Ministry of Transportation (MTO)

Highway Infrastructure Innovations Funding Program (HIIFP)

Program Guide
for Ontario Universities and Colleges

Deadline for Application Submissions:
Monday, January 26, 2026 at 5:00pm

Submit applications to: HIIFP@ontario.ca

Posted: December 2025

2026-27 Fiscal

Table of Contents

1. Introduction

The Highway Infrastructure Innovations Funding Program (HIIFP) was first introduced in 2003. The objective of this program is to encourage Ontario's academic community to research projects that contribute to generating solutions to current technical challenges encountered by the Ministry of Transportation (MTO) in the construction and maintenance of the provincial highway infrastructure network. These research projects are funded through HIIFP.

A diverse range of specific research topics have been developed by MTO that outline: 1) the background of the research requirement, 2) the challenge or problem to be addressed, and 3) the anticipated outcome and/or research deliverables.

The HIIFP for fiscal year 2026-27 invites Ontario's eligible institutions to submit research proposals. Researchers from eligible institutions may select one or more research topics provided by MTO or propose their own topics (i.e., open research topics).

The HIIFP Program Guide for fiscal year 2026-27 will be emailed to representatives of all eligible public universities and colleges in Ontario and will also be available on the MTO website (HIIFP Steering Committee | MTO Technical Consultation Portal).

2. Purpose of the Program

The objective of this program is to supplement the technical expertise at MTO by providing HIIFP funding to eligible Ontario universities and colleges (institutions). This funding encourages the academic community to conduct research that will contribute to the generation of innovative solutions to current technical challenges experienced during the construction and maintenance of the provincial highway infrastructure network. This research aids MTO in achieving its strategic plan.

Research on innovative approaches and methodologies contribute to solutions in several areas of transportation and infrastructure engineering which are included in this program, such as:

- Traffic Operations
- Intelligent Transportation Systems
- Engineering Materials
- Highway Design
- Investment Planning
- Environmental
- Geomatics
- Bridges
- Construction
- Maintenance

A majority of the research topics involve detailed technical issues identified by MTO that will require an innovative solution to address the specified problem. MTO further supports the research methodology and solution generation by assigning an MTO Technical Specialist in the relevant subject area to liaise with the Principal Researcher for all research projects awarded HIIFP funding.

3. Scope of the Program

3.1 Eligible Institutions

All of Ontario's 23 public universities and 24 colleges are eligible for funding under the HIIFP. The Principal Researcher must be a member of the faculty (full or part-time) at the sponsoring institution.

3.2 Eligible Research Topics

A diverse range of specific research topics have been developed by MTO that outline: 1.) the background of the research requirement, 2.) the challenge or problem to be addressed, and 3.) the anticipated outcome and/or research deliverables.

A majority of the research topics involve detailed technical issues identified by MTO that will require an innovative solution to address the specified problem. To qualify for HIIFP funding, an eligible institution's HIIFP application package must cover one (or several) of the specific research topics. An institution may also submit an HIIFP application package with their own research topic (i.e., an open research topic).

3.2.1 Specific Research Topics

Specific research topics are provided based on MTO's research needs in any given fiscal year. Some research topics will be identified as priority research needs for a particular MTO Office and/or subject area. Detailed descriptions of each specific research topic are provided in **Specific Research Topics**.

The specific research topics included in - **Appendix A** are summarized with the following information:

- **Subject Area:** Description of the general subject area.
- **Title:** Briefly describes the challenge for the subject area.
- **Background:** Discussion of the subject area and the impact to MTO, any previous work done to date, the current approach, thoughts on how to solve the challenge, any applicable reference information and/or literature that currently exists, etc.
- **Challenge:** A statement that outlines the challenge and why an improvement is necessary.

- **Anticipated Outcome(s) & Research Deliverables:** A typical deliverable is a technical report that demonstrates how the challenge was addressed and/or met and shows how improvements may be made. A presentation to an MTO technical committee is also expected.

- **Benefits to MTO:** A description or example of the expected result(s).

3.2.2 Open Research Topics

An open research topic describes a proposed research project that is not included in Open Research Topic Form (23-B)of this Program Guide, however the Principal Researcher considers it to be relevant to the provincial highway infrastructure as well as to MTO's business needs.

If the Principal Researcher chooses to submit an HIIFP application package for an open research topic, they shall complete the Open Research Topic Form, 23-B (see Open Research Topic Form (23-B) and include it with their HIIFP application package. See Section 4.1 for details regarding the application package components. The Open Research Topic Form, 23-B shall not exceed two (2) pages in length, and the research topic should clearly identify how it will enhance MTO's practices and business needs. Upon inclusion of this form (23-B), MTO may accept and evaluate HIIFP application packages on open research topics. In the case of an application package for an open research topic, where a topic number is required, please insert the word "open" in the "Topic No." field.

If a Principal Researcher proposes to include fieldwork on MTO highways and/or right-of-ways (ROWs) for their open research topic, this fieldwork must be pre-approved prior to submission of an HIIFP application package (see Section 3.6).

3.3 MTO Technical Specialist Assignment

For each approved research project, an MTO Technical Specialist, in the relevant subject area will be assigned to liaise with the Principal Researcher. Timing of periodic meetings and/or telephone conference calls will be negotiated at the commencement of the research project.

The relevant MTO Technical Specialist will be assigned and specified in the award letter once the project is granted. For queries regarding the research topic, the corresponding contact person for each topic is listed in **Specific Research Topics**.

For all inquiries, the Principal Researcher should contact the HIIFP Coordinator.

3.4 HIIFP Funding and Ineligible Expenditures

The total HIIFP funding amount for any fiscal year is subject to provincial budget approval. MTO may be required to delay the award of HIIFP funds until the provincial budget has been approved.

MTO reserves the right to restrict and/or terminate HIIFP funding at any time, at its sole discretion and without any reasons.

The salary of the Principal Researcher is **not eligible** for funding under the HIIFP, nor is the Principal Researcher eligible to charge any fees in this respect.

3.5 Multi-Year Projects

MTO will consider application packages for research project proposals that are multi-year, meaning funding may be required for the current and future fiscal year(s). In such cases, MTO will endeavour to provide funding beyond the first fiscal year, however, MTO cannot guarantee funding in future years.

For awarded multi-year research projects, institutions will be required to provide written Project Progress Reports, Form 23-F (see **Appendix C**) a minimum of every six (6) months to be considered eligible for funding in subsequent years. The project progress reports shall be sent to the assigned MTO Technical Specialist, with a copy to the HIIFP Coordinator. Failure to demonstrate satisfactory progress, submit progress reports, or clearly outline the percentage completion of tasks as detailed in the original application package may result in the denial of funding for subsequent fiscal years. Additionally, MTO reserves the right to revoke the funding in future years, at its sole discretion, and can terminate the research project upon written notice to the institution.

3.6 Fieldwork on MTO Highways and/or ROWs, and MTO Laboratory Facilities

If the Principal Researcher proposes to include fieldwork on MTO highways and/or ROWs for the research project, this fieldwork must be **pre-approved** prior to submission of an HIIFP application package.

Principal Researcher intending to utilize MTO laboratory facilities for testing must should specify in the proposal.

3.6.1 Fieldwork on MTO Highways and/or ROWs

Whether the institution is submitting an application package for a specific research topic (Section 3.2.1) or an open research topic (Section 3.2.2), the Principal Researcher must clearly define and describe the proposed fieldwork and seek pre-approval.

To ensure proper authorization and alignment with project standards, the following points must be addressed and confirmed prior to the approval of any field work:

1. **Location of Field Work**
    - Confirm whether the proposed field work will be conducted on the traveled portion or the shoulder of the highway.
    - Specify whether the field work will extend beyond the shoulder but remain within the MTO right-of-way.
2. **Traffic Control Measures**
    - Determine whether traffic control measures, in accordance with the *Ontario Traffic Manual* (OTM) Book 7, will be required.
    - If the field work may impact the traveling public, confirm that traffic control measures have been incorporated into the project proposal and budget.
3. **Use of Remotely Piloted Aircraft Systems (RPAS)**
    - Ensure compliance with Transport Canada requirements, including necessary operator qualifications and insurance coverage, for the operation of RPAS.
4. **Encroachment Permit**
    - Obtain an encroachment permit through MTO's Corridor Management process prior to commencing any work within the MTO right-of-way.
5. **Installation/Use of Equipment or Devices**
    - Evaluate any potential impact of installed or used equipment/devices on the traveling public. Where applicable, ensure traffic control measures are included in the project proposal and budget.
6. **Impact on Public**
    - Assess any potential impacts of the field work on the traveling public. If applicable, confirm that appropriate mitigation measures, including traffic control, have been incorporated into the project proposal and budget.

