Country Paths and Surface Construction and Maintenance Part 2

Scope

This guide is intended as an introduction to path construction and maintenance it is not a replacement for skilled advice which may be necessary for safe working and use.

Whether you do the job yourself or employ a professional it is important you understand what is needed so that you can judge and check the work at various stages and at completion.

Before the heavy equipment is engaged and put to work, the path location should be well marked and all preparatory work within the right-of-way should be completed. Marking and preparation will permit immediate and steady use of the machinery and will result in prompt completion at minimum equipment costs. It is important economically that proper size equipment be used. Selecting the smallest size vehicle for the work required limits damage to the existing landscape and requires less ground reinforcement and cutting.

Index

INSPECTION 2

2 ROUTES 3

2.1 PLANNING 4

2.1.1 Climbing Turns 7

2.1.2 Privacy 8

3 WORK PLANNING 9

4 CLEARING & PREPARATION 10

5 BASE PREPARATION & EXCAVATION 11

5.1.1 Wet or flooded areas...11

5.1.2 Sand Dunes and Sandy Areas 11

5.1.3 Brashings 11

5.1.4 Geotextiles 11

5.1.5 Path base or sub-grade 12

5.2 LEVELLING.....13

5.2.1 Sub-grade 13

6 FINAL SURFACE 13

7 VERGES..... 13

7.1.1 Trees 14

8 BACK SLOPES.....14

8.1 SLOPE STABILISATION 15

8.1.1 Seeding 15

8.1.2 Multching 16

8.2 SLIDE DEBRIS 16

8.3 SANDY SOILS..... 16

8.4 DE-BERMING 17

9 PLANTING.....17

9.1 DURING WORK..... 18

9.1.1 Maintenance..... 18

10 SEASONAL & TEMPORARY TRAFFIC ROUTES.....19

10.1 SEASONAL ROUTES..... 19

10.2 TEMPORARY ROUTES 19

APPENDIX A REFERENCE 20

GENERAL TERMS..... 20

HEALTH & SAFETY IN CONSTRUCTION AND MAINTENANCE..... 20

APPENDIX B MATERIALS 22

Country Paths and Surface Construction and Maintenance Part 2

1 Inspection

The surface/paving should be inspected on a quarterly basis, looking for erosion, loose, damaged or stained paving, and checking that any jointing material is intact.

Inspections should also be made during wet weather to check for pooling and flooding of the path.

Where usage is seasonal, i.e. tourist locations, inspection should be made before opening day, leaving sufficient time to carry out any work before visitors arrive.

Investigate the potential for winning local material for use as fill, or even base and surface material. This will reduce or remove the need for imported materials. This is important for sites with poor access, as well as for reasons of appearance and sustainability.

Identify habitats of local importance, preferably assisted by a qualified ecologist. This will ensure that disruption or fragmentation is avoided or minimised, and that opportunities for habitat enhancement and creation are exploited. Changes in population densities of plants, birds and animals can show where a path route is disrupting or enhancing the wildlife habitat. Path operators should hold a catalogue of species which use and border their routes to enable inspections to highlight changes.

If a path is to have a maximum gradient requirement, e.g. for wheelchair use, you may need to determine the existing ground profile and how the required gradient can be attained. This can be done in two ways, depending on the level of detail required and the topography of the land being crossed.

- **A clinometer provides a simple basic reading for local gradients. The can be purchased or home made. These are available from most civil engineering suppliers either to purchase of hire.**
- **For more accurate readings an engineer's level, laser level or theodolite should be used to assess the potential routes and allow placement for platforms and urns with greater accuracy. These can be hired from engineering suppliers at reasonable cost.**

2 Routes

In the UK there is a severe shortage of paths and tracks available for the public. Many paths which existed in the past have become fragmented by new road and building construction. Landowners have quietly closed off routes over the last 50 years and especially since the last foot and mouth outbreak.

What paths there are, are often inadequately singed, poorly maintained, obstructed by barriers or have surfaces which are unsuitable for everyone. Wheelchair riders are not the only disabled persons; there are many other disabilities which need to be planned for including low mobility, hearing and vision. Others with Learning Difficulties or a lack of awareness of dangers need to be planned for when designing the path network. Access for prams, push chairs and children's 'buggies' should be taken into account when considering the range of users and recognising user needs and potential beneficiaries.

Examples of groups of people who can benefit from good planning, construction and maintenance are:

- **People who are blind or visually impaired**
- **People who are deaf or hard of hearing**
- **People who have heart conditions**
- **People with learning disabilities**
- **People with mobility and manual dexterity problems**
- **People who have experienced mental health problems**
- **People who have dyslexia**
- **People who have epilepsy**
- **People who have incontinence**
- **Older people**
- **Families with children and/or grandparents**
- **People carrying heavy rucksacks**
- **Cyclists including special cycles**
- **People who ride mobility vehicles**
- **People who ride horses**

Paths are for everyone. This is not to say that all paths and tracks should be constructed to suit people with limited mobility. Paths are also needed which provide challenges for hikers and ramblers, mountain bikers and joggers.

There are more horses in the country now than at any time in history but the network of off road bridle paths is severely limited and again often poorly maintained.

