



COWICHAN
VALLEY
REGIONAL
DISTRICT

Trail Standards and Guidelines



Prepared by: CVRD Parks and Trails Division

Preface

In order to provide the best possible product to trail users, the Cowichan Valley Regional District first created a draft trail standards document in 2007. By detailing standards for trail types, basic construction methods, and general maintenance these draft standards created a platform for ongoing development and refinement of CVRD trails operations.

Since 2007, the CVRD has more than doubled the length of trails within the Electoral Area Community Parks and Regional Parks and Trails programs. During this time, standards for construction and maintenance have evolved to reflect changes within the CVRD and the overall parks and trails industry. In order to guide future development of CVRD trails the CVRD Parks and Trails Division has amended the 2007 draft Trail Standards, taking into account the ongoing evolution of sustainable trail design and construction.

This updated set of trail standards will be utilized to enhance communication with all those involved in the development, construction, and ongoing maintenance of trails within the CVRD. The specifications and procedures contained within this document are intended to guide the process of trail development and establish safe, consistent, enjoyable trail experiences for all.

On the cover: Cowichan Valley Trail (top left), Cobble Hill Mountain Regional Recreation Area (top right, bottom right), Wilmot Trail – Cowichan Bay (bottom left)

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Photos: Yellowpoint Park – North Oyster (top), Cobble Hill Mountain Regional Recreation Area (middle), Kinsol Trestle Forest Trail (bottom)

Introduction

The Cowichan Valley Regional District is responsible for over 150 kilometres of trail (as of September 2014) within the nine CVRD Electoral Areas, Regional Park sites across the region, and the Cowichan Valley Trail. Trail users are afforded many opportunities to experience the diverse and unique features the Cowichan Valley has to offer.

To ensure the best possible experience for the public, CVRD Parks and Trails follows a balanced approach to trail design that focuses on the following elements:

- **User Safety and Quality of Experience** – The purpose of trails is to create a safe, enjoyable experience for the user. Whether for education, relaxation, recreation, or a host of other experiences, a good trail is designed to provide a safe environment for the enjoyment of all trail users.
- **Sustainable Design Principles** – A sustainably designed trail is one that utilizes design methods and construction best practices that mitigate potential negative environmental impacts.
- **Longevity** – Designing and constructing high quality, sustainable trails not only provide a better experience for trail users, they can also provide long term savings on maintenance. A well designed trail has the capability to last generations; but only if it is constructed with that level of foresight in mind.

The CVRD is dedicated to applying these elements to all aspects of park and trail design. To help achieve this goal, this document has been developed to outline the standards of trail construction undertaken by the CVRD.



Cowichan Valley Trail - Glenora

Glossary of Trail Structure Terms

(see Figures 1 - 5)

The following is a list of trail structure elements that are commonly referred to during trail design and construction:

- **Clearing Limit** – Total width of trail corridor to be cleared of vegetation and other debris.
- **Vertical Clearing Limit** – Height of trail corridor to be cleared of vegetation and other debris.
- **Trailway** – Total width of disturbed area resulting from trail construction. May include ditching and cut/fill slopes.
- **Tread** – Usable trail surface width. May also be referred to as “Surface.”
- **Trailbed** – Total width of placed material. May also be referred to as “Sub Base.”
- **Surface Material** – Top layer of material.
- **Sub Base** – Lower layers of material that provide support for the surface material.
- **Shoulder** – Outer edges of the trail surface and exposed sub base.
- **Cut/Fill Construction** – Method of construction by which material is excavated from a side slope and utilized to create the trailbed by filling below the cut area. This method of construction is commonly utilized in single track trail construction as it is the easiest way to obtain material for the trail and allows for the most effective water control techniques.
- **Side Slope** – The grade of the existing ground line.
- **Ground Line** – The existing terrain onto which the trail is being designed.
- **Embankment** – Fill material onto which a bench cut trail is constructed.
- **Surface Material** – The material used to construct the tread of the trail.

- **Bench Cut** (see figure 3) – Typically utilized to construct trail along a hillside, creating a bench cut involves excavating material from the hill and constructing the trail on exposed ground or excavated material. The percentage of the trail built on excavated ground or fill material is based on the side slope of the terrain in the area of the trail corridor.
 - o Full Bench – the trail is constructed completely on excavated ground. Utilized in areas where the side slope exceeds 50%.
 - o $\frac{3}{4}$ Bench – 75% of the trail is constructed on excavated ground while 20% is constructed on excavated fill material. Utilized in areas where the side slope is between 30% and 50%.
 - o Balanced Section – 50% of the trail is constructed on excavated ground while 50% is constructed on excavated fill material. Utilized in areas where the side slope is between 10% and 30%.
- **Backslope** – The grade at which the cut slope follows from the trail or ditch up to original ground. The ideal backslope varies based on the material being used.
- **Fill Slope** – The grade at which cut material falls away from the trailbed. The ideal fill slope grade varies based on the material being used, but is generally more gentle than the backslope since fill slope material has been moved and is thus more susceptible to erosion.
- **Inslope/Outslope** – The grade at which the trail slopes towards its inner/outer edge. Inslope construction is typically used for banked corners and facilitation of water flow in switchbacks and trail corners. The purpose of outslope is to manage water by allowing it to flow towards the edge of the trail. Typically, the ideal outslope grade is between 3% and 5%.
- **Crown** – Surface material placement technique in which the highest point of the trail surface is the center with a 2-3% outslope to the trail edges. This technique is best in flat areas or for wider trail types.
- **Fill Material** – inorganic soils and/or aggregates utilized to create the trailbed.

