Equitable funding of pavement maintenance for low volume roads – Te Wairoa

A Case Study – Wairoa District Council

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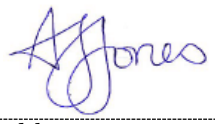
Prepared By



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Contents

1 Methodology

This Case Study has been prepared under the direction of Wairoa District Council (WDC) engineering staff. Key inputs have been provided by WDC including data from WDC's current rating database and Economic Network Plan (ENP) GIS map, which was developed to recognise the relative economic benefit of each type of land use and key routes that carry this productivity.

The methodology used for this Case Study is detailed in the *Guidelines for Equitable Funding of Pavement Maintenance for Low Volume Roads* (2017) produced by the Road Controlling Authorities Forum (NZ) Inc Special Interest Group on Low Volume Roads (RCA Forum SIG-LVR) – hereafter referred to as "the Guidelines".

These guidelines are based on two key reports commissioned by the RCA Forum SIG-LVR. These reports are:

- TERNZ (March 2017). *The Impact of Land Use on Pavement Wear* – hereafter referred to as the "TERNZ Report".
- BERL (3 April 2017). *Equitable Funding of Pavement Maintenance for Low Volume Roads: A Report for the Road Controlling Authorities Forum Special Interest Group on Low Volume Roads* – hereafter referred to as the "BERL Report".

2 The impact of land use on pavement consumption

2.1 Land use activities

The total land area within the Wairoa District (Te Wairoa) is approximately 411,900 hectares. Of this 282,650 hectares is classed as rateable land[1]. Table 1 outlines the category groups of rateable land within the WDC rating database and their associated land area.

Category Group	Category Description	Land area (hectares)	Percentage of WDC's rateable land area
C	Commercial	50.8	0.02%
I	Industrial	72.8	0.03%
D	Dairy	2,040.7	0.72%
F	Forestry	75,443.9	26.69%
H	Horticulture	478.0	0.17%
P	Pastoral	197,518.2	69.88%
R	Residential	622.0	0.22%
L	Lifestyle	4,618.6	1.63%
S	Specialist	619.1	0.22%
U	Utilities	206.5	0.07%

[1] Source: Wairoa District Council Rating Database output spreadsheet dated 09/05/2017

Category Group	Category Description	Land area (hectares)	Percentage of WDC's rateable land area
M	Mining	21.3	0.01%
O	Other	958.8	0.34%

Table 1: Category groups for Te Wairoa's rateable land

The land use activities that have been considered for inclusion in this Case Study for Te Wairoa are included in Table 2. These are the predominant areas of land use activity detailed in Table 1 above, where activity is proportional to land area.

Land use	Area (hectares)	Percentage of WDC's rateable land area
Forestry	75,444	26.7%
Pastoral farming – mixed sheep and beef	197,518	69.9%
Dairy farming	2,041	0.7%

Table 2: Land use activities assessed for Te Wairoa case study

In the past, Te Wairoa had a local dairy factory, but the number of dairy farms has dwindled. There are currently a very small number of dairy farms in Te Wairoa compared to other land uses. However, due to the intensity of dairy farming and possible localised impacts, this has been considered as part of this case study.

Horticulture and cropping land use is currently limited within Te Wairoa. It has not been included in WDC's current ENP model and the TERNZ report does not provide any guidance on calculating Heavy Commercial Vehicle (HCV) traffic generated from such a land use. Given these factors, we have not completed an assessment of the impact of this type of land use on pavement wear. However, Te Wairoa has a high horticulture potential, with recent new plantings such as apples being established. Therefore, this may require review in future.

Lifestyle properties have not been considered as part of this assessment, as the HCV traffic generated from such properties is assumed to be minimal.

In terms of land use activities where HCV traffic generated is not proportional to land area, but these land use activities generate substantial HCV traffic an assessment of pavement impact should be undertaken. For Te Wairoa, HCV traffic generated from quarries has been identified as having an impact on pavement consumption and so this has been included this Case Study.

2.2 Analysis period

A one year cycle has been used for the analysis period. For each activity the average input and output levels are based on this annual cycle. For forestry, we have assumed a 30 year harvest cycle.

2.3 Average input and output volumes

2.3.1 Forestry

The output volumes for Te Wairoa forestry have been based on the 2015 average yield value for Hawke's Bay 30 year old radiata pine plantations detailed in the TERNZ report[2]. This provides an average output volume of **20.83 tonnes per hectare per annum** for Te Wairoa. As outlined in the TERNZ report, there is very little other traffic generated from forestry outside of harvesting.

