

Manual of Aesthetic Design Practice



**BRITISH
COLUMBIA**

Ministry of Transportation

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Revegetation - Vegetation Management

Revegetation - Vegetation Management

Introduction

Highway construction usually involves large scale disturbance to the surrounding landscape. Existing vegetation is cleared from the highway corridor to accommodate changes in grade, the new roadway, and other related facilities. As a result of these changes large areas will become susceptible to erosion, loss of topsoil, and the invasion of weed species. In dealing with these issues revegetation is an important part of the highway design process.

Other chapters in this manual have addressed aesthetic design issues such as alignment, selective clearing, and earthworks which can effectively minimize these negative impacts. Still, the re-establishment of vegetation on affected areas is extremely important not only for aesthetics, but for functional reasons, including erosion control and maintenance.

There is opportunity during highway design to not only preserve desirable vegetation, but to plan for the type of planting suited to the right of way involved. Wise decisions made during the design stage will result in better integration of aesthetic and functional aspects, and ensure maintainability after construction.

Well managed revegetation practices can play a major role in meeting the following objectives:

- controlling erosion.
- reducing problems associated with headlight glare, sun glare, and snow and ice accumulation.
- creating visual interest along the highway.
- screening unsightly conditions.
- framing and providing access to views.
- reducing the visibility of the road from adjacent areas.
- guiding traffic and providing "soft" impact areas for errant vehicles.
- blending the highway into the adjacent landscape.
- facilitate appropriate levels of maintenance.

The Ministry's Landscape Policy and Standards references three categories of landscape treatment, based on, rural, suburban, and urban locations. Revegetation practices should be responsive to specific requirements for each of these areas.

Recommended Practices

The following pages outline recommended practices concerning the aesthetics of revegetation associated with highways in B.C., as summarized below:

1.0 Site preparation must meet requirements as determined by the Ministry.

2.0 Revegetation must maintain operational highway design safety requirements.

3.0 Revegetation should enhance attractive views and screen negative views from the road.

4.0 Revegetation should enhance attractive views and screen negative views toward the road.

5.0 Revegetation should respond to the natural vegetation and habitat of the site.

6.0 Revegetation should minimize erosion and assist in the stabilization of cut and fill slopes.

7.0 Revegetation should minimize the effects of adverse climatic conditions.

8.0 Revegetation should minimize the negative implications of increased traffic volumes.

9.0 Maintain adequate setbacks to both above and underground services.

1.0 Site Preparation

Preparation of the site must be in accordance with requirements established by the Ministry for the various levels of landscape treatment. This manual is based upon the rural category. The following recommendations are considered basic practice for all areas.

.1 Provide adequate subgrade preparation.

- Rough grade to produce lines and grades shown on the drawings.
- Blend existing landforms into the graded areas to create a minimum of visual disharmony.
- Scarify subgrade to a minimum depth of 100mm.

.2 Provide topsoil of adequate depth and quality to ensure healthy plant growth.

- Where it is impractical to topsoil large cut and fill slopes, or topsoil is unavailable, concentrate efforts to adequately prepare existing conditions for receiving seed and plant material.
- Salvage existing topsoil and soil strippings, stockpile, and reuse on disturbed areas wherever possible.
- Where topsoil is available, provide a 300mm depth for shrub planting, and a 450mm depth for tree planting holes.
- When planting into existing material, scarify the bottoms of planting holes and allow for drainage.
- Consider providing limited amounts of topsoil for individual holes when existing conditions are very poor.

.3 Provide adequate water supply to ensure healthy plant growth.

- In rural applications, the establishment of vegetation is dependant on rainfall and existing soil moisture. Revegetation plans should require no supplemental watering.
- Limit installation of irrigation systems to those circumstances where it is essential to plant survival and appearance.*

*refer to REVEGETATION (Response to Natural Vegetation) for specification of appropriate species of plant.



Figure G-1
Once rough grades have been established topsoil will be spread to depths required to ensure adequate plant growth.

2.0 Operational Safety Distances

Proposals for revegetation must recognize and maintain operational highway design safety requirements.

.1 Maintain safety setbacks.

