

The Vulnerability and Adaptation of the Transportation Sector to Climate Change

Assessing the vulnerability of the transportation sector to climate change involves examining past experiences with climatic fluctuations and extreme weather, as well as measuring current resource availability. This process enables the identification of necessary policy changes, knowledge gaps requiring further research, and partnership needs and opportunities. A vulnerability assessment also identifies the coping ranges and critical thresholds for specific areas within the transportation sector. A vulnerability assessment defines a sector's adaptive capacity, which involves available technology, management practices and financing mechanisms.

The Alberta Vulnerability Assessment Project is being conducted by a cross-ministry group, the Alberta Climate Change Adaptation Team, and will define the risks and opportunities for various sectors, including transportation.

Impacts of Climate Change

There are many different consequences to climate change, and each has an impact on the transportation sector. The following section describes these impacts.

Severe Weather

Severe weather events, including flooding and freezing rain, are predicted to increase with climate change. Both these occurrences would cause safety hazards for the transportation sector, and flooding could potentially cause the loss of some infrastructure. The delays caused by these occurrences would also have social and economic impacts on the transportation sector.

The Freeze-Thaw Cycle

If temperatures close to water's freezing point become more common in Alberta, the resulting increase in frequency of the freeze-thaw cycle will likely cause pavement deterioration.

Heat and Drought

Extreme heat and drought would cause heat-rutting, sink holes and heaving in pavements. These conditions would also lead to an increase in forest fires. Forest fires could impact transportation directly by the closure of certain routes and the loss of some infrastructure. Warmer winters might mean a decrease in the amount of snow clearing required, as well as a change in the mix of sand and salt used on the roads. Warmer winters could also mean a decrease in the length of time where seasonal roads are available, and also a change in permafrost location. This would have a negative impact on communities and industries using these temporary roads, however there could eventually be all-season roads in some areas. The subsidence of the ground due to receding permafrost could also affect pipelines and adjacent roadways. An increase in temperatures could also mean a change in the timing and duration of seasonal weight limits for the trucking industry.

Precipitation

Climate change will also potentially cause an increase in precipitation, which would contribute to flooding. An increase in precipitation would also cause an increase in soil moisture, resulting in slope instability and possibly an increase in landslides.

Indirect Impacts

Climate change will affect other sectors as well, such as agriculture and oil and gas, which in the long term will also affect the demand, timing and location for freight transportation.

For an in depth review of these impacts on certain systems, such as northern regions or pavement infrastructure, please see:

http://adaptation.nrcan.gc.ca/display_all_projects_e.asp?class=121

Steps towards Adaptation

Adaptation to the impacts of climate change will require long-term planning and several changes to the transportation sector. Current discussion, policy and programmes related to climate change generally focus on mitigation; however it will be important to integrate adaptation and mitigation efforts.

Planning for new infrastructure will require modification in engineering design to ensure the new structures can withstand the change in length and frequency of weather events, as well as hydrological changes. It has been suggested that technologies for new roadways capable of dealing with these changes already exist. (For further discussion on this topic, please see the report from a Transport Canada workshop; the link is provided below). The safety margin for building codes will have to be adjusted to allow for greater variability in weather and account for a wider range of extremes.

There will likely be a shift in the mode of transportation used, so it will be important to use demand management strategies. Careful monitoring of weather information systems will also be important. There is also a need to monitor, and possibly map, areas vulnerable to receding permafrost, flooding or landslides. The transportation sector will also need to be prepared for any changes to maintenance costs.

Further research is required to determine what specific impacts climate change will have on a regional scale. Local research is also needed to determine the capacity of specific systems (for example, drainage systems) to deal with these impacts. Research could also determine the options available to transportation policy makers in dealing with the impacts of climate change.

The following site provides the report from the “Impacts of Climate Change on Transportation in Canada Workshop” completed in 2003:

<http://www.tc.gc.ca/programs/environment/nwicct/docs/FullWorkshopReport/Full%20Workshop%20Report.pdf>