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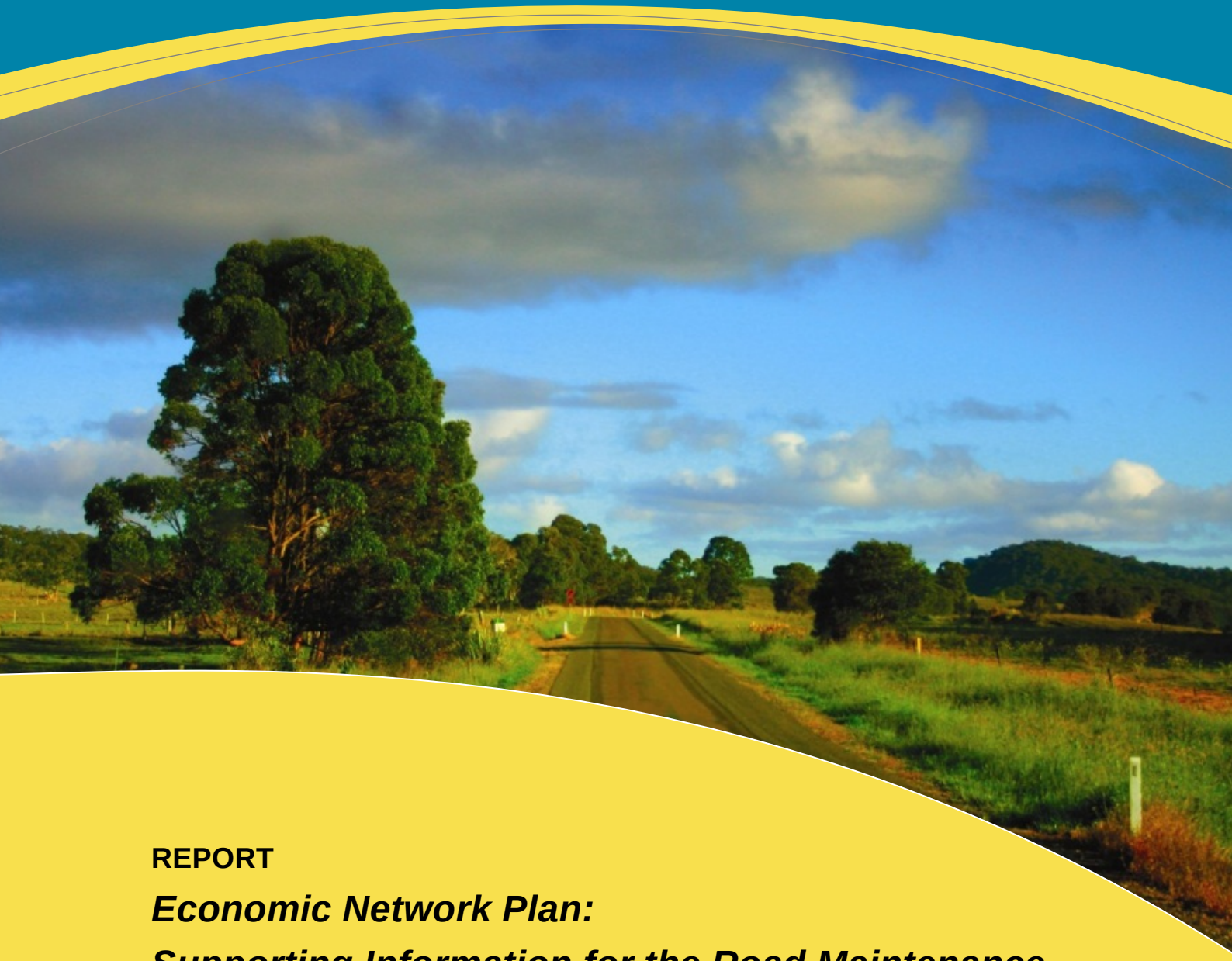

REPORT

Economic Network Plan:

Supporting Information for the Road Maintenance Task Force

Prepared for the New Zealand Transport Agency

October 2012

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Executive Summary

The Economic Network Planning (ENP) work undertaken by Southland District Council was identified through the Road Maintenance Taskforce (RMTF) roadshow workshops as a good practice case study of potential value to road networks in New Zealand.

This report has been prepared as further supporting information on the ENP approach for the RMTF to inform road controlling authorities of the technique and resource requirements, to help identify priority networks that would benefit from the approach, and to provide a high level scope for an urban ENP.

Economic information requirements are outlined in this report and are generally available in the public domain. The GIS modelling capability also generally sits within many councils or is easily accessible. The challenge is to involve key management and operational personnel who know the region sufficiently well to be able to identify the key economic activities of the region and who know the roading network and where the trade-offs exist between levels of service and expenditure. It is the iteration between desktop and roadside that eventually produces the optimal road investment given the financial constraint that exists – a process of questioning and seeking further information before ultimately making a decision.

The initial study was for the Southland District Council. The District is a region of fast-growing rural economic activity with a large expected roading renewal requirement ahead and of a low population base that is only increasing modestly. There are other regions in New Zealand that share some of Southland's roading characteristics. These regions – e.g. Rangitikei, Central Hawke's Bay and Tararua – are likely to benefit from an ENP for their roads. That is not to say that other regions would not also benefit from closer inspection of service needs. However gains in proportion to those in Southland are likely in these first three regions (34% of current roading expenditure could be subject to re-priorisation after assessment of the core roading needs in Southland District).

The method can also be expanded to an urban environment. This will complete the property-to-port view of the supply chain, and hence is a key step towards determining a full regional understanding of the road network. An urban study is also likely to lead to improved measures of economic activity and improved methods for balancing out core economic needs with potentially competing social, cultural and environmental needs.

An expanded ENP, applied consistently, would enable a national view of the core economic supply chains to evolve from regional studies. This would be both a snapshot of the transport role at present but also a means to model changes in land, property and/or ports usage that can shape future plans for roads.

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1 Introduction

The Economic Network Plan (ENP) work undertaken by Southland District Council was identified through the Road Maintenance Taskforce (RMTF) roadshow workshops as a good practice case study of potential value to road networks in New Zealand.

This report has been prepared as further supporting information on this approach for the RMTF to:

- Help road controlling authorities understand how to structure existing information that they have to align with the modelling approach, what skills or people capabilities are required and a guideline on what the modelling minimum requirements (software capabilities) are.
- Identify features of an area controlled by an authority that are relevant to assessing the value of the ENP approach, and then to help identify priority networks based on the likely highest value outcomes from it
- Provide a high level scope for an urban ENP proof of concept covering outcomes measurement and modelling

2 Economic Network Plan Background

The following is background to the Economic Network Plan approach, based heavily on an earlier paper presented to the Ingenium Conference 2012 (attached as Appendix A to this report).

2.1 Introduction

The Economic Network Plan (ENP) was developed jointly between staff at Southland District Council, MWH and NZTA to provide a process to determine the core roading needs of the district.

Southland District Council have a problem common to many councils: they have a current roading infrastructure that is proving costly to maintain and face further demands as the economy grows and as the roading assets age; inevitably spending must be prioritised. More generally, a process for prioritising operating expenditure and capital expenditure on roads – and on many other assets – is required that (a) leads to outcomes consistent with needs, (b) provides a rational and consistent decision making process and (c) enables clear communication of the reasoning to the various stakeholders.

Road Controlling Authorities (RCA) currently employ a number of asset management techniques to shape and inform these decisions. The Economic Network Plan fits within this asset management framework; it provides more information about road usage – namely the mapping of (some) property-to-property economic activity – and focuses attention on the purpose of road travel rather than simply the volume of road traffic.

The Plan emerged from a staged series of projects in Southland. A small trial with manual calculations was first validated in the field. The network of roads examined was widened, the calculations were automated, models were developed and communication tools were designed. Field validation confirmed the appropriateness of the office-based priorisation.

The wide engagement and the iterative nature of the Plan's development was a key part of the success of the combined projects. This collaboration has also become part of the Plan itself. The method has established some smart ways to measure and present the core importance of a road but it will always be necessary to refine what is measured, and refine the balancing of economic, social, cultural and environmental needs.

2.2 The Economic Network Plan (ENP)

The ENP is an asset management approach that considers the needs of a road against the cost of meeting that need. At the core of the Plan are economic data that measure the role of the roading network in providing economic income, to be considered against wider needs to determine an investment programme across the roading network. It is a top down and forward looking approach, differing from a bottom up and often backward looking asset preservation methodology.

In an asset management plan, a level of service is typically determined for an asset (or activity) and then the financial cost of this service established; any financial constraint will then trigger a reassessment of the level of service and a new estimation of cost. A key objective is to maximise whole of life performance of assets. In practice, emphasis is often placed on vehicle volumes as a determinant of the service level required for roads and a key objective becomes the preservation of assets.

The ENP is both an input into the asset management feedback loop – by questioning whether previously prescribed levels of service are still appropriate – and a method to categorise assets (including the 'must haves'). This is the identification stage of the ENP. The second stage is to take this information and integrate it with other roading needs to determine an investment strategy. This is the consultation stage. The first stage provides focus and information to the more collaborative decision making stage.