- Limit plantings of trees whose mature diameter exceeds 100mm to the following setback distances. These setback distances can and should be relaxed where retaining walls and traffic barriers are proposed.

90km/h or greater	=	10m from pavement edge
80-90 km/h	=	7m from pavement edge
60 - 80km/h	=	6m from pavement edge
60km/h or less	=	2m from pavement edge

- Emphasize desired increase or decrease of design speed by modifying tree setback distance accordingly.
- Maintain minimum vertical clearance of 5m over pavement. Revegetation proposals should incorporate tree species with a natural branching structure which can accommodate this requirement.
- Provide setbacks to treeline for special conditions as follows:

passing distance to allow minimum passing sight distance at design speed

signs minimum horizontal setback distance of 2m or as necessary so as not to obscure reading of the sign

intersections distance required to respond and react

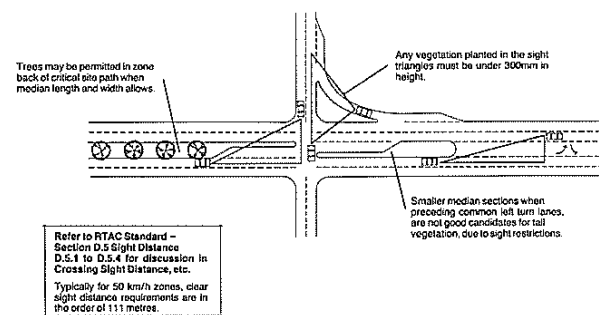
driveways & access roads minimum horizontal distance of 2m

rail crossings (uncontrolled) distance, measured from the crossing of the minimum stopping distance for the highway design speed and, distance, measured from the crossing, travelled by the train equivalent to the interval required for the vehicle to stop. Railway Act Regulations for sight distances must be adhered to.

.2 Maintain height restrictions within sight triangle at intersections and sight distance areas.

- Specify plant material whose mature height will not exceed 600mm above the finished elevation of the highway within critical sight distance areas.

**refer to REVEGETATION and CLEARING AND GRUBBING for required safety setbacks.*



SIGHT DISTANCES AT NON-SIGNALIZED CROSSINGS

Figure G-2

Vegetation within the area of sight triangles should be kept less than 300 mm height above the level of pavement. Refer to the Ministry of Transportation and Highways Landscape Policy.

3.0 Response to Views from the Road

Revegetation will maintain and enhance attractive views and screen or minimize negative views from the road.

.1 Revegetate to frame and define desirable views from the road.

- Maintain designated views for a minimum length equal to 0.5 seconds at the highway design speed if **fleeting** view is desired.
- Maintain designated views for a minimum length of 5 seconds at the design speed if **panoramic** view is desired.
 - consider the option of selective clearing, and/or limbing of remaining or planted trees to the height required to maintain desired view.
 - if the cleared length is greater than 5 seconds, consider retaining or planting specimen trees.
 - if the cleared length is greater than 10 seconds consider retaining or planting pattern of fragmented clump, or specimen tree, typical of adjacent context.

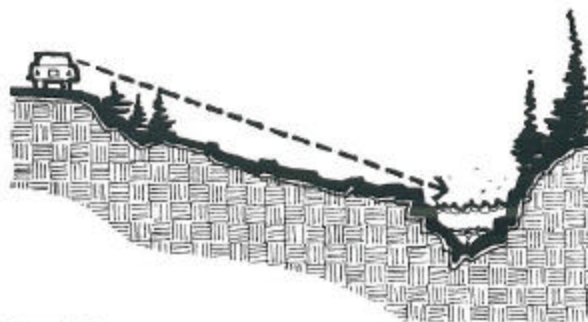


Figure G-3
Where attractive views exist, limit the height of foreground vegetation.

.2 Use the Area of Effective Vision to determine where revegetation will be most effective in screening or framing views.

