Appendix – Road User Charging

Developments since the August Commission Meeting paper

Over the past four weeks, there have been several events which impact on the scope and focus of the work discussed at the August Commission Meeting. Key events include:

- A discussion of road user charging at the Government's economic round table on 20 August 2025, with the Australian, state and territory governments to discuss further at the Council for Federal Financial Relations on 5 September 2025.
- s 47C, s 47E(d) [redacted]
- s 47E(d) [redacted].
- Martin Stokie attended Infrastructure Partnerships Australia's Road User Charging Roundtable which built public momentum for reforms, although this focused more on issues of inequity and declining revenue from light vehicle charging.
- Several media reports paraphrasing comments by the Prime Minister and Treasurer indicating that a road user charge would, in due course, be implemented.

These developments indicate that less work may be needed to build the case for reform than was expected at the August Commission meeting.

Greater attention on highlighting the economic benefits of reform may do more to advance the case for reform at this time. However, data availability and the complexity of performing the modelling task properly mean that this cannot be completed within the timeframes of the National Competition Policy 2025 study and would likely go into the first quarter of 2026 (discussed further below). In addition, s 47(B) [redacted] the modelled benefits of preliminary stages are likely to be very small.

In the timeframes available for the National Competition Policy 2025 study we can continue to deliver the other issues flagged in the August CM paper:

- Identifying current road user charging arrangements for heavy vehicle in Australia,
- Drawing on the discussion in previous PC reports, set out principles to assist in policy implementation on:
  - the limitations of the current approach
  - options for reforming the charging framework
  - options for improving governance over expenditure

The modelling task could be undertaken in parallel with this work with a later release timeframe.

Estimating the economic benefits of road user charging reforms

The economic benefits of road user charging will depend critically on the specific design, coverage and implementation of such a scheme. Estimating the associated economic benefits is a highly complex undertaking, requiring an evaluation of the current road use and provision arrangements, the canvassing of potential road user charging schemes, and their interaction with other parts of the transport system and the broader economy – now and into the future.

Lacking details about a specific road user charging scheme, a simple, illustrative quantification of some potential benefits would require:

- An average road user charge that would apply to the vehicles in scope
- An estimate of the number of vehicles that would be in scope
- A breakdown of the existing cost structure and road funding arrangements for the road transport industry
- Assumptions about the changes in road use and road provision caused by a road user charging scheme
- A baseline projection of the above in the absence of any policy changes
- A framework to turn the above into inputs for the Commission's existing economy-wide models

This simple approach should be sufficient for a crude, illustrative and back-of-the-envelope estimate of the potential fiscal and economy-wide implications of a road user charging scheme in the long run. By applying the average road user charge to the cost base of the vehicles in scope, and using assumptions and other literature to estimate additional costs and savings in road use and provision, we could derive inputs amenable to CGE modelling. This could provide a rough estimate of the magnitude of the financial and economic implications for road users and the flow-on effect throughout industries and the broader economy.

However, there would be serious limitations on the (external and internal) validity of these results and consequently, the value in undertaking the exercise. The Road Transport industry in the Commission's suite of CGE models is underdeveloped, capturing road transport services for hire more than industries' own road transport activities and making no distinction between commercial and passenger road use. Any numbers derived from this approach would rely largely on averages and assumptions, requiring careful framing and risking misrepresentation in a policy area that the Australian Government is beginning to move into.

Moreover, despite its relative tractability the exercise is non-trivial – especially given the proposed time frame. Among other tasks, it would require a small team to gather the necessary data (not all of which is public – discussed further below) and estimate a feasible (average) road user charge, conduct a thorough literature review of the relevant assumptions used in similar transport modelling, and explain the results (and importantly, limitations) of any economy-wide simulations.

Such an approach is not recommended as it attracts significant risk and cannot be completed with the timeframes of the National Competition Policy 2025 study in any case.

A more advanced and comprehensive approach to estimating the economic benefits of a road user charge would require:

- A clear articulation of the road user charging scheme to be introduced, including its interaction with existing arrangements, practical means of administration and the treatment of the revenue collected
- A well-defined time horizon for comparison, accounting for both short-run and long-run effects
- A schedule of distance-based charges varying by vehicle mass and location of travel, derived according to their contribution to road damage
- A schedule of additional charges to address other externalities, including congestion, emissions and road trauma
- A count of the number and type of vehicles that would be in and out of scope, the distance they travel, and how this differs throughout Australia
- A cost-benefit analysis of the changes in road use and provision caused by a road user charging scheme, including
  - Changes in distance travelled and travel routes by different vehicles (requiring a price elasticity of demand for road use)
  - Changes in the efficiency of road maintenance and provision associated with alternative funding and information-collection arrangements