2.3.2 Pastoral farming

The main farming activity for Te Wairoa is sheep and beef farming with sheep mainly on the steeper hill country and beef on the flatter land.

The average input and output volumes for Te Wairoa have been based on the volumes outlined by Beef+Lamb New Zealand for Eastern North Island region (Gisborne, Hawke's Bay, Wairarapa) farm classes, Hard Hill Country, Hill Country and Intensive Finishing[3].

The average pastoral farming input and output volumes calculated for Te Wairoa are detailed in Table 3.

Outputs/Inputs	Measure	Hard hill country	Hill country	Intensive finishing
		kg/ha	kg/ha	kg/ha
Outputs	Wool	21.4	29.0	26.2
	Store stock	41.5	43.1	17.8
	Prime stock	236.6	300.6	559.8
	Total outputs	**299.5**	**372.6**	**603.8**
Inputs	Fertiliser	218.5	293.7	425.2
	Fuel	9.2	11.3	15.5
	Feed	29.9	57.4	56.4
	Total inputs	**257.5**	**362.4**	**497.2**
TOTAL		**557.0**	**735.0**	**1,101.0**

Table 3: Average input and output factors for Eastern North Island sheep and beef farms

2.3.3 Dairy farming

The TERNZ Report[4] outlines five production systems for dairy farms that contribute different intensity levels. For the purpose of this case study it is assumed that all dairying land use in Te Wairoa is medium intensity. Based on the TERNZ Report[5], Hawke's Bay has an average production rate for dairy farms is 11,641 litres per hectare.

[2] Table 7. Yeild data by region for 30 year old radiata pine plantations from Ministry of Primary Industries
[3] http://www.beeflambnz.com/information/on-farm-data-and-industry-production/sheep-beef-farm-survey/eni/
[4] pp23-24
[5] Appendix Table A6. Dairy farming statistics by district from DairyNZ 2014-15

The assumed average input and output volumes calculated for Te Wairoa dairy farms are based on TERNZ report outcomes[6] but modified to incorporate Hawke's Bay average production rate. These are included in Table 4.

Outputs/Inputs	Measure	Medium intensity farm (kg/ha)
Outputs	Milk (density 1.033kg/l)	12,025.2
	Bobby & beef calves	58.5
	Replacement wiener calves	51.3
	Replacement cows – cull etc	206.6
	Total outputs	**12,341.6**
Inputs	Fertiliser	741.0
	Fuel	66.7
	Feed	1621.0
	Replacement heifers	177.8
	Total inputs	**2,606.5**
TOTAL		**14,948.1**

Table 4: Average input and output factors for Te Wairoa dairy farms

2.3.4 Quarries

The outputs and inputs for quarries are not based on land area, but are very much dependent on the individual quarry type and size and therefore average values per hectare cannot be used. For this Case Study, data has been gathered on the tonnes of material transported each year from all the individual quarries identified within Te Wairoa region. The total output tonnage from quarries across the district is **261,640 tonnes per annum**.

2.4 Heavy commercial vehicle (HCV) traffic impacts for different transport tasks

2.4.1 Forestry

Based on the average yield value for Hawke's Bay 30 year old radiata pine plantations of 20.83 t/ha per annum and an average Equivalent Standard Axle (ESA)/tonne of 0.084 for log transport[7], the impact of HCV logging traffic for Te Wairoa is calculated to be **1,750 ESA/1,000ha per annum**.

2.4.2 Pastoral farming

The annual average pastoral farming HCV traffic volume impacts for Te Wairoa have been calculated based on Table 3 inputs and outputs and TERNZ report ESA/tonne of payload values[8], as detailed in Table 5.

