

# Landscape and Associated Environmental Values in the Roadside Corridor: A selected literature review

John Clemens  
Simon Swaffield  
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LEaP Research Report No. 27  
2010

Land Environment & People



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Land Environment and People Research Report No. 27

June 2010

ISSN 1172-0859 (Print)

ISSN 1172-0891 (Online)

ISBN 978-0-86476-238-2

Lincoln University, Canterbury, New Zealand

Reviewed by:

A handwritten signature in black ink, appearing to read 'D McKenzie', written in a cursive style.

David McKenzie  
Opus International Consultants Ltd  
Christchurch

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Contacts - email: [leap@lincoln.ac.nz](mailto:leap@lincoln.ac.nz)  
web: <http://www.lincoln.ac.nz/leap>

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Series URL: <http://hdl.handle.net/10182/580>

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# Chapter 1

## Introduction

This selected review has been undertaken as part of the New Zealand Transport Agency (NZTA) research project *Improving the benefit to cost ratio for highways through multi-use management*. It specifically contributes to the objective *Understanding the perceptions and values of road users, designers and managers*. The purpose of the review is to provide a summary overview of current literature concerned with the environmental and landscape values of roadside corridors and their design and management, with reference to the NZ State Highway corridor. In order to do this, the review has been broken down into three sections:

- Multiple values and perceptions of roadside corridors
- Identifying and applying roadside corridor values
- Current applications of landscape and roadside values to highway management in NZ

The primary focus has been upon values associated with the vegetated reserve alongside the road carriageway, and its relationship with the wider landscape context. Information was gathered through reference to websites of known relevance, internet searching, searching of relevant science databases, scanning of library catalogues, and reading hard copy reports, books, and journal entries where these were not available digitally. Whilst some contextual reference is made to historical influences, the focus is upon modern understandings as expressed in English language sources drawn primarily from the landscape architectural and environmental management disciplines.

Consideration of tangata whenua values is clearly a critical factor in the NZ State Highway system, and is the subject of a separate investigation and report within the wider Landcare Research Ltd programme, and is therefore not explicitly considered in this review.



## Chapter 2

### Multiple Values and Perceptions of Roadside Corridors

Formed roads of different degrees of sophistication have been used in some countries for thousands of years. A range of reinforced surfaces have been created for military and commercial use, durability and comfort. Many long established local roads in many parts of the world comprise no more than the surface of the carriageway, with the surrounding land uses, such as farmlands, forests, or developments directly abutting the strengthened surface. In contrast, a modern highway is typically constructed within a continuous legal right-of-way wider than the carriageway itself. This road corridor can include cut and fill slopes formed for the purpose of road grading and alignment, as well as crash barriers, signs, bridges, gutters, drains, underpasses, and fences, together with a variety of areas and configurations of both modified and unmodified terrain between the carriageway and the boundary of the legal right of way and the surrounding land.

Since the early development of 'state' highways, the values associated with roads have developed from the utilitarian (to foster the rapid, safe and comfortable transport between points), through the aesthetic, to encompass a suite of economic, social, and environmental values (Transit New Zealand, 1998). These are generally regarded as a triple bottom line of outcomes for sustainable highway development, and consideration of these factors is seen as being particularly relevant to a sustainable land transport system in New Zealand (Tonkin & Taylor Limited, 2008). There is an increasing commitment on the part of highway authorities to make highways 'better than before' by placing "conservation and community enhancement on the same plane as functionality and efficiency" (Kassoff, 2004, p.12). These principles were the basis of Transit New Zealand publications following the 'first step' of policy intent towards the environment taken in 1993 (Transit New Zealand, 1993).

The values contained within the three broad dimensions of sustainability – environmental, social, and economic – vary in importance depending on both the roading context and the focus of the particular roading institution. Grieves and Lloyd (1984) identified three sets of values associated with roadside vegetation: Environmental, Social and Economic. There is also an extensive literature upon 'landscape' values associated with road corridors which fall into two broad categories – those associated with landscape as a visual amenity, and those associated with landscape as a functional system – such as biodiversity.

The emphasis in the following review is upon evolving understanding of environmental values associated with the vegetated roadside, under four sub headings: Ecological, Visual Aesthetics and Amenity, Social and Economic. Consideration of landscape as a functioning ecosystem is included in a discussion of ecological values, landscape as amenity is discussed in the section on aesthetics, while landscape as experience and heritage is discussed in the section on social values.

## 2.1 Ecological values

Ecological values of roads include a range of biodiversity values such as habitat, migration and dispersal (Grieves and Lloyd, 1984; Saunders and Hobbs, 1991). From an historical perspective, ecological restoration was a major component of the new Autobahn network constructed by the National Socialist government in the 1930s (Zeller, 2005). Elsewhere, roadside vegetation tended to be regarded primarily as a means of stabilising disturbed ground while offering aesthetic potential for framing desirable views or obscuring others (American Society of Civil Engineers, 1977). From the 1970s onwards, however, there has been much greater interest in the biological values of road corridors, in addition to the visual amenity qualities of roads, and emphasis began to be placed on the nature conservation potential of the road corridor itself (Fairbrother, 1970; Way, 1970).

Saunders and Hobbs (1991) highlight both the positive and potentially negative contributions of corridors, including roadsides, to nature conservation. Most obvious of the potential negative values of road corridors are their ability to fragment populations of animals, affect ecological processes, and be directly responsible for the mortality of animals (Spellerberg, 1998; Serrano et al., 2002; Forman et al., 2003; Jaarsma, 2004; Smith, 2004). These problems have been mitigated in many ways, including the use of underpasses and tunnels where road corridors run across ecological networks (Robbins, 2006). Where ecological corridors run generally parallel to a road alignment, disturbance is less, and is confined to edge effects (Jaarsma, 2004). Fragmentation problems can be avoided or minimised by careful planning and design that considers the ecological context (Smith, 2004; Jongman & Pungetti, 2004). Features directly associated with road corridors, e.g. adjacent hedgerows and creeks, also have potential positive importance for wildlife conservation (Hilty et al., 2006; Anderson & Jenkins, 2005; Spellerberg, 2002).

