

He Tuapapa mo te Punaha Kaiwhakamahi Rori | Background to the road user charges (RUC) system

Including how RUC rates are determined
through Te Manatū Waka Ministry of
Transport's Cost Allocation Model

January 2022



He maramatanga tō tēnei
whetū. He maramatanga anō tō
tērā whetū] Every individual has
their own luminescence

Find out more at hei-arataki.nz

UARA
OUR VALUES



WHAKAPAKARI
IMPROVING OUTCOMES



AKO
CAPABILITY DEVELOPMENT



MAHI TAHI
WORKING TOGETHER



RANGATIRATANGA
EMPOWERING
AND LEADING



KAITIAKITANGA
GUARDIANSHIP AND
PROTECTION



WHANAUNGATANGA
COLLABORATION
AND UNITY



MANAAKITANGA
CARING FOR AND
VALUING OTHERS

Ngā ihirangi | Contents

01

RUC is long-established, stable, and remains world-leading	2
The RUC system is intended to recover charges from vehicles in proportion to the costs they generate	2
RUC rates are based on Cost Allocation Model calculations	3
The pavement wear assumption may not be valid for all roads in New Zealand	5

Table of figures

Figure 1: 2019/20 NLTP expenditure by cost category as percentage of total RUC revenue	4
Figure 2: Allocation of costs making up RUC rates for six common vehicle types	5

List of abbreviations

ACC	Accident Compensation Corporation
ATV	All Terrain Vehicles
CAM	Cost Allocation Model
CNG	Compressed Natural Gas
DME	Dimethyl ether
eRUC	Electronic Road User Charge
ESA	Equivalent Standard Axle
ESPs	Electronic System Providers
ETS	Emissions Trading Scheme
EV	Electric Vehicle
FED	Fuel Excise Duty
GVM	Gross Vehicle Mass
GVW	Gross Vehicle Weight
HFCEV	Hydrogen fuel-cell electric vehicle
HV	Heavy Vehicle
LPG	Liquefied Petroleum Gas
NLTF	National Land Transport Fund
NLTP	National Land Transport Programme
PCE	Passenger Car Equivalents
PHEV	Plug-In Hybrid Electric Vehicles
PV	Powered Vehicle
RUC	Road User Charge
VKT	Vehicle Kilometres Travelled

RUC is long-established, stable, and remains world-leading

New Zealand's road user charges (RUC) regime was first set in place in 1977. There have been multiple substantive reviews and analysis of the system since its introduction. However, throughout the time it has been in place its core concept, that charges are derived based on a vehicle's distance travelled and contribution to road wear, remains unchanged.

A comprehensive review of the entire RUC system was carried out by an independent review group in 2008/09. This ultimately led to replacement of the 1977 legislation with the Road User Charges Act 2012 and associated regulations.¹ The main reform under this legislation was to change the way that vehicle weights are defined for RUC purposes from operator nominated laden weight to a fixed "RUC weight" based on the vehicle's maximum legal on-road weight.

Since the 2012 reforms, the Government has continued to review and assess the RUC scheme. While individual vehicle owners may have concerns over specific elements of the RUC system², an independent evaluation of the 2012 Act³ that concluded in 2016 found no serious concerns with RUC from either a policy perspective or a user perspective. One area where there may be opportunity for future reform is that RUC still largely requires manual transactions and paper labels. This was reasonable in 1977 but seems dated now.

Despite its age, New Zealand's RUC system is considered world leading. Many jurisdictions around the world are now looking to move away from fuel taxes to distance-based charges as a way to ensure their future revenue streams. Te Manatū Waka is regularly asked to speak to international delegations and conferences about our system.

The RUC system is intended to recover charges from vehicles in proportion to the costs they generate

Fuel excise duty (FED) and RUC are the two major sources of revenue for the Government's National Land Transport Fund (NLTF). FED and RUC provide the NLTF with revenue to deliver the Government's land transport priorities. The prescribed RUC rates are set to recover charges from vehicle operators in proportion to the costs that their vehicles generate. The rates also provide the share of revenue from RUC vehicles that is needed to meet the Government's overall transport priorities.

