



Strasbourg, 8 February 2007

T- FLOR (2007) 10

EUROPEAN LANDSCAPE CONVENTION – Florence Convention –

MEETING OF THE COUNCIL OF EUROPE ON “THE EUROPEAN LANDSCAPE CONVENTION”

Council of Europe
Palais de l’Europe, Strasbourg
22-23 March 2007

INFRASTRUCTURE AND LANDSCAPE: ROADS

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COUNCIL OF EUROPE



infrastructure and landscape: roads

DOCUMENT

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30TH November 2006**



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1. INTRODUCTION

The aim of this document is to provide a starting point for discussing the role of roads in landscape. The Convention of Florence draws attention to the landscape quality of all places and the need to improve and enhance them through all public policies. Roads are not only infrastructures which take us to landscapes; they also provide positive scenic routes through landscapes as well as enjoying landscape values and a character of their own. Additionally, roads are collective spaces where everyday community life takes place. They must therefore be considered as community landscapes and managed accordingly. Road planning and management schemes have responsibilities in landscape management which must be seen positively. Recently, many positive experiences have been taking place in the fields of roads as scenic routes, road design for character and landscape enjoyment, or road integration in landscape.

This document reviews landscape qualities of roads, taking their different aspects and implications into consideration. Firstly, the role of travelling in contemporary landscape attitudes is briefly discussed. Then, access to landscapes and road itinerary values are reviewed. The next chapter deals with the perception of landscape from within vehicles and looks at all factors involved from the scenic itinerary to alignment and drivers' attention.

Another chapter focuses on road design for landscape, that is, both in sustaining a sense of identity and character for the road and providing facilities for enjoyment of landscape other than from within the vehicle. Chapter Six approaches the question of road integration within landscape including environmental integration as well as roads within landscape perception and appraisal. Finally, the need to consider landscape values in all roads is argued.

The document is completed with four brief appendices which deal with experiences in road management and design. The first appendix presents the role of roads in a Nature Park, the second deals with itinerary values, the third is about road alignment and integration into the landscape and the fourth presents a road design for landscape enjoyment.



Fig. 1. *Painting a water colour at Ryde Beach, Isle of Wight, England. (Photo by I. Español) Visual aspects are basic in a personal and cultural approach to landscape.*

2. TRAVELLING, LANDSCAPE EXPERIENCE AND ROADS

2.1 Landscape experience as a cultural attitude

Landscape is a dual product of cultural attitudes. On one hand, communities needs and knowledge have shaped land and created landscapes, while, on the other, social attitudes, cultural viewpoints and ideals determine community perception of physical environment.

Primary communities much dependent on the availability of natural resources, had a dramatic view of their environment; while more sophisticated cultures tended to idealise environmental processes through complex intellectual approaches. Landscape, in its current sensual and artistic sense, was much the result of European society ideals. Western idealisation of land had a marked Eastern influence. Nevertheless, early industrialisation held a productive view of the environment and its profitable resources which ran parallel to an idealised view of nature. Later, increasing environmental awareness joined community reaction against standardisation and loss of identity features. Current attitudes towards landscape involve a dual view of both the reality of processes shaping the land as well as the sensual and artistic perception of their scenic results.

2.3 Contemporary attitudes and visual aspects

As a result of the increasing influence of mass media and dynamic communication systems, global society is developing new attitudes towards landscape. These tend to emphasize visual aspects rather than a more comprehensive view of its environmental processes. To a great extent, enjoyment of landscape image is replacing other kinds of landscape experience. Several factors are involved in this process such as:

- The original 18th century approach to landscape resulted from a visitor view of local reality; that is a '*view-from-the-distance*' attitude where idealization, and formal and visual aspects play a main role.
- Landscape has become a by-product of consumption within tourist and cultural businesses as well as a regional identity icon.
- Image representation of reality is very effective in the competitive and dynamic information markets of today.
- Simplification of landscapes into mere images provides a deceiving approach to the real complexity of cultural and natural features of communities and their lands.

2.4 Travelling and landscape experience

Last century, rapid development of transport means played a major role in shaping attitudes towards landscape. Travelling is deeply rooted in the traditional Western sense of landscape, since travellers set the basis for the concept in the 18th and 19th Centuries in Europe. Later, 20th century transport improvements provided people with better access to a wider and more diversified range of landscapes. Furthermore, transport has encouraged urban sprawl which, in turn, has created new approaches towards urban landscapes.

Long distance travel takes tourists and visitors from very different cultures and environments to places where they experience landscape and other local values. In addition, transport experience in day-to-day life involves quite a varied range of landscapes through routine transport systems in conurbation areas as well as in rural regions.

Thus, environment is mostly perceived through the windows of cars, buses, trams and trains. Citizens of modern society spend a notorious part of their time within transport vehicles. This applies not only to everyday landscapes where citizens carry on their daily lives but also to those areas which are protected and distant. Landscape in these pristine or exotic areas is highly valued, but time to visit and enjoy them is generally limited.

2.5 Interest in landscape as a threat to landscape preservation

The number and diversity of landscapes available to people have increased due to the development of transport means. However, the experience people get from those landscapes has become increasingly simplified to an almost exclusively visual perception. Package tours and other means of fast travel are a good example of this. Specifically, scenic routes allow car travellers to view landscapes from the road as they drive.

This emphasis on visual aspects tends to overshadow more complex cultural and environmental values and processes. Actually, awareness of these processes is crucial since they are responsible for the maintenance of landscape values while preservation policies result from that public awareness.

Moreover, there is a dangerous vicious circle which involves transport infrastructures and landscape values at the same time. Roads and other transport means are still seen as basic infrastructures for development. This argument applies particularly in those pristine areas whose cultural and natural landscapes have been preserved due to lagging development.

Thus, landscape roads are envisaged for cultural tourist development based on the preservation of that very landscape which is deteriorated firstly by road construction, and later by resorts developed because of increased accessibility. Coordination between development policies, infrastructure planning and landscape management must be guaranteed.



Fig. 2. *Bad quality road at Jandia Peninsula (Island of Fuerteventura, Spain). Low road service prevents human pressure and development on special landscapes such as this volcanic massif. (Photo by I. Español)*

3. ROADS AND LANDSCAPES

3.1 Roads and landscapes values

Infrastructure's main goal is to satisfy community needs within a given environment. Their alignment and structure result from applying technology to environmental resources in order to satisfy social needs. Specifically, roads serve mobility within a territory so that they belong to the general structure, organisation and processes of that territory. They are thus narrowly related to the cultural and natural aspects of land and landscape.

Therefore, roads enjoy different landscape values which are related to their linear nature and how this linearity involves landscape resources. Accessibility, and scenic and environmental qualities of roads contribute to all these landscape values.

In the first place, roads provide good, fast and safe access to different places, communities, environments and their landscapes. Good accessibility to landscapes gives freedom of choice, which, coupled with availability of information, can result in a deeper landscape experience and knowledge.

Secondly, road itineraries have values of their own, since they have developed as part of landscape dynamics and, as such, reflect cultural and natural aspects involved in those processes. Historic routes, geographical barriers and environmental diversity can be appreciated along road itineraries.

Thirdly, roads can be considered windows on the landscape: they take observers across landscapes which are viewed from the road. Roads have a so-called scenic quality. Moreover, the view from the road makes a fair first approach to landscape which can be experienced later in a wider and deeper sense, once the car is parked.

Fourthly, though functional and highly standardised, roads as any other public places have a character of their own which to some extent reflects the community and the culture where they belong.

Finally, roads take part in landscape scenery, being present as a specific element which can be perceived and appreciated. Road integration into environmental processes and landscape sceneries is crucial in guaranteeing landscape values. After all, roads are flexible infrastructures which can be integrated within landscape with not much effort in design and planning.



Fig. 3. The view from the road approaching Ragusa's new town, (Sicily, Italy), invites one to get to know the town better. (Photo by I. Español) Roads provide scenic views as well as access to landscapes, in doing so they often make an inviting and quite exciting introduction to a more involved and detailed visit after parking.

3.2 Access to landscapes: planning and management

Roads give access to communities and places and also to landscapes. In doing so, they permit sightseeing as well as providing a first approach to those areas which will later be reached and visited. This key visual and scenic quality will be discussed later in this document (see below).

However, road accessibility to areas of interest can be a threat to landscape preservation, if subsequent pressure and development are not duly controlled. Lack of access and a lowered accessibility are quite efficient measures to prevent undesired damaging effects on pristine areas.

An efficient road network will guarantee proper access to visitable areas which could satisfy visitor demands without putting exclusive resources in danger. Moreover, a careful selection of scenic roads can provide a good introduction to visit areas and satisfy some visitors' demands, while keeping pressure away from the most sensitive areas.

Landscape and road management and planning must work together. Accordingly, road networks plans must be coordinated with landscape enjoyment and preservation goals. They should be aimed at compromising development and preservation selectively, taking into account the specific conditions of each case. Although no general rule can be applied, the use of access deterrent measures should be considered together with encouraging access to those areas specially selected for visitors by an adequate landscape planning.

3.3 Itinerary values

Driving by car has become such a dull and routine activity that almost ignores the sense of variation which logically involves any movement. The road environment can be merely functional and standard. It has generally adopted the aspect of a non-place space where reference to land and values are often limited to signalling. Moving along these linear infrastructures, particularly in motorways and other speed roads, has been progressively detached from the sense of travelling through places and land.

However, road itineraries are the result of geographical, environmental and cultural processes, and can be perceived as such. Following road itineraries unveils essential values which are related to cultural, historical and natural features of the land and therefore of its landscape. Big geographical units and territories can show themselves along a long distance road if its different features are appreciated. Mountain barriers, river valleys, high plateaus or sea narrows provide the physical base for road itineraries. Thus, climate diversity, geological structures and features, ecological phenomena and geographical variations can be traced along those itineraries.



Figs 4 and 5. (Left) Paths, roads and land plot boundaries intermingle in this view of Arco San Jorge, Madeira (Portugal). (Right) Land plots and a road on the island of Gozo, Malta. (Photos by I. Español) Road itineraries, alignments and full networks develop as part of landscape patterns and landscape dynamics, as roads are the result of cultural and environmental processes.

