



THE UNIVERSITY OF
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Business School

Thinking Outside the Box

67 Thought Pieces

The Institute of Transport and Logistics Studies (ITLS) at the University of Sydney Business School in 2015 started a commentary series, adding it to its portfolio of engagement with the broader community of interests in the space of Infrastructure, Transport, Logistics and Supply Chain Management.

While academic publications and reports are a very important outlet for high quality research including debates on themes with a rich policy and strategic value beyond theory, methods and evidence, there is room for a series of short pungent commentaries on themes that are of broad community interest. These are short pieces so they can be digested through the many social media platforms and focus on topics of currency that are also likely to be challenging and controversial – hence the titling of the series ‘Thinking Outside the Box’. It has all the elements of critical thinking and the ‘challenge of change’.

Each piece is published monthly since April 2015, but we thought it would be useful; to bring all of the contributions together into a monograph that is freely available. We have integrated the first 67 thought pieces into this monograph. We hope it will be useful to researchers, consultants, government and industry agencies and associations as well as in the classroom for debate and discussion.

David A. Hensher
Founding Director, ITLS

Read the latest from our world-leading academics and researchers. Opinion pieces are available in the ITLS page at <https://sydney.edu.au/business/news-and-events/news/institute-of-transport-and-logistics-studies/thinking-outside-the-box.html>

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Are public transport fares more expensive in Australia than anywhere else?

ITLS Think Piece #5-2015-August

By Geoffrey Clifton & Corinne Mulley

A recent Deutsche Bank study¹ led the [Sydney Morning Herald](#) to claim that 'getting from A to B on public transport costs more in Australia than anywhere else'. The Deutsche Bank study compares "the minimum public transport fare" (p.10) "for single rides" on 'tube rails or mono rails' or suburban rail for cities without a metro (p.11) and Table 5.1 shows Deutsche Bank figures for selected cities around the world:

Table 5.1: Minimum fares from the DB report for selected cities

City	Fare (USD)
Sydney, Australia	US\$2.92
Melbourne, Australia	US\$2.89
Auckland, New Zealand	US\$1.51
Singapore	US\$0.56
Tokyo, Japan	US\$1.42
London, United Kingdom	US\$2.23
Paris, France	US\$1.95
Cape Town, South Africa	US\$0.56
New York, United States of America	US\$2.75
Toronto, Canada	US\$2.37

Source: page 10 and 11 of DB research, exchange rate at 31 March 2015

Is this being fair about fares or does this ignore important variations within cities and between cities? For Sydney's train network, should we be using the minimum cash fare (\$4.00) or the cost of a peak journey using the Opal smart card (\$3.38) or off peak (\$2.36)? And how should the frequent traveller discount be treated: How do we account for free access to the network when 8 trips in a week have been made?

To investigate Deutsche Bank's claim, we look at the single fare, defined as the minimum peak smart card or pre-paid fare for a single metro or suburban rail trip (including upfront discounts such as that available in Perth for linking smart cards to bank accounts) as shown in Table 5.2 alongside the equivalent cash fare. This comparison will be over-estimating the minimum fare where there is a discount for frequent usage (as in Sydney and Brisbane) or where an annual pass is available.

¹ Sanyal, S. 2015, *The random walk: Mapping the world's prices 2015*, Deutsche Bank Research, Deutsche Bank AG, Hong Kong.

Table 5.2: Minimum fares for selected cities in AUD\$ for travel by metro or suburban rail if no metro

City	Cash fare (AUD)	Smart card fare (AUD)
Sydney, Australia	\$4.00	\$3.38
Melbourne, Australia	n/a	\$3.76
Adelaide, Australia	\$3.10	\$1.84
Perth, Australia	\$2.00	\$1.50
Brisbane, Australia	\$4.80	\$3.35
<i>Average, Australia</i>	<i>\$3.48</i>	<i>\$2.77</i>
London, United Kingdom	\$9.22	\$4.42
New York, United States	\$3.84	\$3.17
Amsterdam, Netherlands	\$3.86	\$1.24

Source: websites of respective public transport operators. Exchange rates at 17 April 2015

Sydney's minimum train fares are expensive compared to Perth or Adelaide but comparable to fares in New York or Amsterdam and cheaper than the minimum fare in London. Cash fares are more variable and reflect varying strategy for encouraging smart card take-up. London and Brisbane have made cash fares very expensive relative to smart card fares whilst Melbourne and Amsterdam have abolished cash fares altogether. Cash fares remain cheap in New York as their smart card ticket is not yet deployed.

But what a traveller gets for a minimum fare journey is also significant. In Adelaide, the minimum fare buys you travel between adjacent stations whilst in New York a flat fare covers the entire subway. So better than looking at the minimum fare is to look at how fares vary by distance.

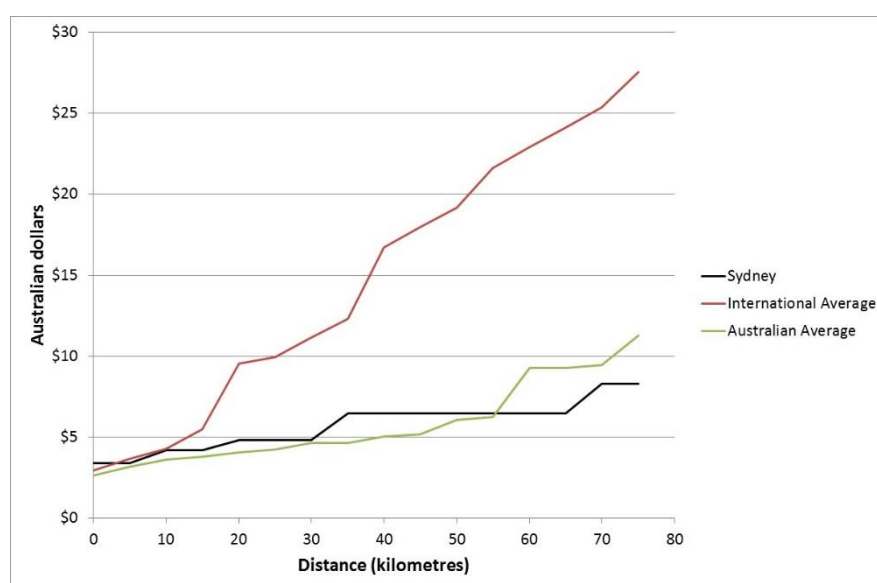


Figure 5.1: Rail fares by distance for Australian cities

Figure 5.1 shows the diversity of fares policies in Australia. Melbourne and Adelaide offer almost flat fare systems for their suburban networks whilst the other three cities vary fares by distance. Fares increase sharply beyond the boundary of Melbourne's flat fare but Sydney offers relatively low interurban rail fares over very long distances. This comparison shows that Sydney is the most expensive city in Australia only for journeys of 10 kilometres.

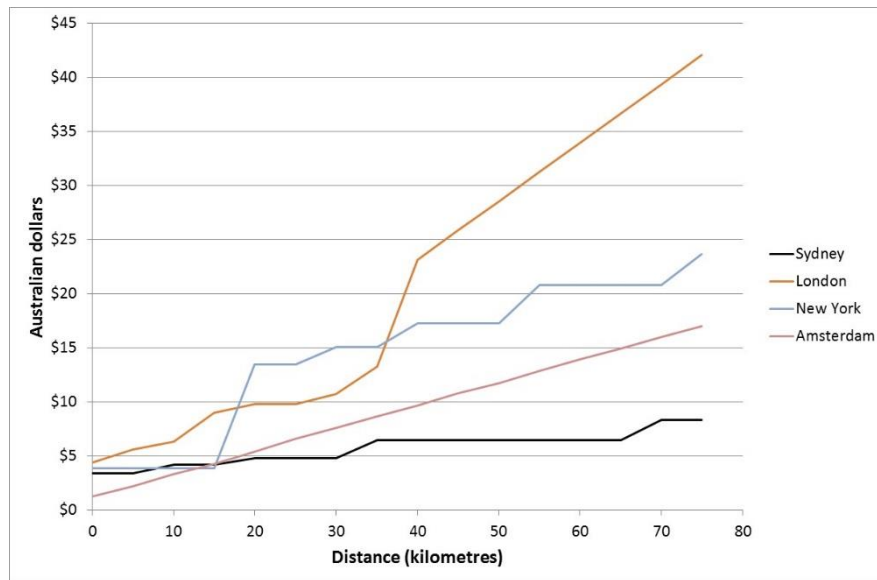


Figure 5.2: Rail fares by distance for Sydney and selected overseas cities

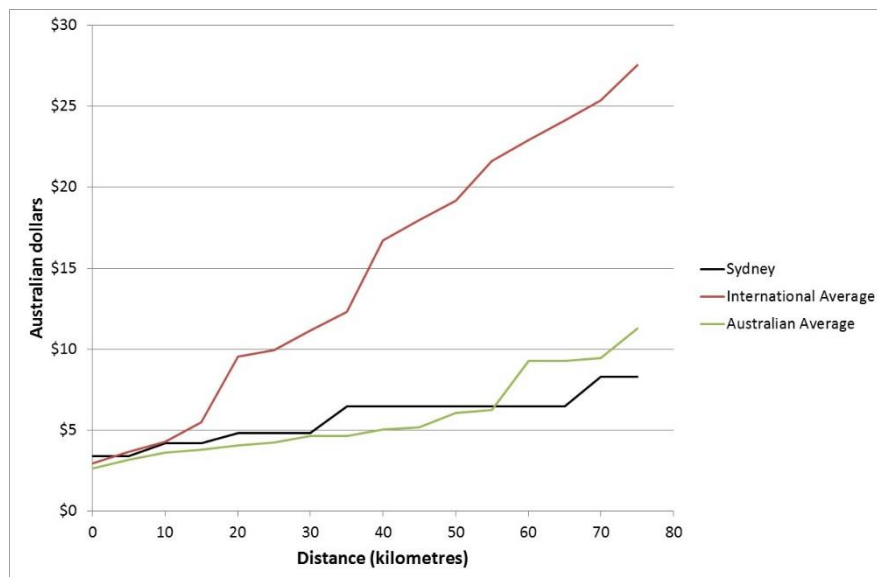


Figure 5.3: Overall comparison of rail fares by distance

Figure 5.2 shows that Sydney fares are cheap compared to some overseas cities. Amsterdam has the simplest fare structure with a standard flag fall and uniform fare per kilometre. Moreover this fare structure operates across the whole of the Netherlands. New York is like Melbourne with a relatively cheap flat fare in the area served by the subway but with commuter rail fares that rise very steeply outside of New York City's five boroughs. Rail fares increase by distance throughout London and the adjacent counties and, like New York, fares increase sharply outside the area covered by Transport for London's Oyster card. Fares are generally higher in London than for comparable trips in New York but Transport for London serves a wider area than New York's subway which means that fares are cheaper for residents of the outer boroughs of Greater London than for residents of the counties adjacent to New York (i.e. over distances of between 15 kilometres and 35 kilometres).

Only one conclusion can be sensibly drawn from these chart: Australian fares are not the most expensive in the world and, particularly for longer journeys, Australian fares offer very good value in comparison to other cities around the world.

The differences in fare systems mean that considering only the cheapest ticket does not allow for a fair comparison of fares but looking at differences by distance is also not entirely fair as this ignores differences in the ability to pay (wage rates, disposable income), differences in typical trip lengths between cities and differences in the frequency, travel times and quality of service provided. Comparing fares is not an easy task.

Still, fare's fair, whilst Sydney's fares are not the cheapest, they are certainly not the most expensive in the world either.

Another way of thinking about public transport delivery

ITLS Think Piece #7-2015-October

By David Emerson

There are a limited number of ways currently used to organise the business of public transport, and it must be asked; are there other innovative ways of providing for the involvement of private enterprise in the provision of this essential urban service? An Individual Line Ownership (ILO) model offers up some new business possibilities.

In most first world countries, public transport is arranged as a government designed service, discrete portions of which are leased out for a limited number of years to the private sector who then operate the service, with or without their own assets. Contracts might be for bus runs, or for particular train routes, for which the operator, on winning a tendering process or following a negotiation process, then receives a fee for implementation of the defined service. This is the case of bus services in Sydney, where all but the central area of the city are provided by commercial operators and which were just recently substantially re-tendered to the private sector in order to obtain the lowest price for the defined service. The bus routes of the central area of Sydney are not leased out, but are provided by Government buses. However, this operation is organised on commercial lines in accordance with the Hilmer recommendations on competition between government and the private sector (Independent Committee of Inquiry into National Competition Policy and Hilmer, 1993).

A second way of organising public transport is in open competition on infrastructure provided by the Government. This is generally the case in the UK where 'out of London' services for trains compete to firstly obtain a franchise for particular services and then for the spare time slots on railways. With the roads, buses compete on common road space in and between the regional cities of the UK. Fares, vehicles and timing are most often left to the operator to judge the market demand and price of the services with a view to profitability. These arrangements are common in Europe as well.

Tendering and deregulation led to an initial reduction in subsidies to public transport compared to when the service was by government public monopoly as was most common before the commercialisation and privatisation of government services that has increasingly been introduced in many countries since the 1980s. However, these initial cost reductions have not been sustained and there is interest to see if the ILO business regime may assist the government in reliably and efficiently providing those public transport services that have proven to be so essential to the functioning of our cities.

At this year's 14th international Thredbo Conference on Competition and Ownership of land passenger transport in Chile, the ILO regime was acknowledged as potentially another way to organise the business of public transport. The ILO has a unique structure that was first identified in the ski fields of the Dolomites in Italy where it has successfully operated for over forty years. It consists of a central overall controlling organisation that assumes responsibility for marketing and ticketing. This body sets the price of passenger access to the transport system, collects all the money for tickets and distributes this money to the transport providers, strictly in accordance to the number of passengers that are carried by any Line. Operators receive payment only for those passengers they carry. The 'rate of pay' for the carriage of a passenger is determined at the start of each season and may vary for the different modes of transport provided. The rate is published annually and is available to any potential provider. Developers of new lines take

this published rate as the means of determining the potential profitability of a route, based on anticipated demand between any two points. It has resulted in a continual improvement in the network of lifting devices available to skiers, a ten-fold increase in passenger numbers and in the creation of the world's largest ski field by number of lifts.

This central organisation does not actually provide any transport services itself. The infrastructure that does this is each individually owned by private enterprise. The owners of any Line must provide their defined service for specific times of day for which they are obliged to operate. A unique feature of this arrangement is that all proposals for new lines come from developers with the central organiser having no role in the planning of service provision: this is all entirely the result of a bottom up process of commercial response to the rate of recompense for passenger usage. This arrangement has the distinct advantage of removing any involvement in infrastructure provision by the central controller.

Apart from the times of operation, the owners have complete discretion as to the mode and operating methods of the Line in their possession. They thus take complete responsibility for the capital expenditure and the operating methods of each line and accordingly they suffer or benefit by those capital expenditure and operational decisions that they make. This ownership and responsibility for each Line provides the incentive to maximise efficiency and ultimately the capital value of the Line. It is noteworthy that the Lines in the Dolomites have a real value that enable bank loans to be arranged and for trading of the Lines and entities that own them, in the same way as most other piece of infrastructure can in a market economy.

The ILO business regime is currently being evaluated as an effective way of organising the lifting arrangements of people in a ski field compared to traditional arrangements. As well it is being assessed as a potential way of organising the movement of the public in and around our cities. If achievable, it would represent a further way for governments to introduce market forces for this vital city function.

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Applying best practice in public transport planning to an urban ferry system

ITLS Think Piece #37-2017-November

By Robin Sandell

Principal, Sandell Consulting, Member, Ferry Transportation Committee, US Transportation Research Board, Associate Member, Royal Institution of Naval Architects.

Sydney's ferry system is a much loved part of the city's public transport network. But is there a way to make ferries more useful for customers and to have them operate at less cost to the taxpayer?

The central business district is not the only, or even the main destination of people living in big cities. Residents need to travel to numerous places across a city, which is why the modern approach to public transport planning is to build multi-destinational networks providing mobility from and to almost anywhere (1;2). Ideally, this is achieved by arranging lines in a grid pattern with high frequency services, which is how metro systems operate in London, New York, Paris and Tokyo. The inconvenience of transferring from one line to another is kept to a minimum because transfer waits are short.

But what about a network where demand does not just justify services operating more than twice an hour? Doesn't that mean it is impossible to have convenient transfer waits at interchanges?

Many European countries, best exemplified by Switzerland, have overcome this problem by adopting integrated pulse timetables. Where intercity trains run at 30 minute intervals, for example, they are scheduled to *arrive* at interchanges a few minutes before the hour and half hour and *depart* a few minutes after the hour and half hour. This allows passengers to effortlessly transfer from one line to another, just as they would in a high frequency grid network. Schedules are also organised so that trains always cross at the same intermediate stops. This optimises bus connections, providing quality public transport even for rural communities.

It would not be difficult for Sydney Ferries to use the same approach. Almost all lines already operate at 30 minute intervals in the off peak. With minor adjustments, lines converging on the main terminal at Circular Quay could operate to a pulse timetable, with transfer waits of between 5 and 11 minutes. The ferry travelling from Darling Harbour, for example, would have favourable connections at Circular Quay with ferries to Manly, Taronga Zoo, Watsons Bay, Double Bay, Mosman and Neutral Bay. Using this method it can be shown that the number of origin-destination pairs in the Sydney Ferry network with regular, convenient connections can be increased from the current number of 96 to more than 400, with a rise of only 11% in revenue hours (3).

Ferry to bus connections are also improved because ferry cross overs occur at the same intermediate stops all day. Convenient transfers can be made from a bus to ferries travelling in both the inbound and outbound directions.

As well as benefiting passengers, there are unexpected operational efficiencies from an integrated pulse timetable. The regularity of the timetable allows crew rosters to be modular, with minimal wastage beyond mandated crib breaks. This reduces the government subsidy per revenue hour. Investment in infrastructure, especially wharf upgrades, can be better targeted as operational requirements are anticipated more accurately than where the timetable is aperiodic

(follows a different pattern at different times of the day). The network itself is modular, which would allow Transport for NSW to contract additional lines or increase service frequency without interfering with existing services.

There are constraints or “rules” to be observed in implementing an integrated pulse timetable. The cycle time for each route (time it takes for the vessel to travel out and back from its destination, including layovers) must be a whole integer multiple of the service interval. And at an interchange like Circular Quay, there needs to be a separate berth for each route to avoid congestion at the pulse point. This second constraint can be overcome by terminating routes originating west of the city at the new Barangaroo terminal.

The science of public transport timetabling needs to be recognised as important in New South Wales as it is in continental Europe, where quality scheduling is considered the most important element of the customer offer.

Poll Question

Should ferries play a bigger role in Sydney's public transport network?

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Is it a bus? Is it a train? Notes on modal etymology and nomenclature

ITLS Think Piece #42-2018-March

By Yale Wong

London has the tube, New York has the subway and Paris has the metro. Each name carries deep historical connotations which have since transcended their original meaning and evolved to become generic terms for urban passenger heavy rail transport. The London Underground (nicknamed Tube) gets its name from its circular, deep-level bored tunnels². The term subway, predominantly used in the Americas (and also [Glasgow](#) and some Asian cities) is also derived from underground lines in the city core³. Many cities, however, including Australia and most Commonwealth nations have adopted the *metro* nomenclature which is common across multiple European languages.

The term metro is derived from the Paris Metropolitan (*Compagnie du chemin de fer métropolitain*), which (despite some protest reflecting cross-channel rivalry!) was itself based off London's [Metropolitan Railway](#)—the world's first underground railway opening some 40 years earlier in 1863. The term metro carries such positive connotations that its use has been extended to cover commuter rail systems (e.g., [Melbourne](#)⁴), light rail systems ([Canberra](#)) and even bus services ([Tasmania](#)). This overuse (or abuse) of the term raises the question as to whether metro ought to continue carry its implied modal meaning.

In their original sense, metro/subway/tube carry an underground implication which exists not only in phonogramic languages like English but also logogramic Chinese languages and derivatives (i.e., Japanese, Korean, Vietnamese). New high speed metro lines (e.g., [Shanghai Metro Line 16](#), [Shenzhen Metro Line 11](#)) and [interurban metros](#) best distinguished by their operating speeds, station spacing and line length are also popping up in sprawling Chinese cities which transcend the English metro definition in other ways (making the [oft-criticised operating characteristics](#) of Sydney Metro Northwest look tame in comparison). This same ambiguity can also be extended to various other forms of rail and road-based urban public transport.

A separate conversation concerns the features of light and heavy rail (and by extension, trams). A major level of ambiguity arises from the essential misuse of terminology. The term light rail has been applied in all sorts of circumstances—think everything from London (the metro-esque [Docklands Light Railway](#)), to the Stockholm [Roslagsbanan](#) (closer to commuter rail), [Singapore](#) (an elevated people mover) and [Melbourne](#) (trams running on former heavy rail corridors). In China, light rail is usually used to describe medium capacity metros and also high capacity monorails (e.g., [Chongqing](#)).

The reality is that the light and heavy rail distinction is based entirely on axle weights. We have since transcended this engineering definition to more user-based standards which offer greater

² The earliest tunnels, however, were not circular—built using cut-and-cover methods at the sub-surface level

³ Other local terms have also emerged in the US like the L (Chicago) and the T (Boston)

⁴ Urban heavy rail in Australia can more accurately be described as commuter/suburban rail (though increasingly with metro elements)

comprehendability and is in itself not a major issue until used to misinform. There does exist also a range of [tram-train systems](#) (particularly in Germany) which complicates this comparison as well as bus-bodied trains in different incarnations (e.g., [Pacers](#) in the UK and [dual-mode vehicles](#) in Hokkaido, Japan)?

The humble bus has long been associated with many negative connotations (e.g., noisy, slow, complicated to navigate). The bus rapid transit versus light rail transit debate⁵ is one of great emotion and ideology and there has been much research on the [choice versus blind commitment](#) dichotomy (coined by Professor David Hensher) exhibited by political leaders. To take advantage of people's preferences (whether founded or not⁶), there is increasing interest in [branded bus services](#) (e.g., Sydney's recently opened [B-Line](#)) and [buses](#) which emulate the look and feel of a tram as more affordable alternatives to giving buses that image upgrade.

Various guidance technologies are further blurring the divide between bus and rail. Rubber-tyred metro systems, for instance, offer better traction and acceleration (especially at grade) on many urban rail systems. Kerb guided buses (e.g., [Leeds](#), [Adelaide O-Bahn](#)) have been around for some time (though many would argue a gimmick only). Magnetic guidance systems have had various incarnations too, as well as optically guided buses—in [Rouen, France](#) and [Castellón, Spain](#) as examples, but recently gaining new attention through the “[trackless train](#)” marketed by China's CRRC and trialled in [Zhuzhou](#). Do these modes operating on virtual tracks qualify as trains and is there an intention to mislead? Increasingly, there is a convergence of modes and so we are invited to ask exactly what constitutes a bus and what constitutes a train.

Ultimately, each mode label is a categorical term with no fine boundary. The blur showcases how language evolves (and used to the advantage of decision-makers) with implications (for instance) on transport research such as the design of choice experiments. Clearly, these elements play out through an individual's experiences with various systems in different countries (consciously or otherwise) as we try to discern mode choice or an individual's preferences for a particular mode (e.g., willingness-to-pay). Naturally, each transport mode (and the mode label itself!) constitutes a bundle of attributes (on technology, right-of-way, etc.) that if left undefined, allows the respondent to make their own judgement which is captured through a larger error term in the modelling.

Mode labels are applied so inconsistently (for political and other purposes) that they often communicate little about the essential characteristics of transport service—i.e., frequency and span. Whilst these labels constitute a useful starting point, there is a need for mode-agnostic thinking and to base transport policy on service characteristics rather than motive technology. We cannot let language cloud our judgement and need to be aware of the potential use, misuse and abuse of mode labels.

⁵ Whilst this is true in the developed world, it is a minibus taxi versus bus rapid transit *formalisation* debate that takes hold in developing countries (i.e., in Africa, South America and parts of Asia)

⁶ Most operating attributes like punctuality and reliability are a result of right-of-way rather than traction technology (i.e., road or rail)

Refocussing benefit-cost analysis: Start with a budget

ITLS Think Piece #48-2018-May

By David A. Hensher

It is common practice in Benefit-Cost analysis (BCA) in the transport sector to pre-define a corridor where future investments may be attractive, and to undertake a formal appraisal on a few selected options. A good example is a specific corridor where a rail based and a bus based investment are to be compared. These projects have different costs and benefits, and within the constraint of placing the service and infrastructure development along the exact (more or less) same corridor, one can arrive at the benefit-cost ratios and use them as an input into the decision making process. But what if we started with a given budget spend for the project instead of allowing that to vary across project options?

We use MetroScan, developed by ITLS, a quick-scan tool for investigating the demand opportunities for both passenger and freight-related activity (all in the one model system), and associated benefit-cost outcomes, as well as the wider economic impacts of transport initiatives.

We have selected the only location in the Sydney metropolitan area where the government has proposed to invest in bus-based rapid transit, in contrast to the many other locations in Sydney where only a rail based system has been proposed. We pose the question – how does a bus-based system compare to light rail on patronage and benefit-cost? The location, known as the Northern beaches, is on the northern side of the harbour along the coast. Access to this location from the CBD of Sydney is across the harbour bridge (or through the harbour tunnel) and through the lower north shore (North Sydney and Mosman). The government has selected a bus-based system known as B-Line to proceed (with some amount of opposition from local residents and businesses); and we have added a more substantial BRT option (BRT Full) together with light rail (LRT).

The two bus-based options are essentially the same as published by Transport for NSW with the service stopping at Wynyard (a main heavy rail station in the CBD), 10 minute off-peak frequency, 5 minute peak frequency, and travel time of approximately 50 minutes between Mona Vale and Wynyard. The B-Line replaces some express bus services from the Northern Beaches to the CBD, but most (local) buses remain unchanged. B-Line buses are counted as "BRT" together with other buses along dedicated corridors (e.g., Liverpool-Parramatta transit way, etc.).



Figure 48.1: Alignment of B-Line. Source: <http://b-line.transport.nsw.gov.au/>

In addition, the BRT Full option is the same alignment as B-Line but with a 20% improvement in travel speed, a completely dedicated corridor with physical separation, BRT stations equivalent

to existing light rail stops (with ticketing machines, platform level with floor of the bus and priority traffic lights when crossing other roads), and approximately double the cost of B-Line with the exception of vehicles that would cost the same. The alignment takes away existing road capacity.

The LRT has the same alignment as BRT except for a short connection from Wynyard to the City and the South East Light Rail line at George Street (the main road in the CBD) into the CBD across the harbour, with all other service attributes identical to BRT Full. Furthermore, the LRT costs four times BRT Full, which covers design/engineering, vehicles, construction, maintenance and operations. The LRT is also connected to the City and South-East Light Rail; thus the Northern Beaches service acts as a direct connection between the Northern Beaches (where Rail is not available) and the whole of the CBD.

We found that network effects have a significant impact on the appeal of the public transport solution for the northern beaches, and it appears that for a single alignment, LRT offers greater value for money simply because of the connectivity appeal offered, especially for lower north shore patronage. This is despite there being more trips on BRT than LRT on the sections within the Northern Beaches. If BRT is to be successful, we concluded that this setting must integrate into the LRT network that will be in place in 2036, and depending on how well this can be achieved (a seamless transfer), it might just satisfy the needs of lower north shore patronage.

If, however, we were to spend the same amount on BRT Full as on LRT at the LRT cost level, then BRT Full would deliver a significantly higher benefit-cost ratio, travel benefits and economy wide impacts making it undeniably a much more attractive investment (and value for tax payers money) than LRT. The resulting service coverage, frequency, connectivity and visibility would mean that the northern beaches (together with the lower north shore) of Sydney would see improved accessibility that only BRT and not LRT can provide for the same dollar outlay of investment.

This is a very important finding and recognises that the served catchment area can change substantially for a given budget in a way that supports many more 'corridors' of service frequency that is typically not identified in an overly constrained corridor interpretation of project appraisal. Maybe it is time to rethink the context within which BCA is undertaken?

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Surprise, surprise - Trackless trams are in vogue with light rail supporters!

ITLS Think Piece #52-2018-August

By David A. Hensher

For many years we have been trying to remove the emotional ideology in the debate on public transport where there have been clear lines drawn between those who support light rail and outwardly (passionately) reject bus rapid transit. Attempts to try and focus on the levels of service and the cost of such service within a dedicated corridor setting have fallen on deaf ears in many locations in Australia, reinforcing my belief of choice versus blind commitment. What we need is a debate that focusses on value for money within the goals of delivering mobility and accessibility in line with broad goals of efficiency, equity and environmental sustainability (the triple bottom line).

To my absolute surprise, we now see that one of the greatest proponents of light rail who has been very critical of any arguments to promote BRT, has said that trackless trams could be the answer to Perth's traffic woes (Exclusive, Kent Acott, The West Australian, Thursday, 28 December 2017). Experts say the new technology could be a game changer for Perth. It is "trackless" because it is autonomous and guided by on-board optical systems that follow magnetic strips painted on the road. The news story goes on to quote Curtin's Professor Peter Newman, a well known critic of bus based systems in favour of light rail, who said that "The trackless tram has a number of unique features that makes it particularly attractive, especially the price," Peter Newman also said. "It is estimated to cost between \$10-\$17 million per kilometre — about four times less the cost of a standard light rail like the MAX system proposed by the previous Barnett government. It could also be made locally." "We have been working on light rail for Perth for several decades — we now believe technology like the trackless tram will be a game-changer for Perth and cities like it." "It is cheap, involves little disruption, can be rapidly brought to market and has all the passenger comfort and ride-quality attributes of light rail — yet it is a new kind of bus on the road." As a result, *it does not require the digging up of streets and disruption to businesses, houses or traffic while it is being built.* The trackless tram would be electric and powered by lithium-ion batteries that are recharged at each station in 30 seconds. Planning has begun on this 'new' concept of public transport that experts believe will be a game changer for Perth.

Despite the clever use of the phrase 'trackless trams' to give some continuing emotional attachment to light rail (Hensher 1999), what we are referring to is a high quality BRT system that ticks all the boxes of the Gold Standard (ITDP 2014). Such a BRT system also recognises the value for money proposition where the same level of service can be provided for a cost considerably lower than LRT. Hensher et al. (2019) present evidence from a survey of public transport preferences undertaken in five countries (Australia, UK, Portugal, USA and France) by ITLS and the BRT (VREF) Centre of Excellence (<http://www.brt.cl/>) on the key drivers of community preferences for BRT and LRT. Service levels can be used effectively to deliver value for money BRT over LRT in the exact same corridor (and indeed many more corridors of BRT for the same dollar sum as LRT), as clearly noted by Newman for Perth.

We hope that the Perth view of a future bus-based system that delivers exactly what the light rail supporters want will send a signal that BRT has great merit and should not be discarded simply because of some emotional attachment to light rail and a misguided view that light rail can carry more passengers than a bus-based system. What matters is not vehicle capacity but service capacity and BRT definitely delivers on this metric. If we have to make our buses look

like light rail to win the debate then so be it! France has already done this - Rouen in France has had such a system for years, optically guided.

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Debunking the myths around optically-guided bus (trackless trams)

ITLS Think Piece #54-2018-November

By Yale Wong

NB: This is a supplement to think piece #42 (March 2018) [Is it a bus? Is it a train? Notes on modal etymology and nomenclature.](#)

“Various guidance technologies are further blurring the divide between bus and rail. Rubber-tyred metro systems, for instance, offer better traction and acceleration (especially at grade) on many urban rail systems. Kerb guided buses (e.g., Leeds, Adelaide O-Bahn) have been around for some time (though many would argue a gimmick only). Magnetic guidance systems have had various incarnations too, as well as optically guided buses—in Rouen, France and Castellón, Spain as examples, but recently gaining new attention through the “trackless train” marketed by China’s CRRC and trialled in Zhuzhou. Do these modes operating on virtual tracks qualify as trains and is there an intention to mislead? Increasingly, there is a convergence of modes and so we are invited to ask exactly what constitutes a bus and what constitutes a train.”

Optically-guided bus is the latest in a long line of initiatives to repackage existing bus as premium rail-based technology. The name ‘trackless trams’, design of the vehicles and modest deployment cost has appealed to many, and the concept has gained traction in Australia, led by prominent individuals including Professor Peter Newman of Curtin University. Whilst we applaud the recognition for the role of upgraded bus and bus rapid transit, a certain level of dogma fuelled by more wilder claims about the technology and its potential has taken hold. Many misconceptions have been promulgated which prompts us to set out the facts and debunk the myths.

Myth 1: Optically-guided bus is a revolutionary new technology.

