
**VOLUME 10 ENVIRONMENTAL
DESIGN AND
MANAGEMENT
SECTION 2 IMPROVING EXISTING
ROADS**

PART 1

HA 85/01

**ROAD IMPROVEMENT WITHIN
LIMITED LAND TAKE**

SUMMARY

This section gives guidance on the environmental design of road improvement schemes developed within limited land take.

INSTRUCTIONS FOR USE

1. Remove HA 62/92, which is superseded by HA 88/01 and archive as appropriate.
2. Insert HA 85/01 into Volume 10, Section 2.
3. Archive this sheet as appropriate.

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THE HIGHWAYS AGENCY



**THE SCOTTISH EXECUTIVE DEVELOPMENT
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**THE NATIONAL ASSEMBLY FOR WALES
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THE DEPARTMENT FOR REGIONAL DEVELOPMENT*

Road Improvement Within Limited Land Take

* A Government Department in Northern Ireland

Summary: This section gives guidance on the environmental design of road improvement schemes developed within limited land take.

REGISTRATION OF AMENDMENTS

Amend No	Page No	Signature & Date of incorporation of amendments	Amend No	Page No	Signature & Date of incorporation of amendments

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1.1 SCOPE

This chapter gives guidance on the environmental design of road improvement schemes that are developed within existing highway land or within limited land take. The improvement may be:

- a junction improvement
- redesign of slip roads
- widening of carriage ways
- installation of structures and plant (including barriers, lighting, signs and masts)
- provision of bus lanes
- provision of cycle lanes and footpaths.

1.2 PURPOSE

The purpose of this chapter is to:

- **give guidance on the constraints and opportunities for landscape and horticultural works undertaken when improvements within the existing highway boundary or where land take is limited**
- **advise on the range of earth retention systems available and their suitability/limitations from a landscape/horticultural perspective**
- **provide information on landscape/horticultural works used on existing improvement schemes and stimulate an informed and innovative approach to future schemes.**

Two of the main undertakings in the 1998 transport White Paper (“A New Deal for Transport”) are to:

- **make better use of existing roads**
- **reduce impact of trunk roads and motorways on people and the environment with safer roads, less noise, less pollution and less intrusion.**

The guidance provided by this chapter will, if properly applied, help the designer achieve these undertakings.

This advice note draws from an extensive survey of existing road widening schemes and a wide ranging review of current technical literature. It is applicable to future road improvement schemes and any schemes that require environmental treatments where space is restricted.

In drawing up this advice the intention has been to avoid being over prescriptive whilst opening up the full range of possibilities to the designer. Technical guidance on slope retention systems, geo-technical issues and safety concerns are not within the scope of this advice note and such advice should be sought from other volumes of the Design Manual for Roads and Bridges.

Experience has shown it is important for the design team to give early consideration to the type, or types, of slope retention systems. The system chosen can severely constrain other decisions for example a reinforced slope may curtail the amount of new planting which can be established which in turn may not be acceptable if a primary objective is to screen nearby residents. Other constraints, which should be taken into account, include limited time for construction, limited space for construction and traffic management.

Whilst roads can be improved within limited land take, opportunities are severely limited, particularly in achieving adequate and effective mitigation.

Road widening within limited land take is severely constrained which is why innovation is necessary. This chapter identifies some successful solutions for designers to consider, however, it is inevitable that there will be other techniques and solutions not touched upon. There are a wide variety of products available but the particular constraints of climate, high traffic levels and difficult site conditions alongside the trunk road network need to be considered before a best choice can be made.

The often unique conditions found in many rural road improvement schemes require landscape designers to adopt a more pragmatic approach to their design whereby the use of hard landscape solutions should not be viewed as a failure more a challenge involving the use of the same design skills.

When assessing alternative solutions important considerations include buildability, appearance and ease of management. All things being equal ‘the most sustainable solution’ should be the favored option. There may be some difficulty determining ‘the most sustainable solution’ as this varies with time, perception, understanding and knowledge. On the whole it is likely that soft solutions (ie planting) and solutions which draw from the locality (for example; gabion filled with locally quarried stone) are more sustainable. Solutions which involve a low level of maintenance can also be said to be more sustainable than those which involve a higher level.

1.3 ENVIRONMENT OBJECTIVES

Traditional road building environmental objectives cannot always be fully achieved for improvement schemes, however, the following environment objectives should be considered and achieved where appropriate:

- minimise impact on natural and built environment
- conserve resources and minimise waste
- conserve and enhance existing landscape
- integrate with surrounding landscape
- conserve and enhance townscape
- maintain and enhance biodiversity
- provide interest for the user
- integrate with other environmental mitigation measures
- ease of management
- unify disparate roadside features (for example lighting columns etc)
- minimise noise disturbance
- respect the historic fabric of our landscape
- minimise impact on watercourses.

1.4 KEY ISSUES

Limited land take means that some of the environment objectives will not be fully achievable due to:

- lack of space
- loss of mitigation (graded slopes and planting)
- loss of valuable habitats to wildlife
- increased proximity of road to sensitive areas
- increased proximity of road traffic to residents and other sensitive receptor sites
- increased air, noise and water pollution from vehicles creates an adverse environment for adjacent vegetation, wildlife and residents
- increased number and scale of structures (walls, fences, signs, lighting etc) creates more visual intrusion/obstruction
- time constraints
- loss of space for maintenance.

1.5 BENEFITS OF ROAD IMPROVEMENT WITHIN LIMITED LAND TAKE

- No or limited direct effect on adjacent land and less potential for significant additional impact.
- Opportunity to improve existing mitigation.
- Quicker.
- More cost effective.
- Less disruptive to road users and residents.

1.6 KEY RECOMMENDATIONS

The design for a road widening scheme should be considered by all of the design team at the earliest stage to ensure an integrated approach to the design which meets all design objectives. During the selection of a[n innovative] solution the following questions should be considered:

- are environment objectives met?
- are performance requirements met in relation to landscape elements?
- are engineering standards met?
- is the solution viable/sustainable in the long term?
- is the solution integrated with other environmental mitigation measures?
- is the solution maintainable?

The Environmental Statement for a road improvement scheme should describe the proposed environmental treatments in sufficient detail to assess their effect on the environment accurately. It will also allow the public including nearby residents to appreciate fully the scope of the works and how it will affect them.

The Environmental Statement for a road improvement scheme should include an outline management plan to ensure the management implications have been fully considered and costed.

The landscape design for a road improvement schemes should aim to be in scale with the road and its features, and in keeping with adjacent land uses. It should also reflect the character of the surroundings (where appropriate).

Future widening schemes will rarely rely on conventional design solutions. Design agents and project managers should consider new and established techniques.

1.7 DESIGNER'S CONSIDERATIONS

The designer should consider the landscape design from the point of view of adjacent residents, land users and the road user. Adjacent land users will require that the improved road should where possible be in scale with surrounding land uses, integrated into the landscape character of the area and be unobtrusive.

The designer should consider the need to integrate the landscape design with other environmental features or elements especially when alongside sensitive landscapes such as Conservation Areas, townscape and nature conservation areas.

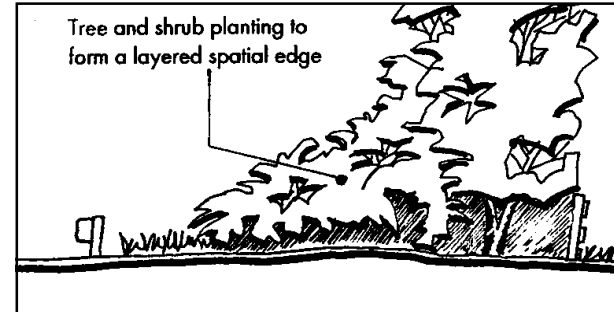
Where this is not possible the aim should be to create a buffer zone between the improvement scheme and its immediate surroundings.



