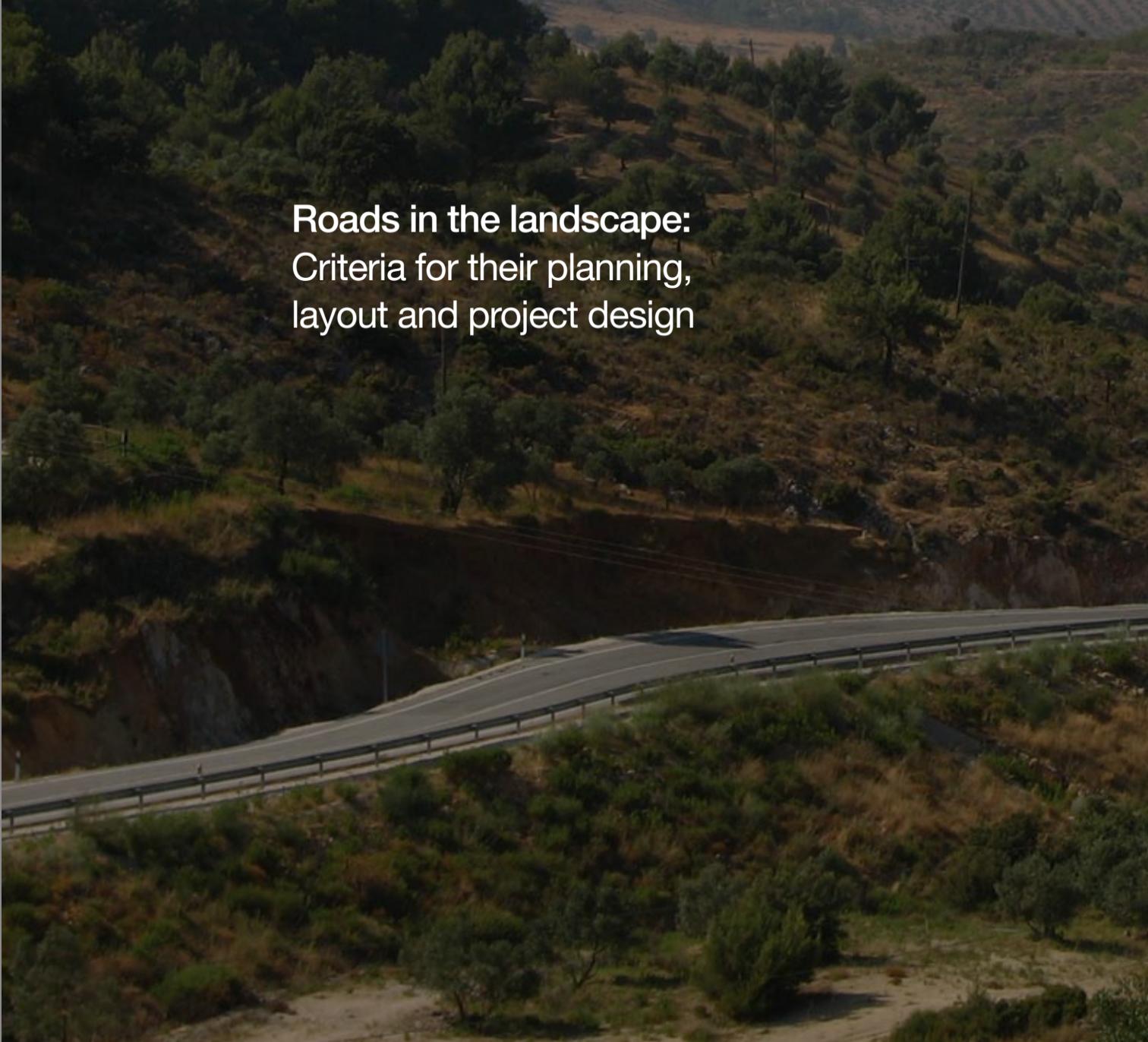


Roads in the landscape:

Criteria for their
planning, layout
and project design





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layout and project design



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The concept of sustainable development takes on a special relevance in the field of transport infrastructures. Road networks have a clear social aim. They are conceived to provide a service to society as structural elements which sustain economic growth as well as social and cultural development, they also articulate and gear those areas they serve. Nevertheless, these important road functions should not make us forget that their routes are built in environments whose character is made up of socio-cultural and natural values and these can be affected to a lesser or greater extent by their construction and use.

According to the latter point of view and following the approach taken by the European Landscape Convention (Florence 2000), priority has been taken to assume landscape awareness as a strategy to qualify infrastructures. The Andalusian Regional Government is well aware of the importance of this perspective, thus it is being implemented as a main and effective policy in its planning and daily activities.

As such, the Department of Public Works and Transport has promoted the production of these recommendations to be applied in the planning, layout and project design of roads. The essential aim is to establish criteria and guidelines to allow an efficient integration of road developments into the landscapes, taking into account the active role which roads can have in furthering public knowledge of Andalusian landscapes. Another step is taken along the line of work which had been undertaken some time ago which resulted in publications of a more general nature such as the Manual of Recommendations for the design of roads in sensitive areas.

This manual is produced therefore with the essential objective of stimulating debate and analysis on how to integrate roads into the landscape, rather than simply as a strict series of guidelines which would have to be applied unquestioningly. Each project requires its own process of reflection and finishing in relation to the territory and landscape in which it is to be developed. This manual aims to assist such a process by offering ideas and solutions which, nevertheless, must be reviewed as the specific conditions of each single case require.

A large part of the manual provides criteria by which roads can be adapted to a new functionality: furthering public knowledge and understanding of landscapes. The idea therefore is not simply to offer new ideas to prevent negative effects of roads in the landscape or to integrate them in the scene but also to allow for roads to become positive instruments to actually valorise landscapes, by providing suitable equipment and facilities to attain this objective.

A key figure in the production of this work has been Ignacio Español, an expert on this subject, Civil Engineer and advisor to the Council of Europe, who was provided with additional technical advice from the Landscape and Territory Research Centre, an organisation set up by the Department of Public Works and Transport as part of an agreement with the Andalusian Public Universities.

Luis García Garrido
Consejero de Obras Públicas y Transportes

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Developing a manual for the integration of roads into the landscape

A key process in the Anglo Saxon academic world involves the formulation of guidelines, recommendations, manuals, technical guides and reference documents which are based on the logical culmination of a process of reflection and analysis. Once a good enough collection of ideas and solid knowledge is produced on a certain aspect of reality, these becomes systematic and a series of criteria are established allowing others to easily learn and use them. This systematic intellectual advance allows new approaches and, with time, the progressive improvement of the State of the Art as a new synthesis is finally produced.

I sincerely feel that with this book the Landscape and Territory Research Centre has played a significant role in this process in terms of redefining the relationship between roads and landscape in Spain. In October 2006 the first congress on «Landscape and Infrastructures» was held in Seville. Following various presentations, and the subsequent debate, one of the sessions concluded by establishing the necessity to create a guide or manual to implement the application of the current ideas on landscape (Florence Convention, 2000) in the various significant road building projects being carried out in Andalusia.

The Department of Public Works and Transport, via its General Directorate for Roads, and the and the public agency GIASA entrusted the task to the Landscape and Territory Research Centre, and a significant part of the work has been overseen by Ignacio Español Echániz, Doctor of Civil Engineering, Senior Lecturer at the Polytechnic University of Madrid, and



expert advisor to the Council of Europe. Thanks to the significant part played by Dr. Español Echániz and his team of collaborators we are satisfied that we have been able to carry out our objectives to the best of our abilities. Having said that, it is clear that this publication is not the first technical document to study this subject, and we make no claims to it being the definitive work, because logically this would be virtually impossible. There are already various important guides and analyses concerning the relationship between road and landscape, particularly in Europe, most notably in Italy, the United Kingdom and France (these are listed in the useful reference section of this work). However, they obviously do not cover the particular peculiarities of the Spanish situation and have not been translated so they are not easy to use as reference documents; hence the present publication. This first task, which has now been completed, should now be further developed with the production of a technical manual featuring recommendations and instructions for more specific technical fields within Spain and even Andalusia.

Roads and landscape - paths and landscape in a broader historic and semantic sense - have a long, close, fruitful, and almost inseparable union. But in the western world, immersed in a false idea of progress and a vertiginous obsession with speed, this relationship has been blurred over the last decades. To stroll calmly through the landscape «at a constant and regular pace permits the traveller to reach a kind of harmony with the surrounding world»¹. This experience is essential to numerous travellers' stories books which have shown us, better than any other form of communication, how to appreciate different landscapes.

This awareness has existed throughout history and can be noticed –apart from in literature– in the multitude of different details present in tracks and roads themselves; for example in

1. Andrzej Stasiuk (2008). *De camino a Babadag, (On the road to Babadag)*, Barcelona, Ed. Acanalado.

the choice of stopping points and in the selection of places to rest – cool and shaded, or sunny and protected from the wind, depending on the circumstances, perhaps indicated by the presence of a large tree and the protection of hedgerows. This appreciation of a certain approach to the quality of public works does not only correspond to times long ago, there are also a number of road engineering works, carried out during the 20th century (the road to the Es Colomer lighthouse on the island of Mallorca, the connection between Zahara de la Sierra and the Puerto de las Palomas in the province of Cádiz, the Seville-Cádiz motorway...) which show this sensitive attitude with efficiency and elegance. It was perhaps the view brought about by that developmentalism which no longer has what contributed to what we can consider just a short period for blindness and lack of sensitivity.

It is not simply a question of denying the validity of a route or road, but to understand how to build it and integrate it into the landscape and its values in the present day whilst appreciating that expression of a sense of refinement and sensitivity which had historically been in the practice. This book establishes an order with systematic criteria, to integrate the road and the landscape environment, by defining various key points in the decision making process: the planning phase, the general concept of the project (election of types and alternatives), the gradual definition of the layout, the design of the full detailed project, and the carrying out of the works, with especial emphasis on the elements of the road which provide a specific service to landscape values. Throughout this manual special attention is paid to that interactive exchange of mutual interest in the relationship between the road and the landscape, taking the landscape into account makes for a better road. A good road should include amongst its functions a sensible enjoyment of the landscape.

Various key ideas in this process of exchange between road and landscape qualities and needs must be pointed out. Firstly, the essential priority of the general criteria of safety. The compilation of these «Criteria» has been carried out whilst taking this operational principle into full consideration, and paying attention to the specific situations of road projects and their relationship with the landscape. The criteria of safety for the user of a conventional road or motorway can be an objective whose fulfilment can help to enhance the landscape potential of a road by increasing its legibility; in another context, safety on a scenic road might mean emphasising low speed and prioritising the cyclist or the pedestrian.

Secondly, each different type of landscape requires a different kind of accessibility. In this publication, which is aimed at improving the integration of the road into the landscape, it is clear that there are some environments to which access should be restricted and others to which it should be encouraged. It is also argued that the most frequented routes, landscapes of everyday life, should be treated and enhanced.

As established in the European Landscape Convention, the definition of objectives for landscape quality is a principal aspect of landscape policies. In this respect it is not only a question of including recognised areas of value in environmental or cultural terms, but also normal everyday landscapes: regular healthy strolls along «*cholesterol paths*», and those of daily metropolitan and inter-urban commuters between the home and the place of work..

As we also clearly point out in this publication, the design criteria can rarely be generalised, and each different place where action is to be taken needs to be considered carefully adopting its own

specific approach. The relationship between road and landscape should not be based solely on the effective functioning of the road but also on the individual character of each different part of the landscape, that is on those aspects which make it exclusive, different to others and therefore unique. The majority of landscapes are similar rather than unusual, but each one is unique and individual and roads need to play their part in differentiating landscapes by providing them with distinctive elements, underlining their uniqueness, and thereby avoiding the overwhelming current tendency to convert areas into «non spaces», places which are anodyne and standardised.

Finally, and perhaps most importantly, throughout this publication the relationship between road and landscape is seen as a profound opportunity to improve the essential nature of a road project and its final implementation. The broad meaning of the concept of landscape allows us to establish a suitable connection between the road and the natural base which supports it, as well as its social appreciation in terms of the symbolic and scenic integration into the area which it crosses, the human processes which have shaped the character of each territory, and how the elements which constitute it are formulated.

We sincerely hope that this document enables the politicians, technicians and administrators who read or consult it to take decisions bearing in mind the landscape dimension of every road project, and that it will be useful in helping them to make concrete decisions, whether it is for minor works or large scale projects.

Florencio Zoido Naranjo
Director del Centro de Estudios Paisaje y Territorio



1

INTRODUCTION TO THE USE OF THIS PUBLICATION



1

INTRODUCTION TO THE USE OF THIS PUBLICATION

The essential aim of this publication is to encourage a positive attitude concerning the integration of the road into the landscape. To this aim, it begins with a revision of the landscape qualities of the road which are essential to this type of infrastructure. Their territorial and scenic nature and their essential role in allowing the movement of people make roads essential landscap projects. Nonetheless, this special characteristic of roads has still never been fully evaluated or systematized: hence the need to provide technicians, analysts and decision makers with this guide and its recommendations.

The landscape qualities of roads have to be specified if a positive technical development of the existing relationship between roads and the landscape is to be achieved. If these qualities are not examined in a systematic, positive and propositive way and are left to a well meaning

but vague discussion without a solid technical basis, the result can be counterproductive, as can be seen by various unfortunate examples from the past. What is required is a positive approach which examines and evaluates these qualities, maximising their potential and further developing them so as to avoid deterioration and possible adverse effects. This approach requires an organised, systematic, and selective analysis which focuses on the fundamental aspects, ignores those secondary and becomes part of the everyday job of management, planning and design of roads by incorporating criteria, recommendations and positive proposals.

The technical and theoretical body of knowledge concerning landscape and roads needs a solid base from which to establish attitudes and this guide aims to provide clear criteria on this issue for the management, planning and design of road projects.

1.1 General approach

The focus of this guide on landscape and roads follows the spirit of the European Landscape Convention (Florence, 2000) of the Council of Europe and in fact the content is based on the principles of the agreement following the directives outlined in the Council of Europe document *Infrastructures and landscape: Roads* (November 2006). The guide therefore adopts a positive attitude, overlooking the traditionally conflicting points of view which have characterised the relationship between the management of the landscape environment and road development and emphasising a productive understanding of the landscape aspects of roads: aspects such as the intrinsic value of the route, its aesthetics and sense of place, its integration into the environmental processes, or its physical presence in the view of the landscape are linked with traditional considerations about the visual or scenic quality of roads to establish the range of criteria and recommendations in this guide.

Following the European treaty, the landscape is considered here to be an expression of the territory, which is understood as being the perception that people have of the territory, going beyond the merely aesthetics or ornamental point of view which only takes into account its formal appearance. The perception of the landscape is important in terms of its capacity to demonstrate the reality, visible or not, of the territory, making it understood and appreciated by people so that they benefit from its knowledge and enjoyment. In this way people are made aware of its value and fragility, and can take responsibility for it.

In this context, the road is a fundamentally social infrastructure, playing a crucial role in the movement of people from one place to another, allowing them to appreciate their surroundings and encouraging a responsible understanding of the landscape. Having said that, the demands of environmental integration, the non-visual but appreciable values of the landscape, and the conditions of safety and functionality which are a necessary facet of public transport infrastructure, are all aspects which cannot be ignored.

1.2 Scope and use

The content of this publication adopts the form of criteria, recommendations and general proposals, the object of which is to highlight the potential possibilities of roads and their relationship with the landscape. It does not aim to be a technical manual with precise instructions but rather a collection of ideas which go to form general criteria and recommendations. The project, planning and management tasks are examined from an open and flexible point of view that should be handled discreetly.

Nevertheless, considerable effort has been made to create a comprehensive and coherent document wherein the essential aspects of roads are related to those of the landscape, thereby

systematizing the essential implications of the relationship between the two. The traditional way of looking at roads by examining their functionality, capacity, level of service, layout or cross section, is combined here with criteria and considerations concerning territory and landscape. The result is a solid point of reference for the resolution of the integration of the road into the landscape.

Considerable effort has been made to make the text easy to follow by incorporating a series of graphic illustrations and photographs, and real examples have been included to focus on technical aspects and recommendations. Special emphasis has been placed on the landscape aspects of road layout, positive examples of existing roads which demonstrate these ideas, criteria and recommendations have been included.

The publication is aimed at road engineers and experts of all kinds, as well as public servants, analysts, and opinion representatives who work in the field of roads. Planners, civil engineers, and other specialists working in the management of roads and road projects will find a whole range of useful recommendations, proposals and criteria which should be assumed with responsibility.

Although we would recommend that the guide is read in full, the way the content has been organised means that it is possible to dip into different chapters since each one has been conceived to a certain extent as an autonomous section. In this way it is possible to consult specific sections of the guide for information on precise aspects which may arise concerning the management of a particular road scheme. An outline of the different sections is given below. Apart from the recommendations and criteria included in the text, the presentation is completed by a series of illustrations and photographs of existing examples showing positive aspects of the relationship between roads and the landscape.

The recommendations which are presented in the different sections of the guide in their various formats, be they texts, illustrations, or photographs, should be interpreted and used with the necessary flexibility required in each different case.

1.3 Content of the publication

The content has been structured in a logical progression, beginning with the initial presentation of general concepts and ideas related to the landscape qualities of roads in the first chapters, and progressing towards concrete ideas about project design at the end of the publication. Thus, chapter 2 takes a positive look at the relationship between the road and the landscape whereas chapter 3 examines the essential concepts of a road scheme as a form of introduction to a series of recommendations concerning the role of landscape in the planning and management of roads. Chapter 4 concentrates on the layout and the cross section and proposes a series of criteria to be taken into account in the designing of layouts. Chapter 5 looks at the design of a project, examining the landscape qualities of the various different elements that make up a road. Finally, chapter 6 discusses the design of roadside areas and looks at how to design and equip them with the required landscape function.

1.3.1 Road and landscape

Chapter 2 concentrates specifically on the contents of the European Landscape Convention (Florence, 2000) in terms of road design. The emphasis lies on the important role which roads have in terms of the maintenance and appreciation of the quality of the landscape. It focuses on the innate capacity of roads to transport us through the countryside and take us to interesting

landscapes as well as their role as scenic routes in themselves through which we can appreciate the value of the landscape, even if only superficially. The road is also seen as having its own landscape character apart from its role as a public space in which various aspects of everyday life take place. This section also examines the idea of creating a sense of identity and character for road infrastructure, based on elements of design, and it looks at the possibility of incorporating specific facilities to enable us to better appreciate the landscape.

The chapter ends by discussing the necessity of integrating the road into the landscape, both in purely environmental terms and in its role as part of the scenic landscape in terms of its appreciation and character.

1.3.2 Landscape and road functionality: planning and management

Chapter 3 revises the traditional analyses of road projects which normally concentrate exclusively on traffic issues, to look at broadening the discussion and including aspects such as the necessity to co-exist with the surrounding area and ways of integrating roads more successfully into the landscape. The internal functionality of a road in terms of traffic, stability, and drainage, is compatible with developing a functionality of an external nature which focuses on how the road is integrated into the different mechanisms of the landscape, its morphology and scenic organisation, its aesthetics and composition, and its appreciation and interpretation, as well as the cultural and natural processes which are part of this landscape. A good road project is one that resolves all of these requirements at the same time in an integrated manner.

This chapter focuses on this balanced vision of road projects to introduce the question of how the landscape should be handled in the road planning process. In the first section of the chapter,

the existing relationship between the diverse aspects which govern the internal functionality of a road are discussed and analysed, essentially its service to traffic, alongside those aspects of its external functionality which are more focused on its integration into the landscape. Different road schemes are then looked at in the subsequent sections and the role of landscape in the process of development of road planning is re-evaluated in order to take a closer look at the different programmes which can go towards improving the landscape qualities of roads.

The third chapter also includes the presentation of a concrete example of a road plan: the access road to the Aljarafe as a planning scheme road in Seville. This road scheme was undertaken as a means of structuring an area which was to be urbanised, and in this sense is a positive example of how to conceive road and landscape as a single entity.

1.3.3 The layout of the road and the landscape

Chapter 4 concentrates on the layout of the road. Road projects have a special landscape quality which lies fundamentally in the qualities of their layouts. This is in terms of the territorial processes in which they participate and which they are related to through the connections and impact of their linear nature. Its layout is also essential in terms of its appearance, aesthetics, and perception because of the linear shape of the roadbed, and of course there is also the unique scenic quality which is afforded by the succession of views along its route.

After looking at various general considerations about layout and landscape, chapter 4 examines the process of definition of layout, and the creation and selection of alternatives, as an introduction to establishing distinct groups of criteria for layout depending on the landscape function of the road (presence, environmental integration, scenic integration, character, visual o

r scenic quality, value of route). It then examines the conditions which determine the presence of the road within the landscape in terms of its linearity and its earthworks. Later it looks at the question of the integration of the road in the processes of the environment. Next, it examines the relationship between the layout and integration in the scenic quality of the landscape and between the layout and the character of the landscape. The chapter also considers the development of the visual quality of the layout and the development of the landscape values of a given route.

Apart from the examples of Andalusian roads which accompany every group of criteria concerning layout and which illustrate landscape functionality (presence, environmental integration, scenic integration, character, visual or scenic quality, value of route), there is also a presentation of a real example of a road project analysed in terms of the scenic quality of its layout. This is the Avenida de Carlos III in La Cartuja (Seville) which is situated next to the flood barrier of the river on the edge of the island.

1.3.4 The landscape design of the road

The design of a road project in the landscape identifies three main areas of intervention which are examined in chapters 5 and 6. These include firstly elements which are intrinsically part of the road itself, essentially functional, which make up the inside scenery of the road, and are examined in chapter 5. In the same chapter there is also an analysis of specific road structures such as tunnels, viaducts, junctions, roundabouts and spoil sites. In chapter 6 the diverse range of spaces adjoining roads are looked at with all their different landscape functions.

The road surface and the hard shoulders, safety elements, road markings and signs, together with the visible engineering structures, slopes and banks, enclosure systems, and containing of hillsides, are the aspects which the user perceives as the essential landscape of

the road. The continuous nature of the lines and road markings in their neat and simple style are the basis of a part of the road which is devoid of meaning but functional, which often seems artificial, hard and uninhabitable.

Taking a panoramic look at the broader picture which extends beyond the limits of the road, the linear strip crosses the landscape and fluently reaches the background and follows up the vanishing points.

The typical natural features (complex, organic, and irregular forms) or those which shape the cultural identity or character of an area (traditional materials, different type of plots and constructions, agricultural areas) can be seen on the edges of the road, enclosing the structural patterns of the linear route with its new materials such as surfaces, plastic paints, concrete (for cladding and engineering structures) and metallic elements (guard rails).

The design of the road and its elements therefore involves a series of contradictory factors in terms of its functional aesthetics, and the natural identity and character of the landscape. Thus, landscape and road characteristics and requirements need to be examined in order to make the best possible use of their respective components by integrating the intrinsic functions of the road and the value of the landscape.

Chapter 5 finishes with the presentation of two examples: a road which is part of an urban scheme and another which goes through a natural park. High capacity roads in urban contexts assume the organisational function which is intrinsic to any road whilst featuring all the typical elements, and serving the existing environment or generating their own. An example of this is the Avenida de Valencia which is part of the La Florida project in El Puerto de Santa María (Cádiz), an urban road, which, thanks to its essential design, could be used as a model for roads in other contexts. Another example is the scenic A-317 road between

Cortijos Nuevos and La Ballestera (Jaén) which was adapted from a series of forest tracks and access roads incorporating elements of the road's design into the landscape itself.

1.3.5 The landscape and roadside areas

Chapter 6 concentrates on recommendations to enhance the scenic quality of a road's lateral facilities. On the side of the road there are a series of roadside service areas which have an important landscape function and positive impact. These include spaces such as rest areas, service stations, parking areas, bus stops etc. There are also lines of trees on the roadsides and numerous other elements which co-exist with the road, the function of which is to attend to the traffic by offering a variety of services.

This function does not impede their landscape potential which is based on the change they produce in the relationship between the traveller and the landscape they are passing through.

There are also other facilities which have a clearly environmentally orientated role such as viewing points, road side paths, or bicycle lanes which are recommended in terms of improving the scenic effect of the road.

Chapter 6 proposes and reviews location and design criteria for roadside areas including:

- | | |
|--------------------|---------------------------|
| I. Rest areas | vi. Landmarks of interest |
| II. Service areas | vii. View points |
| III. Parking areas | viii. Roadside paths |
| IV. Bus stops | ix. Bicycle lanes |
| v. Lines of trees | |

This chapter also includes the presentation of two real examples of scenically enhanced roads which make extensive use of roadside areas. The first case is the inter-urban A-348 road between Laujar de Andarax and Fondón (Almería), where traffic has been drastically reduced by the development of a bypass and the landscape has been enhanced with a whole range of roadside elements. The second example is the A-369 road from Ronda to Gaucín (Málaga), the design of which includes a series of roadside view points as well as a number of other features which give the road a unique character of its own.



2

ROAD AND LANDSCAPE



ROAD AND LANDSCAPE

2

The European Landscape Convention (Florence, 2000) emphasised the importance of the quality of the landscape everywhere and the necessity to improve this quality through all public initiatives. Roads play an important role in the maintenance and appreciation of the quality of the landscape. As part of the transport infrastructure they allow us to move through the territory and give us access to landscape which we can appreciate. Road journeys are valuable scenic routes in which we can enjoy landscape values. Furthermore, each road has its own distinctive scenic character which gives it a special heritage quality. Roads are also public open spaces where everyday life of the community takes place.

Thus, the construction, management and planning of roads play a fundamental role in the management of the landscape, a role which should be viewed in a positive way, going further from the traditionally limited perspectives of the conservation policies. Recently

there have been positive moves in this direction, amongst which it is worth noting the initiatives to adapt roads as scenic routes, as well as the development and application of landscape design in road schemes and the measures taken to successfully integrate roads into the environment.

This chapter sets out the arguments for the development of landscape criteria in the planning and management of roads. In order to do so it re-examines the landscape quality of roads, looking primarily at their function as a means of access to the landscape. It also looks at the intrinsic values of the itinerary visible or not. Next, perception of landscape is dealt with in terms of how it can be perceived from within a vehicle driving along a road. Furthermore it re-examines the concept of the road's intrinsic landscape, focusing on the idea of attaining a sense of identity and character for these infrastructures based on elements of their design and the possibility of developing this singular landscape functionality by incorporating specific facilities to enhance the enjoyment of the landscape.

Lastly it looks at the need to place the road in the landscape whilst considering its purely environmental integration, as well as the fact that the road is undeniably part of the landscape and plays a special role in its appreciation and character.

2.1 Roads and landscapes

The fundamental role of transport infrastructures is to move people or goods across a defined space. The layout and cross section of a road are a result of the technology which is applied to the particular conditions of an area in order to facilitate this movement. Roads allow the movements which are part of the life of the territory and as such are an essential part of its organisation, playing a clear role in the functioning of its processes



and dynamics. The expansion of the cities, certain economic and social processes, the transformation of agricultural areas, the isolation of natural areas, or the bringing together of separated socio-economic agents are just some of their territorial obligations. By participating in all these processes roads are closely linked to the cultural and natural features of a territory, and as such, to its landscape.

The linear nature of roads is an essential feature of the relationship they have with the value of the landscape. In this unique relationship, the line amature, the layout, determines the way in which the different aspects of the landscape interact with the road and its constructed elements as well as its users.

Roads offer a good, safe and rapid access to distant places, i.e., they permit access to communities and environments different to our own, and at the same time, to their landscapes. A road network which provides access to different landscapes guarantees freedom of choice to the traveller. The extensive and varied information available about different places in the media, if combined with the accessibility provided by roads, offers an improved and more complete experience of the landscape.

Secondly, the itineraries which roads follow have their own indigenous qualities, given that the roads are part of the dynamics of the landscape to which they belong, and as such, reflect

Views from the MA-5401 of La Hoya de Málaga with the Sierra de Alpujata in the background. Roads provide scenic views and access to the landscape, i.e. they introduce the visitor to the landscape and offer an invitation for more direct and involved contact once people have left their cars.

the cultural and natural processes which are part of that landscape. Along the length of a road itinerary it is possible therefore to appreciate the diversity of the different spaces covered. If the traveller is attentive it is possible to see the different geographical patterns, historical features, natural elements and many other landscape values which go to make up the territory.

Roads can thus be seen as windows through which the landscape can be appreciated by the travellers which use them.

This is a question of the scenic quality, which is the role that road infrastructures have of making visible or demonstrating the territory and landscape they cross in a particular way. These successive views and this scenic quality permit an initial visual appreciation of the landscape, which can then be enjoyed in more detail and depth once the traveller leaves the vehicle.

Fourthly, roads, like any other public spaces, have their own aesthetics which, although being essentially functional and standardised in appearance, is also unique and individual. This individual aspect of their nature reflects the collective attitudes of the community which they serve and to which they belong.

Finally, roads, as constructed objects, form an essential part of the landscape itself, with their linearity defining the nature of their presence in this context. The integration of the road into the processes of the environment is crucial in terms of sustaining landscape values such as bio-diversity, the quality of life of people, or the maintenance of the basic processes of an area. Moreover, the integration of a road into the scenic landscape and the aesthetics results of this integration are important for maintaining values such as the effect of the composition or character of the landscape.

The successful culmination of all these landscape qualities of the road can be based on the planning, management and construction processes, since, thanks to their linear

character, they are infrastructures which are very flexible in terms of their conception and design and can become part of the landscape in a way which is desired without too much effort in their planning and project.

The aim of this guide is to facilitate an acceptable integration of the road into the landscape whilst at the same time permitting the best possible development of its landscape qualities. What now follows is a more detailed presentation of the landscape qualities of roads which have been outlined in previous paragraphs.

2.2 Access to landscapes: planning and management

Roads enable us to get to places, to villages and towns, and to their landscapes. As we reach our destination it is the roads which give us a first impression of the landscape we are visiting, places where we can then stay and visit. Although accessibility is associated to this basic scenic function of the road, it is a subject we shall return to later. In this section we concentrate on how the management of the landscape can use the road and the service it offers in terms of movement.

The accessibility which transport infrastructures offer has a double role in the sense that although they serve an important social function in providing free movement, they also have repercussions in terms of the pressure they exert on the transformation of landscapes which may be fragile and whose value is often maintained largely due to their relative isolation.

The positive management of complete isolation, establishing barriers to access, or simply maintaining certain limits in accessibility, has been seen to be a fairly successful way of preventing the deterioration of those areas which need to be conserved by preventing excessive frequentation or the intensive development which is generally associated with the improvement of means of transport.



As an idea to begin with, an efficient road network needs to be selective in terms of how it serves the different places it connects. It is important to abandon the idea that access to all areas should be available in the shortest time possible since this would lead to a standardised and uniform treatment of every kind of space and involve huge investment, as well as jeopardising areas of great fragility whilst generally lacking any true social logic.

The planning of selective accessibility is valid at every level of management of the road network. The main road network should be developed to serve high capacity metropolitan and urban areas with extensive human activity, but be limited in territories of great natural value in which transformation should be avoided. This approach should be reflected at an intermediate or local level so that the road network selectively serves the various areas which make up a



territory in accordance with the different requirements and capacities needed. In local terms in areas of natural value, adequate access should be guaranteed in the parts of these landscapes which can absorb more pressure and are therefore desired to be visitable, whereas the areas of most natural value should be kept isolate. In this way the demands of the visitor can be accommodated without putting the exclusive or fragile aspects of these landscapes in peril.

It is also the case that contemplation from a distance may be a more suitable way of approaching the management of pressure on certain areas of landscape whilst still permitting their appreciation. A careful selection of scenic routes is a possibility in this situation, satisfying the demands of the visitor whilst at the same time relieving the pressure on more fragile areas.

A forest track zigzags over a hillside in the Sierra de las Nieves Nature Park with the village of El Burgo in the background (Málaga).

Landscape management and road planning are things which should go hand in hand. In this sense it is highly recommended that planning of road schemes, especially in terms of accessibility, is coordinated with objectives concerning the enjoyment and conservation of the landscape associated to its scenic quality.

Working towards common objectives is a process which involves coming to a compromise about various public aims such as development and conservation, in a selective and efficient way which considers the specific characteristics of each case, abandoning overly simplistic or formulaic approaches such as total accessibility on the one hand or the complete isolating of heritage sites on the other.

In this context of effective and positive management of the landscape it is necessary to combine areas where access needs to be restricted with those where access for visitors can be encouraged and stimulated.

2.3 Values of the route

The development of the means of transport has been separated progressively from the experience of place. As the areas of day to day life for citizens have been progressively de-contextualised and unified to the standard aspect of residential areas, shopping centres and service areas, so travel has gradually lost its capacity to integrate the travellers into the spaces they are travelling through. Driving a car has become such a routine and boring activity that the sense of variety and change which logically goes with movement is often ignored. In this sense the design of the infrastructure and its elements, and the relationship they have with their immediate environment and the landscape play an important role. The aesthetics of the road is intrinsically functional, with its simple appearance and standardised range of

features. The situation is such that quite often the experience of a road journey is limited to a series of place names on signposts. Road trips, especially those on high capacity roads such as motorways and expressways have become progressively more alienated from the conscious feeling of travelling through a particular place or landscape.

Despite this sensation, itineraries of roads, no matter how rapid, aseptic, and separated from their context, are still the result of a series of geographical, environmental, natural, and cultural processes, which can be found along the route and reflected in the landscape in terms of various references and elements which can be seen and appreciated as such. When following the itinerary of a road various essential values are revealed which are associated with the cultural features which are the reason behind the route, with the history that has motivated movements through the landscape up until the present day, and with the natural surroundings through which the route passes. In fact, the combination of these features, patterns, and signs make up the landscape which the traveller perceives beyond the limits of the road.

By appreciating the different features and the signs indicating the natural and cultural processes of an environment, the larger geographical qualities become more evident over the course of long journeys. The mountain ranges, river valleys, raised plateaus or coastal landscapes make up the physical basis of road itineraries. During the course of these itineraries it is possible to register the difference in climate, the various different features or types of geology, distinctive aspects of ecology, and in general the overall variety of geography. The large majority of road itineraries are based on ancient and successive historical processes which have changed over time to create the network we have today. Some small local roads which now perhaps serve a local rural community were once main thoroughfares of complex social and political systems long since disappeared. A fine



example of this is the network of roads dating back to the Roman Empire. Even today you can easily still trace the ancient pilgrimage routes, the old drovers roads, the historical trading routes or the geographical movement of new cultures as they expanded along the valleys or coastlines. The mechanisation and new forms of transport which were part of the process of industrialisation changed the way that people and products moved through the territory, leading to the creation of new routes and the abandoning of some of the older ones, or the renovation of others which had almost been forgotten. Later the development of motorised vehicles and other forms of transport led to the redrawing once again of the map of routes. The popularisation of the automobile and its effect on freedom of movement gave huge new social relevance to the road network.

These cultural and geographical routes are of great value. Apart from their relevance to the observer, they represent in themselves a rich cultural and environmental heritage. Those aspects of the landscape associated with roads have a considerable educational capacity in terms of raising awareness and stimulating interest about their environment, their culture, and their history through the perception and appreciation of the landscape.

The assimilation and understanding of the particular features of these routes is of great value and should be incorporated into the range of objectives of policies concerning roads and the landscape. The information featuring the cultural heritage of a road itinerary should be efficiently supported by the various media which help in the organisation of a journey.

The A -7075 near to the natural area of Torcal de Antequera. Roads, routes, and the network as a whole, all become part of the patterns and dynamics of the landscape, since they are the product of the very cultural and environmental processes which produce it.

Availability of information such as that to be found in maps, road and tourist guides, visitors centres and signposting of routes, can be an effective way of illustrating these aspects especially if they provide useful references for the systematic interpretation of landscape values and avoid only concentrating on the more obvious or spectacular features.

The overall management of the scenic quality of roads and their relationship with features of the landscape can be very effective in this sense. Interesting landmarks and other recognisable features have an important function in helping to facilitate a comprehensive «reading» of an itinerary. A whole range of scenic features such as the vegetation, the shape of the land, rocks forms, rivers and lakes, the form of cultivation, and the way the land is divided in plots, all help to inform this vision of the landscape from the road. Of special cultural and historical significance in this sense are the elements which have been constructed alongside the routes such as bridges, lodging houses, blacksmiths' forges, milestones, or ancient paths.

Nevertheless, explanation and signposting of landscape features needs to be carried out in organised fashion which permits the systematic interpretation of the cultural and natural processes. An arbitrary or disorganised range of references and signposts can be counterproductive because it tends to encourage a superficial view of the landscape and fails to fulfil the aims of education and raising of awareness. It is important to integrate the key features, landmarks, and other aspects of the landscape to be found along a route into a coherent and inclusive overall vision. Having said that, the ability to create interest in the more obvious landmarks should not be underestimated, although they must be included as part of a wider context so as to avoid a merely anecdotal appreciation of the landscape.

A general improvement in the appreciation of the values of a route can be achieved by coordinating the information available to the traveller, effective signposting, information

panels explaining the contents of scenery and the function of rest areas and route landmarks. The effective management of road networks should include the appreciation of historical and cultural aspects and this must be incorporated into designs for road schemes.

Once the significance of being able to read the landscape through these features is acknowledged, it is important to re-examine the way in which the landscape is perceived from the road. This depends on its very special perception and scenic conditions which can easily be enhanced in the management and design of roads. The following sections look at them by examining the factors they depend on and how they could be improved.

2.4 The view of the landscape from the road

Modern roads were quick to start using scenic quality in their layouts. The characteristics of scenic roads parkways and landscape roads respond to the demand for enjoyment of the landscape from within a moving vehicle. Parkway are essentially central lineal elements in scenic parks, the elements of the parkway being designed to contemplate the scenery from the point of view offered by the layout. Scenic roads crossed the interior of the huge North American national parks with the simple aim of allowing travellers to appreciate the wonderful views from their moving vehicles. In addition, landscape roads also incorporate specific aspects of design which are related to their context and the views of the countryside they cross.

All these types of roads took the observation of the landscape as the essential starting point of the development of their design. Their layouts were planned with the basic object of serving the best and most panoramic views in the same way as pedestrian pathways in landscape gardens; Inversely, in park ways, the gardens on the roadsides were designed specifically to be seen from a vehicle.

Nowadays, the scenic function of roads has once again become an important and positive aspect of their infrastructure and looking at the landscape from the road has become a very popular activity. The socio-cultural context of this renewed interest in scenic roads is very different from before but in essence the concept is the same. Concern for the environment, tourist interest, the similarity with the cinematographic experience, and the general demand for better infrastructures have all played their part in encouraging this concept of roads as visual itineraries.

It is now common for road maps to include references to scenic routes as another kind of service to the traveller, often drawing attention to the points on main roads with interesting aspects of scenery. However, reflecting the concerns we mentioned to some extent in the previous section, the criteria for selecting what are deemed recommended scenic routes often lack balance or are inconsistent, whilst themed signs also fail to consider, or advise the observer, about the conditions in which the landscape can be viewed from the road. Having said that, these aspects are undoubtedly important for the various reasons we shall set out below.

The perception of the landscape from moving vehicles is a complex subject which is often not treated with the seriousness it requires. It is important to consider in full all the aspects which are important for viewing the landscape from the road. These can be divided into three main groups:

- The landscape scene and the features which are visible from the road. This refers to the landscape itself, to its structure and processes, its distinctive characteristics and key features, and how these can be viewed from the road. The management of the landscape should be well aware of this scenic potential, this essential capacity which the landscape has to be revealed to the traveller.

- The scenic development of the route or the sequence followed by the vistas which can be seen from it. This can be understood as the series of points of view that the layout of the road generates by aligning vistas in a particular direction and orientation. This is important in the sense that it defines the way in which we approach and perceive the travelled route and, as such, the landscape we are passing through.
- The traveller's attention and their perceptual framework in terms of the surroundings. This involves a number of variables determined by the demands on attention of the actual process of driving, in the case of drivers themselves, and by the vehicle's conditions of the vehicle's movement for travellers in general. The question of road safety is fundamental.

Looking at the first point, the scenic quality of roads should be understood in such a way that an integral management of the landscape is achieved. The roads which enjoy quality scenic views should be managed in accordance with the objectives and programmes which have been planned for these landscapes. On the other hand, the essential value of the landscape, the panoramas, the scenic views, and the landmark features could be actively promoted - the content and significance of a given area of scenery should be taken into account when planning a visual itinerary.

The general scenic organisation and significance is also important since it is within this framework that visibility is created whilst in motion. The location of the highlights or special features of a landscape in terms of the rest of the scenery plays an important role in the sense that it makes an area easily recognisable, when combined with aspects such as the angle of vision, the duration of exposure to the observer, and the general surroundings in which it is situated. Often, the possibility of observing interesting and clearly visible scenery can be a



Drivers on the MA-5402 can make out the profile of the village of Ardales (Málaga) as it appears before them.

good reason to choose one itinerary rather than another which perhaps does not offer the same opportunities to view its more recognizable features.

Roads are part of this tri-dimensional aspect of the landscape because their itineraries offer one particular series of views, rather than another. The rapid succession of different views gives travellers a sense of continuity and depth of the landscape; the views appear whilst in movement, generating a series of different emotions, and also offering a perception of the breadth of the environment in a short space of time. Although a journey may only offer sensations which are fleeting and superficial they are nevertheless much appreciated by road travellers.

The itinerary followed by a road has a precise location in the visual organisation of the landscape. Different itineraries offer different views of the overall scene and the structure of the landscape. Routes for example which follow the sides of a valley offer almost complete views of the surrounding scenery but one often can't see the valley bottom,

whereas routes which follow the valley bottom offer views of the landscape looking upwards giving a very different visual effect. Depending on the structure of the scene, the special landmarks or other features can be seen from some points of view but are hidden when another itinerary is taken.

Not all roads offer acceptable views of the landscape. It all depends on how their layout is related to the three dimensions of a given area. The specific scenic conditions of each road need to be carefully considered if their scenic possibilities are to be maximised.

In this sense the visual concept known as legibility is fundamental. This is a function of the road which allows motorists to see the layout before them thus allowing them to anticipate how they need to change the speed and direction of their vehicle. Roads with good legibility offer motorists a clear view of the layout for several hundred metres. Winding or undulating roads, with successive sections hidden behind curves or beyond the brow of a hill tend to have poor legibility. Good legibility of a layout is necessary to guarantee road safety, especially on roads which are designed for higher speeds, because logically it is necessary for motorists to read the conditions from greater distances.

The legibility of a road also involves the landscape which can be perceived from the road, the landscape which appears before a fast moving vehicle travelling in either of the two directions. As opposed to the legibility of the layout, which is focused on the capacity to understand the lineal progression of the road itself, the legibility of the landscape of a particular road is the visibility which allows the traveller to understand the general organisation of the surrounding area. It is a complex concept which is centred on the capacity to take in the overall structure of a landscape and the different elements which combine to form it. In this sense it involves a perception of the scenic arrangement of



The layout of the A-7075 near to Torcal de Antequera (Málaga), determines the perception of the landscape as it directs the line of vision, providing a rapid succession of views. The movement gives a feeling of depth to the landscape throughout the itinerary whilst at the same scenic arrangement establishes what can be seen and how.

the layout, with basic reference elements which should reveal the organisation, patterns, and special features of a given view. The shape of the horizon, the larger features which shape the land, the vegetation, the way the land is divided, the various other recognisable features, and above all, the way they are perceived from the road, are all elements which help to understand the overall scene, thereby facilitating greater legibility.

When the margins of a road are occupied by continuous solid objects or features such as buildings, trees, hedges, or the terrain itself, these prevent the observation of the landscape behind them, thereby limiting lateral visibility. When considering a visual itinerary therefore it is important to consider the nature of the roadsides since any object situated nearby can affect the appreciation of the views and the legibility of the landscape.

It is also important to consider the available visibility from one side of the road of the landscape which is to be found on the other. The legibility of the landscape on the opposite side of the road is dependent on numerous factors including the total width of the road, the number and speed of vehicles coming from the other direction, and the obstacles situated on the other margin. In general, dual carriageways and roads with high traffic intensity offer poor legibility of the landscape on the other side and the majority of these roads only offer good legibility in one direction. Road layouts on hillsides only offer acceptable views in one direction and only if there are no obstacles in the way, because the hillside itself impedes views in the other direction.

For various reasons the legibility of the landscape from the road tends to be fragmented, either due to obstacles on the margins, or simply because the scenic development of the layout does not permit the adequate perception of all the essential elements of a given area. Despite the fluctuating levels of visibility or understanding of the terrain they are



crossing, motorists and passengers are usually able to obtain a certain visual perception of the landscape, often through a series of occasional fragmented views, sometimes with a three dimensional appreciation fragmented views, sometimes with a three dimensional appreciation of an area, sometimes not, and frequently thanks to the strong impression of the spectacular nature of a series of instantaneous views which the observer is able to enjoy.

The conditions of visibility and legibility of the landscape from the road are an essential aspect of landscape management and as such should play an important role in roads planning and project.

The A-5300 road in the Hinojales area (Huelva). Road safety requires clear legibility of the route ahead. The shape of the landscape ahead can be made out in the distance.

2.5 The perception of the landscape by road travellers

The vision of the landscape from the road is not merely a photographic, aseptic and distant sensation, but one which is governed by the perceptual universe of the traveller

in their vehicle. Although it is difficult to differentiate exactly which aspects of the understanding and appreciation of the landscape are essentially visual, purely optical, and which are more perceptual, or more interpretative, it is possible to identify certain phenomena which are part of the process. The identification of these phenomena helps to understand the complexity of perception from a vehicle, whilst permitting its more effective analysis and management.

Speed, an essential characteristic of road travel, has a limiting effect on the perception of the landscape. The movement of a vehicle produces a narrowing of the panoramic vision of the traveller. The width of the perceptible panorama is reduced the faster the vehicle is moving. The objects to be found at the side of the road, be they trees or buildings, pass through the visual plane of the observer more or less at the same speed as the vehicle is travelling. The closer they are to the vehicle, the closer the speed of the projection of the object on the visual plane is to the real speed of the vehicle, which is why, when a vehicle is travelling at high speed it is difficult to discern the things which are situated next to the road. When they are further away, the angle of projection slows their movement across the visual plane of the observer to such a degree that really distant objects can appear to be almost stationary whilst those in the middle distance only seem to move fairly slowly.

This visual deterioration caused by the way objects enter the visual plane also has a lateral effect when the direction of sight follows the line of the road. The range of panoramic vision which a motorist has of the road ahead is reduced laterally when objects near to the road pass through the frontal visual plane at high speed. The consequence of this is that movement at higher speeds reduces the width of frontal vision whilst moving more slowly allows a greater

appreciation of the total width of the visual panorama. This effect of speed which has been extensively researched for the ergonomics of driving also has repercussions for the vision of the landscape enjoyed by the other occupants of a vehicle since they too suffer the effects of visual movement.

The analysis of this effect leads us to a series of conclusions. Driving at high speed through constricted landscapes such as urban areas or narrow gorges where the terrain is very close to the vehicle, offers only limited perception of the scenery, whereas when driving through broad, open landscapes, like coastal areas, the sense of speed is much less, always assuming that there are no objects close to the road.

In terms of this effect of narrowing of vision it is clear that walking or travelling in very slow vehicles is going to offer much better, more inclusive views, whereas from vehicles travelling on high speed roads such as motorways or expressways it is only possible to appreciate features at a considerable distance in open areas.

Nevertheless, as it has been suggested, the perception of the landscape also involves a number of essentially psychological processes, which is why it is important to consider the factors which capture the attention of motorists and which occur in the process of driving the vehicle.

The worst layouts in terms of a combination of speed and visibility require greater awareness from the driver who needs to pay attention to the shape of curves, to the unexpected incidents which may occur, and to the climbs or descents of particularly steep roads. For this reason mountain roads, despite being situated in privileged scenic places, often have little landscape value because their layouts make them difficult to negotiate and require maximum attention from the driver, who can only enjoy fleeting views of the

landscape because of the difficult manoeuvres which he or she has to carry out. Motorists also need to pay particular attention when they share road space with other vehicles, both those travelling in the same direction, and those coming towards them.

Narrow two lane roads with no hard shoulders can only cater for a limited amount of traffic, whereas motorways, with various lanes in each direction, can absorb dense traffic flows and allow a more comfortable, relaxed and safer form of driving. Although smaller roads place the vehicle much closer to the landscape, they complicate its perception by requiring more attention from drivers. Larger multi-lane roads are more relaxing and permit drivers a certain margin of liberty to appreciate the scenery beyond the limits of the road, although the view of the landscape is more limited.

The effect of traffic congestion for the motorist is to lessen the appreciation of the landscape on roads which suffer traffic saturation, not only due to the visual intrusion of other vehicles but also because drivers need to pay extra attention in order to cope with other vehicles.

The motive for the journey is also an important aspect when it comes to appreciation of the landscape since this can have a clear effect in terms of both the way a vehicle is driven and the driver's perception of their surroundings. Expectations and attentiveness are logically much higher in travellers who are exploring a route. These may include those who are following a certain route for the first time, those who actively enjoy the contemplation of the scenery, or those who intentionally choose a scenic route. However, these travellers are not the only ones who are demanding in terms of the landscapes a road has to offer. Motorists on routine journeys, such as those who drive every day from their homes to their places of work also have a particular relationship with the road environment and the value of its landscape.



The A-366 snakes along the mountainside. The form of the road, with its bends and gradients, complicates the contemplation of the scenery despite the impressive views offered.

It is not unusual in fact for regular users of a road to be more demanding than others in terms of the aesthetics and landscape quality, perhaps due to a sense of familiarity and belonging which makes them feel part of the landscape in which they carry out their day to day lives. Furthermore, daily motorists have a good awareness of the road conditions and traffic which gives them more confidence when driving and allows them a certain freedom to pay more attention to the surrounding landscape, which adds to their special sense of familiarity with the road.

The environments of quotidian roads are seen and appreciated as collective spaces which play a role in the everyday life of a community. Thus motorists who use these roads continually feel more strongly about the deterioration of the landscape which surrounds them and are more demanding than occasional visitors who are more influenced by their own expectations and the effect of surprise. In this sense it is important to remember that the quality of the landscape is demandable on every road, as is established in the European Landscape Convention. It is not something which should be solely limited to rural roads which cover territories which are easy to appreciate for everyone, but also applies to metropolitan, inter-urban or arterial roads which allow day to day mobility; these should also adopt a positive approach to landscape.

The aspects related to the attention of the observer which we examined above also apply to the perception of the landscape for passengers of vehicles. The personal motives for the journey, the poorer aspects of layout which influence the movement of the vehicle, and the stressful situations of heavy traffic affect passengers by producing a certain lack of comfort and tension in the vehicle which influences everyone's perception, nevertheless it is clear that passengers have much greater freedom in terms of the direction of their vision

so that they can pay more attention to the characteristics of the landscape and the scenic development of the journey.

It is clear from the analysis of the factors influencing perception that the better prepared roads in terms of being able to appreciate the landscape from a vehicle are also those which have the highest quality in the purely functional sense of traffic management. Layouts which are comfortable and safe with good visibility and relatively low traffic density are the most ideal in this sense.

2.6. Road design and character

The design of the different road elements responds to its essential role as a safe facility for traffic which offers comfortable conditions for driving. Hence the physiognomy of the road has a very functional aesthetics that is considered excessively more important than other characteristics. Pavements, road markings, signs, and guard rails create an aesthetics which tends to lack individual character or identity since they conform to standardised features and forms. The effects of traffic, especially when roads are busy, with large numbers of heavy vehicles, creates an environment which is noisy, dirty and dangerous, in such a way that the actual road space (roadbed, lanes, stopping areas) tend to be hard, aggressive, and often in poor condition.

The areas adjacent to the road, where traffic movement is reduced and drivers can leave their vehicles (stopping and rest areas, service and petrol stations) are often dull in character. In these places a standardised aesthetics tends to be predominant with a preponderance of repeated commercial names and franchises. When the road and its surrounding areas accept these conditions the design tends to be poor, excessively

functional, or simply very limited. The possibility of enjoying the landscape in these areas is conditioned by the aggressive presence of traffic which reduces the experience to what can be seen from the inside of the vehicle.

All these factors mean that the road landscape is frequently deteriorated or aggressive, lacking in special features or individual identity. This is especially serious when one considers the amount of time which large numbers of people spend in these environments which possess a special landscape function.

The Florence Convention demands a quality of landscape for all areas, even everyday conventional spaces of which roads are a prime example. Those responsible for the road network have to approach their task by interpreting roads as a key part of the environment and a social context for large sections of the population.

Although it may seem that the design of basic elements of the road is defined by its functional necessities this is not always the case by any means, and there are numerous intermediate elements capable of incorporating positive aspects in their design without compromising either safety or functionality. There are many situations where roads could incorporate facilities specifically conceived for the appreciation of the landscape thereby considerably improving the landscape value of these spaces. Examples include panoramic view points, roadside walks and parking, service or rest areas which could also take on landscape functions.

It is clear therefore that roads could be considerably improved in this sense, adopting a distinctive aesthetics design for their different elements and incorporating roadside facilities which encourage the appreciation and understanding of the landscape and which can complement the experience of a journey as seen from inside a moving vehicle itself.

Elements of road design such as road markings and signs, hard shoulders, or the nature of the roadbed itself, are based on the need to guarantee traffic safety and as such tend to have a certain rigidity in terms of their conception and physiognomy in order to meet the stipulated standards. Nevertheless, other elements such as guard rails, embankments, cuttings, retaining walls, gardens areas, and information signs are more flexible in their design. It is also the case that many road structures such as roundabouts, bridges, tunnels, or junctions have a range of aestheticss which make them much more suitable for creating their own identity. The formal identity of the road and its various elements can be approached in various different ways: its design can assimilate features of the character of the landscape, it can take on its own identity, or it can be a combination of the two.

The character of a landscape is based on those aspects which make an area unique: the landform, the different types of vegetation, and other aspects such as trees, crops, the materials used for construction, or traditional architectural features are all part of an area's character and can become part of the design of a road environment. Roads can incorporate these aspects of character and integrate less conventional designs for necessary elements such as guard rails, retaining walls or safety posts. There are a wide range of elements involved in roads which can adopt a certain degree of freedom in their design and as such can play an active role in creating an individual character for a particular road.

Retaining walls, whether they are cuttings in unstable terrain which is exposed to motorists, or protection of embankments which are visible to the external observer, can have a range of styles and characteristics which give a much more interesting appearance than they often tend to have.



Apart from the intrinsic aspects of the road infrastructure, the facilities on its margins form an important part of its character. The roadside areas should be seen as transitional strips which lie between the essentially functional character of the road itself and the broader surrounding landscape. Traditional features such as lines of trees, stone walls, and a varied range of purpose built elements (shrines, fountains, access paths) can become an important aspect of this transitional space if they are included in the design of a road layout and its margins without compromising safety in any way.

The aesthetics and landscaping treatment of a road should be part of an integrated vision of driving conditions and safety. They could be seen as ways of traffic calming, part of larger scale structural solutions, designs for systems of protection, or a method of delimiting and landscaping features on the side of the road, thereby helping nearby elements to give character to the road.

Fountain at the side of the HU-8105 next to the old route used by pilgrims from Linares de la Sierra to reach the shrine located on the the Peña de Arias Montano. The cultural and natural heritage attached to roads is rich and diverse.



Lines of trees are part of a rich heritage of traditional roads which are gradually disappearing, a process which began as the speed and capacity of roads started to increase. Their conservation is important for environmental, cultural, and aesthetics reasons, and methods should be found to preserve them, depending on the situation and bearing in mind the reduction in functionality of the road, by retaining them on original roads whilst building alternative layouts for heavier traffic or creating integrated solutions.

Trees on the margins of the A-4152 (provincial boundary between Granada and Málaga, in the municipalities of Loja and Alfarnate). These important elements of the landscape should not be eliminated solely for reasons of traffic safety since this can be achieved by successfully managing other aspects of design such as road width or speed limits.

Part of the aesthetics treatment of a road could include gardens and other natural environmental elements which soften the appearance of roads, alleviating the dry and soulless aspect which they can tend to have. There are numerous elements which can be useful in this respect on, for example, the margins of urban roads, traffic islands, roundabouts, and central reserves of motorways. Slopes of embankments or cuttings, neglected work sites,

and sections of old roads which are abandoned due to re-routing are all areas which are well suited to environmental recuperation and reforestation.

There are numerous typical elements and facilities which can be used to give a road a unique identity. These include bridges, tunnels, roundabouts, rest and service areas, parking areas, and bus stops. Each one of these elements has different functional requirements and landscape qualities.

Bridges have a clear exterior presence and an aesthetics relationship with the environment, so that when they are viewed as part of a landscape they create a certain sense of identity. Although they are often not so clearly visible from the road itself they nevertheless always have a certain presence. Traditional bridges can give a road a certain sense of location and history, whereas more modern designs, depending on whether they are visually striking or more discreet, can either impose on the rest of the landscape or fit more harmoniously into the surrounding environment.

The role of tunnels is to hide the road beneath the terrain. Inside they tend to lack any sense of place but the portals of tunnels do have their own individual aesthetics which has a considerable impact on the interior picture of the road. The majority of tunnel portals incorporate protective support structures into their design.

Service and petrol stations have a special relevance, together with parking and rest areas, in the sense that they are spaces where travellers leave their vehicles and come into direct contact with the landscape of the road. Despite this, these places tend to have a very irregular landscape profile and only occasionally do their designs consider the character of the road or their relationship with the landscape. This tends to be more the case with rest areas, but service and petrol stations are very much bound to their commercial identities. Parking areas



The A-475 crosses the river Oraque, on the municipal boundary between the villages of Calañas and Villanueva de las Cruces in the Andévalo area (Huelva). The river displays the typical tones of the river network in this part of the province of Huelva. The geometric shape of the bridge closes the scene of the unusual landscape.

are generally essentially functional with little or no reference to the features or character of the landscape, despite the fact that they often form an interface between the road and the landscape itself (nature parks, historical town centres, and villages).

Sometimes the design of a bus stop will faithfully reflect local characteristics, but on other occasions they are essentially functional and minimalistic. All of these areas

where vehicles stop and park have a particular landscape potential and should be treated accordingly.

Finally, to complete this brief look at these types of spaces we should mention roundabouts, road elements which have a special scenic quality. Quite often they incorporate features with a certain semantic content which illustrates aspects of local culture through iconic elements which represent traditional industries or agriculture, art or history, and traditions or festive events.

All of these elements, if correctly and imaginatively used, can combine to create a sense of identity in the interior scene of the road by giving it references and significations which go beyond its mere functionality.

Some roads incorporate roadside areas such as pedestrian routes, bicycle lanes, view points and parking areas which are designed specifically for the appreciation and enjoyment of the landscape. These facilities require a special approach in terms of their planning in the sense that they need to combine the enjoyment of the landscape with their role as functional spaces for traffic.

Roadside pedestrian paths and bicycle lanes need to be safe and comfortable to use. They are ideal on roads with little traffic and logically need to be separated from the road itself, although a discrete form of separation is often sufficient.

View points obviously need to be sited in a special place. The best views of an area of scenery are not always compatible with elements such as safe access and parking. There needs to be space to stand or sit down on benches and places to put information panels or rubbish receptacles. As such, the design of view points needs to be well thought out and safety must be a paramount concern.



Urban promenade next to the HU-8105 with views over Cortegana (Huelva). The line of trees and benches provides shade and separates pedestrians from the traffic.

Indeed, all of the different aspects of landscape design in roads must be considered alongside safety and comfort of traffic flow to create the correct environmental and scenic integration. This integral combination of different criteria (character and identity, scenic facilities, traffic and environmental integration) helps to create a high quality infrastructure which benefits from the resources of the landscape in conjunction with safety and sustainability.

In this sense, the design of the road needs to avoid damaging those features which give a landscape its character; on the contrary, it needs to integrate those elements of the landscape which are to be found on the margins of the road. Traditional characteristics such as walls, agricultural elements, milestones, architecture, etc., as well as vegetation such as trees, woodland, hedgerows, and fields need to be respected and incorporated into the overall road landscape.



A view point on the A-5052 overlooking the Laguna del Portil nature reserve in Cartaya (Huelva).

In order to emphasise identity or character it is best to adopt a consistent approach to these elements. The consistent use of similar designs (types of stone, barriers, signposting, etc.) gives a sense of unity to the road and this is positive both in terms of identity and traffic safety. Consistency helps motorists to understand the role of each element which they find along a given route.

2.7 Integration of roads into the landscape

Roads are linear objects which form part of the landscape and should be treated accordingly. Traffic, earthworks, and the linear layout determine the way in which they



become part of that landscape. They have specific environmental implications in both the shorter and longer term which need to be addressed if landscape is to be successfully conserved. In terms of the surrounding scenery roads play a double role: on the one hand they can be seen as linear view points from which motorists inside their vehicles observe the landscape, as has been discussed in previous sections, whereas on the other, they are elements which are part of the scenery itself, which are viewed by external observers as an intrinsic part of the landscape as a whole. Aesthetically they are linear, continuous, and geometric features which impose themselves on the landscape and their functionality often clashes with the more organic natural characteristics of the spaces which they inhabit.

This functional aesthetics has intrinsic interpretations related to efficiency and engineering, thus the presence of the road, and particularly of some of its more visible facilities (bridges, intersections, signs, guard rails), introduce these meanings into the landscape in which they are situated.

2.7.1 Environmental Integration of the Road

The effects of the integration of the road into the environment can be grouped under four main headings: the destruction of environmental resources which the road and its

The A-7075 in the landscape as seen from the Torcal de Antequera natural area (on the left, the Sierra de las Cabras). The effects of roads on environmental processes, their scenic presence, and their effect on the perception of the landscape are essentially based on their linear nature.

facilities occupy; the barrier effect of roads which impose themselves on areas, causing the fragmentation of broad eco-systems; emissions and traffic associated risks (noise, air pollution, water contamination and safety); and finally their long term effect on the patterns of territorial organisation of human activity , and on patterns of development and conservation.

The construction of a road scheme and the necessary earthworks can cause the destruction of environmental resources such as soil, and flora and fauna, as well as cultural and community assets or farming resources. For this reason, layout for new roads must be carefully designed, especially in the case of roads which require wide transversal sections involving large earthworks or those which cross fragile and valuable areas. In the same way, alterations to existing roads such as road widening schemes or changes in layouts should avoid or at least minimise any adverse and irreversible effects on environmental resources. When applying an environmental impact analysis to plans and projects, chosen design criteria should actively integrate features for the prevention and reduction of adverse environmental effects.

