Transport Economics
A sustainable transportation system for New Zealand

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Sustainability and sustainable transportation

Sustainability criteria have significant implications for transport planning:
• Efficient use of fuel
• Optimal control of traffic

A sustainable transport system should provide the inhabitants:
• Mobility
• Accessibility

➢ What are the current barriers that hinder us from developing a sustainable transport system?
➢ What policies should our government adapt in order to make our transport system sustainable?

Figure 1. The Three Spheres of Sustainability
Source: Rodriguez et al. (2002).
Car ownership in New Zealand

Figure 2. Motor Vehicle Ownership among OECD members in 2010

Source: OECD, 2013.
Note: 2009 data for Canada and Ireland; 2011 data for Australia, Iceland, Japan, Mexico, New Zealand and Switzerland.
2010 data for the other countries. The OECD totals are based on OECD Secretariat's estimates.
Transport choice in New Zealand

Figure 3. Commuting to work in New Zealand (2009 – 2014)
Source: MoT, 2015
Fuels we use

Figure 4. Energy Greenhouse Gas Emissions by Fuel Type (kt CO₂-e)

Source: MBIE, 2015
Fuel consumption in Auckland

Figure 5. Annual fuel consumption ($NZD) in the Auckland region, average

Source: Constructive Thinking, 2014
GHG emissions from transport

Figure 6. Energy Greenhouse Gas Emissions by Sector (kt CO₂-e)

Source: MBIE, 2015
Road transport (negative) externalities occur whereas someone other than the producer or the user of the transportation service is affected by the act of transportation.

Past literature: Greene et al. (1999), Litman (2003), Quinet (2004) and Newbery (2005), etc.

• Congestion cost
• Environmental cost
• Health and accident cost
Congestion cost

• Congestion is a flipside of a city’s success.
• Congestion in Auckland is well above comparable cities (Perth, Brisbane, Adelaide)
• The economic cost of congestion is between $0.9 - $1.3 billion – equivalent to 1% and 1.4% of Auckland’s GDP (NZIER, 2017).
  ➢ hinders job matching
  ➢ reduces labour force participation etc.

Figure 7. The Simple Diagram of Congestion Pricing
Environmental cost in New Zealand

<table>
<thead>
<tr>
<th>Unit Cost of Carbon (NZD$25)</th>
<th>Public Transport</th>
<th>Private Transport</th>
</tr>
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<tbody>
<tr>
<td>Per passenger and km</td>
<td>$0.001</td>
<td>$0.0067</td>
</tr>
<tr>
<td>To Society</td>
<td>$0.67 million</td>
<td>$57.76 million</td>
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Source: Jakob et al. (2006)

What happens if we increase the unit cost to **NZD$157**?
Health and accident cost

- The cost of the health impact of outdoor air pollution in OECD countries, both deaths and illness, was about USD 1.7 trillion in 2010. Available evidence suggests that road transport accounts for about 50% of this cost, or close to USD 1 trillion.

- The best available estimate of the economic cost of the health impacts of outdoor air pollution in China and India combined is larger than the OECD total – about USD 1.4 trillion in China and about USD 0.5 trillion in India in 2010. There is insufficient evidence to estimate the share of road transport in these figures but even if it is less than half, it nonetheless represents a large burden.

Figure 8. Share of Total Social Cost of Injury Crashes, 2016

This is an increase of $0.3 billion (7.8%) compared to the previous year ($3.87 billion in 2015).
Congestion pricing makes sense

Wrong headed focus on fuel tax to fix Auckland's traffic woes will hurt consumers and economy

Congestion pricing is not fail-safe, but the best outcome of easing Auckland's traffic woes and future proofing, road funding.

Every day, commuters have to deal with timetrons and money-related frustration, and, for many, a lack of viable alternatives. The scale of the problem is enormous. If we focus our efforts on more BRT, comme, New Zealanders would be more likely to want to use public transport, but most will continue their car-based ways. Auckland's problem is not a one-size-fits-all solution to the issue of infrastructure and services that need to be maintained and expanded.

Auckland is famous for its traffic jams, which are a daily occurrence for everyone living in the city. The congestion is so bad that it has become a significant issue for the residents, leading to long delays and increased travel times.

The proposal for congestion pricing is a welcome solution. By placing a fee on the use of private cars, the government aims to encourage the use of public transport and reduce traffic congestion. This approach would help to improve public transport services and make them more attractive to commuters.

However, some businesses may be concerned about the impact of congestion pricing on their operations. They may worry about higher operating costs and potential reductions in revenue.

