

6 Highway Green Infrastructure

Design considerations for providing suitable landscaping proposals within road corridors and new developments.

6.0 Introduction

Highway Green Infrastructure (HGI) comprises the network of trees, hedges, ditches, verges, and native and ornamental planting within road corridors. The provision of HGI in and around urban areas is now widely recognised as contributing towards creating better places for local residents, commuters and visitors as well as wildlife. There are numerous benefits; from mitigating surface water run-off and flooding, improving air quality, cooling the urban environment, improving local economy, encouraging walking and cycling, to enhancing biodiversity and ecological resilience. Therefore, HGI should be considered an essential component of good planning, particularly in the face of climate change. This is strengthened by The National Planning Policy Framework for good design.

This chapter covers the information an applicant will need to provide for new development; surveys of existing vegetation and other landscape features; the protection of areas (e.g. Conservation Areas, Areas of Outstanding Natural Beauty (AONBs), Local Natural Reserves, etc.), habitats, species, hedgerows and or trees (e.g. Tree Preservation Orders, 'important' hedgerows, etc.); planting strategies for both rural and urban settings, and future maintenance.

Please note that an application cannot be processed until all the relevant information has been provided. Allow sufficient time for the proposed scheme to receive the necessary technical approvals. Early consultation with Warwickshire County Council highwayconsultation@warwickshire.gov.uk (as the Technical Approval Authority) is recommended

6.1 Planning Considerations for New Developments

Both existing and proposed HGI should form the fundamental basis of environmental design to create resilient, liveable and economically sustainable development for the future. The following should be considered as part of the design process:

Landscape Character

The [Warwickshire Landscape Guidelines](#)¹ map and describe the special characteristics of each of the County's seven landscape character areas (Arden, Avon Valley, Feldon, Cotswolds, Dunsmore, High Cross Plateau and Mease Lowlands). The Guidelines should be referred to for an understanding of local landscape character, its distinctiveness, general development guidelines and indigenous species.

The wider landscape provides a setting for day-to-day activities for living, working and recreational pursuits. Incorporating existing landscape features within a new development helps to more readily tie the development in with its immediate surroundings. It is the combination of landscape features that make up the local landscape character and give it its value and sense of place. All development proposals should reflect this distinctiveness and not be detrimental to the character or value of a particular area. Landscape features can also form part of green corridors, helping to promote species diversity, and they may be surviving historic references.

Planning restrictions

The 1990 Town and Country Planning Act states that trees are a material consideration in planning law. The Act also makes provision for Tree Preservation Orders (TPOs) to be placed on trees, groups of trees and woodlands that are considered to be of high public amenity. This status serves to protect them for the enjoyment of the public.

All WCC trees (those on WCC owned sites and those growing within highway land maintainable at public expense) are currently protected by virtue of being managed by WCC arboriculturalists and therefore considered, in law, to be under good arboricultural management and, as such, not generally requiring the protection of Tree Preservation Orders.

Trees within Conservation Areas are also protected by provisions set out in the Town and Country Planning Act.

A Forestry Commission Felling Licence (refer to the 1967 Forestry Act) may be required for any larger scale tree removal work.

Consider the protection of areas (e.g. Conservation Areas, Areas of Outstanding Natural Beauty (AONBs), SSSIs, Local Nature Reserves, etc.), habitats, species, hedgerows (The Hedgerows Regulations 1997) and trees. For example, ancient and veteran trees now have greater protection under the guidelines set out in the revised National Planning Policy Framework². They can only be removed for 'exceptional reasons' and where a suitable compensation strategy exists.

6.2 Design Constraints

There will be design constraints for any scheme. In the first instance safeguard existing trees and vegetation as well as any other landscape features on or adjacent to the site; a new development should reflect an area's function, history and culture. Consider the layout in relation to adjoining buildings, streets and spaces; the topography; the general pattern of building heights in the area; and views, vistas and landmarks within and outside of the development site.

Service runs, drains, underground utility apparatus and overhead cables

Where drains are proposed close to trees, consider root-intrusion resistant pipe technology, (e.g. welded polyethylene pipes), particularly in green field developments to prevent future root ingress into pipe joints. The use of root barriers, root directors or cellular confinement systems may also be appropriate.

In order to prevent damage or interference with underground services only shrubs, ground cover and small tree species should be proposed within dedicated service strips or margins. It may be necessary to consider alternative routes for services where conflicts are apparent, and in which case the agreement of the service providers must be obtained.

Position overhead services so that they will not conflict with tree positions. Equally, do not plant trees where they will conflict with existing overhead power lines or cables. In new developments, early consultation and cooperation between the developer and the service provider is essential, and proposed service routes should be coordinated with the landscape design proposals. Underground apparatus should be ducted or otherwise protected at the time of construction to enable trees to be planted nearby without conflict. Wherever possible, common service trenches should be specified to minimize the land take associated with underground services and to facilitate future maintenance.

