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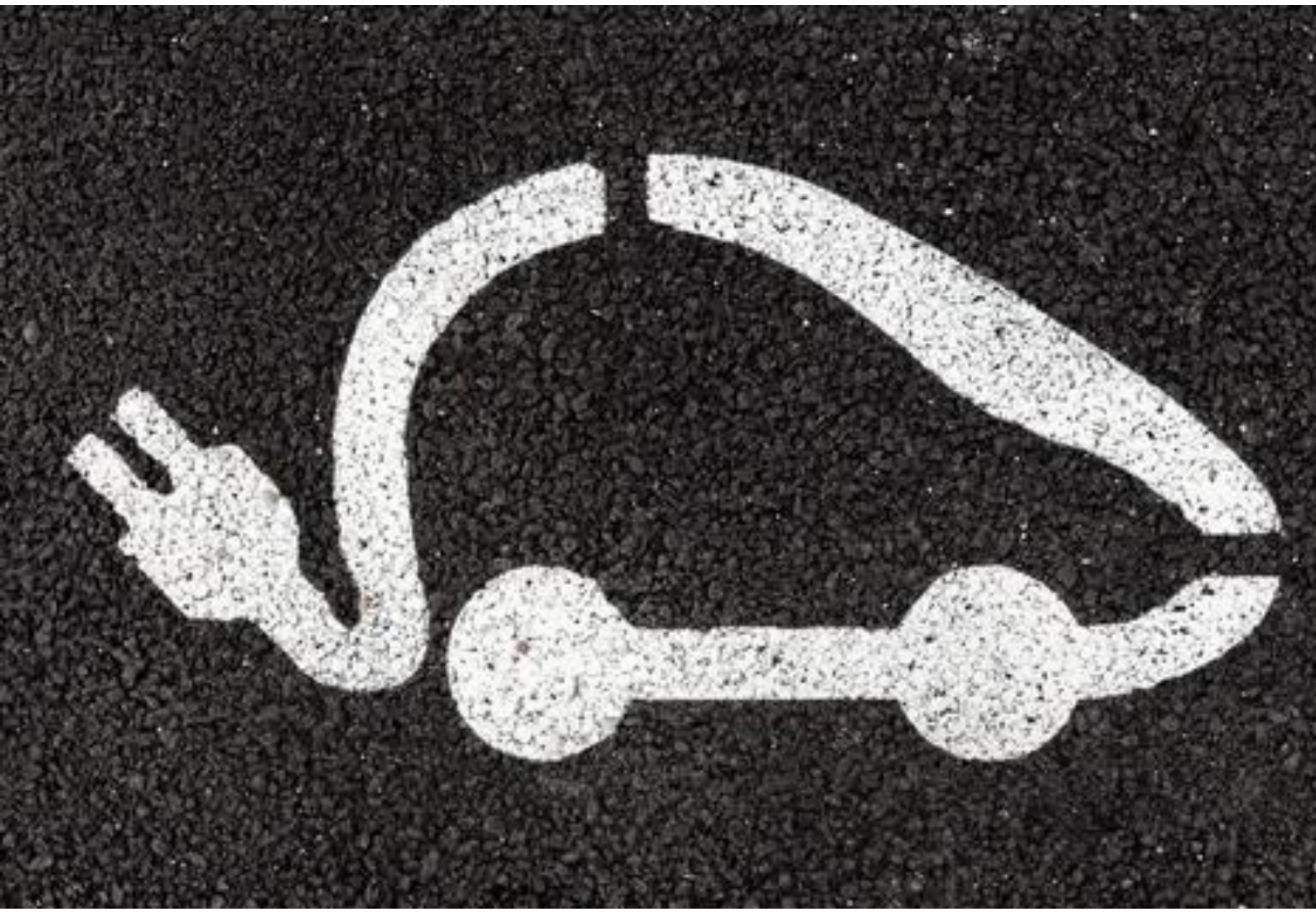

What price to relieve the gridlock?

A non-technical guide to the road pricing implementation debate

NZIER public discussion paper

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Authorship

Each year NZIER devotes resources to undertake and make freely available economic research and thinking aimed at promoting a better understanding of New Zealand's important economic challenges. This paper was funded as part of this public good research programme.

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Key points

Congestion pricing for roads is pivotal to increasing the use of public transport, walking and cycling

The Government's transport strategy emphasises alternative travel options including public transport and cycleways. This requires a switch from cars to using alternative transport. Congestion pricing for roads has a pivotal role to play in encouraging people to switch.

Under-pricing and over-use go hand in hand

Where a publicly-funded product or service is under-priced we typically find over-use. This is the fundamental and inescapable economic truth that needs to be considered when dealing with congestion on selected New Zealand roads.

Until drivers are incentivised through road pricing to stop and think about how and when they use selected roads then congestion will remain a major problem.

What is required for road users to face the true cost of using roads?

Improving the efficiency and effectiveness of the road pricing system requires road users facing the true cost of using the road. This involves:

- Ensuring those who do most damage pay the majority of the maintenance and road building costs (this is about the depth of the road)[1]
- Dealing with congestion (the width of the road). This requires dealing with overload at periodic peak times
- Understanding the impact of accidents and pollution costs (the consequence of using the road)
- Other issues such as ensuring that prices paid allow for further road building.

The current funding regime is relatively fair on issues associated with the depth of the road. This paper has a twin focus: congestion pricing (width of the road issues) and those issues that occur when using the road (accidents and pollution).

This is a non-technical paper aimed at the interested general reader intended to introduce the ideas behind road pricing.

What are the key requirements?

Improving effectiveness and efficiency of public spending in a way that satisfies the public is a goal worth striving for in road pricing.

The key issues are:

- Weighing up the strengths and weaknesses of various road pricing approaches in specific circumstances
- Implementing congestion pricing approaches.

[1] The 'depth' and 'width' of the road are terms coined by Winston in Small et al (1989) and other publications.

Change is required because making more efficient and effective use of roads will be beneficial socially, environmentally, and economically.

Congestion pricing; has its time come?

Undoubtedly congestion pricing's time has come. However, how we approach the issue matters:

- Road pricing is difficult due to the trade-off between providing roads for average conditions (causing congestion) or for peak conditions (causing over-supply), both of which are unsatisfactory and inefficient
- External issues compound the pricing problem e.g. accidents and pollution are missing markets (i.e. road users do not pay the full cost of these even though they occur as a result of road use)
- Congestion (a further missing market) causes substantial costs[2] for the economy and social life more generally and various countries have tackled it with pricing
- Implementation matters since:
  - Congestion pricing regimes set up variable prices with surcharges for particular times and locations, and in the past have relied on either physical or electronic payment systems. Design matters, cordon tolls with few entry points (e.g. Oslo) are generally more cost effective than area charging schemes that have more intensive monitoring (e.g. London) under current land-based monitoring technologies
  - Satellite and GPS technology[3] offer prospects of more precise differentiated pricing but have not yet been widely used because of privacy concerns and risk of inefficient signalling – price needs to be known before setting out on a journey not when halfway into it. Certainty is important
  - Simple approaches to pricing can be effective, complex and complicated technology-driven approaches probably are not.

What do road pricing designers need to consider?

- They need to ensure that it is about effectiveness and efficiency i.e. that the benefits outweigh the costs is essential. Drivers will avoid areas which charge tolls, therefore forecasts for toll road use (for example) need to be realistic
- Overseas experience shows congestion pricing can be effective. However, congestion in one area must not be replaced by congestion in another
- Implementation is key. The public need to be satisfied that the new system improves their situation 'on average'. Getting implementation right is therefore extremely important. One way of assisting this process is through

[2] NZIER (2017) have estimated that decongestion could be worth between $0.9 billion and $1.3 billion per annum for Auckland.