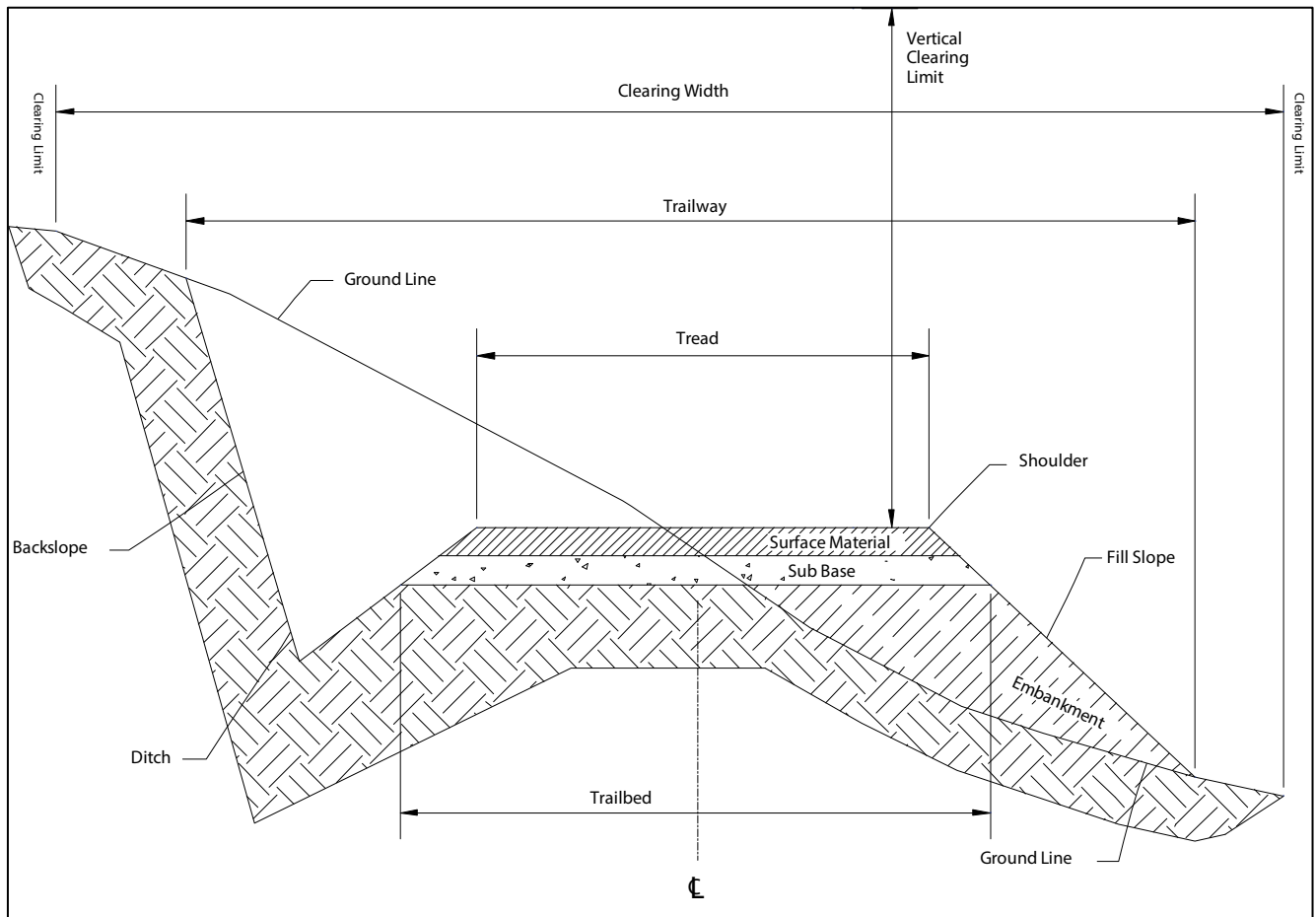


Figure 1 – Illustration of Typical Trail Structure

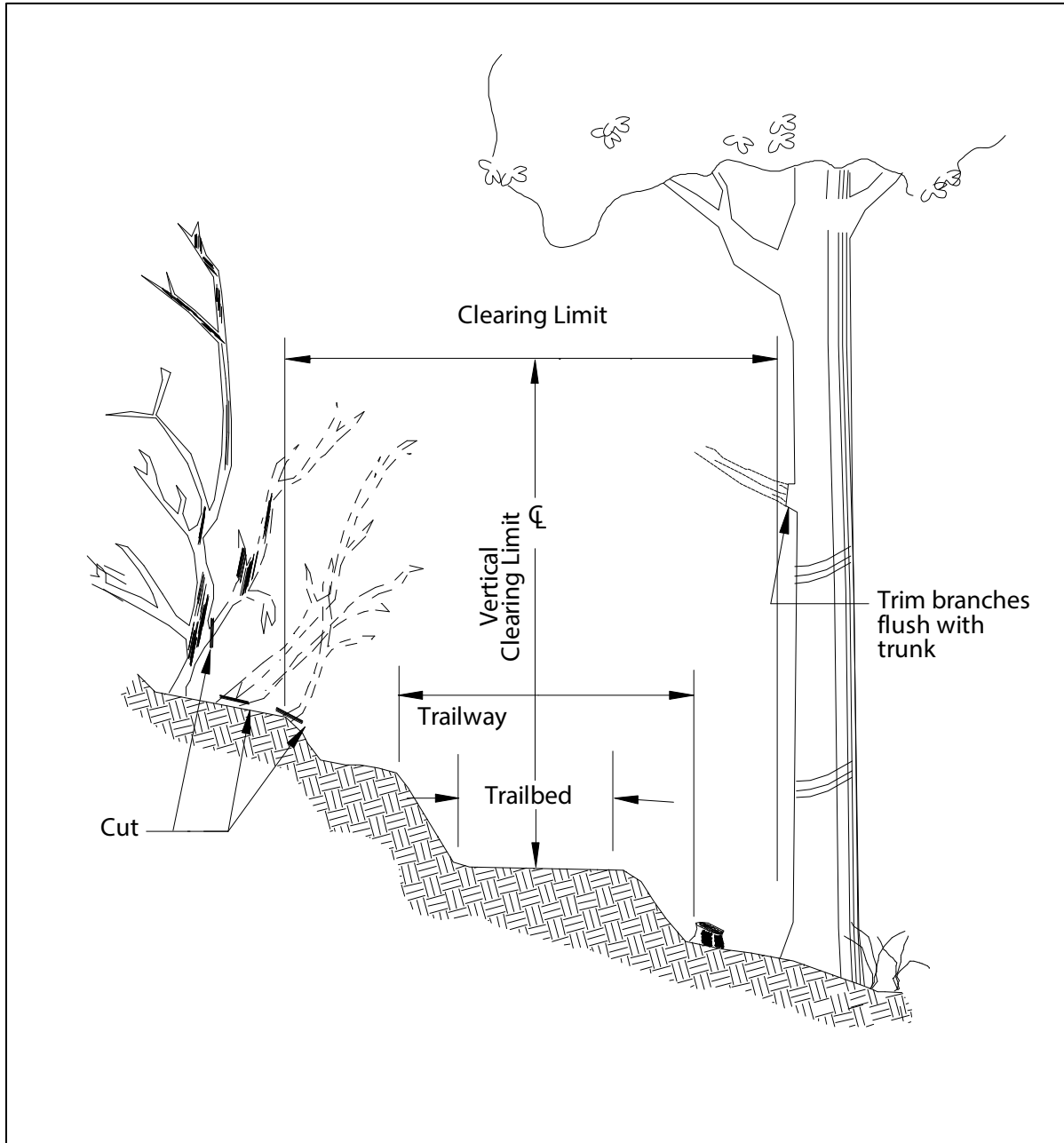


Figure 2 – Illustration of Typical Trail Clearing Limits

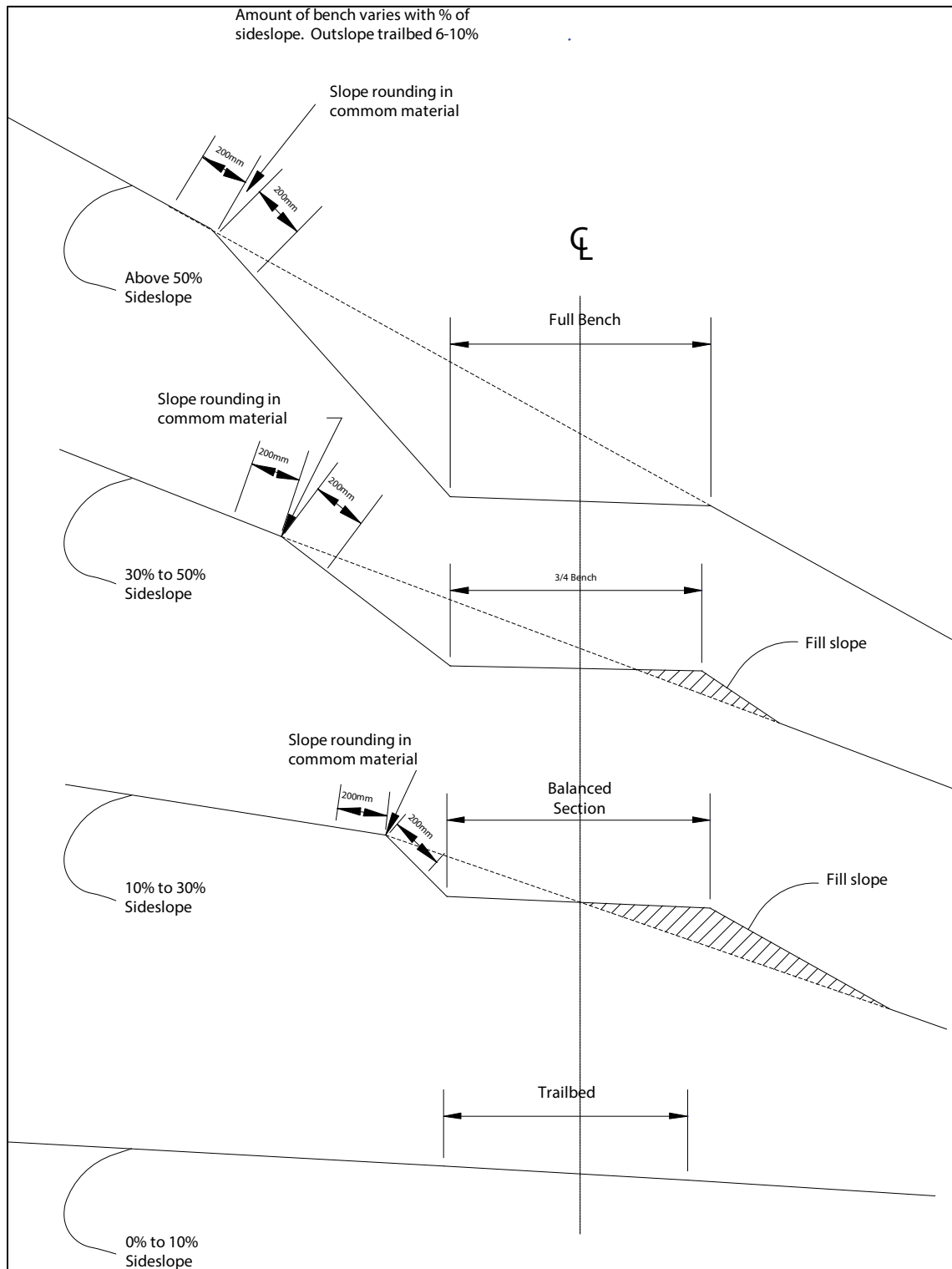


Figure 3 – Typical Trail Construction Design on Varying Slope Angles

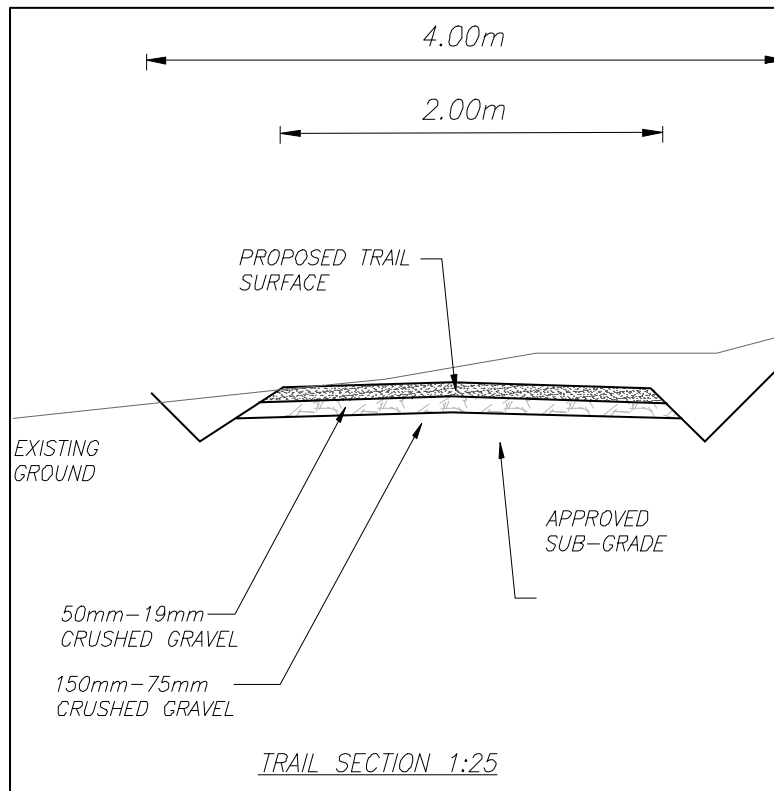


Figure 4 – Excavated Trail Design Example

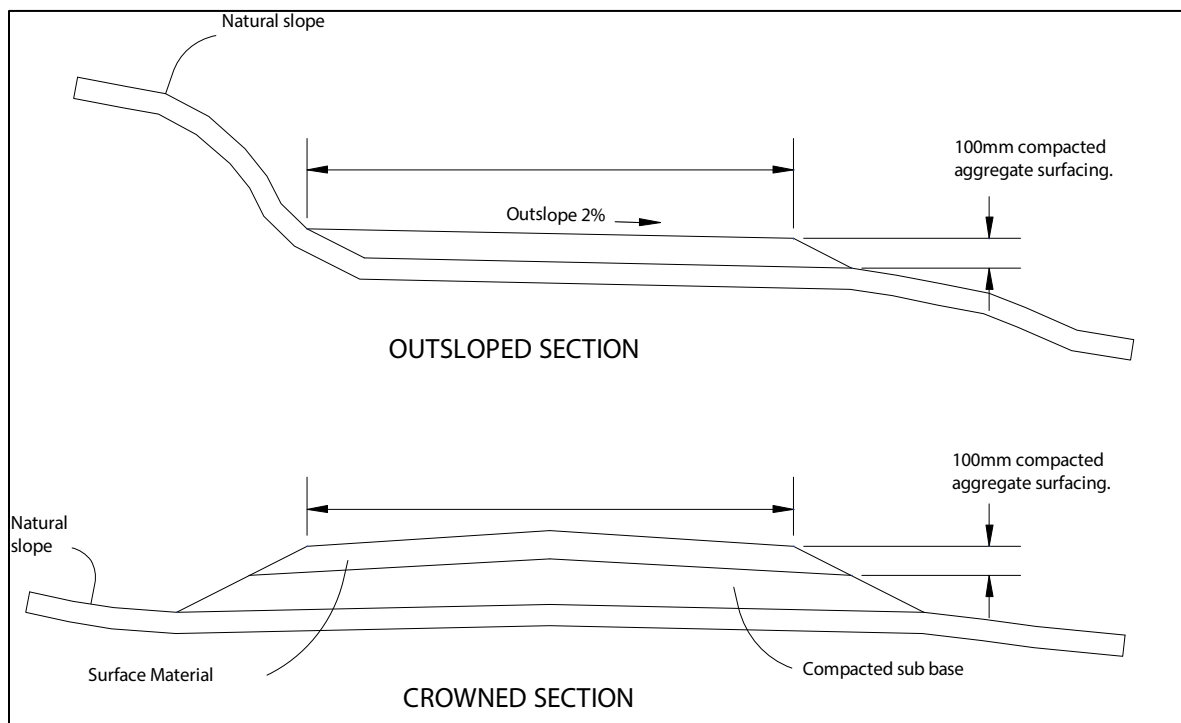


Figure 5 – Outsloped and Crown Trail Design Examples

CVRD Parks Trail Types

TYPE ONE – MULTI-USE TRAIL

This trail design is often used for links between rural and urban communities. The Type One trail is favourable to horses, hikers, bikers, carriages and baby strollers. Type One trails maintain easy grades, have a continuous surface, and are suited to all skill levels within user groups.

The Type One trail is designed to link communities and provide the user with an off-road experience where daily life and the natural characteristics of the Cowichan Valley can be observed. Type One trails also offer the opportunity for residents from neighboring communities to commute on foot or on a bicycle to their local urban center without having to use public roads.

Type One trails such as the Cowichan Valley Trail have a dual purpose as a draw for tourists. Soft Adventure Tourism, such as bicycle touring, is a growing industry in British Columbia, and the Cowichan Valley Trail provides the opportunity for tourists to experience local history and visit local landmarks, such as the Historic Kinsol Trestle.

CVRD Parks and Trails Example: Cowichan Valley Trail

	Metres
Trailbed	Up to 3.0
Trailway	Up to 4.0
Clearing Limit	4.5
Vertical Clearing Limit	3.6
Surface Material	10mm minus
Surface Material Depth	100mm Compacted
Backslope	2:1 Ratio
Outslope	3% Maximum or Crowned
