

# CONSTRAINTS IN THE CANADIAN TRANSPORT INFRASTRUCTURE GRID

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## SUMMARY

In support of the Canadian northern corridor research agenda, the purpose of this report is to compile a review and evaluation of the constraints impairing the Canadian transport infrastructure grid. The corridor concept aims to reduce the costs, duplication and delays associated with the construction of transportation and ancillary infrastructure. These include diversification of export markets, supporting Indigenous and northern development, expanding interregional and international trade, enhancing northern security and relieving bottlenecks and constraints to the existing transportation infrastructure grid.

Corridors have become important geographical constructs that help articulate public policy and infrastructure investments. They can be functional entities, meaning that they are commercially used and provide economic opportunities for surrounding communities and returns on investment for their users. Corridors can also be notional when they are part of a planning exercise that seeks to create a new functional entity.

Transportation infrastructure supporting corridors is complex, capital intensive and subject to an array of constraints in construction, maintenance and upgrade. These constraints include physical and environmental restrictions, level of transport demand, financial capabilities, construction and maintenance capabilities and costs, and regulatory oversight.

Constraints in the transportation system commonly take the form of bottlenecks, imposing delays and restrictions in the normal flow of transportation. They underscore that a constraint to transportation infrastructure usually occurs at specific locations and for specific causes. There are three major types of bottlenecks — infrastructure, regulatory and operational — that are applicable to the northern corridor concept.

Transportation infrastructure and networks have unique vulnerabilities that vary by mode. A review of the major vulnerabilities by modal network reveals that the hubbing propensity (command of flows and logistics by a limited number of nodes) is particularly subject to vulnerabilities. Rail networks are especially important to the Canadian economy and are structured as a linear nodal hierarchy that is vulnerable to disruptions.

Due to its geographical attributes, Canada has unique constraints on the development and operation of its transport infrastructure. The most salient bottlenecks related to the northern corridor initiative include:

- Ports on the Canadian East Coast have some draft limitations but provide extensive hinterland accessibility by rail. Montreal and the St. Lawrence remain inaccessible to the majority post-Panamax container ships, notably the Neopanamax class, able to transit the expanded Panama Canal. This represents a long-term risk that the St. Lawrence (Montreal) could be marginalized as a gateway to Eastern Canada, with some of the traffic handled by American East Coast ports.
- Due to ice conditions, the Port of Churchill is only open from late July until November, severely undermining its commercial potential. Its poor inland connectivity undermines its use as an Arctic port, even as a base to resupply Arctic communities.
- Summer sealift and ferry services are essential to resupply local communities and bring project cargoes. However, they have limited capacity and are seriously constrained by a short operational window (July to September).
- There are limited incentives to connect northern Canadian towns with jet and propeller services, mainly because of the low volumes generated. While jet services allow for carrying a good quantity of cargo, the runways that can accommodate them are more limited.
- Low economic density and vast distances undermine the Arctic's potential as an air transport market. The structure of the northern air transport network does not allow for direct connections between northern and Arctic communities since they do not generate enough traffic. Connections between communities must thus use a southern hub such as Edmonton, Winnipeg, Toronto, Ottawa or Montreal.
- Permafrost remains a severe impediment to the construction and maintenance of road, rail and pipeline infrastructure. The more northern the infrastructure, the higher the construction and maintenance costs, and therefore the more economically attractive the infrastructure project needs to be to justify an investment.
- The lack of pipeline capacity to the West Coast and the United States is a major impediment to Canada's energy exports and expanding this capacity remains controversial.
- Winter impairment of road and rail operations remains a constant issue in northern areas, requiring the costly positioning of equipment and crews over long distances.
- Because of its high reliance on hydro power, Canada requires long-distance, high-voltage power lines that have some vulnerability to geomagnetic storms and freezing rain.
- The availability of telecommunication services is bound to population density, particularly for wireless services. While northern communities have access to telecommunication services, they are generally of lower bandwidth and limited spatial coverage.