Optical guidance systems date back to the late 1980s⁷ and have been deployed with limited commercial success since the early 2000s—we count just three applications in Rouen (Normandy, France), Castellón (Castelló, Spain) and Las Vegas (Nevada, United States). Whilst mechanically-guided bus remains the most popular—including [Adelaide O-Bahn styled] kerb-guided bus and to a more limited extent rail guidance systems—magnetic⁸ and wire guidance technologies have also been trialled to deliver the same benefits including precision docking, lane assist, reduced

⁷ See pioneering work on vision-based vehicle guidance systems by Dickmanns et al. and Pomerleau

⁸ Most prominent being the Phileas bus, using guidance technology from FROG (Free Ranging On Grid) Navigation Systems

road footprint and a better ride quality, but doing so for lower cost due to the absence of continuous physical infrastructure.

The three systems in Rouen, Castellón and Las Vegas are all based on the optical 'self-steering' guidance system developed in France by Matra under the trade name Visée, later rebranded as Optiguide upon acquisition by Siemens. The technology utilises a roof-mounted, forward-facing camera to detect a 'virtual rail' in the form of twin, white dashed lines painted on a darker road surface. The image is transmitted to an on-board computer which combined with the speed, yaw and wheel angle of the bus determines the correct path to be followed and in turn adjusts the vehicle's steering mechanism as required. In partnership with Renault, the Civis⁹ concept was developed into a transport system based on Irisbus Agora articulated buses fitted with the optical guidance system.

The most extensive deployment has been on the Rouen BRT called TEOR (Transport Est-Ouest Rouennais), inaugurated in February 2001 (pictured). The system has subsequently grown to three lines totalling 32 km all using the same guidance technology. The second deployment has been in Las Vegas along Las Vegas Boulevard North on the Metropolitan Area Express (MAX) BRT, which launched in 2004 but was discontinued in 2016. This system was unique in that optical guidance was used for station docking only and not general lane assist. For many years, the technology was deactivated due to poor reliability arising from the desert sun, dirt, grease and oil build-up on the road diminishing the pavement marking's contrast, despite the system stated to work even if just one-third of the stripes are visible. The third implementation (before Zhuzhou) has been in Castellón (Transporte Metropolitano de la Plana), which is an 8 km trolleybus route launched in 2008.



So what is different this time round?

The present incarnation doing the rounds is admittedly a more advanced deployment of previous optical-guidance technologies. Led by Dr Feng Jianghua, the research arm of Chinese manufacturer CRRC¹⁰ has used high speed rail technology (in particular, relating to the latest Fuxing series) to independently develop what it calls autonomous rail rapid transit or ART (智轨

⁹ A derivative called Cristallis was also offered which featured a different driver seating configuration to allow driver-operated fare collection

¹⁰ CRRC is the world's largest rolling stock manufacturer, formed by the merger of CNR and CSR in 2015

列车). The system is more akin to light rail than any of its predecessors. The vehicle dimensions are larger (2.65 m wide¹¹ by 3.4 m high), and can be lengthened or shortened by adding/removing sections from each consist. The vehicles are electric, using supercapacitor batteries which are mounted on the roof and charged via a collector at stations only (which feature an electric 'umbrella'). This allows the vehicles to be 100% low floor (330 mm floor height), as opposed to low entry for most diesel fleets in Australia. Note that the supercapacitor technology is not new, and has been launched in Shanghai (buses), Nanjing (light rail), Guangzhou (light rail) and Ningbo (buses) over the past decade. Despite this, 'new energy buses' in China (including Shenzhen's 16,400 strong electric fleet—the largest in the world) has not taken up this technology, relying instead on traditional lithium-ion batteries.¹²

A major advantage of the CRRC system is its multi-axle hydraulic steering technology and bogie-like wheel arrangement which is designed with less overhang thus requiring less clearance in turns. On the Zhuzhou test track (and as an example for comparison), the vehicles require just 3.83 m of swept path clearance, as compared with 5.74 m for a standard rigid bus. Each section of the 32 m vehicle is around 10.5 m long, and a minimum turning radius of 15 m is required. The cost of deployment is said to be USD 7-15 million per kilometre, as compared with USD 20-30 million for light rail and USD 70-150 million for metro. Capital costs for each vehicle is USD 2.2 million.



Myth 2: Optically-guided bus offers improved ride quality.

This is true but to an extent only, and has as much to do with traction technology, route alignment and driver behaviour as it has with the optical-guidance variable. Ride quality is a direct result of rubber versus steel traction—think rubber-tyred metros compared with their steel counterparts. The track gauge (narrow, standard or broad) and axle loads (light or heavy) also determine the quality of ride on a railway. Another important factor is the alignment geometry. Light rail can handle only 4-6% gradients whilst rubber-tyred traction can reach 9%. A higher quality bus corridor with smoother gradients and curves will hence offer better ride quality.

¹¹ Hence does not meet Australian 2.5 m width limit as specified by the NHVR

¹² Supercapacitor (or ultracapacitor) buses recharge rapidly, but store just 5% of the energy that lithium-ion batteries can, and are thus limited to around 5 km per charge plus suited only for very predictable routes with frequent stops

Pavement quality is another important factor which makes a marked difference to the ride experience.¹³

Optically-guided bus offers a much smoother ride, but this is primarily due to its advanced automation. It is true that the existing bus can be 'jerky', and this has a lot to do with buses getting more powerful (and lighter) over the years. An average bus engine generated 230 horsepower 20 years ago but today this can be up to 330 hp—important for uphill climbs but also allowing the driver (the opportunity) to accelerate quicker. One suggestion is to apply an acceleration limiter (perhaps more accurately the first derivative of acceleration or jerk limiter) in buses so as to limit the potential g-force experienced by passengers. The need for harsh braking is also an issue but linked to the level of bus priority afforded (i.e., traffic signals and traffic congestion) as well as driver training.

Myth 3: Optically-guided bus will be game changing for the provision of transport services and infrastructure.

Two issues with optical guidance technologies have not been considered in the present debate. Like the Civis, these remain proprietary technologies so there are always huge risks when locked into a single supplier. Secondly, the technology remains unproven for snow, heavy rain and fog conditions—and environmental constraints can be quite problematic as proven in the Las Vegas case. The potential success of the technology, however, is not related to whether the buses are optically-guided or not (nor linked to any of the above described characteristics, for that matter).

The modern, sleek, rail-like appearance of these vehicles certainly appeals to the cultural and biological elements within us. There is the potential for optically-guided bus to challenge the age-old adage that “buses are boring, and trains are sexy” and what we term at ITLS as choice versus blind commitment in the bus and rail debate. The challenge always is to avoid being emotionally fixated on technology, but rather choosing the appropriate mode to meet a particular transport requirement. However, the core characteristics of transport service are 'invisible' to the customer—frequency, service span, travel time and connectivity. Running on the road, right-of-way quality remains the critical defining factor. What good is a 'trackless tram' if it continues to be stuck in traffic? In car-dominated Australia, governments have struggled to reallocate road space away from inefficient private cars (averaging just 1.1 people per vehicle for journey-to-work) to spatially-efficient mass transit. Whenever bus priority is built, it usually arises from the widening of a road rather than any redesignation of existing road space.¹⁴ As long as this mentality holds, we will struggle to improve the relativity of bus as compared with car—and this is the most important element for attracting users onto public transport.

That said, if 'trackless trams' can radically alter the political paradigm and garner the necessary support amongst the community for the sensible reallocation of road space including the provision of at-grade signal priority, then there exists a huge opportunity for the cost-effective deployment of high quality mass transit. After all, priority is the key to efficiency and urban amenity. ITLS research has shown there to be huge latent demand for public transport in the middle and outer suburbs of Australian capitals.¹⁵ We believe this to be where the technology holds its greatest potential, and can readily be deployed along cross-town and orbital strategic corridors presently serviced by (for example) Metrobus in Sydney and SmartBus in Melbourne. Time will tell whether 'trackless trams' can shift the conversation including altering the idea of

¹³ A prominent example of how pavement quality affects the ride may be found in Melbourne's Albert Park where roads are built with high specification concrete to accommodate the Australian Grand Prix

¹⁴ Historically, the (incorrect) argument made for LRT has been that it does not take away from road capacity, but rather adds to public transport capacity

¹⁵ See recent work on Metrobus by Chinh Ho and social exclusion by John Stanley

permanence and fixed infrastructure from one synonymous with rail to the pressing issues of right-of-way quality and public transport priority.

Pool question

Were you aware of existing optically-guided bus technologies prior to the present 'trackless trams' incarnation? Y/N

Additional resources

Documentary of CRRC optically-guided bus (in Chinese):

<https://www.youtube.com/watch?v=pTPcJYigg30>

Video footage of Rouen optically-guided bus: <https://www.youtube.com/watch?v=ZrAm-1jVwf8>

Video footage of Castellón optically-guided bus:

<https://www.youtube.com/watch?v=4tP0s7MM5Zg>

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The changing nature of public transport

ITLS Think Piece #56-2019-April

By John Nelson

The nature of public transport has changed considerably over recent decades with a gradual move away from the traditional focus on fixed route, fixed schedule bus services provided by large vehicles and heavily subsidised bus and rail services. With an increased passenger preference for personalisation of travel opportunities (initially encouraged by mass motorisation and now facilitated by ICT applications and the continuing improvement of Apps) and the emergence of shared transport solutions (what some have described as the “uberisation” of transport services), it is imperative that the public transport sector confronts the changing nature of the business and determines what the future of public transport could look like.

Public transport operators, policy makers and researchers can all contribute to the debate on the changing nature of public transport. One important component of this is to appreciate and build on the traditional ingredients of success. These are many and include good service design (for both fixed and on-demand services), awareness of and responsiveness to customer needs, deployment of technology as an enabler (bus operators were early adopters of vehicle locationing technologies), partnership working and the generation of considerable benefits for the economy, environment and society.

Another important component is to understand the external factors that are shaping the future of public transport, such as the emergence of the sharing economy which continues to disrupt traditional businesses (like public transport) and which has led to the blurring of the boundaries between public and private transport with the widespread emergence of the “new mobility modes” (such as car sharing, carpooling, ride sourcing etc). The external factors have been nicely captured by ITDP / UC Davis (2017)¹⁶ as the “three revolutions in urban transportation” (the 3Rs) of electrification, automation and sharing and it behoves the public transport sector to draw out the potential benefits that arise from the juxtaposition of these influences. Given these developments it is not unreasonable to ask where public transport fits within the future of mobility.

In taking this future look we should also be mindful that the future for public transport in urban areas is likely to be very different to that in suburban/peri-urban environments. In the case of urban areas there will likely be greater emphasis on MaaS-type solutions which provide opportunities for public transport to be at the heart of the mobility offer and, if the ingredients are right, MaaS may defer the need for car ownership. As a simple example one might foresee, with the appropriate organisational arrangements in place, car sharing bringing much needed first / last mile connectivity solutions for journeys by public transport. Indeed, a public transport operator could also manage a fleet of car share vehicles, the subject of recent discussion in Europe.

For suburban areas there will be a need for more intermodal journeys perhaps involving car legs. It can be expected that car ownership will remain high, but the possibility exists for shared modes to be used to access public transport corridors – a point which is elaborated on below; and for autonomous vehicles to be used by public transport operators to serve traditionally hard

¹⁶ <https://www.itdp.org/2017/05/03/3rs-in-urban-transport/>

to reach areas. The situation in rural areas will be different to urban and peri-urban areas; we can expect car ownership to still dominate and public transport increasingly to serve only main corridors to/between large cities. Local services, where they exist, will need to be heavily subsidised to serve socially excluded segments.

Some encouraging findings for suburban areas have recently been reported by the European Commission-funded SocialCar project which explored the evolution of intermodal journey planning that incorporates carpooling with public transport in the transition towards MaaS. A new journey planning App (known as *RideMyRoute*) allows users to discover and make connected journeys involving carpooling and public transport. Results from a trial of the *RideMyRoute* App in four European test sites (Canton Ticino, Brussels, Zagreb and Ljubljana) revealed that the App was able to suggest trip planning solutions which included carpool options for one in five journey planning solutions and that the majority (85%) of these were solutions that involved connection from carpool to public transport. This is a significant advance on what is currently available through existing carpool provider systems or journey planning apps/services since *RideMyRoute* generated almost seven times more travel solutions involving carpooling than carpool only systems. So, while spatial density remains a factor in finding suitable matches, it is much less so with the new App than with conventional carpool matching services. This means that carpool initiatives can be targeted more towards commuters who fit the ideal carpooler profile and who have access to direct routes or near-direct fast routes on public transport.

Might it be far-fetched to consider that the blurring of the boundaries between public and private transport should be seen as an opportunity not a threat?

Poll questions

1. Do you agree that the boundaries between public and private transport are blurring?
Yes/No
2. Do you think that public transport operators might also become operators of car share or rideshare fleets in the future? Yes/No

A new metaphor might help bring about change

ITLS Think Piece #6-2015-September

By David Brown

David Brown has an Honours degree in Civil Engineering and practiced in the fields of traffic engineering and transport planning. He is now a media commentator.

A common image we use to symbolise the function of our cities, misrepresents what's really happening. It is now buried in popular use but if we challenge it, we might broaden the solutions we consider for the range of real transport problems.

It's all to do with a metaphor.

We talk about the CBD as the "heart" of the city. Major transport corridors are called arteries. In the body, the heart is the centre of all your blood activity. Blood flows from the heart in arteries. The public debate we have about transport reflects this image.

A large amount of the discussion on transport is about how to get people to or from the CBD - "the heart of the city". Our railways have radial layouts and our best known roads usually originate from the city centre. The other thing about the blood metaphor is that all blood in the body is seen as being the same.

In the public debate about transport we mainly talk about the journey-to-work as though most trips are for the same purpose and thus similar in nature. If everything is seen in such simple terms then the solutions are equally as simple. All you need is the highest capacity transport systems going in and out of the CBD. But the transport task is not like blood in the body.

Some years ago I was interviewed on ABC radio in Sydney by popular self-confessed science geek Adam Spencer. Before discussing the main topic he mentioned a recent survey where 65% of people supported the idea of having a congestion charge for the city centre. He was surprised that the figure was so high. I pointed out that the CBD, the so called heart of the city, was important but not as big as people thought. At the time it had about 13% of the jobs in the whole Sydney region. The majority of people don't have a reason to go there. I said that the survey probably reflected, in part, that most people thought that a congestion charge for the inner city would be a tax on other people. I did not argue that a congestion charge was a good or bad thing. My main point was that any discussion has to be considered in the context of what is really happening.

The spread of activities, and therefore trips, throughout a city should not be underestimated. If you add in the next dozen biggest centres in Sydney you still have less than 30% of all the jobs in the region. Concerning the "typical trip", more trips are made for shopping than the journey-to-work while Professor David Hensher said at a recent meeting of the Australian Institute of Traffic Planning and Management that 60% of peak hour trips in Sydney are not for journey-to-work.

I have mentioned these type of facts to a wide range of people including members of the public, elected representatives and people from all forms of the media and the overwhelming response has been surprise if not incredulity.

Now an expression used frequently and for a long period of time may have lost its significance. We “dial a phone number” without thinking about an outdated style of telephonic device. Or we say a person talks on and on “like a broken record” without thinking about technology that preceded the cassette tape (let alone the compact disc and the iPod).

But if we challenge the transport metaphor and its implications, we might be able to help shift the debate to consider a wider range of needs across a city. I think a better metaphor is that transport in a city is like fish in the ocean. All different shapes and sizes, going to a wide range of locations.

The CBD and other centres are like significant reefs; they are the focus for a considerable number (but certainly not all) trips.

There are schools of fish that are heading in the same direction but they will be passing other fish going the other direction. There is a weakness in this metaphor in that it doesn't readily cover the issue of freight, but nothing is perfect.

This is not just a word play game. Consider the recent Victorian State Election. The transport issues centred on two projects; one was a new rail line through the CBD and the other a large road project near the CBD. While this fuelled a fundamental debate of public transport versus road solutions, it did not address transport in the majority of the Melbourne metropolitan area. The idea of a 'Melbourne Plan' was lost in the contest of two inner city projects either of which would absorb a considerable amount of the transport budget.

The specialist web site The Urbanist (<http://blogs.crikey.com.au/theurbanist/>) ran a number of items that challenged the one dimensional nature of the Victorian debate, noting that it ignored the majority of the city.

That is not to say that nothing is done beyond the inner areas. But the political preference is still for big projects near the CBD. On the other hand, there appears to be an increasing interest in not focusing on a few big projects, of spreading limited budgets, of building the most cost effective projects (not just considering the cost/benefit ratios of a few projects in isolation) and of serving middle and outer areas as well as the inner city ones.

A new metaphor for transport might help to kick along these strategies (so to speak).

The benefits and beneficiaries of urban tollroad expansion

ITLS Think Piece #26-2016-January

By Christopher Standen

After a nine-month investigation into the WestConnex tollroad, the Auditor-General has found the Commonwealth Government committed billions of taxpayers' money to the scheme without appropriate advice. He also indicated that the funding did not provide value for money for taxpayers, and did not protect the government's financial interests. These findings raise the question: if the scheme is a bad deal for taxpayers, then exactly whom does it benefit?

Like the proposed Melbourne Western Distributor and Perth Freight Link, WestConnex is essentially a road freight project, which aims to improve freight productivity between the port and industrial areas. However, the \$17bn cost is largely being funded by ordinary motorists, with new tolls soon to be introduced on the existing M4 and M5. The M5 toll is set to reach \$14 a day in 2020, when tolling begins on the M5 East, and \$27 a day in 2026, when the M5 West cashback scheme ends. Effectively, suburban motorists will be paying for an inner-city freight project.

Of course, a major beneficiary will be the road freight industry, because the new tolls will clear traffic from freight routes. The M5 East will carry less traffic than it does today, after tolling begins in 2020. Which begs the question: why not simply use pricing to improve traffic?

Another beneficiary will be the future private owner. It will inherit an asset with above-inflation toll increases guaranteed until 2060. It will also be granted the toll concession for the existing M5 West from 2026.

The state economy will benefit, in the short-term at least. Spending \$17bn on any infrastructure, useful or not, will usually stimulate the economy. However, there's no clear evidence urban motorway expansion helps long-term economic growth in cities with developed road networks. On the contrary, it facilitates inefficient urban sprawl, and there are few on-going jobs – even toll collection is automated now.

For commuters and tradespeople, the new tolls will clear traffic from existing motorways, and the new tunnels will bypass traffic signals. Those who can afford the tolls should be able to drive into the inner-city faster than today, but will emerge into heavier traffic jams. For those unable or unwilling to pay, driving times will increase significantly. Rail will remain the fastest option for many trips.

Unfortunately, very few commuters will get to enjoy these shorter driving times. A three-lane motorway can handle maybe 14,000 commuters in the morning peak. That's 0.4% of Sydney's working age population. In contrast, a single railway can transport ten times as many into the heart of a city, at a much lower cost.

To encourage motorists to use the new M4 East toll tunnel, the parallel Parramatta Road is being narrowed to four lanes. This is being touted as an urban renewal opportunity – though the remaining traffic lanes will still be congested, and there are plans for high-speed bus lanes right next to footpaths.

WestConnex is being sold to the public as a **“congestion buster”**, though any congestion relief will be mostly down to the new tolls, and is unlikely to last. Many un-tolled roads will become more congested, due to toll-avoidance and **induced demand**. The reality is, there can never be enough road space for us all to drive wherever and whenever we want in free-flowing traffic. Congestion is a fact of modern city life.

Some overseas cities have given up trying to “bust” congestion. They focus instead on improving access to jobs, and making people’s travel time more enjoyable, healthy and productive. Is it the Australian Dream to drive along a dark, monotonous tunnel day after day, inhaling truck fumes?

Proponents of the scheme **claim** it will take trucks off suburban streets. However, by increasing the competitive advantage of road freight over rail, WestConnex may result in more trucks overall on the road network. During peak times, truck operators will pay to use it. However, they may avoid the tolls at other times, meaning more trucks on suburban streets off-peak, and at night.

They also suggest it’s the **“missing link”** in the road network. Yet Sydney already has an extensive and high-capacity road network. You can reach everywhere in the city by road. There are no “missing links”. There’s already a motorway connecting the port and western Sydney (M5), and an under-utilised freight railway.

Transport planning isn’t simply a matter of drawing lines on maps. We aim to improve access for people, goods and services in an efficient, fair and resilient way. The best role for motorways in this framework is moving traffic around populated areas – not dumping it into congested city centres.

Despite construction on Stage 2 having commenced, there are **doubts** the scheme will ever be completed. Stage 3 is currently unfunded, and the plan to raise the estimated \$7bn cost by privatising Stages 1 and 2 assumes very optimistic toll revenue forecasts. The NSW Government will also have to commit to those significant toll increases on the M4 and M5, losing votes in marginal western Sydney electorates. Further cost increases can’t be ruled out. It’s hard to see Stage 3 going ahead without massive additional taxpayer subsidy.

Does Sydney need more private tollroads? Or should the focus be on expanding rail freight, planning for local jobs close to residential areas, reforming road pricing, and investing in more efficient and productive transport systems?

Toll Roads – A view after 25 years¹⁷

ITLS Think Piece #28-2017-April

By David A. Hensher

Tolled roads in Australia have been around now for over 25 years (excluding bridge crossings) and have created camps of supporters and dissenters. Have they delivered value for money (to whom?) and have they reached their use by date as a preferred way to fund and deliver road infrastructure? In looking back over 25 years, this think piece crystallises some of the key elements of the toll road journey, raising questions about whether it is time to transition away from road-specific pricing to network pricing reform.

Toll Roads in Sydney, Melbourne and Brisbane historically have been a response to governments' desires to improve infrastructure through participation of the private sector given a lack of public sector money, with this being a solution that could self-finance itself. This served to remove debt from state government accounts while opening up opportunities for private equity and debt, into what are still believed in the main to be attractive commercial investment opportunities. Many lessons have been learnt as both the public sector and private interests have grappled to understand the different (often conflicting) objectives of social welfare and profit maximisation. Central to the understanding of how tolling works is the allocation (or sharing) of risk. Post-construction, the key risk is patronage (hence revenue) risk, which has had a controversial history shrouded in optimism bias and strategic misrepresentation in order to make the numbers look good. Concessions are typically awarded to the highest bidder due to a public sector focus on upfront value extraction. While lessons have been learnt the hard way (i.e., toll roads going into administration, class actions being settled out of courts on the day of legal decision, private equity investors feeling they have been misled), the appetite for more tolling investment remains. Sydney currently has 135 kilometres of tolled routes (or 270 directional kms or over 700 lane kms), increasing to 185 kms (or 370 directional kms or over 900 lane kms) with current and pending construction.

Some key lessons relate to whether society gets value for money from private sector participation, is the toll level appropriate for the offered travel time savings relative to non-tolled routes, are the risks (patronage in particular) allocated and managed appropriately, and why do we have to continue to require forecasts to predict actual traffic so soon in the settling in period of a tolled road (ramp up)? Private equity investors often expect their returns under what can only be described as overly optimistic expectations ('optimism bias') of early returns. Most forecasts have ramp-up built-in (often deep ramp-up), which is often appropriately accurate; however it is the steady-state that is the problem. Advisors to private equity investors should learn from the accumulated experiences and promote more realistic behavioural incentives that are currently bent out of shape and link them to timelines (in my view no earlier than the 5th year) in which equity related returns start to be more reliable. On top of this, we need to recognise that actual patronage levels, even over this period, are almost certainly to be lower than typically obtained in the medium-long term; with my advice tending towards estimates closer to 60% of forecasts for new road infrastructure. Indeed, I am aware of at least one major bank which acts as an advisor to the equity market doing just this. This starts to resolve optimism bias and strategic misrepresentation and hopefully reducing the risk of heading for administration and legal action. Even under these conditions, where the patronage risk is transferred to the concessionaire, there is a case to be made for focusing on debt financing until

¹⁷ I thank Rob Bain for his many comments on this think piece.

the risk profile of patronage is better established and stabilises and then invite private equity, or write in more binding conditions if this timing sequence is not adopted. This must, however, be distinguished from the benefits of equity during construction, which is very important, as it is equity on the line during the construction phase that makes sure these things are delivered on time (a key objective). This is a delicate mix of risks attached to delivery and operations.

One of the great errors in the current tolling model has been the political decision to prescribe a unit toll rate which is indexed over time by the consumer price index. This has resulted in ring fencing on a crucial mechanism that is capable of recognising the need to adjust the toll to ensure that the travel time savings are delivered commensurate with the value (to the users) of those time savings relative to the non-tolled route(s), given travellers' value of travel time savings. Consultants have struggled to establish the best outcome in relation to patronage forecasts because of this seriously problematic imposition. Added to the fact that consultants associated with the bidding consortia are often told to improve the patronage forecasts in ways that require what might be best described as imaginative ('long tail') futures, extending the range of time related benefits (such as the toll quality bonus) in the search for even higher patronage forecasts for a fixed toll regime. This point aligns with Bain's 21 ways to inflate toll road traffic forecasts¹⁸. This becomes a commercial proposition in contrast to a network efficiency solution, resulting often in the loss of network welfare gains. Unfortunately, there is no incentive for the operator of a stand-alone asset to think 'network'. There currently exists a complete failure across all tolled roads in Australia to optimise the level of toll, and I believe this is generally opposed to by the operating companies of tolled roads on many grounds, but specifically their liking of the greater certainty of revenue flows even if these flows are a mismatch in delivering a better performing road network. Only the state thinks 'network'. This is a key issue. The state gives away pricing controls and then finds it difficult to optimise the network when it only has control over this important lever for part of the network. This is of little concern when there are small, isolated sections of privately-operated toll roads. It suddenly becomes a massive concern when these privately-operated toll roads 'become' the network!

One consequence is that we observe high levels of congestion on a growing number of tolled roads (especially in the peaks) that are meant to deliver noticeably better travel time savings than non-tolled routes. The M4 is a good example of this in Sydney. Meanwhile the competing (as per the contract with the toll road operator) roads tend to deteriorate (less maintenance) or are not expanded as they otherwise might. The criticism of this model is not in having private sector participation and a user pays pricing regime, but in the PPP model in place that has historically been used to deliver the much needed additional road infrastructure. It may be time to rethink the way we fund user-pays road infrastructure that removes the commercial imperative that results in a disconnect in delivering a network wide efficient road system.

A significant strategic question is whether tolling has served an important role of highlighting the need to have a use-related pricing mechanism for roads (like other utilities such as water, gas and electricity); but specialising the charging regime to a single class of roads amounts to no more than a commercial imperative for investors in contrast to the need to ensure that the road system delivers efficient (and equitable) service levels. This requires government to consider the next step of road pricing reform, in which tolling is seen as nothing more than an important transition strategy to reinforce the merit of user pays. But determining the efficient prices for the entire road network is potentially an order of magnitude more complex than fixing a toll price as part of a business case for commercial appeal into the private equity market in particular.

¹⁸ Bain, R. (2012) Twenty-One Limitations & Shortcomings with Traditional 4-Step Models, www.robmain.com. "In Australia, a number of the toll road concessions were awarded to the bidder offering the largest upfront payment to the state. That's a recipe for disaster. Without checks and balances in place the bidding process simply turns into a competition on traffic numbers. Toll road traffic generates revenue, and the largest upfront payments can be justified by those with the highest traffic forecasts. The whole process becomes skewed and the numbers get bent out of shape in response. Considerable pressure is placed on traffic consultants to come up with the 'right' numbers; numbers that meet the requirements of the financial model."

Demand (within certain constraints) should start to influence price as in the US managed lanes; however this experience needs to be generalised to entire networks.

There have been numerous inquiries into the way roads are funded and an increasing recognition that we need to move to a broad based user pays regime for all roads, ideally with variable distance-based pricing in recognition of those who benefit should pay. We know that continues to be out of scope of political agendas even though many politicians espouse it merits, commission inquiries, and then in the main ignore the recommendations. Meanwhile politicians (at least in Sydney, Melbourne and Brisbane) are quite happy to support tolling of specific parts of the network as a short-term, stop-gap mechanism to fund new infrastructure (broadly defined to include upgrades of old infrastructure).

I and colleagues have undertaken research over many years to find ways to get buy in from users that can translate into appealing propositions for politicians (through growing support at the ballot box). One such model for passenger cars in metropolitan Sydney involves halving annual vehicle registration fees, introducing a 5c/km peak period distance-based charge, no such charge in the off peak, while preserving the fuel excise (see Hensher and Mulley 2014 for details). We find that the great majority of motorists are financially no worse off (the hip pocket test), and State Treasury is revenue neutral. Federal government is slightly worse off (financially but not economically) on fuel excise collections as a result of some reduced car use, while the peak traffic levels improve by 6-8 percent. The overall benefits in time savings are substantial (and typically showing a benefit-cost ratio far in excess of building a new road or rail system). This reduction in the amount of traffic is equivalent to the levels of traffic and travel times experienced in school holidays, which we know is greatly improved over other times.

Once buy in is secured and travel time savings demonstrated, the distance based charge can be increased. For example if we increased it by 1c/km (to 6c/km) in the peak, this results in an additional revenue of \$4.2bn per annum, more than enough to remove the tolls on existing tolled routes and compensate the toll road operators over the duration of the concession with part of the distance-based revenue raised on the tolled routes (and additional funding if required, although this is unlikely).

In summary, we are where we are today, we know where we want to be in the future; now the key task is to establish what the transition path to network pricing might (or should) look like. This must ensure that the full social welfare benefits of a road network are priced efficiently and offer value for money to tax payers and society more generally. The existing tolled road system has served us well but is not a panacea for a full rollout of an efficient and effective road network.

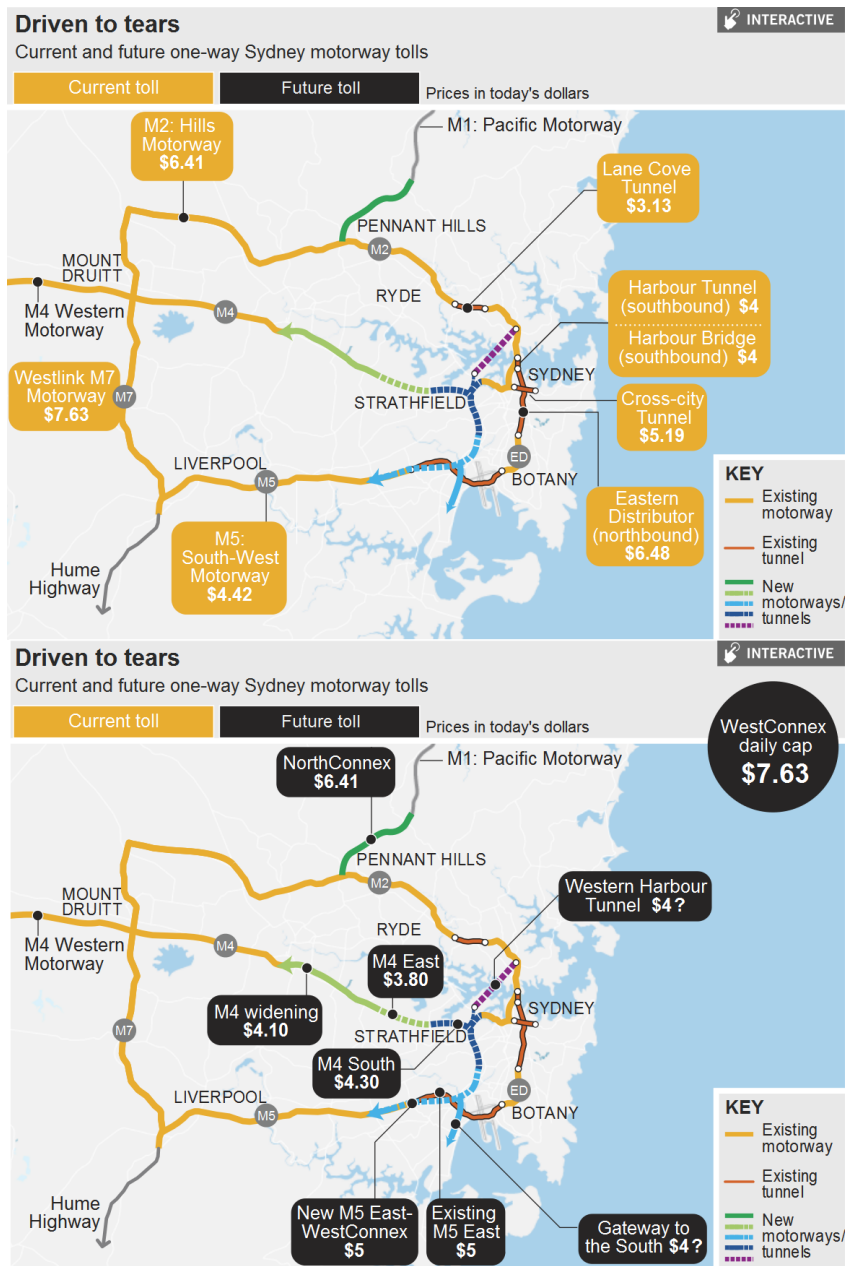


Figure 28.1: Sydney's toll road network: existing and new tollways

Source: Saulwick (2015, Sydney Morning Herald).