Maximum Grade	12%
Average Grade	>5% Maximum
Difficulty Level	Beginner
Typical User Groups	Pedestrians Cyclists Equestrians



The Cowichan Valley Trail route passes through several communities within the region and connects to neighbouring regional districts.

TYPE TWO – COMMUNITY PATHWAY

Type Two trails are primarily utilized as community pathways within the CVRD. These trails connect subdivisions, provide public access to beach front areas, connect road ends, and provide a safe alternative to walking on local public roadways.

Type Two trails are primarily constructed using carpath material.

CVRD Parks and Trails Example: Mill Springs Trail Network

	Metres
Trailbed	1.5
Trailway	2.0
Clearing Limit	3.0
Vertical Clearing Limit	3.6
Surface Material	10mm minus
Surface Material Depth	100mm Compacted
Backslope	2:1 Ratio
Outslope	3-5% or Crowned
Maximum Grade	12%
Average Grade	8% Maximum
Difficulty Level	Beginner
Typical User Groups	Pedestrians



The Kingscote Trail (left) and the Shawnigan Hills Trail (right) provide connections between neighbourhoods and local parks.

TYPE THREE – SINGLETRACK TRAIL

Singletrack trails can be constructed in almost any terrain on most soil types, and can be tailored to specific user groups by way of design. Successful trails blend sustainability, desired experience, interesting features, natural beauty, quality construction, and effective maintenance.

CVRD Parks and Trails Example: Cobble Hill Mountain Trails

	Metres
Trailbed	Up to 1.0
Trailway	1.0
Clearing Limit	Up to 1.5
Vertical Clearing Limit	3.6
Surface Material	Native Soil
Backslope	2:1 Ratio
Outslope	5%
Maximum Grade	15%
Average Grade	10%
Difficulty Level	Beginner - Expert
Typical User Groups	Pedestrians Cyclists Equestrians