Mountain bikes have become more popular as people seek to improve their health and take alternate holidays.

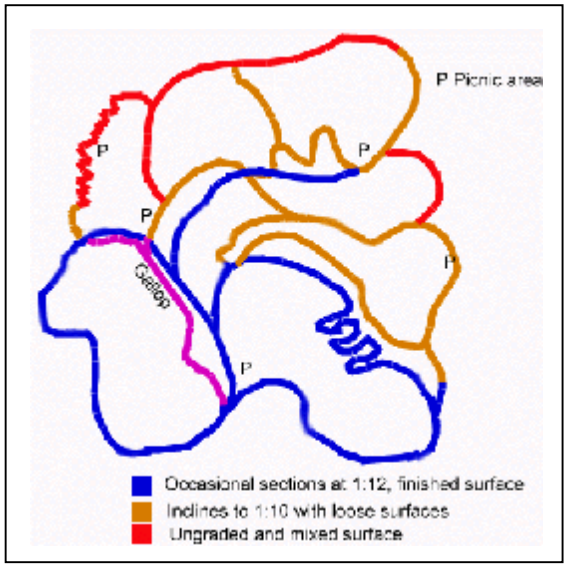
Therefore, when planning your path consider who will use it and the best way of offering something for as wide a range of users as possible. There is no formula for the perfect path design. Ultimately it is about trying to meet the demand within the practical constraints of geography, funding, landowner co-operation, availability of public transport, car/bus parking, etc.

There may be other groups who are constructing paths in the neighbourhood the LA footpaths office or the Council for Voluntary Services (CVS) should be able to tell you who is doing what in your area. A linked path network provides greater opportunity and improves chances of obtaining funding. It also allows for some paths and tracks to be made suitable for older and disabled people while permitting the growth of more challenging routes for others.

Even country lanes and single track roads are becoming busy with motor vehicles. These roads are hazardous for walkers, cyclists and horses so when planning your path consider improving narrow lanes which link parts of it to the local network as a component part of the project.

2.1 Planning

Familiarise yourself with the area. Study maps, aerial photographs, master plans, ordnance surveys, anything that's available. Identify the control points, that is, the places that determine where a path will go ad identifiable places in between.

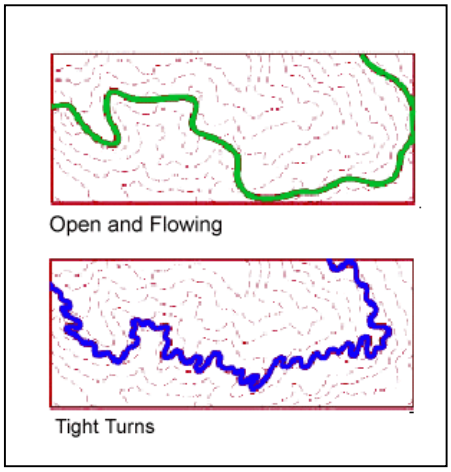


Make loops. Path networks with loops offer the most variety and can offer varying distances and degrees of difficulty, presenting path users with a number of options including short cuts for return if they have overestimated their ability.

Use a contour route. Planning gets a little more technical here.

The contour route will connect the control points. Draw it using a topographical map, making notes of areas to avoid and areas to use.

Avoid fall lines, which allow water to take a direct, concentrated route from the top of a hill to the bottom. (You want water to pass over the area in sheets, not streams, which cause erosion.) Keep the trail gradient to 1:15 for older and disabled people, with other routes holding to 1:10 or less for general walking and cycle purposes. Also decide out where you might need bridges and culverts.



Determine trail flow. Path users can be identified by their means of travel, but their speed is important as well. For example, cyclists, runners and equestrians will travel faster than walkers and mobility vehicle riders.

A path's tempo, or flow, comes in three varieties: Open and Flowing, Tight Turns, and a hybrid of the two.

Open and flowing paths are just as they sound: gentle. Wide with sweeping turns and long sight lines, they're good for learner cyclists, equestrians and ATV users.

Tight Turns paths have sharp turns and twists, which help minimise speed and reduce user conflict. These are often narrower than open paths.

Hybrid paths combine the two and are often good for urban areas.

Some other path features which should be considered are;

- **Place maintenance roads and paths on the contour, taking advantage of natural curves within the landscape.**
- **Develop narrow spur paths into environmentally sensitive areas.**
- **Vary the direction of the route for variety, points of interpretative interest, and to maximise user's exposure to natural features, water bodies, and vegetative changes.**
- **Scenic beauty and recreational opportunities can be enhanced by good forest and waterway management. Providing a well designed road and path network can control public access to your property.**
- **Avoid skylining by running a path straight up and over a crest, route the path so that it goes around the crest.**
- **Avoid the use of cuttings where ever possible. These entail a lot of digging and are liable to erosion and flooding increasing maintenance requirements.**

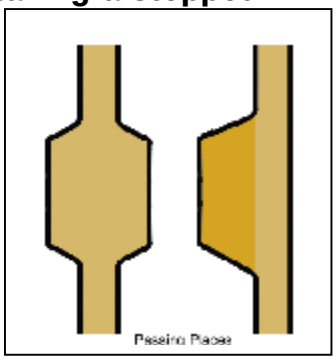
- **Try to follow existing routes, 'desire lines'. These show how people are using the route and following them will decrease the chance of users taking short cuts. If you need to change the route try to make it more desirable and use thorny plantings to discourage short cuts.**
- **If you have a long straight corridor, try to make the edging variable to refocus sight lines. Long straight routes tend to be boring. If possible introduce path meanders and changes in level, use rocks and trees to reduce vision length.**
- **When providing new plantings blend them into existing growth. Isolated clumps of bushes look out of place and detract from the scene.**

Always walk an existing path and scout the route of a proposed new path. You will notice things which are not obvious from a map.