Most current road itineraries are the result of ancient historical processes. Some local roads, which at present serve only small rural communities, were once main tracks for political and social systems that have since disappeared. The Roman Empire road network is a good example of this. Long-distance religious pilgrimage, cattle transhumance itineraries, old trade routes and expansion axes of cultural influence along valleys can still be traced today. Thanks to mechanisation and new means of transport, industrialisation processes reorganised the movement of people and goods in European geography, producing new itineraries, abandoning previous ones and reassuming those which had been forgotten. Later, development of motor vehicles and other means of transports reshaped again the map of movements.



Fig. 6. LP-1 road on La Caldera de Taburiente (isle of La Palma, Spain) a traditional itinerary for communication among pre-colonisation communities, also an itinerary for seasonal pastures, provides an impressive view from the island heights as well as of volcanic formations and relic ecosystems.

Although these cultural and geographical itineraries are not always directly visible in landscape, they are most valuable. They are cultural and environmental assets in themselves, as well as means for self awareness, since they promote people's appreciation and concern for their environment, history and culture through landscape perception.

Thus, understanding the features of these special routes becomes very valuable. This reading approach to road itineraries must be adequately supported by different sources. Availability of information such as that provided by road maps and guides, tourist guides, route signalling or visitor centres can be very effective in illustrating these routes. Moreover, an adequate management of both the scenic quality of roads and its relationship to landscape features can be very productive (see below).

Special landmarks and features of diverse type play a main role in supporting a comprehensive reading of road itineraries. Cultural and natural elements and features noticeable in the road environs are thus important. Preservation of historic and cultural built elements close to or attached to roads, such as bridges, post houses, blacksmith sites, milestones and old tracks, can be useful in this sense. A wide range of landscape features such as vegetation, relief and rocks, rivers and water bodies, crop patterns and plots, etc. are thus important to support this view on road landscape.

Therefore, a comprehensive integration of key elements, landmarks and landscape features within the travel route is required. Coordination of available information, adequate signalling, alerting to contents of scenic views and the role of stopping areas and landmarks should respond to an integrated policy for the enhancement of itinerary values.

4. LANDSCAPE PERCEPTION FROM THE ROAD.

4.1 Roads as windows on landscapes

Scenic qualities of roads were soon assumed by road planners in the beginning of the 20th Century. Scenic roads, parkways and landscape roads were planned and built for landscape enjoyment, that is, from the viewpoint of a moving vehicle. These roads assumed landscape watching as a main project goal. Their itineraries and also their alignments were designed to serve privileged views and panoramas much like pedestrian paths within landscape gardens. Yet side road landscapes were also specifically designed to be viewed from the road.

Nowadays, scenic functions of roads have come into full consideration by road planners and landscape managers. At present, landscape viewing from roads has become very popular.

Environmental concern, tourist Interests and a general demand for infrastructures of a better quality have favoured this approach to roads as visual itineraries. Road maps generally include landscape itineraries within road networks while scenic viewpoints are often signalled along main routes.

Nevertheless, selection criteria for landscape routes in maps and signalling are rarely clear, consistent or specified. Furthermore, landscape viewing from vehicles in movement is a very complex perception process which is often dealt with in a simplified way. A very varied group of aspects must be carefully taken into account if landscape viewing is to be promoted. These can be grouped in three main sets as follows:

- aspects related to **landscape scenes** viewed from the road and its management,
- **itinerary scenic features** such as the location of road viewpoints or the need to obtain an adequate series of views, and
- aspects related to **drivers' and travellers' attention** and their relation to traffic safety.



Fig. 7. Salisbury Cathedral Spire, a main landmark, welcomes incoming traffic to town (Wiltshire, England). (Photo by I. Español)

4.2 Roads as scenic and visual itineraries

Scenic roads should be viewed within comprehensive landscape management schemes. Roads benefiting from views on quality landscapes should always be managed within goals and schemes devised for those landscapes. Inversely, landscape main resources such as panoramas and sights, scenic view points and landmarks can be positively promoted by means of scenic roads.

In addition to considerations on spatial planning of roads and landscape (see above), scene contents and structures should also be taken into account when a visual itinerary is planned. Landmarks play a main role in landscape perception and reading since they provide recognition keys to drivers and travellers who are to benefit from landscape viewing. Often, the availability of landmarks can become a good enough reason to prefer a visual itinerary rather than other views on landscape scenes which lack recognisable features.



Fig. 8. Road alignment leads the direction of sight to the landscape providing a fast succession of views. Movement gives a sense of landscape depth along the road itinerary. (Photo by I. Español)

Factors related to scenic properties of roads are therefore very important. In the first place, roads are part of the landscape three-dimensional scene so that road itineraries provide a series of sights. Fast succession of views gives road travellers a sense of landscape continuity and depth. Therefore, moving views from the vehicle become both emotional and acknowledgeable. Though usually fast and superficial, the experience is much appreciated by road travellers.

Road itineraries have a precise scenic location within landscape visual organisation. Different itineraries provide different views of the whole scene and of the structure of landscape. Routes on the slope of narrow valleys provide quite a complete view of the valley landscape although lacking visual access to the bottom, while routes on the valley floor provide landscape viewpoints from below upwards. Depending on the scenic structure, special landscape landmarks and other items can be viewed from some view points while they will be hidden from view on other itineraries.



Fig. 9. A pedestrian view from a security barrier at a road allows for a view of the landscape. (Photo by I. Español) The little dam on the right, a main landmark in this landscape, can hardly be seen from a car-view angle, but walking along this road is very dangerous.

Therefore, not all roads provide a good view of landscape. This depends on how the itinerary is integrated within the three-dimensional scene. Specific scenic features of roads must be taken into account very carefully if its landscape qualities are to be developed.

Legibility is a feature of roads by which drivers can foresee the road alignment ahead, so they can adapt their vehicle movement and speed to the approaching stretch of road. Roads which enjoy good legibility show their alignment to drivers clearly along several hundreds of meters while bad legibility is typical of curved roads whose next stretch is hidden behind a bend or the top of a hill. Good legibility in roads is always desired for safety, especially in those roads which are designed for high-speed traffic where long stretches must be visible to drivers.



Fig. 10 and 11. Driving safely along hard alignments such as these steep and curved road shown in the pictures above, requires a better legibility of the road ahead, so tall vegetation has been removed at road verges. (Photo by I. Español)

Road legibility quality can be spatially extended to perception of landscape ahead on the road and beyond its sides. Therefore some roads whose sides are occupied by long solid barriers of objects (such as trees, buildings or relief) hide the landscape behind, while open road sides allow travellers to perceive landscape around and ahead.

Legibility of road verges and sides is important when devising a visual itinerary, since it affects basic visual patterns. Some considerations on the issue follow.



Fig. 12, 13 and 14. Landscape legibility on a road along Cantabria Mountains (Alava, Spain.) **Above:** Good legibility for approaching stretches and landscape. **Below left:** Bad safety features for this road hidden behind the curve and only good landscape legibility at the right side of road. **Below Right:** Bad legibility of landscape and traffic safety in this curved road along a thick forest. (Photos by I. Español)

Legibility of landscape on the opposite side of the road depends on the full road width, oncoming vehicles and obstacles on the opposite road margin. Motorways and high-density traffic roads have little legibility of landscapes on the other side of the road. Hence, most roads have good landscape legibility in one direction only. Typically, roads aligned along a slope

provide good views on one side (if there are not obstacles on this margin), while the slope itself prevents views to the other side.

Commonly, landscape legibility appears fragmented along roads since the sides of some stretches will be free of obstacles while others will have visual barriers of different lengths.

Eventually, drivers and travellers get a fair visual idea of landscape from the series of occasional sights they get in between visual barriers. However, this effect can be very disrupting for sightseeing.

4.3 Road traveller perception of landscape

In addition to factors related to scenic organisation of road alignments and sides, there is a speed effect on landscape perception. Moreover, the different attention parameters of the drivers must be taken into account.

Fast movement along the road has a narrowing effect on the sight width of the driver. Objects standing very close to the roadside such as trees and buildings move along the visual plane of the observer almost as fast as the vehicle speed. This is why, when the vehicle travels fast, it is quite hard to recognise objects on roadsides. Objects in the far distance such as mountains or forests remain steady in the visual plane of the driver while those at a certain distance move at a low speed.

This angle effect affects the width of the view a driver obtains of the road ahead. Higher speed reduces vision width while slow movement stretches the view. This speed effect affects not only the drivers' views but also those of other travellers in the vehicle.

Therefore, fast driving through narrow landscape scenes such as urban landscape, prevents an adequate scene perception, while travelling along ample and wide scenes such as coastal roads does not suffer as much from the speed effect as long as there are not many objects close to the road.

In relation to speed, pedestrians and low-speed vehicles get a fair view of landscape, while vehicles on motorways and high-speed roads can only appreciate ample and distant scenes.



Fig. 15. Road from Altsasua to Olazagutia (Navarre, Spain) Mountain roads, curved and steep alignments prevent sightseeing, despite the impressive views available from the road. (Photo by I. Español)

Drivers' attention to landscape occurs within the effort of handling the vehicle. The steeper, more twisted and more visually limited a road's alignment is, the more attention is demanded

from the driver driving on it. Thus, mountain roads which generally enjoy a favoured scenic location have, however, a low landscape profile since they are normally curved, steep and hard to drive.

In addition to the effort demanded by an irregular road alignment, extra attention is required when traffic density is approaching maximum road capacity, when traffic is congested. Narrow roads can support limited amounts of traffic, while wide motorways with several lanes in each direction can handle high-density traffic, allowing for safe and comfortable driving.

Congested roads are usually difficult for landscape enjoyment, not only because of visual intrusion of other vehicles, but also because they require extra attention to deal with other vehicles.

Drivers' travel aim is also important in landscape perception, since they affect personal attitudes towards driving and landscape. Expectations and attention are higher for exploring travellers such as strangers seeking their way for the first time, or those practising sightseeing and landscape-touring. Routine drivers have a special attitude towards road environs which includes a special demand on landscape quality (this is specifically dealt with below in this document).

Routine drivers have a better knowledge of traffic and road features. They have a self-confident attitude towards driving. This somehow liberates attention for landscape perception, which in turn has a specific familiar character. Routine road environs are seen and appreciated just as other collective social areas where community life takes place. Routine drivers despise landscape degradation greatly; they are very demanding on quality standards, including road elements and landscape. Landscape quality is not exclusive to countryside roads in pristine landscapes; roads serving routine movements must also assume a positive landscape profile.