[6] Appendix Table A7. Average input/output factors for Northland dairy farms.
[7] Table 8. ESA per tonne of payload for key transport tasks – Log transport ESA/tonne based on corrected ESA for log truck and trailer combination of 2.33 ESA.
[8] Table 8. ESA per tonne of payload for key transport tasks

Outputs/Inputs	Measure	Hard hill country	Hill country	Intensive finishing
		ESA/1,000ha	ESA/1,000ha	ESA/1,000ha
Outputs	Wool	2.7	3.6	3.3
	Store stock	6.6	6.8	2.8
	Prime stock	17.0	21.6	40.3
	Total outputs	**26.3**	**32.1**	**46.4**
Inputs	Fertiliser	17.7	23.8	34.4
	Fuel	1.9	2.3	3.2
	Feed	2.4	5.6	9.1
	Total inputs	**22.0**	**31.7**	**46.7**
TOTAL		**48.3**	**63.8**	**93.1**

Table 5: Heavy vehicle traffic impacts for Eastern North Island sheep and beef farms

2.4.3 Dairy farming

The annual average dairy farming HCV traffic volume impacts for Te Wairoa have been calculated based on outcomes from Table 4 and TERNZ report ESA/tonne of payload values[9], as detailed in Table 6.

Outputs/Inputs	Measure	Medium intensity farm (ESA/1,000ha)
Outputs	Milk (density 1.033kg/l)	697.5
	Bobby & beef calves	9.3
	Replacement wiener calves	8.1
	Replacement cows – cull etc	32.7
	Total outputs	**747.6**
Inputs	Fertiliser	82.8
	Fuel	13.7
	Feed	207.4
	Replacement heifers	28.2
	Total inputs	**332.0**
TOTAL		**1,079.6**

Table 6: Heavy vehicle traffic impacts for Te Wairoa dairy farms

2.4.4 Quarries

The HCV traffic volume impacts for quarries have been calculated based on cartage being completed by either a 3-axle truck + 4-axle trailer combination or by 4-axle truck. Average ESA and

[9] Table 8. ESA per tonne of payload for key transport tasks

ESA/tonne values for these configurations have been calculated based on TERNZ report ESA/tonne of payload values[10], as detailed in Table 7.

Vehicle Configuration	Payload Weight (kg)	ESA (Average)	ESA/tonne
3-axle truck + 4-axle trailer	28,293	2.305	0.081
4-axle truck	11,293	1.815	0.161

Table 7: Traffic impacts for quarrying vehicle configuration

As HCV traffic generated by quarries is not proportional to land area, an ESA/1,000 hectares calculation is not required.

2.4.5 Summary of HCV traffic impacts for different transport tasks

The impacts of land use activities in terms of HCV traffic loading generated (ESA/1,000ha) gives an indication of the pavement consumption per hectare of production each year. A summary of the outcomes of this assessment for Te Wairoa is included in Table 8. This shows that forestry generates the highest HCV traffic loading, with dairy farming generating 40% less HCV traffic loading based on average production within the Hawke's Bay region. Pastoral farming produces significantly lower HCV traffic loading impacts per 1,000 hectares, based on average production within the Eastern North Island region.

Land use activity	Annual HCV traffic impact (ESA/1,000ha)
Forestry	1,750
Pastoral farming - Hard hill country	48.26
Pastoral farming - Hill country	63.80
Pastoral farming - Intensive finishing	93.08
Dairy farming	1,079.6

Table 8: Summary of heavy vehicle impacts for Te Wairoa land use activities

For quarries, where the HCV traffic impact is not proportional to land area, the calculated ESA/tonne is applied to the tonnes of aggregate transported from each individual quarry, so varies considerably across Te Wairoa's quarries. The total HCV traffic impact for all quarries is calculated based on the sum of each individual quarries HCV traffic impact and **is 25,545 ESA per annum**.

3 Allocating pavement consumption maintenance costs to ratepayers

3.1 Total pavement consumption maintenance cost (PCMT)

Road maintenance costs are funded by WDC in partnership with the NZ Transport Agency (NZTA). Currently NZTA subsidises road maintenance costs, through the Funding Assistance Rate (FAR)

[10] Table A12. ESA values for laden and empty vehicles.

providing 69% contribution. WDC funds the remaining 31% portion from rates. All maintenance costs included in the following analysis are WDC share of the cost.

As outlined in Chapter 8 Methodology of the Guidelines[11], the total roading maintenance cost (RMT) is the sum of:

(i) Total pavement consumption maintenance costs (PCMT) - these include pavement maintenance and renewals costs associated with different land uses, and allocatable using the guidelines;

(ii) Fixed road maintenance costs (RMF) - these include non-pavement operations and maintenance costs, such as traffic services, structures, environmental maintenance, and are allocatable uniformly to all ratepayers; and

(iii) Other pavement maintenance costs (POM) that are not attributed to pavement consumption from specific land use. These are to be decided by councils and are allocatable uniformly to all ratepayers.