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Road pricing reform – A getting started idea

ITLS Think Piece #35-2017-October

By David A. Hensher & Michiel Bliemer

While it is recognised through numerous inquiries and research related activities that road pricing reform is necessary if we are ever to tame traffic congestion to 'acceptable' levels, and the theory is well established on how to price travel under congested conditions, the challenge has always been on how to get started in a way that can demonstrate the merits of a reform scheme without having to have a total system implementation. We have seen congestion charging at a cordon level (e.g., City of London, Stockholm CBD and Milan), and area wide pricing in Singapore, but we have struggled to find a way of introducing a scheme for an entire metropolitan area where much of the congestion is spread around.

The challenge has always been on how to get started. In simple terms, we need to secure buy in from the population at large and especially car and truck users. This means a reform plan that can offer financial benefits as well as travel time savings. Typically it is assumed that gaining travel time savings means paying more but is this always the case?

With digital technology now widely available (via smart phones) to disrupt the way we deliver improved transport infrastructure and services, we have a real opportunity to offer a trial that is essentially an opt in (or opt out) pilot that offers attractive incentives to car (and truck) users to move some amount of travel out of the more severely congested times of the day (including switch some travel to public transport or switching destinations to have shorter and/or less congested trips) so as to relieve the system of congestion, especially severe congestion. We are able to do this without implementing it over the entire travelling population, but to give individuals travellers a choice such that they can see a benefit to themselves while contributing to improving the performance of the network as a whole. Over time we might expect more travellers to take advantage of the scheme and opt in. What do we have in mind?

1. We start with a smartphone App that can be used to establish, for each person, the typical travel times associated with trips between specific origins and destinations (an OD pair) for each time of day. Users can refine starting times to suit their ability to be time-flexible. This will show where travel time gains, in real time, are on offer by specific times of day. This may involve small adjustments in trip commencement times (e.g., 10 mins) or larger adjustments, depending on the specific OD pair. Importantly, travel times are not only based on historical travel times but also on real time information and is applicable to each specific traveller, so it is personalised and relevant information. Clearly this App must be fully functional before we can proceed to the next steps.
2. The reform proposal involves reducing registration charges according to time of day (moving out of peak and even shoulders or some finer granularity of time periods). One must do this for at least three months of a year's travel to be eligible for a discount on registration fees.
3. We can tailor the registration fee reduction to establish enough incentive to trade a lower registration fee with moving to less congested times of day which deliver improved travel times. What we have here is a combined benefit of a reduced registration fee and travel time savings. We understand that not everyone will opt in for many reasons (including they must travel at a particular time of day); although we know from studies

we have undertaken previously that there are sufficient travellers who can switch time of day if the incentives are enough to merit it.

4. To compensate for the loss of registration revenue, the fee will increase if someone stays in the 'peak' period or other periods deemed to be the ones to encourage some switching out of. The adjustment in the registration fee would be on some sliding scale to recognise levels of traffic congestion.

The determination of the adjustment in the registration charge should be based on a level that, together with the available time savings, encourages enough switching to improve traffic flow. If for example, the average value of travel times savings for car commuters is \$16/person hour (which aligns with practice in many jurisdictions in urban Australia), then if the time savings on offer in a particular switch is 20 minutes, then that is worth paying up to \$5.33 per trip (note that it ignores schedule delay penalties, so we think people would be willing to pay less than this). Given an average annual car registration fee of \$400, say, if we reduce this by \$200 per annum for such a switch, and someone undertakes say 10 trips per week over 40 weeks per annum, then the overall benefit is \$200 plus \$2,133 worth of travel time savings. Since the time benefit does not incur a congestion charge but an incentive through discounted registration, this should be very attractive to enough motorists to make a difference. The scheme will also be applicable if a car user switches out of the car and onto public transport, regardless of the time of day. There could also be an adjustment in the registration fee tailored to travelling less in the peak (e.g., 3 of the current 5 days per week) but the discount would not be as great compared to not travelling at all in the peak.

Importantly, the loss of registration revenue can be recouped by a higher charge for those who continue to travel in the peaks. Such evidence will require controls through GPS or other similar data capture technology.

We suggest a trial in a major city such as Sydney. While we admit that if there are only a small number of participants opting in, for example 1,000 participants from all over the city and not concentrated around a certain area, there may not be much of a difference on the roads at a particular time of day, but that is not the point – a specific participating individual who switches to another time of day will observe a noticeable personal time savings (even if many others switch to that same time of day, but over other parts of the road network) as per advice from the real time information provided on the smartphone App. An alternative way of proceeding is to concentrate on specific bottleneck roads (typically bridges or tunnels) with thousands of participants in order to measure a difference in travel times. Maybe the trial should target harbour bridge/tunnel crossing traffic or users or similarly congested roads? But this is not necessary to show a time benefit to a participant which can be the basis of promoting the scheme to specific contexts where time savings will be noticeable, and hence overall levels of traffic congestion are reduced.

We do, however, recognise that such a peak (or high congested time) avoidance scheme (which has been trialled in the Netherlands, but involving giving money directly to travel outside the peak, and not adjusting the registration charge) has to be made fraud proof. Travellers must turn on their GPS on their phone while they are travelling in order to see when they are driving? If they turn their phone off then the data will show up as questionable, such that the person becomes ineligible.

If someone leaves their phone at home and say they are working from home in order to try and be eligible to obtain the registration discount, we may have to reject such claims since the whole point is to switch active travel between specific Os and Ds at particular time of day, and staying at home has to be proven to be a significant switching strategy (like switching to public transport) over a 3 month period. Exceptions will always exist but should not be used as an excuse to not trial an idea which may have merit.

While we still believe that such a scheme is worth piloting, we also recognise that such Peak Avoidance schemes may also require cameras to be installed along corridors (or active police

car surveillance which is used extensively in Sydney to check that vehicles are registered) and GPS devices built into cars. The fraud prevention part is challenging, but it is nevertheless worth investigating and hopefully implementing in a trial where the benefits to individual travellers are very transparent and in time might translate into network benefits with enough travellers opting in. It is all about getting started and getting buy in.

The scheme we are proposing, however, would need to know the OD pairs with departure time, travel times and mode (for individuals). Speed data¹⁹ is desirable in order to build the App and determine realistic travel times for different departure times. This can be extracted from mobile data that does not require the GPS to be turned on (at least not in urban and suburban areas where mobile coverage is good) provided the mobile operators are willing to provide the data and have the capability of processing the data into trips with mode detection. However, this does not prevent people leaving their smart phones at home (or getting a second mobile), but since that would require changing their telephone number and operator, we doubt that too many people would do that.

In time, with buy in we can start looking towards a distance-based charging scheme (by time of day) with discounted registration fees. This is an ongoing approach we are working on, as are other researchers proposing a distance based system (that is not differentiated by time of day initially) using odometer readings to track registration reduction entitlements.

¹⁹ Michiel Bliemer and Mark Raadsen of ITLS have built such an App in the Netherlands together with a company that makes travel time predictions on road networks using loop detectors. This is not easy to do in Australia since there are much fewer loop detectors available here. TomTom and others have speed data available that they use for their own navigation devices. These so-called 'speed profiles' can be bought. Such data is needed in order to build the App. Alternatively, one could use speed data from a model, but that is likely not accurate enough.

Paying for roads – driver of a new road management ecosystem

ITLS Think Piece #61-2019-July

By James Bushell

Road user charging is coming. In what precise form, we don't yet know, but we know that Governments at all levels will need to change the way that they charge for roads. Current funding mechanisms (a fuel tax) will no longer be appropriate with the increasing efficiency of vehicles, and the expected replacement of the vehicle fleet with electric vehicles that will pay no fuel tax (as currently configured). Heavy vehicle road use charge reform is underway now. There will be a political battle to get this reform through, and it is probably a bigger reform than the GST, but the budgetary imperative from the Federal and State treasuries will no doubt be a significant motivator for both sides of politics to reform how we pay for roads. Though if taxation principles are used to frame the argument, implementation might not be as hard as envisaged.

Technically, it is expected that there will be a use charge, levied per kilometre of road use based on accounting information and use of cost recovery principles (with different rates for different masses and volumes of vehicles and possibly by time of day – cars vs trucks for example). Revenues will likely also be set in a regulated price environment, akin to how other network utilities are managed (for example based on theoretical valuation methodologies like Depreciated Optimised Replacement Cost), and so revenues will not necessarily be perfectly linked to a market price. There are also considerations of how to incorporate some form of congestion charge into road user charging, to manage overuse of roads, such as for example, if automated vehicles see widespread use to discourage empty car movements. The calculation of the use charge though will be more difficult to perform.

But there are a few other more strategic and policy related issues that are going to need consideration in the new institutional ecosystem of road user charging.

A revenue stream linked to usage is going to lead to the ability to create a more 'normal' looking road organisation (compared to other businesses across the economy) with financial accountabilities and the ability to establish roads within traditional cost management measures, such as cost and profit centres and management key performance indicators (KPSs). Assuming some factors (including political ones), roads may be managed within such a framework, with revenues and costs brought into alignment, in theory, improving the efficient allocation of resources to the roads where they will be used.

The more efficient management of roads may help ensure that expenditure on a particular segment of roads is matched to the relative value of that road, based on usage (and utility) value. For various reasons (including again politics), the current road planning and funding environment has led to a number of road projects being funded that have poor economic return and so potentially, a new way of analysing road finances will prevent this. Though there are issues to manage around road traffic demand forecasts, as have been shown in toll road projects, which may be overly optimistic and cause project viability (and advisor profitability) problems at later stages. Appropriate, robust estimation methods and mechanisms, and probably their mandated use, will be required.

There will be transitional issues to consider. Some roads may be currently overcapitalised (particularly the ones with poor economic returns as identified above) and usage revenues may

not be able to sustain their maintenance or capital costs. Might we see road standard reductions in some segments? It must be highlighted however that in some cases these loss-making roads may fall within community service obligations and may need additional funding to ensure that communities (likely regional ones) are not isolated and left worse off due to policy change.

The role of the private sector will be an important one. Should they be involved, or should roads remain in public hands? Are roads private or public goods? Current involvement of private sector contractors in road construction and maintenance provision will continue. But as with many parts of government that generate cash flows - will governments (at all levels)²⁰ look to monetise these through privatisation (or other mechanisms such as franchising)? Should they? Should network control be surrendered? (This perhaps helps answer this question). Or should roads be housed within **Commonwealth companies or government business enterprises** (or their state equivalents) like the Australian Rail Track Corporation, Australia Post or Sydney Water, and given a defined role to manage costs and program delivery? On the other hand, could they be privatised like power and gas distribution networks? These entities will be monopolies or at best duopolies, and considering there are very few truly competitive options when it comes to road transport options, this will require detailed assessment from a public benefit perspective. If the private sector is involved, managing the known self-interest of the private sector and their rent seeking behaviours will be important to ensure they do not distort (or obstruct) transport network investment decisions, especially including situations where they may be responsible for calculating and setting prices (unless regulated).

This ownership question is perhaps linked to the bigger question of whether roads should be for or not for profit. Commonwealth and statutory corporations are run as investments and pay dividends to their (department) shareholders though can be structured as not for profit entities. Whilst a profit motivator will help manage costs, the prospects of the private sector profit from what many people see as a basic human right (i.e. that of free vehicular movement) may not be received well. This will no doubt will be woven into the political elements of the transitional discussion.

Finally, a very important mechanism to manage inter-mode competition is required. This is a known and present issue now, however with different management approaches and incentives (including KPIs), it might become a larger issue in a new ecosystem. Road and rail modes compete significantly for traffic (both passenger and freight) and mechanisms to ensure efficient investment by both modes may be required, and the efficiency and productivity of the road/rail network on the whole is maximised. Instead of building a multi-lane freeway, could a rail link do the job more efficiently (both at the local and national network level)? Where might new intermodal connection points be needed to assist this efficient network investment? This will necessarily be supported by new data sources (including mainly vehicle telemetry data that will necessarily be collected to calculate usage charges) to give new insights into the formulation and management of the combined land transport network.

All in all, it will be a far larger exercise, with many more moving parts than just applying a road user charge, and will have a far greater impact than just funding road use. But done well, pricing of roads may be a mechanism to drive increased land transport efficiency across the board, supporting productivity growth of all users of the networks.

²⁰ Historical note – in what could be a full circle moment, some local government authorities had their genesis as road districts and so splitting roads from these LGAs is an interesting irony.

ON the political economy of the road user charging debate.....

ITLS Think Piece #67-2019-October

By James Bushell

Policy makers, researchers and industry all more or less agree that we are going to need to change the way we pay for roads as the current excise and motor vehicle tax regime is expected to fail. But politicians are a different story, with the current anti-tax environment in politics disappointingly preventing any meaningful discussion on the matter (or any tax reform discussion at all), for fear of either party being accused of bringing in a 'big bad tax'. This limits the ability of our national leadership to bring us to what is expected to be a productivity enhancing reform, as road use and construction is managed with more connection to quantified need.

But in discussions recently, it has become clear to me that a greater understanding of this political aspect of the discussion is required, in order to understand how best we might move this conceptual discussion further into reality. And indeed, the conversation at the policy maker and academic level around how to use road user charging (RUC) mechanisms might be creating its own confusions for politicians and the public - the conflagration of the two problems behind the need for road user charging might risk achieving real reform of the sector, if part of the discussion is a political deal breaker...

The road user charging (RUC) discussion is really two discussions, that have merged into one given the role that RUC will play in each discussion. On the one hand, there is a discussion about funding - how do we provide road capacity in the face of falling funding from extant road funding mechanisms? On the other hand, we have a discussion about how to manage road capacity in the face of growing population and the congestion pressure it brings. A RUC mechanism is a possible policy solution to both of these problems, but important distinctions in their policy outcomes and indeed opposing ideologies present a conflict that clouds the debate.

RUC as a funding mechanism is a taxation discussion. More accurately, it is a taxation equity discussion as we move from a collection of imperfect and inequitable taxes to a user pays model of road maintenance and capital funding. This has generally been couched in terms of a per kilometre charge, with different levels of charge for different weights of vehicles, with these charges based on the dollar costs of road provision, which can be determined reasonably easily with accounting treatments. The user pays principle has been utilised to improve equity and efficiency throughout the Australian economy over the last 20 years, and is generally accepted by the population because of this equity improvement. And should funding RUC implementation be hypothecated to roads it comes from (instead of disappearing into general revenue) and be accompanied by the removal of existing inefficient taxes (mainly fuel excises and motor vehicle taxes), the equity argument will be further reinforced. In many ways, it will resemble another major reform, the Goods and Services Tax implementation, which replaced many different taxes with one simpler and more conceptually straightforward tax, but were also seen to be equality building given the flat rate the GST uses (subject to some exceptions).

RUC as a congestion management tool on the other hand is different. It is a consumption discussion where prices are used to limit such consumption and a very different policy result. The way we set these prices is (compared to funding RUC) not well understood in terms of underlying costs, even by policy makers and academia, and in some of the cordon pricing schemes in other jurisdictions overseas, is somewhat arbitrary and the funding is not linked to congestion reduction

activities. It is hard for consumers to understand why these are the way they are and therefore hard for them to accept making payments for something that was previously free.

But more importantly, without that understandable basis for charging they may see it as an affront to their current day to day behaviour. Ideologically, from a liberal/libertarian view, the car can be seen as an extension of the individual. Limiting the use of the car through a congestion RUC measure may be seen (either explicitly or more likely implicitly) to be a limitation on the individual. And so any discussion in this area will encounter resistance, especially from governments that are liberal/libertarian minded, or a population that is used to having fundamental freedoms, such as that has been promoted through the car since the 1930s and that has in many ways formed such a fundamental part of the development of Australian communities since then. And the implementation of a cordon charge, which clearly swathes of the public will see through the lens of the wealthy and not wealthy, will attract particular attention given the perception that the wealthy will be able to afford to drive. The not wealthy (which many Australians – rightly or wrongly – see themselves as) will have to use the ‘lesser’ public transport options which may cost them more when the time cost of public transport is taken into account^[78]. And some people might see the cordon charge as being a thing that makes the drive for the wealthy people easier, whilst the rest of us are lumped on overcrowded public transport. Probably thinking of these things, political leadership simply won’t even entertain the idea of these charges, and immediately shut down debate before it can begin.

Clearly, for each of the problems (funding and congestion), a specific RUC mechanism will need to be designed for each of these situations to achieve a first best solution. Across both, GPS devices in vehicles to monitor specific routes and a system will levy the appropriate charge based on the road used. As above, a funding RUC will likely set a price on road use per kilometre (by type of vehicle) across the whole network, whereas a congestion RUC will involve a separate charge (somehow) for the use of particularly overused parts of the network. However, whilst the congestion RUC won’t recover total road network costs, the funding RUC will no doubt help manage congestion, to some degree, given it will put a price on road usage that is currently not explicitly priced, and lead to different choices by drivers. **Studies in the Netherlands have suggested that in their case,** just doing this will reduce road use by something similar to the reduction in use that Sydney sees when it is school holidays, which we all know is a noticeable amount. Imagine paying for the roads we use on a user pays basis, and having lower traffic all year round? And once the technology and process is in place, congestion charging will be a minor step change to implement, once we see where it is needed and how to charge for it.

As researchers we do have a responsibility to identify the first best solution to problems we encounter, however as policy discussants we also must look at how second-best solutions might be the more achievable compromise that delivers on more outcomes than a non-implementable first best solution might.

^[78] Assuming that public transport is held constant. Improvements in public transport, implemented either in conjunction with cordon charging or subsequently as a result of new market signals provided through changed transport consumption patterns, may reduce this time cost to users. This may be achievable if congestion RUC is hypothecated to congestion reduction (a topic for another day).

Aiming for zero growth in vehicle kilometres of car travel

ITLS Think Piece #4-2015-July

By John Stanley

Why VKT?

There is currently strong policy interest in Australia around increasing our rate of infrastructure investment. Our cities, which are vital for national productivity and liveability, will be the subject of a significant part of any infrastructure expansion. It is crucial, then, that we understand very clearly the kinds of cities we want and the best way to use infrastructure to help deliver those cities, particularly important city-shaping transport infrastructure.

Vision statements for Australia's capital cities, set out in their long term land use/transport strategies, highlight the triple bottom line *sustainability* elements embedded in COAG's (2009) national objective for our capitals:²¹

To ensure Australian cities are globally competitive, productive, sustainable, liveable and socially inclusive and are well placed to meet future challenges and growth. (COAG 2009, p. 15)

Land use/transport integration is fundamental to vision achievement. Transport cannot be detached from desired land use futures, accessibility being the glue that links the two.

If road users were confronted with all the costs that their travel choices impose on the wider community, through what economists call a marginal social cost pricing system, there would be little reason to be concerned about road traffic growth. In the absence of such pricing, however, there are serious concerns about managing the substantial external costs of growing road traffic volumes, particularly in our cities where these external costs are highest on a per kilometre travelled basis. If the will to tackle urban road pricing is lacking, then targeting growth in urban traffic volumes is a second-best way to achieve more efficient travel choices and a more sustainable city.

Leading international expert in land use transport integration, Professor Robert Cervero, argues that Vehicle Kilometres of Travel (or VKT) is the single most powerful indicator of whether an urban land transport system is likely to be sustainable long term.²² The focus in the current note is on person movement. Per capita passenger vehicle VKT growth in Australian capital cities has

²¹ Council of Australian Governments (2009). Communique – 7 December 2009.
http://www.coag.gov.au/coag_meeting_outcomes/2009-12-07/index.cfm?CFID=6029

²² Cervero, R (2014). 'Land use transport integration: implications for infrastructure in North American and Australian cities', in Stanley, J and A Roux (eds). *Infrastructure for 21st century Australian cities: papers from the ADC Forum National Infrastructure and Cities Summit, March 2014*, Melbourne: ADC Forum.

been declining for some years. Further containing growth in VKT will reduce congestion costs, greenhouse gas emissions, air and noise pollution, the road toll and it will improve social inclusion and health.

Land use transport integration

Metro Vancouver's long term transport strategy has adopted a target of zero growth in VKT to 2046. It plans to achieve this by increasing the mode share for walking, cycling and public transport trips from the current 27% to 50% and reducing average trip lengths by 30%. Greater land use intensity is a key component in delivering these changes. Low or zero rates of growth in VKT need not imply lower levels of accessibility in our cities if land use and transport are planned in an integrated way.

The growing research base on connections between built form and travel suggests that the effects of individual measures are usually small but that the combined effect of a number of supportive regional and neighbourhood level measures on VKT can be significantly large, encompassing: increasing destination densities (particularly in CBDs and around major urban transport nodes/stops and along transport corridors); improving the accessibility of major urban nodes; increasing diversity of land uses (mixed use planning); providing supportive urban design (particularly street network characteristics, such as intersection density and street connectivity, that encourage safe walking and cycling); and, reducing distances to (and frequencies of) public transport services.

Infill development should cater for the substantial part of urban population/job growth in our cities, to align with, enhance and share the benefits from emerging structural economic trends (which are centralising knowledge-based jobs) and to minimise the costs of catering for growth. Development should be focused on those locations (nodes and corridors) with the best accessibility, particularly trunk public transport accessibility (commonly known as Transit Oriented Development). Almost half the population increase from 2001 to 2011 in Metro Vancouver, for example, and a little over half the growth in dwelling numbers, was located close to the frequent transit network (defined as within a 500 metre buffer of local bus and streetcar routes and a kilometre of rapid transit). This is strong support for the policy intention to contain growth in VKT.

Overall urban densities in Australia's cities need to increase by 50-100 percent over the next 30-40 or so years, with allowance for local circumstances. Minimum dwelling densities in greenfield development of perhaps 25 per hectare should be adopted, to support development of neighbourhoods in which people can undertake most of the activities they need for a good life and provide an effective market for local and trunk public transport.

In terms of delivering zero, or very low growth in VKT, Australian capital city long term integrated land use transport strategies deal with central city requirements well. They need to increase their focus on:

- how densities will be increased in middle and outer areas, where most people live, work and recreate, and how land transport can best support this, particularly public transport, walking and cycling
- building strong neighbourhoods and ensuring that local transport is supportive (strong neighbourhoods will increase social capital, sense of community, social inclusion, well-being and health, supporting economic participation and reducing the need to travel)
- integrated shorter term (5-10 year) financing/funding plans, which is a serious shortcoming in terms of implementation and achievement.

Transport policies and programs need to be strongly supportive of delivering more compact cities. The main strategic land transport policy and program directions for moving people in our capital cities, to support desired land use development directions, should focus on:

- ensuring that adequate trunk public transport capacity is available to facilitate growth in the central city and movement around the central city
- ensuring high quality arterial road capacity and high frequency circumferential operation of road-based PT systems are in place through middle and outer suburban areas, linked to local PT services to/from transport nodes and local activity centres, at a frequency that will help to facilitate social inclusion and with safe access opportunities.
- attaching high priority to safe walking and cycling
- providing high quality trunk PT services between outer growth suburbs and the most proximate employment hubs
- longer term, reforming road pricing.

Outcomes

A combination of 50-100 percent density increases by 2050, achieved primarily through TOD in the existing urban area (nodes and transit corridors), and setting minimum density targets of about 25 dwellings per hectare for fringe growth, combined with substantially improved public transport service levels and walking/cycling opportunities and reformed road pricing should make it feasible to lower the growth in capital city VKT substantially below the rate of population growth, with an ambitious target of no increase in motor vehicle VKT within reach. A committed policy alignment in this direction would deliver stronger, healthier and more inclusive communities, as well as supporting productivity, job growth and a cleaner environment. Our cities would be more sustainable and more liveable for larger numbers of people. The focus on zero growth in motor vehicle VKT should remain in place at least until such time as a reformed road pricing regime is implemented.

Self-drive motor vehicles lack sex appeal and a great deal more

ITLS Think Piece #21-2016-September

By Matthew Beck

The self-driving car is often presented as the transportation technology of the future. Indeed, Google already has a fleet of 20+ self-driving vehicles which have travelled almost 1 million autonomous miles. Tesla currently sells its Model S with the option of a pre-installed autonomy package. But there remain many physical barriers to these vehicles and, for the average driver, a lot of psychological ones too. If these barriers are not overcome, the self-drive vehicle is destined for the same fate as electric car which has less than 2% of the market to show for 30 years of expensive research.

Of course, the self-drive vehicle has clear transport advantages to offer our congested cities. At 120km per hour, 12,000 fully autonomous vehicles (AVs) can travel in a lane every hour with only 6 metres of space; an increase of nearly 500% over human driving.

Shared AV services could also reduce the number of vehicles needed by around 80%. Fewer cars mean valuable CBD land need not be given over to parking.

AVs are also safer. More than a thousand people die on Australia's roads each year and almost all accidents are caused by driver error; AVs can eliminate these errors almost entirely.

One final positive is the way that AV technology can better connect people to employment, services, family and friends and the local community because they can eliminate the need for car ownership and the costs associated.

On the other hand, the proliferation of sharing services has not resulted in a decline in the number of vehicles on the road. The national vehicle fleet grew by more than 2% over the past year. Simply put, people do not like sharing. Even the halcyon ride-sharing app Uber essentially operates as a traditional taxi service.

If the full benefits of AVs are to be achieved, they must first overcome several psychological barriers such as the primal human dislike of personal space being invaded; will people be comfortable travelling with strangers in a vehicle they don't own and can't control?

At the heart of car ownership is the human need for protection and security and freedom of movement, unconstrained by others. Will owners of AVs allow their car to be used by people they don't know for unknown purposes? Will people accept the reduced flexibility of sharing a service compared to solo driving? Will people travel in a digital vehicle that could be hacked, tracked or fail spectacularly?

The connection between car ownership and the human psyche is ingrained. Cars are objects with which people identify and personalise, places they feel safe and in control. More fundamentally, cars represent an object of sexual desire: men interested in a quick hook-up are more willing to buy more expensive cars and women find a man to be significantly more attractive when in a high status car.

AVs also need very clearly defined road spaces on which to operate. Roads in less than perfect conditions have already confused the semi-autonomous Tesla. Currently Australia has an estimated \$47 billion worth of road infrastructure in poor condition. Additionally, Sydney and many other international cities have large number of narrow streets and follow more organic paths constrained by geography, none of which is conducive to seamless AV navigation.

Furthermore, there are questions around the ability of our national network to cope with an enormous leap in data demanded by AVs despite the \$56 billion NBN roll out.

There have been 11 accidents involving the Google vehicles and none have been caused by the AV itself; most having been rear-ended by other drivers. But while the AV may not have been responsible, nor did it move quickly to seize a small gap in traffic or accelerate to get through a yellow light as a human driver may have done.

This lack of human like behaviour confuses human drivers, who, unlike computers take risks as well as anticipate the future. We could separate automated vehicles from those driven by humans, but of course, this separation of traffic streams will be costly.

Perhaps the most vexing issue with AVs involves crash avoidance algorithms. For example, you are travelling in an AV and a pedestrian steps off the pavement unexpectedly. The AV has three options; hit the pedestrian, swerve to the right into an oncoming car, or swerve to the left onto the pavement where there are potentially more pedestrians.

Hitting the pedestrian would almost certainly kill that individual. Swerving into oncoming traffic may be less likely to kill you but could leave you seriously injured. How a choice is made or the process via which outcomes of different events are speedily calculated is unclear. How comfortable will people be in allowing their fate to be determined by a machine, moreover who is responsible should an accident arise and who should carry the burden of insurance; the driver, the owner, or the manufacturer?

Recently the first accident involving an autonomous vehicle occurred when the vehicle's sensors system failed to distinguish a large white 18-wheel truck and trailer crossing a highway. It has been argued that the accident could have been avoided and that drivers must remain responsible for the actions of the vehicle, but the requirement for the driver to remain alert would significantly erode any benefits offered through autonomy.

While AVs have many benefits, there are immediate physical barriers which will be expensive to overcome. While less costly, there are also complex psychological factors which may be more of a barrier in the longer term. However, with Google and even Apple involved in the development of AV technology, it is likely that they will be part of our transport future. Indeed, Elon Musk has managed to make the electric vehicle sexy finally.

Autonomous vehicles and implications for future transport systems

ITLS Think Piece #24-2017-February

By David A. Hensher, Chinh Ho & Richard Ellison

The rapid development of autonomous vehicles (AV) has prompted considerable speculation on how these vehicles will 'revolutionise' the future of cities' transport systems. It has been suggested that a large-scale adoption of AV would lead to safer roads, congestion-free cities and more public spaces as vehicles can be shared, and hence fewer parking spaces are needed. However, it is far from clear if these visions are likely to be realised and what this might imply for the future transport networks and policy agendas. Recent comments by the NSW Minister of Transport who stated "we have got on-demand movies, we want on-demand transport"²³ and "if I look at the ways in which we're going to have to change our transport planning, our road networks, the way in which insurance is going to change, all of this is going to happen incredibly quickly and I want us to be front and centre"²⁴ underline how extensive the transport systems will change and how critical it is to plan for these changes. If these visions turn out to be the case, questions for which clarity is needed include:

- How AV will change the car ownership model? Will people move away from a private model (outright ownership) toward a sharing model? The latter ranges from fractional ownership (buy equity in a car-share brand) to own and share (own an autonomous vehicle but lease it out when not using) to Mobility-as-a-Service (subscribe to a mobility plan and a smart mobility app will manage the rest, including planning journeys, booking a shared-car or a taxi, paying fees, and billing) to pay-per-ride (much like Uber with driverless cars)
- Will total car kilometres and traffic congestions increase or decrease in the driverless era and whether the effect on congestion is likely to be as significant as claimed?
- What are the implications for the delivering of public transport services and the planning of future transport infrastructures?
- What are the optimal operational measures to tackle the transitional period of transport systems from all human-driven vehicles to fully automated vehicles?

Existing planning and operational management tools are largely unsuited to answering these questions because they rely on several assumptions about how investments in mobility through car ownership and licence holding influence the way people travel, how much people are willing to pay to save wasteful travel time, how the public transport network is structured and operated, and how traffic congestion control is currently implemented in cities. All of these assumptions may no longer hold in the driverless era, when one does not need to own a car or hold a driving licence to be able to use a car, when one can work or do worthwhile activities while travelling and hence travel time is no longer that wasteful, and when public transport can be 'ordered' in advance. In addition, the transitional mixture of human-driven cars and AV further exacerbates

²³ 2nd November, 2016 - <http://www.smh.com.au/nsw/commuters-to-get-ondemand-buses-trains-under-ambitious-plans-to-ditch-timetables-20161101-gsfwtc.html>

²⁴ 26th October, 2016 - <http://www.businessinsider.com.au/nsws-transport-system-is-going-to-be-a-very-different-beast-in-5-years-2016-4>

the complexity and uncertainties of transport systems that entails devising innovative and holistic planning and operational models.

The likely effects of AV on car use and congestion are of particular interest. To accurately predict these impacts, we need to rethink and restructure planning and operation systems in an innovative way. Currently congestion acts as a major disincentive to car use as congestion is perceived to be both highly variable and a waste of time. In contrast, widespread use of AV would be expected to reduce the variability of travel time as this can be accurately predicted before each journey. Furthermore, although congestion is perhaps unlikely to be eliminated entirely, AV also provide the opportunity for time spent in cars to be used productively. Thus, car users may be more tolerable to congestion and the car becomes more attractive than it already is, perhaps prompting a switch from public transport. This has a significant implication on how future transport initiatives are evaluated, particularly in terms of user benefits. Transport infrastructure is currently evaluated on the basis that savings in travel times and reliability are highly valued because time spent travelling is considered 'lost'. Yet, turning time spent in a car into productive time will mean the value of travel time savings will be less and passengers may become less sensitive to congestion. Equally, AV with no passengers will not perceive any benefits from reduced travel time but will still contribute to congestion and incur costs of running. The proportion of AV running empty would therefore be expected to have a substantial effect on congestion levels and this effect will be simulated in this project with new data collected and models developed.

Furthermore, the increasing deployment trend of AV and connected Vehicle-Infrastructure technologies provides potentials to develop analytically tractable and in-depth understanding of mobility patterns in multi-modal transport networks. This enables us to establish holistic and quantitative management schemes to efficiently monitor and control traffic congestion within real-time optimisation frameworks with more realistic and multi-modal representation of traffic dynamics.