Importantly, the ENP is a decision making tool. Through the ENP an RCA is faced with a number of tactical choices on how to invest in their roads to improve returns for their community, including:

- Increase investment, improving level of service
- Retaining current level of service, which may be achieved by maintaining existing investment levels, however because of price increases this tactic is likely to result in increasing levels of investment over time,
- Reduce investment, decreasing level of service

Increased operational efficiency and innovation can also help deliver the same level of service at a lower cost, or a greater level of service at the same cost.

Each of these choices has an impact on the financial sustainability of the Council, and therefore an impact on rates (funding). Each choice also has an impact either directly on the user of the road or on the users of other roads across the district if funds are re-spread from elsewhere to support this road.

Strategic choices include:

- Route optimization, by diverting non-productive traffic onto other routes with capacity
- Modal shift, taking product or traffic off the road onto rail or redirecting to a nearby port to make more efficient use of available capacity, or vice versa
- Extent of network, understanding the value for the community in continuing to own and maintain the road (economic and social benefits)
- Changes to the funding mix, which may include identifying new funding sources based on an understanding of who is deriving what value from the road

Working within the wider asset management process, the economic network plan provides transparency around the positive and negative impacts of a range of investment choices and associated strategies and tactics, so that an RCA is better informed when making their investment decisions.

In Southland District, the economic focus was on exporting activity. However, the ENP can incorporate economic activity other than exporting. It can also integrate other non-economic activity. The approach – and the accompanying tools – offers a general refinement to the optimisation challenge inherent in any asset management decision.

2.3 Inputs, process and outputs

The approach taken with the ENP is to build up knowledge of each road that, in turn, leads to questioning the current level of service. Effectively moving through a series of filters, some roads will be identified for closer inspection – inspection as to whether the current level of service is appropriate, or whether demand can be altered, or where expenditure can be revised. The outcome of this questioning and consultation is a set of rationally derived investment strategies that can be communicated effectively.

In Southland District, the plan takes as inputs (See Appendix B for more detail on data sources):

- Land use (export value per hectare per annum)
- Economic flows (model outputs in value of export receipts per annum)
- Whole of life cost of assets (annualised maintenance plus depreciation)
- Vehicle flows (AADT)
- Crash information
- Emergency events, lifeline infrastructure and intervention, historic records of floods, liquefaction assessments.

In general these inputs can be complemented by other economic and non-economic measures of roading needs as is appropriate to the region.

The ENP combines these data in several ways:

- The transportation route of economic goods is identified either by linking properties by algorithms or by use of direct information
- Land use patterns are built up to give a combined picture of economic activity
- Roads are placed in economic hierarchy[1]
- Mismatches between hierarchy and “as usual” expenditure plans are identified to form a preliminary investment strategy

[1] The economic hierarchy derived in Southland was Regional Arterial, District Arterial, District Collector, District Local, Other Roads

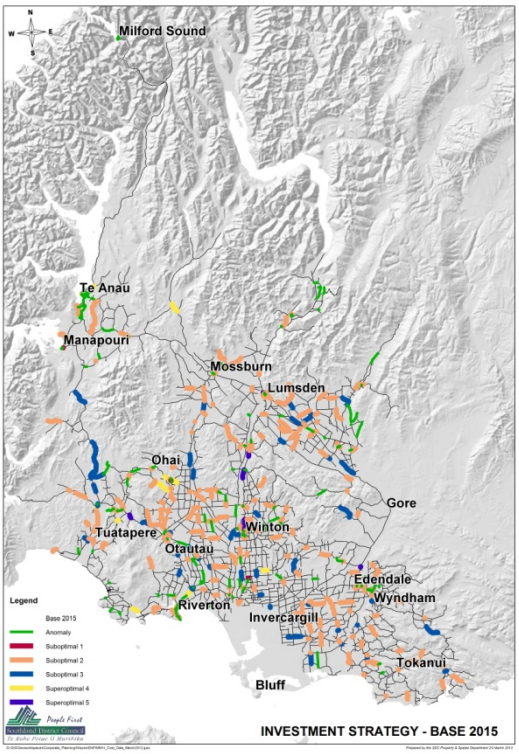
- The preliminary investment strategy is adjusted to incorporate the crash information, annual average daily traffic counts and other non-economic information that is considered important
- Implied investment strategies are validated through field interrogation

A key output of the ENP is the investment strategies for the local roads. In Southland District, the strategies were grouped as:

- Road uneconomic for Council to own (long term – short term)
- Downgrade levels of service (and resulting reduced cost)
- Consider dynamic change of level of service
- Retain or upgrade level of service
- Optimise use of network for: localised growth, farm gate to plant / port and export growth, commercial and social route and access optimisation
- Multi-modal shift and integration (future greenfield) opportunities
- Develop adaptive response of network use to changing funding scenarios (potentially drive land use behaviours through District Planning processes to match network ability to meet future ability to fund provision of the network)

Each of the measures derived for the roads – the economic measures, the costs, the strategies – can be presented in table form and, more informatively, as maps. Shown below is an example of an investment strategy determined in Southland District (not necessarily the final strategy agreed upon).

Figure 2.2 Example of investment strategies considered for Southland District roads from proof of concept work



2.4 Modelling of economic activity

One of the advantages of linking properties and roads together within the ENP is the ability to then model changes in property use and/or changes in routes taken between properties and processing/distribution nodes. This enables consideration, in particular, of economic expansion in one or more districts e.g. more dairy conversions in some parts of Southland District. Hence whole of life roading costs can be assessed for forecast future activity and not just current activity (software requirements are also discussed in Appendix B).

2.5 Consultative and iterative nature of approach

The comparison of economic activity with expected whole of life costs for a road is a core outcome of the ENP. However, this step is not an end-point but rather one information feed into a decision-making process that must now consider any imbalance against other needs and costs of the road, including in particular safety but also potentially any other factor. This requires wider consultation and included in Southland, importantly, discussion with operational staff as to confirm any apparent mismatch between activity and standard of road, and to test whether the implied changes to investment strategy fit with their opinions.

It may be as a result of this wider consultation that the original data were revisited to capture economic activity that had been previously missed, or to correct road expenditure forecasts, or to incorporate other non-economic road usage information – considered of primary importance – into the desktop process.

In this sense, the ENP can be viewed as a filter. It isolates those roads that are of importance to primary economic activity. It highlights roads where likely expenditure levels are at odds with this level of economic activity. It considers other factors to rationalise any apparent mismatch. And out of this process emerges a subset of roads that bear closer attention by council staff – a level of attention not practically possible to provide to all roads in the area. Finally, some rational, transparent and consistent decisions can be made – and communicated – about investment priorities.

3 Opportunities for Economic Network Plan

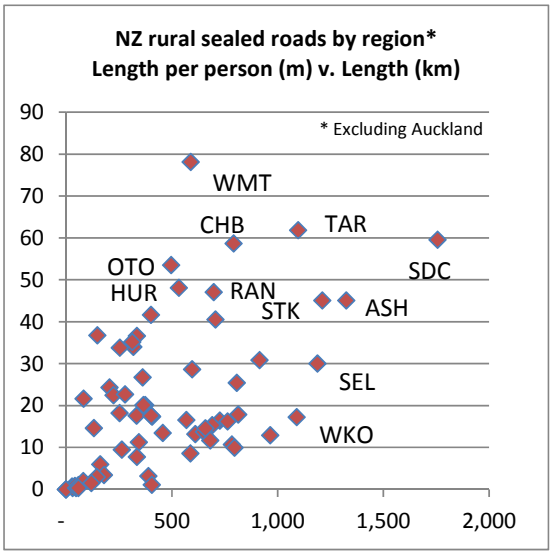
This section explores the opportunity to apply the Economic Network Plan in other regions.

The ENP applied in the Southland District focused on road usage by a small – but significant – group of primary sectors. The roads were largely rural roads and were a mix of sealed and unsealed. The greatest opportunity to re-prioritise road expenditure included questioning whether the current level of service was required on some rural sealed roads.

The following notes result from an examination of 2009/10 financial records of the New Zealand Councils, as reported by Statistics NZ.

3.1 Regions with large rural sealed road networks

The immediate opportunity to replicate the success of the Southland District is likely to be greatest amongst other districts which also have a large sealed rural network. Southland District (SDC in graph opposite) does have the largest rural sealed road network (outside of Auckland). The next five largest rural sealed networks are within Ashburton (ASH), South Taranaki (STK), Selwyn (SEL), Tararua (TAR) and Waikato (WKO).



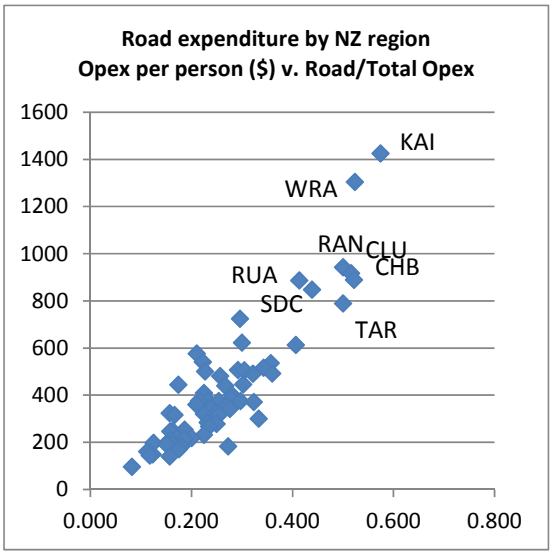
Southland is not the largest rural sealed road network in *per capita terms* – that is Waimate (WMT), followed by Tararua (TAR), Southland (SDC), Central Hawke's Bay (CHB), Otorohanga (OTO), Hurunui (HUR) and Rangitikei.