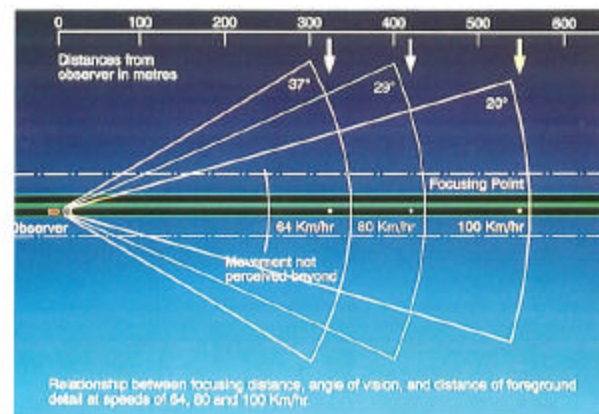


Figure G-4
Note that revegetation undertaken within the darkly shaded areas of this 'Area of Effective Vision' diagram will be more effective in screening and framing views.

3 Screen erratic or confusing views.

- Provide screen where alignments of highway, or alignments of highway and frontage road converge.
 - provide a screen of 3m minimum in width, of a height which blocks the view of other alignment within the area of effective vision for the highway design speed.
- Provide screen of frontage roads which parallel within 20m of highway.
 - provide a screen of 1.5m minimum in height above the finished grade of highway, 3m minimum in width.
 - provide a minimum length of 60m and maximum length equal to 5 seconds at highway design speed.
 - breaks in screen should not exceed 20m.



Figure G-5
Revegetate to screen at convergence of alignments and between highway and frontage roads which parallel within 20m.

- Revegetate open ends of tangents.
 - revegetate the front edge of natural or created clearings (eg. abandoned roadways, construction areas) within forests beginning within foreground area of effective vision, with plant material whose mature height will equal that of adjacent predominant plant material.
 - revegetate openings to utility corridors which appear at the end of tangents.
- Revegetate the ends of tangents in open terrain.
 - plant trees typical in arrangement and species to region.
 - in areas dominated by grid land use pattern, or in areas with dominant hedge or shelterbelt planting, plant minimum 5 trees in row. Begin row at the end of tangent and align with curve of roadway.
 - in areas not dominated by above conditions, plant 1 landmark tree, or minimum 5 trees together for grove effect.



Figure G-6
Revegetate the open ends of tangents.

4 Screen unsightly views.

- Minimize the effect of utility corridors.
 - screen the groundplane of the cleared right of way when viewed from distances up to 5km, where utility corridors cut through forest.
 - screen high voltage powerlines viewed from distances up to 1.5km in terrain dominated by trees.
 - where underground utility corridors, aboveground high voltage powerlines, or maintained haul routes intersect with the highway ensure that vegetated screens are designed to create a natural transition between natural and revegetated areas.



Figure G-7
Screen the view to utility corridors when viewed from a distance of within 5km.

- Minimize the effect of timber cuts.
 - provide vegetation of a height required to screen adjacent timber cuts. Where attractive views exist beyond cut, limit height accordingly.
 - where dominant straight lines of timber cut intersect cleared highway right of way, feather edge of cut for a 10m minimum width.



Figure G-8
Alignments which expose timber cuts within 5km of the roadway will negatively impact the aesthetic quality of the driving experience.

- Screen unsightly land uses i.e.: (junkyards, garbage dumps, quarries, and field camps) where visible within 1.5km from highway.
 - provide a 20m minimum planted buffer of a height and length necessary to screen the entire groundplane of the site.
- Screen the parking areas and yard operations of all other commercial businesses immediately adjacent to the highway.
 - provide a 3m width minimum of dense evergreen vegetation, of a height necessary to screen the groundplane of the commercial business. Height should not exceed that which would screen view of business sign from the highway.
- Where no opportunity to screen unsightly view exists, evaluate opportunity of providing attractive feature which diverts attention.
 - open attractive views in the opposite direction.
 - alternatively, provide exceptional plant display with distinctive grasses, wildflowers, groundcovers, and flowering shrubs within right of way.