  - Any additional vehicle reforms that may be introduced alongside and enabled by road user charging, such as access and mass reforms for heavy vehicle
  - The costs of implementing, monitoring, complying and administering a road user charging scheme
  - Any other cost-saving (productivity) benefits or additional costs of a road user charging scheme
- A baseline projection of the above in the absence of any policy changes
- A suitable transport network model that can accommodate different agent types, intermodal substitution, and temporal and spatial dimensions in a dynamic setting

This advanced approach would allow a detailed exploration of the potential effects of different road user charging schemes and enable their comparison. However, such an approach involves significant informational, computational, and specialised knowledge requirements, entailing a time and resourcing investment that is best suited to a standalone, dedicated project more akin to an inquiry. That is, a team of approximately four dedicated staff with management support working over at least 6 months. The exact timeframe would depend on the project scope (e.g. whether a detailed analysis of road use externalities is undertaken) and further enquiries about data availability to support the analysis.

Overview of publicly available data and data gaps

Road demand

Recent data

BITRE (2024) publishes estimates of the total number of vehicles registered for use on Australian roads, including breakdowns by jurisdiction, vehicle type and for trucks, by mass. Heavy vehicles (including articulated trucks, rigid trucks and buses above 4.5tn) comprised 2.6% (568,950) of motor vehicles on registers in 2024. Heavy electric vehicles – fully powered by battery or fuel cell – comprised 0.003% (578). The small proportion of these vehicles would lead to similarly small results in any economy-wide modelling.

The ABS (2020) used to conduct a survey of motor vehicle use in Australia, with the last reference period being the year to June 2020. This survey measured average and total kilometres travelled and tonne-kilometres travelled for different vehicle types and by state and territory of registration, area of operation, vehicle mass, commodity transported and more. However, the dataset does not separate out electric vehicles from the 'Other' category, which also includes liquefied petroleum gas and dual fuel vehicles.

The total freight transported by road was estimated at 223,949 million tonne-kilometres in 2020 – referring to the number of tonnes moved, multiplied by the distance travelled in kilometres for each individual vehicle carrying freight. Articulated trucks accounted for 77.4% of this total, rigid trucks for 18.7% and commercial vehicles for 4%. On a per-vehicle basis, on average:

- Articulated trucks moved 1,835.7 thousand tonne-kilometres per vehicle
- Rigid trucks moved 94.6 thousand tonne-kilometres per vehicle
- Light commercial vehicles moved 5.2 thousand tonne-kilometres per vehicle.

Victoria had the highest road freight estimate (59,284 million tonne-kilometres), followed by Queensland (52,833 million tonne-kilometres), New South Wales (51,277 million tonne-kilometres) and Western Australia (34,478 million tonne-kilometres).

Forecast data

BITRE (2019) developed a methodology to estimate EV uptake by forecasting EV sales as a percentage of all passenger vehicle sales. The approach is based on modelling of EV prices, taking into account historical trends in EV characteristics, batteries and their prices, and a multi-stage logistic model for EV uptake.

However, this analysis focusses exclusively on passenger vehicles and provides little insight into the potential uptake of heavy electric vehicles.

The National Transport Commission (NTC) (2022b) forecasts vehicle fleet numbers to advise ministers on heavy vehicle charges. They assume that vehicle numbers increase each year by the average increase in total registered vehicles over the previous 10 years (NTC 2022a, p. 24).

BITRE (2022) produced estimates and forecasts of interstate, intrastate and capital city road freight from 1970 to 2040. These are based on statistical models relating historical trends in road freight volumes and economic activity as well as assumptions about future long-term economic and demographic trends. For example, by 2040, interstate road freight is projected to be 78% above 2020 levels and capital city road freight 53% above 2020 levels. Forecasts are provided separately and together for articulated trucks, rigid trucks and light commercial vehicles.

Road supply

Heavy vehicles

The NTC (2022b) estimates and forecasts a 'heavy vehicle cost base' for each year, approximating the expenditure on road provision that can be attributed to use by heavy vehicles. The heavy vehicle cost base is derived under the current PAYGO framework, which takes a weighted 7-year average of historical road expenditure by all jurisdictions and apportions different expenditure categories to the different vehicle types. The four key parameters used to allocate the costs for each vehicle type are: average gross mass kilometres, equivalent standard axles kilometres, passenger car units kilometres and vehicle kilometres travelled (NTC 2018, p. 3).

The latest publicly available PAYGO model is a large Excel spreadsheet from 2019 that uses a cost allocation matrix, several averaging and trend assumptions, and registration and road usage data (including from the now-discontinued Survey of Motor Vehicle Use) (NTC nd). The latest public version of the PAYGO model user manual predates the discontinuation of the Survey of Motor Vehicle Use and it is not clear what data source has replaced this survey (NTC 2018).

