



Mushkegowuk James Bay All-Season Road Feasibility Study



CANADIAN CONSULTING ENGINEERING AWARDS 2021
Category B – Transportation

PRESENTED TO:



ASSOCIATION OF CONSULTING
ENGINEERING COMPANIES | CANADA
ASSOCIATION DES FIRMES
DE GÉNIE-CONSEIL | CANADA

CANADIAN CONSULTING
engineer



PROJECT HIGHLIGHTS



MUSHKEGOWUK JAMES BAY ALL-SEASON ROAD FEASIBILITY STUDY

LOCATION:	James Bay Region, Canada
COMPLETED BY:	2020
TO BE ENTERED IN CATEGORY:	B. Transportation
FIRM NAME:	Morrison Hershfield
FIRM ADDRESS:	2932 Baseline Road Ottawa, Ontario K2H 1B1
ROLE IN THE PROJECT:	Client's Engineer, Design Review & Construction Administration
CONTACT NAMES:	Andrew Harkness, P.Eng. Prime and Lead for Engineering, Environmental Studies, Consultation Email: AHarkness@morrisonhershfield.com Phone: 613-739-3258 Janet Jensen Corporate Communications Phone: 705-262-2451 Email: JJensen@morrisonhershfield.com



SUMMARY

Mushkegowuk Council retained Morrison Hershfield to assess the feasibility of a new all-season road (ASR) connecting four western James Bay communities to each other and the provincial highway network. Complexities including a vast study area, challenging geotechnical conditions and diverging community views were overcome through extensive community engagement, multi-factor quantitative and qualitative assessments, and innovative design methodologies to select a new 525 km ASR route. The ASR could potentially transform life for members of these remote communities.




The vast study area of 150,000 km² presented a host of challenges

Q.1 INNOVATION

The James Bay All-Season Road (ASR) Feasibility Study was a collaborative partnership between Morrison Hershfield, the Mushkegowuk Council (MC) and the coastal James Bay communities of Attawapiskat, Kashechewan, Fort Albany, and Moose Factory. These communities currently rely on winter roads, rail and air to transport people and goods into, out of, and within the region.

The focus of this Study is an area of approximately 150,000 km² in the northern part of the Mushkegowuk Traditional Territory, adjacent to the west coast of James Bay in the James Bay Lowlands. The nearest large urban centre to the coastal Mushkegowuk communities is the City of Timmins, located 315 km south of the Town of Moosonee.





Communities rely on winter roads, rail and air travel to transport people and goods into, out of and within the Region

The primary objective was to investigate, refine, and assess the potential for an ASR to connect the coastal communities to each other and to the Ontario highway network. This involved technical studies in support of building an ASR; socio-economic and environmental studies to assess potential impacts of additional transportation infrastructure; and the development of a functional design and cost estimate for the Recommended Route.

RECOMMENDED ASR

Four Inland Corridor alternatives connecting James Bay to the Trans-Canada Highway (Highway 11) were assessed. They varied in length from 200 km to 350 km. The Coastal Corridor (330 km) identified in earlier studies was confirmed by this study and was common to all Options. The Coastal corridor was combined with the Selected Inland Corridor to create the overall Recommended ASR Route.

The Recommended ASR is 525 km of gravel-surface public highway, with a design width of 9.5 m, a design speed of 100 km/h and a posted speed of 80 km/h. The proposed ASR design includes 70 bridges, and 100 additional medium and large diameter culverts to span watercourses and muskeg conditions.

The ASR is comprised of two primary sections (inland and coastal) that together constitute the Recommended Route. The Recommended Inland Route is 192 km, starting at Fraserdale and heading northeast, relatively parallel to an existing infrastructure corridor, ending in Moosonee adjacent to Moose Factory.

The 333 km Recommended Coastal ASR Route begins at Moosonee and generally heads northwest, some 10 to 30 km inland and parallel to the coast, connecting Moosonee to Fort Albany, Kashechewan and Attawapiskat.

