Ministry of Transportation (MTO)

Highway Infrastructure Innovations Funding Program (HIIFP)

Program Guide
for Ontario Universities and Colleges

Deadline for Application Submissions:
Monday, January 27, 2025 at 5:00pm

Submit applications to: HIIFP@ontario.ca

Posted: December 2024

2025-26 Fiscal

Table of Contents

1. Introduction 1

2. Purpose of the Program 2

3. Scope of the Program 3

3.1 Eligible Institutions 3

3.2 Eligible Research Topics 3

3.2.1 Specific Research Topics 3

3.2.2 Open Research Topics 4

3.3 MTO Technical Specialist Assignment 4

3.4 HIIFP Funding and Ineligible Expenditures 5

3.5 Multi-Year Projects 5

3.6 Fieldwork on MTO Highways and/or ROWs, and MTO Laboratory Facilities 5

3.6.1 Fieldwork on MTO Highways and/or ROWs 6

3.6.2 MTO Laboratory Facilities 7

3.7 Information and Data Confidentiality 7

4. Application Package 8

4.1 Application Package Components 8

4.1.1 Curriculum Vitae (CV) Recommended Information 9

4.2 Application Deadlines & Submission Location 10

5. Project Proposal Budget 11

5.1 General 11

5.2 Budget Summary & Details 11

5.2.1 Salaries and/or Benefits 11

5.2.2 Equipment and/or Facility 11

5.2.3 Materials and/or Supplies 12

5.2.4 Travel 12

5.2.5 Dissemination Costs 12

5.2.6 Overhead 12

6. Evaluation Criteria 13

6.1 Application Package Content 13

6.2 Other Considerations 13

6.3 Final Recommendation 14

7. Notification of Award & Next Steps 15

8. Financial Arrangements & Reporting Requirements 16

9. Amendments to a Research Project 18

9.1 Amendment or Alteration to Research Project 18

9.2 Research Project Extension (No Cost Extension) 18

10. Reports and Deliverables 20

10.1 Project Progress Report 20

10.2 Written Technical Report 20

10.3 Presentation of Findings 22

11. Research Outcomes 24

12. External Communication of Research Outcomes 25

12.1 External Communications 25

12.1.1 Disclosure 25

12.1.2 Publications or Presentations 25

12.1.3 Publication Disclaimer 25

12.1.4 Reference Permission 26

12.1.5 Media Inquiries 26

13. Occupational Health and Safety 27

Appendix A. Specific Research Topics A-2

Appendix B. Open Research Topic Form (23-B) B-1

Appendix C. Project Progress Report (23-F) C-1

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

Appendix E. Research Proposal Summary (23-C) E-1

Appendix F. Budget Summary Form (23-D) F-1

Appendix G. Budget Details Form (23-E) G-1

Appendix H. HIIFP Final Report Template H-1

Appendix I. No Costs Extension Form (23-H) I-1

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 2025-26 invites Ontario's eligible institutions to submit research proposals. 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 2025-26 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 27, 2025 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 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.

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, Pavement Section A-3

Topic 2: Transportation Infrastructure Management Division, Standards & Contracts Branch, Engineering Materials Office, Soils and Aggregates Section A-5

Topic 3: Transportation Infrastructure Management Division, Standards & Contracts Branch, Structures Office, Foundations.....A-8

Topic 4: Transportation Infrastructure Management Division, Standards & Contracts Branch, Structures Office, Foundations.....A-11

Topic 5: Transportation Infrastructure Management Division, Standards & Contracts Branch, Structures Office, Bridge Management A-13

Topic 6: Transportation Infrastructure Management Division, Standards & Contracts Branch, Structures Office, Bridge Management A-14

Topic 7: Transportation Infrastructure Management Division, Standards & Contracts Branch, Structures Office, Bridge Management A-16

Topic 8: Transportation Infrastructure Management Division, Standards & Contracts Branch, Structures Office, Bridge Management A-18

Topic 9: Integrated Policy & Planning, Emerging Technologies Office, Transportation Policy.....A-20

Topic 10: Integrated Policy & Planning, Emerging Technologies Office, Transportation Policy.....A-22

Topic 11: Transportation Infrastructure Management Division, Standards & Contracts Branch, Contract Managment Office A-25