Depending on their axle configuration and weight, different types of vehicle contribute differently to each of the costs of the transport system. For this reason, vehicles are grouped into RUC vehicle types, with each vehicle type charged a different rate based on key attributes.

Light RUC vehicles are the most numerous RUC vehicle type. There were approximately 800,000 light RUC vehicles in the New Zealand vehicle fleet at the end of 2019. These vehicles do not use petrol as their primary fuel and have a gross vehicle mass (GVM) up to 3.5 tonnes. Light RUC vehicles are almost all diesel-powered commercial vehicles, such as vans and utes, along with SUVs. Unlike Europe, New Zealand has, as a proportion, fewer diesel-powered passenger cars, which may be an effect of having to pay RUC.

Vehicles weighing less than around 6 tonnes do almost no damage to roads and so they impose very similar costs on the road network. For this reason, all light RUC vehicles pay the same RUC rate – \$76 per 1,000 km (from 1 July 2020).

Since 2012, the amount of RUC paid by light vehicles has been set to be equivalent to that paid in FED by a petrol vehicle consuming 9.5l/100 km (the average consumption across the fleet). Petrol vehicles with a fuel consumption greater than 9.5l/100 km will pay more excise duty to use the road network than vehicles that pay RUC, and those that use less fuel than the average will pay less.

¹ www.transport.govt.nz/land/road-user-charges-ruc-and-petrol-excise-duty-ped/roaduserchargeslegislationchanges/

² For example owners of fuel efficient diesel vehicles may be concerned they are paying more tax than equivalent petrol vehicles, and owners of mobile homes also feel that they are overcharged due to their different usage patterns from commercial vehicles

³ www.transport.govt.nz/assets/Uploads/News/Documents/d72418c14d/RUC-Evaluation-Cycle-3.pdf

Heavy vehicles, of which there are approximately 190,000, including heavy trailers, vary much more in weight and axle configuration than light vehicles. The wide range of RUC vehicle types means that a wide range of RUC rates apply. However, most heavy vehicles, fall into one of four standard powered vehicle types and five trailer types.

There are a small number of petrol-powered vehicles that have a GVM greater than 3.5 tonnes and are therefore also required to pay RUC. Their owners are entitled to a refund of the FED that they pay as part of the price of the petrol they use.

As well as recovering the 'common costs' faced by all road users, a number of additional factors are used to determine the RUC rate for heavy vehicles, including:

- the damage and wear a vehicle causes to the road surface
- the stress that vehicle weight places on bridges and other structures
- the space a vehicle takes up on the road
- the costs of enforcing heavy vehicle rules and regulations.

Each vehicle contributes differently to each of these costs, depending on its axle configuration and weight. Vehicles are grouped into RUC vehicle types, some of which are in turn divided into weight bands (for example there are four weight bands within vehicle type 2, which includes most two axle trucks). Each vehicle type and weight band is charged at a different rate.

RUC rates are based on Cost Allocation Model calculations

To calculate the appropriate RUC rate for each RUC vehicle type (and weight band where applicable) Te Manatū Waka uses a spreadsheet-based cost allocation model (CAM). The CAM is a cost recovery model based on a set of physical engineering principles and engineering expert-based judgements. The model is also broadly consistent with cost accounting and economic principles.

While some elements of the CAM have been questioned (especially the fourth power rule discussed further below), all assessments have accepted its general fitness for use. A 2008 report by Infometrics that summarised previous reviews of the CAM concluded:

"The CAM has served its purpose rather well. Structurally it represents a sound approach to dealing with recovering the costs of road use and presenting users with prices that are a reasonable representation of long run marginal costs."⁴

To determine the appropriate allocation of costs, the CAM assigns a share of the expenditure from the National Land Transport Programme (NLTP)⁵ to each kilometre travelled by each vehicle.⁶ These assumptions and engineering principles are explained below.

