The economics of walkability

Peter Nunns, Principal Economist

Smart Urban Futures 2018
Road congestion to become a $9 billion drag on Victoria's economy, report warns

The cost of delay on Melbourne's major roads is set to triple to more than $9 billion a year by 2031 if nothing is done to reduce congestion, with rapid population growth on the city's outskirts likely to be the biggest cause of the problem.

A comprehensive audit by Infrastructure Australia of the nation's infrastructure demands has identified where the handbrake is being most heavily applied to Victoria's economy and where the problem will worsen in coming years if no projects are completed to reduce delay on our roads.
The public face of transport economics

NEW ZEALAND / TRANSPORT

Auckland traffic congestion costs city almost $2b a year

4:02 pm on 2 August 2017

Todd Niall, Auckland Correspondent
@toddniall todd.niall@radionz.co.nz

Traffic congestion in Auckland could be costing nearly $2 billion a year and is having a big impact on the city’s productivity, according to a new report.

The public face of transport economics

East West Link business case revealed: 56 years to pay off

An initial assessment from March 2013 found the road would return just 45 cents for every dollar spent. After factoring in so-called wider economic benefits - including an assumption people would work longer hours and pay more tax because of the road - this was lifted to a loss-making 84 cents for every dollar spent.

Three months later the government prepared a new business case which relied on separate projects including widening CityLink, the Tullamarine Freeway and the Eastern Freeway, and north-south tram and bus upgrades, to produce an estimated return of $1.40 for every $1 invested. These figures were spruiked by the former government in a glossy short-form business case.

How these estimates are derived

Figure 12: Representative profile of total urban traffic delay, across an average weekday

Percentage of total daily delay by vehicle type

- Cars
- Motorcycles
- LCVs
- Buses
- Articulated trucks
- Rigid trucks

Notes: Proportion of daily total by current hourly amounts. Weekend traffic distributions tend to show less severe concentrations during peak periods than such average weekday patterns.

Sources: BTRE (2007) and BITRE estimates.

How these estimates are derived

Figure 12: Representative profile of total urban traffic delay, across an average weekday

The ‘economic costs’ of congestion are mostly about time spent sitting in traffic

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Sources: BTRE (2007) and BITRE estimates.

Fact or fiction?

https://nzta.govt.nz/resources/state-highway-traffic-volumes/
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Auckland Harbour Bridge
171,900 vehicles per day
5.9% heavy vehicles

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SH16 Ports of Auckland
48,100 vehicles per day
8.1% heavy vehicles

https://nzta.govt.nz/resources/state-highway-traffic-volumes/
Fact or fiction?

Auckland Harbour Bridge
171,900 vehicles per day
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SH20 Nielsen St interchange
97,100 vehicles per day
7.5% heavy vehicles

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### Fact or fiction?

#### Why people are driving in New Zealand

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<th>Share of distance travelled</th>
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<tbody>
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<td>31%</td>
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New Zealanders drive twice as far for shopping as they do for business trips!
The ‘big lie’ of transport economics:

Time savings for people in vehicles directly translate into monetary economic benefits
The reality of transport economics:

Most benefits relate to faster, more convenient, or more comfortable journeys for people in vehicles.
These also matter for people who are walking
Valuing the benefits of walking

Direct user benefits

Social benefits
Valuing the benefits of walking

Direct user benefits

Reduced delay while walking

Social benefits
Valuing the benefits of walking

Direct user benefits:
- Reduced delay while walking
- Improved quality of experience

Social benefits:

Valuing the benefits of walking

Direct user benefits
- Reduced delay while walking
- Improved quality of experience
- Health benefits of walking

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- Improved safety around vehicles
Valuing the benefits of walking

Direct user benefits

- Reduced delay while walking
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Social benefits

- Improved safety around vehicles
- Agglomeration / productivity benefits
What we usually value

Direct user benefits
- Reduced delay while walking
- Improved quality of experience
- Health benefits of walking

Social benefits
- Improved safety around vehicles
- Agglomeration / productivity benefits
Case study: walking in the Auckland city centre

Rapid growth…

Employment

+27,000 workers since 2001

Source: Statistics New Zealand
Rapid growth ...

+27,000 workers since 2001

+41,400 residents since 2001

Source: Statistics New Zealand
... no growth in cars

Mode share for travel to the Auckland city centre in the AM peak

<table>
<thead>
<tr>
<th>Year</th>
<th>Private vehicle users</th>
<th>Walking and cycling users</th>
<th>Public transport passengers</th>
</tr>
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<tbody>
<tr>
<td>2001</td>
<td>59.8%</td>
<td>8.1%</td>
<td>32.2%</td>
</tr>
<tr>
<td>2006</td>
<td>52.3%</td>
<td>7.6%</td>
<td>40.2%</td>
</tr>
<tr>
<td>2011</td>
<td>50.8%</td>
<td>7.2%</td>
<td>42.0%</td>
</tr>
<tr>
<td>2016</td>
<td>47.7%</td>
<td>6.8%</td>
<td>45.4%</td>
</tr>
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Public transport has picked up 97% of the growth in city centre access

Also growing fast: Walking commuting trips within the city centre

Source: Auckland Transport
Improving access ...