[3] Technology also causes other problems. How will electric vehicles be dealt with since they undermine the use of petrol taxes for revenue raising purposes? One solution may be provided through the wider use of Road User Charges (RUC). How this might be implemented requires extreme care to avoid unforeseen impacts.

signalling i.e. if costs go up through road pricing, other taxes specifically tagged to road maintenance and building should go down

- Efficiency, in theory, may mean building less roads i.e. rather than building an extra lane for peak traffic congestion, pricing could reduce this need since the road is used more evenly throughout the day, however this needs to be validated
- Providing mode choice for drivers in a road pricing environment also assists in public acceptance. Provision of high occupancy toll (HOT)/ high occupancy vehicle (HOV) lanes, increased public transport that is convenient, and carpooling options can go a long way to assisting well designed road pricing schemes
- Careful consideration must also be given to the options considered. Transaction costs must be kept to a minimum and the technology used must be robust and reliable.

What might best practices look like?

Table 1 sets out a summary of questions for stakeholders. These are based on questions that need to be answered prior to the introduction of a road pricing arrangement.

Table 1 Questions for stakeholders

The driver
• Is the system easy to understand? • Is it convenient to use? • Have I got transport options (alternative routes, times, modes, and destinations)? • Have I got payment options (cash, prepay, credit)? • Are the charges transparent i.e. can you see how the system works and corresponding reductions in other taxes?
The regulators
• What are the traffic impacts likely to be i.e. does the driver have to stop? • Do charges match the cost? • Does driver behaviour match the intended impact? • Does the system promote flexible use by all who want to use the system? • Is the system reliable? • Can we prevent fraud and non-compliance? • Will it generate the necessary funds to make the adjustments to the roading network? • Can it be implemented with minimum fuss and disruption?
Society
• Will it produce a positive well-being result for society? • Are any distributional consequences adequately addressed? • Does it fulfil the public's need? • Does it have positive outcomes for the environment? • Is the approach integrated i.e. can it be extended in a consistent way?

Source: Adapted from the Victoria Transport Policy Institute (updated to 2017)

Contents

Figures

Tables

1. What are the pricing consequences of using the roads?

1.1. Road pricing requires serious consideration

The Government Policy Statement (GPS) on land transport 2018 reflects a new approach to transport with greater emphasis on public transport and investment in light rail and cycleways. To be successful this will require less car use and more use of alternative transport.

If Government is to be successful in meeting its zero-carbon goal the existing tax base for transport investment (petrol-driven vehicles) will disappear over the long term.

Both these factors require serious attention being given to the role of road pricing.

1.2. Politics is framed and constrained by the economic factors

Over the past thirty years one of the enduring themes of public policy has been how do we improve efficiency in the New Zealand economy in a way that satisfies the public's needs/concerns.

Developing best optimal solutions however does not always match the public need/concern and this is complicated in some policy areas by complex implementation/transition requirements and seemingly new upfront charges for services that the public consider as 'free'.

Therefore, political and implementation management of any change – in this case road pricing arrangements – is potentially just as, or more important, than the economic theory underpinning change and the increasingly user-friendly technology that may support such a change (including GPS devices, number plate recognition software, and open road tolling devices).

While the politics always comes first in determining the policy priorities and the feasible set of solutions in New Zealand, the durable policy solutions are framed and constrained by economic factors. Road pricing is no different from any other area of government activity.[4]

1.3. Traffic congestion has forced itself onto the political agenda

Traffic congestion is front of mind after any holiday season when many people experience bottlenecks on roads with high levels of traffic. In the main cities, congestion is also an everyday occurrence for thousands of commuters caught in rush hour.

[4] In fact, economic principles are part of the funding calculation. Road User Charges have been with us since 1977, HOV lanes are in operation in Auckland, and specific tolling operations have been introduced.

Congestion occurs when roads experience more traffic than they can comfortably handle, leading to slower average speeds and some cases gridlock. Inevitably as roads are built to a 'fixed capacity' which handle average capacity, and as traffic flows increase, congestion becomes a problem.

A production solution is to build more roads. This becomes increasingly expensive in urban areas when high land values are taken for new roads. It may also not be good use of government funds since in some parts of the day the road will be under-used. Building new roads may also contribute to the cycle where new roads induce more traffic increasing the need for more roads (i.e. new roads are under-priced and over-used).

Road pricing – if implemented carefully – is a way of ameliorating this problem:

- Drivers face a price for using the roads at times where congestion is an issue encouraging some to switch/alter the way they use the road (i.e. by using it at a different time or using public transport)
- The cost of new roads or upgrades will be met by those who contribute to the cost of the upgrade by using the roads at peak times.

The high fixed costs of building roads complicate matters since land, construction, and weather-related maintenance does not very with road use. For society to obtain the most it can from its road investment (promoting efficient use) the government ideally needs to charge a marginal cost (the incremental cost for adjustments to an existing road e.g. the cost of maintenance etc.). The problem is that the incremental cost only covers a fraction of the full cost of building the road. However, charging a higher rate – say an average cost – will exclude some motorists who cannot afford the charges.

In general, average cost is greater than marginal cost. However, to complicate matters further, congestion can mean that the marginal cost is higher than the average cost as each car that clogs the road increases costs for other users. Therefore, designers need to keep multiple factors in mind when developing pricing regimes:

- The estimates of congestion in various cities and towns – the higher the cost of congestion the higher the road charge. There is no one size fits all
- Pricing the impacts of road use is key for society to get the most out of its roading network i.e. providing the right quality and quantity of roads
- Considering the methods of road pricing:
  - Area charging
  - Cordon tolls
  - Corridor pricing
  - Other charges (petrol taxes, HOV lanes, HOT lanes etc.).

These charges are likely to become more important as time goes on as petrol operated cars (with their substantial taxes) are replaced by electric cars.

1.4. The importance of the roading system

The roading system in New Zealand is essential and its economic importance is clear. At any time of the day or night you might see different activities associated with construction, tourism, services, manufacturing and agriculture.

Road transport is important not only because the annual resources used dwarf other transport modes, but because it also connects other transport modes. The contribution to the growth of the New Zealand economy of transport is not only vital for moving goods around but it is also a substantial GDP contributor. Total sales of road transport industry activity to the rest of the economy is around $8.3 billion. The share of GDP is roughly 1.5% or $3.5 billion (March year 2016).

In this brief paper, we will examine:

- The characteristics of the road network (size of the network and impacts of the status quo)
- The basic economic approach to road pricing (it's about how deep the road is, how wide it is, and the consequences of using the road)
- How others have approached road pricing
- The implications of introducing road pricing approaches (including implementation, pricing methods, effects and impacts, and traps to be avoided) and
- Present some conclusions.

In the next section, we look at the characteristics of the road transport sector, its size and importance and how we have attempted to fund roads.

2. The characteristics of road transport

2.1. The problem with roads

A road's value stems from its ability to allow drivers to go where they want to go. They are arteries on which raw materials are trucked, salary and wage earners travel to work, and consumer goods are transported to shops.

Roads are fixed infrastructure, built to accommodate expected demand. Vehicles (and people) make varying use of roads, with peaks around commuter rush hours and holiday periods, resulting in congestion unless road capacity is much greater than that required to accommodate average use.[5]

In the past, it hasn't been cost effective to charge people for every road trip they make, so they have been provided by governments: you cannot exclude people from using the roads and one person's use does not prevent others using the road most of the time. Although congestion shows that there are limits to this last point.

Even if it were possible to charge people for each road trip, the network characteristic still makes it difficult to efficiently charge for roads. For most of the time on uncongested roads the additional cost of an additional road user is very low.[6]

Road users may view the private costs of running their vehicles as the effective price of their use of the road network. But socially optimal pricing would also reflect activities created by road use arising from:

- Wear and tear on the road fabric
- The so-called missing markets (since they are not priced):
  - Risk of accidents
  - Congestion
  - Environmental impacts (e.g. emissions of greenhouse gases, air quality, noise, visual impact and other local effects).

Ideally road pricing would cover for each trip the external costs as well as the private costs faced by vehicle users. But measuring, attributing and setting charges is not straightforward.