These requirements must be thoroughly addressed in the request for field work approval to streamline the process and ensure compliance with MTO standards.

Email the HIIFP Coordinator with the Subject Line: 'HIIFP Fieldwork Approval' to receive written consent for proposed fieldwork. Be certain to include the written consent with the application package.

3.6.2 MTO Laboratory Facilities

Principal Researcher intending to utilize MTO laboratory facilities or equipment must provide a detailed description in the proposal. Upon project award, the Principal Researcher should contact the designated MTO representative for information on approval procedures, operational constraints, and occupational health and safety requirements.

3.7 Information and Data Confidentiality

The Principal Researcher and the institution agree that all information and data that MTO provides in respect of the research project shall be kept confidential. The institution shall only use the provided information and data for purposes related to the submission of a written technical report to MTO for the research project. The institution shall ensure that reasonable methods are taken to secure the confidential information and data of MTO.

Failing to comply with this provision may result in the termination of the research project, where upon the institution shall return all information and data, return all monies paid by MTO and may result in the institution being precluded from the award of future HIIFP funds.

4. Application Package

4.1 Application Package Components

The HIIFP Steering Committee will deem the information contained in the submitted application packages as confidential. Refer to Section 6 for the evaluation criteria implemented by MTO for selecting research project proposals to be awarded HIIFP funding. The application package for a research project proposal shall consist of the following components:

1. HIIFP Application Form (see **Appendix D**, Form 23-A)

2. Research Proposal Summary (see **Appendix E**, Form 23-C)

   - 300 words maximum, Arial 12-point font, 1.08 line spacing.
   - Use plain language suitable for communicating with the public.
   - Portions of this summary may be used in a media release, therefore the language should be non-technical and free of acronyms or jargon.

3. Budget Summary (see **Appendix F**, Form 23-D)

4. Detailed Research Project Proposal

   Ten (10) pages maximum, Arial 12-point font, minimum 1.08 line spacing, and including the following information:
   - Understanding of the need for this research and the objective.
   - Proposed methodologies, innovative approaches, and potential outcomes.
   - Details of the analysis process.
   - Schedule of the activities to be undertaken during the research project, identifying key milestones and associated dates and/or timelines.
   - Qualifications of the Principal Researcher (applicant) in the subject area.
   - Related work performed by the applicant and others on the research team.

5. Budget Details Form (see **Appendix G**, Form 23-E). See Section 5 for details.

6. Curriculum Vitae (CV) for:

   - The Principal Researcher.
   - The Co-Applicants (if any) listed in the HIIFP Application Form (23-A).
   - See Section 4.1.1 for recommended information to include in the CVs.

7. Additional Approvals (where required). For example:

   - Pre-approvals (use of MTO facilities, work conducted on MTO highways, etc.)
   - Open Research Topic Form 23-B (if applicable, see Section 3.2.2 for details).

4.1.1 Curriculum Vitae (CV) Recommended Information

To encourage consistency across all submitted CVs when evaluating the HIIFP application packages, the following information is recommended for the CV of the Principal Researcher and any other Co-Applicants listed in the HIIFP Application Form.

CV Section	Recommended Information (where applicable)
Personal Information	• Name, Address, and Contact Information
Education	• Degrees and Diplomas
Recognitions	• Prizes, Awards, Distinctions and Honors – describe the recognition received and its importance
Employment	• Academic Work Experience – include the nature of your research, teaching, training, and/or other activities • Non-Academic Work Experience
Research Funding History	• List all sources of support (e.g., grants and research funding) held as an applicant or a co-applicant
Activities	• Supervisory Activities – students (e.g., postdoctoral, undergraduate, summer projects, etc.), research associates and technicians • Mentoring Activities – list all students you have mentored • Advisory Activities – for example, as an expert witness in a legal proceeding • Knowledge and Technology Translation Activities – list activities related to a practical application such as: community engagement and outreach, activities with industry, activities with government, and innovations • International Collaboration Activities – list all collaborations outside of Canada that may be relevant to the application
Memberships	• Committees and other memberships
Contributions	• Presentations (at conferences and events), Interviews and Media Relations, Publications (as author or co-author), Intellectual Property (patents, licenses, disclosures, registered copyrights, trademarks)

4.2 Application Deadlines & Submission Location

The deadline date for the receipt of application packages is:

Monday, January 26, 2026 at 5:00pm.

Completed application packages (including all supporting documentation) must be received by this stipulated deadline date.

An electronic PDF copy of the complete application package shall be submitted to the HIIFP Coordinator (HIIFP@ontario.ca) with the Subject Line: HIIFP Application Package.

Subsequent to emailing the HIIFP application package to the HIIFP Coordinator, the applicant (e.g., Principal Researcher) shall receive a return email confirming receipt of the HIIFP application package.

5. Project Proposal Budget

5.1 General

The detailed budget must include a full account of purchases and activities to be financed by the HIIFP grant. The level of budget breakdown and supporting information provided should be sufficient to justify the items relative to the Detailed Research Project Proposal (Item #4, Section 4.1).

Multi-year project proposals (see Section 3.5) may be considered and evaluated on the condition that sufficient information is provided in the application package. A Budget Summary Form (23-D) should be completed for each fiscal year in the multi-year project proposal requiring funding.

The HIIFP Steering Committee reserves the right to disallow expenditures in the budget that are not adequately justified.

5.2 Budget Summary & Details

A Budget Summary Form (23-D) and a Budget Details Form (23-E) shall be included in the application package. It is important to consider the provisions outlined in Section 3.4 which describes available funding and ineligible expenditures.

The following types of expenditures are eligible for funding, unless specified otherwise:

5.2.1 Salaries and/or Benefits

Salaries, stipends and related federal, provincial and institutional non-discretionary benefits for research work performed by research personnel (e.g., students, research associates, and technicians) may be included in the budget.

The salary of the Principal Researcher is **not eligible** for funding under the HIIFP and should not be included in the budget.

5.2.2 Equipment and/or Facility

Equipment and/or facility costs directly attributed to the research project may be funded. The Principal Researcher may propose to use MTO equipment and/or laboratory facilities as part of their application, where similar equipment and/or facilities are not available at their institution.

MTO will not normally fund the purchase of major equipment, or the rental of existing equipment. However, in exceptional cases that satisfy MTO, major equipment purchases, rental of large, shared equipment or the purchase of computer time will be considered on a case-by-case basis.

5.2.3 Materials and/or Supplies

Materials may include the purchase of engineering materials directly attributable to the research project proposal. Supplies may include expendable materials, printing, photocopying, and other similar office supplies.

Materials that are to be supplied by MTO will be indicated in the “Background” section of the Specific Research Topic included in Appendix A of this Program Guide.

5.2.4 Travel

A presentation of the research findings to the HIIFP Steering Committee and/or an MTO Technical Committee may be a key deliverable for the research project proposal. Travel and accommodation, if required, shall be in accordance with the institution’s internal travel policy and all associated costs shall be included in the budget summary.

5.2.5 Dissemination Costs

Dissemination costs include costs associated with the preparation of the written technical report. All written technical reports shall be in conformance with the Ontario Government accessibility requirements in order to be accepted by MTO. See Reports and Deliverables for details related to the requirements for written technical reports.

5.2.6 Overhead

Overhead may be included in the budget for the research project proposal. The Budget Summary Form (23-D) requires that the applicant identify the rate (as a percentage) of overhead for the institution. Please note that HIIFP funding is considered a research grant, therefore overhead rates should be calculated and presented accordingly. Overhead rates shall not exceed **25%**.

6. Evaluation Criteria

MTO will **only** accept, review and evaluate application packages (see Section 4.1 for the required components of an application package) that are received by the deadline date specified in Section 4.2.

To assist institutions and applicants in completing their application package, the evaluation criteria implemented by MTO for awarding research project proposals HIIFP funding is summarized in the following subsections.

6.1 Application Package Content

Each of the following four items are awarded a numerical score, a maximum of 20 points for each item:

- Demonstrates an understanding of the research need and the desired objective(s)/outcome(s).
- Exhibits a degree of innovativeness to address the problem described in the research need.
- Feasibility of accomplishing the required deliverables within the proposed timelines and budget.
- Experience and qualifications of the Principal Researcher (and Co-Applicants, where applicable) in the subject area(s).

The maximum total for this section is equal to **80 points**.

6.2 Other Considerations

Each of the following four questions are awarded a numerical score based on the reviewer's response ("yes" = 5 points, "no" = 0 points):

- Does the overall cost of the research project provide good Value-For-Money to MTO?
- Is the research project of great importance to MTO?
- Does the MTO Office have a Technical Specialist available to support the research team for the duration of the project?