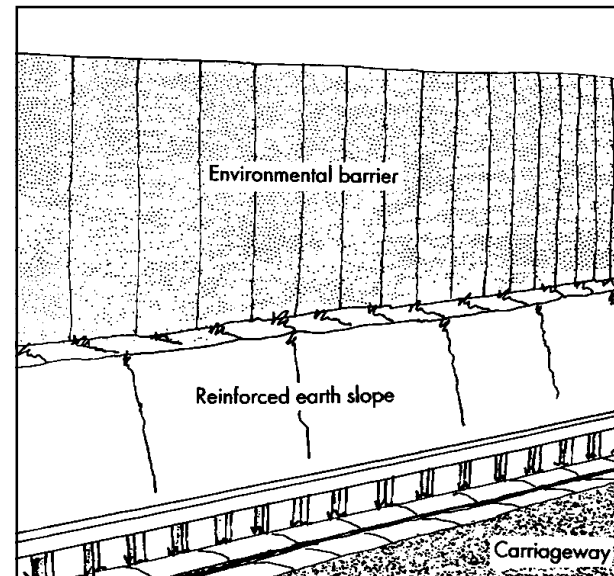
Creating a buffer zone between the road and its immediate surroundings

The landscape design should also be considered in terms of aesthetic concepts such as enclosure, proportion and scale, unity, harmony, contrast, variety, sequence, colour, texture and materials.

1.7.1 ENCLOSURE

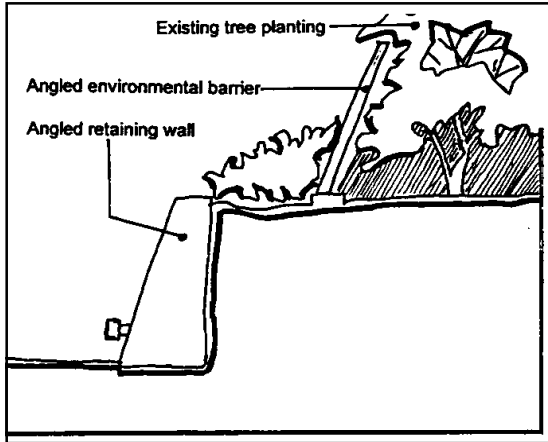


The sense of enclosure can be reduced by producing a layered spatial edge. This spatial edge can be created with a 5-10 metre width of tree and shrub planting.



Widening schemes can produce a closed spatial edge because of the lack of available space and the demands of mitigation. Such mitigation can be either in the form of a retaining wall, an earth embankment, planting or an environmental barrier. This closed spatial edge can increase the sense of enclosure experienced by the vehicle traveller.

One way of reducing the sense of enclosure in locations where space is limited is through the use of recessive light tones, and the use of fine textures or small areas of coarse textures.



The use of angled retaining walls sloping away from the carriageway and environmental barriers or a porous spatial edge can reduce the sense of enclosure particularly in cuttings.

A porous spatial edge can be created with a single row of trees or a narrow woodland belt which allows filtered views.

1.7.2 PROPORTION AND SCALE



A low cutting with small landscape units

The design of landscape solutions incorporated in widening schemes should reflect the intrinsic scale of the road landscape. For example a low cutting which is visually enclosed exhibits reasonably small visual units. This is determined by the relative size of the elements found within the landscape such as a low hedgerow which forms the visual horizon.

Large landscape elements would need to be integrated with skill.



M25 Reigate Hill. A good balance between hard and soft landscape elements although in this example the inappropriate use of hard landscape elements detracts from the overall scheme. Ideally there should be a balance between the proportion of hard and soft landscape elements within a widening scheme. In rural locations it may be appropriate to have a higher proportion of soft landscape elements.



Reducing the impact of large structures

Where high structures are required the use of taller growing tree and shrub species may be used to redress the balance between hard and soft elements.

The use of combinations of materials, with different colours and in different proportions can reduce the visual impact of large structures.

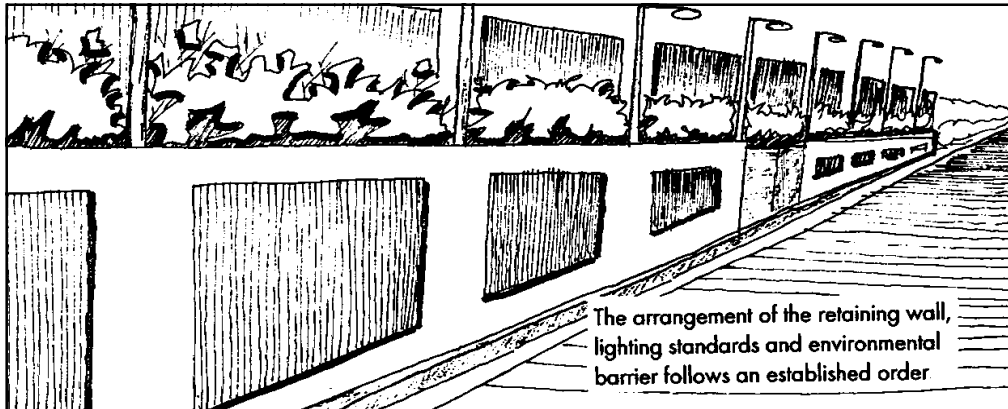
1.7.3 UNITY



Many widening schemes are composed of disparate landscape elements with no unifying element or structure. The use of colour, texture form and planting can all be used to unify a scheme.

Good practice

1.7.4 ORDER



The arrangement of the retaining wall, lighting standards and environmental barrier follows an established order

Existing roadside features/furniture should be used as a framework into which new elements are added such as light columns and vehicle safety fencing. This will help to produce a systematic, logical and controlled arrangement of landscape elements. However, in situations where the existing situation is visually chaotic this may not be appropriate.

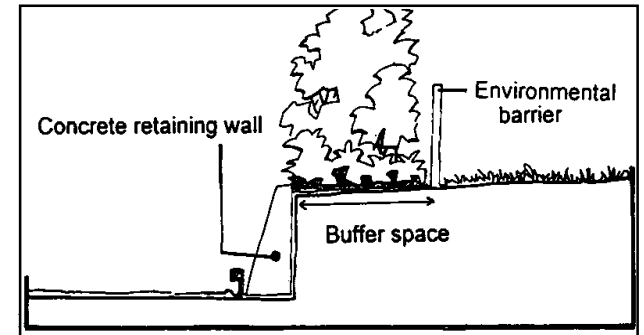
1.7.5 HARMONY

A harmonious relationship can exist on three levels within the landscape of a widening scheme.

The use of planting or materials similar to those found beyond the highway will ensure a link between the road corridor and the visible landscape beyond.



Planting can be used to create buffer space between individual elements.



Planting can provide a graded change giving a gradual transition between one element and another.



1.7.6 CONTRAST

The juxtaposition of strikingly different forms, colours and textures can create visual interest for both the vehicle traveller and outside observer. The element may be a large mass around smaller masses, a bold shape protruding against an amorphous background, a bright colour against dull ones or a dramatic coarse texture surrounded by fine receding textures.



Visual contrast in the road landscape

1.7.7 VARIETY

Introduce variety into the verge [verge, and/or earthworks, and/or environmental barriers] treatments. This can be achieved through the introduction of different landscape components. However it is important to only introduce variety which is appropriate to the scale of the road, traffic speed and the scale/form of new structures. Over fussy design is to be avoided.

It is usually best to avoid mechanistic [change for the sake of change] variety however the design of a more formal landscape incorporating change at regular intervals may be appropriate in some circumstances.

Variety can also be introduced through the use of various textures, materials and colours.



Contrasting colours, textures and materials

1.7.8 SEQUENCE



The vehicle traveller experiences the road landscape as a cinematic event. It is important to introduce variety into the road landscape to maintain user interest through a series of connected spaces and events which form a sequence as the vehicle traveller moves through it.