The problem with roads is to provide them at an optimal and non-wasteful level; and fund them efficiently. Given the effects that need to be covered, funding for roads is therefore something of a hybrid.

2.2. How big is the roading system?

Public roads are owned by the government through the New Zealand Transport Agency (NZTA) (state highways) and by territorial local authorities (local roads). Table 2 describes the network. The length of road per person in New Zealand is one of the

[5] If infrastructure is built to accommodate peak demand it stands to reason that reducing peak demand will allow a reduction in infrastructure supplied – reducing cost and improving efficiency.

[6] But this cost would not be enough to fund its maintenance and upkeep.

highest in the world reflecting our low population and the wide dispersion of the population e.g. see for example "what's different about driving in New Zealand".[7]

Table 2 Network length, quality and responsibility

Road statistics	Local roads	State highways
Total length	83,000 kms	11,000 kms
Sealed	61%	100%
Urban / Rural	20% / 80%	
Responsibility	Local authorities	NZTA

Source: https://www.nzta.govt.nz/roads-and-rail/research-and-data/state-highway-frequently-asked-questions/

As well as roads, the government owns and operates a limited rail network which competes directly with road transport operators. Around 70% of freight (according to NZTA) goes by road and most people (around 80%) go to work by motor car, truck, or motorcycle.

Long distance and most urban passenger services are operated by private companies – the only exceptions being Council Controlled Organisations (CCOs) which operate urban bus services in various parts of New Zealand (e.g. Christchurch).

In New Zealand, a small number of toll roads exist, notably the Auckland Northern Gateway, Tauranga Eastern Link and Tauranga Takitimu Drive; however, there is no general price control for privately-operated transport services and no restrictions on entry other than compliance with basic health and safety regulations.

Transport-based businesses are highly competitive and are dictated by demand from customers. Prices therefore cover the costs under the current pricing regime in most instances, except in some public transport services which may be subsidised by local authorities to divert some transport demand away from private vehicle use of road space at peak periods.

2.3. What has this led to?

2.3.1. Funding approach

Funding for roads comes mainly from motorists (through fuel excise duties i.e. petrol tax), road user charges on diesel vehicles (Road User Charges or RUC), and vehicle licensing charges. The general approach adopted in New Zealand is a variation of the fully allocated cost (FAC) method. It measures the total cost of its roading provision and allocates it to users in a way seen as 'equitable'.

[7] https://www.newzealand.com/int/driving-in-new-zealand/

The focus is on financial costs rather than social costs to the country. Social costs include aspects of road use that are external to the user but are a direct result of using the road (e.g. emissions and road accidents).[8]

Is this important? Traffic congestion is getting worse; a study commissioned by the NZTA estimates costs to be in the region $1.25 billion per annum.[9]

Approximately $4.0 billion is spent on roading in New Zealand each year.[10] Of this approximately $800 million per annum comes from local government. Local government uses that money for roads and the provision of public transport. Government spending focuses on maintaining national highways, road safety, local roads and public transport. Funding comes from a number of sources:

- Fuel taxes (approximately 40%)
- RUC on diesel road vehicles collected by the NZTA. RUC is directly linked to the actual distance travelled and weight of the vehicle (approximately 30%)
- Motor vehicle registration (including annual vehicle licence fees) on road vehicles collected by the NZTA (approximately 4%)
- Local body rates (approximately 20%)
- The balance is made up of Crown appropriations and other funding.

Figures 1 and 2 set out who pays for state highways and local roads.

State highways are owned and funded by the government. Despite making up a small part of the vehicle fleet, heavy vehicles pay a considerable portion to the maintenance and construction of state and local roads. The rationale for this is that they cause significant damage to roads and therefore road user charges increase as the weight of vehicles increase.

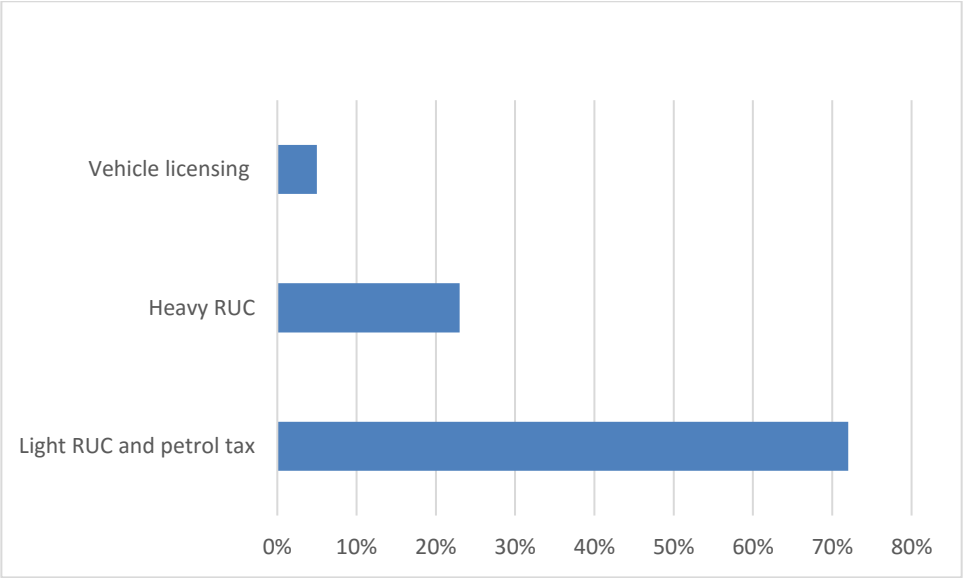
8 Although road accidents are partially covered by the ACC levy system.

9 This figure is based on comparison with free-flow conditions. The cost is $250 million per annum compared to networks operating at full capacity. See Wallis, I and Lupton, D (2013) The Cost of congestion reappraised, NZTA Research Report 489. NZIER (2017) have estimated that decongestion could be worth between $0.9 billion and $1.3 billion per annum for Auckland.

10 http://www.transport.govt.nz/land/roadusercharges/where-does-the-money-go/ and https://nzta.govt.nz/planning-and-investment/2015-18-national-land-transport-programme/about-the-2015-18-national-land-transport-programme/revenue-and-investment-flows/

Figure 1 Who pays for state highways?

Percent



Source: http://www.transport.govt.nz/land/roadusercharges/where-does-the-money-go/

RUC is revenue collected from road user charges and is dedicated to the National Land Transport Fund (NLTF). The NLTF funds road improvements and maintenance, public transport, road safety, and walking and cycling for state highways.

However, a significant proportion of roading costs (up to 44% of costs for local roads in 2013) are covered by rates, which are paid according to property values and are independent of roading costs. Rates, motor vehicle registration and relicensing costs are totally unaffected by the amount drivers use the roads, therefore, they are fixed charges and not affected by any vehicle use decisions.