Also of significant interest to future transport and infrastructure planning and investment is how these changes will alter the nature of road requirements and the transport network, and how this will interact with the push for Mobility-as-a-Service (MaaS). MaaS is a demand-responsive resolution for a user-oriented and tailor-made transport service that provides flexible and personalized mobility services to passengers. MaaS platform leverages dynamic car- and ride-sharing opportunities within an electrified (and possibly automated) fleet along with a dynamic faring policy to optimize network-wide travel costs. Specifically, the width of traffic lanes that is mainly driven by safety considerations may be narrowed and the design of intersections may be changed, both increasing the road capacity. In addition, AV may have almost perfect information and the ability to communicate with other AV to optimally spread themselves across the network, thereby increasing the road capacity further. Finally, with the rollout of autonomous vehicles, MaaS providers will be able to bring all modes of transport into a single mobility package and allow all people to subscribe (including those who do not hold a valid driving licence). This coupled with no parking worries will open a much bigger market for MaaS which will significantly change the ways people travel. Incorporating these changes into planning and optimization processes and tools will require a revision of different assumptions, and the development of new models to forecast travel demand and manage traffic across the network.

I can't wait to get my Ls! A Perspective on High School Travel

ITLS Think Piece #25-2017-February

By Stephen Greaves

Last week marked the end of the school holidays in Sydney and a resumption for many of frustrating levels of congestion as the 'school-run' resumed. Well over half of school children were driven, which is roughly double the levels when many of their parents would have been attending school, 25-30 years ago. How have we arrived at this situation and what can we do? High-school represents the start of a new adventure, part of which is associated with getting to/from the school, which in turn involves a number of considerations; the need to get there on time, constraints associated with after-school activities, travel costs, physical exercise, promotion of independence and social interaction on the journey to/from school etc. More altruistically, this represents one of the main opportunities to promote sustainable travel habits, which children can hopefully take forward into their adult lives before the temptation of car travel becomes too strong.

Such were the ideals we embraced as we planned with our son, how he would get to his new high school, some 5.2 km away within the inner west of Sydney, an area not devoid of public transport options. Using Google maps, we discovered he could get there by car in 12 minutes, bicycle in 21 minutes, public transport in 48 minutes and walking in 56 minutes. Given he had a heavily laden rucksack with expensive equipment and sports bag to carry, several steep hills and busy roads to navigate, we quickly ruled out walking or cycling. What about the public transport option, which involved getting him to a station, where a contracted school bus would do the rest? Day 1, we tried this option. Unfortunately, the bus turned up late to the station and he ended up being late for school, hardly a great start. What about coming home? On the way home, following last lesson sport, he was required to change back into school uniform, which subsequently meant he missed the 'strictly on time' bus. Net result - we had to pick him up. Day 2, we persisted assuring him these were 'teething issues'. Things went smoothly until the journey home, where the 'strictly on time' bus from the day before picked him up 20 minutes late, a common occurrence according to the 'regular' users. Day 3, we drove him to school and picked him up after installing an Uber app on his phone in case of emergencies.

What lessons can be taken from this? First, public transport is pretty decent if you live close to a train line and need to get to/from the city but it is inflexible, unreliable and quite constraining for anything outside this even for short distance travel. For school travel, there is the additional bonus that in most cases it is free or heavily subsidised in Australia. However, freedom of school choice, combined with changes in settlement patterns, has led to increasingly complex school travel and public transport has struggled to keep pace. Ironically, this is one area where the oft-criticised Americans have our number with dedicated school bus services that get into the neighbourhoods. Arguably, the catchments for (some) high schools are so vast, this may be impractical in some cases but certainly not all. Second, there is some disconnect between school perspectives on certain issues and promoting independent travel – for instance, the insistence on wearing an expensive school uniform to/from school is hardly compatible with riding a bicycle or walking to/from a train station in the searing heat. Third, why in this day and age of laptops and iPads do we send kids to school laden down with a back-breaking rucksack full of books that have been blamed among other things for increased visits to the physio? Fourth, we cannot overlook this is an impressionable age, when a lot of habits and attitudes form, which is exactly the time when we want to ensure we provide great public transport services or risk losing the next generation to the allure of the private car. It is possible, evidenced by Northern European

cities in particular, where the numbers of children being driven to school are around half those of Sydney.

As an epilogue to this we have figured out a compromise solution involving driving/light rail/walking, which gets our son there in 25 minutes. Building this sort of multi-modal flexibility into trip planning apps, could be a useful addition. Looking further into the future, perhaps this is a ready-made market for autonomous travel, although this could lead to more cars on the road if we're not careful. Oh and by the way, our son can't wait until he's 16, so he can get his Ls!

Autonomous cars: Placing them in context

ITLS Think Piece #31-2017-June

By David A. Hensher & John Stanley

The Roads Australia National Conference in Sydney (May 31, June 1, 2017) had a lot of presentations on autonomous cars (ACs); and despite some suggesting we should go directly to level 5 fully autonomous cars (in next few years), and with 5G communications we will then also solve safety and have no congestion on our roads, some of us question this²⁵. The total road capacity is not infinite - we may reduce congestion, but speeds may have to drop given volume-capacity ratios of our road infrastructure. This will depend on the extent to which the digital disruption revolution will reduce the number of cars on the road when the sharing economy is fully actioned, and/or increase car use because of the sheer simplicity of getting around.

To illustrate the challenge, being able to work in your vehicle may encourage people to live further from where they usually work, perhaps flooding the peri-urban areas of our major cities with new residences. This will mean consequential increases in trip lengths and travel volumes. Similarly, easy access to mobility for people who currently may be unable to drive or may lack access to a private vehicle, will increase their vehicle use. This is likely to be of significant benefit in terms of social inclusion but will add to pressure on road space.

A crucial issue is the challenge in moving to the sharing culture (to relinquish personal car ownership) which is far more of a challenge than having driverless cars. ACs in private hands could be a traffic nightmare and the techno people appear to be uninterested in this risk. So the AC is great technology, but we do not want our cities to become even more car centric, given ACs expected growing dominance. If the sharing culture can be sorted, then regardless of whether a car is driverless or not, it will hopefully be the seed to reduce the number of cars on the road (typically delivering 10 times the amount of trip kms per vehicle due to sharing and lower cost travel), while improving safety and social inclusion.

Sharing needs to develop in two ways – sharing a vehicle accessed through a pool but used by an individual and their family; and sharing with other passengers (often called pooling) who are not members of the family. The latter may take more time to evolve but will in time effectively turn the shared car into a form of public transport, with cars being redefined to be larger in carrying capacity (like mini buses) but offering very attractive cost savings to households through subscription to mobility packages.

Sharing packaged through a Mobility contract (under Mobility as a Service – MaaS or called by others as Transport as a service (TAAS)) will effectively become modally agnostic, enabling subscribers to select a package that satisfies their travel needs and which has sufficient flexibility built in to accommodate not only habitual travel but variety seeking and once off emergency needs. These mobility contracts should be priced to ensure that the benefits derived by using the publicly provided networks (roads etc.), and any costs imposed on wider society (e.g., congestion costs), are captured through internalised user charges, a component payable to government. This may be the way we can eventually get road pricing reform into the system, ‘hidden’ within the

²⁵ It is worth noting that much of regional and remote Australia is struggling with less than 3G.

subscription package price. Importantly once the cost of individual ownership is taken out of the equation there will be significant transport cost savings to households, often quoted as equivalent to a 10% increase in wages (linked to the fact that about 12% of annual expenditure is on owning a car).

'Uberisation' and the AC culture could result in serious patronage loss from conventional bus and rail (indeed evidence from the USA (reported by James Moore of Jacobs at Conference) suggests it is already happening with Uber, reducing bus patronage in a few cities by 5 to 15%), adding possibly to the subsidy woes of government. However, it may be in the future that, as we merge services into modal agnostic mobility packages, cost efficiency gains and meeting the needs of regular public transport users will result in significantly reduced costs of travelling, especially in the pooled context, such that the need for government subsidy will decline significantly. This is linked also to the likelihood that the boundaries between public and private transport will disappear for much of the PT task (mainly bus, but possibly not mass transit rail?). Many bus operators will need to become platform providers to survive.

The locations least likely to benefit from AC technology are low volume rural/regional settings. Even here, however, creative route/school bus providers have an incentive to change their business model to provide a wider range of service offerings, using newly available technologies. Some of the best Australian bus operators are already thinking along these lines.

Finally we need to be reminded that it is the city and regions, as complex networks in which we live, which really matters. We need to start with an understanding of what kinds of cities and regions we want in coming years, for people to live a good life. Then there is much to do to ensure we position electric-sourced ACs and mobility or transport as a service initiatives to support this vision and add value to the performance of our cities, not just functioning as a profit centre for investors in ACs. But it may be that if ACs are managed well they will become the catalyst to achieve this.

When is car sharing value for money: the car centric traveller?

ITLS Think Piece #39-2017-November

By David A. Hensher

There may be many car owners where the economics of sharing does not stack up until we have shared autonomous vehicles that have significantly lower user costs (i.e., no driver wages for example). All the while we have a driver in a shared car, the economics are not very attractive for regular car (centric) users. This is the dominant travel mode in most cities in Australia, and hence I anticipate that the exercise below reflects a circumstance of many current car owners and users.

Suppose I have bought a car for cash for \$60,000 (which is a price for a quality car), and let me assume I keep it for 10 years and simplify the annual capital cost (depreciation) as \$6,000, maintenance costs of \$1,000 and parking costs of \$300, and the car has a residual value of \$5,000 after 10 years, which is reasonable.

The annual registration, insurance, maintenance, parking and fuel/toll bill is around \$5,000 per annum, giving a total outlay of \$11,000 per annum. There is also foregone interest by not investing elsewhere; however the shared vehicle user cost also has an opportunity cost, so I can assume that it is reasonably financially neutral.

I now sell my Car (assume I only own one car) and enter the shared society and use Uber. Assume I used to drive my car to work 5 days a week and use the car on weekends, and that I intend to continue using a car based model for these same trips.

If I use Uber for the same trips, then assuming each Uber trip is \$20 (which is a basic charge and likely to be greater for some trips, even under a driverless scenario); the weekly cost is around \$250 or the annual cost is \$13,000, \$2,000 greater than the ownership model. If we assume that Uber is used on average 5 days a week (which may be a mix of weekday and weekend), then the annual cost is \$9,285 which is less than the ownership cost of \$11,000. Clearly the comparison depends on the number of trips to be made under sharing and whether this might be less than under the private car ownership model.

Regardless of the specific evidence, this simple exercise is a stark reminder that a sharing model may not be financially attractive to some (indeed many) car centric users. When we consider a view that for many, car ownership is not about cost, this adds another layer of issues to think through in the shared car society.

Hmm - what is the sharing deal? Not currently very attractive!

Some other points worth making are:

1. Even if we assume this possibility, and note the \$2,000 difference for the 7 day activity, this is equivalent to 100 Uber trips switching to PT if that is desirable.
2. If a car owner was to take full advantage of the car share systems existing and proposed, they could rent out their own car (if they continue to own it) when they are not using it, and further recoup some of the costs of owning a car. The private car may then become nothing more than a rentable asset. (This hardly helps traffic congestion!)

3. Most people we suspect believe that it is less expensive to own a car than to take Uber. This is the issue of perceived costs associated with usage. Hence, for who would it be a good idea to actually sell their car and take Uber instead? Most people forget to include all the ownership costs in this consideration, since they see a high Uber fee, while not considering the hidden costs of owning a car, which have been included in the exercise above.
4. This is only one market segment, but with dominant interest in the car it seems a very important segment to focus on.
5. The assumption of owning one car might be different to owning 2 cars and the second car may have a different treatment, especially where someone has trips in between car 1 or where households allocate the car according to need and any surplus need is satisfied by Uber.
6. Not included are some future possibilities such as selling or renting the garage at a private residence. Selling garages is quite common in London. One in central London recently sold for over \$1,000,000: <http://www.dailymail.co.uk/news/article-4048546/Garages-goldmines-London-2016-s-expensive-lock-goes-670-000-nearly-TRIPLE-average-UK-house-price.html>.
7. One questions whether a household might the sell garage at home (worth on average \$70,000 in Sydney); however when deciding on a future house purchase, they may avoid having a garage, or may include one but rent it out just like a sublet (like Airbnb but airG)? This may impact, however, the future design and scale of residential dwellings and lead to reduced purchase (and rental) prices.

Food for thought.

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Eradicating road accidents: A driverless future?

ITLS Think Piece #40-2018-February

By Stephen Greaves

In 2017, 1225 people needlessly lost their lives on Australia's roads with the holiday period in particular tarnished by several high-profile tragic accidents marking a six-year spike in fatalities in New South Wales. While formal investigations continue to uncover the causes and propose solutions, around 90% of these accidents involved human error in some shape or form. Whether this error results from having a bit too much to drink, disobeying speed and other road rules or being distracted by the kids in the back of the car, is neither here or there: surely this is too high a price to pay for simply being human? Fast forward 20+ years to a future where human driving on public roads is a distant memory. Fleets of interconnected emissions-free driverless vehicles summoned by an app, provide a service that safely chauffeurs workers to the office, kids to school, and families to the beach leaving occupants free to catch up on work, their favourite movie or sleep. Groceries and the latest 'must-have' consumer products are delivered by drones, driverless trains and trucks, while the B-doubles of 2018 are dinosaurs from a by-gone age. The Australian road toll is a fraction of what it was in the 2010s, with the occasional high-profile accident due to a system glitch, an unforeseen act of nature and the ever-present threat of sabotage. Driving pleasure now has to be satiated in private tracks or U.S. styled 'driving ranches' that have sprung up as a profitable business in Australia's vast open spaces.

Much has been debated about the driverless future and what we should be doing to prepare: When is it coming and in what form? Will we embrace it for ourselves and our loved ones? Will vehicle ownership and usage change? Will congestion get better or worse? Will it free up space in our cities? What are the implications for public transport, cycling and walking? While these issues will continue to ignite different views and opinions, it is important they do not distract the primary argument for driverless vehicles, which is safety. On-road trials in mixed traffic in the U.S., suggest around a nine-fold reduction in collisions where the driverless vehicle was at fault with the majority of collisions caused by human-operated vehicles. Australia has yet to embrace on-road trials, but most states are conducting controlled trials, which to date have no major safety violations to report. Sceptics are eager to point out the potential for machine failures and hacking, but the fact is driverless vehicles do not drink and drive, do not drive tired, get distracted, or use drugs, and do not speed or break laws.

So what is holding things back? First, the safety benefits of driverless vehicles are unlikely to be realised in mixed traffic, suggesting we need major infrastructure changes to accompany changes in the vehicle technology itself, which is still admittedly far from perfect. Second, recent evidence suggests that while public opinions on driverless vehicles are moderating, over 90% would not feel safe in a driverless vehicle that did not have the potential for manual override, suggesting we are not close to being willing to relinquish control of the driving task to a robot. Compounding this is recent evidence from Sydney and Perth that suggests 60% of people are unsure about whether driverless vehicles will make our roads safer with 22% actually thinking they will make the situation worse. Third, while we now tolerate a significant amount of human error on the roads, we are unlikely to be so accepting if a robot is deemed to be 'at fault'. Fourth, there is substantial inertia in our transport systems – Australia has one of the oldest vehicle fleets in the developed world and many fall short of current ANCAP safety standards. Consider also that various technological advancements have been made to improve safety (e.g., rear and 360 degree cameras, intelligent speed adaptation), yet integration of even the most basic technologies into the general vehicle fleet has been painfully slow. Finally, and likely to raise the hackles of some, while Australia is among the world leaders in road safety, we still by-and-

large adopt the view that road accidents involving human error are somewhat inevitable and the policy focus is on their reduction as opposed to eradication. Perhaps we should take a leaf from Sweden who have a vision of zero accidents and make this a catalyst that drives our autonomous future.

Adelaide can lead the field with the right transport technology

ITLS Think Piece #43-2018-March

By David Brown

Introduction

Adelaide has the chance to be a world leader with autonomous vehicles, but probably not in the area that is currently getting the most publicity.

Many Governments are embracing the “jobs and growth” opportunities of encouraging technological development in their jurisdictions.

But in the area of transport, a lot of attention has been given to individual cars serving personal needs or small pod-like buses at airports and university campuses. South Australia should continue to pursue this trend but it is unlikely to get ahead of the field. The more pressing need and a greater opportunity is mass public transit systems.

Adelaide recently hosted the second Australian & New Zealand Driverless Vehicle Initiative ([ADVI](#)) forum. This conference lacked some of the dynamic excitement of the first forum held two years ago because it dealt, in more detail, with the necessary but rather dry subjects of legal liability, insurance issues and guidelines for conducting autonomous tests on public streets.

The focus was clearly on “cars” including a presentation about 3-D printing of individual vehicle body types (which is a technology that could see Australia “build” cars again). The state minister for transport Stephen Mullighan’s reflected the “cars” approach in his closing speech. In fairness to the Minister he did enthusiastically agree, in a personal conversation afterwards, to the need to embrace transit corridors as an essential opportunity for autonomous vehicles and for the benefit of the community.

The critical issue is not just cashing-in on the most marketable aspect of new technology. Rather it is how to develop a future strategy that is the most cost-effective way to offer travel options to as many people as possible. Autonomous vehicle technology indicates that a strong emphasis should be placed on non-railed, mass transit systems.

Adelaide is very well suited to embrace this opportunity.

Firstly, they see the need. In June 2017 the South Australian government released an update of its 30-year plan for Adelaide. The plan looks at recent major changes to the city and maps out a strategy to make it “more livable, competitive and sustainable into the future”. Number one of the fifteen priority policies and actions is “Transit corridors, growth and activity centres”. Number 8 is for transport in general.

Secondly, they have been pioneering with the implementation of the O-Bahn guided bus way. Adelaide’s O-Bahn was introduced in 1986 to service the city’s rapidly expanding north-eastern suburbs, replacing an earlier plan for a light rail extension. Autonomous technology makes this style of transport even more enticing.

And thirdly they, like most cities, are looking to actively expand their transit network although there is still a lot of work going on with light rail options.

Focus on cars

It is important to see why automating every aspect of a trip and a focus on relatively low capacity vehicles is a limited approach.

The recent flurry of autonomous concepts has led to fantasies of motoring utopia with door-to-door transport for all your needs.

While working in the back seat as your car drives itself and sharing vehicles are positive options for some, they are not a total solution for all.

The reality is that we do not have the capacity to accommodate all our trips with a “chauffeured” vehicle no matter how comfortable it is..

Further the inconvenience of a long, time consuming trip is not totally ameliorated by the possibility of being able to work while you are on the move. Not all work and not all people are suited to sitting reading and/or writing especially in a moving vehicle.

Sharing vehicles seems a way of increasing capacity but it may mean that you wander around to pick up passengers which adds considerably to the pain of the trip as anyone who has used an “airport taxi” will attest.

Why non-rail systems

There are strong beliefs, passions and perhaps even some blind faith in the ability and value of railed systems.

But autonomous vehicle technology is fast allowing non-railed systems to catch up.

Trains and light rail can link carriages together to form a “set” and increase carrying capacity. Autonomous technology will be able to do this electronically rather than the more cumbersome physical coupling.

Railed systems have a clear and permanent presence that indicates that there is an available service. Autonomous systems can have defined corridors, stations, signposting and electronic indicator boards that we also give similar impression.

Railed systems have the biggest impact on nearby land values at the moment. But there is an equity issue. Because railed systems are limited in their coverage they provide benefits in selected areas. A more ubiquitous autonomous system will give value growth to many more areas. The issue is not how much a few individual property values are increased but what is the overall benefit to the community.

There appears to be no doubt that we need extensive transit systems, but if the product is expensive to build, then the first stages are often built with much fanfare but the next stages are not often reached (See a short video piece from the AITPM “[Has Light Rail past its use by date?](#)”).

It is important that any part of the system fits in with the whole network. With the removal of the expensive cost of a driver, a more expansive bus network through local areas providing feeder services, could revolutionise transport in our communities.

Conclusion

South Australia has strived to be innovative in many areas. It can now take a very clear position with autonomous vehicle technology that fits into a sustainable strategy for the future, by developing expansive transit systems including high capacity corridors based around autonomous technology.

- Can Australia have a prominent role in autonomous vehicle development? Y/N
- Should we concentrate on a specific area or try and cover most of the bases for autonomous vehicles development? Y/N
- Can a road based autonomous mass transit system ever compete with light rail? Y/N

The final race for WestConnex

ITLS Think Piece #47-2018-April

By Martin Locke

Recent press reports have indicated that the shortlisted bidders for the 51% equity stake in Sydney Motorway Corporation ("SMC") being sold by the NSW Government, are now in the process of preparing final binding bids scheduled for the second half of July.

There is no doubt that this will be a fiercely competitive process as the likes of Transurban, IFM, Plenary, Cintra, CIMIC, fight it out under the watchful scrutiny of Goldman Sachs. And I can predict that the forthcoming press release will claim a great outcome for NSW. But it will not that easy to assess value for money beyond the quantum of the initial payment.

The initial strategy behind WestConnex was that after the failure of numerous tollroads, such as Lane Cove Tunnel and Cross City Tunnel, Government needed to step in and intervene and take away the uncertainty of traffic risk. So the logic was that Government should build the tollroad, impose the toll and allow the traffic to ramp up and stabilize, and then sell the equity as brownfield operational infrastructure. The benefit of WestConnex was that delivery of the project could be staged, with the first two stages, M4 Widening and Extension and M5 Duplication, having the potential to be sold with capital being recycled to help fund the more difficult third stage, M4/M5 Link. This approach could try and match the availability of private finance to acceptance of traffic risk.

However, the Government is now proceeding to sell 51% in the entire project through SMC, even though most of WestConnex remains under construction apart from the M4 Widening. According to leaked traffic reports obtained by the Sydney Morning Herald, patronage on the widened M4 is performing well, so early signs are positive, but it is not unreasonable to expect the prospective investors to be cautious in assessing the forecasts for the sections of road still under construction. This caution might manifest itself in two ways.

Firstly, investors might apply a healthy discount on forecast traffic. Citi suggested a discount of 10% might be reasonable in a research report. By contrast in the bidding frenzy on the last suite of transactions brought to market pre-GFC, traffic forecasting was massively overly optimistic. Lane Cove Tunnel experienced only 40,000 cars a day compared to the forecast 100,000, implying a discount of 60% in hindsight would have been wise.

Secondly, investors might seek a higher equity return reflecting the uncertainty of traffic risk. Recent indications from Europe indicate that investors require a premium in the order of 200 to 300 basis points depending upon the assessment of this risk. And Citi in its research report assessed 15.1% as being an appropriate equity cost of capital for WestConnex reflecting the mix of greenfield and brownfield assets.

In order to enhance the attractiveness of SMC and encourage a competitive auction process, certain commercial features have been included:

- **Concession Term extends to 2060.** This permits SMC to collect tolls for over 40 years. By contrast the Concession Term on Lane Cove Tunnel was for 30 years. The logic for extending the concession term is based on providing a longer time period for the investors to collect tolls and amortise capital. However, given the high discount rates applied by private financiers related to uncertainty and time line, the net present value

of the incremental revenues could be regarded as marginal. The present value of \$1 collected in 25 years time is only 3 cents based on a 15% discount rate.

- **Tolls escalate at the greater of 4% or CPI for the first 20 years reverting to CPI thereafter.** This provision has been included in some but not all of the past concession contracts. For example, it was not included under Lane Cove Tunnel but was included under Cross City Tunnel with a 4% floor and NorthConnex, albeit at a much lower floor of 1%. In the current low inflation environment, the 4% ratchet becomes effective, negatively impacting the affordability of tolls by entrenching real price escalation. Government has alleviated this pressure by allowing frequent toll payers to claim an offset against motor vehicle registration but this imports an ongoing future financial cost to Government, whilst providing a free kicker to SMC.
- **SMC is required to share upside revenues when a 130% threshold above the base case is achieved.** In the case of M7 the upside sharing hurdle was fixed at 105%. This means that in the event that a higher level of toll revenue is earned in excess of 105% of the initial base case forecast, then the Government shares in the upside in accordance with an increasing scale. Between 105-110%, Government receives a revenue share of 10%, progressively increasing to 30% for revenues above 130%. By contrast SMC retains 130% of upside for its investors before being required to share with Government, according to leaked documents obtained by the Sydney Morning Herald; Government stands to realize little benefit. This begs the question why Government felt it necessary to raise the sharing threshold to 130% for SMC, compared to other precedents.

Government and its advisers will be mindful of giving away too much potential return and upside to the SMC investors and will be exploring options to obtain the right balance. One possible strategy is for the private sector to provide additional payments to Government beyond the upfront equity purchase payment, linked to future actual outcomes. Another approach might be to agree a mechanism for a future reset of the base case financial model based on actual traffic outcomes to that point. Some adjudication of appropriate rates of return for the changing risk profile of SMC might be warranted implying a need for incorporating flexible future regulation rather than trying to fix all conditions up front in a 40-year contract.

Government is intending to retain a 49% stake, which provides scope for retention of value uplift, as the risk profile of WestConnex is gradually mitigated with the completion of construction and the ramp up of traffic. However, Government will need to grapple with the conflicting interests of, on the one hand, maximizing profit from its investment in SMC and, on the other hand, safeguarding the affordability of tolls. This raises the question as to what future corporate governance rules will apply to SMC, such as how Government can be provided with adequate voting rights, notwithstanding potential misalignment of shareholders' interests. In addition, investors may look to Government to provide a shield for some of the construction risks not passed onto contractors such as on M4/M5 Link. It is inviting unreasonable risk premiums to be proposed by prospective SMC investors, if they are required to take cost risk on roads being built by third parties outside their control. What type of protection might Government be willing to offer?

And the Federal Government has an interest as provider of the \$2bn concessional loan. The concessional loan has been provided on highly attractive off-market terms including subordination, low interest rate, extended interest capitalization and long loan maturity. Prospective SMC investors would like the Federal Government to continue to provide long-term cheap patient capital, but the Federal Government may be looking itself for earlier opportunities to recycle its capital, and be less comfortable in providing deeply subordinated debt to an SMC entity controlled by the private sector.

The level of the implied return bid by prospective SMC investors is a better indication of value, as the price paid is a function of forecast projected net cashflow and the investor yield. Whether this provides a premium over the equity capital invested to date by Government, will grab the headlines. But assessment of value also needs to consider the tollroad assets made available to SMC, which have been delivered by other parties at no cost to SMC. The old M4 and M5 tunnel

are part of that inheritance, contributing significantly to SMC revenue. And the reversion of the current M5 South West Concession in 2026, represents another valuable asset transferring into the SMC pool.

Finally, one of the unfortunate consequences of selling off SMC with entrenched Concession Contracts extending to 2060 is the prospect of needing to deal with change and renegotiate with SMC in the future. It is not unreasonable to assume that at some stage there will be a need to alter the tolling regime. For example, there may be a requirement to introduce time of day tolling, other forms of congestion pricing or amend the rego rebate currently proposed to improve the affordability of tolls. The standard approach in these contracts is for investors to be kept financially harmless and to be provided with the same return originally forecast. This opens up possible claims for compensation and preservation of the status quo. Cashback on the current M5 South West has many critics but lives on. The ultimate protection is an early termination of the Concession Contract but at the cost of fair market value reflecting private financiers' original return requirements. A better approach might be to build on the earlier reference to the potential updating of the base case financial model and the use of a regulated return in these circumstances.

In summary, the competitive auction process will force up the sale price of SMC equity, but inevitably the risk/return equation will reflect market reality. The other side of the coin is that investors are taking on risk and face potential gains or losses depending upon the outcome of construction and ramp up risks. As an illustration, if the assumed equity return for investing in a brownfield operational tollroad is say, 9%, investors may add 250 basis points for construction risk and 250 basis points for traffic risk, resulting in a required return of 14%. Simplistically, if prospective SMC investors subscribe \$1bn at a required return of 14%, and WestConnex construction and ramp up risks are successfully resolved in accordance with the assumptions in the financial model, then the investors may look to sell the SMC equity at a 9% return and reap a capital gain of \$555m. This is the reward for taking the risk. Now assume that in the land of optimism SMC traffic beats the base case forecast and reaches, but does not exceed, that 30% upside sharing hurdle. The 30% uplift in revenue might simplistically translate to 60% earnings uplift, assuming SMC is 50:50 geared. This could result in the original SMC investors' \$1bn equity now being worth \$2.5bn. SMC should not be perceived as a potential gold mine but investors need to have the prospect of reward for taking on significant risk.

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Guess What – I actually like driving my car!

ITLS Think Piece #49-2018-July

By David A. Hensher

The interest in autonomous cars in both the popular, industry and academic literatures is becoming overwhelming. There is a sense that this future is totally desirable and we cannot wait to see all cars (as well as buses and trucks) sold without a steering wheel and operated by a computer using rules derived from machine learning and artificial intelligence. Despite the many advantages primarily linked to safety gains as a result of taking total control away from the driver, and the less clear prospect of significantly reduced traffic congestion on our roads (or at least much more predictable travel time variability), one has to ask the question – what if we actually like driving our car?

Might we consider a future where there is a sense of respect for drivers who do not cause accidents, and to focus on finding ways to utilise in-vehicle technology and any remote computerised monitoring to control a vehicle (much like we can already do with aircraft and trains) so as to mitigate the consequences of actions by those on the road who are a danger to themselves and society? It seems to me that we have this capability already and/or could easily integrate it into the advanced technology of cars and trucks that are already on the roads of today.

Specifically, car manufacturers should (and are able to) build in compulsory standard technology to detect who is in car (especially children) and the number of such people, the presence of alcohol or other drug smells associated with anyone sitting in the driver's seat, and to deny starting of the engine. Drivers on P-plates already provide data to the motor registry of their age and the obligations they have in respect of drink driving (zero reading) and number of passengers they can carry by age, and it seems very possible to have this embedded in the programming of the start-up of a vehicle with the salient reminder of obligations and compliance with the law as well as a check undertaken to establish if the engine start of the car will be allowed to occur.

If we were to see such technological initiatives, then one might question why we must move to level 4 or 5 (see below) in the autonomous vehicle classification spectrum with total removal of a driver's role in steering a vehicle. This might open up choices for those who still wish to drive their car and act responsibly on the road without fear of being involved in an accident caused by others.

Autonomous Vehicle Status levels:

Level 4: This is what is meant by "fully autonomous." Level 4 vehicles are "designed to perform all safety-critical driving functions and monitor roadway conditions for an entire trip." This is limited to the "operational design domain (ODD)" of the vehicle—meaning it does not cover every driving scenario.

Level 5: Refers to a fully-autonomous system that expects the vehicle's performance to equal that of a human driver, in every driving scenario—including extreme environments like dirt roads that are unlikely to be navigated by driverless vehicles in the near future.

Traffic safety in developing countries: Is colonialism still to blame?

ITLS Think Piece #50-2018-August

By Nina Verzosa

Economic structuralism has often been used to explain the stunted growth of less developed countries (LDCs), particularly in Africa, Latin America, and Asia. Some structuralists employ the core-periphery theory to support claims that the current woes of developing countries, which are considered as part of the periphery, are determined by their previous (colonisation) and current (globalisation) relationship with the core. I will use this theory in this think piece to ponder on three aspects where vestiges of colonialism may have impacted traffic safety in rapidly globalising LDCs.

1. Institutions

A study by Acemoglu, et al. (2001) found that institutions formed by colonizers persist. The study divides the types of colonialism into two categories: exploitative and settler colonies. The study argues that exploitative colonialism mostly practiced by Spanish and Portuguese conquistadors, did not produce good institutions, unlike in settler colonies where a capitalist structure, justice system, and property rights were established. How is this historical occurrence correlated to traffic safety today?

Developed countries that experienced settler colonialism such as Australia and the United States have lower fatality rates per 100,000 persons as compared to LDCs who have undergone exploitative colonialism. The latter has recorded high road fatalities, with some LDCs having more than 25 deaths per 100,000 persons (World Health Organisation [WHO], 2013). Of course, there are endogenous factors that contribute to traffic safety in LDCs. Nevertheless, it could be argued that institutions established during the period of colonisation primarily have a path-dependent effect on the development of facilities which has traffic safety implications.

For instance, the Laws of the Indies, which was instituted by King Phillip II of Spain, mandated that all colonies of Spain should follow a uniform guide in the construction of infrastructure and political administration. One of the requirements of this law was that cities in all colonies should follow a gridiron street pattern around a plaza. Hence, some of the cities in the former colonies of Spain, particularly the capital cities, such as Lima (Peru), Manila (Philippines) and Mexico City (Mexico), follow a gridiron street network. The gridiron street network may be conducive to non-motorise activities as streets are well-connected, allowing pedestrians to use different routes to reach their destination directly at the shortest possible time. However, with the sharp increase in motorisation in LDCs but scarce resource towards traffic improvements, the gridiron street network is less adept to intermodal overcapacity and can be more susceptible to road crashes between motorise and non-motorise users. A study by Rifaat et al. (2011) found that compared to gridiron street pattern, the likelihood of a road crash occurring in locations with a warped parallel, loops and lollipops, and mix shapes road patterns is lower. With non-motorise transport and public transit still being the dominant modes of transportation in LDCs coupled with the motorisation, pedestrians and bicyclist remain to be at risk in this inherited street pattern. Since street networks are difficult to dismantle, former colonies with a traditional gridiron street pattern are left to deal with its safety consequences on their own.