The per capita ranking is likely to be more indicative of the opportunity for an ENP-type analysis: first, the high per capita length of roads will in many cases also translate into low usage per road; and second, the high per capita length of roads will likely require high per capita expenditure and funding. Both low usage and high costs are key factors that lead to questioning the currently provided level of service.

3.2 Regions with large roading expenditure relative to funding base

While rural roads were of importance to the ENP in Southland District, more generally councils with relatively high road expenditure are likely to benefit from re-examining the levels of service currently provided relative to the cost of this provision.

The region with the highest relative road spending is Kaipara (KAI), both in terms of road operating expenditure in 2010 per person and of road operating expenditure as a ratio of total operating expenditure. Other regions to record highly on both counts include Wairoa (WRA), Rangitikei (RAN), Clutha (CLU), Central Hawke's Bay (CHB), Ruapehu (RUA), Tararua (TAR) plus Southland (SDC).



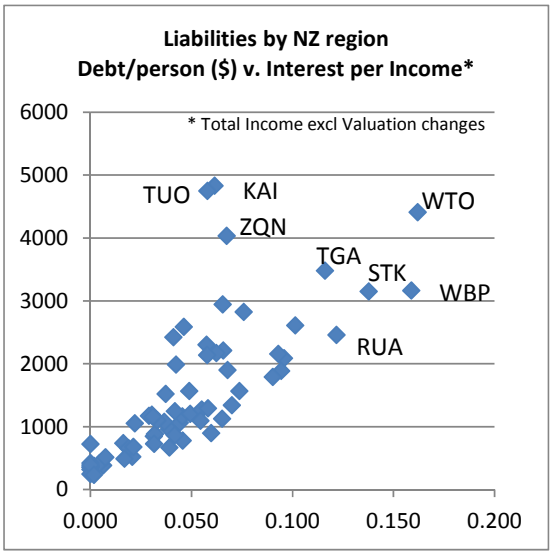
Of interest, the six regions with the largest roading expenditure in dollar terms are all below average in spending per capita terms. Conversely, the next four highest regions in terms of road expenditure – Kaipara, Far North, Southland and Gisborne – all have above-average per capita costs. It is this population issue, and hence the limitation of the local funding base, that is one of the key factors behind the challenges in Southland District.

3.3 Regions with large debt servicing requirements

While not necessarily directly related to road expenditure, and also not the major driving force in the Southland District, the level of debt currently held by council is potentially also a factor that may lead to a relatively greater financial constraint in future.

The region with the largest debt burden as measured by Total Liabilities per person is Kaipara (KAI), followed by Taupo (TPO), Waitomo (WTO), Queenstown-Lakes (ZQN), Tauranga (TGA).

However debt within some regions is used to finance income-earning assets. A more telling measure of debt pressures is provided by Interest paid in 2010 relative to Total Income (excluding changes in Valuation). The regions with the highest Interest-to-Income ratio are Waitomo (WTO), Western Bay of Plenty (WBP), South Taranaki (STK), Ruapehu (RUA).

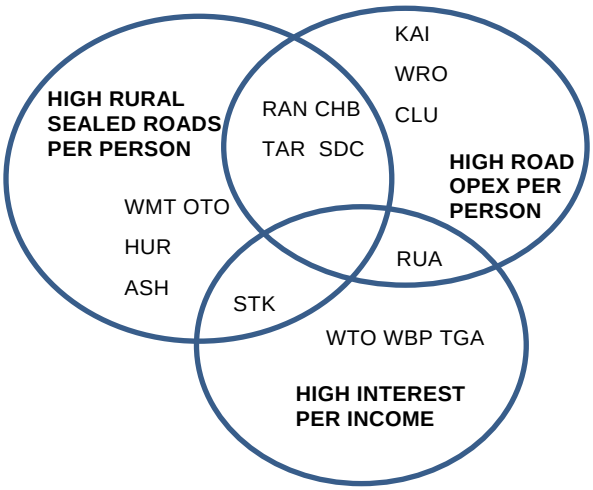


3.4 Regions with multiple factors

The opposite Venn diagram brings together the aforementioned districts. Notably, Southland District (SDC) ranked highly in terms of rural road length per person and road expenditure per person but not in terms of debt. In fact no region ranks highly across all three of the above measures.

The regions that share a high rural sealed and road expenditure per person ranking comprise Rangitikei (RAN), Central Hawke's Bay (CHB) and Tararua (TAR).

South Taranaki (STK) and Ruapehu (RUA) both rank highly on one road measure and on high debt servicing.



3.5 Discussion

The benefit of an ENP in any region will depend on the desire of the local council to question the current level of service of their roads. In Southland, this questioning was required because of the increasing burden of rural sealed roads on a small population.

The above desktop analysis implies three regions are prime targets to benefit from an ENP, having similar roading characteristics to Southland, plus several others that share some of Southland's characteristics.

That is not to say that other regions would not also benefit from closer inspection of service needs. However gains in proportion to those in Southland are likely in the first three regions (34% of current roading expenditure could be subject to re-priorisation after assessment of the core roading needs in Southland District).

Regions likely to benefit from an ENP analysis similar to that of Southland	
Rangitikei Central Hawke's Bay Tararua	*Rural North Island regions that, like Southland, have a large rural sealed road network and relatively high road expenditure per person.*
South Taranaki Ruapehu	*Rural North Island regions that have large debt servicing costs at present and also a large rural sealed network or large roading expenditure per person.*
Waimate Ashburton Hurunui Otorohanga	*Rural regions that have a large rural sealed road network relative to the population but where spending on roads and debt servicing levels have not reached high levels.*

4 Application in an Urban Environment

This section contains a stand-alone scope statement report for an Urban ENP.

4.1 Background

The economic network planning work undertaken by Southland District Council was identified by the Road Maintenance Taskforce (RMTF) as good practice of potential value to many road networks in New Zealand.

The ENP took a New Zealand Incorporate (NZ Inc.). view of roads in Southland District: what export revenue is this road generating versus what it costs to provide? Therefore how can road investment be prioritised to enable continued, and potentially growing, export revenue?

This model has worked well informing road maintenance, renewal and resilience for growth decisions on a rural network. However, it does not provide an economic measurement for journeys of all export-related journeys and it does not provide any economic measure of journeys that do not contribute to export receipts. The road network in cities and urban areas are more complex than rural road networks. They also relate more to the movement of people to generate economic productivity than goods or produce.

This proposed study would explore the appropriateness of an extended export value measure as an indicator of value for urban roads within the context of a set of filters employed to isolate roads of core significance; and determine what value this approach would add to investment decision making processes.

4.2 Concept

4.2.1 In principle

The challenge is to build a rationale for an appropriate level of road investment, as opposed to maintaining roads to historic standards. This requires determining the value (social and economic) derived from a road and then questioning how much this value changes under various scenarios.

In principle the value of a road could be measured by ascertaining the lifetime benefits to society of a road, net of externalities such as the costs of vehicle and personal damage, and then comparing these net benefits against the whole of life costs of the road. The impact of any change to road investment would then be measured by the change in the net present value of the benefits. At any one point in time, all investment expected to produce a positive net present value would be determined acceptable or, under a budget constraint, the mix of investment per road expected to provide the highest net present value over the network would be recommended.

In practice the full measurement of these benefits is difficult, if not impossible, due to the lack of direct payment for road use, due to the network effects that accompany road usage and due to externalities not being readily measurable, especially in dollar terms.

4.2.2 In practice

Nonetheless practitioners are required to make these judgments, typically under a budget constraint.

The usefulness of the ENP in a rural environment encourages development of the method. Two parallel threads of work are considered necessary to widen the application of the method: the measure of economic benefit can be broadened to capture economic benefits beyond the five export sectors considered in Southland District; and rules can be built up to best integrate any economic measure with other social and safety factors.

<u>The value of a road</u>

First, it would be useful to put a dollar value on all the net benefits of a road. To provide one such number is an ambitious target but it is possible to provide partial estimates of road value which can assist the ranking of roads. This is the approach taken with the ENP.

The initial emphasis of the ENP has been on the export value of a road network. The hypothesis used is that the 'export supply chain' is a fundamental contributor to the wealth of New Zealand and that a road enabling transportation of export product is an important part of the network of roads that gets the export product from gate to port; disrupt this network and the export receipt may not be realised.

In time the ENP can be broadened to incorporate journeys related to a wider set of income-producing activities and eventually extended to include those activities more directly related to domestic consumption and general wellbeing. However, at present, an export measure can be derived in a cost efficient manner and it has been shown that this approach helps determine and justify the investment level required for rural roads.

That need not mean journeys not directly related to export activity are of no or little value. But rather the isolation of export-related journeys does enable a core network of roads to be identified which are of fundamental importance to the local and national economy. There will be other trips and other roads appended to this core transport network but preferably without compromising the core economic intent of the road, and possibly funded via a different mechanism.