1.7.9 COLOUR



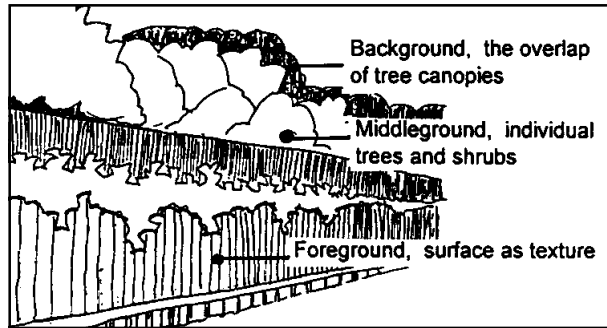
Neutral/recessive colours



Bright/advancing colours

The use of neutral and recessive tones and colours can increase the sense of space and merge elements into rural landscapes. Bright colours and high tonal contrasts can increase the sense of enclosure from the road, but when used with care they can also provide a prominent visual focus and create a more stimulating road landscape, although designers must avoid distracting the driver.

1.7.10 TEXTURE



Perception of textures within the road landscape

Fine textures tend to recede when contrasted against medium or coarse textures. The mixed use of textures within a road landscape can provide a greater level of visual interest. However the designer should be aware that complex textural effects will often be degraded by weathering and so may require a greater level of maintenance or careful design to reduce or utilise the weathering effect.

1.7.11 MATERIALS

Materials should be appropriate to the context of the road corridor, the landscape character of the road scheme and relate to adjoining built forms and/or adjacent townscape.

In urban locations, hard landscape elements with geometric [concrete] finishes and textures, and areas of brickwork are more likely to be appropriate. In these circumstances more formal planting is usually appropriate however this choice should not be solely driven by the road location. There are many examples of roads in urban locations yet which have a much more rural character where it would be inappropriate to select anything other than native species [The use of ornamental or naturalistic planting may be acceptable.]

In rural situations more natural finishes and textural effects, naturalistic planting, uncoarsed stonework and the use of vegetated reinforced slopes are usually more appropriate. In rural and urban situations the designer should avoid schemes with a profusion of different materials.

FEBRUARY 2001



An urban solution



A rural solution

ANNEX 1 SUITABILITY OF EARTH RETAINING METHODS

The table is based on an assessment of the physical and aesthetic factors which determine the success or otherwise of innovative methods used in Widening within Limited Landtake schemes. The information contained within it is based purely on aesthetic and horticultural considerations. Its intended function is to guide designers in their choice of an appropriate method for a given location once specialist Geotechnical advice has been sought.

- 1/2. Form of finished structure.
- 3. System allows for variety which will reduce the visual impact of the scheme.
- 4. Introduce terraces to reduce the visual mass of the structure.
- 5/6. Combining these methods with planting will produce these effects (refer to Part 1.6, Ch 5).
- 7/8/9. Comparative assessments of method's suitability for sites with different levels of development.
- 10/11. Surface treatments to create more varied effects.
- 12/13/14/15. Methods where planting can be accommodated or be an integral part within their structure. Many of the hard landscape solutions can accommodate planting where terraces are introduced.
- 16/17. The gradient of the slope will be a factor when determining the success or otherwise of planting.
- 18. The introduction of terraces may be necessary particularly on south facing slopes to ensure successful vegetation establishment.
- 19/20. Irrigation will/will not be necessary to ensure the successful establishment of vegetation.
- 21. Semi-hard facings may be used on sections of the scheme exposed to harsh environmental conditions, for example areas adjacent to the carriageway which are prone to salt damage.
- 22. Comparative assessment of annual maintenance requirements based on the extent and type of planting.

<p>Suitability of earth retaining methods based on field survey results and literature review.</p>	
<p>Key</p> <p>■ High Y Yes</p> <p>▲ Medium N No</p> <p>● Low A Not applicable</p>	
Reinforced Earth	<p>Soil nailing</p> <p>Soil panels</p> <p>Geogrid layers</p> <p>Geotextile honeycomb</p> <p>Cellular concrete units</p>
Gabions	<p>Box</p> <p>Mattresses</p>
Concrete Retaining Walls	<p>In-situ concrete</p> <p>Precast concrete units</p> <p>Faced with brick</p> <p>Faced with precast units</p>
Crib Wall	<p>Concrete</p> <p>Wooden</p>
Rock treatment	
Piles	

Aesthetic considerations										
Organic form possible	Geometric form possible	Variety in slope profile possible	Introduce terraces (over 4m)	Can form layered spatial edge	Can form closed spatial edge	Urban solution	Semi urban solution	Rural solution	Textural variety possible	Bright colours possible
1	2	3	4	5	6	7	8	9	10	11
Y	Y	Y	Y	■	■	●	■	■	A	A
Y	Y	Y	Y	■	■	●	■	■	A	A
Y	Y	Y	Y	■	■	●	■	■	A	A
Y	Y	Y	Y	■	■	●	■	■	A	A
Y	Y	Y	Y	■	■	■	▲	●	A	A
N	Y	Y	Y	■	■	■	■	▲	■	▲
N	Y	Y	Y	■	■	▲	■	■	■	▲
N	Y	Y	Y	■	■	■	■	●	■	■
N	Y	Y	Y	■	■	■	■	▲	■	■
N	Y	N	Y	■	■	■	▲	●	■	■
N	Y	N	Y	■	■	■	■	▲	■	■
N	Y	N	Y	■	■	■	▲	●	●	●
N	Y	N	Y	■	■	■	▲	●	●	●
Y	Y	Y	Y	■	■	▲	■	■	■	●
N	Y	N	Y	■	■	▲	▲	●	▲	■

Horticultural considerations											
Trees	Shrubs	Grass/herbaceous	Climbing plants	Planting within structure	Slope steeper than 1:1	Slope shallower than 1:1	Introduce terraces (over 4m)	Irrigation (north facing slope)	Irrigation (south facing slope)	Semi-hard finishes required	Annual amintenance requirem'ts
					12	13	14	15	16	17	18
▲	■	■	■	■	▲	■	Y	N	Y	■	■
▲	■	■	■	■	▲	■	Y	N	Y	■	■
▲	■	■	■	■	▲	■	Y	N	Y	■	■
▲	■	■	■	■	▲	■	Y	N	Y	■	■
●	●	▲	▲	●	■	Y	N	Y	●	■	
●	●	●	●	▲	■	Y	N	N	■	▲	
●	●	●	●	▲	■	Y	N	N	■	▲	
N	N	N	N	▲	■	Y	N	N	■	▲	
N	N	N	N	▲	■	Y	N	N	■	▲	
N	N	N	N	▲	■	Y	N	N	▲	▲	
N	N	N	N	▲	■	Y	N	N	■	▲	
●	▲	▲	■	■	●	Y	N	Y	▲	■	
●	▲	▲	■	■	●	Y	N	Y	▲	■	
●	▲	▲	▲	■	■	Y	N	N	■	●	
N	N	N	N	■	●	Y	N	N	▲	●	

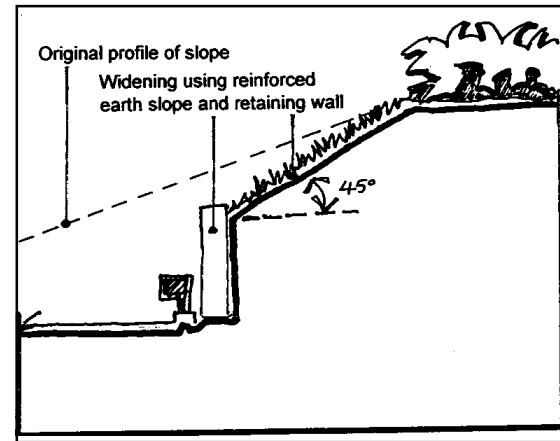
A2.0 KEY ISSUES

- These systems are best used in rural and semi-rural (or suburban) locations.
- Because adequate moisture is essential to successful plant establishment this method is not appropriate to soils which are prone to drought [free draining sandy soils] and on south facing slopes unless the design of the slope is modified [through terracing or a less steep slope].
- On steep embankments higher than 5m vegetation establishment is often poor although this effect can be reduced through careful design.
- There is no apparent limit to height when used in cuttings in terms of the successful establishment of vegetation.
- To ensure success these structures should be sown with drought and salt tolerant [grassland mixes] species in spring or early autumn.
- Avoid seed mixtures which depend on a limited number of constituent species where the failure of one of these species would have a widespread effect upon the grass sward coverage.