2. Investment allocation

Government activities during the colonial period are still reflected in the current practices of governments in LDCs. A study by Huillery (2009) examined French investments in health, infrastructure, and education during the colonization period in West Africa and found that most of the investments were directed to the same geographical recipients since the colonization period. One reason for the occurrence of such phenomena is that the areas where most investments were placed during the colonial period have the advantage of attracting more residents early on, and most of these early residents have capitalized on the opportunities during the colonial period (i.e. existing educational establishments). A consequence of which is the formation of local elites. Throughout the years, these areas have accumulated human, financial, and manufacturing capital that takes advantage of the economies of scale, reducing the marginal cost of building additional infrastructure and facilities. Such practice drains off some of the investments that could have been distributed to other areas of the country. This includes resources allocated for improving traffic safety. Case in point, the region with the highest number of road crash-related deaths in the Philippines is Region V or the Bicol Region (Department of Public Works and Highways, 2011). Yet, most of the transport investments and traffic safety initiatives are centred in the regional capital, Metro Manila, which not coincidentally was the capital of the Spanish East Indies during the colonial period.

3. Enforcement

A highly efficient traffic enforcement mechanism is the key to implementing successful policies. Unfortunately, LDCs continue to struggle with this as exemplified by the pervasiveness of corruption, which has colonial roots. In particular, the “encomienda” system established during the Spanish Colonial period have paved the way to the formation of local elites who continued the practice of demanding labour and fees from natives long after the system was abolished (Acemoglu and Robinson, 2012). Such practice perpetuates in traffic enforcement today. According to the traffic safety enforcement score calculated by the WHO (2015), most developed countries in the Asia Pacific recorded a high score (above 7) in enforcing the national speed limit, motorcycle helmet laws, and seatbelt laws. On the other hands, LDCs that have undergone exploitative colonialism received a low score that ranges from 1 to 5.

These three issues tied to LDCs colonial past require a heterogeneous response. That is, traffic safety policies in LDCs should be uniquely based in their existing capacity and road user needs rather than caving into external pressures for a “globalised policy”. Globalisation in a way is a new form of colonialism by which the current and future policies of periphery countries are dictated by the actions and policies of the core countries or of the international community. The pressure to compete globally also forces LDCs to adopt transport policies that are perceived to allow them to swiftly develop economically without considering its long-term consequences to the low-income population. Kaltheier (2002) argues that LDCs’ focus on Western-led motorise transport policies which push for road expansion projects and motorise transport improvements to boost economic growth has further worsened the safety of non-motorise road users in LDCs. The intention here is not to deny the big role that core countries and the international community play in supporting LDCs but rather a call for them to optimise aid and support by understanding traffic safety issues from the ground up with recognition of the LDCs’ colonial past rather than through a blanket prescription. Keeping in mind that transport policies that worked in developed countries will not necessarily translate to a success in LDCs.

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Are we doomed to repeat history with automated vehicles?

ITLS Think Piece #51-2018-August

By Tony Arnold

Automated Vehicles (AVs), otherwise known as Driverless Cars, are likely to arrive in the next decade, bringing with them a raft of changes to the way we move around cities. Some pundits predict that, because AVs will be programmed to protect humans, people will deliberately walk and cycle in front of cars, exercising their dominion over these new, subservient vehicles. If so, automobile travel would be hampered, potentially allowing walking and cycling to reclaim the public space gradually lost to the motor vehicle over the past century.

While this vision (a utopia to some and a nightmare to others) sounds plausible, there is little evidence in the history of the motor vehicle to suggest that AVs will make cities more friendly for walking and cycling (although perhaps not so many will die). In fact, the introduction of AVs may simply repeat the history of the motor vehicle, with public space once again cleared to make way for people travelling in cars at the expense of people who are walking and cycling.

Studies have anticipated that AVs will be able to make better use of road networks than human-driven vehicles by travelling closer together, by making more efficient route choices and by communicating with each other²⁶. This may suggest that traffic congestion will disappear, however, studies have also found that the number of vehicle kms travelled is likely to increase significantly²⁷, suggesting that we may just end up with roads that are even more saturated with motor vehicles.

Traffic simulations predict that AVs will interleave seamlessly at intersections without the need to stop for traffic lights, however these simulations conveniently ignore the rights of people to walk and cycle in this mechanised future. Technology companies (always keen to find a technology solution to a problem) have proposed that people will use mobile apps that operate as beacons to alert AVs of our presence. This approach sounds futuristic and exciting; however, it creates a world where everything that moves, including children, dogs and native wildlife, will need to emit a beacon to ensure their safety.

For insight into the likely impact of AVs on walking and cycling, it may be instructive to examine the first pedestrian fatality involving an AV which occurred in March 2018. The **preliminary report from the NTSB** found that, despite the pedestrian being detected around 6 seconds before the crash, the vehicle did not take any steps to avoid the collision. **Some reports** have suggested that the software had been “tuned” to be less sensitive to objects on the road so that ride quality was better for passengers. This prioritisation of occupant comfort over the safety of people who are walking and cycling is a concerning development, but is unsurprising.

While Uber’s automated vehicles currently utilise a human operator to monitor performance and intervene if necessary, the system was not designed to alert the operator when intervention may

²⁶ Fagnant D, Kockelman K (2015), *Preparing a nation for autonomous vehicles: opportunities, barriers and policy recommendations*.

²⁷ Truong LT, De Gruyter C, Currie G, Delbosc A (2017), *Estimating the trip generation impacts of autonomous vehicles on car travel in Victoria, Australia*.

be required. The assumption that a vehicle operator (who is mostly passive) can be relied upon to intervene when necessary has always been questionable, given the likelihood for distraction. In this case, it has turned out to be fatal, with reports indicating that the Uber operator was watching TV before the crash.

If roads are dominated by computer-controlled vehicles, then the only type of transport that will be controlled by humans will be walking and cycling. It is therefore likely that road safety messaging and Police enforcement will focus more heavily on walking and cycling as they struggle to remain relevant in an automated world. Given that the choice to cycle in Australia and the US has already been cast as a brave and somewhat foolhardy endeavour, an increased focus on the dangers of walking and cycling by safety agencies is likely to further marginalise these healthy forms of transport.

We have two paths ahead. Down one path, we cede more public space to the automobile and fence off roadways to prevent pedestrians from ruining the highly-efficient streams of automated vehicles (an approach somewhat akin to the introduction of jaywalking laws 100 years ago). Down the other path, we reprioritise public space to favour walking and cycling, thereby improving the liveability of our cities and the health of its inhabitants.

The choice is up to us.

Poll Questions

1. Should automated vehicles be programmed to be more cautious than a human driver, even if this means a reduction in motor vehicle traffic flows?
2. Should roads be designed to give greater priority to walking and cycling, even if this means a reduction in motor vehicle traffic flows?

Does slower driving make us go faster?

ITLS Think Piece #53-2018-September

By Michiel Bliemer & Mark Raadsen

Many drivers use motorways (toll or untoll) in order to have a fast trip without traffic lights. Often these motorways are congested with slow moving traffic. There exist however traffic management measures that try to prevent traffic flows on motorways from breaking down (avoiding congestion as a result). However, these measures typically reduce vehicle speed and begs the question: are we in fact faster by driving slower?

As an example, consider ramp metering. Ramp metering is a widely used traffic management measure in which access to the motorway is actively restricted to prevent congestion. The idea being that if too many vehicles enter a motorway simultaneously this leads to traffic breakdown, simply because the merging of these new vehicles with motorway traffic causes friction in the form of lane changes and sudden braking. Consequently, all vehicles on the motorway suffer congestion delays if this friction becomes too severe. Ramp meters are traffic lights near the on-ramp of the motorway that let only one or two vehicles access the motorway at the time. Detectors on the motorway continuously count the number of vehicles and are used to optimise traffic flow by dynamically adjusting the ramp meters. By letting some vehicles wait in a queue at the on-ramp, all traffic on the motorway is kept in free-flow as shown in this [animation](#), which – in the end - benefits all drivers, even the ones that are temporarily forced to wait.

However, even with ramp metering in place there still exists the possibility of traffic breaking down on motorways. If the motorway is near capacity (i.e., when counting around 35 passing vehicles per minute per lane) then vehicles drive at high speeds with only small distances between them, making traffic flow very unstable. A driver that suddenly forcefully brakes for a slower vehicle in front (possibly merging from another lane) can set off a cascading effect called a wave in which following vehicles also have to brake, resulting in traffic flow break down. Many people will have experienced such stop-and-go waves with so-called phantom jams in which there is suddenly congestion for no apparent reason. These phantom jams were already described in 1972 by Professor Wilhelm Leutzbach from the University of Karlsruhe, and a nice [video](#) demonstrates these phantom jams.

Professor Katsuhiro Nishinari from the University of Tokyo has suggested that drivers on a motorway [keep a constant and sufficiently large distance to the lead vehicle](#) when driving in order to prevent traffic flow breakdowns. The idea behind this advice is that it creates buffer space in order to prevent sudden braking from cascading. While keeping more distance will indeed help in reducing phantom jams, it unfortunately also decreases throughput. For example, keeping a headway of 40 meters or more when driving 60 km/h, as suggested by Professor Nishinari, results in a throughput of only less than 22 vehicles per minute per lane, much lower than the road capacity of 35 vehicles per minute per lane. While this will keep traffic on the motorway flowing, it means that less vehicles can be admitted to the motorway by the ramp meters. This will result in long queues on on-ramps that will likely spillback onto other intersections and cause problems on urban roads. In other words, increased traffic flow stability can lead to decreased traffic flow efficiency.

Improvements in both traffic flow efficiency and stability can be achieved by reducing the maximum speed on motorways during peak periods to 80 or 90 km/h. At this speed, traffic flow is maximum at 35 vehicles per minute per lane while it will also decrease speed differences between vehicles. This creates more homogeneous traffic flow in which sudden braking by drivers is significantly reduced.

Further, reduced speed limits also reduce speed differences between lanes such that drivers have less incentive to change lanes, which again increases traffic flow stability. Daganzo's behavioural theory of multi-lane traffic flow distinguishes two types of drivers, namely *slugs* that prefer to be in the slower lane(s), and *rabbits* that prefer to be in the faster lane(s). Because of differences in preferred driving speed, some lanes are not used efficiently (except when there is an optimal mix of slugs and rabbits). Reducing the speed limit forces rabbits to adopt the same speed as the slugs, removing the urge to overtake and resulting in traffic flow being spread more evenly across lanes. The end result of this measure is an increased efficiency of the motorway as a whole. In another think piece the same theory was used to argue that forcing everyone to stand (not walk) on an escalator can improve throughput and reduce delays.

To summarise, we can all be faster by slowing down during peak periods. This counterintuitive result stems from the fact that motorway capacity is used most efficiently when traffic flows and speeds do not vary much over time, which can be achieved through ramp metering and reducing speed limits. Given that traffic flow is composed of individual drivers, it is the duty of each driver to ensure that they cause minimal disruption to traffic flow, since small disruptions can have large consequences for everyone.

Poll question

Should we impose maximum speed limits of 80 km/h on all motorways during rush hours?

How green are electric vehicles?

ITLS Think Piece #58-2019-April

By Jiayu Wang

More and more people are into electric vehicles, reported by the Federal Chamber of Automobile Industries. Over the past five years, the number of sales of electric vehicles has increased slowly but steadily as Australian consumers perceive electric cars to be greener and more environmentally friendly than cars fuelled by petrol, diesel or other traditional fuels.

It is true that electric vehicles have zero emissions on-road, whereas conventionally fuelled cars emit carbon dioxide when fuel is combusted in their combustion engine. For example, a car with a fuel economy of 10L/100 km requires 10 litres of petrol to travel 100 km, which will emit around 23kg of carbon dioxide, as combustion per litre of petrol emits about 2.3 kg of carbon dioxide.

Although electric vehicles have zero tailpipe CO₂ emissions, the electricity they use to power the vehicle must be generated somewhere, and this will cause CO₂ emissions. The Green Car Guide gives data on fuel lifecycle emissions for all types of vehicles, and measures emissions from both production and combustion of fuel. Not only does fuel lifecycle emissions take into account the direct tailpipe emissions, it also considers emissions from fuel extraction, refining and transportation. Therefore, this approach more accurately estimates the environmental impact of a car, giving a fairer, more consistent comparison across vehicle types.

From a fuel lifecycle emissions perspective, an electric vehicle may not be the greenest choice. A conventional small car, say Toyota Corolla (2L 4cyl Petrol 91RON, 1 Spd CVT, 4-door 5-seat Hatch, 2WD, Released: 2018), has a fuel lifecycle emission of 163 g/km CO₂, whereas a small electric car, say BNM i3 (BMW i01 i3 i3s BEV 120Ah Pure Electric, 1 Spd Other, 4-door 4-seat Sedan, 2WD, Released: 2019), has fuel lifecycle emissions of up to 130 g/km CO₂, according to the Green Vehicle Guide. A hybrid Toyota Corolla (1.8L 4cyl Electric/Petrol 91RON, 1 Spd CVT, 4-door 5-seat Hatch, 2WD, Released: 2018), however, has the lowest fuel lifecycle emissions among the three types, at only 101 g/km.

In fact, the fuel lifecycle emissions for electric vehicles differ from state to state since the emissions intensity of electricity production varies across states. According to the National Greenhouse Gas Accounts Factors, on average, Australia electricity generation has a greenhouse gas factor of 0.90. New South Wales has a factor of 0.92 kg CO₂-e/kWh, showing that per kWh generated emits 0.92 kg CO₂ equivalent. The value of the factor ranges from 0.22 (Tasmania) to 1.36 (Northern Territory) across states. The reason the greenhouse gas factor for Tasmania is low is because over 90 per cent of Tasmania's electricity comes from hydro-electric generation. This suggests that riding an electric car is more environmentally friendly in Tasmania than in New South Wales because the electricity is cleaner in Tassie than in NSW, where over 80 per cent of the electricity is generated by coal.

From 2006 to 2016, the greenhouse gas factor has dropped from 1.03 to 0.90 in Australia. In the next twenty years, if we take decisive steps to transfer from a coal-fuelled economy to a renewables-fuelled economy, electric vehicles will indeed be greener to drive. There might be one day when electric vehicles have truly zero emissions at a life span, but all depends on the electricity generation process.

There are various impacts of the fuel-efficient cars on consumers' choices, government revenues and, consequently, the environment. The annual fuel costs associated with these three vehicles,

Toyota Corolla, BMW i3 and Toyota Corolla Hybrid are \$828, \$629 and \$1,338, respectively. Apparently, consumers pay least if they drive electric cars because in this way the drivers avoid paying fuel excises. Consequently, government gains less revenue from drivers. It might be fairer if the government could tax electric vehicle drivers according to their road usage because they cause as much congestion when driving on busy roads during rush hours as conventional cars and, at the same time, cause negative environmental impacts.

Many European countries, such as Austria, Croatia, Luxembourg, Portugal and Sweden use renewables to generate over 50 per cent of their electricity for home and industrial use. Utilising renewable energy makes electric cars a greener transport alternative in those countries than in Australia. As Australia is committed to reducing carbon dioxide emissions by 50 per cent per capita by 2030 (compared to 2005), electric vehicles will play an important role in achieving this goal if the electricity production becomes progressively cleaner.

Poll Question

Do you think the Federal government will eventually have to impose a fuel excise tax (linked to kwh of power) or some equivalent charge on electric powered vehicles as their market share increases? Y/N

Why the government can't blame us (yet) for clinging to our cars

ITLS Think Piece #59-2019-May

By Mark Raadsen

We all know that, in an urban environment, having multiple cars – or even one car - per household is likely going to become an unsustainable proposition in the future. At the same time, we all like to believe that the solution to this is that our neighbour gives up their car(s) so that we don't have to. People are inherently selfish creatures and it is in our nature to prioritise our own needs over someone else's. We can of course hope that we change our ways and miraculously give up our vehicular pride and joy even though no one else in our street does but I hope you agree this is unlikely to happen out of the blue.

In Sydney, public transport is comparatively cheap compared to many European countries, so there is little opportunity to increase patronage (and get vehicles off the roads) via cheaper ticketing. Another reason not to go down this route is the fact that the quality and experience of the public transport system will become even more of an issue due to the lack of cost recovery which is at a worryingly low level as it stands. Ideally, we would significantly increase the ticket price, improve the quality of the experience, and increase patronage. But how to achieve this without having to face issues like social exclusion due to the ever-increasing sprawl of our city?

Of course, there is no silver bullet here, but taking inspiration from purposely developed schemes around the globe there exist some success stories that could contribute to a larger uptake of public transport without penalising commuters who do not have the means to live close to their workplace.

Before we go there however, I want to mention a personal experience I had on public transport in NSW. When I first moved to Sydney from the Netherlands (quite some time ago), I did the touristy thing and visited the Blue Mountains, Newcastle, and other places that were easy to reach by train. I was amazed that the 6-hour round trip to Newcastle would cost me roughly the same as 3-4 barista made coffees. The same goes for the very scenic route through the Blue Mountains. I personally think that I (as a tourist at that stage) should have paid at least triple the amount for the service that I got. Yet, as a commuter I think the costing structure as it currently stands does make sense.

It seems only logical to differentiate between the type of traveller to achieve the goal of making the transport system available to those who need it and making it less available for those who don't, achieving this is no rocket science. For example, when I was still working overseas (northern Europe), I'd commute every day between two cities on a 45-minute train trip. Being a commuter, my employer would – due to legislation – have to reimburse me for the cost. But hold on, they would only pay each employee the cheapest public transit fare, which is a severely discounted fare for taking up a monthly/yearly ticket on that employee's particular route. These two elements: (i) special low fares for regular commuters, (ii) employers contributing to the commute but only for this discounted fare, resulted in the situation that for most people, it became economically unattractive to commute by car, ensured higher patronage of the public transport system, and also allowed for a higher cost recovery, since tourists and incidental travellers pay a much higher ticket price than this discounted commuter fare. This in turn, allows for higher quality experiences. Free Wi-Fi on the trains, digital screens indicating where to transfer, money-back arrangements in case of delays, etc.

So, when starting to work in Australia – in my naivety – I quickly glanced at my secondary benefits only to find out - to my bewilderment - that not public transport but car usage is being incentivised. We do not get any compensation for using public transport. Instead, I am only able to salary package my car, which is only beneficial when I drive more than a certain amount of kilometres. In other words, there exists a perverse incentive to drive as much as I can in my car to get a better deal out of my benefits.

As a conclusion, I would therefore urge policy makers to stop alluding to the goodness of our hearts in order to create a sustainable future, but instead look at practical, pragmatic, and existing legislative measures that would promote sustainable transport. I understand that this is not as sexy an idea as promoting driverless electric vehicles, but contrary to the latter, it is a directly feasible one and has proven itself in other parts of our beautiful planet. These measures can avoid social exclusion (in case of unemployment similar benefits could be made available), improve cost recovery, and improve patronage, all at the same time. Oh wait, that does sound like a silver bullet after all.

Poll Questions

Do you think government should provide (tax) incentives to employers to incentivise sustainable commuting for employees? Y/N

Increasing the cost of public transport tickets for incidental users and using that money to improve the quality of public transport is a good idea Y/N

Electric cars – They will in time increase car use without effective road pricing reform

ITLS Think Piece #62-2019-July

By David A. Hensher

We are told that electric vehicles, cars in particular, will be good for the environment. We agree totally, but what exactly might this mean? It is true that end use emissions will be significantly reduced when we move from fossil fuels to green energy sources (putting aside the life cycle implications when we account for the energy generation source – be it coal or water or hydro etc.)

With a substantial (hopefully total) switch to electric cars, the general position of experts is that the cost of an electric vehicle will be significantly less than a petrol or diesel car (the switching point is unclear, but many suggest in about 10 to 20 years), and that the cost of using such vehicles will decline. A taxi driver of a fully electric taxi in London said recently that his fuel costs have dropped by one hundred pounds per week or \$Aud178 per week, or close to \$Aud10,000 per annum. This is substantial. In Australia, the EV Council suggests that an EV's fuel cost will be 34.3 cents per kWh compared with average petrol cost of \$1.36 per litre. This translates into 5.15 cents per kilometre for an EV compared to 14.39 cents per kilometre for an internal combustion engine using petrol, an average saving of \$1,275 per annum on fuel costs alone.

Simple economics, which often drives decisions, suggests to me that the private car will be more affordable and more attractive to use. So all other things being equal, we can expect a notable increase in car kilometres travelled. However if 'all other things being equal' is modified to become a reform of road pricing, such that government introduces a re-pricing of road use that reflects a position that 'those who benefit' should pay an efficient (and equitable) charge for using the roads, then we may be able to contain what is expected to be a huge growth in car use. This will also be important as fuel excise on fossil fuels disappears, although we expect governments to find new charges for green energy electric vehicles. With road pricing reform this latter action can be avoided. If, for example we have a 5c/km peak period distance based charge with an average annual peak kilometres of 4,000, this amounts to \$200, which is still well below the annual savings in fuel on an EV.

Thus, moving to green energy to reduce (if not eliminate) end use vehicle emissions runs the very real risk of increasing congestion significantly if governments continue to reject road pricing reform. The amount of money committed in Australia to new public transport investment is, in my view, inadequate to put a significant dent in the continuing dominance of the private car, which has always been a key objective in investing in public transport, rail in particular. Indeed the fantastic new Metro rail system in North West Sydney has resulted, to date, in a major loss of bus patronage (21% on the long haul M2 services) and a small 2% reduction in car use. 2% is still a good number, but does illustrate that one of the best new rail services is likely to have a small impact on car use as it grows in popularity as car ownership and use costs plummet over time under a green energy plan. Congestion will increase, and in itself may make some car users give up using their car, but we doubt it is enough without road pricing reform.

Automated vehicles: Ubiquity of mobility or a profanity for humanity?

ITLS Think Piece #65-2019-August

By Tony Arnold

Automated Vehicles (AVs), otherwise known as self-driving cars, are emerging from the pages of science fiction novels into our present reality. Australian jurisdictions are competing to provide a petri dish for the testing of new technologies, with each vying for leadership in the Automated and Connected Vehicle arena. Austroads provides a stocktake of current initiatives in this space, with over 30 pilot projects in Australia alone¹.

Of course, AVs promise to deliver a significant improvement in quality of life for the many people in the community who have mobility difficulties or are unable to drive a car. For these people, everyday tasks can be difficult, particularly in environments that have been fundamentally built around motor vehicle usage. At first glance, it may seem that only a minority of the population is unable to drive a car. However, licence-holders in Australia in 2017 made up around 17.5 million of a population of around 24.6 million people², leaving 29% of the population without a licence.

Of course, a large portion of those without a licence are too young to drive, however, the fact remains that almost a third of the population are dependent on non-car modes or on others for transport. For these people, the future availability of AVs is being heralded as a massive step towards equality of access to mobility. Not only could these vehicles provide cheap, safe and convenient movement along roadways, they could also go beyond the kerb and enter spaces that have been conventionally reserved for pedestrians such as footpaths and plazas.

For those unable to walk even a short distance from a vehicle to their destination, there will undoubtedly be benefits to providing AV assistance that goes beyond the kerb. However, excessive use of AVs in pedestrian spaces may introduce a number of disbenefits. Firstly, for those who are perfectly able to walk, it is likely that the provision of AV services will decrease physical activity levels and therefore negatively affect health. In addition to this, AV services that operate in pedestrian spaces will generate negative externalities that are likely to outweigh the benefits provided to vehicle occupants.

If footpaths become crowded by Automated Vehicles, pedestrians will feel unwelcome, unsafe and alienated. This could potentially lead to a greater desire to give up on the humble and healthy act of walking, and instead encourage more people to sit in the air-conditioned, comfortable, but sedentary environment of an Automated Vehicle. The potential decrease in physical activity that could occur is worrying, as the incidental physical activity we receive by walking plays a vital role in keeping us healthy. And it is not just the health of our bodies that we may lose with this transition. The health and vitality of our cities is at stake, with AVs threatening to convert town centres bustling with human activity into sterile landscapes dominated by distinctly non-human, computerised vehicle interactions.

Companies seeking to bring AV technology to our footpaths have leap-frogged the companies seeking to bring AVs to our streets, primarily due to the greater simplicity of solving problems at 10 km/h vs solving them at 100 km/h. In Australia, trials of AVs on the footpaths of campus areas are occurring in several states. However, before we race towards a future where walking is largely replaced by footpath-bound AVs, we need to consider how we would like our cities to look and feel in the future.

A key consideration is determining how governments can facilitate the needs of those who are currently marginalised by their lack of access to mobility, while also being careful to protect safe and pleasant pedestrian spaces. If the addition of AVs in pedestrian-only spaces results in a reduction in walking, then we will have failed to deliver a transport system and a public realm that fosters healthy people and healthy communities.

Just as we currently allocate disabled parking permits to those who need them, there may be a role for the regulation of AVs to ensure that only those who need assistance can use AVs in pedestrian spaces. Without such regulation, we may find that while AVs provide a ubiquity of mobility, they also become a profanity for humanity.

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Asset recycling – A case study in communication?

ITLS Think Piece #1-2015-April

By Matthew Beck

What is it and Why?

Asset (or capital) recycling was a contentious issue in the recent New South Wales state election. It is controversial because while the language refers to leases, it is effectively part-privatisation; no physical asset that the government leases can be expected to still be in existence in 2115.

Broadly speaking, the any perceived 'privatisation' of public assets has been viewed with consistent cynicism by the general public. For this reason the term recycling is most likely used in communication of the idea due to the positive connotations associated with the word, perhaps making the potential sale (or franchising) of politically sensitive assets more palatable to a wider public.

Much of the current interest in asset recycling is likely attributable to a 2014 report by the Productivity Commission that recommended that governments sell currently held public infrastructure to unlock otherwise unavailable funding for investment in new infrastructure.

Another argument is that consumers will be better off under private ownership because the private sector is better incentivised to maximise profit via two channels; firstly better innovation and better service (to attract customers); secondly by reduction in costs or operating more efficiently (and more profitability).

Does it Work?

There is evidence that electricity privatisation has been a positive. In Victoria there has been an 18% decrease in network charges and South Australia has seen a fall of 17%. This compares to a rise of 140% in Queensland and 120% in New South Wales.²⁸

On the other hand, evidence of negative consequences also exists. Retail prices paid by end users are higher in South Australia than any other Eastern State despite the fall in network charge.²⁹ In settling a \$0.5 billion law suit, it was also found that 5 out of 11 of the 2009 bushfires in Victoria were due to poor network maintenance.³⁰

²⁸ nsw.gov.au/sites/default/files/miscellaneous/electricity_network_services.pdf

²⁹ mysunshinecoast.com.au/articles/article-display/ernst-and-young-report-slammed--privatised-electricity-in-sa-and-victoria-dearer-for-consumers,37142

³⁰ supremecourt.vic.gov.au/home/contact+us/news/victorias+largest+civil+trial+settles

Perhaps the foremost reason why the public are generally negative towards a more active private sector involvement in the management of public assets is the potential for once public assets to create windfall gains for private companies. For example, in the UK some have found privatised rail to be a shambles creating artificial profits for the franchise holders and hidden costs for the public.³¹

The Productivity Commission says that the public interest can best be protected through government regulation along with sale conditions and also via community service obligations. In NSW, what level of regulatory oversight could one expect to see and how will that authority deliver outcomes for the energy consumer?

What is the case for NSW?

Many voters understand that government budgets are stretched and that revenue is falling. What is incongruous, however, is that asset recycling involves the sale of an asset that will only be acquired if it generates sufficient return on investment. If the income on the asset is attractive enough for someone to spend in excess of \$1 billion to purchase it, then many voters may ask why would a government scrambling for income sell that asset? Particularly in an environment where it has been found that the loss of the income stream from poles and wires would be detrimental.³²

In contrast, perhaps the time for selling poles and wires is right. As solar technology becomes cheaper and more affordable, the sale of electricity to consumers who are able to generate their own energy source may be significantly less profitable. One need only drive down a local street to see the growing popularity of solar panels. Additionally, there is rampant speculation that companies such as those run by Elon Musk are investing heavily in battery technology so that households may not only generate electricity, but store it.

Confounding Issues

The decision to engage in asset recycling is in response to the Federal incentive of a \$5 billion pool of infrastructure funding available on a first come first serve basis. Is the rush to secure funding in a first come first serve system distorting good decision making?

Why is Federal money tied exclusively to road infrastructure, not what infrastructure might be best for each state? Because NSW can only access Federal money for roads, it is forced to hypothecate the network sales to WestConnex but as reported, there is limited wider understanding around this project.

Is WestConnex the best project for NSW and if so why? If it is so important then why is getting it entirely dependent on the sale of the electricity network? Should citizens of NSW be faced with this type of choice? Why can it not be funded via existing means or through innovative financing methods? These questions, which have been asked, show a cascading failure to communication from Federal to State, which leaves a general public confused and disengaged.

³¹ https://www.tuc.org.uk/sites/default/files/tucfiles/The_Great_Train_Robbery_7June2013.pdf

³² <http://www.smh.com.au/nsw/nsw-state-election-2015/nsw-election-2015-governments-electricity-privatisation-adviser-says-poles-and-wires-sale-plan-bad-for-nsw-budget-20150317-1m1ni9.html>

Erosion of Confidence

A disenchanted public is problematic for all levels of government and all political parties. It results in a lack of buy in and a consequent loss of mandate that many governments are struggling with.³³ Without buy-in to the decision making process, governments begin to walk a dark path with their citizens. Infrastructure decision making is difficult, and unfortunately some have noted that it is fraught with delusion and deception.³⁴

At the risk of being controversial (the point of this think-piece series), at its worst the poor communication can lead to distrust; are decisions like WestConnex or Newcastle Light Rail or sale of NSW poles and wires being made for the benefit of the public or in the vested interest of others. While I am not saying this is the case with any of the issues discussed herein, recent ICAC findings in allow connotations do exist and failure to communicate allows them to linger and fester.

Gaining Trust into the Future

The upshot of this is that the decision to 'privatise or franchise' electricity networks or other assets is an argument worth having. However, there is still much confusion over what asset recycling is, which is further compounded by the linking of the scheme to a poorly understood road project. Moreover, the very word 'privatisation' (used incorrectly) creates a very visceral response that is often not taken into account.

Infrastructure is inherently captivating. It is my opinion that citizens of NSW and Australia are willing to engage in a discussion of these issues if framed the right way, if given the opportunity to be heard and if educated rather than lectured to. A better communication channel needs to be established with respect to what are the problems confronting electorates, what are the alternative solutions that have been considered, how alternatives have been selected, and why one solution is the best!

Perhaps most importantly, infrastructure decisions involve winners and losers. Those who lose or who bear a disproportionate level of costs need to be convinced that this imposition is valued and worthwhile, or why it is important that those who benefit from the decision do so.

³³ [washingtonpost.com/opinions/people-have-lost-faith-with-companies-and-governments/2014/12/07/2af26d3e-7cc0-11e4-b821-503cc7efed9e_story.html](http://www.washingtonpost.com/opinions/people-have-lost-faith-with-companies-and-governments/2014/12/07/2af26d3e-7cc0-11e4-b821-503cc7efed9e_story.html)

³⁴ http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2229781

To tender or not: How transparent is the process?

ITLS Think Piece #2-2015-May

By David A. Hensher

There is a general sense in many government circles that society is better off if service contracts are put out to competitive tender, for this ensures value for money which comes out of the taxpayers' purse. But is this always the case? What if the incumbent is doing a great job? Why should we disrupt (or risk) the continuity of good service provision because of some possibly strong simplistic view that the market (and its assumption of full knowledge surrounding all bidders) will always deliver the best outcome?

We now know that the cost of undertaking a tendering exercise in contrast to negotiation with an incumbent who has satisfied all the required key performance indicators adds significant transaction and transition costs. For example, in Adelaide, over \$12m extra costs (on awarded contracts of approximately \$750m over 5 years) associated with tendered bus contracting (\$5m for government and \$7m for operators) compared to negotiation were incurred in an annual assessment leading to renewal of contracts simply in the administration of the process and changeover matters (for government and operators), money that might be better spent on improved services. Before deciding if one could claw back this amount and some more from a lower bid price through tendering, one has to also add in additional risks associated with potential (and known real) disruption when there is a transition from an existing operator to a new operator.

We believe from research that this could be as much as an additional 10 percent mark up and should be factored into the assessment of offer prices as a way of neutralising the relative risk and uncertainty in deliverable outcomes. We suspect that the tender assessment committees know this but ignore it. The implication is that this is a cost of society and if we believe in value for money as the overall basis of assessing the welfare benefits to the community, then the lowest offer price may not cut the mustard.