To be able to apply the export ENP beyond a rural region, and to improve the outcomes in rural regions, the current methodology can be extended by (a) considering other significant export-related journeys along the region's roads and, (b) further investigating the appropriate export value to ascribe to each journey.

An extended export-focused ENP can then be applied to a large cross-section of regions – urban and rural – and provide a region-wide and nation-wide representation of the roads – from hinterland to port – that are important to the flow of export products.

This then forms a base model that can be extended by either inclusion of other value-adding trips in the economic measure or by developing other economic measures to consider alongside the export indicator.

Filters to determine the roads of importance

The second thread of research is to develop a set of rules or filters that can be applied to determine the appropriate road standard, or more particularly determine whether the current road is fit-for-purpose. In the Southland District, the set of roads that appeared to be currently above/below fit-for-purpose standard were isolated by combining the results of the export assessment with other measures such as vehicle flows, social cost of crashes, use of roads as lifelines and flooding/liquefaction assessments. It may be appropriate to give these data different emphasis in an urban environment, an exercise that in turn may be insightful for the application of the ENP generally.

4.2.3 The next step to develop the usefulness of the ENP

The export-focused ENP of Southland District was one step down the path to develop a fuller understanding of the capacity of a road network to 'convey export income', and therefore gain an understanding of return on investment of roads. This rural ENP can be extended by considering, initially, the completion of the product journey from farm to port and by including the product journeys of other export industries. An urban region with a sea port would be a suitable location to enable these developments of the ENP.

Such an urban ENP can then be combined with the ENP of its rural hinterland to provide a map of the regional road network of significance to the local major exporters, which in turn can be combined with other regional ENPs to provide a map across the country of important roads for the major export industries of New Zealand.

The other dimension to improving the ENP as a measure of export activity is an appraisal of the appropriate number to link to each journey. The local share of export receipts was employed in Southland District. This proved both insightful and easy for users to understand and explain. However it may be that an export sector with a low value-add component does not actually value the road network to the extent implied by their export revenue; in this case export value add may be a more appropriate metric to apply. This difference between export receipts and export value add is expected to be more material in an urban setting and hence the application of the ENP in an urban region provides an opportunity to test the efficacy of each export measure as an indicator of road value.

Likewise the social and non-export reasons for road use are proportionally greater in an urban environment. The filters employed in Southland District were insightful for their rural roads but these filters may require adjustment to better match the roading needs in an urban region.

4.2.4 Benefits of applying the ENP in an urban region

The advantages of proving the usefulness of the ENP approach in an urban setting include:

- The ability to then apply the methodology to a wide set of New Zealand regions.
- Any refinement of the methodology in an urban setting will also increase the ability of the export ENP to identify roads of significance in a rural region.
- The identification – and quantification – of the export supply chain from the hinterland, and hence a full understanding of the farm-to-port network for the key primary industries.
- How the information from an ENP process can be integrated into existing urban transport models can be identified.
- Once models are established for each region, then the pressure on urban corridors can be modeled under assumptions of changed land use in the hinterland.
- The ENP, and any modeling undertaken using this information, will isolate any potential bottlenecks in the supply chain, especially near storage/processing nodes and ports.
- The ENP measure per road or transport link will provide infrastructure owners with a rationale and justification for any changes to investment plans.
- The use of the ENP will reinforce a more strategic outcomes approach to asset management.
- The ENP measures can be employed to rationalise and justify various funding arrangements.

More generally, the extension of the ENP to an urban region is the next step along the way to improving the decision process around investment in transport infrastructure. First, there is the multiple filter (that is, more detail and quantification around non-economic benefit filters) approach that can be expanded to further hone in on core significant road needs, and extended to provide filters for ‘non-core’ roads. Second, there is the quest to develop a sole measure of road value that could potentially represent all information about future benefits from roads. Further development of the ENP approach is a step down the path to both ends and will potentially facilitate integration of decision making processes across transport infrastructure such as rail in addition to roads.

4.3 Methodology

The proof of concept for an urban ENP will require four parts: the determination of the set of core economic measures to ascribe to each road; the modeling of these trip data to determine the impact of chosen land use changes; the determination of how other filters are applied to prioritise road investment requirements; and the visualization of the information gathered as flow maps for communication with key stakeholders.

In general, a proof of concept study will:

- Establish the inputs for the methodology
- Validate the appropriateness of the outputs
- Show how the analysis can assist asset management

The region of study would preferably include a sea port, thus enabling the completion of the gate-to-port supply route for key export sectors. The cost of such a study will be considerably reduced if the economic flows of the port’s hinterland are already known and mapped.

4.3.1 Determining an economic measure to each trip purpose

It is accepted that a complete value of each road section will be difficult, if not impossible, to derive but that some economic measures can be attributed to a road that will be a significant component of road value. Export receipts for several sectors provided such a measure in Southland District. The steps in an urban authority are to:

- Define the appropriate export measure and sectors to be used.
- Confirm that the economic measure can be determined to an acceptable accuracy for the geographical area of the transport model.
- Determine an average value of each trip purpose by land use type to apply in the model.

- Describe the limitations inherent in the aggregation of values.
- Confirm the sum of all trip values equals total measured economic value for area.
- Identify who this information can be integrated into any existing urban transport model.

4.3.2 Modeling the impact of land use changes

Having established an economic measure per road, it is necessary to then determine how this measure might change under different scenarios of land use. The following steps are required to develop a model to enable this exploration:

- Establish a model that links an economic value of selected properties via a network of roads to a set of potential destinations.
- Determine methods to optimise these trips.
- Run the model to show the likely impact of various land use changes, including changes within the hinterland.

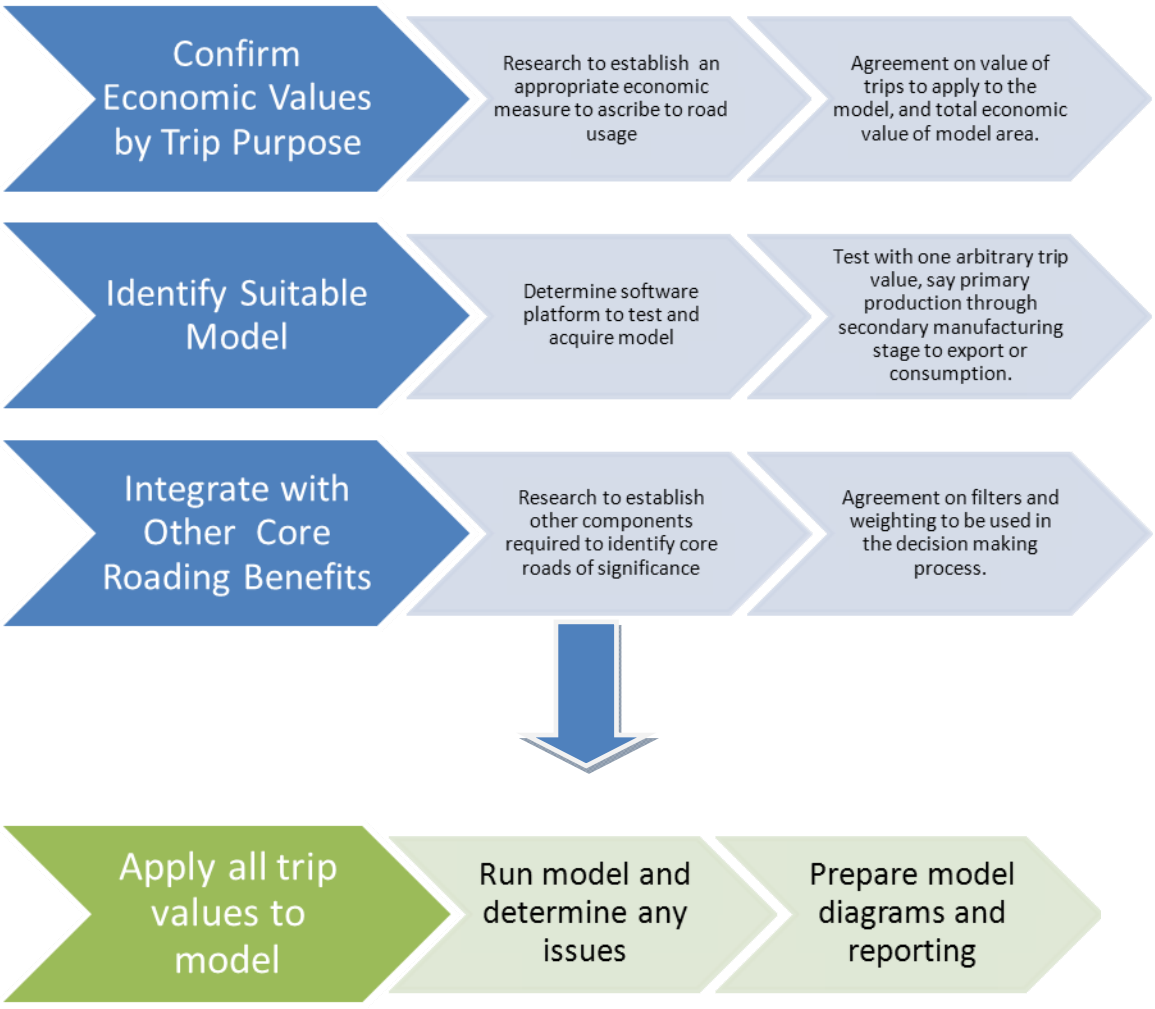
4.3.3 Combining filters to determine the appropriate investment requirement

An export assessment of a road is not the only value driver - it is necessary to combine this information with other components of road usage. The following steps are required:

- Establish the components of road usage of importance to the urban region with regard the decision about future road investment.
- Develop a methodology to combine the economic and non-economic components to inform the road investment decision.

