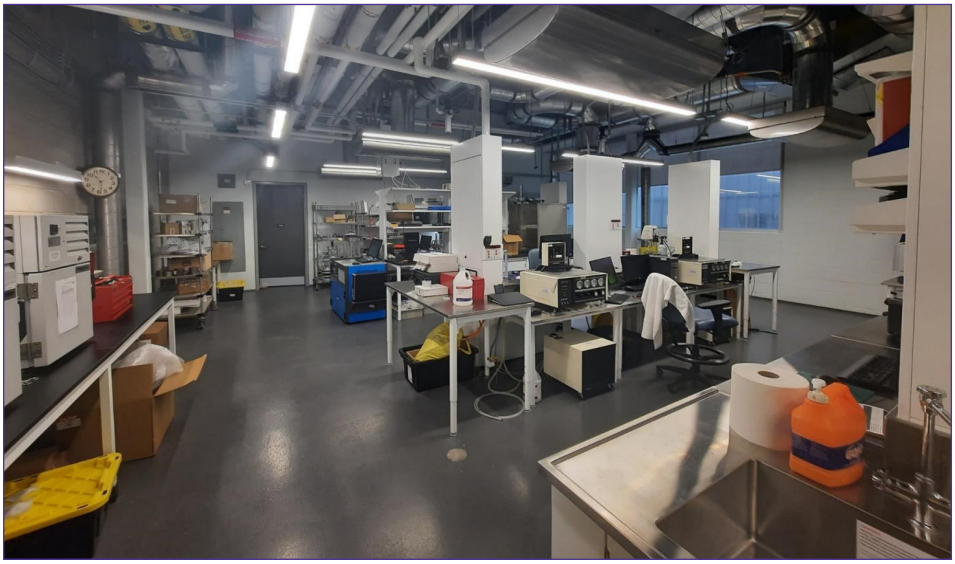
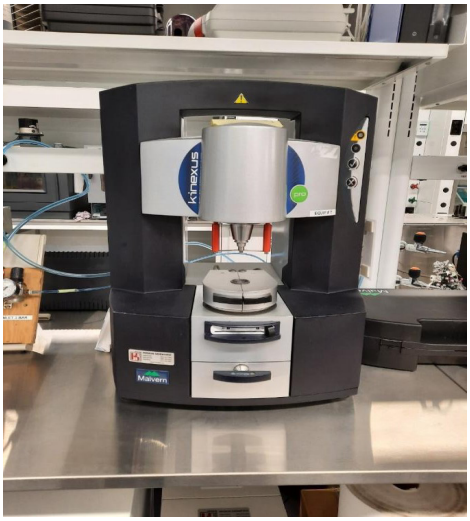


Bituminous Performance Grade Asphalt Cement (PGAC) lab.

Bituminous Mix evaluation equipment.

Walk-in fume Hood protects the user from fumes and vapors generated by larger apparatus. The fume hood sash goes from floor to ceiling. Equipment is rolled inside for use.



Dynamic Shear Rheometer (DSR) is used to characterize the viscous and elastic behavior of asphalt binders at medium to high temperatures. This instrument is used to study the properties of asphalt binders - the waterproof, adhesive that holds asphalt gravel together.

Bituminous Mix evaluation equipment.

Bituminous slab compactor is used to produce representative sample slabs of several dimensions of bituminous mixtures laid and compacted on site.