Attention aspects also affect other travellers in the vehicle. Personal motivation for travelling, poor alignments and high traffic situations affect all travellers, and produce uncomfortable vehicle movements and general distress within.

Consequently, roads best suited for drivers' and travellers' enjoyment of landscape are those which enjoy safe and comfortable alignments together with relaxed traffic conditions.



Fig. 16 and 17. Road character is generally functional and standard thus lacking sense of identity and place. However, there is room for non-functional design (Photos by I. Español).

5. ROAD DESIGN FOR LANDSCAPE CHARACTER

5.1 Road aesthetics and landscape

Road design is aimed mainly at satisfying traffic capacity and driving safety and comfort. Road elements, aspect and environment tend to be seen as merely functional, that is, it is conceived and devised to serve traffic. Therefore, pavements, traffic signs, road marks and safety barriers

create a special environment which lacks character and identity. Moreover, high intensity traffic flows, including large numbers of heavy vehicles, make the road environment noisy, polluted and hazardous. Consequently, road structures such as platforms, lanes and side areas are frequently hard, aggressive and filthy.

Even those special areas attached to roads where traffic pressure relaxes and travellers get out of vehicles, such as lay bys, resting areas, petrol and service stations, generally have a banal character. In those places, trademark icons and franchised styles are predominant. Where this is not so, design is generally poor, plainly functional and very limited. Additionally, often aggressive traffic conditions in road environments generally prevent enjoyment of landscape other than from within the vehicle.

Thus, a road's own landscape is often aggressive and poor, lacking landscape features, a sense of identity and character. Yet people spend a great part of their time in road environments because they have become part of their day-to-day lives.

The Florence Convention demands landscape quality for all areas including those routine and conventional areas such as roads and other public works. Infrastructures must take into account that they are perceived and can be appreciated as an important part of our community environment.

Despite its basic approach, road design can easily take quality and positive landscape goals into account without compromising safety and functionality. Furthermore, some roads can integrate side elements for specific landscape enjoyment such as scenic viewpoints, sidewalks or parking places.

Landscape profile of roads can be improved in two different ways. Firstly, some road design features can use landscape character as a basic reference. Secondly, additional side elements can allow for a closer appreciation and experience of landscape rather than that obtained from within moving vehicles.

5.2 Road design for identity and landscape character

Elements of road design such as road marks, traffic signs, pavement, hard shoulder etc. arise from the need for traffic safety. These have rigid designs since they must satisfy strict safety standards. However, other road elements enjoy different degrees of design freedom. Safety barriers, embankments and cuttings, retaining walls, gardening elements and information sign posts are among the latter. Furthermore, some special road structure elements such as roundabouts, bridges, parking places, petrol stations, service and resting areas are specific areas where road character can be developed positively.

Road identity can be promoted by different design strategies. Road elements can integrate landscape character features, or assume a formal identity of their own. The latter includes different possible approaches such as naturalisation and others.

Landscape character is based on those features which make landscape unique. In addition to large scale aspects such as relief or vegetation pattern, features such as local trees and bushes, or traditional building materials can easily be used by road designs. In addition to characteristic references, roads can include non-conventional design elements such as safety barriers, parapets, prevention posts and others which can give a specific sense of identity to road environs.



Fig. 18 and 19. Wooden safety barriers in roads. They provide a sense of the natural and rural. Although as increasingly-used standard elements, they run the risk of creating a lack of identity (Photos by I. Español).



Fig. 20 and 21. Traditional parapets newly built in the old-fashioned way (left,) or preserved in their original state (right,) provide a familiar look (Photos by I. Español).

Supporting structures, such as retaining walls for embankments or cuttings, can play a main role in road character. Cuttings in unstable terrains require supporting elements at the slope base. Where normally-inclined embankments are not feasible due to lack of room or other reasons, strong retaining walls are required to support the road platform. These structures are often constructed with concrete walls, standard plaque walls, or piled with heavy rocks. Although they guarantee stability, all three systems present a very poor aspect.

Traditional stone walling is a common retaining solution when quality design is intended. Local traditional stone walls can be easily integrated into road structures, thus providing a sense of local character. Stone walling is sometimes used to help naturalisation when this is new to traditions in the area. Generally, the retaining structure is a modern and effective system constructed with concrete or tension-supporting elements concealed under a stone wall finishing.

In addition to elements within the road structure, road verges are basic in providing roads with a sense of character. Actually, side areas are transition fringes which span from the functional and aseptic road environment to the local landscape itself. Traditional elements, such as rows of trees, traditional rural stone walls and others, can play this transitional role adequately if they are adopted and integrated positively.



Fig. 22 and 23. Traditional stone walls are features of landscape character. **(Left)** Walls made of dry limestone are a traditional feature of Ise of Mjlet (Croatia). **(Right)** Characteristic retaining walls made of volcanic stone for vertical vineyard embankments on the island of Madeira (Portugal). (Photos by I. Español)

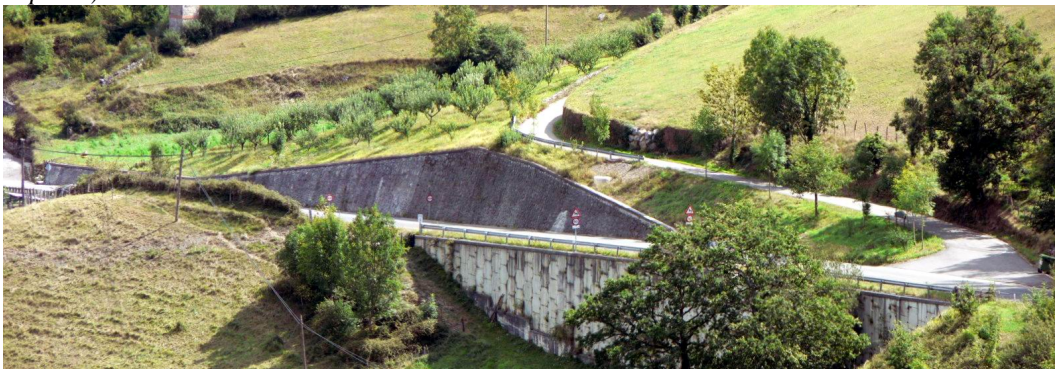


Fig. 24. The picture above shows a road whose embankment is supported by a prefabricated slabbed wall partially hidden behind a tree on the right side of the picture. The road cutting on the same stretch leans on an inclined concrete retaining wall which helps to support both the slope and a ramp. (Photos by I. Español)



Fig. 25. A traditional stone wall works as a retaining wall for the road cutting, while the embankment has been successfully naturalised by grass. (Photos by I. Español)



Fig. 26. The road platform is held by a retaining wall concealed under a finishing of traditional stone walling. Traditional stone walling and an old-fashioned white parapet provide a positive result in functional and landscape terms. (Photos by I. Español)

However, objects at road verges, that is, close to driving lanes, present traffic safety problems, so integration of the road-side areas must consider safety aspects carefully. Adjacent historic and cultural elements and vegetation must be adequately taken into account in road design and maintenance. Among these elements, rows of trees require special attention (see below).

Measures such as traffic calming, special structures solutions (tunnels, bridges, lowered roads, barriers, etc.), landmark isolation for protection, gardening for transition fringes and others, should be implemented in the integration of special elements next to roads. Furthermore, transition fringe can be designed under continuity criteria so that the road can benefit from the adjacent landscape character.



Fig. 27 and 28. (Left) “Humilladeros” are traditional countryside chapels on the verges of old ways in Spain, Comillas, Cantabria (Spain). Cultural and natural heritage adjacent to roads is extensive. (Right) Local road and the old wall at Sant Gimignano (Italy), a safety area has been established between lanes and monument. (Photos by I. Español)



Fig. 29 and 30. Road verges provide a landscape sense to roads, their integration into road design must take safety standards into account. (Left) Traditional housing very close to the road’s hard shoulder creates safety problems (reduces visibility, access problems to and from the road, etc.) (Right) Side-road area creates a clean transition between pavement and landscape; it includes gardening, a stonewall parapet and traditional cropped rounded walls. (Photos by I. Español)



Fig. 31. *Trees at a road verge in southern England (UK). Proximity to road lanes makes these rich landscape elements a safety risk (Note an accident memorial on the tree trunk on the left side of picture). (Photos by I. Español)*

Trees at road verges present some driving problems, as does any obstacle very close to driving lanes. These problems are related to safety and frequently cause fatal accidents involving vehicles leaving the road. They also have a narrowing effect on lane width. Nevertheless, rows of trees at road verges are a very special and rich landscape resource. In most cases they are a cultural product which is much appreciated by local communities, being a main feature of many cultural landscapes. They also have the benefits of bringing environmental cycles to the arid road landscape as well as providing protection from wind and sun. As they are dangerous obstacles for traffic, their preservation must be combined with speed control measures. Rows of trees must only be recommended for slow roads such as roads approaching urban centres, mixed traffic pedestrians roads and other local roads.



Fig. 32 and 33. *Lines of trees at road verges. (Left) Road in Pyrenees-Atlantic (France). Road-verging trees are considered a cultural asset whose preservation and maintenance are positively managed in France. (Photo by B. Uriarte) (Right) Chestnut trees at the side of a road at Ezcaray, La Rioja (Spain). (Photo by I. Español)*



Fig. 34 and 35. *Lines of trees at road verges. (Left) Tree gallery in the Cotswolds, England (UK). Rows of trees filter sunlight and wind, and give a vertical sense to roads. (Right) Line of cypresses in Tuscany (Italy). Lines of cypresses are an internationally renowned Tuscan landscape feature. (Photos by I. Español)*

Gardening and environmental recovery measures can be adopted in order to naturalise the road landscape. While gardening is more sophisticated and creative, usually involving exotic species,

environmental recovery is aimed both at landscape and environmental purposes, such as preventing erosion. Environmental recovery measures include soil treatments, plantations and reafforestation. Urban road verges, traffic islands, roundabouts, and motorway medians are areas suitable for gardening. Cuttings and embankment slopes, road works sites and decommissioned roads are typical areas for environmental recovery and reafforestation.