The CAM's RUC calculation is driven by three key inputs:

- Expenditure by activity class and work category. Since 2019, the CAM has used forecast expenditure as set out in the NLTP. This ensures that vehicle charges reflect the expected costs that occur in the year in which the RUC is paid.⁷
- Forecast vehicle kilometres travelled (VKT) by each RUC vehicle type for the year for which the rates are being set.
- Revenue from other sources. The most significant other source is FED. Others are motor vehicle registration and licensing fees along with other minor fees and charges and fuel excise duty on CNG and LPG.

Base rates are calculated by the CAM to allocate costs fairly and equitably, consistent with the five cost categories discussed below, across all vehicle types.

Engineering principles are used to classify planned expenditure set out in the NLTP into five categories of costs. These categories are then allocated by the CAM to the individual RUC vehicle types. Figure 1 on the following page shows how the NLTP expenditure is allocated to RUC.⁸

⁴ Economic Assessment of the Cost Allocation Model, Infometrics 2008

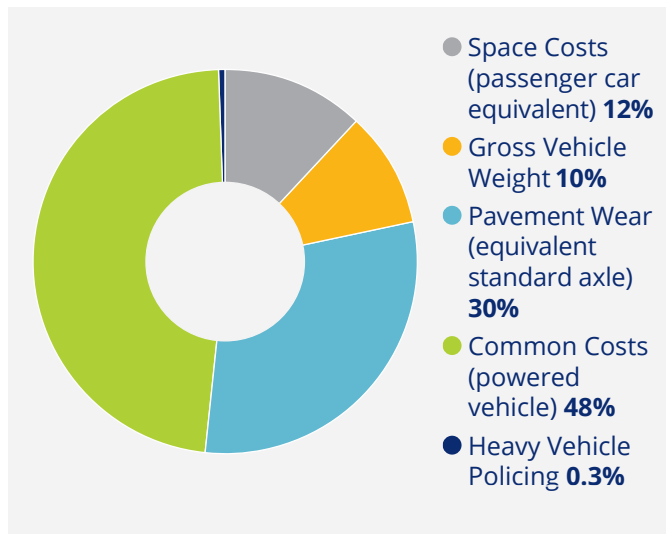
⁵ www.nzta.govt.nz/planning-and-investment/national-land-transport-programme/2018-21-nltp/

⁶ This includes assigning a share of NLTP expenditure to petrol (FED) vehicles. It is forecast for 2019/20 that FED will fund 37 percent of the NLTP and RUC 31 percent. The rest of the NLTP expenditure is offset by rate payer funding, motor vehicle licensing and other Crown revenue

⁷ Distortions can emerge if the actual expenditure varies significantly from that forecast

⁸ The classification does not include externalities such as congestion, noise, and emissions. These costs are not directly part of the roading system

Figure 1: 2019/20 NLTP expenditure by cost category as percentage of total RUC revenue



The five cost categories and method of allocation are described below⁹:

- Pavement wear costs (referred to in the model as “equivalent standard axle” (ESA) costs)** are allocated using a formula that calculates a wear index for a vehicle based on its average laden weight, and tyre and axle layout. Essentially this is an assessment of the damage that the vehicle does to the road surface. For 2020/21 about \$512 million of pavement wear costs were allocated to heavy RUC vehicles, 93 percent of total pavement wear costs (\$552 million). The category of pavement wear costs includes pavement maintenance, resurfacing and rehabilitation. It also includes the estimated costs of adding wear resistance to pavements intended to carry heavy traffic.
- Space related costs (referred to in the model as “passenger car equivalents” (PCE))** are allocated according to a vehicle’s classification in terms of “passenger car equivalents”. For example, a rigid truck is considered to be equal to two passenger vehicle equivalents. A truck towing a heavy trailer is equal to three passenger vehicle equivalents. For 2020/21 \$76 million of space related costs were allocated to heavy RUC vehicles, 15 percent of total space related costs (\$518 million). Most of these costs are for State highway construction, property purchases and local road construction.