Be realistic about shared usage paths; do not accept one party's views over another unless the section has a specific objective, i.e. a cyclist challenge.

- **Cyclists are often enthusiastic about sharing with pedestrians; however, they can be a problem for people with disabilities and add to a sense of fear for many older people.**
- **Horses are large and to some intimidating animals. Remember many visitors will be town dwellers with little or no understanding of the need and precautions which are necessary.**
- **Wherever there is path sharing provide plenty of passing places, provide alternate sections where cyclists and riders can relax their control and speed up.**

Where there is a steep section which has been graded to provide a ramped route consider offering a short cut by installing a stepped route which links the path at different levels.

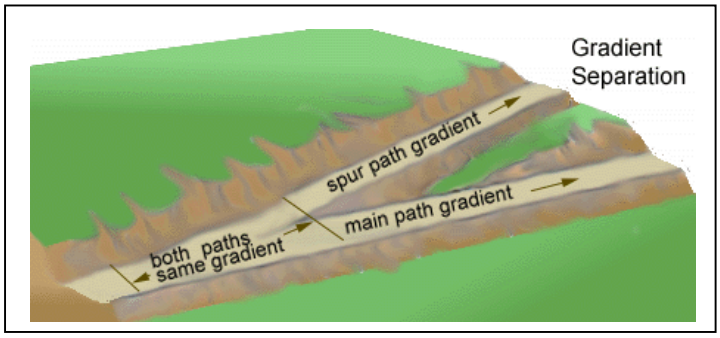


On paths up to 1:10 always make turns on the level and provide a resting area to one side of the path. These should have seating of some type available. See our guide 'Street Seating' for further details.

Any path 1200 mm wide or less should have 1800 mm wide passing places at least 2000 mm long. These should be no more than 10 metre centres and on inclines always place the next passing place so that it can be seen from the current passing place. On equestrian routes passing places should be 3000 mm wide. Passing place surfaces should be constructed to the same standard as the path, the sub-base should be capable of carrying a vehicle.

If you have problems with wet sections of the path and want the area to dry faster, you do not have to increase the path width. Try

improving drainage first or try clearing a larger area of trees and brush so more sunlight can help dry the wet section of road causing problems.



Where paths diverge care must be taken not to create a spur that branches off a path/road too abruptly leaving little room for the gradients to separate. Both the main path/road and spur must have the same gradient for a distance equal to at least the sum of half the width of each. For example, a 3 metre -wide spur and a 4 metre-wide path/road should both have the same gradient for a distance of (3+4)/2 = 3.5 metres. This allows maintenance vehicles to operate safely and reduces erosion at the junction.

2.1.1 Climbing Turns

Next to water bars, climbing turns are the path structures most often constructed incorrectly. The problem is usually that when constructing a climbing turn it is built, or attempted, on steep terrain where a switchback would be more appropriate. A climbing turn is built on the slope surface with little or no excavation, and where it turns, it climbs at the same rate as the slope itself. If the slope is 1:2, the turn forces users to climb that 1:2 incline. A climbing turn is almost impossible to protect from erosion.

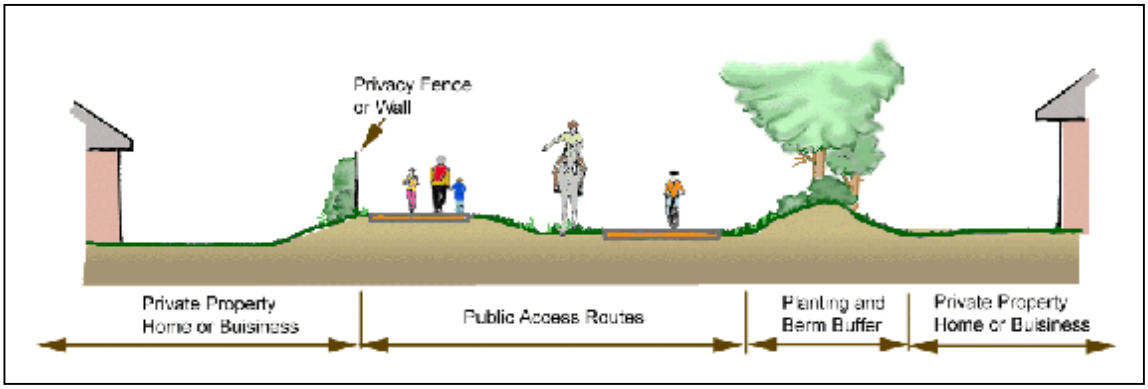
The advantages of climbing turns in appropriate terrain are that a larger radius turn 4 to 6 m is relatively easy to construct. This makes them more suitable for cyclists especially if the turn is banked by in-sloping. If the turn is out-sloped there is a tendency for users to be thrown off the path if they are moving quickly. A drainage ditch should be constructed on the inside of the curve along the lower quadrant and above the path on the top quadrant. This can help reduce water on the path surface and reduce erosion.