- Does the research project demonstrate the use of sustainable materials and processes?

The maximum total for this section is equal to **20 points**.

6.3 Final Recommendation

Evaluators will make a final recommendation for each application package by choosing one of three potential outcomes:

- **Yes**, recommend for HIIFP funding.
- **Yes**, recommend for HIIFP funding with suggested changes and/or modifications.
- **No**, do not recommend for HIIFP funding.

7. Notification of Award & Next Steps

A letter announcing the award of HIIFP funds will be sent at the beginning of the award period from MTO to the Principal Researcher. A copy of the award letter will also be sent to the Authorized Signing Officer of the Sponsoring Institution as designated in the HIIFP Application Form (23-A).

Upon receipt of the award letter, the institution accepts and agrees to: 1.) the provisions in the award letter, 2.) the contents of the submitted application package for the research project proposal, and 3.) the requirements set out in this Program Guide. The award letter also provides authority for the institution to incur project expenses for items and amounts specified in the approved Budget Summary Form (23-D). Note, expenses incurred in excess of the approved budget are not the responsibility of MTO.

Following receipt of the award letter and prior to beginning the research project, the Principal Researcher shall connect with the MTO Contact (MTO Technical Specialist) listed in the award letter. This communication between the institution and MTO is critically important to re-confirm all research project proposal items such as:

- The required resources.
- The project schedule.
- Any assistance requested of MTO.
- The specific project deliverables.

Recipients of HIIFP funding and their research team and/or associates are not considered employees of the Ministry of Transportation (MTO) or the Ontario Government. MTO reserves the right to terminate HIIFP funding without cause, at any time, by providing written notice of termination to the institution.

Any public announcements about the award of funding for the Highway Infrastructure Innovations Funding Program shall be made by MTO, unless the institution obtains the prior written approval by MTO. MTO will publish the list of awarded projects for each fiscal year on the MTO website (HIIFP Steering Committee | MTO Technical Consultation Portal)

8. Financial Arrangements & Reporting Requirements

HIIFP funds shall be paid to the institution in one instalment. As outlined in the award letter, the institution will be required to send an invoice to the HIIFP Coordinator for the specified funding amount.

The institution must submit an invoice for each project, clearly indicating the Agreement Number/Project Number and the institution's HST number, for the total amount of the project.

Recipients of HIIFP funding are required to maintain periodic contact with the HIIFP Coordinator and/or the MTO Contact assigned to their research project.

A financial report must be submitted to MTO by the Authorized Signing Officer of the Sponsoring Institution upon completion of the research project. This financial report shall include a full account of purchases and activities financed by the HIIFP grant. The financial report shall also include an itemized list of equipment that was purchased in whole or part with the HIIFP funds.

The following items shall be included in the financial report:

- Salaries and/or Benefits
- Equipment and/or Facility Use
- Materials and/or Supplies
- Travel
- Dissemination Costs
- Other Costs

MTO reserves the right to audit any research project. The institution is required to keep any records that may be required for a financial audit for a minimum of five (5) years.

For approved multi-year research projects, in order to be considered for funding in subsequent years, institutions will be required to provide written Project Progress Reports, Form 23-F (see **Appendix C**) a minimum of every six (6) months. The project progress report shall be sent to the MTO Contact, with a copy to the HIIFP Coordinator.Failure to demonstrate satisfactory progress, submit progress reports, or clearly outline the percentage completion of tasks as detailed in the original application package may result in the denial of funding for subsequent fiscal years. Additionally, MTO reserves the right to revoke the funding in future years and can terminate the research project upon written notice to the institution.

Any surplus or unspent funds must be returned to MTO by the institution. If the research project is not started or is terminated part way through the proposed timeframe, any unused portion(s) of the HIIFP funding must be returned to the HIIFP Coordinator within thirty (30) calendar days.

9. Amendments to a Research Project

Any amendment or alteration to the research project must be formally proposed and approved in advance to ensure alignment with project objectives and funding requirements.

9.1 Amendment or Alteration to Research Project

The Principal Researcher shall notify the HIIFP Coordinator, in writing, in advance of any intention to:

- Alter the direction or intent of the research project.
- Terminate the research project.
- Reassign research responsibilities to other researchers, other than those named in the original HIIFP application package.
- Modify the research project work schedule.
- Reallocate funding described in the Budget Summary Form (23-D) and/or Budget Details Form (23-E) included in the original HIIFP application package.
- Alter the research project deliverables and/or timelines.

Written approval from the HIIFP Coordinator must be obtained before any alterations or amendments to the research project are implemented.

If the Principal Researcher is uncertain as to what constitutes an alteration or amendment to the research project, the Principal Researcher shall contact the HIIFP Coordinator and/or the assigned MTO Contact to discuss further.

9.2 Research Project Extension (No Cost Extension)

Extensions for research projects may be granted if a valid reason for the extension is provided in advance. The Principal Researcher must complete and submit the No Cost Extension Form (See Appendix I No Costs Extension Form (23-H)), which must include the following details:

- **Reason/Justification**: Clearly explain the need for the extension.
- **Proposed Completion Date**: Provide a detailed breakdown of the revised schedule, including updated milestones for deliverables.

- **Potential Implications**: Identify any potential impacts or consequences of the proposed extension.

The No Cost Extension Form must be completed by the Principal Researcher and signed by:

- The Principal Researcher,
- The Head of the Department, and
- The Authorized Signing Officer of the Institution.

The completed No Cost Extension Form must be submitted along with an interim Project Progress Report (Form 23-F).

Submission and Review Process:

- The Principal Researcher must submit the *No Cost Extension Form* to the corresponding MTO Technical Specialist.
- The MTO Technical Specialist will review and endorse the request before forwarding it to the HIIFP Coordinator.
- The request may be subject to further review by the steering committee. The Ministry reserves the sole discretion to approve or decline the extension request.
- The HIIFP Coordinator will inform both the Principal Researcher and the MTO Technical Specialist of the decision.

Additional Requirements for Approved Extensions:
If an extension is granted, the Principal Researcher must submit a *Project Progress Report* within six months of receiving the extension approval.

10. Reports and Deliverables

For projects awarded HIIFP funding, the Principal Researcher, and their research team shall:

- Submit a progress Report every six (6) months following the award of the project
- Submit a written technical report(to be published in the MTO Library Catalog), demonstrating how the research need was addressed and/or met and recommendations where improvements may be made.
- Present their findings to the HIIFP Steering Committee and/or an MTO Technical Committee interested in the specific subject area.

10.1 Project Progress Report

The Principal Researcher is required to submit written Project Progress Reports (*Form 23-F*, see Appendix C) at least every six (6) months following the award of the project.

Submission Details:

- Progress reports must be submitted to the assigned MTO Technical Specialist.
- A copy of the report must also be sent to the HIIFP Coordinator.

Failure to Comply:

- Failure to demonstrate satisfactory progress, submit required reports, or clearly outline the percentage completion of tasks as specified in the original application package may result in:
  - Denial of funding for the current fiscal year.
  - Ineligibility for funding in subsequent future fiscal years for multi year projects.

Additionally, MTO reserves the right to revoke the funding in future years, at its sole discretion, and can terminate the research project upon written notice to the institution.

10.2 Written Technical Report

The Principal Researcher shall submit a written technical report to MTO Technical Specialist and HIIFP Coordinator , no later than three (3) months after the research completion date (as specified in the submitted HIIFP Application Form, 23-A) or after termination of the funding by MTO.

The Principal Researcher shall use the HIIFP Report Template, an MS Word™ template (see Appendix H) as a baseline when preparing the written technical report to maintain consistency of all submitted HIIFP reports. The Technical Report Style Guide for the Engineering Materials Office (EMO), EMO-208 may also be used as a resource to aid the Principal Researcher in producing a written technical report that is well organized, functional, and professional.

To be accepted by MTO, all HIIFP written technical reports require inclusion of a Technical Report Documentation Page (see page ii of the HIIFP Report Template) and shall be submitted in a PDF format. Prior to converting the MS Word™ document to PDF, an accessibility check should be performed using the MS Word™ Accessibility Checker to ensure the written technical report is in conformance with the Ontario Government accessibility requirements. Some best practices for ensuring accessibility requirements are met when preparing written technical reports include:

- Placing a focus on accessibility early in the process of preparing the written technical report.
- Using the HIIFP Report Template, an MS Word™ template with accessibility choices, e.g., font type and size, paragraph spacing, line spacing, etc. pre-defined for the written technical report.
- Choosing font types that are sans serif, e.g., Arial, Calibri, Raleway, etc. and 12-point font size or larger.
- Avoiding large sections of text set in all caps, bold and/or italic.
- Limiting the use of underlined text, except for hyperlinks.
- Using meaningful and descriptive hyperlink text. Avoiding words like “click here” or “go here” for the hyperlink text.
- Avoiding the use of visual cues alone to convey important information, e.g., text effects, highlighting text, low contrast colours, serif fonts, etc.
- Avoiding over use of the **Enter** key, **space bar** or **Tab** key to create white space in the document. An individual who uses a screen reader will hear “blank” repeated several times and this can be distracting or lead the person to believe they have reached the end of the document.