So where does this leave us in practical terms? If transparency is the basis of justifying a course of assessment action, then ignoring this important matter is effectively covering up a real cost, and it violates the notion of transparent government. Society might well be justified in raising a concern about whether those looking after our interests are actually doing so? We should factor these costs in and do the comparison which may still result in the same outcome as before, but at least we can then have a straight face and say the assessment is based on a truly level playing field. This can be broadened to a more pressing concern about the institutional arrangements in place that are used in ranking (often a narrow set of) alternatives (using some form of Cost Benefit Analysis), and how this might be improved.

The high cost of housing and how to reduce it

ITLS Think Piece #32-2017-July

By Michael Bell

There is a debate about whether the current high cost of housing in Australian cities like Melbourne, and especially Sydney, is caused by excessive demand or insufficient supply. The finger of blame is often pointed at investors, taking advantage of the negative equity tax concession, with the suggestion that the removal or watering down of this concession would ease prices. The counter argument is that if the tax concession were axed, investment in houses would indeed be discouraged, but the supply of rental property would be correspondingly reduced, driving up rents. There is evidence from past Australian experience that this is exactly what would happen. People need homes after all and will pay whatever it takes (and afford) to find one, whether bought or rented. The solution to the high cost of housing must therefore lie ultimately in increasing the supply of housing.

An important factor generally overlooked, however, is the accessibility of housing for the many whose work requires them to commute. Where accessibility is poor, workers who need to commute will find their house hunting more confined, reducing their price elasticity of demand for housing. Where demand is less price elastic, landlords can command higher house prices or rents. Economists are able to quantify this effect: The profit maximising markup for a developer selling new units increases as the price elasticity of demand is reduced toward one (the **Markup Rule**). It therefore follows that improving accessibility gives house hunters more choice, increasing the elasticity of demand for housing and reducing its cost.

The implication of this argument is that a more effective way to reduce the high cost of housing would be to invest in better accessibility, which in large conurbations like Sydney, implies building more public transport infrastructure to overcome road congestion. Supply-side housing policies aimed at densification can only have limited success in bringing down the cost of housing without matching investment in the transport infrastructure. Ironically, the veracity of this argument is demonstrated by the rapidly increasing cost of housing in those inner suburbs of Sydney, like Alexandria, which benefit from good and growing public transport access, because house hunters are willing to pay more for the better accessibility. Rather than constructing more units in these inner suburbs, the more effective antidote to the high cost of housing would be to improve access to outer suburban areas.

Lack of elasticity in the housing market resulting from poor accessibility is matched by lack of elasticity in the job market. By improving accessibility, firms in search of workers with specific skills are more likely to find what they need, because the search area will be larger. Conversely, workers with specific skills are more likely to be able to find employment, or indeed have a better choice of jobs. As argued in an earlier opinion piece on shrinking supply chains and the end of globalisation, the range of job opportunities has a direct bearing on social welfare. All of which adds further weight to the need to focus on accessibility in conurbations like Sydney.

Abuse of private financing

ITLS Think Piece #46-2018-February

By Martin Locke

Does the demise of the UK Private Finance Initiative (PFI) suggest where the Australian PPP market is headed? How applicable are the findings of the recently published UK National Audit Office report on PFI for Australian PPPs?

Not too long ago the UK was seen as the godfather of privately-financed infrastructure with some 55 PFI deals signed annually and over 700 operational deals with a capital value of around £60bn. But only one PFI transaction was executed in 2016-17 and the pipeline is non-existent. The UK National Audit Office (“NAO”) published a highly critical report on PFI in January 2018. Could Australia experience a similar decline?

The most startling revelation in the NAO report concerns the accounting treatment of UK PFI, indicating that the transactions are still categorized as off-balance sheet. Despite the tightening of financial reporting obligations with the latest accounting standards, specific tweaks to the PFI model were made to ensure off-balance sheet treatment persisted, in order to avoid a downgrading of the UK credit rating. Moreover, the future liability to pay availability payments under PFI is unfunded by central treasury, leaving departments to find the cash to repay the capital component in addition to the operating costs and stay within budget.

In Australia, PPPs have always been considered to be on-balance sheet, with State treasuries allocating capital to fund the capital recovery element of future availability payments. So in the absence of superficial accounting benefit labelled “fiscal illusion” in the UK NAO report, the prime motivator of Australian PPPs has been the pursuit of value for money as driven by optimising competitive tension between bidders and ultimately tested against the Public Sector Comparator. The UK approach highlights the asset-based emphasis of PFI with the use of an off-balance sheet financing tool. By contrast, recent published project summaries in Australia, for example, Melbourne Metro PPP, indeed quantify the future financial obligations.

The NAO notes that, in the face of affordability pressures, departments sought to squeeze PFI contracts by cutting back on maintenance and removing soft services from the scope of the outsourced PFI provider. This logic does not apply to Australia, where State treasuries have increasingly stressed that PPPs should be used as a deliverer of infrastructure services with the benefits of fully funded whole-of-life maintenance, innovative solutions, improved risk transfer and introduction of financial discipline from private financiers.

The NAO also highlights the cash impact of the need to pay future availability payments on PFI deals amounting to some £199bn until the 2040s, and comments upon the use of a high discount rate based on social time preference (6.09%) to assess the future cost rather than actual government borrowing costs (2-2.5%). It can be argued that the use of differential discount rates masks the higher private financing costs at the expense of cheaper government finance in projecting the narrow financial impact. So how do we treat this in Australia? Methodology prescribed by Infrastructure Australia requires discount rates to be based reflecting risk. An underlying risk-free interest rate (reflecting government bond rates) is the benchmark to which is added a margin for risk. So in the case of the recent Melbourne Metro PPP, the discount rate to determine the public sector comparator benchmark was 3.09%, whilst the discount rate for the private sector was 5.7%. This means that effectively the increased cost of private financing will result in higher nominal payments being paid over the duration of the contract, but that this increased cost reflects adjustment for pricing risk in financial markets.

HM Treasury responded to the failings of PFI to deliver value for money by introducing PF2 in December 2012. Only six deals have been completed under PF2 as at September 2017 indicating limited acceptance of the revised model. Some of the key changes were a requirement for public sector equity in PPP SPVs and changes in risk allocation including retention by government of risk around change-in-law, site contamination, utilities costs; but the lack of deal flow suggests that these structural reforms have failed to restore faith in the model.

The government equity stake, typically 10%, was intended to improve transparency but the NAO rightly questions why the public sector would be willing to take on equity risk rather than become a debt provider. The contrast with Australia is dramatic with States not favouring co-investment by way of government equity in preference for public sector capital to be contributed as a non-repayable funding source designed to reduce the availability payments by paying down expensive private sector capital. For example, under the \$6bn Melbourne Metro PPP, the Victorian Government is set to make a \$2.5bn construction contribution, followed by a \$1.5bn payment upon provisional acceptance, reducing the private financing to be repaid through the availability payments to \$2bn. The use of the capital contribution has clearly helped to deliver value for money by mitigating the higher cost of private finance, whilst still ensuring the risk allocation and payment mechanism retains strong financial incentives to perform.

Interestingly, in the UK some thinking was given to the introduction of an equity gain share provision (or cap on returns) to mitigate the risk of windfall capital gains being made by investors. Such profits could be realised upon the sale of equity at lower yields, reflecting projects progressing beyond high-risk construction phases and becoming operational; movements in financial markets and the shift to a lower interest rate environment were also factors. (The NAO refers to investors in the M25 PFI contract realizing equity returns of 31% a year and the risk of inefficiencies in the initial pricing of contracts.) The UK rejected the introduction of an equity gain share on the basis that this might result in reduced investor demand and potential on-balance sheet treatment of PFI investments. Equity gain share has not been included as a standard provision of Australian PPP contracts. Initial equity investors in recent Australian PPPs, who have opted to sell down post-construction, have been able to realize substantial capital gains as a reward to overcoming greenfield project risks. Sharing of gains in standard Australian PPP contracts relate to debt refinancing on more favourable terms and upside revenue sharing on user-pays infrastructure such as toll roads.

In conclusion, obsession with off-balance sheet financing has not been a prime motivator of PPPs, so a similar decline in the use of private finance as seen in the UK is unlikely. There remains a healthy pipeline of PPPs with major transactions in procurement such as \$5.4bn Cross River Rail, with the primary justification for the PPP model being based on whole-of-life efficiencies, potential for improved risk transfer/cost outcomes and scope for innovation.

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Infrastructure financing: Following the money

ITLS Think Piece #3-2015-June

By Alastair Stone

It is generally agreed we need more public infrastructure. So what if infrastructure financing was linked to investment by superannuation funds as a mandatory part of their portfolio in return for continuing the current generous superannuation tax concessions? To do so would be a logical extension of current trends in institutional arrangements and simply following the money. Let us explore why.

Background

Around the 1970's the OECD countries began to experience a shift in the willingness of the community to finance public infrastructure services away from tax payments. Partly in response we saw the adaptation of "privatization" policies, originally used for moving industries back to the private sector after being nationalized during World War II, to fund projects such as intercity toll roads. Over time, these policies spread to the provision of other projects such as water treatment plants and ever smaller segments of service networks such as Sydney's cross city tunnel. Big emotive words like "competitive tendering" and "efficiency of the private sector markets" were used to convince politicians and the public that there was an efficient market for delivering such projects and indeed the community received services that would not otherwise be available.

Efficiency of Markets

In the last decade or so the privatization model (now called PPPs for Public Private Partnerships) has been seen for what it is; the combination of three separate efficient markets in finance, design and construct, and management and operations - not quite the single "efficient market" claimed for PPPs. In reality the chances of getting the three most efficient inputs in one PPP consortium are pretty low. Similarly, it is unlikely that the efficiencies of having large private corporations manage the three inputs instead of the state bureaucracy, will make up for the loss of efficiency of not having the most efficient input from each of the three existing efficient markets.

Financial Markets

The shrinkage of the general tax base as a source of financing for infrastructure services has been accompanied, since 1992, by an increase in another form of compulsory and heavily incentivized savings, superannuation levies. It is notable that the long term financial profile of much infrastructure is a good match to the long term financial profile of financing retirement. It is not hard to financially engineer the matching up of these financial profiles to meet the needs

of infrastructure investment and retirement cash flows. We already accept “user pays” principles for infrastructure services which could generate the cash flow required to service whatever form of credit is offered to attract superannuation funds to finance infrastructure. So what is holding us back?

User pays vs. Rent Seeking

There are ongoing arguments about the form of user payment, as in “who pays for what and when?” In the original PPPs, uniform tolls had the goal of covering over time all costs in an uncongested flow regime. Leaving the congestion issue aside for another time, the countervailing behavior to “user pays” can largely be attributable to **rent seeking**, or, why should I, as a consumer, pay for the service if I can use my political clout to get the broader community to pay for it out of general taxes. Rent seeking is more successful where there is an election in the offing and/or the feedback between those consuming the service and those controlling the supply is not strong. So maybe we need to add geographical scale of the supply entity as another issue to how we finance infrastructure. In this scenario it is hard to see the logic and effectiveness of the Federal Government’s Asset Recycling program. So let us get the financing focus back on the bankers concern for creditworthiness and cash or money flows.

Creditworthiness and Money Flows

At least the asset “recycling” policy brings into focus the value of the public infrastructure balance sheet. The application of the accepted user pays policies provides the money flow to service investors. We also have the history of governments providing putative guarantees to financially faltering infrastructure projects that are seen to be critical, which is analogous to government actions during the global financial crisis in supporting banks deemed too big to fail. So to a superannuation investor, a debt instrument to finance infrastructure projects within a designated regional economy, with government backing, would have to be pretty attractive. So what would it take to develop such a market for infrastructure financial instruments?

Firstly a portfolio of “shovel ready” projects needs to be available. We already have antecedents for most elements required for this. Infrastructure Australia and similar state entities such as Infrastructure New South Wales are already driving public infrastructure strategy processes into shape. Secondly, similar instruments are already being managed by Treasuries (and their corporate offshoots) at the State and Federal levels. Combine these two elements in an independent entity with a longer term outlook than the electoral cycle and you have something like an Infrastructure Development Bank. The World Bank and similarly structured regional banks provide strong precedents. Given Australia’s Federal Constitutional structure, the scale of these Banks probably needs to match our State boundaries, with strategic foci that match policies and projects to agreed regional economies.

Following the money, and existing trends in institutional arrangements point us towards mandating superannuation funds to finance infrastructure.

We need value-for-money no matter what the funding level

ITLS Think Piece #8-2015-November

By David Brown³⁵

The change in prime ministership has been warmly welcomed in many quarters because the new PM has spoken positively about the federal government funding some public transport projects. A more balanced approach to planning is encouraging but it must not become just a wish list of big projects. We must build the best transport options which will include many public transport projects and 'best' must include value-for-money.

As soon as Malcolm Turnbull was elected as PM a wave of state politicians from both side of politics began to pitch for funding for public transport projects.

Victorian state premier Daniel Andrews immediately began to lobby for funding for his Metro rail scheme (1). The Queensland Premier was hot on the phone (2). Western Australia Premier, Colin Barnett, got in quickly (3).

Nothing wrong with this, but no matter who is lobbying for funds we must avoid the attitude of the lottery winner that says "I can now afford all those big projects that have been on the books for years". It's not true when you win the lottery and it's not true with government funding.

The lottery metaphor is worth taking a little further. I did some analysis a while ago to show my friends how Lotto does not guarantee a big, luxury lifestyle. The thing is you have to share the first prize with other winning tickets. And in Lotto there are usually quite a few winners which significantly reduces your return. The average payout was \$1 mill on games even when the first prize pool is anything from \$4mill to \$20mill. The lowest pay out I found (per winning ticket) was just over \$148,000 (twenty seven winners for a \$4mill prize). The point is that if you share the prize across a range of winners then you don't have funds for a gratuitous splurge. Alternatively, even if you can afford one or two big spends then there are a lot of other things that you cannot afford.

This assumes that there is some windfall in funds. Political commentator Michelle Grattan recently interviewed our new Minister for Cities, Jamie Briggs. One of things he said is that "The government's budget situation has not improved with the change of government". He went on to point out that we will "Never be able to meet the infrastructure needs purely through the balance sheet" (4).

This led him to suggest the need for private funding. But private finance does not lead to unlimited funds (and someone has to pay in the end). It can also lead to funding projects that

³⁵ David Brown has an honours degree in Civil Engineering and practiced in the fields of traffic engineering and transport planning. He is now a media commentator.

suit private involvement, which is one of the reasons the former Prime Minister focused on building roads. It is worth looking into private funding in more depth at another time.

Actually it doesn't matter if we have a little or a lot of funds, we have to be cost-effective because there will always be more projects to do even if we get a rush of funds from an enlightened approach from the Federal Government, asset sales, Public Private Partnerships, or if the GST is increased.

One of the great problems that can arise with an environment that seems to offer a surge of funds is it can reinforce a supply-side approach. We are inclined to projects because they look good to voters, we like the mode of transport or they fit into a definition of providing a nice system.

This is often justified with the classic supply-side expression "Build it and they will come".

Jonathon Daly, an environmental psychologist, urbanist and design researcher has spoken out against this approach. He has challenged people not to focus on the systems but rather on the users. If you build something that is not in the realm of peoples' experiences and needs then you will not bring about effective change (5).

Daly was invited to participate at the 2014 Australian Institute of Traffic Planning and Management annual conference. It is interesting that the AITPM started its life nearly 50 years ago with technicians and engineers. To have an environmental psychologist on one of its panels suggests an organisation that is now considering a much broader range of professional input. Transport solutions are only to serve people's needs, they are not an end unto themselves.

Accepting that there are some public transport projects that are not worth funding does not make you anti-public transport. Under the heading "A street car not desired?" Politico Magazine in America reported that the Obama administration's half billion dollar investment in light rail has not been very successful (6). This should not be used as anti-light rail propaganda. Although the article is negative overall, if you read it carefully it suggests that some of the projects have been successful. Good! We just have to recognise that there are lessons to be learnt about getting the right projects.

The Baird government went to the NSW election on the policy of leasing out the electricity grid for 99 years so that they could fund infrastructure. Subsequently they have said "The NSW Government is turbocharging the NSW economy by investing \$20 billion in infrastructure through its Rebuilding NSW plan" (7). Not all the money came from the leasing but it was the major trigger.

On the government's website they listed where a considerable amount of this money would go. Only two specific schemes were listed on the home page; both were transport projects: an additional \$1.1 billion to invest in the northern and southern extensions to WestConnex along with the Western Harbour Tunnel; and an extra \$7 billion for Sydney Metro, to fully fund a second harbour rail crossing (7).

In fairness, if you click on the more detailed pages you see references to a Parramatta Light Rail (not specifically defined), some urban and regional programs (mainly roads) and other non-transport projects. But two big projects take a major part of the funds.

Will the money raised from asset sales ultimately be reported in the future as "we spent so many million dollars on transport"? That is not the key measure. The measure should be how we encouraged the best land-use in our cities and how we encourage public transport as a good form of transport for as many people as possible, in an equitable manner.

Politicians love ribbon cutting projects, the bigger the better, but a proper consideration might give us two or more projects for the price of one.

When talking about road safety projects in the media, I have often been presented with the statement "If it will save one life it has to be worthwhile". My response is to say "No, if you can spend the money in some other way and you can save two lives then that is what you should do". In an ideal world you would do both, but we may not have that option.

But back to transport options. Consider public transport trips to Melbourne's Tullamarine airport.

There have been the usual calls that every major airport has a train system and that trains carry the most people. I don't think either of these reasons are automatically enough to justify the expense.

Before we make a decision let's reflect on the situation. The existing bus system is very successful (better than train services in other Australian major cities); train systems especially to airports have high construction and on-going operating costs; and bus systems have greater flexibility (8).

I have used the bus from Tullamarine and found it quite good although the loading and unloading locations are anything but salubrious. Perhaps we should spend a few million dollars to make the bus service look more funky. We could build a big, separated area to get on and off the bus with a waiting area. We could call it a Transit Lounge (not a bus stop). We could also look at bus lanes on the major links and provide services to centres other than the CBD.

Potentially this will leave over \$3 billion to spend on transport in areas other than for those who can afford to fly.

Actually the train will not carry more people. I bet that we can serve more people on public transport if we were to build several light rail systems or maybe a couple or more express bus lanes (using a lot of existing corridors) for the same money; it's just that they are not all going to the airport.

The outlook from the Federal Government looks promising but it will never be a gold rush and should never be used with the flamboyance of a lottery win.

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We need a longer term view on infrastructure investment and good ideas – Australia needs to be less myopic

ITLS Think Piece #9-2015-December

By David A. Hensher

Infrastructure and innovation are two buzz words that have taken on a new lease of life in Australia over the last 12 months. Although we have believed for many years in the need for more and appropriate infrastructure investment in Australia (and indeed in many nations), especially in the transport sector, and greater efforts to deliver innovative solutions (i.e., in respect of financing, project definition and procurement strategy) to improving the performance of existing and prospective infrastructure, especially as a network in contrast to narrowly defined project investments, a major constraint on fully realising opportunities in Australia is the rather short term or myopic view of commitments to infrastructure, especially from the private financial sector. Government as well needs to recognise the growing opportunities to partner with all participants in industry in the origination, hibernation and evolution of ideas from thoughts to actions – which is real innovation

Linking innovation through ideas to infrastructure investment is fundamental. The possibilities are endless, but identifying the right ones is a not a game for the fainthearted. New ideas often come from unexpected quarters and can add immeasurable value, and as such should be encouraged through the entire process of building capability and not as a response to a pre-ordained request to construct something that others have already decided should go ahead. In recent years we have seen a growing number of examples of transport projects that have been pre-ordained (often for political reasons) such as the North West rail and CBD light rail projects, both of which may have merit; but what is missing is knowing if we could have done better. The proposed Metro West rail project is exciting, but what other alternatives might have been considered as a consequence of a competition of ideas?

While there are examples of the transformative effects of infrastructure such as the growing distribution hubs that saturate the light horse interchange on the M7/M4 in the outer west of Sydney metro area, and even in public transport by the growth in the Macquarie business park as a result of the new train stations, there are many more potential opportunities waiting to be realised and it seems that we can learn from the past to inform the future. If there are flowthrough benefits to others who have not contributed to the investment in transport infrastructure then one might anticipate that this throws up opportunities to capture these benefits in investment design in such a way that it may support greater engagement between government and industry *ex ante* in delivering much needed network based transport infrastructure? We see less than can be achieved in this space and indeed this highlights the need for better integration between land use planning and transport infrastructure planning to reveal opportunities.

Long term partnership between government and the private sector is a key to successful development of truly global cities with hubs of excellence. Part of this package must be major improvements in transport, especially public transport, that ensures that critical knowledge and business hubs are connected in an efficient way. This can involve many possible public transport initiatives in Sydney, including trains, buses and ferries, but it must be delivered in a way that unencumbers the bus mode from the perils of having to compete with the car and truck for road space. Crucial to any investment in transport infrastructure is the delineation of movement

corridors that support the new global city aspiration, regardless of what mode or modes of transport are provided along these corridors.

With the private sector, particularly the finance sector, increasingly interested in investing in public transport, something I was not confident in suggesting a year ago, in part due to the changing landscape of Federal government interest, as well, in the case of Sydney, of now having an integrated electronic ticketing system (the Opal Card) that is tap on and tap off enabling identification of revenue streams that can be attributed to specific parts of the network (although with one important caveat associated with free travel after eight one way trips per week), the revenue risk has reduced considerably. The private sector equity partners have never been keen to invest in projects which rely on significant levels of government subsidy attached to the gap between costs and the revenue box, despite the fact that this may turn out to be less risky than the patronage forecasts associated with toll roads.

If we are to achieve a long term view of the commitment to investing in transport infrastructure, then it makes good sense to ensure that all parties have a clear understanding of the reasons and value for this commitment, and especially the risks and associated longer term return on investment. In general, the private sector is prepared to invest long term so long as they can see relatively stable revenue streams (and are not forced to assume too much of the demand risk); they also need some stability in the pipeline of projects so they can gear up and properly investigate / invest. Large investors such as the superannuation funds have a certain risk profile; they are dealing with retirement savings and so are naturally conservative; hence generally prefer straight debt involvement rather than having to assess and accept demand revenue and construction cost risks. Maybe pension funds could consider investments that benefit retirees – like accessible public transport?

What may help here is a funding model that is less myopic and works with long term returns under a trusting partnership (albeit with clear commercial obligations for the private partner). We should move away from using any short run (i.e., up to at least 5 years, if not longer) patronage forecasts and use medium term estimates as the basis of likely returns from patronage. In addition there needs to be an increased commitment to risk sharing, and preferably in a context in which we move away from rather narrowly based project ideas to a more appropriate program packaging framework in which we recognise opportunities for elements of the package with lower risk to cushion the greater uncertainty of elements with higher risk. A good example is a blended program of public transport infrastructure together with real estate and retail elements (linked to the ideals of value uplift and value capture). Why not internalise this to the benefit of the program partners in contrast to offering it up on a plate *ex post* to those who have made no contribution to the provision of the infrastructure investment? This also raises broad questions on how we make decisions on infrastructure services and how net additions to utility should be allocated.

Finally, there is public relations aspect of infrastructure investment that should not be ignored. Stakeholder engagement works well on a small scale (e.g., pedestrianisation, traffic calming, road space reallocation, etc.) but is rarely practised on a larger scale, leading to widespread and possibly avoidable opposition to major schemes, like West Connex. There could be greater public involvement in the design and funding. BART in the San Francisco Bay Area was funded by public bonds, creating an atmosphere of public involvement.

Acknowledgment: the comments of Matthew Beck, Alastair Stone and Michael Bell are appreciated.

Infrastructure Banks: The solution to Australia's infrastructure problems.

ITLS Think Piece #14-2016-March

By Alastair Stone

Australia's infrastructure financing, policies and investment planning institutions at Federal, State and Local levels are a dog's breakfast of institutional arrangements. For example, arrangements in NSW include:

- Proposing local government councils be amalgamated to solve financial inefficiencies that at heart are regional infrastructure supply and financing problems;
- Selling off existing assets such as electricity system "poles and wires" as the only way to finance new infrastructure (thereby shifting financial servicing obligations for existing infrastructure to future generations).

The conversations around such decisions are welcome for the potential clarity of economic/financial understanding that they bring, but currently are largely disconnected and the infrastructure lexicon continues to have a **project** rather than a **network service** focus. As a solution, some have proposed upgrading infrastructure planning and project approval organisations at state and federal levels to, as for example in Sydney, forming independent planning bodies, to presumably complement state "independent" infrastructure institutions. Ultimately, these bodies dissipate decision making power and responsibility to where the community being served has little chance of understanding or exerting influence over why service levels are not adequate.

This article addresses the problems in the institutional arrangements that an "Infrastructure Bank" model could solve. The rationale for this claim lies in the lessons available from the experience of long standing successful development banks like the World Bank and the Asian Development Bank.

Development Banks

Fundamental Goal

The fundamental goal of the likes of the World Bank is economic development of the client countries. A major element of achieving that goal is to develop institutional arrangements of organizations and policies that long term, shift the economy from dependency on concessionary loans and grants to central governments, to market like self-sustainability at the regional level of service provision. In Australia, if we substitute the Federal Government for the World Bank and States (or more accurately Regions) for client countries, then the description fits pretty well. So let us break the institutional arrangements underpinning infrastructure banks down and discuss the geographic scale of operation, governance, finance, and policy as the core elements of institutional arrangements.

But before proceeding with that discourse, this article takes the position that separate existing private sector deep markets in finance, design/construction/operation and maintenance are the

most efficient mechanisms for procuring each element of the service and the assembly of PPP consortia by the private sector is highly unlikely to include the most efficient supply of each input, except where other sources such as tax based finance is deemed politically unavailable.

Let me now return to the issue of appropriate scale of organization.

Geographic Scale of Operation

It is widely accepted that public infrastructure service networks and usage do not match State or Local government boundaries. Australia needs a regional approach to service provision in part because for example, in road transport, based on data from the UK, roughly 90% of all urban trips are less than 45 kilometres long. Similarly for other services such as water where the topographic catchment scale and boundaries differ from those of local government.

We have already seen the emergence in urban areas, of arrangements such as organisations of regional associations of local councils to deal more efficiently with contracting for infrastructure service supply. It is not much of a stretch of imagination to observe that a two level hierarchical organizational structure, with a regional organization connected and represented in a federal organization, would cover all scales of demand for public networked infrastructure services. And of course given Australia's constitution, the States would need representation in the governance structure, to which I now turn.

Governance Structure

Australia's current governance structure for infrastructure follows historic arrangements that result in a mismatch of power and responsibility between those demanding service and those controlling its supply. Since World War II the Federal Government has control of most of the funding of discretionary investment in new service supply (via income and excise taxes), while State and Local governments have responsibility for maintaining and operating services. Sure, States have sold off assets or structured PPPs to provide new service investment, but this leads to less than efficient outcomes that get mired in the political gaming of investment and policy decision-making that we saw in say, the decision to build Sydney's North West rail line.

The long standing better solution pursued by international development banks is to structure governance and control around the principles of subsidiarity to put **power, control** and **responsibility** as close to the consumers as possible - which means at the regional level. It is here that you get the opportunity of economic efficiency from "market like" balanced interplay between demand and supply. The further the institutional distance between who is paying and who is investing, the more likely rent seeking behavior emerges together with the opportunity for political manipulation to garner votes to retain power. The issue of efficient sustainable provision of services depends on consumers being sufficiently engaged in the decision making to be aware that they are balancing their obligations under some form of user pays policies, with their having sufficient influence and control of investment decision making.

Financial Structure

It is worth emphasizing that inherent in the suggested governance structure (and micro-economic theory) that demanders of the service should take direct responsibility for paying for the cost of the service. And again, it is the **network service** not any one **project** that is the product demanded by consumers.

On the fund raising side of infrastructure investment, the lessons from the World Bank, reflecting the desires of the finance market in general, suggest spreading and mitigating project risk by central fund raising. In Australia's case this could take the form of a National Infrastructure Bank (NIB), issuing infrastructure bonds supported by some form of guarantee from Federal government and contractual loan servicing obligations of the Regional Infrastructure Banks (RIB) to the NIB. Allocations from the NIB to the RIBs would be determined by the Board of the NIB,

that would include private sector experts and representatives from RIB stakeholders (particularly local consumers). Importantly the loan agreements between RIBs and NIB would be conditional on regions/states adopting policies to improve economic efficiency in support of economic growth, as well as suitable user pays regime that ideally combines availability charges with time of use charges to service the loans. With the proposed independent NIB, the treasury operation of said bank would be free to access the finance market with a full range of bond type products including profiting from repackaging existing loans as they move from high risk early stage to low risk mature phase.

Policy Framework

The cost functions of infrastructure services suggest in general, regulated monopoly supply with network technical and financial compatibility as supply moves from regional to national and even international scale. With the proposed loan based financial structure and the consequential demise of the rent seeking grant mentality, leverage to change policies as disparate as congestion pricing and maximum wheel loads, becomes powerful.

Beyond technical and financial standards, there is much scope for a RIB to respond to regional demand for say more public transport or bike paths and less road building given the inclusion in the RIB governance structure of users, and their obligation to pay for such services. Proper programming, planning, budgeting and procurement processes with full transparency would reinforce the RIB's responsiveness to the community.

Conclusion

Much of Australia's problems with public infrastructure provision lie not in whether it is controlled by public or private sectors, nor on the availability of financial, technical or managerial resources. It lies in our confusing mishmash of institutional arrangements that do not match the actual economic actions of the entities demanding and supplying infrastructure services. A blueprint of the solution lies in the proven institutional arrangements of successful international development banks.

Density matters

ITLS Think Piece #20-2016-August

By Geoffrey Clifton

Transport planning and urban planning are two sides of the same coin: A successful public transport service needs residents, businesses and activities to generate passengers and a successful urban development needs good transport links to attract customers. However, too often urban planning and transport planning (and research and teaching) exists in silos with neither side talking to the other.

However, it wasn't always like this. In the early years railways were built alongside new housing often by the same developers. The Metropolitan railway which gave the name to all modern urban railways is a classic example of this with the housing that developed around the station now amongst the most desirable in England. Ironically, some of the inhabitants of Metro-Land are now protesting the coming of the HS2 railway. Integrated transport and land developments were also the standard model in Japan with railways building office and retail complexes alongside stations.

Furthermore, the silos are starting to break down with many modern transport projects only being supported by governments if they can lead to significant urban (re)development. Sydney's metro going via Eveleigh rather than [Sydney University](#), the development of the North West Metro facilitating more development opportunities than [transport benefits](#) for existing residents are two examples from Australia along with the [Capital Metro Light Rail](#) in Canberra that is marketed as a combined transport/urban development project. In New York, a subway station was built to serve the Hudson Rail Yard development site whilst a proposed station at 10th Avenue that would have served existing residents was cancelled. In London, [the Bakerloo extension](#) is explicitly being planned around the development opportunities rather than the provision of transport benefits to existing passengers. Some people see this as regulatory capture by developers but in reality our cities need the new housing and without the taxes generated by developers governments would not be able to justify the expense of new transport projects.

So what is the link between transport and density. Jarret Walker (who spoke at ITLS in 2015) has a good [primer](#) on these issues. Basically, successful public transport needs a good density of residents and activities along the length of its route with strong anchors at either end (in Australia this often means a regional shopping centre on one end and the CBD on the other). But there also needs to be a diversity of activities so there is a good flow of patronage throughout the day not just in the peak direction, the buses running empty from the CBD to the Hills District on the M2 busway in the morning peak and back again in the afternoon peak are a good example where lack of demand for back haul services makes the provision of public transport services more expensive on a per passenger basis than on the Brisbane busway network where there is a better demand for back haul services.

Furthermore, density on its own is not sufficient if the urban area is not walkable. As the crow flies, ITLS's offices are only 400 metres away from the Australian Technology Park but it is four times that far to walk as there is no way across the railway. Examples abound of this sort of poor urban design in otherwise dense suburbs.

A further point is the need to get the terminology correct around density. Density can refer to the density of residents, employment or activities and is the ratio of the number of people (jobs, activities, etc.) to the area of land. Counting people or jobs is straightforward but defining the

land area in a consistent manner is difficult. There is a big difference between the area of the City of Sydney (26 square kilometres), the Urban Area of Sydney (2000 square kilometres) and the metropolitan area of Sydney (either 4000 square kilometres or 12,400 square kilometres depending on which of the ABS' two measures are used).

International comparisons are even harder as there is no internationally recognised definition of an urban or metropolitan area. This explains why people often confuse urban density with metropolitan density. The [CLARA](#) High Speed Rail project team are justifying their project partly on its ability to combat urban sprawl. They have written that the 'population density in Sydney is approximately 350 people per square kilometre over a 12,000 square kilometre basin' compared to London, Paris and New York which 'all have population densities in excess of 6,000 people per square kilometre'.