INNOVATIVE DESIGN

Conceptual designs for roadway structures were developed to mitigate the varying and poor subsoil conditions in the sub-Arctic region. Through studies and analysis, conceptual designs were developed including the proposed use of composite layers of geosynthetic pavement structure to mitigate concerns of differential settlement thus allowing uniform distribution of loads over a wider footprint. The conceptual design allows for a floating pavement design over the organic mat (muskeg) where peat depth is greater than 2 metres. The proposed design solution in these conditions includes a granular surface layer over Granular B Type I over geocells filled with earth borrow between geogrid and geotextile layers.

Morrison Hershfield considered the following:

- The lack of readily available granular materials typical for construction.
- The suitability of available construction materials and identification of potential uses for more marginal local materials.
- Options to source suitable construction material in proximity to the alignment, including drilling programs, surficial geology interpretation, and subsurface electromagnetic resistivity scans.

Q.2

COMPLEXITY

Even at the feasibility stage, the Project Team's consideration of alternatives faced a variety of constraints and challenges, including:

- a vast, 150,000 km² study area
- challenging soil conditions, and uncertain aggregate availability
- Potential environmental and socio-economic effects

VAST STUDY AREA & HIGH COST OF COMMUNITY ACCESS

Determining a preferred corridor was challenging given the sheer size of the study area and the strongly held preferences of the different communities. The Recommended ASR Route selection relied on a multi-factor approach to assess the relative merits of each corridor alternative and to ensure traceable, clear and logical decision-making. The evaluation used 44 criteria with associated indicators and metrics, considering natural, socio-economic, and cultural environment and cost factor groups – each with identified indicators and metrics. Input on methodology and recommendations was received from the affected communities.

Despite a host of logistical challenges, a dynamic and interactive engagement program was implemented to build the trust and positive relationships needed to produce beneficial outcomes throughout the study. The Study Team recognized the value of early and ongoing community engagement, remaining focused and working proactively towards mutually acceptable solutions for all parties.

Engagement activities included Chief and Council presentations, multiple rounds of facilitated community meetings in remote communities (up to 5 locations each round), focus groups with elders and youth, social media and radio ads/ interviews. Additionally, the Project Team connected with community members off-reserve throughout the study (at their Annual Land Use Planning Conference and Climate Summit, Mushkegowuk's Annual General Assembly and, at mid-year Chiefs Meetings.)



Great care was taken to build trust within each of the affected communities and build community consensus at each key stage in the study. Flexibility was critical, particularly as it related to the community engagement travel plans and community meetings.

CHALLENGING SOIL CONDITIONS


Difficult geotechnical conditions typically represent a considerable obstacle for construction of transportation infrastructure in Ontario's Far North, where underlying soil conditions are typically composed of muskeg. Such soil conditions are typically unable to support high loads. Non-conventional methodologies are required to provide a stable foundation and to prevent deformation of the embankment and pavement structure.



Morrison Hershfield proposed innovative methodologies to manage the forces that are applied to the underlying road layers to allow construction of roadways capable of supporting up to 36,000 kg (maximum truck weight) of dynamic loads at speeds up to 100 km/h. The proposed design mitigates concerns of differential settlement, subsidence and premature failure of the road, all while minimizing environmental impacts. A floating pavement design was proposed for areas where peat depth was greater than 2 metres.

POTENTIAL ENVIRONMENTAL AND SOCIO-ECONOMIC IMPACTS

A detailed socio-economic evaluation determined the potential positive and negative effects of implementing the recommended James Bay ASR route, as detailed under Question 3. Twenty two benefit enhancement measures were identified that can be implemented to help ensure that positive effects are experienced by the communities and that these benefits are maximized to protect their social, economic and/or cultural values.



An ASR could transform lives for the western James Bay coastal communities



An ASR would improve overall community mobility and linkages among communities

Q.3

SOCIAL AND ECONOMIC BENEFITS

If constructed, the James Bay All-Season Road (ASR) will provide year-round ground travel between the western coastal James Bay First Nations communities and the Ontario provincial highway network.

The ASR Project has the potential to provide significant benefits and opportunities for the affected communities and their members if implemented in a manner that sustainably protects the environment, traditional land use and the long-term socio-economic interests of the Omushkego people.