Climbing turns are very difficult for wheelchairs and other mobility vehicles to negotiate as cambers and cross falls tend to deflect the wheels. These cross falls can also make movement more hazardous for people using walking aids as the stick on each side is at a different height.

Climbing turns are usually less expensive to construct than switchbacks because much less excavation is required, and fill is not used. However, increased maintenance requirements can quickly reverse this apparent saving.

2.1.2 Privacy

Maintaining privacy and controlling noise can be a problem unless it is addressed at the outset. People living along a path will often site noise or invasion of privacy for objecting to a new or refurbished path. These matters can generally be countered by sympathetic routing, landscaping and plantings.



Plantings and walls also reduce noise generated by groups of people using the path.

Plantings and walls also restrict pets in homes or with walkers becoming a nuisance. Dogs in premises bordering a path can become agitated and aggressive when continually challenged over space they regard as their own.

Care must be taken with plantings as they should not reduce light availability to homes or become a hazard in high winds.

The route including any plantings should be regularly policed for litter and broken glass. Hedgerows need to be trimmed and good neighbour policies should include offering to trim the hedgerow facing into bordering property.

The preferred planting scheme should comply with the following:

- **Planting should be no higher than 0.5m within 1m of the surfaced area;**
- **If directly adjacent to a footway/footpath the plants shall not be of a thorny species. Thorny species may be used further back in a planting bed to prevent trespass;**
- **Ground cover planting up to 1.0m high, combined with advanced nursery stock trees (clear stemmed up to 1.8m), is the preferred approach to planting in an urban situation, in order to maintain sight lines and psychological safety for pedestrians;**
- **Similarly, medium and large shrubs should be spot planted as specimens. Large areas of shrub cover should be avoided, because these can cause security problems and harbour anti-social behaviour ;**

- **Planting should require little maintenance. Therefore, unless part of a hedge, shrubs should not be planted in locations that will necessitate regular pruning to keep them away from areas used by the public or requiring entry to private property.**
- **Where existing trees relocated along the route minimise the number which need to be cut down and replaced.**
- **Shrubs are particularly suitable where grass cannot readily be looked after by residents, for example where a verge joins a screen wall.**
- **Trees should not be planted close to highways. Nor within 1m of a route for major underground services or sewers, shallow rooting shrubs should be used where there is a need to exclude path users. Care must also be taken with the choice of trees where overhead power and telephone lines pass.**

3 Work Planning

The following matters should be built into the work planning, schedule and costing;

- **Plan to provide adequate training and supervision of work and remember that Health & Safety is an essential part of work planning and activities. Volunteer workers (especially children and some disabled people,) are likely to be less aware of dangers and lack the experience necessary for safe work. All path implementation will involve some form of construction work, even if it is only fence and gate installation. There are numerous health and safety requirements relating to the construction industry, as well as general health and safety at work legislation. The application of this legislation relates to the scale and nature of each construction project. All path works will be covered by some, if not all of the legislation. See Appendix A Health & Safety**
- **Use the least site disturbing method to accomplish the planned result.**
- **Plan to maintain all perennial and intermittent streams' possibly using temporary culverts which can be removed and reused elsewhere.**
- **Inspect roads, paths and fire-brakes to be certain that all water control structures are in place and functional. Where long construction periods are expected this inspection should be made at least weekly in dry seasons and bi-weekly at other times.**
- **Minimise movement of soil or avoid soil disturbance altogether.**
- **On steep terrain and/or fragile soils, herbicides, controlled fire, or manual (by hand) site preparation is preferred over heavy equipment.**

- **Place no debris, oil, or other waste in or close to streams. Remove and properly dispose of all toxic waste, tires, oil, and waste at the end of construction.**
- **Provide mulch, brush, or vegetative cover on bare soil areas to stabilise the area and reduce the potential for surface runoff and accelerated erosion.**
- **Carefully remove, stabilise and revegetate all temporary stream crossings.**
- **Often times improperly designed or maintained fills will input significant amounts of fine sediment into the stream system. The storm events required to cause a path fill to input fine path/road base sediment into the stream are often not large, so sediment enters the stream at times when there is not as much energy available to transport the sediment and the fine sediment is able to intrude into the stream bed degrading spawning and other gravel deposits. This can be especially important during construction and maintenance periods.**

4 Clearing & Preparation

Saleable trees in the right-of-way are cut down and sawn into logs before construction begins. Logs and tops should be moved far enough off the right-of-way that they will not interfere with construction of the path.

Stumps that will be covered by a 300 mm or more of fill material should be cut low but need not be removed. All other stumps and roots over 100 mm in diameter should be dug out of the ground. Leaving a stump about 600 mm high will facilitate its removal with the bulldozer blade. Where the right-of-way supports only brush or young timber, or where a sufficiently heavy tractor-bulldozer is engaged, no felling need be done, and all material can be cleared by machine. Trees moved by bulldozer should not be left leaning or suspended above the ground. They present a hazard that should be eliminated at the time of path construction. Snags that may fall into the path should also be felled.