- Performing an accessibility check using the MS Word™ Accessibility Checker prior to converting the source document (e.g., HIIFP written technical report) to PDF to ensure the written technical report meets digital accessibility requirements.

- Converting the source document in a way that ensures the accessibility considerations and information, e.g. cues, tags, styles, etc., are not lost during the conversion process.

The corresponding MTO representative/ Technical Specialist will retain the written technical report, generate an ISBN (International Standard Book Number) and publish the final report in the MTO Library Catalog. The corresponding MTO representative or Technical Specialist will provide the HIIFP Coordinator with an updated copy of the published report. It is important to note that a copy of a student thesis or dissertation is **not** a substitute for an HIIFP written technical report.

Members of the HIIFP Steering Committee that recommended support of the research project may also review the written technical report.

The institution or Principal Researcher shall also provide MTO with a copy of any follow-up publications which the Principal Researcher prepares following the research project and which incorporates any portion of the research outcomes.

10.3 Presentation of Findings

Upon submission of the written technical report, the Principal Researcher and their research team shall prepare and present the findings of their research project to the MTO Contact assigned to the research project and/or any other interested MTO staff members. In coordination with Principal Researcher, the presentation will be scheduled by the HIIFP Coordinator within two (2) months of the submission of the written technical report.

The presentation shall be prepared using MS PowerPoint™, with consideration made for the following best practices:

- Ensure each slide title is meaningful and unique.

- Choose font types that are sans serif, e.g., Arial, Calibri, Raleway, etc. and 18-point or larger for slide content.

- Avoid large amounts of text set in all capitals, bold, italics, and/or underlined.

- For colour, ensure text and background colours have a contrast ratio of at least 4.5:1, or 3:1 (for large text, 14-point bold and larger).
- Do no use colour alone to convey important information
- Ensure sufficient white space is provided between text and graphics.
- Abbreviations and acronyms shall be fully explained and/or spelled out in their first instance in the presentation.
- Use the notes pane to provide supplementary information or longer descriptions, if required.

11. Research Outcomes

When MTO elects to use the findings from research projects funded by HIIFP, as a condition of the HIIFP funding, MTO shall be granted a non-exclusive, royalty-free license, without charge to use the research outcomes, data, tools, and/or conclusions for MTO's own non-commercial internal purposes. This includes use on MTO highway contracts and work conducted on behalf of MTO.

In the event the institution is able to obtain patent protection for any of the outcomes and/or conclusions in the research project, MTO shall be granted a royalty-free, non-exclusive license without charge to use the outcomes and/or conclusions in the research outcomes with no right to sub-license to third parties. The institution shall arrange for the execution of the appropriate documents to provide such licenses to MTO.

Should the research outcomes be further interpreted and/or refuted by MTO, then MTO's findings and/or conclusions shall become the responsibility of MTO.

Should MTO's findings and/or conclusions differ from the findings and/or conclusions in the research outcomes, the names of the Principal Researcher, original authors, and institution shall not be associated with MTO's findings and/or conclusions.

12. External Communication of Research Outcomes

For the purpose of this section, the terms "disclosure", "publication" and "presentation" include articles, seminars and any other oral or written presentations as deemed appropriate by the institution to the public. This does not include a student thesis or other communications submitted for the purpose of evaluating the student's performance. The institution retains the right to have a student's thesis reviewed and defended for the sole purpose of academic evaluation in accordance with the institution's established procedures.

12.1 External Communications

The Principal Researcher and/or institution shall notify MTO of any external disclosure, publication and/or presentation of the research project findings, outcomes and/or conclusions by adhering to the information in the following sections, where applicable to the particular situation.

12.1.1 Disclosure

Both MTO and the Principal Researcher/institution shall be sensitive to the need for timely approval of a student's thesis and/or essay.

12.1.2 Publications or Presentations

The Principal Researcher/institution, using their best efforts, shall notify MTO at least sixty (60) calendar days in advance of any proposed external publication or presentation. The associated outline or abstract shall be submitted to the HIIFP Coordinator with the Subject Line: External Communication.

The researchers/ institutions shall not proceed with external publications without first ensuring that MTO's publication (HIIFP Technical Final Report) rights are not restricted.

12.1.3 Publication Disclaimer

Any publication resulting from a research project funded through HIIFP shall acknowledge the source of the funds and include a disclaimer indicating that the views of the authors may not necessarily reflect the views and policies of MTO. Sample wording of a disclaimer to be used is as follows:

"This research project was supported [whole or in part] by a grant from the Ontario Ministry of Transportation (MTO). Opinions expressed in this report are those of the authors and may not necessarily reflect the views and policies of MTO."

12.1.4 Reference Permission

Should the Principal Researcher/institution wish to make specific reference to MTO and/or name an MTO staff member in the publication, permission by MTO shall be obtained prior to publication. Permission requests shall be sent to the HIIFP Coordinator with the Subject Line: Reference Permission.

12.1.5 Media Inquiries

The Principal Researcher/institution should not speak directly to the media regarding the research project or any findings, outcomes and/or conclusions. Any Principal Researchers/institutions contacted by the media shall communicate the following:

"The Highway Infrastructure Innovations Funding Program policy is to refer all media inquiries to MTO's Communications Branch".

All media inquiries regarding awarded HIIFP research projects should be sent to the HIIFP Coordinator with the Subject Line: Media Inquiry. Once the request is received by the HIIFP Coordinator, they will refer the inquiry to the MTO Communications Branch where an Issues Advisor will draft an appropriate response. The reporter/media outlet that made the original inquiry will be sent an official response by an MTO Issues Advisor from the Communications Branch.

13. Occupational Health and Safety

The institution and Principal Researcher shall be responsible for understanding and complying with all legal obligations under the Occupational Health and Safety Act (OHSA). Any procedures undertaken as a result of the awarded HIIFP research project shall be carried out in accordance with the OHSA and all applicable regulations.

Principal Researchers intending to carry out fieldwork on MTO highways and right-of-ways and/or proposing to make use of MTO laboratory facilities shall contact MTO for additional information on approval process, operational constraints and occupational health and safety requirements.

APPENDIX

Appendix A. Specific Research Topics

Topic 1: Transportation Infrastructure Management Division, Standards & Contracts Branch, Engineering Materials Office, Pavements Section

Subject Area	Pavement Materials
Title	Molecular and Microstructural Evaluation of CIR/CIREAM Mixes with Rejuvenator and Cement Additives
Background	Cold In-Place Recycling (CIR) and Cold In-Place Expanded Asphalt Mixes (CIREAM) are increasingly being adopted in Ontario as sustainable pavement rehabilitation strategies, particularly for applications involving high RAP content. These technologies provide substantial environmental and economic benefits; however, their long-term performance is not yet fully understood due to the complex interactions among aged binder, rejuvenators, and cementitious additives. Current specifications and mix design approaches rely heavily on empirical performance tests, offering limited insight into the molecular- and microstructural-level mechanisms that drive durability, aging resistance, and mechanical behavior.
Challenge	Although CIR and CIREAM are increasingly used in Ontario, several challenges limit confidence in their long-term performance: • Understanding of binder–additive interactions: The chemical and microstructural effects of rejuvenators and cementitious additives on highly aged RAP binders remain poorly defined. • Uncertain aging pathways: How binder chemistry and mix microstructure evolve under environmental exposure and traffic loading is not well documented, especially for high-RAP systems. • Weak mechanistic linkage to performance: Current empirical tests do not adequately capture the fundamental mechanisms governing cracking resistance, stiffness development, moisture susceptibility, and overall durability. • High material and field variability: RAP source characteristics, binder aging levels, rejuvenator types, and in-place construction conditions introduce significant variability not fully addressed in current specifications. • Limited predictive tools: Existing mix design and specification frameworks lack mechanistic approaches to assess time-dependent performance and optimize CIR/CIREAM mixtures.

Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	**Clear understanding of binder–additive interactions:** Quantified effects of rejuvenators and cementitious additives on aged RAP binder chemistry, structure, and aging pathways. • **Microstructural characterization of CIR/CIREAM mixes:** Detailed identification of how binder, aggregates, and cementitious phases interact and evolve over time. • **Mechanistic linkage to performance:** Established relationships connecting molecular and microstructural changes to stiffness development, cracking resistance, moisture susceptibility, and overall durability. • **Improved mix design framework:** Evidence-based enhancements to CIR/CIREAM mix design, including additive selection and dosage guidance. • **Specification-ready findings:** Clear recommendations for modernizing MTO specifications based on laboratory data and mechanistic insights.
Benefits to MTO	**Reduced performance uncertainty:** Mechanistic data will help MTO better predict long-term behavior and confidently apply CIR/CIREAM on high-volume corridors. • **More durable rehabilitation treatments:** Optimized additive use and mix design will improve cracking resistance, stiffness control, and overall service life. • **Stronger, more consistent specifications:** Findings will support updates that address RAP variability, additive compatibility, and material quality across Ontario. • **Cost-effective pavement management:** Improved durability and optimized use of RAP can reduce lifecycle costs and extend rehabilitation intervals. • **Alignment with sustainability and circular-economy goals:** Enhanced performance of high-RAP recycling treatments supports reduced emissions, lower virgin material consumption, and greener rehabilitation strategies. • **Improved quality assurance tools:** Chemical and microstructural indicators may provide new options for verifying material compatibility and construction quality.
Contact (Name, email, phone number)	Stephen Lee EMO, Pavement Section Stephen.Lee@ontario.ca (437) 655-6825

Topic 2: Transportation Infrastructure Management Division, Standards & Contracts Branch, Engineering Materials Office, Soils and Aggregates Section

Subject Area	Soils and Aggregates
Title	Analytical Assessment of The Effect of Various New Stabilizing Additives for Aggregates and Subgrade Soils
Background	Stabilization of soils and aggregates with additives has been utilized for centuries as a tool for economic road building, conservation of materials, and highway upgrading. For example, Full-depth reclamation (FDR) has been used as one of the sustainable in-place engineering technologies applied to MTO's pavement rehabilitation or reconstruction projects since 2001. In some projects, the pulverized materials were stabilized with expanded asphalt to increase the bearing capacity of the new base layer before a thin surface overlayer is paved. Cement-based and limebased stabilizing additives have also been used to improve the performance of aggregates and soils. However, Continually escalated cost of construction materials and practices may impact competitive bidding process when the bids are much higher the budget of the project. There have been ongoing changes in the construction industry for stabilization including development of new equipment, new materials and more cost-effective construction and design procedures. In support of Ministry's mandate to promote suitability in design and construction, the Soils and Aggregates Section continues to evaluate new stabilization procedures and techniques that • limit the consumption of natural resources; • reduce energy consumption that is required for extract and transport raw materials and the manufacturing process; • promote innovation; • reduce greenhouse gas emissions; and • limit pollution. As more stringent requirements are regulated on the application of new aggregate extraction sites in Ontario, escalated transport cost from remote aggregate sources results in an increase in highway construction and rehabilitation costs as well as greenhouse gas emissions. There is a great need to find more economical replacement for new aggregates. Hence, stabilization techniques that can improve marginal materials inplace more cost-effectively is a sustainable option to alleviate this problem

Challenge	The major tasks need to be carried out to: 1) identify and develop the tests required to assess the quality of each proposed stabilizer. 2) perform testing of stabilized materials to: a. determine the appropriate applications of each proposed stabilizer as well as limitations. b. define the operational conditions, and c. determine strength properties, performance and durability of stabilized materials. 3) correlate or compare material tests on stabilized materials and the common tests performed on untreated materials. 4) perform analytical assessment of the economics, life-cycle cost analysis and effectiveness associated with varying amounts of proposed stabilizers to be used on their intended applications. 5) propose pavement structural design parameters for stabilized materials. 6) propose material and construction specifications for the proposed stabilizers
Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	The anticipated outcomes and deliverables from this research include: 1) Develop and implement a research and test plan to assess the proposed stabilizers. 2) Testing methodology and quality protocols. 3) A report that sets out all the test data collected, analytical results and identifies the applications of the proposed stabilizers. 4) specifications that govern the material quality and construction operations. 5) Technical Report and presentation to MTO as part of the research results and findings. The scope of the testing program must be statistically significant and include tests as specified in applicable Ontario Provincial Standard Specifications, as well as new tests that are required to assess the quality of the proposed stabilizer and stabilized materials.
Benefits to MTO	The information will be used to determine the potential use of the stabilizers to support construction of Ontario infrastructure. Since material and construction specifications for the proposed stabilizers are deliverables of the research, MTO would be able to plan a field trial to evaluate the operation conditions of the proposed stabilizers as well as their effect on infrastructure performance.
Contact (Name, email, phone number)	Zhiyong (Gem) Jiang; (416) 230-9805; zhiyong.jiang@ontario.ca

Topic 3: Transportation Infrastructure Management Division, Standards & Contracts Branch, Structures Office, Foundation Engineering

Subject Area	Foundation Engineering
Title	Application of Cellular Concrete as Backfill to Structures
Background	The selection of backfill material to abutment walls and retaining structures must consider drainage, frost susceptibility, constructability and economics. Earth pressures exerted against the abutment and retaining structures are calculated during design to ensure performance requirements including bearing capacity, settlement, deflection, sliding, overturning and global stability are satisfied. Cellular concrete is a lightweight material with unit weights controlled by the mix design but typically as little as 20 – 25 % the unit weight of conventional granular A and granular B used as backfill on MTO structures. Advantages of lightweight fill as backfill to structures include: i. Reduction in lateral earth pressures ii. Reduction in vertical stress iii. Accelerated construction
Challenge	A fundamental component of any retaining structure design is to ensure proper drainage and to avoid hydrostatic pressure build up. Neglecting this during design will compromise the performance and durability of the structure. The current state of practice in Ontario is to use non-permeable lightweight cellular concrete, but this imposes a challenge in ensuring proper drainage. Typically, vertical and horizontal drains become an inherent component of the design within a controlled drainage system, but these measures may be ineffective without a permeable backfill material. Other jurisdictions have used permeable lightweight cellular concrete, which inherently promotes drainage. However, the application of permeable lightweight cellular concrete provides some uncertainty regarding the long term performance and durability of the permeable lightweight cellular concrete. Degradation of the cellular concrete can result in heavier and non free draining material which will have adverse consequences on the performance of the structure.

	A comprehensive comparison of permeable and non permeable cellular concrete is required and shall include: 1. Conducting a literature search and summarizing the state of practice in jurisdictions locally, nationally and internationally. 2. Development of a 2D finite element model to analyse retaining structures using conventional backfill, permeable and non permeable cellular concrete. 3. Conducting parametric analyses using varying strength and unit weight properties, backfill/structure interface properties, heights, coefficients of hydraulic conductivity, backfill geometries, and native soils/rock. 4. Conducting a laboratory study to assess loads, bending moments and deflections as a product of height, backfill geometry and backfill permeability. 5. Providing a summary of the advantages, disadvantages, costs, risks and consequences of permeable vs non permeable cellular concrete. 6. Providing a guideline for the application of permeable and non permeable cellular concrete with a focus on but not necessarily limited to MTO highway infrastructure applications (abutment walls, retaining walls).
Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	Bi-annual (every 6 months) written progress reports per HIIFP Guidelines, in addition to informal check-ins with MTO Technical Contact at least once every 2 months for the duration of the project. Progress reports and informal check-ins shall be accompanied by virtual calls via MS Teams. Written Technical Report and Guideline detailing the methodology, outcomes, and procedural instructions (framework) for the application of permeable and non permeable cellular concrete. Final Presentation with the Ministry to demonstrate the use of permeable and non permeable cellular concrete as backfill to structure.
Benefits to MTO	1. Provide designers with an alternative lightweight fill as backfill to structure. 2. Enhance performance of abutment walls and retaining walls. 3. Produce more cost effective abutment and retaining wall designs. 4. Faster construction of abutment and retaining walls.
Contact (Name, email, phone number)	Hugh Gillen hugh.gillen@ontario.ca, 343-999-2142

Topic 4: Transportation Infrastructure Management Division, Standards & Contracts Branch, Structures Office, Foundation Engineering

Subject Area	Structural & Foundation Engineering
Title	Welding of Reinforcing Steel Cages in Deep Foundations
Background	Currently, tack welding or reinforcing steel is prohibited by CSA S6 and OPS specifications for non-load bearing (NLB) joints. Nevertheless, Contractors propose tack welding of rebar, either manual or robotic, for rigidity of the rebar cages and to improve efficiency. For example, on the Dunlop St Underpass on Hwy 400 project, the Ministry of Transportation (MTO) adopted Continuous Flight Auger (CFA) piles for the first time, requiring installation of rebar cages into freshly poured concrete by force. The rebar cages needed sufficient rigidity to be pushed into the deep, concrete-filled holes. Typical rebar tying methods failed, leading the contractor to propose welded cages. Welding of rebars has the potential to improve constructability, reduce project timelines, and lower costs.
Challenge	Current CSA S6-25 and OPSS standards do not accept welded rebar assemblies. These welding restrictions are based on concerns about reduced yield strength, reduced elongation, and increased hardness at welds. But does this reduction in structural properties of the bars at the welds translate to a decrease in overall performance and strength of a reinforced concrete member? MTO requires an updated best practice reflecting current technology and knowledge, focused on the impact of tack welds to members' strength.
Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	• Conduct literature surveys on welding of rebars, rebar cages, and assemblies to identify existing research, standards, and codes. • Perform structural analyses and experimental testing to evaluate welding quality and long-term performance of welded rebars. Determine feasibility and limitations of welding in rebar assemblies. • Develop acceptable criteria and guidelines for welding in rebar assemblies for project implementation. • Deliver a comprehensive Final Report and Presentation summarizing findings, conclusions, and recommendations.