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

Subject Area:	Pavement Management
Idea Title:	Investigating the Role of Pavement Friction in Enhancing Road Safety: A Comprehensive Analysis and Network-Level Validation
Background:	Road safety is a complex issue that involves the interaction between vehicles, tires, roadway design, road conditions, and how users interact with road infrastructure. Since the early 2000s, significant advancements in road safety have been achieved through evolving research, technological innovations, multidisciplinary approaches, and the increased use of evidence-based practices. These efforts aim to reduce traffic-related fatalities and serious injuries on public roads. One critical factor influencing highway safety is pavement friction, which plays a key role in determining the likelihood of skid-related accidents.
Challenge:	In contemporary road safety discourse, skid-related incidents have emerged to the forefront as a prominent concern. These incidents are influenced by various factors, including driver behavior, road geometry, traffic flow, pavement conditions, and weather. To accurately assess the safety performance of a specific roadway section, it is essential to evaluate these factors in conjunction with friction data.
Anticipated Outcome:	Highway agencies in Canada and the U.S. are currently focused on establishing or enhancing Pavement Friction Management (PFM) programs to ensure adequate surface friction and pavement texture, ultimately reducing the risk of skid-related crashes. A comprehensive analysis of friction data serves as a key guide for the design, construction, and maintenance of pavement surfaces, ensuring they maintain sufficient friction throughout their lifespan. Establishing a strong correlation between pavement macrotexture and friction will enable the proactive prediction of friction changes based on macrotexture measurements, facilitating more efficient and strategically planned maintenance. Additionally, this research includes the development of a screening tool to identify pavement sections that require

	friction testing. This tool will enhance the ability to target areas for friction assessment, improving the effectiveness of PFM programs. The maximum allowable friction number will also be analyzed in relation to different speed limits and pavement surface types.
Benefits to MTO	The outcomes of this analysis can serve the critical function of validating the effectiveness of friction data collection at a network level. Additionally, they have the potential to contribute to the development of a comprehensive system for assessing in-service pavement friction data, taking into account the diverse array of highway types and segment lengths. This holistic approach is fundamental in furthering our understanding of pavement friction's role in enhancing road safety.
Contact:	Stephen Lee Email: Stephen.Lee@ontario.ca Ph : (437) 655-6825

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

Subject Area	Soils and Aggregates Section, TIMD
Title	A Global Review of Alkali-Aggregate Reactivity (AAR) Test Methods and Mitigation Techniques Compared to Current Practices in Ontario
Background	Alkali-Aggregate Reactivity (AAR) is a critical concern for the long-term durability of concrete infrastructure. In Ontario, the primary methods employed to identify AAR risk in aggregates are the Accelerated Mortar Bar Test (AMBT) and the Concrete Prism Test (CPT), as specified in OPSS 1002. While these tests provide a basis for screening aggregates for AAR potential, they may not be sufficient in all cases, especially for slowly reactive aggregates, where inconsistencies between the two tests may exhibit. Hence, more advanced methods may be required. Globally, other jurisdictions have employed more sophisticated and comprehensive approaches for testing and mitigating AAR. Test methods like the Stiffness Damage Test (SDT) and the Damage Rating Index (DRI) have gained traction in Europe and North America for their ability to assess the extent of AAR damage more accurately. Additionally, advanced chemical screening tools (CST), such as RILEM AAR-8 and the TTI Model-1 pore solution model, have been developed to evaluate the appropriate type, dosage and effectiveness of supplementary cementitious materials (SCMs) in mitigating ASR by assessing the alkali contribution from these materials. Treatments like Nano-Silica and carbonation are being explored to enhance the durability of recycled concrete aggregates (RCA) and reduce AAR expansion. This research seeks to compare the world's leading practices and tests for AAR mitigation to MTO's current tests and explore more robust solutions that can better prevent AAR-related damage in Ontario's infrastructure.
Challenge	**Limitations of AMBT and CPT**: AMBT is a relatively rapid screening test but is known to overestimate reactivity for certain aggregates. The Concrete Prism Test (CPT) is a long-term test (1 year), which limits its practical application in fast-paced construction environments. **Reliability for Slowly Reactive Aggregates**: Ontario has many slowly reactive aggregates, and the current CPT method may not capture their long-term potential for damage. Slowly reactive aggregates may exhibit expansions after the test durations.