- Vehicle weight related costs (referred to in the model as “Gross Vehicle Weight” (GVW) costs)** are allocated according to the gross vehicle weight of vehicles in each RUC vehicle class. Gross vehicle weight (also known as gross vehicle mass (GVM)) is the maximum allowable weight for a vehicle when in use and is usually much higher than the average laden weight used in the ESA calculation. Gross vehicle weight costs are related to the required structural strength of bridges and other structures and are assumed to vary according to kilometres travelled by the vehicle type, multiplied by the total gross vehicle weight.

For 2020/21 \$115 million of gross weight related costs were allocated to heavy RUC vehicles, 40 percent of the total of such costs (\$287 million). This includes significant shares of sealed road resurfacing and new roads, especially bridges.

- Heavy vehicle policing costs (referred to in the model as “Heavy Vehicle Policing” (HV) costs)** are attributed equally to all vehicles over six tonne GVM. For 2020/21 there are \$28 million of heavy vehicle costs allocated to heavy RUC vehicles. Most of these costs relate to enforcement of regulations specific to heavy vehicles by the New Zealand Police’s Commercial Vehicle Safety Team.
- Common costs (referred to in the model as “Powered Vehicle” (PV) costs)** are shared equally between all on-road powered vehicles. Powered vehicles include both petrol and non-petrol vehicles, but not pedal cycles, for example. Costs are allocated to all RUC vehicle types at the same rate per kilometre travelled. Common costs are costs that are not related to road wear, vehicle weight, or vehicle size. They include public transport subsidies¹⁰, general road policing (not the specific heavy vehicle enforcement (HV) costs) noted above), road signs and marking, emergency works, and most routine road maintenance. They also include 45 percent of the costs of building new State highways and 68 percent of the costs of new local roads.
- For 2020/21 common costs are forecast to be \$4.49 billion, less fixed revenue of \$1.55 billion made up of ratepayer funding, motor vehicle registration and licensing fees and other Crown revenue, which leaves almost \$3 billion of

⁹ Cost allocations are based on international engineering best practice and evidence, and have been adapted for a New Zealand context. Te Manatū Waka last had this methodology independently reviewed in November 2010 (*Advice on the Allocation of National Land Transport Programme Costs* (GHD, ARRB Group, 2010)), and Te Manatū Waka believes that it remains sound

¹⁰ Public transport benefits road users by reducing congestion

common costs to be recovered from RUC and FED. RUC is allocated \$941 million of these costs, of which \$207 million relates to heavy vehicles.¹¹

Figure 2 below shows the resulting output of the CAM for the costs for several common combinations of RUC vehicles. This shows that for a heavy vehicle over 20 tonnes, road wear costs (ESA) are significantly greater and contribute to a larger percentage of the overall base rate than for light RUC vehicles. They also show the effect that spreading weight over a greater number of axles has on RUC costs, with the H91 type vehicle paying less RUC than the similar size “408” type vehicle.

By separating the costs by RUC vehicle type and the features of these vehicles, the CAM calculates RUC base rates in a way that ensures that heavy vehicle operators pay fairly for the additional road maintenance and construction costs that they generate.

The pavement wear assumption may not be valid for all roads in New Zealand

Increased weight leading to increased damage to the road pavement is the principal driver of increased RUC costs for heavy vehicles. This can be seen clearly in Figure 2 below. It is well accepted that increased axle weight affects pavements exponentially ie, a doubling of axle weight does much more than double the damage.