Fig. 36 and 37. Gardening and environmental recovery in road design. **(Left)** Olive trees and ornamental plants on a gardened roundabout. (Photo by I. Español. **(Right)** Environmental recovery of an embankment slope (Photo by E. Rico).

In addition to regular road elements, other special elements and areas of roads have a specific role in creating a sense of identity. There are bridges, tunnels, roundabouts, resting areas, service stations, parking areas and bus stops. Each of these elements has special functional requirements and different landscape roles.

Road bridges have a strong presence, especially in landscape integration terms, that is, when viewed as part of the landscape. They also play a role in securing a road identity. They are very singular and must be dealt with specifically. Traditional bridges can provide a colourful aspect to roads, whereas modern structures can have a discreet effect with little effective presence or, on the contrary, they can have a spectacular aspect imposing on landscape.



Fig. 38, 39 and 40. Bridges and road character. *(Above)* Simple arch bridge on the Segura River at Los Gallegos (Spain). The modern and simple structure has a modest presence. *(Below Left)* Stone bridge and parapets at a road in Montseny Nature Park, Catalonia. Consistency of materials and techniques give a sense of road character. *(Below Right)* Spectacular bridge by Santiago Calatrava in Ondarroa, Bizkaia (Spain). Bridges can have an imposing presence which is not always positive to landscape character. (All photos by I. Español)



Fig. 41 and 42. Tunnel Mouths I. *(Left)* Carved tunnel for a one-lane road on the island of El Hierro (Spain). (Photo by I. Español) *(Right)* Red ornamental protection marquee and plastered rocks at a tunnel in Ricote Valley, Murcia (Spain). (Photo by L. Cruz)



Fig. 43 and 44. Tunnel Mouths II. *(Left)* Structure covered by stone wall on the island of La Palma (Spain). (Photo by J.T. Rodríguez) *(Right)* Sophisticated ornamental walls for the Cantabrico Motorway (Spain). (Photo by I. Español) Note in both cases the slope above the tunnel's upper collapse which is partially integrated by the external structure design.

Tunnels hide the road under the ground. Yet tunnel entrances have a special role in road identity and character, and they have to deal with the special features of their surrounding areas. Here road and tunnel functional elements merge with the resulting effects of construction works (rock collapses, land fills, previous working tracks and facilities, etc.) as well as with pure landscape elements such as rocks, vegetation, buildings and others.

Most tunnel mouth design solutions include support and protection structures. Small tunnels can show their carved rock uncovered. This gives a very powerful aspect to the landscape. Medium and big size tunnels have to deal with rock collapses of the slope above the tunnel entrance, so they generally include either special treatments for the slope surface (extra cuttings, forced local collapses, rock special plastering, etc.), or protective structures of different size and shape, or both. As in bridges, the outer part of these structures can be spectacular, merely functional, colourful and traditional, or just simple and discreet.

Petrol and service stations, together with rest and parking areas are special areas in the sense that travellers get out of the vehicle and have a direct experience of landscape. However, these places have an irregular landscape profile since only exceptional landscape and road character are taken into account in their design. While rest area designs normally follow quite a sensitive

approach to landscape and environment, petrol and service stations are basically oriented to serve trademark identity.

Parking areas are generally functional with little or no reference to landscape or character features. Parking areas are strategic in providing adequate road access to quality landscape areas such as nature parks or historic urban centres without allowing cars to get into these sensitive areas. Their location must be discreet.

Bus stop design sometimes reflects local features strongly; other times it adopts a functional and minimal approach. All these “stopped-vehicle” areas have a special landscape potential which can be developed positively.



Fig. 45 and 46. Parking area design. **(Left)** Stone walling and fruit tree at a parking area in Eivissa (Spain). **(Right)** Parking area at Oma, Bizkaia. (Photos by I. Español) Character elements such as trees and traditional stone walls have been integrated within the parking area.



Fig. 47 and 48. Bus stop design. **(Left)** Colourful and picturesque bus stop, Cantabria (Spain). **(Right)** Minimal and functional bus stop design in The Netherlands. (Photos by I. Español)



Fig. 49. *Homage to La Rioja wine tradition at the centre of a roundabout in Labastida (Spain). (Photo by I. Español)*

Finally, roundabouts must be pointed out as special character elements since frequently they adopt a clear identity message by including gardening, monuments and settings in their centre areas. Very often they present installations which show the area's main cultural features, such as traditional industry and agriculture, art and history, traditions or celebrations. The motifs one can find in the centre of roundabouts are very varied.

5.3 Road elements for landscape enjoyment

Some roads include side areas which are specifically devised for people's enjoyment of landscape, such as footpath, bicycle lanes, scenic viewpoints and parking areas. These areas require a special planning approach since they have to combine landscape enjoyment together with traffic functions.

Footpaths and bicycle lanes must be safe and comfortable. They are better suited to low-traffic roads and need to be separated from road traffic. A discreet separation can be efficient.



Fig. 50. *Separate bicycle lane. Safety barrier and low parapet separate pedestrians from traffic. (Photo by I. Español)*



Fig. 51. Footpath. Row of trees gives shade and protection from traffic. (Photo by I. Español)

Scenic viewpoints require a very specific location. The best landscape views are not always found in suitable places. There has to be at least enough space for safe access, vehicle parking, standing areas or benches, information panels and waste disposal. The design of their facilities must be adequate. Safety conditions must be guaranteed for vehicle access to the scenic viewpoint.



Fig. 52 and 53. Scenic viewpoint. **(Left)** Parking lane and access. **(Right)** Parapets and barriers for pedestrian safety. (Photo by I. Español).



Fig. 54 and 55. Scenic viewpoint information panels. **(Left)** Sight panel at Setecidades volcanic lakes in San Miguel de Azores (Portugal). **(Right)** Killarney National Park map panel at a scenic viewpoint (Ireland). (Photos by I. Español)



Fig. 56, 57 and 58. Scenic viewpoint facilities design. **(Left)** Stone parapets, stairs, lanes and standing areas displayed on a slope at different levels. **(Centre)** Rust steel, white parapet and badlands lava rocks make up the scenic viewpoint facilities. **(Right)** White clay and sand walls, stairs and arch frame the view. (Photos by I. Español)

5.4 Landscape approach to road design

All different aspects of landscape design of roads must be considered together with traffic safety and comfort, and the need for environmental and landscape integration within a comprehensive approach, so that criteria for character, identity, landscape facilities of the road, traffic and landscape integration (see below) produce a quality infrastructure which benefits from landscape resources without compromising safety and sustainability.

In this sense, road design must avoid damaging landscape character features and instead should integrate landscape elements which are found at road verges. Traditional structures, such as walls, agricultural infrastructures, milestones, architecture, etc., as well as vegetation elements, such as singular trees, tree groves, hedges, lawns and others should be respected and incorporated within the road landscape.



Fig. 59. Typical stone waling and chestnut trees at the road margins are features of Cotswolds landscape character. This can be easily and discreetly integrated into road design. (Photo by I. Español).



Fig. 60, 61 and 62. Sandstone is a consistent material which being used in different road elements (retaining wall, drains and parapets) builds up a sense of identity (Photos by I. Español).

A consistent approach to design criteria of special elements is also recommended so that identity and character are reinforced. The consistent use of the same design criteria (type of stone, barriers, signalling, etc.) gives a sense of unity to road space. This is good for both infrastructure identity and traffic safety. Consistency helps the driver to understand the role of each element within the road.



Fig 63. Parapet in the foreground is a traditional stone wall together with modern materials like prevention posts. In the background a retaining wall is covered with a traditional black stone wall, while at margins gardening includes local plants and big rocks as well. All these elements together manage to create a sense of road identity. (Photo by I. Español).

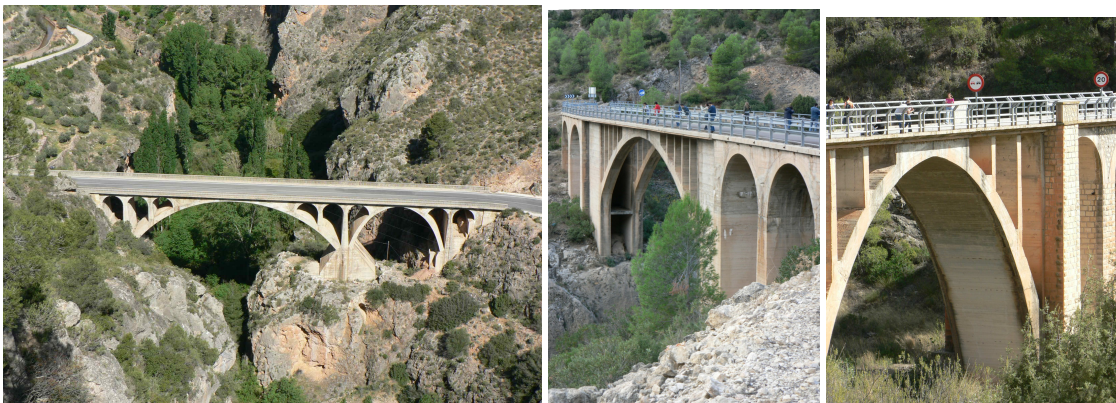


Fig. 64, 65 and 66. Consistency among three different road bridges at the Sierras of Alcaraz and Segura (Spain) - they all share similar arched structures - gives a unified identity to roads in their landscapes (Photo by I. Español).



Fig. 67. The linear character of roads determines their role in landscape. Road environment effects on landscape processes, the scenic presence of roads, together with the effect of roads on landscape perception are based mainly on their linear condition. (Photo by I. Español).

6. ROAD INTEGRATION WITHIN LANDSCAPE

6.1 The role of roads within landscape

Roads are special elements within the landscape and they should be treated as such. They have a specific role which is mainly related to their linear character. Traffic, earthworks and their essentially functional aspect are special features which determine their effect on landscape.

Firstly, roads have some specific environmental short and long term effects which must be taken into account if landscape preservation is desired.

Secondly, from a scenic viewpoint, roads have a dual character since they can be considered as windows moving across the landscape (see above) as well as part of the scene. Roads run along the landscape taking part in different sights and landscape views.