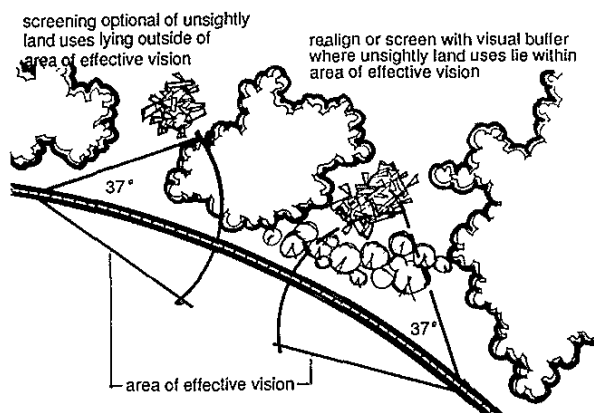


Figure G-9
Typical screen between roadway and unsightly adjacent land use.

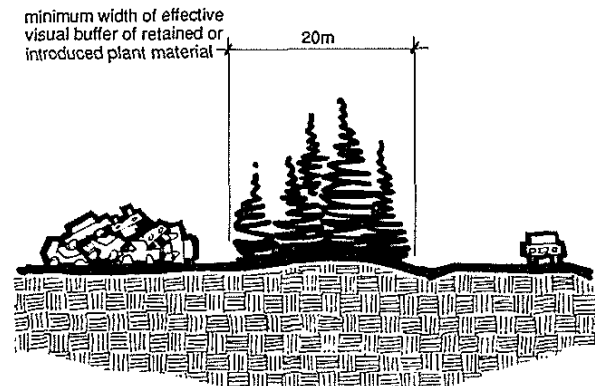


Figure G-10
For unsightly land uses, provide a 20m minimum planted buffer.

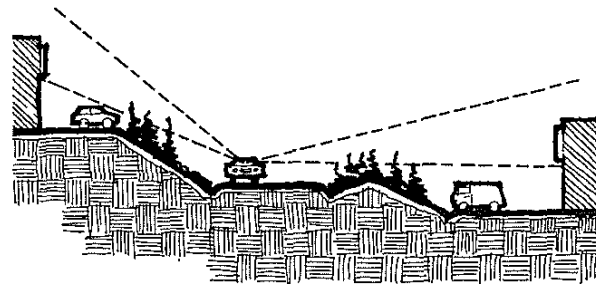


Figure G-11
For normal commercial business screen parking areas and yard operations.

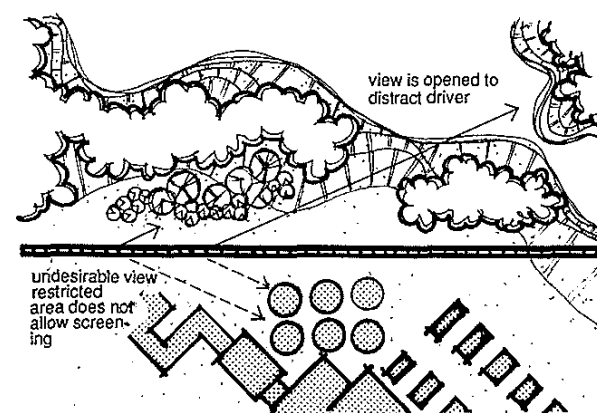


Figure G-12
Where screening of businesses cannot be accomplished, consider providing of alternate visual focus.

5 Mitigate the effect of highway structures.

- Screen base of overpass support piers.
 - provide single species mass planting 1.5m minimum width in front of piers, extending for a length of 15m parallel to the roadway on both sides of pier.
- Consider screening at base and/or top of retaining structures.*
 - provide shrub borders of 1.5 minimum width, of a 3m maximum height, for walls **not exceeding** 3m high.
 - provide vines 1m on centre at base and/or top of wall for walls **exceeding** 3m height.
- Consider planting of traffic islands.
 - consider planting of traffic islands over 200m square and of 3m minimum width.*
 - plant shrubs, groundcovers, grasses, or wildflowers whose mature height does not exceed 600mm.

**refer to REVEGETATION (Operational Safety Distances) for height requirements within sight triangle and sight distances.*

**refer to REVEGETATION (Operational Safety Distances) for height and setback requirements.*



Figure G-13
Typical planting at the base of bridge and overpass support structures.