The roadside corridor and the vegetation it contains can enhance wildlife connectivity as well as providing a habitat in otherwise unfavourable environments, such as intensively managed agricultural landscapes. The land uses neighbouring the road corridor are critical to the success of greater connectivity (Robbins, 2006). van Bohemen (2002) provides a vision in which road (and rail) corridors will provide positive contributions to biodiversity as well as to the views to and from the road, a situation that can best be achieved by regarding these corridors as part of the local ecology, not as fragmenting or alien infrastructure.

There are multiple potentials for planting and management of the roadsides of road corridors and active use of road reserves as greenways to enhance ecological objectives in the New Zealand context (Viles and Rosier, 2001). Ecological values of roadsides have been studied in New Zealand with respect to sampling techniques for roadside vegetation (Overton et al., 2002), the measurement of biodiversity (Overton et al., 2000), and the study of environmental gradients and how these affect vegetation (Ullmann et al., 1995; Wilson et al., 1992). Viles and Rosier (2001) used case studies to demonstrate the multifunctional character of road corridors. In particular, greenways were examined for the way they incorporate planting within the road corridor to meet ecological objectives while not compromising transport and safety objectives.

Viles and Rosier (2001) also explored the scenic/historic/cultural dimension of the multifunction greenways. Massa et al. (2004, p.199) argue that the design and construction of ecological networks for the conservation of biodiversity “is often much more based on politics and human sciences than on bio-geographical and bio-historical considerations”. In other words, the conservation of biodiversity is a cultural phenomenon that can result in ecological gains. They discuss a case study of a generally open agricultural landscape and the importance of the details of hedgerow design and layout. One distinctive feature of the NZ situation is that agricultural landscapes through which roads pass are typically dominated by exotic species (Meurk & Swaffield, 2000), and this raises the question of the relative values associated with exotic species and those associated with indigenous species, and their management.

Strongman (1999) reports arguments throughout the 20th century about whether native or exotic plant species should be used for beautification and plantings in NZ. The relative merit of exotic and indigenous species was vigorously debated during roads beautification projects in the 1980s and 1990s. The Beautiful New Zealand project, which aimed “to promote the enhancement of the New Zealand landscape, primarily by means of large scale planting along the broad scenic corridors through which the main tourist routes pass” (Beautiful New Zealand Advisory Committee, 1984, p.1), recommended introduced plants for more modified areas, as well as indigenous species.

The agency responsible for highways until its disestablishment as part of public sector reforms was the Ministry of Works and Development (MWD) who managed the State Highway system on behalf of the National Roads Board. The MWD also managed its own plant nurseries and undertook field experiments and management trials of roadside vegetation. Manuals were produced to help MWD staff, local authorities and private landowners use and manage native and exotic species on roadsides, farmland, and elsewhere (van Kraayenoord & Hathaway, 1986a, 1986b; Pollock, 1986).

The adoption of the NZ Biodiversity Strategy (MfE & DOC, 2000) has reinforced a progressive shift in emphasis from the use of introduced/exotic plants towards greater use of indigenous plants for biodiversity purposes. By 1991, the New Zealand Adopt-a-Highway scheme listed only indigenous plants in its proposal document. Nonetheless, Meurk and Swaffield (2000) highlight the importance of culturally ‘framing’ indigenous species within modified landscapes. Similar species debates have been reported for the UK (Kendle & Rose, 2000), the USA (Leland, 2005) and in a comparison of Germany and the USA (Gröning & Wolschke-Bulmahn, 2003).

One practical consideration in selecting roadside vegetation is whether its habit is frangible (breakable). The definition adopted for frangible and non-frangible will have an effect on the structure and type of plants that can be used on road reserves, and can vary between different road authorities. In South Australia for example, ‘frangible’ and ‘non-frangible’ roadside vegetation are defined as:

- ‘frangible’ – plants which will readily break, bend or crush upon impact by a typical passenger vehicle, absorbing energy and minimising the risk of injury to vehicle occupants. Frangible vegetation is defined as being plant species with a maximum stem

diameter (at maturity) of less than 100 mm. It therefore generally excludes 'tree' species but may include many shrubby species.

- 'non-frangible' – plants with rigid, large or sturdy stems which will not readily break, bend or crush upon impact by a typical passenger vehicle, and could be expected to inflict significant damage to the vehicle and possibly cause injury to vehicle occupants (Welsh, 2005, p.2).

The New Zealand Transport Agency have produced lists of indigenous New Zealand plants suitable for different parts of New Zealand, including their frangibility (trunk diameter <100 mm measured 400 mm above the ground) and lack of frangibility (Transit New Zealand, 1991a; New Zealand Transport Agency, 2006b).

## 2.2 Visual Aesthetics and Amenity

Measures specifically designed to enhance the aesthetics and amenity of public highways can be traced back to pre industrial eras, but the idea of highway 'beautification' as a modern impulse emerged with the introduction of motorised transport in the early 20th century. In the UK, for example, Beautifying Associations were established to mobilise community action, and bring about changes to visual and other amenity features of local environments in towns and villages. They incorporated public highways in their activities, and the Roads Beautifying Association was established in 1928 (Roads Beautifying Association, 1930). Road beautification focused upon mitigating the appearance and effects of industrial areas alongside roads by using ornamental plants such as Lombardy poplars, flowering cherries, and scarlet oaks (Merriman, 2007). In the USA, similar local and state initiatives to manage roadside aesthetics culminated in the 1965 Highway Beautification Act, but here the focus was upon control of billboards, and in some cases resulted in loss of vegetation (Floyd, 1982).