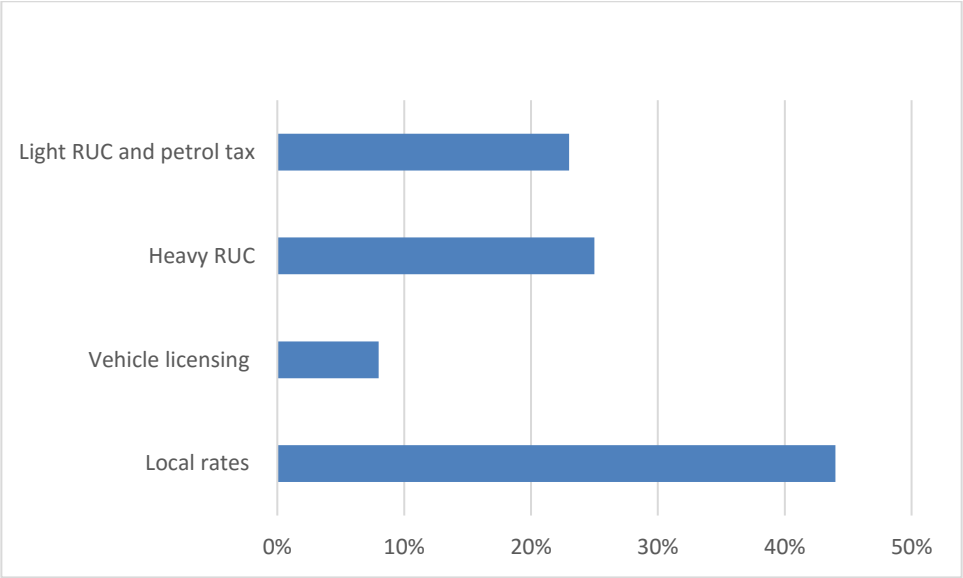
Since 2008, all revenues collected from road users (fuel excise duty, RUC, registration fees) have been earmarked for the NLTF and used to support some aspect of land transport spending (including a portion of fuel tax and registration fees that goes to the ACC Motor Accident Account). These NLTF revenues fully fund provision of state highways by the NZTA and partly fund local roads through a grant matching local authority (rates-funded) spending, which varies across local authorities at a financial assistance rate that is inversely related to rating capacity (so high rateable value urban areas get a lower assistance rate than lower value rural areas).

Under the current arrangement only a small number of road users pay direct tolling charges. However, this only occurs where there is an alternative route available. Beyond these relatively few direct charges and the RUC, the pricing of road access is invisible to the user.

Contributions from the NLTF to local government ensure that heavy vehicles cover the cost of their damage to local roads. Approximately 23% of local road maintenance and renewal costs are attributable to road wear, the majority of which is from heavy vehicle use.

Figure 2 Who pays for local roads?

Percent



Source: http://www.transport.govt.nz/land/roadusercharges/where-does-the-money-go/

2.3.2. Policy and allocation mechanisms

NZTA is a statutory agency responsible for the building and maintenance of state highways – new and existing. The Crown (i.e. the government of the day) may require it to build additional roads such as the Roads of National Significance (RoNS). However, those roads like RoNS are still the responsibility of NZTA (it can also delegate authority to local bodies).

For decades New Zealand has treated roads as a form of 'club good' in which funding comes from the 'club' of road users (including ratepayers whose property values are supported by the quality of local roading).[11] Using combinations of the beneficiary[12] pays' and exacerbator[13] pays' principles, funding instruments have been set at a level associated with costs attributable to different types of vehicle, using a cost allocation model.[14] The cost allocation model considers the following:

- All common costs to drivers e.g. road markings and landscaping are allocated to all powered vehicles
- Capacity – related costs resulting from the space requirements of vehicles are allocated to all powered vehicles

11 Club goods are excludable but non-rival at reasonable cost. These are non-rival since up to a point it does not matter how many people use the road (until congestion kicks in). They are excludable because they benefit the community e.g. Christchurch roads benefit Christchurch road users. Intercity highways benefit all so they are funded for the benefit of all by the government.

12 Those who benefit from using the road e.g. transport companies.

13 An exacerbator is someone who causes the problem e.g. driving at peak times cause congestion.

14 NZTA has recently released research that suggests that the 4th power rule should not be applied to all roads, since the degree of wear is determined not just by axle weight, but by road quality and extent of use. See: https://www.nzta.govt.nz/assets/resources/603/RR-603-The-relationship-between-vehicle-axle-loadings-and-pavement-wear2.pdf

- Strength imposed costs resulting from the gross weight of vehicles such as bridge strength, account for only a small proportion of costs but are expressed as a function of weight and allocated to heavy vehicles
- Durability costs such as pavement wear principally result from vehicle weights transmitted through axles (using the fourth power rule[15]) and are attributable to heavy vehicles.[16]

The government sets the level of RUC and petrol excise given its road building priorities. A cost sharing arrangement between local and central government is in place to fund the building and maintenance of local roads. Local contributions are funded by rates.[17]

The revenue for investment in roads and maintaining state highways and local roads is governed by the Land Transport Management Act 2003. The road priorities are set through the Statement on Land Transport. This gives indicative ranges within which road transport priorities can be funded.

Once the government has set the priorities (RUC and excise), local councils prepare a Regional Land Transport Plan, which is then submitted to the NZTA as an input to the National Land Transport Programme (NLTP). The NLTP allocates funding to individual roading projects.

Central government also has other funding options. The government is able through the budget process to fund other projects such as Accelerated Regional Roads Package, Urban Cycleways and the SuperGold Card public transport scheme.

2.3.3. Inching towards a fresh approach to road user charges

The NZIER has a long history setting out its views on road pricing in a consistent manner. Clough (1993), Clough (1995), Clough and Gale (1993, 1995, 1995), Chapple et al (1996), Malcolm and Gale (1997), Strong et al (1998), and NZIER (2003, 2004, 2005, 2006, 2008, 2009a, 2009b) illustrate ways that road pricing is being developed overseas, demonstrate the size of the problem of inefficient road charging and/or suggest ways of tackling road pricing in the New Zealand context.

While the numbers have changed, and the problems have become more pressing, the message from these documents is unwavering: road users; “as far as possible” need to face the individual costs of using the road.

The current funding regime provides some assurance that New Zealand has a fair and equitable allocation of costs between the various classes of road users. However, there are some issues with the current approach.

New Zealand has a model that recovers costs from those who contribute to the physical wear and deterioration of the network. It does not attempt to deal with the

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15 Most important has been the application of the fourth power rule. Doubling an axle load could cause up to 16 times the pavement damage. See for example: https://www.nzta.govt.nz/about-us/consultations/land-transport-rule-vehicle-dimensions-and-mass-2016/overview/

16 A recent NZTA report suggests that this should be modified since the degree of wear is determined not just by axle weight, but by road quality and extent of use. See: https://www.nzta.govt.nz/assets/resources/603/RR-603-The-relationship-between-vehicle-axle-loadings-and-pavement-wear2.pdf

17 Electric powered cars create a problem for this system since they do not use petrol. As electric vehicles become more common the RUC must be broadened to ensure all vehicles pay for the use of the road.

external (to the user) costs, except to the extent that the Emissions Trading Scheme allocates the costs of climate change to be incorporated into the price of petrol (but not diesel).[18]

Overwhelmingly, the network is free when it is used. There is no mechanism that shows how motorists are impacting on other motorists. These external impacts are set out in section 1.3.[19, 20] The result is that a driver on a little used country road is subsidising a driver going to work on a clogged city road at rush hour. If you assume that both drivers have similar types of cars, they both pay the same access costs even though the external costs to the city driver are much higher (at peak times).[21]

The same is true with two city drivers where one only uses their car at off-peak times or uses public transport while the other uses their car at peak times. The off-peak driver is subsidising the high-use driver who drives to work during peak hours each day.

The issues are not so much about the theory of road pricing but practical application of theory. This puts the focus squarely on implementation of any changes and how these changes are perceived by the various stakeholders over time.

Given the importance of implementation, caution is required when introducing untested but theoretically sound approaches and discarding well-developed and well-understood methodologies.

The next section investigates how we might deal with this issue.

18 There is also some attempt to recover the costs of road accidents from road users as a whole, through a small ACC levy collected from retail fuel sales and from the allocation of most registration fee revenue to safety spending. Although it provides no incentive to use roads more safely.

19 Known in economics as externalities.

20 There is a view that road users who cause accidents do not cause an externality. Medical costs that a road user on average causes are external. This is because the health care costs are funded publicly, and road users do not pay more health care costs than others. There is no reason to believe that a road user would adopt safer behaviour on roads to reduce medical costs!

21 Care is required here since this not the full story. City road users – in some circumstances – may have funded rural roads.

3. Improving outcomes by understanding user behaviour

An effective roading network requires understanding user behaviour enough so that we can assist in ensuring that road costs are sheeted home in proportion to those who benefit. The aim is to supply enough roads (and maintenance) to meet the reasonable demands of the users in a way that provides value for money for taxpayer investments.