A detailed socio-economic evaluation determined the potential positive effects of constructing and operating an ASR in the region which include:

- A reliable alternative to the increasingly unreliable winter road network.
- Year-round vehicular access to the Ontario provincial highway network.
- Lower cost of living through reduced transportation costs for goods and services.
- Improved overall community mobility and linkages among communities.
- Enhanced social opportunities such as access to friends and family in other northern Ontario communities.

- Enhanced access to emergency, health and social services, and educational opportunities.
- Increased employment and economic opportunities including significant regional construction employment opportunities (up to 1,800 direct, indirect and induced jobs/year over 7 years).
- Enhanced opportunities for local sustainable economic development initiatives that benefit the Mushkegowuk Council's member communities.

22 benefit enhancement measures that can be implemented to maximize the positive effects experienced by the communities as they relate to the protection of Omushkego social, economic and/or cultural values were identified by the study team.



22 benefit enhancement measures were identified that can be implemented to maximize the positive effects experienced by the communities as they relate to social, economic and cultural values



Q.4


ENVIRONMENTAL BENEFITS

The Mushkegowuk Traditional Territory is distinguished by its wilderness areas, clean water and air, and abundant populations of wildlife, plants and fish. The land sustains the Omushkego people physically, culturally, and spiritually. The process of selecting the Recommended ASR Route considered all aspects of the environment (i.e., natural, socio-economic, cultural) and included due regard for:

- Traditional Land Use (Hunting, Fishing, Gathering, Sacred Sites)
- At-Risk and Sensitive Species
- Woodland Caribou
- Wildlife Habitats
- Wetlands
- Areas of Natural and Scientific Interest
- Protected Areas
- Water Crossings
- Aquatic Thermal Regimes
- Fish Species
- Sensitive Aquatic Areas

Morrison Hershfield used the ENVISION sustainable infrastructure rating system to holistically assess the community, environmental and economic benefits of the project. The team determined areas where the project has already incorporated sustainability and resilience (given the early project stage) and identified areas where sustainability can be developed and enhanced as the project progresses.

Incorporating sustainability principles and practices throughout the planning and design stage (rather than looking for sustainability opportunities late in the project development process) can provide much greater sustainability returns at lower cost. The project performed well in the ENVISION rating system for the tenets of sustainability in areas such as overall improvement of community quality of life; improving community mobility and access; early and sustained stakeholder involvement; preservation of historic and cultural resources; and incorporation of sustainable principles. Additionally, climate resilience was addressed via avoidance of less suitable development areas and assessing climate change vulnerability.



The Mushkegowuk Traditional Territory is distinguished by its wilderness areas

The partnership between Morrison Hershfield and the Mushkegowuk Council was collaborative with frequent, ongoing communication



Q.5

MEETING CLIENT'S NEEDS

Morrison Hershfield was retained to undertake the James Bay All-Season Road (ASR) Feasibility Study to investigate, refine and assess the potential route for an ASR to connect the western James Bay communities of Attawapiskat, Kashechewan, Fort Albany, Moose Factory and Moosonee to each other and to the Ontario provincial highway network.

Study objectives defined at the outset by the Mushkegowuk Council were met and documented in the Feasibility Study Report, including the assessment of corridor and alignment alternatives for the both the coastal and inland sections of the ASR, and the selection and functional design of a recommended 525 km ASR route along with a preliminary project cost estimate and recommended next steps. The feasibility of the recommended ASR route was assessed from environmental, social and engineering perspectives, with early and ongoing community engagement to ensure traditional cultural values were considered.

The partnership between Morrison Hershfield and the Mushkegowuk Council was collaborative with frequent and ongoing communication. While several adjustments were made to the project schedule, they were largely to ensure adequate opportunity for community input, and for community consensus-based decision-making at key project milestones. The final project was delivered within the originally contracted project budget.

It was determined that, despite challenging conditions, the design, construction and operation of the ASR Project is feasible. If built, the project has the potential to transform the lives of the remote Mushkegowuk James Bay communities and their members.