Initiatives to ameliorate the effect of adjoining land uses upon existing roads have been complemented by design and management of roads specifically to provide scenic experience. A key feature of 18th and 19th century landscape design in Europe was the experience that could be gained from the sequence of views from carriageways laid out within the extensive rural estates (Daniels, 1999) and urban parks (Chadwick, 1966). As landscape architecture became established in North America as a professional design discipline, this scenic approach to roadway design was expressed in public 'parkways', through parks such as Central Park New York, and in the expanding suburbs, for example in FL Olmsted's development of Riverside Chicago (Olmsted, 1915).

The establishment of National Parks extended the design of roadways for landscape amenity into wilderness areas, and by the early decades of the 20th century the idea of a scenic parkway drive had become established – exemplified in the Blue Mountains Parkway (Myers, 2004, 2006). The Summit Road along the Port Hills in Christchurch (Baughan, et al., 1914), initiated early in the 20th century by Harry Ell, and constructed through into the 1930s is an early example of a New Zealand scenic road.

The growing numbers of automobiles in rapidly growing industrialised countries with large urban populations, such as North America, lead to wider recognition of the future impact of highways on urban and rural landscapes. In the UK, the establishment of the Institute of Landscape Architects (ILA) in the 1930s provided the impetus for a wider perspective on the relationship of roads with landscape. In *Land and Landscape*, Colvin (1948) argued that road corridors in post war Britain be viewed as part of the landscape and not as infrastructure for horticultural beautification. Roads should be sited and aligned in sympathy with the landscape. Roadside plantings were to be designed to provide “interest and variety to keep the driver alert and vigilant” in order to overcome the monotony induced by engine and road sound (and other soporific features of road transport) (Colvin, 1948, p.246). The use of native plants was favoured to knit the road into the landscape and to make the ‘road read’ (Crowe, 1960, p.114).

Similar ideals were being expressed in the USA (Clarke, 1932, Nichols, 1940, Ellis, 2005). While being aware of other dimensions of experience, they focused particularly on the analysis of the view along and from the road corridor. Scenic qualities were important, as was the legibility of the landscape to enable a sense of place to be experienced (Snow, 1959; Appleyard et al., 1964; Robinson, 1971; Carpenter et al., 1975).

There was an important shift in conceptual thinking about roadside landscapes in the 1970s, prompted by the expanding use of Environmental Impact Assessments and their incorporation into various forms of legislation within developed countries. Three features are of particular relevance, first, the emphasis upon consideration of ‘impacts’ of development such as roading, and their mitigation; second, the adoption of a parametric approach to analysis; and third, the development of analysis and management systems. An example of this shift is the Visual Resource Management systems developed for Federal lands and infrastructure in the USA, including highways (Jones and Jones, 1978). VRM systems specify ‘scenic’ and visual resources using formal descriptive and classification and protocols, evaluate both the resources and the sensitivity of the wider public to change, and develop prescriptive management policies. Current management systems (see section 3) draw upon this legacy.

### 2.3 Social and Cultural Values

The social and cultural significance of roads and road travel extends well beyond the scenic and visual, and embodies “a complex social practice and activity...inhabiting and consuming the spaces of the car and road in a myriad of distinctive ways” (Merriman, 2007, p.11). This sense of place for ‘the road’ would appear to be particularly strong in the cultural consciousness of the United States (Merriman, 2007), and has been the subject of numerous literary and cinematic works of fiction and biography, such as Jack Kerouac’s classic *On the Road*. The sense of place of particular roads as cultural features of identity has also been established through film in New Zealand, e.g. open road scenes in *The Runaway* (1964), in *Smash Palace* and *Goodbye Pork Pie* (1981).

The cultural values associated with the road corridor are complex and may include features of identity and a sense of expectation established over several decades, or longer. Road

corridors have become symbols of progress and part of the way of life of local populations (Merriman, 2007). 'Heritage' values of roadside corridors can include attachment to particular road corridors that has accumulated and developed over many years, and embody a sense of place. They can refer to the tangible remains of former industrial or activities or other practices that have been serviced by the highway, and can include highways and highway infrastructure itself that has acquired value because of its age and association with historical events.

The community-based approach to the restoration of the Paris-Lexington Road in Kentucky, USA, is a good illustration of the depth of feeling attached to certain historic roads (Schneider, 2003), whilst in New Zealand there are a number of former bridges that have been preserved and now form heritage features. The literature used to promote scenic drives and tourism in different regions shows how both heritage and nostalgia are used to enhance road use and associated tourism opportunities. Examples of photograph collections include books which take readers 'up the East Coast' and 'down Highway 35' of the *Blue Sky Highway* (Clapham, 2006), or the length of New Zealand's State Highway One in *The 1 Thing: A Small Epic Journey Down New Zealand's Mother Road* (Moore, 2006).

Road corridors and the landscape they pass through are vital parts of the tourism experience in New Zealand (Simmons & Fairweather, 2005). For both tourists travelling to a particular destination and for those on touring holidays more generally, the road journey can enhance their tourist experience. One can *Explore New Zealand* via 'uncrowded roads that travel through an incredible range of scenery' including farmland, in a book of 60 scenic driving tours (Cobb, 2005). There are also driving holiday itineraries (Blaber, 2005), and guides featuring selected 'greatest hits' of places and landscapes accessible to tourists (Chowdhury, 2004). Regional promotional material is produced for scenic road journeys such as the Whanganui River Road and the West Coast Road to Haast. Moir (1991) reports on the depth of feeling associated with the design, appearance and maintenance of road corridors and how these relate to the landscape, especially on scenic roads used by local and overseas tourists.