The presence of a road as it crosses ecological systems, living communities, or water resources, and its tendency to cause fragmentation, has a direct effect on the processes which keep these resources alive. This can be seen in the isolation of villages and communities, the fragmentation of habitats, and the impact on the flow of run off water. In new road schemes these effects should be minimised by adopting designs which are sensitive to the environment by including special solutions such as tunnels, bridges, and artificial tunnels. Schemes should, if possible, avoid residential areas, be they urban or more dispersed, as well as natural areas, floodplains, etc. And

any new roads in these areas should incorporate elements to enhance permeability (see the Manual COST 341: Habitat Fragmentation due to linear Transportation infrastructure). For existing roads, any modernisation schemes should include measures to make habitats more cohesive, to reduce isolation of communities, and restore rivers and water courses wherever possible.

Effects such as noise pollution and air or water contamination are a function of the composition and intensity of the traffic, as well as its speed and other driving conditions. Residential areas, natural areas such as woodland, and places with good quality water supplies (lakes, reservoirs, marshlands, etc.) are particularly sensitive to noise, contamination, and adverse traffic effects in general. All these effects must be taken into account when planning new road schemes or updating existing roads.

Finally, road management programmes should consider the long term effects on development and on the conservation of places of interest, especially when the road in question is a motorway or other type of high capacity route. There are a wide range of structural economic, demographic, and social effects caused by roads, as well as their potential negative impact on fragile natural areas caused by the increased pressure. Improvements in accessibility stimulate urban expansion, leading to loss of agricultural land, decentralisation of industry, expansion of area of influence of shopping centres, growth in number of second homes, social decline of adjacent areas, etc. They lead to an increase in human activity in fragile natural spaces with growth of large scale housing developments and other infringements on protected areas.



The A-354 in La Hoya de Málaga. The presence of a road can be more discreet and less imposing when its size and layout follow the basic patterns of the landscape.

2.7.2 The road and the aestheticss and character of the landscape

The linear presence of the road has a direct effect on the way we contemplate and appreciate the surrounding scenery. Firstly, the general effect of the road on the composition of the surroundings depends on how it relates to the patterns of the landscape. The morphology, the rivers, cultivated areas, natural vegetation, and the shapes of buildings, are what make up these patterns and create a landscape's character, the arrangement of features which make it unique. Some roads tend to fit in well with these landscape patterns, reaffirming its character, whilst others clash with their surroundings

imposing themselves on the landscape and ignoring or contradicting its character. Thus, whilst one could generally say that the former are in tune with the character of the landscape, and reinforce it by integrating positively into the surroundings in terms of its aesthetics and meanings, the latter provoke a sense of disruption and untidiness which can damage the character of an area and the overall value and sense of meaning of a landscape.

When the elements which go to make up a road are discreet and compatible, its linear nature can have a positive effect on the perception of a landscape and even enhance its features. The layout of a road can tend to give a certain sense of depth to areas which would seem flatter if it were not there. The linear form and the continuity of the layout create a reference point in areas of changing morphology, giving a sense of coherence amongst the variations of the landforms. The regular nature of the functional elements of the road such as the guard rails or the markings may contribute to this sense of depth in the landscape. All these perceptual effects of the lineal layout can work with the landscape or against it.

Apart from this the layout of the road requires earthworks such as cuttings or embankments, which, when the morphology requires it, can sometimes be large and imposing, especially when the speed and capacity of the road is high (necessitating moderate slopes and wide, gentle curves, as well as wide cross sections). Cuttings often show the naked form of the rock. When they are large and run closely parallel to the road the walls can sometimes give an effect of tearing the hillside if they are not adequately treated. Embankments are generally more discrete since they are usually not so steep and can be given a «natural» appearance more easily. When embankments or cuttings are

substituted by retaining walls, the aesthetics integration of the road is more effectively achieved if they employ designs in natural stone. The bridges and tunnels which are used for crossing deep valleys or to cut through mountainous areas tend to be visually pleasing in themselves.

These and other construction elements are often large in scale and this can make them very imposing in the landscape. Depending on their relative position and their visibility they can provoke large contrasts in scale when they are disproportionate to other elements of the landscape, or alternatively, if they are overly artificial or functional they can sit awkwardly in a particular area.

The intrinsic properties of these elements in terms of their modernity, functionality, or efficiency, can damage either the perception of the natural value of the landscape in which they are situated or certain cultural characteristics.

A well thought out layout when planning new roads can reduce these negative aesthetics and perceptual difficulties. Road widening schemes or other changes in layout, although they are not completely new projects, can, by increasing the size of the roadbed and involving greater earthworks, multiply the impact of the presence of a road on the perception of a landscape if these factors are not born in mind during the carrying out of a project.

The environmental restoration of the slopes of earthworks and other areas affected by the works can reduce the artificial aspect of a road, as can the landscaping and incorporation of gardens in traffic islands and roundabouts, although their essential presence will always be determined by the biggest elements involved and their relationship with the landscape in terms of their aesthetics and visibility. There are certain elements which accompany the road and have been discussed previously in

terms of their positive aesthetics effect. These include rows of trees, bridges, traditional guard rails, stone walls, milestones and other features, which enrich and improve the landscape by providing cultural meaning in terms of the perception of the road as part of the landscape. Road bridges, for example, have a particular presence in the landscape, thanks to their essential scenic nature and their disposition. The way that bridges close the empty space between two areas of landscape means that despite their role as carriers of vehicles there is a quality of lightness in their pillars, arches, and tensioning wires which give them a certain sense of naturalness.

Plans for road schemes should bear all the scenic qualities of the various aspects of roads in mind, be they the roadbed itself, the elements which are an essential part of them (guard rails, traffic guidance equipment, ditches, kerbs and hard shoulders, signposts and road markings) or other essential engineering features such as embankments, cuttings, retaining walls, bridges, junctions, and tunnel portals.

2.8 Landscape values of all roads

The various landscape values of roads which have been covered in previous sections are not limited to a small number of roads or particular areas of unusual land, but on the contrary, are an important consideration in all roads and all spaces. As such, it can be said that all roads possess, to a lesser or great extent, these positive scenic features and aspects, but in many cases intervention is required in order for these landscape values to be made more evident. In the end, all roads form part of a territory whose structures and processes become directly or indirectly part of a landscape in such a way that the road either relates to them and becomes part of them, or, on the other hand, ignores them.

Roads situated in conventional surroundings which might on the face of it appear to lack any real scenic value are also of interest, if only because they are collective spaces which play a part in the quality of the environment they serve. As has been discussed previously, users of day to day routes can be even more demanding in terms of the quality of their surroundings because they see the same views regularly and these become part of the collective identity of a community.

Inter-urban roads which link communities, roads which cross areas of agricultural land, and even those which encircle large cities, or permit access to city centres, allow contact with spaces and landscapes with their own values which are evident to a lesser or greater extent. By providing access they allow us to visit new places or enable us to use routes already known to us, thereby permitting us to enjoy aspects of culture or nature which are an essential part of the areas they cover.

All roads can have scenic qualities in the sense that they pass through changing environments with a variety of views, and they can take advantage of this if their layouts are planned in such a way as to maximise this potential. It would be fair to say that any road in any type of landscape has some kind of scenic quality, a certain potential to present and offer views of the surroundings. In order to enjoy the visual potential it is not essential that the landscape through which a road passes is, for example, a natural park. Views over metropolitan areas or roads passing through agricultural areas can also be of great interest if we know how to show them.

Even if it is not always evident, the itineraries followed by roads are associated with the nature, culture, and history of the territory they cross. It is certainly true that all roads in all surroundings have landscape values which are related to the landscape's structures and

processes: they are the intrinsic values of the route itself, which always has some kind of scenic quality and possesses an individual character.

In terms of the identity and individual character of the road, although the aesthetics adhere principally to the demand for functionality and safety, and designs are often poor, with large numbers of advertising hoardings, these are not the only possibilities by any means, and designs could clearly be a lot more positive. It is true that the immediate surroundings of a road always have a certain identity, which can be more or less apparent, and which is based on the essential features which lie nearby. These features give a sense of place which is not always obvious but which the design of the road could make more evident.

Apart from roads which are much appreciated in themselves for the views they offer motorists, there are many others which include specific facilities for enjoying the landscape which can be regarded as reference models which could be applied to almost any road, especially if their scenic potential is understood and appreciated for what it is. There are pedestrian pathways, panoramic view points, or simply parking areas where we can leave our vehicles and appreciate more closely our environment. Roads which do not have these types of facilities could be provided with them without much difficulty, to take advantage of real or potential scenic value.

In terms of integration into the landscape, the reality is that all roads form part of the process of an area; that is to say that they all have some role in the landscape which, if not positive, could be improved. Some roads tend to disrupt processes of great importance such as ecological connectivity or the environmental quality of a particular area. These effects often have solutions and can be corrected if adequate studies are carried out and improvements are made to road design.

In conclusion, the various different landscape values of roads should be an important aspect of landscape and transport policies. With efficiently coordinated management of both policies, roads could be provided with their own sense of landscape which would combine with their essential function of adequately serving the traffic. Landscape resources are part of the natural and cultural heritage, but are often unclear, undervalued, hidden, or poorly interpreted, which tends to lead to their deterioration, especially if those responsible for planning do not look upon them in a positive light, and road management programmes are essential in this respect.

The relationship between road travelling and the appreciation of the landscape is one that can be enriching and beneficial since it allows, assuming it is correctly approached, greater awareness amongst the population as a whole, and as such, it is important for the institutions and bodies which are responsible for the landscape to take this positive function into account. It is clear that the positive approach to the scenic aspects of roads should not only be limited to areas of landscape which are already well known for their scenic value because although it is obvious that in these areas any measures taken reap more obvious benefits, all areas need to be considered as objectives for landscape value policies, and roads are an important part of this.

If there is political will, the access to landscapes which roads provide, the scenic quality of their layouts, and the construction of individual characteristics related to the area they cross, are facets which can be combined with can be improved through their planning, design and management.

All these values should be considered in their different aspects in the various road management programmes. In accordance with the Florence Convention, programmes

for the management, and planning of road networks should recognise these values as the cultural resource they represent. Values such as the visual capacity, identity, and the cultural and natural aspects of a route can be improved through the application of specific measures included in a sensitive process of planning and design.

The following chapters examine a variety of recommendations for the improvement of the landscape quality of roads in the planning, layout and project phases.



3

ROAD PROJECTS, PLANNING AND LANDSCAPE



ROAD PROJECTS, PLANNING AND LANDSCAPE

3

Traditionally, the quality of a road has been defined purely in terms of the service which it provides to traffic, but nonetheless, road quality should also be judged on how it is integrated into the landscape.

As such, it is possible to analyse the intrinsic functionality of a road in terms of how it copes with traffic flow, including the safety and comfort conditions it provides for motorists, the internal stability of its subformation, slopes of cuttings and embankments, and other structures, or the efficiency of its drainage systems. However there is also a question of external functionality which focuses on how the road is integrated into the different features of the surrounding landscape, its morphology, its aesthetics and scenic composition, as well as the way it can be «read» and appreciated, and its relationship with the cultural and natural processes of the surrounding area.

These functional aspects of the road, which are directly associated with traffic and driving on the one hand, and to the integration with the processes of the environment on the other, are closely inter-related in such a way that a good road project is one which resolves and combines all these demands at the same time.

In order to design good roads it is important therefore to understand the existing relationship which exists between these different aspects and how they interact in the conception and definition of a road project. It is clear that in order to achieve a successful combination of these elements designers need to avoid favouring certain criteria above others in an arbitrary way. On the contrary, it is important that they are aware of how to successfully combine each and every one of the criteria, be they those which are essentially part of the intrinsic nature of the road or those which are associated with the surrounding environment. As such, the essential objective of road engineering should be to design a project that satisfies equally both sets of criteria.

This chapter focuses on this balanced vision of road projects, and examines the question of how the landscape should be treated in road planning. The first part of the chapter looks at the existing relationship between the various factors which make up the internal functionality of the road and its service to traffic, with those of its external functionality and the way it is integrated into the landscape. This covers aspects such as its level of service and capacity, the geometric parameters of its layout, speeds and journey times, continuity, visibility, legibility and the cross section.

The different facets of road management should consider this integral approach to functionality in both the strategic phases of development such as planning of the road network as well as the more concrete phases of project definition and the intermediate



The A-366 from Alozaina to Coin (Málaga). A road project is essentially a landscape project, part of a morphological modification that takes on a scenic and environmental dimension. It involves earthworks and the channelling of waters, and links different places whilst at the same time displaying them to us as we pass through.

phases of route definition and layout. The following sections examine the various criteria which need to be considered in each of these important phases in order to successfully integrate the road into the landscape.

The role of the landscape in the planning process is re-examined in order to take a closer look at the different specific programmes which can have a positive effect on improving the landscape quality of roads. These programmes propose the structuring of accessibility to the landscape, the aesthetics treatment of the construction actions of the road plan, the improvements of the layout of landscape roads, the aesthetic improvement of the aesthetics of the road itself and its integration, the improvement of the environmental integration of the road, the improvement of the habitability of the road, and the improvement in the scenic appreciation of the surrounding area from the perspective of the road and its facilities.

The chapter is completed with the presentation of an example of a road scheme: the Seville road scheme and access to the Aljarafe. This scheme was conceived as a means of structuring an area which was to be urbanised, and in this sense is a positive example of how to create and organise a project of this kind in the landscape.

3.1 Aspects of the road project and its relationship with the landscape

3.1.1 Level of service

The level of service of a road is a qualitative value which describes the operational conditions of traffic flow. This is based on parameters such as speed and journey time, as well as issues such as the degree of manoeuvrability available to motorists, interruptions in traffic flow,

and comfort. Therefore, the level of service is related to the degree of fluidity with which a vehicle may navigate a section of road. This is determined by factors such as the dimensions of the road, and its width and layout, as well as the presence of other vehicles, and as such is a variable condition dependent on traffic intensity.

Generally, the level of service can be evaluated on six different grades depending on the functionality of a road, which are as follows:

- **Level A:** The vehicle can be driven by simply attending to the geometric conditions of the layout. This offers free movement giving driver and passengers considerable comfort.
- **Level B:** The vehicle can be driven by attending to the geometric conditions of the layout but the movement of another vehicle present on the road also needs to be considered. This involves greater concentration than the previous level but does not affect the speed of movement.
- **Level C:** The vehicle is driven paying attention to the geometric conditions of the layout and the presence of other vehicles. Their proximity raises levels of tension for road users but traffic circulation is still fluid.
- **Level D:** The driver needs to pay more attention to the presence of other vehicles than to the geometric conditions of the layout. This situation can give rise to interruptions in traffic flow.
- **Level E:** The driver needs to pay complete attention to the presence of other vehicles. Large queues can be formed and traffic density is very high.
- **Level F:** The driver has to deal with considerable congestion and traffic fluidity is subject to frequent interruptions.

In spite of their good layout quality and broad cross section, some motorways still offer low levels of service with frequent periods of congestion when dense flows of traffic are channelled, whereas other roads with ostensibly worse physical layouts and lower design speed (see more later) can present A or B levels because they have much less traffic. A certain section of road can also offer different levels of service at different times of day, or different days of the week or month, depending on fluctuations in levels of traffic intensity.

Levels E and F are associated with situations of congestion and reducing this problem is a traditional object of road management policy. In order to achieve this, strategies include both ways of reducing traffic intensity (demand management strategy), and increasing road capacity (designing roads which can support greater traffic fluidity), or a combination of the two.

In terms of the landscape, conditions of low quality (D, E and F) become situations which are environmentally undesirable since they generate levels of emissions and noise which are more annoying and complex, less sustainable (lower energy efficiency), and make it more difficult for the atmosphere to absorb and dilute the contaminants. Many roads with middling levels of service (C and D) can have very adverse sound levels when they are used by large numbers of vehicles travelling at high speeds, especially if this includes a large proportion of heavy vehicles and there are steeper sections.

The traffic conditions have clear repercussions on motorists and passengers' capacity to contemplate the surrounding landscape, and as such it is not advisable to encourage this activity with levels lower than A and B.



3.1.2 The capacity of a road

The capacity of a road can be understood as the maximum level of vehicles per hour which it can reasonably manage with normal conditions of traffic circulation. Wider roads (with more lanes, wider lanes, additional lanes for slow vehicles, acceleration and deceleration lanes, etc.), have greater capacity because they allow freer movement for larger numbers of vehicles, and in general are better equipped for vehicles to move without interfering with each other.

The increase in capacity of sections which suffer congestion has long been a traditional objective of road planning. Increasing road width with greater number of lanes, installing climbing lanes for slower vehicles, or road duplication (physically separating the two different directions), are all ways of improving traffic flow at points of conflict. Nevertheless, a more comprehensive analysis of context and the dynamics of a section of road may lead to the conclusion that maintaining the capacity or even reducing it could be a better way of

The A 381 Jerez-Los Barrios dual carriageway (Cádiz). The differences between the dual carriageway and the normal road are easily visible; the former is more rigid and flat and the latter more winding and adapted to the shape of the terrain. Higher speeds are a factor of high capacity roads which is why they are more rigid. They are also designed to provide a service to heavier traffic, which affects their width and consequently their presence in the landscape.

improving the whole system conditions in a particular area, in terms of all kinds of movement (pedestrians, public transport) and quality of life (air quality, risk, noise pollution). Thus the capacity of a road should be determined in an integral fashion by considering:

- The complete organisation of the road network
- The dynamics of the evolution of traffic over time
- The environmental effect on the area in which the road is situated

Sometimes a situation occurs whereby resolving congestion on one section and increasing capacity can cause problems of congestion in a later section. Congestion solved by capacity increase in a section of growing traffic will appear again in the future unless the actual dynamics of the traffic is modified in some way. This involves the reason for travelling and the territorial structure of the activities that cause people to travel. Maintaining and even reducing capacity could be an objective to aim for in environmentally sensitive areas such as landscapes of high quality, natural spaces, or urban areas where the objective is to reduce the negative effects of traffic.

When carrying out an integrated analysis of a road's capacity it is also important to consider overall aspects such as the number of people or amount of goods transported rather than simply the number of individual vehicles, i.e. consider the actual amount of people moved and quantity of goods. In this way it is possible to achieve a broader understanding of the real problems involved in transport since it considers the occupancy of each vehicle and the use of public transport (buses, trams, high occupancy vehicle lanes, etc.).

There are various sustainable alternatives that go beyond the simple increase in road capacity and can be categorised under the title of demand management strategies, which seek to modify the actual characteristics of traffic, reducing it in absolute terms through the use of various possible solutions such as moving people from private vehicles to public transport (buses, trams, high occupancy vehicles), encouraging other forms of movement (pedestrians, bicycles, trains, etc.) or reducing it in overall terms (selectively controlling access).

Furthermore, the containing or even reduction of traffic capacity in a particular area is a measure which is often used in dense urban areas or areas of special natural importance where:

- Capacity is very rigid due to the context (it is not possible to widen the section of road due to buildings or other routes, or because of the natural or environmental quality of a particular area for example).
- The aim is to reduce traffic nuisance by decreasing its presence (particularly in densely populated urban areas or places of natural interest), or simply
- A more sustainable form of transport would be preferable because it is more efficient in energy terms and less damaging to the environment.

High capacity roads tend to have an imposing presence in the landscape because they are wide and involve extensive earthworks or other structures. Traffic on these types of roads generates higher levels of noise pollution and vehicles are more apparent. Their negative effect as barriers for both people (who are forced to use long transverse structures), and



Roads form part of the landscape and are just one more element in its aesthetic composition. They are integrated into its scenography, interacting with its processes to create the sensation of an overall scene: They are part of its character.

animals, (who find their routes closed off, or have to use long crossing structures), is much more pronounced than on roads with lower capacity.

3.1.3 The speed of a route, reliability of journey time, and time saving

The layout of a road is designed for a specific vehicle's speed. The radius and camber of curves, gradient levels, stopping sight distances to unexpected obstacles and other geometric parameters of the layout are designed with a maximum physical vehicle speed in mind. If a vehicle goes beyond this speed it increases the risk of losing control, going off the roadbed and suffering an accident.

Each point on a road layout is designed for a certain speed level (referred to as **design speed**) which determines the camber and radius of a curve in that point. Vehicles which negotiate this point at a higher speed have a higher risk of accident, the effects of which are greater, the higher the speed the vehicle is travelling.

A section of road has a design speed level at each of its given points. The lowest of these is the design speed of that section which is that which achieves, without putting the vehicle at risk, the best use of the passage of road with the lowest journey time, assuming a grade A level of service (whereby no other vehicle is impinging on the driver's freedom of movement).

Nevertheless, motorists have a certain liberty to dictate the speed of their vehicle and adapt it at any given moment to a range of driving conditions which allow the driver to benefit from the geometric situation or drive in a more relaxed manner. The «route speed» is that which the driver of a vehicle actually adopts at each point either by taking full advantage of the geometric conditions of each section of road (equalling the design speed) or not (driving

slower than the design speed). On the other hand, some drivers risk driving faster than the safety limits (faster than the design speed), or driving at speeds which are so low that they may impede other road users (much slower than the design speed).

When a road is improved by enhancing the geometric characteristics of its layout (camber, radius of bends, gradients, etc.) a change is created in terms of the time taken for the journey within the prescribed safety limits. This is known as «time saving». The time saved, which is defined as the difference between the time taken before the improvement and the time taken afterwards, or once a new alternative route is constructed, is frequently used as a reference when justifying the investment in a road improvement project or the construction of a new road (in comparison with the time the journey took via the original itinerary).

As with the capacity of the road, questions of journey times (or the amount of time saved in road improvements) need to be interpreted in a time/space context. For example, on itineraries entering urban areas, which inevitably suffer regular problems of congestion, particularly on arterial routes, time saving is not prioritised since the duration of a journey time is extremely variable due to the varying conditions at the final destination.

The way that many road networks are set up allow situations to be resolved with a certain ease and as such the improvement of journey times in these cases is not a fundamental issue. Saving of time is often less of a priority than other factors such as guaranteeing safety, ensuring a certain reliability in the route (allowing motorists to arrive at a destination at the expected time), or maintaining a level of environmental quality in the surroundings through which it passes.

The reliability of journey time is a criterion which is becoming more important than time saving in terms of perception of journey quality and a motorist will have certain expectations at the beginning of a journey which will either be confirmed or frustrated upon reaching

a given destination. Different destinations generate different expectations. For example, someone entering a densely populated metropolitan area would expect a journey to take a reasonable amount of time rather than for it to be very quick. An inter-urban traveller who chooses to use a motorway toll road can become frustrated if upon leaving the motorway they have to deal with congestion at the urban access point of their destination. It is not time saving as such that is the priority in choosing a route or itinerary in either case but rather the need to achieve expectations so as to arrive for an appointment, make a delivery, or arrive in time for a plane or train.

The speed of a road has a direct repercussion on its landscape characteristics. Roads which are designed for higher speed levels need to be more linear with gentler, flatter straighter and more open layouts. This has implications on the kind of earthworks they require, which tend to be large, especially when passing through areas of irregular terrain. As such, they have a more dominant presence in the landscape. Slower roads on the other hand tend to be better adapted to the landform and as such require less imposing earthworks or other structures. They have less presence in the landscape.

The speed at which a vehicle is travelling has an effect on both the frontal contemplation of the landscape, since higher speeds reduce the width of frontal vision, and the lateral vision, because it is much easier to appreciate objects at greater distances rather than those which are nearby which pass through the visual plane very quickly.

3.1.4 Geometric parameters of layout and landscape

The geometric characteristics of a road are designed for a determined sharp bends with a small radius can cause vehicles to overturn if they are taken at high speeds. For this reason

high speed roads feature straighter bends and this has considerable implications in terms of their layout in areas of adverse landform.

Steep gradients mean that heavy vehicles are forced to use low gears and their reduced speeds have repercussions for other road users. The gradients on high speed roads are normally much less steep and a maximum of 5% of slope is recommended for normal motorways, with a maximum of 6% in areas of particularly adverse terrain. Motorways tend to have open, flat layouts which go around steep landforms or employ viaducts or tunnels in the most problematic areas: solutions which add considerably to the costs of construction.

Apart from the parameters which are associated with the speed of the vehicle, safety requirements call for certain conditions of visibility in the general road layout, particularly in terms of stopping distances, junctions, and overtaking manoeuvres.

Earthworks on high speed roads are generally much more extensive than on routes which are designed to be used at lower speeds, and these larger constructions obviously have repercussions for the landscape. When an embankment is high (more than 35metres in height) its cost can be so high that it is actually cheaper to construct a viaduct. The same can be said for the excavation of cuttings and when they are more than 40 metres deep the costs are very similar to those of constructing a tunnel.

Some projects use a process of cutting a trench, then constructing a support structure and covering the top with earth. This is known as cut and cover. This solution has certain geotechnical advantages in that the materials used can prove more stable than a double excavation, whilst in environmental terms it is more attractive in the sense that it isolates the road from the surrounding area. Nevertheless the costs involved can be

very high, bearing in not only excavation and backfilling processes, but also the necessary construction of a resistant covering structure.

The geometric necessities of a high speed road mean that these types of roads try to make the best use of the landform whenever possible. Thus many roads stick to valley bottoms which tend to be fairly flat with only slight inclines, whereas others are situated in such a way that their platform follows a horizontal line halfway up a hillside, with an excavation on one side and an embankment on the other.

It is very common for roads to use favourable routes such as passes or gorges, whereas others create their own strategic routes by constructing tunnels through mountainous areas or large viaducts across rivers and deep valleys to link the more integrated layouts on each side.

When a road with low speed limits or intrinsic dangers is improved by changing its layout it is often the case that many of the original sections cannot be used because they have too sharp bends, poor visibility or very steep gradients, and if this is the case it is necessary to construct a completely new platform, leaving the original sections to one side. On road duplication projects the same thing tends to happen because a single carriageway's layout is often not suitable for a dual carriageway.

Generally, over the course of a section of road, layouts are planned in such a way as to balance the volume of material excavated for cuttings with the volume of filler material for the embankments. For various reasons this is not always possible (distance between the cutting and the embankment to be constructed or the characteristics of the material excavated) which means that spoil can be left behind (excess material deposited near the roadsides) or that large quantities of extracted material are required from quarries and other sites.



The A-381 Jerez-Los Barrios (Cádiz). The geometric parameters of the layout (gradient, curve radius, stopping sight distance) determine driving safety and comfort as well as its presence (linearity, sinuousness) in the landscape.

On occasion the layout is designed in such a way that the excavations are purposely generated in order to provide material for embankments, always bearing in mind of course, the necessary geometry for the desired design speed. The excavations for cuttings and trenches (which are sometimes difficult to secure), embankments, viaducts, and the portals of tunnels all add to the presence of the road in a given landscape whilst spoil sites and quarries, especially if they are not sympathetically treated in terms of the environment, can have a very detrimental effect, depending on where they are sited.

3.1.5 Level of concentration required for driving and continuity of the route

Roads are designed to conform to a certain degree of required effort and level of concentration from motorists. On motorways, because the two directions of traffic flow are separated, layouts tend to be straighter and flatter, and they can absorb a larger volume of traffic, lower levels of attention are required. Routes in urban areas on the contrary require that the motorist uses all their faculties to safely drive their vehicle, whilst paying attention to a wide variety of stimuli which are not always predictable.

Between these two models of concentration and effort there is a wide range of intermediate situations. Mountain roads for example require considerable concentration, whilst many inter-urban roads in the countryside with little traffic permit a certain degree of relaxation, especially if it is a route that the driver is familiar with. Required levels of attention by motorists should not change too brusquely. A section of relaxing road should not be immediately followed by one which is extremely demanding, since this change of layout, attitude, and expectations has been demonstrated to be extremely dangerous. Approach

roads to cities for example are designed to gradually increase the attention of motorists in such a way that they progressively change from a more relaxed attitude to one of much greater concentration. Another similar example are sections of road which immediately follow a long tunnel. Tunnels tend to create a certain attitude in motorists who drive through them in a rapid and fluid way and it is important that the sections immediately after leaving a tunnel have a certain layout for some distance afterwards, since sharp bends, slip roads, or other complications can be extremely dangerous.

This distribution and quality of layout over a specific stretch of road or itinerary needs to be adequately formulated and planned, and this is a key objective in the development of road plans. Layouts for long distance itineraries tend to be designed in such a way as to maintain similar driving conditions since a much more demanding section inserted sporadically creates the dangers that have been indicated above. Routes passing through towns or villages, for example, need to be planned with intermediate transition sections to avoid brusque changes in driving styles.

It is important therefore to approach long distance trajectories in such a way as to guarantee them a certain level of continuity by making the layouts homogenous and maintaining similar conditions.

The level of necessary concentration of motorists establishes the framework for the possible contemplation of the surrounding landscape from the vehicle. More relaxed driving conditions allow this function of an itinerary to be developed, whereas more demanding sections do not encourage contemplation. The style of driving also has repercussions for vehicle passengers, because although they have more freedom of attention this is still affected by the type of movement (fast or slow, brusque or fluid).

3.1.6 Visibility and legibility of the layout

Along with the factors associated with the speed of a vehicle, safety considerations require that the layout fulfils certain conditions of visibility. At higher speeds motorists need to be able to anticipate potential problems sufficiently far in advance, and in order to achieve this it is necessary to establish a certain sight distance in the layout which permits motorists travelling at design speed, to be adequately advised of a certain obstacle and be able to brake before reaching it: stopping sight distance. Apart from possible obstacles on the roadbed (pedestrians, animals, vehicles crossing, a stopped vehicle, loose rocks, etc.), there are numerous situations which need to be visible to motorists from a sufficient distance such as, for example, other vehicles joining the road (which should be facilitated with slip lanes), or warning signs indicating problems such as road works, provisional detours, etc.

Stopping sight distance is greater on faster roads and shorter on slower ones since logically a vehicle needs less time to slow down when it is travelling less quickly. This parameter has an important effect on the geometry of road layout and frequently requires much more extensive earthworks on faster roads than slower ones.

Apart from visibility on the roadbed itself, the layout must allow motorists to be able to read the conditions which lie ahead. The legibility of a layout permits the motorist to adjust the conditions of the vehicle (position, speed, etc.) to the oncoming situation. Changes of gradient at crests or tight corners in cuttings hide the oncoming layout and require drivers to proceed with more caution, whilst increasing levels of risk.

This whole question of legibility can be applied to both the immediate and the more distant surroundings of the road, taking in the landscape as a whole, and permitting

its appreciation from the vehicle, assuming other necessary conditions also apply (see chapter 5).

3.1.7 The cross section. Functionality and habitability

Another important factor in the design and functionality of a road is its cross section as formed by the separate lanes for each direction as well as lateral safety strips or hard shoulders. The cross section of high capacity roads also includes acceleration and deceleration lanes for the incorporation or exit of vehicles, or climbing lanes for slow vehicles on steep gradient sections. Some roads have multiple lanes in each direction. On motorways, the lanes in different directions are separated and a central reserve is installed which may be narrow with a safety barrier for the whole length, 3 metres in width in order to improve safety or even up to 12 metres wide, offering maximum safety guarantees and providing space for possible future widening schemes.

The widening of the cross section improves road capacity as well as level of service, safety, and comfort, in other words the overall internal functionality of the road. On the other hand, this generally implies a worsening of the integration into the surroundings, and a general deterioration of the exterior functionality, (although this is not always the case), since wider cross sections normally imply a greater barrier effect for people and wildlife. For people it is necessary to construct large crossing structures at strategic points which are generally elevated. However, these can be problematic for people with reduced mobility or who are carrying children or shopping for example, who have to walk some distance to the crossing point and climb steps. Fauna passes have to deal with all the difficulties of creating a suitable ecological ambience in the crossing point,

whether they are overpasses, which have to be isolated from the traffic passing below, or underpasses, which have to be made sufficiently attractive for the different species to use them.

Wider roads also involve more extensive earthworks. A broad motorway situated halfway up a hillside for example requires extensive excavation of the hillside on one side and a large embankment on the other, and in general, the wider the cross section the more notorious the road. Furthermore, these dimensions establish the framework of the interior landscape of the road so that it is more strictly functional and distant from the characteristics of the surrounding area the further it is from the borders.

There are aspects of the cross section which are designed specifically to make the internal functions of the road for traffic (capacity, level of service, safety) more compatible with the external functions (habitability of the margins). Large avenues in urban areas diversify their format to accept different types of transport, leaving central lanes for faster vehicles or longer distance routes, middle lanes for slower vehicles and more localised trajectories, and roadside lanes for public transport, bicycle lanes, and pedestrian areas. Sometimes additional extra spaces are included as transitional collective public areas. Although these models still tend to have a strong barrier effect, they do limit the presence of traffic and its effect on lateral spaces, thereby often achieving acceptable levels of habitability on the margins.

It is not only the larger urban avenues which feature diverse transversal sections, and many inter-urban roads also incorporate roadside lanes, pedestrian paths, and other similar features which allow them to be used not only by traffic. The development of these transition spaces, equipping them for social functions such as walking, leisure,

or the contemplation of the landscape, all helps to make better use of the landscape aspects of roads. There are a wide range of lateral features which aid this function of landscape appreciation (see chapter 6).

3.2 The landscape in the development process of road plans

A road plan should be based on a thorough analysis of the road network examining questions such as the dynamics of mobility in the area, how it is served by the existing road network, and how these roads are integrated into the territory. Based on the findings, the plan needs to establish what the needs of the network are, and what are the principal problems or the potential possibilities, so as to devise a strategic proposal which is formulated to achieve a set of specific quality objectives. Essentially, the plan should respond to the necessity to provide the road network of an area with a defined functionality and level of service.

Road plan can have a pro-active role in the road network and mobility. Road plans have the capacity to play an active role in the organisation of the activities which they serve, affecting demand and correcting inefficiencies. Road plans which concentrate solely on increasing capacity in congested areas without analysing where the problem lies and trying to solve it, are essentially inefficient and doomed to failure in the long run.

It is important to make clear that amongst the functions and services which a road network offers, its integration into the landscape and its landscape appreciation function are important and should constitute specific areas of focus in road planning. For this aspect to be effectively dealt with it needs to be considered at all stages of the plan, from the initial outline to the development of specific management programmes and activities.

That is why the Andalusian 8/2001 Road Act establishes a number of guidelines as part of the General Plan for Roads in Andalusia:

«The diagnosis of the situation of the road network based on the description and analysis of roads in relation to their territorial expression, their natural and socio-economic environment, and their relationship with the landscape in a given area ». (Art. 22b.).

Additionally, the planning of roads needs to define «the criteria of landscape integration in urban, peri-urban, rural, and mountainous environments, and consider the protection of cultural, archaeological, and especially historical heritage in public works». Sectoral, territorial, and provincial road plans which are part of the various planning phases must also contain landscape considerations.

What follows below are a series of recommendations focusing on the specific working areas for road plans.

3.2.1 Analysis and diagnosis of the road network

Road plans are based on the analysis of the mobility of people and goods in the territory which they serve, bearing in mind the functionality of the road network and the service it provides in terms of its role in this mobility. The diagnosis of the road network focuses on establishing both its deficiencies and its potential possibilities. Traditionally the capacity of the various sections and itineraries which form a road network have been analysed essentially in terms of their level of service as this is considered their basic function: the service offered to the traffic. Nevertheless, other lateral aspects have also traditionally

been looked at such as deficiencies in basic accessibility (badly served remote areas), the quality of the service provided to other related areas, amount of accidents, and more recently, the environmental profile of roads. This includes factors such as noise levels, the barrier effect in different habitats, the contamination they generate, and other negative aspects.

As has been made clear in previous chapters, the functionality of a road should not be seen solely in terms of the service it offers to traffic, but must also be judged on other relevant factors including the question of how the road is integrated into the territory which it crosses and how it resolves its co-existence with the surrounding environmental and landscape processes and the preservation of its values. The question of how the integration of a road becomes part of its functionality covers a variety of different parameters. For example, the studies of fragmentation of habitats lead to solutions to improve this aspect of functionality, generally by the implantation of permeability measures. Another similar example are the strategic noise pollution maps which evaluate traffic noise levels in nearby residential areas in order to develop plans to alleviate problems of excessive traffic noise. In the same way, the concept of the integration of the road into the landscape can be seen as a question of compatibility with the values of the areas through which it passes.

The analysis and diagnosis of the road network in road plans should include an evaluation of the way roads are integrated into the landscape by looking at the following aspects:

- The presence of roads in terms of earthworks, linearity, and special structures.

- The integration of roads in the processes of the surrounding area (instability, erosion, geological heritage, hydrology, biocenosis, productive use of the land, quality of life and noise levels, cultural heritage).
- The presence of roads in the scenic structures of the landscape.
- The relationship between roads and the character of the landscape, including an evaluation of the interior scene of the road.

Another function of the road is the question, on the one hand, of the important part they play in the use and exploitation of the landscape in terms of providing access to different areas, whilst on the other hand, in themselves, they constitute scenic itineraries of considerable interest and quality. For this reason, a key object of the plan should be to evaluate the landscape potential of the network by examining both the scenic quality of roads and their problems, as well as their positive aspects as scenic or environmental itineraries, and how successful they are in terms of providing access to distinct areas of landscape.

The role of the road in terms of maximising landscape potential should be analysed in various ways by evaluating:

- The scenic quality of different areas of landscape: the scope for scenic routes and the intrinsic values of their itineraries.
- The existing relationship between the levels of accessibility provided by the road network and the dynamics of the way that each area of landscape is used and organised.

To carry out both aspects of the analysis, that of integration, and that of maximising landscape potential, studies should include evaluations of the landscapes through which the road network passes, and combine this analysis with the objectives and criteria outlined in strategic documents concerning landscape management. On the other hand, these landscape management strategies should consider the role of roads in the organisation, maximisation, and improvement in quality of the landscape.

3.2.2 Areas of landscape intervention in road schemes

Road plans should consider the relationship between the road and the landscape as an area of intervention by proposing clear strategies and objectives for its improvement. There is a wide window of opportunity in this respect which should be treated positively by considering both the road's integration into the landscape, and the appreciation of the landscape from the road.

Areas of activity related to the landscape should be part of basic areas of activity of road plans, from the more strategic and structural aspects to the more specific and concrete. As such, considerations about landscape should embody the policies and strategies which address the patterns of mobility of an area, and more precisely the organisation of accessibility which the road network provides. Landscape values also need to play a role in defining the specific construction schemes established in a given plan for the improvement of the road network. Integration in the landscape should be an area of intervention in itself with its own range of specific initiatives for the development of landscape appreciation from the perspective of the road.

To sum up, the following areas of intervention are proposed in terms of the role of the landscape in road planning:

- Structuring of accessibility to landscapes. A road plan should adhere to established objectives outlined in strategic documents for landscape management in terms of restricting access to landscapes requiring conservation and encouraging access to areas which have been designated for landscape appreciation and enjoyment.
- Landscape treatment in road construction schemes. Projects for the improvement of the road network, be they new schemes or improvement of existing roads, should incorporate landscape considerations in terms of both evaluation of viability and definition of layout and design.
- Adapting or improving the layout of scenic routes. Road plans should include the adaptation of the layout of roads which are likely to become part of scenic routes.
- Improvement of the interior landscape of the road and its integration. The improvement in design of the interior scene of the road and its integration into the landscape should be a fundamental part of the implementation of any planning programme.
- Improvement of the environmental integration of a road. The reduction of negative environmental effects of roads in the existing network (noise, fragmentation of habitats, co-existence with cultural heritage, etc.) should be a specific area of action in road plans.
- Improvement of the road's landscape habitability. Road plans should include a programme of activities for sections of roads where existing environmental conditions could be improved (crossings, urban access roads, etc.) to encourage better collective use of these public spaces.
- Improvement of scenic appreciation from the perspective of the road and its facilities. Making the landscape values of an itinerary more clearly obvious and improving facilities for the appreciation of the scenery should be considered through a specific programme of interventions in road planning.



Roads provide a selective access to the landscape, with a greater or lesser degree of service and comfort. This aspect is an efficient instrument for regulating pressure on more fragile areas.

3.3 Organisation of accessibility to landscapes

A road plan is based on the necessity to organise the capacities of the road network to serve the territorial model which is envisaged for each area, establishing a basis for road communication which has to serve the main routes of movement of people and goods, whilst also considering secondary routes or distribution networks, and a system for more localised movement. As such, the network has to serve the main economic centres and link them with intermediate or more remote areas and the model for a road network needs to consider the service provided by roads to all the different landscapes.

Strategic documents which establish the form of management of landscapes need to define the level of human activity which each kind of landscape can withstand depending on its intrinsic qualities and the way its use is envisaged.

In this sense the road network has a crucial part to play and must be properly considered in any such documents or plans. In general, main routes of communication should be removed

as far as possible from fragile and valuable areas of landscape. Nevertheless at an intermediate or district level, all areas need to be connected to the overall network and this is achieved via roads which avoid damaging the more sensitive areas. Meanwhile, at a local level, the system needs to provide access to the interior of every area, encouraging access to sites which are appropriate for visitors, whilst limiting access to areas which should be preserved unaltered.

All these criteria and their different levels of access to landscapes (inter-territorial, district, and local), need to be incorporated into the model of accessibility set out in mobility plans. In order to achieve this, the landscapes management goals, particularly those which affect conservation and public access, need to be incorporated into territorial mobility plans as clear objectives to be achieved, whilst coordinating them with other criteria (reducing congestion, territorial organisation of patterns of mobility, reducing accidents, improving level of service, etc.).

3.4 Landscape treatment of construction schemes of road plans

3.4.1 Landscape diagnosis of works undertaken in road plans

Construction activities as established by road plan, whether they are new roads, or upgrades of already existing ones, should incorporate landscape criteria in their definition and design which favour both their integration into the landscape and the possibility of maximising the appreciation of surrounding scenery. Whilst the integration of the road into the landscape should be based on the reduction of the presence of the road, the appreciation of the landscape from the should be centred on developing the full potential of scenic quality.

The integration into the landscape of a new road should seek the best possible environmental integration, limiting the extent to which it is visible as much as possible, and controlling the way that the road and its multiple elements are amalgamated into the surrounding scenery, by including elements of the character of the landscape through which it passes into its basic design and conception. In terms of the landscape appreciation function of the road, the best views which it affords should be identified, resorting if necessary to changes in layout so as to give a better series of views, and perhaps including specific facilities for the contemplation of the landscape (view points, walks, etc.), or simply pointing out landscape values along the itinerary by use of signposts or information points. Both aspects, integration and appreciation, need to be part of the conception, definition, and design of the works, thereby establishing the main landscape principles which justify the need and viability of the works in the strategic document of the road plan so that these considerations can be subsequently developed during the layout definition phase (see recommendations in chapter 4). Later, during the elaboration of the actual construction project, a more detailed design approach which is more sensitive to the structural elements of the road should be developed (see recommendations in chapter 5), and specific facilities for the enjoyment of the landscape can be incorporated (see recommendations in chapter 6).

3.4.2 Scope of landscape considerations

The plan itself should define the scope of the measures to be incorporated into each intervention for their definition and design. As such, a set of general guidelines are presented, but the way that integration is achieved and the opportunities for landscape appreciation from the road are dependent on the specific conditions in each individual case. In terms of the successful integration of roads into the landscape the essential criteria are as follow:



The A-381 Jerez-Los Barrios road, next to the Barbate, reservoir (Cádiz). The integration of roads into the landscape is more successful when questions of earthworks and linearity, environmental and scenic integration, and the relationship between the infrastructures and the features of the landscape, are interrelated. Additionally it is possible, if considered convenient, to add specific installations to the design of the landscape, to encourage a positive approach to non-statutory aspects of the road's character or to emphasize the values of the itinerary.

- Minimize the presence of the road in the landscape by reducing earthworks, linearity and the most obvious structural elements which go to make up the road (links, viaducts, etc.) as much as possible.
- Enhance the integration of the road into the environmental processes by utilising the necessary changes in layout so as to avoid damaging the principal environmental values (geological and cultural heritage, water quality, biodiversity, soils and land use, natural resources, quality of life,) or adopting corrective measures to rectify any environmental changes.
- Promote the optimum scenic integration of the road by limiting excessive exposition of the most notorious elements (cuttings, embankments, junctions, structures etc.).
- Stimulate a positive relationship between the road and the character of the landscape by respecting its reference patterns and landmarks as much as possible.
- Include references to the character of an area in the design of the elements making up the road.

In terms of making the best landscape use of road schemes by pointing out the landscape values of the itinerary, the following guidelines are recommended:

- Aim to achieve appropriate scenic itineraries for all roads which are undergoing improvements or being constructed.
- Enhance the scenic quality of the road, giving it landscape functionality wherever possible to permit the contemplation of the landscape from the vehicle itself.
- Consider the possibility of incorporating specific facilities into the works for the enjoyment of the landscape.

3.4.3 Incorporation of landscape considerations into the definition of road plan actions

A road plan should be based on the analysis and diagnosis of the landscapes where the road network is in such a way that each proposal of action can be contrasted with its landscape context. The initial diagnosis should systematise the landscape values and the relationship with the insertion of a road in terms of the road's presence, the value of the environmental processes, the, scenic location and the repercussions on the character of the landscape.

This initial evaluation of the landscape values should permit a basic examination of the possible relationship between the proposed scheme (new motorway, widening of an existing road ,etc.) and the surroundings, in order to assess the need to apply structural measures (global definition of the project in terms of types of scheme, definition of layout, structural elements, etc.), recommend partial measures (inclusion of landscape facilities, cut and cover sections, etc.), or employ additional measures (character elements, retaining walls, gardenised areas, etc.).

The necessary measures for the integration and landscape use of each scheme are incorporated into the definition for their future development during the process of implementation of the plan. In terms of these recommendations it is suggested that readers refer to the layout criteria discussed in chapter 4, the integral elements of the road discussed in chapter 5, and the specific landscape facilities discussed in chapter 6.



The positioning of a road provides a visual reference of the surrounding scenery and this can be an integral objective of an improvement scheme. A programme of improvement of visual itineraries can help to enhance this quality on sections where they are required.

3.5 Adaptation or improvement of the layout of landscape roads

3.5.1 Diagnosis of the road network

Planners should identify those roads which are already part of the network which could be adapted as scenic routes: roads which, once their layouts are modified, would be well suited to the contemplation of the landscape from a vehicle. In order to fulfil this role a wide range of demands need to be met. In the first place the road must be situated in an area of interesting landscape and it also needs to follow an itinerary which is well sited in terms of being able to appreciate the views. The layout needs to be planned in such a way as to allow comfortable and safe driving conditions whilst offering a sequence of attractive views and the levels of service and traffic have to be adequate in terms of allowing safe contemplation of the surrounding scenery.

The identification of potential scenic routes can either be incorporated into the general analysis of landscape values of the road network as a whole or treated separately

in a series of different sections or specific itineraries. The overall objective should be to identify roads or sections which, thanks to the nature of their itinerary, offer a certain level of scenic potential, and which, at the same time, can be coordinated with programmes to valorise and organise the landscape which are already being implemented in accordance with existing strategic documents concerning landscape management.

3.5.2 Criteria for intervention

Criteria for intervention in the adaptation and enhancement of scenic roads depend on the possibilities in each case, although the basic ones are as follows:

- Roads with extensive scenic views in landscapes of high quality.
- High volume roads with regular users, featuring extensive scenic views, as part of the improvement of everyday landscapes.
- Roads with extensive scenic views in rural environments as part of general improvement to the countryside.

3.5.3 Programme for the adaptation or improvement of layout of scenic roads

The programme for the adaptation and improvement of layout of scenic roads should be based on a thorough analysis of each case which has been considered as a target project, bearing in mind the following aspects:

- The current scenic itinerary of the road and its possible improvement;
- The disposition of the scenic landscape and the visual route which the road provides;
- The form of the current layout and the necessity for improvements in terms of visibility, gradients, bends;
- The current traffic conditions in terms of density, amount of heavy vehicles, seasonal changes, and possible ways of managing demand levels.

In terms of these aspects of the layout design it is suggested that the reader look at the recommendations set out in chapter 4.

3.6 Landscape and aesthetics improvement of roads

3.6.1 Diagnosis of the road network

Plans for the road network should involve an analysis of the state of the current situation and identify roads which need improvements to their interior scene, as well as those which could be enhanced in terms of their integration into the landscape. Whereas the first concept refers to the condition and character of the elements which go to form the interior scenery of the road, such as guard rails, signposting, retaining walls, stopping areas, etc., the second refers to the way a road is integrated into its surroundings, particularly in terms of its construction features and how they fit the environment.

Both aspects can be examined together in order to create the basis for a programme of initiatives to improve the aesthetics and landscape characteristics of a road with its various elements and facilities.



The object of this approach should be to identify those roads or sections of roads which are in a state of deterioration or are suitable for improvement in terms of their interior landscape or their integration, whether this is in relation to the essential elements as perceived by road users, or the state of the elements which are related to the exterior landscape such as eroded slopes, the surroundings of supports or abutments of viaducts, construction sites, or abandoned spoil sites.

The elements of the roadway and its margins make up the road's landscape. This is often an aseptic and functional space but when treated appropriately in terms of positive road planning and management it can assume character and identity.

3.6.2 Criteria for intervention

The plan should define the possibilities and full scope of the criteria for intervention for the scenic and aesthetics improvement of roads although the basic elements are as follows:

- Improvement of the interior scene and the integration of roads which pass through landscapes of high quality.
- Improvement of the interior scene and the integration of high volume roads with regular users, as part of the improvement of everyday landscapes.
- Improvement of the interior scene and the integration of roads in rural environments as part of a programme of general improvements to the countryside.

3.6.3 Intervention programme for the aesthetics and landscape improvement of roads

The programme of intervention for the aesthetics and landscape improvement of roads should be based on a thorough analysis of the characteristics of each case which has been considered as a target project, bearing in mind the following aspects:

- The formal references of the character of the landscape to be used in the creation of the interior landscape of the road;
- The environmental requirements for the treatment and recuperation of eroded areas;
- The specific conditions which require particular interventions in certain areas, either for environmental considerations (rivers, high temperatures, natural parks, high altitudes, etc.), social functions (bus stops, access to villages, etc.), or their particular function (bridges, tunnel portals, bridge supports, etc.).

The programme should include the substitution and improvement of the intrinsic features of a road such as:

- The substitution of guard rails
- The organisation of directional and thematic traffic signs
- Aesthetics treatment of retaining walls
- Environmental recuperation of deteriorated areas
- Gardens in roadside areas
- Treatment of specific structures such as viaducts, roundabouts, tunnel portals, etc.

Recommendations for the carrying out of these works are outlined in chapter 5

3.7 Improvement of the environmental integration of the road

3.7.1 Diagnosis of the road network

Plans for roads should involve an understanding of the degree of integration of roads into the processes of the environment and their relationship with the safeguarding of its values. This involves the identification of the effect that the presence of a road network has on the sustainability of desired levels of environmental quality which form the essential basis of the landscape. Plans should at least outline the role that roads can play in terms of:

- The increase of erosion,
- The coexistence with water courses and lakes or reservoirs and the implications in maintaining their quality,
- How they impact on ecological connectivity,
- How they directly contribute to human activity, and its long term effect on areas of natural quality,



The following aspects should be addressed in specific road development programmes: revegetation of slopes to prevent erosion; permeabilisation for animal life to minimise the fragmentation of habitats; prevention of contaminating spillages through the installation of settling basins; reduction of noise levels to improve quality of life; and, in general, the measures necessary to guarantee the required level of coexistence between the elements which make up the road and the processes of the environment.

- Their integration in the systems of agrarian exploitation,
- Their effect on noise levels in the surrounding area, and
- Their coexistence with elements of cultural heritage.

The consideration of these environmental aspects can either be combined with questions of aesthetics and scenic improvement of a road and its various elements, or on the other hand, be dealt with as an issue in itself.

The essential object of these analyses of the road network should be to identify those roads or sections of road which display a certain degree of environmental deterioration of any kind, be it in relation to the presence of construction features (erosion of slopes and

banks, interference of works on the margins, isolation of its fencing, etc.) or because of the traffic itself (noise levels, animals being run over, accidental spillages, etc.).

3.7.2 Criteria for intervention

The plan itself should be based on a thorough analysis of the possibilities and scope of the criteria for intervention for the improvement of the environmental integration of roads, although the basic criteria are as follows:

- Sections with high levels of potential erosion on slopes or banks and other constructed elements.
- Sections which are near to rivers or other water sources with repercussions in terms of flooding.
- Sections with high numbers of accidents involving animals.
- Sections with high levels of noise in nearby residential areas or other sites which are close at hand.
- Sections which affect conservation of elements of cultural or historical heritage.

3.7.3 Programme of initiatives for the improvement of environmental integration of roads

A programme of initiatives for the improvement of environmental integration of roads should be based on a thorough analysis of the characteristics of each case which has been considered as a target project, bearing in mind the following aspects:

- The environmental conditions of the surroundings of the sections to be considered (erosion, hydrology, ecological connectivity, systems of agrarian exploitation, noise pollution, heritage features, etc.) and how these are related to the deficiencies in the environmental integration of the section.

- The possible engineering or management solutions (environmental recuperation of slopes/banks, correction of hydrological interferences, defragmentation of natural habitats, permeability for agricultural machinery, noise reduction screens, improvement of access to heritage sites, etc.) which can improve the environmental integration of the section;
- The specific conditions which require attention in these sections either because of their special environmental conditions or their particular function.

The programme should include the use of environmental correction measures such as:

- Fauna passes and fencing
- Noise reduction screens, permeable roadbeds
- Environmental restoration treatments in deteriorated areas
- Settling basins

In order to implement these measures it is recommended that the standard guidelines are followed.

3.8 Improvement of the habitability of the road

3.8.1 Diagnosis of the road network

Plans for road schemes should include an understanding of the conditions of environmental quality in order to maximise the habitability of roads. This concept refers

to the conditions which permit the use of the road as a collective space beyond the basic function as a transport route. This involves encouraging the public use of these linear spaces in situations where it is compatible with traffic use, i.e., in sections with low traffic density or moderate speeds which are compatible with other possible uses so as to maintain the required levels of environmental quality which are essential to the enjoyment of the landscape of the road.

In this sense, road plans should indicate the level of habitability offered by the different sections which go to make up the road network, stipulating specific areas of urban character such as:

- Access roads to small towns and villages, the so called «fitness routes» on the outskirts of towns,
- Roads passing through towns and with low levels of traffic,
- Roads which have been substituted by bypasses,
- Access routes to large cities which have lost their previous role, and
- Inter-urban sections where habitability can be improved.

These improvements in habitability on different sections of road can go hand in hand with programmes to improve the aesthetics and landscaping of roads with their various elements and facilities, or, on the other hand, be treated by an independent programme.

The aim of these analyses of the road network should be to identify those roads or sections where noise levels, atmospheric contamination, barrier effects, and risk of accidents can be reduced by combining measures for controlling traffic (re-routing, segregation of heavy vehicles, traffic calming measures, construction of bypasses, etc.) with ways of improving



The conditions of environmental quality of the road's surroundings, basically the emission and noise levels, determine the habitability of this public area (the road and its margins). Road planning could develop specific intervention with the goal of improving these areas.

the margins of the roads, by providing them with facilities for collective use (footpaths, lighting, gardens, view points, etc.).

3.8.2 Criteria for intervention

The plan itself should be based on a thorough analysis of the possibilities and scope for intervention for the improvement of habitability in roads, although the basic criteria are as follows:

- Sections with moderate traffic levels
- Sections with non aggressive traffic (low speeds, no heavy vehicles, urban traffic, etc.)

- Sections near to residential areas which would benefit from improvement
- Sections which are socially interesting in terms of their environmental conditions (wooded areas, coastlines, riversides, etc.), cultural aspects (pilgrimages, walking routes, etc.) or landscape (good views, scenic areas, etc.)

3.8.3 Programme of intervention for the improvement of habitability of roads

A programme of intervention for the improvement of habitability of roads should be based on a thorough analysis of the characteristics of each case which has been considered as a target project, bearing in mind the following aspects:

- The traffic conditions which a section serves in terms of average daily intensity, percentage of heavy vehicles, types of journey, average speeds, driving conditions, seasonal factors;
- The possibility of reducing traffic pressure through demand management measures (selective limitation of access, traffic calming measures, etc.), opening of alternative routes (bypasses, reorganisation of access), or ways of isolating traffic (tunnelling, fencing, flyovers);
- The social conditions of the section in relation to its collective use (urban character, pilgrimage routes, routes in natural parks);
- The conditions for the implementation of improvements for collective use of the margins (overall width, access from other itineraries, available lighting facilities, walkways, gardens).

In terms of these initiatives the recommendations outlined in chapter 6 are particularly useful, especially, but not only, in terms of walkways and bicycle lanes.

3.9 Improvement of the landscape appreciation from the road and its facilities

This programme does not refer to the altering of existing roads to improve their scenic function (which is examined above in section 3.4), but rather to the potential for scenic landscape appreciation on roads whose layout is maintained as it is.

3.9.1 Diagnosis of the road network

A road plan should include an analysis of the potential for contemplation and appreciation of the landscape of the road network by identifying those routes which could benefit from improvements in their specific facilities and the introduction of systems of information which can increase awareness of landscape values.

Whereas the first concept refers to the state or possible implantation of facilities for the contemplation of the landscape such as view points or pathways, rest areas, service areas, parking, etc., the second refers to increasing awareness of landscape values through specific systems of information such as visitors' centres, directional signposting, and information signs about the surrounding area.

Both approaches can be adopted simultaneously to form the basis of a programme of initiatives to maximise appreciation of the landscape from the road by coordinating the various aspects which go to make up this function.

The essential object of this approach should be to identify those roads or sections of road which offer a certain potential for appreciation of the landscape because their itineraries allow travellers to be aware of the inherent cultural and natural wealth of an area. This can be achieved through special facilities for enjoying the scenery from a



Jerez-Los Barrios (Cádiz) A-381. The capacity of roads to display and explain the landscape, whilst encouraging its enjoyment and understanding, can be improved by installing signposts, view points, interpretation centres, and other facilities.

stationary vehicle, or by offering specific information to the traveller about structural elements and landmarks or patterns which make up the landscape character.

3.9.2 Intervention criteria

The plan itself should identify the relevant criteria for intervention in order to encourage appreciation of the landscape from the road. The essential basic criteria are as follows:

- Putting in place or improvement of facilities for landscape appreciation and elements for the demonstration of landscape values in areas of natural and cultural significance.
- Putting in place or improvement of facilities for landscape appreciation and elements for the demonstration of landscape values on roads in everyday landscapes (metropolitan contexts, inter-urban roads, etc.) which are used for routine journeys, with the aim of raising awareness and appreciation of familiar landscapes.

The intervention criteria for this programme should be established in line with the strategic documents which govern landscape management and appreciation in terms of their different priorities and approaches.

3.9.3 Programme of activities for the improvement of landscape appreciation from the road and its facilities

The initiatives which go to make up the programme for landscape appreciation from the road should be based on a thorough analysis of the characteristics of each case which has been considered as a target project, bearing in mind the following aspects:

- Landscape values in terms of the structures, patterns and landmarks which make up its character;

- The relationship between these elements and the itinerary of the road itself, identifying the best scenic sites in terms of contemplation, explanation, or access;
- The relationship between these elements and the itinerary of the road itself, identifying the best scenic sites for signposting and maximising awareness;
- Traffic conditions and access in terms of the possible siting of facilities and specific signposting.

The programme should include constructive initiatives for the creation of specific facilities for the appreciation of the landscape such as:

- Panoramic view points,
- Rest and service or parking areas,
- Roadside pathways, bicycle lanes, or inter-connecting points with paths through the landscape.

The programme should include specific initiatives to encourage awareness of the landscape values of a route such as:

- Landscape information centres,
- Information panels,
- Specific signposting of the landscape along a route.

It is suggested that readers look at the recommendations on these topics discussed in chapter 6.

A key road in the structuring of a metropolitan area. Central access route to the Aljarafe area of metropolitan Seville



Aljarafe access road and transversal bridge connection, 1994.

This is a road which was planned following a clear organisational strategy as outlined in the Directrices de Coordinación del Planeamiento Urbanístico del Área Metropolitana de Sevilla de 1989 (Guidelines for the Coordination of Urban Planning in the Metropolitan Area of Seville, 1989). This document

Example

Example



View of the Aljarafe access road
from Mairena in 2003.

was aimed at organising the internal structure of a development area on the right bank of the river Guadalquivir, the central part of the Aljarafe area, which was suffering considerable problems caused by urban sprawl, the destruction of organisation resources, the growth of a conurbation, and the deterioration of the traditional characteristics of the landscape. As such, it is an example of a route conceived from the planning stage, as a specific element of organisation.

An earlier project based on the increase in capacity of the existing road between San Juan de Aznalfarache and Mairena was substituted for an innovative star shaped structure with a new high capacity layout, which was aimed at being a collector and distributor for the growing amount of daily traffic between the city centre and the Aljarafe. At the same time it introduced into an area comprising various different municipalities, a uniform spatial organisation, facilitating access and communication between them, whilst also combining with the surrounding open spaces to act as a way of limiting the process of conurbation.

The construction comprised the main artery, some 2,500 metres in length, the large distribution roundabout, and the initial parts of the interior routes of the star. It takes the form of a dual carriageway with two lanes in each direction on independent platforms adapted to the general shape of the landform, with a wide central reserve and roadside areas of variable width, which were planned for possible future metropolitan transport schemes (such as the recently opened Line 1 of the Seville metro system), and frontage roads. The route has three important access points and transversal connections: two underpasses, and one overpass.

Before the implementation of the project the layout of the road was adapted to the urban and landscape organisation as set out in the «Estudio de Ordenación del Sector Central del Aljarafe» (Organisational Study for the Central Sector of the Aljarafe).

The project has various interesting aspects in terms of the landscape:

- It provides a general framework for urban development in the Aljarafe, via which the process of conurbation is limited, whilst both open spaces and the pre-existing perception of the landscape are protected.
- With a flexible layout and wide spaces on its margins, it provides a clear view of the area it crosses..
- Clear structural and layout criteria have been employed in the design of all its elements – bridges and underpasses, retaining walls, ditches, central reserve, lighting, etc.

Example



4

ROAD LAYOUT AND LANDSCAPE



ROAD LAYOUT AND LANDSCAPE

4

Due to its territorial nature, the road project has a special landscape condition which is essentially based on the characteristics of its layout. This is so because of the territorial processes in which it participates and interacts, through the connections and interferences established by its linear character, which can, for example, enhance the dynamics of an urban area by providing accessibility, cause fragmentation in a habitat it passes through, or occupy a floodplain, pushing the water back towards the other side of the river with an embankment.