Footpaths, cycleways and structures

Consideration must always be given to the particular risks to users of the highway that could result from the inappropriate species selection and poor positioning of trees and shrubs. Similarly, where certain species of existing trees or shrubs are retained within new highways, account must be taken of any leaf or other litter they may produce and the effects this may have with regard to footways or cycleways.

Some species of trees and shrubs, when planted in certain soil types, are more likely than others to cause damage to adjacent paving, buildings and structures. Wherever there is a risk of this happening root deflectors or other appropriate

protection must be provided. Where trees and shrubs are included within a development it is essential that nearby structures, and the foundations of these, are built to a sufficient specification to withstand the potential damage that could be caused by roots, either directly or indirectly.

Refer to the British Standard guidelines (BS5837:2012 'Trees in relation to design, demolition and construction – Recommendations'³ relating to trees, buildings and soil types and the recommendations of the National House Builders Council (see NHBC Standards, Chapter 4.2 Building near trees, or subsequent revision) with regard to foundation depth and design when building in the proximity of trees and shrubs when on shrinkable soils.

Visibility splays

Where it is proposed to include landscaping within visibility splays at road and access junctions, driveways and around bends then, normally, this should be either a grass verge or ground cover planting. If a tree is situated within a proposed visibility splay then options should be considered for the access to be repositioned. Evidence of this option appraisal will be required during technical review. However, in some circumstances it may be acceptable to allow trees to be planted or retained within visibility splays, provided they constitute no more than a momentary interruption to driver visibility. Therefore, where landscaping proposals require trees within visibility splays, particular regard must be given to their exact positioning, their form, and dimensions at or approaching maturity. As a general rule smaller diameter trees in long splays will be less likely to cause problems than larger diameter trees in short splays. All proposals which contain trees within splays will need to satisfy a formal Safety Audit.

Street lighting

Please refer to the following extracts from British Standard BS5489-1:2013 'Code of practice for the design of road lighting - Lighting of roads and public amenity areas with regard to highway trees'⁴:

"The design and siting of road lighting and other road equipment can make a great difference to the street scene, even though this might not be consciously appreciated. In situations such as a processional way or monumental bridge, the design and placing of lighting columns can make a positive formal contribution to the scene. In such cases, the siting should be carefully related to the architectural or landscape setting. More usually, however, buildings, trees, paved surfaces, grass and people provide all the interest required, and road lighting equipment should be made as unobtrusive as possible. The designer should consult the client to determine whether there are opportunities to reduce street clutter."

"Lighting columns when first installed should be sited so as not to require substantial cutting back of trees, taking into account the fully mature spread of the tree."

"In tree-lined roads, lower mounting heights than usual may be used to bring luminaires below the tree canopy. In new streets where trees are to be planted, the lighting should be designed in consultation with the landscape architects and/or by taking into account the landscaping plan or the tree schedule."

"Careful siting of trees and luminaires can help to minimize interference with the performance and operation of the lighting by the foliage. Lighting columns in the vicinity of trees should be sited so as to minimize issues such as:

- incorrect photocell operation;*
- impaired maintenance access;*
- damage to luminaire, column, foundation and electrical cables".*

"The lighting at night of parks, gardens and landscaped areas can change what would otherwise be a dark zone into an attractive amenity that enhances the environment and encourages use as a source of pleasure in comparative safety and security."

"With the availability of a wide variety of luminaires and coloured light sources, the opportunity to create a visual night scene by the subtle use of illumination on foliage and features can produce a dramatic impact. Variation of light, shadow and silhouette can offer a pleasing effect that changes with the direction of view, inviting visitors to enjoy the ever-changing shape of their surroundings. Although there has to be an interrelationship for the lighting of flora, features and forms to produce an artistic composition, the specific illumination of foliage can give a spectacular effect. This can be carried out by using projector floodlights remotely positioned to create an effective background if viewed from a distance. If adjacent to trees with descending branches, floodlights can be placed underneath or within the trees", (emphasis added).

"Lighting in landscaped areas should be designed in consultation with the landscape architect and/or the arboriculturalist. Lighting column positions should include potential growth of trees and account for summer foliage."

It is therefore advisable to provide WCC with drawings showing both the positions of proposed street lights and proposed trees, so advice can be given and decisions made in view of the requirement for technical approval from both WCC Street Lighting and WCC arboriculturalists.

The approval of all landscaping within areas proposed for highway adoption (S38) will be required from WCC Arboricultural Area Managers at the Technical Approval stage. Their formal approval will also be required at adoption stage.

6.3 Existing trees outside of the development

As trees are a material consideration in planning law, it is a planning requirement to provide a tree survey and report for all developments that have the potential to affect any trees on the site or adjacent to it. If a landscape scheme is relevant to the development then landscaping details should be submitted to an acceptable scale and accurately plotted. This should cover both hard and soft elements and include existing landscape features that are proposed for retention.