Fig. 68 and 69. Roads on the slope and at the bottom of a valley in Serra de Agua, Madeira, Portugal. (Photos by I. Español) A variety of road environmental effects should be taken into account. **(Left)** Short term effects: water aquifer reserves can be drained by the effect of road cutting at the base of the aquifer formation. **(Right)** Roads are an axis for human activity which must be taken into account by strategic planning.

Thirdly, they are linear, continuous and geometric elements whose aspects often contrast with the generally organic features and elements of landscape.

And fourthly, their functional aspects, particularly of some of their special elements (such as bridges, road markings, safety barriers, regular signalling, etc.), bring functional meanings to the perception of traditional and natural landscapes.

6.2 Road environmental effects

Environmental effects of roads can be grouped into the following sets:

- Destruction of environmental resources
- Barrier effect of roads
- Traffic effects on noise, air and water pollution and safety
- Long term effects on development and conservation patterns

Destruction of environmental resources such as soil, flora and fauna, cultural and community assets, etc. takes places during construction along the fringe of land which is occupied by the road and its earthworks. Alignment of new roads must be defined carefully, particularly that of roads which have wide sections or require much earthwork, or those that cross rich or fragile areas. Similarly, reforms of existing roads, such as those for capacity increase and alignment improvement, must avoid, or at least minimize, these unrecoverable effects on environmental resources. In addition to the application of environmental impact assessments procedures to road projects and plans, which is always advisable, road planning and design criteria must also be integrated positively into the prevention and reduction of environmental effects.



Fig. 70. Road barrier effects are varied. Road embankments affect tide cycles and therefore inland wetlands biodiversity in this estuary of La Rabia, Cantabria (Spain). (Photo by I. Español)

The effects of roads as barriers affect different environmental processes. There is road community severance, habitat fragmentation and run-off disturbance. Context-sensitive design, and definition of alignment and transversal section, (including special solutions such tunnels, bridges and cut and cover tunnels) must include prevention of these effects. Sensitive areas (urban and dispersed housing areas, nature areas, flood and river plains, etc.) should be avoided. New roads in those sensitive areas must incorporate special permeability elements (see COST 341 Handbook of Habitat Fragmentation Prevention). For existing roads, habitat defragmentation, community severance recovery and hydrological restoration of rivers affected by roads should be included as part of road planning schemes.

Traffic effects on noise, and air and water pollution result from traffic composition, traffic intensity, speed and road driving quality. Some areas, such as urban areas (particularly housing areas), nature areas (fragile forests) and quality water bodies (reservoir, wetlands, etc.) are especially sensitive to exposure to noise, pollutants and traffic hazards. All these should be taken into account when planning new roads and reforms of existing road networks.

Finally, long-term effects on development and conservation should be taken into account in road management schemes, especially when high capacity roads (such as motorways and others)

are involved. There is a large set of deep structural effects such as economic, demographic and social changes of different types, as well as increasing pressure on fragile nature areas and consequent environmental degradation. Among the former, accessibility improvements brought about by roads encourage long-term urban sprawl, abandonment of agricultural land, industrial decentralisation, enlargement of trading centres catchment areas, second residence areas, social deprivation of adjacent areas, etc. Among the latter, there are the increase of human activities in fragile nature areas, and major land and housing developments in protected nature areas. A strategic view of road management schemes should integrate the prevention of these long-term effects on quality landscapes.



Fig. 71 and 72. Roads not only allow for landscape viewing, they are also part of landscape views. **(Left)** The coast road which offers impressive views of Dubrovnik (Croatia), shows itself on the slope. **(Right)** The road leading to this view on the limestone cliff in Malta runs at its bottom between walls. (Photos by I. Español)

6.3 The road into the landscape

Roads run across landscape scenes providing views of the landscape and taking part in the scenes. In addition to road environmental effects which transform landscape processes, roads also have a clear effect on landscape perception.

In the first term, this scenic effect depends on how the road alignment relates to the landscape patterns. Morphology, rivers, crop areas, vegetation formations, as well as building lines, form landscape patterns. Some roads are aligned following the general landscape organisation, whereas others cross landscape patterns. While it can be said that the former collaborates with the landscape composition and enhances it (that is, it is compatible), the latter favours a sense of disruption which, in some cases, can damage landscape value.

When road elements are discreet and compatible, the road's linear character can have positive effects on landscape perception. A road's alignment gives a sense of depth to scenes which would be perceived flatter without the road. Alignment linearity and continuity mark irregular morphologies providing a reliable reference on relief variations. Regularity of functional elements, such as safety barriers and road marks, contribute to this sense of depth and relief.



Fig. 73. The road runs at the base of the slope in this narrow valley of the River Jucar (Albacete, Spain). (Photo by I. Español) Road presence can be discreet and not imposing when its size and alignment follow basic landscape patterns.

However, road alignment requires earthworks such as cuttings and embankments. These can become notorious and very imposing when road speed and capacities are high (which in turn implies soft ramps, open bends and wide sections) and morphology is adverse. Additionally, roads include bridges and tunnels when they need to go across deep ravines or under high mountains. When these constructive elements of roads have large dimensions, they can have an imposing effect on landscapes. They produce scale contrasts and introduce new shapes in landscape morphology. Alignment adjustment of new roads minimizes these effects. Road reforms can enlarge cuttings and embankments greatly. Environmental recovery of earthwork slopes and side areas, together with gardening at traffic islands and roundabouts, can reduce the artificial aspect of earthworks.



Fig. 74 and 75. The linear effect of a road can emphasise landscape composition by giving a sense of depth. (Left) The alignment of a small road shows morphology by providing a continuous reference to the observer along the hills. (Right) Linear presence of roads, reinforced by “teeth-like” parapets, gives a sense of depth and real relief. (Photo by I. Español)



Fig. 76. Construction of a separated dual carriageway to expand capacity. (Photo by I. Español) Earthworks, particularly those of high- speed and high-capacity roads, determine road presence in

landscape. Road infrastructure involves a variety of elements, such as separate lanes (1 and 2), embankments (5 and 4), cuttings (3), service side road (7), and building installation areas (6).



Fig. 77. Slope-cutting of roads produces a “scar effect” on landscape which can only be partially reduced by revegetation measures and rock treatments when the slope is adequate. (Photo by I. Español).



Fig. 78. Stone walls as retaining walls have a positive effect on landscape. (Photos by I. Español)

Cuttings have a strong landscape effect since they expose bare rock material. Slope cuttings can have a “scar effect” when the slope is not adequately treated. Embankments are normally more discreet since they are not steep.



Fig. 79. Cypresses on an old path, Tuscany, Italy. (Photo by I. Español) Roads, tracks and paths, and their formal elements play a positive role in landscape character.

When embankments or cuttings are replaced by retaining stone walls, the road integration in landscape is more effective.

Special character elements of road, such as rows of trees, bridges, traditional safety barriers, stone walls, milestones and others, have a very enhancing effect on landscape. They provide cultural keys to landscape perception.

Road bridges have a very singular presence in landscape scenes not only because of their special aspect, but also because their scenic condition and location. Bridges screen landscape from one side of the river or ravine to the other. Despite their supporting character, there are light elements which enjoy a certain airy nature created by pillars, arches or suspension cables.

All these landscape properties of road elements, such as alignments, regular items (safety barriers, road marks, etc.), embankments, cuttings, retaining walls, bridges and others should be taken into account in road management schemes and plans.

Landscape management schemes must include considerations on the landscape role of roads and how this is performed according to their alignment and special elements.



Fig. 80. Traditional character elements, such as a teeth- like safety barrier and retaining walls made from local stone, encourage a positive landscape integration. (Photo by I. Español).



Fig. 81. Road bridges have a powerful effect on landscape which can be spectacular or discreet, the latter being the case in this stone bridge on the Avon River (England, UK). (Photo by I. Español).



Fig. 82. *The bridge at Mostar, (Bosnia-Herzegovina), built in 1566, destroyed in 1993 and restored in 2003. (Photo I. Español) Infrastructures are not merely functional artefacts, they often possess special cultural and social meanings.*

7. LANDSCAPE VALUES ON EVERY ROAD

7.1 Landscape values

Landscape values which have been reviewed in the previous paragraphs are neither exclusive to sanctuary areas, nor to very special roads. On the contrary, all roads enjoy these positive landscape features. This is so because all roads are part of territories which are perceived as valuable landscapes. Landscape values are shared by all roads to a greater or lesser degree, though.

Routine drivers have a better knowledge of traffic and road aspects. They have a self-confident attitude towards driving. This somehow liberates their attention to landscape perception which has a special familiar character. Routine road environs are seen as just other collective social areas where community life takes place. These drivers despise landscape degradation, being very demanding on quality standards in these areas. Landscape quality is not exclusive to countryside roads in pristine landscapes; roads serving routine movements must also assume a positive landscape profile.

All roads provide access to places and landscapes of varying degrees of interest. Some take to and from home and work every day. Others lead us through our regions and countries. They also ease our visit to new and different places and allow us to enjoy their own culture, nature and landscape.

All roads have scenic qualities in so far as they provide itineraries through different scenes and views. In addition to pristine landscape areas, road management must consider the scenic quality of roads. Any road through any landscape has some sort of scenic quality, that is, it has a certain potential to present and show landscapes. Although not always noticeable, roads follow itineraries which are related to the nature and history of the land they cross. Thus, any road through any landscape enjoys different landscape values, such as cultural and natural aspects of its own itinerary, some sort of scenic qualities and a certain character of its own.

In relation to identity and character, it is true that functional elements, safety standards, advertising and trademark images are always present and very much imposing in road scenes, yet these are not the only available clues. Road environs always enjoy a certain sense of identity - often hideous and in some cases conspicuous - supported by available hints and clues around. These give us a sense of place which frequently lies underneath the noticeable.

Many roads include facilities for the enjoyment of landscape other than from within the vehicle. There are footpaths, scenic viewpoints, or just parking areas to leave our vehicle and start walking into the landscape. When roads do not enjoy these specific facilities, they can potentially have them, particularly if there are landscape resources available and those goals are positively adopted.

Finally, roads enjoy a certain degree of landscape integration in terms of the environmental processes they disrupt and in relation to their role as elements of landscape perception and enjoyment.