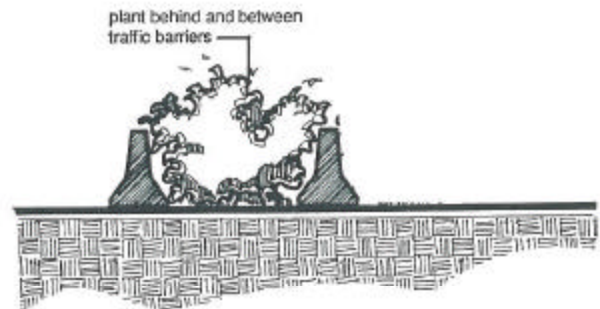


Figure G-14
Provide shrub planting between median traffic barriers.



Figure G-15
Provide for revegetation at the base and/or top of retaining structures.



Figure G-16
Provide planting within traffic islands and interchange loops.

4.0 Response to Views Toward the Road

Revegetation should enhance attractive views and screen negative views toward the road.

.1 Revegetation should consider the visual impact of roadway development on adjacent land use.

- Where highways are developed within 60m of residential property provide dense evergreen vegetation to a height required to screen the view of the roadway including the glare from headlights.
- Where roadways are developed adjacent to commercial interests revegetation should create a smooth transition between businesses and the highway.
- Specify plants which are responsive in character to adjacent residential or commercial planting.



Figure G-17
Revegetation developed in conjunction with adjacent landholders should provide a buffer between the highway and adjacent commercial or residential interests.

.2 Where highways are to be viewed from recreational areas revegetation should screen the view towards the highway.

- Where highways pass within 60m of recreation areas revegetation should be undertaken to screen the view to the highway.
- Where highways pass within 60m of wilderness recreation areas, revegetation should be undertaken with native vegetation to provide a complete visual screen.
- Where highway alignments pass near to lakes, rivers or waterbodies, ensure that revegetation is undertaken to preserve the visual integrity of the shoreline.
- Where highways pass through valleys or steep terrain ensure that revegetation is undertaken to restore cut and fill slopes.

5.0 Response to Natural Vegetation

Respond to the natural vegetation and habitat of the site.

.1 Recognize effects on natural vegetation remaining as a result of new road alignment.

- Assess potential "blow-down" of mature trees left without root support.
 - allow "blow-down" specimens to take a natural course where this presents no threat to pavement, safety setback or sight distances.
 - consider felling only that portion of "blow-down" specimens which threaten pavement, safety setback or sight distance. Preserve remainder of specimen as snag for wildlife habitat.
 - specify fast growing, soil stabilizing plant species for adjacent buffer areas to "blow-down" susceptible species.
 - where "blow-down" specimens are felled, retain topsoil and root systems to encourage root sprout regeneration.
 - where population of root sprouting trees is inadequate, specify pioneer tree species for adjacent buffer areas.



Figure G-18
Revegetation should consider and respond to the character of existing vegetation.

.2 Rehabilitate water edges disturbed by road alignment to improve and maintain aesthetic quality of water bodies.

- Replace stream-side trees to provide variety in enclosure along water's edge.
- Re-establish water edge shrubs, grasses, and reeds to integrate new shoreline with remaining undisturbed water edge.



Figure G-19
The crown vetch used as groundcover in this photograph blends with the surrounding context.



Figure G-20
Undulate the forest edge.

.3 Reflect natural vegetation habitat.

- Undulate the forest edge.
 - avoid straight lines within planting pattern and at planting edge.
- Fragment the forest edge by providing tree clumps as transition to forest edges, on cut and fill slopes, and as visual relief and landmarks in open areas.
 - provide a clump 10m minimum in diameter, maintaining a distance between forest and tree clump approximating the average distance occurring in natural vegetation.
 - provide a distance of 10m minimum where naturally occurring fragmentation of forest does not occur.
- Feather the forest edge.
 - reflect the natural gradation of forest edge (eg. from forbs and grasses, and shrubs, through pioneer trees, to mature forest). Plant any one area at 3m minimum width.
 - where slope exceeds 3:1 begin feathering of forest edge 1m beyond rounding of slope.

.4 Specify plant material which is hardy and fast growing, drought, salt, pollution and wind tolerant, requires low maintenance, and establishes quickly.