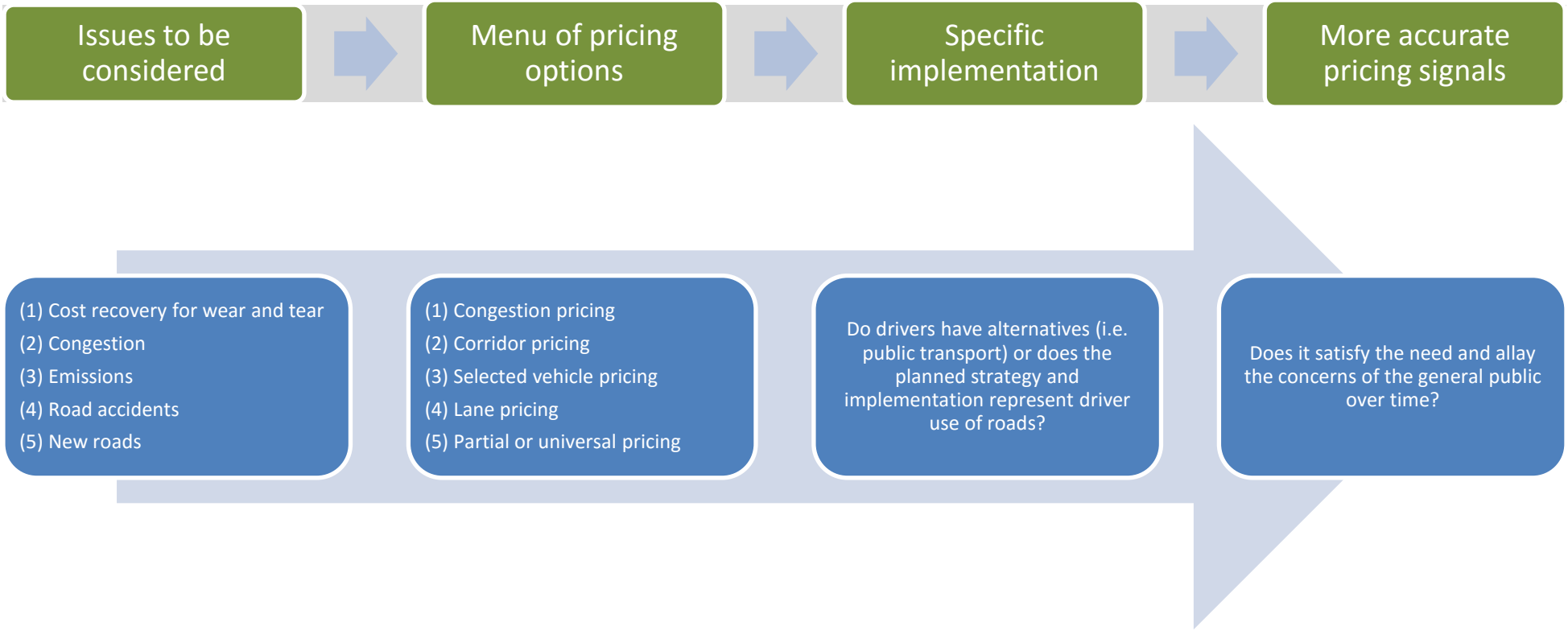
In the main, the private costs of road use are met by the driver and are not a public policy issue.[22] The focus therefore is on the social costs of road use. How you might address the social cost of road use depends on what issue you want to address. This cannot be over emphasised: **the tools that you use must address the problem you are trying to fix**.

Further, developing a strategy where different design elements can be incorporated in a consistent way in different regions of New Zealand will also assist in a smooth transition to a system that better reflects users paying the full cost of their road use.

In the following diagram, we set out the issues to be considered, potential menu of pricing options, the critical issues around implementation, and the desired impact of improved pricing signals. The aim of improving the signals to road users is to match the extra social cost with the extra social benefit. If the right tools are chosen and implemented in a way that the bulk of users see as fair, then the approach is likely to be more efficient and effective than the current approach to road pricing.

[22] Except to the extent it is socially relevant to avoid market failures such as monopolistic behaviour and over-pricing.

Figure 3 Approach to improving signals to road users



Source: NZIER

In particular, we are interested in addressing the missing markets i.e. markets where road use causes impacts that should be priced. The focus on missing markets puts a spotlight on congestion, emissions, and road accidents.[23]

Below we look at various aspects of the road pricing issue, identifying the critical issues that need to be considered.

3.1. The depth of the road[24]

How you might set a price for road damage depends upon the various components of road building and maintenance:

- Creating a foundation (clearing areas for new roads)
- Creating a base-course and sub-base (to absorb shock)
- Creating a surface layer.

There are some complications. The road network is not uniform. It has different age characteristics, different links into the network meaning that resurfacing is required at different times. Optimal charges will have to be traffic-weighted across the network.

Most of the damage (99%) done to roads is attributed to heavy trucks. The RUC system, in place in New Zealand since 1977, recognises this and covers most of the costs associated with heavy truck damage to the roads.

There have been a number of reviews of this system over the years and so far, only minor adjustments have been made to the methodologies used so we can be relatively confident that heavy trucks are paying their way in terms of road wear and tear.

3.2. The width of the road

The width of the road deals with congestion.

The question is how do we transparently allocate capacity on the existing roading network so that it copes with excessive demand at peak times while at other times during the day it is under-utilised? This fits the specification of a missing market – roads are seemingly free so over-use at specific peak times occurs. Charging a premium for peak times seems a logical step to relieve pressure on the roading network.

Congestion can be a symptom of a misfiring traffic management system. A way of dealing with that issue could be to set up access charges to a specific corridor, area, or as part of more comprehensive road pricing strategy. Once established, a discounted access charge can be applied to journeys outside of the commuter peak, increasing the efficiency of both the freight and passenger transport tasks, without expensive and avoidable investments in new lanes that are only used for a few hours each day (for example).

The overall impact of this is to more fully utilise the roading system and potentially reduce the need for more roading infrastructure.

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[23] It is not quite true that all markets are not being partly priced. ACC for example do levy drivers for accidents, but these average costs across drivers, not marginal costs imposed by individual drivers with different accident risks.

[24] Terminology taken from Small et al (1989).

3.3. Using the road

Accident and pollution costs are by-products of using roads.

Potentially, accident costs could dwarf all other components of roading costs.[25] Some of these costs are already covered through ACC and other insurance. However, there is no clear link between traffic flow and accident rates and therefore no connection with the cost of using the road for any particular trip and the price paid for access to the roading network.

Pollution costs mainly occur through emissions, noise and run-off through oil. Valuing the additional cost of pollution will need to be developed. This is complicated since individual vehicle use is unobservable.

Emissions pricing to date has been used overseas but the connection between the pollution cost and charging has not been established. There is some correlation between emissions that lower local air quality and congestion due to less efficient engine running at low speeds, so an emission charge could be wrapped into a congestion charge.

3.4. Other issues

Another issue is mode neutrality i.e. ensuring that competitive neutrality between transport modes is maintained.[26]

This is an imprecise science and it may be that a 'rule of thumb' or averaging pricing regime will be more practical than devising a regime that is more theoretically sound but difficult to implement. We also want to give drivers certainty – they need to know the costs prior to embarking on a journey.[27]

Any pricing regime requires factoring in what can be priced (the incremental cost of using the road) and what is more difficult to be priced (pollution). It will also be a function of the technology available, design, and how the public respond to pricing.

Given that these problems are not new, how have developed and selected developing nations managed the issues? In the next section, we look at how various schemes have been developed to deal with congestion, damage, accidents, and emissions.

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25 We are saying that there is a high social cost and value in avoiding accidents, not that it's feasible to charge people for their individual contribution to reducing risk on the roads.

26 Over time this is a serious issue, for example, twenty years ago people would have laugh at you if you had said that air travel would seriously compete with intercity bus travel.