The layout is also an essential element of the road in terms of its appearance, its aesthetics and meanings which are defined by the linear sense established by the disposition of its platform, and naturally, in terms of the singular scenic quality of the succession of views provided by the route.

Following a series of general considerations about layout and landscape, this chapter examines the process for the definition of the layout, as well as the design and selection of alternatives, as an introduction to approach the different sets of layout criteria in accordance with the scenic function of the road (presence, environmental integration, scenic integration, character, scenic or visual quality, and the values of the route). It then examines the conditions which define the presence of the road in the landscape, namely its linearity and earthworks. Later, we consider the integration of the road into the processes which take place in its surroundings and then look at the relationship between the layout and its integration into the physical context of the landscape, and between the layout and the scene of the landscape. The development of the visual quality of the layout and the landscape values of the route are also considered.

In addition to examples of Andalusian roads given for each set of layout criteria, which illustrate their landscape functionality (presence, environmental integration, scenic integration, character, scenic or visual quality, and the values of the route) a presentation of a real road project based on the scenic quality of its layout is also included.

4.1 General considerations on the road layout and the landscape

The linear presence of a road in a landscape is defined by the conditions adopted by its layout, which is an essential element of the road project because it defines its functionality and the way in which it is incorporated into the terrain. From the point of view of the landscape, the presence of the road has a dual effect: looking towards it from outside it is an element which forms part of the landscape, but looking outwards, the road, as it carries its travellers, has its own viewpoints of the surrounding scenery. On the one hand, the road is part of the landscape and becomes part of its environmental processes and the general composition of

the surroundings and scenery, but at the same time it offers users a point of view and a visual route which is widely appreciated.

Thus, it can be said that the integration of the road into the landscape depends essentially on its layout and on how the earthworks that sustain it are designed. This includes the whole range of excavations, embankments, lateral fillings and other large scale transformations next to the road (spoil sites, quarries, earthworks of ancillary construction sites, etc.).

As such, the dimensions and characteristics of these construction features and how they are situated in the surrounding scenery are what define the degree of presence and intrusion of the road in the landscape.

On the other hand, a territory is not an inert and static space; on the contrary, it has interactive processes and mechanisms (e.g., erosion processes, water systems, mechanisms of biocenosis, processes of human occupation of the territory, and others), with their own distinctive values which are affected by the road. The layout and earthworks of a road are the primary cause which results in a certain type and extent of the effects it produces on the environment.

From the point of view of the observer of the landscape, the layout also defines the extent to which a road is evident within the scenery of a landscape. Its visibility depends on the layout and volumes of the platform with respect to the scenic structure of the landscape, i.e., in terms of the visual patterns of the topography, the organisation of visual interaction, the panoramic points of view, and the visual routes which permit the perception of the scenery.

In addition to its merely visual dimension, the layout and the defining elements of the road contribute, through their appearance and the meanings they induce in the observer, to the processes of appreciation and understanding of the landscape, because they become part of the general composition of the scenery and its aesthetics. The road becomes an

integral part of the complex system of perceived meanings and values which are distinctive to every landscape and its character, affecting its qualities to a greater or lesser extent. For example, the excessively functional appearance of the road, its geometric simplicity and its linearity can diminish the character of landscapes with a high natural or cultural significance, affecting their understanding and appreciation. The specific and detailed design of the elements of the road permits a coordination of its aesthetics and meanings which goes beyond its traditional functional conception, with those of the surrounding landscape, thus giving the road a sense of meaningful identity which is related to the character of the area, without diminishing its functionality and level of service¹.

All these characteristics and qualities of layout contribute to integrating the road into the landscape at different levels, be it in terms of volume (earthworks and linearity of the layout), environment (interaction with the processes which take place in the surroundings), scenery (visual presence) or the aesthetics and character (interaction of the meanings of the road with those of the landscape). There is therefore an active part of the engineering of roads in which the process for the design and definition of the layout plays a crucial role in improving the landscape quality of the road. In the same sense, in addition to techniques for the integration into the landscape, it is important to realise the landscape potential of the layout, which is associated with its visual or more specifically scenic quality.

Legibility is the visual quality of the layout which makes the road safer. It basically involves the capacity of road users to visually anticipate the conditions of the layout of the road they are travelling through. This visual capacity of the layout to literally be able to see itself, can be physically extended to the areas which are near to the margins of the road and further beyond, covering the surroundings of the road as a whole. In fact, legibility is

1. This chapter focuses on recommendations for the layout of the road; the following chapters look into the possibilities offered by the detailed design of elements which are intrinsic to the road (signage, safety barriers, retaining walls, etc.), its large structures (bridges, tunnel portals, junctions, etc.) and even adjacent facilities with a specific landscape function (view points, roadside paths, car parks, etc.).

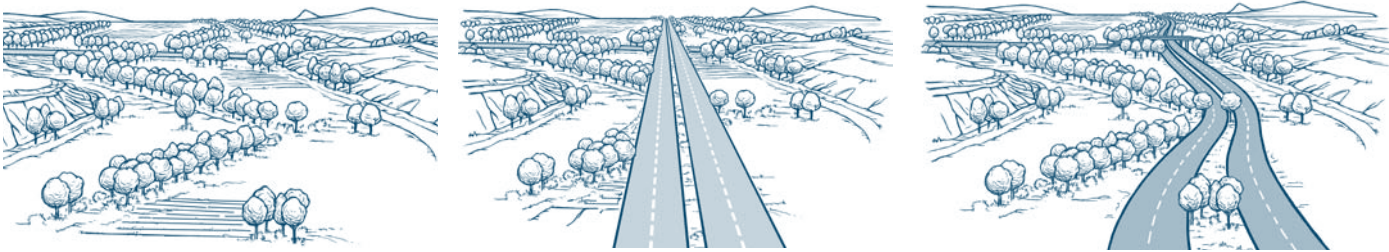
an indispensable quality in a scenic road, the primary function of which is to permit the contemplation of the landscape from a moving vehicle. In this type of project, the definition of the layout is essential because it responds to scenic criteria which define the route and its characteristics in accordance with the intended views. Furthermore, the scenic qualities of the layout must be combined with other conditions (traffic intensity, speed of the route, level of service, etc.) which also affect the landscape viewing capacity of motorists and are necessary to make the enjoyment of the scenery compatible with safe driving.

Scenic roads have complex functional conditions which are extremely difficult to fulfil, especially in terms of achieving a layout which offers motorists safe and uninterrupted views of the landscape. However, motorists have the capacity to understand and appreciate the landscape of a route even if this continuous visual route, in the style of cinematic *travelling*, which is precisely the main purpose of scenic roads, is not possible. The objective values of the landscapes of a route can be presented to travellers in different ways, using a variety of information systems or formats for their appreciation and enjoyment.

Furthermore, the routes followed by roads are not arbitrary, they often feature geographical and/or cultural elements of special interest and full advantage should be taken of them. On roads with interesting visual routes whose driving conditions require a great effort, there is always the possibility of creating appropriate view points, or using efficiently themed signs and other facilities and services which exploit their potential.

This chapter examines the various diverse qualities which are present in roads in a range of different ways depending on the factors which define their layout.

The integration of the layout and landscape potential of a road, independently of whether its layout has been newly constructed or is an already existing one which has been upgraded



or adapted, will therefore depend on the suitability of its definition and design. From this we can infer that there is plenty of scope for the positive treatment of the layout of roads. The factors which define the different landscape qualities of the road are explained separately here and outlined as recommendations and criteria for the design of the layout.

From the exclusive point of view of the landscape, the management, conception and design of the layout of a road should be defined by the necessity of integrating the linear shape of the road into its setting, and the possibility of taking maximum advantage of the scenic potential of the surrounding area. A set of reference criteria and recommendations concerning landscape elements are therefore needed to make the landscape quality of the layout compatible with the rest of the objectives of road design (service to traffic, safety, capacity, geotechnical requirements, etc.).

The various different landscape qualities of the layout must therefore be approached in this integral context. With this aim in mind, after an initial section which offers an introduction to the essential processes involved in the design and definition of the layout, examining how these landscape considerations can be incorporated, this chapter then goes on to look at the following themes:

- Presence of the road in the landscape: linearity and earthworks.
- Integration of the road into the environmental processes.

A road's layout determines its presence in the general composition of the landscape (left). This could involve a brusquely imposed approach (centre), or alternatively (right), one which adapts more organically to the structure of the landscape. In general, more winding roads which are better adapted to the landform can be integrated more successfully into the character of the landscape.

- The layout and its integration into the scene of the landscape.
- Relationship of the layout with the character of the landscape.
- Development of the visual quality of the layout: scenic layout, legibility of the landscape and characteristics of a scenic road.
- Layout and development of the scenic values of a route.

Additionally, the following chapters offer a series of recommendations for the positive development of the internal scene and character of the road, including the design of the typical elements and structures of the road itself (Chapter 5. Landscape Design of the Road), and specific areas for the landscape (Chapter 6. Roadside Areas).

4.2 Process for the definition and design of the layout, and selection of alternatives

4.2.1 Layout and landscape criteria

As well as satisfying all the functional requirements of a road, essentially complying with the geometric curvature and gradient parameters, the definition of the layout must generate a design which causes as little alteration to the terrain as possible, since this reduces the costs derived from earthworks, mitigates geotechnical risks, minimises environmental impact, and reduces the presence of constructed elements in the landscape. The occupation of land of high economic value, social interest, or natural, historic, or cultural value must also be avoided wherever possible.

Developing a satisfactory layout which complies with all these requirements is often a difficult and cumbersome task. For this reason, the process is implemented gradually in



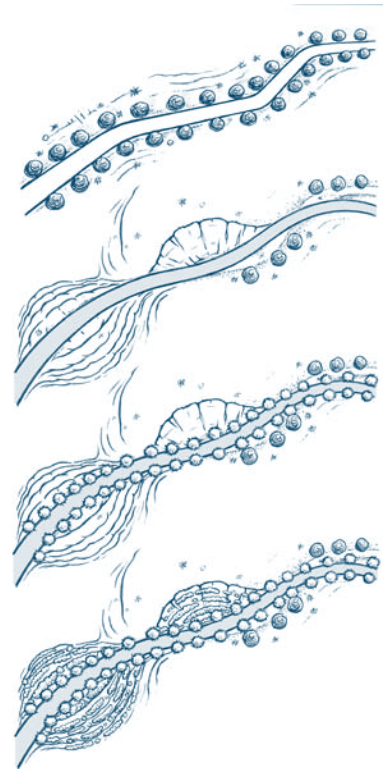
The definition of the layout should take advantage of the elements and character of the landscape as much as possible.

several stages, each one more precise than the preceding one, so that the route and layout steadily become more defined. Firstly, the possible corridors which could accommodate the road are defined at a smaller scale (from 1:25.000 to 1:10.000). Then, at an intermediate scale (from 1:5.000 to 1:2.000), the actual layout is gradually established in the specified corridor. At this level we start to obtain a degree of definition which permits an approximate extrapolation of some of the essential dimensions of the future roadbed and its main construction features. Finally, during the design of the construction project, the disposition of the alignment of the road itself, and its cuttings and embankments, are defined in more detail (from 1:2.000 to 1:1.000), together with the essential engineering works (structures, drainage, underpasses, etc.).

This method of gradual definition of the project must incorporate the scenic considerations required for each phase of the works by including them at each point in the process. It is important that a territorial analysis which identifies the characteristics, values and mechanisms of the surrounding landscape is completed before the definition and design of the layout is completed so as to avoid contradictions in criteria. This territorial analysis must be applied to each of the stages and scales, interpreting the processes of the landscape to the degree permitted by each different scale, and providing positive criteria and recommendations to the layout and the project designers.

4.2.2 Gradual Definition of the Layout

During the definition of corridors, generally at a scale of between 1:25.000 and 1:10.000, the presence of the road in a specific landscape is assessed using only a rough definition of the work, its disposition and volumes, whose extrapolation can only be estimated.



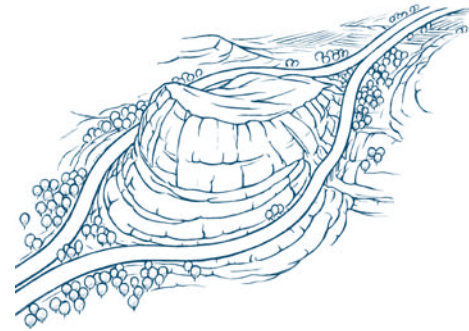
Trees and other elements on the margins can be used positively and enhanced in road upgrade schemes.

Often this degree of precision can be enough to rule out a particular corridor in favour of another one on the grounds of the quality of its landscape, or the way in which it would be affected by the presence of the road, bearing in mind the necessary earthworks, proximity to certain sensitive landmarks, or, simply, the environmental values which would be at stake.

At this first stage of defining the corridor, the basic landscape units should be considered together with their most significant elements such as landscape landmarks of special relevance, woodland, bodies of water, or human settlements. During this stage, the characteristics of the landform, the various types of environmental features, and the general scenic, and the general physical organisation of the area, as well as the character of the landscape, and the potential views must be efficiently extrapolated so as to be able to complete the selection and definition of corridors for the proposed route.

The intermediate scale of layout definition, normally between 1:5.000 and 1:2.000, provides a more detailed analysis of the works which are to be carried out. The linear disposition is still approximate but considerably more defined, whilst the embankments and earthworks can be interpreted with a certain degree of precision. The effects of composition on the scene, of imposing proximity to significant landscape features, and the scenic or visual characteristics can be perfectly extrapolated at this scale, which subsequently allows the incorporation of recommendations on the general disposition of the project and its various elements, as well as the coordination of the landscape and environmental considerations concerning the different criteria of the route (functional, geometrical, geotechnical, economic costs, social return, etc.).

This intermediate phase requires a detailed analysis of the landform and the physical characteristics of the land (considering at least the visual units, terrain intervisibility,



The division of the dual carriageway into two roadbeds, on either side of an elevation for example, can result in a more successful incorporation into the landscape by reducing the imposing effect of the road and minimising earthworks, as long as the ecological conditions, particularly in terms of connectivity, do not make it unfeasible

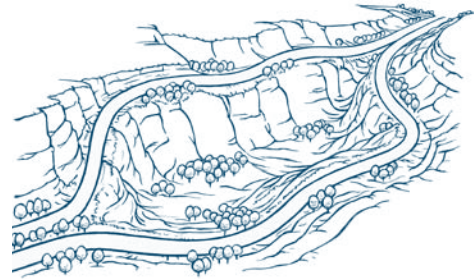
frequenciation, existing routes and view points, panoramic views, and potential itineraries, etc.). This scenic analysis must be accompanied by an environmental analysis of the territory and its values, along with a diagnosis of the character of the landscape and the potential for views on the routes being considered.

The final phase, the construction project scale, is extremely precise, leaving no room for change in terms of the presence of the projected road in the landscape. At this stage it is only possible to enhance constructed elements with complementary superficial or ornamental measures such as re-vegetation and landscaping, or by selecting specific elements (barriers, walls, etc.). For this reason the most detailed and important aspects of landscape analysis must be applied during previous phases (planning, definition of corridors) and at intermediate scales (1:5.000 to 1:2.000) where positive landscape integration criteria can still be incorporated.

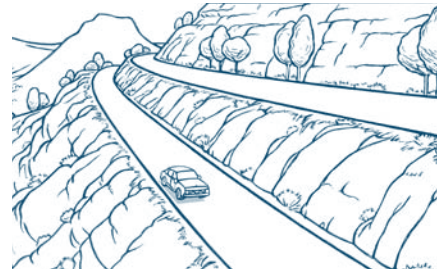
In the project phase, detailed information about the area which is close to the infrastructure (including vegetation, paths, constructed elements, fluvial morphology, etc.) must be compiled so as to be able to bring the recommendations of the previous phases to this level of precision (for example, an excessively exposed slope which needs to be rectified, the simplifying of excessive signalling or signposting, provision of elements for disguising the road, or maximising the visual potential of a nearby area by installing a view point on a lateral spoil site, etc.).

4.2.3 Alternatives, definition and selection

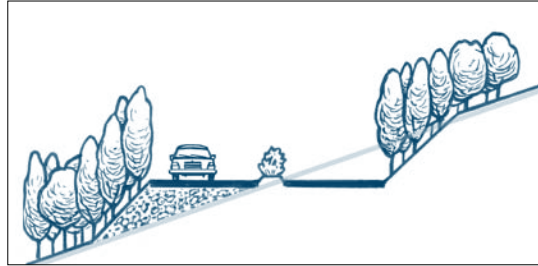
The definition of alternatives is a methodological process recommended in civil engineering for improving the technical product through the construction of different solutions for the same problem. In the case of linear works, the development of comparable alternatives is



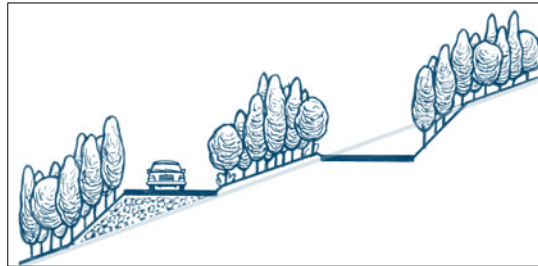
The division of the dual carriageway into two roadbeds, on each side of a valley for example, can reduce its imposition on a landscape. It could however, have negative effects in terms of permeability for people and ecological connectivity.



A possible solution for certain dual carriageways is to have two staggered roadbeds. Like this, earthworks are reduced and the road adapts better to the landform and structure of the landscape, although it should not be adopted in areas of high ecological connectivity since this layout increases the barrier effect.



Treatment of slopes should be coherent with the landscape conditions of the margins to avoid brusque transitions as much as possible.



The treatment of the central reserve can employ elements which reflect the landscape conditions on the margins so as to reduce the imposition of the infrastructure and the harshness of its interior character.

crucial because they offer the opportunity of identifying and studying different itineraries and approaches to the layout.

Thus, a layout which may appear functionally inadequate because it is only based on the upgrading of an existing one could offer advantages in terms of costs when compared with a newly constructed one, which requires high investment and has considerable environmental effects without being functionally optimal.

The multi-criteria comparison of well developed alternatives effectively illustrates the possible solutions for solving a particular technical problem by providing a range of viable options to the layout design team.

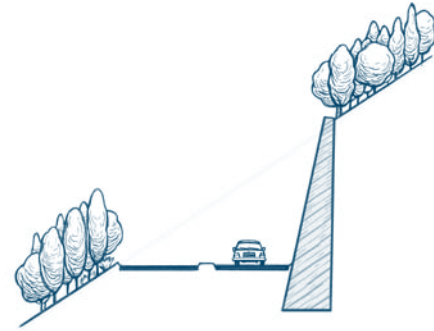
The development of alternatives can nevertheless be flawed from the beginning if this creative technical task is reduced to merely an exercise of strict compliance with the requirements set out in the technical consulting contract. Unfortunately, this tends to

happen, for example, when a single (main or preferred) layout alternative is used as the basis and other options only include local variations on specific sections or points on the route. In fact, the alternatives developed in this way do not represent the full range of technical solutions, only offering a single solution with small, anecdotal variations which rule out other more creative options which could have been far better than the original one.

An effective development of alternatives requires a careful survey of the territory through which the road could be routed. This study permits the identification of the main natural corridors available (a plain, valleys, plateaus, etc.), as well as possible specific passages (mountain passes, ravines, isthmuses, etc.) and the whole territorial network of possible interconnecting and complementary routes which could be used as a basis for the layout.

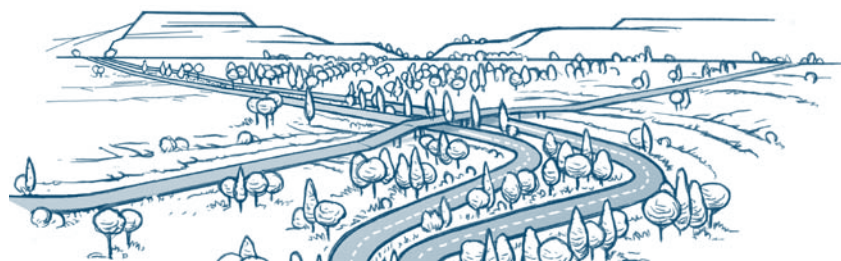
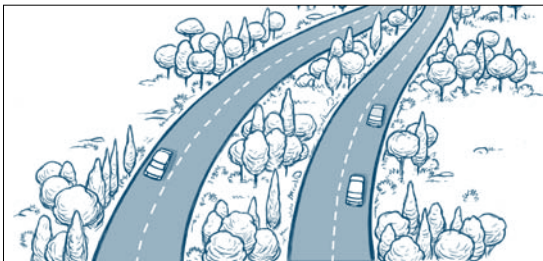
The development of various alternatives is very important for the final outcome in every respect. Although the study costs of developing proper alternatives are higher, this option is always better than developing a preconceived alternative using arbitrary criteria which are generally based on a superficial or preconceived view of the problem.

To be fully effective, the development of alternatives must be applied to all the different phases of a project, both during that in which the definition of corridors is carried out on



The introduction of a containing wall permits continuity on the margins by reducing the width affected.

The area of the central reserve can be flexible, allowing a dual carriageway to be adapted to the conditions of the landscape by narrowing or widening, and providing space for smaller or larger elements, depending on the nature of the landscape in which it is situated.



small scale, at an intermediate level, when more precise alternatives for the layout are being studied, and at a specific level in the project phase, when different options for the detailed elements are proposed (slope instead of retaining wall, different options for supporting structures, etc.).

4.3 Presence of the road in the landscape: linearity and earthworks

The integration of the road into the landscape depends essentially on the layout and how the earthworks which sustain the structure with the necessary excavations, embankments, and other soil movements, are adapted to the surroundings, along with the abandoned quarries, and spoil and worksites. The dimensions and conditions of these elements in the scene define the degree of presence and notoriousness of the road in the landscape. Thus, while abrupt landforms do not adapt well to road layouts designed for high speeds such as motorways, low functionality roads, such as those going through mountainous areas, are better suited to the landform, requiring less movement of terrain in the process of construction.

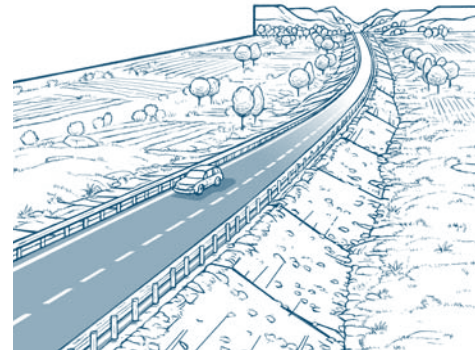
The presence of the road in the landscape is defined primarily by the dimension of the earthworks, the volume of which increases in proportion to the capacity of the road, as well as the geometrical requirements of the layout, and the irregularities of the landform which supports it. In addition to the volume of earthworks, there are other aspects which can also contribute to increasing this presence, such as for example, the fact that it is situated in more visually exposed terrain, failure to restore eroded banks, or the general appearance of its elements and installations. These environmental, visual, and aesthetic aspects are examined in the following sections (see sections 4.4, 4.5, and 4.6).

4.3.1 Linearity, cross section and earthworks

The disposition of the layout and its earthworks is essential to the definition of the presence of the road in the landscape. The platform of the road is situated in the terrain via a series of earthworks, which can consist of building an embankment with slopes which generally have a recommended slope of 3H:2V or excavating a cutting into the terrain of a hillside, the inclination of which depends on the natural stability of the terrain and the revegetation process.

The definition of the layout is a complex process which seeks to obtain a continuous linear platform over which vehicles can move safely. This implies that the homogeneity of the geometric characteristics of the road must be guaranteed so as to allow motorists to drive without excessive fluctuations in speed. The design speed is therefore the main determining factor of the layout, since it defines its geometric characteristics (in general, roads with wider bends and gentler slopes permit greater average driving speeds), and the sight distances which must be respected so as to guarantee the safety of traffic. There are other essential aspects, such as legibility (capacity to anticipate the conditions of the section ahead), continuity (smooth transition between wider and narrower sections and changes of gradient at crests), slip roads and junctions, the separation of traffic directions, and, in general, the level of attention required from drivers, which must be incorporated into the definition of the layout so as to guarantee safety and a certain level of service to traffic.

Roads designed for greater speeds are more demanding in terms of these parameters when compared with others which are conceived for lower speeds (greater speeds require, for example, wider bends, flatter surfaces, and greater sight distances). There is



The construction of large embankments creates a barrier to the natural processes of the surroundings, as well as having an imposing presence and a strong visual impact.

also the question of the width of the roadbed, which should be designed in such a way as to permit a specific flow of vehicles to pass safely and comfortably at certain speed most of the time.

Longitudinally, the layout defines the sections which must be excavated or filled to achieve a continuous platform whose geometrical conditions meet the intended functionality criteria. Furthermore, the layout should also try to synchronise excavation and filling volumes so as to avoid unnecessary costs, by avoiding the generation of material which would have to be deposited in spoil sites, and by ensuring that there is no need for additional filling material which would have to be sourced from nearby quarries. There is also the possibility however that excavated material is not suitable to be used for filling, and has to be abandoned in spoil sites. In general the balance of the earthworks in a road layout is another aspect of landscape integration which should be observed wherever possible.

The transversal disposition of the platform, i.e., the total width, also has an important significance concerning the presence of the road in the landscape. This disposition can adopt different solutions depending on how the layout fits into the original terrain:

- On an embankment
- On a hillside (cut and fill or sidecast)
- In a cutting
- On a viaduct
- In a tunnel
- In a cut and cover structure

Each of these transversal dispositions affects the presence of the road in landscape in a different way:

- On an embankment; the platform is situated above generally depressed or flat terrain, creating a barrier of considerable size;
- On a hillside; the best solution is to create an excavation into the hill on the upper side of the road and an embankment on the lower side; this is known as cut and fill or sidecast construction;
- In a cutting; the road sinks into the terrain so that only the upper parts of the excavated slopes can be seen (the crest). If the slopes are of different heights the broken effect in the landscape is exaggerated;
- On a viaduct; a viaduct has an especially visible and striking presence in the landscape, with the aesthetic effect of the more unusual structures being much appreciated;
- In a tunnel; the road is hidden beneath the land leaving only the portals or ends of the tunnel visible;
- In a cut and cover structure; the road is constructed in a trench which is covered with a barrel vaulted structure. This in turn is covered with the excavated material until the original morphology is re-established. They tend to be short structures so that cut and cover is often perceived as a sort of natural bridge over the roadbed.

4.3.2 Strategies for the integration of road volumes into the landscape

The presence of the road volumes in the landscape can never be fully eliminated, and

therefore a proactive strategy must be adopted for every stage of the project, from the definition of the layout to the final treatment of the elements which go to make up the road. Although it is important to bear in mind that each case requires a specific strategy, a series of general recommendations can be established as a point of reference: These are outlined below.

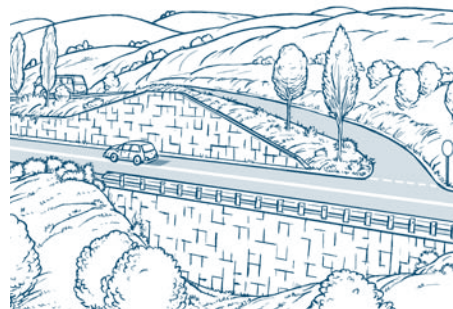
Layouts with low volume of earthworks

Roads which require lower volumes of earthworks are more easily integrated into the landscape. This landscape principle is in line with other project criteria such as environmental integration and reduction of costs. However, this objective is not always easy to fulfil because it depends on the relationship between the landform and the functionality requirements which are demanded from the projected road. It is therefore necessary to maintain an open and flexible attitude, and as such, trying to minimise the volume of earthworks as much as possible is the most realistic and feasible objective.

Layouts with balanced volumes of earthworks

Roads where excavation and filling have been properly balanced are easier to integrate than those with large imbalances between the two, since additional elements such as spoil sites or use of quarries are best avoided if possible. This balance must be approached not only in terms of the total volumes of the overall project, i.e., for the entire length of the road, but also in terms of balancing all the individual transverse sections.

The traditional approach has been to carry out this compensation process by adjusting the layout to reduce costs in materials. Despite its undeniable landscape benefits, this approach



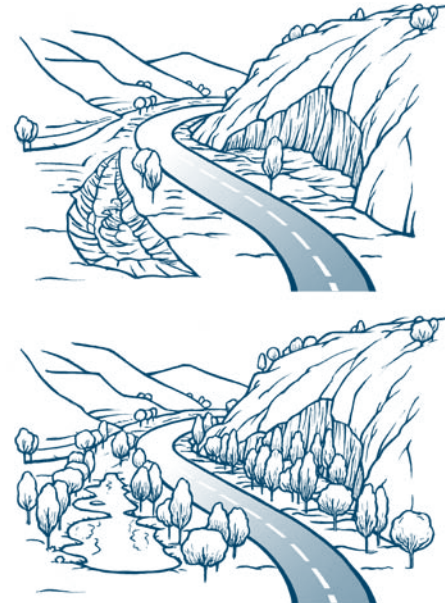
The utilization of retaining walls, either for embankments or natural terrain, is a good option for reducing the size of the platform and, at the same time, guaranteeing stability. Their integration into the environment, and the use of shapes, volumes, materials and colours which reduce their presence should be taken into account.

can however be somewhat deficient when it is applied for the sole purpose of reducing costs and can lead to excavations on sections of the layout which are unnecessary for other reasons (geometric conditions, avoiding impact on sensitive areas, etc.) but are carried out to source material for the construction of a nearby embankment, thus generating large excavation walls which can have an adverse impact on the landscape. This practice of sourcing material from the road project itself is also used in transverse sections, when the lateral excavation of a hillside is increased simply for the material it can provide. Furthermore, during the construction phase, modifications and additional excavations (works which were not initially foreseen but are carried out during the process of construction) are often made simply so as to reduce costs to the contractor, who then obtains the required material free of charge (as this only results in a slight increase in the amount of land expropriated) rather than having to pay for material in quarries. All these practices should be avoided in both the layout assessment and project management phases, as well as during the actual implementation of the construction works.

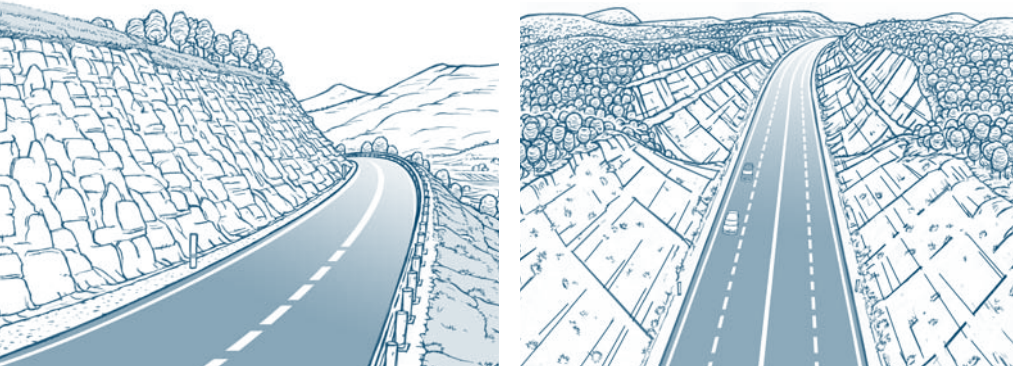
In general the criteria of continuous compensation of layout contribute to a better integration of the road into the terrain, especially when applied in conjunction with the objective of minimising the total volume of earthworks.

Layouts built on hillsides

Platforms which are built on the side of a hill (using the cut and fill or sidecast method) are the easiest to adapt to the pre-existing volumes of the landscape. This option permits the direct compensation of excavation and filling volumes and enhances the visual potential of the road (see further information on scenic roads, section 4.7). However, this solution does have certain inconvenient aspects, including the degree of intrusion of the road as



The lack of balance between volumes of earthworks for embankments and excavation materials can lead to the creation of spoil sites and quarry excavation areas, which, together with the gravel pits necessary for concreting and road surfacing, lead to deterioration of the landscape surrounding the road. These areas have to be treated with efficient measures for environmental recuperation. While spoil sites can be flexible in terms of their location and configuration for landscape integration, gravel pits and quarries require specific treatments in situ.



Left, a roadbed situated on a hillside involves less earthworks and fits in better with the original landform. Nevertheless, the bare excavated wall can generate a strong visual impact due to the chromatic and textural contrast of the naked rock, particularly when the steep slope makes it difficult to achieve satisfactory revegetation.

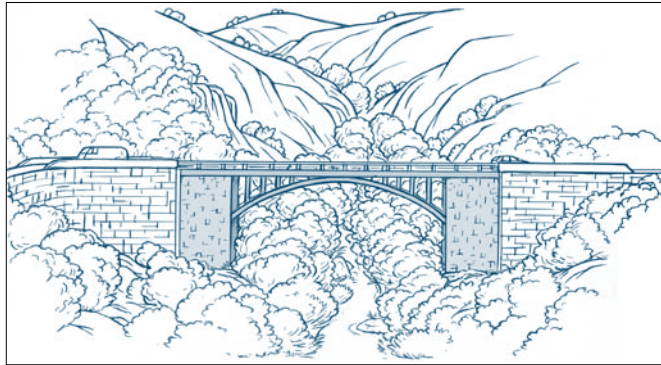
Right, a road in a cutting which hides the road from the external observer and achieves greater landscape integration. There are however, a number of environmental problems associated with this approach, including the surplus of excavated material where it cannot be used for other earthworks such as embankments. There can also be difficulties with drainage if the gradient is inadequate.

seen from the valley bottom, especially if its positioning on the hillside requires numerous cuttings and embankments.

This effect is enhanced by the relative height at which the layout is situated in terms of the landscape, since if it is high on the hillside it will tend to have an imposing presence over the scenery below. In this situation, special attention needs to be given to the treatment of the complementary elements of the road, such as excavated slopes, retaining walls, guard rails, traffic signing, etc., because they will all be highly exposed to the views.

Layouts in cuttings

On the other hand, layouts in cuttings tend to hide the presence of the road, generating an enclosed and artificial landscape for the roadbed, and also creating a number of problems in terms of drainage. Low points of the layout must be avoided in cutting areas to prevent problems with run off water from the platform (the cutting must be always constructed on



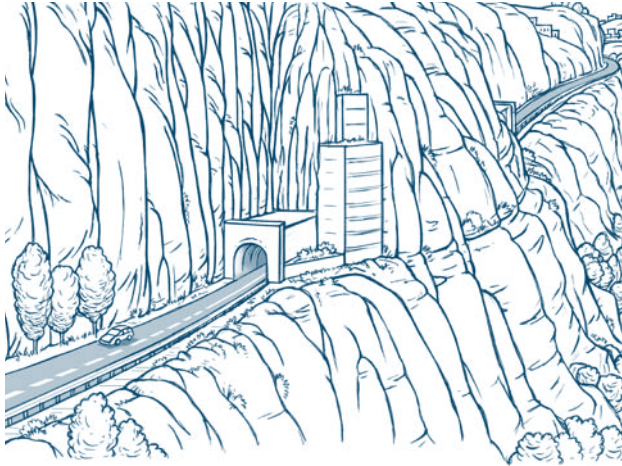
Viaducts are a good solution for crossing lower lying areas or valleys. They provide the best environmental option and have greater landscape potential than embankments, although the environmental risks involved in their construction must not be forgotten, particularly in terms of not disrupting the riverbank areas themselves.

terrain which is steep or whose central part is slightly higher than the sides so as to allow run off water to flow towards an end of the cutting area).

Sometimes when the cutting is excavated on a hillside, one of the walls can show its upper part over the other, creating a very uneven visual effect of tearing the terrain, and a succession of cuttings at the base of a mountain can generate a somewhat negative scenic effect in the surroundings.

The concealment capacity of a cutting is reduced when the excavated banks are flatter and the cross section of the cutting is very broad.

Despite these reservations, the solution of situating the layout in a cutting can be very effective in sections which go through urban areas since isolating the road from the environment by partially interring it prevents the interaction of the road and its traffic with the margins, aiding other aspects of isolation (noise reduction) and permeability (bridges etc.).



Tunnels have a minor presence in the landscape if three critical aspects are managed appropriately: works management tasks; the volume of surplus earth and spoil; and the integration of their portals.

Solutions using viaducts

Using a viaduct to cross a depression or a river can be the solution for a well thought out section which, thanks to that pass is well balanced overall. It is important to know how to effectively resolve the continuity between different sections, identifying the main points of difficulty, and analysing how the possible layout options can be developed accordingly. In some cases a river crossing does not have such an influence on the whole layout, allowing greater freedom of choice.

Although in landscape terms it is usually better to cross a river at right angles, the line of a viaduct may be influenced by the design of the sections on either side of the structure and their driving and safety conditions, making it necessary to cross the river in a diagonal fashion so as to maintain the continuity of the layout.

Viaducts and bridges raise the roadbed above the landscape conferring it a special visibility which can have a decisive effect on the composition, meaning, and character

of the landscape, although this does not necessarily imply a loss in value. Even when standardised and conventional structures are used, the costs of these solutions are significantly high.

The works required to erect a viaduct can cause environmental damage at the base of the spanned space (margins of a river, valley bottoms, gullies) and in the accesses to lateral supports (abutments) if measures to correct these effects are not taken.

The layout solutions using viaducts are scenically striking, with aesthetic and landscape qualities which are addressed in the chapter dedicated to the special features of the road (see chapter 5, section 5.2, and sub-section 5.2.1).

Solutions using tunnels

As with viaducts, a short section inside a tunnel can solve the problem of a geographical barrier which is difficult to cross on the surface, facilitating the development of a well integrated layout in the rest of the section. The decision of whether to develop a route through a tunnel must be based on an integrated and balanced approach to both the territory which is to be crossed and the points which are difficult to negotiate (bottlenecks, adverse terrain).

Solutions using tunnels hide the presence of the road completely and minimise its effect on the landscape, provided that appropriate treatment is given to the spoil sites they generate, and to the effect of the work installations on the areas which surround the entry points and the crown of the tunnel. The traces left by the operations for these works, including spoil sites, access points, and installation areas, are particularly damaging in the case of tunnels, because they are almost always undertaken in extremely complex landforms

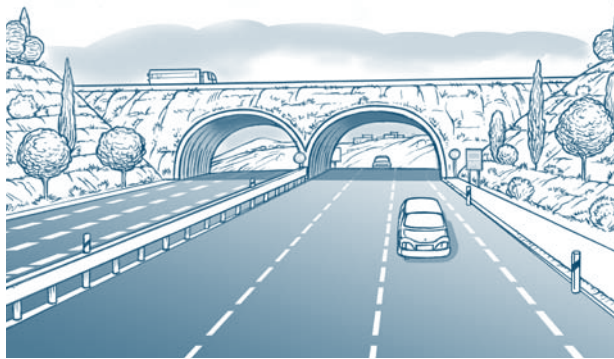
in which engineering works require a considerable surface. The portals and access sections of tunnels have to contend with the fragility of the rocky structures which support them and it is not unusual for unforeseen collapses to occur. These accidents on the hillside have a counterproductive landscape effect which should be anticipated and treated with morphological adaptations and effective environmental restoration treatments (see chapter 5, section 5.2, and sub-section 5.2.2).

The road layout immediately on exiting a tunnel must have special conditions of visibility at both ends (straight layout, greater stopping sight distance, avoiding changes of gradient) since the sudden change in lighting can confuse motorists, and create considerable danger if this is not the case.

Solutions in cut and cover

The cut and cover or false tunnel solution is in fact a platform excavated in the form of a trench which is covered with a structure, generally a barrel vault roof, over which the excavated material is placed until the original morphology of the terrain is achieved. The cost of these structures is very high due to the fact that their constituent elements require a delicate construction process which is similar to that of a viaduct, and for this reason they tend to be only used for short sections.

Cut and cover is an appropriate solution for sections of road where the depth is insufficient to guarantee the viability of excavating a conventional tunnel, and for sections in which the geotechnical conditions suggest this solution to improve stability. Despite its high cost, this option is highly recommended for environmental and landscape reasons, since it hides the road and contributes to giving the surrounding area a more natural appearance.



Although costly, cut and covers are an adequate solution with clear environmental and landscape benefits for certain areas with cuttings.

The most efficient crossings for wild animals adopt this construction option, by placing a corridor over the cut and cover section and utilising suitably naturalised lateral access points which are isolated from the roadbed and the traffic.

Although the cut and cover approach can be a good solution in itself, if used as a prolongation of a conventional tunnel it is also a way of extending the environmental and landscape benefits which a tunnel can offer.

This prolongation of tunnels using cut and cover must be considered in the earliest stages of the project (viability study, layout project) and coordinated with the disposition of the layout because, as indicated above, at the exit of a tunnel the layout must have special visibility for several hundred metres. As such, any prolongation of a tunnel added after the planning of the original layout (during the construction project itself, or during a process of upgrading which does not involve a change of layout) could create great risks in terms of road safety.

4.3.3 Presence of the road: the example of the A-315 road from Torreperogil to Baza via Pozo Alcón (Granada)

The itinerary of the A-315 alternates between sections which cross the plateau of Baza with others which have to negotiate the steep hills and ravines at the point where the river Guadiana Menor crosses the sedimentary material from the Betica sierras. This great change in topography and geomorphology requires different solutions in terms of layout and earthworks and has considerable implications for the presence of the road in the landscape.



Location of the A-315 from Torreperogil to Baza via Pozo Alcón (Granada)

A-315

As such, in the sections which go through the flatter areas, near to Cuevas del Campo and Baza, the road is characterised by having a straight layout, with open bends and minor earthworks, thereby minimising the presence of the road in the landscape. On the other hand, the sections which run through the terrain hollowed out by the Guadiana Menor are more striking in landscape terms, due to their more winding character and the markedly vertical slopes where the road is built on a hillside or runs through a cutting. The steepness and characteristics of the rock in the cuttings make environmental and landscape restoration difficult, and the nakedness of the walls is evident either from a distance or close up.



A deep cutting on the A-315.

A-315



Above, cuttings and berms on the A-315.

Below, vertical cuttings on the A-315.

A-315



General layout of the A-315.

In addition to the conditions which define the presence of the A-315 in the landscape, it is important to point out that the layout has a significant visual or scenic quality (see section 4.7 of this chapter) since it offers interesting views, including those which can be seen from the Negratín view point, access to which is via a partially surfaced track at chainage 82.2 (near to Cuevas del Campo). This view point, which is situated in an ideal location for contemplating the views of the reservoir and the scenery of the badlands, has benches, tables and other elements, as well as well designed railings, pavement and other features, although it is important to note that it does not have information panels. There is also a small view point next to the restaurant facilities at chainage 86.0, close to the sailing club, whilst the parking area of Negratín reservoir dam (chainage. 86.3) offers a number of information panels.

A-315

4.3.4 Presence of the road: the example of the SE-6103, off the A-4, to La Campana (Seville)



Location of the SE-6103 to La Campana and the A-4 (Seville).

The SE-6103 runs through the geological terraces of the Guadalquivir, a scenic area situated between gentle slopes and floodplains. The morphological configuration of the area through which the road passes, with its horizontal character, permits the geometrical necessities of the road to be met with the use of limited earthworks solely for levelling the actual roadbed. Thus, the presence of the road is reduced to the roadbed itself and the necessary road markings and signs, since the few lateral

SE-6103



SE-6103

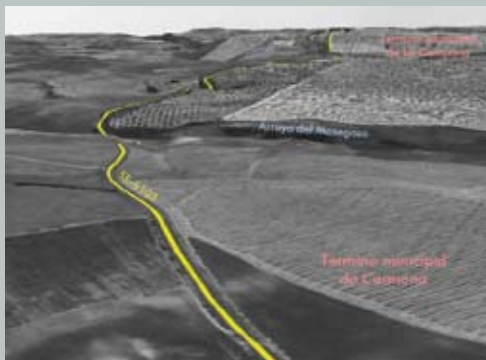
Above, the SE-6103 has been adapted to the undulating countryside.

Below, the SE-6103 imposes itself on its surroundings despite the lack of earthworks.

embankments which have been constructed have been fully integrated into the natural morphology of the terrain.

The substitution of the original Mediterranean woodland by an intensive farming system with a predominance of non-irrigated land for the cultivation of arable crops (mostly wheat and sunflowers), has created a homogeneous agricultural landscape of little value in terms of diversity and natural character, which follows the road along the whole length of its route. This relatively monotonous physiognomy does nonetheless offer a few significant nuances and formal changes throughout the year which are derived from the cultivation cycles.

In this context of gentle shapes and marked homogeneity, the presence within the area of influence of the road of traditional Andalusian farmsteads, cortijos and haciendas, and other typical agrarian buildings, is remarkable. These constructions, which reflect traditional forms of habitation and exploitation of land in the flatter areas of Andalusia, are amongst the valuable landmarks which can be found along the route. Likewise, the presence of lines of trees on the margins of paths and the driveways of farmsteads contribute to breaking up the dominant formal homogeneity of the surroundings of the SE-6103.



The route of the SE-6103.

4.4 Integration of the road in the environmental processes

The processes of the environment, its landform, hydrology, ecology, human uses, and the values of its cultural heritage, are the primary aspects which define the reality of the landscape we perceive.

A treatment which only takes into account the scenic, visual or aesthetic considerations of the works to be undertaken on a road project, which is colloquially known as a cosmetic treatment, would not be an appropriate option since it would ignore the objective deterioration which would take place in the processes and values of the environment, thus damaging the essential value of the landscape. Hence the importance of assuming a definition of layout which properly addresses its integration into the processes of the environment.

In the following section there are a number of recommendations relating to the disposition of the road and its layout, and how this can be made compatible with the key processes and values of the environment.

4.4.1 Layout and geomorphology

The considerations relating to the earthworks and the presence of the road in the landscape are applicable here in terms of reducing their effect on morphology and thus on collateral processes (potential erosion, instability, hydrogeology, geological heritage). Apart from reducing the extent of the morphological effect, it is recommended that areas of greater sensitivity in terms of erosion, instability, aquifers, or heritage, are avoided as much as possible.

The following are considered sensitive areas:

- unstable and erosive formations whose excavation must be avoided where possible;

- vulnerable aquifers and their surroundings, which must be avoided, especially in recharge areas;
- a whole variety of geological heritage features (geological formations, geomorphology, paleontological sites, hot springs, mineral veins, etc.).

The effects of the layout can be reduced by adopting dispositions which minimise the impact on sensitive areas, by using, for example, retaining walls to prevent instability, moderate slopes to contain erosion, or impermeable walls to avoid lateral effects on aquifers.

To adjust the layout or adopt these measures it is essential that the layout definition survey incorporates an evaluation of the relevant geological formations and their different elements in the territory in which the works are to be carried out, specifying the different areas of fragility (instability, erosion, permeability) and significant values (geological heritage, strategic reserves, mining resources, etc.), so as to go beyond merely guaranteeing the viability of the road platform, and considering the fragility of the environment which is to be affected.

4.4.2 Layout and hydrology

Layout must avoid, where possible, the courses, banks and flooding areas of rivers, and keep away from bodies of water such as reservoirs, lakes, lagoons, marshy areas and wetlands.

It is recommended that rivers and floodplains are crossed orthogonally, avoiding diagonal or excessively short structures, and siting abutments well away from the margins of the river so as to permit the development of uninterrupted riverside corridors.

In coastal areas, the layout must be situated away from the coastline, leaving a sufficiently wide transitional strip. The layout must avoid water systems such as estuaries, river mouths, deltas, marshlands and other coastal wetlands as much as possible.

The layout can limit its effect on the hydrology of an area by adopting dispositions which minimise the effects on watercourses and flooding areas (structures with long spans, disposition of abutments, etc.).

To successfully address these aspects it is essential that the layout definition survey incorporates an assessment of the hydrology of an area and all its various different elements (watercourses and bodies of water, margins, flooding areas, aquifers, etc.) where the works are to take place, indicating levels of importance and vulnerability.

4.4.3 Layout and biodiversity

The layout must avoid causing fragmentation in habitats of special interest. If this cannot be avoided, it is preferable for the layout to cross smaller habitats rather than larger ones, and to do so by following the outer edges of the area in question. If this is not possible, it is better to isolate small portions of the habitat rather than dividing it into two large areas of a similar size.

Amongst the different habitats of interest, the priority must be to avoid affecting those which act as biological corridors, i.e., those which are valuable not only in themselves but also because they establish ecological links between habitats of interest, supporting the existence of productive relationships between them.

It is recommended that the layout avoids occupying the edges of habitats of interest (unless such a disposition is the only solution to avoid fragmentation of the habitat). If the occupation of the edges of a habitat is unavoidable, it is preferable to occupy edges which are

well-defined rather than those with irregular shapes and diffuse heterogeneous transitions, which tend to be the most productive.

The layout can reduce the fragmentation of habitats by lowering or raising the road to permit the installation of transversal passes for animals or simply by adopting dispositions which reduce impact on these habitats (cut and covers, viaducts, etc.).

Other relevant habitats include:

- Agricultural areas with social and cultural value (smallholdings, etc.);
- High-yield agricultural production areas (greenhouses, orchards, etc.);
- Systems of agrarian operations which retain significant ecological value (meadowland, orchards, vineyards, etc.);
- Other primary operations of cultural value (interior salt marshes, salt and fishing marshes in coasts, mining sites of archaeological value, etc.).

The layout can reduce the impact on these exploitation systems by adopting dispositions which minimise their occupation, thus reducing the barrier effect or other disruptions as much as possible. To this aim, the study for the definition of the layout must incorporate a thorough diagnosis of the exploitation systems of the area where the works are to take place.

4.4.5 Layout and quality of life

The layout should avoid the occupation of, or proximity to, residential and urban areas or those suitable to be urbanized, and particularly collective facilities such as schools,

healthcare or religious centres, and recreational areas, which are especially sensitive to noise.

The layout can also contribute to the reduction of noise disturbance by raising or lowering the roadbed or adopting dispositions which reduce the level of exposition to noise of potential receptors.

A successful application of these criteria requires that the study for the definition of the layout incorporates an analysis of the sensitivity to traffic disturbance in terms of the use of the territory in which the planned works are to take place.

4.4.6 Layout and cultural heritage

The layout must avoid the occupation of, or proximity to, cultural heritage elements, both on an individual basis and in general, thereby avoiding damaging their quality, meaning, conservation and enjoyment. Included in this category are a heterogeneous group of elements (unusual buildings or settlements, archaeological sites, areas of communal use, etc.).

The layout can minimize the risk of affecting conservation or uses of an area by adopting dispositions which are specifically conceived to reduce the impact of its effect.

To this aim, it is necessary that the study for the definition of the layout incorporates a thorough analysis of cultural heritage resources in the territory in which the works are to take place, covering all known and potential archaeological resources.

4.4.7 Integration into the environment: the example of the A-6178 road from the Virgen de la Cabeza sanctuary, to the border with Castile-La Mancha (Jaén).

The landscape which accompanies the A-6178 road as it goes through the Sierra de Andújar Natural Park is a good example of low Mediterranean mountains, with areas where the significant presence of meadowland in some parts gives way to Mediterranean woodland and reforested pine woods. The itinerary, which follows a route of constant changes in orientation and altitude, offers numerous points for the contemplation of the surrounding scenery from the road. This is especially the case in the middle section (summit of El Junquillo - chainage 15 -) which affords 360° panoramic views over the Sierra Quintana.



Route of the A-6178 from the Virgen de la Cabeza sanctuary to the border with Castille-La Mancha (Jaén).



Cork trees and Holm oaks on the margins of the A-6178.

A-6178

From a technical and design point of view, the A-6178 has a series of characteristics which are very positive in terms of its environmental and landscape integration. In this sense, it is especially important to note the organic character of its layout. The adaptation of the road infrastructure to the mountainous landform has, on the one hand, minimised the impact of the road on the natural processes of the surroundings (run-off water, erosion, continuity of habitats,...) whilst on the other, limited the amount of earthworks, thus favouring the integration of the road into the scenery of the



area it crosses. The narrowness of the roadbed (5 metres) is another factor in minimizing the presence of the road in the landscape, reducing the amount and size of embankments, , and cuttings which are necessary to insert the road into the topography.

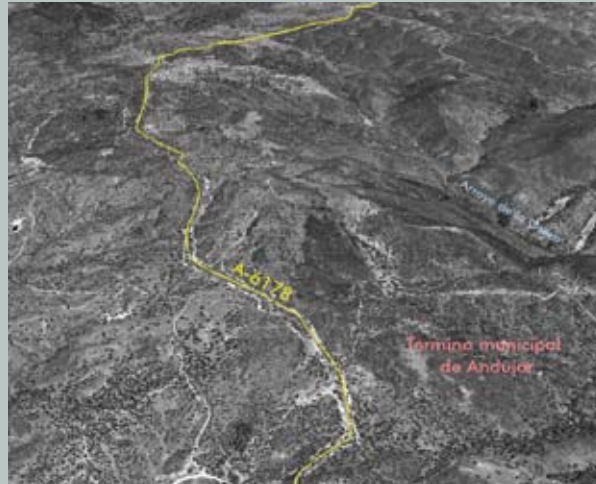
In this way, the narrowness of the road and the low level of traffic reduce the barrier effect of the infrastructure and allow it to be crossed by the various types of wildlife which inhabit the surrounding area (lynx, wild boar, deer, and mouflons). Nonetheless, with the objective of improving the transversal permeability of the road, a variety of complementary environmental measures have been adopted along certain sections of the itinerary: installation of road signs which warn of the presence of animals, reduction of average speeds, prevention of accidents with animals by clearing roadsides, construction of passing points for passes, . . . etc.

Above, panoramic views from the A-6178.

Below, signposting on the A-6178.



A-6178



The route of the A-6178.

A-6178

4.4.8 Integration into the environment: the example of the A-1075, linking the A-348 with the A-92 (Almería)

The A-1075 crosses the Almerían part of the Alpujarras in a north-south direction using the route which historically connected Alhama and Fíñana along the valley of the river Nacimiento. The route, which begins almost at the foot of the Sierra Nevada Natural Park, negotiates the abrupt gradients of the Sierra de Gador before crossing the irrigated areas of the floodplain of the river Nacimiento, and finally coming to the flat area near Jérgal, which is characterised by cereal growing and craggy enclaves of scrubland and pines.

The area surrounding the road shows a marked degree of contrast between the more dramatic topographic features (the foothills of the Sierra Nevada, and above all, of the Sierra de Gádor) and



Location of the A-1075 from the A-348 to the A-92 (Almería).

A-6178

the alluvial plains of the Andarax and Nacimiento rivers. As such, whereas the mountainous hillsides have an essentially forested landscape, with pines, scrubland, and grazing areas, or even barren areas which, can be observed at some points, with almost no vegetation, the flatter, more accessible areas especially the floodplains, are occupied by irrigated crops, stretches of riverside vegetation, and human settlements. This contrast, with its clear aesthetic and visual manifestations, is particularly evident in the mid valley of the river Nacimiento, where the difference between the barren hillsides and the lushness of the irrigated areas is especially noticeable.



Above, section of the A-1075.

Below, surroundings of the A-1075.

It is precisely in these mid sections of the itinerary where the road has to combine the technical aspects of its design, which are necessary to fulfil its role as a means of communication with the preservation of the fertile soils of the floodplain, and the cultural and productive resources which characterise the valleys of the Alpujarras. To achieve this balance between the functional and landscape aspects of the road it follows a route on the upper border of the floodplain, limiting the





The route of the A-1075.

roadbed and the necessary earthworks to a narrow strip of land situated at the foot of the hillsides. This technical solution limits the occupation of the richly productive soils to that which is absolutely necessary, whilst at the same time avoiding the spatial and scenic fragmentation of the floodplain and the associated barrier effects.



4.5 Road layout and its integration into the scenography of the landscape

The presence of the road in the scenography of the landscape (i.e., in its visual organisation) defines how much of the road and its various elements can be seen, from where, and in what conditions.

Apart from the earthworks and the dimensions of the elements of the road and their effects on the environmental processes, it is the disposition of the layout through its visual organisation what defines to a large extent the effect of its presence.

Thus, it is important that the technical team which designs the layout is fully aware of the visual conditions of the area so as to be able to incorporate criteria concerning the degree of exposure or concealment of the road, thereby defining a specific degree of visual presence. To this aim, the following aspects must be identified:

- The limits of the distinguishable visual fields; i.e., the parts of the territory which have a certain visual uniformity and a level of separation between each other, since the presence of the road in one of them focuses the problem on that particular area and on its visual conditions.
- The dimensions of these visual fields; the presence of the road will tend to be diluted in broader areas (plains) but have a more imposing effect on enclosed environments (narrow valleys).
- The limits between the fields and their degree of definition; some will be precise and well-defined, with precise lines (mountainous divisions), whereas others will be more diffuse and without precise limits (point where a lateral trough joins a valley).
- The visual conditions of each field; open and with ample visibility in flatter areas, with fragmented visibility in more abrupt spaces, or with some special type of visibility organisation

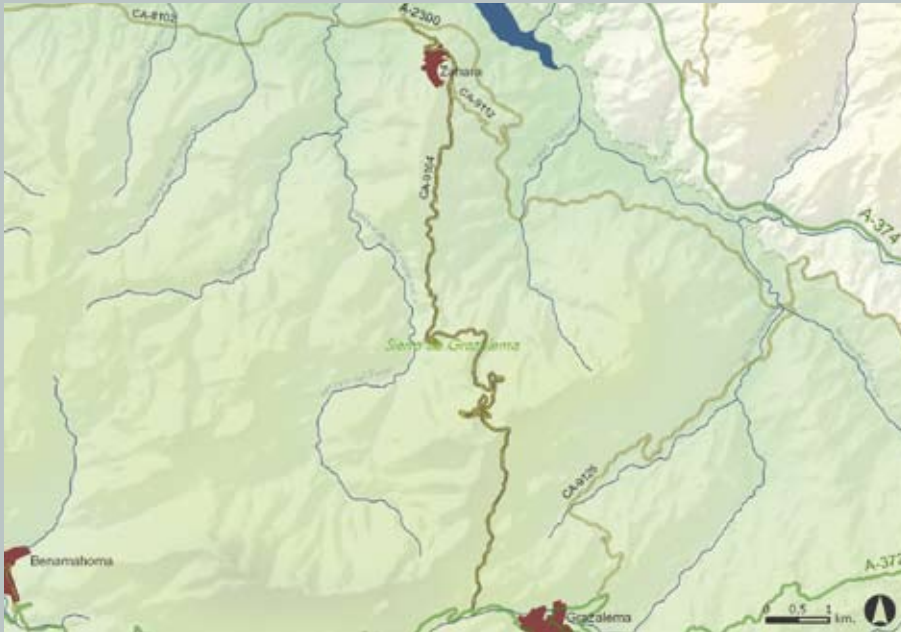
(coastal strips, mountainsides, curved ravines, etc.). In the first case the overall presence of the road will be evident, whilst in the fragmented parts the presence will be cut into sections.

- The visual spaces which are more exposed within each field; for example, areas which mark the transition between two fields, such as narrow passes (which are visible in both fields simultaneously), cliff tops, hillsides, and other areas where the layout must be aware of its visibility.
- The areas with lower visibility within each field; such as, for example, the interior of small enclosed areas (which are only visible from within), valley bottoms, depressions, and other parts which are isolated in visual terms.
- The frequency and characteristics of the observation of the landscape in each field; identifying the abundance and type of observers, and specifying whether they are mainly permanent residents or visitors, whether they expect more from tourist areas, etc.
- The presence of landmarks of interest (historic sites, interesting buildings, areas of woodland, rivers, bodies of water, etc.) and their visual field, so as to minimise the effect on them of the most visible elements of the road, and, where possible, of its platform and earthworks, since the presence of landmarks can be significantly diminished when situated near to these kinds of undesired elements.

Nevertheless, as we said earlier, it is impossible to fully eliminate the visibility of basic elements of the road such as the roadbed, earthworks, and special structures, therefore a certain degree of exposition of the infrastructure must be always assumed. Although the way in which the road is integrated into, or hidden from, the views varies for each specific case, there are some general outline criteria and recommendations:

- Avoiding, if possible, siting the more visible elements such as junctions, large embankments, large cuttings, petrol stations, viaducts, tunnel portals, spoil sites or quarries in the areas which are more visually exposed in the landscape.
- Avoiding, where possible, layouts which are raised above the surrounding landscape which are always more imposing than those which are situated in lower lying areas.
- Mitigating the presence of the road in the landscape by combining measures to disguise the layout such as siting it in enclosed spaces and areas which are less exposed, with the reduction of earthworks through adjustments in the layout, cuttings, retaining walls or tunnels, and with concealing and camouflaging treatments such as tree screening, as well as the application of environmental restoration elements.
- Approaching the visual presence of the road and its elements by applying an effective process of integration in each of the relevant areas, without necessarily resorting to techniques of concealment. In some cases, treatments could even be applied to highlight and enhance the presence of the road in particular sections.

4.5.1 An example of integration into the scenography of the landscape: the CA-9104 road from Grazalema to Zahara de la Sierra (Cádiz)



Route of the CA-9104 from Grazalema to Zahara de la Sierra (Cádiz).

