

# **Sustainable asset management: culture, ecology and transport**

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## **Abstract**

Highway agencies generally consider roads as a collection of embankments and cuttings that provide alignment and pavement support in addition to engineering infrastructure such as bridges and culverts. However, highways are society's most significant construct which connects as well as severs ecosystems, communities and business affecting everyone's quality of life. By involving stakeholders in a collaborative approach an *Environmental and Cultural Asset Management System* (EAMS) concept has been developed to include cultural and ecological aspects as well as traditional transport engineering to evolve toward sustainable and integrated asset management. This paper will briefly describe how an interdisciplinary team used a multi-value approach to identify statistically significant regionally based highway related cultural and ecological values and aspirations and consider policy implications for its implementation.

## **1. Introduction**

Context sensitive design is usually showcased on capital works projects; however, new or improved roading takes place on a small fraction of the network. Approximately one third of the state highway budget is spent on maintenance and operation where the idiosyncratic key performance drivers of rutting, skid resistance, roughness and texture serve as prompts for pavement renewal, spot repairs or area wide treatment. With tar on our gumboots and eyes on the edge markers we can easily lose sight of why the road is where it is. There's more to highways than reliable journey time and accident reduction. Highways affect the lives of every citizen and extend beyond the pavement including and affecting ecosystems. As roading authorities, we may be able to account for every bridge, culvert and edge marker but in general have little knowledge of the nature and state of vegetation, sensitive receiving environments adjacent to the highway nor the cultural and historical significance of people's movements over hundreds if not thousands of years. To this end NZTA embarked on a community based approach to develop an EAMS to inform and influence the day-to-day management of state highway corridors.

## **2. Definition and scope**

For the purposes of this paper the non-engineering highway assets are named environmental and cultural assets that include:

- soils and substrate,
- vegetation,
- ecosystems,
- biodiversity,
- historical, heritage and recreational events,
- natural features and
- travellers' experiential values.



We measure what we value. Engineering asset accomplishments are acknowledged with ceremonial sod turnings and ribbon cuttings (Figures 1 and 2.) Operational engineering accomplishments are measured by monetized budgetary reporting against key performance indicators.

**Figure 1: Turning sod at Tauranga Eastern Link**



**Figure 2: Cutting ribbon at Mt Roskill**



Environmental and cultural assets have traditionally been unvalued; consequently, unmeasured. In order to evaluate and assess appropriate measures for and EAMS we need to first determine the values.

A personal/cultural value is an ethical value, the assumption of which can be the basis for ethical action. Groups, societies or cultures have values that are largely shared by their members. The values identify those objects, conditions or characteristics that members of the society consider important; that is, valuable (Wikipedia, 2011.) For example, the cultural value of tree lined roads can be traced back to 3,500 years from an Egyptian queen's funeral shrine to Kublai Khan in China. Tree lined roads may be natural (Figure 3) or anthropogenic; commemorating war tragedies (Figure 4) or fueling new ones like King Henri of France's royal declaration to plant tree lined roads for the purpose of supplying the army with timber (Pradines 2010)

**Figure 3: Ancient kauri  
Waipoua forest sanctuary, NZ.**



**Figure 4: Avenue of Oaks  
Gladstone, NZ.**





Cultural values are sometimes codified into legislation, e.g. The Land Transport Management Act (2003) which provides the basis for managing and funding land transport activities and specifically requires integrated planning that takes into account affected communities as well as mandating NZTA to exhibit a sense of environmental and social responsibility. These legal requirements are operationalized by NZ Transport Agency's:

- Transport Strategy,
- Environmental Plan,
- Guidelines for Highway Landscaping and
- MoUs with Department of Conservation and Historic Places Trust.

In order to determine appropriate measures for a highway's environmental and cultural assets we need to understand the cultural values; thus, we need to ask members of the culture. NZTA funded a study by Lincoln University (Wilson and Swaffield 2010) to conduct a pilot project on a clearly defined highway corridor, the West Coast of the South Island:

- SH 7 Reefton to Greymouth,
- SH 6 Punakaiki to Ross and
- SH 73 east to Jacksons.

### **3. Approach**

#### **3.1 Methodology**

A detailed description of the methodology can be found in Landcare Report 16 (Wilson and Swaffield 2010) the following will summarise and provide examples of the methodological approach.

















Cultural values definition began with finding individuals who represent internal and external stakeholders and key informants. These included:

- Automobile Association of NZ,
- consultant architects and planners,
- cycling clubs and conservation groups,
- NZ Department of Conservation,
- economists and ecologists,
- Federated Farmers of NZ,
- Ministry of Transport,
- NZTA engineers, managers and planners,
- regional regulatory authorities,
- road maintenance contractors,
- Tangata whenua, (New Zealand aboriginal peoples)
- tourism operators and
- Truckers Association.