	Global Innovations in AAR Testing and Mitigation: New testing methods like SDT, DRI, and chemical screening tools (AAR-8, CST) provide deeper insights into material reactivity and SCM performance. These methods offer more rapid and accurate assessments, which could better predict long-term performance and aid in identifying optimal mitigation strategies, including the use of ternary cements and nano-materials. **Need for Better Testing Protocols for Recycled Concrete Aggregates (RCA)**: As MTO explores sustainable materials, including RCA, it is critical to consider global best practices that ensure these materials do not contribute to AAR-related deterioration when reused in new concrete.
Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	**Global Testing Methods Review**: A comprehensive study of global AAR test methods, including SDT, DRI, AAR-8, and CST, and their comparison to AMBT and CPT used in Ontario. **Test Method Evaluation**: An evaluation of which test methods are most reliable for identifying different types of reactive aggregates, including slowly reactive aggregates and RCA. **Mitigation Strategies**: A review of mitigation techniques used globally, such as the use of ternary blends, nano-silica treatments, and carbonation treatments for RCA, and how these compare to practices in Ontario. **Proposed Enhanced Testing Protocol for Ontario**: A set of recommendations for the incorporation of more advanced AAR testing protocols and mitigation techniques in MTO's standards, improving the long-term durability of concrete infrastructure. **Presentation and MTO EMO Report:** Presentation of the findings to the Engineering Materials Office. Generate and publish a comprehensive report that encompasses all data and evaluation.
Benefits to MTO	**Improved Screening of Reactive Aggregates**: By learning more advanced AAR testing methods, MTO will be better equipped to identify aggregates with long-term reactivity risks that may be missed by current tests (AMBT and CPT). This may increase the number of competent material sources and prevent the incorporation of potentially reactive aggregates in infrastructure projects. **Faster and More Accurate Testing**: Exploring rapid and more reliable tests, such as AAR-8 and SDT, can offer new insights into aggregate reactivity and the effectiveness of SCMs. This has the potential to reduce project delays associated with prolonged testing procedures and improve decision-making during material selection. **Better RCA Utilization**: As Ontario moves toward more sustainable construction practices, knowledge of enhanced testing and treatment protocols will allow for the safe and

	effective use of RCA in concrete, without increasing the risk of ASR-related damage. **Alignment with Global Best Practices**: Incorporating global innovations in AAR testing and mitigation will position MTO as a leader in delivering sustainable and resilient infrastructure, aligning Ontario's practices with those of leading jurisdictions in Europe, Asia, and North America.
Contact (Name, email, phone number)	Veronica Ayetan Email : veronica.ayetan@ontario.ca Ph: 437-249-0859

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

Subject Area	Foundation Engineering
Title	Application of Artificial Intelligence (AI) in Foundation Engineering
Background	Earth materials are inherently heterogeneous and complex, and characterizing and modelling the subsurface conditions is correspondingly difficult. Acquiring subsurface data by means of field and laboratory testing is time-consuming and costly, and it is prohibitive to collect sufficient data to wholly encompass the complexity of the subsurface. Alternatively, analytical and numerical solutions involving the use of formulae developed from historical data and performance and/or modelling software can be highly cost-effective. However, the difficulty lies in developing a model that adequately and reliably captures the complex behaviours and interdependency of different subsurface factors, which may not be well understood to begin with. Artificial intelligence (AI) based modelling methods have been studied for the past several decades as an alternative to these traditional approaches. Advantages of using AI methods include the ability to: i. Analyse large amounts of data in a variety of contexts to identify patterns even when relationships between parameters are unknown; and, ii. Model complex and nonlinear processes, often with limited reliance on user-inputted assumptions, to predict and even create data to supplement or complete datasets. The Ministry's extensive repository of available historic subsurface investigation data, contained within almost 9,000 reports, presents a considerable opportunity to develop purpose-built AI tools for foundation engineering applications in Ontario.

Challenge	Current practice involves costly field and laboratory investigation followed by time-consuming analysis using simplified empirical and/or analytical solutions which may not wholly capture the complex behaviour of the subsurface conditions. AI methods offer a complementary approach which can significantly reduce the necessary input efforts and enhance design outputs. The application of AI methods also remains challenging as it requires large and high-quality datasets to train the AI algorithms. MTO has a unique opportunity through the availability of almost seven decades of foundation investigation data for transportation infrastructure across the province. However, much of this data is in PDF format and would require extraction to a database to be used. Development of an AI tool to extract this data is proposed as a first step in the development of AI tools for Ministry Foundation Engineering applications. Depending on the success of the data extraction AI tool, development of additional AI tools using the extracted data should be considered.
Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	Development and handover of an AI tool to extract data from the PDF format in which it is available on the Foundations Library (GEOCRES); Written Technical Report detailing the methodology, outcomes, and procedural instructions (framework) for Ministry staff to utilize the developed AI tool for extracting data from Foundation Investigation Reports in PDF format; Final Presentation with the Ministry to demonstrate the use of the AI tool.
Benefits to MTO	1. Immediately improve MTO's ability to analyze the existing and extensive database of foundations investigation data to identify and predict relationships, to undertake quality control audits, and to inform the development of improved or new standards and guidelines. In turn, these improvements are anticipated to lead to safer and more optimized (less costly) design outcomes. 2. Immediately improve public access to MTO database by enhancing user interface of existing Foundations Library. 3. Enable future development of additional tools to predict soil strength parameters, settlement, slope stability, or more,

	thereby enhancing quality and safety without added time or cost.
Contact (Name, email, phone number)	Hugh Gillen Email:hugh.gillen@ontario.ca Ph : 343-999-2142