## 2.4 Economic Values

Economic values attached to road corridors include their strategic and local transportation functions, their role as a tourism resource and as a stimulus for businesses such as garages, roadside cafes, and an increasing number of retail outlets. More specific uses have historically included grazing, soil conservation, microclimate control, fire barrier and suppression, road safety, weed suppression, and noise reduction (Grieves & Lloyd, 1984). Grazing is no longer allowed in unfenced areas, but other uses and 'ecosystem services' are significant. Viles and Rosier (2001) also identify the importance of roadside conditions for adjoining property values, and local employment from roadside enhancement projects.

Many of these values or dis-benefits relate directly to the configuration and management of the verges and their vegetation. For instance, vehicles generate noise that can be unpleasant for those in surrounding neighbourhoods, and noise abatement can be achieved by a number of different measures. Typically in New Zealand, the technique is to use earth

or inert material barriers, or to lower the road corridor into cuts in the terrain (McCallum-Clark et al., 2006). Roadside vegetation can also reduce the noise of traffic from affecting the surrounding landscape, although to have an appreciable effect this vegetation would need to be denser, taller and deeper than would be possible on most roadside reserves (Fang & Ling, 2003; VicRoads, 2003a). The way vegetation reduces road traffic noise (and people's perceptions of road traffic noise) is technically complex (Geiger et al., 2003).

A further potential effect of roadside vegetation on the perception of noise is its ability to screen traffic from view, creating a quantifiable psychological effect over and above any physical effect on noise levels (OECD, 1995). Road safety is another critical economic consideration, and management of vegetation is undertaken to maintain sight lines, and to keep an area near the carriageway free of solid obstacles (New Zealand Transport Agency, 2006a).

A more traditional economic value associated with roadside verges has been their use for grazing farm stock. The potential for stock to graze arises from the natural establishment of palatable species of grass and other plants, or from soil conservation efforts that have resulted in the establishment of these plants. The occurrence of roadside grazing varies from country to country. Traditional graziers in New Zealand and Australia formerly used travelling stock routes to move mobs of sheep or cattle between locations in rural areas, grazing as they moved, although roadsides might also be grazed locally (Macaulay, 2000). Today safety concerns limit the use of unfenced areas but reconfiguration of the corridor can release land to be reincorporated into adjoining fields.



## Chapter 3

### Identifying and Applying Roadside Corridor Values

Highway authorities have developed a range of strategies, guidance notes and handbooks in response to the changing attitudes and insights into the potential for road corridors to provide the public with multiple, relatively intangible values in addition to safe and efficient transport routes. This section describes some international perspectives and applications of values into highway management before considering value applications in the New Zealand context. It then briefly reviews methods used in research into landscape values associated with roadsides, both internationally and in New Zealand.

#### 3.1 International Perspectives

VicRoads (Australia) *Roadside Management Strategy* provides an international example of a value based approach, which considers all the values and requirements of the roadside, with sections on roadside management, environmental and cultural heritage, amenity and access (VicRoads, 2003b). Statutory obligations with respect to the environment (e.g. for protecting biodiversity, weed control, and sustainable development) were combined with community and stakeholder expectations to devise the strategy. The most important 'outcome areas' for the public were safety, landscape, environmental and cultural heritage, and the aesthetic and amenity of the roadside.

Amongst the environmental, cultural heritage and amenity values identified as being strategically important by VicRoads are:

- The control or eradication of plant and animals pests;
- Development of a *Draft Native Vegetation Management Framework* involving regeneration / revegetation for a net gain for biodiversity of any new projects;
- Reduction of erosion and road runoff into the surrounding landscape;
- Improving the aesthetics of road corridors and rest areas for travellers and local communities; and
- Supporting the VicRoads Adopt-a-Highway scheme (VicRoads, 2003b).

The roadsides of Victoria (and other parts of Australia) are unusual in that they often contain significant remnant plant and animal populations surrounded by land completely cleared for extensive grazing and cropping. Thus, the VicRoads roadside documents tend to focus on the conservation of existing biodiversity. The *Roadside Handbook* identifies roadsides as being "unlike private land, because they have been protected from agriculture and development" (VicRoads, 2006c, p.8). The environmental guidance in the handbook contains several practical sections, including minimising disturbance, tree and vegetation protection, avoidance of 'tidying up' vegetation (through vegetation thinning or the unnecessary clearance of dead vegetation and small plants), and weed avoidance.

In addition to their remnant vegetation and fauna, roadsides in Victoria are also noted for their Aboriginal cultural heritage, and as historic reminders of colonial times. This focus on

the conservation of existing high value biodiversity and cultural features is also developed in the 2006 VicRoads *Roadside Conservation Management Plan Guidelines* (RCMP guidelines), where listed values include landforms, rivers, wetlands, vegetation, fauna and aboriginal and non-indigenous heritage (VicRoads, 2006b). The approach adopted by VicRoads towards protecting the environment is set out in its 2006 *Environmental Management Guidelines* (VicRoads, 2006a).

The process of conserving biodiversity is described in detail in the VicRoads Biodiversity Guidelines where the benefits are listed under three headings: ecosystem services, biological resources, and social benefits, the last providing a link between the environmental and social value sets (VicRoads, 2005a). Ecosystem services provided by the generally existing vegetation and biology of roadsides in Victoria include: the maintenance of ecosystems, and the protection of water resources and the soil from erosion and nutrient leaching; reduction of airborne and soil pollutants; and, contribution to climate stability, and recovery from unpredictable events (VicRoads, 2005a). Social benefits include research and education, the use or appreciation of a biodiversity asset in recreation, education and the cultural values associated with natural landscapes (VicRoads, 2005a).