- Native plant material is generally preferable in rural conditions.
 - native plant material, typical to region, provides best selection of material to meet local conditions.
- Plant native plants to minimize maintenance.
 - plant in masses, limit number of species to five.

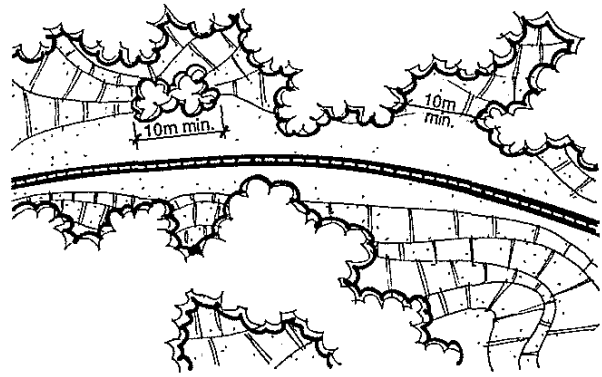


Figure G-21
Fragment the forest edge.

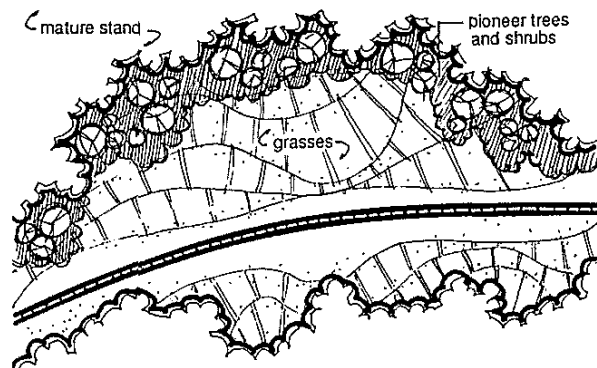


Figure G-22
Feather the forest edge.

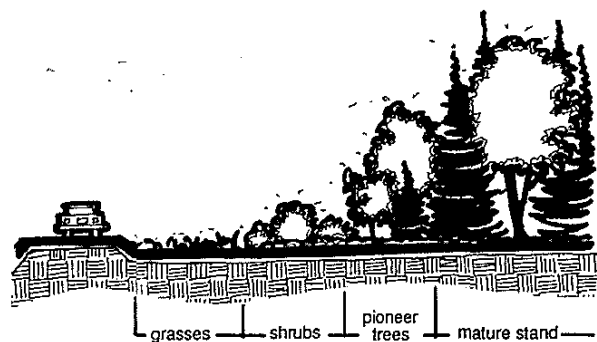


Figure G-23
Revegetation should create a transition from grasses through to mature trees.

6.0 Response to Erosion

Early establishment of vegetation on disturbed lands will minimize general surface erosion and assist in the stabilization of cut and fill slopes.

.1 Grasses are an adaptable, useful, and readily established groundcover, and are recommended as the first line of defense in controlling erosion caused by wind and surface runoff. A dense cover of grass also discourages invasion of undesirable weed species.

- Determine appropriate seed mixes based on soil conditions and local climate.
- Provide fertilizer suitable to site based on soil analysis.
- Consider the use of nurse crop grasses to assist in early establishment.
- Consider the use of nitrogen fixing legumes to develop more favourable growing conditions.
- Consider the inclusion of wildflower mixes to enhance the appearance and diversity of seeded areas.



Figure G-24
A dense groundcover can reduce erosion and assist in the stabilization of cut and fill slopes.

.2 Specify appropriate methods to ensure the vigorous establishment of grass cover.

- Generally seed should be applied by hydroseeder.
- Specify the use of mulch where necessary for seed stability, or when seed cover is required and conditions are not ideal.
- Consider the use of soil tackifiers, and erosion control mats and netting for severe slope application or drainage courses.
- Use helicopters for seeding otherwise inaccessible sites.



Figure G-25
For large areas seed mixtures can be applied by hydroseeders.

.3 Establish woody plants for long term erosion control.