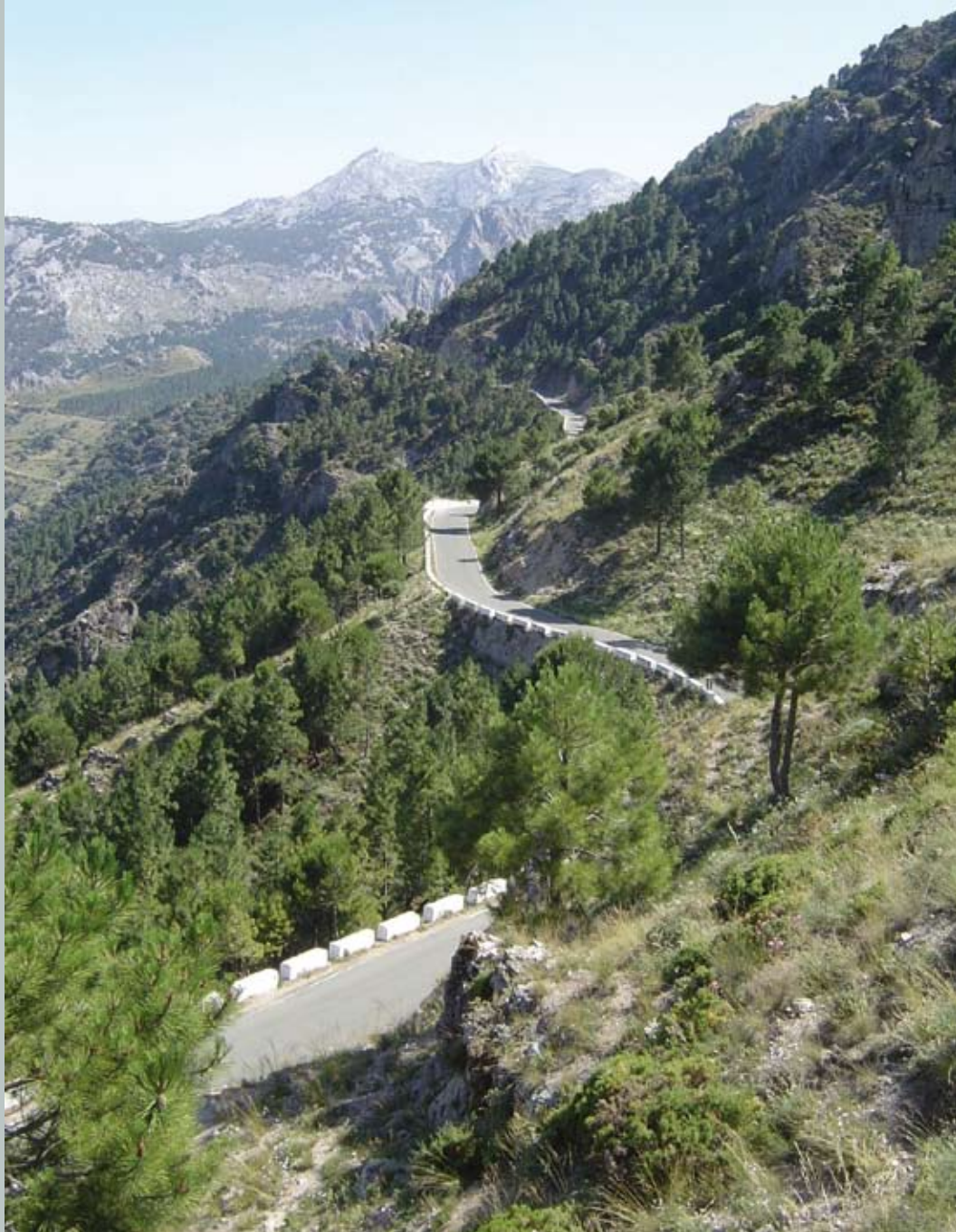
Despite the precautions required by its more winding sections, the CA-9104 has a privileged itinerary from the landscape point of view. The itinerary followed by the infrastructure provides good panoramic views of some of the most interesting landscape features of the provinces of Cádiz and Málaga, including the sierras of Grazalema, Ronda, and Las Nieves. The climb to the Las Palomas pass and the subsequent descent, are, in scenic terms, the best moments of the route, and offer

CA-9104



Views from the CA-9104.

CA-9104



CA-9104

Landscape, scene and
layout of the CA-9104.

observers excellent panoramic views over the Zahara reservoir, the high limestone formations of the Garganta Verde, and the sierras of Algarín and Malaver.

In terms of the integration of the road into its scenographic context, it should be noted that both the layout, which is especially harmonious in terms of the conditions imposed by the topography, and the geometrical and design characteristics of the earthworks and construction elements (retaining walls, rigid barriers) enhance the incorporation of the road into the different scenic areas with which it interacts throughout the entire length of its itinerary. Having said that, in some sections, especially those which wind their way through abrupt slopes, the whitewashed stone parapets and the stone retaining walls which support the platform do emphasise the presence of the road in the scene.



Route of the CA-9104.

CA-9104

4.6 The relationship between layout and landscape character

It is certainly true that the landscape has a determined aesthetic organisation or composition into which the road is incorporated, often with a clear effect. However, seen from an abstract perspective, the appearance or aesthetics of the landscape are not valuable in themselves as would be the case with a work of art created with the intention of prompting an aesthetic reaction. In the case of landscapes, the value of their appearance is defined by the significance of the territory in terms of its natural and cultural value. The territory is a vital resource of nature and culture and the appreciation of the landscape is, above all, the appreciation of its formal manifestation.

The issue is not so much as to whether the road can make the landscape in which it is incorporated uglier but to what extent it can make it lose its essence and identity or those aspects which make it unique, i.e., its character (for a more thorough examination of this concept, see the works carried out in the UK by the Countryside Agency and English Heritage, amongst others).

The value of the landscape is thus defined by its character and by the way this materialises in its organisation, its formal conditions, and its reference points. The relationship which each road establishes with the character of the landscape and how it becomes part of it in the least conflictive way should be properly defined in the road project and especially during the layout definition and adjustment phase.

In this respect, it should be born in mind that the character of the landscape is dynamic and non-static, but actually evolves, i.e., it responds to certain changes and to how it is perceived and appreciated, such that only certain ways of acting on the territory can maintain the character of the landscape by considering and developing it, whilst others can actually contradict or obscure it to a lesser or greater extent.

A road can form part of the character of the landscape and its intrinsic features such as the territorial organisation, the local references or meanings, and the key interpretation elements which sustain it. Some road projects can actually contribute to shaping the character of a landscape. This happens, for example, when a traditional route is upgraded by a new infrastructure which modernises it and gives it a new functionality, without destroying its basic geographical essence. This also occurs in cases in which the road and its layout interact and coexist with other important features of the landscape such as areas of woodland, river corridors, or a particular form of settlement, thus contributing to the preservation of their identity and presence.

On the other hand, a road can disrupt the character of the landscape with its presence by diluting it or making it more confusing, thereby hindering its understanding and appreciation. This tends to happen when the layout of the road ignores the essential organisation of that landscape, imposing a new orientation which completely disregards the general organisation of the area. This negative effect can also occur when the road project affects key reference points in the landscape by occupying them either partially or completely (when the embankment of a dual carriageway occupies an area of orchards in a village for example), or when it affects important features of the landscape by replacing them (construction of a service area next to a spring), eliminating them (constructing a new viaduct to replace an old metal rail bridge from a mine) or confusing them (when it reroutes the access to a town or village from a new point which completely ignores the local dynamics).

Roads have a considerable level of vitality in the sense that they can actively stimulate or restrain the dynamics of an area. Therefore, their incorporation into a landscape is rarely inert or aseptic; quite the contrary, they govern and channel the processes of use of space,

and can either preserve, dilute or obliterate the character of the landscape with their high territorial impact.

For all these reasons it is important that the character of the landscape is incorporated into the criteria for the definition of the layout of the road, which acts as a central axis for the subsequent definition of its functionality, level of service, and presence in the landscape. The relationship between layout and character is essential to guarantee the integration of the road into the landscape.

For this reason, it is essential that the technical team which studies and proposes the layout is provided with an analysis which evaluates the character of the landscape through which the road is to be built. A good understanding of the dynamics and potential changes of that landscape in the short, medium and long term, as well as an adequate knowledge of its different structures and features, are fundamental in guaranteeing an efficient diagnosis and identification of its essential character and patterns. This process of evaluation of the character of a landscape should lead to the identification of its specific elements. Among them:

- a) Those of a structural nature
- b) The formal references of the landscape
- c) The specific landmarks

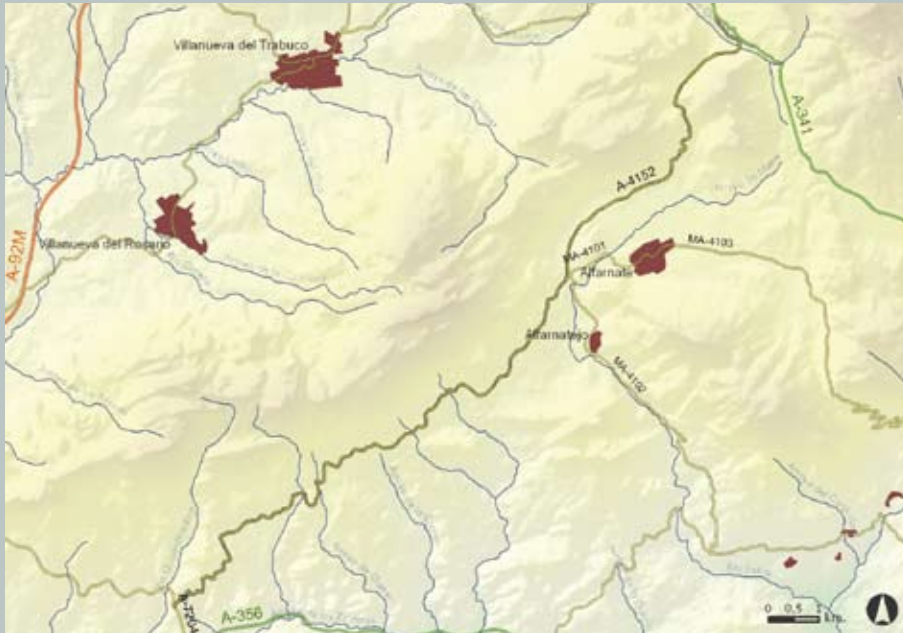
The first group is comprised of the patterns of scenic organisation in both natural and cultural structures, including for example the shape of the terrain, the various natural habitats which are characteristic of the area, the agrarian systems, the type of habitation, or the communications network.

The references of a landscape shape its identity and have a generic character: these include, for example, the typical vegetation, the characteristic geological formations, the traditional architectural features, the plot organisation, and the road network. Finally, the character of the landscape must be defined on the basis of its specific elements, i.e., its most significant landmarks, including distinctive geological formations, ancient trees, historic buildings, or places of special significance.

A positive approach should be adopted to resolve the relationship between the road project and the elements which shape the character of the landscape. In this sense, the layout and its territorial definition are closely related to the various aspects of the character of the landscape when they establish the general organisation of the scenery at a territorial level, and when they affect the maintenance and viability of key character elements, whether generic or specific, at a more immediate level.

In some cases, the project of the road has to address the need to preserve the character of the landscape, whilst in others, when projects are to be implemented in more characterless landscapes, it may be necessary to restore, consolidate or develop their character. In these cases the road would operate as a partial element in the restoration process, which should be suitably defined through the appropriate planning instruments. There are no situations in which a road project should forego favouring and consolidating the character of a landscape.

4.6.1 Layout and character of the landscape: the example of the A-4152, off the A-341, to Colmenar (Málaga).



Route of the A-4152 to Colmenar (Málaga).

The route of the A-4152 updates the historic route which linked the cities of Granada and Málaga through the foothills of the Sierra de Loja and the «polje» (depressed flat plain in karstic territory) of Zafarraya. This unusual karstic landscape, which is situated between the rocky formations of the sierras of Alhama and Tejeda, was, for many centuries, the main access route to the Mediterranean coast from the western side of Granada, forming a geological corridor some ten kilometres in length.

A-4152



Section of the A-4152 and the surrounding scenery.

From a landscape point of view, in the immediate surroundings of the A-4152 there is a clear distinction between the areas which are topographically more noticeable, and those which are more depressed. The former, dominated by limestone formations, wooded areas, and grazing land, is formally characterised by medium to thick textures, as well as the light saturation of colour of the vegetation and the rock forms. In the case of the low foothills and flatter areas on the other hand, the agricultural land displays fine grain textures, creating different chromatic contrasts throughout the year. The scenic coexistence between the two, which are generally divided by well defined demarcations, is harmonious and well organised, and is helpful in terms of the legibility of the landscape.

The historic character of the route on which the road lies, with origins which can be traced back to an old Roman road, explains the significant presence of territorial and historic landmarks in the surrounding countryside. In addition to vestiges of the original Roman road itself, it is also worth mentioning the urban settlement of Alfamate, which is nearby, and contains important buildings from the 16th century, as well as the various archaeological remains dating from the Neolithic period to the

A-4152



Above, roadway, parapets, and landscape on the A-4152.



Centre, pine grove and lime rock formation adjoining the A-4152.

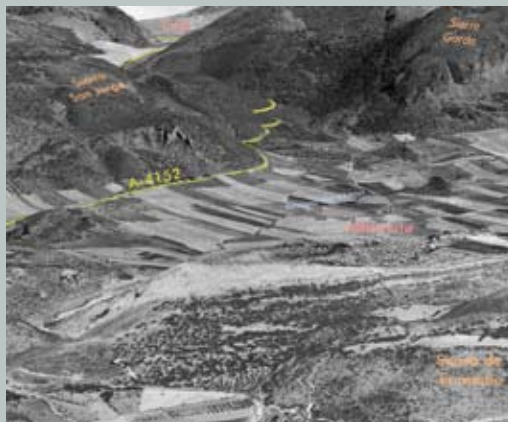
Below, traditional building next to the A-4152.



A-4152

era of Moorish control, the Venta de Alfamate restaurant (17th century), and the heritage features linked with the construction of the road itself (houses of road workers).

It is in this context, where the general organisation of the character of the landscape is based on the close relationship between the natural features, the use of the land, and the heritage sites which reflect the historical past of this important corridor, that the layout of the road is established. It is worth pointing out in this respect that the infrastructure blends discreetly with the surroundings in harmonious co-existence with the elements and features which define the character of the landscape. The choice of a layout which avoids the unnecessary fragmentation of the distinct homogenous areas which appear alongside the route, the use of modest technical and functional parameters, the application of design and construction techniques which aid the landscape integration of the functional elements of the road, and the subtle dialogue which has been achieved between the road and the heritage sites on its margins, are all mechanisms which reinforce and strengthen the landscape character of the landscape of the road as a whole.



Route of the A-4152.

A-4152

4.6.2 Layout and character: the example of the A-5300 from Arroyomolinos de León to Cumbres de Enmedio (Huelva).



Route of the A-5300 from Arroyomolinos de León to Cumbres de Enmedio (Huelva).

The A-5300 runs between the basins of the rivers Guadalquivir and Guadiana, following an itinerary which crosses the Sierra del Viento, and then descends to the Rivera de Montemayor, before rising once again, and climbing the steep slopes of the Sierra de la Nava. The layout of the road is characterised by the way it adapts to the terrain of the areas it crosses, which results in a number of extremely sinuous sections, especially on the highest parts of the route.

A-5300



The A-5300 surrounded by pastureland.

The route is situated entirely in the hilly and mountainous landscapes of the western end of the Sierra Morena. These landscapes, characterised by the almost ubiquitous presence of «dehesas» (a traditional combination of pastures and disperse trees) and the elements associated with livestock farming (animals, fencing, feeding troughs...), are essentially what constitutes the view of the countryside as seen from the road. There are also more limited areas of original Mediterranean woodland, as well as plots of arable land and olive groves.

In terms of buildings and villages, it is important to point out that the settlements next to the road, apart from facilitating legibility and adding to the visual interest of the surroundings, are also fundamental reference points for understanding the character, historical evolution and patrimonial wealth of the landscape in which it is situated. Of special interest in this sense are the villages of Cumbres Mayores and Cañaveral de León, which contain two of the most unusual historical elements in this part of the countryside: the system of irrigation channels and cisterns in Cumbres Mayores and the 14th century castle of Sancho IV in Cañaveral de León. Away from the centres of population there are numerous elements of interest including dry stone walls, irrigation systems, and the farmhouses which still retain the traditional architecture of the region.

The relationship between the itinerary of the road, its layout and construction elements, and the main natural and cultural features of the landscape, is one of coexistence and mutual reinforcement. As such, the essential elements which go to make up the character of the area such as the patterns of livestock farming, the typical houses, and the general organisation are maintained unaltered and reinforced thanks to the road's functionality.

A-5300



Above left, the A-5300 running between stone walls.

Above right, irrigation channel next to the A-5300.

Below left, route of the A-5300.

A-5300

4.7 Development of the visual quality of the layout

Scenic roads are those whose main function is to provide good views of the landscape from within the vehicle itself. In order to achieve this they need to combine a series of basic conditions which permit the fulfilment of this function and are as follows:

- 1) They must be sited in a landscape of interest whose values can be seen from the road;
- 2) They must follow a route which dominates and encompasses the visual organisation of the scene;
- 3) Their layout and margins must provide good views of the landscape², and,
- 4) Their driving conditions must allow the contemplation of the landscape without compromising safety.

2. While the previous point refers to the scenic organisation and the role played in this respect by the itinerary of the scenic road, this refers to the conditions of visibility in the immediate surroundings of the vehicle.

The values of the itinerary and how they can be appreciated from the road without taking into account visibility and driving conditions are examined in the following section (see 4.8 Layout and values of the itinerary).

The second condition, which is related to layout design and adopts a proactive approach to its scenic potential by literally taking maximum advantage of the vistas offered by the territory it crosses, is examined in the section below (see 4.7.1)

The third condition is based on the framework of visibility available to travellers who follow the road - the legibility of the landscape. This is addressed in sub-section 4.7.2.

The fourth and last condition encompasses a series of specific determining factors associated with the parameters of the layout, such as the intensity of traffic and the capacity of the road, which are related to the service provided to traffic. These aspects are examined in the last sub-section (see 4.7.3).



4.7.1 Scenic development of the layout

The route or layout of the road as it crosses an area of landscape creates a concrete visual approach which corresponds to the series of views which are obtained as the driver passes through the terrain following that layout. This visual effect is very similar to what is known in cinema as the *travelling effect*, which is that produced by a camera as it captures a scene by moving along a particular path, without cuts, at a determined rhythm and speed.

This positive scenic quality can be efficiently exploited if the design of the layout targets a specific series or sequence of views of the landscape. In order to achieve this, the technical team which defines the layout of the road must have a sound knowledge of the visual and scenographic organisation of the area through which it will pass, so as to be able to incorporate criteria about the views which can be obtained and their sequence, in other words, to develop the desired travelling as the layout is designed.

The A-366 as it runs through the narrow gorge of the Sierra Blanquilla pass (Málaga), a landscape «door» which marks the separation between different scenes.

In order to achieve this, the following aspects of the scenography must be identified:

- The visual organisation into which the succession of vistas is to be incorporated, and the way in which this can be resolved in terms of the layout and the dimensions and territorial disposition of the visual areas to be covered; aspects which structure the visual itinerary into different stages or sections.
- The features of the landscape which are interesting for the views, be they individual features or combinations of elements, or even whole areas or parts of the territory, and from where they can best be seen.

The use of digital terrain modelling systems with rendering programmes which facilitate the gathering of information about the territory and the visual diagnosis of the potential visual itinerary is recommended.

As is the case with other layout criteria, each scenic situation requires a specific approach to visually optimise its layout. However, some basic criteria are always applicable, particularly if they are adapted to the specific conditions of the case in question. Various recommendations are outlined below:

- In a layout with variations in altitude, interesting and effective visual itineraries can be developed by taking maximum advantage of this aspect. The most attractive itinerary for a scenic route is one which overlooks an area of landscape by climbing the hillside to a peak or pass and then descends to the bottom of the landscape on the other side, thereby creating a series of dramatic views.

■ Layouts which follow the border of the landscape are also recommended, since they permit a highly productive visual appreciation of the scenery. Some routes which feature landscapes without great changes in themselves, where views tend to be similar in scenic terms can also be very popular. Examples include roads which follow lines of cliffs, the edges of raised plateaux, or those which cross broad, open expanses of landscape.

■ A positive approach is to make the most of places of scenic interest by developing layouts which approach them gradually, creating a certain level of anticipation, and avoiding arriving at them in too brusque a manner. Some itineraries can benefit from variations in the succession of views without having to depend on changes in altitude. This is the case when they successively pass through different types of scenery: moving from a deep valley into a flat open area via a ravine for example.

■ It is helpful if a layout can take full advantage of successive changes in direction, as long as these are not excessively brusque. If a layout can even include sections which double back on themselves this can be much appreciated since it maximises the variety of views which can be obtained.

■ In general, taking maximum advantage of the irregularities of the landform and the presence of large geographical features by making the road to go through the widest variety of scenic landscapes is always productive in terms of creating interesting *travelling* effects.

The territorial disposition of the layout does not, in itself, guarantee a good view of the landscape from a vehicle which is travelling on the road; it is thus necessary to consider the visibility which can be obtained from both the road and the vehicles which use it and, more specifically, the visibility of the broader landscape which lies ahead of the moving vehicle, which is known as the legibility of the landscape.

4.7.2 Layouts for the legibility of the landscape

Often the layout of the road permits motorists to obtain a view of both the platform which lies ahead of them and the sections which they will subsequently go through, allowing them to anticipate the route and how they have to adjust the speed and direction of their vehicle. Layouts with a good legibility are safer than those in which «hidden» sections, obscured by the disposition of the roadway, require greater concentration from motorists in preparation for any unexpected events.

Local motorists who use a road more frequently and are familiar with it, get to know the characteristics of each section well, and can therefore anticipate them more efficiently. This sometimes means that they can tend to negotiate many sections at unnecessarily high speeds, putting themselves at considerable risk. Good legibility permits travellers who are not familiar with the road to anticipate its layout.

The legibility of the layout is also extendable to the landscape which the drivers will come across as they travel through the road. The landscape which is in the line of vision of drivers and travellers forms a hypothetical visual triangle which encompasses the oncoming scenery in the direction of travel, and gathers the views of the landscape which the travellers can see without turning their heads to one side or looking behind them, which is a rare occurrence. In general, the movement of the vehicle governs this frontal line of vision.

The legibility of both the landscape and the layout can be disrupted by the presence of opaque obstacles on the margins of the road, such as trees, buildings, or the terrain itself, which can impede the views of the landscape. Consequently, a suitable treatment of the margins is fundamental in guaranteeing good legibility. Here it is important to note that the presence of an isolated object on the margin of the road does not in fact disrupt the view



Above, good legibility of the road and the landscape on this stretch of the A-366 as it rises towards the El Viento pass, between the municipalities of Ronda and El Burgo (Málaga).

Centre left, fragmented legibility limiting awareness of conditions in the next section

Centre right, lack of legibility and visibility beyond the bend in the road. This could be improved by planting vegetation on the sides to help to identify the bend. Sierra Blanquilla, in the municipality of El Burgo (Málaga).



Below, lateral legibility on the SC-MA 02 which overlooks the fertile plain of the river Guadalhorce (Málaga).

to any significant extent and therefore does not necessarily need to be removed. It is the sections with a continuous sequence of opaque objects which really impede the views.

The speed with which a vehicle moves generates a narrowing effect on the views which can be seen from the moving vehicle. Thus, the objects which are closer to the margins move through the visual plane of the observer at a speed which is similar to the real speed of the moving vehicle, whereas the objects sited at medium distances move more slowly across the visual plane, whilst distant objects seem almost static. This lateral effect tends to reduce the visual field of motorists as speed of travel increases, further reducing the legible amplitude of the landscape before them.

Every cross section of road offers a different landscape legibility. A road positioned in a cutting directs the views exclusively towards the platform itself, whereas when built on an embankment, it can offer extensive views of the landscape which lies ahead of the observer. On the other hand, when the road crosses a viaduct the legibility of the landscape is very different, since the fact that they tend to be short means that the visual itinerary is also reduced. Furthermore, the safety barriers on the sides of viaducts close the angle of vision even further, directing the line of vision towards the opposite hill side of the span being crossed.

Roads built into the side of a hill offer an interesting type of legibility because, although they may seem to be laterally limited by the terrain itself, their raised position on the border of the landscape permits the development of vistas with powerful travelling effects which are popular and widely appreciated. These visual itineraries are particularly pleasing when the road also climbs gently up a hillside, offering increasingly extensive views of the landscape below.

The design of layouts with a visual quality, i.e., with a good legibility of the landscape, should be based on a sound knowledge of the scenography of the landscape in general, and more specifically, of the views which we want to obtain along the route.



The presence of objects on the margins, such as lines of trees or other features, can improve the legibility of a road by anticipating its directional development.

The scale of the analysis is of paramount importance, since small elements (e.g. raised elevations, lines of trees, etc.) which would only be shown in more detailed maps (1:2.000, 1:1.000) can impede overall views, disrupting the legibility of the landscape of a route, although the initial analysis of potential views tends to be carried out at intermediate scales (1:10.000 to 1:25.000). For this reason the design and definition of layouts with a visual quality must be carried out gradually, starting from the corridor design phase, in which potential views are analysed, passing through the intermediate scale which defines the disposition of the itinerary within the scenery, and finally coming to the level of detail required for the construction project and the selective treatment of the road margins.

In addition to the visual aspects examined earlier, the conditions which a road must have to allow the appreciation of the landscape from a moving vehicle without compromising the safety of the driver should be based on specific aspects associated with the layout and traffic. These aspects are analysed in the following section.

4.7.3 Layout and conditions of the landscape road

The definition of the layout of a landscape road must be addressed from an integrated approach which takes into account the requirements for landscape integration in all its multiple facets³, the basic elements of an efficient visual itinerary⁴, and the conditions needed to ensure safe driving conditions and a suitable level of service to traffic. This section looks into the aspects related to driving conditions.

The service provided by the road is associated with a number of factors, including the geometric parameters of the layout themselves, the intensity of traffic, and the capacity of a



A layout can benefit from the presence of relevant landscape elements on its margins by visually incorporating them as focal points into the scene the driver perceives.

3. These facets were reviewed in the first sections of this chapter (presence, environmental compatibility, scenic integration and coexistence with character).

4. Reviewed in the previous sub-sections (scenic disposition and legibility).

road, which, when combined with the previous aspects, determines the conditions for the circulation of vehicles and its perception by motorists, i.e., its level of service.

The geometric design of the layout should not compromise comfortable and safe driving conditions, or require additional effort from drivers. Good geometry in terms of road layout must feature bends which are sufficiently straight for the speed of the traffic, gentle slopes which do not have repercussions on the speed of heavy vehicles, thus avoiding disruption to the rest of the traffic, and the correct camber for the radius of each bend. Paradoxically, these geometric conditions of layout are difficult to find in mountain roads, many of which have a significant visual and scenic potential, which cannot therefore be appreciated by drivers who have to focus their full attention on manoeuvring their vehicles through adverse layouts.

Low traffic intensity, i.e., a small number of vehicles on the road, is positive in terms of the contemplation of the landscape, since the presence of other vehicles moving in either direction, especially if they are heavy vehicles, demands added attention from drivers, who are then unable to contemplate the views of the landscape.

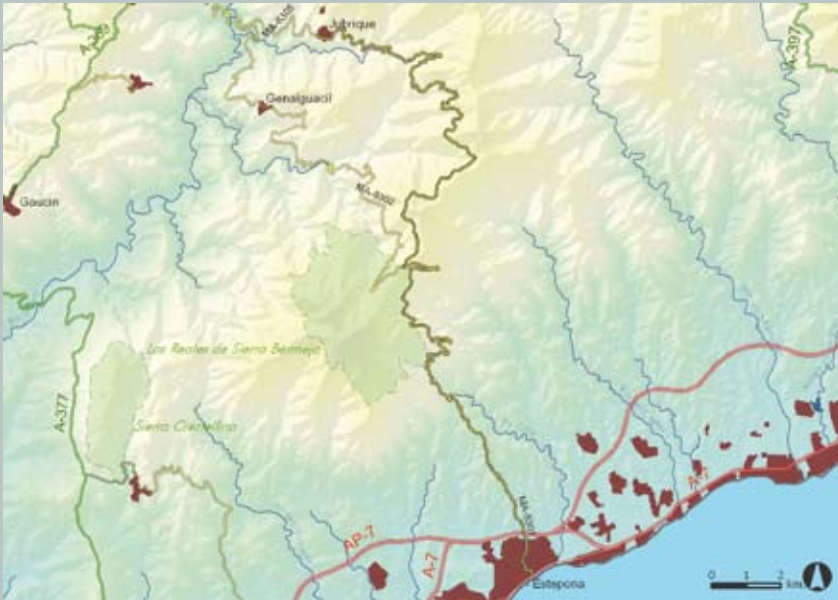
In general, a high level of service, which guarantees smooth driving conditions for all vehicles travelling on a scenic road, is required, i.e., it is imperative that the road has the sufficient capacity to cater for the traffic which uses it. Higher capacities are attained with broader cross sections, sufficiently wide lanes, and the availability of hard shoulders and climbing lanes for slow moving vehicles. However, since the desired amount of traffic in a scenic road should be relatively low, to avoid the distraction caused by other vehicles, cross sections can be designed to absorb these lower levels of traffic.

The seasonal changes in the distribution of traffic is another important issue since many roads which could be adapted as scenic routes provide access to places which only

receive a high number of visitors at very specific times of the year (to see the winter snow, religious festivals and pilgrimages, trips to the coast, etc.). This concentration of traffic flows generates serious over-use and even congestion which hinders the potential enjoyment of the landscape. This also happens in holiday resorts, which receive greater volumes of traffic during vacation periods, just like access points to large cities on working days, adding to the problem of high traffic volumes on potentially scenic roads at very specific times or periods (weekends, summer holidays). Therefore, seasonal factors which affect the intensity of traffic must be appropriately addressed if the layouts are to be adapted to fulfil their role in terms of contemplating the scenery.

Finally, another factor which affects the perception of the landscape from within the vehicle is the attitude of drivers and other travellers, which is essentially based on the motive for the journey. In this respect, special attention should be given to certain types of tourism (inland, cultural, nature), in which drivers tend to be more demanding of the landscape and pay more attention to it. Having said that, the contemplation of the landscape is not to be ignored on routine journeys. In fact, in some cases, regular users of a road tend to be more demanding as they have some relationship with the identity of the place, perhaps because they feel themselves to be part of the landscape. All these factors must be taken into account when studying the possible adaptation of layouts as scenic routes.

4.7.4 Layout and visual quality: example of the MA-8301 road from Estepona to Jubrique (Málaga).



Route of the MA-8301 from Estepona to Jubrique (Málaga).

The MA-8301 connects the landscapes of the west coast of Málaga and the valley of the river Genal, its middle section crossing through the hillsides of the Sierra Bermeja. Following a general SE-NW orientation, in just 13 kilometres the road completes the climb from the coast of Málaga to the top of the Sierra Bermeja, its altitude changing dramatically from approximately sea level to 1,010 metres. From this point (the Peñas Blancas pass), the road begins a tortuously winding descent until it reaches the deep valley of the river Genal.

MA-8301

The existence of sections which are situated at high altitude and the general configuration of the landform offer a whole range of broad and commanding views which are ideal for the appreciation of the scenery of the coast and the surroundings of the Genal. The views which can be seen during the climb to the Peñas Blancas pass are particularly interesting, since this section features various points which afford commanding views of the western coast of Málaga, and on cloudless days, it is also possible to see the north coast of Africa. However, although the areas which surround the road in this section are characterised by their essentially natural character, with enclaves of craggy scrubland and conifers, in the distance it is possible to make out areas which are heavily built up, such as the densely populated urban coastal strip and the large road infrastructure which runs parallel to the coastline.

The valley of the river Genal and the surrounding area is of great scenic interest, and particularly the descent from the Peñas Blancas pass, which offers good panoramic views of the whole valley and its wooded areas of chestnut and cork oak trees, which are particularly prevalent in the lower part. There are also interesting panoramic views at various points in the Los Reales de Sierra Bermeja natural area.



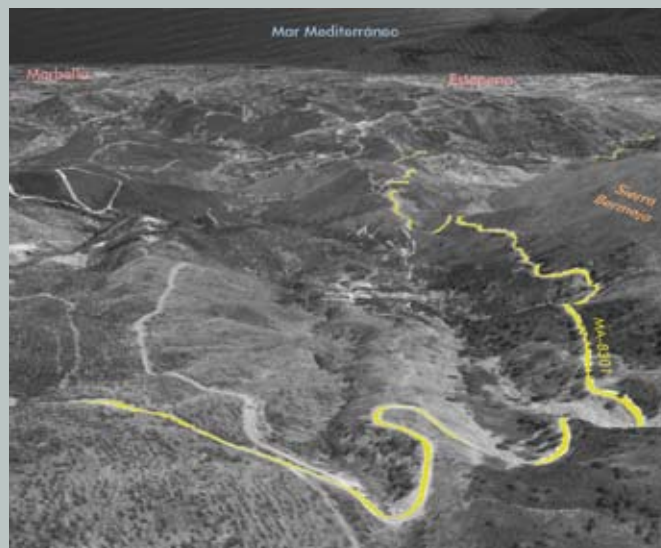
Views of the MA-8301.



Above, layout and views from the MA-8301.

Centre, views from the MA-8301.

Below, route of the MA-8301.



MA-8301

4.8 Layout and development of the landscape values of the road

The conditions associated with driving and the visibility of the layout are indispensable for adapting scenic roads from which the movement of vehicles permits the simulation of a *travelling* effect in a continuous sequence which successfully registers the characteristics and details of the adjoining landscape. These are highly challenging conditions which are difficult to attain to the required degree of quality.

That being said, making travellers aware of the landscape values of a route is not difficult. It does not necessarily require that a cinematic simulation of televised images is seen from the windows of the vehicle, since there are many other resources which allow us to read the surrounding landscape. Without underestimating the basic appeal of scenic quality, simply by making the traveller aware of the characteristics of a landscape and some of the key elements required for its interpretation, it is possible to create a relationship which is more comprehensive and intellectual than the merely visual and contemplative. Therefore, it is important to make the existing values of a route recognisable, rather than just visible, i.e. offer an interpretative reading of the landscape which permits movement at greater speed through a wide area.

A road journey offers the possibility of comparing the reality of the information related to landscape if the resources needed to interpret the landscape values (geographical, cultural, natural...) of the route are made available to the traveller. Roads can thus incorporate an interpretation of the natural and cultural systems they cross.

These systems can be made more visible and recognisable to the traveller if they are provided with the appropriate reference features. The route of one particular road can go through a range of very different systems by climbing the side of a mountain, descending



Left, the A-475 as it approaches the Tharsis mines with the landscape dominated by the mineral slag heaps.

Right, view of the village of Cumbres Mayores (Huelva) from the A-5300, showing the castle of Sancho IV and the parish church.

into a valley, or approaching the coast, thereby offering travellers the chance to contrast, compare, and perceive all the geographical variations and different values of an area.

The values which are perceived on a journey, even if seen in a partial or fleeting way, cover the whole spectrum of the structures and processes of a landscape (geology and geomorphology, hydrology, flora and fauna, cultural manifestations, history, and heritage landmarks). Because they form part of the essence and character of the landscape, these values are actually perceived in the form of organisational structures (landform, vegetal formations, patterns of field boundaries), and recognisable features (architectural styles, typical vegetation, rocky formations), or specific landmarks (limestone outcrops, springs, castles, churches, hamlets, ancient trees, etc.) which are easily recognised by travellers, making them more aware of the route they are travelling through.

In this respect it is important to provide sources of information which offer travellers the references required for the interpretation of the landscape. These sources, which can range from the more general and basic to the more specific and detailed, include generic

education programmes, specific (non-propaganda) publicity campaigns, travellers guides, direction and themed signs, en-route information panels, information centres, and view points by the side of the road.

Roads which are identified by the values of their itinerary should have a specific service providing information about the route. A selection should be made of all the possible itineraries which pass through the various landscapes and can be served by the road network, structuring itineraries in accordance with the intended approach to the values of the landscape, as well as identifying and highlighting their main landmarks, reference points, and elements of interpretation.

The treatment of these values should be formally implemented through a comprehensive project for the development of the scenic values of a route, including an initial analysis and diagnosis of the landscape, the public information measures to be implemented, and the facilities to be incorporated into the road infrastructure.

The implementation of facilities for the landscape appreciation from roads is of strategic importance in terms of realising this potential. Special attention should also be paid to the viewing points, which should be appropriately equipped and designed, the rest and service stations prepared for landscape viewing, and even parking areas or landscape interpretation systems (information panels, etc.) installed by the side of the road which are made accessible to travellers. Roadside pedestrian paths or bicycle lanes are other elements which can be incorporated into roads to enhance their landscape potential (although this is only feasible if the required width is available)⁵. Other solutions for establishing an effective connection between a road and the various pathways which go through an area include the construction and installation of suitable access points and parking areas and good sign posting.

5. For further details about facilities for landscape appreciation see chapter 6.



Series of views of the A-7075

Above. A view of El Torcal with the Sierra de las Cabras to the right, (Málaga).

Centre. The plains of Antequera can be made out in the distance to the right, while the Sierra de las Cabras (Málaga) is situated in the centre and to the left.

Below. In the distance, the plains of Antequera. On the left, El Torcal de Antequera (Málaga).

4.8.1 Values of the route: the example of the A-317 from La Puerta de Segura (Jaén) to Vélez-Rubio (Almería).



Route of the A-317 from La Puerta de Segura (Jaén) to Vélez-Rubio (Almería).

The A-317 follows a long North West - South East route passing through the provinces of Jaén, Granada and Almería, forming an inter-provincial connection corridor through an area with serious infrastructure deficiencies and significant problems of de-population. The route begins near Tranco, rising rapidly through the steep climbs of the sierras of Cazorla

A-317



and Segura, and then crossing the valleys of Segura and el Zumeta. The transit between the provinces of Jaén and Granada is via the Puerto del Pinar pass, where the road reaches an altitude of 1,600 metres in a short steep climb with constant changes of gradient. From here

[View from the A-317.](#)

A-317

there are views to the South East towards Llano de la Puebla, a visual prelude to the plateaus of the most northern part of the province of Granada which the road then crosses. After passing this noticeably flatter area the road then climbs steadily once again on the northern slopes of the Sierra de María, reaching a height of 1,200 metres. After crossing this high mountainous area for twelve kilometres the road descends once again through the valley of the Cruz del Pinar before reaching Vélez Blanco and Vélez Rubio.

The first section of the road, which crosses the Sierra de Cazorla, Segura y Las Villas Natural Park, follows a terrain which is clearly mountainous, characterised by abrupt, craggy slopes formed by geo-morphological action on the carbonate dendritic materials of the prebetic period. The environmental riches of this first part of the A-317 are well known and documented. It is a Natural Park which has been designated a Special Protection Area for Birds and a Biosphere Reserve by UNESCO. The variety of animal life in the area is of great

A-317



The A-317 surrounded by crops and pasture land.

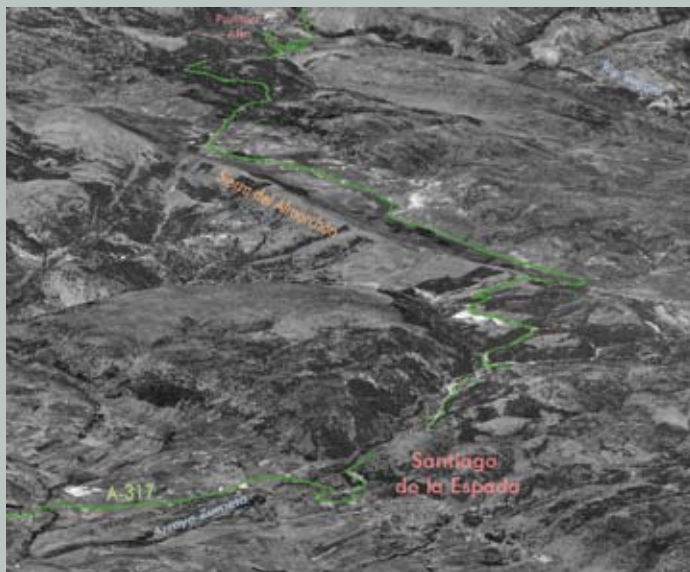


Above, view of pine woods from the A-317.



Below, roadbed of the A-317.

A-317



Route of the first section of the A-317.

A-317

importance, and species include deer, mountain goat, wild boar, and the **segureña** squirrel, an endemic local species which has become an important symbol of the area. Apart from these autochthonous species there are also other animals such as the mouflon and fallow deer which were introduced in the 1950s to coincide with the creation of the National Hunting Reserve.

The diversity of the landscape is one of the most notable features of this first section of the A-317, characterised by a succession of open areas occupied by pine woods and large stretches of meadowland which intermingle with large expanses of farm and grazing land, as well as limestone outcrops and other types of rocky formations. In terms of the notable

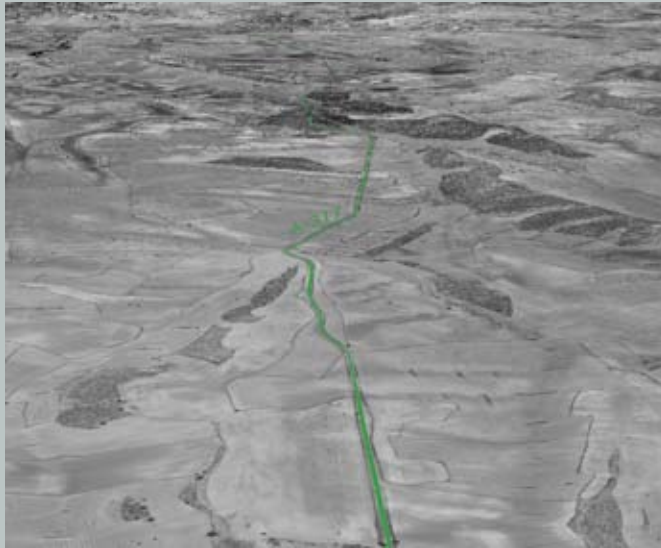
presence of pine trees in these mountainous areas, it is important to highlight that forest exploitation has long been a well established industry in the Cazorla and Segura sierras, as can be seen by an Order going back to 1748 which sets out the rules for the management and operation of the area's forestal resources for the Royal Navy. The intense and continued operation of timber resources in the area explains the prevalence of reforested zones as opposed to autochthonous vegetation. The distribution of species follows a clear altitudinal pattern, with aleppo pines being predominant in the lower parts of the sierra, mountain pines at medium altitudes (between 800 and 1200 metres), and black pines in the higher, colder areas.

A-317



A bridge on the A-317.

The corridor formed by the second part of the road descends the northern foothills of the prebetic sierras of Taibilla and Guillimona towards the plateaus of the northern part of the province of Granada, passing through Huéscar and Puebla de Don Fadrique. There are stark contrasts between the landscape in the sections which follow the road on its descent towards the plateau and that of the flatter areas. Thus, whilst the surrounding scenery along the section which descends towards the plateau continues to have clearly mountain-like features, with rocky escarpments and deep gullies covered by trees and scrubland, the horizontal character of the terrain and the predominance of arable land are the most distinctive characteristics in the sections which surround the flatter parts of the route.



Route of the second section of the A-317.

A-317



The last section of the road, which begins at the foothills of the Sierra de María, is radically different from that of the plateaus. Here, areas reforested with pines and woodland of holm oaks and scrubland play an important role in the scenic configuration of the surroundings. Over its last few kilometres, the road enters the area of Los Vélez in Almería, and follows a route of significant historical interest whose heritage and origins can be traced back to the Neolithic period, when it was already being used by the primitive communities living in the area. Later, during the Middle Ages and the 16th and 17th centuries, the route was used by itinerant herders and caravans of muleteers to access the areas of Huéscar and the Sierra de Segura.

A-317



Today, the road passes by numerous ancient farmsteads or cortijos (Higueruela, Gobernador...) and cortijadas (Casablanca, Toscana...) as well as several traditional inns, including that of El Puerto. It also serves various historic and cultural sites such as the ancient towns of Vélez Blanco and Vélez Rubio, declared Sites of Cultural Interest.

Terraced landscape as seen
from the A-317

A-317

Example of a general metropolitan road on the outskirts of a city whose design is based primarily on the landscape: Avenida de Carlos III in the La Cartuja area, Seville



Location of the Avenida de Carlos III (B.3 middle section) in La Cartuja (Seville).

The incorporation into the city of Seville of the previously floodable strip of land known as «La Cartuja» offered an opportunity to rethink the systems for crossing the river Guadalquivir within the context of the planning schemes developed for the metropolitan area. The objective of the Avenida de Carlos III project was to cover all the significant needs posed by the expansion of the metropolitan area of the city. This road is now one of the essential new elements which make up the crossing system

for the Guadalquivir whose design was established in the planning model for the metropolitan area of Seville (1989 Guidelines) and in the «Esquema de Ordenación para los terrenos del «ACTUR» de La Cartuja» (Planning Scheme for the ACTUR area of La Cartuja) of 1986.

Its objective was to develop a N-S axis along the left bank of the river which replaced the historic system of single crossing plus ring road by another system with several crossings of avenues over the river as part of a broader network.



Situation of the Avenida de Carlos III in La Cartuja (Seville).

This road is one of the essential elements in the structuring of the La Cartuja sector, a key green area with multifunctional equipment for the metropolitan area which was the site of the 1992 World Exposition.

The project is part of a programme for mixed, general and local traffic and its treatment as a transitional element between the internal urban landscape of the Cartuja island, the exterior of the floodplain, and the course of the Guadalquivir.

The avenue is 2,000 metres long with three lanes in each direction, a central reserve, and parking strips. It is landscaped by three rows of plane trees, one on each side of the road, the other along the central reserve.

Left, carriageways of the Avenida de Carlos III in La Cartuja (Seville).

Right, wooded area and pathway on the flood barrier wall next to the Avenida de Carlos III.



The new road runs parallel to the flood barrier, and its surface is situated a metre below the height of the barrier. It is wooded with Mediterranean species of trees, and there are paths and approach roads to the riverside, as well as view points looking over the valley of the Guadalquivir and towards the escarpment of the Aljarafe area.

The low level of the road compared with the flood barrier and the vegetation means that traffic cannot be seen from areas outside La Cartuja, and this contributes to creating an interior visual basin in terrain which was initially flat, with no perceptible limits. The road and barrier, together with their respective lines of trees, make up a visual backdrop which is essential in the organisation of the spaces located inside the sector.

Example



5

LANDSCAPE DESIGN OF THE ROAD



LANDSCAPE DESIGN OF THE ROAD

5

The design of road projects in terms of the landscape is based on three main areas of intervention which are examined in chapters 5 and 6. Firstly we look at the basic elements of the road which have an essentially functional role and make up its interior scene. Then we examine special engineering features such as tunnels, viaducts, junctions, roundabouts and spoil sites. This chapter focuses on these two aspects whilst chapter 6 examines a heterogeneous group of spaces which can be found by the side of roads and fulfil various landscape functions. These have been grouped under the heading of roadside areas.

The platform, hard shoulders, safety elements, traffic guidance equipment, signs, visible engineering structures, embankments, and retaining structures cuttings and embankments, fencing and retaining walls make up the visual scene which users perceive as the typical landscape of a road. This perception is characterised by a standardised appearance which is

clearly based on a functional necessity and specifically aimed at guaranteeing fast and safe travelling conditions for road traffic.

The continuity of direction lines, with their simple and clear markings, shapes the character of the functional part of the road, which is devoid of meaning, and often feels artificial, hard and uninhabitable. Its role as a space which is specifically designed to cater for the movement of traffic is reflected in the fluidity of its visual perspective. Taking a panoramic look at the broader picture which we see beyond the limits of the road, this linear strip crosses the landscape, continuing fluently towards the background and the vanishing points. Internally however, within the environment formed by the actual roadway and its adjoining spaces, the functional process of movement takes place in an a-temporal and almost a-geographical context, lacking broader historic or territorial references, as if suggesting the aseptic space of modernity.

While the typical natural features (organic, complex, and irregular forms) or those which shape the cultural identity and character of a place (traditional materials, field boundary patterns, constructions, crops) are to be found on the edges of the road, the actual scene of the road itself is dominated by the structural patterns of its linear nature, and its construction elements, including the surfaces, plastic paints, concrete (in cladding and engineering structures), and metallic elements (guard rails).

The standardised solutions associated with driving safety and comfort criteria contribute to creating the sense of a non-place, although the distinctive features which can be found on the sides of a road and beyond help us to relate to the spaces we are passing through. The design of the roadbed, carriageways, and traffic signs easily distract our attention from the locality, region, or country we are travelling through, and this necessary functional neutrality minimises the points of reference which are associated with a specific place and the key features of the surrounding landscape.

The design of a road and its structural elements therefore involves a series of factors which are contradictory in terms of the interaction between their functional role and the natural identity and character of the landscape. Therefore, the characteristics and requirements of the landscape and the road need to be reviewed in order to make neither the best possible use of their respective components, whilst trying not to ignore either the intrinsic functions nor the landscape values of the road.

The chapter is completed with the presentation of two examples: a road which is part of an urban development scheme and another which goes through a natural park. Higher capacity roads in urban contexts assume the organisational role which is intrinsic to any road, featuring all the basic design aspects, and fitting into the existing environment, or generating one of their own. An example of this is the Avenida de Valencia, which is part of the La Florida project in El Puerto de Santa María (Cádiz), an urban road, which thanks to its internal elements design features, could be used as a model for roads in other contexts. The second example is the scenic A-317 road between Cortijos Nuevos and La Balletera (Jaén), which was adapted from a series of forest tracks and access roads, incorporating elements of the road design into the landscape treatment.

5.1 Elements of a road

The internal components of a road (signs, guard rails, fencing, etc.) impart an essentially aseptic, a-territorial character to the surrounding scenery, which does not suggest a connection with either the territory through which the route passes or anything situated beyond the edges of this essentially linear space. Roads would, in most cases, be artificial, standardised spaces which are devoid of a sense of place, were it not for the important connection they have with their surrounding environment and the strategic role that their



Left, the elements of the road themselves, apart from satisfying safety, comfort and orientation functions, are very evident in the landscape. They combine to create the scenic identity of the route and how it relates to the landscape; hence the importance of their design.

Above, the intrinsic elements of the road combine to create the interior landscape of the route. They provide the user with a legibility which is not only functional but often also affects the perception of the landscape itself.

basic elements play in their shape and character. Thus, within the limits imposed by their functional requirements (safety, visibility, resistance, etc.), the components of a road can impart a certain local sense to the landscape.

The typical components of a road shape our perception of the identity of the places we travel through, and the extent to which they feel natural or even habitable to us. Therefore, the formal and scenic approach to these components shapes our perception, not only of the road itself, but also of its connection with the surrounding environment. Both functions are mostly based on partial elements which have varying degrees of presence, and whose importance is not always given enough consideration in road projects.

The following are recommendations relating to the basic elements of roads and the possibilities they offer for imparting a particular sense of character to the landscape.

The elements described are as follows:

- Road surface and markings.
- Traffic signing and traffic guidance equipment.
- Direction and themed signs.
- Safety barriers.
- Ditches, manholes, kerbs and culverts.
- Retaining structures for hillsides and embankments.
- Cuttings in rock, berms, and forced collapse areas.
- Revegetation of roadside slopes.
- Landscaping of roads.
- Traffic moderation measures.
- Environmental integration devices.

5.1.1 Road surface and markings

The appearance of the road surface and its graphic elements (road markings) define and delimit the space available for vehicular movement, efficiently contributing to enhance the functional character of the road's landscape. The lines which define borders or separate the



Road markings are a key part of the interpretation of the road, organising its interior space and defining its limits.

direction of traffic, the road markings which indicate zones such as special lanes (climbing lanes, acceleration and deceleration lanes, etc.) or traffic islands (on junctions), the direction arrows, and explicit signs (stop signs, etc.) make up the comprehensive graphic universe which defines the essential structure of the internal scene of a road, particularly on high capacity routes.

Road markings play a crucial role in the direction, movement and fluidity of the road's scenography. The continuous and regular lines on the road surface seem to come closer together the further away they are, creating the effect of perspective. The composition and design of these markings provide us with a specific cognitive understanding of the space focused on the driving of the vehicle.

The presence of these graphic elements on the road surface is particularly visible from above, showing the whole road and its surrounding scenery. The presence of road infrastructure, which is always an essentially functional element, is reinforced by the solid geometrical presence of the road markings, generating a process in which the organic,

irregular shapes of the landscape clash strongly with the clear geometrical and functional character of the infrastructure.

This high level of legibility is sometimes rejected because of the contrasts between the two aesthetic categories. This is so much the case that attempts have been made to remove markings, whose extreme clarity and visibility reinforce linearity and continuity, from roads which pass through landscapes of special quality. However, road markings are features of crucial importance in the perceptual universe of motorists because they clearly delimit the areas which are suitable for driving, and as such, their removal could compromise the safety of drivers. Consequently, these elements must be accepted as essential features of the road, and simplistic approaches which reject the traditional (functionality and safety) features which are intrinsic to the character of roads must be avoided. To eliminate the excessive geometrical effect from certain landscapes, the layout can be partially or completely modified (see previous sections). The partial or total elimination of signs is only feasible on roads which have been decommissioned as elements of the actual road network.

5.1.2 Traffic signing and traffic guidance equipment

Traffic guidance elements, road markings and vertical signs make up the perceptual universe of drivers, providing them with clear graphic information about the conditions required to manage their vehicle. The clear, synthetic and visual aesthetics of road signing is fully compatible with the internal aesthetics of the infrastructure, and diversifies its functional and geometric appearance.

Road signs impart meaning and interpretations to the landscape of the road. Motorists and travellers read and recognise their meaning, incorporating the information provided to their behavioural criteria.



Above, a road sign on the A-7204.

Below, signs which are visible from the A-366. They provide information and references for a personal reading of the landscape being travelled through.

Traffic guidance elements, including cat eyes, reflective posts, or rumble strips, work alongside road markings in creating the sense of direction and space on the road.

To successfully fulfil their function, road signs should conform to a series of criteria in terms of clarity, simplicity and uniformity. Signs must also be:

- Visible: motorists circulating at the maximum permitted speed should find no obstacles between their line of vision and a particular sign, whose design and siting must give drivers sufficient time to read and interpret it, decide on a manoeuvre, and, if necessary, carry it out.
- Legible: they must have a simple and clear content, with a limited amount of information which makes them easy to read and understand;
- Intelligible: the information contained must be comprehensible, systematised, arranged from top to bottom, updated, and
- Reliable: their development must be cohesive and uniform over the whole road network and coherent with other road signs, avoiding contradictions, reiterations, and gaps. They must not overload the attention of motorists by reiterating obvious messages and must impose the least possible restriction on traffic.

Vertical road signs, which are metallic, simple, and easy to see, stand out in the landscape, emphasising the presence of roads and traffic.

Large signs and information panel gantries which are to be found on high capacity roads, also have these characteristics, emphasising the presence of dual carriageways in the landscape. This clear presence of signs, which is necessary for their adequate

visualisation and interpretation, must be seen as an essential part of the presence of the infrastructure, in which they play a key role.

According to their function we can distinguish several types of signs:

- Traffic control signs (indicating maximum speed, no overtaking, warning of bends, etc.),
- Direction signs (provide indications about the road network such as the name of the road, its beginning and end, entries and exits, distances in kilometres, and destinations or places which are accessible from the road), and
- Themed signs (which feature specific information about the route and adjacent areas).

Left, signposts on the A-7075 near to Antequera looking towards the sierra of El Torcal (Málaga).

Below, signs on a high capacity road. Apart from their statutory or informative role they reinforce the continuity and linearity of the infrastructure of the road, giving it a sense of depth, particularly where successive signs follow one another.



5.1.3 Direction and themed signs

Within the different types of road signs special attention is paid to those which give sense to a place, such as those which indicate the situation of a particular point of the route (direction signs) or which provide information about place names or the characteristics of the areas through which the route passes (themed signs).

Direction signs which show distances in kilometres or the names of roads provide drivers with a certain sense of time and space, helping them to create their own mental map of the territory and programme their journey. They are highly functional, landscape references which can also support other more elaborate interpretations. By placing us in our own map of the territory, these signs help us to establish a connection with the different meanings which we have previously identified. By checking the distances and routes, we can establish the distance to a particular destination and how far we have travelled, or confirm information about previous trips.

Themed signs follow a semantic process which is similar to that of direction signs, and cover a wide range of concepts including place names, administrative boundaries, cultural references, geographical features (rivers, mountain passes), and heritage sites (urban centres, historic sites, isolated monuments, historic bridges, etc.).

All these points of reference are used by observers as a basis for interacting with the territory and its related structures or processes. Thus, road signs play a very significant role in the mental construction of the landscape. For example, the signs which indicate provincial, cultural, and regional boundaries have made a major contribution in shaping our intellectual (and by extension social, collective, and political) perception of precise administrative divisions whose definition would have been extremely imprecise in the past without the existence of road signalisation.



Above, signposts on a footpath off the Almonte to Los Cabezudos road (Huelva).

Below, themed and directional signposting on the A-7000 (Málaga).

Nevertheless, travellers continue to incorporate landmarks as landscape reference points, i.e. features of the landscape which are easily visible and recognisable and help them to monitor the progress of their journey. This other type of signage, which is often anecdotal, with its errors and imprecision, is nonetheless an important cultural resource, because it shapes the vision that the observer, and more importantly their entire social group, has of the world they live in or of the territory they are travelling through.

The social and cultural importance of road signs and their codes is thus undeniable in the sense that they contribute to the appreciation of the most frequented landscapes. These semantic keys are automatically perceived and easy to understand and, although this may seem paradoxical, they provide very personal and subjective references, because they refer to the private universe of meanings which individual travellers have coded in their vision of the territory.

There are numerous aspects of the landscape (objects, shapes and easily visible and recognisable features) which operate in a similar way in the mind of the traveller. These landscape references are completed by precise and unequivocal road signs which provide information about administrative boundaries, journey distances, and names of cities, towns or districts as well as other locations or landmarks. As such, signs provide an initial and basic interpretation of territories, and therefore, it is not surprising that road signs are sometimes the subject of political or cultural controversy.

An effective landscape organisation and management must involve the system of direction and themed signs because of the way they contribute to the construction of an accurate and personal interpretation of the landscape. This role must however be fulfilled within the limits set out by the regulations which specify the nature of, and distance to, the elements of the landscape which can be signaled, whilst establishing the need to obtain



Rigid crash barrier which prevents vehicles from leaving the roadbed. This is a solution for low capacity roads (mountainous, local, or rural roads).

previous authorisation for the rest of them, as specified in OM 8.IIC «Señalización vertical», OC 3/96 «Elementos de Señalización de la Red de Carreteras de Andalucía », Ley 8/01 de Carreteras de Andalucía (OM 8.IIC «Traffic signing», OC 3/96 « Signposting Elements for the Andalusian Road Network», Andalusian Road Act 8/01).

Signs which provide additional information about a place and its landscape or characteristics are thus essential in the sense that they develop and enhance the landscape through which the road passes by providing users with points of reference which help them to shape their own personal view of that landscape. Therefore, the information provided by road signs, together with their siting, design and appearance, play an important role in the reading of the landscape for travellers.

The values of a landscape must therefore be incorporated into this interpretation system, whilst not ignoring the primary function of the codes and the conditions under which this rapid, synthetic, efficient interpretative «reading» takes place. Themed landscape signs must observe the requirements which are applicable to the rest of the signs (visibility, legibility, ease of understanding,) whilst offering a well-structured and consistent approach to the structures, processes and values of the landscape, without hindering the effectiveness of the rest of the road signs in any way.

5.1.4 Safety barriers

Safety barriers (parapets, low walls, flexible barriers or guard rails) are linear elements whose role is to provide a certain level of containment for vehicles which lose control, mitigating potential physical injuries for car occupants and the rest of road users, and damage to objects situated in close proximity. It is important to understand that the role of these elements is to replace the potential accident which takes place when a vehicle crashes off the road with another of less serious consequences.

The characteristics of the safety barriers sited on the edges of the roads managed by the Spanish Ministry of Development are defined and classified in the 321/95 T and P Circular Order of the Ministry of Development, and applied by the Junta de Andalucía in roads that come under their control.

Traditional rigid barriers such as low walls and parapets act as inert obstacles which literally restrain the exit of vehicles from the road, avoiding collision with large nearby obstacles, and protecting them from falling from high embankments or ravines, or into the sea, a reservoir, or a river.

However, it is not always guaranteed that the replaced accident they induce (preventing vehicles travelling at high speeds from jumping the safety barrier, mitigating the seriousness of the potential injuries involved in an accident, and reducing the possibility of vehicles bouncing back into the road) can minimise the potential consequences of the crash.

So-called flexible barriers, generally made of flexible steel or covered in wood, are designed to crumple and absorb the energy of a vehicle's impact, thereby preventing it from veering or falling off the road, embedding itself into a large rigid obstacle, or stopping it from bouncing back into the roadway.



Flexible crash barrier with its characteristic undulating profile and bright metallic geometric design.

Due to their importance as safety features, barriers have an extremely visible and prominent design.

However, they tend to be relatively low in height and only sited on sections of the road where their role in vehicle safety may be required. The criteria for the siting of guard rails is based firstly on the «seriousness of the potential accident» which they need to respond to (a crash against a fixed obstacle, falling onto a road situated at a lower level, etc.), and on the specific «level of containment» required for each particular section of the road. The «level of containment» is a characteristic which is intrinsic to each specific type of guard rail, and varies according to their response to standardised tests. The seriousness of the potential accident (very serious, serious, or average), together with the «type of alignment» (straight, inside or outside of a bend with a specific radius) and the «transversal gradient» of the roadway (the angle between the horizontal and vertical planes), are the aspects which define the distance between the edge of the road and the obstacle or dangerous zone which calls for the installation of a guard rail (see Table I).

Guard rails play an important aesthetic role because their presence defines the physical limits of the roadway, significantly contributing to the sensation of a continuous, flowing linearity. Their capability of preventing vehicles from exiting the road also warns drivers of the physical limits of the usable part of the platform. However, other elements of the road, including drainage ditches, retaining walls or slopes of cuttings, extend beyond these barriers, gradually being absorbed into the character of the surrounding landscape. In these instances, guard rails act as the limit between the functional scene of the road and the landscape of the surrounding territory, hence the strategic role of their design. Their aseptic, modern and functional appearance has a particularly striking visual impact on landscapes with natural, picturesque or idiosyncratic values. In such cases, it is recommended that metal barriers are

Table 1. Distance (m) from the edge of the roadway to an obstacle or dangerous zone below which a guard rail is justified.

Type of alignment	Transversal gradient of the margin (H/V)	Type of accident	
		Very serious or serious	Normal
Roads with a single carriageway			
Straight, internal side of a curve or external side of a curve with radius > 1500 m	> 8/1	7,5 m	4,5 m
	8/1 a 5/1	9 m	6 m
	< 5/1	12 m	8 m
External side of a curve with radius > 1500 m	> 8/1	12 m	10 m
	8/1 a 5/1	14 m	12 m
	< 5/1	16 m	14 m
Roads with dual carriageway			
Straight, internal side of a curve or external side of a curve with radius > 1500 m	> 8/1	10 m	6 m
	8/1 a 5/1	12 m	8 m
	< 5/1	14 m	10 m
External side of a curve with radius > 1500 m	> 8/1	12 m	10 m
	8/1 a 5/1	14 m	12 m
	< 5/1	16 m	14 m

Compiled in accordance with Circular Order 321/95 T and P containing «Recommendations for Vehicle Containment Systems» (12/12/1995.)

replaced by others which are either less conspicuous or represent more traditional or natural characteristics.

Furthermore, the angled supports of these metal barriers are particularly dangerous in accidents involving motorcyclists, whose bodies can be propelled at great speed against the sharp angular post. For this reason, a series of protective systems aimed at motorcyclists have been developed, tested, and approved over the past few years to minimise this hazard. (Outlined in the catalogue annexed to the 321/95 C.O. T and P).