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

Subject Area	Bridges
Title	Corrosion Rates of Steel Piles in Ontario
Background	Other agencies and groups such as CALTRANS, National Association of Corrosion Engineers (NACE), and standards/codes such as British Standard BS8002:1994, and Eurocode provide guidelines for corrosion assessment. The guidelines list the requirements for field investigations related to corrosion, including requirements for sampling of soil and water, required corrosion testing, reporting of results, requests for assistance, and corrosion mitigation measures (design alternatives). An understanding of Durability and Expected Service Life is essential in assessing the durability of new piles as well as assessing the feasibility of the reuse of existing foundations. The Reuse of Existing piles has several advantages including cost and schedule savings, minimizing traffic disruption, environmental and sustainability. In order to make this assessment, an understanding of the corrosion rate of piles in Ontario is needed.
Challenge	The corrosion rate of steel piles in soil is influenced by a number of corrosion related parameters. These include soil minimum resistivity, pH, chloride content, sulfate content, sulfide ion content, soil moisture, and oxygen content within the soil. Measurement of these parameters can give an indication of the corrosivity of a soil. Unfortunately, because of the number of factors involved and the complex nature of their interaction, actual corrosion rates of driven steel piles cannot be determined by measuring these parameters. Instead, an estimate of the potential for corrosion can be made by comparing site conditions and soil corrosion parameters at a proposed site with historical information at similar sites. For steel piling driven into soils (whether disturbed or undisturbed), the region of greatest concern for corrosion is the portion of the pile from the bottom of the pile cap or footing down to 3 feet below the lowest recorded/measured ground water elevation.

	Bridge Engineers need quantitative estimates of corrosion rates and predictions of section losses in order to assess the service life of piles.
Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	Tables and charts are required to assess corrosion as a function of how aggressive the soil/groundwater environment is and the exposure (e.g., splash zone, immersed zone, embedded zone). This information will help designers to determine any mitigative measures for new piles such as sacrificial thickness, coatings, etc. and also to assist in the prediction of extended service life for existing piles. Presentations to be included.
Benefits to MTO	Knowledgeable Owner Upgrade Technical Standard Better understanding of Durability which will result in Cost reduction especially as it pertains to the Reuse of Existing Piles
Contact (Name, email, phone number)	Tony Sangiuliano Email: Tony.J.Sangiuliano@ontario.ca Ph: 647-330-3743

Topic 5: Transportation Infrastructure Management Division, Standards & Contracts Branch, Structures Office, Bridge Management

Subject Area	Bridge design
Title	Design of compression structural components within soil
Background	In the design and construction of pile foundations for MTO projects, there is a sense that structural piles subjected to combined compression and bending are overly conservatively designed, and there is potential for optimization. CSA S6, Canadian Highway Bridge Design Code, covers typical column design as a compression member in structural steel, concrete, timer, etc… When designing deep foundation members such steel, concrete or timber piles (installed by driven or drilling methods), design of compression members with and without bending is based on a typical column design where the unbraced length of column may dictate it's capacity. However, all pile members are surrounded by soils so that piles will behave differently than typical beam-column members above ground.
Challenge	The current CSA S6-19 and the upcoming CSA S6-25 do not address the design of compression members in subsoil condition. When beam column provisions are applied from based on current code provisions, the structural pile design is not optimized.
Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	- Perform a literature review of structural pile design criteria in research and codes to date and summarize findings. - Perform analysis and/or experimental testing for columns in various subsoils and review and examine the results to determine proposed design recommendations. - Provide design recommendations for structural pile design with steel, concrete or timber. - Final Report and Presentation
Benefits to MTO	- MTO will update/implement a policy and/or its manuals/guidelines on structural pile design based on research outcome. - Structural pile design may be more optimized, saving materials, cost, and construction time.
Contact (Name, email, phone number)	Ben Huh Email: Ben.huh@ontario.ca Ph: 289 228 7042

Topic 6: Transportation Infrastructure Management Division, Standards & Contracts Branch, Structures Office, Bridge Management