The trails in the Cobble Hill Mountain Regional Recreation Area (above) provide semi-wilderness experiences for hikers, equestrians, and mountain bikers of all ability levels.

TRAIL TYPE FOUR – ROADSIDE PATHWAY

Type Four trails are roadside pathways that create safer means of travel for pedestrians, cyclists, equestrians, and disabled users when travelling along a public road. Type Four trails may be a widened road shoulder, a roadside offset trail with a paved surface, or a roadside offset trail with a gravel surface.

CVRD Parks and Trails Example: Wilmot Road Trail

	Metres
Trailbed	Up to 2.0
Trailway	Up to 3.0
Clearing Limit	Up to 3.5
Vertical Clearing Limit	3.6
Surface Material	10mm minus
Surface Material Depth	100mm Compacted
Backslope	2:1 Ratio
Outslope	3% Maximum or Crowned
Maximum Grade	10%
Average Grade	>5% Maximum
Difficulty Level	Beginner
Typical User Groups	Pedestrians Cyclists Equestrians



Roadside Pathways such as the Wilmot Trail (above) provide safety and comfort to trail users and motorists alike.

Trail Planning Components

Planning and Layout

Trails of all types require extensive knowledge and experience when designed to ensure longevity, reduced maintenance costs, and a high quality user experience. Major trail works or projects in challenging areas need to be designed and stamped by a civil engineer to ensure trail integrity and safety (project example: the Cowichan Valley Rail Trail in Chemainus within the active E&N railway corridor).

On all trail construction projects, CVRD Parks and Trails invites input from stakeholders; including, but not limited to: trail user groups, local parks and trails commission members, and the contractor undertaking the project (if applicable). This helps to create the best possible trail experience for the users while streamlining construction expenses and reducing potential surprises during the project.