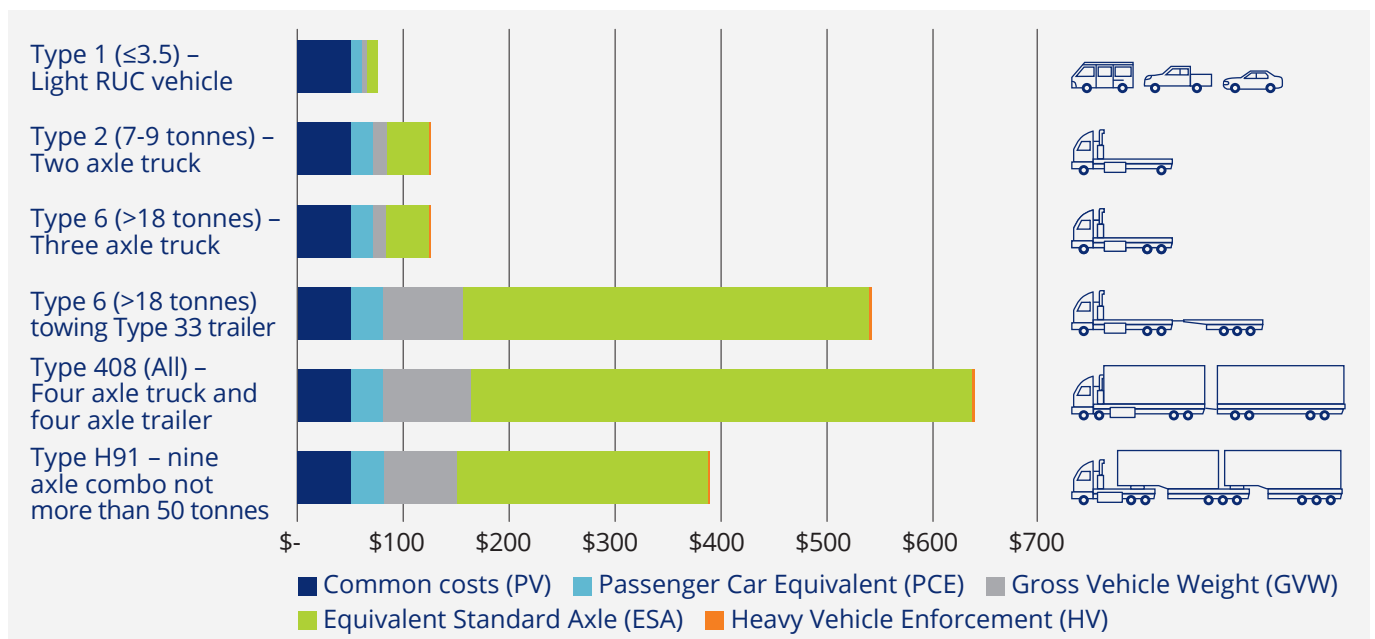
The assumption of increased weight leading to significantly greater road wear is the most important concept in the CAM.

The weight related damage costs are allocated according to the so called fourth power rule. This is written as $ESA = (\text{laden weight}/\text{axle factor})^4 \times \text{load factor} \times \text{number of axles}$. The fourth power rule is based on historical research from the USA, South Africa and New Zealand, and is widely accepted as a rule of thumb for road design. The CAM uses a single pavement damage calculation for all roads.

For vehicles with a gross vehicle mass up to six tonnes, the CAM’s assessment of their contribution to pavement wear is probably correct, as they do little damage regardless of the nature of the road. This is reflected in the very low RUC component for road wear (see Figure 2).

Given the variability of pavement strengths, especially outside urban areas, that the concept is generally accepted by the heavy vehicle sector and that past reviews have found that it to be a valid measure, the fourth power rule remains the most appropriate assumption for road wear across the whole road network. If a future revenue collection system captured vehicle location, then it may become possible to calculate the road wear factor for each section of road with similar properties, rather than all roads being averaged to the fourth power rule as they are now. The implications of this for RUC paid by heavy vehicle operators in different locations could, however, be very significant.

Figure 2: Allocation of costs making up RUC rates for six common vehicle types



¹¹ The percentage of common (powered vehicle) costs allocated to heavy vehicles relates directly to their share of powered vehicle kilometres travelled (about 7 percent)

Directory

Wellington

Head Office

Te Manatū Waka
3 Queens Wharf
Wellington 6011
PO Box 3175
Wellington 6140
Telephone: +64 4 439 9000
Email: info@transport.govt.nz

transport.govt.nz

ISBN 978-0-473-61928-2



Te Kāwanatanga o Aotearoa
New Zealand Government