4.3.4 Process Flow Diagram

The urban ENP study brings together these three pieces of research and presents the results in a manner that improves communication.



4.4 Conclusion

One key component of the value of many roads is its role within a network of roads used as a supply chain for exported goods and services. The ENP methodology enables a link to be made between properties within a region with a major destination node via a network of roads. Thus an economic value – a partial measure of the value of the road – can be attached to each road. This method proved useful when it came to determining the appropriate standard of rural roads. It is also possible that the roading impact on the export supply chain is important in an urban setting. This is to be tested. Furthermore consideration of value drivers in the urban environment may enable the ENP to be expanded generally for all regions and to provide a national view of economic flows through the roading network.

Applying the ENP in an urban environment is also another step along two threads of research, namely a quest to determine a dollar value of a road and in particular how this value changes under different investment plans, and secondly, a quest to find rules to be used to balance measured economic benefits against a wider set of social and community interest when making road investment decisions.

5 Summary and Recommendations

The challenge in a fiscally constrained environment is that we may not gain the highest value decisions by just focusing on doing what we have done before but doing it cheaper and faster. However "cheaper and faster" is often the strongest and quickest reaction to the challenge, but not necessarily the most sustainable solution. Forward looking analyses by infrastructure owners in New Zealand and abroad show that if they do not have increased revenue they are unlikely to be able to address shortfalls in asset preservation investment by improved efficiency measures alone; they need a combination of:

- innovation in materials that deliver the same or better levels of service with a lower whole of life cost,
- operational efficiencies including improved supply chain performance that do not compromise achievement of required service outcomes, and
- a rational basis for establishing a level of service that delivers service outcomes required from the infrastructure.

The ENP is an approach that is unique in the way the third bullet point is addressed; a rational basis is established for an appropriate level of service while still enabling delivery of required service outcomes.

The approach does fit within NAMS good practice asset management frameworks. It considers levels of service and whole of life costs. It uses outputs from tools such as RAMM[2] and dTIMS[3]. It takes advantage of GIS mapping to communicate choices and decisions. It involves wide consultation about the appropriate investment strategy. What is does differently, though, is introduce more information in the form of core economic activity along on a road. This number is an incomplete measure of the worth of any network of roads but it does, when matched with the region's economy, provide a measure that will be indicative of relative economic importance. Furthermore, the asset manager's attention is more generally shifted to the purpose and potential value of road trips rather than simply the number of trips or kilometres travelled. The ENP forces the asset manager to confront the issue that not all kilometres travelled are of equal value, that some roads and trips are of more strategic importance to the region's wellbeing. It is in this sense that the ENP brings more vitality to current asset management – rather than offering an alternative methodology.

The recommendation is that the ENP is explored further and applied in a wider set of regions.

In terms of the methodology, it is recommended …

- *that a consistent methodology for collating this information across regions be established using the Southland District work as an initial guide*
- *that the approach for assessing value be tested by applying the ENP to higher priority areas where there is an interest from the Road Controlling Authority in doing so*
- *that a proof of concept for an urban network be investigated further.*

In terms of application of the methodology, it is recommended …

- *that a guideline on how to establish and form this network is provided to those wishing to establish an ENP approach*
- *that a GIS network should be established for each regional road network examined into which economic and base data are organised, enabling a continuous network that aligns with modelling requirements.*
- *that any organisation seeking to develop their own ENP have information and tools to establish the core economic activities of the region, to make the economic calculation, to model changes in land use and present the output in map form.*

[2] Road Assessment and Maintenance Management (RAMM) is road asset management software
[3] Deighton Total Infrastructure Management System (dTIMS) is a software application which has been applied to develop multi-year programming of road works.

Appendices

Appendix A Ingenium ENP Paper

25TH INGENIUM ANNUAL CONFERENCE

Rotorua, New Zealand
21-23 June, 2012

ECONOMIC NETWORK PLAN: PRIORITISING INVESTMENT AND VALUE MAPPING ROAD INFRASTRUCTURE

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Abstract

This paper discusses an investment prioritisation approach developed for Southland District Council's road transport network. It presents opportunities as to how the Council can maximise their return on investment while still being financially sustainable.

Southland District is a highly productive farming area with low population density and exceptionally high economic growth. With this growth has come significant land use change, which is forecast to continue for the next 10 years.

The network has 5,000km of roads servicing an area of 30,750km^2 and a population under 30,000. On a per capita basis it can be viewed as significantly over capitalised – yet, export income generated and future growth is nationally significant.

In the current austere economic climate, it is a challenge for infrastructure providers to effectively prioritise investment and maximise community benefits. A granular prioritisation of investment is developed using spatial maps, linking the contribution of the transport network to economic income growth and the whole of life cost of providing that network.

Decision making is transparent and focuses on optimizing levels of service across the network. It integrates and balances social and environmental needs while not constraining core economic activity.

Key Words

Road infrastructure, investment planning, econometrics, asset management

Introduction

The Economic Network Plan (ENP) approach has been developed against a background of rapid and widespread large scale economic growth throughout the Southland District. The desired outcome of the approach is to dynamically support a financially constrained economic network.

The key to the approach is the change to asset management thinking, from the conventional 'preservation and incremental level of service adjustment' approach, to an 'investor's thinking' approach. As a result, significant opportunity to increase the value of the network is being identified and significant opportunities to rationalise (optimise) expenditure are also being identified.

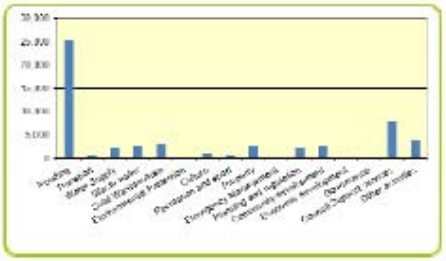
This paper presents the approach that has been developed to a network wide proof of concept relating economic need (derived from land use) to economic flows resultant on the road network, including the whole of life cost(s) of the network. It establishes a methodology to balance long term district wide investment strategies to localised differentiation.

Analysis and outputs are represented using GIS maps which are an effective communication medium for Council decision makers. This new use of spatial mapping enables a clearer understanding of economic heat maps, current instances of funding volatility, and conflicts showing whether a changed investment intervention is required or not.

Background

Southland District has a resident population of around 28,500 people and covers an area of around 30,750km^2 in the southern part of the South Island, New Zealand. It currently contributes in the order of 10% of New Zealand's dairy exports and dairy conversions are likely to double the regions dairy output in the next 10 years. It also contains the nationally significant tourist destination of Milford Sound to which an estimated 500,000+ people visit annually.

Southland's 5,000km road network, alongside 770km of State Highway, is the primary conduit of economic activity for the region. Operating expenditure on roading equates to around 45% of Council's total operating expenditure (includes around 75% of their total annual depreciation amount), and also accounts for around 35% of Council's rates.



In the order of 50% of Councils operating expenditure on roads is non-rates funded through grants and subsidies.

Road infrastructure investment decisions made by Council have a significant impact on the long term financial sustainability of Southland. The ENP approach takes a broader view than that of the current funding model which is based on population and GDP. The current model is based upon consumption and given Council's situation, basing funding on population appears inherently 'flawed'. The ENP platform and revised strategic planning depicts export

receipts and the Economic 'Well-Being' which are inextricably linked with the financial cost of providing supporting infrastructure. Associated with GDP Income, this is the favoured side of the 'balanced trade' ledger (NZ Inc.).

While a rural authority may have a small population and have a small effect on the deficit side of the NZ Inc ledger, a balanced overall investment strategy maximises income for least cost; it does not focus on reducing costs everywhere as the sole means for improving financial (or economic) position.

Project Overview

The project concept was developed to help address a number of issues identified through asset management planning processes. Primarily how do we optimise where we invest in levels of service (get the biggest bang for our buck), and how do we prioritise in an increasingly austere environment. To do this we needed a baseline to work from.

An overall base level of need was difficult to quantify so this was broken down further into a hierarchy of needs. The four well beings (economic, social, cultural, environmental) were chosen as defining the community needs that Council was required to consider in making its investment decisions. This was further (and simplistically) broken down into a hierarchy of needs using the approach taken by Abraham Maslow (1954) and his grouping of human needs into five basic categories (in ascending order): physiological, safety, belongingness and love, esteem, self actualisation.

Of the four well beings, it was considered that if the economic well being was not being supported, it was difficult to deliver against the remainder of the well beings. Therefore, economic need was considered to be the underlying (physiological) need for the road network, and helped define our base level of service.

At this early stage it was felt measurement of export receipts was a fair indicator of how Southland contributes nationally to the economy, with economic function being one of the primary purposes of having a road in Southland. Therefore, at the concept development phase, this was established as the base function and base measure.