The flexible crash barrier has been replaced on this bridge by a rigid crenellated parapet.

The various solutions which have been proposed to reduce the effect of the metallic appearance of barriers include the use of similar flexible barriers partially or completely covered with treated wood, or the reintroduction of traditional restraining elements, such as, for example, low concrete walls sited on the sides of the road like merlons. Some roads

still retain traditional restraining elements such as continuous low parapets or flat walls on supports, which in some cases do not comply with current standards. There are numerous different types of protection systems with a wide range of aesthetic features and designs. The continuous low stone walls which are sited on the sides of the road have a solid and aesthetically pleasing appearance and offer a more elegant solution, since they do their job of delimiting the borders without being discordant with the surroundings.

In general, the increasing popularity of scenic roads has led to the development of less geometrical types of protection, such as guard rails covered with treated wood, whilst the reintroduction of traditional parapets (merlons) has become widespread in more recent road improvement schemes. In this respect it is important to note that, as we mentioned earlier, the safety conditions of the more modern elements must be subject to laboratory tests and be granted official approval.

The type of material used to construct these elements is important because it can end up having the opposite effect to that desired, especially when a particular innovation begins to be widely used and becomes standardised (wooden barriers are widely used in all kinds of landscapes today), or when the internal composition of the element is exposed (some wooden barriers are only covered on the inner side). It is also important to bear in mind that some traditional restraining elements may have inherent safety problems.

These low barriers have a clearly visible presence in the landscape, since their linear disposition reinforces the effect of continuity of the road. Their imposing effect on the landscape must be fully considered in the design of the road project, since metal, reflective, or simply brightly painted (whitewashed) elements can tend to have an overimposing presence on the surroundings.



5.1.5 Ditches, manholes, kerbs, culverts

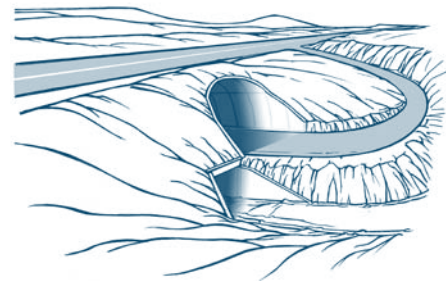
Roadways must be able to drain rainfall water easily, since water retention can damage their surface. For this reason they are designed with convex surfaces so that run off water drains to the sides and is collected by a channel, a lateral drainage system (situated beyond the guard rail) which directs the natural flow of water to a lower point, carrying it away from the road. Discharge points situated on embankments are completed with drainage ditches which are laid over the slope, and have a significant visual presence in the landscape of the road.

When run-off towards the exterior of the roadway is not possible (because of the natural slope on which the platform is supported), a manhole (a simple well) is used to collect the water from the ditch and direct it via a culvert, a small channelling tunnel underneath the roadway, to the other side (the lower side of the embankment) where it is then discharged.

Even the simplest of roads have a system of ditches on the sides to prevent water from accumulating on the surface. Sometimes these ditches are wide trenches which are dug into the terrain and sometimes these excavations are then covered with a layer of concrete (lined ditches), thus reinforcing their presence on the edges of the road. Often the lower edges of the interior carriageway have a low kerb, only a few centimetres

Left, flexible wood covered crash barrier which reduces the negative effects of metallic barriers.

Right, internal view of the barrier showing the metallic part of the structure.



Drainage works can have an imposing presence on the landscape of a road because of their geometric and standardised appearance.

in height, which retains run off water and channels it towards the culverts. On dual carriageways a ditch in the central reserve collects the water which accumulates in the middle of the road by means of manholes, and uses culverts to channel it towards the outer sides of the platform.



In this respect it is important to bear in mind that, in accordance with current legislation (Instruction 5.2 IC «Surface water drainage»), surface drainage facilities (ditches, open channels), or buried devices (gullies, carrier drain pipes) must never constitute a danger for vehicles passing over them after getting out of the roadbed.

In addition to the ditches which collect water from the roadway itself, drainage systems are completed with external channels which are sited on the crowns of cuttings, i.e. on the highest part of a cutting, which intercept the water flowing from the hillside, or with ditches at the foot of embankments which collect the water flowing down the slope, and direct it to the roadsides. These are in turn completed with the regular presence of channels which are built into the cuttings to carry the water from the upper collection point to the channels

Left, a culvert which diverts the flow of a stream from one side of the road to the other. Note the rock fill at the base of the embankment which is a system to limit erosion.

Centre left, both the ditch on top of the cutting, and the one at the foot of the slope can be seen to the left of the road.

Right, a channel which drains water to the foot of a cutting comprising precast elements placed in stepped form on a reduced gradient to limit water energy.

situated at the foot of the slope. In some cases, when high levels of rainfall are common, these vertical channels incorporate a series of steps to reduce the pressure of the falling water.

The linear drainage elements tend to reinforce the directional sense of the road within the landscape, particularly if they incorporate lined ditches, which have a more visibly striking presence.

Due to their essential role in channelling water, ditches accumulate a certain amount of dampness during the rainy season which remains during dryer periods, leading to the development of spontaneous vegetation which, in turn, hinders the drainage capacity of the system and must therefore be removed.

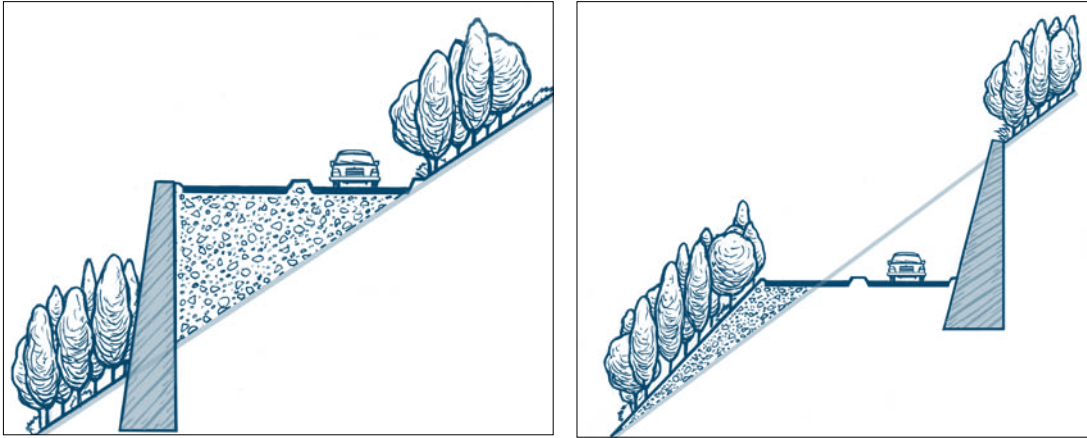
The siting of very broad ditches which are more than 3 metres wide is recommended for the foot of high cuttings, to prevent any potential loose elements from the excavated walls falling onto the road itself. These open safety ditches, which do not have any particular water channelling role, broaden the physical area of the road and keep vehicles away from large excavation walls. They can be used scenically to create character-enhancing features (hedgerows at the foot of slopes) but must nonetheless follow the recommendations for the containment of vehicles.

5.1.6 Slope and embankment retaining systems

Apart from being efficient stabilisation structures, the elements used to contain and reinforce unstable slopes excavated on the sides of the roadway offer a good opportunity to enhance the character of the landscape of the road. These protection systems, which are intermediate elements and connect the road with its immediate environment, enhancing direct interaction with the landscape beyond, can therefore impart a certain character to the road as a whole, if approached correctly.



Riprap drainage ditch. This is an alternative which integrates better with the surroundings than concrete lined or precast elements.



Furthermore, using natural stone cladding, discreet geometrical panels, or other specific elements, as a means of retaining slopes of embankments can contribute to the harmonious integration of roads into the landscape, whilst mitigating their presence or giving them a particular character.

All the rigid elements designed for the protection of slopes must be approached in terms of safety, installing the relevant vehicle restraining barriers if the specific characteristics of alignment, type of accident, and distance from a solid object, make it necessary.

Apart from superficial treatments, i.e., those which are applied to the conditions of the surface of an excavated slope (which are reviewed later in this section), there are numerous structural solutions for the protection of slopes which have varying degrees of presence and character in the landscape of the road. This section reviews the scenic qualities of the following systems:

Left, the introduction of a retaining wall to an embankment means that natural features on the margins can be maintained by reducing the width of the affected area. The use of suitable materials (riprap, stone) can add to the aesthetic character of the installation.

Right, the retaining wall acts as an important element on the character of the road.

- Earth gravity walls and concrete structures.
- Precast panel walls.
- Riprap and traditional stone gravity walls.
- Rockfills and gabions.
- Protection meshes and stabilisation measures.
- Rock excavated slopes and forced collapse areas.

The protection of slopes can be resolved with the installation of a gravity earth wall whose own weight and inertia can sustain the pressure of the weight of the slope above. Generally these walls are reinforced with heavy, compact materials which are capable of withstanding pressure, and their outer side is visible from the inside of the road. Other more efficient structural solutions, including concrete walls or screens, are also commonly used. These vertical walls are typically used in the abutments of viaducts and in the retaining walls of embankments, to which they provide lateral support.

Concrete walls or vertical screens have an essentially aseptic, geometrical and functional character, and their external appearance can be perfectly suitable for urban contexts. Their presence however, in open countryside, tends to clash with the natural and traditional features of the landscape.

Precast panel walls. Another version of the previous solution involves using walls made up of a series of repeated standardised precast panels or blocks with geometrical shapes, such as hexagons or squares, to cover the whole surface. Whilst in some instances these types of panels are used to cover the sides of concrete walls which are visible from the road, in others, such as



The retaining walls made from precast pieces (bottom left-hand corner of the picture) clash with more natural finishes, such as the rockfill wall on the right and the excavation on the left.

reinforced earth constructions, they fulfil a more structural role. As with the previous example, these types of walls can be a suitable solution for urban contexts, but in other environments they stand out due to their artificial character, which is even more marked than that of plain concrete screens.

Other stabilisation elements adopt more aseptic and de-contextualised solutions which should only be used in exceptional circumstances. Prefabricated pieces which are used to protect the base of slopes are generally relatively discreet in design, which permits their incorporation into the overall aesthetic characteristics of the road where their aseptic and functional appearance makes them compatible with certain given contexts.

As is the case with other structural elements and solutions, there are numerous options and designs. The decision to use one rather than another must respond to the criteria adopted for the specific approach to the landscape treatment of the road. In general, the more discreet solutions tend to be more acceptable than those with a strikingly visual or spectacular appearance. However, in certain cases and contexts, it could be useful to use elements which, without being excessively superficial or cosmetic, have an intrinsically natural appearance or a distinctive character of their own.



A dry stone wall marks the edge of an estate. Imitating these character references when installing retaining elements can give identity to the road infrastructure.

Riprap and traditional stone walls. Structural solutions used for the protection of slopes, abutments, or embankments, such as gravity walls or concrete screens, can be clad with dry stone to simulate old masonry walls, a procedure which significantly increases costs but offers greater aesthetic quality. As a structural solution, it is also possible to use stone walls whose weight can use the effect of gravity to contain the earth behind if the pressures are not particularly high (on smaller slopes).

Thanks to their aesthetic and interpretative qualities, these kinds of stone walls built at the foot of slopes can be an extremely attractive feature of the landscape and the use of local rock

material in this type of structure is advantageous for a number of different reasons. Firstly, the use of locally sourced materials permits the reproduction of local scenic references which revive the traditional use of stone in the constructions of a particular culture, reintroducing it in a more modern context. In this respect, it should be born in mind that original stone walls were used in the past as a basic form of containing structures on terraced cultivation slopes, and these terraced walls are much appreciated for their evocative character and sense of identity. In a similar vein, dry stone walls are also landscape features in their own right and have been traditionally associated with other types of agricultural constructions which tend to use local materials. The typical stone of an area is an important geographical reference point and the rocks and stones collected by farmers to prepare land for cultivation were then used to build the dry stone walls which defined the boundaries of fields, and which are now such a widely appreciated landscape feature.

In fact, the retaining walls built with real stone or riprap which are used to enclose roadside slopes purposely imitate the appearance of the walls traditionally used to support terraced cultivation systems, or those which define the boundaries of fields which are often found on the edge of roads.

The stone wall structures built to protect the excavated slopes take the same form as the traditional retaining walls used by farmers to stabilise slopes on their land. They combine a well consolidated, compact structure, constructed stone by stone, with spaces which allow the water which accumulates on the slope to drain away, thereby preventing the terrain from becoming waterlogged and weakening the wall. Although the original artisan method of constructing a stone wall, a slow and studied process, completed piece by piece, cannot be efficiently adapted to the needs of the modern construction process, since the speed and urgency with which some



of these geotechnical problems need to be solved make the traditional procedure an unsuitable solution, covering emergency structures with a layer of stone can improve the situation.

Stone walls have been the source of inspiration for the cladding of excavation or resistant walls to give them the appearance of dry or cemented stone walls. Although this solution requires sophisticated techniques and costly procedures, the results are spectacular and permit the creation of ambiances which have a striking presence in the landscape, particularly if used for large walls in strategic locations, or along a whole stretch of road.

Furthermore, the use of traditional stone, for geotechnical or covering walls, is a resource which can be easily adapted to other road elements, such as low ornamental walls or edging markers, or to the side walls of culverts. It is also highly compatible with other features, such as landscaped gardens or wooded zones, and is extremely efficient when its use is approached in a consistent manner, since it can impart a distinctive character to the road environment.



Rockfill and gabions. Rockfill structures, i.e., retaining walls formed by rows of large rocks placed on top of each other, are extremely effective as an intermediate solution because of their good mechanical and resistance properties, low cost, and general viability. However, the fact that they are constructed with naked rock means that they sometimes clash somewhat with the environment, especially when they have just been completed.

Furthermore, their clean appearance, and the size of the rock fragments and gaps, means that these structures lack the charm of traditional dry stone walls, which are made with more delicate and smaller pieces of stone. Nevertheless, rockfill can help to preserve much of the natural character of an area, particularly if vegetation, either artificially introduced or spontaneous, takes root on their rocky walls. The gaps between the rocks can be used for the planting and subsequent colonisation of flora, although plants do have to face the numerous challenges posed by the lack of earth, extreme dryness, and exposure to the elements.

Rockfill walls on the roadside have a notable effect on the landscape of the road.



Left, walls with rough hewn blocks of rock which are more gross looking than riprap can be appropriate as earth retaining systems.

Right, stone gabion supported by a metallic mesh. In spite of the material employed, the geometric appearance of these elements tends to limit their character, although the result can be acceptable.

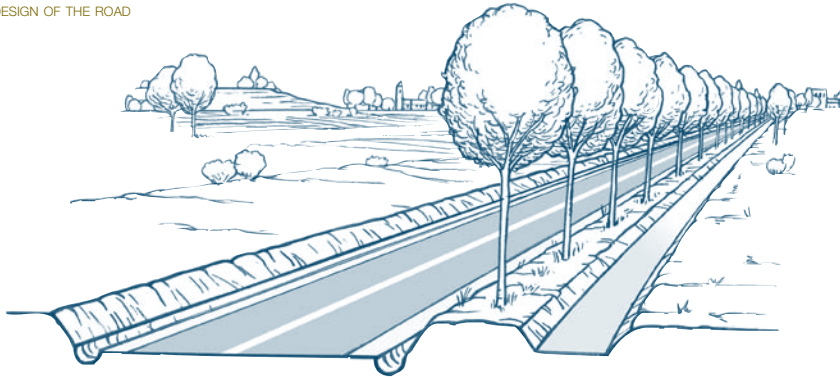
For this reason, the use of more ambitious and sophisticated solutions, particularly those offered by bio-engineering, is recommended for the treatment of rockfills. These treatments must be performed on the intermediate layers of rock, before the rockfill is completed, since the more protected interior space facilitates the growth of vegetation, thereby helping to consolidate occupation of the outer face.

Stone gabion walls are another type of stabilisation solution which relies on the weight of stone to prevent the sliding of hillsides, which are contained by resting against the inside walls of the gabion. Gravel gabions, formed by packets of material compacted inside metal wire mesh, have a highly unusual appearance because, although they use natural materials, they tend to have extremely geometrical and artificial looking designs, and require specific treatments for their revegetation.

Another effective solution is to construct walls and structures of different materials at the bottom of slopes, which, without embedding themselves into the actual slope, operate in the same way as gabions in the sense that their internal structure provides support to the slope. They offer a wide range of possibilities both in terms of their morphology and type of finished surface.

5.1.7 Cuttings in rock, berms, and areas of forced collapse

Cuttings excavated from rocky, vitreous terrain, with steep slopes and a south facing orientation are difficult in terms of environmental restoration. For landscape and environmental reasons, in general, it is recommended that the excavation walls of cuttings in rocky terrain are flattened as much as possible (with maximum gradient of 45° , since steeper gradients require special protection systems for revegetation).



A road layout within a cutting allows it to be isolated and hides the traffic. Nevertheless, drainage problems can arise if its longitudinal development is not resolved appropriately.

However, the levelling of slopes to facilitate revegetation produces larger amounts of excavation material, which, if it cannot be reused as filling material or balanced with other nearby road embankments, generates spoil sites, which have a negative impact on the landscape. This aspect and other criteria (construction, economic) sometimes leads to adopting vertical gradients in cuttings, where the naked rock is left exposed, with the consequent negative effect on the landscape .

In any case, it is recommended that excessively sharp edges and straight lines are to be avoided when shaping excavation cuttings, by rounding off their crowns and favouring the development of irregular shapes on the slope. In many cases, collapses or minor slides of the terrain produce faults on the surface of the rock which can give a messy and dangerous appearance although on other occasions, depending on the type of rock and the stability of the terrain, this can result in forms which are slightly more natural. These abrupt and irregular morphologies are better for environmental restoration.

For reasons of stability, very high cuttings or excavation walls incorporate longitudinal steps or berms along their entire length. These excavated terraces permit the introduction of vegetation, generating the effect of naturalisation in strips, in the style of hanging gardens, which can end up occupying the entire slope if their development is actively encouraged.



The morphology of excessively geometric embankments with very well defined edges (above) are more imposing than those more irregular and naturalised (below).

In general, it is recommended that sharp edges should be rounded off and irregular shapes employed, whilst excessively geometric excavated walls without topsoil should be avoided. It is especially important to avoid pure geometrical shapes and well defined edges on sections in which a number of different roads meet in cuttings, (typically junctions or slip roads) since they generate an extremely artificial environment.

There are a number of ageing treatments which can be used to darken recently excavated surfaces in rock cuttings through the application of abrasive agents, acids and coloured dyes. The idea is to reduce the contrast between the exposed naked rock and the surrounding terrain. In some cases these solutions can be very effective.



5.1.8 Revegetation of slopes

Despite their delicate nature and the fact that they require a major effort in terms of consolidation and maintenance, particularly during the first few years, revegetation schemes are highly recommended not only because they enhance the natural character of roadside areas damaged by earthworks, but also because of their beneficial environmental effects in terms of protection against erosion and microclimatic compensation of the surroundings.

The revegetation of roadside slopes has to contend with the task of making vegetation thrive through the planting of seeds and plants in an adverse, inert surface. Unlike other elements of the road, the fact that revegetation involves the use of living materials which must achieve a certain degree of autonomy and consolidation, makes the success of these processes delicate and fragile. Some slopes are difficult to re-vegetate, particularly if they have a southern orientation, their gradient is steeper than 3H:2V, or are mainly formed by inert rocks. These cases require specific and careful treatment with frequent risks, soil protection systems, and extensive addition of topsoil.

The definition of the gradients of the planned cuttings should not only be limited to guaranteeing natural stability, but should also anticipate the potential difficulties facing the revegetation process by avoiding excessively vertical walls, favouring irregular shapes, and incorporating terraced sections or steps at a certain height. The definition of slopes should

The stability of steep cuttings can be improved with the excavation of successive horizontal shoulders (every 5/7 metres). This approach also favours the scenic treatment of large vertical rock walls (right).

Left, the finish of excavated cuttings should avoid geometric forms and edges (left) so as to achieve a more organic and natural appearance (centre).



The slope on the right makes revegetation extremely difficult due to its almost vertical layout and lack of soil, although planting can be carried out in excavated hollows.

also, where possible, maximise the balancing of earthworks, thereby reducing the steepness of gradients so as to facilitate the revegetation process and, in many cases, increase the availability of refill material.

During the construction process, efforts should be made to make the best possible use of topsoil by removing the superficial surface of the terrain which is to be occupied by the road and storing it in small mounds or ridges which should be regularly aired and irrigated to maintain its internal vitality.

In cuttings with steep gradients (more than 3H:2V), the use of erosion control systems such as jute mesh mats, nets, or other materials which are spread over the slope to stabilise the topsoil is recommended. The laying of these systems during rainy periods should be avoided so as to prevent the erosion of the treated surface.

The bushes and trees which are to be planted on the slope must be placed in previously excavated holes filled with topsoil. Seedlings should be irregularly distributed, with greater density on the higher parts of the slope (so as to prevent erosion from above slipping onto the lower parts).

The use of species which are common to the area is recommended and, if possible, they should be sourced from nearby nurseries and therefore adapted to the conditions of the context in question.

Maintenance is certainly one of the main weak points of revegetation techniques. Indeed, while most of the elements and structures of a road project require relatively simple implementation and maintenance procedures because they are based on essentially physical construction processes, revegetation and landscaping schemes involve extremely fragile biological and ecological processes whose successful consolidation and development faces numerous difficulties. Management approaches which are limited to controlling the parameters associated with the mechanical construction procedures often fail to guarantee the consolidation of soil and vegetation (i.e. the successful germination of the seedling), tending to certify the completion of the vegetation scheme as a whole when the layers of topsoil have been installed and the planting process has been completed, regardless of whether their consolidation has been successful. Later, during the maintenance period, if it becomes clear that certain aspects of the project have been unsuccessful, with loose soil, failed plants, etc., compensation measures are usually limited to repair work and the replacement of damaged elements, but there is no commitment to guaranteeing their full consolidation and development.

The location and characteristics of the species used for revegetation schemes must never create a risk of accidents caused by drivers becoming distracted. Shapes, size and location must provide the highest possible visibility to motorists, particularly at intersections and on bends, and vegetation must never conceal road signs.

Environmental restoration treatments must also be applied to working areas such as spoil sites, ancillary facilities, and material and machinery storage zones, so as to prevent their

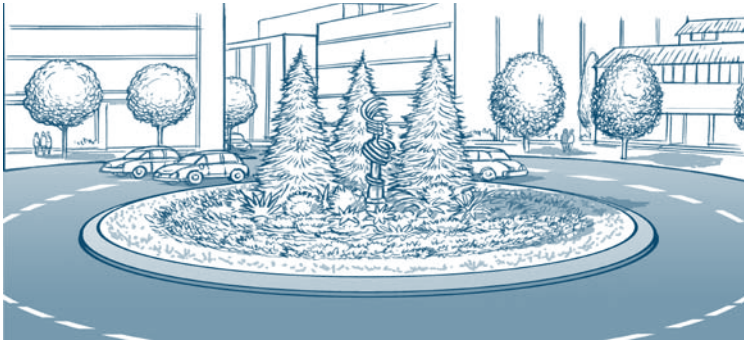


Planting on steep slopes. Revegetation, apart from improving the landscape, is an efficient method of stabilising slopes and protecting them against erosion.

degradation and guarantee their integration into the landscape. These treatments, which should be performed at the time of completion of the works, also tend to be afflicted by the weaknesses highlighted above for other environmental restorations, with the consequent negative environmental impact.

The management of these procedures (development on site and replacement during the guarantee and maintenance period) must be based on their demonstrated effectiveness as ecological resource techniques whose vitality and autonomy are guaranteed. Although nowadays the inclusion of budgets for revegetation and landscaping is common practice on road projects, even small-scale ones, this does not seem to have had the desired effect within the construction process as a whole, and therefore it is better to address them as independent projects which are implemented by specialised companies.

Contrary to how it may seem, revegetation techniques are actually relatively cheap, especially when considered within the context of the overall cost of a road project. However, the inherent difficulties they entail in terms of implementation and maintenance, which must be carried out on a continuous and gradual basis, seem to undermine their role in the development of the road work scheme as a whole. In fact expenditure items allocated to these procedures are the first to be eliminated in favour of others when the development of the works requires reallocation of funds, even though their cost is relatively low. This attitude needs to be eradicated from the management of road construction.



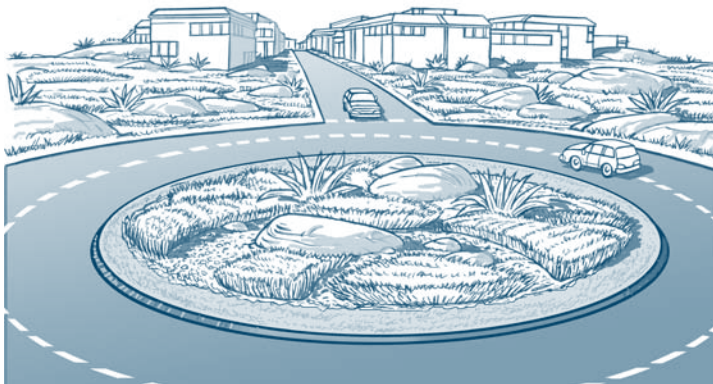
Landscaping the central and lateral spaces of the road must allow visibility for drivers.

5.1.9 Landscaping and gardens

Landscaping is a widely used resource in the treatment of isolated areas which are adjacent to the roadway, such as traffic islands at junctions, central reserves, or roundabouts. Landscaping has an essentially ornamental function in the sense that it tries to reduce the hostility of the arid, aseptic facet of the road which is subject to the pressure of traffic. This generally involves the development of landscaped zones which can be seen from a certain distance, with a series of natural features including grass and ornamental bushes and trees. They also often incorporate artificial elements such as bricks, rocks, and sculptures, or other visually striking elements (monuments, old machinery, etc.).

Although essentially decorative in their nature, landscaping schemes are also affected by the difficulties faced by the other living elements on the road and therefore complex procedures are required to guarantee their viability. Nevertheless, landscaped features are popular and much appreciated by the public and are generally associated with the enhancement of the habitability of roads, particularly in urban and semi-urban areas. They are a widely used resource for softening the interior landscape of roads and enhancing their natural appearance.

In the context of city streets and plazas, landscaping brings back the more user-friendly, natural character to roads, transforming them into spaces which are less hard, rigid and sterile.



Good design can provide a natural character and identity for the road environment without compromising safety. Medium or large-sized elements are recommended, with simple and discreet layouts which avoid excessively picturesque or overly dramatic designs

The plant species chosen for urban environments are usually ornamental and often exotic in character, and they are chosen for both their aesthetic qualities and resistance. Although the plants used in landscaping schemes are usually unfamiliar with the natural conditions of the context where they are introduced, local and endemic species are sometimes used if they meet the specific aesthetic and maintenance requirements.

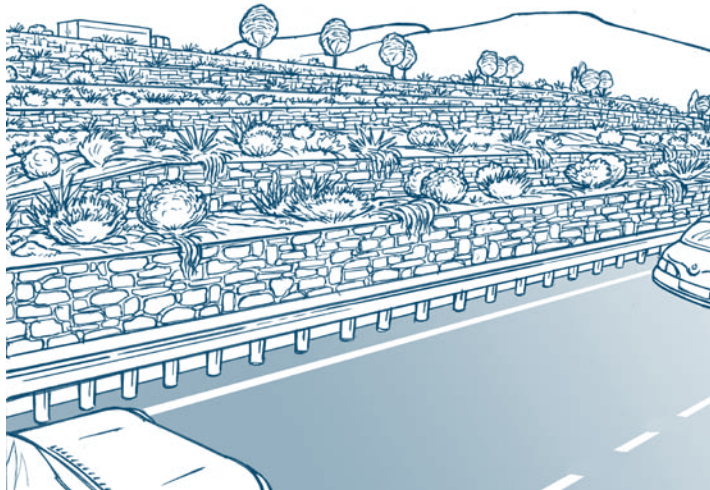
Spaces which are often landscaped include road margins, traffic islands, the central areas of roundabouts, and central reserves. The physical reality of these zones, which are generally small in size and exposed to the road conditions, means that the species chosen from nurseries must be hardy and low-maintenance. They must be able to survive in the adverse

conditions which are typical of the road margins, i.e., they must be resistant to atmospheric pollutants, particularly suspended solids and environmental acidity, and be able to adapt to the extreme conditions resulting from dryness and exposure to the wind and the sun. They are also required to have a certain degree of aesthetic quality.

As we said earlier, the location and characteristics of the selected species must never represent an immediate risk of collision due to potential distraction of drivers travelling on the road. Their shape and size must permit maximum visibility to motorists, especially at crossings and on bends, and they must never conceal road signs.

Landscaping schemes are not limited to planting and sowing, they also include a wide range of decorative structures such as sculptures, rock features, stones, low ornamental walls, railings, and edgings which enhance the visual and aesthetic qualities of the area in question.

The different approaches to the design of landscaped areas are generally defined by their specific scenic requirements, i.e., by the need to create a visual ensemble which can be



A variety of elements (rocks, sculptures, ponds, stone walls, etc.) can be used in the design of margins, traffic islands and central reserves, as well as planted or seeded areas. Maintaining a consistent style is recommended, with simple references to the nearby landscape.

appreciated from a stationary or moving vehicle. Below there are a number of examples of possible approaches to landscaping, including garden-style, scenic, and parterre designs.

Garden-style design: an approach which focuses on emphasising a small group of plants with special aesthetic qualities which are placed separately in flat contexts delimited by areas of grass, graded aggregate, earth, or mulch. This strategy is commonly used on traffic islands of motorway junctions.

The scenic design: tends to recreate scenes with a naturalist character, i.e., with deliberately irregular organic compositions. Features small areas wooded with trees or groups of bushes, with an organic combination of the volumes and heights of the selected plants. Rocky features and ponds are sometimes incorporated into these compositions on the traffic islands of junctions.

Parterre design: involves the use of low plants or bushes with flowers to compose a combination of irregular shapes. This style, which places the emphasis on the flowers and the different colours of the plants, is sometimes used to highlight a central area. This is a particularly useful solution for the spaces which are close to road traffic, such as small traffic islands or roundabouts, where landscaped features must not impede visibility.

5.1.10 Traffic calming measures

In addition to ornamental measures, the improvement of the landscape conditions of roads can also be approached in terms of reducing the effect of the traffic itself, by moderating its intensity and concentration. Traffic calming measures thus contribute to the environmental improvement of roads, and are particularly effective if they are combined with the introduction of measures or facilities for the enjoyment of the landscape, with which they

can successfully interact. The improvement in habitability of the road and its surroundings is directly associated with the control of traffic and the potential reduction of the impact of its effects on the areas for public use which are situated on the margins.

Measures to limit traffic and mitigate its effects, which are typical strategies for the environmental enhancement of urban areas, are perfectly applicable to any road where the improvement of habitability is desired. Urban carriageways, access roads to natural parks, coastal roads, and scenic routes, are all, amongst others, types of roads whose landscape profile and habitability can be effectively enhanced through traffic moderation.

In addition to the various measures used for the physical isolation of traffic, including raising or lowering the roadbed or using lateral or overhead covering systems, there are basically two different strategies for moderating traffic:

- Reducing average traffic intensity through deterrence measures, and
- Reducing speed by using indirect road design features.

These measures must be applied within the context of an integrated traffic management scheme associated with landscape management programmes.



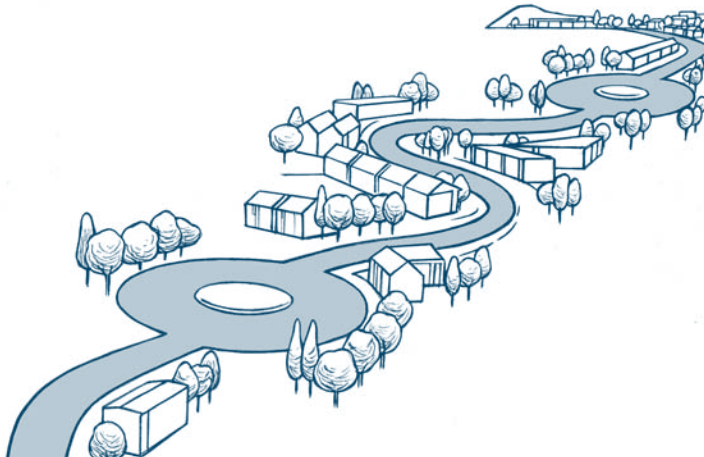
The narrowing of the road and the appropriate landscaping treatment on the margins (the introduction of trees for example) will have the effect of slowing down the traffic.

Traffic deterrence strategies tend to combine measures for obstructing the flow of traffic on the road which is to be protected with strategies to improve traffic conditions on alternative routes. Deterrence can be addressed in itself by obstructing vehicular access and movement in the areas which are to be improved, although it is always far more effective to promote alternative routes and modes of transport such as collective transport.

Reducing the drivable section of roads, preventing vehicles from parking or stopping temporarily, and increasing the use of rigid zigzagging itineraries, are effective ways of obstructing and therefore discouraging traffic. However, these must never imply additional risks which may compromise road safety.

Speed reduction has a very positive effect on the habitability of the road environment. There are a number of design measures to attain this objective:

- Installing a successive series of roundabouts;
- Designing roads with bends, winding layouts, or regular lateral obstacles;
- Reducing the effective width of the roadway, thus narrowing carriageways and/or lanes.



On sections where a reduction in vehicle speed is desired, this can be achieved by inserting bends and roundabouts which relax the traffic and reduce average velocities.

A number of devices can also be installed on the surface of roads to reduce the speed of traffic. These include physical speed control structures such as humps (sleeping policemen) and rumble strips.

This type of measure must be properly signposted and motorists must be warned of their presence with sufficient time so they can gradually adapt their driving to the new circumstances without creating risks.

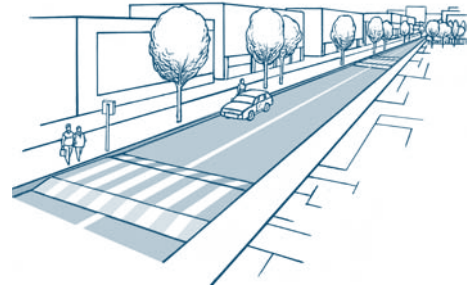
Likewise, the application of regulations which limit speed through restriction signs can lower average driving speeds, thereby reducing acoustic pollution, exhaust emissions and the risk of accidents.

Although this may seem contradictory, it is important to achieve a certain degree of traffic fluidity, avoiding brusque braking and acceleration situations which seriously hinder environmental quality by generating additional noise and emission of pollutants. The installation of traffic lights, for example, on roads with residential areas close to the margins, can create this type of problem.

5.1.11 Environmental integration devices

The presence of roads in the landscape must be compatible with the preservation of environmental processes. This positive coexistence between roads and the processes which sustain the environmental values associated with biodiversity and environmental quality, or the preservation of cultural heritage, can be achieved if a positive approach to environmental criteria is adopted in the conception and design of the road.

As we have discussed in previous sections, during the planning phase, a thorough hierarchical analysis of the road network must be carried out, taking into account the



The siting of speed humps obliges vehicles to drive more slowly.

specific environmental characteristics of the corridors and making an effective selection of improvement and maintenance measures. In the layout study phase it is necessary to adjust the layout of a road so as to address potentially fragile aspects of the environment, avoiding, wherever possible, proximity to sensitive elements and the fragmentation of communities and habitats, whilst taking full advantage of the characteristics of the cross section to reduce potential damage to the margins of the road.

During the design phase of the construction project, it would be useful to introduce specific environmental integration devices, such as those aimed at reducing traffic noise, preventing fragmentation of habitats, or controlling erosion, although these should only be considered once the implementation of positive environmental criteria in the initial planning and layout design phases has been fully completed.

Finally, during the actual works management process, the implementation of good practices in terms of environmental procedures can help to mitigate any negative aspects generated during the construction phase.

The most frequently used systems for the environmental integration of roads can be grouped into the following categories:

- Systems for the reduction of traffic noise, such as porous surfaces, dikes, and noise screens;
- Systems to avoid habitat fragmentation, such as fauna passes, and systems aimed at keeping animals away from the roads (fencing and escape ramps);
- Systems aimed at preventing spillages and contamination from the roadway caused by runoff water;
- Environmental restoration treatments for areas degraded by construction works, embankments, and other road elements (traffic islands, central reserves, etc.).



Animal escape ramp. The treatment of environmental integration includes various methods which allow cohabitation and compatibility with the surrounding natural processes.

For more information about this subject, see the specific manuals relating to the justification, selection, location, design, and installation of these systems (see references).

5.2 Special structure elements in the landscape of the road: viaducts, tunnels, roundabouts, junctions, spoil sites and ancillary installations

This section examines large-scale structures which form part of the road and offer special scenic qualities and conditions both in terms of the interior scene of roads and how they are integrated into the landscape. They include bridges or viaducts, tunnel portals, and roundabouts or junctions, as well as spoil sites and old ancillary construction installations.

The following sections look into the landscape qualities of each of these structures and how they can be effectively developed.

5.2.1 Bridges and viaducts

The necessity of building a bridge to guarantee the continuity of a road over a span always has a special landscape implications. The main implication lies in the unique visual quality of a linear construction which spans an opening, which may or may not be addressed successfully in terms of its design. The other implication is that the aesthetic quality and functional character of a bridge nearly always make it somewhat spectacular.

Bridges generally have noticeable dimensions, in both absolute and relative terms, within the context of the place they are sited, as they span across a river, a valley, a gully, the road itself, or merely a depression. This basic characteristic defines the landscape properties of bridges in their various facets as elements of the landscape which have unique scenic, aesthetic, perceptual and environmental qualities.



A-381 Jerez-Los Barrios (Cádiz).
Bridges, whether they cross the motorway as seen here, or support the platform itself, are key elements in the landscape of roads in terms of both the way they define the internal scenery and their effect on the overall landscape .

The scenic environment in which the bridge is situated is also particularly unique in terms of its organisation, since it is formed both by the connected sides and the scenery which lies beneath the actual structure in both directions. Bridges occupy a «central» place within their environment.

The structure, materials, and elements of a bridge (deck, piers, arches, cables, towers, etc.) and its disposition tend to capture the attention of the observer, who can appreciate the contrast between the bridge and its environment. As such, the relationship between the aesthetic qualities of the actual structure and those of the surrounding area, create a pattern of contrasts which influences the perception of both elements. Furthermore, these transversally sited structures have a significant impact on the overall perception of an area, since they establish a reference system in the landscape, which is impossible to miss: a geometric point of reference which, as in the case of the roads they serve, are essentially linear, subtly combining both vertical and horizontal planes.

There are two different types of road bridges. On one hand there are the standardised conventional structures which are built systematically and regularly along roads or dual carriageways, contributing to their functional character, and on the other, there are bridges or viaducts which are purposely given a distinctive character for specific reasons. In both cases, their design provides planners with a unique opportunity to improve the relationship between roads and their landscape which should not be ignored.

The following paragraphs examine recommendations in this respect, focusing especially on the following:



Viaduct on the A-8126 over the river Guadalporcún, in the municipality of Coripe, in the province of Seville.

- A) Standard and box girder bridges, and transversal drainage structures.
- B) The aesthetics of bridges and their surrounding landscape.
- C) The scenic potential of bridges.
- D) Environmental processes and bridges.

Standard overbridges, underbridges and transversal drainage structures.

Road projects incorporate standardised bridges with various different functions, overbridges on dual carriageways and smaller bridges for normal roads, including box structures to provide passage for machinery and drainage structures. These standardised concrete structures are generally small and discreet.

Overbridges tend to be constructed with cylindrical support columns and trapezoid crossheads which support the T section beams which make up the deck. Their abutments also incorporate standardised solutions such as concrete retaining walls covered with precast panels or other more aesthetic forms of cladding such as riprap. Box underpasses for machinery can have significant dimensions (interior height 7 metres, width 5 metres, and variable length depending on the section to be crossed) with concrete walls and pavements, and concrete wingwalls to contain the embankments where the crossing is placed. They are

hard, sterile and characterless structures, and the fact that they are located underneath the road, means that they have little connection with the users' environment although they do define the shape and character of the immediate surroundings of the road, especially for those who cohabit with it.



Depending on the basin they serve, the dimensions of transversal drainage structures vary considerably in size. They tend to incorporate triangular concrete wingwalls on the sides, and other concrete elements, and are sometimes equipped with sand filters to collect sediment, and energy dissipators (steps, alternating blocks, etc.) to reduce the pressure of the water being channelled. In general, they are aesthetically poor in design with an essentially artificial appearance and, although there are more elaborate models such as the Matier



Right, concrete underpass with the harsh aesthetics typical of such structures.

Left, viaduct with deck made up of simple girders supported on continuous or screen pillars.



Viaduct over the river Oraque on the A-475, marking the municipal boundary between Calañas and Villanueva de las Cruces, in the Andévalo area of Huelva.

transversal drainage structures with their bird feather shaped ends, they mostly have a functional and artificial character.

Despite the fact that these structures are geometrical and functional, and have poor, limited designs, they nevertheless tend to go unnoticed within the road environment as a whole due to their ubiquitous nature. This is especially the case in large-scale infrastructures like dual carriageways or expressways, although at a more local level, when seen as part of the landscape, they tend to emphasise the presence and artificial character of the road and its elements (fencing, embankments, etc.) more clearly.

Naturalisation treatments which include revegetation and planting in the areas which surround underpasses, abutments of overpasses, drainage structures, and box underpasses, tend to soften the presence of these elements, although it is important that planted and revegetation areas do not compromise the safety of traffic, or interfere with the adequate visibility of road signs. Stone cladding or other typical local scenic features can also be used in the same way, although they tend to offer a less efficient solution.

Aesthetics of bridges and their surrounding landscape. Although bridges are always subject to a series of essential requirements which are governed by their role in crossing over a span, their aesthetics are defined by the type of structural solution which has been adopted. Thus, continuous beam bridges, double or single deck bridges, arch bridges, truss bridges, and suspension bridges for example, create very different effects and compositions. The type of structure and materials used defines their design, siting, dimensions and orientation, and these in turn influence the way in which we perceive them in the context of their surroundings. The process involved in the perception of structures which are suspended in the air is as subtle as it is complex. In fact, although the different aspects associated with the fascination that bridges produce in us may be recognised, the process governing our perception of them involves a series of complex sensory mechanisms which can be grouped into the following categories:

- Contrast between the bridge and its surroundings
- Orientation of the structure and its surroundings
- Presence and lightness of the structure within the overall composition
- Absolute and relative proportions of the bridge with respect to its surroundings
- More spectacular or discreet character of the bridge.

It is certainly true that a structural contrast exists between, for example, the clearly defined geometry of a simple, heavy, prefabricated structure which crosses over a river and its forested banks, and the organic, flowing appearance of the course of the river and the vegetation on its margins. In general, contrasting compositions tend to be extremely obvious, legible and visually satisfying and, as such, the differences and similarities between

a bridge and its environment are, in this respect, what lies at the basis of its effect on the landscape.

Structures which are uniform and aesthetically consistent as a whole are also visually pleasing, but the organisation of bridges is essentially different from that of their surroundings, since their landscape always consists of a central piece and the various elements on each side. As such, a certain degree of internal order can exist in this combination of elements with essentially discordant shapes, but contrasts will be the most predominant quality.

Undoubtedly, the most striking aspect of the landscape impact of a bridge lies in its situation in relation to its surroundings, as well as its orientation or direction. The absolute (vertical, horizontal) and relative orientation (in relation to the span beneath, gradients, and hillsides) are parameters which are either defined by the structural elements of the bridges themselves (abutments, piers, deck, cables, etc.) in the case of absolute orientation, or by the rest of the objects and shapes of the surrounding scenery, in a relative sense. Thus, bridges are set in a specific context which has its own organisation and horizontal or vertical nature.

The way in which the structure responds in directional terms to the span it is crossing plays a significant part in the perception of the viewer and the more spectacular structures offer striking combinations of these vertical and horizontal properties, which makes them visually highly attractive. However, large arched or suspension bridges with vertical elements are not the only structures which can captivate us with their visually striking combination of orientations; the subtle combinations of directionality used in other more simple and apparently more modest bridges can also have a significant impact on the overall perception of the viewer. Although not as visually striking, these subtle combinations are still effective



in shaping the viewer's overall perception and this aspect is important both in terms of the design of the bridge and the intended effect.

Arch bridges, for example, are very positive in terms of their aesthetic quality (and their structural concept which is based on the principle of transferring the load towards each end of the span), because they take the form of a curve which gradually rises and then falls as it reaches the opposite side. This curve does not exist in an abstract space but creates a particular scene which corresponds more or less with its orientation. The aesthetics of directions can either be extremely complex and intricate or simple and unitary. Medieval bridges for example, which were unable to sustain a sufficiently long arch to cross over the whole course of larger rivers, incorporated several arches which negotiate the crossing gradually, in sections, which makes for an interesting combination of vertical and horizontal proportions in terms of height and width, over the course and banks of the river.

This viaduct completely changes the orientation of the scene (previously dominated by the river) by imposing the transverse direction.

This combination of directions is important in terms of the abstract appreciation of the structure, and it also plays a part in relation to the landscape crossed by the bridge and all its various elements. In this respect, it must be remembered that the appreciation of the landscape as a whole is the result of the synthesised perception of each of its individual parts. The direction of the structure can be aligned with the orientation of the landscape where it is located, force a contrast or combine with it in a more neutral fashion.

Another important aspect of the overall perception is the lightness of the structure of the bridge both in itself and in terms of its relationship with the landscape where it is located. These structures are designed to rise above the ground and be suspended in air so that to a certain extent they always have an aerial quality. The volatility of a bridge is defined by the combination of its dimensions, orientation and supports with the level of presence of its structural elements and the degree of opacity of the whole construction.

In some bridges the structural problem is solved with the large, heavy elements which are typically found in the continuous girder bridges of dual carriageways, whereas others feature lighter and more transparent structures, which are common in metal truss bridges.

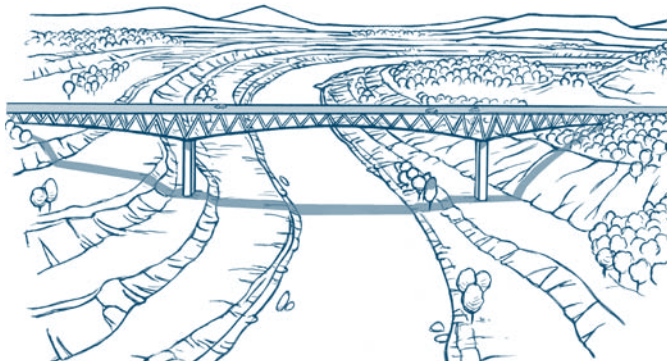
There are others which combine broad vertical elements with a very solid presence, such as towers, with almost invisible cables. In these cases the structure either imposes its thick solid shapes on the surrounding scenery, or blends into it with a less evident physical presence, although not necessarily with less effect on the overall composition.

As is the case with other elements of the landscape, the proportions are a key aspect in terms of influencing the appreciation of a bridge and its surroundings. The observer takes in a view automatically and almost unconsciously on the basis of the dimensions of each of its individual parts and elements. This process of appreciation is thus based on a complex combination of the

relative proportions of certain objects in relation to others, which ends up creating the sensation of a uniform, harmonious, or contrasting whole, as with all the qualities we have examined earlier.

The appreciation of a structure is therefore mainly based on the relative proportions, for example, of its length, height, and width, and those of its individual parts. However, one aspect that should be born in mind is that in this perceptual process we tend to overestimate the height, and, as a result, the slenderness of a structure (the relationship between height and width). This relationship reflects the connection between verticality and horizontality to a certain extent, but does not affect our perception of the orientation and directionality of the structure as a whole, since these aspects are more to do with the spatial arrangement of the parts which make up the bridge (arches, piers, deck) than with their relative dimensions.

The concept of proportion is what defines an object in terms of its integration into the landscape in which it is situated. The objects which are present in a scene, regardless of whether they are differentiated physically (buildings, roads, small areas of woodland) or perceptually (river banks, hillsides, topsoil) are distributed by size. The bridge, as an object in itself, can either fit into the existing range of sizes (building scale, vehicle scale, size of mountain) or contrast with them. The perception of the monumental character of viaducts in large-scale linear transport infrastructure is based on this concept of relative proportions.



The aesthetics of the bridge have an effect on the the landscape as a whole by introducing a clearly geometric transversal layout, with a strong horizontal and vertical effect and explicit functional meanings. Unusual bridges are an important landscape resource.

Much of the fascination they produce is based on their proportions when compared to the elements of the surrounding landscape (relative scale), but also with the size of the observers who perceive them (a scale understood by humans as absolute).

In bridges on more minor roads, which are always more modest in terms of size than the large viaducts found on dual carriageways because they cater for smaller geometric parameters and traffic volumes, there may still be an element of lack of proportion, although never to such a high degree. Height, be it absolute or relative, is a dimension which is always overestimated and is heavily influenced by the possibilities of the project.

Large structures which are suspended in mid air impose their presence on the landscape not only because of their size, but also because of the overall aesthetic sense produced by the elements which form them. This is the basis of the aesthetic power of these structures, which, without necessarily being monumental in character, draw the attention of the observer thanks to the organisation of their elements, i.e. their very composition. This is the case in both more spectacular structures and more discreet ones. Of special note in this respect is the appearance of a number of bridges built during the nineties, whose combining elements, generally a series of interconnected ribbed structures, have an essentially spectacular character, without necessarily being monumental, (although sometimes they combine both aspects) and an extremely photogenic compositional form.

In general, the aesthetics of a road bridge have the effect of restructuring the overall composition of the landscape, sometimes overshadowing the surrounding environment, sometimes complementing it, and sometimes blending in harmoniously. The factors involved in its appreciation are influenced by a heterogeneous combination of elements including the appearance of the bridge in terms of the place where it is situated, the orientation of the

structure and the landscape in general, the presence or lightness of the structure in relation to the context, its monumentality, i.e., the relationship between the proportions of the bridge and those of its immediate environment, particularly its vertical height, and finally, the degree to which it constitutes a more or less spectacular sight in the surroundings.

The meaning, character and identity of road bridges. The aesthetic characteristics of a bridge and its relationship with those of the surrounding environment are abstract qualities which intervene in the appreciation process but are not perceived as such, because they are interpreted by the observer in terms of meanings. Large-scale suspension or cable stayed bridges impress observers even if they are not fully aware of the different aesthetic effects that they create in terms of their monumentality, verticality, opacity or general presence. There is also the question of the large proportions and the composition of orientations, but, rather than understanding abstract aesthetic categories, observers tend to process meanings which, although conceptually more elaborate and figurative, are assimilated in a more automatic and general way.

The association of meanings and how they are used to construct the identity of a place and its relationship with the character of the landscape is essential for understanding, facilitating or encouraging landscape appreciation. The character of an area of landscape is defined by all the physical features and aspects of its processes and structures which make it unique and recognisable: the morphology of the landform, the physiognomy of the biocenosis, the forms of human habitats, and the cultural exploitation of the environment are all essential elements of the character of the landscape. The introduction of superficial elements, i.e., elements which are unrecognisable, devoid of meaning, standardised or simply striking in appearance, adulterates the character of the landscape and confuses observers.



Junction of the A-7204 with the A-356 (Málaga). Standardised and purely functional bridges add to a road's lack of identity.

The symbolic character of large bridge structures, like the architectural works undertaken in important cultural and art centres, has been excessively magnified over the past few decades. This is what is known as the «iconic or spectacular effect», which in bridges has its parallel in the «celebrity designer effect». In fact, this is an added social function of distinctive large-scale viaducts which has led to them becoming hugely popular, at least among public decision-makers, to such an extent that their presence threatens more balanced and well thought out approaches to the meanings and character of the landscapes in which they are located.

The design of a road must assume its incorporation into the landscape references which define the character of a place and, in this respect, the design of its bridges must take into account the context of the places in which they are located, enhancing existing features without overshadowing, camouflaging or diluting them by imposing their own aesthetic effect.

New bridges which develop a distinctive aesthetic character of their own do not always blend harmoniously with the distinctive features of their surroundings. Restrained by the limitations of traditional engineering methods, old bridges completely assimilated the references of their surroundings (landform, vegetation, cultural elements) interacting directly with them, and being forced to interpret them. New structures which are the product of complex calculation systems and benefit from the availability of new generation materials which unleash them from the limitations of the context, have total freedom to detach themselves from their physical context and ignore the place where they are situated to interpret crossings on a purely mathematical basis.

On the other hand, more modest solutions do not offer a guarantee of success in terms of their harmonious integration into the landscape, or their significance and character.

How then, can aesthetic effects be attained which assume meanings which are appropriate for the landscape in which a bridge is constructed? Design criteria can rarely be generalised and require careful analysis and development. As is the case with other elements of the landscape, bridges can play an active role in the general interpretation of a specific area and its character, either by interacting with it, ignoring it, or confusing it with different references.

The main issue here is to bear in mind that the structural elements of the past do not always have to be preserved. The sense of the character of the landscape is dynamic and any new interventions must assume that as they become part of it they will enhance and update its character, thereby avoiding excessively historicist or picturesque approaches which can often be dishonest and false. The design, particularly of unusual bridges, must therefore assume part of the formal identity of an area without losing sight of functionality, creativity, or a sense



In small-scale structures successful integration can be achieved with discreet but effective elements, as can be seen here, in this simple arch with its traditional finish.

of context. Discretion is to be recommended therefore, although the abstract treatment of partial aspects such as materials and shapes, can certainly be an interesting option.

Bridges as roadside paths and view points. Due to their high situation above the space they span, bridges have a special scenic quality. Firstly, they have the capacity to generate a visual itinerary, both for traffic or pedestrians, within their own space (although this is not always straightforward), and secondly, as structures which overlook the adjacent landscape, bridges can be used as view points for the enjoyment of the surrounding landscape, generally offering considerable potential.

The possibilities offered by a pedestrian route which runs along a bridge are defined by the design of the cross section. In most cases bridges on the open road do not include a footpath for

pedestrians, something which is much more common in urban situations, so to take advantage of the potential, the cross section of the deck must be able to accommodate footpaths.

On bridges with significant volumes of traffic, it is advisable to physically separate the pedestrian area from the traffic. Footpaths must have continuity along a considerable section of the road and be provided with lighting if the habitability and landscape potential of the bridge is to be properly fulfilled. The design of these elements and resources should take into account the context of the location where they are placed, adopting strategies which enhance interaction with the key features of the surrounding landscape.

However, the views of the landscape from a bridge can be considerably hindered by safety elements and borders since the safety requirements on elevated structures tend to include pedestrian and vehicle protection systems which restrict vantage points. In many cases elements adjacent to a bridge can be adapted as lateral features or view points, provided that their possibilities in terms of the functional requirements of the pathway, the enjoyment of the views, and their coexistence with the traffic which uses the bridge are taken into account. Areas close to the abutments of bridges can fulfil this interesting role if they are suitably adapted to accommodate a safe area for parking and a view point. These places offer the double advantage of affording good views of the landscape as well as the perspective of the structure of the bridge.

The bridge and the environmental processes of the span beneath. The relationship between bridges and viaducts and the environmental processes which take place in their immediate surroundings must be taken into account in their design. Although generally considered as less invasive when compared to other types of layout developments

(embankments, roads on hillsides, etc.), the construction process of viaducts and bridges still has a major impact on the fragile environment of the immediate span. Rivers and estuaries are areas which sustain important ecological processes, acting as habitats which are valuable both in themselves, and in terms of their productive interaction with other habitats.

Because the structure is built over an open space, it is important that the relationship between its supports (piers, abutments, foundations) and the ecological resources of a river and its banks are taken into full consideration. In this respect, the situation of the support elements and the construction processes employed in building the bridge must avoid causing irreversible damage to these elements of the river, and an effective environmental restoration programme should be put in place to compensate for any damage caused.

Firstly, the hydrological processes which take place (river flow, flooding of fluvial plains, alluvial movement, inter-tidal mechanisms, etc.) are important because they influence the biological and ecological processes which take place in the watercourses spanned by the bridge. This aspect is particularly important for bridges situated above firths and estuaries, but is also significant for river banks and floodplains. The siting of the abutments can reduce the width and ease of movement of water underneath the bridge, affecting flooding patterns and restraining water upstream from the bridge. In coastal areas this can have implications for tidal movements and the meeting point between rivers and the sea. The permeability of structures is a key factor since it defines the development along river margins and firths, affecting the productive periods of these changeable ecosystems and restructuring their functionality by drying some areas and flooding others.

Bridge supports and abutments tend to be sited on the river margins, an important linear ecosystem which sustains the lateral transfer of biomass and energy of the river towards the

banks and the continuity of its downstream biological corridor. The construction of ancillary engineering structures can affect these fragile environments, destroying their diverse vegetation. When these structures are removed, the resulting damage can be repaired by the application of re-vegetation measures which benefit from the innate recuperative capacity of river banks.

The damage is far greater in cases where the abutments, piers or their foundations which are situated in these riverside areas make restoration of the original environment impossible. Unfortunately, both types of solutions are widely used in the construction of road bridges with disastrous consequences, especially in areas where the quality of riverside ecosystems depends mostly on their efficiency as connective elements. Interventions beyond the bridge area which use prefabricated structures or rockfill to channel or divert the river as part of an integrated bridge project or riverbank restoration programme are also commonplace.



The placing of bridge abutments and pillars can cause very serious damage to the ecology of the riverside, by destroying its banks or affecting the flow conditions. Restoration measures have to be taken once a project of this kind is completed.

5.2.2 Tunnel portals

Tunnel portals have a special landscape quality since they play a key role in the relationship between the linearity of a road and the landform into which it is brusquely inserted. As is the case with other civil engineering elements, functionality and aesthetics are combined in different ways depending on the structural solutions adopted.

Tunnel portals must provide a smooth transition from the outside to the inside of a rocky formation, creating a particular environment with a cutting which gets progressively deeper until it reaches the face of the rock wall into which the tunnel is inserted. Portal areas are usually heavily influenced by the dynamics imposed by the natural stability of the surrounding hillside and the way this is resolved in the excavation of the side walls of the cutting and the front of the tunnel. Portals are the most fragile area of an underground tunnel, because the materials above them tend to become unstable as a result of the excavation process, frequently leading to collapses, which are sometimes envisaged in the construction plan itself.

The surroundings of tunnel portals. It is rare for a road building programme to confront a completely vertical wall, therefore, before entering the actual tunnel, the road follows a trench-like transitional space or double excavation wall of increasing height (or depth). In terms of the landscape, this cutting operates as an artificial hollow dug into the hillside which receives the layout of the road and channels it into the tunnel. This progressive cutting, together with the excavation of the frontal part of the tunnel and the collapsed area above the entrance, make up the scenic space of the tunnel portal and the internal landscape of the road which precedes the actual tunnel. When seen from a distance, these elements are what define the tunnel portal in the landscape.

The various solutions used for the design of tunnel cuttings and portals create different road environments and produce different effects on the landscape. A cutting which is abrupt and short, gaining depth very quickly, is almost imperceptible. This is the case where a road confronts a more or less vertical rocky wall, normally preceded by a viaduct supported by a small abutment. In cases where the terrain surrounding a tunnel is less steep, the road gradually follows a long shallow cutting until finally entering the tunnel. This is the typical situation when roads approach a mountainous area from its foothills, giving the appearance that they are gradually sinking into the terrain, whereas in fact, it is the terrain which rises gradually and envelopes the layout of the road.

More commonly, the road approaches the tunnel via a medium length, progressive cutting, creating a preliminary space, a kind of shelter or lateral cave, whose design must be approached with the appropriate sensitivity due to its special scenic quality. The excavated walls on the edges of the road, which often have lateral safety ditches, enclose the space and lead to the face of the hillside in which the tunnel portal is situated.

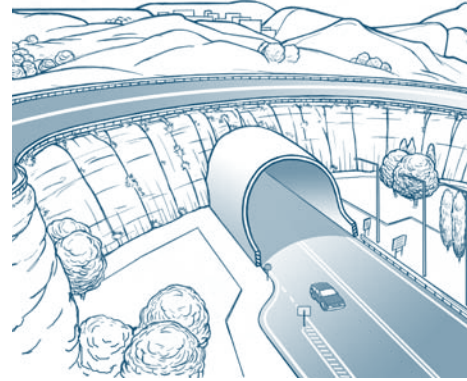
The overall area formed by the gradually deepening cutting through which the road passes before entering the tunnel can have a uniform design which blends the portal and the frontal wall where it is inserted with the side walls and the spaces between them (central reserves, traffic islands, etc.) by using landscaping treatments of different degrees of elaboration. The lateral walls of the cutting and the frontal wall of the tunnel can be landscaped, using regular steps with plants which structure the space of the portal area, or simply left as steep walls, the re-vegetation of which tends to require fixing elements or organic covers. These treatments can either take a functional and sterile approach or be based on naturalisation elements with more irregular patterns.

The design of the space which precedes the tunnel, its disposition with respect to the surrounding scenery as a whole (valley, mountain, etc.), and the finishing treatments, define the presence of the tunnel portal in the landscape. It can either be quite imposing or go almost unnoticed, depending on the orientation in terms of the external views (view points, visual itineraries, etc.) of the excavated areas and their process of naturalisation.

Opportunities for landscape viewing in the surroundings of a tunnel portal.

Many modern tunnels replace original layouts on the surface, which were generally built into the side of a hill and offered worse driving conditions. The surroundings of the portals of these tunnels often have a landscape potential which can be successfully developed if efficiently structured and adapted to their function. New tunnels may have retained their connection with the old layout, which may have been preserved to guarantee access, or converted into a scenic pedestrian route. Some old roads are simply abandoned and suffer deterioration, thus requiring intervention for their restoration and improvement. To fully realise this scenic potential it is necessary to provide places to stop (with space for parking), safe access points (which do not entail the risk of people crossing or walking on the roadway), view points, and/or well designed pedestrian paths with safety hand rails, information panels, and landscaping (see next section for more details on roadside areas), whilst also applying measures to prevent the collapse of excavated walls and outer hillsides.