The heavy vehicle cost base was estimated at $4.3 billion in 2020-21 and $5.2 billion in 2021-22, and was forecast to increase to $6.15 billion in 2023-24 (NTC 2021, p. 12, 2022a, p. 25). Although this heavy vehicle cost base may capture a rolling average of annual road maintenance and expansion costs attributable to heavy vehicles, it does not reflect the marginal (or social) costs of heavy vehicle road use required for efficient road user charging. The PAYGO model also does not account for the lifetime of road assets, thereby likely overestimating costs.

Overall road-related expenditure

BITRE also provides estimates of total annual road-related expenditure in Australia, but there appears to be notable year-to-year variation. BITRE's (2025) annual statistics yearbook indicates that total road expenditure by all governments amounted to $38.64 billion in 2022-23, whereas their *Economics of Road Maintenance* report estimated the annual figure at $30.8 billion in 2020-21 (BITRE 2023).

Moreover, it is not clear whether road-related expenditure is currently and consistently under- or over-funded by road users. BITRE's (2025) annual statistics yearbook indicates that road users paid $39.43 billion in 2022-23 across all presented sources of road-related funding, which exceeds the $38.64 billion in expenditure. If road-related expenditure is currently overfunded by road users, further data on the current incidence on commercial, passenger and heavy vehicles would be required to inform any modelling exercise. If road-related expenditure is currently underfunded, increasing the quantum of funding through a road user charge or other tax mechanisms would lead to declines in output in economy-wide modelling that may harm

the case for reform (absent more complex modelling or any additional, simultaneous road and vehicle reforms).

Road wear

There is a complex literature on road deterioration and its determinants in Australia that indicates that a range of data would need to be acquired to estimate genuinely cost-reflective road user charging. Austroads (2023) recently updated its road deterioration models, publishing technical reports including data-heavy modelling on four measures of road deterioration: rutting, roughness, cracking and deflection.

Taking rutting as an example, pavement strength – determined by a road's materials and engineering design – explains a larger share of the variation in road rutting progression than traffic loading (Alaswadko and Hassan 2018). While traffic loading is a significant contributor, so is pavement age and moisture and weather factors (Sen 2012; Toole et al. 2004), and these interact together in complex ways to inform rutting damage. Hence, geospatial data on the make-up, design and environmental factors affecting different sections of the road network would be required to accurately estimate road wear and its variation throughout Australia.

Available estimating approaches have limitations

Pigovian taxes

There is a large literature focussed on estimating optimal Pigovian taxes, but less so on estimating cost-reflective road user pricing. Parry and Small (2005) developed a seminal theoretical model to estimate optimal fuel and vehicle-miles-travelled in the United States and United Kingdom.[1] Their model accounts for the emissions, congestion and road accident externalities of road use, but crucially not the maintenance and expansion costs of road use. Incorporating this into the theory of their workhorse model would be non-trivial given the high degree of heterogeneity in road users, road types and location that determines different types of road wear.

The optimal VMT tax is estimated at 22.5c/km for the US and 24.9c/km for the UK. The authors present a breakdown of their estimated fuel tax, with congestion charging making up approximately 29% of the tax, road accidents 24% and pollution 21%. The remaining 26% is a Ramsey tax component. The size of these per-kilometre estimates indicate that a significant portion of an optimal road user charge would similarly seek to price in externalities, which would be beyond the scope of any shorthand analysis we could conduct.

Cost-benefit analysis

Deloitte Access Economics (DAE) (2017) conducted a cost-benefit analysis of five different options for a road user charging scheme. They provide a framework for thinking about the potential costs and benefits from the demand and supply sides, and use a combination of data analysis, literature reviews, and elasticity assumptions to quantify CBA inputs for several likely impacts of a RUC.

For example, they consider several behavioural responses across the RUC options: changes in road use (elasticities taken from literature), better quality roads and efficiencies in road provision (productivity improvements in road supply), supply chain reorganisation (percentage reductions in supply chain costs), and improved road access and monitoring, compliance and administrative costs (annual expenditure increases).

[1] The authors used a static, closed economy model with a representative agent whose utility is affected by fuel or distance taxes and the negative externalities of driving. Exte5rnality parameters were calibrated via literature reviews into the costs of pollution, congestion and motor vehicle accidents.

DAE's is a feasible approach to estimating potential cost savings and productivity benefits associated with different road user charging schemes, which could also be used as inputs to CGE modelling to estimate economy-wide effects beyond funding redistribution and deadweight loss. However, the time investment required to make defensible, updated cost-benefit estimates and assumptions is currently beyond the scope and timeframes of this project. Moreover, their approach requires specific details about the road user charging scheme/s being considered.