A2.1 ANGLE OF RETAINED SLOPE



The angle of north facing slopes.
The methods used are capable of retaining slopes of up to 60°. Successful vegetation establishment can be achieved on north facing slopes in areas with clay or loam soils at this angle.



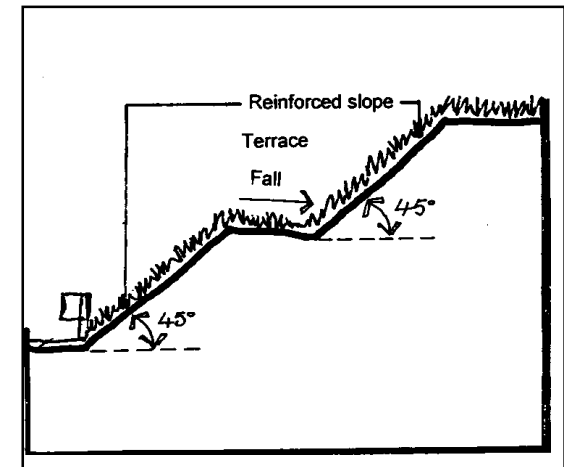
Angle of south facing slopes

On southern facing slopes and in soils of high permeability, vegetation may only be sustainable at angles of up to 45°. Where steeper slopes are called for, or where desirable for reasons of increased confidence on the sustainability or appearance, these solutions can be faced with more resistant materials but which still allow some flexure of the strengthening ie 'semi hard' finishes such as interlocking cellular concrete units or concrete panels.

A2.2 TERRACING

In most cases large grassed slopes should be divided by terraces. This will improve the vegetation establishment and ease maintenance operations.

Where existing site conditions and engineering considerations allow, these terraces should be sloped into the embankment or cutting to ensure that any rainwater collected is retained.



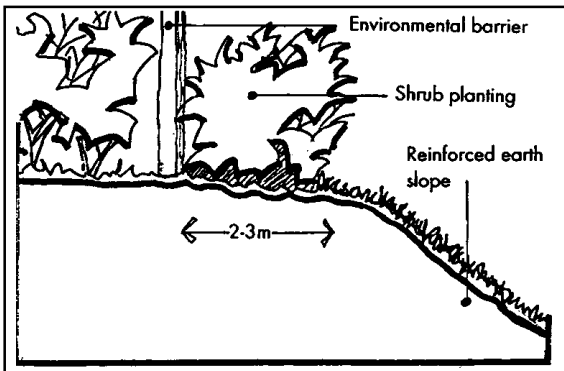
Sectional view of grassed slope with terraces

A2.3 VARIATION WITHIN SLOPES



M6 Lancashire, the slope exhibits little variation in angle or profile and so consequently forms a harsh, engineered landscape element. Where possible reduce the angle of the slope and introduce local variation into the profile of the retained structure. These variations should be sinuous for visual subtlety and ease of maintenance.

A2.4 JUNCTIONS BETWEEN LANDSCAPE ELEMENTS



Where a reinforced slope joins an upright structure, for example an environmental barrier, leave at least a 2-3 metre [preferably wider] wide flat terrace onto which tree and shrubs can be planted. Periodic maintenance of the planting through coppicing will allow access for barrier inspection and maintenance.

Good practice

A2.5 SEMI HARD FACINGS



In areas prone to damage in harsh environments and where steeper slopes are required but where vegetation would be difficult to establish, it may be appropriate to use a 'semi-hard' facing.

The advantages of the small cellular concrete units are that they provide immediate weather protection, come in a variety of sizes, shapes, textures and colours and can include soil pockets. Planting

on the face can either be relatively uniform or be contrasting (grass, climbers or creepers). It is however very difficult to successfully integrate discrete planting pockets within hard surfacing. Too often the paucity of planting combined with poor growth in a hostile environment leads to at best a patterned hit and miss effect and at worst a visual disaster.

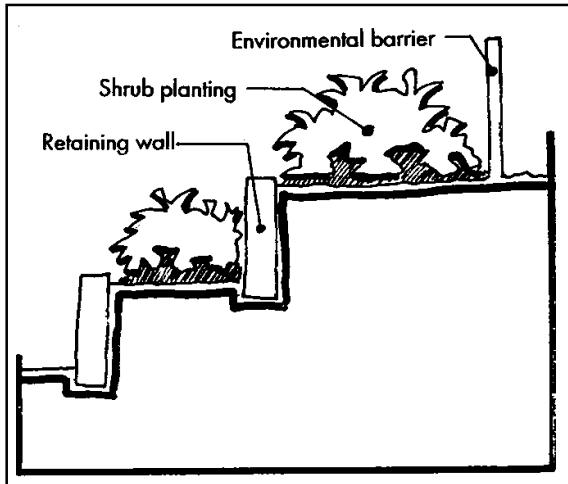


A39 Bude, a semi-hard facing has been used to produce a green effect. A thorough survey of site conditions must be undertaken to inform species choice and the use of establishment techniques.

A3.0 KEY RECOMMENDATIONS

- These systems offer flexibility being suited to rural, semi-rural and urban locations.
- These systems are best used in conjunction with soft landscape elements such as tree, shrub and ground cover planting rather than in isolation.
- Textures and finishes should reflect the context of the road landscape.
- Introduce variety through the use of different heights and textures.
- Avoid where possible high retaining [5m+] walls. However if there is no alternative they are more appropriate to the urban location. In rural situations terraces should be introduced.
- Particular care is needed in constructing retaining walls near established planting.

A3.1 WALL HEIGHT



Retaining wall incorporating terraces

Divide high walls using terraces. The minimum dimension for the terrace depends on the height of the wall. However, generally a terrace 2m minimum width is appropriate in most cases.

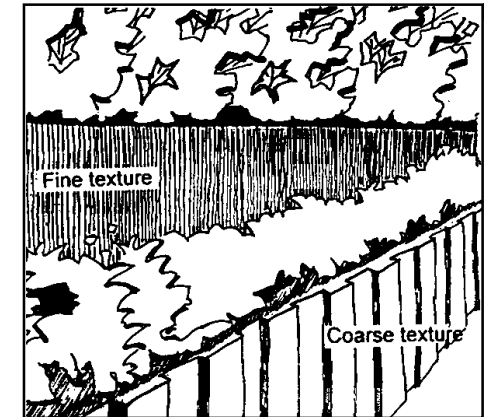
Where there is no alternative, high retaining walls are more appropriate to urban locations. In rural situations terraces are preferable.

A3.2 WALL TEXTURE

Textures and surfaces should be designed to reflect context. Precise and stylised patterns are more appropriate to urban and suburban locations while rural areas require a more natural approach. Textures with a vertical emphasis seem to reduce the perceived length of the structure.



Textures in cuttings. Bold or coarse textures which involve a lot of shadow are appropriate to high walls.



Texture can be used to create a greater sense of space through the use of coarse texture on near surfaces and finer textures on background surfaces.



Coarse textured panels can be used to break up the visual mass of a wall.



Brick or concrete precast units can be used to face insitu concrete retaining walls. This allows the use of more intricate designs and better quality control.

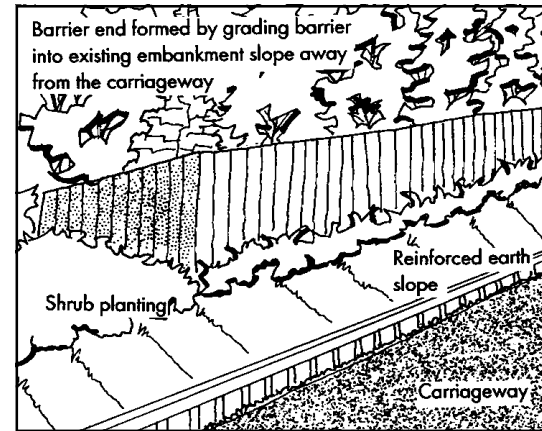
A3.3 UNNECESSARY STRUCTURE



The reduction of unnecessary structure. There may be scope to select the type of safety fence and method of support. In some cases steel safety fences can be supported by the retaining wall and in others it may be possible to design the wall itself as a vertical barrier.