The *Roadside Strategy*, the *RCMP Guidelines* and the *Environmental Management Guidelines* documents do not mention the aesthetic and scenic characteristics of roadsides, although the local Planning and Environment Act 1987 notes the relevance of 'visual amenity' (Appendix 2 of the RCMP guidelines) and the New South Wales RTA guidelines explicitly refer to aesthetics. The *Biodiversity Guidelines* note the aesthetic qualities of planted indigenous plants, but contain no consideration of the visual or landscape effects of measures to conserve biodiversity. This highlights the pattern of typically high biodiversity values within the road corridor through an agricultural landscape in Victoria. The full range of economic, environmental, and social values are brought together in the VicRoads *Environment Strategy 2005-2015* document, including considerations of good design, amenity and liveable communities, and the aesthetic values of roadsides (VicRoads, 2005b). VicRoads also promotes an Adopt-a-Roadside scheme (VicRoads, 2009).

In its *Handbook of Environmental Practice*, the Western Australian roading authority also notes the importance of existing remnant vegetation in roadside corridors in a landscape extensively cleared of all original cover (Roadside Conservation Committee Western Australia, 2005). Here, the aim of roadside construction and maintenance is to minimise the loss of native vegetation and associated biodiversity, as well as to maintain aesthetic values of roadsides. However, the latter are largely confined to the reduction of nuisance such as noise and dust, and there is no consideration of the visual environment of roads as features in the landscape.

In the UK, concern for a suite of landscape, amenity and biodiversity conservation values expressed during the 20th century has been translated into the Design Manual for Roads and Bridges (DMRB) with comprehensive sets of management handbooks and advice notes (Highways Agency (UK), 2009a). Volume 10 contains sections on environmental objectives, landscape management, and nature conservation. The purpose of landscape management includes the provision of a visually interesting journey, contributions to the national biodiversity, and sympathetic treatment to "fit the road back into its setting" (Highways

Agency (UK), 2009b. p.1/1). These are similar to the ideas earlier advanced by Colvin (1948), Crowe (1960) and Fairbrother (1970). The DMRB also contains detailed volumes on wildflower meadows (regarded as a native ecosystem in the UK) and on nature conservation and biodiversity.

These examples show that the less tangible values of roadside planning, design and management associated with biological conservation and visual considerations can be integrated and organised along with the economic aspects of the triple bottom line of sustainable development. This type of multi-value approach now falls broadly under the concept of 'context sensitive design' (Burley et al., 2009), in which the positive as well as adverse effects of roads, the view from, as well as views to the road, the surrounding landscape context, and the number of people affected, are all identified as factors for consideration.

### 3.2 The New Zealand Experience

The organisational predecessor to NZTA, Transit New Zealand, recognised that many of the types of values associated with roads are descriptive and not readily quantifiable (Harris, 1994). These include both 'intangibles' – "Factors which are not readily converted to monetary terms" (Harris, 1994, p.31), or "effects for which there is no market" (Chivers et al., 1992, p.13), and 'externalities' in the form of "Costs and benefits stemming from the [road] work but which do not reside with the roading authority or road user" (Harris, 1994, p. 31). Harris (1994) singled out the 'the view from the road' as an example of an intangible that is also not an externality.

In 1994 a pilot market research project, using a combination of a household telephone surveys and a personal interviews, was undertaken by Transit New Zealand to investigate road user's ratings of the importance of 24 attributes of the state highway system (Travers Morgan (NZ) Ltd, 1994). The results suggested that people considered the most important factors to relate to the safety and efficiency of traffic movement. The survey was not designed to measure the depth of feeling (or lack of it) associated with road use and perception, and intangible factors such as scenic views were not considered beyond 'well maintained road edges' and 'overall maintenance of the road and verges', and the provision of rest stops and picnic areas.

Chivers et al. (1992) demonstrated a procedure that allowed 27 intangibles to be scored to give a total, unweighted score of intangible cost or benefit. The intangibles were principally a combination of environmental and social values that might be affected by roading construction and operation. Intangible effects were grouped into environmental impacts resulting from direct proximity to the roadway, the effects of the roadway on transport users and a broader set of environmental impacts associated with the roadway. The list of factors was derived in part from an earlier Transit New Zealand research report, which itself refers to the appendices of the *Project Evaluation Manual* (PEM) (Transit New Zealand, 1991b). They included: visual effects; effects on physical landscape; community severance and disruption; stress of change; cultural spiritual and historical effects; loss/disruption of animal habitat; water pollution; air pollution, dust and vibration; traffic noise; heritage

effects, recreational values; lighting; civil defence; and, global atmospheric effects (Chivers et al., 1992).

While this does address those values that are hard to quantify, the method appears to downplay the significance of landscape experience or meanings, unless these values are captured indirectly through other social effects on spiritual or cultural values. Visual impacts were originally covered by the terms 'visual obstruction', which was based on the angle subtended by the obstruction and 'visual intrusion' which, because of its highly subjective nature required assessment by an expert such as a landscape architect (Chivers et al., 1992).