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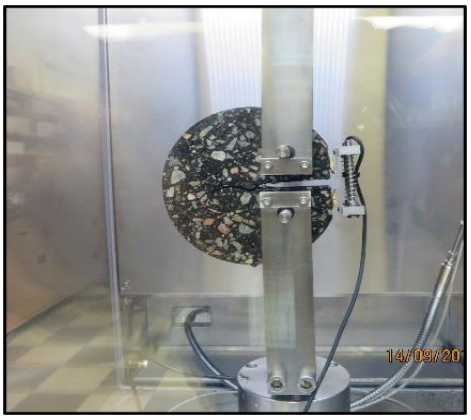
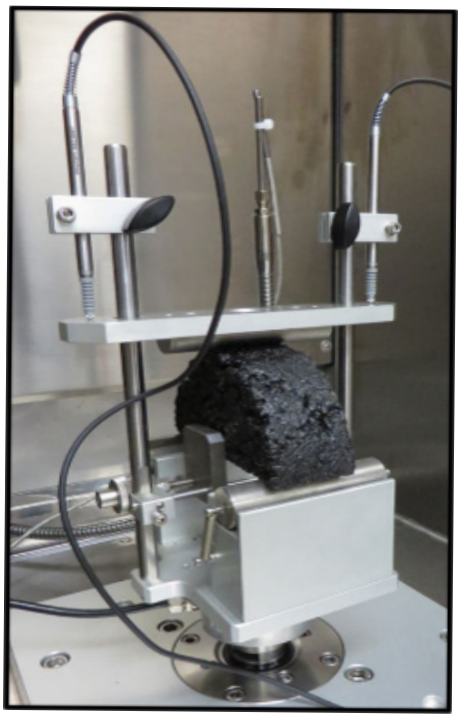
Dynamic Modulus. Part of the bituminous mix evaluation equipment.



Disk-Shaped Compact Tension (DCT) - part of the bituminous mix evaluation equipment.

Bituminous rut testing equipment in MTO's state-of-the-art laboratory.



Semi-Circular Bend (SB) - part of the bituminous mix evaluation equipment.

Equipment in the bituminous materials lab.

Ontario's Centre for Excellence in Transportation Infrastructure

MTO has developed a robust quality assurance testing and oversight system for construction projects which safeguards Ontario's infrastructure investments. Industry stakeholders and academia collaborate on research and innovations at CETI, as the ministry partners with organizations and universities to enhance highway construction standards, materials specifications, and to develop test methods for emerging materials, products, and technologies.

MTO laboratory staff, using the new state-of-the-art equipment, are frequently sought as subject matter experts. Staff at the CETI labs also conduct unique, specialized quality assurance testing of engineering materials used in provincial pavements and bridges using equipment that isn't available in the private sector.

The ministry lab services section helps implement programs to verify the testing proficiency of private sector laboratories that undertake quality assurance testing on ministry construction contracts.

MTO's labs specialize in field and laboratory investigations, forensic investigations, and the evaluation of construction practices.

The CETI laboratories support the ministry's capital construction program by achieving the best value for infrastructure spending, better user experience, enhanced durability, and improved transportation infrastructure. This benefits all of Ontario.

An asphalt saw in the CETI lab.

Automatic Road Analyzer (ARAN) Pavement Data Collection Vehicles.

Pavement friction trailer, mobile retroreflectivity vehicle, line markings vehicle and other ministry vehicles stored in the CETI garage.

Preserving History

During CETI construction, several items of historical value were preserved, .including an original 1950s laboratory pine door, a concrete headwall salvaged from a culvert on Highway 17 historic ministry photos and notable correspondence.

The preserved photographs and historical items are now displayed in the CETI complex.

Ontario's Centre for Excellence in Transportation Infrastructure

Aligning with Ontario Emerging Technology Priorities

The new ministry laboratory supports Ontario's delivery of technical expertise and strengthens the ministry's ability to respond to emerging technologies and innovations.

The new complex aligns with several of Ontario's key multi-year priorities, including:

- Future-ready infrastructure and transportation networks
- Strengthened public safety and security
- Ontario's Realty Transformation Strategy for asset modernization and its greening agenda

By adopting improved or innovative testing methods for the long-term performance evaluation of new materials and products, the ministry ensures that highway infrastructure will be durable, requiring modest maintenance. The state-of-the-art facility sustains the ministry's position as an innovative, industry leading transportation agency. ●

For more information on the CETI facility, please contact:

Joel Magnan, P. Eng. Manager,
Engineering Materials Office,
Standards & Contracts Branch,
Transportation Infrastructure Management Division,
Ministry of Transportation

Phone: 416-235-3708 or
Joel.Magnan@ontario.ca

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