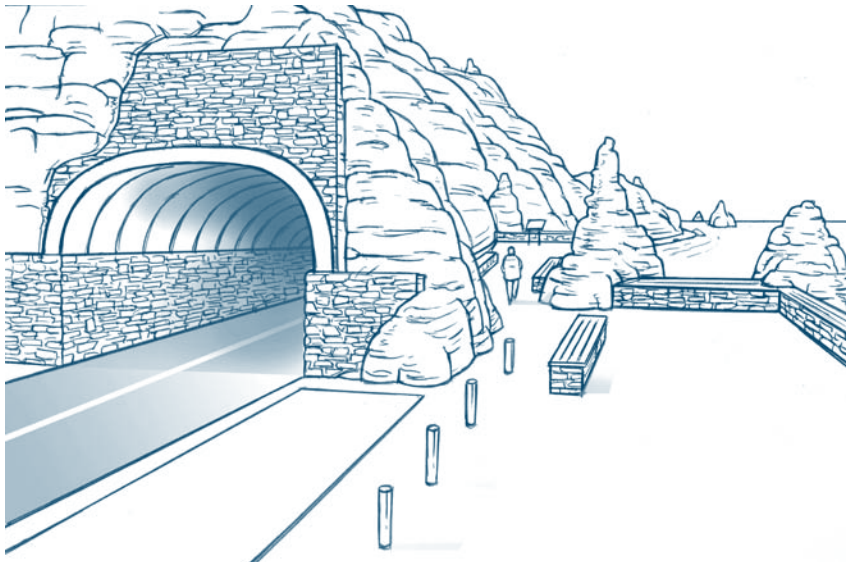
The special safety conditions required at tunnel portals in terms of traffic movement must be carefully considered, particularly those associated with vehicles or people crossing the road or moving around close by (see below).



The surroundings of the tunnel portal need to interact with the elements of the road: the vault of the tunnel, the collapses of the surrounding hillside, and the cuttings preceding the entrance.

Design of tunnel portals. The way in which a tunnel portal is finished implies different levels of presence on the landscape of the road. In small tunnels measuring perhaps only 6 metres, which are generally older and excavated manually or mechanically, the walls of their portals often feature the exposed rock. As the collapsed area at the head of the portal tends to be smaller in these kinds of tunnels, they can feature circular or square sections of exposed rock (which are generally finished with rounded edges), imparting a certain character, which, despite the geometrical nature of the excavation, can give the morphology of the excavated walls a more natural appearance, reflecting the characteristics of the stone itself. This is an interesting and scenically satisfying solution which makes the construction process of the structure more legible.

However, this exposed rock solution for portals is not as effective in larger tunnels where the collapsed frontal area tends to be larger, disfiguring the finishing of the structure. This situation requires protective structures to prevent material falling from the



Tunnels sometimes form alternative sections leaving the original road unused. In these cases the original sections can be used as rest areas or vantage points if appropriate safety measures are taken (access and exit points, parking areas, and visibility from the tunnel).



The design of the tunnel portal needs to consider the collapse in the hillside above the final stretch of the tunnel which surrounds the opening. Various strategies are used to camouflage it with ornamental façades or other solutions.

upper wall. For this reason, many tunnel portals adopt screening solutions, i.e., vertical structures situated above the vaulted roof at the very end of the tunnel. Generally, in this situation, vertical elements of an ornamental character with some degree of elaboration are used. Some classic 19th century tunnels incorporate architectural structures which screen the mouth of the tunnel whereas more modern ones often feature elements associated with their ventilation systems.

These vertical screening systems conceal the irregular shapes produced in the rock wall by the collapsed area over the portal (depending on the nature of the rock some collapses can reach a considerable height on the hillside), thereby achieving a more consistent and functional appearance.

Another more modern solution, which is widely used in more recent constructions, is to prolong the concrete vaulted ceiling of the tunnel beyond the external rock face. These ceilings usually feature barrel vaults, although there are some with more open and parabolic arches. Sometimes there is a direct prolongation of the vaulted structure, whilst on other occasions the prolongation of the tunnel is contained within a prismatic structure which advances from the foot of the hillside.

In these cases, the mouth of the tunnel takes on the appearance of a large circular concrete cover which advances a few meters beyond the rock face giving the structure a certain sense of movement. Another variation involves tunnel portals where the barrel vaulted ceiling is finished off with a feather shaped end piece which gives it a more dynamic appearance.

The resolution of these structures in terms of finishing and measures to prevent rock falls offers a wide variety of possibilities even including, as has been said before, architectural structures. As is the case with other road engineering elements, some tunnel portals are covered with stone walls which adapt well to the local character, many of them incorporating landscaping and naturalisation treatments of various kinds or simple gunite. Others involve more creative or artificial structures, but most tend to adopt simple solutions, with pure geometrical shapes, which are more discreet and elegant.

In addition to the portal itself, the area formed by the increasingly deep cutting through which the road passes can be given a coherent design by means of various kinds of landscaping treatments. The lateral walls of the cutting and the frontal wall of the tunnel can be landscaped, using regular steps with planted areas which structure the space of the portal area, or simply left as steep walls, the revegetation of which tends to require fixing elements or organic covers. These treatments can either take a functional and sterile approach or be based on naturalisation elements with more irregular patterns.

Cut and cover. Some tunnel portals complete the tunnel excavated into the rock with a final cut and cover section, i.e., covering part of the excavated trench and the collapsed area with the original material so as to achieve a longer underground layout (for environmental or landscape reasons) and a more natural finish on the transitional portal.



Cut and cover structures, which are in fact trenches backfilled with material over a supporting cover structure, are common solutions for roads and dual carriageways in the following contexts: when the intended depth of the excavated layout is insufficient to guarantee the stability of the tunnel, or when they are employed as modifications to planned cuttings for their environmental (a covering structure to reduce noise or avoid the fragmentation of habitats) or geotechnical benefits (instability of slopes).

Cut and cover finished off in riprap.

Generally these tunnels are expensive due to the additional cost associated with the resistant cover over the road, the complete excavation from the surface, the temporary management of the spoil site and the tasks associated with its subsequent covering and finishing. They are solutions for shallow situations, since deeper constructions would require a much greater effort in the double task of excavating and refilling the trench after the interior structure of the tunnel has been completed.

Safety in tunnel portals. A priority aspect in the design of the areas around the portals of tunnels and their immediate surroundings are the stringent safety requirements for the sections of roads which precede the tunnel. The transition between the inside and the outside of the tunnel requires special attention from motorists, who must adapt to the changes in light, legibility and the dynamics of the layout, and for this reason, a transitional section is recommended which must be specifically designed for easy and automatic driving.

Measures to eliminate or mitigate the potential glare suffered by motorists when they exit a tunnel need to be considered, particularly when the alignment of the road coincides with the orientation of the sun's rays at specific times of the day. In general, alignments with an east-west orientation should be avoided.

Sudden bends or gradients and lack of visibility or layout legibility must be avoided, along with junctions or crossings, since all of these create a higher degree of risk. It is important, therefore, that the sections which are next to tunnels are free from difficulties or potential obstacles which may affect safe driving.

In this respect, special attention must be paid to safety considerations when designing the geometry of the cross section and the horizontal or vertical alignment of the tunnel and its access sections, since these parameters have a considerable influence on the probability and severity of accidents.

5.2.3 Roundabouts and traffic islands

Due to their special scenic qualities within the road environment, traffic islands and roundabouts are areas with specific characteristics and high landscape potential. Traffic islands provide systems for the incorporation or intersection of roads which also have

landscape properties. Because they are spaces which are separated from road traffic but are reasonably close to it, and due to the fact that they are situated at strategic points of the route (access roads, entries, exits, points of distribution), they have a special effect on the character of the road landscape, which is related to their dual role as ornamental spaces and landmarks.

The circular disposition of lanes around the central space of roundabouts gives them a special visual potential as places which can be easily seen from a vehicle, even if they cannot be accessed by traffic or pedestrians. Thus, they are ideal exhibition points or shop windows within the context of the road although they must never impede the adequate reading and interpretation of the required signs.

The combination of their exhibiting and isolating roles (shop window), together with their strategic situation in the travelled route, is what defines the clear potential of roundabouts as points of reference, or more generally, settings for the exhibition of symbolic and commemorative features. Indeed, the central spaces of roundabouts provide an ideal setting for displaying symbols which represent a culture, a community, a social group, a specific group of workers, or the remnants of an idealised past, as well as monumental objects which commemorate historic events, or pay tribute to people, great inventions, or achievements. Furthermore, as part of their role as landmarks along a given route, roundabouts often take on the role of information points which present the features of a particular place.

The central spaces of roundabouts share the capacity of museums to enhance the value of an abstract space. Thus, when placed in a roundabout, a conventional element takes on a special significance because of the way it is displayed, thereby receiving more conscious

attention by the observer, who is then able to construct a more abstract and symbolic interpretation, rather than one which is superficial and without meaning.

Thus, in addition to their intrinsic characteristics, roundabouts play a significant role as landmarks which makes them part of the meaning which a particular place presents to the traveller.

The junctions of a route, and by extension, of the road network as a whole, have always had a clear identity and character, i.e., they operate as landmarks, and are remembered, together with stopping places, difficult sections, and other features of a route. Their situation in the network tends to coincide with places which mark the transition between long distance journeys and local trips. In the development of a journey, roundabouts act as a doorway, i.e. in a user's personal landscape, they mark the moment of arrival, welcoming travellers and providing information about the place where they have just arrived. In this respect, they are the heirs to the commemorative arches found on Roman roads, or the gates of ancient and medieval walled cities, as well as their successors, the great arches from the Age of Enlightenment, many of which are actually located on roundabouts today.

It is therefore not surprising that the special scenic conditions offered by roundabouts provide such a striking range of artistic and semantic features since the special power of these abstract and welcoming places seems to encourage designers to exploit their scenic potential with considerable determination and imagination.

Traffic related safety measures require special attention in terms of visibility in the areas surrounding roundabouts, intersections, or junctions. Ornamental features on traffic islands and smaller roundabouts should not be too broad or excessively high, although taller elements may be found on large roundabouts, where vehicle visibility is guaranteed.



Roundabout on the A-475 as it passes through the village of Tharsis, in the municipality of Alosno, (Huelva). This is an old steam locomotive used in the mining industry, which was the main activity in the region until the end of the 20th century.

By examining the various different types of roundabouts it is possible to establish the main approaches adopted by designers, which can be divided into the following categories:

- Monumental roundabouts.
- Roundabouts which celebrate a place and its population.
- Landscaped or neutral roundabouts.
- Iconic roundabouts.
- Artistic roundabouts.

In fact, most types of roundabouts combine several of these five approaches to a certain extent, although they tend to highlight one aspect more than another. Monumental roundabouts are those which take advantage of the conditions of the central space to display a celebration or tribute element, a monument in the strictest sense of the word, which perhaps pays tribute to a group of people or an individual figure, or commemorates an event.

Central areas of roundabouts feature elements with a strong iconic power, i.e., elements which act as icons or signs whose shape and concept represent or suggest ideas, groups, etc. In fact, all monuments represent much more than their physical appearance and they have a clear symbolic role, which in many cases is what forms the basis of their emblematic significance.

These contextual functions often refer to the qualities of a particular place. Although roundabouts are situated inside the space of the road infrastructure, which tends to be detached or have no particular link with the character of a place, they are rarely unconnected with the socio-cultural and geographical context of the environment where they are situated.

In fact, peri-urban roundabouts seem to have consciously taken on this role of reviving the character and identity of places and transferring them to the road infrastructure, and as such, they celebrate places and the local population in various different ways. The languages used vary in sophistication and scope but in general, the more figurative, legible, and obvious approaches are favoured over the more neutral, abstract, and symbolic ones. Thus, the winegrowing tradition of a place, for example, could be represented by a bottle of wine, whilst the effigy of a bull would evoke its bullfighting culture.

In other cases, the central spaces of roundabouts are used for clearly artistic features, employed as elements to enhance the quality of the road environment. Indeed, for larger works of sculpture and abstract art, these public spaces are the ideal setting for the creative work of artists. Their scenic characteristics, and especially the fact that they can be seen from vehicles, define the way in which viewers appreciate these visually striking installations. Traffic islands, roundabouts and other roadside spaces can thus fulfil the role of outdoor museums of sculpture.



Roundabout on a motorway slip road which combines natural elements (Stones and Rocks) with a neutral garden.

In addition to their representative role, roundabouts have always been places of strategic importance for the embellishment and naturalisation of roads through the development of areas of contemplation such as gardens, which are conceived to be seen rather than visited, since this would be unfeasible (see previous section on landscaping). Yet, the gardens and ornamental features of roundabouts often use combinations of symbols, metaphors, and references which are generally incorporated into the composition.

There are also examples of simpler designs which have successfully avoided the temptation to over-complicate the design, resorting to more elegant and discreet compositions. In these cases ornamentation is discreet, elegant and restrained, the design limiting itself to acting as a subtle complement to the scenic conditions of the road.

The composition and style of gardens on roundabouts responds to unified concepts. The fact that these small circular central gardens are conceived to be seen, and to be driven around rather than through, means that they can cater for very different types of designs, whose power of attraction is sometimes in their simplicity. Once again discretion and sensitivity seem to be the most suitable approaches for the interior of these islands in the traffic.



5.2.4 Intersections

The intersections of roads and dual carriageways are constructions with a spectacular character thanks to the fact that they combine large structures and earthworks in a relatively small space. Overpasses, curved ramps on embankments or cuttings at different heights, slip roads, roundabouts and the abutments of engineering structures make up a space which has its own distinctive and essentially functional aesthetic qualities which is at the same time scenically spectacular.

Roundabout on the A-366 in Alozaina (Málaga).

The resulting structure has a highly artificial and functional character which organises the flow of traffic through junctions or crossings at different levels, and even the simplest intersection includes geometrical and functional elements which are visually striking. The intersection of a road with a dual carriageway is a very simple structure formed by an overpass and lateral embankments. Jughandle junctions incorporate an additional semi- direct slip road that loops around leading from the overpass to the incorporation into the mainline. While some dual carriageways include elaborate mixed junctions which are in reality the combination of two or more isolated junctions, others use various levels at different heights, generating intricate combinations of bridges and elevated slip roads.

In these contexts, the treatment of abutments and traffic islands, which are clearly visible to motorists, are of strategic importance in terms of imprinting a certain character on a junction. The design and finish of the structures is also relevant whereas the scenic role of the intersecting routes is always governed by the necessary function of traffic flow and



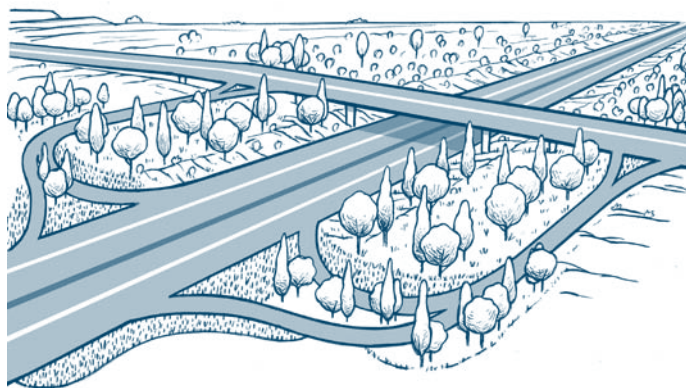
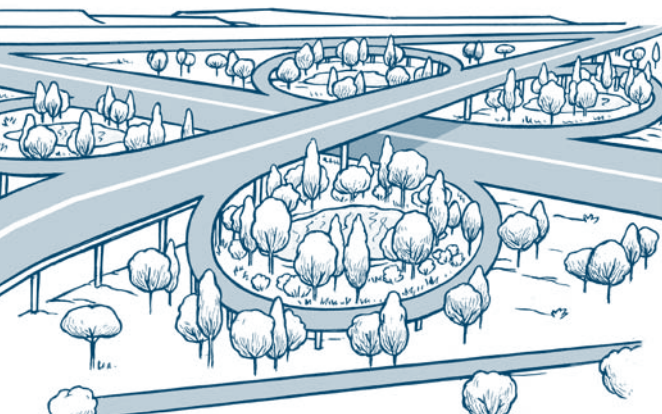
The use of tall trees at junctions and intersections works as an effective form of signposting, by improving legibility, especially on roads which are straight, flat, or otherwise confusing.

continuity, which restricts a relaxed view of the vistas from the inside of this complicated tangle of intertwined routes.

From the outside of the road or dual carriageway, with traffic flow being organised by the intersection, the visual presence of the infrastructure is defined by the situation of the mainline and slip roads and the size of the earthworks. Some junctions are excavated into the terrain, with the mainline and the slip roads buried in cuttings, and overhead structures supported on the crowns of these cuttings. This type of junction has a closed internal scene, which is limited by the walls of the cutting and the finishing materials, thereby concealing to some extent their external presence in the landscape. On the other hand, junctions which are constructed in flat spaces, feature several slip roads built on embankments of increasing height and arranged around the mainline, which rests on the ground. These are visible from a distance and often have an organised and functional appearance. There are also junctions which are built into the side of a hill which use the morphology and different levels of the terrain to their advantage to form irregular structures.

The treatment of free spaces, such as traffic islands, areas around abutments, excavation walls, and embankments, can contribute a more natural appearance to these structures, but they nevertheless retain an essentially functional character, both internally and with respect to the surrounding landscape.

Some junctions incorporate iconic, monumental, or ornamental elements, and occasionally even complex scenic compositions featuring lagoons, trees and gardens, small areas of woodland, rock features, relocated structures, or winding streams. These take full advantage of the basic characteristics of the traffic island, including its morphology, its natural or channelled drainage system, the presence of pre-existing woodland, or, simply the



potential environmental advantages of their situation and orientation (south facing, north facing, leeward side, etc.). In this respect, these areas can fulfil the role described earlier for roundabouts, although the context is far more artificial.

5.2.5 Spoil sites and disused ancillary installations

Due to their close proximity to the road, spoil sites and disused ancillary installations from road construction or upgrade schemes offer special landscape enhancing opportunities which should be considered in the construction project with a view to assigning them a positive landscape role.

As such, the project management must take these elements into consideration during both the planning and carrying out of the works since their situation, both in relation to the road and the surrounding landscape, is of strategic importance for the fulfilment of their potential.

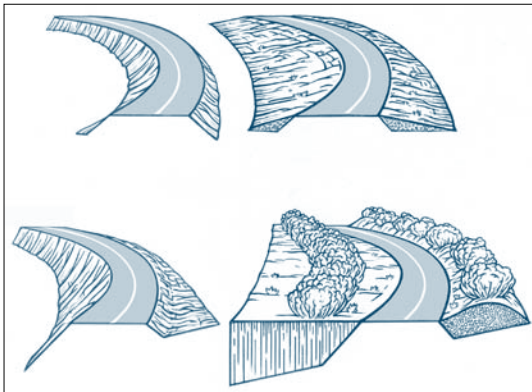
As we discuss in the following section, roadside areas fulfil an important landscape function, and spoil sites or areas which contain ancillary installations can be suitably treated and adapted to incorporate parking areas, view points, and rest or service areas.

Left. Integral treatment of intersections. Plants may be set in roundabouts or gaps in intersections creating a landscape that gives them a certain natural aspect.

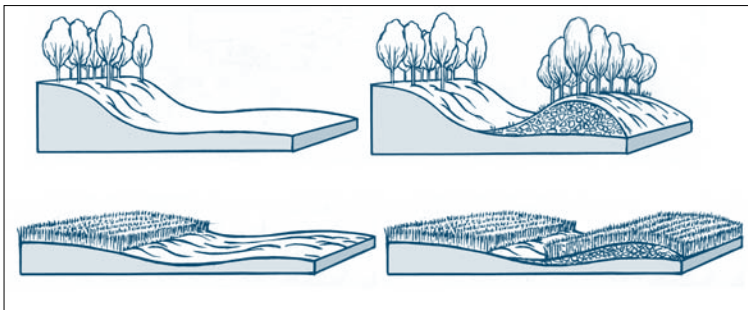
Right. Landscaping treatment of junctions and slip roads. Plants should be set out in such a way so as not to obstruct drivers' visibility when approaching the junction and lead drivers through the slip road, leaving taller plants for the inner parts of the islands



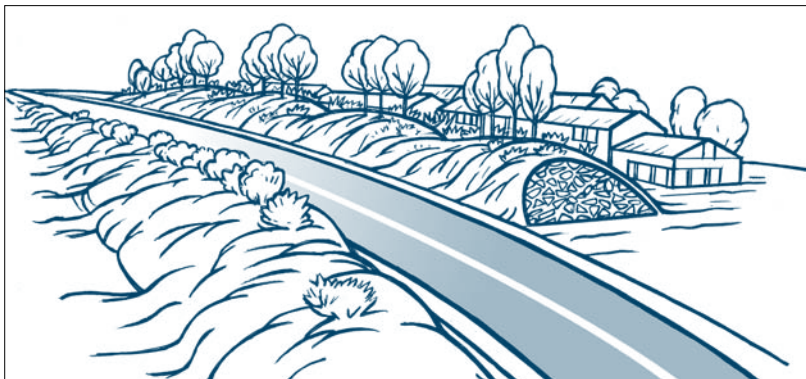
Top, disused construction site next to the MA-5401. An ideal opportunity for landscape treatment.
Bottom, MA-5402, eroded spoil site with spontaneous vegetation.



The use of excess material as a landscape element in the road. The excavation material could be used to flat the slope of the embankment and favour natural treatments.



The use of excess material for landscape development of nearby areas. The excavation material may be used for developing and improving landscapes by adding volume.



The use of excess material for isolating the road. The excavation material can be used to construct small dikes for the visual and acoustic isolation of the road.

Example of a parkway and link road between urban areas: Avenida de Valencia in El Puerto de Santa María (Cádiz).



Location of the Avenida de Valencia in El Puerto de Santa María (Cádiz).

The design of the Avenida de Valencia, in the La Florida area of El Puerto de Santa María, was based on the concept of using a parkway (a linear park with the road in the centre) to structure sectors which are expanding along with the town. The project incorporates various additional functions apart from that of serving general through traffic. Firstly, the design of its elements is especially aimed at providing lateral structuring to both margins, giving a specific treatment to the relationship with each of the areas through which the road passes. The road also operates as a public space.

Example



Example

The Avenida de Valencia borders the urban development to the left.

Conceived as a road which marks the boundaries of a large-scale development project, the avenue adopts various designs and functionalities to create a well structured urban landscape which is sensitive to the specific conditions of each particular context.

This avenue is part of a development plan implemented in the La Florida sector, an area of land covering 67 hectares allocated for the construction of 3,500 houses. This is a development project aimed at expanding the town towards the external ring road of the general metropolitan system of the Bay of Cádiz and Jerez. The new road is 950 metres in length and stretches from the external ring road to the centre of the town, passing through the new development sector and a series of peripheral housing estates with serious deficiencies in terms of planning, access, public facilities, and services.



The Avenida de Valencia. At the top is the site for the residential development of La Florida



Design elements for the Avenida de Valencia.

The project, which was implemented prior to the redevelopment of the rest of the area, was designed to fulfil functional road targets on three different levels: it is one of the radial access routes from the metropolitan area and operates as a bypass from the outskirts to the town centre; it acts as a space which structures the urban sectors through which it passes; and it is one of the main roads and public spaces of the new sector.

To fulfil these three objectives, the design of the road includes an integrated system for channelling general traffic, as well as landscaped public areas with trees, and planning guidelines for the buildings which are to be constructed on its margins. The horizontal alignment is composed of two straight sections and another one with a broad curve, with a constant gradient on each of the three sections. The cross section consists of a four lane carriageway with a central reserve and lateral parking strips, as well as footpaths and a bicycle lane. It varies in width but averages approximately 40 metres.

Example

Example



View of the Avenida
de Valencia and its margins.

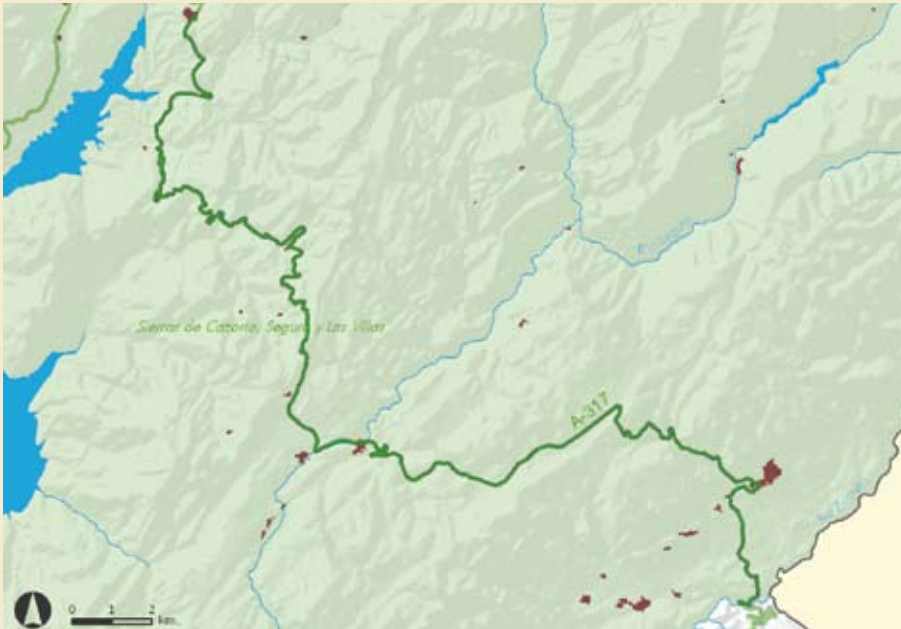
In accordance with the planning criteria established in the partial development plan, the avenue is designed as an open space which is not confined by the buildings situated on its edges, whose alignments are perpendicular to its layout.

A series of free spaces delimits each block of the sector adjoining the avenue with the trees planted on its eastern margin.

The central section of the avenue is planned as the main space for the interaction between the two sectors, because it forms the main access road to the existing housing estates. This central section is paved with cobblestones, whilst the rest of the road is surfaced with tarmac. The road bordering the existing estates is incorporated into the project as an approach and service road, and the free space between this street and the main roadway is left as an open area which is landscaped with trees and has space for the installation of terraces with parasols, temporary markets, etc...

The southern end of the road is linked to the city's general road network via a roundabout, and the margins have been structured and landscaped with trees to delimit the boundaries of the adjacent urban areas. In this respect, the project features a garden on the eastern side which reflects in miniature the general design criteria for the public spaces of the new sector as a whole. These criteria can be grouped into three main types: gently raised areas landscaped with areas of Mediterranean woodland and bushes on the uppermost parts, tree lined promenades using deciduous species in the intermediate parts, and geometrical Mediterranean gardens with palm trees on the lower levels.

Example of a scenic road: the A-317 road between Cortijos Nuevos and La Ballestera (Jaén).



Route of the scenic A -317 between Cortijos Nuevos and La Ballestera (Jaén).

The works carried out on the A-317 road have permitted the transformation of pre-existing forest tracks into a road which, despite low traffic volume (360 ADV) is necessary to improve accessibility to a number of small mountain villages which in the past were extremely isolated, especially during the winter. The project incorporates idiosyncratic features and specific facilities for the contemplation of the landscape, on a route which goes through the heart of the Cazorla Natural Park.

Example



Top. Layout of the A-317 between Cortijos Nuevos and La Balletera.

Bottom left. Green wall on the A-317 to La Balletera.

Bottom right. Rock wall on the A-317 in winter.

In complex topographical conditions, and situated mostly on hillsides, the road has been adapted as much as possible to the pre-existing tracks, and exceptional measures have been adopted to reduce excavations or the construction of embankments, including suspended sections, stone walls at the foot of slopes, rockfills, and green walls.

The layout of the road has allowed the installation of view points, which afford uninterrupted views of the Tranco de Beas reservoir and the surrounding sierras. It features seven view points situated on minimum impact zones on short disused sections of the original forest track. The management of road cuttings on rocky terrain required special techniques, such as oxidation, geo-mesh and stone plant bedding areas at the foot of cuttings.



Example



6

ROADSIDE AREAS



ROADSIDE AREAS

6

On the sides of roads there are a series of facility areas such as rest areas, service stations, parking areas, and bus stops, which fulfil an important landscape function. There are many other elements, such as lines of trees and a multitude of other features, which are located on or near to the sides of roads, coexisting with them. The original role of all these installations is to tend to the traffic by providing a variety of services. These functions do not impede the realisation of their landscape potential, which is based on the effect they produce on the relationship between the traveller and the travelled landscape.

There are also other facilities with a clearly landscape-based role, such as view points, roadside footpaths or bicycle lanes, which are recommended for improving the landscape profile of roads. These are either located on the sides of roads or are closely connected with them, fulfilling this potential.

Although not properly developed in all cases, each of these roadside areas has a significant landscape role in its own way which should be taken into consideration to maximise potential. This section proposes and reviews a set of criteria for the siting and design of the following roadside areas:

- | | | |
|-------------------|---------------------------|----------------------------|
| i. Rest areas. | ii. Service stations. | iii. Parking areas. |
| iv. Bus stops. | v. Lines of trees. | vi. Landmarks of interest. |
| vii. View points. | viii. Roadside footpaths. | ix. Bicycle lanes. |

The chapter is completed with the presentation of two real examples of landscape enhanced roads which make extensive use of roadside areas. The first is the inter-urban A-348 between Laujar de Andarax and Fondón (Almería) which, freed from long distance traffic by the construction of a bypass, has been improved with the introduction of a whole range of roadside elements which enhance the landscape function of the road. The second example is the A-369 from Ronda to Gaucín (Málaga), the design of which included a series of lateral view points as well as a number of design features which gave the road a unique character of its own.

6.1 Roadside areas and landscape

The edges of roads are transitional places between the platform itself and the surrounding landscape. For this reason, they are capable of establishing different forms of interaction with the landscape which, although maintaining a certain distance and a clearly visual character (i.e. they favour a merely visual understanding of the landscape), also offer more



The margins of the A-7075 after crossing the river Campanillas (in the forefront the stone parapet and the guard-rail can be seen), in the municipality of Almogia (Málaga).

direct relationships which encourage a more sensitive and productive appreciation and understanding of the landscape.

These types of installations must respond to a series of aspects which are common to them all and can be grouped under the following generic recommendations:

Access to roadside areas. Relationship with the landscape. Siting and design of roadside areas.

6.1.1 Access to roadside areas

The various functionalities of the different kinds of roads (motorways, dual carriageways, expressways, or conventional roads) and the range of installations and uses of roadside areas means that the requirements of their access points must also be different and specific to their respective operational needs.

In general, the access to roadside areas must be conditioned for both directions and properly signposted. Access points must also offer enough visibility in both directions, and be sufficiently large to provide enough room for manoeuvring. The siting of these access

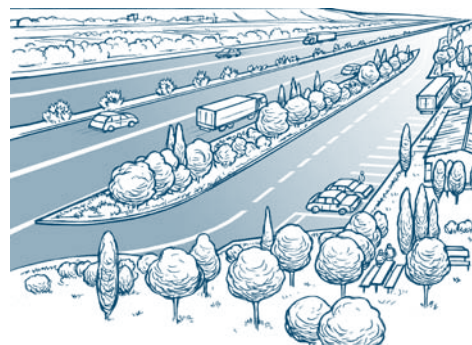
points tends to be regulated in such a way so as to minimise interference with the different movements which take place on the road itself. In some cases, this rule implies limiting direct access from the main carriageway, which necessitates the provision of a service road. This is particularly the case with motorways, dual carriageways, expressways, and bypasses. These roads usually require the channelling of access routes via service roads connected to junctions or speed reduction lanes whose situation complies with the statutory safety distances between the consecutive entries and exits of the main road.

On conventional roads, access to roadside areas can be subject to a series of limitations, mainly due to issues concerning visibility, traffic intensity, and proximity to other access roads or special sections.

In general, all access points to roadside areas must be clearly visible from further than the so-called stopping sight distance on the side of the road where they are situated (distance covered by a vehicle which is forced to stop suddenly due to the presence of a non-moving obstacle on the roadway). This requirement is however less strictly applied in cases where its implementation has economic, environmental, or social cost, or an impact on heritage, which are disproportionate to the safety benefits attained.

In those cases where the access to a roadside area involves turning left (in a right-side driving country), the sight distance must be greater than the distance travelled by a vehicle during the time it takes another vehicle to cross the road.

As a general rule, access to service facilities should not be constructed near to junctions or intersections with other roads on either side, or in areas with special cross sections (tunnels, structures more than 100 metres long, additional lanes, speed change lanes, mergings and bifurcations, emergency stopping lanes, etc.)



Lateral areas should be separated from the road by isolation elements (hillocks with gardens and trees) which conveniently isolate traffic and hide its effects.

As we said earlier, right hand access (in a right-side driving country) from the lane adjacent to the roadside area must always offer maximum visibility along the entire section (both before and after the area).

Access to the left (in a right-side driving country) from a lane on the opposite side of the road, must only be allowed on roads with low volumes of traffic (an average of less than 5,000 vehicles per day) and only providing that it offers good conditions of visibility. In all other cases the exit and turnaround must be located in a suitable section which is within a reasonable distance from the roadside area and must be properly signposted. Manoeuvres which involve turning to the left hand side and crossing the road must be prevented where there is bad visibility by introducing specific road markings (continuous lines), or even placing obstacles on the roadway, such as physical barriers or traffic islands.

Exits to the left (in a right-side driving country) should feature a central lane which permits vehicles making the turn to stop and wait in a queue. This solution is safer than that in which vehicles make an initial right turn before crossing the road, with traffic coming from both directions. The specific risk factors associated with left hand access points are practically eliminated if priority is regulated by traffic lights. However, this solution is not feasible in all types of roads.

Left hand access points where crossing safety cannot be guaranteed (due to traffic conditions, poor visibility, or lack of a turnaround nearby) must be eliminated, allowing access only by vehicles travelling on the same side as the roadside area.

In terms of the design of the access to roadside areas, deceleration lanes are recommended, particularly in the case of conventional roads with fast traffic or high volume (average daily volume of 1,500 vehicles).



«Área de Naturaleza» on the A-7075, near the El Torcal de Antequera natural area, which makes use of an element of road heritage, the old abandoned house of a road worker, as an area for environmental education.

The most suitable way to access a roadside area (parking area, rest area, view point, etc.) from the road itself is via an exit or deceleration lane which is long enough to permit the progressive transition from the specific speed of the road to the lower speed required in the new context.

Some roadside areas are quite small (particularly view points) often limiting the possibilities for lateral access points. In such cases, where the space for slip roads is insufficient, this can be partially solved if the roadside area is sited on a straight section of road, or one with an open curve, which offers the required visibility to permit progressive deceleration.

As is the case with the entry approach road, the most suitable way of leaving a roadside area and returning to the main road is via an entry or acceleration lane with sufficient length to permit progressive incorporation into the road.

Again, as with the access lane, the lack of sufficient space for a re-entry slip road can only be partially solved if the roadside area is sited on a section which offers enough visibility to allow vehicles to accelerate progressively having turned onto the road.

It is also recommended that the entry or exit lanes are constructed in parallel to the road (i.e. with a deceleration/acceleration lane running alongside the main road), although direct access lanes (where the deceleration/acceleration lane runs tangential to the edge of the main road) are sometimes unavoidable.

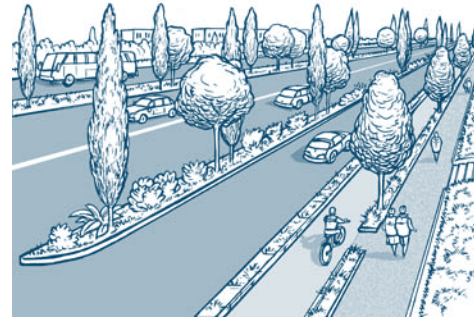
In all other cases it is advisable to construct curved entry/exit areas for secondary roads to facilitate speed change.

Although their importance is often overlooked, temporary car parks are a key element in the organisation of roadside areas due to their implications for safety and the capacity of the installations, apart from the character they can impose on the roadside facilities as a whole.

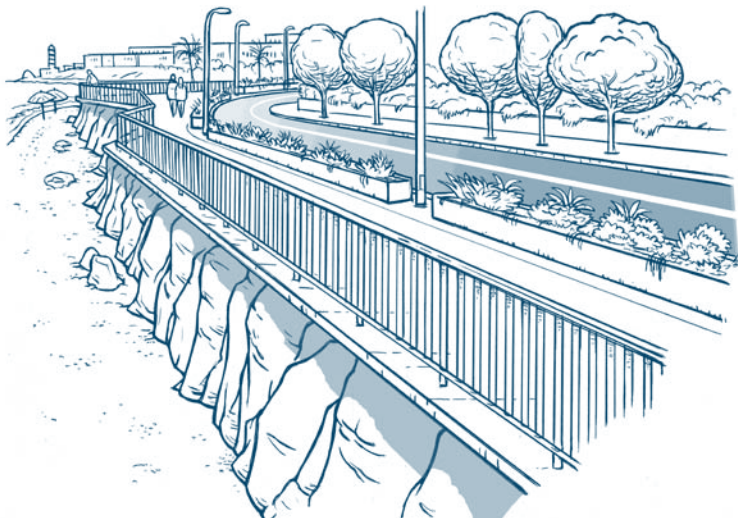
Finally, it is important to emphasise that access points to roadside areas must be signposted sufficiently far in advance in order to allow motorists travelling at the maximum permitted speed to see the sign or panel, interpret its message, take a decision to enter the roadside area, and manoeuvre safely without compromising the safety of other road users.

6.1.2 Relationship with the surrounding landscape

The characteristic speed and visibility of traffic on the road heavily influence our perception of the landscape and, although it is obvious that this is what allows us to reach more destinations and appreciate more views and scenic features, the enjoyment and understanding of a landscape is strongly conditioned by the vehicle itself, and the encapsulating effect of being inside it, as well as its speed, and the level of attention required by driving or by the journey as a whole. Our perception of the landscape is therefore reduced to a rapid, flat, and distant view of the scenery we are travelling through.



The lateral area and its function as a collective space depends on the effective development of the cross section of the road, with heavier and faster traffic remaining in the middle and the sides being used for progressively less invasive forms of transport (bus lane, bicycle lane, pedestrian area) to limit the effects on the margins



The space of the lateral area can be achieved with the imaginative development of the road margins, using raised structures for example to complete the cross section.

The attraction of roadside facilities is that they have a pedestrianised character which offers travellers the possibility of establishing a more direct interaction with the surroundings. Walking around or simply staying still in one place provides a special enjoyment of the surroundings which is direct, relaxed, and rewarding, whilst not requiring major alterations to the landscape, since only minor development works are usually required to construct and design these roadside areas.

Speed of movement in roadside areas - walking pace on roadside footpaths, slow speeds on bicycle lanes, stationary in service stations or simply static or non-existent in view points or rest areas (benches, bus stops) is the main factor which defines the different formulas for the appreciation of the landscape. The speed of movement in these areas also influences the requirements of the facilities, the most relaxing ones needing the least structural alterations.

A small rest area with a few benches and a balustrade only requires minor changes. The quality of the environment of the view point itself is another factor favouring the installation of facilities for relaxed contemplation. In this respect, these are mixed solutions which combine the area of the road with the surrounding landscape, allowing observers to interact with it.

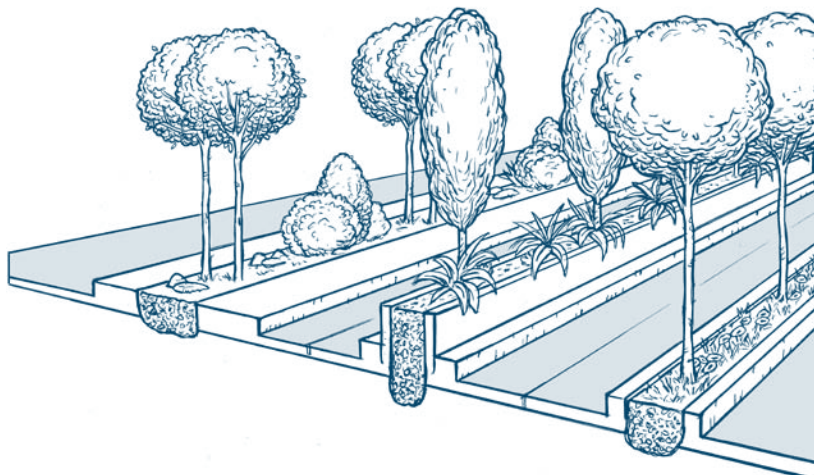
For this reason, the complementary facilities of roads are fundamental to the appreciation of the landscape, because they allow travellers to leave their vehicles and enjoy the views in a more relaxed manner. These facilities provide a direct appreciation of the landscape for those who wish to enjoy it, and in general offer a healthy and relaxing way of making a road journey more pleasurable (hence, for example, paths adjacent to access roads to towns are popularly known in Spain as «cholesterol routes»).

6.1.3 Siting and design of roadside areas

The types of relationship that roadside areas establish between the road with its traffic, and other activities, contribute to the development of a more sensitive approach to mobility, since they connect motorists with the more direct and social movement of pedestrians. In other words, thanks to the lateral areas associated with the margins of roads, motorists have the possibility of appreciating the landscape in a more relaxed, involved, and sensitive way.

Hence the importance of the design of these lateral roadside areas in terms of realising the landscape possibilities of roads. In this respect, their location is crucial since it is governed precisely by this landscape potential. The difficulties which are inherent to the siting of these areas, both those associated with traffic facilities and those which are of a specifically landscape nature, can be significantly reduced if their installation is foreseen in the layout assessment phase, and naturally, in the construction project.

The use of separating elements is a key factor in the design of lateral areas. These should include both functional elements (kerbs, lighting, signposting) and aesthetic features (trees, jardinières, character elements).





Spoil site next to the road used as a picnic area. The treatment of the sides and the revegetation need to be considered.

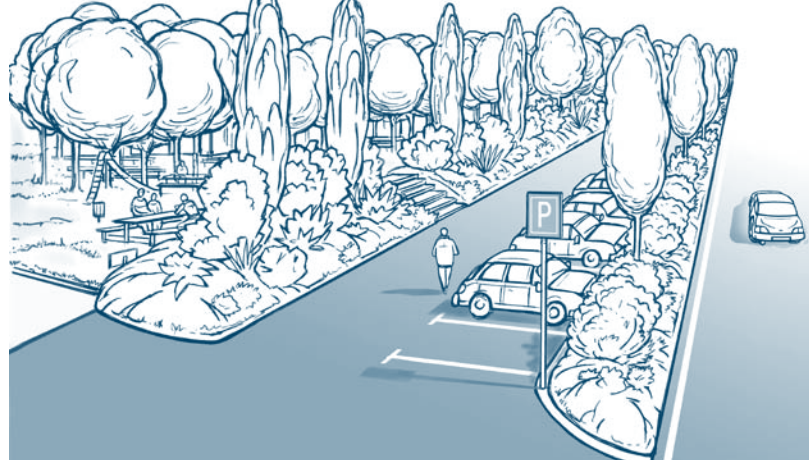
The opportunities in terms of the balancing of earthworks could also be efficiently applied for the siting of roadside areas, both during the layout assessment phase, with estimations of the viability of the location, and during the development of the construction project (both in new roads and upgrades), by approaching them as an element of the earthworks themselves, or even by incorporating lateral spaces which are purposely generated for these functions during the construction work.

This is the case with spoil sites, quarries, and ancillary construction sites, as well as sections which have fallen into disuse due to road upgrade schemes, or even other functional facilities of roads (service stations, rest areas, etc.) which can be successfully utilised if provided with effective view points. In this respect, the works for the improvement, adaptation, and renewal of the layout, or even the design of a new one, or the duplication of a single carriageway, are ideal opportunities for the creation of roadside areas with landscape functions.

6.2 Rest areas

Rest areas have an important landscape role which is associated with their capacity to establish a more relaxed and direct relationship with the traveller, provided that their scenic potential is fully realised. In this respect, the following aspects are of key importance:

- The selection of the location of rest areas
- Their relationship with the landscape
- Their relationship with the road
- A suitable internal design.



6.2.1 Location of rest areas

The successful selection of the siting of rest areas must not only take the overall conception of the route into consideration, but also take full advantage of the scenic conditions of its surroundings, avoiding the marginal location of facilities. In fact, rest areas must not be simply sited wherever there is free space available by the side of the road since it is far more productive to generate spaces in locations which can offer more scenic advantages or in areas where the landscape has specific qualities.

As we mentioned when outlining the general considerations, although the siting of rest areas in marginal roadside spaces generated by the construction process itself, such as disused sections of road, spoil sites, quarries, and ancillary construction areas, is a convenient solution, these spaces must be properly addressed during the planning and layout assessment phases, and particularly during the project design and management phases, including them as an integral element of the road.

The arrangement of the different parts of a rest area should isolate the higher quality spaces (recreational areas) from the road and its traffic, by delimiting with lower quality areas (car parks), and intermediate areas (gardens, mounds, vegetation).

6.2.2 Rest areas and landscape

Rest areas must have a positive and productive relationship with their surroundings which need not be limited to the more or less strategic scenic quality of the views which can be seen from them. Efforts should be made to include areas of special interest in terms of their

topography, ecology, traditional industries or crafts, and historic and cultural values, i.e., for their distinctive character. Thus, the situation of these areas can also be strategic, siting them in locations where the values of the landscape processes or those which define the area or territory through which the route passes, can be understood or interpreted more easily.

The role of rest areas should therefore go beyond that of serving as places for rest and relaxation. Thus, if planned in a positive way, it is also possible to adapt them as view points (see below), and develop them, however modestly, as landscape interpretation centres, or simply promote them as starting points for nearby scenic routes which can help to further the understanding and appreciation of local environmental values (a pedestrian path for example, leading to the base of a road bridge which cannot be seen from the roadway or to other key scenic features situated nearby).

Their presence in their immediate surroundings should also be properly considered, using less imposing designs such as areas on different levels or in enclosed enclaves, and adopting naturalisation elements such as trees, or incorporating already existing structures (old buildings, terraced land, traditional walls, etc.).

6.2.3 Rest areas and the road

The relationship that the rest area establishes with the road and the traffic is important to guarantee that they offer adequate conditions in terms of quality and relaxation. In general, rest areas are exposed to the sound of road traffic because they are at the same level as the roadway and often do not have measures to reduce noise or visual barriers.

Nevertheless, as is the case with other roadside areas, their relationship with respect to the road must be planned in such a way as to attain a certain degree of visual and acoustic

insulation either by siting them at a different level, with raised or depressed platforms, or by using insulation elements, with mounds of earth or noise reduction screens being the most effective solutions for limited spaces. Many projects opt for this solution, especially when the intended purpose is to create a certain degree of insulation.

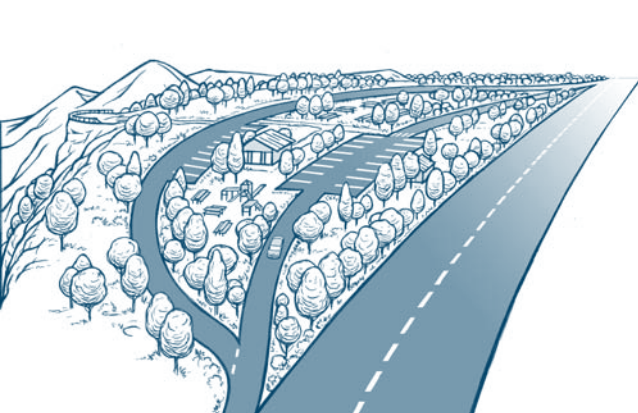
6.2.4 Design of rest areas

Based on the considerations outlined above, rest areas must have a suitable internal design, which, apart from contributing to the enhancement of the character of the road by assimilating certain features in its design, should cater for the various functions they need to fulfil, which are:

- Access
- Parking for vehicles
- Spaces for accommodation, rest, and recreation
- Water supply, rubbish collection, and lighting

Left. A rest area should include elements to isolate it from the road, as well as areas prepared for picnics and recreation, a parking lot, and, if possible, a view point, an interpretation centre, and connection with routes which have access to the landscape.

Right. A rest area should be properly equipped with waste bins, lighting, recreational areas, protection and safety elements (fences), and if necessary, water and electricity connections



- Other specifically landscape functions such as contemplation
- Interpretation, or access to scenic routes

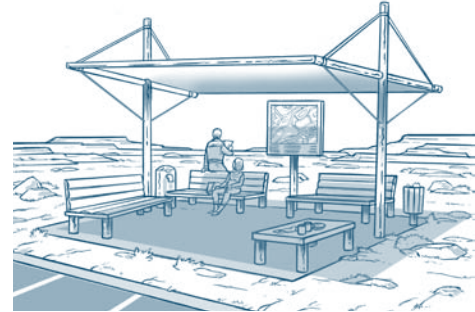
6.3 Service areas

The landscape function of rest areas is also to be found in service areas, although on this case it coexists with the significant presence of the businesses and services which cater for the needs of travellers, including petrol stations and garages, restaurants, shops and hotels.

This range of businesses is given priority in the planning and design criteria of service areas. However, the somewhat inadequate approach to these facilities needs to be effectively overcome by providing service stations with public services and facilities which efficiently reflect their role as spaces which provide a service to the community whilst at the same time fulfilling a landscape function.

The character of service stations is essentially defined by the predominance of commercial brands and franchise outlets which efficiently impose an overwhelmingly visual presence. In this respect it is important to bear in mind that all these businesses are subject to public concession regulations and therefore, the protection and appropriate development of landscape values should be incorporated as a decisive criteria in the concession process itself, paying special attention to the following aspects:

- The treatment of their character
- Their presence in the landscape
- Their overall organisation
- The inclusion of spaces with specific landscape functions.



A rest area could have an innovative and bio climatic design with shaded areas, protection against the wind, or a meeting point.

6.3.1 Location of service stations

The siting of service stations usually prioritises road safety and exploitation criteria, thus they are often situated in sections where there are no suitable existing alternatives.

The site selected for the location of a service area must not compromise the safety of traffic or pose environmental problems, providing ease of access for supplies and services.

There are no limitations regarding the distances between service stations other than those imposed for safety reasons or the adequate exploitation of the road.

Thus, service areas must be sited in sections with good visibility which permit their potential users to see them with sufficient anticipation.

Where applicable, the minimum 2.5 km distance between petrol stations as set out by the Ministry of Industry and Energy must be complied with (Royal Decree-Law 2/28 Nov1991).

Barring exceptional circumstances, which need to be specifically justified, the maximum recommended distance between service stations is between forty and sixty kilometres.

6.3.2 Service stations and the landscape

The aesthetics of commercial brands, which have such a trite and imposing influence on these types of facilities (often seen as examples of «non-places») need to be addressed through an approach which successfully adapts the character of these places to the surrounding landscape. Service areas often lack naturalisation elements, such as simple landscaped and garden areas or zones planted with large plants or trees as well as more idiosyncratic elements, such as traditional buildings, or positive design features (which do not necessarily need to be traditional or picturesque).

Therefore, the presence of these facilities in the landscape should be suitably treated by taking the following aspects into consideration:

- Their role as landmarks of the route
- Their presence in the perception of the landscape
- Their scenic location in areas of interest.

Although on the one hand service areas must have a strong visual presence due to their important role for travellers, this does not mean that their recognisable character should be defined by the exclusive and dominant criteria of commercial publicity which can seriously harm public spaces with its excessive trivialisation.

In general terms, service stations should be signposted using panels which simply describe the services provided in the facilities without offering any additional information aimed at encouraging users to buy goods or services. The size, characteristics, and brightness of these signs, should be clearly established so that they avoid dazzling, confusing or distracting road users.

Thus, the presence of service stations in the landscape should be approached in a way which transforms their role as basic elements of the infrastructure into positive landscape spaces which, as well as catering for the services required by road traffic, have an appropriate presence in the context of the scenery as a whole. Applying naturalisation measures, organising the facilities, and controlling the aesthetics of commercial brands are general recommendations which help to achieve this objective.

The potential advantages of their presence in the landscape is often wasted, since these facilities tend to disregard their surroundings, by ignoring their potential as sites for viewing

and interpreting the landscape, and overlooking the possibilities that they could offer as starting points of scenic routes.

6.3.3 Service stations and roads

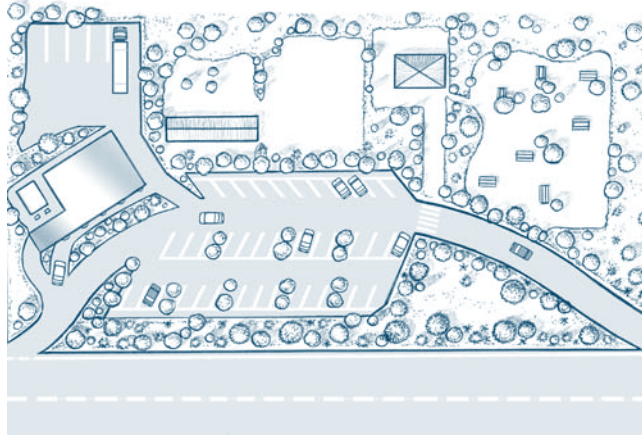
Service stations are functional elements of the road which are specifically designed to accommodate the facilities and services required to cater for traffic needs. These generally include petrol stations, restaurants, hotels, garages, and other similar facilities.

Access to service stations should be via speed change lanes, in which there should be direct deceleration lanes with progressively increasing curves so that users are aware that they have exited a road with high standard geometrical characteristics. The acceleration lanes should always be constructed in parallel with the road, since these provide maximum visibility to the traffic approaching along the main road and increase the opportunity for incorporation.

The buildings and all the other elements featured in the facilities (awnings, roof covering, petrol pumps, deposits, etc.), must be situated beyond the limits of roadside building lines, as well as slip roads and intersections, and must conform to all the requirements set out in the applicable technical standards.

Areas of right-of-way will be designated as separation zones to be used exclusively for the siting of the obligatory access roads and their ancillary structures, and, where applicable, service roads, traffic islands for the separation of traffic, or, occasionally, other access roads and parking spaces.

The various elements of the facilities must be designed in a way that does not adversely affect road safety or the landscape quality of the road or service road.



All the installations of a service area should be well organised to mitigate the somewhat hard and sterile aspect of such places.

6.3.4 Design of service stations

The organisation of the facilities should be approached in a unified and well-structured manner, avoiding the chaotic clutter or concentration of elements in vast, open spaces which is unfortunately quite common.

National regulations establish however that service stations must have a minimum area of 2-3 hectares, and that in open rural environments, horizontal structures should take precedence over vertical ones, with open spaces between the different functional areas for refuelling or leisure and well differentiated parking spaces.

From the safety point of view, petrol stations are considered high risk sites because they are places where there are potentially sufficiently large amounts of gases or fumes to generate an explosive or flammable atmosphere.

For this reason the rest of the facilities of a service area must be located at a suitable distance from the fuel tanks, the typical minimum distance ranging between 2 and 10 metres, depending on the capacity of the deposits. Traffic inside fuel supply facilities must also be properly controlled so that positioning and entrance/exit manoeuvres can

be easily carried out, and maximum attention must be paid to the emergency exits for tanker vehicles.

The structuring of facilities must include criteria relating to:

- The need to take the landscape into consideration by adopting an appropriate approach to the external areas of the facility, so that they are suitably integrated into the local environment and its distinctive historic, geographical and climatic characteristics;
- The isolation of «harder», areas or high pressure features such as service stations, garages and the road itself, whose presence should be adapted, and their effects modulated by using elements to isolate or separate them;
- A positive approach to «softer» areas such as hotels, catering and commercial facilities, as well as spaces with an essentially landscape function, such as view points, paths, and interpretation centres. In this respect, it is recommended that resting facilities are situated in the most attractive part of the service area, away from the noise and pollution generated by traffic. Buildings should have one or two storeys at the most, and external walls should preferably be constructed with stone or brick rather than prefabricated panels. Wherever possible efforts should be made to employ traditional construction materials which are used locally;
- Intermediate spaces such as parking zones and access lanes should be used as separation elements between hard and soft areas. This function can be aided by the use of landscaped zones with gardens or vegetation, as well as constructions which delimit the various internal spaces and enhance the character of the place as a whole;
- The internal roadways of service areas should be laid out with an orientation which prevents the traffic using them from blinding road users with headlights, installing anti-glare screens if necessary;

- All service areas must be provided with green spaces and rest areas. Embankments and other areas of soil must be revegetated;
- Free spaces with no specific use must be reforested with autochthonous tree species. Herbaceous and climbing plants should be selected in accordance with the necessary aesthetic criteria whilst taking into account their resistance and maintenance requirements.

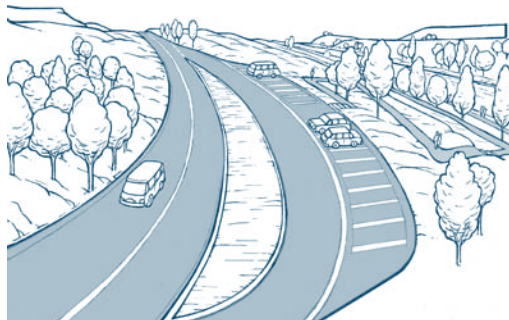
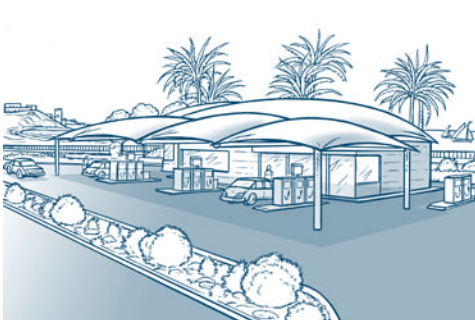
The inclusion and installation of elements with specific landscape functions should be considered as part of the general facilities of the service station, whilst external spaces and raised areas (flyovers, towers, and other buildings) can be adapted as landscape viewing or interpretation points. Service areas can also be used as suitable access points for scenic walking routes, provided that it is not obligatory to completely enclose the whole area.

6.4 Parking areas

Parking areas situated on the side of the road are spaces of significant importance for the landscape because they are the places which permit the transition from the car journey, which is essentially one of anticipation and where the perception of the landscape is heavily influenced by the vehicle, to a more direct relationship with the environment, which although perhaps equally ephemeral and temporary, is none the less more intimate and

Left. A petrol station may adopt an innovative and unusual design to improve the functional, standardised appearance of typical franchises.

Right. A parking area is a space of transition on the road and provides a different relationship with the landscape.



comprehensive. The traditional appearance of parking areas, often consisting of an arid open space with no character, needs to be approached in a different manner if they are to play a part in the approaching to the direct enjoyment of the landscape. Parking areas have a crucial role in the itinerary of landscape users, who normally use their cars to get to places of interest, such as cultural landscapes, beaches, coastlines, traditional villages or towns, city centres or natural parks. After reaching their place of destination (in an area which effectively acts as a doorway) they leave their vehicle in the parking area and set off to carry out the activities which brought them to that particular place.

Therefore parking areas, fulfil a triple function:

- A parking area is a simple intermodal facility for the interchange of forms of mobility (cars, pedestrians, bicycles, etc.) which must be suitably equipped to fulfil its functions with well-structured access points, parking spaces, and interior link roads, as well as a series of basic services and facilities. At the same time, their siting and capacity modulate the pressure exerted on the environment they serve;
- Parking areas are the spaces which precede the place of destination, and in this respect they mark the first impression people get of the place, helping to define their level of expectation. Parking areas which are scenically badly sited, have a poor or excessively functional design, or are oversubscribed due to failures in the design of their capacity and organisation, hinder the quality of the landscape they serve;
- Parking areas are facilities which are integrated into an environment and its processes, and as such, their environmental impact on the surrounding area should be reduced as far as possible. Their dimensions, their relationship with the environmental structures and processes, and the management of the waste they generate, are all aspects which need to be fully considered in terms of this integration.

The siting, overall design and internal organisation of the parking area are factors which are fundamental in the development of their landscape potential. The following aspects concerning parking areas are examined in the sections below:

- Capacity and siting of parking areas.
- Integration of parking areas into the scene.
- Access points and internal organisation of parking areas.
- Design for the naturalisation and enhancement of the character of parking areas.

6.4.1 Capacity and siting of parking areas

The siting and capacity of parking areas define the intensity and distribution of the pressure exerted over the surrounding landscape, therefore the decisions concerning these two aspects are of critical importance. Their role as strategic elements at certain stages of a journey is also important because on the one hand they must have organised access points, and entries and exits, and on the other, encourage users to leave their vehicles, thus avoiding the pressure exerted by travellers from damaging the area to be visited.

Spontaneous parking, i.e., leaving vehicles in places which are not specifically designed for the role, can lead to serious problems especially if it happens in areas where there is a high risk of accident, such as hard shoulders or edges of roads, where visibility is poor and both travellers and vehicles are exposed to unnecessary risks. There is also the question of the damage caused by vehicles themselves, which includes a wide range of negative effects such as the spillage of oil, un-burnt fuel, solid waste, noise, and engine pollutants generated by forced manoeuvres, which add to the environmental pressure exerted by pedestrians. These

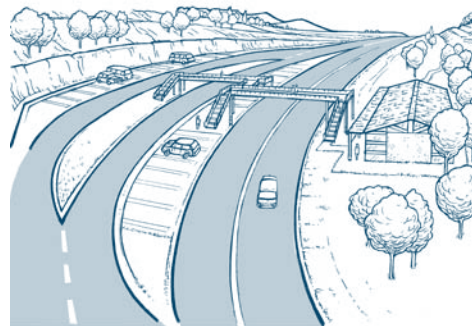
effects can be magnified when people attending large-scale events (celebrations, festivals, or simply weekend traffic) park their vehicles in vast open areas, with the consequent negative impact on the environment. For this reason it is important to plan parking areas and modulate their capacities in an efficient manner.

Thus, the management of areas of landscape interest requires an efficient approach to the planning of parking areas which clearly identifies the vehicle routes which can be promoted more extensively (those which avoid fragile areas) and defines their relationship with the areas which are able to sustain the pressure of frequent visits (itineraries avoiding fragile areas).

Due to their structural character, the decisions concerning the siting and capacity of parking areas should be explicitly included and appropriately resolved in the landscape management guidelines.

The first aspect to be taken into consideration is the capacity of each parking area (or group of areas), and this needs to be adapted to the target use of the landscape it serves, establishing the effective size of the parking area and its location in terms of the territorial structure and visitor capacity of the landscape. On one hand, it might sometimes appear advisable to reduce capacity so as to limit pressure on sensitive landscape (historic centres, natural areas, etc.), but on the other hand, the phenomenon of spontaneous or non-regulated parking often generates a far more negative impact than that caused by additional pressure on the landscape in question.

In this respect, the congestion which arises at specific times of the year (weekends, seasonal breaks, and bank holidays) is particularly difficult to solve, and it is important that in these instances the siting and dimensions of parking areas and their access points should be planned in such a way as to prevent traffic jams from spreading to the main roads situated



A parking area can provide a relationship with the landscape through which the road is passing, which may be areas of highly environmental quality.

nearby. In certain cases, it may be necessary to impose selective access restrictions at specific times (during a particular season of the year or specific times of the day) or to limit the number of vehicles or people accessing key areas, so as to reduce pressure at the entrance to the parking area and on the area being visited.