Create areas of safe refuge for stranded vehicle travellers and maintenance staff in widening schemes where barriers are erected in close proximity to retaining walls.

A3.4 TRANSITION POINTS BETWEEN SCHEME ELEMENTS



Graduated or stepped ends at the transition points between the retaining wall and other structures such as environmental barriers can be achieved through the use of shaped earth mounding with tree and shrub planting. Where there is no alternative and the ends of structures are visible these should be locally thickened.

Careful detailing is required for other transition points such as copings, terminal points, piers, expansion joints, wall base trims and verge finishes.

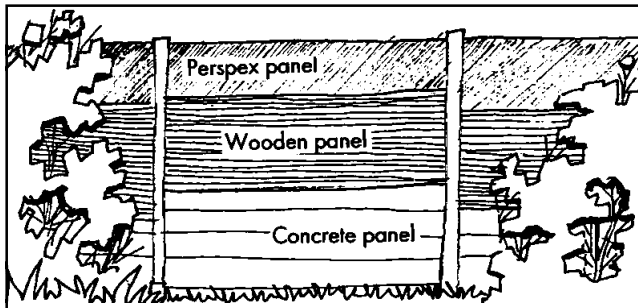


Horizon. Avoid situations where the horizontal line of the top of the retaining wall forms the visual horizon. Use planting to mitigate this effect. In an ideal situation the proportion of hard to soft landscape elements would be at least equal in urban locations and 1:2 in rural situations.

A4.0 KEYISSUES

- Make full use of current techniques and materials to solve site-specific problems.
- Widening can be an opportunity to install better environmental barriers than those presently in place and to improve the quality of life for people living close to the road or motorway.
- In urban-fringe or suburban areas new environmental barriers should, where appropriate, reflect their setting. Walls, fences or other solutions should be used in partnership with planting.
- Environmental barriers should be used in preference to planting where successful establishment and ease of maintenance cannot be achieved.
- Carefully designed barriers can be appropriate for rural locations where valued landscape features or local amenity are to be protected from significant environmental effects.
- Where possible environmental barriers should be used with other landscape elements such as planting to reduce their visual impact.
- Earth bunds should only be considered where sufficient land is available to allow sensitive profiling.

A4.1 URBAN AND URBAN FRINGE



M25 junction 10-11.
Reducing the impact of large fence structures. The use of several different types of material including Perspex panels can reduce the visual mass of the fence.



Good practice in the design for urban situations

In constrained areas where mass planting is either inappropriate or not feasible, good environmental barrier design using varied materials can greatly improve the character of the area, as the examples drawn from Dutch and German practice show.

A4.3 RURAL AREAS



The use of simple construction methods and recessive colours are appropriate in rural locations. The use of earth bunds can reduce the required height of the fence and ease its integration in the existing landscape.

A4.4 THE USE OF PLANTING WITH ENVIRONMENTAL BARRIERS



The use of random groups of tree and shrub planting can greatly reduce the visual impact of the barrier.

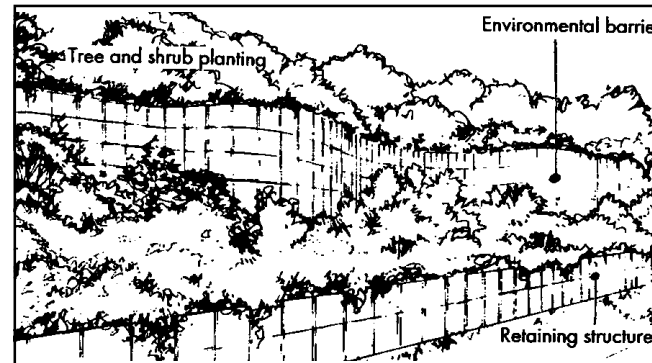
Try to avoid situations where the fence forms the visual horizon, use tree and shrub planting to form a background to the barrier.

Using planting to integrate barrier into road landscape



A4.5 VARYING ELEVATION

On high speed roads use the existing landform and the road alignment to create sinuous fence alignments. The barrier may have a simple form which is appropriate to the speed at which it will be observed.

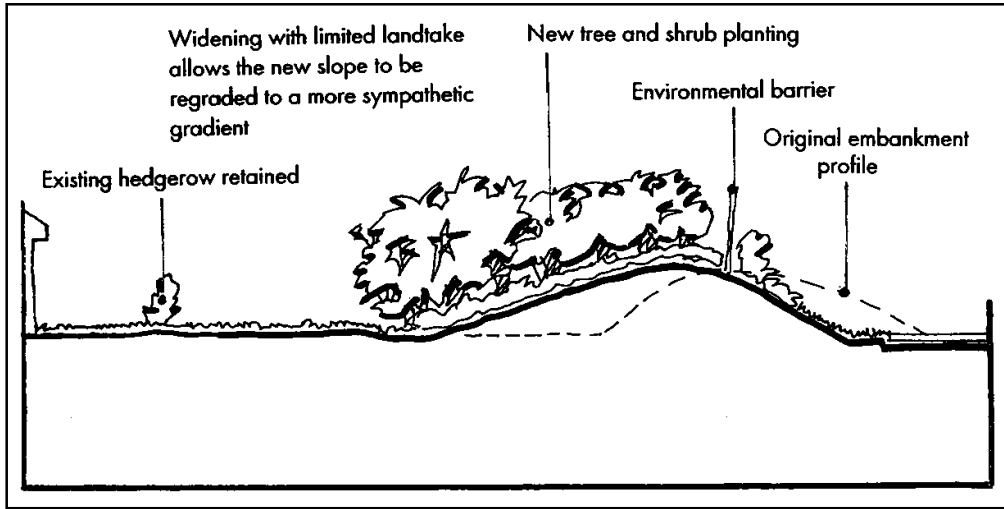


The speed of the viewer dictates the form of the barrier

Where possible use tree and shrub planting to produce a layered spatial edge or a porous spatial edge leading to the environmental barrier.

On other roads the design of barriers can be intricate where the traffic is likely to be travelling at slower speeds. Use rebates and different wall heights to create local variation.

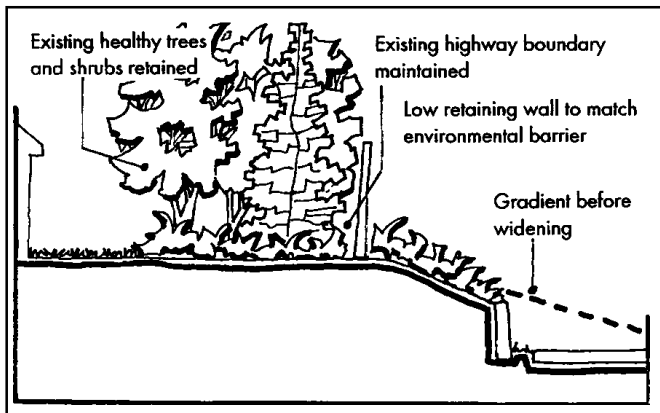
A4.6 EARTH BUNDS



M25, Surrey While the existing earth bund was an effective screen its landform and rough grassland are inappropriate to the setting.