Dynamic optimisation approach

Dynamic optimisation can allow the estimation of optimal road user charges in a fiscal sense. Verma et al. (2017) propose a dynamic programming model to estimate the time-path of a vehicle-miles-travelled (VMT) tax required to collect a specified level of revenue over a given time horizon. Using optimal control theory with a cost function, value function and a differential equation for VMTs (which takes into account the effect of a user charge on total demand), solved via numeric simulation, the authors estimate a long-run tax of 7.8–8.4 cents/mile to fund US road expenditure.

This mathematical model would be sufficiently tractable to estimate a crude and average road user charge to achieve a given level of revenue, such as the heavy vehicle cost base. The model could be extended to account for different vehicle types and other externalities at the risk of complexity and confidence. Nonetheless, an average RUC might be sufficient to estimate economy-wide, aggregate effects, but would need to be paired with out-of-model cost savings and productivity benefits to yield positive economy-wide effects. Moreover, an averaged road user charge would be far removed from the policies being considered by governments and would overlook the significant distributional differences and impacts that a road user charging scheme would address in practice.

Road use modelling approaches require development

A more comprehensive model of road use decisions would require an understanding of the price sensitivity of road users to changes in the cost of road use, on a per-kilometre basis if possible. For example, RMIT and CSIRO have designed an open-source, agent-based model for consumer travel choices in Melbourne, including private fuel-based vehicles (Jafari et al., 2021). Although a model to inform the average effects of a road user charge would not need to be agent-based, a well-designed universal road user charge would require detailed road use data in combination with estimates of:

- changes in distance travelled when the cost of road use increases, both for freight and consumer vehicles. This could be based on fuel-price elasticities, for example Zhang and Burke (2020) and Spasojevic (2024).
- substitution between EVs, traditional vehicles, and hybrid vehicles when the operating costs of one option change
- substitution between road use and other alternatives to road transport – for example, from consumer vehicles to public transport or from road freight to rail.
- substitution towards lighter vehicles in response to mass-based pricing.

Much of the above information does not exist in the literature, typically because sufficient data is not available. For example, traffic monitoring data exists in some Australian states but is highly variable and usually concentrated in large capital cities. In some cases, this analysis would be better undertaken after the introduction of an early version of a road user charge (when new information becomes available to road administrators) and used to refine a charging scheme.

Estimates of road-user elasticities vary greatly

Source	Vehicle type	Mechanism	Short run elasticity	Long run elasticity
Goodwin, Dargay & Hanly (2004)	Passenger cars – limited direct freight evidence	Fuel price	-1% traffic volume -2.5% fuel consumption	-3% traffic reduction -6% fuel consumption
		Income	+4% vehicle numbers & fuel consumption +2% traffic volume	+10% vehicle numbers and fuel consumption +5% traffic volume
de Jong & Gunn (2001)	Passenger cars	Fuel price	-1.6% car trips -1.6% car kms	-1.9% car trips -0.26% car kms
Graham & Glaister (2002)	Passenger cars	Fuel price	-1.5% car kms	-3.1% car kms
Oum, Waters & Yong (1992)	Automobile usage	Travel costs	-2.3% travel demand	-2.8% travel demand

Government action on PC's previous recommendations

At the August Commission meeting, Commissioners were interested in hearing more about Government responses to previous reports that have recommended road user charging. As noted in the August paper, over the past two decades, the PC has consistently recommended reforming Australia's road funding model to better align charges with actual road use. These reports include a focus on heavy vehicles (*Road and Rail Freight Infrastructure Pricing*, 2007), proposals for pilot schemes and road funds (*Shifting the Dial*, 2017), integrating road pricing into congestion management (*Public Transport Pricing*, 2021), and most recently a national distance-based charging system (*Advancing Prosperity*, 2023). Through these reports, the PC has provided a clear and repeated blueprint for reform.

Despite this consistency, successive governments have not implemented these recommendations. Several factors explain this inertia:

- political difficulty from framing reforms as the introduction of a 'new tax'
- a lack of broad public support potentially resulting from uncertainty about equity and transparency issues
- need for intergovernmental agreement on interacting parts of road user charging (excise, registration, general taxation) and expenditure
- competing policy priorities and trade-offs in dealing with the costs of road infrastructure and the externalities of road use
- limited pilots to demonstrate success of policy reform – the current National Heavy Vehicle Charging Pilot, which tests charging on vehicle mass and distance travelled may go some way to addressing this.

The combination of these barriers may have contributed a lack of progress on reforms aligned with the PC's recommendations.