- Install deep rooting trees and shrubs having good soil binding qualities.
- Use larger quantities of inexpensive seedling stock at closer spacings for rural locations.
- Use larger containerized material when advantageous visually or when larger root mass is required initially.
- Specify coarse growing, massing and suckering forms of plant material for slope stabilization.
- For developed locations, consider using plants having both erosion control and decorative characteristics.
- Anticipate requirements for speciality plant materials that may be of limited availability, eg. - native plant stock, and prepare custom growing contracts well in advance of the time of installation.



Figure G-26
In this situation grasses have not established. Deep rooting perennials are needed for this application.

.4 Incorporate bio-technical slope stabilization techniques during construction of cut and fill slopes and along water courses.

- When appropriate, plan to provide additional mechanical stability to constructed slopes by using revegetation practices such as brush layering, fascines, and live staking using plants that are aggressive rooters.
- Locate sources of donor material for cutting in the general vicinity of the job site, and well in advance of the actual work.
- Specify requirements for supply of custom grown nursery stock applicable to this type of work well in advance.



Figure G-27
Additional slope stability is provided by using aggressively rooting plants and layering in plant material.

7.0 Response to Climatic Conditions

Revegetation should minimize rather than add to the effect of adverse climatic conditions.

.1 Revegetation should minimize potential for icing conditions in high risk areas.

- Avoid planting high growing coniferous trees in locations which would cast early morning shade on roadways in climates subject to black ice. Use of deciduous plants would be appropriate in these circumstances.



Figure G-28

In areas where snow drifting caused by high winds is an issue trees should be set back from the edge of pavement.

.2 Revegetation should minimize the potential for snow drifting in high risk areas.

- Set vegetation back from the road edge a distance of 7 to 8 times the height of a moderate (50%) vegetative screen (preferred).
- Set vegetation back from the road edge a distance of 11 to 12 times the height of a light (25%) vegetative screen.
- Set vegetation back from the road edge a distance of 13 to 14 times the height of a dense (75%) vegetative screen.

.3 Minimize the occurrence of sun glare.

- Feather revegetated edges to reduce abrupt transitions from full shade to full sun.

8.0 Response to Increased Traffic Volumes

Revegetation should minimize the negative impacts of increased traffic volumes.

.1 Minimize the visual impact of highway development.

- Ensure visual privacy of residences, where rear foundation line is within 60m of the highway pavement edge.
 - provide a dense evergreen screen of 3m minimum width, for the length of the respective property line, of a height necessary to screen the rear yard from the highway.
- Mitigate the visual impact of excessive fill earthworks or retaining walls visible to residences and tourist accommodation within 5km.
 - provide naturalized stands of evergreen trees, from the base of the slope and extending over slope, of a height necessary to screen the slope or wall face, where visible to communities within 5km. Mitigate the visual impact of excessive fill earthworks or retaining walls immediately adjacent to residential areas.
 - comprise buffer of both evergreen trees and deciduous shrubs.

.2 Screen to supplement noise abatement for the benefit of adjacent land uses.



Figure G-29
Vegetation can supplement other forms of noise abatement.

.3 Minimize headlight glare.

- Provide a screen between opposing directions of traffic, and between the highway and frontage roads.
 - provide a dense evergreen screen 3m minimum in width to a height of 1.5m above the finished elevation of the highway pavement.
 - where truck traffic is prevalent provide a dense evergreen screen 3m minimum in width to a height of 1.8m above the finished elevation of the highway pavement.
 - provide a minimum length of 60m and a maximum length equal to 5 seconds at highway design speed, broken by gaps not exceeding 10m.
 - plant on the outside of curves where the width of the median between opposing lanes is 20m or less.
 - plant in the median at the end of tangents where two alignments converge.



Figure G-30
Where roadways pass close by residential areas revegetation should provide a screen against headlight glare.

9.0 Response to Utility Services

Maintain adequate setbacks of both above and underground services.

.1 Provide adequate setback of trees.

- Trees whose mature height will exceed trunk diameters of 100mm or larger must be setback as follows:

luminaire standards	6.0m
utility poles	3.0m
underground services	1.5m
catchbasins	2.0m
manholes	1.5m
valve boxes	1.5m
fire hydrants	3.0m



Figure G-31
Note setback distances from trees in this rural situation.



Figure G-32
Note setback distances from trees in this urban situation.