



## *Primer*

# *Synthesis of Practices of Geometric Design for Special Roads*

## *Introduction*

“Special roads” is a category for roads that tends not to fit into the standard definition for either urban or rural roadways. In design guidelines and research publications, special roads are often referred to as “low-volume roads” (LVR), although volumes are only one criterion for designating a roadway as a special road. Other important criteria related to special roads include function, seasonality, traffic composition and roadway structure. Examples of special roads (besides LVR) include recreational roads (scenic and seasonal, including park, campground, winter lodge, cottage and beach access), resource access roads (including mining, petroleum and logging access) and winter roads (made of ice and snow), amongst others.

Special roads surveys were sent to transportation officials and academics throughout Canada and the United States. An extensive review of recent research publications from around the world related to special roads was also carried out. In the final sections of the document, all of the individual components were combined to produce a complete synthesis of special roads, including jurisdictional practices throughout Canada, the United States and the rest of the world.

## *Special Roads Guidelines*

### *Canada*

A review of current design guidelines being used by Canadian jurisdictions revealed that, while several have comprehensive guidelines regarding special roads, more specifically low-volume roads (LVR), most provinces and territories have very limited guidance on the topic

and either address these situations on a project-by-project basis or rely on guidelines from the 1986 Transportation Association of Canada *Geometric Design Guide for Canadian Roads* (see Table 1, below).

**Table 1 – Special Roads Guidelines:  
Canadian Provinces and Territories**

Province/ Territory	Jurisdictional Guidelines	Reference to 1986 TAC Guide
Alberta	Comprehensive	Yes
British Columbia	Comprehensive	Yes
Manitoba	Formal yet Limited	Yes
New Brunswick	No	Yes
Newfoundland and Labrador	No	Yes
Northwest Territories	Informal	Yes
Nova Scotia	Formal yet Limited	Yes
Nunavut	No	Yes
Ontario	Minimal	Yes
Prince Edward Island	No	Yes
Quebec	Formal yet Limited	Yes
Saskatchewan	Comprehensive	Yes
Yukon	Informal	Yes

### United States

A literature review was completed for design guidelines and other relevant material regarding low-volume and other Special Roads within the United States. Documents were found for all 50 states; however, many of the documents do not contain geometric design criteria specific to Special Roads. The search revealed that 15 of the states have their own in-house geometric design guidelines for Special Roads; eight of these fifteen States also make reference to AASHTO’s 2001 *Guidelines for Geometric Design of Very Low-Volume Local Roads*. Six US states that do not have their own Special Roads guidelines make specific reference to the 2001 AASHTO guide as their exclusive source for design guidelines for these types of roads.



Other key design guides that are referenced by state-specific manuals include the *Roadside Design Guide* (AASHTO), the *Guide for Design of Pavement Structures* (AASHTO), *A Policy on Geometric Design of Highways and Streets* (AASHTO, 2011 Green Book), and the *Highway Capacity Manual* (TRB, 2010).

The US Fish and Wildlife Service has issued a roadway design document which focuses on Special Roads within national wildlife refuges. Likewise, the US National Park Service has issued a Park Road Standards document which is a well-developed resource for geometric design of park roads.

### Australasia

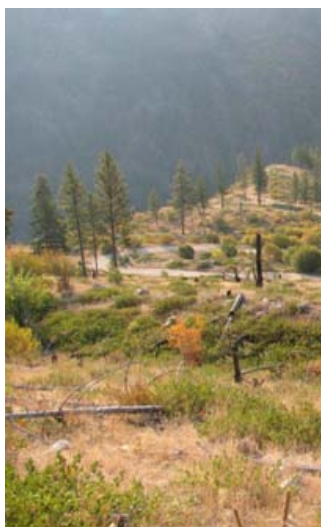
The standard resource for road design in Australia and New Zealand is the *Austrroads Guide to Road Design* which is an extensive series of documents jointly developed between 2006 and 2011. Each Australian state and territory, and all of New Zealand have adopted this guide as their primary roadway design standard; although, it should be noted that New Zealand previously had their own design guide (dated 2003) that made specific reference to low-volume roads.