Hence: RMT = PCMT + RMF + POM

For the purposes of this review the pavement maintenance cost (PCMT and POM) includes both maintenance and renewals costs for all local roads by funding Work Category (WC) as detailed in Table 9. These costs have been adjusted to December 2016 dollars using NZTA's Maintenance Index[12].

WC	Description	2016/17 Cost	2015/16 Cost	2014/15 Cost	2013/14 Cost	2012/13 Cost
111	Sealed pavement maintenance	$186,482	$143,472	$240,637	$290,010	$372,067
112	Unsealed pavement maintenance	$394,638	$344,560	$382,418	$404,316	$366,748
113	Routine drainage maintenance	$204,940	$210,805	$98,831	$91,070	$115,329
211	Unsealed road metalling	$131,204	$123,738	$161,261	$74,148	$160,682
212	Sealed road resurfacing	$217,223	$72,395	$270,192	$330,839	$331,868
213	Drainage renewals	$124,028	$27,485	$79,180	$59,833	$88,551
214	Sealed road pavement rehabilitation	$167,575	$71,805	$133,283	$81,312	$101,060
	TOTAL COST	**$1,426,090**	**$994,259**	**$1,365,803**	**$1,331,528**	**$1,536,304**

Table 9: WDC historic pavement maintenance costs by funding work category

Notes:

[11] Guidelines for equitable funding of pavement maintenance for low volume roads 2017
[12] Lastest Values for 1991 Infrastructure Costs Indexes New Presentation, http://nzta.govt.nz/resources/procurement-manual/procurement-tools.html/

1. Drainage maintenance has been included as a pavement maintenance cost as this reduces moisture susceptibility of the pavement, which has a significant contribution towards reducing pavement consumption under loading.

2. Maintenance and renewals costs for the SH38 Special Purpose road have been excluded as these are currently 100% funded by NZ Transport Agency.

3. The 10 Year Forward Work Programme (FWP) for the Transport Activity for 2018-2028 has not yet been finalised, therefore historic maintenance costs have been used to determine the PCMT at this stage. This should be reviewed when the 10 Year FWP becomes available, in order to take into account any significant future traffic growth that may impact on future pavement maintenance costs.

Based on the average historic maintenance costs the assessed future annual pavement maintenance cost is $1,330,800 (in December 2016 dollars).

As the land use generating HCV traffic is rural, it is important to factor in the rural vs urban split of the Te Wairoa roading network. 8% of the roading network is urban and 92% is rural. Therefore, simplistically we can attribute 92% of the total pavement maintenance cost to rural roads, resulting in an **annual pavement maintenance cost of $1,224,300** for rating against rural land use.

3.2 Pavement maintenance cost for each industry (PMCI)

The methodology provided in the Guidelines for allocation of targeted rates suggests that the PCMT consists of the sum of the pavement consumption maintenance costs for each industry (PCMI), i.e.:

PCMT = PCMI(forestry) + PCMI(pastoral) + PCMI(dairy) + PCMI(quarries)

In order to determine the proportion of pavement consumption maintenance costs (PCMT) associated with pavement consumption due to land use activity HCV traffic loading impact, we first need to know the total ESA loading for the network. Simplistically, we can then calculate the ESA loading produced by each land use activity and determine the proportion of pavement consumption maintenance costs associated with this.

The approximate total ESA for the rural road network has been calculated based on Annual Average Daily traffic (AADT) traffic count data for Primary Collector, Secondary Collector and key Access roads feeding onto the State Highway. **The approximate total traffic impact for the road network is 260,000 ESA per annum**.

The proportion of HCV traffic loading impact from each land use activity is shown in Table 10, and this has been used to determine the PMCI for each land use activity. Where:

PMCI = proportion of total traffic impact x $1,224,300

Land use activity	Annual HCV traffic impact (ESA/ 1000ha)	Total area of land use (ha)	Total annual traffic impact (ESA)	Proportion of total traffic impact	PMCI
Forestry	1,750	75,444	132,027	50.8%	$621,944
Pastoral farming - Total			12,202	4.7%	$57,542
Hard hill country	48	98,759*			
Hill country	64	59,255*			
Intensive finishing	93	39,504*			
Dairy farming	1,080	2,041	2,203	0.9%	$11,019
Quarries			25,545	9.8%	$119,981
Total			**171,977**	**66.2%**	**$810,486**

Table 10: PMCI for assessed land use activities in Te Wairoa

**Total area or land use for pastoral farming is 197,518 hectares. This has been split based on assumed percentages of farm class within the Wairoa District – 50% hard hill country, 30% hill country and 20% intensive finishing.*

Therefore, based on the Guidelines formula:

PCMT = PCMI(forestry) + PCMI(pastoral) + PCMI(dairy) + PCMI(quarries)

PCMT = $810,486

From this we can also attribute the other pavement maintenance costs (POM) that are not attributed to pavement consumption from specific land use.