Auckland’s future bus capacity challenges

... improving walkability

Source: Auckland Transport
Valuing reductions in pedestrian delay

Location Choice

Queen Street and Victoria Street
- Barnes Dance Signal
- Nearby Pedestrian Counters
- High Volumes of Pedestrians

Karangahape Road and Queen Street
- Protected Signal
- Nearby Pedestrian Counters
- Lower volumes of pedestrians

http://www.knowledgeauckland.org.nz/publication/?mid=1662
Valuing reductions in pedestrian delay

Count pedestrian movements
Empirical approach: videotape and document movements

Calculate average delay per person
Simple method: Apply formulas to signal timing data Calibrate to observed behaviour

Convert delay to monetary values
Apply average value of travel time from transport appraisal guidance

Factor up from daily to annual outcomes
Apply annualisation factor based on observed annual counts

Assumption
People arrive at the intersection at random intervals
Case study: Victoria / Queen intersection

- Midday peak: 7,700 pedestrians, 1,200 cars
- On average, people walking through the intersection were delayed 27 seconds apiece relative to ‘free flow’ conditions
- This ‘wasted time’ is valued at around $2.7 million per annum
- This extrapolates to a ‘cost’ of around $13.6 million per annum for Queen Street as a whole
Valuing improvements to the urban realm

https://www.virtualoceania.net/newzealand/photos/cities/auckland/queenstreet/nz1101.shtml
Valuing improvements to the urban realm

Count the number of people there
Empirical approach: videotape and document movements

Assess existing and proposed quality of environment
Best practice: Independent assessments and peer review

Convert quality scores to monetary values
Apply willingness to pay values from survey data

Factor up from daily to annual outcomes
Apply annualisation factor based on observed annual counts

PERS scoring
Rank environment quality on many criteria

Caveat
Different people may value things differently!

Case study: Queen Street light rail

- Boffa Miskell (2017) applied Transport for London’s *Valuing the Urban Realm Toolkit* to Auckland
- Estimated annual benefits of around $425,000 from Queen St pedestrianisation
- Extrapolates to around $3 million in benefits for Queen St as a whole
Valuing the productivity impacts of walkability

The world is not flat.

People and firms like to be accessible to each other.

Dense, walkable places offer the best prospects for agglomeration.
Valuing the productivity impacts of walkability

- We have good evidence on agglomeration economies at the ‘citywide’ scale
- Doubling city size / density leads to a 3-10% increase in economic productivity
- There is less evidence on agglomeration economies at the ‘micro’ scale

Auckland's productivity premium, 2006

Industry-adjusted value added per worker

- New Zealand excluding Auckland
- Auckland urban area
- Auckland isthmus
- Auckland city centre
Case study: Auckland city centre

Rohani and Lawrence (2017a) measured walkability in the Auckland city centre. They examined how variations in walkability related to variations in productivity. Results were used to predict productivity impacts of changes to walkability.

Figure A: Walking effective job density for buildings inside the study area

Case study: Auckland city centre

Figure 19: The association between walking EJD and labour productivity

Key result: Positive correlation between walkability and productivity

This finding was robust to controls for industry composition

Source: Authors’ estimates

Adding it up: Walkability benefits of Queen St LR

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\(^1\) MRCagney (2017) estimates
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**Walking user benefits add ~20% to the benefits of Queen St Light Rail**

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Walking user benefits add ~20% to the benefits of Queen St Light Rail

Agglomeration benefits could be even larger – but the exact magnitude is still uncertain
Conclusion: Measure what you treasure

Direct user benefits
- Reduced delay while walking
- Improved quality of experience
- Health benefits of walking

Social benefits
- Improved safety around vehicles
- Agglomeration / productivity benefits
Bonus material: valuing safety

People on foot are exposed to unsafe environments
People on foot are exposed to unsafe environments

Busy bus stop on Mt Eden Rd

450m to nearest safe crossing point
Pedestrian crashes are low-frequency events

Low frequency events are inherently hard to evaluate

- I simulated pedestrian crash outcomes on a hypothetical 200m corridor with a national-average crash rate before and after a safety intervention.
- Around 5000 people per day (~city fringe).
- Intervention reduced crash rate by 30%.
- I used Monte Carlo simulation to run 5000 trials.

![Frequency distribution of DSI crashes per year (5000 simulations)](chart)
Low frequency events are inherently hard to evaluate

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The frequency distribution of DSI crashes per year (5000 simulations) shows a significant reduction in crashes post-intervention.
Very large samples are needed to identify effects

<table>
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<tr>
<th>Modelled change in crashes</th>
<th>First 10 simulations</th>
<th>First 50 simulations</th>
<th>First 100 simulations</th>
<th>First 500 simulations</th>
<th>First 2000 simulations</th>
</tr>
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<tbody>
<tr>
<td>Reduction</td>
<td>0%</td>
<td>12%</td>
<td>15%</td>
<td>18%</td>
<td>24%</td>
</tr>
<tr>
<td>No change</td>
<td>60%</td>
<td>70%</td>
<td>71%</td>
<td>67%</td>
<td>61%</td>
</tr>
<tr>
<td>Increase</td>
<td>40%</td>
<td>18%</td>
<td>14%</td>
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This data indicates no effect – a false negative!

The true picture emerges only after hundreds of observations!