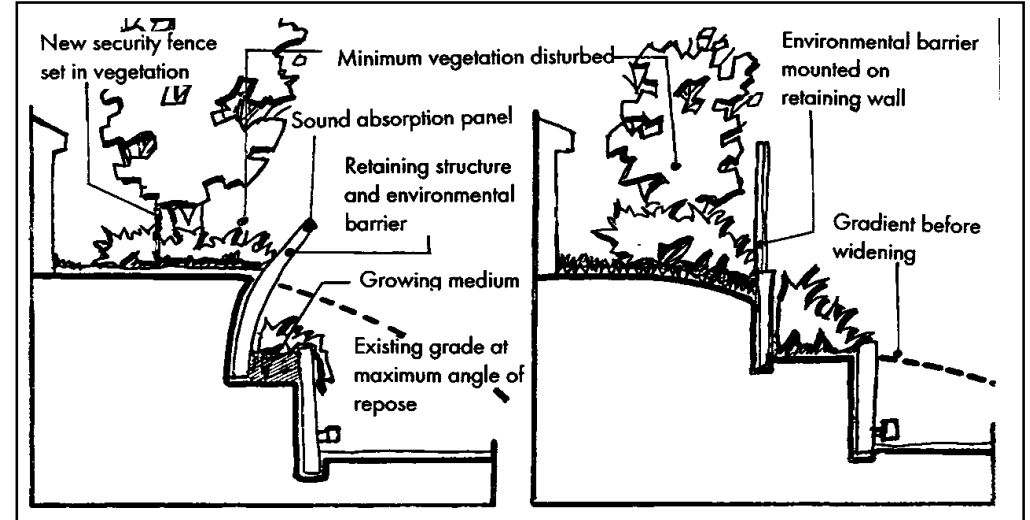
Widening could provide an opportunity for new earthworks and mass planting.

A4.7 PROVIDING AN IMPROVEMENT ON CONSTRAINED SITES



A widening scheme provides an opportunity to provide new environmental barriers to current standards, reducing noise and visual intrusion into adjacent property.

A4.8 COMBINING ENVIRONMENTAL BARRIERS WITH RETAINING WALLS



This reduces the space required for hard landscape elements and maximises that available for planting. For this to be visually effective there should be adequate planting.

A4.9 TRANSITION POINTS BETWEEN SCHEME ELEMENTS



M6 Lancashire. Use graduated ends, vegetation or landform to terminate a fence line. Avoid abrupt ends.

A5.0 KEY ISSUES

- This system is best suited to rural, suburban and semi-rural locations although it can be successfully used in urban situations.
- Gabions can utilise locally won fill materials which contribute to the establishment of a landscape character appropriate to the locality.
- Existing roadside vegetation can be retained using gabions whilst minimising the potential damage to tree and shrub roots.
- Introduce variety through the use of different heights, profiles and steps.

A5.1 GABION STRUCTURES



Large areas of gabions can be visually obtrusive and should not be used.

Limit wall height to 1.5 metres. Use terraces to separate courses.

Use the flexible nature of this modular system to create sinuous forms. Local variety can be introduced using small irregularly shaped units to provide more subtle transitions in height and profile.

Use graduated or stepped ends to gabion structures.

A5.2 CONSTRUCTION

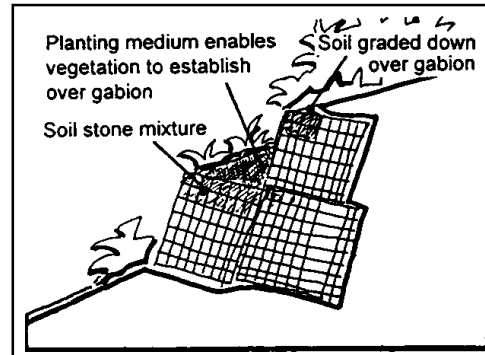


Gabions with coursed stone facing

The gabion baskets should where possible be filled with locally won stone. Where the filling material allows, the facing stones should be coursed mirroring the local vernacular styles as in areas for example where dry stone walling may be common.

In areas where the locally worn stone is irregularly shaped and of uneven size it may be appropriate to have a more random loose fill arrangement within the baskets.

A5.3 PLANTING



When establishing vegetation over gabions allow topsoil to become mixed with top layer of stones in the basket and grade topsoil down from retained cutting or embankment over top of gabion. Sow with grass seed.



M40, Stockenchurch Widening using gabions. Here the use of gabions to form a low stepped structure is not oppressive and much of the roadside vegetation has been retained.

A6.0 KEY RECOMMENDATION

- During widening the cutting can be recut or reprofiled to take advantage of the natural strata of the rock, using its natural formation and fissures.

A6.1 ROCK CUTTING PROFILE

This is often dependant on the nature of the material. For example some rock types such as granite and sandstone lend themselves to steeper slopes, rocky outcrops and small terraces.



A417, Cirencester. The rock has been shaped to take advantage of its natural structure.

In softer rock as in chalk cuttings, these would have a less steep gradient although small shelves may be appropriate.



M25, Walton on the Hill. The chalk cutting has been formed with slope variation and small shelves.

A6.2 SURFACE TREATMENTS

The face of the rock should be defined in three planes with outcrops, shelves and fissures to reflect those found under natural conditions.



Face defined in three planes



Strong block formation



Well defined vertical fissures



Good practice

Clawed finishes are appropriate to some rock types although this depends on their structure and the way in which the finish is applied.

Avoid finishes where the surface character and texture of the rock will be lost or obscured.

A7.0 KEY RECOMMENDATIONS

- The aspirations of designers and project managers for planting may seem unrealistic in widening schemes where space is limited and growing conditions difficult. The challenge is to develop new techniques to improve on past performance.
- Planting in the unique conditions of a widening scheme should be used to either balance the use of hard materials or create visual cohesion between disparate elements within an overall scheme.
- If local topsoil is unavailable, the designer should determine if the existing subsoil can be improved for planting through analysis and prescribed amelioration and if not should introduce imported topsoil.
- The establishment of planting is often unsuccessful due to poor species choice, planting practice, the quality of the material being planted and inexpert supervision.
- There may be engineering implications to establishing trees in shrinkable clays in close proximity to structures such as retaining walls.

A7.1 SOIL PREPARATION

Ensure that indigenous soils are retained, correctly handled and stored during the construction period. Where topsoil from a local source is available allow 100mm of top soil for grassed areas and 300mm for shrub planting areas. (The Scottish Executive have a different approach, consult Overseeing Organisation’s Designer).



Where local topsoil is unavailable, opportunities to improve the existing subsoil medium through amelioration are often preferable to importing topsoil from an unknown source.

Schemes with challenging site conditions can be treated as reclamation schemes in that site specific amelioration could be implemented based on research and substrate analysis undertaken by specialist agencies. However in such instances the risk of failure needs carefully balancing against the need to establish vegetation.



Good practice, M3 Belfast where vegetation has been established without soil.

A7.2 SPECIES CHOICE

These grass seed mixtures are suitable for roadside planting in widening schemes particularly those involving soil nailing and reinforced soil slopes. The species lists are for guidance only and specialist advice is required on a scheme specific basis.

Drought tolerant

Hard fescue	15%
Sheeps fescue	15%
Slender creeping fescue	20%
Chewings fescue	17.5%
Creeping bent	2.5%
Dwarf perennial rye grass	30%

Shade tolerant

Wood meadow grass	15%
Smooth stalked meadow grass	20%
Slender creeping red fescue	20%
Chewings fescue	15%
Hard fescue	10%
Strong creeping red fescue	20%

Salt tolerant

Slender creeping red fescue 'Dawson'	20%
Strong creeping red fescue 'Franklin'	20%
Hard fescue 'Crystal'	15%
Smooth stalked meadow grass 'Geronimo'	15%
Creeping bent 'Carmen'	2.5%
Browntop bent 'Highland'	2.5%
Dwarf perennial rye grass	25%

Drought and shade tolerant

Dwarf perennial rye grass	25%
Hard fescue	15%
Chewings fescue	17.5%
Strong creeping red fescue	20%
Slender creeping red fescue	20%
Creeping bent	2.5%

Ensure that grass areas, particularly slopes, are seeded in spring or early autumn to ensure suitable growing conditions for successful seed germination.



Wildflower species can, if properly selected, enhance or stimulate visual interest and contribute to biodiversity.



Tree, shrub and wild flora species should be selected after a detailed assessment of site conditions. The species choice is also determined according to the design intentions and the context of the widening scheme. As a general rule use small nursery stock from 450-600mm to 1/2 standards. Larger stock may be appropriate to more intensive establishment techniques.