POM = pavement maintenance costs – PCMT

= $1,224,300 – $810,486

= $413,814

These costs can be allocated uniformly to all ratepayers.

3.3 Adjusting PCMI for benefits and detriments of industry

The Guidelines outline a method for attributing industry benefits (detriments) to the community and recognising these as a reward (penalty) that reduces the PCMI. The net result for each industry after such rewards and penalties is a net PCMI. This can be calculated by applying a simple multiplier to the PCMI.

For Te Wairoa, benefits of each land use activity in terms of Potential Export Flow dollars have been calculated as part of WDC's ENP model. However, these do not necessarily correlate with benefits seen by the Te Wairoa communities. A review of the benefits by land use activity is included below.

3.3.1 Forestry benefits

As suggested in the BERL Report[13], the benefits from forestry for social, environmental and cultural outcomes can be limited for some districts. This is the case for Te Wairoa, where the two major forestry companies have processing plants outside the district. Forestry that has been established generally utilises temporary workers who reside outside the district for harvesting, but contributed 1.1% of Te Wairoa's jobs in 2014[14]. Although forestry has contributed to stabilisation of slip-prone country, logging traffic also has detrimental environmental impacts, for example causing excessive dust to roadside properties. Therefore, it is assumed that a benefit multiplier for forestry is not able to be justified in Te Wairoa.

3.3.2 Pastoral farming

In 2014, Sheep, Beef Cattle & Grain Farming contributed 19.90% of Te Wairoa's jobs and the resulting industry of Meat & Meat Product Manufacturing contributed 13.70% of Te Wairoa's jobs[15]. However, given the relatively low PMCI for pastoral farming, any benefits could outweigh the costs associated with HCV traffic impact. Therefore, a benefit multiplier for pastoral farming has not been applied for Te Wairoa.

3.3.3 Dairy farming

The small number of dairy farms within the region, coupled with the fact that milk processing is completed outside the district, leads to the assumption that a benefit multiplier for dairy farming is not able to be justified in Te Wairoa.

3.3.4 Quarries

Quarries provide a key benefit for Te Wairoa, in that much of their aggregate product is actually produced to form unsealed and sealed road pavements. Although this means carting of aggregates from outside the district is limited, potentially reducing aggregate supply costs, payment made for these aggregates offsets this benefit. There are environmental impact risks associated with quarrying, however these can be managed through Environmental Management Strategies minimizing any impact on nearby communities. Given these factors, a benefit multiplier for quarried is not able to be justified for Te Wairoa.

3.4 Land use rating policies

Proposed land use rating models have been based on two contributing factors as outlined in Section 5.3 of the Guidelines, a distance factor and a production intensity factor.

The distance scale will be based on distance from the nearest State highway and is divided into two distances levels:

- **Near**: property within 20km of State highway
- **Far**: property ≥ 20km from State Highway

[13] Section 5, pg 14
[14] Wairoa District Council Economic Development Strategy (Draft), November 2015 – Appendix 1
[15] Wairoa District Council Economic Development Strategy (Draft), November 2015 – Appendix 1

The production intensity can be based on land area, land use intensity (farm class[16] or farm production system[17]) or production tonnage depending on the land use type as shown in Table 11. At the time of this Case Study, the farm class for pastoral and farm production system for dairy are not known for individual rating units, therefore the land area has been used as the basis of production intensity for these land uses.

Production intensity	Land area (Forestry)	Farm class (Pastoral)	Farm production system (Dairy)	Production tonnage per annum (Quarries)
High	Greater than 500 hectares	Intensive finishing	System 1 & 2	More than 20,000 tonnes
Average	Greater than 100 hectares but less than 500 hectares	Hill Country	System 3	More than 5,000 tonnes but less than 20,000 tonnes
Low	Less than 100 hectares	Hard Hill Country	System 4 & 5	Less than 5,000 tonnes

Table 11: Production intensity factors

For each land use activity assessed, this method produces a matrix of six categories of rating unit based on these two contributing factors. The matrix shows the resulting rating policy weighting for each rating unit. As part of this Case Study assessment, a number of rating policy weightings have been used for each of the land use activities, to produce a range of possible total rating outcomes for each land use activity. Scenario policy weightings have used the Guidelines hypothetical examples[18] as a base for assumed values. These scenarios are outlined in more detail in the following sections.