It is important to consider the area immediately beyond the defined development boundary in terms of existing trees and the landscape setting. This helps to gain an understanding of the extent of the wider landscape that may be affected by the proposals. Tree surveys should be prepared by a suitable professional in accordance with the British Standard 'BS5837:2012 Trees in relation to design, demolition and construction - Recommendations' (or subsequent revisions). The tree report should include a detailed survey, impact and mitigation proposals, and should cover all trees on the development site, any adjacent to the site where there is any potential for the development to affect them.

Care should be given when planning roads adjacent to existing trees outside the curtilage of the proposed development. Proposed highways must be located at an adequate distance away from the site boundary to avoid developing within the Root Protection Area (RPA) and overhanging canopies of existing trees both within and outside the curtilage of the development.

6.4 Existing trees and hedges within the curtilage of the development

Where there are existing landscape features present and where trees are being considered for adoption the following will apply:

All tree surveys should be in accordance with British Standard BS5837:2012 'Trees in relation to design, demolition and construction – Recommendations' (or subsequent revisions of this). These should note any trees which are protected by a Tree Preservation Order or are within a Conservation Area.

Where buildings are proposed within the shade of a tree there may be a requirement for a tree shade evaluation to be provided, or to follow other guidance / good practice. The shade of trees must be fully considered in the siting of recreational areas such as gardens. The same applies to the positioning of windows in buildings to minimise future conflict that could lead to the tree becoming a target for pruning or even removal.

Where trees are to be retained they will need to be detailed within the tree report with appropriate protection measures. Submission of plans clearly defining these protection measures is encouraged as part of a planning application. This helps to avoid the need for conditions and their subsequent discharge.

Where the Highway Authority agrees to the removal of highway trees, hedges or shrubs the applicant must pay an agreed sum for the loss of these assets and for the necessary replacement / new planting. A nationally recognised system for assessing the monetary value of these will be used to determine this. A monetary sum that covers the loss and the necessary mitigation planting will be required prior to any tree, hedge or shrub removal works commencing.

The Highway Authority will seek compensation from all organisations / individuals responsible for any damage or removal of Council owned trees.

6.5 Landscape and Visual Impact

All major developments will require a detailed landscape and visual impact assessment. Applicants are advised to follow the methodology set out in the most recent edition of the Guidelines for Landscape and Visual Impact Assessment (GLVIA)⁵. The GLVIA is the industry standard and presents detailed advice on the process of assessing the landscape and visual effects of development and their significance. It also covers cumulative effects; the combined effects of a proposed development in proximity to other significant developments.

Landscape sensitivity is of equal importance. Understanding the character, quality and value of the landscape determines the sensitivity of that landscape to accommodate change through development. There are several published Landscape Sensitivity studies, (for Rugby, Stratford and Warwick District), providing robust evidence for local plans that have been tried and tested at Public Inquiry.

The landscape assessment should guide the design for the new development and identify appropriate mitigation measures. Mitigation will be required to address any adverse visual and landscape character impacts that are identified.

It is essential that you ask a chartered landscape architect for professional advice on all landscaping matters relating to new development.

For all applications that include existing trees and hedgerows and require additional landscape works an applicant will need to provide landscape details, to an acceptable scale, which cover both hard and soft elements:-

- Existing landscape features such as trees, hedges and ponds to be retained or removed need to be accurately plotted;
- Planting plans should include a schedule of plants noting species, plant sizes and proposed numbers/densities;
- Specifications should include all operations associated with tree, plant and grass establishment and long term management;
- Proposed plans should indicate existing and proposed finished levels (to include details of grading and contouring of earthworks, the relationship of proposed mounding to existing vegetation and surrounding landform);
- The means of accommodating change in level (e.g. steps, retaining walls, ramps);
- Hard surfacing materials - details of manufacturer, type, design, colour and bonding pattern where appropriate. Samples may be required to be submitted and approved;
- Historic landscape features to be retained, removed or restored.
- Sustainable Urban Drainage features, (SuDS), and
- Street lighting.

6.6 Ecology and Archaeology

A biodiversity survey and summary report must be provided where a proposed development has the potential to significantly impact on biodiversity.

6.6.2 Where existing hedgerows are affected by a proposed development then the applicant must be mindful of legislation relating to the protection of these under the Wildlife and Countryside Act 1981⁶. A hedgerow is protected if it contains species in part I of Schedule 1; Schedule 5; or Schedule 8 or various other defined species including certain Red Data Book species. The Hedgerows Regulations (1997)⁷ a guide to the law and good practice, published by the Department of the Environment also protect countryside hedgerows. A countryside hedgerow is protected if it meets the following criteria for: length,

location and 'importance'. Please refer to the Government website for further details <https://www.gov.uk/guidance/countryside-hedgerows-regulation-and-management>.