This is, unfortunately, wrong. Sydney does have a low metropolitan density over the 12,400 square kilometres of the Greater Sydney area but this includes the national parks of the Blue Mountains, the Central Coast, the Hawkesbury and the Royal National Park. The density figures for London is just for the urban built up area, including the Green Belt around London would give a much lower figure whilst the figure for New York seems to be just for the City of New York. The actual built up urban area of New York has a lower density than Sydney as the suburbs of New York (which extend beyond the city limits) are much less dense than Sydney's suburbs. The US academic [Wendell Cox](#) publishes consistent information for all major urban centres.

Visible hands or invisible hands – Who should build the ports in developing countries?

ITLS Think Piece #27-2016-April

By Xiaowen Fu

More than 80% of international trade is carried by sea. The supply of quality maritime infrastructure and services are of critical importance to the global economy. As of early 2015, there was 89,464 commercial vessels world-wide with a total tonnage of 1.75 billion. Large container ships are expensive to build, costing up to US\$200 million for the largest models. In addition to the huge capital costs, there are also various costs for labour, maintenance, insurance, inspection and fuel. Since large ships are very expensive to hire and operate, it is important to have efficient port systems so that ships can spend more time on the sea instead of at the berth. However, the construction of ports are costly, and involves lengthy planning, consultation and construction periods. Port operation and management also needs specialised labour and expertise. All these requirements impose major challenges to developing countries that have an ambition to build up modern port systems. In addition to the huge investments, there is also significant risk associated with the demand and cost within the maritime sector. The Baltic Dry Index, a measure of the shipping price for dry bulk goods, dropped from over 10,000 to below 1,000 following the 2008 financial crisis. In 2016, the 7th largest container shipping carrier, Hanjin Shipping Co, filed for bankruptcy. The general decline in shipping and trade has put huge pressure on ports, as they have significant sunk/fixed costs and rely on shipping carriers to bring in cargo. With huge investments and associated risks, it is often difficult for the private sector to undertake very large port investments independently, especially in developing countries with relatively less efficient capital markets. As a result, many countries have relied on governments or state enterprises for port investment and development. However, state enterprises are often not efficient nor adaptive to changing market conditions, which may lead to unsatisfactory investment outcomes - as well learnt, careful planning is as important as deep pockets in the maritime industry. Government involvement also discourages market competition, another necessary factor that promotes efficiency and corrects management misjudgement. Although state enterprises and government investments are quite common in the maritime industry, there has been no consensus to what extent governments should be directly involved in port development.

The Republic of Indonesia is a good example of an ambitious plan to upgrade the system of ports. Indonesia consists of approximately 17,500 islands, divided into 34 administrative provinces over five main islands and four archipelagos. The country shares land borders with Malaysia, East Timor and Papua New Guinea, and marine boundaries with Singapore, Philippines and Australia. As the world's largest archipelago country, marine shipping is a major transportation mode for Indonesia. The Indonesian president, Joko Widodo, has declared in several occasions that he wants to develop the country into a strong maritime nation, and will put high priority on investments and development of the maritime sector. One program, called Pendulum Nusantara, was proposed by the state corporation PELINDO 2 in 2012 and is expected to be finished by 2018. This program plans to develop six main hub ports connected with regular shipping services, and to develop the Port of Sorong into an international gateway in the West Pacific. The development of the new Sorong port alone is anticipated to cost about US\$245 million. Meanwhile, there is another even more ambitious plan proposed by the government, the Maritime Highway Initiative, which aims to build 24 strategic ports (5 hubs and 19 feeder ports) and the build-up of new ships to be deployed on the routes linking ports. The

ports of Belawan and Bitung are also to be expanded into international hubs. It has been reported that this big project would receive approximately US\$49 billion over 5 years.

Despite such tremendous investments planned for, it seems that there has not been much coordination between the two programs. If these plans are indeed implemented independently and as the current plans indicate, there can be substantial network and capacity redundancy, a wasteful outcome for a developing country such as Indonesia. There has been no general agreement on the development strategy for the Sorong port neither. The port was planned as an international gateway in the Pendulum Nusantara program, but was designed as a feeder port only in the Maritime Highway Initiative.

Good planning often starts with detailed data analysis. Yet in Indonesia, as in many other developing countries, it is not easy to compile accurate and consistent data. For example, the national statistics record “Statistical Yearbook of Indonesia 2015” reports the amount of unloaded cargo in Maluku province in 2015 to be over 1.7 million gross tons. However, Maluku’s own province record, “Maluku Dalam Angka 2015” states that the amount of unloaded cargo was slightly less than 0.8 million gross tons. Few reports, at least in the public domain, have estimated the detailed Origin-Destination cargo flows in the country. An immediate solution for these problems seems to be more government intervention and coordination: to compile more reliable and detailed data; to sponsor in-depth study and planning; to coordinate the investment plans of different companies. Although such a “social planner” approach seems intuitive and reasonable, increased involvement and intervention from the government could raise concerns of inefficiency, bureaucracy, corruption and state monopoly, especially for an industry characterized with lumpy investments and high risks. Numerous studies have suggested that the free market, or the “invisible hand” as named by economists, is the best solution in the long term. Government interventions, the “visible hand”, should be only called for when there is a clear market failure.

Recently we have carried out a study on the network configuration and port investment strategies for Indonesia. Our study suggests that the best shipping network and port investment plan changes over time. A hub-and-spoke shipping network is good for the current low level of shipping demand. However, in the long term a point-to-point configuration with additional domestic hub ports will be a better choice. Such a pattern might make some progressive policy options viable: government intervention in the early stage may be justified, which may avoid duplicate investments and thus increase the utilization and return of infrastructure investment. In the long term, since multiple hubs will be needed anyway, it is possible to rely more on market-based mechanisms which are often more responsive and efficient, and brings inter-port/inter-firm competition. That is, the optimal decision may evolve dynamically with market conditions. Visible hands with government intervention may be needed in the early stage to get the basic infrastructure done and jump-start the industry growth. As the market grows, there is enough room to accommodate competition and more private investors, when the invisible hands are more sustainable. If this plan is indeed feasible, there is a need for policy makers to think far in advance, and be prepared to change their own policies even at the time of developing such policies.

Corridor protection for infrastructure and transport

ITLS Think Piece #36-2017-October

By Peter Thornton³⁶

Infrastructure Australia (IA) recently released a paper in its reform series entitled “Corridor Protection”³⁷ in which the case is argued for effective corridor protection for future infrastructure projects. In particular, the argument is advanced that the cost of acquiring the land needed to build tomorrow’s infrastructure is much less, in discounted cash flow terms, than would need to be expended in the future when, potentially, the land needed for such corridor may have been crowded out by urbanisation and other higher forms of land use.

On the face of it, it would appear to be a “no – brainer” to make such strategic investments but something as seemingly sensible as doing so may have its pitfalls and downsides, which need to be very carefully assessed along with the more obvious benefits.

IA correctly argues that historic efforts to reserve corridors for Sydney’s future motorway systems ultimately allowed their development some 50 years after they were designated and reserved.

But this was not so in all cases.

Corridors so designated through Sydney’s northern suburbs to both the direct north and to the northern beaches had to be abandoned as increased urbanisation led to them being compromised as community attitudes to environmental issues intensified and, in many cases, such as the F6 corridor west of Botany Bay, as communities came to see such reservations as the only remaining open space for recreational purposes and have been energised to defend them as such. Governments also came under pressure from Sydney’s “rapacious” development industry and for state revenue generation purposes to relinquish such long held but not as yet utilised reservations for urban development purposes - for example, near Castlecrag/Willoughby on the former Warringah Freeway extension reservation. This was compounded as local community opposition to the use of such land for surface transport also increased. Whilst many of the reservations did enable the provision of urban motorways, the operational performance of some of these was compromised, in places, by having to limit road speeds to less than optimum to minimise exposure to road noise to residents who had built or bought houses close up the road reservation boundary – as occurred on the M2 where speeds were limited initially in places to 90km/h. In other places, surface alignments became politically unachievable with passage of time and, as IA rightly points out, had to be (and may yet have to be) accommodated in tunnels which are not only expensive to build in the first instance but ruinously expensive to expand at a later date, if just for the misery costs imposed on road users of long periods of delay due to construction zones speed limits and reduced lane capacity – as was the case for example with the M2 Epping tunnel, as is the case with the new WestConnex tunnel and would be the case if the M5 tunnel has to be expanded.

³⁶ Peter Thornton is a member of the Board of Advice at the Institute of Transport and Logistics, University of Sydney and Managing Director of Transportation Associates Pty Ltd, a consultancy in strategic advice for the transport sector.

³⁷ Infrastructure Australia “Corridor Protection – planning and investing for the long term” July 2017.

Having too much foresight can be problem as well.

In Sydney, in the development of the City railway in the first part of the 20th century, the redoubtable Dr JJC Bradfield made numerous “investments” in infrastructure to permit the future expansion of the system. A few examples are the Northern Beaches railway stub tunnels at North Sydney and those extending north out of St James Station. And then, of course, there are the “ghost” platforms 26/27 at Central which date from the 1950s. A more contemporary example was the “acquisition”, by use of planning instruments, of a corridor reservation for a future rail tunnel through the western corridor of the Sydney CBD. This required a strata title through various building basements. Given that Metro Sydney has now adopted an entirely different alignment through the CBD, this seemingly sensible – at the time - planning precaution now looks unlikely to be utilised – though of course one can never say never. The author has been involved in many studies for augmenting Sydney’s rail system and has made “valiant” efforts to make use of such provisions but, to date, no workable schemes have been able to be devised which meets contemporary needs - for example, use of the spare platforms at St James for a airport rail link CBD terminal. This is because, in the intervening period, the city has reshaped and transport infrastructure solutions of 50 – 100 years ago and even only 20 years ago are no longer deemed appropriate for operational, economic, social, environmental, political or any other reason.

And as far back as the 1980s, the ACT government very responsibly designated corridors for facilitating high speed rail into and through the Territory and the City of Canberra and has defended these against incompatible forms of development. Commendable as this was, the last study in 2012 into high speed rail did not propose the connections to Canberra anywhere near these reservations. Worse, the ACT’s corridor was and still is predicated on an extension of high speed rail south towards the Monaro and Gippsland which neither of the Commonwealth’s studies since 2001 have supported and which does little to bringing high speed rail close into a CBD terminus or even a CBD through station to permit the more logical westwards extension – should that ever happen - to the inland cities of Wagga Wagga and Albury and onwards to Melbourne in the very long term.

In terms of high speed rail, IA calls for corridor protection for the entire east coast corridor from Brisbane to Melbourne. While this is commendable in regard to the short range regional corridors into and around the major cities – where inevitably the great problems occur - for which the Commonwealth now has a plan and policy³⁸ to investigate, there is no plan or policy, as yet, for the creation of the entire east coast system. The work required to conduct the engineering and environmental planning studies needed to enable the precise geometric designation in legally binding cadastral terms to facilitate land acquisition over a ~2000 km corridor would not only be vast but may prove premature – put simply, by defining a corridor in the wrong place given the likely time lapse between such designation and its use. Being ultimately located in the wrong place is not helpful given the impact in the interim that such a reservation potentially has on lives and on lands it transects or even merely adjoins. As such, a much better than even chance of it being used at some reasonably foreseeable point in time for its intended purpose is needed.

Of course, it is not possible to discuss making such reservation for infrastructure without mentioning that made for another airport in the Sydney Basin. Those of us around at the time gravely opined that “until the question of a site for another airport is settled the entire future structure of the greater metro area of Sydney cannot be determined” such is the footprint of an airport on a city. And we weren’t wrong! Again, responsible and foresighted planning in the

³⁸ “The National Rail Program: investing in rail networks for our cities and regions” Commonwealth of Australia 2017

1980s led to acquisition by the Commonwealth of a site at Badgerys Creek, laying, so we thought, the ground work which would allow metropolitan planning to proceed rationally.

But the politics of such a project led to this site being disavowed by both by sides of politics for decades and strangely absent from strategic transport planning documents prepared by the State – which doesn't have responsibility for air transport, only land transport. And although it was shown in statutory land use planning documents as being zoned SP1 Commonwealth Land "Special uses", the long delay since its acquisition till today when, finally there is political alignment and commitment, may have lulled some in the community into thinking, however foolishly, that it would never happen and that their lives would never be affected. Fortunately in this case, notwithstanding that there remains some opposition to use of the site, it has been sufficiently protected from incompatible development to still be operationally viable 30 years on. I say, "fortunately" advisedly because, as was shown clearly in the Joint State-Commonwealth "Sydney Region Aviation Capacity Study" of 2012, whilst Badgerys Creek may not be, by today's major airport standards, the very best possible site for another airport, it is by far the best site that Sydney still has left.

In summary, provided it is affordable and for some form of infrastructure that has a better than even chance of being implemented within a realistic time horizon which - given what it takes to actually plan, design and gain approval - would be of the order of, say, 10 to 15 years – i.e. well with the lifetimes of planners and politicians - if only to ensure their continued commitment to it! - it makes sense to invest in the foundation of the project which is its land corridor or reservation. But the corridor itself is not enough – sufficient curtilage must be acquired and/or protected, physically or through land use planning regulations, to ensure the future operation of that infrastructure can occur and without compromising its performance e.g. speed limits below maximum, curfews and the like. And it must be defended at every turn by politicians against those who would comprise it or water down its projection.

IA rightly points to the need for *"government at all levels... to work together on corridor protection"* and indeed, in Australia's geopolitical situation, and with simultaneously both the division of and increasingly overlap of responsibilities for delivering projects of the scale that Australia is now both contemplating and needing, that need extends beyond corridor protection to the entire gamut of infrastructure provision.

Finally, IA's call for increased attention and activity by Governments to make provision for future infrastructure by acquisition of corridors is sensible, provided it is a response to a policy and plan which has been thoroughly tested by the parliaments and for which there is not only bipartisan support at the Commonwealth level but also at other levels of government. This may be a *"high bar"* to surmount and therefore in need of a different approach by parties and governments but if infrastructure is to be effectively delivered, it cannot continue to be a political *"football"*. Debate the policy by all means but let's have majority commitment to the outcomes and what is needed to deliver the policy! There is little doubt that countries who do not have to observe the niceties and protocols that we do can get things done faster but that is not our way.

Notwithstanding the very many merits of Australia's democratic form of government, infrastructure *"planning by marginal electorates"* is not one of them. We need to get beyond that, and fast, if a truly national infrastructure agenda is to be delivered on time and on budget.

The role of human behaviour in supply chain decision-making

ITLS Think Piece #10-2015-November

By Behnam Fahimnia

Supply chain decisions are associated with design, planning and scheduling of various operations. Numerous analytical models and optimisation techniques have been developed and applied to tackle these issues. For example, analytical models have been used to assess and compare alternative solutions to production planning problems so that the preferred solutions can be selected and put into practice. Or sophisticated optimisation techniques have been used to address multi-objective and multi-criteria supplier selection problems.

The basic assumptions in all these tools and models are that the objectives and criteria are known in full, that they are quantifiable and prioritisable, and that a decision maker is perfectly rational and consistent. In practice, these are unrealistic assumptions. The use of tools and techniques with a strictly rational view may not be very effective when decisions are greatly affected by human behaviour. For example, studies show that decision makers are only “boundedly rational” and suffer from systematic biases. The term “bounded rationality” describes the phenomena where a person’s decision-making and logical reasoning is impaired by personal beliefs and cognitive limitations.

Of all the decision-making tools we have developed in the past decade, only about 20% have ever been fully implemented in the real world. The remaining 80% have been either impractical or used only to perform base analysis and forecasting the results of which are subsequently manually adjusted. This illustrates the shortcomings of the existing models which fail to take into account the behavioural influences. Designing practical decision making tools requires thinking outside the box and questioning the conventional assumptions.

For example, upstream supply chain, strategic sourcing decisions involve evaluation and selection of suppliers using a number of assessment criteria. The selection, measuring and weighting of these criteria typically involve cognitive biases due to the large number of influencing factors as well as the limited information processing capacities of individuals (i.e., when overloaded with information, individuals tend naturally to limit the amount of information taken into consideration, in this case the number of criteria or metrics). In addition, decision-making capabilities can be impaired when under stress. In particular, when things are going badly, people are more likely to make riskier decisions. A realistic supplier evaluation and selection model, therefore, needs to identify and eradicate such biases and cognitive limitations that can result in riskier decisions.

Another example is demand forecasting, downstream supply chain. Statistical system-generated forecasts often go through a number of manual adjustments made by forecasters and supply planners. Some of these adjustments can be essential and unavoidable to address exceptional circumstances and unexpected events (e.g., unforeseen sales promotions, climate/weather change, price change, product perishability, alterations in strategic plans, and new product developments). Yet, in most cases there are biases and inefficiencies in manual adjustments (such as over-optimism of the forecaster or over-reaction to a particular event) that may actually exacerbate the accuracy of the system-generated forecasts. There are approaches to identify and eradicate these biases, and improve the learning rate of forecasters for more effective adjustments. Some of these approaches may include the use of more advanced statistical forecasting systems that can standardise the magnitude and frequency of adjustments, more

reliable market information, more coordinated S&OP and forecasting meetings for integrated forecasting decisions, and more effective training of forecasters.

Studies show that much of our decision-making is habitual and not a result of conscious deliberation. When learning to drive a car, a person focuses and pays conscious attention to all details. Once a seasoned driver though, he may find himself at the destination without any recollection of how he got there, nor the decisions he made during the journey. Similarly, supply chain decision-making can become routine, even though they may involve several biases and limitations. There are interventions to break such decision-making habits, the most effective of which is regulating behaviours (such as restricting a forecaster to no more than 10% data manipulation). Designing and implementing such regulations require a deep understanding of the contextual decision biases, the influencing factors, and the circumstances in which supply chain decision makers show more tendency to change their behaviours.

The Institute of Transport and Logistics Studies within the University of Sydney Business School has a research team specialised in investigating a range of topics in the area of behavioural supply chain decision-making. The team collaborates with companies in various industries to help supply chain practitioners make better behaviourally-informed decisions at the strategic, tactical and operational planning levels. Laboratory experiments, simulation studies, empirical field experiments, choice modelling experiments, and game theoretic approaches are used to identify the decision biases and inefficiencies, understand the underlying causes, and develop advanced behaviourally-informed decision support tools to effectively regulate human behaviour and change bad decision-making habits.

Logistics information quality and availability in e-retail: The end consumer deserves better value

ITLS Think Piece #12-2016-January

By Jyotirmoyee Bhattacharjya & Andrew Collins

The growth of e-retail has been accompanied by the globalisation of business-to-consumer (B2C) logistics. Australian consumers, for instance, purchase a range of different products including clothing, footwear, craftwork, computer accessories, and video games and consoles from international e-retailers³⁹. Popular online sites include Amazon, ASOS, Boohoo, Etsy, and Missguided amongst many others. These e-retailers generally partner with multiple third-party logistics companies to manage the local and global distribution of their products. In essence, the customer experience is co-managed by two or more entities in the supply chain.

As the complexity of the supply chain increases, the importance of information flows also increases. These flows help facilitate highly efficient distribution practices and supply chains, by supporting the business-to-business (B2B) interactions between the e-retailer, and the various logistics service providers (LSPs).

In a B2C context, the consumer derives value not just from the quality of the logistics services provided, but the availability and quality of the information related to those services. The following are some typical questions the consumer might wish answered: When will my product arrive? What is the chance that it will be late? Will I be provided with advanced notice of the exact arrival time, or can I select the delivery time? Is there an option to expedite my delivery? How and when will the delivery be made? Is there an option to pick up the delivered product at a time and place convenient to me?

Appropriate information on the logistics service helps the consumer ascertain if a particular online offering is competitive with other online and offline alternatives, by clarifying the immediacy and total cost of the online offering under consideration. It also serves to reduce uncertainty surrounding the logistics service component of the value proposition. Together, these functions link information availability and quality to purchase behaviour, with consumers using logistics information to make choices between e-tailers, conventional retail, competing products, and purchase abandonment. If the information is inadequate, the customer might provide negative feedback through private channels, such as the now ubiquitous online customer survey, or public channels, such as social media. The latter will have potential reputational consequences for e-retailer and LSP alike. Poor information provision might also impact on repurchase intention, again with consequences for both e-retailers and LSPs. Finally, information quality can help set customer expectations, which may moderate customer satisfaction.

A lot then is potentially riding on the quality of logistics information in B2C contexts. Are e-retailers and logistics service providers presently doing an adequate job in this respect? Largely, no. There are widespread information problems prior to purchase, and, notwithstanding the

³⁹ <http://www.roymorgan.com/findings/5942-australias-online-shoppers-more-likely-to-buy-local-201411252208>

prevalence of tracking information, during the delivery process also. We will consider each in turn.

Pre-purchase information⁴⁰

Lack of adequate information provision and expectations management in relation to costs and payment related processes ⁴¹ are significant contributors to the ongoing problem⁴² of shopping cart abandonment.

Shipping costs and customs duties are often not clear to customers until they proceed to checkout. Currency exchange rates add to the problem. Shoppers might need to go through additional steps to split up orders when the costs become clearer at checkout. Another common issue is the lack of adequate information regarding all LSPs used by the e-retailer for regional and global shipments. Customers are often surprised that so many service providers may be involved, and uncertainty around which providers will be used prevents the customers from evaluating the overall package using reputation, prior experience, online reviews, etc. E-retailers that use high quality LSPs should promote as much. Amazon is better at this than many other retailers to the extent that it provides a list of LSPs on its websites for countries in which it operates (US, UK, India, etc.). However, these websites do not explain whether each LSP will handle the process end-to-end. As is often evident from complaints on social media and other public forums, more than one LSP may be involved in the process resulting in varying levels of efficiency on different legs.

Many e-retailers (including larger companies) provide somewhat opaque explanations regarding the differences between various shipping options and the estimated order processing time. There needs to be better acceptance of the fact that customers are not inclined to spend additional time reading lengthy shipping policy documents elsewhere on a retailer's website. All essential information needs to be easily accessible as part of the shopping process. AliExpress provides estimates for both order processing and shipping/delivery periods prior to checkout. However, Amazon and many others do not state the order processing time upfront. This becomes an expectation management issue as a customer with limited previous experience with a given retailer is then left to assume that the order was processed immediately and there is a delay associated with the delivery process. This can lead to negative feedback through various social media channels and recommendation sites. This is an easily addressable problem that requires willingness for change and better collaboration between user interface designers and customer service staff. The provision of real-time updates regarding stock levels and backorder options could also help avoid disappointments at checkout and keep customers from heading off to other sites.

Information during shipping and delivery²

Despite the widespread adoption of delivery tracking solutions, the shipping and delivery processes also come with their share of transparency issues. Different members of the supply chain tend to provide tracking information with different levels of granularity and update

⁴⁰ For additional examples, see: Bhattacharjya J, Ellison AB and Tripathi S, 'An exploration of logistics related customer service provision on Twitter: The case of e-retailers.' *International Journal of Physical Distribution and Logistics Management* (2016, forthcoming)

⁴¹ <http://www.statista.com/statistics/232285/reasons-for-online-shopping-cart-abandonment/>

⁴² <http://www.listrak.com/digital-marketing-solutions/email/shopping-cart-abandonment-index.aspx>

frequency. Little is known about how customers perceive different types of tracking information, and differences in update frequency across and within orders. This is an important area for further research. What is clear though is that the language used in the updates is often more geared towards the LSPs than the consumer, and the messages often lack context. For example, what really is happening at that depot, and why has it been sitting there for two days when the parcel crossed the globe in just 24 hours? Understanding and guiding customers' expectations is important here.

Many of the problems are systems based. If an event is not logged when an international shipping firm hands off to a national carrier, it is impossible for either party or the end consumer to track down a missing package. The other issue is one of inaccurate tracking information. One example of this is items showing as 'delivered' due to a somewhat hasty update by the last mile service provider while the relevant truck is in the process of making deliveries. Another issue is the use of multiple tracking systems. It is not uncommon to have multiple systems, one each for the e-retailer and each of the LSPs, with separate tracking numbers and websites for each. Furthermore, the messages in each system are often in conflict.

Cross-border e-shopping could be a much less stressful experience for customers if they could use a single tracking system, and if standardisation were achieved in the quality of tracking information, the events that must be recorded and the timing of updates.

Implications

With the proliferation of social media, there is an increasing shift in power towards the end consumer. The issue is not just the current levels of shopping cart abandonment but also how consumer choice could change as consumers disseminate negative feedback to a large international audience of fellow online shoppers.

The responsibility for information provision extends to logistics partners as well. If these companies fail to collaborate to provide a seamless experience for end consumers, then the reconfiguration of supply chains is an increasing possibility. This could take the form of vertical integration where larger international LSPs absorb smaller local players in markets of interest. The recent acquisition of Bongo International by FedEx and Toll by Japan Post⁴³ might be indicative of future trends. This integration could help make choices simpler both for e-retailers and the end consumer. Irrespective of any market consolidation in the LSP field, e-retailers need to understand the extent to which they are competing on the logistics services they provide to consumers through their partners, and improve their offerings accordingly.

⁴³ <http://www.smh.com.au/business/toll-becomes-part-of-japan-post-as-investors-accept-65b-takeover-20150513-gh0e1m.html>

The crisis in the container shipping industry and its resolution

ITLS Think Piece #22-2016-September

By Michael Bell

The recent bankruptcy of the world's seventh largest container carrier, Hanjin Shipping, has sent shock waves through global supply chains. Following the refusal of banks to continue financial support, Hanjin ships and containers have faced the prospect of arrest in ports around the world as stevedores, tug boat operators, ship owners and others fear going unpaid, leaving thousands of containers stranded on ships or in ports. This shock comes after a long period of low freight rates caused by an excess of carrier capacity combined with the weakening containerized trade flows. Excess carrier capacity has been driven by the delivery of ever larger ships in search of lower unit costs combined with the cascading of ships from the major trade routes to lesser trade routes.

After being supported for a while by lower fuel oil prices, many, if not all, container carriers are now making losses. This includes Maersk, the world's largest and arguably most efficient shipping line. The laying up or scrapping of ships has so far been insufficient to remove excess capacity from the industry. Other ploys, like slower sailing speeds to save fuel and absorb excess capacity, have also been unable to stem the losses. So, a shock of this kind was to some extent inevitable.

The immediate consequence of this bankruptcy has been that container rates have increased substantially as nervous shippers attempt to secure space with alternative shipping lines. While this may improve the revenue for the remaining shipping lines in the short term, the longer term prospects for the industry are less rosy. If Hanjin is liquidated, its assets, principally the ships owned by Hanjin, will be auctioned off. Those ships operated but not owned by Hanjin, around sixty percent of Hanjin ships, will re-enter the charter market. In short, the excess capacity in the industry will not be reduced rather Hanjin ships will switch to owners with less debt, potentially putting further downward pressure on freight rates.

Underlying the current problems in container shipping are changes in the nature of trade flows. One such change has been a reduction in the size and weight of containerized cargo, typically TVs, vacuum cleaners and other consumer durables. A second has been a trend to "near sourcing" or "reshoring" driven by realignments in labour costs and labour saving automation. This shortening and shrinking of trade flows in manufactures has made air freight more competitive at the margin, for example for high value electronic goods requiring just-in-time delivery to meet global marketing campaigns. The net effect of these changes is that container shipping can expect demand to remain depressed even when the world economy recovers, as it eventually will.

Instead of waiting for demand to recover, the container shipping industry, which includes maritime and inland terminal operators as well as shipping lines, should identify and focus on those areas where shipping has a natural advantage, namely energy consumption and a lower environmental footprint. Terminal operators have the possibility to switch to electric or hybrid power for cranes and vehicles, and to source the electricity from zero or low emission providers. Through electrification and zero emission electricity generation, Rotterdam's recently opened Maasflakte 2 maritime container terminal claims to have drastically reduced its environmental footprint. Ships have the possibility to switch to cleaner fuels, for example away from high

sulphur oil to marine diesel or LNG. In some cases, like ferries and short sea shipping, hybrid or battery propulsion may be an option.

The greening of shipping is currently being driven by the International Maritime Organisation (IMO) through the introduction of Emission Control Areas (ECAs) on the US and Canadian east and west coasts and in the North, Baltic and US Caribbean Seas. In addition to the ECAs, an upper limit on the sulphur content of fuel. So far, Australia has no ECAs to protect its port cities, although the Australian Maritime Safety Agency (AMSA) is enforcing IMO sulphur limits for fuel oil.

In addition to moves to clean itself up, the container shipping industry could look at new ways to add value while cargo is at sea, which can amount to weeks. Would it not be great if raw materials and/or components were loaded at the origin and final products were unloaded at the destination? Alongside reefers in on ships, containerized assembly or processing plants could be plugged in. These containerized plants would be stocked with the raw materials, other components and a robot or plant at the origin. Upon loading on a ship, the container would be plugged in and the robot or plant would start its work. Relatively slow processes would be suitable for this treatment, for example fermentation. How about a containerized brewery, delivering beer brewed en route to its destination?

Feasibility of increasing volumetric load of freight heavy vehicles

ITLS Think Piece #23-2016-January

By Mary Chiang

Background

The National Transport Commission (NTC) recently published an issues paper on increasing heavy vehicle (HV) volumetric load capacity without increasing mass limits in an effort to increase the productivity of road freight. The NTC paper identified a number of key issues that require further consideration and resolution prior to developing a national policy for introducing higher productivity vehicles (HPVs) onto Australian roads. While there is rationale for the NTC to pick the freight productivity 'low hanging fruit' by increasing the volumetric load capacity, there needs to be some dialogue around overarching socio economic issues and macro trends as an initial step to any policy change.

Policy objectives and rationale

Policy intervention is typically only warranted when it is used to address a market failure where the market is unable to reach Pareto Optimum without changing the rules that govern the dynamics of the market behaviour. It would be useful to take stock of the objectives and rationales for changing an existing policy and ask “*What would be the objectives, in terms of efficiency, economic, road safety, environmental, infrastructure, and urban structure (Visser, et al., 1999) that the change of current freight transport policy can achieve?*”⁴⁴ While there seems to be a strong efficiency rationale for changing the current road freight transport policy, it may not be as straight forward when considering the other objectives. In particular, as NTC pointed out in the issues paper, there would be winners and losers from the policy change which may crowd out smaller road freight transport operators and favour larger operators with better financial resources. There could also be quite significant initial infrastructure investments required as a result of the policy change, which would be borne by road agencies and further exacerbate the potential windfall gain by the larger freight transport operators. The issue is also worth considering in the context of the larger picture.

⁴⁴ A paper from the First International Symposium on City Logistics in Cairns described the six areas of objectives for urban freight transport in detail (Visser, et al., 1999). *Efficiency* objectives relate not only to minimising or reducing transport costs, but also to improvement of the quality of transport services (access, reliability, travel time, flexibility or security of freight). Often times, as a result of the efficiency objectives being achieved, it may also serve *economic* objectives, such as creating business opportunities and employment. *Environmental* objectives can range from the reduction in harmful air pollutants to the slowdown in the depletion of natural resources, such as materials and fossil fuels. While *infrastructure* objectives refer to the reduction of road maintenance costs and *urban structure* objectives refers to the preservation and revitalisation of (historic) city centres, and maintaining the level of services within urban areas.

The big picture

Perhaps the industry needs to think about the likely future end state—*what would freight transportation look like in 20 years' time?* With the current discussions on the trialling of autonomous and semi-autonomous vehicles, should autonomous HV be added to this conversation? If autonomous HV is highly likely to be introduced in the next 10-20 years' timeframe, is there enough marginal benefit to outweigh the likely high margin cost of introducing a major change to the current freight transportation policy in the interim period? It may be the case that the high initial marginal cost of introducing HPVs onto Australian roads may never outweigh the marginal benefits in time as an interim policy change before the next wave of reform required for the introduction of autonomous HV. In this context, there may be a real option value in delaying the introduction of a costly major policy change and instead adopt the lower cost incremental policy arrangement.

There are also some larger socio economic trends emerging in Australia, which would particularly impact on the safety aspect of any policy change. Australia has an aging population and a number of lifestyle sea-change / tree-change trends particularly by baby boomers. This results in increasing proportions of older residents in rural and regional Australia. How would these demographic shifts impact rural and regional on-road interactions with larger vehicles given that rural roads tend to have higher fatality rates for a given number of crashes?

Feasibility of increasing HV length/height/width

Based on the limitations of the existing road design, there appears to be no convincing rationale for increasing the width of HVs for productivity purposes given the wide-spread impact it may have on the long-held road design standard. On the contrary, increasing HV height or length may be feasible, albeit such policy decision would need to be accompanied by additional research and testing for implications for/of road side architecture such as gantries, power lines, safety signs, etc. For example, increasing height above 4.3 metres would require an exercise of mapping out suitable routes (similar to the Victorian Cubic Freight Network) to ensure suitable routes have been considered and meet the height requirements by the HPV. The most feasible option for increasing volumetric load capacity at this stage seems to be through the use of increasing length. Although increased vehicle length, such as replacing a standard 26 metres B-double with a Super B-double or other HPV configurations, would impact on the vehicle's swept path. It's unclear whether such information is currently available in the most current *Austroads Design Vehicles and Turning Path Templates Guide* to aid road authorities in assessing the suitability and identification of appropriate routes for HPVs. It may be possible that the risks associated with the likely wider swept path requirement for turning longer length HPVs may be partially managed by choosing a better suited HV type and/or vehicle configuration with a compulsory "LONG VEHICLE" signage on the HPV for warning other vehicles travelling alongside the HPV.