3.4.1 Forestry policy weighting scenarios

Three scenarios have been considered as shown in Table 12. Scenarios 1 and 2 have the same production intensity factors, with varied distance factors. Scenario 3 has the same distance factors as Scenario 1, but the production intensity factors have been changed. Production intensity factors have been selected to reflect the higher traffic loading impact of forestry land use.

Production intensity		Scenario 1		Scenario 2		Scenario 3		
		Distance NEAR	Distance FAR	Distance NEAR	Distance FAR	Prod intensity	Distance NEAR	Distance FAR
		0.8	**1.3**	**1.0**	**1.2**		**0.8**	**1.3**
High	1.1	0.88	1.43	1.10	1.32	1.4	1.12	1.82
Medium	1.0	0.80	1.30	1.00	1.20	1.0	0.80	1.30
Low	0.9	0.72	1.17	0.90	1.08	0.8	0.64	1.04

Table 12: Policy weightings for forestry scenarios

[16] TERNZ Report Table 1. Beef+Lamb NZ Survey – Farm classes.
[17] TERNZ Report Reference: Mounsey, Z (2015) Analysis of Production Systems in the New Zealand Dairy Industry. Kellogg Rural Leadership Programme. Research Report. DairyNZ.
[18] Section 8

3.4.2 Pastoral farming policy weighting scenarios

Three scenarios have been considered as shown in Table 13. Scenarios 1 and 2 have the same production intensity factors, with varied distance factors. Scenario 3 has the same distance factors as Scenario 1, but the production intensity factors have been changed. Production intensity factors have been selected to reflect the lower traffic loading impact of pastoral farming land use.

Production intensity		Scenario 1		Scenario 2		Scenario 3		
		Distance NEAR	Distance FAR	Distance NEAR	Distance FAR	Prod intensity	Distance NEAR	Distance FAR
		0.8	**1.3**	**0.6**	**1.1**		**0.8**	**1.3**
High	1.1	0.88	1.43	0.66	1.21	1.0	0.80	1.30
Medium	1.0	0.80	1.30	0.60	1.10	1.0	0.80	1.30
Low	0.9	0.72	1.17	0.54	0.99	0.8	0.64	1.04

Table 13: Policy weightings for pastoral farming scenarios

3.4.3 Dairy farming policy weighting scenarios

Three scenarios have been considered as shown in Table 14. Scenarios 1 and 2 have the same production intensity factors, with varied distance factors. Scenario 3 has the same distance factors as Scenario 1, but the production intensity factors have been changed. Production intensity factors have been selected to reflect the higher traffic loading impact of dairy land use.

Production intensity		Scenario 1		Scenario 2		Scenario 3		
		Distance NEAR	Distance FAR	Distance NEAR	Distance FAR	Prod intensity	Distance NEAR	Distance FAR
		0.8	**1.3**	**1.0**	**1.2**		**0.8**	**1.3**
High	1.1	0.88	1.10	1.32	2.4	1.4	1.12	1.82
Medium	1.0	0.80	1.00	1.20	2.0	1.0	0.80	1.30
Low	0.9	0.72	0.90	1.08	2.0	0.8	0.64	1.04

Table 14: Policy weightings for dairy farming scenarios

3.4.4 Quarry policy weighting scenarios

Three scenarios have been considered as shown in Table 15. Scenarios 1 and 2 have the same production intensity factors, with varied distance factors. Scenario 3 has the same distance factors as Scenario 1, but the production intensity factors have been changed. Production intensity factors have been selected to reflect the moderate traffic loading impact of quarry land use.