The quality of the view that might be lost was not considered, neither was the 'view from the road', which is crucial for scenic perception as well as driver satisfaction and alertness. These shortcomings were subsequently recognised and improvements suggested for the assessment procedure. With respect to visual impact, a number of new, or improved, factors for consideration were recognised which included:

- Positive as well as adverse effects of roads
- Views 'from' as well as views 'to' roads
- The surrounding landscape context
- The number of people affected
- Continued place of an expert assessor but with consideration and/or values and opinions of local people who might differ in cultural or educational backgrounds, i.e. expert and user-dependent assessment.
- Continuing interest in the development of techniques to assess visual impacts

The Transit New Zealand document on the *Quantification of Intangibles* also considered how others have assessed these different factors and potential effects. For instance, visual obstruction can be assessed quantitatively by reference to the angle occluded from different viewing points. However, to assess the significance of this effect requires the judgement of an expert or consideration by the viewing public. Moreover, the effect might depend on the quality of the view in the first place and the characteristics of the obstruction by comparison. The view from the road is highlighted as a value that is particularly important on tourist routes and one that required further research to understand and quantify (Chivers et al., 1992).

With the technological advances made in recent years in the visual simulation of the impacts of new infrastructure, there has been a tendency for visual values to dominate over other, more complex multisensory or associative values (Schmid, 2001). With respect to road corridors, there is an understandable emphasis on the view from (or to) the road corridor rather than with a sense of place; to the aesthetic components of a view rather than with an attachment to a view. Therefore, perceptions of road corridors captured by means of visual imagery need to be interpreted with care, and in the context of the emotionally rich information supplied by respondents.

### 3.3 Methods to Identify Values and Perceptions

Understanding how people respond to landscape is complex. Research on visual qualities of roadside corridors, including both public and stakeholder preferences and values, has followed one of two paradigms – user independent or user dependent.

User independent studies by experts – typically landscape architects – seek to identify values believed to be embedded in the landscape. An example of a New Zealand based expert study was *On the Edge* (Moore et al., 1991) which presented guidelines for visual management of forests alongside highways based upon established design principles. User dependent studies focus upon understanding the perceptions and values of the wider community. Understanding how people respond to landscape is a complex area of study: each person's 'view' is different (Meinig, 1976). There is also no universally accepted methodology to elicit and understand these views for a given purpose. Reviews have appeared periodically that indicate the complexity of the subject, e.g. by Arthur et al. (1977) on scenic assessments, Zube et al. (1982) on landscape perception, and Aoki (1999) on the psychological assessment of landscape.

Nonetheless, several studies have been undertaken on the assessment of scenic qualities or changes to the landscape associated with road corridors. Akbar et al. (2003) surveyed people's perceptions of the 'scenic beauty' of roadside vegetation in northern England, recognising that changes to biodiversity goals for roadside vegetation might affect acceptance by the public. In a questionnaire administered directly to members of the public the majority of respondents regarded scenic quality as important, although roadsides were regarded as 'unpleasant and drab'. Respondents appreciated structural variety, e.g. grass with trees in the background, with a preference for the use of native species in the revegetation of road verges (Akbar et al., 2003).

The issue of changing agricultural patterns of land use, and how this might affect the perceptions of sightseeing tourists was investigated in Scandinavia using a photograph free sorting and interview procedure. While productive land has been developed more intensively, regrowth of woody vegetation has tended to occur on retired land, a process similar to that on a roadside moving from grassland to shrubby vegetation. There was also potential for landscape features that are valued as "shrines to the past" to be lost (Fyhri et al., 2009, p.202). The first stages of re-growth of agricultural lands were not viewed unfavourably, although further regrowth towards afforestation was less attractive for respondents (Fyhri et al., 2009).

In relation to what people prefer to see when they use roads, preference can vary depending on prior knowledge of farm and forestry operations. In a video questionnaire administered in Wisconsin, for example, tourists from cities and those associated with forestry showed a preference for forest landscapes rather than farm and urban edge landscapes, whereas farmers preferred a view of farmed landscapes (Brush et al., 2000). Similarly, it could be expected that city dwellers' preference for roadside vegetation would differ from that of those living in rural areas.

In another study more related to the view 'from' the road, than the view of the road corridor itself, public preference was elicited using photographs of different scenes in southern Spain, and analysed against the variables exhibited by each photograph (Ariazza et al., 2004). Both wilderness and positively evaluated man-made features were critical for perceived visual quality, followed by the presence of water and colour contrast. Negative scenic appreciation was associated with homogeneity of agricultural landscapes (monotony) and the maintenance of low productivity agricultural land. Similar findings were reported in a study of landscape preference in Norway, i.e. wildland scenes containing water were preferred to modern farming landscapes, with traditional farmed landscapes having intermediate preference (Kaltenborn & Bjerke, 2002).

Each of these studies has limitations and assumptions associated with methodology and interpretation. Assessing scenic beauty or related landscape features is often undertaken by experts educated and trained in the field. However, when public preference is paramount, such as in road corridor appreciation for local or touristic values moderated by concerns for wild life conservation and safety, an approach based on the perceptions of the users would appear to be more appropriate, more reliable, and more precise in their determinations. A combined expert/user-dependent approach has been envisaged (Daniel, 2001).

In New Zealand one of the more widely used techniques used for assessment of landscape preferences has been the approach known as Q sort (Brown 1980; Fairweather & Swaffield, 2000; Swaffield & Fairweather, 1996; Swaffield & Fairweather, 2003). This has been used as a means to elicit values, beliefs, and opinions of participants with respect to land use change and landscape preferences in a range of contexts, including landscape perceptions of tourists (Fairweather et al., 2003). The Q sort technique can be applied to the investigation both of preferences and values of landscapes already in existence, and of responses to possible changes that could take place in the road corridor and surrounding landscape.

## Chapter 4

# Current Applications of Landscape and Roadside Values to Highway Management in NZ

This section summarises regulatory provisions and management guidelines regarding landscape management of State Highway reserves in New Zealand. The examples draw specifically upon the West Coast region, in recognition of the case study focus in a related part of the programme (see Wilson & Swaffield, 2010); however, similar policies and regulations apply in other regions of New Zealand.