Early bottom lines – Road user charging

Key points

- **Australia's heavy vehicle fleet of just under 600,000 pays fixed and variable charges intended to recover the costs of their road use.**
  - 40% of the charges are fixed registration charges imposed by State Governments but agreed nationally to recover the costs of road use.
  - 60% of the charges are variable, imposed through a 32.4 cent reduction to the fuel tax credits received by heavy vehicle operators.
- **The current system of road user charging cost recovers for the impact of heavy vehicles through the PAYGO system operated by the National Transport Commission. This system sets charges equal to a 7-year average of total road expenditure attributable to heavy vehicles.**
- **The current charging framework indirectly charges for road use and could be improved by directly charging for road use based on vehicle mass and distance travelled. Such an approach would provide neutrality for technological change to vehicles that do not use conventional fuels.**
- **It is not straightforward to measure distance and mass for the purposes of a charge. Although modern telematics present an opportunity, these come with a range of challenges including privacy considerations. A mix of measurement and charging approaches for different road users could be required.**
  - International experiences provide some models to address these practical challenges. For example, New Zealand allocates costs on a per-kilometre basis using weight, axle configuration, space-related costs and common costs.
- **PC has previously recommended establishing a Road Fund to collect revenue and allocate funding to independently selected infrastructure projects. This should be used to hypothecate revenues from a new charge and could build on financial arrangements under the Fuel Indexation (Road Funding) Special Account.**
  - This could draw on New Zealand's experience with a hypothecated National Land Transport Fund, particularly as they move towards a universal electronic RUC model.

The current system for charging heavy vehicles cost recovers for road use but could be improved.

How does Australia charge heavy vehicle road use?

Australia's heavy vehicle fleet of just under 600,000 vehicles (table 1) is subject to a nationally agreed system of charging through fixed registration charges (approx. 40% of total charges) and variable fuel-based charges (approx. 60% of total charges) administered by the National Transport Commission. Heavy zero emissions vehicles (HZEVs) do not pay variable charges as they do not use conventional fuels.

Table 0.1 – Australia's fleet of heavy vehicles

	2024 registered total	Proportion of all vehicles	2024 registered zero emissions vehicles
Articulated trucks	124,296	0.6%	13
Rigid trucks (above 4.5 tonnes)	396,894	1.8%	197
Buses (above 4.5 tonnes)	47,760	0.2%	368
Total	568,950	2.6%	578

a. Note label. **b.** Note label.

Source: BITRE (2024).

The overall amount of charging is determined by the National Transport Commission using the PAYGO model. The PAYGO model estimates the annual cost of road provision from the average of total road expenditure over the last seven years. In this sense, it recovers both maintenance and capital expansion costs. PAYGO was introduced to help recover marginal cost of road wear and tear for each heavy vehicle type, recover a share of common road costs that benefit all users and ensure heavy vehicles pay their share of road spending.

Fixed registration charges

Annual registration charges are made up of two components, a road component and a regulatory component. The road component is designed to recover the costs of road expenditure that can be attributed to heavy vehicles. The regulatory component is designed to recover the costs of the National Heavy Vehicle Regulator and any regulatory services that are provided by the relevant State and Territory Government.

Registration charges vary based on vehicle type and number of axles. In 2025-26, charges range from $714 for the smallest, 2-axle truck, though to $17,039 for a long combination truck. Of these fees, the specific road component ranges from $459 to $13,959.

Variable fuel-based charges

Heavy vehicles pay a road user charge of 32.4 cents per litre of diesel fuel purchased. Administratively, this charge is applied through reducing the fuel tax credits that operators of heavy vehicles for business purposes are otherwise entitled to claim – so a heavy vehicle used on public roads for business purposes in 2025 is only eligible to claim:

$$Fuel\ Excise\ Refunded\ per\ litre = Fuel\ Tax\ Credit - Road\ User\ Charge$$

$$Fuel\ Excise\ Refunded\ per\ litre = 50.8c - 32.4c = 18.4c$$

The National Transport Commission estimated that the revenues from heavy vehicle fuel-based charges totalled $3.4 billion in 2021-22, compared to a cost base of $3.8 billion. HZEVs are currently exempt from the NTC's road user charge as they do not use conventional fuels nor receive a fuel tax credit (NTC nd).

Other relevant fees

Heavy vehicle operators also face several other fees and charges that are not related to their use of the roads. This includes obtaining a national heavy vehicle licence and paying audit fees to the National Heavy Vehicle Regulator.

Possible inefficiencies in this approach

A heavy vehicle's impact on the road network is largely determined by its mass and the distance travelled. The current road user charging framework for heavy vehicles provides an indirect charge for this impact as it is based on fuel consumption (which varies with mass and distance travelled) – a 32.4 cent per litre charged on diesel fuel purchased.

The current system is relatively simple to implement, as it is handled through fuel excise and business activity statements, both of which may continue in some form even with the introduction of a road user charge. The current system also cost recovers the 7-year average of road expenditure attributed to heavy vehicle road use.

However, the current system will not be fit for purpose as the use of heavy zero emissions vehicles increases. While there are some practical barriers to the adoption of the EVs for very large vehicles (e.g. technological barriers and charging infrastructure barriers), the adoption of EVs for smaller vehicles has at least commenced (Table 1.1).