### United Kingdom & Ireland

The *Design Manual for Roads and Bridges* developed by the Department for Transport in the United Kingdom has been adopted by all countries within the UK (England, Scotland, Wales, and Northern Ireland). While the manual does not specifically use the term “low-volume roads”, it does directly address design standards associated with low-volume, park and recreational, and non-motorized traffic routes.

### Other Countries

A key document that provides guidelines for the design of low-volume roads in Africa is entitled *Guideline: Low-volume Sealed Roads*. This document was prepared for the Southern African Development Community (SADC) in July 2003. Countries which have adopted these guidelines include Angola, Botswana, the Democratic Republic of Congo, Lesotho, Malawi, Mauritius, Mozambique, Namibia, Seychelles, South Africa, Swaziland, Tanzania, Zambia, and Zimbabwe.



## *Jurisdictional Survey*

For this Study, an online survey was developed and distributed to select stakeholders in Canada and in the United States to develop an understanding of the Special Road design guidelines being used throughout the industry and experiences related to those guidelines. The survey questions included in this Study were developed in close consultation with the Transportation Association of Canada (TAC) Project Steering Committee (PSC).

While different jurisdictions and companies view the issues related to Special Roads at different levels of priority, it is clear that most Canadian provinces and territories would like to have structured, specific Special Roads guidelines available. Representatives of Canadian jurisdictions that were contacted directly for this Project have unanimously expressed that they wish to be able to make individual design decisions, using the national guidelines as a technical resource, on a project-by-project basis.

## *Special Roads Design Criteria*

### **Classifications**

Special Roads are classified, defined, and described differently depending on the jurisdiction in which the design criteria have been established. Canadian jurisdictions tend to refer to Special Roads as recreational roads, resource access roads, service roads, local roads, property access roads, and, more commonly, low-volume roads. In the United States, jurisdictions tend to refer to Special Roads as local roads, private roads, recreational and scenic roads, resource recovery roads, agricultural access roads, and very low-volume roads.

### **Traffic Volumes**

In general, throughout North America, Special Roads, or more specifically low-volume roads (LVR) tend to include roadways with Average Daily Traffic (ADT) volumes of 400 vehicles or less; however, there are variations in these classification criteria on a jurisdiction-by-jurisdictional basis.

### **Design Speeds**

Throughout North America, jurisdictions have been using design speeds ranging from 30 to 110 km/h for Special Roads, although maximum design speeds for these roadways tend to be in the 70 to 90 km/h range.

### **Other Design Criteria**

Other design elements related to Special Roads which have been included in various Canadian and US jurisdictional highway design



guidelines include, but are not limited to right-of-way, Clear Zones, lane widths, ditches, vertical and horizontal alignments, and stopping sight distance.

### *Design Guides and Manuals*

#### **AASHTO Policy on Highways and Streets (2011)**

In the recently published 2011 AASHTO “Green Book” there is a relatively short section which discusses “Special Roads.” In this section, AASHTO presents the following three functional classes of Special Roads, each one defined by its function and special design criteria: Recreation Roads, Resource Recovery Roads, and Very Low-Volume Local Roads (ADT d” 400). This document refers the designer to the 2001 AASHTO Geometric Design of Very Low-Volume Local Roads (ADT d” 400), described below.

#### **AASHTO Guidelines for Very Low-Volume Local Roads (2001)**

This set of guidelines, which was developed by the US Standing Committee on Highways, addresses many concerns related to Special Roads, more specifically very low-volume rural and urban local roadways with ADT less than 400 vpd. Chapters 1 to 3 of these guidelines present a background and scope of very low-volume roads (VLVR) in the United States, explaining that these types of roadways account for a large portion of the American highway system.

AASHTO regularly states that the guidelines are to be implemented in conjunction with the engineering judgment of the designer involved.

#### **TAC Geometric Design Guide (1999)**

The 1999 TAC *Geometric Design Guide for Canadian Roads* (the most recent such guide published by TAC) includes design principles that are broader and more current than the 1986 TAC manual. However, the 1999 TAC guide does not include a chapter exclusively discussing Special Roads or LVR-specific design principles. In fact, throughout the entire 1999 guide, design criteria specific to Special Roads is extremely limited.