A number of statutes guide the legal, social and environmental requirements associated with the New Zealand State Highway network. There are relevant provisions under the Resource Management Act 1991 (RMA), the Land Transport Management Act 2003 (LTMA) and the Land Transport Management Amendment Act 2008, and the Local Government Act (LGA) 2002.

The RMA is focused upon sustainable management of natural and physical resources, and places focus upon procedures and actions to avoid, remedy or mitigate adverse environmental effects caused by land use activities, including transport infrastructure. Changes to the existing condition of the corridor through new construction or its extension both require assessment under the provisions of the RMA. These are made operational through a range of instruments, the most relevant for highways being Regional Plans and District Plans.

The statutory basis for managing and funding land transport activities is provided by the LTMA, and amongst its purposes are to provide an integrated approach that takes into account the views of affected communities and to improve social and environmental responsibility in land transport funding, planning and management. The LTMA also defines the roles of regional transport committees and provides for the development of National Land Transport Strategy and regional land transport strategies.

The LGA empowers territorial local authorities to play a broad role in promoting the social, economic, environmental and cultural well being of their communities, taking a sustainable development approach. Public roads that are not part of the State Highway system are managed as local authority assets under the LGA. The Land Transport Management Amendment Act 2008 took effect on 1 August 2008 giving Regional Transport Committees greater functions and responsibilities. The first Regional Land Transport Programme (RTLTP) for the West Coast (prepared in accordance with this Act) highlighted a number of transport priorities, including: improvement of road safety; increased use of active modes (for example walking and cycling); ensuring the security and efficiency of transport corridors; and, support/enable increasing traffic due to the mining, dairy, and tourism industries (West Coast Regional Council, 2009).

There are a range of other statutory instruments and strategies that also shape the way the relationship between the highway corridor and the wider landscape is managed. For example, each National Park Management Plan prepared under the National Parks Act

includes policies addressing road construction, alignment and maintenance, vegetation and weed control, the rehabilitation of redundant road reserve and public road use including pedestrian safety and park access. A *Memorandum of Understanding* (2005) between Transit New Zealand and the Department of Conservation (DOC) addresses issues related to the interface between the State Highway network (including passenger transport, cycling and walking) and any National Parks, Reserves and Conservation Areas managed by DOC. In the case of Arthur's Pass National Park, for example, much of the present road alignment is not legalised and there are no formalised boundaries between the Park and the State Highway and the road gives the public a high degree of access (DOC, 2007).

Local and regional government strategies prepared under the LGA, such as the *Regional Pest Management Strategy for the West Coast* (2005) are also important. This strategy recognises the potential for weed problems as a result of road construction and maintenance and sets out the road verge responsibilities of land occupiers, including Crown land. The NZTA is bound by the strategy to undertake the control of plant pests in rest areas, motorway reserves, weigh pit and stockpile areas, state highway reserves adjacent to land that is free of plant pests and state highway reserves adjacent to land where the landowner is undertaking plant pest management (West Coast Regional Council, 2005).

Another example of a local government strategy prepared under the LGA that is applicable to the roadside reserve is the *West Coast Visitor Waste Management Strategy* (2006). This was prepared in order to minimise the effects of rubbish dumped along roadsides and in rest areas along the State Highway network of the West Coast, and sought to rationalise roadside stopping places: closing some, and providing signage and services (such as toilets, rubbish bins, water taps) at others (Tourism Resource Consultants, 2006).

Environmental and landscape values are explicitly addressed in the current management framework for the New Zealand Highway system at several levels, including Strategic Priorities, Environmental Planning, and *Guidelines for Highway Landscaping*. *The Strategic Plan* (2004), for example, "proposes a programme of works to improve the visual quality of state highways to reduce adverse social and environmental effects of state highway operations", while the *Environmental Plan* (New Zealand Transport Agency, 2005) contains objectives to "incorporate multi-purpose landscaping as an integral part of all new state highway construction projects" and "to improve the visual quality of the existing state highway network" (New Zealand Transport Agency, 2006a, pgs 1-1 & 1-2).

Through the *Guidelines for Highway Landscaping*, the NZTA aims to foster best practice in landscape management by: maintaining and improving safety; promoting biodiversity; improving visual quality; managing stormwater run off; managing pests; improving local air quality; and, improving business practices. The promotion of biodiversity includes helping to halt the decline of New Zealand biodiversity and "managing its state highway corridors in such a way that protects and enhances ecosystems and habitats, avoids adverse environmental effects and promotes biodiversity" (New Zealand Transport Agency, 2006a, p. 2-2). This can be achieved through the protection of existing pockets of biodiversity along the highway, and by planting native species that are: appropriate to the environmental context; positively affect ecosystem integrity; protect ecological values in adjoining land; and by managing pest plants to reduce the bio-security risk to biodiversity.

The *Guidelines* recognise that ‘improving visual quality’ must take account of the complexity of the interaction between the highway and the wider visual landscape, and the strong feelings this can engender, through ‘visual quality’ approaches such as planting and earthworks within the state highway corridor to create “viewing corridors that enable road users to appreciate the surrounding landscape” or “help integrate the highway into the surrounding landscape”. Taken together, these are intended to minimise the highway’s intrusion on the landscape and protect the natural character of an area as well as improving “visual amenity values, particularly in rest areas, at entrances to towns and cities and along highways in scenic or tourist areas” (New Zealand Transport Agency 2006a, p. 2-4).