Subject Area	Bridge bearings
Title	Elastomeric Bearing Contact Repair Material and Evaluation
Background	Elastomeric bearings are the most common type of bearing used in everyday bridges in Ontario today. The Canadian Highway Bridge Design Code (S6-19) specifies 100% bearing contact for elastomeric bearings and stringent requirements for the materials used in bearing fabrication. However, issues with construction tolerances or replacement of bearings on old bridges often presents challenges with successfully achieving full contact. The Ministry has experimented with the use of polyurethane grout to fill bearings gaps in an attempt to select a material that closely matches the properties of natural rubber and can be injected into small voids. However, there is a need to evaluate alternative products that are materially compatible and can be used to fill bearing voids practically in the field. Cementitious grouts and epoxies are not considered compatible with the material and loading conditions.
Challenge	Designers are tasked with addressing poor fabrication geometry on existing sites and options are limited to correct contact issues. Several polyurethane grouts have been identified for potential bearing gap filler repair and need to be assessed for performance under compression and shear. Repair materials need to have the following characteristics: - Pot life sufficient to mix, apply and set - Hardness close to rubber - Flexibility to conform to both surfaces during rotation - Ability to resist cracking and degradation - Excellent creep resistance - Low enough viscosity to be pumped/injected and flow and fill in tight gaps down to 1mm with minimal air voids - Good adhesion to the rubber bridge bearing pad - Low exotherm - Ability to cure in variable field conditions (%RH and temperatures)

Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	- Review potential materials compatible with natural rubber that can be injected via pressure pump into small bearing voids (approximately between 2- 6mm in height over 25-40% of the bearing area). - Perform experimental injection with several materials in a lab test with bearing geometry that replicates a geometric imperfection/ tapering void and assess quality of installation result. - Perform a series of quality control tests on the materials used to measure and record their properties and draw comparisons with the S6 code requirements for natural rubber and their chemical and physical compatability. - Load repaired bearings in compression and shear representative of actual bridge load limits as defined in S6-19. Cyclic horizontal translation of bearings is preferred, but scale specimens may be considered. Assess the performance of the various repair materials under the test conditions and report findings. - Summarize performance of the different materials studied and provide recommendations for the use of contact repair materials, procedures and limitations in the field. - Final Report and Presentation.
Benefits to MTO	- Expand the potential materials to be used in bridge construction to address and ongoing problem. - Reduced delays and construction claims due to bearing contact issues with existing bearings.
Contact (Name, email, phone number)	Craig McLeod Email : craig.mcleod@ontario.ca Ph : 226-377-3684

Topic 7: Transportation Infrastructure Management Division, Standards & Contracts Branch, Structures Office, Bridge Management

Subject Area	Bridge Rehabilitation
Title	Using non-destructive testing methods to assess the concrete condition of bridge soffits (with focus on voided slab post-tensioned bridges).
Background	Closing traffic lanes to perform up-close sounding of concrete soffits during bridge inspections is generally not feasible. This has led to discrepancies in construction, where estimated removal quantities differed significantly from actual. In voided slab post-tensioned bridges, the presence of voids often causes 'false positive' delamination sounds when the concrete directly beneath the voids are sounded during construction. This has lead to unnecessary removal of significant amounts of concrete directly beneath these voids.
Challenge	The challenge consists of two main aspects: To explore the application of non-destructive testing techniques, such as infrared thermography and other methods, for assessing the condition of soffit concrete without requiring 'up close' access. To investigate the use of non-destructive testing techniques for evaluating concrete delamination in voided slab post-tensioned bridges, particularly the concrete located beneath voids.
Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	A technical report with a literature review of existing and emerging non-destructive testing methods that are appropiate for the stated purposes. In coordination of MTO, conduct field trials & validations on Ministry bridges to assess the effectiveness, accuracy and practicality of the non-destructive testing methods for determining soffit concrete conditions.

Benefits to MTO	The Ministry has a significant number of voided slab post-tensioned bridges in its inventory. Accurately and effectively assessing their concrete condition is essential for optimizing cost-efficienncy and ensuring the long-term health of our bridge network.
Contact (Name, email, phone number)	Richard Zhang Email: richard.zhang@ontario.ca Ph: (289) 407-6690

Topic 8: Transportation Infrastructure Management Division, Standards & Contracts Branch, Structures Office, Bridge Management

