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CREATING CLIMATE RESILIENT RESOURCE ROADS: WATER CROSSINGS

Mark Partington, R.P.F., M.Sc.

Introduction

The planning, construction and maintenance of resource roads are required in support of various industrial and resource management activities and are often the primary access for remote communities and public recreational experiences.

This is the fourth Info Note in a series of five focused on the key issues of creating climate resilient resource roads.

Creating resiliency

Climate change is anticipated to have important impacts on the forest sector in Canada principally as a result of forecasted changes in temperature and precipitation patterns. Warmer summer and winter temperatures and an increase in high intensity, short duration rainfall events are expected in many regions. Developing and implementing adaptation practices that reduce the negative impacts and the vulnerability of resource road infrastructure to climate change needs to be a priority for resource road managers.

Water crossings

In many regions of Canada, climate change is expected to bring changes in precipitation patterns.

This could result in more frequent, short duration, high intensity rainfall events, or other changes, that will alter stream peak flows and the times of year in which they occur. These changes will require a specific analysis of the hydraulic capacity of water crossing structures, as well as their projected needs to mitigate the risks to these structures. The following practices may address these concerns:

1. Evaluate the needs of current culverts and bridges to adequately pass or accommodate flood conditions and increased flows of water, bedload and debris. Where needed, remediate or replace existing structures with higher capacity structures.

2. Consider the use of low water bridges and vented fords in locations where these types of structures are deemed appropriate (Figure 1).

Figure 1. Low water bridges and vented fords allow the passage of high water, large debris and bedload over the structure with a minimum of damage.

3. For new culverts, consider implementing streambed simulation designs to determine sizing rather than a standard hydraulic design. Streambed simulation considers the fish passage requirements and geomorphology of the site to determine culvert size, shape, and installed elevation and have been shown to be more resistant to flooding and peak flows.

4. On watercourses where high amounts of bedload movement and debris are anticipated, consider installing upstream trash racks and catch basins to intercept materials before they can reach the crossing structure.

5. Ensure that water crossings on winter roads are able to accommodate flows from early thaws or from rain-on-snow precipitation events. In many regions, climate change can be expected to increase the frequency of mid-winter thaws and winter rain events which can alter the water passage requirements of existing infrastructure.

6. Ensure that water crossing structures are oriented with the natural stream channel, and avoid installing structures that divert the natural stream channel. This allows the water to follow its natural path and provides for a consistent water velocity, important factors to aid in minimizing structure blockages, erosion or scouring of the structure and stream banks.

7. Design the structures to include the least amount of fill material as possible. This can be accomplished by evaluating common buried structure shapes such as round, arch or low-profile arch, and estimating fill requirements based on site characteristics. A structure containing less fill will create less of an environmental hazard if it fails, and will have lower repair and maintenance costs.

8. Consider the use of full span bridges without mid-span piers. Depending on the design and location, these types of structures may be more likely to be able to pass debris and will have a lower risk of blockage.

9. If ongoing maintenance will not be performed, and the road will be inactive, consider removal of the water crossing to prevent maintenance issues and environmental concerns (Figure 2).

Figure 2. Water crossing structure removal can reduce future maintenance costs and impacts to aquatic habitat related to structure failure.

Summary

This Info Note is part of a series of short reports focused on the key issues of creating climate resilient resource roads. The series includes the following reports:

1. Adapting to climate change
2. Planning and construction
3. Water management
4. Water crossings
5. Road maintenance

For further information, please consult the following publication, Partington, M. Bradley, A.H., Durand-Jezequel, M., Forrester, A. (2017). *Adapting Resource Road Infrastructure to Climate Change* (Technical Report 61). Pointe-Claire, Quebec: FPInnovations.