Benefits to MTO	• Enable immediate updates and implementation of policies, manuals, and guidelines for structural pile design informed by research findings. • If tack welding could be acceptable (with some accounting for the impact on the members' performance), it could improve productivity from faster installation and reduced on-site labout, and results in savings in construction time, and reduces overall costs.
Contact (Name, email, phone number)	Ben Huh Ben.huh@ontario.ca 289 228 7042

Topic 5: Integrated Policy & Planning, Transportation Policy, Emerging Technologies

Subject Area	**Winter Performance of Automated and Connected Mobility**
Possible Title(s)	***Evaluating the Effects of Ontario Winter Conditions on Automated and Connected Mobility Systems***
Background	Ontario winters create challenges for emerging mobility technologies due to snow, ice, and low temperatures. These conditions affect safety, reliability, and public confidence in automated and connected vehicles, and may require adaptations to technology and infrastructure.
Challenge	How can MTO ensure safe, reliable, and accessible automated and connected mobility throughout winter conditions? • Develop winter-specific testing scenarios for AVs and connected vehicles, including extreme cold, snow, and ice. • Examine vehicle performance, infrastructure interactions, and public perception under these conditions. • Test programs could test technology adaptations, maintenance protocols, and operational practices to improve year-round reliability and safety.
Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	A written Technical Report and a Presentation to a Ministry Technical Committee.
Benefits to MTO	MTO could use evidence from program assessments to show: • The specific winter challenges affecting automated and connected mobility. • Data to inform infrastructure design, technology adaptation, and maintenance planning. • Insights to maintain public confidence and safe operation in winter conditions, supporting regulatory and operational policies.
Contact (Name, email, phone number)	Michael DeRuyter Michael.deruyter@ontario.ca 647-631-6138

Topic 6: Integrated Policy & Planning, Indigenous Relations, and Environmental Policy Branch, Environmental Policy

Subject Area	Environmental – Air Quality, Air and Noise Barrier
Title	Field Study – Performance Monitoring of a Combination Noise and Air Pollution Reduction Barrier
Background	Air pollutants from vehicles have the potential to pose significant health risks, particularly for populations near major roadways. Ontario Ministry of Transportation (MTO) monitors emerging pollution reduction measures as part of efforts to reduce environmental impact of the roadway projects from an air quality perspective. MTO is assessing combination noise and air pollution reduction barriers for their ability to reduce highway-related air pollution. One such barrier reduces emissions through two mechanisms: (1) An angled baffle atop, which generates vortexes, enhancing vertical mixing while directing a portion of air into the space between the panels and (2) A patented photocatalytic coating, which breaks down NOx into N2 and O2 with presence of sunlight. MTO has one existing installation of a combination noise and air pollution reduction barrier on the north side of Highway 401, west of the Bayview Avenue interchange in Toronto and one installation planned on northeast side of the Highway 400 and Dunlop Street northbound on ramp in Barrie. MTO conducted a field study at Highway 401 and Bayview, from August 2017 to February 2018. Integrated sampling heads were installed at the inlet and outlet of the barrier. The initial study did indicate a reduction of NOx, however the results were limited and subject to some challenges related to environmental conditions during the study (e.g., installation of a noise barrier in the vicinity and road resurfacing). Furthermore, this study did not assess the aerodynamic design of the barrier. Full study details are attached as a reference document.
Challenge	MTO is seeking to build upon the previous testing at the existing barrier through the development and implementation of additional monitoring at the existing Highway 401/Bayview Toronto location and/or the planned Highway 400/Dunlop Street project in Barrie through this HIIFP. The study will supplement the initial field study by assessing performance at potential receptor locations, comparing it to a typical noise wall, and evaluating its durability. Additionally, it will provide additional insights into the health benefits of pollution reduction, helping to justify the added cost of these barriers. The following should be considered in support of this objective: • **Review Existing Studies:** Identify gaps in data, methodologies, or findings from MTO studies or other publicly available reports. This review will help ensure new monitoring efforts address missing or inconclusive information from past evaluations. • **Identify Appropriate Monitoring Locations**: Current field results are limited to relative difference of inlet and outlet concentration measurements, which may

	not accurately reflect the air quality at the receptor locations. Sampling should be conducted both on the highway side and behind the barrier. Monitoring behind the barrier should occur at potential receptor heights, with measurements taken at increasing distance away from the barrier. This will help identify optimal locations for future installations. • **Compare with Baseline**: Combination noise and air pollution reduction barriers should be compared with a typical noise barrier, which serves as the baseline for pollutant reduction. Based on various research, a typical wall can reduce pollutant concentrations behind the barrier under certain meteorological conditions. The typical noise wall set for comparison should ideally be at the same height and orientation as the combination noise and air pollution reduction barrier for a fair comparison. • **Control or Account for External Factors:** Past pilot study has shown that incidents like roadwork and changes to surrounding infrastructure can significantly impact performance. These external influences should be minimized where possible and clearly explained if they are unavoidable. • **Key Parameters**: NOx levels, along with wind speed, direction, and other relevant factors, should be measured. • **Study's Duration**: While NOx does not have specific air quality criteria for the environmental assessment purpose, Canadian Ambient Air Quality Standards (CAAQS) and Ontario's Ambient Air Quality Criteria (AAQC) has criteria for NO2 1-hour, 24-hour, and annual averaging periods. The experimental design should take these averaging period and statistical form into considerations. • **Timing of the sampling:** Products with photocatalytic coatings require sunlight to be activated, which result in lower performance at night. • **Durability**: Evaluate how long the subject combination barrier maintains its performance over time.
Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	The deliverables should include: • A review of previous studies (both those undertaken by MTO and others which are publicly available) to identify data gaps. • An experimental design to evaluate barrier performance, including assessments at potential receptor locations and comparisons with a typical noise wall. The design will be reviewed by MTO prior to being implemented. • Implementation of the monitoring program based on the experimental design approved by MTO. • A report detailing monitoring results and findings. • Recommended criteria for MTO to assess barrier implementation, considering project location and cost-effectiveness of the combination noise/air barriers based on testing results.
Benefits to MTO	This study will align with MTO's commitment to the evolving landscape of pollution control technology, provide an enhanced understanding of barrier durability and performance in pollution mitigation on provincial highways in Ontario. It will also support MTO in making informed decisions about when and where combination

	air/noise barriers would be most suitable and effective, ensuring diligent allocation of funds to contribute to the protection of public health.
Contact (Name, email, phone number)	Andrea Bulanda, Team Lead, Indigenous Relations, and Environmental Policy Branch Email: Andrea.Bulanda@ontario.ca Phone: +1 (289) 696-1564

Topic 7: Integrated Policy & Planning, Indigenous Relations, and Environmental Policy Branch, Environmental Policy