Next, methodologies were trialled and worked through to develop a way to objectively quantify the economic importance of a road. The economic network plan in its current form was developed in a preliminary design form as an output of this phase.

The methodology seemed to make sense in terms of logical outcomes, so a trial was undertaken on a discrete part of the network for Dairy land use. The results were validated in the field by Council and MWH operations staff. Validation showed that there was consistency between the model and what was observed in the field – the opportunities to change the investment profile were real opportunities. The importance of non-economic factors such as safety and broader community benefits were highlighted through direct feedback from the Council executive team at this point, and while always envisaged to be part of the process, they were brought in more strongly as part of the brief for the next stage of development. This trial was a completely manual calculation trial.

Early in December 2011, NZTA approved further funding support for a network wide trial which has facilitated the development of a more automated model. This has enabled larger amounts of information to be analysed more quickly, therefore enabling an assessment of the network wide economic profile.

Operational deployment will be the next phase if this final trial demonstrates the envisaged value across the whole of the

network. The network wide proof of concept is going through a final validation process at the time of authoring this paper.

The staged proof of concept approach to managing this project has been invaluable in refining both the approach and the supporting tools. It has enabled regular engagement with the key project stakeholders throughout the development phase – elected representatives and NZTA – ensuring the project has remained focused on the key objectives and the fundamental project drivers.

Issues

In preparing Council's long term plans there were a number of strategic issues which had no strong base of information to support decisions such as:

Where should the network responsibilities extend to for Council?

Investing based upon vehicle volumes, which were typically low, did not appear to reflect the true value or strategic value and economic contribution of roads. How do we prioritise our investment to deliver community outcomes?

What is the optimal standard to deliver the roads to so that Council is investing enough to achieve their outcomes, but not to become financially insolvent or further debt overburdened?

How do we achieve our target of zero debt within the next planning period and maximise benefits from capital investments?

How do we ensure Council has the necessary vision and insight to our networks condition to intervene with the best investment strategy sustaining the required service capability? What is the required service capability?

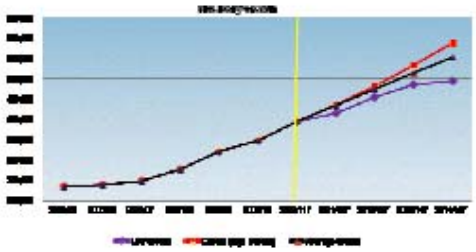
How does Council plan for future constraints to funding, and how does it then prioritise its investment in the provision of levels of service while delivering an acceptable level of community outcomes?

How are a range of future demand scenarios rapidly assessed and appropriately addressed in short, medium and long term investment plans?

How are trade-off opportunities identified transparently for Council to decide where investment is made? What is the existing resilience of the network to cope with change?

In addition, there were some key external issues and constraints for Council:

High growth in dairy conversion with dairy production forecast to double over the next 10 years



There was a future likelihood of reduced external available funding (funding flat line), a large portion of the network reaching end of life, and a potential increase in cost of renewals.

Limited ability to increase rates to match either an increase in level of service or a decrease in external funding

50 tonne route trials identifying potential areas of additional stress on current assets

Council also noted that nothing remains static or resilient to incessent change. On top of a prolonged economic downturn and a shrinking funding envelope, there is increasing commercial export growth and demand in Southland.

The Economic Network Plan (ENP)

The ENP is an asset management approach that uses economic data, as a primary indicator of the value of having a road, to establish rational investment strategies, and

then investment programmes across the roading network. It is a top down and forward looking approach, differing from a bottom up and often backward looking asset preservation methodology.

Maximising whole of life performance of assets is important. However, we have found there are even greater opportunities to provide value for money to communities by providing assets that achieve the greatest good, and only for as long as those assets are needed. Preserving assets efficiently, and maximising their life, is not necessarily adding value if the community is no longer receiving benefits from those assets.

Components of the plan include:

- Land use (export value per hectare per annum)
- Economic flows (model outputs in value of export receipts per annum)
- Whole of life cost of assets (annualised maintenance plus depreciation)
- Vehicle flows (AADT)
- Social cost of crashes
- Emergency events, lifeline infrastructure and intervention, historic records of floods, liquefaction assessments.

The economic hierarchy derived for Southland is:

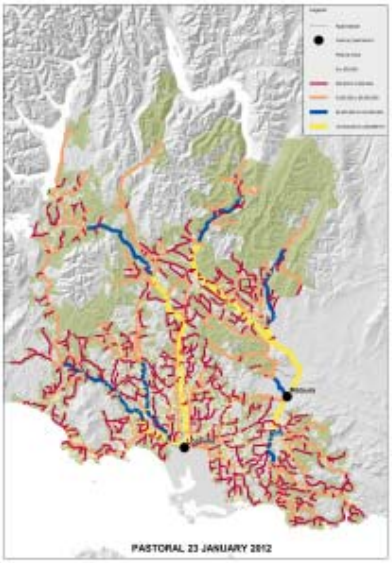
- Regional Arterial
- District Arterial
- District Collector
- District Local
- Other roads

Example investment strategies are:

- Road uneconomic for Council to own (long term – short term)
- Downgrade levels of service (and resulting reduced cost)
- Consider dynamic change of level of service
- Retain or upgrade level of service
- Optimise use of network for: localised growth, farm gate to plant / port and export growth, commercial and social route and access optimisation
- Multi-modal shift and integration (future greenfield) opportunities
- Develop adaptive response of network use to changing funding scenarios (potentially drive land use behaviours through District Planning processes to match network ability to meet future ability to fund provision of the network)

Outputs

Economic flow maps are built up as layers for each land use type, and economic flows are represented using the economic hierarchy which is a series of economic value bands.



The land use layers are built up to give a total picture of the economic value of roads on the network.

Maintenance and depreciation costs are combined to give a picture of the whole of life cost for individual roads across the network on a $ per metre per annum basis.

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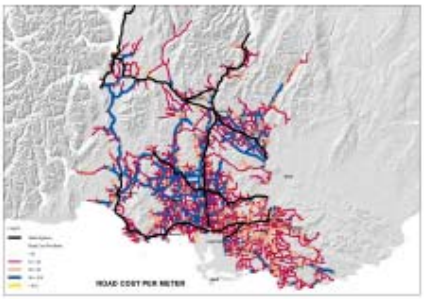
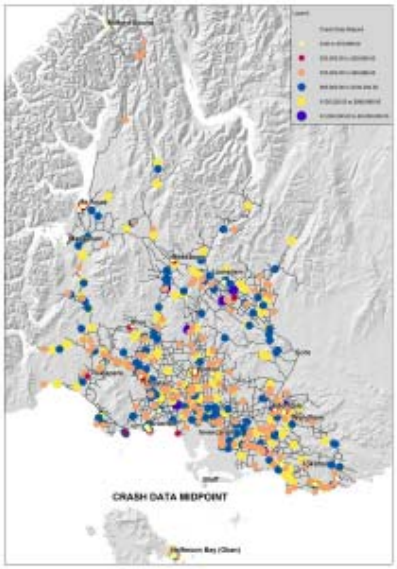


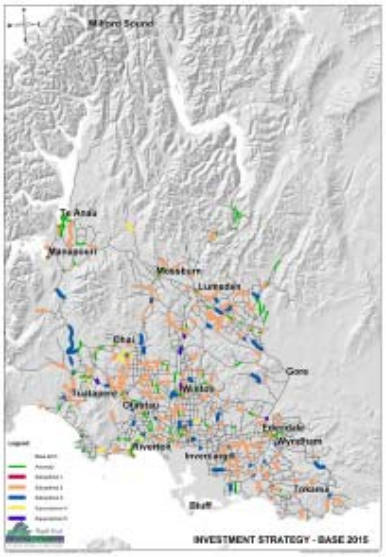
A preliminary investment strategy is determined, and this is adjusted based on the social cost of safety and annual average daily traffic counts.

A social cost of safety map is shown below.



The adjusted preliminary strategy is then validated through field interrogation of results.

This map is a comparison of the preliminary strategy and the current renewals programme to 2015. Different colours relate to different strategies suggested for each road section. In this example, light brown indicates a decrease in level of service opportunity, blue proposes retaining the existing while yellow indicates there may be a need for an increased intervention.



Investment Strategy Validation

The investment strategies are validated in a number of ways. However, the primary challenge used through the proof of concept phase has been comparing the knowledge of operational staff with the model outputs. The primary model outputs challenged through the process have been:

- Do economic flows from the model match the operational knowledge of use of the roads?
- Are the roads selected as optimal roads robust selections?
- Do the strategies make sense at an individual road section level?

In previous table shows how images from Council's network video are used to analyse a proposed investment strategy for an existing road (current) with an optimal for that hierarchy (proposed equivalent).

6

Early proof of concepts identified examples such as a road which had an increase in standard because of a 1984 flood that closed the State Highway for six months, diverting traffic to this local road. Subsequently, the standard of the State Highway was increased meaning the local road was more at risk of closure than the State Highway but the road has continued to be maintained to the higher standard.

When the road is renewed in the future, there is an investment optimisation opportunity to reduce the standard of this road, and there may be a current opportunity to reduce the cost of maintenance. In some cases the current whole of life cost of a road is around $7 per metre per annum, whereas based on evidence from elsewhere on the network a level of service that is likely to support economic activity (current and future) is in the order of $2 per annum per metre.