If the site conditions are poor it may be appropriate to use pioneer species such as Birch, Alder and Willow. Avoid planting designs which rely on a single or limited number of species where the loss of one species due to disease or environmental stress would have a significant effect on the landscape of the widening scheme.

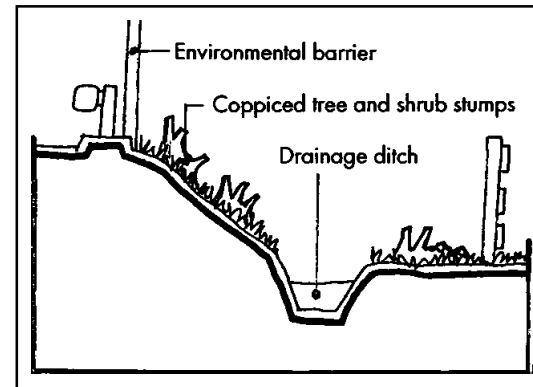
Innovations such as the use of deep-rooted containerised stock should be used to ensure a more successful plant establishment rate. Direct tree seeding in hydroseed mixes may be considered on steep inaccessible slopes.

A7.3 MAINTENANCE

Innovative, but not impossible/unrealistic maintenance techniques may be necessary in schemes which involve the use of steep vegetated slopes. The ease of maintenance must be a prime consideration in any scheme design.

Ensure that grassed areas have adequate water during the first growing season. A simple piped irrigation system may be a more efficient system of delivering water to areas than the traditional bower, particularly on reinforced soil slopes and areas of soil nailing where access is restricted.

The use of performance indicators at intervals of 5, 10 and 15 years should ensure that mitigation objectives relating to the growth of planting will be achieved. The maintenance regime can more easily be tailored to meeting these objectives and its success monitored. (See DMRB Vol 10, Section 1, Part 8).

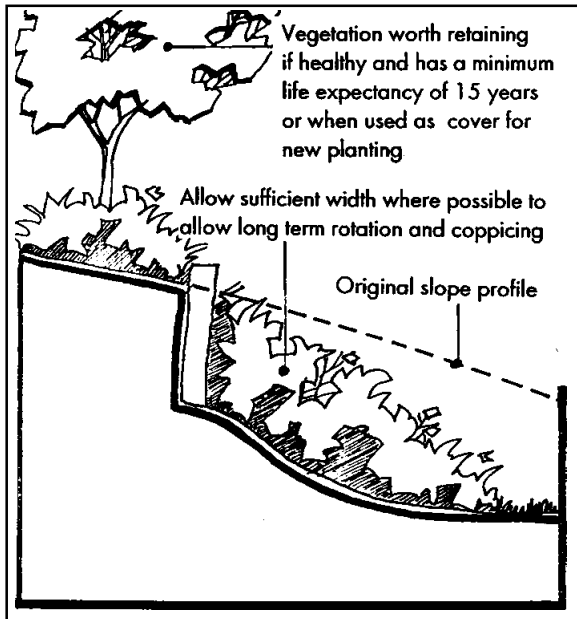


Where space is limited and access restricted, management objectives should allow for the simultaneous maintenance of both hard and soft landscape. This may involve for example the coppicing of tree and shrub planting on a ten year cycle to coincide with the clearance of drainage channels, thus allowing direct access and reducing conflicts.

A8.0 KEY ISSUES

- Retaining the existing vegetation can provide a significant immediate screen and soften the impact of road widening but this must be balanced against life expectancy, cost and opportunities for regrading and replanting.
- The potential for retaining established trees and shrubs should be considered in the first instance.
- Significant vegetation which has a positive future role in the landscape of the road should be protected whether inside or outside the scheme fence line.

A8.1 PRINCIPLES OF RETENTION

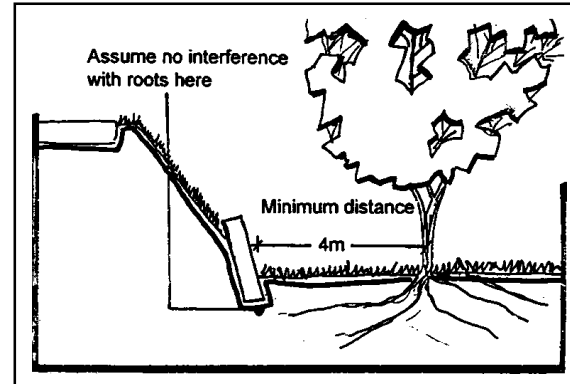


Principles of retention

The limited space available for planting in many widening schemes can mean that the traditional use of planting as a screen will not be effective unless it is combined with a structure such as an environmental barrier.

Pressure to retain vegetation which has a short life expectancy and which will restrict the proper establishment of a long term screen should be resisted. However the existing vegetation can act as a nurse to newly planted trees and shrubs on exposed sites.

A8.2 EXTENDING EMBANKMENTS

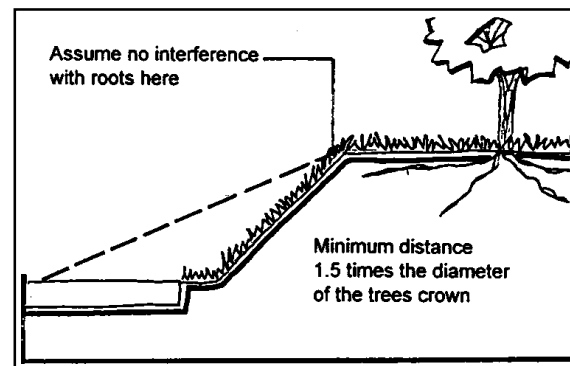


Extending embankments near vegetation.

Avoid disturbing significant vegetation at the foot of embankments. Where this is not possible and a retaining wall extends into vegetation, the minimum safe distance is the diameter of the existing crown or 4m whichever is bigger.

If the retaining wall is closer than this, clearance and replanting may be necessary and essential if the retained tree is mature and its possible instability poses a threat to road user or resident. It should be remembered it is far easier to take down a tree at construction stage rather than on a live scheme where at the least traffic management will be required if not road closure.

A8.3 EXTENDING CUTTINGS



Extending cuttings near vegetation.

The regrading of a cutting can also effect the potential survival of retained mature trees.

Where possible retain a minimum distance of one and a half times the diameter of the existing crown between the tree and top of the regraded slope.

The removal of highway vegetation can also have an effect on significant vegetation beyond the fence line. Removing trees from the edge of a wooded area can expose the remaining trees to potential damage from environmental stress and windblow.

A8.4 CHOICE OF WIDENING OPTION



M5, between Lydiate Ash and Catshill. Asymmetric widening has allowed the retention of mature planting on the unwidened side to protect nearby housing.



A7 Dalkeith Bypass, where special efforts have been made to save a valuable tree.



M40 Stockenchuch, gabions offer a flexible method of saving mature vegetation.



M56 south of Manchester. Symmetrical widening within the highway boundary through the use of the retaining walls has facilitated the retention of mature woodland planting and protected nearby housing.

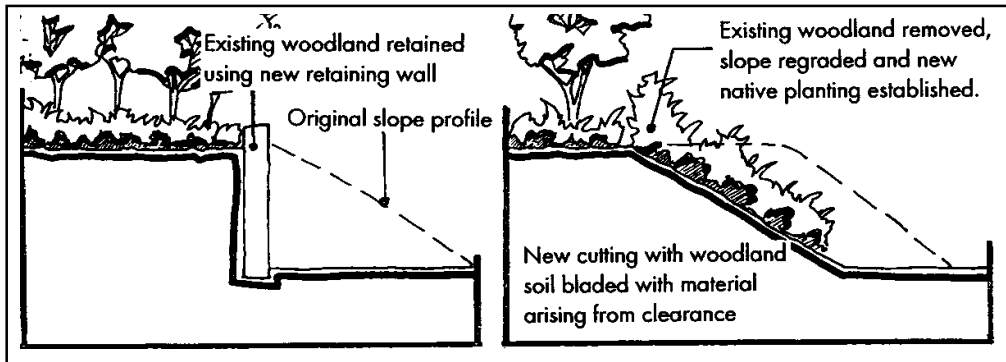


M25, Junction 10-11. Symmetrical widening within the existing highway boundary through the use of reinforced earth banks has allowed the retention of much of the original mitigation planting. This planting has a fundamental role in reducing the visual impact of a 5 metre environmental barrier.