Subject Area	Traffic Barriers on Bridge Structures
Title	Evaluation of Traffic Barriers on Bridges for meeting Manual for Assessing Safety Hardware (MASH) Test Level
Background	The Manual for Assessing Safety Hardware (MASH) has updated and replaced the NCHRP Report 350 as the standard for crash testing and evaluating new safety hardware devices. The MASH system is introduced to capture the changes to the vehicle fleet, it is based on research of real-life impact conditions and formulates the updated criteria for evaluating barrier performance. As an improvement to highway safety, most transportation departments are adopting traffic barrier standards which meet MASH testing criteria. These standards are either based on actual crash testing or have been evaluated by using analytical method such as FEM Models to assess and confirm the crash worthiness of traffic barriers. In USA this evaluation and acceptance of crash worthiness is regulated by Federal Highway Administration (FHWA). Often the US DOTs seek approval of the updates to their existing NCHRP 350 test level barriers to meet MASH testing levels and after acceptance they move forward to adopt the standard. These standards serve as starting point for MTO to move forward in adoption of MASH tested Barrier. Following the MTO's core objectives of constructing and maintaining the highest level of safety, it is prudent to start updating our current NCHRP 350 test level barriers to MASH testing levels. Historically MTO has been adopting the Traffic Barrier Standards of various American DOTs as found suitable to meet MTO's design and construction practices. Hence, MTO's current inventory of NCHRP 350 traffic barriers standards are very similar to various American DOTs. Due to differences in construction practices and design standards, the American DOT's MASH standards cannot be directly adopted. The MTO must make additional updates to the design and details.

Challenge	The Structures Office has begun reviewing available MASH-tested barrier standards. After selecting a few that align more closely with MTO's current NCHRP 350 based barrier standards, adjustments are made to suit MTO's needs. Although the changes and updates are based on best engineering judgment, Clause 12.4.3.4.5 of CSA S6-19 only permits changes and updates to crash-tested systems that can be demonstrated to not adversely affect vehicle-barrier interaction and the behavior of the barrier. MTO would like to find methods to evaluate the proposed changes before implementation. This will serve as assurance that the safety & crash worthiness of the MASH test levels have not been compromised by introducing the changes to either current NCHRP 350 barriers or to currently available MASH tested which we aim to adopt from other DOTs.
Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	- Create & verify analytical model to simulate actual crash test. - Use the analytical model to perform analysis of the various barriers with proposed changes related to MASH and review and examine the analysis results to determine the impact of the changes on the behaviour of the barrier. - Come up with simpler analytical model & guidelines to evaluate the barriers for future changes that could also be proposed to include in future version of CHBDC. - Prepare a final written report and presentation.
Benefits to MTO	-This project will speed up adoption of MASH Tested Barriers & use in MTO's structures - This project will enable us to verify that the safety & crash worthiness of the MASH tested barrier standard have not been compromised through small changes and that standards meet the CHBDC requirements. - Use of the MASH tested barriers on bridge structures will offer safe transition to MASH tested barriers on the approaches and roadway part of highways.
Contact (Name, email, phone number)	Erum Mohsin Email: erum.mohsin@ontario.ca Ph : 905-321-4180

Topic 9: Integrated Policy & Planning, Emerging Technologies Office, Transportation Policy

Subject Area	Emerging Technologies Office
Title	Assessing Pathways to Shared Electric Vehicle (EV) Charging
Background	As Ontario continues to promote EV uptake, a barrier for people living in Multi-Unit Residential Buildings (MURB) and Long-Term Rental Accommodations (LTRA). Residents in such housing types tend to face higher costs, more approvals, and fewer incentives (e.g., shorter tenancy) to install chargers. New approaches to charger provision including shared charging and shared vehicles may provide one path to increasing EV uptake in MURB and LTRA housing situations.
Challenge	MTO would like to understand what innovative EV and EV charging options for MURB and LTRA housing could be encouraged through incentives or regulatory changes. Projects need to identify options, assess cost, approval, and life-cycle considerations, and present incentive and regulatory changes, and how these would affect EV uptake in these housing types. MTO would favour projects that more generally promote mobility, reduce congestion, and increase safety within the transportation system. Other electric transportation modes that options could support should be considered (e.g., combined EV + micromobility charging). MTO favour projects that employ a multi-disciplinary approach, including expertise such as behavioural science, technical and engineering analyses, economics, as well as public governance.
Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	Projects should include a final report presenting and assessing innovative options for EV and EV charging programs to demonstrate the relative pros and cons of each option, including recommendations for incentives and regulatory changes that would support each option. The deliverables of this project include: 1) Initial meeting to discuss and refine project scope and timelines, 2) Interim meeting(s) to review progress and seek MTO feedback/input on work,

	3) Final presentation of results including recommendations and future work opportunities, 4) Final report documenting project, including: • Executive Summary • Project Phases • Results • Conclusions • Recommended next steps for the Ministry
Benefits to MTO	Given approximately one-third of Ontarians live in MURBs or LTRAs, the results will inform MTO and other ministries' future work on policies and programs to support EV uptake in MURB and LTRA housing, which will support the government and ministry's priority to increase EV uptake and reduce range anxiety.
Contact (Name, email, phone number)	Michael DeRuyter Email : michael.deruyter@ontario.ca Ph : 647-631-6138