Production intensity		Scenario 1		Scenario 2		Scenario 3		
		Distance NEAR	Distance FAR	Distance NEAR	Distance FAR	Prod intensity	Distance NEAR	Distance FAR
		0.8	**1.3**	**0.9**	**1.2**		**0.8**	**1.3**
High	1.1	0.88	1.43	0.99	1.32	1.2	0.96	1.56
Medium	1.0	0.80	1.30	0.90	1.20	1.0	0.80	1.30
Low	0.9	0.72	1.17	0.81	1.08	0.8	0.64	1.04

Table 15: Policy weightings for quarry scenarios

3.5 Targeted rate – calculation of charge

The formula used to determine the targeted rates is as detailed in the Guidelines[19]:

Targeted Roading Rate = PMCI x Sh x Wt

Where:

Sh = the rating unit's share of total production area (or production volume) for the industry in the District
= rating unit land area / total land area for land use activity

Wt = the "policy weighting" applied to account for distance and production intensity
= distance factor x production intensity factor

The outcomes of the targeted rating assessment for each land use activity scenario is included in Table 16.

Land use activity	PMCI	Total targeted rates for roading based on equitable funding scenarios		
		Scenario 1	Scenario 2	Scenario 3
Forestry	$621,944	$767,135	$760,839	$934,120
Pastoral farming	$57,542	$68,676	$56,399	$63,506
Dairy farming	$11,019	$8,968	$10,089	$9,632
Quarries	$119,981	$108,676	$118,271	$113,724
TOTAL	**$810,486**	**$953,455**	**$945,597**	**$1,120,983**

Table 16: Total targeted roading rates for each land use activity scenario

This shows that Scenario 2 provides close alignment between the total targeted rates and the PCMI for all land use activities except forestry. The Guidelines provides a method for scaling the adjusted PCMI to ensure that the sum of the PMCI for each rating unit equals the total PMCI for each land use. This is considered appropriate for pastoral, dairy and quarries land use in this Case Study.

However, in the case of the forestry scenario above, the increased total targeted rates can be mostly attributed to two large forestry blocks on Willowflat Road with a total area of 26,359 hectares. Both

[19] Section 5.3, Equation 5-1

have a "far" distance factor and a "high" production intensity factor. The total targeted rates for these two land parcels for Scenario 2 is $286,842. Although scaling each rating unit PCMI can be completed, it may also be appropriate in this case to place a cap on the total rates that can be charged to a single rating unit to achieve better alignment between the PMCI and the funding scenario outcomes, prior to applying the scaling factor.

4 Comparison of rating outcomes

4.1 Current WDC targeted rates - roading

WDC has a roading targeted rate set under section 16 of the Local Government (Rating) Act 2002, with different rates in the dollar of **land value** for all rateable land in all differential categories. These categories for rural land use are detailed in Table 17.

	Differential Category	Rate in the $ of Land Value
iv.	**Wairoa Rural (all properties not included in 3(v), (vi), (vii), (viii) and (ix) below) / Roading Rural** being all rateable properties defined under the Rate Review Special Order "Differential Rating Special Order Resolution – E: Explanatory Statement 3a as Wairoa Rural" with a land value less than $100,000.	0.0034066
v.	**Rural Villages of Frasertown, Nuhaka and Ruapunga** being all rateable properties defined under the Rate Review Special Order "Differential Rating Special Order Resolution – E: Explanatory Statement 3a as Wairoa Rural Residential" (the rural townships of Frasertown, Raupunga and Nuhaka).	0.0042582
vi.	**Rural Non-Forestry (LV ≥$100,000 and < $1,000,000)** being all rateable properties defined under the Rate Review Special Order "Differential Rating Special Order Resolution – E: Explanatory Statement 3a as Wairoa Rural", with a land value equal to or greater than $100,000 and less than $1,000,000.	0.0034066
vii.	**Rural Non-Forestry (LV ≥$1,000,000)** being all rateable properties defined under the Rate Review Special Order "Differential Rating Special Order Resolution – E: Explanatory Statement 3a as Wairoa Rural" with Land Values greater than or equal to $1,000,000.	0.0034066
viii.	**Roading Rural Residential / Residential One (Mahia)** being all rateable properties defined under the Rate Review Special Order "Differential Rating Special Order Resolution – E: Explanatory Statement 3a as Mahia Rural Residential".	0.0028956
ix.	**Roading Rural Residential - Residential One (b) (Tuai)** being all rateable properties defined under the Rate Review Special Order "Differential Rating Special Order Resolution – E: Explanatory Statement 3a as Tuai Rural Residential".	0.0017033

	Differential Category	Rate in the $ of Land Value
x.	**Rural Roading Forestry (<100ha)** being all rateable properties defined under the Rate Review Special Order "Differential Rating Special Order Resolution – E: Explanatory Statement 3a as Wairoa Rural Forestry" and with a land area less than 100 hectares.	0.0034066
xi.	**Rural Roading Forestry (≥100ha)** being all rateable properties defined under the Rate Review Special Order "Differential Rating Special Order Resolution – E: Explanatory Statement 3a as Wairoa Rural Forestry" and with a land area equal to or greater than 100 hectares.	0.0052461

Table 17 : WDC current roading targeted rates for rural land use

This table shows that currently non-residential rural roading targeted rates are based on whether the land use activity is Non-forestry or Forestry and either the land value (for non-forestry) or the size of the land parcel (for forestry).