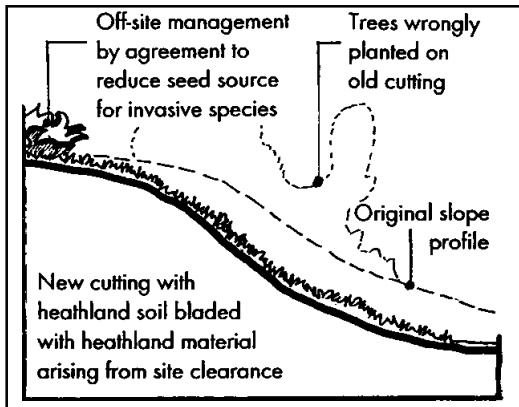
A9.0 KEY RECOMMENDATIONS

- Where widening into a site of nature conservation interest cannot be avoided, there may be opportunities to mitigate the impact of the road or even make good some of the adverse effects of the original road scheme.
- For each widening scheme site specific proposals need to be developed with ecologists, landscape managers and engineers.

A9.1 WIDENING INTO WOODLAND



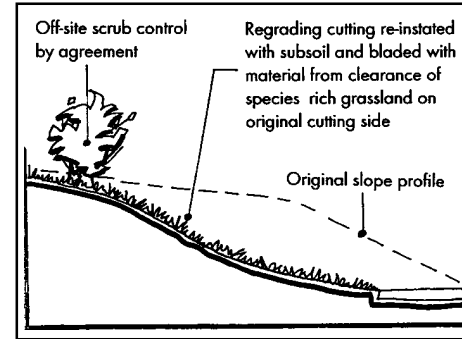
A9.2 WIDENING INTO HEATHLAND



Some forms of heathland, particularly good quality lowland heath are scarce of such high nature conservation interest that avoidance must be a major consideration in widening options.

Where widening is proposed in areas of sandy soil and degraded heathland new wildlife habitats can be created, making a genuine contribution to the nature conservation of the scheme.

A9.3 WIDENING INTO GRASSLAND

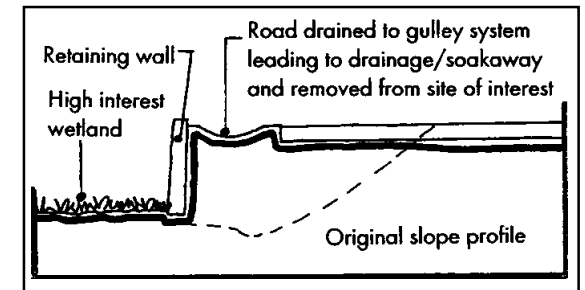


With existing knowledge and techniques it is very difficult to transplant grassland of significant nature conservation interest.

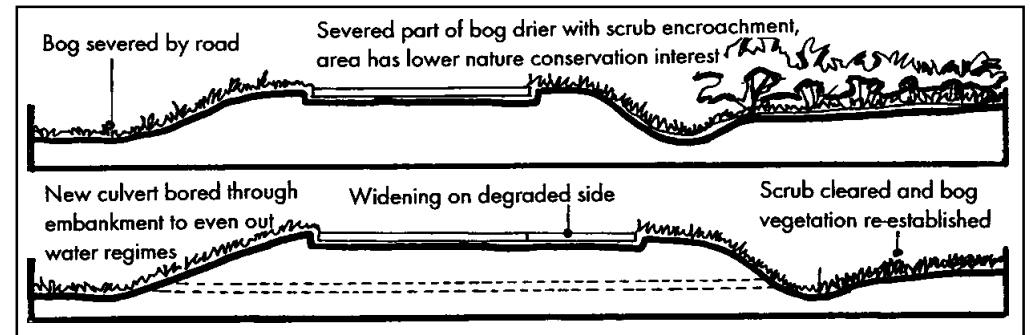
However, where widening is unavoidable, it is possible to use the grassland removed to establish grassland of some interest on the new embankment or cutting.

A9.4 WIDENING INTO WETLAND

In situations where the restoration of wetlands and establishment of wetland habitats cannot be achieved the designer should where possible minimise the land take, restore the water regime to be more favourable to adjacent wetlands and provide measures which filter the run-off from the road.



Minimising land take



Restoring wetland regimes

1. **Biodiversity**, the total range of the variety of life on earth or any given part of it. (Biodiversity - the U.K Action Plan, 1994).
2. **Closed spatial edge**, a spatial edge lining the widening scheme which has a vertical emphasis and is visually impermeable.
3. **Coppice**, periodic cutting back of trees to ground level, causing them to send up multiple stems from the cut stumps.
4. **Deep rooted containerised stock**, larger than normal cell grown stock approximately 1000-7000cc. as opposed to 175-300cc. Typically a deep rooted containerised tree will have a rootball approximately 200-360mm deep and 125-200mm in diameter. Plants in these sized containers are not readily available in this country but have advantages over other planting methods.
5. **Drip feed irrigation**, plants supplied with controlled amounts of water directly to the root zone from holes or simple valves in a water pipe.
6. **Environmental Statement**, a document which sets out the developer's assessment of the likely effects of a project as required by EC Directive 85/337/EEC and 97/11 as implemented by the Highways Act.
7. **Environmental stress**, environmental factors such as nutrient supply, or pollution levels which can cause plants to exhibit signs of restricted growth, disease or even lead to death.
8. **Habitat**, often complex natural communities of native plants and animals which can take hundreds of years to develop and become stable. Simplified imitations can be created but these may be described as naturalistic communities.
9. **Layered spatial edge**, this forms a more subtle, less intimidating sense of enclosure created through the use of layers of vegetation which get steadily higher with distance from the observer. So in the foreground there may be groundcover plants rising to tall shrub or tree growth in the background.
10. **Mass planting**, this is a method of planting using large numbers of plants at relatively close spacing either as single species or mixed species blocks to create an almost instant effect or ensure the success of a scheme under difficult site conditions.
11. **Performance indicator**, this is a method either written or graphical by which designers can communicate their design intentions to managers based on predicted plant growth and structure at regular intervals of 5, 10, 15 years and beyond. These are useful tools in ensuring management continuity beyond the usual project maintenance period.
12. **Pioneer species**, plant species which are the first to colonise. These species are often able to tolerate poor growing conditions.
13. **Porous spatial edge**, this is a physically incomplete edge allowing filtered views, or a perceptibly incomplete edge where a physical structure such as an environmental barrier is fronted by an open structure of trees and shrubs.
14. **'Semi-hard' facing**, facing systems to strengthen earthworks which do not rely on vegetation to bind and protect the soils, as well as being visually appropriate to the location and robust for the purpose.
15. **Structures**, a physical construction designed to facilitate widening through the stabilisation or retaining of earth on cuttings or embankments and the mitigation of adverse impacts resulting from the widening.
16. **Sustainable development**, the central premise of this philosophy is "not sacrificing tomorrow's prospects for a largely illusory gain today" (This Common Inheritance, 1990). That is that the earth has a finite supply of certain resources which are non-renewable and should not be squandered for short term gain at the expense of future generations.
17. **Vegetation**, in the context of this report vegetation refers to grass swards, and tree and shrub planting.
18. **Vernacular styles**, direct and unselfconscious translation into physical form of culture which is expressed in its building forms. Historically these styles were often unique to an area or region.
19. **Visual impact**, a visual change, which may be adverse, beneficial or both, is brought about in the existing landscape as a result of 'development'.
20. **Windthrow damage**, often caused by the wind on existing mature trees within a woodland when nearby trees which provide shelter are removed.

2. ENQUIRIES

All technical enquiries or comments on this Advice Note should be sent in writing as appropriate to:

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