27 The implication here is that 'real-time pricing' which some emerging technologies appear to provide is inefficient. It is no use being told your price for occupying road space is going up when you're stuck in a traffic jam. Congestion pricing needs forward prices, so drivers known the price they will face in an area before setting out to visit it.

4. How have others thought about roads?

Now we turn to the types of pricing models which have been applied to roading around the world in developed and selected developing countries. In this section, we want to demonstrate how different pricing models could be employed and outline their purposes.

4.1. Cost allocation models

There are few examples in the literature of cost allocation models.[28] The models typically come from Australia and the USA. They are like the New Zealand general approach but have some details that differ.

European systems (particularly German), utilise similar approaches to New Zealand (RUC) for heavy truck pricing (axle load/road-wear power relationships etc.).

There are two types of zonal mechanisms:

- Cordon tolls charge vehicles on entry to the controlled zone. Movements within an area without crossing the cordon are not charged. Charging rates are limited to places where roads cross the cordon
- Area charging catches any vehicles moving within an area. They require extensive monitoring technology to recognise vehicle number plates and the ability to check against a registry of those who have paid. These have high fixed and variable costs and typically require exceptions for those living in the area.

4.1.1. Congestion charging by zones or cordon

A cordon applies a fee or a tax on all road users entering a specific area. The objective of cordons has changed over time. For example, the Norwegian approach at first was to raise revenue to improve the transport system including funding alternative public services: buses, ferries and trains with a low charge. Only after new investments were made that charges were raised to deal with congestion.

Congestion has become the single most important objective of cordon charging.[29] Part of this process involves incentivising motorists who might drive into these areas to consider public transport.

This type of approach has been successful in a number of jurisdictions such as London, Stockholm, Oslo, Milan, Singapore etc. Their success is based on creating a strong incentive for private vehicles or those involved in low value journeys to avoid the area. Most of these schemes are demand-management approaches aimed at reducing the number of cars on the road in specific places and times (Singapore, London). In Milan, the implied goal is improving air quality. As already discussed, the Norwegian approach

[28] See for example http://www.transport.govt.nz/assets/Import/Documents/NZIER20Road20costs20and20charges20lit20review.pdf

[29] Managing congestion also includes raising revenue to provide other modes of transport as alternatives (e.g. providing more public transport).

has morphed from revenue raising to a congestion charge. This approach allows for flexibility of mechanisms depending on the objective.

The key to the schemes in London, Olso, and Singapore is their simplicity. Reducing congestion by using a pricing mechanism that creates a new revenue stream that can be invested in better road and mass transit options. Therefore, those who are affected by the scheme are also beneficiaries – through complementary investments in the network and less congestion.

These schemes have been successful in reducing congestion, with initial grudging public acceptance, which has increased as public transport has increased inside these zones and the technology used has improved to make it more convenient (particularly in Singapore where a paper system was first introduced in 1975). However, in some places, the initial decongestion effect has worn off over time, e.g. in London, as traffic growth in peak periods has resumed.

Singaporean authorities provide an interactive map where users can click on the blue ERP tabs and receive up-to-date information on charges. The next step is to implement distance, time, location, and vehicle type charging using satellite-based technology. The vision is to introduce this by 2020 (see Figure 4 below) and Section 4.1.6.

Figure 4 Singaporean road pricing scheme

Source: http://roadpricing.blogspot.co.nz/2016/03/singapore-will-have-worlds-first-gnss.html

4.1.2. Corridor pricing

Corridor models collect road user fees for access to specific highways working in a similar way to a toll road. In some instances, revenues are allocated for investment in the priced road corridor. On this basis, the system is attractive to motorists and the community because it funds upgrades and improvements within a specific road corridor.

It has the impact of shifting funding away from central and local government. In New Zealand, there are a number of examples of toll roads, for example, the Puhoi to Wellsford highway and the Tauranga Eastern Motorway. Another example, now discontinued, was the Auckland Harbour Bridge toll.

There are also many examples of tolling occurring in North America, Europe, South Africa and Latin America.

4.1.3. Selected vehicles classes

The use of electronic RUC can also potentially be used for congestion pricing. It has the ability to tailor charges to specific routes used. In New Zealand, the RUC is used for tonne-kms regardless of route

The German Heavy Goods Vehicle scheme – for example – uses a system where tolls are applied to vehicles over 12 tonnes travelling 12,000 km on major highways and arterials using GPS tracking. Charges are aligned to the route, emissions, vehicle weight, and number of axles.

4.1.4. High occupancy toll (HOT)

HOT lanes are designed to reduce congestion. A HOT lane allows for a limited number of high occupancy vehicles and other qualifying vehicles in specific lanes. More vehicles can use specific lanes while maintaining an incentive for mode shifting and raises revenue. First used in California in the 1990s on specific roads, they are now used in Washington DC and Minnesota, for example.

A variation of this approach is to designate certain lanes for vehicles with passengers (known as high occupancy lanes or HOV lanes). Used in Australia and New Zealand they promote carpooling and attempt to reduce congestion without tolls.

HOT and HOV lanes are often proposed as a compromise between current pricing regimes lanes and comprehensive tolling regimes e.g. HOV lanes are used extensively around Los Angles (no charge if more than one occupant) while HOT lanes are used extensively around Washington DC (these require charges). HOV lanes (or T2 or T3 lanes) are also in operation in Auckland and Australia.

4.1.5. Selected vehicle class across the network

A more comprehensive approach applying a whole-of-network charge for a vehicle across the whole network (specifically this charge will apply to heavy trucks and or light commercial vehicles).

For example, the Swiss heavy vehicle fee (HVF) approach applies to vehicles over 3.5 tonnes and uses a tonne per km fee based on class of vehicle. This is collected by an on-board unit or periodic declarations.

4.1.6. Universal charging model

While not strictly focused on pricing, general charging models can have features that impact on congestion. Of particularly importance for congestion pricing will be the use of GPS that can allow for the tracking of vehicles.

These approaches cover the whole roading network. Instead of fuel excise tax, fixed access and registration charges, vehicles are assigned direct user charges based on vehicle mass, distance travelled, location, and time of travel.

The universal model was to be implemented by the Dutch Government but due to a change in government the scheme was halted. It sought to gradually introduce a road pricing framework, based on per km tax (including a variable charge for the place and time of use and emissions characteristics of different vehicles). All vehicles would have been fitted out with a recording device which utilises GPS to establish distance, time and location of use.

As discussed above, the Singaporean authorities are attempting to move to a model that covers all vehicle use. This will be watched closely in countries like New Zealand given the likely impact of electric cars on funding regimes. With the move from petrol to electricity new funding mechanisms will have to be found to replace the fuel excise tax.

Given that Singapore has been a world leader in this area regulators around the world will be interested in the practicality of the system and whether it can be transported to other jurisdictions.

4.1.7. Conclusions

In Table 3 we have set out a menu of road pricing approaches used in developed and developing countries. Each approach is dependent on the type of pricing, the structure of the pricing regime, transport modes, time of pricing, and geography.

We cannot emphasise enough the importance of the conditions that a road pricing regime is applied to including how responsive users are to prices charged e.g. a corridor pricing regime may not assist in reducing congestion if there are no alternative modes or alternative routes are a poor substitute.

Table 3 Categories of road pricing regimes

Type of pricing regime	Description	Aim
Road corridor toll (fixed rate)	A fixed fee for a driver on a specific road	Raise revenue
Congestion pricing (time variable)	A fee that is higher at peak times	Raise revenue and reduce congestion. It has also been used as an emissions charge
Area fees	Fees for driving in a specific area. High transaction costs, high charges to reduce congestion and fund other transport alternatives	Reduce congestion
Cordon fees	Fees charged for driving into specific areas. Low transaction costs. Low charges (raising revenue) or high charges (relieve congestion)	Depends on the objective. Reduce congestion or raise revenue
HOT lanes	Reserved lanes for those who pay fees	Raises revenue. Favours those who are prepared to pay
HOV lanes	Reserved for drivers with passengers	Reduce congestion
Distance based fees (partial and universal approaches)	Vehicles pay charges for using roads based on kms travelled	Raise revenue, reduce congestion and address other road costs
Note there are other methods, but these are the main approaches.		