This rating system produces a more even spread of rates than between different land use activities (Table 16), as the rate is the same for all rural land use activities except for forestry blocks greater than 100 hectares, which is 50% greater than the rate for other rural land use activities.

4.2 Comparison of rating outcomes

It is important to note that the existing targeted rates represent the total roading maintenance cost (RMT) not just pavement consumption maintenance costs (PCMT), where:

$$RMT = PCMT + RMF + POM$$

Because this Case Study has not included any review of fixed road maintenance costs (RMF), a direct comparison of the Case Study targeted rate outputs (PMCT) with the existing targeted rates cannot be made.

However, to give an indication of the likely comparative outcomes, a simple calculation has been completed for each land use activity assuming the remaining roading maintenance costs (RMF) are applied uniformly based on land area. A resulting comparison of the proportion of rates attributed to "Rural Roading Forestry" and "Rural Non-forestry" is shown in Table 18.

Existing differential rating category	Case study land use activity	% of existing roading targeted rates	Potential % of targeted rates using equitable funding methodology
Rural Roading Forestry	Forestry	23%	43%
Rural Non-forestry	Pastoral, Dairy & Quarries	77%	57%

Table 18: Comparison of existing roading targeted rates with potential equitable funding methodology outcomes

In reviewing the proportions of target rates for each land use in Te Wairoa, using the pavement consumption targeted rates assessment will attribute more cost to forestry land use, as opposed to the current targeted rates calculation. This reflects the key difference in the rating calculation methodologies:

- The equitable funding case study assessment using traffic loading impacts generated from land use activity i.e. user pays method
- The current rating method using land value or land area i.e. uniform charge method

5 Case study key findings

5.1 Land use activities considered

This case study assessment has focussed on four key land use activities. This provides a good base for allocating rates, and is comparable to WDC's current targeted rating structure (which generally divides rural land use between forestry and non-forestry). However, this could be reviewed further to assess whether there are any other land use activities where the traffic generated from such activities may impact on pavement consumption.

5.2 Average input and output volumes

Average values from Hawke's Bay and/or East Coast region have been used in the calculation of all inputs and outputs for this case study. This follows the TERNZ report methodology, but may not reflect Te Wairoa's contribution within these larger regional areas. It is recommended that average inputs and outputs be reviewed at a district level if this methodology for rating is to be implemented.

5.3 Determining pavement consumption maintenance costs associated with traffic loading impacts

The traffic loading impact assessment completed as part of this case study gives an indication of the pavement consumption related to each land use activity considered.

In order to take into account any significant future traffic growth that may impact on future pavement maintenance costs, it is recommended that the PCMT be reviewed based on the 10 Year Forward Work Programme (FWP) for the Transport Activity for 2018-2028, when it becomes available.

5.4 Comparison of rating outcomes

The Guidelines provide a methodology for the equitable allocation of total roading costs to ratepayers. Where the total roading maintenance (RMT) is the sum of:

(i) Total pavement consumption maintenance costs (PCMT)

(ii) Fixed road maintenance costs (RMF)

(iii) Other pavement maintenance costs (POM)

This review has focussed on roading pavement maintenance costs, and has attributed a portion of these costs as pavement consumption maintenance associated with different land uses (PCMT).

Review of the remaining portion of the pavement maintenance costs (POM) and fixed road maintenance costs (RMF) has not been included in this Case Study. These costs may be allocatable to all ratepayers uniformly or based on the current differential rating categories.

The way the PCMT and POM have been proportioned has been based on traffic loading impact (ESA), which is inherently about pavement consumption. Further review could be completed to confirm that the split of pavement maintenance costs (PCMT and POM) used in this Case Study is appropriate, by reviewing more detailed pavement maintenance cost data to assess the actual reason for maintenance (e.g. using Fault and Activity data in RAMM). This would give a better indication of how much pavement maintenance is associated with pavement consumption as opposed to pavement wear.

6 References

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