Topic 10: Integrated Policy & Planning, Emerging Technologies Office, Transportation Policy

Subject Area	Emerging Technologies Office
Title	Investigating Cross-Border and Cross-Provincial Compatibility of Electrification Technologies for Medium- and Heavy-Duty Vehicles (MHDV)
Background	• The transportation sector accounts for 32% of Ontario's total emissions. • MHDV truck emissions increased by 89% between 1990 and 2019 in Ontario. • Canada has pledged to achieve 100% zero-emission new truck sales by 2040. • The MHDV sector offers multiple ZEV options, including battery-electric trucks, hydrogen fuel cells, catenary systems, and RNG. • The success of these technologies in the market and across jurisdictional borders remains uncertain, making it challenging for Ontario to plan infrastructure and develop programs to support the accelerated adoption of MHD ZEVs.
Challenge	In order to accelerate freight electrification, address emission reduction targets, reduce range anxiety, and support ZEV adoption in the industry, Ontario must understand the MHDZEV technologies and ensure compatibility of electrification technologies across provinces and countries, facilitating smooth freight operations. • **Technology Assessment:** Evaluating different electrification technologies—such as catenary systems, hydrogen fuel cells, and renewable natural gas (RNG)—is crucial to identify the most economically viable solution suited to Ontario's unique conditions, including highway capacity and energy supply. • **Cross-Provincial/Cross-Border Compatibility**: Given the prevalence of long-haul trucking, ensuring cross-border and cross-provincial compatibility of electrification technologies is critical to seamless transportation, necessitating an integrated approach across jurisdictions. In other words, without standardized technologies across systems, how does this technology fare?

	• **Economic Feasibility:** The selection of the best technology must also consider financial constraints to ensure that the chosen solution is cost-effective and sustainable for the province.
Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	A Technical Report support MTO to accelerate the transition to MHDZEVs by answering the following questions: • What type of MHDV technology is best suited for Ontario's specific needs and infrastructure? • How can hybrid solutions, combining dynamic charging (catenary) and stationary charging (fast-charging stations), be optimized to improve compatibility/efficiency in cross-provincial and cross-border logistics? • How can energy supply and demand for each technology be analyzed to find the optimal solution, considering installation, operation, and maintenance costs? • What are the technical and regulatory challenges in standardizing electric road systems (ERS) and charging station protocols across provinces and countries?
Benefits to MTO	• This will help MTO identify infrastructure needs as well as regulatory or policy changes to support MHDZEV acceleration.
Contact (Name, email, phone number)	Katie De Palma Email: katie.depalma@ontario.ca Ph : (647) 973-9083 Michael DeRuyter Email: michael.deruyter@ontario.ca Ph : (647) 631-6138 Afreen Khan Email: afreen.khan2@ontario.ca Ph: (647) 624-1831 Elizabeth Baker Email: elizabeth.baker2@ontario.ca

	Kamand Khosravian Email: kamand.khosravian@ontario.ca

Topic 11: Transportation Infrastructure Management Division, Standards & Contracts Branch, Contract Management Office

Subject Area	Building Information Modeling (BIM) / Digital Twins
Title	Enhancing the usage of BIM and Digital Twins technologies for MTO
Background	BIM for Infrastructure is a collaborative work method for structuring, managing, and using an agency's enterprise-wide data and information for transportation assets throughout their life cycles. BIM integrates and leverages digital information found in lidar/UAS surveys, 3D design models, eConstruction data, georeferenced assets and eventually geographic information system (GIS), to bring profound improvements for project delivery and lifecycle data management. The data capabilities are envisioned to better connect the silos within our agencies towards greater collaboration and real-time, fact-based decision-making in managing our highway assets. BIM is about "liberating" data from siloed systems and making it available in an automated way to anyone who needs it when they need it. – California Department of Transportation MTO has developed initial draft documents including draft roadmaps, an implementation plan, project decision tool, execution plan template, tested different software technologies, conducted jurisdictional scans and interviews. • Ontario is investing $5 million to test the application and benefits of digital twins. • Infrastructure Ontario is partnering with local and global organizations, including Toronto Metropolitan University and the United Kingdom's Geospatial Commission, to leverage their experience with digital twins and explore solutions to help modernize the delivery of public infrastructure. • The City of Toronto and York Region are using digital twins to monitor wear and tear on water infrastructure in real-time to support better decision-making and allocation of public resources. • The City of Ottawa is leveraging aerial data collection and 3D mapping technology which could be used in digital