#### **TAC Guidelines for Winter Roads (2011)**

Winter roads are another, important category of Special Roads. The purpose of the TAC guidelines on winter roads is to educate the reader on the history and purpose of winter roads and to provide guidelines on how to construct and maintain these Special Roads. This document explains that “winter roads play an important role servicing remote communities with all-weather road access within the territories and northern regions of Canadian provinces.” These temporary roadways are less-expensive alternatives to building and maintaining permanent roads, although they are usually only traversable for a few winter months.

### TAC Manual of Geometric Design Standards (1986)

The 1986 version of the Transportation Association of Canada (TAC) Geometric Design Guide included Chapter H: Low-Volume Roads, which provided design guidelines for roads with volumes (ADT) less than 200 vehicles per day. Three main classifications of Special Roads were addressed in these guidelines: Rural System Roads, Recreational Roads, and Resource Development Roads. These guidelines were relatively comprehensive and included parameters for design speeds, horizontal and vertical alignments, sight distances, cross-sectional elements, clear zones, and roadside barrier applications. The primary purpose of these guidelines was to address inconsistencies among jurisdictions in the treatment of LVR and to standardize road requirements as they relate to service function.

Throughout this Study, it was found that Chapter H in the 1986 TAC guide provided the most comprehensive design guidelines for Special Roads compared to any other design document available in Canada or the United States. Research Articles

This Project included a synthesis of more than 40 literature sources, including geometric design guides, journal articles, conference proceedings, and jurisdictional standards. They represent a broad geographic area, including North America, Scandinavia, Southern Europe, East Africa, South Africa, Australasia, and South Asia.

The key findings of this research synthesis are:

- A major longevity concern for Special Roads, especially those without a paved surface, is drainage. Without proper drainage, unpaved roads will usually deteriorate quite quickly.
- Using superior materials will reduce the lifetime costs of Special Roads due to lower maintenance costs.
- Design guides must be non-prescriptive, as the needs of each Special Road are unique. These roads must be designed and treated holistically, on a project-by-project basis, using engineering judgment.
- Special Roads should be planned with the design requirements of potential future upgrades considered.
- Environmental impact should be a key consideration when planning, designing, and maintaining Special Roads.

This research synthesis has established that the majority of Special Roads design guides and other related documents provide lenience in the design of Special Roads. This lenience allows for more design and construction efficiency than would be observed with strict guidelines. In addition, through further research into more efficient construction and maintenance methodologies for Special Roads, transportation funding can be focused into more critical and high-cost areas such as bridges and highways.

## Summary

### Discussion

It is clear that, while most Canadian provinces and territories would like to have structured, specific Special Roads guidelines available, representatives of all of the Canadian jurisdictions contacted for this Study have unanimously expressed that they wish to be able to make individual design decisions, using the national guidelines as a technical resource, on a project-by-project basis. Often times, these jurisdictions must weigh safety, environmental, and budgetary factors when deciding how to approach each project; and with Special Roads, there is a wide array of geometric, environmental, and functionality issues, which must be considered when making planning and design choices.

An important component of this Study was to make a comparison between current, Canadian jurisdictional documents related to Special Roads and those presented in TAC and AASHTO geometric design guidelines. This process helped identify which geometric features of Special Roads are already addressed in Canadian design guidelines, which topics have not been addressed, and which issues require specific attention and, perhaps, additional investigation, should a new section on the geometric design of Special Roads be included in future TAC publications.

### Conclusions

The following conclusions have been made based on the guidelines, practices, and research efforts presented and discussed in this Report.

1. Special Roads exist in all 10 provinces and 3 territories of Canada. These roadways represent 75 to 80% of all Canadian roadways and, therefore must be considered an important topic of concern for Canadian highway designers and government agencies, at all levels.
2. Most guidelines presented in Special Roads-related design documents emphasize the importance of engineering judgment where addressing issues related to new or existing Special Roads. All project-related issues, including cost and constructability must be considered when making decisions related to these roadways.



### *Disclaimer*

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