Blasting of rocks and boulders may be necessary on rare occasions, although this need can usually be avoided at the time the path location is planned. Blasting requires special permits and professional licensed operators.

Even after construction is under way, it may be possible to bypass such obstacles by minor changes in alignment. If the path has a dead end, sufficient space should be cleared and levelled so equipment can easily turn around. On long paths turning spaces should be cleared so that there is no need for reversing over long distances and construction machines can pas each other.

Find safe places for dumping cut materials and removed soil etc. These should be off the right of way and located where they will not damage the local hydraulics of the area.

5 Base Preparation & Excavation

Generally, topsoil should be removed from the path route to the required base width in order to expose firm subsoil. Save the turf as this can be used to repair other sections or construct and reinforce banks.

Soil containing a lot of clay (soft and sticky when wet) or organic soil (peat) can be a problem. The formation can be a 'tray' cut into the soil with a level base and straight sides which will support the edges of the path. Or, it could be a causeway built up from fill material. If soils do contain clay or peat or are wet, a geotextile may be required to reinforce the path base.

5.1.1 Wet or flooded areas

Always try to avoid wetlands or flooded areas. Otherwise build up the path onto a causeway or boardwalk to ensure it is well above the highest expected water level.

For soft or marshy ground, the causeway can be floated on a geotextile.

Be aware that causeways and boardwalks can affect the natural drainage of an area get an expert opinion if necessary.

5.1.2 Sand Dunes and Sandy Areas

Blown sand can make a surface treacherous or close it off for use by people with mobility impairments. Consider using a boardwalk with shield boards to reduce blown sand. This will raise the path above the land and provide routes for the passage of small animals and water.

5.1.3 Brashings

These are bundles of tree branches, heather or brush wood – for tens of thousands of years these were commonly used to float paths over marsh type landscapes. They are still used in remote areas where bringing in a geotextile would be difficult and natural materials are available or cost is an impediment.

5.1.4 Geotextiles

A geotextile is a sheet of machine-made fabric which is strong and water permeable. They are used to reinforce the path base when building a path over soft ground. They effectively convert a loose

mass of stone or rubble into a solid slab which literally floats across a soft formation.

They are also used to prevent fine material from being washed out of the path base and so can be used in areas subject to flooding, or with a high water table. In reverse filter drains are often lined with a geotextile liner. This filters out silt (fine soil particles) carried in water trickling into the filter drain which would otherwise block it up.

5.1.5 Path base or sub-grade

This is the structural part of the path, i.e., it is the part that supports the loads imposed by the path users. The path base should be of a sufficient depth and width to provide a solid foundation for the surface. Base stone should be thoroughly compacted to maximise its strength and prevent erosion.

Consider making the sub-base wide enough to support construction vehicles as both construction and maintenance work can be carried out more cheaply and quickly than relying on manpower. A wider sub-base below the verge also reduces plant growth

Materials for the path base will depend on the path location. In most cases today, the path base is made of stone from a commercial quarry. The most common material is called DBM Type 1. This is a crushed aggregate made up of all different sizes of stone produced to a recognised standard.

A cheaper alternative is scalpings, crusher run or demolition rubble. However, the quality of these materials is variable it is advisable to get expert advice when selecting them.

The path base (often referred to as sub-base) is the foundation for the path surface. It is made up of a layer of graded stone or aggregate comprising various stone sizes right down to dust. The bigger stones provide most of the base strength. The smaller sizes fill in the gaps to ‘bind’ the base together and prevent lateral movement. The deeper a path base, the stronger it will be. binding properties.

It is best not to excavate more than about 150- 200 mm looking for a firm sub-soil. Where the topsoil is so deep that more excavation is required, then simply strip turfs and float the path on a geotextile with an appropriate covering. This reduces the amount of material produced during construction works and reduces the amount of imported fill material required. Where small localised soft spots occur these may be excavated and back filled with stone.

Base stone is generally laid by tipping successive loads of stone from a dumper or trailer and then spreading with an excavator. In harder to get to areas wheelbarrows may have to be sued and hand raking used to spread the base materials. Base stone should be

thoroughly compacted to maximise its strength and binding properties.

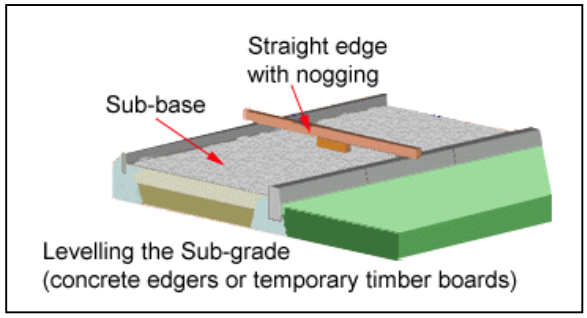
Providing enough base depth to place the final path surface above (about 50-100mm) the level of the surrounding ground will ensure surface water drains away effectively. The verge should be bermed up to provide a level meeting with the path surface to prevent tripping and permit machine mowing.