	modelling to enhance its urban planning and asset management programs. MTO needs assistance to leverage its existing extensive experience in highway design, construction, maintenance and operation to: - host workshops with industry, academia and subject matter experts - pilot technologies and recommend user-friendly technologies to use - conduct surveys with industry (including contractors, designers, contract administrators, MTO staff, municipalities, other academia members) - assist with change management ideas - continue jurisdictional research
Challenge	BIM / Digital Twins continues evolving in particular as more Departments of Transportation explore further opportunities. This is a challenge because the learning curve is already steep when learning about the resources available to support BIM / Digital Twins and with continued updates one has to try to forecast future recommendations which considering known information to date.
Anticipated Outcome(s) and/or Research Deliverable(s) (e.g. Written Technical Report and a Presentation)	Written Technical Report, Presentation to stakeholders.
Benefits to MTO	Provide a perspective from experts in the field. This is a similar approach to what other ministries (in Quebec) and Departments of Transportation in the United States have used when starting their BIM journey. This exercise would help with other research initiatives involving the use of Artificial Intelligence in construction as an example.
Contact (Name, email, phone number)	Mireya Hidalgo Email: Mireya.Hidalgo@ontario.ca Ph: 289 983-5976

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

Ontario

Open Research Topic Form

Notes: Form shall not exceed two (2) pages in length. Include a detailed description of the open research topic and clearly identify how it will enhance MTO's practices and business needs (i.e., benefits to MTO).

Subject Area	
Title	
Background	
Challenge	

Anticipated Outcome(s) **and** **Research Deliverable(s)**	
Benefits to MTO	
Principal Researcher (name, email, phone number)	

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

Ontario

Project Progress Report

		For Ministry Use Only	
		Project Number	
Date (dd/mm/yyyy)		HIIFP Funding Year	
Principal Researcher (print name)		Email Address	
Institution Name		Institution Address	
Telephone No. (of Applicant)			

Topic No.	Title of Research Topic

Start Date		Completion Date (estimated)	

Brief Description of Progress Completed to Date.
Include information about: (1.) the status of major tasks (2.) the status of outcomes and/or the final report (3.) changes and/or issues (if applicable)

…..continue on Page 2 (if necessary)

Signatures

	Principal Researcher	Head of Department	Authorized Signing Officer of Institution
Print Name			
Signature			

Ontario

		For Ministry Use Only	
		Project Number	
Date (dd/mm/yyyy)		HIIFP Funding Year	
Principal Researcher (print name)		Email Address	
Institution Name		Institution Address	
Telephone No. (of Applicant)			

Topic No.	Title of Research Topic

Start Date		Completion Date (estimated)	

Brief Description of Progress Completed to Date. (continued)
Include information about: (1.) the status of major tasks (2.) the status of outcomes and/or the final report (3.) changes and/or issues (if applicable)

…..continued from Page 1.

Appendix D. HIIFP Application Form (23-A)

Ontario

HIIFP Application Form

	For Ministry Use Only
	Application Number

Principal Researcher (print name)	Email Address
Institution Name	Institution Address
Telephone No. (of Applicant)	

Co-Applicants (Name, Email Address, Institutional Affiliation)	
1.	
2.	
3.	

Topic No.	Title of Research Topic
open	

Brief Purpose of Research

Start Date		Completion Date (estimated)	

Financial Summary

Total Funds Requested from MTO	Total Funds Requested from Other Sources	Total Funds Requested (MTO + Other Sources)
		$ 0

Have you applied to any other funding agencies in support of this research?

YES ☐ (provide details) **NO** ☐

Signatures

It is understood that the provisions outlined in the MTO HIIFP Program Guide AND the details contained in the Research Project Proposal submitted by the Institution are hereby accepted and agreed to.

	Principal Researcher	Head of Department	Authorized Signing Officer of Institution
Print Name			
Signature			

Appendix E. Research Proposal Summary (23-C)

Ontario

Research Proposal Summary

Topic No.	Title of Research Topic
open	

Principal Researcher (print name)	Email Address

SUMMARY OF RESEARCH PROPOSAL
(Non-technical language, 300 words maximum, Arial (12-point) font, 1.08 Spacing)

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)

Ontario

Budget Details

Principal Researcher (print name)	Total Funds Requested from MTO

Topic No.	Title of Research Topic
open	

Research Item	**Direct Cost [$]**
Salaries and/or Benefits	
Equipment and/or Facility	
Materials and/or Supplies	
Travel	
Dissemination Costs	
Other Costs (specify)	
Overhead Cost (_____ % overhead on all Direct Costs) =	$0

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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