Refer also to British Standard BS8596:2015 'Surveying for bats in trees and woodland guide'⁸. Hedges, trees and shrubs should not be removed in the bird nesting season without an ecological survey having been undertaken immediately prior to the works. The loss of nesting birds and their young can lead to a prosecution by the police. Contact WCC's Ecology team for further information and advice.

An 'important' hedgerow may include associated features such as banks or walls; ditches; gaps; standard trees or ground flora woodland species (as defined in Schedule 2 of the 1997 Regulations). Connectivity to other existing features should also be taken into account, particularly, parallel hedgerows, broad-leaved woodlands or ponds.

Appropriate buffer strips will need to be provided in order to protect existing hedgerows and their associated habitats.

Highway verges and the wider 'soft estate' both have implications for conservation and biodiversity. Specialist advice should be sought on the management of these areas to achieve the correct balance between safety, amenity and nature conservation. Where landscape management plans, biodiversity action plans, or environmental databases exist they should be consulted before any work is carried out.

Trees and hedgerows may also have landscape and historic value, for example, old orchard sites. Refer to the Warwickshire Landscape Guidelines and the County's Historic Landscape Characterisation⁹. Contact WCC's Historic Environment team for further information and advice.

Discuss your proposal to remove a hedgerow with WCC's archaeology and ecology teams first to make sure it's legal to do so. You must apply in writing before you remove it. Find out what restrictions there may be for trimming, cutting, coppicing or laying a hedgerow before you start work.

6.7 Highway Green Infrastructure Planting Strategies

Consider a range of planting in addition to tree planting. The benefits of Green Infrastructure are discussed in section 6.12.

Before preparing detailed planting and grass / wildflower seeding strategies consider the type of vegetation and species' composition that will be appropriate to the landscape setting, provision of nature conservation benefits, driver and pedestrian interest.

Take into account the topography of the site and its surroundings. For example, screen planting on relatively flat landscapes can be difficult to blend in with existing landscape features as these landscapes often have very little vegetation cover. In this instance concentrate new planting around existing tree groups and within and around the development area. Using vegetation of variable heights and intermittent planting will also help to maintain views. Planting native trees in groups will help to reinstate parkland landscapes or in providing a broken edge to an area of woodland to complement local character.

Incorporate into the design safe routes for pedestrians, cyclists and public transport users. National standards including 'Manual for Streets' ¹⁰, advocates the creation of a clear and well-connected street network, well defined public and private spaces, and streets that can be used in safety by a wide range of people. Consider an individual's perception of safety along these new routes. See Sections 2 & 3 for appropriate guidance relating to safe routes for non-motorised users.

6.8 Designing for New Trees

All new tree planting proposals are an essential consideration in the layout, design, and future use of a development site, the local landscape character and the contextual surroundings. As trees generally form the dominant elements of the long-term landscape structure of a site, careful consideration needs to be given to their ultimate height, spread, form, habit, colour, density of foliage and future maintenance requirements, in relation to both the built form of the new development and retained landscape features. Trees, either individually or as formal or informal groups, perform a variety of roles that can be maximised by a well-designed landscape. These include:-

- a) Contribution to green infrastructure (HGI) networks, (WCC consider this to be of particular importance in urban areas);
- b) The inherent aesthetic attractiveness of trees as prominent landscape features;
- c) Screening of undesirable views and provision of privacy;
- d) Articulation and definition of spaces;
- e) Definition and direction of routes and views;
- f) Introduction of natural character and seasonal change that can relieve / complement artificial environments;
- g) Reflection of local landscape character, providing a 'sense of place', sometimes as significant landmarks;
- h) Control of soil erosion, attenuation of surface water run-off and mitigation of flood risk, through root system reinforcement and canopy interception of precipitation;
- i) A reduction in heating / cooling costs;

- j) Improved physical health and mental wellbeing, and
- k) Pollution reduction.



Many of these factors can provide a significant enhancement to the value of property. This is reflected in research carried out by CABI in '*Does money grow on trees?*' (CABI, 2005),¹¹ and in anecdotal evidence of high property values in urban areas where trees are prevalent.

The purpose of any proposed planting should be understood from the start of the design process so that long-term landscape objectives inform decisions regarding appropriate locations and species. Advice on detailed design and how this would integrate within a proposed development should be sought from a landscape architect and an arboriculturist or other competent person.

Large stature trees often form an important part of the landscape and open space network of a settlement. Such trees can often be located to advantage at the end of a vista, within village greens and along the street itself. The most suitable location will depend on the character of the settlement and the specific circumstances.

When considering new developments, Developers are encouraged to involve landscape consultants at an early stage in the design process to help determine if there are any major issues (topographic, access, services, drainage, etc.). As the design evolves allied disciplines start to investigate and develop their own design with greater detail.