Parking areas can also be used to force travellers to change their mode of transport by providing connections with larger vehicles or other forms of transport (buses, 4x4, bicycle circuits, etc.) which centralise and channel pressure to designated areas of the landscape.

The second aspect is the siting of points which provide access to the landscape. One strategy which can reduce the pressure exerted by parking spaces on a specific place is to distribute them in separate zones spread over a broad area, thereby reducing the intensity of potential pressure.

The option of siting small clusters of parking spaces over a large area is also useful as a partial solution to the problems associated with specific or seasonal demand, since some of the facilities could be closed during quieter periods, and only opened at peak times. This can also be an effective solution for landscapes on which pressure varies throughout the year thanks to natural or cultural cycles (religious pilgrimages, estuaries, etc.).

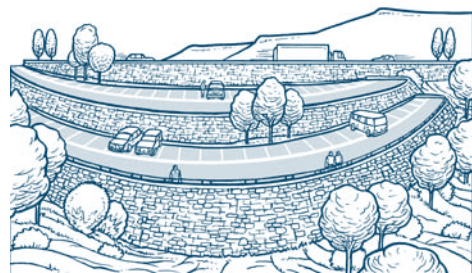
These criteria need to be understood in a generic manner, since solutions will depend on how well the specific conditions of each particular case are known, both in terms of the characteristics of demand for access and parking, and the conditions of the landscape in question.

The routes and activities available to visitors in a particular area must be carefully assessed, identifying the level of fragility of nearby areas, so as to decide whether parking should be concentrated in one single large facility or be distributed over smaller scattered sites, and if so, where. Thus, in areas where the visitor access is, for one reason or another, mostly centred on one single point, one large parking facility is the best solution, whereas in

places where access is spread out through a broader network (such as mountainous areas, reservoirs, lakes, forests, etc.) or along a linear axis (in coastal areas), and where there is already a certain amount of pressure, facilities can be distributed in small groups.

On the other hand, maximum advantage should be taken of the physical form of access to fragile landscapes and their geographical barriers, so as to channel pressure on the environment and structure the system of access points and car parks. These factors of geographical accessibility must therefore be fully considered when deciding the siting of parking areas, together with the specific level of fragility of the territory in question, and the network of access points.

The peripheral and buffer (or intermediate) zones of a landscape are generally the recommended locations for the siting of parking facilities. However, the location of a parking area must take into account the spatial structure of the most fragile areas, and be sited a considerable distance away. An effective strategy is to use the parking facility itself as a buffer zone between areas of minor interest and higher levels of traffic, and those which are more sensitive. Buffer zones are transitional areas which separate more deteriorated areas from others which are in better state of preservation, and the way that they work is to gradually reduce the pressure exerted by human activity, and by the movement of vehicles in this case, to attain more peaceful conditions for the environment (slow moving vehicles or pedestrians only).



The terracing has the effect of hiding a car park, reducing its presence in the landscape and making the most of opportunities to lessen its impact (view point, stone walls, trees, etc.)

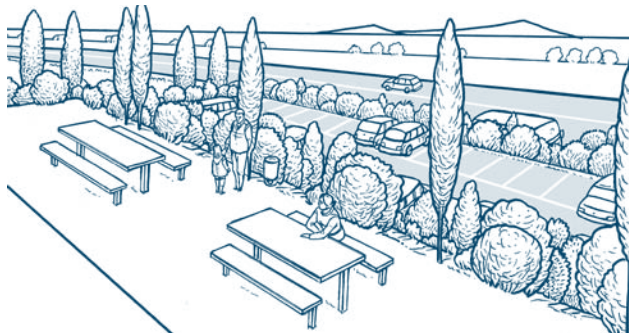
6.4.2 Integration of parking areas into the scene

The siting of a parking area must be considered in terms of its scenic characteristics, i.e., its presence in the landscape must be addressed by adopting a strategy for its integration which encompasses a series of aspects, ranging from the selection of the scenic location and its organisation, to the design of systems of integration.

A commonly recommended strategy is to find remote locations which are hidden from view so as to disguise the parking area or hide it from the most appreciated or frequent views.

Firstly, areas exposed to interesting views from the access roads, pedestrian itineraries, recreational zones, etc. must be avoided as much as possible. Secondly, the general organisation of a parking area, including the design of its surface and earthworks and its functional organisation, can contribute to its integration or occultation. In flat areas, the compensation of earthworks can be used to generate screens which protect the views from the desired areas and in some cases, terraced arrangements can be an effective solution to make the parking area less visible. Screening these parking areas at various levels is also an effective measure, although it may increase the presence and volume of dividing lanes between them.

Thirdly, the screening of areas with trees and hedges is an extremely effective way of concealing both the vehicles and the parking area as a whole. The siting of hedges can also help to make vehicles less visible, and together with large trees situated next to the rows of parked vehicles, they help to conceal them from views from above or from the side. Sometimes the presence of a few trees is enough to obscure the overall view of the parking and break up the undesirable sense of austerity and continuity of the area.



Different levels and vegetation are used to hide the presence of vehicles, separating them from each other and from the access road, as well as from places where people have picnics or walk about.

In general, the integration of parking areas into the landscape needs to be taken into account during the internal design of the facilities. The presence of large clusters of parking spaces has an extremely imposing effect on the landscape. Therefore, the design and organisation of these facilities must be based on the idea of diluting the overwhelming presence of large paved surfaces occupied by symmetrically arranged vehicles as much as possible.

Dividing parking areas into several lower capacity zones, interconnected by internal roads, spreads the presence of these facilities over a larger area, but, if done in an appropriate way, their effect can be significantly diluted, particularly if full advantage is taken of unusual or complex locations. However, the scattered facilities of a fragmented parking area can also have a negative impact on an area with a high quality landscape by surrounding and sieging it. This type of approach is typical of the central area of historic towns where fragmented parking sites with smaller individual zones are dotted around the particular features (moats, walls, earthworks, etc.), of an area, with mixed results.

The imposing effect of small parking areas arranged in terraces can be efficiently disguised when the terraces themselves conceal the presence of vehicles and platforms from view. Unfortunately, they do however require larger internal connecting lanes to allow vehicles to reach the different levels and are also forced to employ larger construction elements such as retaining walls or embankments.

Layouts on different levels, with the parking area being sited beneath the area of interest (area of natural or cultural value), are favourable in terms of concealment, especially when the site is complemented with visual obstacles such as lines or groups of large trees which conceal vehicles beneath their branches.



A single continuous zone has a more imposing presence in the landscape than solutions where parking areas are fragmented and spread out.

6.4.3 Access points and internal organisation of parking areas

A parking area must have appropriate entry and exit roads, as well as an efficiently structured network of internal lanes and parking spaces. Entry and exit roads must be approached in a way that permits ease of movement, avoiding difficult crossing manoeuvres or disruption to other roads nearby. To achieve this, it is advisable to separate entry and exit roads, and implement internal one-way systems to access the parking spaces themselves.

Fragmented parking areas also require lanes to interconnect the various different zones and permit the free movement of traffic throughout the whole site.

Internal lanes and parking spaces must be clearly delimited (by painted lines, signs, vegetation, etc.) and arranged in a way that avoids unnecessary diversions or manoeuvres. Internal lanes must be wide enough to provide enough of an angle for vehicles to be able to manoeuvre in and out of the parking spaces as quickly as possible and without additional obstructions.

In addition to the access points and parking spaces, which must be efficiently organised so as to maximise the use of space, parking areas should have a series of complementary facilities, such as:

- A network of paths for pedestrians which are compatible with traffic movement and cover not only the parking area itself, but also link up with external pedestrianised areas. These must be properly signposted and protected (with bumps or rumble strips) so as to guarantee the safety of pedestrians;
- An adequate drainage system which covers the whole parking facility and its access lanes. The surface of both parking spaces and internal lanes must be properly designed with slightly raised central areas, and well-structured border ditches to conduct rainwater towards the lowest point of the facility. Catchpits, with grid and spillway should be installed if necessary to treat runoff

water before it reaches the surrounding environment (especially in natural areas which can be ecologically sensitive to water from parking areas);

- Surveillance and security systems (parking attendants, access restriction, etc.), including at least some type of fencing which stops pedestrians or vehicles wandering freely into adjacent areas;
- A cleaning system and maintenance for vegetation and other facilities, including rubbish containers to collect the waste generated by vehicles;
- Internal signalization and sufficient lighting for hours of darkness;
- Naturalisation elements, such as trees, hedgerows, gardened areas, and other characteristic elements, such as walls, pavements, and other structures, which must have efficient cleaning and maintenance systems;
- A system of information about the landscape served by the parking area. This involves a variety of facilities which cater for the needs of travellers, ranging from simple information panels with themed or explanatory maps, to information centres with a whole range of guide books, brochures or personnel;
- Pre-existing sites of interest. It is common for parking areas to incorporate pre-existing features (trees, buildings, etc.) which become part of the new site. Full advantage should be taken of these special features by using them for example as visual reference points at the entrance, for protection and shelter, or as supports for the provision of information.

All the landscape integration criteria must be efficiently coordinated with the functional needs of the parking facility, particularly in terms of safety and security. This is an aspect which must be addressed with special care, since failures in the structural design of the organisation of these facilities can lead to serious problems. In this respect, special attention

must be paid to considerations which affect the visibility of both pedestrians and motorists and the way in which pedestrians move around the access points of the parking facility, as well as the proliferation of undesired or risk-inducing public activities.

Potential visibility limitations for pedestrians or motorists caused by decorative elements, signing, fencing or vegetation which are badly placed or poorly designed can be a serious safety hazard in these areas which, as we must not forget, can be particularly problematic because vehicles and pedestrians must coexist in a relatively uncontrolled and improvised environment which is complex and unfamiliar to the users.

A common potential risk of accident in this type of facility occurs when pedestrians who have left their vehicles, walk along the access road itself to enjoy the views, and run the risk of being knocked down. For this reason it is important to guarantee that the car park is properly separated from the road and that users can see the views from the facility itself, without having to go to high risk areas.

Undesirable activities or behaviour within the parking facility constitute another area of potential risk. The visual and/or physical separation of these spaces can act as a magnet for marginal or illegal activities such as prostitution, drug trafficking and use, theft, and other types of crime. The prevention of these activities is closely associated with the specific characteristics of the site (isolation), the level of surveillance and maintenance, and the design of the parking areas themselves. In more populated areas it is advisable to attain a good level of natural surveillance (proximity of other activities, human presence, clear visibility from roads and nearby buildings, etc.) with treatments which efficiently integrate the facilities into the surrounding area and avoid the barrier effect or the sight of large numbers of stationary vehicles.

6.4.4 Naturalisation and character-enhancing designs for parking areas

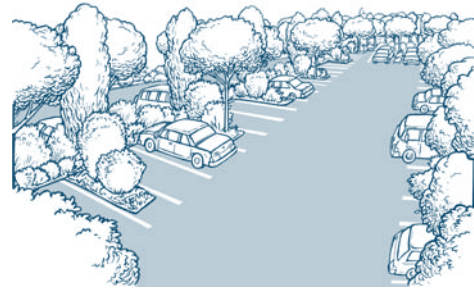
Often seen as low quality landscapes, parking areas have not received the attention they require. In this respect, the Florence Convention gives special importance to the demand for improvements in landscape quality of places inhabited and frequented by citizens. Parking areas are amongst these communal spaces which are increasingly becoming an essential element in people's daily life, but they often feature extremely aggressive landscapes due to their arid, inhospitable, and excessively functional design, which is frequently lacking in natural features or identity.

This is not however always the case, particularly in those parking areas, which, as we discussed earlier, act as a place of transition between two modes of travel, where travellers can leave their vehicles and engage in a more direct and natural interaction with the landscape.

Some parking areas incorporate distinctive local features, such as trees, traditional walls, or simply landscaped areas, which seek to mitigate the rigidity of their environment. Trees, stone walls, or just a few signs can have a significant effect on the landscape references of these places.

Apart from being useful as elements to conceal, disguise, or screen parking areas, trees can also fulfil other important functional roles. Therefore, the use of trees and vegetation in general is recommended because it enhances the natural appearance of these facilities, helping to soften their bleaker aspects, whilst reducing exposure to the sun, wind and rain, and generally creating a more user-friendly environment.

Furthermore, in addition to structuring the internal space and concealing vehicles, the introduction of small wooded spaces, hedgerows, or lines of trees creates shaded areas in the summer which are beneficial for both travellers and vehicles.



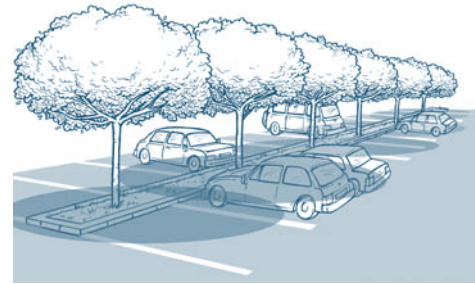
The areas between parking spaces and access lanes can be used to introduce vegetation, wooded areas, trees, bushes, etc.

At the same time, if deciduous species such as plane trees, chestnuts or others are used, their falling leaves help to keep parked vehicles warm during the winter. In this respect, the bioclimatic conditions of parking areas, which are generally arid, with poor thermal conditions, need to be taken into consideration. These facilities tend to suffer extremes of temperature, mainly because of a lack of protective structures. Cars themselves are extremely fragile in this sense since their low thermal inertia means that they rapidly accumulate heat when exposed to the sun, particularly in hot countries like Spain, and cool down quickly in low temperatures. Trees can therefore play an efficient role in compensating thermal and humidity conditions in these environments.

It is important to bear in mind that the design of roofing structures such as awnings and other shade providing structures must allow rising hot air currents to exit through the roof, otherwise the effect is exactly the opposite to that desired. For this reason the use of permeable mesh, and thatched, or naturally based covers which provide shade, but at the same time permit hot air to escape, is recommended.

Trees also contribute to imparting more character to these facilities, with their foliage, blossom and fruit providing a sense of seasonal change and thus helping to integrate them into the adjacent landscape. Wooded areas and bushes soften the aggressive and exposed appearance of parking areas, which offer a generally arid, cold, and hard scene. Vegetation relieves this markedly industrial atmosphere, making it more user-friendly, natural-looking, and agreeable.

Furthermore, the use of trees, particularly if they are tall and thick or are grouped together in rows, or in small areas of woodland, can have significant scenic effects. The introduction of individual or groups of trees in the spaces between parked vehicles also helps to give a more



The use of broad-leaved deciduous trees planted in rows or between parking spaces has a useful environmental function because in summer they protect cars (and people) by creating shade, whilst in winter they let the sun shine through.

fragmented view of the whole area, because they conceal the vehicles which are parked further away, making these large open areas feel smaller, more accessible and user-friendly.

The use of barriers of vegetation can allow the arid setting of a parking area to be divided into small enclosed «rooms» separated by plants, whose appearance is closer to that of a flower garden than a vast area of tarmac. Other decorative elements such as walls, fences, and paving, or facilities and utilities such as drinking fountains, paper bins, recreational gardens and other features, can also fulfil this fragmentation role if designed accordingly.

Apart from the introduction of these individual elements into parking areas, an alternative design approach is to use pre-existing structures, and adapt them to the functions of the facility. This is an efficient solution, using the resources already available on the site, and incorporating them into the parking area, even if this reduces capacity or functionality. These pre-existing elements, which can range from simple trees to other more complex features such as buildings or walls, can contribute significantly to the enhancement of the character and identity of parking areas, thus making them more user-friendly or simply creating a more pleasant atmosphere. In this respect, the conservation of ancient trees should be a compulsory requirement for parking areas constructed in natural areas.

If handled carefully, the use of pre-existing terraced cultivation systems, wooded areas with clusters or lines of trees, and stone walls or traditional elements can also enhance the quality of parking facilities.

Terraced areas for the cultivation of fruit trees, tree planted areas, and old farming or industrial facilities can thus be adapted to the needs of parking facilities, by preserving some of their elements and taking advantage of their regular shape and organisation for the incorporation of lanes and parking spaces. This option can be used to create a kind of mixed

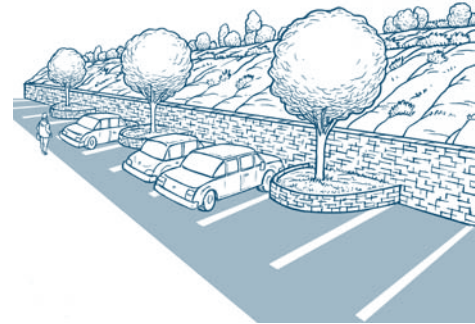
space in which the preservation of pre-existing elements in their original layout (fruit trees, tree planted areas, buildings, etc.) can enhance the character of a parking area, and make it more user-friendly.

There are no general rules for a natural approach to design which enhances the character of parking areas other than the recommendation that a thorough assessment of the site's pre-existing conditions is carried out, paying special attention its topographical features (slopes, flat areas, terraced systems, escarpments, depressions, etc.), climate (seasonal characteristics, extreme weather conditions, wind direction, and exposure to the sun), buildings (both nearby and inside the siting area) or vegetation (wooded areas, hedgerows, fruit trees) so as to be able to identify the way in which they can be incorporated into the overall parking scheme.

Indeed, the way in which both pre-existing elements and new installations are incorporated is decisive for the final outcome. The inflexibility of the flat tarmac surface should be alleviated with the use of organic, shady, traditional and rustic elements, although excessive folklore type quaintness should be avoided. In some cases it could be useful to use special paving which allows, for example, the growth of a certain amount of vegetation between the sections.

Signs and road markings should be discreet, simple, and functional since their presence contributes to the sensation of lack of character. Markings and signs which can be seen from beyond the physical limits of the parking area and interfere with the landscape whose character and value we want to highlight should be avoided.

In general, the only valid broad recommendation is to assess and address the specific conditions of each particular case, since there are no overall rules other than those dictated by common sense. It is important to highlight the unique multifunctional character of parking



The personality of an area can be maintained by integrating already existing elements (fruit trees, terraces, buildings) or constructing features with local references (stone walls).

areas and their extremely delicate role in combining moving vehicles and pedestrians, whilst at the same time serving as transitional places between the journey and the landscape. For all these reasons parking areas should be efficiently designed as places with high quality environments, and new approaches need to be adopted to overcome the traditional lack of attention paid to these facilities. As such, special efforts should be made in their organisation and design in order to take maximum advantage of the pre-existing features of the area (morphology, location with respect to access points, pre-existing vegetation, etc.).

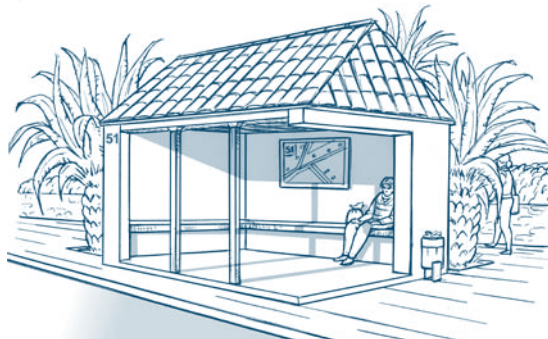
The location of parking areas, whether they are centralised or dispersed, terraced or flat, or have one or many access points, must thus be governed by the specific conditions of each particular case. Nevertheless, it is important to always bear in mind the level of fragility of nearby areas and the scenic organisation of the environment (from where the parking area and vehicles can be seen and vice versa), and their scenic organisation, and the way in which these spaces are visually related to the network of access roads. These visual conditions play a decisive role in mitigating the potential negative impact of the presence of flat car parks in attractive landscapes. In this respect, screens and the presence of wooded areas and hedgerows can contribute to softening the landscape of parking areas. Thus, in general, the criteria for the internal design of these facilities must be based on interventions which relieve their typically inflexible and barren appearance by the introduction of vegetation which breaks up the monotony of their structure, balances their hard bioclimatic conditions, and gives them a certain degree of character. In this respect, the incorporation of pre-existing elements such as low walls, wooded areas, terraces, fruit trees, etc. can be an effective approach if implemented appropriately. Finally, safety and a subtle aesthetic approach are always valid criteria.

6.5 Bus stops

Bus stops can, in general, be considered as elements of road furniture with landscape significance in two respects. On one hand, a bus stop is a place for public use which provides shelter to people waiting for collective transport and, in this respect, it is a transitional point between two modes of transport. On the other hand, bus stops also have a strong visual presence on the margins of roads which can contribute (if they are designed to do so) to the creation of their character.

As is the case with other elements, bus stops are part of the interior scene of a road, and have a significant presence in it. They are places which are designed to provide access to pedestrians and vehicles, as well as offering shelter or serving as waiting areas, and permitting buses to stop so as to collect or drop passengers. Bus stops are intentionally designed with a certain functionality in mind. This is often not simply limited to the provision of a service but can also incorporate various types of idiosyncratic features, which are sometimes picturesque, and other times purely functional. Although consistent modular designs are the most widely used, bus stops also sometimes take on a distinctive design of their own.

Thus, with their presence and appearance, bus stops contribute to providing the road which they serve with a certain sense of identity. This is especially the case when all the stops of the bus companies serving a specific route and territory (basically the areas served by the



The design of a bus stop could incorporate formal reference points of an area by developing its own style to make it a recognisable landmark.

institutions which run the collective transport system at a regional, provincial or metropolitan level) feature a unified modular design.

The main aspects to be considered in the design of bus stops are as follows:

- Their location.
- Their relationship with the landscape.
- Their relationship with the road.
- Their design

6.5.1 Siting of bus stops

Bus stops should be sited in lateral lay-bys which permit the safe stopping of buses and passenger transfer. Where this lay-by is non-existent, stops should be sited on sections of the road with sufficient visibility and width to allow buses to stop safely.

Bus stops should not be sited on curved sections or close to curves, as this would hinder the visibility for bus drivers and increase the risk of collision for vehicles approaching the bus from behind, and for this reason, they should always be sited in sections in which the stopping sight distance is guaranteed at least for the vehicles following the bus.

Neither should they be sited in restricted areas where there is not enough space for people to wait, or for the bus to stop safely. For this reason at stops which do not have their own access road, it is advisable to add extra width to the hard shoulder, so that buses can stop without disrupting the traffic. This needs to be of sufficient length to facilitate the acceleration of the bus and its subsequent reincorporation onto the main road. These measures help to reduce traffic disruption and potential accidents, as well as lessening the

danger of pedestrians being run over by other vehicles, and, at the same time, improving passenger comfort.

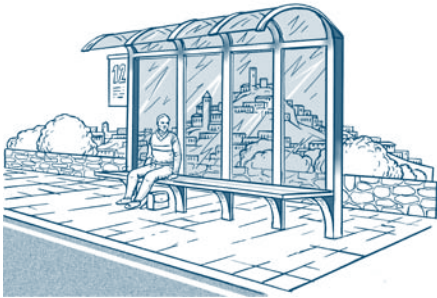
Where possible, bus stops should be sited in locations which take full advantage of the scenic conditions of a road, permitting uninterrupted and interesting views, although this is generally not considered a priority.

Another important consideration regarding the siting of bus stops is their connection with a path which guarantees safe access for pedestrians. This should be a prerequisite in the selection of the location of all bus stops, and, in cases where a path does not exist, the possibility of constructing one which leads to the nearest pedestrian access point must be considered. It is also important that the section of the access path nearest to the bus stop is fully paved (to avoid the accumulation of mud in the waiting area) and has sufficient width to allow easy access for people with reduced mobility.

6.5.2 Relationship with the landscape

Bus stops rarely take full advantage of the landscape potential derived from the fact that they are located on the margins of roads. They tend to be conceived as mere shelters which isolate waiting travellers from the external area of the road, as if protecting them from the landscape. Thus, their potential as view points is hardly ever developed and, although many incorporate large windows or glass panels, very few of them are designed with this aspect in mind.

Another important feature to be considered is the informative role of panels which are adjacent to bus stops, which are often occupied by commercial adverts, but could be used to provide travellers with information about the surrounding landscape.



Left. Bus stops can have an interesting landscape potential depending on their location and design.

Right. Bus stop with rustic styling on the A-8126.

It should not be forgotten that bus stops are also the starting point of pedestrian pathways leading into the landscape which passengers enter as soon as they get off the bus and this is another area of potential which should be fully considered in their design and situation.

6.5.3 Relationship with the road

The safety of users is a priority concern in terms of the relationship between the bus stop and the road and governs its functional design to a considerable extent.

Thus, the internal design of the bus stop and its immediate surroundings must provide a certain degree of shelter for waiting passengers from the dangerous environment of a road. This is usually achieved by respecting a series of minimum distances and by equipping stops with bus shelters that protect passengers.

Bus shelters should be sited at the necessary distance from the roadway to protect travellers from passing traffic whilst allowing enough room for buses and their protruding rear-view mirrors. They ideally should be sited at the far end of the stopping area and offer good visibility for both bus drivers and passengers.



Bus stops on the HU-8105 with a very functional design.

From the point of view of safety, the walls, signposts and solid structures which are situated near to the bus stop, whilst providing shelter, can also impede visibility. It is therefore advisable to carefully assess their role in each specific case, as well as considering the situation and maintenance of plants or trees, which can also act as visual barriers.

Finally, bus stops should be provided with sufficient lighting so as to guarantee good visibility and functionality during the hours of darkness.

6.5.4 Design of bus stops

Bus stops are a very good example of how to resolve the character of road infrastructure. Firstly, the standardisation of their constructed elements goes beyond the mere justification of the costs of production and installation. Indeed, the fact that bus stops are part of a specific transport system makes it necessary to establish an identifiable brand image, a style which is common to all the bus stops of a particular transport system, and makes them more consistent and easily recognisable.

Secondly, these facilities form part of the landscapes of the places they serve, affecting, like all other roadside areas, the space which marks the transition between the road and the landscape. The question therefore is how to address a standardised element which belongs

to the functional and sterile landscape of the road but is, at the same time an essential and strategic part of various landscapes, in the sense that it operates as an entry and exit point between these territories.

Attempts to change the characterless aesthetics of the road have led to a search for counterbalancing approaches which can capture the essence and identity of different places. As part of this initiative, a revision of key elements of typical architecture, and particularly the most picturesque characteristics of each region, has been used as a basis for the design of bus stops. Thus, what is essentially a structure involving a cover, a bench, open support columns, panels and paving, has taken on a picturesque language which reproduces the materials and systems of an abstract, regional, or simply rustic, architecture.

The result is spectacular but not always successful. The idea is based on an interpretation of the identity of a region and the distinctive formal character of each particular area which is perhaps excessively picturesque and quaint. Nevertheless, the concept can still be essentially valid if solutions which incorporate local features in a creative way are adopted.

Thus, there are many other examples which have also a picturesque base but have successfully adapted key local features to produce simpler, more discreet compositions, making subtle references to the local character without overusing complex formal aspects. Their approach has been to attenuate the traditional character of features before incorporating them into the structural design of the bus stop.

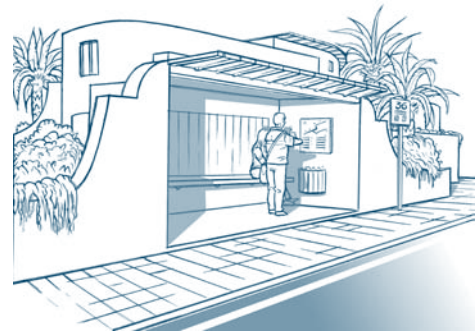
On the other hand, the vast range of possibilities offered by new materials and structures produced using modern technology, has opened the door for the development of standardised bus stop designs whose innovative and striking appearance is in stark contrast with the places where they are located, with somewhat varying results.

Aware of their own universal character, a number of international manufacturers of urban furniture have created modern designs, avoiding an overly aggressive structural and visual approach, to produce more discreet or lighter models which can be used in a wide range of contexts. The resulting products are functional structures with character, which do not clash with the landscapes where they are located. Although in other instances, manufacturers have produced more intentionally traditional designs, their range of products always includes more minimalistic models.

Those searching for new solutions should not be afraid to further develop the typical aesthetic features of this type of infrastructure, with its consistent geometric shapes and functionality, without ignoring the aim of establishing styles which are unique to every specific place, but blend discreetly into the landscape, coexisting with it, and acting as a transitional space on the margins of the road. Functionality, habitability and identity, are therefore the essential elements which must be combined to produce the different solutions.

6.6 Trees on the side of roads

Roads with lines of trees on their margins are landscape features of considerable value and character, both in functional and aesthetic terms. Nevertheless, the viability of this landscape resource creates a conflict between its great appeal and the risks involved in its maintenance in terms of safe and comfortable driving. However, it is possible to maintain a positive attitude towards preserving their value by adjusting the functionality of the roads where they are sited. Lines of trees on the margins of roads have a significant landscape quality thanks to a series of factors which are related to cultural structures and environmental processes, as well as, aesthetic and, of course, scenic characteristics, particularly when seen together as a whole.



The design of the bus stop should integrate character features with functional elements such as signposting (bus stop sign and timetable), a bench, waste basket, garden areas and a shelter structure to protect users from rain, wind and sun, satisfying all these functions with their own style to make them recognisable as landmarks on the road.

As well as being systematically used on the sides of the roads and paths on European routes since the 17th century, lines of trees are associated with other landscape references which are derived from their use for a variety of purposes in rural environments. In fact, the tradition of planting trees by the side of roads is a key cultural feature in many parts of Europe, and has survived, despite the huge development of the road infrastructure during the 20th century.

A line of trees is a traditional ecological, environmental and landscape resource which is frequently found next to traditional rural constructions. Typical agricultural architecture frequently included tree-lined access roads for two reasons: firstly to use the presence of trees to protect the road, and secondly to create a striking visual effect by highlighting the importance of what is at the end of the road, reinforcing its depth, and giving it an essentially solemn character and undeniable elegance. Other references which are deeply rooted in the collective consciousness include the typical roads lined with cypresses which lead to a cemetery or sanctuary, and the rows of palms or other trees which decorate the driveway to a property and its main buildings. Here their function is purely ornamental, scenic, and symbolic of prestige. The trees planted on the sides of these types of roads reinforce the sense of perspective, separating the road from the surroundings and guiding it towards the sacred or private places. Furthermore, the line of cypresses, with their uppermost branches rising up into the sky, emphasises the site of the sacred place, from any direction, particularly if it is to be found in flat open countryside on the outskirts of small towns and villages.

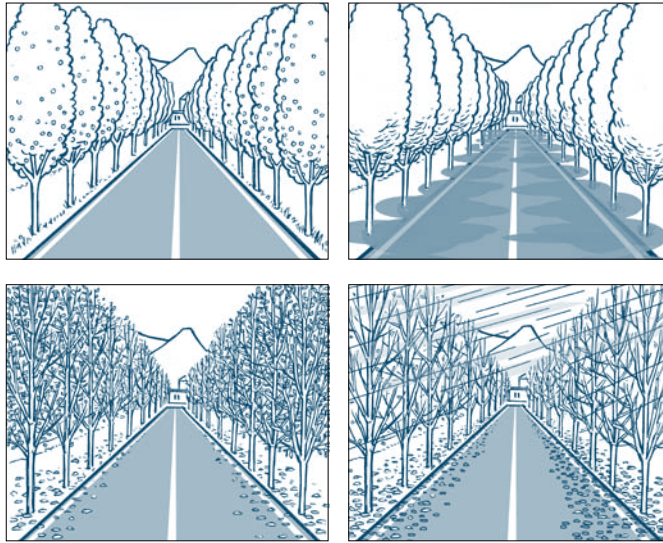
However, lines of trees are not only appreciated for their solemn character, but also for the beneficial protection they provide to roads and their users, which can be still felt today, even from the inside of a vehicle driving at high speed through these natural galleries. This



The selective presence of trees, either in rows or on their own, works as an effective reference along a route by emphasising changes in the travelled area.



The trees on the sides of paths and roads are a cultural element of the landscape. They are elements of the road heritage and should be maintained as such.



The trees on the roadsides reflect the environmental cycles and provide the functions of vegetation for the road.

positive association between the protective presence of trees and the travellers they shelter has existed since ancient times.

The shade provided by trees in the summer, protecting the traveller from the intense heat and light of the sun in the vast expanses of open countryside which can be found in many parts of Spain, together with the shelter they give against the wind, are functions which have long been associated with the use of lines of trees and wooded hedgerows on the margins of roads and grazing areas. Trees have also fulfilled a social function in the sense that they have been traditionally used to delimit the boundaries between fields, and between fields and paths, acting as static and obvious markers of the boundaries between private property (boundaries of fields) and between public and private spaces (margins of public paths).



Gallery of trees on the HU-8105
as it enters Aracena (Huelva)

6.6.1. Tree lined roads as cultural heritage

Undoubtedly, the most widely appreciated role of lines of trees is their use on the margins of roads and pathways, although today it is difficult to find roads which retain lines of trees along much of their route or on both sides of the roadway. Lines of trees were included as essential structural elements in the construction of networks of royal roads.

Their functions were wide-ranging. Firstly, they were used to mark the boundaries of public roads, protecting them from potentially becoming part of adjacent fields. In addition to this role, they were also used to protect the surface of the road and its users. The slow nature of the modes of travel of the time, horses, carts and travelling on foot, increased the duration of the journey, exposing travellers to all kinds of weather. Exposure to the sun and heat on long journeys which involved crossing plains and arable valleys, whose natural woodland had been removed, was significantly alleviated by these galleries.

Trees also offered good protection against the wind, and rain or hail, which, apart from being an unpleasant inconvenience, eroded the soil base of road surfaces.

In Spain, there was a significant development of tree-lined roads and paths. The climatic and environmental conditions of large parts of the country, and the protective properties against both the sun and the wind favoured the development of this type of road. Unfortunately however, only a few short isolated sections of the vast network of old roads has survived, and in some cases, the line of trees only remains on one of the margins, because the widening of the roadway made it necessary to cut down the trees on the other side.

This network of old roads has had to content with the demands of modernisation, which, during the mid 20th century was focussed mostly on the direct improvement and restructuring of the layouts of existing roads. The widths between the lines of trees were too

small, and the modifications of the layouts to adapt them to new more stringent geometrical requirements led to the widening of roadways and the subsequent occupation of their original margins.

Some of the longest and best preserved sections of tree lined roads are to be found in situations where the construction of new layouts for modern roads or dual carriageways has left the original roads for low levels of local traffic, allowing them to retain their original width and traditional features.

The networks of tree-lined roads are an important part of cultural heritage and should be considered in themselves as landscape resources of significant value. These roads, or their surviving sections, to be more precise, need to be listed, and established as priority objectives in road plans, which should include programmes for their preservation and maintenance.

In addition to the valuable heritage of normal tree-lined roads, the importance of what we could call «tree-lined entrances», found on the outskirts of numerous medium-sized towns and villages and on the driveways of large farmsteads, should be highlighted, alongside the galleries of cypresses which are commonly found on the roads to shrines and cemeteries. In this respect the lines of trees on the outskirts of towns and places of special interest seem to have fared better than those situated out on the open road.

These accesses have a more urban and recreational use. In many cases, access routes to larger cities have been reorganised using by-passes, often following new itineraries, so that the original road can assume a secondary role as a recreational space. The proliferation of isolated residential buildings on their margins has contributed to their transformation into tree-lined urban avenues, many of which have been planted over the past few decades.

The beauty of these impressive welcoming galleries outside towns and villages is much appreciated by both the local population and visitors.

Finally, we should mention the use of lines of trees as an ornamental feature on road margins in recent projects where wide ranging types of species are employed. Perennial species such as pines, cypresses and eucalyptus, are widely used on the margins of paths due to their rustic character. Various species of palm trees (*Phoenix canariensis*, *Phoenix dactylifera*) which have a clear ornamental role are also used on paths but are rare on the margins of roads, where it is more common to use shady deciduous species with broad leaves which fall during the winter, including plane trees (*Acer pseudoplatanus*), poplars (*Populus sp.*) and elms (*Ulmus sp.*), although these have suffered extensive damage from Dutch elm disease and have largely disappeared from public spaces. Chestnuts, both the native species from Spain (*Castanea sativa*), and those from the Indies (*Castanea indica*) are also commonly found, particularly in woodland areas, as are ash trees (*Fraxinus sp.*) which are a common sight on the margins of roads and paths.

6.6.2 Scenography and aesthetics of tree lines

Siting lines of trees on both sides of roads gives them a special scenic character which is associated with the way in which vertical repeated elements influence perspective, and their effect on the visual plane.

This is due in the first place to the important effect of depth generated by any series of objects of similar dimensions located on the vanishing line. The line of trees, especially of uniform shape in terms of separation distances, heights and volumes, thus acts as a descending geometrical reference which reinforces the sense of distance or depth.



Eucalyptus trees near Campillos (Málaga) on the sides of a disused road which runs through the countryside.

The strikingly linear effect of the road (which is examined in a different section of this book) is reinforced by this succession of vertical elements on its borders, which also delimit the views by forming a linear canal which directs our attention towards the road's destination. It is on this visual effect that the main attraction of tree lines is based.

Roads with wooded galleries have a distinctive internal scene of their own, whose special power of attraction is based on their easy legibility, i.e., on the fact that they facilitate the visual interpretation of the three dimensional space they create. This visually attractive quality is further enhanced by the organic and natural appearance of trees and the way their foliage gives shade to their immediate surroundings.

The siting of these organic reference points on the margins of the road thus enhances its legibility in terms of linear development, thereby reinforcing its orientation and visibility. Therefore, the presence of trees aids the reading of the orientation of the road layout, of its gradients and curves.

The three dimensional character is significantly more visible from inside the road by this simple visual combination of effects, which is increased by the speed of the vehicle as it passes through. This effect is also clearly visible from outside the road.

A relatively flat and longitudinal element such as a road seems to increase in volume thanks to the galleries of trees which project it vertically, making the route more visible. To appreciate how striking the effect is we only have to imagine how it would look like without the presence of the trees.

The scenic qualities created by lines of trees play an important part in the perception of motorists, and although paradoxically their removal has been justified for reasons associated with traffic safety, tree lines are an extremely useful resource in improving the legibility of a road.

As is the case with other landscape resources, lines of trees on the margins of roads warn motorists of changes in the layout, enhancing the visibility of the route ahead of them, and providing them with references in terms of scale, speed, and direction. The safety criteria which led to the rejection of lines of trees on the edges of roads during the second half of the 20th century were of a different nature and were applied essentially on older narrower roads.

The effect of the trees is particularly spectacular when they are displayed in their full glory, and fully developed branches and foliage reach their maximum size and volume. In such cases, the wooded galleries bear a striking resemblance to the typical riverside gallery forests as they lead to a particular town or village, or other road.

As is the case with other landscape resources with scenic qualities, the presence of trees in terms of their perception and appreciation by the observer is connected with their significant ornamental presence and evocative power and, of course, with the recognition of their evident ecological and environmental benefits.



Trees on the margins define the physical limits of the road's scenic space, making it more legible and giving it more of a sense of depth.

An especially attractive feature of areas landscaped with deciduous trees with broad leaves is their seasonal character and the significant transformations they go through throughout the year as they adapt to the changing climatic conditions. The dynamics of this change are spectacular for road users who never cease to be surprised by the seasonal transformations.

In general, lines of trees on the margins of roads create a strikingly scenic effect, when seen from both within the road and from outside, which enhances the legibility of the road space. Their impressive aesthetic effect is also much appreciated for its natural character, seasonal variations, and its cultural and idiosyncratic connotations. However, lines of trees have gradually disappeared from the sides of roads and been abandoned due to the functional limitations of their presence at the edges of the road.

6.6.3 Functionality, safety and design of roads with lines of trees

Despite the appealing landscape properties derived from their scenic, aesthetic and evocative qualities, the use of tree lines on road margins poses a series of problems in terms of functionality and safety. There is some confusion in this debate and it is important to look at two particular aspects:

- The extent to which it is possible to preserve old roads lined with trees;
- The potential uses and applications of tree lines on the margins of new roads.

The safety-related issues are certainly proven and not in doubt. The presence of large obstacles on the margins of a road tends to «shrink» the usable width of the roadway as a result of the containment effect perceived by motorists which makes them try to avoid

Holm Oaks on the A-8126. Trees on the margins can involve risks for vehicles that abandon the roadbed. In general, it is preferable to protect or warn vehicles rather than removing the trees.



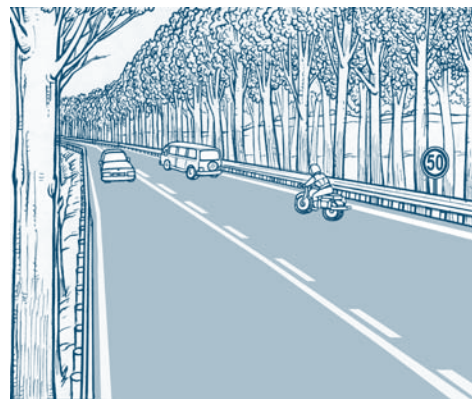
the object by moving the vehicle away from the object in question. This effect is far more dangerous when there is a succession of visually striking objects.

Furthermore, trees are particularly dangerous when an unexpected movement makes a vehicle lose control and leave the road, since they contain the thrust of the vehicle as it crashes into them, with a violence which increases the higher the driving speed and weight of the vehicle. As rigid isolated obstacles, trees do not help to redirect vehicles which are out of control back onto the road, as barriers do. On the contrary, they stop them completely, increasing the chance of the vehicle becoming embedded and increasing the seriousness of the accident.

The lack of physical references in the spaces between trees also increases the risk of accidents in cases where the car swerves, since there is no linear limit which the driver can use as a reference point to correct the direction of the vehicle in time.

All these factors suggest that it is the proximity of trees to the road, rather than the presence of the lines of trees as such, which is the real source of risk. The situation of danger arises when works are undertaken on a narrow tree-lined road in order to increase its design speed. In these cases, the presence of trees is an unavoidable limitation.

Measures like the installation of guard rails or parapets can solve the problem of lack of linear references on the road margins, although there must be sufficient width for their installation (generally on the edge of the roadway) and they will not eliminate the permanent presence of these large unmovable obstacles on road margins. Furthermore, although a collision against a vehicle restraining system causes an accident with more predictable and less serious consequences than might otherwise have been the case, this obviously does not mean that there is no risk at all for the occupants of the vehicle.



The risks involving in crashing against trees on the sides of roads should not lead to them being cut down. It is preferable to redefine the functionality of the road in question or install suitable safety measures.

It is thus obvious that any schemes to retain these old trees by the side of roads must involve the renouncing of high speeds. Speed and capacity limitations, as well as the necessary signs, are therefore inextricably linked to their preservation.

In cases where the increase in capacity and speed is imperative, it is always possible to study the opportunity of introducing new layouts which avoid the use of an existing tree-lined route, perhaps changing its functionality to that of a scenic route with a semi-pedestrianised path, to maximise the way it can be appreciated and enjoyed. Although the efficiency of the solutions will depend on the specific conditions of each particular case, a possible alternative would be to separate the carriageways, using the existing tree-lined road for a single direction, and constructing a completely new one for the other direction on the other side of the line of trees.

If the requirements concerning their functionality are adhered to, tree-lined roads are acceptable solutions for semi-urban roads, low speed scenic routes, and short strategic sections which provide access to areas of special natural or historic character, where they can fulfil their functions more effectively.

The planting of trees along the margins of roads can also be efficiently adapted to safety requirements by maintaining minimum distances on the margins and incorporating these attractive landscape resources into the new contexts of modern road infrastructures.

In this respect, it is important to note the rules set out in the 7.1 IC standard concerning «Plantations in right-of-way areas of roads», which sets a minimum distance of 20 m between lines of well-developed trees and 16 m for medium-sized trees. The standard also specifies that the minimum length of the line of trees must be 500 metres, and that, to facilitate visibility at intersections, the end of the lines must not go beyond the stopping sight distance from the first point of conflict.



The presence of trees on the margins allows the development of more complex landscape elements such as pedestrian pathways next to the road.

In terms of their transversal location, the regulations establish that lines of trees will not be sited less than half a metre from the external edge of the ditch which corresponds to the theoretical section of the road, although other lower limits are possible depending on the speed and average of daily volume of the road.

6.7 Landmarks of interest on road margins

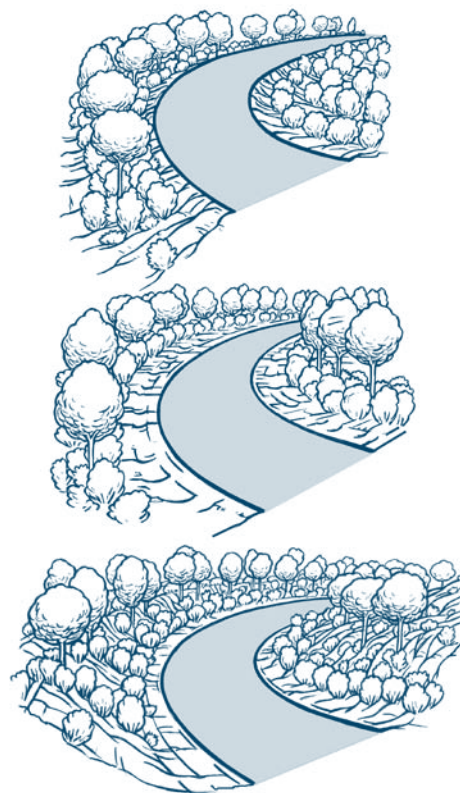
The margins of roads contain special features of historic, ethnographic, artistic or cultural interest which are associated with the context of the road, the journey, or simply with the surrounding environment.

Houses of former road workers, old taverns, bridges on decommissioned sections of roads, shrines, disused service stations, old signs, guesthouses and inns, fountains, crosses, ornamental gates, watchtowers, etc. are all elements which are part of the cultural heritage of roads and have an important scenic value.

Additionally, the presence of other traditional rural and urban elements such as old walls, ancient trees, enclosures and fencing, gateways, doors, railings and entrances of farmsteads near to the road also offer presence and significance. Equally significant are the range of archaeological features of various types on the margins, which complement this varied range of physical heritage elements.

Cultural resources of a more intangible nature, such as pilgrimage routes, sites where traditional celebrations take place, or historic routes are also intrinsically linked to roads.

Road plans must cater for the need to regulate the harmonious coexistence of this heterogeneous range of heritage features, both in existing road networks and in sections where upgrade or new road works are being planned. Development schemes for new roads



Trees should be selectively located on the road margins by integrating them into the safety and visibility conditions of the cross section. On bends with embankments (1), it is better to plant low level bushes rather than trees on the inner side of the bend, in order to avoid visibility problems and reduce the seriousness of accidents if vehicles do crash off the road. At grade (2), trees can be set a certain distance from the platform, making the section more versatile and isolating carriageways, whereas in sections with cuttings(3), taller trees should be planted at the top, with smaller bushes on the lower parts of the slopes.

and upgrade projects (adaptation and layout improvement works, restructuration of routes, increase in capacity, etc.) need to efficiently manage the coexistence of the road with these valuable and interesting cultural and historic landmarks. Features of special interest which are to be found next to the margins of roads are not only valuable in themselves, in historic, artistic or socio-cultural terms, but are also of great importance in terms of our capacity to interpret the surrounding landscape.



Cemetery in Almonaster la Real, next to the HU-805. The road solves the question of access to this special element of social heritage by having an adequate intermediate area.

Thus, the significance of these landmarks is based on the subtle relationship they have with their landscape, and to preserve their value, it is not only essential to maintain their physical presence, but also to safeguard their relationship with the landscape and their special interaction with the road. On occasions, a road can affect the physical preservation of these elements, impeding their use and the extent to which they can be enjoyed or, of



Gothic gate of the old convent of the Order of the Poor Clares in Cumbres Mayores (Huelva), next to the A-5300. Simple posts separate pedestrians from traffic and protect the heritage site from risk of accident.



Roman bridge over the river El Burgo, in the village of the same name, (Málaga).

course, transforming their relationship with the landscape and its structures. On the other hand, the road can also actually contribute to their physical preservation and protection, aiding their use and the way they can be enjoyed, whilst reinforcing their relationship with the landscape. It all depends on the way in which the road, the traffic, and all the related elements interact with heritage features and their uses and relationships.

As with the preservation of other cultural heritage features, the issue here is that the landscape of «modern roads» is not always able to maintain the functions which originally gave rise to the place of interest in the past, since geographical, cultural and functional conditions may have changed radically, even if some of their causes and mechanisms have survived.

The level of service and conditions required by modern roads necessitate specific types of roadways, layouts, embankments and access cuttings, and these can sometimes be

incompatible with the conservation of heritage values. However, a positive approach can find compatible solutions and compromises between the new contexts and the presence of elements of interest, between the level of service and the type of functionality of the new road, and between the respect for conservation, and the use and appreciation of these cultural landmarks.

6.7.1 Coexistence of cultural heritage and roads

This is a far reaching problem which not only involves the need to guarantee an appropriate coexistence between the road and the cultural elements which are near to it. These resources have different characteristics and conditions and, as such, they interact with both the landscape and the road in very different ways. On the sides of roads it is common to find cultural elements associated with the functions of the old pathway, which has evolved into a road but still retains some of its original features. Old signposts, historic bridges and a wide range of cultural landmarks enhance roads with their presence. The significance of the cultural features which can be found along roads is based on their roles as reminders of abandoned cultural patterns, and peoples' capacity (road users included) to appreciate them.

The examples of relationships between roads and historical relics are numerous and varied. New roads, i.e., paths which have been adapted to cater for the requirements of motorised traffic, are often forcibly integrated into large-scale heritage features or sites with basic traditional functions from the past. There are numerous processes which have led to this coexistence, including for example, the building of new roads in the centre or outskirts of historical towns, the reutilisation of original infrastructures and historical



The recently built shrine to Nuestra Señora de Fátima on the A-5300, outside the village of Cañaveral de León (Huelva).

features which have been assigned new functions (and pressures), or simply the natural evolution of historic routes which have been converted into major territorial or urban routes of communication.

Even more fragile and complex is the coexistence between the functions of the road and the preservation of intangible aspects of cultural heritage associated with places of special significance or popular appeal, or specific routes. In these cases, the road and its functional elements are incorporated into processes of social interaction which are extremely fragile, which can be destroyed, unaltered or in some cases, even revived by a new road scheme. Pilgrimages and traditional celebrations are just some of the numerous examples of this type of coexistence.

Road projects must consider the need to incorporate and preserve these heritage resources as an essential part of their functionality, and often the best solution is to find a new physical and functional model which meets all the requirements and functionalities at stake. The preservation of heritage requires that a new role is found for these structures which fall into disuse, so that they have a part to play in the new context.

6.7.2 Intervention criteria

It is difficult to make generalised recommendations in terms of avoiding damaging these cultural landmarks, whilst guaranteeing their harmonious coexistence with the road because of the wide variety of different specific situations involved, but in general, the less significant the heritage feature, the greater its flexibility and potential. In fact, the inclusion of small local heritage features in a road project is an effective resource for enhancing its quality and character, reinforcing its collective value. The presence of trees with a special or historic character, or traditional stone walls, terraced cultivation land and other agrarian structures, as well as buildings with traditional architectural features, milestones, and numerous other distinctive features, can be incorporated into the landscape of the road simply by using common sense.

The essential recommendation is to make a positive use of these resources by efficiently incorporating them into the road project and its environment. This does not only entail the preservation of the heritage feature itself, but also requires a positive solution for the environments where the particular historic, cultural, or idiosyncratic elements are situated. The main question is how to achieve this.

It is therefore important to make an initial assessment of all the values at stake and their various facets, to form a clearer idea of how to take maximum advantage of the circumstances and possibilities of each specific context. The analysis of solutions to preserve the cultural values of each different situation is essentially the same as any other aspect of road engineering, be it geotechnical stability, hydrological viability or the overall functionality of the layout.

In a positive sense, we would thus say that the solution lies in adopting an approach which solves the design requirements of the road, in terms of its layout, orientation and



Information point on the A-475 near La Puebla de Guzman (Huelva) describing the pilgrimage of the Virgen de la Peña, declared an event of Andalusian tourist and ethnological interest.

essential elements (embankments and cuttings, signs, barriers, etc.) whilst at the same time fully appreciating its surrounding cultural features. In this respect, it is important that road projects recognise the value of cultural landmarks and their environment as well as the various elements of this value and how it can be potentially used.

The procedural recommendations for each specific case include the stages described below:

- Identification and characterisation of the heritage features associated with the road.
- Diagnosis of the value of the heritage features.
- Definition of objectives for the preservation and use of the heritage assets associated with the road and the surrounding landscape.
- Design to adapt the functionality of the road to the targets concerning preservation and use.
- Use and preservation of the heritage features adjacent to the road and their landscape function.

The first step to be taken in any intervention should be the identification of the heritage assets associated with the road. However, some heritage features require specific studies for their identification and characterisation. This is particularly the case with archaeological sites, whose study and evaluation poses numerous difficulties, but intangible heritage features, whose characterisation depends on the way the community understands and perceives them are also complicated, particularly in terms of their landscape value, i.e., on the capacity for interpretation of territorial structures which have a non-specific heritage character and the aspects which sustain them. The spatial relationship between two related historic features and their role in large-scale geographical structures, or their relative situation, are aspects

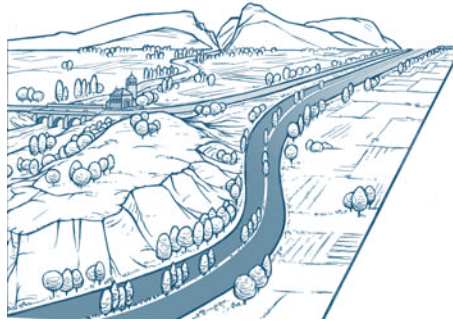
which can be damaged by the presence of a road and should therefore be properly identified so as to guarantee their preservation.

The first step in terms of establishing the needs of heritage features is a diagnosis of their value, which can then be used as a basis to determine the functionality which the road must assume. If their essential value depends on the physical preservation of the element in question, its proximity to a geographical feature, its potential use, the quality of the surrounding environment, or any other related aspect, the road and its elements must assume these requirements as part of its intrinsic function.

The objectives for the conservation and use of heritage with respect to both the road and the surrounding landscape closely define the framework for the coexistence between road and heritage. A road can enhance access to a heritage site, or impede it, if this is deemed necessary for the established targets of conservation and use. To this aim, it is necessary to consider noise emissions and the risk of accidents by adopting measures which are viable for the target traffic level, or simply by developing an area which offers a suitable, progressive transition between the roadway and the heritage feature.

The design for the adaption of the functionality of the road to the objectives of conservation and use defines the elements which are to be constructed or restructured. Thus, actions such as the relocation of the roadway, the replacement of a slope with a retaining wall, the lateral isolation of the margins, or the construction of a parking area, should be planned on the basis of positive, functional, and efficient criteria.

Finally, it is important to highlight the essential role of road signs in providing access to the content of the landscape by giving travellers information about the places of historic or artistic interest which are adjacent to the road. Nevertheless, the presence of signs must be



The layout of the route and the design of the cross sections should consider the need for a proper coexistence between the road and the surrounding elements of cultural heritage, guaranteeing both the feasibility of isolation and its environmental quality.

justified by the special nature of the places about which they offer information (heritage sites, places of cultural interest, historical sites etc.) and conform to the principles of hierarchical order, continuity, and legibility which are characteristic of road signs in general.

The conservation and use of heritage features on the sides of roads, combined with their landscape function, is precisely what guarantees the continuity and improvement of this coexistence.

6.8 View points

A panoramic view point is a pedestrian area situated on the side of the road or linked to it, which has been specially designed for the contemplation of the surrounding landscape.

The essential function of view points is to provide a facility for the contemplation and appreciation of the landscape, and in some cases include facilities for its interpretation. View points complement the perception of the landscape which travellers see from their cars by offering different conditions for its appreciation. View points also have a strategic role since they offer selected views and provide an opportunity to improve travellers' understanding and awareness of the values of the landscape they are travelling through, as well as its processes and structures.

Often other areas situated on the margins of roads fulfil the function of view points, even if they have not been purposely built for this role. Examples are numerous and typically



View point on the A-5052 overlooking the Laguna del Portil nature reserve in Cartaya.

include rest areas, service stations, park and ride facilities, and in general, any space next to the road which offers travellers the possibility of enjoying the views by leaving their vehicles.

Recommendations for the design of view points include the following:

- Location of view points.
- View points and roads.
- View point facilities.



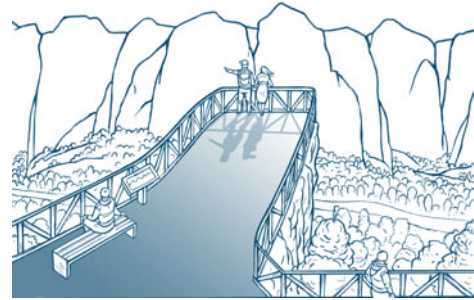
A view point should be located where the best sights can be obtained, either in terms of the scenic broadness, the attractiveness of the area, or the particular features (nature, culture). It should be positioned higher than its immediate surroundings.

6.8.1 Location of view points

The siting of a view point must respond to the coincidence of scenic and road-related criteria, i.e., they must be sited in a place which allows adequate and interesting contemplation of the surrounding landscape whilst guaranteeing minimum safety conditions both for vehicles, and for the people moving around both the road and the view point itself.

View points must be conceived for their landscape function, i.e., their location must be strategic in scenic terms. A good viewing point is one that encompasses a landscape of interest and whose value is based on the breadth and range of the views it offers, the objective values of the area, the obtained degree of appreciation and interpretation of the landscape, or an effective combination of several of these aspects.

The most suitable location for a view point is one that occupies a central place in the scene of the landscape, and is situated at an appropriate relative height with respect to the scenery, with no large obstacles which may impede the continuity of the views. The visual scope of view points can be anything from 360° , offering all round views (tower-like elevations), to much tighter angles (only 60°). View points with less than 180° have better or worse viewing times depending on their orientation and the position of the sun. In the northern hemisphere, view points facing north offer the best views whereas those facing south have to contend with visibility problems, particularly during the winter, when the position of the sun is lower. In the morning better views are to be had to the west, and in the afternoon to the east.



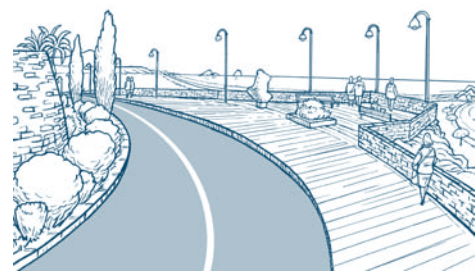
Top. The shape and location of the observation area defines the extent and nature of the available views. As such, the morphology of the surrounding area is a key element in maximising the view point and its possibilities.



Left and opposite page. View point on the HU-8105 in Almonaster la Real, (Huelva).

Left. Location with regard to the road.
Right. Views from the vantage point and elements of furniture.





Above. The space chosen for a view point has to have a combination of conditions including potential views, relationship with the road and enough space for safe access and insulation.

Left. View point on the HU-8105 in Almonaster la Real (Huelva) and its position with respect to the road.

There is also a visual effect which can vertically distort the views caused by the solid angle formed by the profile of the terrain as seen from the view point, so that a high view point does not, for instance permit good views over a deep, enclosed valley.

It is the same with view points situated at the foot of a high vertical hillside, (with a very small solid angle), whereas a view point situated on a medium-height hill overlooking a broad open valley will provide a very accurate view (broad solid angle).

Roads which are built into the side of a hill, or are situated at the highest point of a plateau, or those which follow coastal routes, tend to have a range of sites which make good view points. Roads with an urban character, or those which follow the bottom of a valley or areas of woodland, rarely have locations on their margins which are suitable for view points, although there may be other suitable sites nearby (see below).



Certain areas which are situated near to the sides of roads, such as the space between a road and the banks of a river, wooded areas, groups of houses, historic buildings, walks, and bridge abutments fulfil an interesting and rich landscape function because they offer travellers the possibility to leave their cars and establish a direct and satisfying interaction with the landscape. They cannot however, be regarded as view points as such, because they are not planned with this the specific scenic function in mind.

View point on the A-8126. Covers a large surface but is not structured in any way in terms of access, parking or specific viewing areas.

6.8.2 The view point and the road

View points must be conceived as facilities which are adjacent to the road and this necessarily implies a series of minimum accessibility and safety requirements. Access to the view point must be possible from both sides of the road and must offer good visibility from both directions whilst being wide enough for manoeuvring easily (see access points to roadside areas).

There must also be enough space for vehicles to park without compromising basic safety requirements. Apart from the access points, the actual view points themselves should be isolated from the road as much as possible so as to prevent people using the facilities from invading the road, whilst at the same time preventing cars circulating on the road from invading the view point. This isolation or separation of pedestrians can be achieved by using an appropriate design and organisation of the facilities and/or by installing barriers or obstacles.

View points need not necessarily be sited in areas which are adjacent to the road and in fact there are some that are situated further away, although in practice they tend to be fairly close to it. Those that are further away have access points from the road, and then normally a track for cars or pedestrians which leads to the view point itself. In these cases the parking area may be situated either next to the access area, at some point on the track, or at the view point itself.

The siting of a viewing point must efficiently combine the safety and landscape quality criteria mentioned earlier, although safety considerations must always be made a priority. The conditions of landscape quality are not necessarily the be all and end all, since it is always possible to take advantage of the potential scenic, objective, and perceptual resources which can be found to a greater or lesser extent in any location within a landscape.

The general approach must be thus based on a comprehensive understanding of the safety and landscape conditions which can make the best possible use of the characteristics of the road and its margins. In fact, many areas which are adjacent or close to a road can be effectively used as view points (old spoil sites, quarries, ancillary construction sites, disused sections of road), including even more functional facilities (service stations, rest areas, etc.) if appropriate viewing facilities are designed. Thus, the undertaking of works to upgrade, adapt or widen the layout of a road, or to construct a new one, offers designers a good opportunity to incorporate one or several view points into a project. In this respect, it should be born in mind that all landscapes, even those that are apparently characterless and degraded, are intrinsically valuable if efforts are made to enhance, explain, and exhibit their values in an appropriate way.

6.8.3 Facilities of a view point

Although view points tend to be relatively small, they should include a series of facilities and features which cater for the specific functions they fulfil including access, parking, stay and landscape viewing site. Thus, a view point should be equipped with the following:

- Signposts associated with the view point
- Suitable access from the road to the parking area
- A car park
- Suitable access from the parking area back to the road
- Road markings associated with the view point
- Viewing area
- Protective handrail
- Instruments for the interpretation of the landscape
- Furniture for the viewing area

Signposts associated with the view point. The presence of a view point next to the road must be properly indicated with sufficient anticipation by signs on the margins of the road. Logically, the siting and content of the signs must conform to the applicable standards concerning the distance from the access point (generally 100 or 150 metres) and the hierarchical way the information is set out (bearing in mind that information about road conditions or nearby centres of population might take priority).