Assessing these values is complex, however, and involves the identification of significant features, character and value of the existing landscape; identifying the concerns of interest groups and stakeholders; and, identifying how landscaping contributes to the local sense of place and community. In natural areas, assessment includes the makeup and complexity of the surrounding vegetation, the integrity and sensitivity of that vegetation, the significance of ecological values that apply on a local, regional or national scale and the scenic qualities of the surroundings. While detailed guidelines outline the assessment process, the actual level of assessment required is based on a matrix describing the environmental setting and type of highway development. The environmental settings represent the wider landscape and there is recognition that it is important to consider how various landscapes might relate to one another, and not just view them in isolation.

The *Guidelines for Highway Landscaping* presents a comprehensive checklist list of landscape quality attributes, including ecological integrity, rarity (within a local or regional context), aesthetic values and heritage and community values. Attributes of aesthetic values include: degree of modification of the surrounding environment; activity; iconic parts of the landscape; diversity or uniformity; remoteness or close connections to adjacent areas; physical features (such as the variety, patterns, colours, composition and scale of landform, vegetation and water bodies; and, visual attractiveness. Landscape heritage values may result from a combination of natural and cultural features and may provide strong continuing links to the past.

In addition to the identification of landscape qualities, the actual or potential effects of highway development are also considered, alongside possible mitigation strategies. Highway development may, for example, create a range of issues in regard to safety, biodiversity, visual quality, stormwater, pests and business practice (New Zealand Transport Agency, 2006a).

Landscape sensitivity to development is the combined outcome of landscape quality and visual absorption capability (VAC). VAC is the capacity for the landscape and environment to accommodate change, while retaining its inherent character and quality. Factors considered when determining VAC include vegetation abundance and diversity, visual diversity, slope and topography, exposure and visibility and soil stability/erosion potential.

Visual assessment of landscape involves the determination of the extent of the visual catchment (the main area from which any part of highway development can be viewed), as well as defining the viewing audience. The guidelines recognise that the ‘views-in’ audience

(those with a view of the highway), have different needs and expectations to the 'views-out' audience and take more care with identifying the location, composition and relative numbers of people in the views-in audience (New Zealand Transport Agency, 2006a). Sensitivity to change appears to only be considered in the case of the 'views-in' audience. In urban areas, the NZTA has adopted elements of the New Zealand Urban Design Protocol, and management of the State Highways within built up areas is guided by relevant landscape and urban design frameworks and plans.

## Chapter 5

### Summary and Conclusion

The New Zealand state highway system is a critical component of the country's public infrastructure. The state highway and its corridor interact with the surrounding landscape in which it is located in a number of ways, and there is a complex mix of values associated with the road network and the wider landscape. Considerable effort is being made in policy and through management guidelines, both in New Zealand and internationally, to understand and incorporate these values in roading construction and maintenance.

Attitudes towards roadsides and their landscape values have changed considerably over time. The early focus was on values associated with roads, roadsides (road corridors), and the wider environment through which these passed as seen from the perspective of road users (rather than road makers). While road corridors had value as a means to insulate road users from their surroundings and to offer safe transport through the wider environment, they also offered significant opportunities for scenic appreciation. Roadsides offered visual amenity through beautification projects and gave the public access to scenic views, in many cases through the deliberate construction of scenic roadways.

Road corridors, and in particular their relationship to the wider surroundings through which they passed, became a key area of interest for landscape architects. While this interest occurred in a number of countries, subjective judgements and cultural understandings often underpinned ideas of what type of landscapes should be preserved or fostered and these varied considerably. Much of the ensuing debate surrounded the type of vegetation to be used at the roadside, although there were variations between more pragmatic uses of vegetation (to stabilise slopes or as a means to frame wider views) and the enhancement of the roadsides themselves through planting. A feature of these developments, in New Zealand as well as overseas, was a changing cultural appreciation for native or indigenous vegetation over introduced species.

While these changes indicate some consideration of multiple values, research and interest in landscape and environmental values has remained piecemeal. Increasing interest and focus on the conservation and biodiversity potential of roadside corridors resulted in a number of scientific studies on the ecology of roadside vegetation. There was recognition of the negative impact of roads on their surrounding environments (in respect of both flora and fauna), and on ways to mitigate these impacts. A number of positive environmental impacts were also identified, including the importance of road corridors as wildlife and vegetation habitats.

Despite widespread acknowledgment that decisions on the types of landscapes that should be conserved were culturally-determined, it was also recognised that understanding and quantifying these more subjective values was difficult. Generally, cultural values, along with social and heritage values have been widely discussed and understood to be important, but have been rarely applied in any practical sense. Many of the economic values of road corridors are also underpinned by social values.

A notable feature of the increasing diversity of values identified has been a shift away from interest in the purely visual amenity values of roadside corridors (primarily from the perspective of road users) to a focus on the identification of multiple values and the more pragmatic application of these values by the road makers. The scale of 'views' addressed in literature on visual amenity varies considerably – sometimes the road itself is under review, at other times it is the wider landscape. The land lying alongside the roadway is either considered as part of the road corridor, or as a frame for the wider landscape rather than as an entity in its own right. It is difficult to isolate the values associated with each of the three components of the highway corridor: i.e. the road, the roadside reserve and the wider landscape. It is also difficult to measure and quantify many of the values involved, and there is no standardised approach that has been developed. Some of the problem lies with the difficulty of understanding the perceptions and values held by many different users.

The early literature highlighted some key differences in focus between 'road users' and 'road makers' and more recent research on landscape values indicates that further segregation into a wider range of stakeholder and community groups may be required to identify all the values held. The involvement of stakeholder and community groups is formalised in statutory requirements and there are a multitude of key stakeholders involved with the construction and management of the road network, including NZTA, local government, other statutory bodies (e.g. DOC), community members who serve on road planning and road management committees. However there is little empirical research into stakeholder values in New Zealand, and there is a clear need and international precedents to enhance understanding of the different ways in which the State Highway corridor is valued by different interest groups.

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