For vehicles of similar weight, EVs and non-EVs are substitutable. For example, in principle, a diesel truck in a road freight fleet can readily be replaced with an electric one, provided technological and infrastructure considerations allow for it. A well-designed charge should treat all vehicles of a given weight as neutrally as possible, except for a carbon charge component.[2]

The current system also fails to effectively deal with the carbon emissions externalities presented by petroleum use. While the amount of road user charge increases with the amount of fuel consumed by vehicles driven on public roads, the current arrangements do not recover the external costs of fuel consumption from businesses that receive the fuel tax credits but are not required to pay the road user charge – for example, the mining sector.

International experience, particularly New Zealand's system of road user charges, could provide an example of how an increased link between these can improve outcomes.

Practical issues with adopting mass-distance-location charging to recover economic costs of road use

For a road user charge to effectively recover the costs of road damage, it should account for the mass of a vehicle in addition to its distance travelled. This could act as a 'base' charge that applies to all vehicles, with other components of a charge (such as a price for carbon emissions or for driving on congested roads)

[2] This is also a more general problem with the potential 'phased approach' of charging heavy EVs first, followed by heavy vehicles more broadly. An ideal charge would not rely on entirely separate schemes for vehicles with a similar weight and function.

applied separately. The August 2025 CM paper explained the principles behind charging for each of these components. Practical considerations are explored in more detail here.

Mass

Measuring vehicle mass, and the changes in associated infrastructure costs, is not always straightforward. The mass of a particular vehicle will depend, for example, on whether it is fully loaded at a specific time and will need to vary to avoid over- or under-charging a road user for some trips. The relationship between road damage and mass is also moderated by a vehicle's axle configuration.

However, the mass of road freight on a given journey already needs to be measured to ensure vehicles are not overloaded and manage compliance with the use of load-limited infrastructure, such as bridges. It is also an input into cost management for freight operators. In this sense, it should be more straightforward to administer a mass-based road user charge to heavy freight vehicles than to private consumer vehicles.

For this reason, the way that mass is measured should differ between heavy and light vehicles. For heavy vehicles, a charge could be based on its actual weight during any given journey, including the mass of any freight it is carrying. For light vehicles, the charge could be based on tare weight alone (that is, the weight of the vehicle when empty).

Distance

Measurement of distance travelled for the purposes of a road user charge does not need to be complex. Information on distance travelled for a given vehicle could be collected annually as part of typical registration processes. For example, applicants could be required to submit a photo of their odometer readings. But if the charge is required to vary based on the mass of a vehicle as well as the mass of its current load, this approach would not provide sufficient detail to administrators.

Modern telematics provide an opportunity to monitor distance travelled more granularly. They also allow for information about the time and location of road travel to be incorporated into a charge. But obtaining this kind of information is not straightforward. Firstly, not all vehicles will be equipped with telematics, and it may not be reasonable to expect all road users to pay for expensive vehicle upgrades, at least for private light vehicles. Secondly, requiring detailed location information to be shared with road operators raises genuine privacy concerns.

Future road user charging models could combine the two options. It is not unreasonable to expect a higher level of compliance from heavy commercial vehicles compared with light private vehicles. Freight operators could be required to equip their fleets with telematics, at least for heavy electric vehicles (most of which already likely are equipped), as well as to report a subset of their information to road administrators in order to operate. A charge levied on light vehicles could be simpler and based on odometer reporting.

Location

Road user charging that is intended to recover the costs of road damage does not necessarily need to be location specific. However, if governments intend to move towards a congestion charging component, information on the specific route taken in a road journey will be necessary.

As with the measurement of distance, this could be straightforward. Standard corridor charges are already used on some tollways, partly as a cost-recovery mechanism, and can help to ease congestion along popular routes. Corridor and cordon charges could be used more widely without many major changes to the way journeys are monitored and charges are administered.

An ideal congestion charge would include more detailed location data along with current traffic levels. This is also technologically feasible with modern telematics, but again may not be appropriate for all private road users or politically viable. Future consideration of congestion charging could include a mix of approaches to collect data on distance and location for different classes of vehicles.

Increasing the link between road demand and road infrastructure investment

In several previous reports (e.g. PC 2014, PC 2017), the PC has highlighted that the accountability mechanisms for choosing road infrastructure projects with the highest net benefits are relatively week. The frameworks for the allocation of grants and project funding are inconsistent and subject to political motivations.

For this reason, the PC has recommended the establishment of Road Funds, to act as a ring-fenced financial fund that collects revenues and directly links road-user preferences with spending decisions through an independent decision-making body that selects projects.