6.9 Tree Species Selection

The Warwickshire Landscapes Guidelines provide species lists for tree and shrub species common and characteristic for each of the seven regional character areas across the county. All suggested plants form the basis for native planting schemes (with the exception of the common ash tree, *Fraxinus excelsior*, which cannot be planted at the time of writing and until further notice). The Guidelines set out the distinctive characteristics for each of these character areas and provide advice and specific guidance about the individual local landscape types and how acceptable and successful landscaping schemes can be best developed.

Cultivars are not appropriate in rural settings whilst fastigiated trees have some merits they should not be specified along wider highways where there is room for trees with more stature.

The 'Application of Biosecurity in Arboriculture' Guidance Note 2 (published 2018)¹² provides information on how to help prevent a pest or pathogen (e.g. bacteria or fungi) outbreak which could result in the accelerated mortality and loss of large numbers of trees. Guidance Note 2 is free to download as an eBook.



Unfortunately tree pests and diseases can be transported between or within countries via a number of pathways, including:-

- [live plant and tree products](#), such as potted plants;
- timber and wood packaging materials such as shipping crates and pallets;
- tools, equipment, machinery and vehicles, such as chainsaws, boots and all-terrain vehicles;
- soil and organic material, such as leaf litter, and
- natural methods, such as wind and water.

In this context the origin and provenance of planting stock is of increasing importance. Wherever possible planting stock should be grown from UK seed collections and grown on in UK nurseries. Sourcing planting stock of local provenance is always preferable for native species.

Over the last twenty years there has been a significant rise in the number of non-native tree pests and diseases being introduced to the United Kingdom. Therefore, it is good practice to implement appropriate biosecurity measures.

Section 14 of the 1981 Wildlife & Countryside Act prohibits the release of any non-native plant species that are specifically listed in Schedule 9 Part 1. This is to prevent the planting or otherwise cause to grow of invasive species which have become established in the wild and continue to pose a threat to natural fauna and flora.

'The Urban Tree Manual', (Produced for Defra by the Forestry Commission, England, Forest Research, Animal and Plant Agency, University of Birmingham and Royal Horticultural Society, 2018)¹³, provides advice on the selection and procurement of trees for urban areas and Tree and Design Action Group's 'Tree Species Selection for Specifiers', (published 2019)¹⁴, provides tree species selection for HGI.

Although there is an abundance of published guidance available on the selection of ornamental tree species, there is an important role to be played by the experience, intuition and vision of individual specifiers for projects as no single document will have all the answers. It is recommended that WCC's landscape architects and arboricultural officers are presented with a list of proposed species and associated plans at an early stage of the development.

Trees planted close to the highway

Selected species should not cause conflict with the highway apparatus mentioned throughout this document. The following parameters are recommended:

Canopy clearance

Height clearances of 2.4 metres over footpaths, 3.5 metres over cycleways and 5.2 metres over the carriageway will ultimately be required. Prune back lateral branches or crown lift a tree as it matures.

Fig 6a. Required Canopy clearances

	Footpath/Footway	Cycleway	Carriageway
Canopy Clearance Required	2.4m	3.5m	5.2m

Species diversity

Species diversity is vital to provide the highway tree stock within rural settings with some resilience to pests, diseases and changes in the climate (see 'Application of Biosecurity in Arboriculture' Guidance Note 2, published 2018). Include species from at least two or three different genera in planting specifications and follow the preferred 10-20-30 model (Source: Tree Health Resilience Strategy, Defra, 2018):-

No more than:

- 10% of the tree stock in the area being of one species;
- 20% of the tree stock in the area being of one genus, and
- 30% of the tree stock in the area being of one family.

Note that there are always exceptions to the rule, particularly in urban settings for example in the design of formal avenues and tree lined streets.

Planting in the verge

Where proposals include trees to be planted in verges, whether between a footway and carriageway or adjacent to a carriageway where no footway is provided, then the verges must be of adequate width to accommodate the trees at maturity.

6.10 Ornamental Planting within the Urban Environment

There are some situations where a distinctive road corridor landscape, or the use of non-native species, is appropriate because it provides a sense of place and can signal the change from rural to urban environments, examples include:-

- Planting along the roadside edge to help to break up the scale of the built environment and to focus views on buildings of interest.
- Planting an avenue of trees along a road corridor to create a distinctive character which may enhance the setting of historic landscapes.
- Bold planting using robust ornamental species, tolerant of roadside conditions, where roads pass through urban areas. Planting on roundabouts to signal a change from rural to urban areas and to provide local landmarks. In some instances private local sponsorship can be secured for landscape planting and maintenance, especially at prestigious locations such as roundabouts.
- Avoiding block planting of thorny species as these can trap litter.