7.2 Road policies and management, and landscape values

All these road features are positive in themselves. If adequately managed they can create a sense of landscape in addition to the functional traffic benefits. Landscape is a unique cultural and

natural heritage which often appears disguised, misperceived, and thus, degraded, if it is not positively adopted by planning policies. Road management schemes are crucial in this sense. Inversely, the relationship between road travelling and landscape is very rich and fruitful for landscape awareness and perception; it must therefore be adopted by agents responsible for landscape. The promotion of road landscape features should not be restricted to special landscape areas. If positively adopted, access, scenic qualities, character and other landscape values of roads can be greatly enhanced by road planning, management and design.

Therefore, road landscape values should be considered in any road management scheme. According to the spirit Convention of Florence, schemes for management and planning of road networks must assume scenic values of roads (as well as other landscape values) as a cultural resource. Values such as visual capacity, identity, and natural and cultural aspects of the route can be enhanced through specific measures within an adequate and sensitive process for planning and design.

BASIC REFERENCES

AASHTO, 1991, "A Guide for Transportation Landscape and Environmental Design" American Association of State Highway and Transportation Officials, Washington.

CLEMENTI, A. "*Infrastrutture e paesaggio. Dieci indirizzi per la qualità della progettazione*". Mandragora, Florencia, 2003.

COUNSEIL DE L' EUROPE, 2003, "*Code de pratiques sur la prise en compte de la diversité biologique et paysagère dans les infrastructures de transport, Sauvegarde de la nature n° 131*", Editions du Conseil de l'Europe, Strassbourg.

CONSEIL GÉNÉRAL DE LA MANCHE, 2005, *Charte départementale de l'environnement pour un développement durable de la Manche 2002-2006*, La Manche Conseil General.

CONSEIL REGIONAL ILE-DE-FRANCE, 2000, "Geometrie de la Route et Relation au site. Les Routes Vertes. Volume 3", September 2000.

COUNTRYSIDE COMMISSION, 1995, "Roads in the Countryside", Advisory Booklet, Countryside Commission.

McCLUSKEY, Jim, *Roads in the landscape: the route and the parked vehicle*, London Landscape Consortium, London

DEPARTMENT OF TRANSPORTATION, 1980, "Environmental design guidelines for roads", Test Research Consulting Transportation and Environmental Systems, Cagliari, 1980, Alberta, Canada.

DIRECTION DES ROUTES, 2003, *Le Paysage et la Route, Document du travail, juillet 2003*, Arche de La Défense, Paroi sud, Paris.

ESPAÑOL ECHANIZ, Ignacio, 2005, "*Documento 27: Carretera Local y Paisaje*", Vías y Obras de la Administración Local VYODEAL, Benidorm.

ESPAÑOL ECHANIZ, Ignacio, 1998, "*Las obras públicas en el paisaje. Guía metodológica para la evaluación del impacto paisajístico*", CEDEX, Ministerio de Fomento, Madrid.

GALLÉTY, Jean-Claude, 1991, *Le paysage des entreées de ville*, Recherche Transports Sécurité n°32, decembre 1991.

HERRERO, Agustin (ed.), 1995, *Carreteras y paisaje*, Consejería de Transporte, Comunidad de Madrid, Madrid

IUELL, Bjorn (Ed.), 2003, "*COST 341 Habitat Fragmentation Due to Transportation Infrastructure*" *Wildlife and Traffic - A European Handbook for Identifying Conflicts and Designing Solutions*.

IARRERA, Rosaria Anna, 2004, *Autostrade come progetto di paesaggio*, Gangemi editore, Rome.

JACOBS, A. "*Grandes calles*", Colegio de Ingenieros de Caminos, Canales y Puertos, Madrid, 1996,

LEYRIT, Christian, LASSUS, Bernard, (ed.), 1994, "*Autoroute et paysages*", Les Editions du Demi-cicle.

MAROT, Sebastián, en NICOLI, Pierluigi, *Desvigne / Danloki - Il ritorno del paesaggio*, Whitney Library of Design, Nueva York, 1987

STRANG, Gary, *Infrastructure as Landscape*, in *Theory of Landscape Architecture*. Ed SWAFFIELD, Simmon, University of Pennsylvania Press, Philadelphia, 1996

WALL, A. “*Movement and Public Space: Equipping the City for a Mobile Culture*” in *Journal of Architectural Education* (1984 -), Vol. 49 (1), 1995, 22-28.

WRIGHT, C. and CURTIS, B. “*Aesthetics and the urban road environment*” in *Municipal Engineer*, Vol. 151 (2), 2002.



APPENDIX 1: LANDSCAPE MANAGEMENT AND ROAD PLANNING



Fig. I-1. *Los Genevoses Bay is a sandy bay within the Nature Park of Cabo de Gata, Almería, Spain. (Photo by I. Español)*

Appendix 1: Landscape management and road planning.

Cabo de Gata Nature Park is located in the southeast of the Iberian Peninsula. There are chains of volcanic mountains which approach the Mediterranean Sea, leaving little sandy bays in between. It is a hot, dry environment whose harsh climate conditions encourage rare flora and fauna including numerous endemic species. The shallow waters keep extensive and rich posidonia seaweed forests. Old fortresses and small fishing villages are scattered along the coast. Historically, this lagging area endured inland isolation and remoteness, the sea being a better connection to outside influences. Exhausted gold mining and very poor agriculture could not manage to develop the area during most of the 20th Century. Lack of development preserved the natural features of its landscape. The end of the 20th Century saw the rapid development of tourism on the southeastern coast of Spain. Tourist resort developments on the coastal fringe, together with the expansion of greenhouse-intensive agriculture, threaten the landscape values of this area. Currently, the development pressure which has transformed most of the Western Mediterranean coast is here restricted to some nuclei. However, tourist demand in the area is a pressure on this landscape.

The role of road accessibility, particularly access to beaches and the coast, is crucial in determining the development potential. Some tracks are kept unpaved and rough as part of the Nature Park management scheme.



Fig. I-2. Volcanic sierras and cliffs by the sea at Monsul Beach create a well preserved wild beach and an impressive pristine landscape. (Photo by I. Español)



Fig. I-3. Rare psammofile and halophile flora (foreground) survive alongside tourist activity at the beach in Los Genevoses Bay. (Photo by I. Español)



Fig. I-4. Traditional fishing village of Isleta del Moro, currently a modest tourist centre. (Photo by I. Español)



Fig. I-5. 17th Century Fortress at Rodalquilar bay. (Photo by I. Español)

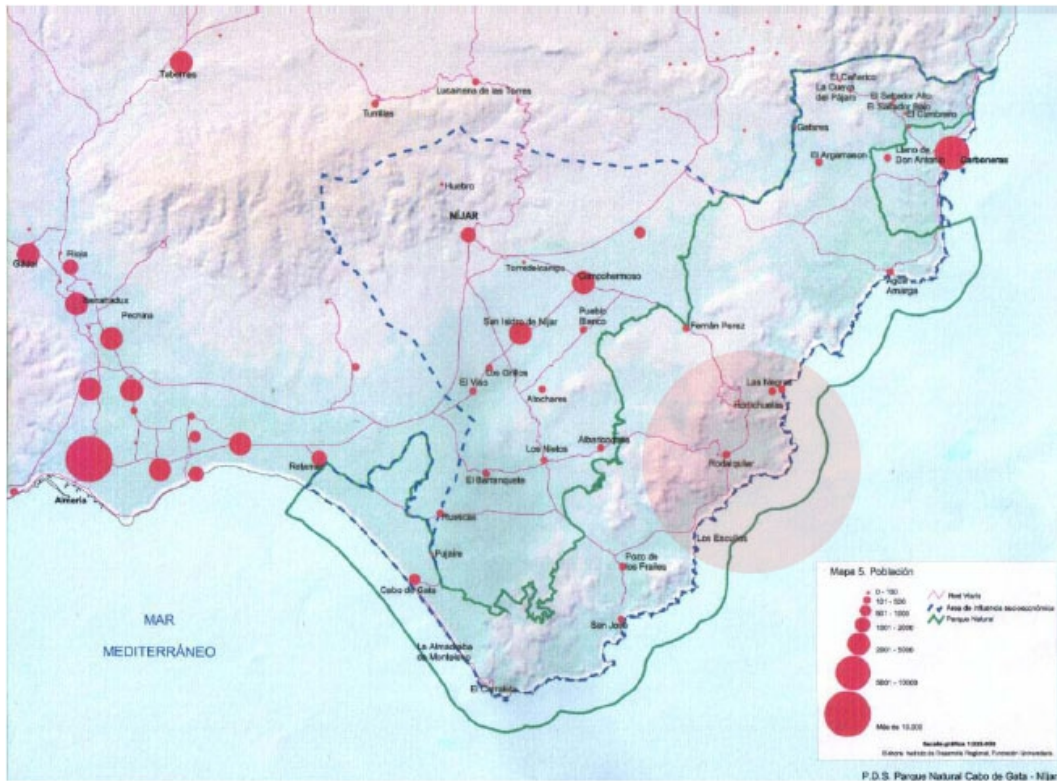


Fig. I-6. Population settlements and roads at Cabo de Gata Nature Park. Dark circle shows the area. (Graphic by L. Donada)

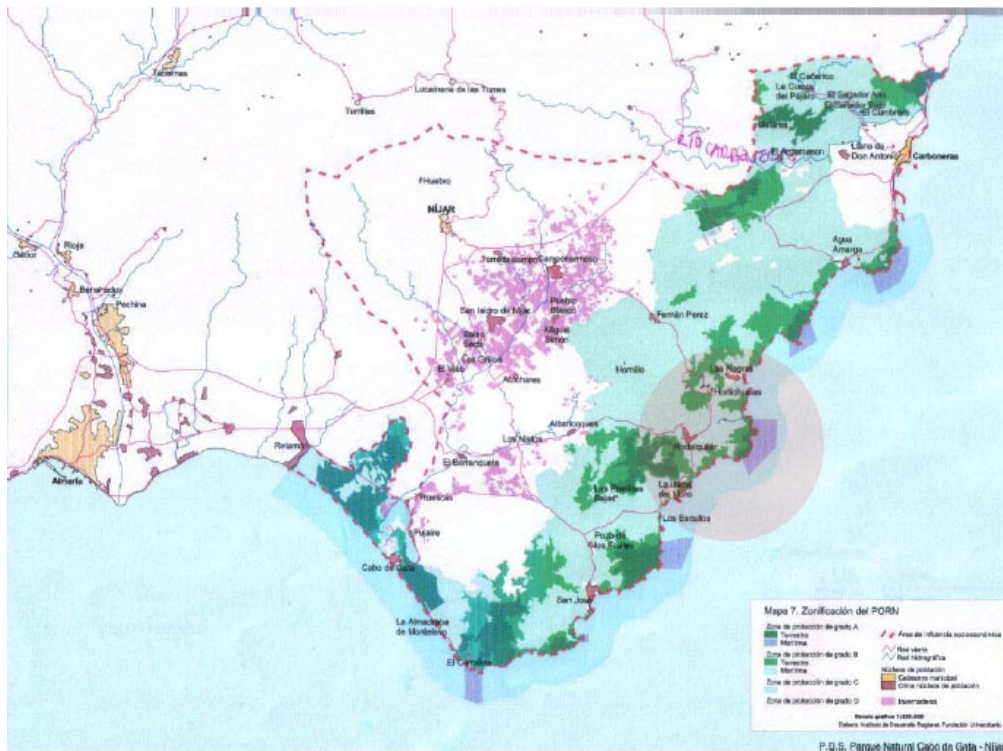


Fig. I-7. Cabo de Gata Nature Park Nature Resource Management Scheme. Red dotted line is the Nature Park boundary; blue areas are posidonia seaweed forest; dark green are areas of strict protection; pink areas are greenhouse cropping. Note the road network and its relation to preserved areas. Dark circle shows the area. (Graphic by L. Donada).