Upon completion of the planning and layout process, a scope of work will be generated to provide those undertaking the work with design details, materials requirements, and other information regarding the project.

Scope of Work

The scope of work is created by the project supervisor as a guide to completing the trail project to the standards put forth by the CVRD. It will contain project details and materials including design specifications and drawings, materials specifications and quantities, site safety requirements, an area map, site photos, and any relevant special instructions and site requirements.



Trail Construction Components

Brushing and Clearing (Appendix 2)

Brushing and clearing vegetation and debris from the trail corridor is the first step in trail construction. The clearing limits of the trail corridor will be defined in the scope of work and are based on the type of trail being constructed.

When cutting any living or dead vegetation, ensure cuts are flush with the trunk or ground so as not to create a hazard for trail users.

Trail Bed (Sub Base) Construction

Correct sub base preparation and construction is critical to the longevity and ongoing quality of a trail. This layer of construction acts as the intermediary between the native soil and the surface material. The trail sub base is generally constructed using larger diameter material such as 19mm minus crushed rock (also referred to as "road base") or larger, and is designed for long lasting strength and resistance to erosion.

To ensure proper compaction of the sub base material, all organic soil and materials should be removed.



A cleared trail corridor – Shawnigan Lake



Wilmot Road Trail trailbed construction – Cowichan Bay

In instances where organic material is very deep, the area will need to be assessed to determine alternative construction methods and material requirements.

When constructing the trailbed, it is critical that the edges are straight and tidy as this layer is the foundation for the trail surface.

When placing larger diameter materials for sub base such as 70mm minus crushed rock, shot rock (70mm to 300mm+), or larger aggregates, a top dressing of other sub base material such as 19mm minus crushed rock may be required to reduce downward migration of final surface material when it is placed.

Drainage Mitigation

Mitigating water runoff is the top priority for trail projects. Water is a powerful erosive force that can easily wash away a poorly designed and/or built trail, resulting in significant negative impacts to the local environment and trail user experience. The following is a list of water management techniques that can be used during trail construction:

Ditching – open ditches are a very effective means for channelizing water to protect the integrity of the trail. Ditching specifications including depth and width are site dependent and will be detailed in the scope of work. General requirements applying to all ditches include smooth, tidy edges, removal of all vegetation, and light compaction to reduce erosion.

Culverts (Figure 6) – a properly constructed culvert is an effective means of allowing water to flow under the trail. For CVRD Parks and Trails, the preferred culvert type is Boss 2000 (corrugated exterior, smooth interior) due to its longevity and effectiveness in self clearing of debris. When installing a new culvert, ensure the following:

- The culvert is installed a minimum of one foot below the surface of the trail. This will prevent the culvert from collapsing due to vehicle traffic.
- Place the culvert on a slight downslope from inlet to discharge (minimum of 2% slope) to ensure proper flow of water.
- Create a catchment area at the inlet to trap water and slow it down before it enters the culvert. This will reduce potential for erosion and flooding. The catchment area should be a minimum of four times the diameter of the culvert in surface area and a depth of six inches below the bottom of the pipe.
- Headwalls are to be solid with straight seams. If constructing with sandbags, include cement in the sand mix for firmness and ensure stitching is not visible.

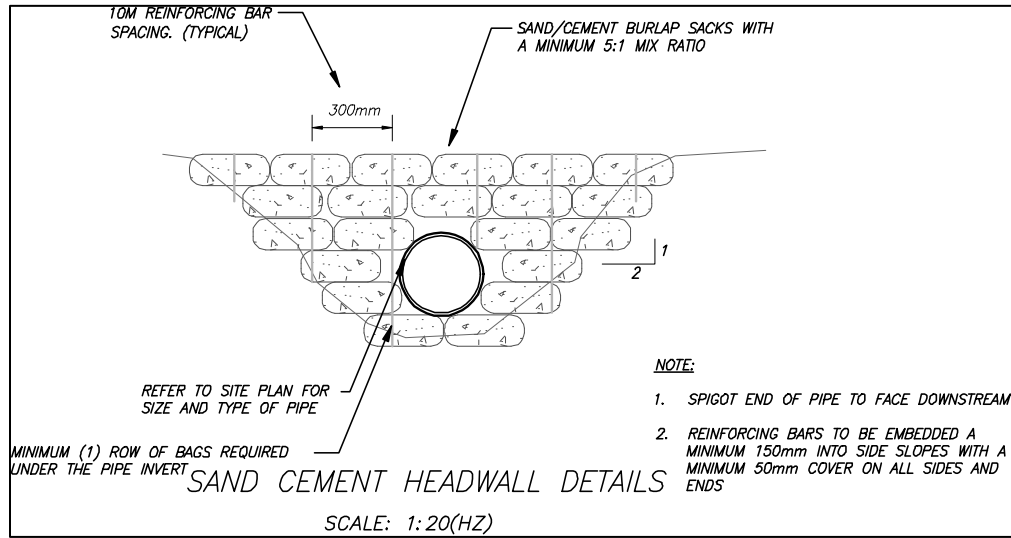


Figure 6 – Culvert Headwall Design

Grade Reversal – A commonly used feature on single track trails, grade reversals are the most effective form of water management for most trails. A grade reversal, as the name suggests, involves a change in gradient to effectively catch water and allow it to flow off the trail. The purpose of this feature is to prevent water from gaining velocity when travelling downhill.

When constructing a grade reversal, it is important to build it as smoothly and seamlessly as possible. A sudden drop or rise in grade not only takes away from the trail experience, but can also become a safety hazard over time. Grade reversals are simple features that require attention to detail and forethought when being designed and constructed.

French Drain – A French drain is a very useful method for allowing the sheet flow of water to continue under a trail. It involves laying clear crush material (3" to 1' depending on the amount of water expected), covering that layer with landscape fabric, then building up the sub base and surface of the trail. The clear material allows for slow moving water to pass under the trail without channelizing it and using a culvert. This maintains the natural flow of water in the area, thereby reducing the impact of the trail.



A French Drain in Stocking Creek Park - Saltair

Surfacing

Crusher Fines – Also known as cart path, 10mm crusher fines under the correct specifications make an exemplary surface material for trails. The material binds well, is accessible for nearly all trail users, and requires little maintenance over time.

Natural Soil – Many areas of the Cowichan Valley contain good soils for trail building right on site. Combining a nearly ideal mix of sand, clay, silt, and coarse material; local soil mixes excellent binding qualities with forgiving permeability.

Before utilizing native soils in trail construction, the soil available on site should be assessed for composition to determine suitability as a trail surface material

Placement –

Special care and attention should be taken to ensure:

- The specified depth of material is met at any given section;
- The width of the trail is uniform and meets specifications;
- All edges are clean and well groomed;
- Straight sections are just that (it is recommended that a string line is used when laying straight sections of trail); and
- Compaction of the surface material is effective and meets specifications. Surface material that is too dry or too wet will not compact properly.