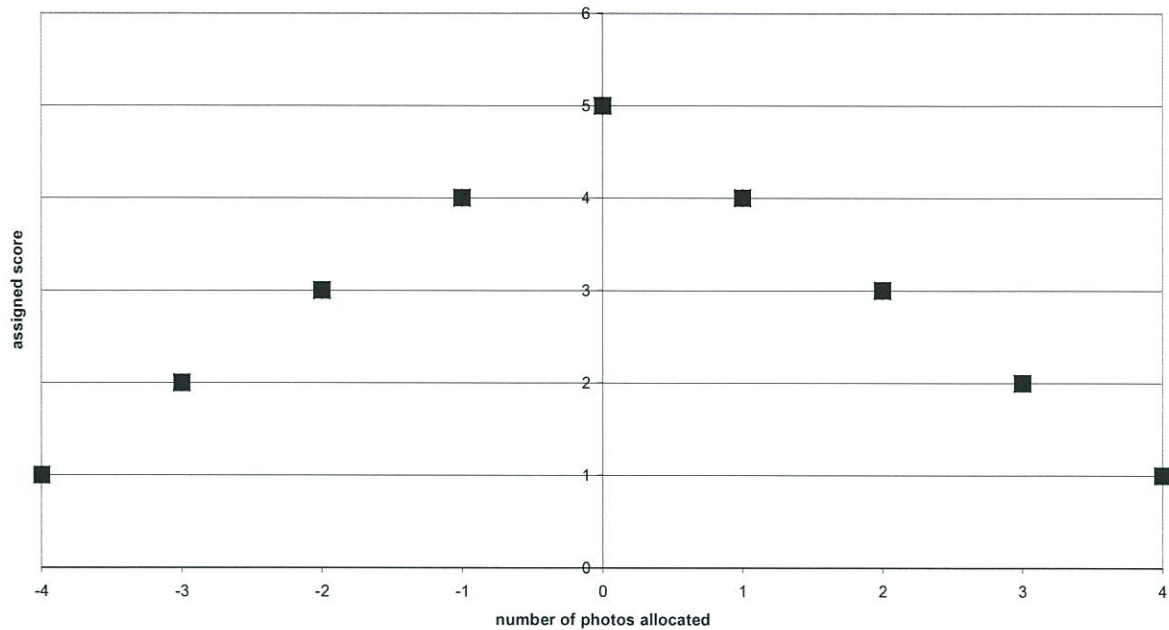
The approach taken was Q method which examines how people think about a topic and uses factor analysis to find their viewpoint. Sixty participants were used as key informants because they are involved with an aspect of the West Coast state highway. This approach provides a means to understanding the underlying way people think and feel about landscapes. From a set of 300 representative photographs (taken from a drivers view at a 45 angle,) 25 were selected for use in a workshop setting. An example of the photographs used is shown in Figure 5.

Participants independently sorted photos by preference having been asked the question, “which do you prefer?” into a normal distribution while recording their reasons for likes and dislikes. Scores were allocated to each column; for example, see Chart 1 below.

Figure 5: Matrix of photographs

	Conservation land	Rural/farmland	Infrastructure/urban
<b>Pristine</b>			
<b>Re-vegetated native</b>			
<b>Mixed exotic &amp; native</b>			
<b>Grass &amp; re-vegetated native</b>			
<b>Long grass</b>			
<b>Weed</b>			



**Chart 1: Predetermined distribution of photo selection and assignment of score**

Participant personal values; that is, what people think and feel, determined allocation. Values were identified by analysis of both explanations offered (three highest and lowest scored photos only) and image composition.

Participants were asked to sort three times. Once in response to the question, “which settings do you prefer?” and more specific questions for the remaining sorts asking:

- expression of regional identity and
- roadside management type.

Wilson and Swaffield analyzed each of the Q sorts separately with the PQ method the results are summarized in Table 1. All factors had at least 12 people loading them, which “demonstrates a high level of factor stability” (Fairweather 2002.)

**Table 1: Results for Q sorts (Wilson and Swaffield 2010)**

Q sort	Number of Q sorts	Factor					Total loading		Correlation between factors		
		single	1	2	3	NL		%	1&2	1&3	2&3
preference	60	53	33	23		4	56	93	0.64		
regional identity	60	-	21	17	12	10	50	83	0.562	0.383	0.328
roadside management	60	-	18	13	18	11	49	82	0.208	0.641	0.521

The results found only minor variation between stakeholder groups despite a wide range of backgrounds. Based on participant explanations factor 1 was named “Cultured Nature” because previous studies have noted a similar viewpoint (Newton, Fairweather and Swaffield 2003.) and factor 2 was named “Wild Nature.”

### 3.2 Findings

The overall preference (accounting for 88% of responses and 45% of variation) was for natural looking but well maintained roadsides with a variety of native vegetation. A general preference was expressed for two distinct values; cultured vs wild nature (accounting for 90% of responses and 55% variance) which were both sensitive to the context of the roadside and congruence with landscape setting.