Council has an organisation-wide integrated risk management approach which overlays all decision making and is simple to apply to the less quantifiable non-economic benefits. It is proposed that in discussion with Council investment recommendations are presented based on:

- Economic investment strategy (post site validation)
- Semi-quantitative analysis of non-economic risk impacts of strategy (incorporating social, cultural and environmental context)
- Balanced recommendation

The proof of concept process demonstrated the benefit of the approach in identifying a large number of potential investment optimisation opportunities across the network.

Targeted Benefits

Benefits targeted through the development of this approach included:

- Road investment decisions linked to long term outcomes
- Improved integration between asset management and Council long term planning and policy setting
- More adaptive and resilient network
- Spatially mapped and optimised levels of service (guiding investment to the highest priority areas for sustainable community outcomes)
- Rapid scenario modeling to enable effective contingency planning as well as idealistic strategic planning
- Clear communication of the impacts of investment decisions to non-technical decision makers – the elected representatives
- Knowing where to extend asset lives with increased maintenance and renewals to achieve long term investment plans
- Enable Clear communication to many differing parties on the impending impacts of divergent investment decisions.
- Help the elected representatives better understand the process and interventions available – how they were arrived at and what drivers affect the prioritization required.

A district wide 'proof of concept' has been completed at the time of preparing this paper. The full Council has been kept informed of progress and preliminary outcomes through regular reporting through the development process and has been supportive throughout.

The next stage is likely to be the most challenging for Council as it intends to review the service and investment approach that best suits the current environment. It is Council's view that GIS platforms will become part of the necessary discussion with its community, commercial stakeholders,

and collaborative partners to communicate investment plans. In effect ENP is an approach that is the glue for facilitating communications with several target audiences and stakeholders – each having a significant holding and governance linkage to the network.

The level of opportunity appears to be significant without compromising the ability of the network to support forecast growth in exports. The approach does not make decisions for Council, nor does it indicate that there has been an overinvestment in the past; it shows where there is opportunity to reprioritise investment without compromising the ability of the network to support future economic activity, and how big this opportunity is. This then enables Council to make investment decisions with more confidence and with a greater appreciation of the impacts of these decisions.

Conclusion

This project has taken the concept of return on investment and philosphy of best commercial investment and has applied it to roads on the largest local authority rural road network in the country. This has led to the establishment of an objective way of quantifying opportunities to reprioritise the level of investment on Southland's road network in harmony with the levels of service expected. Future ENP opportunities are clearly represented using an accessible visual media – maps which all parties immediately relate to and can easily understand. In the recent past, the spreadsheet to mapping intervention always ended in confusion and distortion.

The approach provides Council with the necessary key indicators of merit; equipped with a tool box of additional mapped spatial layers of knowledge (formerly disparate silos of data) to make more informed decisions for future investment.

By using existing information and applying a well understood and transferable concept (as for example 'return on investment'), Council has established a useful top down assessment tool that, when compared with bottom up asset preservation plans, will help it more effectively inform and negotiate with its community on investment strategies and priorities moving into the future.

Taking this approach Council feels it will be more confident of its financial sustainability even when confronted with significant funding challenges.

Acknowledgements

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- **NZTA** both for funding support to Southland District Council and input into challenging the formulation of the approach. In particular Bruce Richards (Regional Manager, Planning and Investment, Southern), Dave Brash (Group Manager, Planning and Investment) and Ernst Zoellner (Group Manager, Strategy and Performance).
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Appendix B Resource requirements

Resources required to apply the ENP are (A) economic and roading data, (B) software and (C) expert operators and managers.

A Data:

Data are required on the economic income transported along a network, plus the traditional measures of road usage and whole-of-life costs.

A.1 Economic data:

Information	Source
• Export receipts (NZD per hectare per annum):	http://www.stats.govt.nz/infoshare/
o dairy	Statistics NZ
o nondairy / pastoral (sheep/beef)	Statistics NZ
o Deer	Statistics NZ
o Forestry	Statistics NZ
o Tourism	Ministry of Tourism accommodation data Statistics New Zealand Tourism NZ Satellite Accounts http://www.med.govt.nz/sectors-industries/tourism
• Land use maps (location and hectares):	
o Dairy	Pathways
o Deer	Pathways
o Forestry (by forestry type)	Pathways
o Pastoral (sheep, beef) low country intensive	Pathways
o Pastoral (sheep) high country	Pathways
o Tourism flows extracted from the Ministry of Tourisms Flow model	NZTA State highways Classification document

A.1.1 Economic Data (export receipts)

Southland District Example

Below is a table of estimated Southland export production for the 2008 and 2009 June financial years. The regional export revenues are estimated from national exports per sector, local land use patterns and regional production by sector.

Excluded from the current analysis is:

1. Coal production from Ohai/Nightcaps was excluded. Coal is currently moved by rail to Clandeboye near Temuka, so it is not recorded as an export per se. However the value of production could be estimated and added into the table.
2. For the economic value of roads project Fishing is not relevant as little if any fish production is moved by road.
3. Tourism - a proxy utilising values derived from the tourism satellite accounts www.tourism.govt.nz can be included. The commercial accommodation nights information within the satellite accounts provides a basis for estimating the total spend within Southland. The key limitation is the way Export services are calculated by Statistics NZ and the Ministry of Tourism. Exports of services are not reported in the same series as other exports (commodities) and there is a risk of comparing 'apples to oranges'. A net margin approach to valuing roads may negate this issue; however, values have been used in their unadjusted form in use as an initial indicator. Tourism flows extracted from

the Ministry of Tourisms Flow model (http://www.tourismresearch.govt.nz/Data--Analysis/Analytical-Tools/Tourism-Flows-Model/) and also represented in the State Highways Classification document are used to spread / apportion tourism flows around the network.

Table 1: Estimated Southland District Exports

	2008	2009
	$m	$m
Dairy	689,303,344	707,326,783
Meat	527,246,664	623,908,728
Wool	107,518,369	98,747,276
Live animals	2,111,785	2,077,303
Animal originated products	39,041,719	43,907,349
Fats	20,938,334	19,288,358
Offal, sausages	12,419,468	17,528,982
Albuminoidal substances, glues	88,817,414	104,849,978
Ice Cream	2,886,062	3,174,421
Animal Meal	13,999,210	22,062,519
Hides and Skins	45,338,574	41,611,787
Wool	94,741,195	86,342,025
Carpets	12,777,174	12,405,251
Forestry	134,404,818	148,894,915
Total	1,791,544,130	1,932,125,675
% NZ merchandise exports	4.66%	4.71%
% NZ Primary Production	7.52%	7.29%

The above information is able to be broken down to provide the average $ per hectare for land within Southland that is categorised dairy, non-dairy (sheep/beef) Deer and Forestry.

A.1.2 Land Use and property information:

Council Pathways System provides the land use and property information. Infor Pathway functionality streamlines the recording and management of National Property Database (NPD) information for New Zealand local governments and this is used as a layer within Council's GIS.

A.2 Base data:

Relevant Information	Source	Required for economic calculation	Required for decision process	Used for scenario modelling	Used for reporting	Data format
• AADT	RAMM	No	Yes	No	Yes	Number
• Road name	RAMM	No	No	No	Yes	Text
• Seal (sealed, unsealed)	RAMM	No	Yes	No	Yes	Text
• Maintenance cost:						
o Bridge structures	Maintenance contracts	Yes	Yes	No	Yes	$ per metre per annum; 5 year average
o Road corridor assets (all depreciating assets excluding bridges)	Maintenance contracts	Yes	Yes	No	Yes	$ per metre per annum; 5 year average
• Annualized depreciation cost per metre:						
o Bridge structures	RAVM	Yes	Yes	No	Yes	$ per metre per annum
o Road corridor assets (all depreciating assets excluding bridges)	RAVM	Yes	Yes	No	Yes	$ per metre per annum
• Social cost of safety	CAS NZTA procedures	No	Yes	No	Yes	Annualised $ amount per road section, costs at intersections associated with road segment approaching intersection; 5 year average
• Risk maps:						
o Liquefaction	Council GIS	No	No	Yes	Yes	Road segment intersection; risk hierarchy
o Flooding	Council GIS	No	No	Yes	Yes	Road segment intersection
• Lifelines routes	Regional	No	Yes	No	Yes	Point feature

Relevant Information	Source	Required for economic calculation	Required for decision process	Used for scenario modelling	Used for reporting	Data format
	Council GIS					
• Road segment (node link) lengths	Council GIS	Yes	Yes	Yes	Yes	A GIS layer segmenting the network into fixed lengths, typically 1 km but less when ends of segments are reached.
• Renewal dates:						
o Reseal	Forward Works Programme, RAMM location	No	Yes	No	Yes	Treatment lengths aligned with GIS
o Rehabilitation	Forward Works Programme, RAMM location	No	Yes	No	Yes	Treatment lengths aligned with GIS
o Bridge replacement	Forward Works Programme, RAMM location	No	Yes	No	Yes	Bridge location aligned with GIS

A2.1 Additional notes on maintenance and annualized depreciation costs

A2.1.1 Breakdown of network costs: maintenance and annualized depreciation

Network costs, excluding improvements, are broken down into the following categories:

- **Residual –** cost of the land, road formation, and most pavement subbases. These are the non-depreciating costs associated with the network – those which are either book values i.e. land, or are only incurred during the original construction of the road and which will not need to be replaced over the life of the road. These costs are not included in the EP calculations.
- **Replacement –** the annual depreciation, or the cost of replacing the asset divided by the assets estimated useful life, of all depreciating (limited life span) assets i.e. sealed surfacing, sealed pavement basecourse, unsealed wearing course, bridges and bridge, drainage, street lighting etc.
- **Maintenance –** the proportion of the current SouthRoads network maintenance costs prorated across the network

The Residual and Replacement costs are calculated from the Council Asset Revaluation results stored in RAMM. Further detail on how these individual values have been calculated can be found in the Roading Infrastructure Asset Valuation Report. There are some minor differences between the valuation results and the dollars used in the ENP assessment which are due to changes in the network data stored in RAMM since the time the valuation was completed. These differences are minor and do not affect results materially.