Surfacing the Cowichan Valley Trail

Recommended Procedures for Trail Construction

Brushing and Clearing

- 1) Identify marked and unmarked hazard trees. Under no circumstances should workers enter the danger area of any identified hazard tree.
- 2) Trail Workers: walk the trail route with the project supervisor to receive specific instructions and ensure project objectives are clear.
- 3) Remove limbs encroaching on the cleared width and height as specified in the scope of work. Ensure branches are cut near to the main stem in a clean, neat fashion.
- 4) Remove ground vegetation within the cleared width. Dispose of vegetation as specified in the scope of work.
- 5) Ensure the site is safe at the end of the day and project by adequately blocking the entrance to the trail section under construction.

Sub Surface Excavation and Drainage

- 1) Trail Workers: walk the trail route with the project supervisor to receive specific instructions and ensure project objectives are clear.
- 2) Excavate the trail sub base to the depth and width specified in the scope of work. Where organic soil is deeper than originally specified, assess this change with the project supervisor to determine the appropriate course of action. Material excavated will likely not be usable and must be removed from the trail corridor in the manner specified in the scope of work.
- 3) Construct drainage features as specified in the scope of work under the direction of the project supervisor.
- 4) Place specified sub base material in a neat and tidy fashion. Any spillage should be cleaned up as soon as possible.
- 5) Rake the sub base material to ensure the outslope gradient or crown is as specified in the scope of work. Compact the sub base in preparation for the surface material and ensure pot holes and imperfections in the gradient are limited.

Placing of Final Surface Material

- 1) Trail Workers: walk the trail route with the project supervisor to receive specific instructions and ensure project objectives are clear.
- 2) Make any necessary spot repairs to the sub base prior to placement of final surface material. The better the integrity and quality of the sub base, the better the final product.
- 3) Place specified final surface material in the manner dictated in the scope of work. Proper depth and a clean, uniformly sloped edge are paramount. Material must also be groomed to ensure the specified outslope gradient or crown will be achieved after compaction.
- 4) Compact surface material to the project specifications and review with the project supervisor. Any imperfections affecting the quality of the trail must be fixed prior to sign off of the project.
- 5) Once surfacing is complete, all drainage features should be reviewed and cleaned to ensure their effectiveness. A general walkthrough of the site is to be performed and all garbage, construction debris, and other items that affect the aesthetics of the trail are to be removed or fixed. The major focus at the end of the project is creating the appearance that the trail has been there for some time.



Cowichan Valley Trail - Sahtlam

Repairs, Renovations and Maintenance

Regular, thorough maintenance of trails and trail corridors is critical to their long term integrity and value. Often, this maintenance involves simple tasks such as re-defining drainage features, brushing back vegetation, clearing displaced material that gathers at the trail edge, protecting and covering exposed roots, etc. These tasks, if performed at appropriate regular intervals, can realize long term cost savings while maintaining a high quality trail experience for park users.

Below are the maintenance prescriptions for each trail type. Further maintenance requirements may arise depending on the trail design and location. These additional tasks can be determined by CVRD Parks and Trails Staff:

Maintaining Clearing Limits – To protect trail users and prevent the encroachment of vegetation, perform regular trimming and pruning to maintain the trail clearing limits.



Mowed edge of the Cowichan Valley Trail

Trail Surface Maintenance – Over time, environmental factors will affect the integrity of the trail surface. It is important to monitor the ongoing effects of weather and use and make repairs to the trail surface as necessary. Filling of pot holes, filling over exposed roots and rocks, re-alignment of the trail bed, and raking raised trail edges are common forms of trail surface maintenance.



Blowing Leaves from the Cowichan Valley Trail

Debris Removal – Removing leaves and other debris from the trail surface is an important consideration in the maintenance of any trail. Where leaves and other organic debris are left on a trail surface they will decompose and create soil. Where leaf fall and/or trail use are high, this layer can quickly build up and create wet, muddy conditions.

Drainage Management – To keep drainage features functional and effective it is critical to keep them clear of debris. The autumn season is the most important time to monitor drainage features as the combination of fallen branches toppled by wind and leaf fall can quickly create blockages in culverts and ditches that lead to trail flooding.

Trailheads and Road Crossings –

Trailheads are the welcoming point to any trail. Extra care in the maintenance of these areas should be taken to keep them visible and inviting for trail users.

Road crossings should be maintained to ensure effective sightlines for both trail users and vehicle traffic.



Cowichan Valley Trail in Shawnigan Lake

Appendices

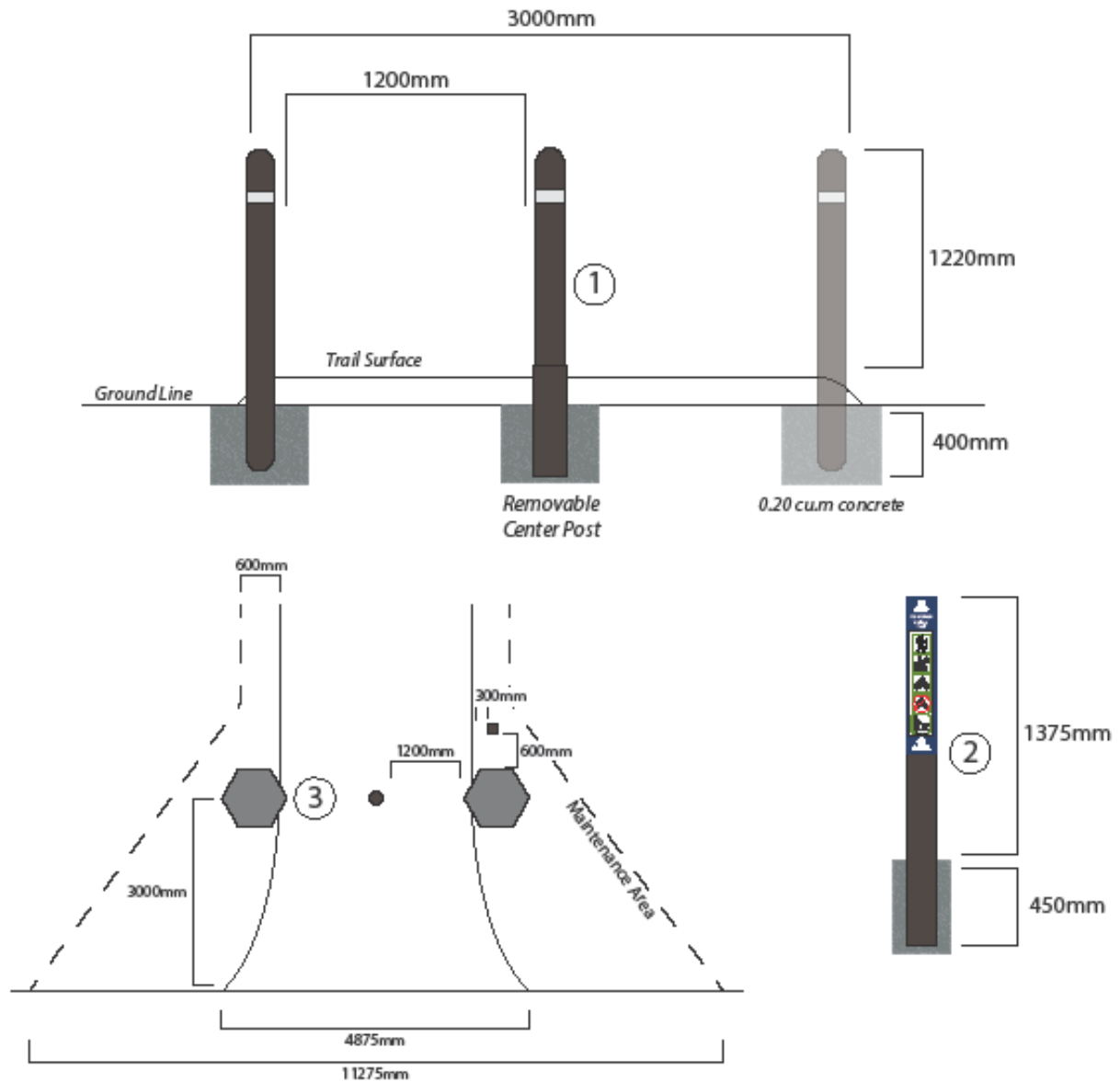
Appendix 1 – CVRD Parks and Trails Division – Typical Trail Switchback Cross Sections