Subject Area	Environmental
Title	Developing Standardized Mitigation and Compensation Approaches for Species at Risk under the proposed Species Conservation Act.
Background	The proposed *Species Conservation Act, 2025* (SCA) is anticipated to replace the *Endangered Species Act, 2007* (ESA) in early 2026. Under the ESA, Ministry of Transportation (MTO) undertakings that may impact Species at Risk (SAR) or their habitat require authorizations (e.g., permit or registration). MTO must comply with all authorization conditions throughout the undertaking. Mitigation and/or compensation conditions are typically developed on a project-specific basis. Once enacted, the SCA will apply to MTO highway planning, design, construction, and maintenance activities that affect SAR or their habitat. The SCA will retain prohibitions on harming species and/or habitat but introduces a registration-first model. This shift will place the responsibility of evaluating, mitigating, and addressing potential impacts on proponents, such as MTO. Certain species in particular taxonomic groups present unique challenges for MTO, including the following: • Vascular plants (e.g., Black Ash and Butternut) • Migratory Bats (e.g., Eastern Red Bat, Hoary Bat, Silver-Haired Bat) • Reptiles (e.g., Blanding's Turtle) Gaps in current understanding of appropriate survey methods, effective mitigation/compensation and/or complex habitat requirements for these species result in challenges to developing a standardized, coordinated framework for MTO's approach to SAR management in our undertakings.
Challenge	With the transition to a more proponent-driven model under the SCA, there is a need to develop a standardized, coordinated framework for MTO's approach to SAR management in our undertakings. MTO is interested in exploring research opportunities to address current gaps. MTO is hoping to achieve this by understanding what appropriate survey methods, effective mitigation/compensation and/or complex habitat requirements are needed for various species to support a coordinated approach for SAR management. The researcher should: 1. Identify survey, mitigation, compensation, and monitoring measures under previous MTO ESA permits for one or more

	taxonomic group of mutual agreement between the researcher and MTO; 2. Conduct targeted literature reviews, jurisdictional scans, field investigations and/or other analyses to evaluate the efficacy of previous or new measures to support a streamlined approach to SAR protection and habitat recovery, and; 3. Support the development of standardized survey, mitigation, compensation and/or monitoring criteria, decision frameworks and/or other tools for applying specific mitigation, compensation and monitoring measures to MTO undertakings under the SCA. The research initiative may focus on different locations across Ontario.

Anticipated Outcome(s) and/or Research Deliverable(s)
(e.g. Written Technical Report and a Presentation)
	• Initial virtual meeting to define the scope of the study, followed by one-to two hour virtual touchpoints every month per the duration of the study.
	• Provision of a workplan outline including detailed scheduling for deliverable milestones, and provision of final deliverables.
	• A document that provides a suite of survey, mitigation, compensation and/or monitoring tools for MTO undertakings under the new SCA for a specific species/species group(s) as mutually agreed upon between MTO and the researcher.
	• This guidance document must be:
	  ○ AODA compliant;
	  ○ Be provided in Word format to allow for editing;
	  ○ Provide information in detail sufficient enough such that effective survey, mitigation and/or compensation measures for the chosen species/species group could be selected and implemented on MTO undertakings.
	• Alternate approaches/formats to achieve this goal will be considered by MTO in proposals.

Benefits to MTO	This research will help develop a standardized approach for MTO-led mitigation and compensation for SAR. This allows MTO to address risk (e.g., scheduling, cost, and regulatory compliance) to our undertakings. This will also help MTO undertakings align, where practical, with federal requirements to protect SAR, supporting streamlined project approvals and delivery.
Contact (Name, email, phone number)	Andrea Bulanda, Team Lead, Environmental Policy Office Andrea.Bulanda@Ontario.ca (289) 696-1564

Topic 8: Operations, Maintenance Management Office

Subject Area	Provincial Highway Maintenance
Title	Winter Materials Management Leveraging Innovative Technologies
Background	The Ministry of Transportation of Ontario (MTO) outsources highway maintenance through value for money contracts, shifting operational responsibility to contractors while maintaining oversight. This model encourages innovation but requires strong process controls to ensure accountability and effective maintenance. Inefficient winter material management can lead to significant financial implications, environment concerns, operational issues and safety concerns to the travelling public. Some technologies exist in the marketplace to assist with the management of winter materials such as: - Truck Scale Data (TSD) - LiDAR - Loader Scales - Drones - Acoustic-Based Technology - Calibrated Material Spreaders - Truck Load Cells Research on the accuracy, reliability and operational issues of these technologies has also been completed by Clear Roads, "*Evaluation of Indoor Automated Stockpile Measurement Systems*".
Challenge	Many current technologies provide reliable accuracy but require recalibration, dedicated personnel or are expensive to deploy at a larger scale. New methods for winter material management are required that offer reliable accuracy and limited operational impacts while remaining fiscally responsible. The ability to automatically identify and quantify material deliveries and use would help to reduce required oversight.

Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	Research deliverables include a final Technical Report and a Presentation. The final Technical Report is anticipated to include review of current processes and technologies used. A prototype of the proposed new technology and how data will be collected and compared to other baseline technologies (ie. LiDAR, Surveys, Material Spreaders, etc). The prototype details shall include equipment specifications, processes, controls and anticipated challenges that will be encountered.
Benefits to MTO	This research is expected to assist with salt management across Ontario. The expected benefits include better winter material management, more accurate data on salt usage per event, reduced salt usage and a decrease in labour for salt reconciliation.
Contact (Name, email, phone number)	Nedim Oren Nedim.Oren@ontario.ca 1-647-984-5192

Topic 9: Operations, Traffic Office

Subject Area	Infrastructure Asset Management for Traffic Planning Data Collection System
Title	Research on a Multi-Layered Asset Management Framework for Legacy Traffic Data Collection Infrastructure in Ontario
Background	This research initiative investigates methods to enhance the management and analytical use of Ontario's legacy traffic data collection infrastructure - specifically, the approximately 2,900 Inventory Counting Station (ICS) sites that currently operate offline and exhibit high rates of malfunction and data unreliability. The study will examine how research-informed methodologies can improve system reliability and inform long-term infrastructure planning without requiring full system modernization. Emphasis will be placed on developing and testing conceptual frameworks rather than operational prototypes. The research will explore: • Theoretical models of multi-layered asset management for distributed, aging infrastructure. • Integration concepts for separate legacy datasets across MTO systems (e.g., TES). • Analytical methods for data validation and anomaly detection in low-frequency monitoring systems. • Conceptual architectures for digital twins and GIS-based oversight of legacy assets. The objective is to generate new knowledge and methodologies that can guide evidence-based modernization and asset renewal strategies.
Challenge	The current system faces several interrelated challenges: • Lack of connectivity: ICS units operate offline, with no remote access. • Infrequent data collection: Traffic data is gathered only one to three times per year, often manually. • High malfunction rates: Approximately half of the stations are non-functional or require immediate intervention. • No validation processes: Collected data is not systematically verified or analyzed for anomalies. • Fragmented information: Legacy databases are not integrated, complicating data-driven decisions.

	These limitations create a pressing need for a research-based framework capable of diagnosing systemic weaknesses and guiding future modernization within constrained resources
Anticipated Outcome(s) and/or Research Deliverable(s)	Research Objectives: 1. Conceptualize a multi-layered asset management framework tailored to legacy data collection systems. 2. Model integration strategies for existing data repositories within MTO systems. 3. Investigate methodologies for data validation and error detection in intermittent data environments. 4. Design and evaluate a conceptual GIS-based digital twin model for infrastructure visibility and planning. 5. Assess how the proposed framework can support scalable modernization and resource optimization. Anticipated Research Deliverables: • A conceptual GIS-based asset management framework, illustrating relationships between asset condition, functionality, and data reliability. • A research model for data validation and anomaly detection, suited to offline, low-frequency monitoring systems. • An integration framework outlining how existing MTO datasets could be harmonized for longitudinal infrastructure analysis. • A methodological guideline for applying digital twin principles to legacy infrastructure management.
Benefits to MTO	• Strategic insight into pathways for extending the life and utility of legacy systems through research-based planning. • Evidence-based tools for prioritizing maintenance and modernization. • Enhanced data governance, enabling more consistent and transparent infrastructure analytics. • Foundation for future collaboration between MTO and research institutions focused on infrastructure data science and policy.
Contact (Name, email, phone number)	Justin White, Justin.white@ontario.ca , 905-321-5103