Examples of ornamental planting include:-

Green walls

Green walls generally involve the use of climbing plants to create a living cladding system. The principal types are:-

- Climbing wall plants – these can be grown directly against a wall or trained against a trellis or steel cables. Commonly used species for wall-greening are ivy, Russian-vine and Virginia-creeper. These systems are usually irrigated but can survive without irrigation if rooted in the ground.
- Hydroponic green walls – these systems are usually constructed from plastic mesh, geotextiles, horticultural mineral wool or a combination of materials fixed to supporting frames. Plants are grown without substrate or soil and rely on nutrients added to irrigation water.
- Modular green walls – these are usually manufactured from purpose made HDPE modules containing cells which are filled with growing medium and planted. Modules are fixed to a wall or frame.

All green walls should be regularly maintained to ensure that irrigation systems are working and the growing medium does not dry out. If the walls are maintainable by WCC a commuted sum will be payable. It is likely that each wall is unique and would therefore qualify as a non-standard commuted sum. (See Annex 10.1)



Ornamental Flowering turf

Ornamental flowering turf is a cost effective method of establishing a high impact floral display which then matures and develops year on year. The displays tend to be stunning, rich in nectar, attracting a range of wildlife. The flowers are not wild but comprise a selection of annuals that will provide a succession of interest from June to October, so they will need good, fertile soil. The flowering turf can also be established from seed.

6.11 Native Planting within the Urban Environment

Examples of native planting include:-

Wildflower verges

The specification and sowing of wildflower seed is a simple yet effective way of enhancing habitats for biodiversity, particularly invertebrates. This can be incorporated into most schemes where verge excavation occurs. However, it is important to establish which flora species are appropriate to the location. WCC's Ecology team can specify appropriate seed mixes on request. Sub-soils should be used for wildflower planting and/or sowing to counteract nitrogen deposition that occurs alongside roads (topsoil contains seeds of more vigorous competing grasses, thistles, docks and rushes). Flower swards need to be managed usually by a single cut after flowering.



Wildflower meadows

Consider wildflower meadows which can provide a floral display for many months as an alternative to amenity grass areas. Choose plants that are appropriate to the site – there are wildflowers for every aspect and every kind of soil/ pH. Try to source wildflower seeds that are common and characteristic to the local area to help boost local populations. Details of native wildflowers can be found using the National Biodiversity Network's database¹⁶. However, not all wildflowers listed on the database are commercially available.

Obtain seed of British origin from an approved supplier who can make up the required mix. Garden 'wildflower' seed mixes and/or plants (which may contain non-natives or be of unknown provenance) must not be sown in the wider countryside or close to environmentally sensitive areas.

Perennial wildflowers prefer a poorer soil than annuals, if the topsoil is very fertile it may need to be removed before sowing. Try to find a use for the removed topsoil locally, to fill raised beds, or create a new planting area.

Hedges

Hedges need to be planted and managed in a way that reflects the local landscape character. Species composition should mimic that of existing hedges in the vicinity (refer to the Warwickshire Landscapes Guidelines for planting of

appropriate native species). Hedgerow trees are being lost gradually in many parts of the county and roadside hedges offer an opportunity to provide replacements and enhance landscape character as a result.

Plant hedges in double staggered rows using transplants. If hedgerow trees are included in the mix they must be clearly indicated by marker stakes, so that they are not cut accidentally during hedge trimming. It may be advisable to offset the trees from the hedges.



Hedgerows need to be managed sensitively to maintain their biodiversity value and to maintain their effectiveness as a stock proof barrier. Hedgerows bordering the highway may be eligible for or already included within an agri-environment management scheme (wildlife-friendly management that helps to support biodiversity, enhance the landscape, and improve the quality of water, air and soil on farmland).

There are exemptions to the 1997 Hedgerow Regulations, i.e. hedges that form the boundary or curtilage of a dwelling. TPOs can apply to individual trees, groups, areas of trees or whole woods and hedgerow trees.

Green bridges

Green bridges are landscape bridges or wildlife overpasses planted with a variety of local trees or shrubs and other vegetation. The 2015 report: "*Green Bridges – a literature review*" for Natural England suggests that green bridges could become an important part of the sustainability of future transport projects.

Green bridges can be constructed to: - create safe crossing points for wildlife as well as people; join up habitats and connect colonies; offer potential homes for wildlife; benefit pollinators, and help to integrate roads into the surrounding landscape. Although green bridges are common in Europe and North America only a few have been built in the UK. Examples include the preservation of a historic drive to a castle, the continuity of an area of landscape parkland, and the use of recycled rainwater to maintain the water content of surrounding soils.

6.12 Green Infrastructure and Urban Air Quality

Highway Green infrastructure (HGI) can influence pollution dispersal and deposition. Trees, shrubs, hedges, green walls and roofs, with their differing heights, can help to create a rough surface creating turbulence that increases mixing and pollutant dispersion leading to locally cleaner air. Using planting to help mitigate urban air pollution requires a context-sensitive approach; consider the location of the source of the pollutants to be removed, and the characteristics of the surrounding built form (i.e. street height-to-width ratio). In open road conditions, thick, dense and tall vegetation barriers can help to restrict vehicle emissions from reaching roadsides in high concentrations where people walk, cycle or live nearby. In dense urban environments with no in-canyon pollution sources (e.g. a pedestrianised street), trees can produce “filtered” avenues, in which air is cleaner than on the regional scale. Likewise, in a low density context where the building arrangement will not cause a canyon effect, trees can remove air pollutants, especially particulate matter.