Ideally the signposts for view points should provide the following information:

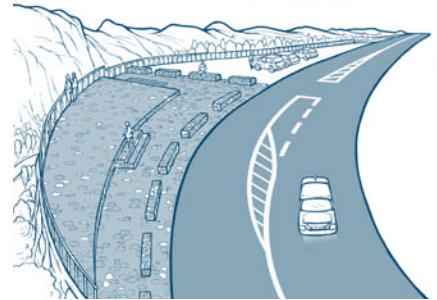
- Distance to the access point
- Whether the access to the view point is situated on the left or right hand side of the road
- The name of the view point, if applicable, and
- The most suitable viewing times (morning view point, afternoon view point, night view point, etc.).

In cases where turning to the left (in a right-side driving country) is not viable in terms of road safety limitations (visibility, manoeuvrability, lack of turnaround, etc.) it is best not to indicate the presence of the view point to traffic on that side of the road, and install the signs only on the right hand side.

Suitable access from the road to the parking area. The most suitable way to access a parking area from the road itself is via an exit or deceleration lane which is long enough to permit the progressive transition from the specific speed of the road to the lower speed required to enter the view point.

In situations where there is insufficient length to install a deceleration lane, the problem may be partially solved if the view point is situated on a straight section of road, or one with an open curve, which offers the necessary visibility to permit progressive deceleration, and always with a low speed limit.

Although their importance is often overlooked, car parks are a key element in the organisation of view points, due to their implications for safety, capacity, and the character they may give to the viewing facilities as a whole.



Access to a view point should be possible from both directions for traffic. The access area and space for parking should be separated from the viewing area with either a connecting pedestrian track, a slope with steps, or simply an intermediate area. If they are adjoining, vehicles should be separated using discreet elements (kerbs, low walls) which do not compromise ease of manoeuvrability.



It is quite common to find areas which are used as alternative parking when the spaces available in the view point itself are full (normally on both margins of the road, with the consequent risk for pedestrians and vehicles). In terms of solving this problem, the recommendation is to provide as much parking space as possible, although the essential nature of view points often means that limitations are inevitable.

Parking areas can act as an effective barrier between the environment of the roadway and the view point, providing additional safety and isolation for landscape contemplation. Normally, parking zones are located in the spaces which are adjacent to the entry and exit roads of the view point. These spaces should therefore have an appropriate size and be properly signposted. It is extremely dangerous to park in the entry or exit lanes of view points.

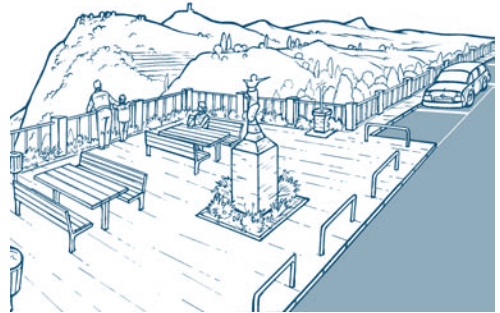
In view points situated further away from the roadway, which are connected via a service road or track, a wide variety of parking solutions are possible and in these cases the general recommendations outlined in the section dedicated to parking areas should be followed (see the section on parking areas).

View point of the Confederación Hidrográfica del Sur with views of the Guadalhorce Reservoir in the sierra of the Valle de Abdalajis. Different types of handrails.

It is important that parking spaces are well designed and that all traffic movement is adequately organised both internally, and in relation to their access points, independently of their size. Well structured lanes, parking zones, and signs should be used to regulate the movement of vehicles both near to the road, and in the view point itself, particularly at peak times (weekend, morning, evening) to avoid negative safety repercussions for both the road and for pedestrians walking around the view point. An efficient organisation of the actual parking spaces themselves is necessary at small view points, but is also fundamental in both those with ample space for vehicles, and those which are situated further away from the roadway, where vehicle movement tends to be greater.

Suitable access from the parking area back to the road. As is the case with the entry, the most suitable way of leaving the parking area and returning to the main road is via an acceleration lane with sufficient length to permit progressive incorporation into the road. The lack of sufficient length for an acceleration lane can be partially solved if the view point is sited on a section which offers enough visibility to allow vehicles to perform the manoeuvres required for progressive acceleration and safe incorporation onto the road.

Road markings associated with the view point. Road markings must be used along the whole length of the entry and exit lanes of view points, so as to permit an organised and harmonious coexistence between these manoeuvres and the normal movement of the rest of the traffic on the road.



It is also important to avoid left turns (in a right-side driving country) on both entering and exiting view points by using solid white lines in the middle of the road. Broken white lines should only be used where there is sufficient visibility, low volume of traffic, or low average speeds (see section 6.6.1 on access points to roadside areas).

Left. Interpretation panel about the Flecha del Rompido (Huelva) next to the A-5052.

Right. The inner elements of the view point should be properly planned and include: 1. road access and parking area; 2. if there is enough space, an inner zone with items of furniture (waste bins, benches, lighting, fountains, decoration); and 3. Viewing area (hand rails, explanatory panels).

Viewing area. The organisation of the actual viewing area must always be based on the objective of maximising the use of the space available in each particular situation, but in general the following recommendations can be applied:

- The spaces which are parallel to the road can be effectively used as access points on each side, with a parking area in the middle. When these spaces are smaller, their role as access slip roads and parking areas is obviously more limited but this does not preclude the need to structure them appropriately;

- The space close to the edge of the view point must be specifically designed and designated as a viewing area by introducing the necessary furniture, either in the form of interpretation panels, or, in some cases, seats and benches, which must not be very high so as not to disrupt the views;
- Intermediate spaces can be used to develop a rest or leisure area with gardens, seats, lighting and rubbish containers.

Some viewing facilities take full advantage of vertical layouts by developing terraced viewing areas on different levels equipped with stairs and access points which enhance the effect of the views.

Others incorporate buildings integrated into the hillside, generally in the form of commercial outlets (shops, bars, restaurants, etc.) with outdoor terraces, which are situated at the same level as the roadway, and act as view points.

Many include gently terraced spaces which structure the areas close to the edge of the view point. Others feature sculptures, gardens, monuments or simply landmarks which, together with other elements of urban furniture, give the view point the character of a more general public space.

Although view points are generally conceived for the contemplation of the surrounding landscape in broad daylight, some offer interesting night views (urban, rural or mixed landscapes whose special lighting makes them particularly attractive). Lighting in these facilities is important since a view point can also provide other services to motorists.

Lighting must be suitably arranged so as to avoid «obscuring» views, for instance, of the night sky, or blinding users using the main road, access lanes and parking areas. The use of ground, downward facing, low level or peripheric lighting is recommended in view points.



Information panel on the A-336: explanations on a picture of the landscape, interpreting the Sierra de las Nieves (Málaga).

Protective handrail. The design of the protective handrail is important because it frames the views of the landscape, delimits the position of the observer, and acts as a safety element. The key aspects concerning the design of handrails are as follows:

- Its height
- Its location with respect to the edge
- Its transparency
- Its longitudinal development
- Its style
- Its solidity.

The protective handrail of a view point must never be higher than 1.5 metres, since this would limit the views of the landscape, although, as we shall see below, it can feature high vertical elements, provided they are thin and there is plenty of space between them.

Some view points include extremely low barriers, hardly measuring 30 centimetres (and some do not even have a barrier) which enhance the quality for the observer by having very little effect on the view. In these cases the drop of the terrain must have a clear definition, and access to the edge must be limited (if the platform of the viewing point ends suddenly, or the terrain is arranged in steps, etc.) unless the space has no obvious risks (no steps or steep drops nearby).

The siting of the barrier must avoid empty spaces being left between the barrier itself and the edge of the step or promontory on which the view point stands so as to prevent people from accessing this unprotected space. It is important in this sense that the handrail is sufficiently long to cover the whole width of the space designated for the facilities of the



Elements for shade, protection against the wind, and bio climatic designs in general, are very welcome at view points, because they improve their quality and encourage their use.



The design of the outer border of the view point defines the frame and the visual and scenic relationship which viewers have with the landscape.

view point, regardless of the conditions of visibility of the lateral spaces, so as to prevent users from accessing any dangerous areas beyond the view point.

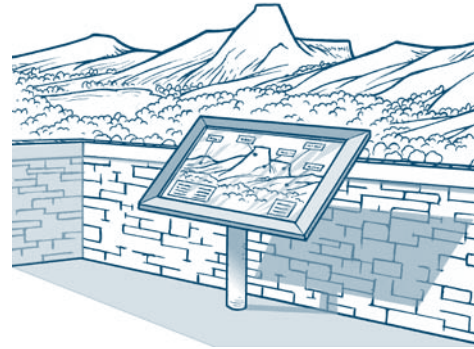
Some barriers are completely opaque (stone or brick walls, concrete barriers, wooden panels, plantpots) and are much more imposing. However, they may be used deliberately to raise the line of vision of the observer and to conceal lower points which are not of interest for any number of reasons. Others can be more or less transparent like balustrades or fences with vertical elements connected by upper and lower bars or simply by a single upper banister. Transparency reduces the presence of barriers whilst still providing a certain degree of safety and preventing small children and animals from going near the edge.

Some barriers feature a homogeneous longitudinal design with elements which are repeated regularly (metal supports), while others use larger regular elements (a pillar every 3 metres and wooden beams for example), or more random and varied sequences (wave shaped walls), and as such, the range of possibilities is immense. There are more discreet barriers using simpler arrangements whereas others use more complex patterns increasing their presence and highlighting the differences between the distant views and the space of the view point itself.

The same is true for the styles of barriers. Thus, while some are extremely simple, with pure, light shapes and uniform materials, others incorporate more elaborate designs which combine complex shapes and different kinds of materials, adopting, in some cases,

picturesque styles and forms. The first type is almost imperceptible whereas the second is more noticeable, requiring a different treatment in each viewing point and landscape. In this respect, it is important that the viewing point adopts a distinctive style of its own which is compatible with the character of its landscape. The recommendations given for rest of the furniture of the viewing point are also valid for the protective barrier.

Finally, there is the question of the solidity of the barrier, which refers basically to its width and resistance. Some narrow barriers are specifically designed to fulfil a preventive function, but in others, width is increased with the incorporation of low supports, terraced walls, observatories, information panels, and even concrete benches. The first type are transparent and fit well into smaller view points, whereas the second type more successfully develop the role of community space and standing area by resembling public promenades.



A view point is an opportunity to provide an interpretation of the landscape, from a simple presentation of place names to the explanation of complex processes.

Instruments for the interpretation of the landscape. Not all view points include fixed elements for the interpretation of the landscape, leaving it to the expectations and the understanding of the traveller. Landscape viewing offers an ideal opportunity to make travellers more aware of the area they are passing through, in terms of its more valuable assets or problems, and this is the real value of these interpretation systems. Interpretation instruments consist mainly of information panels which contain different degrees of explanation, and can be classified into three different types according to the level of information they provide:

- Maps of the environment of the view point;
- Images or diagrams which reproduce the views and explain them;
- Diagrams and pictures which interpret the elements, characteristics, and processes of the landscape.

Some systems simply include panels with maps of the area which surrounds the view point, and highlights the main features or characteristics of the landscape. Although this type of objective information requires a certain degree of spatial abstraction to be able to interpret the location of each feature, it tends to be popular with travellers who have an interest in understanding the dimensions of the route, and finding out where the most popular landmarks are located, etc. It would be true to say therefore, that these systems provide an adequate level of introductory information about a place.

The criteria of style and representation are also important aspects in the design of cartographic panels, some of which reproduce themed maps, whereas others feature more simplified diagrams of itineraries, landmarks, and features in the landscape.

Panels which reproduce the views which can be seen from the view point by representing them in a diagram provide an intermediate level of interpretation. In some cases these may represent only the shape of the horizon with the name of peaks and mountains, whereas others include a more realistic and detailed representation, highlighting some details, historic sites, itineraries, and place names, with a more varied and comprehensive interpretation.

Many maximise their visual effect by situating the graphic panel in line with the scene they wish to interpret, and some even use a transparent panel with diagrams and explanations which overlays the real view.

The different styles and forms of interpretation panels vary widely, and can include ceramic, metal, or plastic structures. The siting and format also vary (walls, paved surfaces, posters, etc.) as does their location within the view point.

The third type is represented by panels which are generally set out in groups or form part of a more comprehensive interpretation centre and offer a more detailed analysis of

the landscape and its processes. The information provided at this level does not necessarily correspond to the views that we actually see, although it is connected to the individual elements and processes. Thus, this type of panel may include graphical representations of the area's flora and fauna, architectural features, or landform characteristics, which may be visible in the landscape, but are not depicted in the interpretative element exactly as we see them. These types of panels are more common in centres for the interpretation of cultural or natural heritage, and are also often found on itineraries which pass through areas of special interest, such as natural parks or the historic centres of towns and villages.

As with other elements of interpretation, it is important to adopt a certain museum-like strategy which should be identified in the following terms:

- The main targets for interpretation (basically identifying the main elements and processes which are to be highlighted in the landscape);
- The way in which appreciation and perception of the landscape is managed (making the best use of the most attractive views and their relationship with the explanations);
- A linear and cohesive interpretative approach in all the proposed locations for its implementation (within a view point itself, or in the various view points to be found along a particular stretch of road, if applicable).

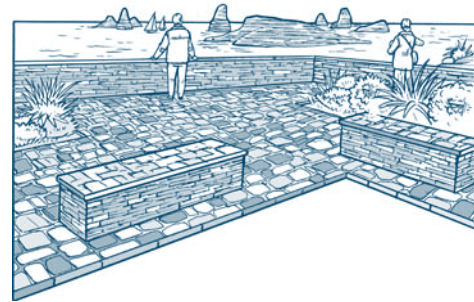
A fourth group would be one that combines the interpretation of views with the explanation of the processes and features of the landscape, although in reality this could in fact be considered to be a subgroup of the other three groups.

Furniture for the viewing area. The general recommendation, particularly in the case of smaller view points, is to equip them with a small number of isolated items of furniture so as to keep their presence to a minimum, whilst using, where possible, a series of multifunctional elements (such as bench-barriers, panel-barriers, etc.). The range of possible items of furniture is wide and varied and includes benches, lampposts, interpretation panels, rubbish containers (paper bins and others), landscaped areas and hedgerows, plant pots, and shade providing structures (pergolas, wooded areas).

The location and amount of these elements must respond to the specific conditions of the facility, reserving the space next to the protective barrier exclusively for viewing the landscape. In lateral or central zones standing areas can be established which do not impede people's access and movement.

All the elements must have a homogenous style, incorporating, where possible, character enhancing features which are typical of the area, such as traditional stone walls, or local species of trees. Although more distinctive styles can also be adopted, the most suitable are those which are discreet and have a less imposing presence.

Picturesque elements can be popular and are often used despite the somewhat over-imposing effect of their striking designs. Some view points incorporate works of art, monuments dedicated to famous personalities, or elements which represent typical traditions of the area or the view point itself. These features have a presence of their own and therefore the surroundings of the space where they are situated must be appropriately adapted without detracting from the organisation of the view point as a whole. In some cases, the elements of the view point adopt a style which is coordinated with other elements of the road, helping to enhance its character, independently of whether it is integrated into the character of



The constructed elements and furniture of view points are what give these lateral areas their character. They may use reference features of the viewed landscape, of the surrounding area, or simply create their own character.

the landscape it goes through and the scenery which can be seen from the view point. This is especially recommended when several view points are planned for the same road.

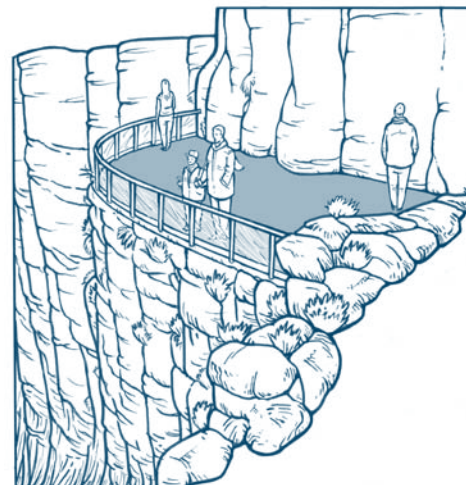
6.9 Roadside footpaths

The roadside paths described here are pedestrian pathways on the margins of roads whose aim is to develop the landscape potential of a route, by providing it with a pedestrian area which is as comfortable as possible for the user.

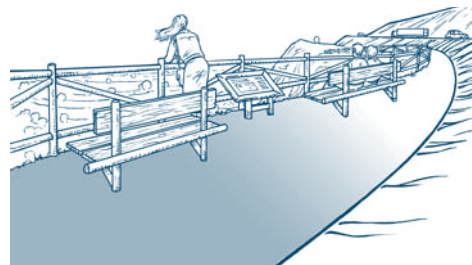
There are a wide range of paths conceived for the enjoyment of the landscape including, for example, those incorporated into areas of special interest, natural parks, gardens or urban parks, or historic centres of towns. However, although they may share a similar range of functions, properties and design features, none of these match the characteristics of the type of roadside footpath discussed in this section.

The installation of roadside footpath on the margins of scenic, periurban, or peripheral roads, or on roads with low traffic volume is a landscape resource of great significance. Roadside footpath improve the existing relationship between road and landscape in the sense that they offer better conditions for the appreciation of the landscape. This is because they provide a type of itinerary which can be used by pedestrians, where the contemplation of the landscape is more pleasing, relaxed and direct than the views obtained from inside a moving vehicle.

Roadside footpaths are also increasingly taking on an important public and social role in Spain, since the need for physical structures which permit people, particularly the elderly, to walk and exercise for therapeutic reasons, is growing consistently. Many municipalities in Spain are responding positively to this demand for public walkways, especially since



The structure of the view point and its various exterior elements should be carefully designed and discreet so as not to impose on the landscape.



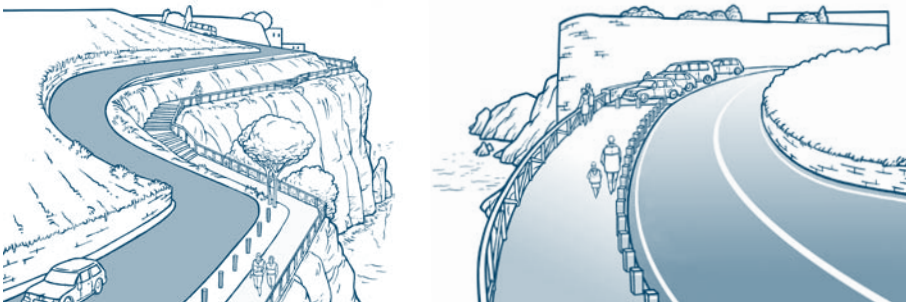
Roadside footpaths provide a gentler, more direct, and more profound relationship with the landscape than the road itself, encouraging a different attitude when walking, standing, or simply observing.

pedestrians should never walk on the margins of roads if it can be avoided. For this reason, it would be particularly useful to make the most of the scenic opportunities offered by roadside footpath by transforming them into healthy spaces which are specifically designed for the enjoyment of the landscape.

The main functions of a roadside footpath are:

- To develop the scenic potential of a road by giving users the opportunity to follow the same route on foot;
- To help to enhance the habitability of a road by catering to the demand for pedestrian space on its borders.

The second function is often exclusively fulfilled by paths constructed along roads in semi-urban or intermediate areas which are not necessarily associated with other types of scenic routes (coastal, ecological, cultural, etc.). In these cases, the roadside footpath re-evaluates the typical landscape of the road, making it more accessible, and enhancing its quality and essential characteristics. For the footpaths which fulfil the first function the relationship between both routes, the road and the pedestrian path, and the view of the landscape is fundamental. In fact, roadside footpaths become linear view points on the margins of roads which permit the viewing



Left. The development of a lateral pathway can benefit the landscape of a road by providing a more relaxed route on its margins which takes advantage of its scenic quality.

Right. A roadside pathway should begin at the edge of an urban area or in a parking area which allows motorists to leave their vehicles and enjoy a stroll.

of the landscape beyond. Therefore, where possible, it is advisable to include view points with stopping and resting facilities for pedestrians at the most strategic points of these paths.

As was mentioned earlier, roadside footpaths can also be conceived exclusively for the purpose of enhancing the habitability of the road by encouraging pedestrian use. This objective is typical of urban or periurban areas where demand for pedestrian use is high and roads tend to be exclusively designed to cater for the needs of traffic. In fact the planning of footpaths in such areas is more complex because they need to interact simultaneously with the functions of both highways and streets which are typical of these mixed corridors.

Below we examine the following aspects concerning roadside footpaths:

- Landscape viewing from a roadside footpath.
- The footpath as a scenic route.
- Elements of a roadside footpath.
- The footpath/road relationship.
- Other determining factors for the design of roadside footpaths.

6.9.1 Landscape viewing from a roadside footpath

Walking permits access to more environmentally fragile zones including certain built-up areas, the historic centres of towns and cities, areas of difficult topography, or places with landscape potential. The essential character of this type of pedestrian movement which is free from pressures of time saving, is defined by the special relationship of immersion and contact with the collective which is enacted in public spaces and services.

While the capacity of a road is mainly focused on maximising speed, saving time, and permitting large-scale transportation of goods and people, the capacity of a pedestrian route seeks to optimise an engagement with the surroundings in which the negative environmental impact is almost non-existent. Pedestrianisation invites the observer to enjoy the landscape in the best possible conditions of environmental quality and integration. Thus, the pedestrianisation of the margins of a road is in fact a combined formula which can cater for both types of capacity at the same time, so that the roadside footpath connects the road with the environment it goes through whilst segregating the two modes of travel, and allowing them to coexist without disrupting each other's rhythm or capacity. The main question therefore, is exactly how to organise these different forms of movement on the same road in a way that allows both options and their individual benefits to coexist, whilst minimising the interference between the two.

Footpaths are constructed next to a road with the aim of improving its habitability, by emulating the user-friendly and more relaxed atmosphere which is typical of some city streets. In these environments motorised traffic is permitted but is limited by their essential role of serving as public spaces for the enjoyment of the population as a whole. Although the conditions of pedestrianised areas in the centre of cities cannot be attained on roadside footpaths, it is possible to facilitate the enjoyment of the actual road and the landscape beyond. The way to do this is by reducing the interference of traffic as much as possible, whilst trying to establish a less aggressive coexistence between vehicles and the adjoining pedestrian space.

For all these reasons, lateral roadside footpaths must respond to an integrated treatment of the road, particularly in terms of the development of its cross section, which should be widened and diversified. This approach must take the following aspects into account:

- The conditions of the road, which should preferably be low capacity, with low levels of service, low average speed, and low traffic intensity;
- The conditions of the actual footpath, which should be safe and comfortable, with suitable facilities for walking;
- The relationship between the two linear elements, which needs to be one of harmonious coexistence.

Access points to interurban roads, especially on the entry sections to towns, and roads which go through landscapes of special interest within natural parks or scenic areas, or coastal roads, are particularly suitable for the incorporation of roadside footpaths, especially on itineraries with low traffic capacity and low speeds which offer good potential for interesting views.

Roads which incorporate a roadside footpath must share the same properties as slow or low capacity roads and ideally, they should have no heavy vehicle traffic, low or very low traffic density and low or very low average speed.

Below there are a number of recommendations for traffic calming measures, which should be applied when a roadside footpath or bicycle lane is being installed. If well separated, these elements can also coexist with high capacity roads.

6.9.2 The footpath as a scenic route

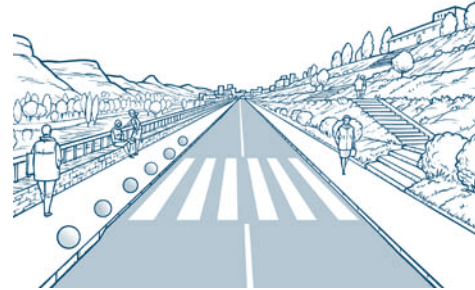
The conditions of roadside footpaths must be adapted to the fulfilment of their scenic function, by installing facilities for viewing the landscape and it is important that footpaths maintain an appropriate level of continuity. They should also be properly insulated from the traffic and wide enough to permit walking without disruption or risks.

Footpaths are thus conceived as a visual, scenic route which passes through a particular area of scenery and permit its appreciation. Their location on the margins tends to direct the views of walkers away from the road towards the exterior, as along the road itself in both driving directions.

Some scenic routes offer the opportunity of developing an interpretation of the surrounding landscape. This requires the implementation of an interpretation system which adopts the appropriate museum-based strategies (interpretation objectives, orientation for the reading of the surroundings, maximisation of the scenic quality of the route).

In this respect, it is important to bear in mind that the routes followed by roads are not arbitrary, but are the culmination of natural, cultural and geographical processes, which can be maximised in terms of the reading and interpretation of the landscape. A roadside footpath running alongside these routes provides a slower, more conscious pace of recognition and reading, whilst at the same time passing the different natural, historic, and geographical landmarks which give meaning to the adjacent road. The succession of views and landmarks permits the construction of a positive reading of the landscape which should not be ignored by the roadside footpath.

Continuity is the condition which gives meaning to the roadside footpath, and therefore, as well as maximising their landscape interest, efforts should be made to make these paths as long as possible. This is not however always an easy task since the process of achieving an unbroken linearity has to contend with numerous obstacles which need to be overcome. The width limitations which are common in roads with landscape value (in coastal, mountainous, or historic areas) are difficult to solve, especially in sections with cuttings, viaducts or which are supported by retaining walls. In these cases, a possible solution is to divert the path away from the road in the narrower sections and rejoin it further ahead.



Roadside footpaths must solve their continuity by providing crossings for pedestrians on straight and flat stretches with good visibility.



Pedestrian crossing on the A-5052, which connects Punta Umbria with El Rompido in the municipality of Cartaya (Huelva).

These partial «diversions» can actually add interest to the route because they permit the incorporation of areas whose environmental quality is actually greater than that offered by the margins of the road, so in these situations the width limitation can actually provide an opportunity for the improvement of the path.

The continuity of a roadside footpath must maintain a series of standard conditions, without losing its capacity to adapt to the specific conditions of each local section, both in terms of the roadway and the environment of its margins. Think of sections with bridges or tunnels, in areas of woodland, or inside towns, in which the conditions of the environment are different.

The itinerary of a roadside footpath can incorporate a number of areas for the contemplation of the landscape and these should be equipped with a full range of view point facilities wherever possible. In some observation points which are interesting because of their views, a small panel or a simple rest area are all that is needed for contemplation. In

general, it is recommended that the development of a roadside footpath takes full advantage of the whole route by using any possible public space or feature of special interest. Riversides, roadside footpaths on road bridges, rest areas, sections in which paths are separated from the road, and partial or complete view points, are all elements which must take advantage of the conditions of the route.

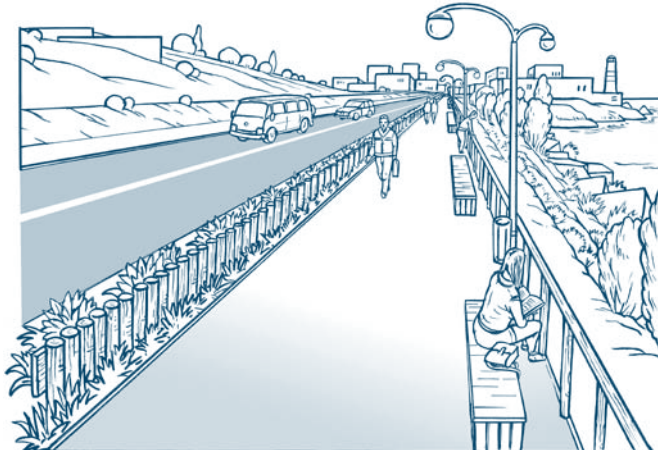
A problem in terms of the continuity of roadside foot paths is the crossing of roads at intersections and accesse. This can be solved by means of crosswalks, which must offer good visibility and be properly signalized (with traffic lights if necessary). Other aspects which need to be resolved include the coexistence with bicycle lanes, which run alongside or cross the roadside footpath at specific points, and bus or tram stops, which must be appropriately coordinated with the route of the roadside footpath, and interact with it in a mutually beneficial way. One of the greatest limitations of roadside footpaths is width since they must generally be incorporated into the margins of road platforms which already have significant width restrictions themselves. The widening of the margins can be attained by broadening the base of a cutting or the surface of the top of an embankment, sometimes using cantilevered platforms or supporting structures to attain the required width.

A minimum width of two and a half metres is recommended to ensure that pedestrians can move comfortably in both directions, although narrower paths are still common.

The effective space which can be used by pedestrians on a roadside footpath must have a certain degree of isolation, i.e., it must be separated from the edge of the road and enclosed on the other side by a series of barrier elements which should either be continuous or at least maintain a degree of regularity (see barriers below), so as to clearly delimit the path and its functional spaces.



Information panel describing a walking route which begins at the A-336 and makes use of an old livestock route which ends in Ronda.



The cross section of a lateral walkway should include the following aspects in its design: a system of separation from the road, a properly set out walking area, and a positive relationship with the landscape.

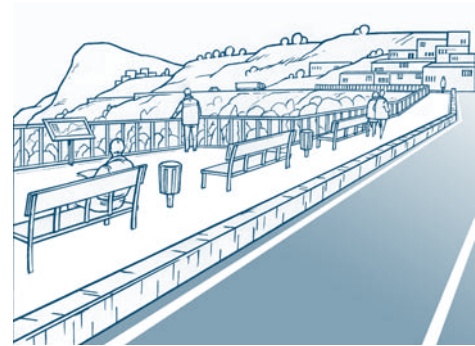
6.9.3 Elements of a roadside footpath

The elements of a roadside footpath can be grouped as follows:

- The external barrier (as opposed to the barrier used to isolate it from the roadway);
- Street furniture and regular landscaping of the path;
- Vertical lighting features and structures which provide shade and protection.

An external barrier is of paramount importance on paths situated on raised areas where the views depend on their location, such as mountainsides, next to rivers or the sea, or adjacent to roads on the edge of cliffs, and raised urban roads, etc. These barriers act as a protection system for pedestrians, whilst at the same time framing the landscape which can be viewed from the path.

Regular elements of street furniture such as paper bins and benches. The street furniture of pathways defines their spaces and uses. It is important that the path itself is open and free of obstacles with sufficient width along the entire route, and a layout which avoids, as much as possible, too many sharp bends or brusque changes in gradient. It is also advisable that paths adhere to the recommendations of accessibility for people with motor difficulties, by avoiding steps, excessively narrow points or brusque turns, whilst providing flat level surfaces which permit the use of wheelchairs. The width and layout must also allow sufficient room for the comfortable movement of prams and pushchairs, wheelchairs and elderly people who may need support to walk long.



Top. The pedestrian area needs to be properly equipped according to its functions, incorporating resting and observation areas with benches, waste bins, lighting, and explanatory panels.

Left. Development and cross section layout of the A-5052 in El Portil, within the municipality of Cartaya (Huelva), which includes service roads, a bicycle lane and a pedestrian walkway

The location of the street furniture, basically rubbish containers and benches, must not therefore interrupt free movement on the path. The general recommendation is to establish rest areas by siting benches and rubbish containers on the external side, wherever there is

sufficient space. Benches must be situated to maximise enjoyment of the landscape, which does not necessarily imply that they should always be facing away from the road, but simply that they should look towards views or features of public interest. Where there are wider spaces, larger resting areas with other facilities can be created.

A certain regularity is recommended. There should be zones for sitting and resting every 200 metres, and drinking water fountains can also be installed. Some paths use seats and ornamental features as external barrier elements, although in general, seats, fountains and play areas must never be situated next to the road.

Shade and lighting elements. Lighting on pedestrian paths is important for a number of reasons. One of the main ones is safety, both in terms of preventing the route from becoming marginalised, and guaranteeing that pedestrians are sufficiently visible from passing vehicles.

In this respect, it is important that roadside footpaths have good lighting at night due to the safety implications for both pedestrians and traffic, although efforts must be made to avoid blinding drivers travelling on the main road.

Lights should be raised and regular, and shaped so as to contain the beam in order to avoid light pollution which obscures the sight of the stars in the night sky. There are low level forms of lighting which can complement higher normal street lights, or in some cases, be used on their own.

Roadside footpaths must feature elements which provide protection and shade regularly distributed along the whole route and at the spaces designated for resting. Lines of trees are extremely effective for this purpose. Equally, awnings and pergolas (whose covers must have a certain degree of permeability which permits hot air currents to rise) can provide protection for resting areas or more extended sections of the path.

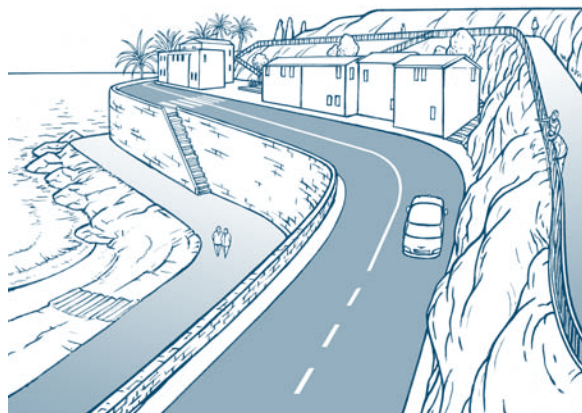


Pathway on the A-5300, as it passes through the village of Arroyomolinos de Leon (Huelva).

The design and development of scenic roadside footpaths must also bear in mind the need to avoid obstructing the views by the poor siting of items of furniture. This is by no means a consideration of minor importance since it implies a careful and thorough process in terms of the development and location of the elements, which should be re-evaluated once they are in place, so as to guarantee their intended effects.

6.9.4 The relationship between the road and pedestrian pathways

The secret of a well designed roadside footpath lies in the approach which is adopted to separate the path from the road. In general, the design of roadside footpaths must be based on the premise that the road is a source of inconvenience and risk for pedestrians. This was not so much the case in the past, when traffic was slower and less dense, leading to a



general approach which involved certain coexistence between both forms of mobility. This coexistence was possible because traffic was more «relaxed», and this is an idea which is now being reintroduced on some scenic routes, where traffic limitation is being adopted as a determining factor in the enjoyment of the environment.

The coexistence between footpaths and roads and the way they are designed, depends therefore, on the way they relate to each other. Thus, as well as relaxing traffic conditions in the most valuable areas by incorporating, if necessary, the type of access restrictions used in some natural reserves, it is also necessary to separate the source of risks and emissions from the pedestrian area. For this reason, the various design approaches must always be governed by the design of the cross section of both elements, and by the way they interact with each other.

As with all the other aspects of a roadside footpath, its design must adapt to the circumstances of each particular case, and often of each particular section, since the characteristics can vary constantly along the route. Certain circumstances (frequent

Left. The pedestrian area needs to be effectively separated from the road to protect users from traffic. Only on roads with little traffic and low speeds or those which are dead ends can there be an open design between the walkway and the road (urban streets).

Right. Very effective separation is achieved when the pedestrian area is raised or lowered in relation to the road, thereby reducing risks and nuisances. The height difference also allows more interesting scenic development.

junctions, areas of special interest, difficult driving conditions, ease of spontaneous crossings, etc.) may require a separation of the two elements which needs to be approached with care.

Separation or isolation is the most obvious solution to this problem, with structural solutions which set the traffic and pedestrian routes at different levels being the most efficient. Footpaths can thus be either raised, crowning the top of a cutting, or lowered, and situated at the base of the retaining wall of an embankment. This is an efficient way of solving the coexistence between the roadway and the pedestrian route, although it requires a series of pre-existing conditions. It is a solution which is particularly useful in urban environments, over fairly short sections, where there is a need to combine a high capacity road with a level of habitability for pedestrians. It is also applicable for roads in open countryside, especially those built into the side of a hill, although in these cases the approach can usually only be applied on certain sections. These solutions which involve separating the levels of the two parts of the infrastructure necessitate the installation of handrails, safety barriers or parapets to prevent accidental falls to and from the road.

It is not unusual to find roadside footpaths where there is a direct relationship between the pathway and the road, which are simply divided by a modest guard rail to separate pedestrians from fast moving traffic. The development of a scenic route of special interest often has to contend with significant functional or spatial limitations. These are often overcome with lower quality solutions which barely meet the basic requirements.

A well thought-out design of roadside footpaths must address the separation of pedestrians from the roadway in an efficient way. There are numerous intermediate solutions which can provide effective physical separation and guarantee reasonable safety conditions, even if they cannot eliminate all the inconveniences caused by traffic.

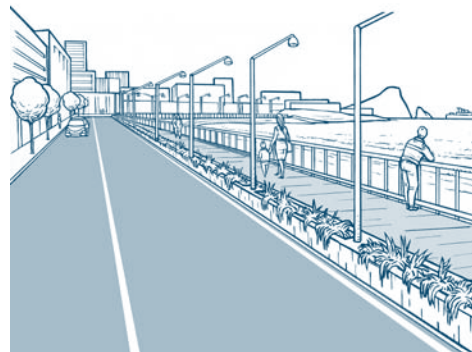
In general, the relationship between the roadside footpath and the roadway should ideally be governed as much as possible by separation and isolation elements which guarantee a certain level of safety in the event of accidents, thereby limiting physical injuries to the people involved. Systems of isolation can cover a wide range of possibilities including elements which simply resolve the separation or others which can be used for other additional purposes.

There are several types of continuous physical barriers, including, despite their aesthetically poor design, guard rails sited next to the kerb at the edge of the surface of the path. Low barriers made of concrete, stone, riprap and other materials can also be used to delimit the area of the path, and although these are very simple solutions, they do conform to minimum safety standards.

Other elements which can be used as low physical barriers include low walls, hedgerows, plant stands, handrails or a combination of elements. These are useful on narrow paths because while they delimit the space of the roadway and protect pedestrians by preventing them from entering the road, they do not have an overly imposing presence and allow a certain width.

Handrails, regularly positioned lights, trees or simply wide open spaces which separate the road and the path, are more elaborate alternate solutions.

An appropriate approach for roads with low traffic volume is to place a low lying support structure which can be adapted to a wide range of uses such as a bench, lamp post base, or plantpot. Without being visually or physically over imposing, low walls can be used to separate pedestrians and vehicles and can be made aesthetically pleasing. Furthermore, their reduced height means that they do not obstruct the potential views from vehicles, thus permitting the scenic function of the road at the same time.



The separation of the pedestrian area from the road can be achieved either by the installation of street furniture (low jardinières, benches, lamp posts, flower pots, trees) or by rigid signposting elements, although the latter are not advisable on roads with higher capacities and speeds.

Gardened and landscaped areas can also be efficiently used to create barriers of vegetation of different heights and volumes, from low parterres which simply indicate boundaries, to thick hedgerows or lines of tall trees. In fact, landscaping in all its different forms permits a more natural development of separation barriers which, can either be more subtle, or provide complete segregation which prevents pedestrians from accessing the roadway. Thick, medium height hedgerows are ideal for this function.

Using trees, as has traditionally been common on roads, is another effective way of separating the footpath from the roadway, and at the same time they can provide protection from the summer sun (plane trees, chestnuts and others). Trees are an efficient form of barrier to isolate pedestrians from road traffic, but if they are sited too close to the roadway, they can affect its functionality (narrowing the effective width of the carriageway and generating safety problems for high speeds). Planting lines of trees (see section 6.6 for specific information about lines of trees) is a particularly appropriate solution for pedestrian paths, not only as a way to delimit their separation from the roadway but also, as we will see, as an essential feature of their design. There are a number of successful examples of this approach, which is particularly effective when original tree lined sections are used and given a new pedestrian functionality.

6.9.5 Other aspects of the design of roadside footpaths

The approach to the development of roadside footpaths must take the following fundamental factors into full consideration:

- The frequent spatial limitations on the side of the roads
- The need to give continuity to the linear development of the footpath.

The first of these factors certainly plays an important role, particularly on mountain and coastal roads, where the spatial limitations of very steep hills impose significant constraints on the range of possible designs. Fortunately, the dimensions required for a pedestrian path are small and easily adaptable to the conditions of the layout, although in more extreme cases it is sometimes necessary to resort to solutions which offer lower standards of isolation, comfort, and adaptation.

Furthermore, roadside footpaths must be designed with a certain continuity throughout the length of their itinerary, and this involves a whole range of different solutions for each specific section or point of the route. Here again, the only general recommendation is to use common sense and take full advantage of the specific situations found in each section, taking advantage of wider spaces wherever the opportunity arises (view points, rest or service areas, etc.).

Equally, the design of the path can be very flexible since it is only determined by the requirements of pedestrians and is therefore highly adaptable to changes in gradient and width restrictions.

The design of the roadside footpath and the furniture it includes defines its capacity and functionality. A more ornamental approach emphasises the role of paths as spaces for public

recreation, and can be discreet or more visually striking and ambitious. The use of landscaping and other ornamental elements (furniture, services) offers numerous possibilities in this respect, whilst helping to reinforce the organisation of the footpath.

Furthermore, when applied to restricted areas, this more ornamental approach can easily incorporate functional elements, such as lighting, lines of shady trees, benches or simply plant stands to delimit specific areas.

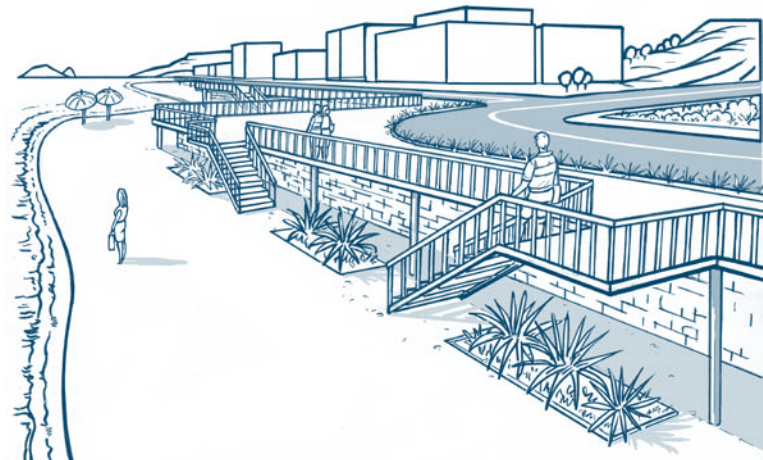
Thus, in general, the approach to the design of scenic or semi-urban roadside footpaths responds to the development of an outdoor open space of a linear character which meets the essential requirement of coexisting with vehicles on the road on one side, and the surrounding scenery on the other.

It is important to develop view points adjacent to roadside footpaths wherever possible. However, this is often restricted by the availability of space, which also limits the development of the path itself, and therefore, efforts should be made to take full advantage of any available space, no matter how small, since view points are an essential part of the concept of landscape appreciation for which these facilities are actually conceived.

On semi-urban paths, where there are both highway and street functions, the roadside footpath must serve, (as streets do), the activities located on the margins.

Therefore, their relationship with the activities on the edges of the road must be addressed in an appropriate manner, and in general, it is important to resolve the transversal permeability of such paths so as to avoid emphasising the road's barrier effect, by providing access to the margins.

The relationship between the pedestrian area and the landscape does not have to be limited to observation, but can also provide more integrated connections, by, for instance, providing regular access points.



Similar considerations need to be born in mind for scenic paths situated on the sides of mountains or coastal roads and they must be addressed accordingly. For example, raised paths must occasionally provide access points to lower lying areas, as is the case in maritime promenades.

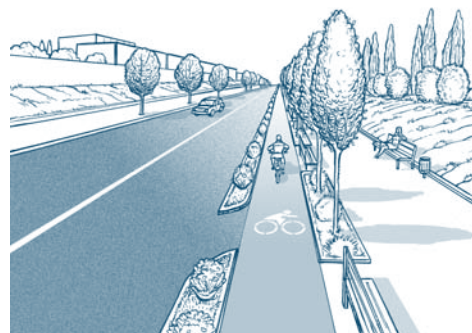
Lateral permeability can involve frequent crossings with other roads and pedestrian routes, whose continuity must be maintained.

6.10 Bicycle lanes

The scenic profile of bicycle lanes is similar to that of roadside footpaths, of which they could be considered a subgroup in many respects. However, the complexity of their siting, design and functionality is far greater, since it entails solving issues related to their relationship with both road traffic and pedestrian movement. Furthermore, the continuity of a bicycle lane is more complicated than that of pedestrian paths because it requires specific gradient and visibility conditions.

Bicycle lanes must be properly isolated from traffic lanes, particularly bus and tram lanes, since these are both extremely dangerous for cyclists due to problems associated with the visibility, manoeuvrability, and the size of these vehicles.

Sometimes, the necessary isolation can be achieved simply by virtue of the road markings of the bicycle lanes themselves (red or green lane) which, despite not providing any kind of physical protection, must be respected by vehicles. The ideal situation however, would be to install more effective and solid separations, such as kerbs on the roadway, low barriers, or even hedgerows, low walls, or lines of trees. Bicycle lanes should also be separated from pedestrian areas with similar isolation elements.



A bicycle lane needs to be a properly designed part of the cross section, running parallel to the road in an intermediate position between the road itself and the pedestrian areas.



An example of a bicycle lane completely separated from the traffic. The bicycle lane has also been separated and protected from a parallel service road by a discontinuous row of kerbstones, whilst pedestrians are served by a footpath (far left of the picture).

In cases where the isolation of cycle lanes is impossible due to lack of space or because of the coexistence strategies adopted, limiting the speed of motor vehicles is an alternative solution.

Due to the spatial limitations which are typical of urban environments, the separation between the different traffic zones is often limited to the structuring of the transversal lanes. This solution has also been applied on many rural roads, where the bicycle lane is simply part of the hard shoulder of the actual roadway, a solution which is technically deficient for a wide range of reasons.

Visibility is particularly important in the design of bicycle lanes because speed difference implies serious risks for cyclists. Furthermore, not all rural roads comply stringently with stopping sight distance requirements (the section of the road must be visible for the full stopping sight distance, i.e., the distance needed by a vehicle travelling at the road speed to come to a full stop after seeing an object on the road ahead).

The total width of the road itself, including both the car and bicycle lanes, must be sufficient to avoid lateral collisions at the design speed of the road. The creation of a bicycle lane on an existing roadway implies a reduction in these safety widths which is especially dangerous during the first few months of operation, when local users are still not familiar with the new conditions.

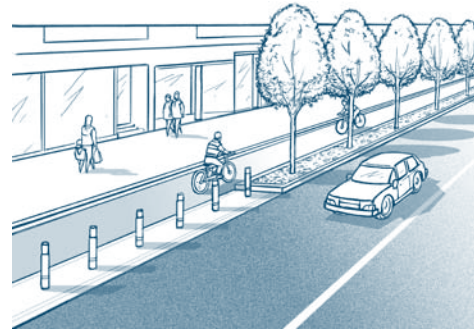
Road traffic can be particularly annoying for cyclists when it is intense, fast, or includes heavy vehicles, especially when the width of the lanes is limited.

Furthermore, each type of bicycle lane has its own specific characteristics. In terms of their functionality, bicycle lanes adjacent to roadways can be designed for:

- Sporting use, aimed at competition cyclists.
- Leisure and recreational use.
- Routine journeys.

Bicycle lanes for sporting use are specifically designed for experienced amateur or professional cyclists and generally feature steep climbs and a combination of sections with different layouts and gradients. They usually follow mountainous routes, which require more effort and have low traffic volumes. Although they generally offer good scenic potential, their design is mainly guided by their functionality. Cycling clubs often use roads which are not specifically adapted as bicycle lanes, with serious implications for their safety.

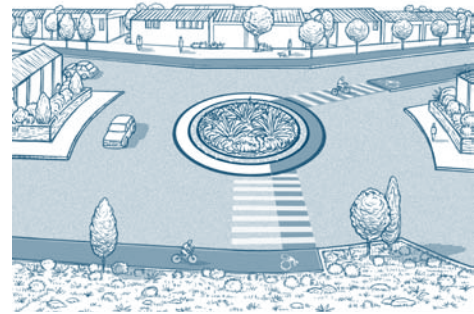
Bicycle lanes for leisure or recreational use feature more relaxed gradients and have a more scenic character. Specifically designed for less experienced cyclists, these types of bicycle lanes are more family-oriented and therefore the quality of their itineraries and interaction with other activities (camping areas, information centres, etc.) is of paramount importance. They have a clear scenic function and are thus recommended in general as lateral lanes for roads with low traffic and a scenic character, although this does not mean that they are completely free from the associated traffic risks.



In order to improve safety it is recommended that physical elements of separation are installed between the bicycle lane and the pedestrian area on one side, and the traffic on the other, to prevent the invasion of lanes. Separation can be achieved with raised kerbs, with simple vertical posts, with gardens, or even with rows of trees.

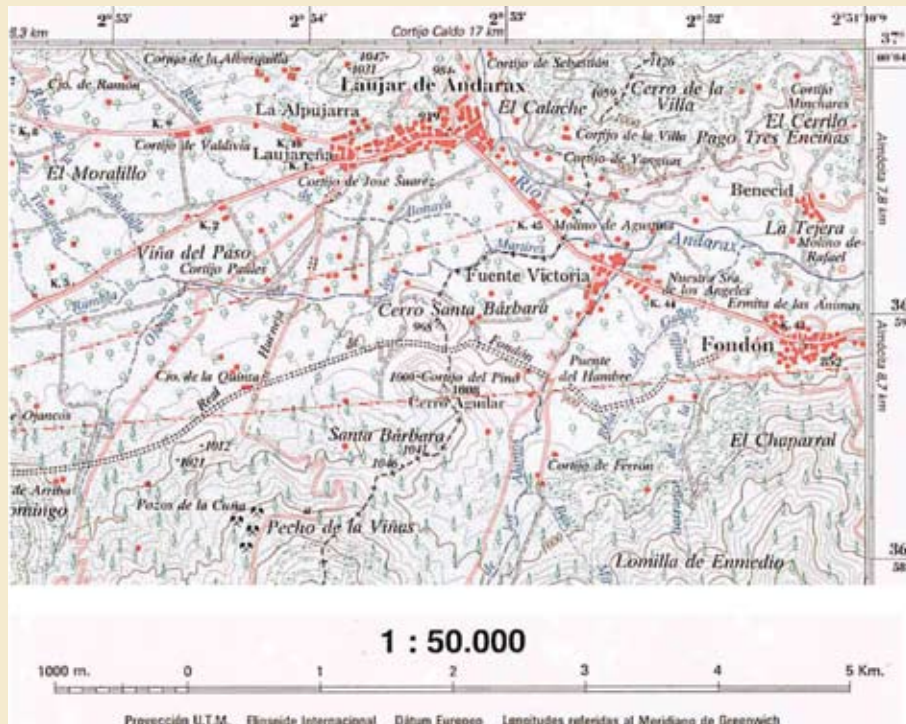
These cycle lanes must have an appropriate width, be suitably isolated from traffic lanes, and situated along roads with comfortable layouts and good visibility. The siting of bicycle lanes on the space available on the hard shoulders of roads can pose serious safety problems since road traffic tends not to modify its behaviour, maintaining the high speeds of the previous layout and conditions of visibility, and thereby endangering the safety of cyclists. Furthermore, inexperienced cyclists using these types of lanes can carry out dangerous manoeuvres which increase the risk of accidents (cycling groups, stopping in the middle of the road, crossing on foot, etc.).

Bicycle lanes for routine journeys are conceived as a sustainable alternative to car use. They generally follow urban itineraries, although sometimes cover longer metropolitan and even inter-urban routes. They are generally adjacent to roads with high volumes of traffic, and have to resolve the coexistence with both private and collective transport vehicles. Users of these types of lanes tend to be more skilled and law abiding than inexperienced cyclists, but they are exposed to risk situations which are more difficult to resolve, including frequent junctions with other roads, sections without cycle lanes, and constant stop and start situations.



The continuity of a bicycle lane sometimes involves road crossings, which need to be installed in areas of good visibility and in places where the road is permeable.

Roadside areas. A parkway as an example of the structuring of inter-urban landscape: Project for the improvement of the road between Laujar and Fondón in Alto Andarax, Almería.



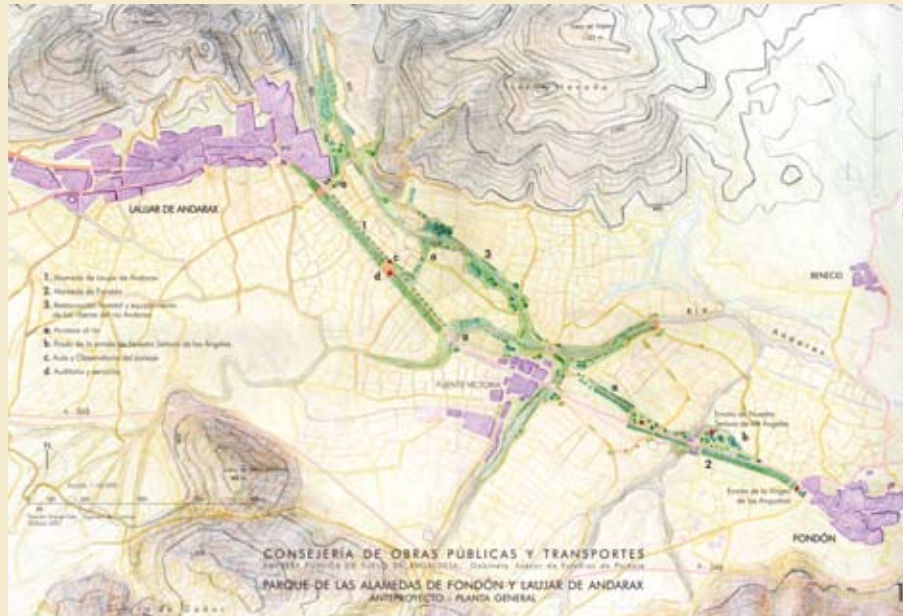
Route of the A-348 inter-urban road between Laujar and Fondón, (Almería)

Example

This is a section of the A-348 interurban road situated between the villages of Laujar de Andarax, Fuente Victoria and Fondón, which has been freed from long distance traffic by the construction of a bypass. This situation permits the development of a linear landscape which is typical of roads which have been freed from traffic (parkway) by designing its cross section and roadside areas to fulfil new recreational and educational functions, with the incorporation of facilities for the interpretation of the landscape. The project thus introduces a range of important elements for public use including the lateral linear park itself, which has been structured in the style of a traditional tree-lined boulevard, a landscape observation centre, interaction with the surroundings of the shrine, the different access points to the nearby rivers, and the restoration of the river Andarax and its banks are also addressed.

The westernmost sector of the river Andarax lies in the upper section of the course of the river, between the south-eastern foothills of the Sierra Nevada, and the northern side of the Sierra de Gádor. The natural and agricultural conditions of the area contrast with the arid, barren terrain which is typical of this part of south-eastern Andalusia, and forms a distinctive landscape of significant diversity and beauty. These favourable conditions are particularly notable in the area situated between the towns of Laujar and Fondón. There, the river leaves the initial steeper section to cross a small flat valley situated at an altitude of around 850 metres, which is enclosed by the two sierras, which face each other. The valley is less than a kilometre wide in Laujar, and only two kilometres wide in Fondón.

Occupied by numerous small holdings, the valley is dissected by an intricate network of watercourses and irrigation channels, which descend from the two hillsides, flowing into the main river, and by a well developed network of pathways which coincides with the boundaries between different bits of rural land. The development and shape of the urban structures of Laujar and Fondón has been defined by the two reticular systems of water channels and paths, and in particular by the



Example

Planned route of the Laujar de Andarax-Fuente Victoria-Fondón road scheme (Almería)

course of the river Andarax and the layout of the A-348 road. This now only serves local traffic, since a new road which bypasses both towns has been constructed at the foot of the Sierra de Gádor.

The concentration in such a small area of two mountain ranges, with their snow capped summits and diverse landforms, their different colours, solar orientation and vegetation, and the course of the river with its tributaries, as well as the smooth flat arable land of the valley, and the two main villages, gives the area an especially attractive landscape, the enjoyment of which is further enhanced by the transparency of the atmosphere, the clarity of the layout and the existence of areas of good visibility for observing and interpreting the surroundings, particularly in the section of road which joins the two villages.

The landscape thus plays a significant role in the environmental quality of these two municipalities and is a resource of significant importance for their economy, even if its potential has not yet been fully realised. Apart from other benefits, efficient management of the area could attract more weekend and seasonal visitors, and contribute to boosting the service industry (hotels, restaurants, recreational and educational activities, etc.).

Consequently, equipping the area with facilities for the promotion of environmental education is especially appropriate, and the existing resources which could be used for this purpose include two road maintenance service buildings which are no longer used, one of which has been recently refurbished and made available for this use by the General Directorate for Roads.

The project proposes the construction of two tree-lined boulevards or promenades on the old road, one starting at Laujar, the other at Fondón, and the implementation of a scheme for the restoration of forest areas and the banks of the river Andarax. The tree-lined boulevards would link the two villages, incorporating facilities and services for environmental education and recreational use. The project also outlines measures to restructure the existing network of pathways, and includes a specific treatment for the section which crosses the river.

The two tree-lined boulevards and the pathways on the riverbanks are connected by existing paths, which are to be upgraded, and the old road, having been freed from long distance traffic, can be integrated as a public space, acting as an axis for the interaction of the two towns.

The paths which run alongside the road are approximately one kilometre long, and feature wider spaces or esplanades at points of special interest, which include shrines, landscape observation centre, services, and play areas. The central sector is to be developed on the banks of the river Andarax, precisely at the point where the road meets the course of the river, and in general the path retains the original field boundary patterns, walls, constructions, areas of woodland and other features of the area's historic structure.

Example



ALAMEDA DE LAUJAR



RIBERAS DEL ANDARAX

CONSEJERÍA DE OBRAS PÚBLICAS Y TRANSPORTES.
EMPRESA PÚBLICA DE SUELO DE ANDALUCÍA. Gabinete Asesor de Estudios de Paisaje
PARQUE DE LAS ALAMEDAS DE FONDÓN Y LAUJAR DE ANDARAX
ANTEPROYECTO - DETALLES

Sections of the boulevard in Fondon and the Andarax riversides.

The works to be undertaken by the project on the axis of the road include: the earthworks and tree planting programme for the creation of the tree-lined boulevards; the construction of a landscape observation centre; an auditorium; a bicycle track; and the provision of a range of services and facilities. The project also envisages the environmental and ecological restoration of the areas surrounding the river Andarax and its banks, the reforestation and protection of indigenous fauna, the upgrading of the access accesses at Fondón, Laujar and Fuente Victoria, and the construction of pathways which can be followed on foot, by bike, or on horseback, as well as drinking water fountains, rest areas, and nature observation posts.

Apart from catering for the environmental education and landscape interpretation needs of the local population, the park also offers spaces for recreation, walking, and sporting activities for people of all ages, and plays a fundamental role in regulating the ecological process of the area as a whole.

Roadside areas. Example of a road of special scenic landscape: the A-369 road from Ronda to Gaucín (Málaga).



Route of the A-369 from Ronda to Gaucín (Málaga).

The valleys of the rivers Genal and Guadiaro lie to the south of Ronda, in the westernmost area of the province of Málaga. Leaving Ronda towards the south on the old road to Algeciras (A-369), the road winds its way down the lower foothills of the Serranía de Ronda, crossing the valleys situated between the Sierra del Hacho, Sierra de Líbar and Sierra Bermeja, and passing by the villages of

Example

Atajate, Benadalid, Algotocín and Gaucín, before finally reaching the Mediterranean coast and the Campo de Gibraltar.

The road, which is built into the hillside, passes through an area of recognised landscape interest situated between the Sierra de las Nieves, Grazalema and Los Alcornocales natural parks, where the valley of the river Genal acts as a structuring element of both landform and landscape. The richness of the landscapes lies in the diversity of the landform and the contrast in vegetation. The area also has significant historic and cultural value.

The works undertaken in the A-369 road have essentially been aimed at improving communications between the villages situated in the Ronda area, whilst linking inland areas of the province of Málaga with the Costa del Sol and Campo de Gibraltar. The project emphasises the importance of the landscape quality of the itinerary, by adopting a design approach which enhances both the basic elements of the road and the lateral areas.

The most notable aspect of this intervention lies in the adoption of a technical solution for the upgrading of the existing road which improves its section without significantly altering the layout, and makes every possible effort to avoid negative impact on the landscape. Equally significant are the incorporation of construction solutions which permit the use and interpretation of the landscape and the natural, socio-cultural environment of the area, which is integrated into the infrastructure itself.

One of the most relevant aspects is that the typical stone of the area, sourced from the cuttings, is extensively used. Embankments are replaced in much of the layout by masonry walls to contain the earth which would otherwise invade nearby water courses, whilst the size of cuttings is reduced by walls constructed at their bases.

Stone is also widely used in the low walls which are used as protective barriers. Ditches and milestones are also made of masonry. Drainage and engineering structures are covered with locally



Top. View of the Encinas Borrachas landscape from the A-369.

Bottom. Interesting design features on the A-369.

sourced materials to simulate the appearance of pre-existing structures, whilst on certain sections, the low safety walls are replaced with flexible barriers covered with wood.

The range of measures also includes the treatment of the surfaces of rock cuttings, the addition of topsoil to the embankments, the sowing of seeds and planting of vegetation, and a minimal but functional approach to signposting aimed at avoiding the proliferation of successive road signs and limiting road markings to the lines which delimit hard shoulders. The lack of a central line in most of the layout encourages drivers to reduce their speed. The maximum speed limit is set at 60 km/h, with clear indications that motorists are following a mountain road.

As well as a detailed design for its integration into the landscape, the project recognises the potential for scenic views and the value of the landscape through which it passes.

Example



As such, a total of nine view points are situated in those places with greater scenic broadness, and equipped with parking zones, wooden benches, ornamental elements such as stone circles and unusual vegetation. These view points feature ceramic panels especially designed to help visitors to further their understanding of both the visible area and the natural, cultural, and values. There are also additional panels which provide information about the area and its traditional customs and activities, etc. In terms of materials and construction techniques their design shares the aesthetic criteria of the road itself, whilst traditional tiles which are typical of the Genal area are used in the actual panels. Each view point has a specific name which permits its identification and makes it uniquely distinctive.



Top. Installations of view points.

Bottom. Information panel at the Cañada Honda view point on the A-369.

Example



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APPENDIX

APPENDIX: BIBLIOGRAPHY

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