**Table 2: Stakeholder expression of regional identity**

<b>Regional identity values</b>	<b>Associations</b>
proud community	unpretentious nature of a small community
rugged bush	history of human endeavor within a vigorous natural landscape
working landscape	evidence of mining history

Roadside management found three distinctive and pragmatic values (82% of responses and 60% variation.)

**Table 3: Values and associations**

<b>Roadside management values</b>	<b>Associations</b>
care	tidy, neat and well maintained roadsides
safety	minimization of hazards
amenity	attractive rest areas

Notwithstanding significance of the above findings, New Zealand's indigenous peoples, the Maori, are unwilling to have their values co-opted and de-contextualised within western knowledge systems. Therefore, a Q-sort, multi criteria or cost benefit analysis falls far short of their expectations for decision-making and power sharing as Treaty of Waitangi partners. Landforms and landscapes including water bodies are not simply viewed as resources; they are manifestations of their collective identity and considered taonga (treasured possessions) which should be safeguarded for future generations (NZTA 2011.) Consequently, kaitiaki (resource managers) shoulder responsibility for present and future generations.

## 4. Policy implications

The state highway network is a critical nationally significant physical resource that enables people and communities to provide for their social, health, safety, economic and cultural well-being. Evolutionary changes can achieve even the most ambitious visions therefore it is not unreasonable to consider timeframes bridging incidents and events (days to months,) seasons and contracts periods (1-3 years,) financial and statutory plans (5-10 years,) as well as multi generational visions and goals (25-100 years.) Institutionally NZTA will need to build on existing systems, continue to inculcate environmental values in strategic planning documents while reconising and integrating stakeholder expectations.

### 4.1 Environmental asset management system (EAMS)

An EAMS will need to be context sensitive and able to relate to the:

- regional character



- landscape context and
- functional relationships.

Information should include nearby land uses in order to manage the transition between highway and non-transport land.

Data on vegetation must take into account the wider landscape as well as vegetation within the road reserve in order that the road side vegetation maintenance is considered within the context of the surrounding environment.

## 4.2 Roadside management

Stakeholders prefer vegetation management that reflect the surrounding landscape rather than standardised solutions. Specifically, the following preferences are directly affected by current maintenance specifications and key performance indicators:

- limiting grass to areas needed for safety,
- layered or gradual transitions to surrounding landscape,
- minimizing visual impacts of gravel dumps or quarries,
- weed management that doesn't kill vegetation with chemical sprays (below,)
- minimise use of exotic plants and
- rest areas featuring subtle reminders of history and heritage.

**Figure 6: Indiscriminate use of biocides for weed control**



## 4.3 Vision for the future

More than a hundred years ago, the Council for the Preservation of Rural England believed roadsides should be harmonized with local landforms and planted with native vegetation. Road corridors as an experience was further advanced in the 1930's and 40's as motorways were extended both overseas and in New Zealand. However, post WW II the introduction of herbicides and availability of cheap energy led to the indiscriminate use of chemicals, growth hormone inhibitors and soil clearance resulting in the "long acre" of grassed verges devoid of natural character. More recently, society had learned that engineered, energy intensive solutions have unsustainable whole of life costs. Thus, minimally impacted natural systems provide better solutions as embodied in low impact design philosophy and demonstrated by:

- Christchurch City Council's *Wetlands and Waterways Asset Management Strategy*,
- Brisbane's Environmental Asset Management Plan based on ecosystem services natural assets provide,
- UK Environmental Information System's spatial database contribution toward landscape legibility, and
- USA Scenic Byways program valuation of intrinsic valuation of scenic, archeological cultural, historic, natural and recreational qualities.

Once we establish the values and features, which make up a highway's environmental and cultural character the next step is deciding what to do about it. The state of Nevada in the USA completed a similar exercise and produced a visionary document titled "Pattern and Place" (NDOT 2003.) Similarly the Australian Road Transport Authority produced a series of urban design frameworks for the Pacific Coast and Great Western Highways (RTA 2005, 2006.)

An example of how an approach can go wrong is described in the Journal for Transport Geography (Brown 2003.) The Alaska Department of Transportation proposed the seemingly prestigious designation of the Richardson Highway as a National Scenic Byway that a non-consulted community resisted resulting in the suspension of the nomination process.

A starting point for New Zealand might be a series of community based engagement exercises based on the West Coast pilot project focused on the pre existing themed routes; such as, Twin Coast Discovery, Thermal Explorer, Forgotten World or Great Alpine highway. As a result, Environmental/Cultural Framework Plans could be developed which articulate stakeholder/customer preferences. These preferences could then be woven into the methods and approaches used for maintenance, operations and design of capital works.

## 5. Conclusions

For most people, New Zealand's natural environment is mainly experienced from the vantage point of the state highway. One could argue that protection and enhancement of highway intrinsic values should supersede engineered improvements. However, transport planning currently only values efficiency and safety. Perhaps as a result of this study other societal values will more directly influence the operation and maintenance of the state highway and consequently enrich the experience of both tourists and local residents.

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