Fig. I-8. Landscape of Monsul includes exclusive resources such as a huge sand dune, unique palm bushes (*Chamaerops humilis*) and an agave tree on Monsul Beach. A sandy track (right) provides access to the beach. (Photo by I. Español)



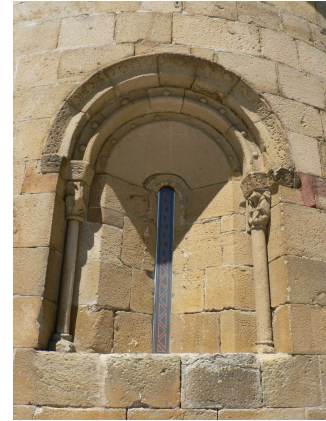
Fig. I-9. A ground track descends from the arid hill towards the bay of Los Genoveses. (Photo by I. Español)



Fig. I-10. Narrow ground roads at Isleta del Moro. Note groves of palms and pines. (Photo by I. Español)



Fig. I-11. A fully-equipped road crosses Rodalquilar Valley. It provides a connection from South to North to all main nuclei in the Nature Park of Cabo de Gata. (Photo by I. Español)



**APPENDIX 2: LANDSCAPE, ECOLOGY, ART AND HISTORY
OF A ROAD ITINERARY**



Fig. II-1. A view of the upper part of the Valley of the Rubagón River (Palencia, Spain). In the background to the left, the Castilian plateau stretches away. To the right of the picture, the Nature Park of Fuentes Carrionas. ((Photo by I. Español)

Appendix 2: Landscape, ecology, art and history of a road itinerary

The valley of the Rubagón River leans along the limits of the Old Castile, in the province of Palencia (Spain). From a height of 1.000 metres at its head, the valley opens as it descends gently from North to South. The sierras at the upper and western part of the valley form a natural barrier between the central plateau and the Atlantic valleys. Geographically, the valley of the Rubagón River is a transition piece between the Mediterranean and the Atlantic systems. The Nature Park of Fuentes Carrionas has extensive mountain forests of Mediterranean oak, where the influence of the Atlantic climate can be sensed. Throughout history, the Rubagón River itself has served as a main communication element. Roman Empire communications systems in northern Hispania included a main road to the north, parallel to the Rubagón River, and another across the river, to Cantabria in the Northeast.

Later, after the Muslim invasion, Christian colonisation of the plateau started in this valley. The original settlement system, which was established by Christian settlers during the 10th and 11th Centuries, has been preserved to the present day. As a result, a rich set of Romanesque hermitages are scattered around the valley. Hermitages are also historic evidence of the North-to-South settlement process, since they were built when sufficient resources were available, that is, when the new community was deeply established in the land. Though housing and nuclei evolved, the settlement distribution was maintained because the local economy was based on primary agriculture and hunting.

It was not until the beginning of the 20th Century, when coal mining was begun, that the expansion of some settlements in the north of the valley occurred and some new ones appeared in the east. However, the Rubagón River still functioned as the main communication axis when a new railway line for coal transport ran parallel to the river. A landscape of industrialisation took over until mining was exhausted and pits closed in the last century. At present, the exclusive and varied collection of Romanesque hermitages, and the nature areas in Fuentes Carrionas attract cultural tourism which still follows the Rubagón River as its main communication axis. The current P-220 road gave rise to this very rich geographic, ecologic, artistic and historic itinerary.



Fig. II-2. Oak tree (*Quercus pyrenaica*) forest in the Rubagon Valley shows the transition between Mediterranean and Atlantic ecological systems. (Photo by I. Español).



Fig. II-3. Stone bridge of Roman origin on the Rubagon River at Nestar. The Roman road to the Northeast and current P-220 road run parallel to the river to the left of this picture. The Roman road to Cantabria diverted here. (Photo by I. Español)



Fig. II-4. The P-220 road passing by Villavega de Aguilar where new housing stands near the parish church and cemetery (a listed monument). (Photo by I. Español)

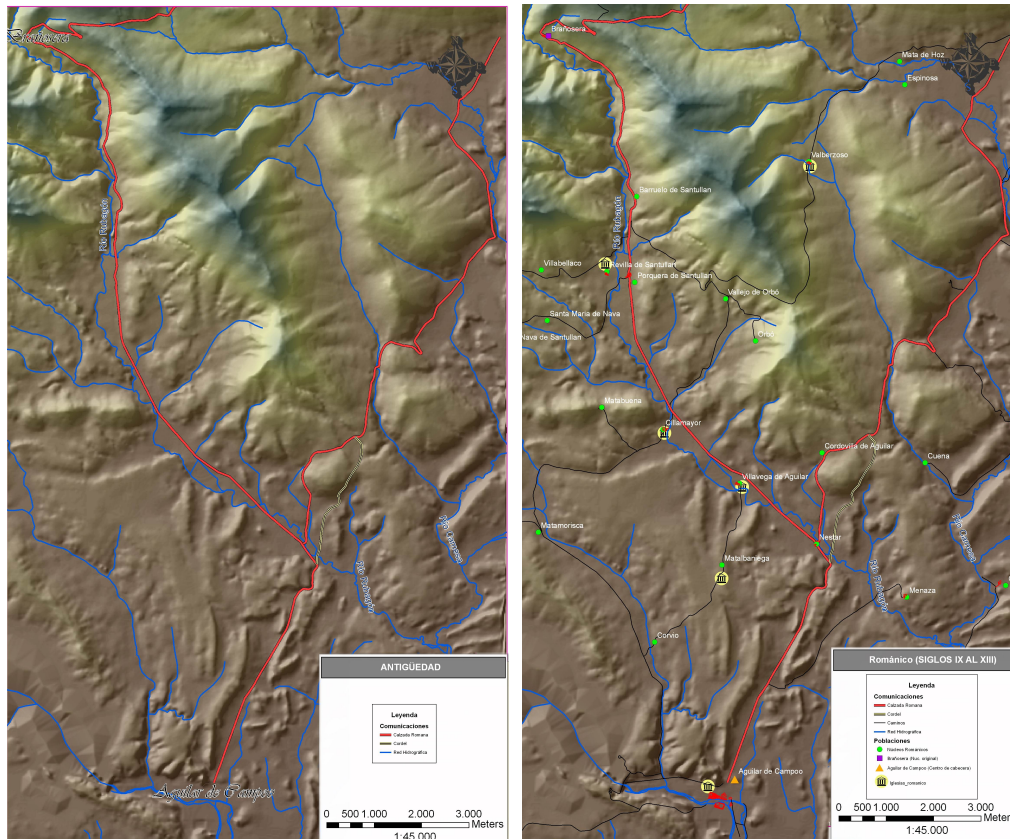


Fig. II-5 and II-6. (Left) Main roads in the Roman period. (Right) Christian colonisation settlements, 9th and 10th Centuries. (Maps by J. García-Villar)

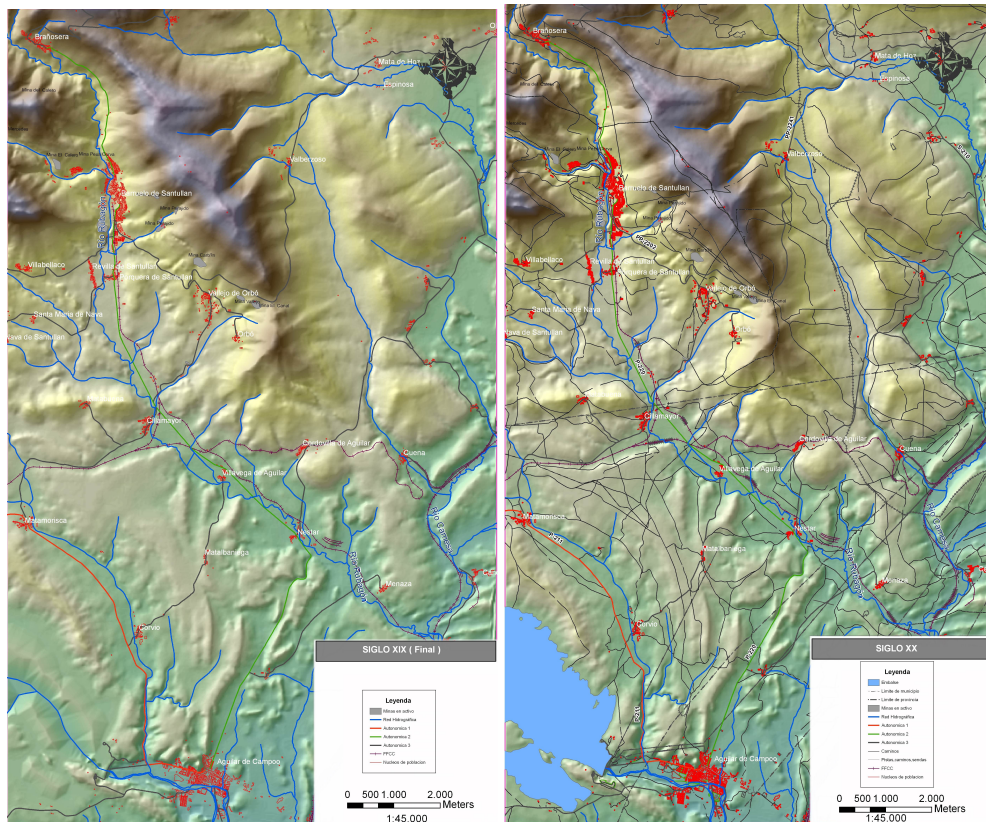


Fig. II-7 and II-8. (Left) Mining settlements at the beginning of the 20th Century. (Right) New developments in the 20th Century: reservoir (1950s), motorways (1990s) and windmills (2000s). (Maps by J. García-Villar)



Fig. II-9 and II-10. (Left) Archaeological research works at Santa Maria La Real in Cillamayor. (Right) San Cipriano and San Cornelio in Revilla de Santullán. (Photo by I. Español) Two impressive Romanesque churches in the Rubagon Valley.