It is widely recognised that air quality is significantly compromised due to increased energy consumption and traffic-induced emissions. Therefore consider the amount and connectivity of HGI when developing urban green infrastructure to promote biodiversity. Build in flexibility to future management plans to accommodate changing needs of HGI features.

For suggested further reading and case studies refer to *Local Green Infrastructure Helping communities make the most of their landscape*, (Landscape Institute, (2011))¹⁷.

6.13 New Planting

A soil survey should be conducted before planning or designing any new landscaping and remedial works undertaken to treat poor ground conditions. It is recommended a waste of because failed planting schemes due to poorly-prepared soils will need to be re-designed and planted.

Assess the condition and extent of the soil below ground. During construction activities surrounding soils can become damaged by compaction and contamination. Compacted soil becomes starved of oxygen which is essential to the survival of plant roots. Compaction can be improved by deep ripping or cultivation (or both) allowing oxygen to penetrate the soil and improving drainage. Remove any soil that is badly contaminated from the site and replace it with fresh topsoil. Apply organic surface mulches, such as pulverised bark, to a planting area to help retain soil moisture, suppress weed growth and encourage the colonisation of soil organisms (mycorrhizae) which are beneficial to plant roots.

Prepare a suitable area for planting and carefully handle plants so they arrive at the site in good condition. The plants should be planted at the same level on the stem as they were when they were in the nursery. All roots should be covered with friable (crumbly) topsoil, firmed so the plants stand upright. Large stock, such as standard trees, should initially be supported with stakes and ties. Any hard surfaces close to planting areas should be designed to withstand roots developing and expanding. Consider using root barriers around trees which help to deflect root development downwards and away from vulnerable surfaces.

HGI and gardens can soak up rain, unlike paving, tarmac and concrete areas which are less porous and increase the amount of rainwater that runs off by as much as 50 percent. This additional water usually flows into highway drains which would need to be designed to cope with the expected run-off otherwise this will lead to localised flooding. Therefore use permeable paving where possible and keep hard surfaces to a minimum. Permeable hard surfaces will help to improve drainage and oxygen penetration to the soil below. A variety of materials ranging from gravel, pavers, matrix pavers, grass reinforcement and open soil can be used in tandem with a sustainable drainage system (SuDS). SuDS systems can be supported by channel drainage and oil interceptors, in order to effectively and safely manage surface water that needs to drain into surrounding water bodies. There is also an opportunity for reducing run-off by creating rain gardens.

It is critical to understand both above ground and below-ground conditions for the long term survival of existing trees and or the planting new trees in hard landscapes. Assess the need for; load bearing capacity for new or refurbished hard surfacing; below-ground services; water infiltration, and rooting space). Consider using raft, crate or structural growing media to create a good rooting environment while protecting hard surfaces from potential damage, (refer to the case studies within *Trees in Hard Landscapes – A Guide for Delivery*, (Trees & Design Action Group, 2014)¹⁸.

Refer to nationally recognised guidance on the creation of SuDS.

6.14 Provision of Load Bearing Surfaces during Construction

The construction of pedestrian routes, cycleways, extensions to existing or new buildings and the construction of temporary access roads all have a potential impact on a tree's longevity.

'No-dig' (cellular confinement systems) relate to 2 and 3 dimensional 'load spreading' materials that are used where construction is within rooting areas of existing trees for both footways and carriageways. If development is to be phased the need for any temporary or permanent accesses must be indicated / provided as part of the planning application process. All construction works have to occur above the existing ground level. Passage of all vehicles across an unprotected soil surface must be avoided, particularly where the soil is wet or is high in clay content, because there is a high risk to surface roots, soil compaction and consequently reduced soil aeration. Over-compaction can prevent oxygen reaching the roots, as well as inhibit drainage, both of which can severely limit long-term tree growth. Protect the Root Protection Area of all affected trees using appropriate fencing in accordance with BS5837:2012 (or subsequent revision).

The system the contractor proposes to use to protect trees needs to be included in the Contractor's method statements and designers should consider suitable construction methods when preparing their designs.

6.15 Permanent Load Bearing Construction

Consider both the long term effect on roots to ensure the tree's health as well as the life span of the road / access. Ensure that the tree roots beneath a cellular confinement system will be protected from vehicle loads by confining the sub-base and stabilising the ground conditions.