Spreading the base under the verge provides extra strength and erosion resistance at the edges and permits the use of machinery without heavy damage to the surfaces during maintenance work.

5.2 Levelling

5.2.1 Sub-grade

It is important to ensure the sub-base surface is as level as possible. This can be achieved by installing and levelling the concrete edges, or, by installing temporary timber guidance and making sure this is level.



Levelling the Sub-grade
(concrete edgers or temporary timber boards)

The path base will also regulate any surface imperfections left in the formation. A smooth and even base is essential for a high quality surface.

The using a straight edge with a 'nogging' set at the correct distance a quick check of any irregularities can be made.

Where a crossfall is needed the nogging will have to be set at the correct angle by ensuring that the edges are at the correct heights for the desired slope angle. (i.e. 1:50)

6 Final Surface

Dependent on the final surface material chosen checking the level and crossfall can be achieved using the edges and a straight edge with no noging.

Alternatively on large wide expanses of surface an engineer's level and stave and other construction methods can be used to obtain the correct cross falls and gradients.

7 Verges

Verges are an important part of the path they provide an intermediary between path and land reducing the impact of abrupt changes.

They provide support to help prevent the path edge breaking up.

They allow water to flow off the path unlike edging boards reducing damage to path surfaces by flowing water.

They can be use to provide warning for people with low vision or hearing of departure from the path. A 300 (low drops) -600 (higher drops) mm wide verge should be provided wherever there is a drop and no guardrails or walls.

Manage pathsides with perennial vegetation to enhance wildlife, visual quality, and erosion prevention.

7.1.1 Trees

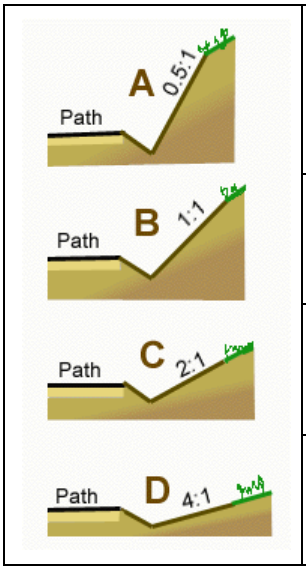
Paths and roads create wind tunnels. Create structures such as groups of trees that slow the wind down. Fight wind with wind by alternating groups of trees, much like check dams do to water. Avoid long sections without curves as curves especially if planted help break the wind force. Don't line a path or road with rows of trees.

8 Back Slopes

The best time to shape back slopes is during path construction, because it is more expensive to reshape the path profile after it is constructed and vehicles may damage the completed surface.

Back slopes can contribute a significant amount of sediment until some type of vegetative cover is established. That is why it is important to seed these areas as soon as conditions are right for this type of activity (usually spring or autumn).

The angle of repose for the slope, which is the natural slope of the material, will be determined by the types of soil in your area. An example would be a 2:1 back slope, which is 600 mm horizontal to 300 mm vertical slope. Successful re-vegetation will be greater on gentler slopes. There is little benefit in flattening the slopes beyond the angle of repose, which would increase the area exposed to erosion. Table gives an example of some common proportions of back slopes and describes the type of treatment needed to stabilise them (Hartung and Kress 1977).

	A – may hold in the right soils. Likely to need re-cutting
	B – multching & fertilisation normally needed
	C – can be loosened for seeding
	D –can be machine cultivated,

If you have a complex stabilisation problem requiring the use of riprap, dams, terraces or retaining walls, consult a professional engineer.

8.1 Slope Stabilisation

8.1.1 Seeding

Seeding and mulching should be completed as soon as possible to reduce erosion and sedimentation on both cut and fill portions of the path.

Seeding is usually accomplished with best results in spring or autumn, but results will depend on local weather conditions.

A wide variety of seed is available; contact an agronomist or the county highways engineers for recommendations to suit your area.

A note of caution: if you have cattle, sheep, or animals that could damage your cut and fill slopes, select a seed mixture less palatable than the surrounding vegetation.

Cut and fill slopes should be stabilised, which can be accomplished by reducing them to their natural angle of repose. If not stabilised, slopes will not revegetate and will continue to erode.

Some types of vegetation stabilise banks and ditches better than others. Clover (which self fertilises and resists drought), alfalfa, ferns, and gorse do well when mixed with grasses and creeping grasses for early growth. Although some of these plants are considered undesirable by some vegetation managers, they should be used or left in place simply because they do help control erosion.

Vegetation control of erosion-control areas can use mowing, but not closer than about 450 mm from the ground. This allows low-growing ferns and shrubs to take hold. Use of these low-growing plants can help limit roadside maintenance and costs, as well as facilitating erosion control.

Limit the use of herbicides to gravelled areas such as road shoulders and be very selective in its use on other flat areas.

Bare soil erodes by the impact of rain drops. Make sure all soil is covered. Be suspicious of grassed path verges, since scrub and forest are more stable while requiring less maintenance. They also retain more moisture and prepare a better soil structure. Pay attention to the difference between the sunlit and shaded sides of the road. It affects the plant species willing to grow there, but also the angle you can cut.