Source: Adapted from Victoria Transport Policy Institute (updated to 2017)

The next section examines some of the implications of applying road pricing principles to the roading network.

5. Implications

5.1. Matching implementation to pricing strategies

Developing a road pricing regime is typically developed by public or private agencies as part of an overall transport strategy.

The development of an all-embracing consistent approach that allows for the development of different objectives for different issues in different parts of New Zealand is the recommended approach.

This means that having a consistent approach to congestion, heavy trucks, light commercials, accident levies and policing i.e. there is a tendency to think that Auckland traffic and road development funding is the problem that needs to be 'fixed'. Our view is that fixing Auckland's problems may be part of the solution but what needs to be done in Auckland needs to be consistent with the rest of New Zealand.

One key lesson is the need to avoid confusing objectives. Is the scheme attempting to maximise revenue, manage congestion, or other objectives? Being clear about the outcome will dictate the design and road pricing impact.

Below we match pricing regimes with the locational situations to illustrate where the different techniques overlap. The most comprehensive scheme is the distance-based approach. However, this could be combined with other schemes to alleviate specific problems.

Table 4 Matching pricing regimes to situations

Pricing regime	Facility	Corridor	Cordon	Regional/ national
Road corridor toll (fixed rate)	X	X		
Congestion pricing (time variable)	X	X	X	
Cordon fees		X	X	
HOT lanes	X			
Distance-based fees (partial and universal approaches)				X

Source: Victoria Transport Policy Institute (updated to 2017)

5.2. Pricing methods

Pricing regimes that use more portable technology may be lower cost and potentially have greater flexibility e.g. use of toll booths is expensive. However, reliability and public acceptability is essential.

A further non-trivial issue occurs around more portable technology such as the use of GPS and satellite tracking technologies. They have not been used because of privacy concerns. Also, the type of approach needs to be considered. Drivers need certainty about cost, so they need to know the cost of a trip before they undertake the trip. Use of variable pricing (i.e. pricing changes day-to-day based on demand) is likely to be unacceptable to the public.[30]

When drivers suddenly face an up-front cost (not the current partially hidden cost) acceptability is only given after the new regime is seen to work e.g. the London congestion cordon was widely criticised prior to its introduction however within months of its commencement it was generally accepted.

In a congestion pricing zone, potential drivers should have increased public transport options that are easily substitutable or options for drivers to avoid the congestion charges (i.e. by improving carpooling options and variable pricing in the congestion zone). The London congestion cordon[31] resulted in:

- The London Underground running 5 percent more train-kilometres on the Tube, and traveller delays are down around one-third, versus a decade prior to its introduction
- Bus usage increasing by 30 percent with more services and 20 percent less waiting compared to 2000-01
- Bike trips increasing 79 percent from 2001 to 2011, after having stagnated between 1993 and 2001
- Travel fatalities and serious injuries were the lowest on record in 2011, although cycling casualties have risen in recent years, perhaps owing to increased cycling.

However, the London cordon scheme is not cheap because of the intensive monitoring required. It has nearly 1,500 close circuit cameras monitoring the cordon at nearly 350 sites. Oslo on the other hand with fewer entry points is more cost effective – so geography and the method chosen matters as it constrains the feasible pricing options, particularly in smaller countries.

[30] By unacceptable we mean that the public will take action against politicians at the next election. In a similar way, voters/taxpayers voiced fears over the perceived privatisation of the health system in the 1990s.

[31] http://nyc.streetsblog.org/2013/02/15/lessons-from-london-after-10-years-of-the-congestion-charge/

Below we set out the options for implementing charges.

Table 5 Pricing approaches and their costs

Type	Description	Equipment cost	Operating cost	User inconvenience	Price adjustability
Pass	Drivers purchase a pass to enter an area	Low	Low	Medium	Low to medium
Toll booths	Stop and pay option	High	High	High	Medium to high
Electronic tolling	An electronic system bills users as they pass a point in the road network	High	Medium	Low	High
Optical vehicle recognition	Optical systems used to bill users passing a point in the system	High	Medium	Low	High
GPS	GPS used to track vehicle location	High	Medium	Low	High

Source: Victoria Transport Policy Institute (updated to 2017)

5.3. Equity considerations

Three types of equity issues need to be considered:

- Income inequity: Are the poor carrying a disproportionate amount of the road user charges?
- Geographic inequity: Are some regions hurt more than others by road user charges?
- Modal inequity: Does the user charging regime address multi-modal transport issues?

Most of the focus is on the first issue: Income inequity. Geographic and modal are inequities are highly dependent on specific road pricing schemes; whereas income inequity is a generic issue for all road pricing schemes.

In the United States (US Congressional Budget Office, 1990; Schweitzer and Taylor, 2008) suggests that road pricing approaches do burden the poor more than the rich. One of the issues is that households that do not have credit cards, bank accounts, or cannot afford large deposits may be unable to set up toll accounts with cheaper per ride tolls, limiting the use of these facilities by the poor.

These groups tend to pay more because they pay by less automatic means i.e. paying at service stations which include a service cost. Parkany (2005) estimates that this impacts between 10% and 20% of United States society.

In Stockholm, Transek (2006) found that affluent men, typically paid more tolls because of the higher use of cars. Those who paid least were women, students, single people, and lower income individuals. This highlighted the importance of public transport options. If public transport was available, the ability to use different transport modes reduce significantly the burden on the poor.

A United Sates Department of Transport primer[32] suggest that road pricing scheme design can overcome income equity issues relative to a fuel tax system e.g. fuel tax is already a regressive system since low-income drivers tend to drive old less fuel-efficient cars. These use more fuel per kilometre and therefore lower income people pay more than other drivers.

United States evidence suggest that when alternative public transport is not available all income groups use toll roads. Therefore designer[33] need to take this into account by offering tax rebates, income supplements and/or toll credits to compensate the lower income workers.

5.4. Impacts are situation dependent

The effectiveness of road pricing is situation dependent. The type of impact depends on the size of the fees, where applied, the alternative routes and modes, and what would happen without road pricing. Some of the impacts can be:

- Road pricing can shift traffic to unpriced routes ('rat-runs'), alternative modes and closer destinations, and reduce vehicle trip frequency
- Congestion pricing can move traffic to off-peak hours, but this can be limited by fixed work patterns
- If road pricing funds are used for road building it may or may not increase traffic. This is complex since new road links reduce congestion along them but can increase congestion where they re-join the old capacity. Also, road pricing new capacity that would otherwise be unpriced can reduce total vehicle travel compared to the unpriced alternative
- With enhanced alternatives (e.g. public transport, ridesharing, cycling) more explicit road pricing will cause mode shifts.

The effectiveness of congestion charging, and HOT lanes depends on price. Too low and the roads will be congested. Too high and the roads will be under-utilised. Ensuring the 'goldilocks' solution does require an understanding of the responsiveness of drivers to road pricing.

Some studies are available that suggest that the responsiveness was between -0.1 and -0.4 i.e. a 10% increase in tolls reduces car use by between 1% and 4% (Spears et al, 2010).

Litman (2012), NCHRP (2006), Brinckerhoff (2012) suggest that car travel is sensitive to the level of tolls applied. In the United States, Washbrook (2002) using survey techniques suggests a $US3.00 round trip toll can reduce travel by up to 25%. This has

[32] https://ops.fhwa.dot.gov/publications/fhwahop08040/fhwahop08040.pdf

[33] ibid p19.

major implications for funding road building since the optimistic forecasts for use of toll roads typically do not materialise. Drivers tend to avoid toll roads.