Using Road Funds, revenue raised as part of a distance-based road user charge could be notionally set aside for the purpose of future road infrastructure investment and to cover the cost of road maintenance. Hypothecation alone will not improve the efficiency of road expenditure allocation. However, it can improve public perception that revenue raised from a charge is being used for its intended purpose. That is, it implies that any future road user charge acts as a fee for road use as a government-provided service (PC 2015, p. 160).

Under current road user charging arrangements, the Fuel Indexation (Road Funding) Special Account has allocated the net revenue from the 2014 reintroduction fuel excise indexation to state and territory government road expenditure. This means that a portion of fuel excise revenue has been notionally hypothecated to road funding. However, the exact amount credited to the Special Account in any financial year is determined by the Treasurer, and the amount available for grants to the States and Territories is determined by the Infrastructure Minister. In practice, we understand that the total expected amount has passed through this Special Account, but ministerial control of public finances has been maintained. In 2021-22, this arrangement covered around 5.5% of fuel excise revenue (PBO, 2022).

The establishment of a Road Fund could build on the financial arrangements set up by this Special Account and implement independent decision-making for road projects based on detailed cost benefit assessments of proposals. Further consideration could also be given to administrative arrangements to identify the components of a road user charge dealing with externalities of road use, so that funds are available to address those externalities.

International experience

International experience in implementing a road user charge demonstrates how a road user charge could be implemented in Australia, including arrangement to establish funds to manage the moneys received for investment in the road network (Box 1).

Box 1 – Road user charges internationally

Jurisdictions tackling road wear

Several jurisdictions around the world have introduced distance-based charges for road users. When these schemes are based on a user-pays principle for cost recovery, heavy vehicles are typically the focus, as

lighter vehicles contribute minimally to road wear. This approach differs from congestion pricing or emissions charges, which apply to the entire vehicle fleet.

Below is a summary of jurisdictions that have implemented distance charging schemes based on the user-pays principle for road network cost recovery, excluding New Zealand, which is discussed separately.

	Scheme	Vehicles	Method	Charges
Austria	LKW Maut – distance-based charge	All vehicles over 3.5 tonnes gross weight (HGVs, buses, heavy motorhomes) must pay this distance-based toll on Austrian motorways and expressways	Windscreen mounted OBUs – toll portals along the road network. Based on weight, axels and emissions class. Some routes more expensive than others.	Roughly €0.058 to €0.613 per km
Switzerland	Performance-related Heavy Vehicle Charge (LSVA)	All trucks and trailers over 3.5 tonnes used for freight transport (domestic or foreign) must pay the LSVA on all Swiss public roads	OBUs. Distance and mass based – emphasis on emissions class.	Roughly €0.06 per km for lightest/cleanest vehicle to €0.613 for heavy/high-emitting vehicles.
Germany	Federal truck toll (LKW-Maut)	All commercial trucks over 3.5 tonnes gross weight are subject to tolls on Germany's entire federal highway network	OBUs or manual booking via app. Distance and mass based. Varies on weight/axels and emissions class. Externalities like noise-cost also included.	Roughly €0.151 per km for the lightest/cleanest trucks up to about €0.516 per km for the largest/high-emitting trucks
California	RUC pilot (2016-2017)	Light-duty and heavy-duty vehicles	Manual odometer, plug-in devices, apps.	1.8 cents/mile (based on average state fuel tax). Separate diesel truck rate.
Eastern Transportation Coalition (DEL, NJ, NC, PEN)	Multi-state MBUF pilots (2018-2022)	Trucks and passenger vehicles	Telematics/GPS devices, odometer reporting; integrated with tolling accounts.	Tired rates by miles per gallon; passenger vehicle rates set revenue-neutral with state gas tax.

New Zealand's RUC

New Zealand's road transport network is funded through a hypothecated National Land Transport Fund (NLTF), drawing primarily from petrol excise duty (PED) on petrol and road user charges (RUC) on vehicles not paying PED (MOT 2022, p. 2). Since 1978, diesel and heavy vehicles have paid RUC based on distance and weight, calculated from the government's cost allocation model. In April 2024, RUC was extended to light electric vehicles (LEVs), with heavy EVs to follow in 2025 (MOT 2024). In August 2025, Cabinet agreed to legislate for all 3.5 million light vehicles to move from PED to an electronic RUC model, marking a full transition away from fuel-based taxation (Bishop 2025).

Who pays	All diesel vehicles, most heavy vehicles, and (since April 2024) light EVs/PHEVs. By 2027, heavy EVs will be included (NZTA 2025a).
How charges are calculated	RUC charges are calculated using the Cost Allocation Model (CAM), which allocates a share of the expenditure from the NLTP to each kilometre travelled by each vehicle. The four main cost categories by percentage of total RUC revenue are: • common costs (shared equally between all on-road powered vehicles), • space related costs (measured in passenger car equivalents), • gross vehicle weights (allocated in proportion to the average laden weight of vehicles in each RUC vehicle class, • pavement wear costs (measured by equivalent single axle (ESA).
Administration	Pre-paid in 1,000 km units via electronic or paper licences; compliance enforced through NZTA (NZTA 2025b). Multiple approved electronic providers offer automated hub-odometer/GPS solutions.
Use of revenue	All RUC and PED revenue is ring-fenced to the NLTF for spending on the National Land Transport Programme (MOT 2025).