In the long run, congestion pricing would lead to a better and more efficient public transport system. It would also contribute to a cleaner environment, reducing emissions and improving air quality.

In summary, congestion pricing is a necessary step in the right direction. It will help to ease traffic congestion and improve public transport services, benefiting both businesses and residents.

Raising road tax will not solve Auckland's congestion. Congestion policy needs to step into the digital age.
It uses the pricing mechanism to charge highway users for the negative externalities generated by the peak demand of travel in excess of available supply.

Assume travellers could pay to enter a fast route/simply opt for a free slow route.

How fast the fast route is depends on how others will respond to the introduction of a toll.

Whether a toll will successfully reduce congestion and eliminate the high fluctuation in the entry rates is unclear.

Binary decisions between a fixed payoff/a payoff dependent on how many other road users choose it too.

Receiving real-time information about their overlapping decisions.

We want to investigate:
- whether a toll can reduce congestion
- whether there is a high variance in entry rates after implementing the toll
- whether the provision of public travel information before entry can reduce the variance level and improve efficiency
- whether the group size of participants matters for entry decision
Alternative fuels and its associated infrastructure

- Electrification of road transport has the added benefit of reducing emissions.
- In NZ, the total # of Electric Vehicles (EVs) grew by 148% in 2017.
- The overall % is still miniscule compared to the large body of other types of vehicles in the fleet i.e. 1% of the entire vehicle fleet.
- **Range anxiety factor**
- Inductive Power Transfer (IPT) system (Zaheer and Covic, 2016): EVs can be energised wirelessly by embedding a roadway charging network while travelling in-motion.
  1. Stationary Inductive Power Transfer (SIPT): requires the vehicle to remain stationary in order to get charged.
  2. Semi-dynamic Inductive Power Transfer (SDIPT): charging the vehicle in slow moving traffic areas (traffic signals, taxi ranks or bus bays etc.)
  3. Dynamic Inductive Power Transfer (DIPT): transfer power to the vehicle while in full motion and potentially in high speed areas without requiring the vehicle to stop.
- Policy advise: IPT system could be funded through public–private partnership (PPP).
Travel behavioural change -1

- **What factors are important when people make their travel decisions (which transport mode to use)?**

- **What is the probability that a transport user will choose to use public transport to go to work, given the transport mode preference of his/her neighbours and the characteristics of the regions where he/she lives?**

**Social Network Effects**
Transit patronage: infrastructure service & accessibility; do not vary across neighbourhood

**Positive Social Network Effects**
When people prefer to use public transport *together* with other people as a result of social spillover

1) A utility gain through complementarity – not alone;
2) Avoiding a utility loss by not following others: meet & communicate, feel safer;
3) A rise in utility level which stems from sending signals – feasible & reliable transport mode

Neighborhood effects/peer effects/social interactions/social spillovers
1. Transport mode choice model WITHOUT social network effects

- The probability that Selena chooses public transport over car:
  
  *Her utility level of using public transport > Her utility level of using car*

- Selena's utility level could be dependent on:
  
  - She has a relatively large family and lives in Silverdale (Household size & Origin)
  - She is a mother of 2 boys (Gender & Children?);
  - Her household has 2 cars (number of vehicles);
  - She has a full – time job and works in the CBD (work status & Destination);
  - She has to walk 3km to the nearest bus stop (Distance to stations); etc.

2. Transport mode choice model WITH social network effects

- Social network effects:
  
  *How to define a "neighbour" e.g. Selena & Bas?
Transport mode choice decision-making is dependent on social network effects.

People’s transport mode choice decisions DO influence each other, positively. As the % of commuters taking public transport to work increases, a spillover effect that changes some non-public transport users travel behaviour.

The social network effects = the 2nd largest impact (approx. 20%) on commuter’s transport mode choice (in Auckland, after household vehicles, approx. 30%). Shifting road user’s travel behaviour - a more economical way?

For urban/transportation planners:
1. on infrastructure improvements
2. on strengthening the city’s ‘greener’ transport mode culture

For future transport policy:
1. Campaigns
2. Ads on social media
3. Public transport Ambassadors
Reducing accident risk

• Improving road infrastructure
• Educating road users
• Reducing the severity of a crash by improving vehicle technology
• Enforcing seatbelt and helmet laws *etc.*
Current research

1. Transport Mode Choice Modelling and Social Networks Effect:

2. Traffic Congestion:

3. Economic Analysis on Future Transport Infrastructure for Electric Vehicles:
Thank you 😊

Any Questions?