In the United States, Harvey and Deakin (1997) show that a small reduction in urban traffic volumes can have major impacts on congestion. These areset out in Table 6.

Table 6 Summary of travel impacts

United States

Travel impact	Toll road funding	Congestion pricing	Comment
Reduces traffic	X	XX	Pricing structure and quality of alternatives have the biggest impact
Reduces peak traffic	XX	XXX	Fixed tools cause moderate reductions in peak hour traffic
Shifts peak to off-peak	neutral	XXX	Fixed tolls provide no incentive to shift
Improves access	-X	neutral	Can encourage low density urban expansion
Increases car pooling	XX	XXX	Encourages ridesharing
Increase public transport	XX	XXX	Encourages public transport and may fund improved services
Increases cycling	X	XX	Encourages public transport and may fund improved cycle ways
Increases walking	X	XX	Encourages public transport and may fund improved pedestrian improvements
Increased telework	X	XX	Encourages telework
Reduces freight traffic	X	X	May have a minor impact
Note: Rating XXX very helpful and -XXX is harmful			

Source: Harvey and Deakin (1997)

5.5. Traps for 'inexperienced' players

5.5.1. It is about effectiveness and efficiency

The basic approach to road pricing is that drivers (those that consume the road) should pay their share of the full cost of the road that they use. In many places – including New Zealand – those that use the road may not be paying all of the road costs.

Unfortunately, full cost recovery is difficult to achieve in practice. The full cost of road infrastructure cannot be efficiently covered in a single price, and externalities are not generally covered. One of the main issues is that users use differing amounts of the road. A single price will undercharge some and overcharge others.

If roads are to be fully self-funding the price must include:

- The cost of using the road (the so-called missing markets: congestion, pollution, accidents etc.)
- A fixed cost for replacement and maintenance.

To improve welfare for New Zealanders, the benefits of introducing a road pricing system must outweigh the costs of doing so. While this sounds straightforward there are far too many examples of unwieldy policies having to be withdrawn because of the high cost of administering and complying with badly designed approaches. This is particularly important in this case since any approach is going to rely heavily on new technology (relative to say toll booths).

Most importantly driver behaviour suggests toll road avoidance – so understanding the likely demand impact is crucial. Typically, the demand forecasts for toll road use are wildly optimistic and over hype the benefits.

In short, an effective and efficient approach means good service delivery underpinned by good economics. This will be the only way that the public will be convinced that the approach is sound over time. They will need to be convinced through a demonstration effect of how any road pricing system will work.

In such a complex area, there will be unintended consequences. Dealing with these complexities will require flexibility. Not the least of which will be whether the enabling technology is able to deal with drivers trying to game the system, whether a system protects driver privacy, and whether the system has any impact.

A further issue may be distributional issues associated with road pricing. If for example, low paid workers are travelling unavoidably at peak times (where charges are highest) how will the system develop alternatives to cope with this?

5.5.2. Congestion pricing is effective

Overseas experience suggests that congestion pricing is very effective in some cases. Efficiency and effectiveness can be achieved if implementation matches the designers aims of reducing congestion and providing enough alternatives (in public transport) to meet the needs of the users (and achieve value for money). However, system designers need to be careful since congestion pricing in one area can create congestion in other areas as traffic is diverted.

Therefore, focus needs to be on the total vehicle fleet in the wider geographic area thus avoiding spillover traffic problems for the regions bordering the congestion pricing zone.

Implementation, implementation, and implementation

Road pricing increases consumers' direct costs. This is not the easiest of selling points. However, this is an illusion since system designers are just transferring the payments from one payment process to another. Therefore, to convince a sceptical public that it is worth doing they must see a corresponding decrease in other taxes (e.g. fuel taxes, registration etc.).

If these taxes are kept in place for other purposes drivers will be worse off and are unlikely to appreciate new taxes, placing the whole scheme in jeopardy.

Signalling therefore is extremely important. For example, in the 1980s when the government bought in GST they were warned that no government in the western world had been re-elected bringing in a sales tax. The introduction of GST was accompanied by a reduction in income tax. This demonstrated to the public that the tax was not about increasing the overall tax take but redistributing the way tax was collected.

Another way of introducing a universal road pricing system would be to stage its introduction over time with a corresponding drop in other taxes which fund the roads. In this way, the public can see the 'direction of travel' and make up their own minds about the efficiency and effectiveness of road pricing.

Efficiency may not mean more roads

One of the aims of efficient road pricing is to make the network as small as it could possibly be i.e. shift traffic volumes to off-peak thus avoiding the need to build extra lanes (increasing the width of the road). However, if road pricing allows road designers to build more roads than is necessary then it might encourage more traffic. This requires a coordinated response by network system designers examining the whole network not just part of the network.

Providing choice is helpful for the driver

We have already suggested that providing choice in congestion cordon approaches assists drivers switching modes.

Also, the use of HOT lanes can provide drivers with choice. In an unpriced environment, drivers must live with congestion. By using a HOT lane situation, drivers have options. They can pay the toll and drive in an uncongested lane, drive in a congested lane, or carpool.

Choices of tools for tolling

Careful consideration is required when considering tolling options. Toll booths can take up to 40% of the collection. They also requires drivers to stop, causing more delays, emissions and energy consumption. New tolling approaches need to avoid these issues and reduce transaction costs.

These could include unstaffed tolling booths where drivers slow down but do not stop as their details are recorded electronically. This system is in place south of Washington DC.

6. Conclusion and next steps

6.1. Conclusions

New Zealanders are finding to their cost and frustration that over-use and under-pricing of roads are the flip side of the same coin. While road pricing can solve the problem in an efficient and effective manner, the key issues are not theoretical but how to practically develop a transparent and workable road pricing approach. This is underlined and made more pressing by the government's initiative for a zero-carbon economy by 2050.

This involves:

- Ensuring that those who damage the road pay for that damage (the current system has effectively dealt with this issue through road user charges for heavy vehicles)
- Dealing with congestion. A major issue that the current system is silent on except in rare circumstances
- Understanding the impact of accidents and pollution costs. This is partly dealt with in the current system although pollution costs are yet to be considered
- Other issues such as ensuring prices paid allow for future road building (if necessary). A challenge for any road pricing approach.

The next steps section below sets out the issues that need to be carefully considered by policymakers.

6.2. Next steps

The successful implementation of road pricing schemes is highly dependent on the situation where it is introduced. When planning a road pricing scheme, we need to:

- Ensure that the political constraints are managed. In particular:
  - Equity issues are dealt with in a transparent fashion. Ensure that all groups receive benefits, either through rebates or improved travel choices
  - Credible transport alternatives are available
  - The focus is on changing behaviour not raising revenue: with no hint of double taxation
  - Ensure that privacy is protected
  - Ensure that the public is satisfied that this is the best way forward
- Develop a business case which clearly states the non-political reasons for pursuing a new road pricing approach i.e. makes the social, economic and environmental case
- Design should focus on:
  - Developing methods that are cost effective and convenient to users. Charges should accurately match each trip – good implementation is

good economics. Simple is likely to be cost effective and complex technologically-driven options probably are not

  - Introduce variable tolls with higher rates for peak times to reduce congestion
  - These tolls can be readily be adjusted over time
  - There also need to be credible alternatives in-place so drivers have options e.g. improve public transport (e.g. HOV and HOT lanes)
  - Consider the whole network and ensure congestion pricing is used on existing and new roads and watch for congestion problems in districts close to congestion zone pricing areas or 'rat running'
  - Pricing should focus on individual trips and avoid discounts
  - Encourage the development of mode swapping, including flex-time, ridesharing, transit improvements and bicycle facilities
  - Consider the whole network when introducing pricing and attempt to increase driver mode options
  - Minimal exemptions and carve outs
  - Be transparent and upfront about pricing – certainty is important.
- Develop a lengthy public information campaign during the implementation showing why the system is necessary: one cannot over-communicate the purpose and benefits.

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