6.16 Maintenance Considerations

All planting must be established before it can be adopted by the local authority. Design schemes to keep long-term maintenance to a minimum. Where appropriate, a commuted sum will be required as a contribution towards future maintenance costs. (Please see Annex 6.1 and Part 10 Annex 10.1 for further details on commuted sums on Section 38 Agreements and Section 278 Agreements).

Maintenance works should meet the relevant British Standards and should always relate to the specific scheme. For example, establishing an avenue of heavy standard trees planted in a grass verge is very different to establishing a forestry plantation.

The growth of weeds in footways and cycle routes, paved verges, central reserves filter drains and along kerb lines may cause structural damage, drainage issues and the general perception that the environment is untidy. In some circumstances, weeds are considered to have implications for pedestrian safety. Weed treatment should therefore be undertaken according to traffic and pedestrian usage and at an appropriate frequency. The use of weed-killers should be the minimum compatible with the required results.

Pruning after planting should only be necessary where it is required to enhance or guide the shape of the tree. Trees proposed for pollarding should be avoided as it is costly, time consuming and unattractive. Expert advice should always be sought in the management of any tree within the highway environment, whether on highway land or not.

6.17 Adoption and Technical Approval of Highway Trees

The adoption of existing trees into a highway network can add instant benefits to a site and, if protected properly during construction, can continue to provide benefits for many years.

Where planting within private plots immediately abutting an adoptable highway is proposed, due regard must be given to the ultimate height and spread of the species at maturity. This is to avoid the risk of overhanging tree branches and shrubs projecting into the highway which could constitute an obstruction.

If the Highway Authority is to adopt an existing tree, the tree report must show the protection measures that will be taken, in order to safeguard the tree during construction. This should be submitted as a Tree Protection Plan.

It is important to involve the Highway Authority in the development of all landscape proposals which affect adoptable highways to ensure that there will be no conflicts of interest once a planning consent has been granted.

The planting of all new trees within, or directly adjacent to land that is proposed for dedication as public highway, will require technical approval by WCC Arboricultural Area Managers. The same applies for existing trees proposed for retention, including if there is a need to partially remove, prune, or undertake any ground works near to any existing highway trees to facilitate a development and/or access to it.

Following the granting of technical approval, formal approval by WCC Arboricultural Area Managers will also be required at the final adoption stage.

6.18 Suggested Further Reading

A number of documents are referenced in the text (see numbered sequence below). These and others should be considered to ensure that best practice is being applied in the development of landscape schemes:

1. Warwickshire Landscapes Guidelines - <https://www.warwickshire.gov.uk/landscapeguidelines>
2. National Planning Policy Framework (NPPF)
3. BS 5837:2012 'Trees in relation to design, demolition and construction - Recommendations'
4. BS 5489-1:2013 'Code of practice for the design of road lighting - Lighting of roads and public amenity areas with regard to highway trees'
5. Guidelines for Landscape and Visual Impact Assessment (GLVIA), 3rd Edition
6. Wildlife and Countryside Act, (1981)
7. Hedgerow Regulations, (1997)
8. BS 8596:2015 'Surveying for bats in trees and woodland guide'
9. Historic Landscape Characterisation Project - <https://www.warwickshire.gov.uk/historiclandscapecharacterisation>
10. Manual for Streets, <https://www.gov.uk/government/publications/manual-for-streets>
11. 'Does money grow on trees?' (CABE 2005) - <https://webarchive.nationalarchives.gov.uk/20110118095356/http://www.cabe.org.uk/files/does-money-grow-on-trees.pdf>
12. 'Application of Biosecurity in Arboriculture' Guidance Note 2, (2018)
13. The Urban tree Manual, (Defra publication, 2018)
14. Trees Species Selection for Specifiers, (Trees & Design Action Group), (2019)
15. National Biodiversity Network Database - <https://nbn.org.uk/>
16. Local Green Infrastructure Helping communities make the most of their landscape, (Landscape Institute, 2011) - https://www.landscapeinstitute.org/PDF/Contribute/LocalGreenInfrastructurewebversion_000.pdf
17. Trees in hard landscapes – A Guide for Delivery, (Trees & Design Action Group, 2014)

Further reading:

- Warwickshire District & Borough Design Guides
- Design Manual for Roads and Bridges, Volume 10
- BS 8545:2014 Trees: from nursery to independence in the landscape

- BS 3998:2010 Tree work. Recommendations
- BS 3936-1:1992 Nursery stock. Specification for trees and shrubs
- BS 4428:1989 'Code of practice for general landscape operations (excluding hard surfaces')
- BS 3882:2015 'Specification for topsoil'
- Trees in the Townscape: A Guide for Decision Makers (Trees & Design Action Group)
- NJUG Volume 4 Guidelines for the planning, installation and maintenance of utility apparatus in proximity to trees (National Joint Utilities Group)
- Building Near Trees – NHBC Standards Chapter 4.2 (National House Building Council)

(For undated documents, the current edition including any revisions, updates or amendments apply).