Fig. II-11. Old mansion house in Santa Maria de la Nava. (Photo by I. Español)



Fig. II-12. Miners' housing at the verge of the railway and the P-220 road. Note mining wastes being restored in the background. (Photo by I. Español)



Fig. II-13 and II-14. (Left) Upper part of Rubagon valley where mining wastes are being restored. (Right) Bus stop and traffic signs at P-220 road in Villavega de Aguilar. (Photo by I. Español)



APPENDIX 3: ROAD ALIGNMENT AND INTEGRATION IN THE LANDSCAPE



Fig. III-1. The A-3002 road in Alava (Spain) has a good scenic quality. It has been reformed to include landscape facilities such as a bicycle lane and a footpath. (Photo by I. Español)

Appendix 3: Road alignment and integration into the landscape

The road A-3002 connects the town of Vitoria-Gazteiz, in Alava (Spain) to the recreational area of Ullibarri-Gamboa, twelve kilometres north. This road starts in the northern suburbs of Vitoria-Gazteiz, soon crosses the A-1 ring road motorway, and then runs north along the Alava plains and the villages of Durana and Arroiabe to reach the shores of the Ullibarri-Gamboa reservoir. This area situated at the bottom of the Aitzkorri Mountains is very popular. Its landscape is very much appreciated.

The road has a high scenic quality. It goes north along the plains by the river Zadorra until it reaches the concrete dam. The road then runs around the reservoir between the mountain slope and the water shore. The road was built using cuttings on the former and embankments on the latter. Despite little room being available, its section was later extended and diversified to include a bicycle lane in the plains and a footpath around the reservoir.

A platform was built along the side to hold the footpath without damaging shore vegetation. This vegetation has a strategic role since it supports ecological connectivity underneath the road. A safety barrier and a low parapet separate pedestrians from traffic. A banister prevents access to the shore. In addition, traffic calming measures such as rumble strips were adopted.



Fig. III-2. A conventional bridge allows the A-3002 to cross the A-1 ring road motorway. (Photo by I. Español) Note urban graffiti on the walls.



Fig. III-3. The road follows an old way and passes through two villages, Durana and Arroiabe. Traditional stone walling and old housing very close to the road's hard shoulder give character. Speed reduction is applied here for safety. (Photo by I. Español)



Fig. III-4. The Ullibarri-Gamboa dam seen from the A-3002 road. (Photo by I. Español)



Fig. III-5 and III-6. (Left) Picturesque bus stop. (Right) Recreational activities by the reservoir; parking and access from the A-3002 road. (Photo by I. Español)



Fig. III-7. A view of Ullibarri-Gamboa from the A-3002 road. (Photo by I. Español)



Fig. III-8. A footpath has been included along the itinerary of the A-3002 a side platform. A white parapet and a safety barrier separate pedestrians from traffic and a banister prevents access to the shore. (Photo by I. Español)



Fig. III-9. Cuttings and embankments alternate together with short bridges on the small ravines which allow slope habitats access to the reservoir shores. (Photo by I. Español)



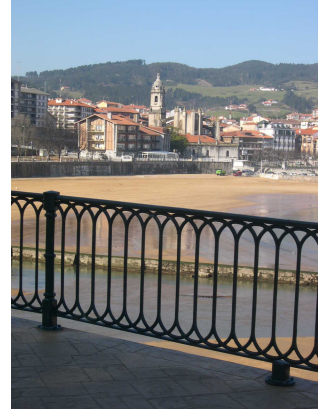
Fig. III-10. The side platform (on the left) respects vegetation on both sides of the road, encouraging ecological connectivity underneath. (Photo by I. Español)



Fig. III-11. Speed reduction marks on the road and a low safety barrier create more footpath safety and comfort. (Photo by I. Español)



Fig. III-12. *The A-3002 follows a scenic itinerary around the reservoir. (Photo by I. Español)*



APPENDIX 4: A ROAD FOR THE ENJOYMENT OF LANDSCAPE



Fig. IV-1. A view of Lekeitio from the road to Karraspio on the opposite side of the mouth of the River Lea: the beach of Isuntza (left) and the fishing harbour (right). In the foreground a tide dam runs across the picture. (Photo by I. Español)

Appendix 4: A road for the enjoyment of landscape

Lekeitio is a fishing town on the coast of Biscay (northern Spain). The nearby beach of Karraspio is connected to Lekeitio by a road which starts on the other side of the mouth of the River Lea. This road runs around a cliff - half cut into its vertical slope and half on a flying platform – and finally descends down to the beach of Karraspio. This beach is covered completely at high tide. The alignment of the road on the opposite side of the Lea mouth allows for a beautiful panorama of Lekeitio fishing port, surrounding traditional housing, the central town park, the beach of Isuntza, the Lea river mouth and the small rocky island of Saint Nikolas right on Karraspio beach.

The road is in fact a cul-de-sac which ends at the beach. It has little traffic which is only seasonal. In addition to conventional use by traffic, the road has an important social use as an attractive landscape walkway. Some road facilities allow for this enjoyment of landscape. There is a footpath which runs along its full length. It is separated from traffic by a low parapet decorated with some gardening. A series of lights stands on the parapet, reinforcing the separation effect. An unpretentious railing protects people from falling from the outer side of the walk to the beach and high tide.

The narrow space cut into the slope for the road has been extended by a side platform which allows for two traffic lanes, the pedestrian walkway and two scenic viewpoints. Near the river mouth, where the road starts, there is a resting area with some shady trees (*Acer pseudoplatanus*) and a pair of benches.

At the round corner of the cliff, there is another scenic viewpoint which has been built on the flying platform. This belvedere at the corner has a privileged location because it allows people to contemplate Lekeitio to the West, the island of Saint Nikolas to the North and Karraspio beach to the East. Finally, the road and its footpath reaches Karraspio beach. Here some panels explain the character of this beach. There are stairs which descend to the beach from the footpath.



Fig. IV-2. A view from the road to Karraspio shows the fishing harbour and historic centre of Lekeitio, and the open sea on the right. In the foreground the tide mill dam. (Photo by I. Español)



Fig.IV-3. Saint Nikolas Island and the beach of Karraspio as seen from the road. The tide dam runs from the island to the left. (Photo by I. Español)



Fig.IV-4 and IV-5. (Left) The Karraspio road cut into the rocky slope. The cuttings of the main road to Ondarroa are noticeable above. Note the flying platform on the left. Sea is at high tide. (Right) The dam for the tide mill shows its alignment from Saint Nicholas Island to the river mouth at low tide. Note on the right of the picture the flying platform of the road to Karraspio. (Photo by I. Español)



Fig.IV-6 and IV-7. (Left) Bridge over the River Lea. (Right) The beginning of the road to Karraspio includes a small resting area with shady trees and some benches. (Photo by I. Español)



Fig.IV-8 and IV-9. (Left) Saint Mary's church in Lekeitio as seen from the side walk. (Right) A view of the mouth of the River Lea at low tide. (Photo by I. Español)



Fig.IV-10 and IV-11. (Left) Footpath separated from traffic lanes by a white parapet, including top gardening and lights. (Right) The footpath around the road bend includes a scenic viewpoint. (Photo by I. Español)

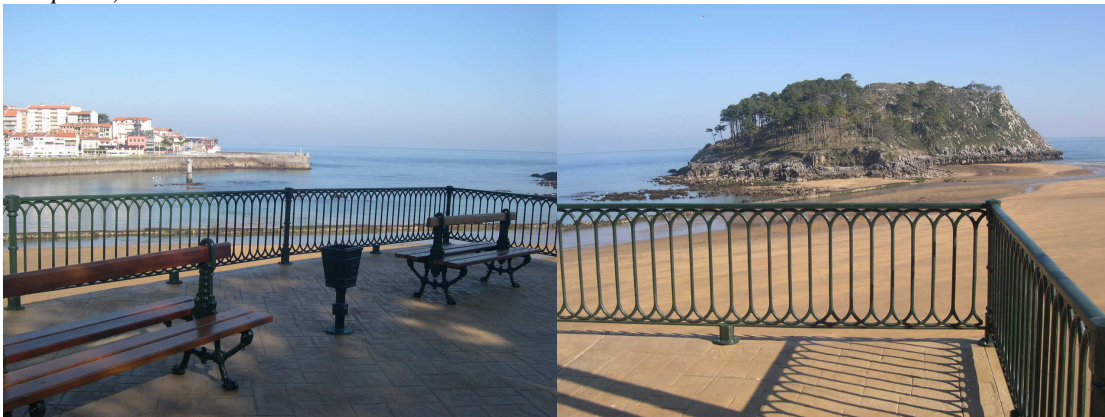


Fig.IV-12 and IV-13. (Left) Double-sided benches and a litter bin. (Right) The beach and the island of Saint Nikolas can be seen through the railing. (Photo by I. Español)



Fig.IV-14 and IV-15. (Left) Side platform on the rocks (Right) Stairs down to the beach (Photo by I. Español).



Fig.IV-16 and IV-17. (Left) Footpath by the beach, in the background Lineation (Right) A panel explains Karraspio beach features (Photo by I. Español).