Appendix 2 – Typical Trailhead – Type 1 Trail

Appendix 3 – Typical Trailhead – Type 2 Trail

Appendix 4 – Typical Trailhead – Type 3 Trail

Typical Trailhead - Type 1 Trail

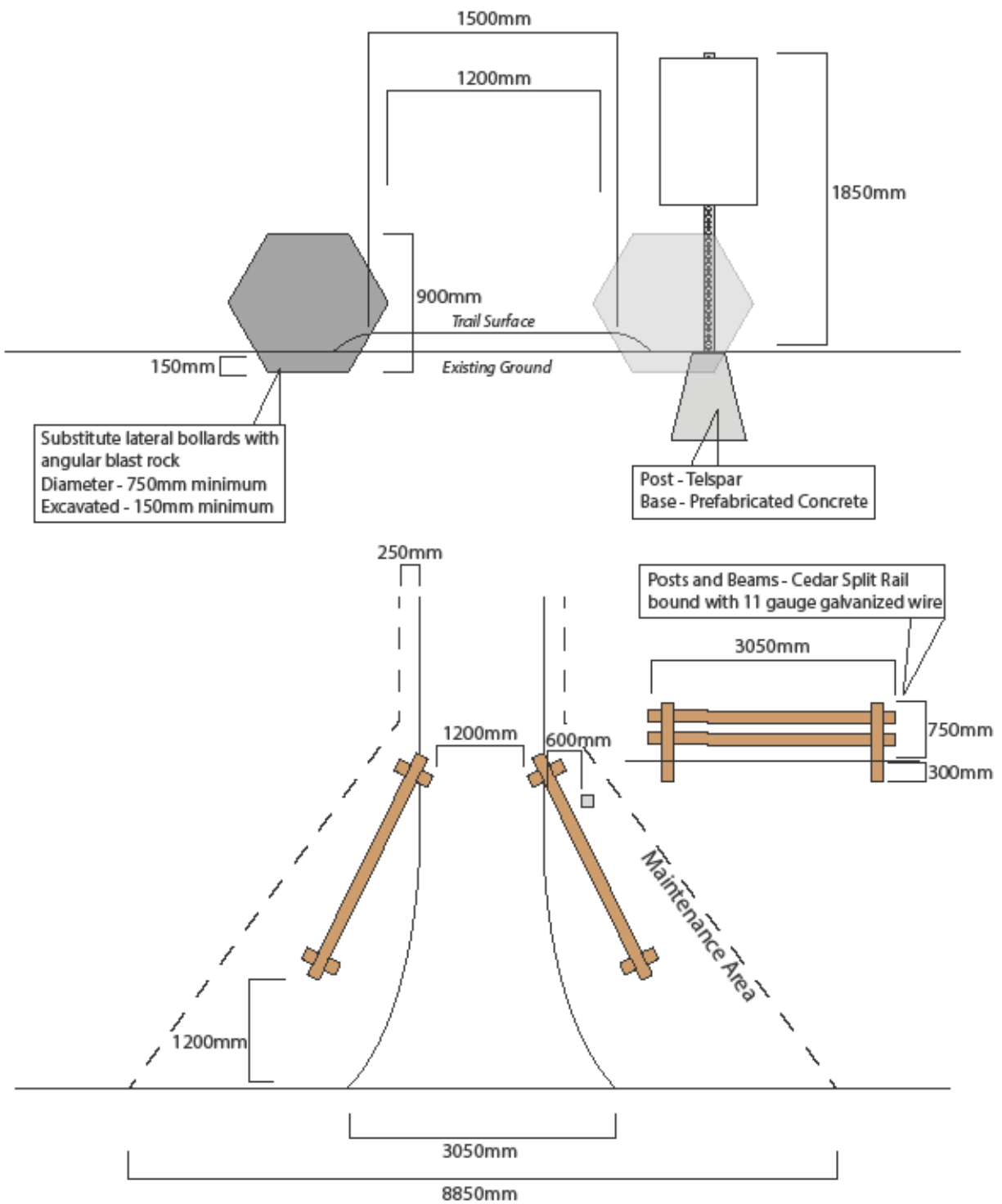


- ① Bollard - single steel post
 Paint - Black
 Other - 75mm strip of reflective tape 150mm below bollard cap.
 Base - 0.20 cu.m concrete