Maintenance costs were calculated initially from a current maintenance contract for one area. A Council network wide analysis of maintenance costs on sealed and unsealed roads has then been used to assess overall maintenance costs across the full network for rural sealed and unsealed. Urban figures make up only 5% of the network so these have not been interrogated in any detail.

Costs have been calculated and then mapped (excluding residual costs) in GIS for each link i.e. the road section between each of the intersections, or nodes, with additional breaks where necessary for changes from sealed to unsealed and urban to rural.

A2.1.2 Residual costs

These are the Replacement Costs associated with Land under roads, Formation including earth surface water drains, and all non-depreciating sealed (rural only) and unsealed (all) pavements.

A2.1.3 Replacement costs

These are the annual depreciation costs associated with all depreciating assets (from a local government road valuation process):

- Sealed pavement surfacing
- Sealed pavement basecourse
- Sealed pavement subbase (urban only)
- Unsealed wearing course – The costs associated with replacing unsealed wearing course are also included in the maintenance cost calculations. Those costs calculated from the maintenance contract are used in preference to those from the valuation as they are based on current actual costs.
- Drainage
- Surface water channels
- Footpaths
- Traffic facilities includes signs, railings etc.
- Retaining walls
- Street lights
- Bridges and bridge culverts (end area greater than 3.4m^2)

A2.2 Maintenance

Maintenance costs from contract claims were used as the basis of the maintenance cost calculations. The contract to date amounts were annualised and categorised by urban / rural and sealed / unsealed. This information was then used to calculate the length of network each particular maintenance cost is associated with resulting in an annual cost per km for each maintenance cost item. These are then combined to form a maintenance cost per km matrix (see below). Each road section can then be assigned an annual maintenance cost based on which of the four categories it falls into and the road length. This was further broken down for Southland into the different contract areas and apportioned across the network according to those contract boundaries.

North West $/m	Urban	Rural
Sealed	$ 0.83	$ 1.55
Unsealed	$ 0.86	$ 0.87
Bridges	$ 50.29	$ 50.29

Central	Urban	Rural
Sealed	$ 1.18	$ 2.19
Unsealed	$ 1.22	$ 1.24
Bridges	$ 52.10	$ 52.10

South Eastern	Urban	Rural
Sealed	$ 1.16	$ 2.15
Unsealed	$ 1.19	$ 1.21
Bridges	$ 75.75	$ 75.75

No contract area nominated	Urban	Rural
Sealed	$ 1.06	$ 1.96
Unsealed	$ 1.09	$ 1.11
Bridges	$ 59.38	$ 59.38

A2.2.1 Maintenance Costs From Claims vs. Maintenance Costs From RAMM

The maintenance costs used in Council calculations have been extracted from claims rather than from the maintenance cost data stored in RAMM. The maintenance contractor is required to update the Council's RAMM database on all physical maintenance changes that have occurred on the roading network including their cost. Any maintenance works that did not cause a physical change are not recorded in RAMM e.g. any costs associated with inspections, programming, and reporting, or associated with frost and ice gritting and snow clearance etc. Therefore the maintenance claims are a more accurate record of all of the maintenance costs associated with the network.

Maintenance costs for the State Highway Network have been calculated using a combination of RAMM data and an assessment of the annual programme. The accuracy of this information could be improved significantly, but is sufficient to allow a rational comparison of the economic efficiency across an integrated network to a tolerable accuracy in the overall approach.

A2.2.2 Figures used in economic calculations

Annualised rates are used to align with the annualized export receipts data. A dollar per metre rate is calculated for maintenance and depreciation costs so that they are comparable across the network regardless of the segment length.

B. Recommended minimum software requirements:

Computing software is required at various stages

- Spreadsheets to accumulate the economic data, and estimate the export receipts for the region (Excel was used in SDC)
- Standard software is used to derive the usual Council roading statistics ((RAMM and RAVM was used for Southland)
- GIS software is used to (GeoMedia plus its extension GM Transportation Manager were used in SDC):
    - locate properties and roads (with nodes fixed at 1 km horizontal spacing or at each intersection or road end point, whichever is closer),
    - connect properties and roads (GIS software that enables shortest path analysis is able to numerically merge data from multiple analyses, and can model physical constraints such as varying speed environments),
    - model changes in land and road uses,
    - provide maps of roads and various measures per road.

The GIS network is used as a base into which economic model information and base data are organized. This is needed to ensure consistent comparison and consistent results regardless of scenario. This is a simple but significant step in the overall process of organizing the ENP data, and is an important communication tool through visualisation of outputs.

It is recommended that all networks and ENP analysis are built in the same way.

C. People capabilities:

People capabilities include:

- Economists to derive economic measure per road
- Advanced users of the GIS software and asset databases such as RAMM
- Operational knowledge of the local transport network and associated assets to enable validation of results and practicality of resultant strategy options
- Intermediate spreadsheet capabilities

Appendix C Council statistics 2009/10 year

Council	Rural sealed km/person	Road opex $/person	Interest per Income excl Valuation Change
Waimate District	78.1	490.1	0.042
Tararua District	61.8	788.7	0.046
Southland District	59.5	847.5	0.006
Central HB District	58.7	888.9	0.049
Otorohanga District	53.5	612.8	0.090
Hurunui District	48.1	540.5	0.000
Rangitikei District	47.0	942.8	0.000
Ashburton District	45.1	374.1	0.074
South Taranaki District	45.0	408.9	0.138
Waitomo District	41.6	622.4	0.162
Clutha District	40.5	916.9	0.000
Mackenzie District	36.7	723.2	0.000
Stratford District	36.6	491.3	0.019
Westland District	35.1	506.8	0.058
South Wairarapa District	34.0	535.3	0.070
Carterton District	33.8	384.6	0.017
Manawatu District	30.8	370.4	0.032
Selwyn District	30.0	353.5	0.060
Waitaki District	28.6	480.8	0.000
Ruapehu District	26.7	885.6	0.122
Matamata-Piako District	25.4	345.9	0.065
Wairoa District	24.3	1303.3	0.000
Gore District	22.6	325.2	0.054
Buller District	22.4	500.0	0.065
Kaikoura District	21.6	315.8	0.058
Central Otago District	20.1	439.6	0.000
Hauraki District	20.1	375.3	0.031
Grey District	18.2	505.4	0.022
Waipa District	17.8	284.5	0.032
Kaipara District	17.6	1424.8	0.061
South Waikato District	17.6	218.3	0.007
Masterton District	17.4	341.9	0.033
Waikato District	17.2	299.7	0.021
Whakatane District	16.5	319.8	0.029
Timaru District	16.4	316.0	0.049

Tasman District	16.2	359.4	0.076
Marlborough District	15.3	375.3	0.002
Opotiki District	14.6	277.8	0.021
Western Bay of Plenty District	14.5	374.4	0.159
Waimakariri District	13.7	231.1	0.016
Taupo District	13.4	323.5	0.058
Gisborne District	13.1	516.1	0.031
Hastings District	12.9	266.3	0.039
Far North District	11.7	445.2	0.057
Horowhenua District	11.2	212.4	0.055
New Plymouth District	10.7	245.9	0.068
Whangarei District	9.9	400.0	0.066
Queenstown-Lakes District	9.5	575.5	0.067
Rotorua District	8.6	160.3	0.062
Wanganui District	7.7	252.9	0.093
Thames-Coromandel District	6.0	444.4	0.046
Invercargill City	3.4	209.9	0.037
Dunedin City	3.1	248.4	0.041
Kapiti Coast District	2.9	182.2	0.094
Upper Hutt City	2.0	170.3	0.039
Auckland City	1.7	139.5	0.044
Palmerston North City	1.5	196.8	0.096
Christchurch City	1.1	191.1	0.030
Napier City	1.0	191.0	0.005
Porirua City	0.8	96.0	0.042
Nelson City	0.6	197.8	0.037
Hamilton City	0.3	216.2	0.101
Hutt City	0.3	194.7	0.046
Wellington City	0.3	182.1	0.042
Kawerau District	0.0	143.1	0.002
Tauranga City	0.0	148.7	0.116

Source: Statistics NZ, Local Authority Financial Statistics

http://www.stats.govt.nz/browse_for_stats/government_finance/local_government/LocalAuthorityFinancialStatistics_HOTPJun11.aspx