Heavy vehicles take centre stage in NZ RUC

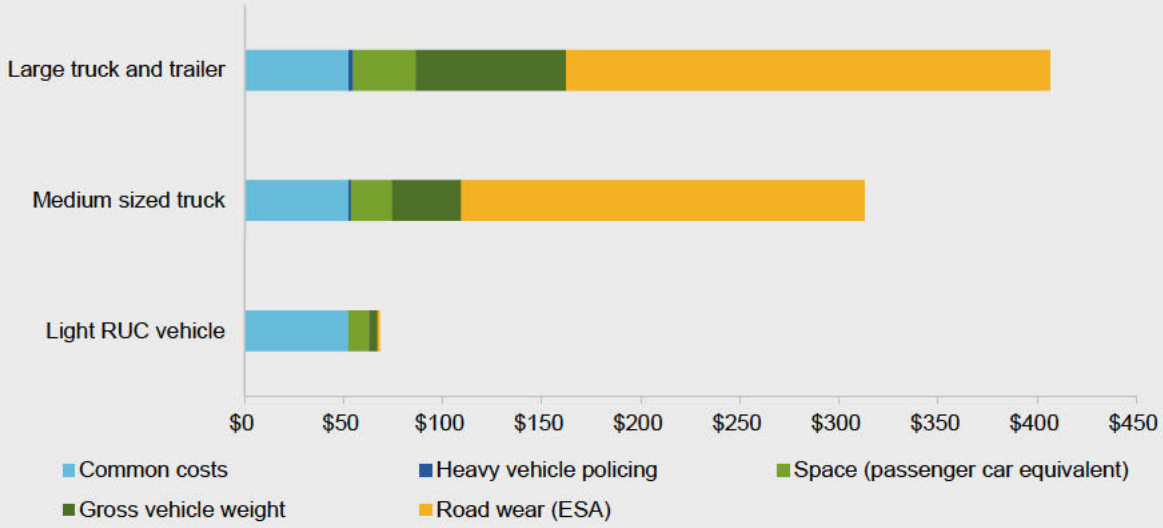
The CAM that underpins the NZ RUC regime centralises heavy vehicles, as they account for a small fraction of the fleet (5.4% of diesel vehicles in 2009) but contribute 46% to RUC revenue (2009) (Road User Charges Review Group 2009, pp. 25–26). RUC paid by light vehicles is set to be equivalent to the PED paid by a petrol vehicle consuming the average amount of fuel (Office of the Minister of Transport 2020, p. 42). This approach is informed by the fact that vehicles less than six tonnes in weight do essentially no damage to road infrastructure.

The ESA component of the CAM dominates all other variables that allocate costs to heavy vehicles. It operates on a 'fourth power rule' that assumes pavement damages rises with the fourth power of axle load, meaning small increases are not linearly associated with pavement damage. It is written as:

$$ESA = \left(\frac{laden\ weight}{axel\ factor}\right)^4 * load\ factor * number\ of\ axels$$

The figure below demonstrates the outsized effect of the ESA component of the cost allocation has in applying costs to heavy vehicles.

2019/20 NLTP expenditure by cost category for three RUC vehicle types



Link between CAM and actual road costs

CAM was designed primarily to recover the costs of building, maintaining and operating the roading network. It was not designed to send precise time and location-based price signals. The model aims to align charges with long-run marginal cost (LRMC) rather than short term fluctuations. There is no explicit recognition of externalities such as emissions or noise (Infometrics 2008, p. 3).

Multiple reviews of the CAM have highlighted a weak link between actual road costs and the costs allocated through the model. For example, the ESA component has been questioned as a reliable proxy for road wear. The Infometrics report also noted that some RUC revenue funds activities not directly attributable to heavy vehicles, further weakening the connection between charges and marginal costs.

In addition, legislated RUC rates do not fully align with the Ministry's CAM. This is partly because expenditure profiles shift over time (with common costs increasing and road-wear costs declining), while regulatory settings only permit rates to remain static or rise, often uniformly across all vehicle classes. Caps on rate increases (typically 10% per year) further limit alignment with CAM calculations, creating discrepancies across vehicle types.

Despite these issues, most reviews have concluded that the CAM still provides a reasonable indication of the LRMC of road use, though it is less effective at reflecting short-term costs or congestion pricing. Moreover, it is uncertain whether making small adjustments to the CAM's components would materially alter the prices faced by the RUC fleet.