8.1.2 Multching

Straw is the most commonly used mulch material as long as slope gradient, slope length, and rainfall intensity are not excessive. Straw mulch applied at 2 tons per acre is effective in reducing erosion. If weed-free hay is used, seed at a rate of 2 ½ tons per acre. Straw can be used in combination with other bank erosion control measures to increase its effectiveness. Combinations of mulch and netting products are commercially available for areas that are difficult to seed.

Some agencies spray a mixture of seeds added to shredded newspaper and water. The wet paper pulp helps hold the seeds in place on the slope and provides moisture for germination. A tank that can be stirred inside to make a slurry and a water pump provide the only needed equipment. Seed can be mixed into the slurry to spread new growth.

8.2 Slide debris

Slide debris can cause increased sediment loads in established pathway drainage systems as well as in established streams. Do not side cast removed material if there is a chance it will enter a stream. The cause of the slide needs to be evaluated.

Under some circumstances, removal of the slide debris makes the situation worse by further undercutting the toe of the slope. In some instances, removal of some debris may be required and stabilisation of the remaining material may prevent further problems.

Consult an engineer for advice if the problem persists. General recommendations will not work on slides because there are too many variables that can trigger them, thus local expertise is needed.

8.3 Sandy soils

In sandy areas, it helps to add something to harden the tread surface and make it sustainable. If there is a layer of compactable soil on the surface and sand or glacial till (the debris left when a glacier retreats) underneath, then the upper layer can be removed and set aside, then mixed with the sand for the top of the tread. If there is no compactable layer, then other hardening techniques must be applied.

In areas that have a lot of sand it is a good idea to build a bench path/track, as opposed to just raking back the surface vegetation and letting the users establish the tread. If not, the thin layer of topsoil will quickly punch through and cause the tread to become cup shaped, channelling water down the path.

8.4 De-berming

Sometime after an unpaved path has been properly cut in and out-sloped, the most used surface area will settle from compaction, especially along equestrian routes and narrow cycle ways. This is normal. However, the lower edge of the path will not compress as much as the centre, creating a berm. Berms can also form from erosion.

Fortunately the cure is simple and very effective. Using simple hand tools (spade, adz hoe, pick, etc.), remove the berm to create out-slope, being careful not to disturb the already compacted centre of the path any more than necessary. Varying by soil types and climate, many path segments will require another de-berming every two to five years. This is perhaps the most common maintenance needed on unpaved paths, but also one of the easiest.

9 Planting

The following illustrate general principles but various LAs have their own rules which should be checked.

- **The developer has a legal responsibility to check with the LA before work commences on site for any Tree Preservation Orders, or hedgerows protected by similar orders.**
- **Where the path meets a highway a splay should be used to provide good vision of each other for path and highway users.**
- **These areas should be grassed or planted with approved shrubs and form part of the adoptable highway, any such planting must not exceed a mature height of 600mm above the channel on all residential roads. Where footways are provided these should follow the back of the visibility splay. The planting of trees within 2.4 metres setback visibility splay is not be permitted.**
- **At greater setbacks, trees may be permitted for example to retain mature trees or to continue avenue style planting where the species has a narrow girth and a minimum clear stem of 3m to the bottom of the crown. In these instances the visibility setback should be extended to compensate for the visibility obscured by the tree.**
- **Where planting can be shown to relate to a particular highway feature or function (e.g. traffic calming) it may rank for adoption by the Highway Authority. Landscape planting specifically for highway purposes may be justified on Local Distributor roads where the public pass and re-pass frequently. On these, road verges may be 3 metres wide (excluding footway if provided) in order to accommodate planting.**
- **The species of trees selected should not cause damage to adjacent paving, buildings or services underground or protection**

should be provided. Tree pit construction should ideally have root barrier material or root directors included to help prevent physical lifting of the surrounding surfaces. There design should prevent surface water run-off draining into the tree pit, as in winter de-icing salt water run-off will contaminate the soil and kill the trees.

- Paving design and tree species should be chosen together, with non-slip paving used under trees to reduce slip hazards in autumn. In addition the trees selected should not create droppings that form a slippery surface for pedestrians,
- No trees or shrub species may be planted where at their mature size, they will obstruct street lights or road signs.
- Suitable tree species should be selected for their site surroundings taking into account their ultimate crown size and form.
- Where possible select native rather than imported species of shrubs and trees. Problem plants such as forsythia, rhododendron and Japanese knotweed must not be used as they are recognised as pest plants in some areas of the county.

9.1 During Work

For a larger project an Arboricultural Consultant should be employed throughout the construction process to ensure compliance with the regulations and where the health and safety of existing trees is to be safeguarded and monitored.

- Trees should not be subject to alterations in existing ground levels over the area of their root systems or adjoining the base of their trunks;
- All excavations under canopies should be carried out by hand and no roots over 25mm in diameter should be severed or damaged;
- No construction materials must be stored within the trees protected area
- It may be desirable to prune the crown of a tree, with the LA's consent to make it safe and lift lower branches above vehicle and head height;

9.1.1 Maintenance

Weed control in landscaped areas is essential for its good establishment and long term viability. This should form part of the initial maintenance plan.

Mulching with bark mulch or mats or geotextile sheet can help cut down the cost of weed control until the areas of landscaping become well established.