Topic 10: Operations, West Operations

Subject Area	Maintenance - Vegetation
Title	Economic Evaluation of Phragmites Remediation Treatments
Background	*Phragmites australis,* hereafter Phragmites, is an invasive weed with major impacts to infrastructure, drainage, and biodiversity. In Ontario, the Invasive Species Center (ISC) states that municipalities and conservation authorities spent 2.8 million CAD in 2019 on this invasive species alone. Once an invasive species has arrived in an area, the expenditures increase exponentially as more area is colonized, the ISC cites a 100x return on investment to prevent the colonization of an invasive species than it is to control. Presently the MTO uses chemical control as the primary method for the treatment of Phragmites, however, even with the robust program for this species, it continues to spread to new regions and is re-colonizing treated patches. There is novel research being performed analyzing the effects of plant and fungal species composition and the resilience of an area to colonization of non-native species, but there is a gap in the research regarding the effect of species composition and resilience to Phragmites colonization along roadways. In the spring of 2024, the MTO installed 2 test areas to analyse various treatments and their efficacy in the containment and prevention of recolonization of Phragmites in our Right of Ways (ROW's). Treatments were: 1) Conventional: Cut and Spray, 2) Reseed: Cut, Spray and drill seed with MTO standard roadside mix (non-native species composition), 3) Naturalize: Cut, Spray and drill seed with MTO Southern Ontario Native Grass and Forbs Mix and 4) Restore: Cut, Spray, drill seed MTO Southern Ontario Native Grass and Forbs Mix and drill-seed application of a Native Prairie Species specific Arbuscular Mycorrhizae product. Further details on the various approaches will be available to the researcher.
Challenge	MTO is responsible for maintaining sight lines, drainage pathways and to prevent the spread of invasive species between sites during operations and construction projects. This is an increasing expense to the tax paying public as invasive species colonize new areas and increase land coverage over time. The MTO is interested in exploring research opportunities into alternative methods to prevent the colonization and improve the effects of invasive weed control in our rights-of-way. Standardizing the abatement and seeding procedures after Phragmites spray will allow for greater success in the prevention and control of this species and reduce the cost to the public. Specifically, the researchers should: 1) Evaluate the effectiveness of Phragmites treatments And,

	2) Evaluate the cost of various treatments as compared to the level of control achieved The research initiative can focus on two (2) locations each with three (3) replications of five (5) treatments in the West Region where Phragmites has colonized, and populations are expanding and are difficult to control.

Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	• Initial virtual meeting to define the scope of the study, followed by one- to two-hour virtual touchpoints every month for the duration of the study.
	• Provision of a workplan outline including detailed scheduling for deliverable milestones, and provision of final deliverables.
	• A technical report or publication of the results and efficacy of each treatment that includes:
	  ○ An economic analysis of control level achieved by treatment
	  ○ A report on the proportion of Phragmites that has recolonized after treatment
	  ○ A review of the impacts on highway operations – drainage, maintenance needs and invasive weed control
	  ○ Recommendations for the adoption of a treatment as a standard specification for the control and abatement of Phragmites
	  ○ A format which is AODA compliant;
	  ○ Be provided in Word format to allow for editing;
	• Alternate approaches/formats to achieve this goal will be considered by MTO in proposals.

Benefits to MTO	Currently, there is insufficient research on the effectiveness of treatments, the cost benefits of treatments, and monitoring of spread. This knowledge gap has resulted in an inconsistent approach to compensation across MTO projects, and potentially not using the most resource effective methods to control and abate invasive species colonization. The information received from this report will support a more effective and economically viable treatment plan for Phragmites treatment. MTO will use this information to improve the cost efficiency of our Phragmites treatment program and restore the function of our vegetation rights-of-way.
Contact (Name, email, phone number)	Jessica Smeekens, Vegetation Services Coordinator – West Region Email: Jessica.Smeekens@ontario.ca Phone: 519-643-8378

Topic 11: Transportation Infrastructure Management Division, Construction Management East, Capital Program Delivery

Subject Area	Contract management through construction administration and oversight including Quality Assurance and potentially contract development.
Title	investigating the Use of AI-Driven Remote Inspection Technologies for Data-Informed Contract Administration, Construction Dispute Analysis, and Future Design Optimization
Background	The Ministry of Transportation of Ontario (MTO) relies on service providers to deliver comprehensive on-site contract administration for construction projects. This includes daily inspection activities, quality assurance testing, monitoring construction progress to validate payments, resolving design and construction issues, and facilitating dispute resolution. A significant portion of this oversight depends on the presence of on-site personnel to observe, document, and assess critical elements such as equipment usage, material deliveries, safety compliance, and production rates. While this traditional approach has proven effective, it presents challenges in achieving consistent and complete documentation, particularly on large and complex projects. These limitations can lead to gaps in data, which may compromise safety, quality, and cost control. The emergence of advanced technologies—such as AI-powered analytics, drones, and remote camera systems—offers an opportunity to enhance the accuracy, efficiency, and transparency of contract administration. By supplementing on-site monitoring with remote inspection tools, MTO can improve decision-making, support dispute resolution with objective data, and generate insights that inform the design and planning of future infrastructure projects.
Challenge	While MTO has well-established inspection protocols—including defined levels, frequencies, and tasks—the practical realities of large, complex construction projects make it challenging to staff adequately for full coverage. These processes are resource-intensive, time-consuming, and heavily dependent on the availability, expertise, and experience of on-site personnel. As a result, gaps in monitoring or incomplete records can introduce significant risks to safety, quality, and cost control. Although various risk mitigation measures are in place, traditional inspection methods can fall short at time as on-site

	and cannot always provide comprehensive oversight. Compounding this challenge is the ongoing decline in interest in the construction inspection industry and the loss of experienced staff due to retirement, which has strained succession planning and workforce sustainability. To address these challenges and reduce risk to the project owner, MTO must consider enhancing current practices through the integration of advanced technologies. Remote monitoring tools—such as drones and fixed cameras—combined with AI-powered analytics, offer a transformative opportunity. These technologies can automate the collection and processing of visual and operational data, enabling real-time monitoring, trend analysis, and early detection of non-compliance, design deviations, and delays. Furthermore, AI can support more accurate cost assessments and provide actionable insights to inform future project designs and delivery strategies.
Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	Enhanced Contract Administration Practices Identification of practical methods to integrate AI and remote inspection technologies—such as drones and camera systems—into existing contract administration workflows, improving efficiency, consistency, and coverage across complex construction projects. Improved Risk Management and Decision Support Development of AI-driven analytical tools to detect trends, schedule delays, non-compliance, and design deviations in real time, enabling proactive issue resolution and reducing risks related to safety, quality, and cost. **Jurisdictional Benchmarking and Best Practices** A comprehensive review of how other jurisdictions are applying AI and remote technologies in infrastructure delivery, providing valuable lessons learned and adaptable strategies for MTO. **Data-Driven Design and Construction Optimization** Leveraging data collected from current projects to inform future design and construction decisions, identify gaps in current practices, and highlight opportunities for innovation and process optimization. **Modernization of Technical Standards** Use of AI to analyze historical and real-time data to update

	outdated technical information, including production rates, equipment capabilities, traffic and safety impacts—supporting more reliable and evidence-based design standards. **Technical Report and Implementation Framework** Delivery of a detailed technical report outlining recommended approaches for integrating AI and remote inspection technologies into MTO's practices, including implementation strategies, jurisdictional insights, and potential pilot project opportunities.
Benefits to MTO	I**mproved Oversight of High-Value Infrastructure Projects** Enables more accurate and comprehensive documentation of construction activities on large-scale, multi-million-dollar projects, supporting quality assurance and fiscal responsibility during a period of record infrastructure investment. **Risk Reduction and Early Issue Detection** Provides real-time alerts for non-compliance, design deviations, and schedule delays, allowing for proactive issue resolution and minimizing risks to safety, quality, and budget. **Enhanced Decision-Making Through Data Analytics** Facilitates the extraction of meaningful trends from project data using AI, empowering informed decisions for future design and construction initiatives based on real-world performance and outcomes. **Support for Workforce Sustainability and Succession Planning** Offers a scalable technological solution to address industry-wide challenges related to declining interest in inspection roles and the retirement of experienced personnel, helping to maintain continuity and expertise in contract administration. **Modernization of Technical Standards and Practices** Leverages AI to update outdated technical data—such as production rates, equipment capabilities, and safety implications—ensuring that design decisions are based on current, reliable, and data-driven insights. **Knowledge Transfer from Jurisdictional Best Practices** Incorporates lessons learned from other jurisdictions to inform MTO's implementation strategy, ensuring alignment with industry-leading practices and accelerating innovation.

	Strategic Integration of Technology into Existing Workflows Delivers a practical framework for incorporating AI and remote inspection tools into current contract administration processes, enhancing efficiency without disrupting established protocols.
Contact (Name, email, phone number)	Rebecca Li, Rebecca.Li@ontraio.ca, 647) 518-2229 Frank Lucente, Frank.lucente@ontario.ca, (519--870-7711

Appendix B. Open Research Topic Form (23-B)

Appendix C. Project Progress Report Form (23-F)

Appendix D. HIIFP Application Form (23-A)

Appendix E. Research Proposal Summary (23-C)

Appendix F. Budget Summary Form (23-D)

The attached MS Excel™ file (Form 23D_Budget Summary.xls) may also be used to complete this form.

Appendix G. Budget Details Form (23-E)

Appendix H. HIIFP Final Report Template

See attached MS Word™ template (HIIFP_Final Report Template.docx)

Appendix I. No Costs Extension Form (23-H)

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