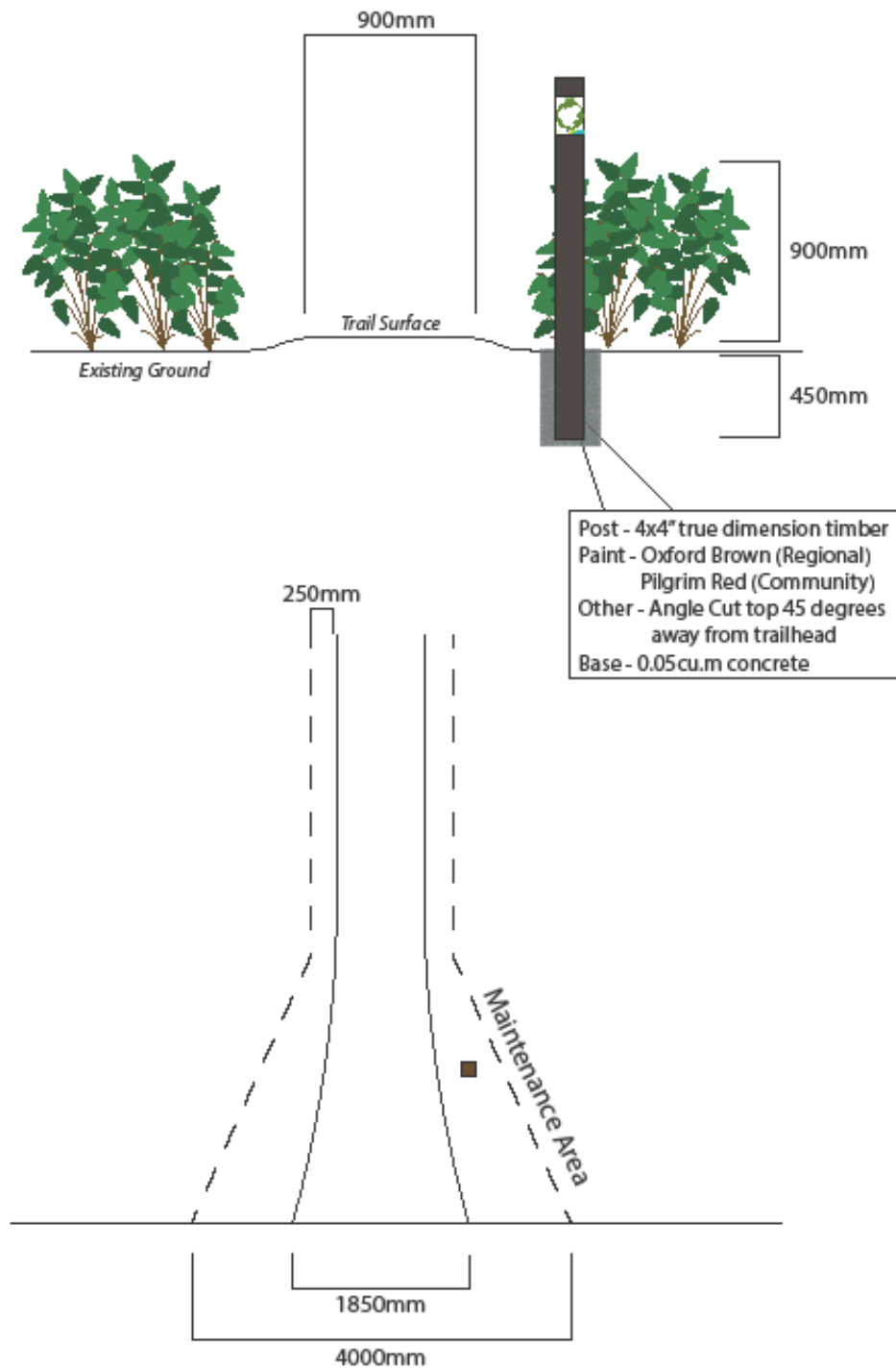
- ② Post - 6x6" true dimension timber
 Paint - Oxford Brown
 Other - Angle Cut top 45 degrees away from trailhead
 Base - 0.05cu.m concrete

- ③ Rural Trailheads
 Substitute lateral bollards with angular blast rock
 Diameter - 750mm minimum
 Excavated - 150mm minimum

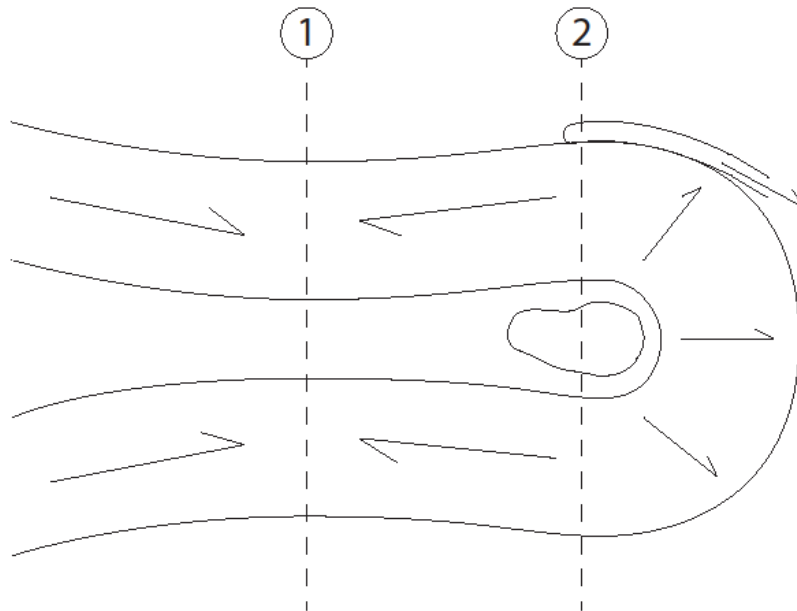
Typical Trailhead - Type 2 Trail



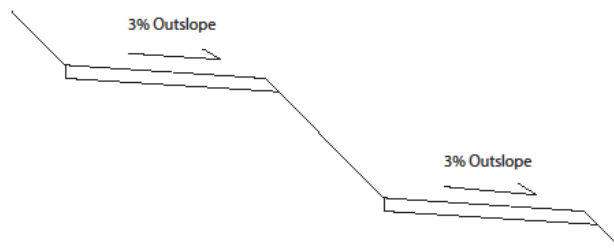
Typical Trailhead - Type 3 Trail



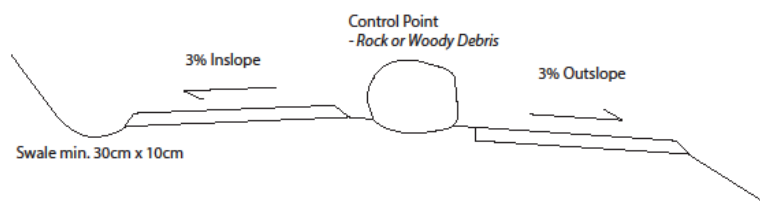
CVRD Parks and Trails Division Typical Trail Switchback Cross Sections



① Cross section at grade reversal



② Cross section at approach



References

United States Forest Service National Trail Drawings and Specifications

<http://www.fs.fed.us/database/acad/dev/trails/trails.htm>

Recommended Reading

Trail Solutions: IMBA's Guide to Building Sweet Singletrack

International Mountain Bicycling Association, 2004

National Trails Training Partnership

<http://www.americantrails.org/resources/trailbuilding/>