In urban areas to reduce the need for weeding after planting, the planting beds should be fully prepared and treated before cultivation to remove or kill all perennial weed roots prior to planting.

10 Seasonal & Temporary Traffic Routes

10.1 Seasonal Routes

Permanent seasonal roads should have controlled access to keep maintenance costs low.

- Ensure the road surface is in stable condition by reshaping to its original specifications. Seed and mulch any remaining disturbed surfaces.
- Check all drainage structures to ensure they are in proper working order.
- Remove any logging slash or debris that has the potential to block a drainage structure.
- Periodically inspect the road to ensure drainage is being maintained.
- Maintain the gate or barrier. Ensure the access to the route remains accessible.
- In some cases earth may be mounded across the road or large boulders used to control traffic.

10.2 Temporary Routes

Consider doing the following before the last piece of equipment capable of doing path maintenance leaves the site.

- Remove all temporary drainage structures and replace with water bars.
- Remove any stream crossing structures and reshape the stream channel to its original contour.
- Stabilise the path bed and cut and fill slopes with seed, and mulch when necessary.
- If public access is a problem close the path with a gate or some other structure at a point where topography prevents people or vehicles from going around the closure device. Place a notice giving information about the works and when the route can be expected to reopen.

Appendix A Reference

General Terms

- **Clinometer – A clinometer is a measuring device you use to measure the angle of a line of sight above or below horizontal. For example they are used by construction workers to measure grade angles, by forestry workers to measure the height of trees. To use the clinometer, you look through an eyepiece with one eye to see the angle measuring scale and a horizontal line. With the other eye, you sight on the object you want to measure, such as the crest of a waterfall. When the horizontal line is aligned with the crest of the waterfall, you simply read the scale to find the angle in degrees. When you use a clinometer, try to sight on a distinct object like a small sapling, stick, or rock at the crest of the waterfall or the edge of the plunge pool. Take your sighting three times and then average the results.**
- **Rangefinder – A rangefinder is a device that measures the distance to a distant object. They are used in construction, surveying, and forestry to estimate distances and are also quite popular with golfers and target shooters. The two basic types are Laser Rangefinders and Optical Coincidence Rangefinders. They bounce a laser beam off the remote object and measure the time it takes the laser light to travel out and back. You sight through an eyepiece and see a double image through the two lenses. You turn a knob which rotates an internal mirror to align the two images and then read the distance from a scale You then simply read the distance from the display. When you use a rangefinder, try to sight on an object with a distinct vertical edge since this makes it easier to align the two images. If you can't find a vertical edge, try holding the rangefinder vertically and sight on a horizontal edge. Take your sighting three times and then average the results.**
- **Theodolite – Instrument for the measurement of horizontal and vertical angles, used in surveying. It consists of a small telescope mounted so as to move on two graduated circles, one horizontal and the other vertical, while its axes pass through the centre of the circles**

Health & Safety in Construction and Maintenance

Pamphlets and guidance is available from the HSE on their website for these and other related Health & Safety requirements.

Remember if volunteers are employed extra care should be exercised in providing training and supervision, likewise where

people with disabilities are employed additional truing and alternate work methods may be required.

The following all have free guidance available from the HSE website www.hse.gov.uk plus an Approved Code of Practice issued by the HSE which are available from HSE Books www.hsebooks.com.

- **Construction, Design & Management (CDM) Regulations, 2007 – Framework for construction projects defining various roles in a project, and defining information to be sought and how it is communicated between parties. Relate to general welfare provision on site – shelter, drinking water, first aid provision as well as traffic routes and site accesses, public safety around a site, fire precautions and specific regulations for working in hazardous environments e.g. confined spaces.**
- **Health & Safety at Work Act, 1974 – General legislation.**
- **The Control of Substances Hazardous to Health (COSHH) Regulations, 1994 – Relate to all materials (stone, dust, paint, pipe work) used on site and how they should be stored and handled.**
- **The Health and Safety (First Aid) Regulations 1981 establishing this duty specifies requirements regarding the provision of first aid in terms of trained first aiders and the equipment to be available and the information to be given to the employees regarding this provision.**
- **The Lifting Operations and Lifting Equipment Regulations 1998 (LOLER) - The Regulations relate to the reduction of risks to people's health and safety from lifting equipment provided for use at work.**
- **The Management of Health & Safety at Work Regulations, 1992 – General employment regulations but they define the need for risk assessments for all aspects of work.**
- **The Manual Handling Regulations, 1992 – Give specific details on lifting loads by hand.**
- **The Personal Protective Equipment (PPE) Regulations, 1992 – Relating to safety clothing and personal equipment such as harnesses, breathing apparatus, etc.**
- **The Provision and Use of Work Equipment Regulations (PUWER), 1998 – Relate to all plant and equipment used on site referring to operator training, correct use, correct maintenance etc.**

Appendix B Materials

Steel Reinforcement

All steel used in reinforced concrete must comply with the requirements of the appropriate British Standard as set out below.

Type	BS
Hot Rolled Steel Bars	4449
Cold Worked Steel Bars	4449
Hard Drawn Mild Steel Wire	4482
Steel Fabric	4483