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GUIDELINES FOR THE DETERMINATION OF THE GEOMETRIC DESIGN CRITERIA FOR ACCESS ROADS TO SKI RESORTS

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Guidelines for the Determination of the Geometric Design Criteria for Access Roads to Ski Resorts.

1) Background

Ski resorts provide recreation for both residents of British Columbia and visitors from outside the Province. British Columbia has world class winter and year round destination resorts. Ski resorts provide employment and create wealth for British Columbians and therefore make a net contribution to the Provincial economy.

The access road to a ski resort is generally through rough mountainous terrain and thereby represents a substantial investment on the part of a developer. B.C. regulations stipulate that private land, when created by subdivision, must be accessible by a public road. Therefore, the access road to any new ski resort development will likely become a public road maintained by the Ministry of Transportation and Highways (MoTH) either at the opening of the resort or sometime after the development of the resort and its ancillary works.
MoTH has the responsibility to ensure that the public interest is preserved prior to and after the transfer of the responsibility from the developer to the Province. The public interest covers both the costs to the Province and the safety of the users of the road.

The following guidelines deal with the determination of appropriate geometric design criteria for access roads to ski hills during the various stages the resort's development. Part three of the technical circular gives advice to Ministry technical and development approval staff on how to achieve an appropriate balance between the developer's overall financial commitment towards the construction of the access road and the Ministry's responsibilities in representing the public. The guidelines apply only to roads which serve essentially a single destination (ski resort) traffic.

2) Design Classification

The following are the design classifications and design speeds to be used depending on expected traffic volumes.

Low-volumes:

For ski hills with projected traffic volumes of 500 ADT or less during the life time of the resort (ADT: is usually the average daily weekend traffic during peak ski season, normally for Jan. & Feb.), the Design Manual Low-volume Road Standards and the Low-volume Roads Bridge Guidelines apply (Refer to Chapter 500 of the Design Manual). These standards and guidelines would be used only for a very small number of ski hill developments as most ski hills that are financially viable will generate higher traffic volumes.

Higher volumes:

For projected traffic volumes greater than 500 ADT during the life time of the resort, use the Design Manual Rural Local Undivided (RLU) standard template with a design speed of 80 km/h. This gives the following dimensions:

Lane width: 3.6 m

Shoulder width: 1 m (excluding the 0.5 metre gravel rounding)

3) Access Road Design Considerations

In applying the above Design Manual Standards to ski hills, the following approach is recommended:

A. Phasing of construction and reduction of design criteria

◊ Decisions on the design criteria to be used for the ski hill access road should be based on engineering studies such as a trip generation and traffic report and a preliminary design study. Any local deviation to standards or phased development of the access road should be supported by engineering and economic analyses. In considering gradual improvements to the road (either through local deviations to

the standards, followed by a local upgrade when warranted by traffic growth or a phased approach tied to each phase of the development) the Ministry representatives should ensure that the public safety and interests are well served.

◊ A phased approach to road pavement construction is typically tied to specific stages of the ski hill development. It is also applicable to long access roads through not excessively severe terrain, where the 80 km/h design can reasonably be maintained for some acceptable distance. In this case, care is taken to match as close as possible the road's alignment vertically and horizontally to the ultimate RLU80 standard. This option is generally less costly and disruptive than having to significantly realign the road at a later date, when it is warranted by higher traffic volume.

◊ The following is an example of phasing for the surface treatment:

⇒ start with a full top RLU gravel surface;

⇒ the second stage would consist of using a lower cost surface treatment such as chip seal to a minimum 7.2 metre width;

⇒ the third stage would be a full design pavement with a shoulder pavement to a minimum of 0.5 metre and preferably to the full 1.0 metre shoulder width.

◊ A design speed lower than 80 km/h may be appropriate for long road sections through exceptionally steep terrain which is normally encountered near the top of the mountain. The use of switchbacks may be appropriate. A road section with different design speed should be consistent with the drivers' expectations (a sudden change in the steepness of the terrain offers a clue to the drivers that the road conditions will likely change).

◊ Use the Design Manual Table 350.A for maximum grades. In the uphill direction the use of truck climbing lanes or slow moving vehicle pullouts should be considered. If two-lane sections are considered in the downhill direction, use the longer recommended optimal lengths for passing lanes in the Ministry standard on grades steeper than 6%. Avoid terminating an auxiliary lane too close ahead of a speed reduction zone or sharp curve. Slow moving vehicle pull-outs are not recommended on down grades steeper than 6%. On long stretches of very steep

topography, a reduced cross-section may be justifiable. This is usually done with a reduced shoulder and 1.5:1 fill slopes.

◊ Local reduction of standards: This is normally done with a case by case evaluation of each location that presents unusually severe constraints. For example: Very high cliff in rock or unstable material requiring a localized narrowing of the shoulder, a deep gorge necessitating a sharp curve at the end of a bridge, a very steep embankment requiring a curve with reduced design speed. For these isolated spots, a reduction in the standards may be cost effective for several years, without unduly reducing safety, until traffic has increased to the point where a local upgrade is justified.

B Safety Considerations and Ski Hill Traffic Characteristics that should be addressed in Designing an Access Road to a Ski Resort

The following is a list of factors that should be specifically considered in designing a road that accesses a ski resort. These factors should be a primary concern at every stage of the quality assurance review of the access road design and in dealing with the resort development application.

◊ The access road will likely be through much steeper terrain than that encountered on most other highways and roads. As a result, the consequence of leaving the roadway can be much more severe. Mitigating measures, such as the installation of roadside barriers at critical locations, should be used wherever it is cost effective to reduce accident rate severity.

◊ Driving on a lower standard ski road in rough terrain is not the usual driving experience for many travelers who primarily commute back and forth to work on roads familiar to them. Therefore, it is important to design an alignment which will minimize surprises to drivers. For example: A series of gradually sharper curves through a rough section is less dangerous than a long straight tangent leading to a sharp curve.

◊ Peak traffic demand will be during the winter in the early hours of the morning and in late afternoon when the road is most likely to be covered with freezing snow and ice.

- ◊ The peak traffic in the downhill direction will be after sunset which is far less than ideal driving conditions.
- ◊ This road is traveled at the end of a day or weekend of skiing when drivers are most likely to be tired.
- ◊ At the end of the day, in the downhill trip, there will be a significant number of impatient drivers who may be tempted to overtake slower vehicles in dangerous situations. The construction of two-lane downhill sections near the top and middle of the downhill would assist in sorting fast from slow traffic at the beginning of the trip.
- ◊ On a ski hill, a very large percentage of the daily traffic volume occurs one hour before the opening of the ski slopes in the morning and within one hour of the closing of the ski slopes in the evening. The designer should be made aware of these sharp traffic peaking characteristics.
- ◊ Ministry representatives should stress to the developer's representatives and local officials that ski hill access roads cannot be designed in the same manner as forestry roads. The vehicles, speeds, traffic peaking characteristics and driver familiarity with the road and their level experience are vastly different than logging truck operators which explain the great difference in design standards and construction specifications.