Access by HPVs

The Victorian *Moving More with Less* scheme was accompanied by an identified Cubic Freight Network and the compulsory monitoring requirement through Performance Based Standards Scheme (PBS) and the Intelligent Access Program (IAP). It may be the case that HPVs can be feasible by only allowing them to run on certain identified routes for specific purposes, freight task, vehicle types and only at certain time of the day. These routes would primarily be between distribution centres, farm gates, warehouses, ports, and intermodal terminals. Compliance could be best monitored through the use of IAP with the approved PBS HPV with higher volumetric allowance. One of the key barriers to the practical adoption of HPVs is around inter-jurisdictional matters such as the need to work with local governments to determine the 'last mile' access issue. Until this is resolved, HPV uptake would be impeded even if the option is technically viable.

Transitional pathway

Perhaps a pragmatic interim solution to the current freight transport challenges can explore the following three elements. Firstly, there is opportunity for the policy to explore the way current HV access is assessed, whereby the regulator bases its decision on the legal maximum mass rather than the actual mass carried on the HV. There is potential that HV with an actual weight that is much lighter than the legal maximum mass may access greater number of alternative routes based on existing road geometry and design limitations. Secondly, before introducing HPV to the national network beyond those currently on trial in Victoria a national forum where VicRoads can share its learnings from *Moving More with Less* scheme would be beneficial to expedite national conversation on this key policy change. Thirdly, additional research and analysis based on cost-benefit analysis of the different scenarios should be undertaken to measure the true social costs and benefits of the policy change to add analytical depth and provide evidence to inform decision makers.

Pool Questions

1. Should the government change its current road freight transport policy that clearly favours larger transport operators, knowing that this change would increase the efficiency of road freight transport which may or may not benefit you as the end consumer of goods you purchase?
2. Are you concerned that larger and longer vehicles, and potentially autonomous heavy vehicles, will soon be travelling alongside your car on the road – knowing that these higher productivity vehicles would reduce the overall heavy vehicle traffic on the road?

Shrinking supply chains, greater welfare?

ITLS Think Piece #30-2017-May

By Michael Bell

Recent tectonic shifts in the global economy are challenging the ocean container shipping sector. In “The crisis in the container shipping industry and its resolution” (Thinking Outside the Box, 1/11/16) some of the causes of the current malaise in the container shipping industry are presented. Since then, the situation has not noticeably improved, and indeed additional economic factors adding to headwinds facing the industry have become evident (for a succinct and readable discussion of these factors, see the Danish Ship Finance 2016 Shipping Market Review, <http://www.shipfinance.dk/shipping-research/shipping-market-review/>).

As economies develop, there is a natural shift in the composition of gross domestic product away from tangible goods to intangible goods and services. In addition to this, the digitisation of some products means their physical distribution is no longer necessary. Books are being replaced by ebooks and DVDs by music and film downloads. Of course, there is still a demand for tangible goods, if only to enable ebooks to be read and music and film downloads to be played. However, even here, we see some products becoming more compact, for example flat screens are becoming flatter, meaning that more will fit in a shipping container.

The relentless march to automation in production is reducing the attraction of large pools of cheap labour, which in the past enabled first Japan and then Korea and China to industrialise and develop. Increasingly it makes good commercial sense to move some forms of production closer to the consumers, thereby reducing transport costs and inventory in the supply chain, and enabling products to be better tailored to meet customer needs. 3d printing is the ultimate expression of this trend, as it opens up the possibility to relocate production directly to the consumer equipped with a 3d printer, and tailor it to meet the consumer’s needs. This shift to sourcing products locally or regionally rather than importing them by sea from afar is contributing to less demand for ocean container shipping.

The whole range of technologies covered by the “fourth industrial revolution”, or “industry 4.0”, will do little to rescue the container shipping industry (“Logistics Trend Radar” by DHL, www.dhl.com/en/about_us/logistics_insights/dhl_trend_research/trendradar.html), provides an excellent review of these technologies and their anticipated impacts on supply chains). On the one hand, robotics, artificial intelligence, autonomous vehicles, the internet of things, and 3d printers make production more mobile, thereby facilitating greater local or regional sourcing. On the other hand, these innovations could result in relatively jobless economic growth, improving productivity but without distributing income to workers who would consume, and without this consumption there is little to drive a growth in containerised imports.

A recent article in the Economist (“The Retreat of the Global Company”, 28/1/17, www.economist.com/news/briefing/21715653-biggest-business-idea-past-three-decades-deep-trouble-retreat-global) presents statistics which show that multi-nationals are losing profitability in comparison to local rivals. Labour costs, particularly in China, are increasing and in any case automation is making labour a less significant input in production. Multi-nationals are difficult to run because of the need to operate under multiple jurisdictions and the scope for reducing taxation through imaginative transfer pricing is increasingly meeting with resistance from taxation authorities.

All-in-all, supply chains are shrinking in terms of both volume and length, so the demand for ocean container shipping will stagnate at best. There will, of course, be short-term recoveries,

and there is no suggestion of terminal decline, but the trend is clear. Further reductions in unit cost brought about by increases in ship size and improved operational efficiency resulting from the consolidation of container shipping lines into three mega alliances (the 2M Alliance, the Ocean Alliance and the THE Alliance) will maintain downward pressure on freight rates, but cannot reverse the shrinkage of supply chains.

In the earlier Thinking Outside the Box (1/11/16) piece, it was suggested that container shipping lines could look to greater vertical integration in supply chains as a solution. The two to three weeks that containers spend on the High Seas could be put to productive use by converting mega carriers into factory ships. This would suit processes that take time but could be automated, like brewing or the cultivation of certain plants. In this Thinking Outside the Box piece, we consider the welfare implications of shrinking supply chains.

A fundamental dimension of welfare is diversity. Economic theory suggests that the greater the range of products available to the consumer the greater consumer welfare. However, there is another side to welfare, namely job satisfaction. The greater the range of job opportunities open to a given population, the higher the chance that each worker will find a satisfying job. One of the consequences of globalisation and the lengthening of supply chains has been that manufacturing has gravitated to locations where large pools of cheap labour are to be found or to where particular skills have accumulated (or, agglomerated, as economists say), leaving behind not only industrial dereliction but also pools of unemployed workers, some with valuable skills. This thinning of the range of jobs available in any given location reduces welfare, unless labour is mobile, in which case industrial dereliction is added to. It also reduces the diversity of products available to consumers as the economies of scale lead to market domination by a limited range of products.

The current shortening of supply chains has the potential to reverse this process. Local sourcing can increase the diversity of products available to all consumers and at the same time provide a wider range of careers for all, irrespective of residence. Rather than concentrating cheese production in, say, France it would create a vast range of local cheeses with different characteristics and flavours, and at the same time provide employment for would-be cheese makers from many countries and regions. Few would dispute that this constitutes a welfare gain! It would also, ironically, restore some longer supply chains as French consumers discover the delights of Australian cheese, although French cheese lovers may prefer to travel to Australia for the full experience.

The data driven supply chain: A retail perspective

ITLS Think Piece #45-2018-March

By Gareth Jude, Behnam Fahimnia,

Supply chains have existed since the earliest days of human civilisation, but the idea of supply chain management is a relatively recent concept. At the core of supply chain management is the idea that more value is created by collaboration than by competition. One of the earliest examples of supply chain collaboration in action was between Walmart and Proctor and Gamble in the mid 1980s. Walmart agreed to share point of sale data with Proctor and Gamble and, in turn, Proctor and Gamble agreed to ensure optimal on-shelf inventory at Walmart. The results were increased sales, decreased inventory in the supply chain, lower costs for Walmart and better market intelligence for Proctor and Gamble. Since then, supply chain collaboration has become a well-established practice in parts of the retail industry. Supply chain management is especially important in the retail industry as the Reserve Bank has calculated supply chain costs represent an average of 40% of retail selling prices.

Supply chain management is about to be transformed by technology. Gartner predicts 5.5 billion smartphones and 20 billion Internet of Things (IoT) devices will be in market by 2020. It will be possible to collect data not just on sales and production schedules between retailer and manufacturer (as in the Walmart and Proctor and Gamble case), but also on the location and condition of goods throughout the supply chain, consumer and team member movements (both in and outside stores), stock levels in consumers' fridges and appliances, the availability of consumers to receive a delivery, and much more. Data storage is already being transformed through the increasing capacity and flexibility and decreasing cost of cloud computing. Blockchain and data exchanges, will mean information can be shared by all parties – not just point-to-point collaborators – easily and securely. Data analysis will also be transformed as autonomous or semi-autonomous platforms (AI) allow businesses to discover deeper insights, make predictions, or generate recommendations in virtual real time. In addition, high-speed data networks such as 5G in combination with dedicated low cost, low data rate networks like 4G Cat-M1 and Narrowband IoT (NB-IoT), will enable information to move between partners at a pace that allows timely business decisions.

What will this new capability to collect, store, analyse and collaborate with data mean for the management of retail supply chains? German online retailer Otto has introduced AI to predict demand and produce orders for 200,000 items per month. Overstocks are down by 20%, returns are down by two million items a year and goods are being delivered more quickly leading to increased customer satisfaction. Chinese convenience store retailer BingoBox has introduced IOT and AI to enable unmanned stores. Customers use their smartphone to gain entry and as they leave their goods are scanned via RFID and charged to their WeChat Pay or Ali Pay account. By removing checkouts and automating inventory management, BingoBox believe a team of four staff members can manage up to forty BingoBox stores. Scott Galloway has predicted that in the future, Amazon will send you two boxes a week: one containing everything they think you will need, and another to return what you didn't use.

A recent survey shows Australian retail supply chain professionals are overwhelmingly convinced of the benefits of data driven supply chains and have begun to transform, but there are also obstacles. A reluctance to share key data, the need to properly secure it, skill gaps, challenges with current technology, organisational issues and relational issues relating to alignment of goals and processes with partners, were identified as barriers to deployment. One thing that is easy

to forget in an age that emphasises data analytics, is the significance of the 'human factor'. There is a human element that links data to decision making. Better understanding and formulating this human element is a critical aspect of data driven supply chains. David Ferruci, IBM's lead in the creation of the Watson computer system, views the future of decision making as a combination of human judgment and algorithms. The use of data is almost entirely dependent on human judgment in various forms.

The transition to data driven supply chain management will not be easy for the retail industry. Universities and researchers have a key role to play. Data driven supply chains require the traditional skills of supply chain professionals, but new skills from various disciplines will also be required. In particular, data scientists will be needed to interrogate the data and build the algorithms that turn supply chain data into useful business information. Data science is predominantly the domain of university qualified PhDs and research fellows. Online retailers like Amazon have long recognised the benefit of academic data scientists in their businesses. Target USA now employs 40 PhD data scientists in their IT team. Australian retail companies now need to fill this skills gap. Forming closer ties with Universities who have pipelines of PhD students and research fellows who have knowledge of the discipline and the supply chain sector would be a logical first step.

Omni-channel retail in harmony with green city logistics

ITLS Think Piece #63-2019-July

By Michael Bell

City logistics is currently undergoing a radical transformation at the same time as improvements in the urban environment, including air quality and streetscape, are gaining a higher public profile. Fortunately, these two developments can support each other, so cities seeking to improve their environments can do so by facilitating changes in city logistics, and conversely cities seeking to improve their logistics, can simultaneously achieve significant environmental benefits. For example, Sydney, which is actively looking at ways to improve its city centre logistics, is presented with an opportunity to simultaneously improve air quality and reduce noise in the central business district.

Significant progress is being made in some cities, notably the UK and mainland Europe, on measures to clean the urban air. In April 2019, London's Ultra Low Emission Zone (ULEZ) went live. Heavy Goods Vehicles (HGVs) not meeting the Euro 6 standard for NO_x and particulates have to pay GBP100 (about AUD180) per day to operate in the ULEZ⁴⁵. Vans and other smaller vehicles not complying with the Euro 6 standard will pay GBP12.50 (about AUD23) per day. The ULEZ is the first step in an ambitious strategy for London to become a 'zero carbon city' with energy efficient buildings, clean transport and clean energy by 2050⁴⁶.

While adopting the Euro 6 emission standard will undoubtedly improve urban air quality, further improvements to the urban environment will necessitate a switch to electric vans and trucks. Not only do they eliminate air pollution at the point of use, they are also quieter and therefore better suited to the overnight replenishment of stores in residential areas. Although battery and recharging technology continue to improve, measures like ULEZ in London are already driving the introduction of electric vans and trucks. One interesting example is the DPD parcel service in London. A depot on the periphery of the city is connected by 7.5 tonne electric trucks to a satellite in Westminster, from where smaller electric vehicles pickup and deliver parcels from/to central London locations⁴⁷. The limited range of electric vehicles and the desire to restrict recharging to overnight at the depot or satellite necessitate the use of this two-echelon operation, where before with diesel trucks a single echelon operation might have sufficed.

Retail in urban areas is undergoing a dramatic transformation, starting with the rapid growth of e-commerce. Initially e-commerce operated in parallel to conventional retail. Order picking centres, sometimes referred to as 'dark stores'⁴⁸, arose to connect product suppliers to customers, deploying vans for home deliveries from order picking centres. Then retailers began to use

⁴⁵ <https://motortransport.co.uk/blog/2019/02/12/locity-fuels-in-action-event-to-take-freight-operators-beyond-ulez/>, 7/4/19

⁴⁶ https://www.london.gov.uk/sites/default/files/osd21_es_executive_summary.pdf, 2/7/19

⁴⁷ <https://motortransport.co.uk/blog/2018/10/17/dpd-opens-its-first-all-electric-last-mile-delivery-site/>, 30/1/19

⁴⁸ <https://www.commercialrealestate.com.au/news/prices-surge-on-shortage-of-undeveloped-industrial-land-in-sydneys-inner-south>, 10/2/19

conventional 'bricks and mortar stores' to offer 'click and collect' services⁴⁹, improving the productivity of parking spaces, which can be in short supply in urban areas. The next logical step is for retailers to offer same-day home delivery from conventional stores. Convenience stores, like restaurants, have been forming links with third party delivery operations to offer on-demand services⁵⁰. Alternatively, the convenience store could conceivably come to the consumer on demand, preferably in the form of an autonomous vehicle⁵¹. Areas where there are no stores or where the cost of one could not be justified could particularly benefit from such a solution. Concerned by the impact of e-commerce on local shops and fears of the 'death of the high street'⁵², one German startup is forming cooperatives of local businesses to provide on-demand and same-day delivery to local customers⁵³.

One obstacle to same-day home delivery has been the requirement that someone should be home to receive the goods. To avoid this constraint and to decouple the delivery from the pickup by the customer, lockers of various kinds have been installed or proposed. For example, Australia Post is operating lockers at some Woolworths stores⁵⁴. Other possibilities include the use of car boots for pickups and deliveries, facilitated by a system developed by DHL and VW⁵⁵, or secure in-home delivery, as offered by a smart key system marketed by Amazon⁵⁶. Other uses of lockers in city logistics include as micro-hubs for last-mile delivery on foot or by cargo bike⁵⁷.

The result of all these developments in retail is that the consumer is enjoying an increasing range of delivery options, including more same-day deliveries. However, this comes at the cost of increased channel complexity. The widespread use of bar codes and RFID tags is increasing the transparency of inventory. E-commerce, reward schemes and store cards are providing retailers with extensive data on their customers, their shopping behaviour and their preferences. The huge increase in data is enabling retailers to better position inventory and move it between channels, so that the increase in channel complexity need not result in a corresponding increase in inventory in the supply chain⁵⁸, which would increase costs.

The move to omni-channel retail fits well with moves to improve the urban environment. Same-day delivery of shopping can displace some car trips to edge-of-town supermarkets, and home deliveries can be made by electric cargo bikes. Nearby lockers, for example at commuter rail stations, can reduce the frequency of failed delivery trips. The electrification of omni-channel retail is proceeding incrementally but inescapably, improving air quality and facilitating night-time replenishment of stores without the disruption of noisy diesel trucks. Smaller electric vehicles are less intrusive in city centres than larger diesel trucks, help to conserve historic streetscapes, and can take the pressure off on-street loading zones. The introduction of a tram line down Sydney's historic George Street, combined with resurfacing and refurbishment, sits harmoniously with developments in omni-channel retail, indeed they support each other.

⁴⁹ <https://www.woolworths.com.au/shop/discover/shopping-online/pickup>, 8/7/19

⁵⁰ <https://csnews.com/should-c-stores-dive-delivery>, 8/7/19

⁵¹ <https://www.retaildetail.eu/en/news/food/self-driving-convenience-store-brings-fresh-food-your-door-step>, 8/7/19

⁵² <https://www.forbes.com/sites/cherryreynard/2018/04/26/death-of-the-high-street/#6067cbf45cf5>, 8/7/19

⁵³ <https://www.fastcompany.com/3045525/who-needs-amazon-support-local-businesses-and-then-get-same-day-delivery-by-bike>, 28/3/19

⁵⁴ <https://www.woolworths.com.au/shop/discover/shopping-online/auspost>, 9/7/19

⁵⁵: <https://theloadstar.com/dhl-thinks-outside-box-inside-car-boot/>, 9/7/19

⁵⁶ <https://images-na.ssl-images-amazon.com/images/I/D1GdfdfMVmS.mp4>, 9/7/19

⁵⁷ https://civitas.eu/sites/default/files/documents/cyclelogistics-civitas_final.pdf, 9/7/19

‘Uberisation’ of Public Transport in the digital age - what is in store in the next 10 to 20 years?

ITLS Think Piece #16-2016-April

By David A. Hensher

The Transport for NSW Future Transport Summit held on April 18-19 2016 looked to the future of transport. In the context of autonomous vehicles, big data analytics, internet of things, disruptive technologies and customer service in the digital age, there was much formal and informal discussion on the likely new context in which public transport services might be provided, including driverless vehicles of all types (cars, taxis, buses, trains) in which mobility services come to the fore with no need for individuals to own a car, with regulatory reform (and contracts) that supports a customer-focussed mobility model in which point to point transport can be provided via smart technology.

The opportunities for public transport to match customer expectation under a mobility service model are exciting but also disruptive in terms of current practices centred around mode-specific contracts, protected service areas and under-utilised capacity (it being well known how often buses move ‘fresh air’ plus the driver and no passengers). Has the time arrived for the digital age to provide the much needed technological spur for the take off into the new mobility services era? In NSW this is clearly influenced by the Uber experience and the legalisation of their taxi-like services with an emphasis on high quality point to point customer service bookable through smart technology. ‘Uberisation’ of public transport might now be the catch cry to get us all thinking about future states. (The word Uber has Germanic heritage and refers to ‘being a superlative example of its kind or class’).

So where might we start? The first point is to recognise that the existing model for delivering public transport services (especially the way contracts are designed) may in itself be a constraint on the ability of public transport to fulfil a more useful role in point to point mobility services. With such a large amount of capacity provided and often excess under-utilisation, but a recognition that existing assets may not be the best fit in delivering point to point mobility services (which might benefit by a mix of vehicle types –including cars, small buses, large buses etc.), if there is a desire by government to relax the modal regulatory regime to accommodate mixed-mode opportunities offered by one or more service providers, then we are very likely see a huge change in the services available to customers. The recent move to a multimodal public transport contract offer in Newcastle (NSW) involving buses and trains is a good sign of the willingness of the regulatory setting to accommodate such a plan.

Imagine a metropolitan world in which we no longer have geographic contract areas for bus services, but a model in which operators run their business in a way that gives them the flexibility to provide (if they so wish) traditional timetabled services along specific routes (with designated bus stops), but also a bookable system using smart technology that provides point to point services, be they from home to a rail station, or even longer distances from home to work (the latter is like the old subscription bus service in some countries before the digital booking era). Operators will use this digital platform to compete for business and develop many ways to incentivise users to stay with them (e.g., loyalty programs, fare discounts for multi-riding, discounts on products from various stores etc.).

What is exciting is that there are many smart bus operators out there and they can be part of this journey, make profits and taking pressure off of the funds currently provided by government (or the tax payer), resulting in significant improvement in value for money to the tax payer, something that has been somewhat alien for many years in this very fragmented and protected sector. While operators are encouraged to be innovative and to grow patronage, the contracting regime often has limited incentives to do so, which together with the difficulties in attracting patronage in a market often dominated by the car (which is seen as the preferred point to point mobility mode), bus operators struggle to build patronage even under incentives. Indeed these new service models are expected to make the need to use a car owned by a traveller significantly reduced, even if the substitute is a point to point serviced car operated by the smart multimodal transport mobility provider.

The entrepreneurial zeal may not be something to whet the appetites of all existing bus operators, but many will relish the opportunity while others might just decide to call it a day. New service providers are likely to enter the new mobility space. The same arguments might be put for rail; however the focus is likely to be on rail operators moving into the point to point space as a way of gaining patrons for the rail network through a single point to point service offered by the refreshed multimodal rail enterprise. Whether the rail enterprise does this through a partnership with other mobility providers or themselves should be entirely up to them.

Smart Cities, Smart Thinking about innovative financing?

ITLS Think Piece #18-2016-June

By Martin Locke

Malcolm Turnbull and Angus Taylor, Assistant Minister for Cities and Digital Transformation unveiled the Smart Cities Plan on 29 April 2016.

I had high hopes for the Plan and I like the basic argument that we need to focus new infrastructure investment on developing precincts within our cities to create economic activity and create jobs. The Plan highlights the agglomeration benefits of forming clusters around hubs stimulated by education, health and transport initiatives. The Knowledge Economy needs to be built on relevant research, which can be commercialised. Macquarie Park is evidenced as a shining example.

The Plan discusses the need for transport connectivity and creation of the right enabling environment with use of smart technology; difficult to argue with that.

However, my high aspirations were brought down to earth when I turned to the discussion on innovative financing. I accept the logic that by focusing on developing economic precincts, we are investing today to create a future stream of income, some of which will be reflected in higher taxes. And the concept of value capture is founded on the principle that people who benefit from investment in infrastructure should pay, or at least make a contribution to the cost of that infrastructure. But there are some critical challenges that need to be overcome. Value capture provides a “future” funding source when all that income is earned and tax payments start to flow. But we cannot readily access this future funding source to finance the cost of infrastructure, which obviously has to be paid up-front. This is where we need innovative financing to bridge this gap. Otherwise this attempt to unlock infrastructure funding through value capture fails unless we can demonstrate to financiers how they are repaid.

The Plan rightly advocates for the establishment of value capture schemes but basically stops there. A link is provided to the Department of Infrastructure and Regional Development “DIRD” website and a flyer setting out the new innovative financing principles, which are best described as policy settings, but there is no substantive discussion of an innovative financing mechanism that explains how we are going to use value capture to actually finance the cost of infrastructure. Value capture, through the imposition of special infrastructure contributions (“SIC”), may allow a proportion of infrastructure to be financed up-front by beneficiaries, but I suspect the amount will be relatively modest. We want to encourage developers to step up and be forward thinking around investment for the future but, if we are trying to encourage investment in innovation and new technology-based industries, shouldn’t we be providing incentives rather than imposing new taxes dressed up as SICs? Moreover, the new prospective revenue streams are only realisable in the long term and even then fraught with uncertainty. Getting developers to pay up-front a SIC as an entry ticket to an innovation incubator can only lead to heavily discounted payments.

I believe there is a significant opportunity for the Australian Government to intervene and address this gap by providing innovative financing along the lines of the Northern Australia Infrastructure Facility (“NAIF”). There is far more developed smart thinking about innovative financing mechanisms in the Investment Mandate for NAIF (the Act passed on 3 May 2016). The approach builds on the concessional loan structure, as used on WestConnex, which provides for the Australian Government to provide financing which:

- Provides a longer loan tenor than offered by Commercial Financiers, up to the longest term of Commonwealth borrowings;
- Offers lower interest rates than offered by Commercial Financiers, by being based on the rate at which the Commonwealth borrows;
- Offers extended periods of capitalisation of interest beyond construction completion;
- Offers deferral of loan repayments or other types of tailored loan repayment schedules;
- Offers lower fee structures than those offered by Commercial Financiers
- Is subordinated to loans from Commercial Financiers.

The above list provides an appetising menu for a creative investment banker to develop a scheme, whereby a developer could be provided with the time necessary for the new Knowledge Precinct to be in a position to have access to finance to pay the SIC. For example, on the WestConnex the project, a company is relieved of the obligation to pay interest for the first ten years; this feature would be highly attractive to investors in new start-up businesses and could not be provided in the commercial market.

Moreover, the finance provided by the Australian Government under NAIF is not a grant but a sophisticated debt instrument that is shaped to provide a return based on the time profile of the prospective revenues to be earned by the developer. The Australian Government is cleverly leveraging its balance sheet, minimising the short-term budget impact, yet properly participating in any upside revenues. And the Australian Government will be playing this role in partnership with the private sector, specifically benefitting from the skills of the Commercial Financiers. This takes some of the strain off the shoulders of the Australian Government as the credit assessment workload is shared. But it does require experience to ensure the partnerships are appropriately structured.

The Smart Cities Plan talks about the establishment of an Infrastructure Financing Unit ("IFU") to explore innovative financing, including private partnerships, balance sheet leveraging and value capture for major projects. My suggestion is that one of the first tasks of this new unit is to explore the application of the NAIF principles. This begs the question how will the IFU be resourced? And I note that EFIC is involved with administering the NAIF. The Australian Government is intending to be an informed and involved investor requiring key conditions to be met as a prerequisite for funding, with involvement in project development and delivery teams, and requiring approval at major decision points in a project. I hope it backs up these objectives by mobilising a smart unit fully equipped with smart thinking based on relevant experience.

Sharing must work in a transport future

ITLS Think Piece #33-2017-July

By Corinne Mulley & John Nelson

Doesn't everyone think that sharing is a good idea – especially for everyone else? Of course there is always an element of “I know that if everyone else shares I won't have to”.

“Sharing reinvented through technology” or collaborative consumption is increasingly seen in many walks of life. Most people are aware of Airbnb, even if they have no first-hand experience. A low tech approach works too; for example, a local café where a sign offers something off the menu in return for organically grown produce from an allotment.

Transport in the future is predicated on technology change and a willingness to participate in collaborative consumption. Connected and Autonomous Vehicles (CAV), and here we are talking about cars, are promoted as solving the ills of the city but if they are used like personal vehicles are used to-day we can look to a future of greater congestion fuelled by empty cars entertaining themselves whilst their owners are otherwise occupied.

Returning to sharing and some thoughts about the different sorts of sharing that can exist in the transport domain as illustrated by the two types of car sharing that already feature in Sydney's road-scape. GoGet, Hertz24/7 and Popcar are return to base commercial car sharing schemes where membership of the scheme takes care of the formalities of driver eligibility and insurance with booking and payment being facilitated by Apps. The evidence suggests that commercial car sharing substitutes for second cars. For the future success should be judged more by the number of first cars they replace if we are to take sharing seriously. Commercial car sharing contrasts with peer to peer car sharing (in this case Car Next Door) where personal asset sharing is the basis, i.e. an individual making their car available to someone for rent. Again, it is App based but more informal with no local government support for parking spaces, as with the commercial schemes.

It is interesting to observe that Car Next Door (only four years behind Airbnb in terms of year of foundation) has a considerably smaller market presence. Both Airbnb and Car Next Door are about sharing personal assets so why the difference? Car ownership is characterised by owners forgetting the sunk costs of ownership and so having a travel behaviour that is linked with the low marginal cost of use. Car Next Door is a high marginal cost mode because it includes some contribution to the fixed cost. Airbnb is more similar to its hotel competitors by virtue of the Airbnb and hotels having a high marginal cost of use. Is this the reason for the difference between Airbnb and the Car Next Door or is that a car asset is mobile whereas a property based asset is fixed? Does the difference just boil down to Airbnb being something you purchase intermittently whereas Car Next Door rental would be part of everyday life? Against this the Car Next Door could benefit from greater use through familiarity but we do not see this.

In the future the culture of sharing has to change and this includes citizens' attitudes towards transport assets (particularly cars). Is it a problem that we need to share something which in Australia is very close to everyone's heart? Or is it a lack of visibility? Particularly as peer to peer car sharing is not commercially branded? Like flexible transport services (where the more flexible a service the less visible it is to the community) marketing is crucial to success. It seems like peer to peer suffers from a lack of self-promotion.

We know from mobile phone use and App use that the younger generation is more technologically focussed. Their use of twitter, Facebook, Instagram and Snapchat demonstrates

their willingness to share data for which they show a much less risk averse profile. Spatially, younger people are more likely to use GPS data to announce their location. We know that mobile devices for young people are more important to them than cars. This segment of the population will show by example how to share resources in a way that makes CAV a sustainable outcome.

The million dollar question is whether the younger generation's willingness to share will be enough to encourage responsible use of CAVs when they achieve critical mass? Currently, the outcome does not look promising. Governments need to invest in understanding how the sharing culture needs to develop and how citizens can be incentivised to take part in collaborative consumption for resources which are mobile and find ways to incentivise greater take up of sharing resources when faced with the dichotomy of using a personally owned asset with low marginal costs versus a high marginal cost good when rented.

Mobility as a Service (MaaS) and modal capacity shortfall

ITLS Think Piece #34-2017-August

By David A. Hensher

Mobility as a Service (MaaS) is talked about a lot as the new approach to delivering transport services that are better tailored to the needs of travellers than the existing modal services that, with exceptions, do not allow switching between all possible modes (public transport, car in its many variants including taxi, Uber, car next door, go get, electric bikes etc.,). MaaS is a mobility subscription plan that gives modal flexibility under various pricing offers. As MaaS is rolled out across metropolitan areas over the next 5 to 15 years (with or without the presence of autonomous cars and buses - the latter being mainly smaller buses), and growing acceptance of a sharing culture and disposal of privately owned cars, public transport operators will be given the opportunity to both operate a mobility plan and/or to offer up their current and future public transport services. The bus in particular is expected to play a significant role as a service provider under mobility plans. This all sounds very attractive and may indeed reduce the need for government subsidy where the mobility subscription plan can deliver much more cost efficient services that reduce, if not eliminate, the need for government subsidy. Even where it is recognised that a community service obligation (CSO) has merit within a mobility contract, it is anticipated that the level of subsidy will be small. To what extent is currently unknown.

An issue that I recently considered is the extent of demand for the current (or expanded) bus services when they migrate to a subscription service. Imagine a situation of multiple brokers and existing bus operators offering their services into a number of such broker-designed and controlled MaaS subscription plans. Suppose we suddenly find that there is a high demand for the use of the bus services in a number of plans such that the supplier of the bus services cannot honour the service level agreement under each of the mobility contracts they have with the number of brokers. What do we do?

This is potentially a major issue. At present we have a one to one arrangement between a bus operator and government (principal-agent), and such contracts typically ensure that contracted services can be delivered with the existing stock of vehicles; however under MaaS we may have a one to many (brokers) situation. The arrangement may work well with cars since it is relatively easy to bring more on board, but with buses this may be a significant challenge. There will need to be a contingency plan to access additional bus capacity (or an alternate modal solution), but from where?

The way this may have to get sorted is to use car capacity (drawn from a brokers pool) which is much easier to obtain when there is a shortage of bus capacity and have users pay the equivalent bus fare. Although this is encouraging in ensuring the continuity of mobility services (effectively a sharing under a pooled car use model), it will require a commitment of either the mobility plan provider, the bus service provider or government to provide the gap between the bus fare and the car-based fare. Under an autonomous car (and bus) regime this may be a relatively small amount compared to today's gap since labour costs will be significantly reduced (i.e., no driver).

As we continue to explore the appeal of MaaS in digitally induced mobility setting, we can anticipate many new question and hopefully new solutions. The proposition herein is but one we need to think through as we scale up the delivering of MaaS.

Personal preferences of managers in designing sustainable supply chains

ITLS Think Piece #38-2017-October

By Behnam Fahimnia

Strategic supply chain decisions include determining the number and location of suppliers, manufacturing plants and warehouses. Such decisions have been traditionally made using cost-based performance measures (i.e., cost minimisation and profit maximisation goals). The growing interest of supply chain stakeholders (e.g., customers, governments, and non-governmental organisations) in sustainable practices have made organisations start rethinking the design of their supply chains by considering a set of environmental and social performance measures.

The environmental performance measures may include carbon-equivalent emissions, waste generation, energy consumption, water usage, the use and generation of hazardous materials, toxic substances and other pollutants, land use, and resource depletion issues. Social performance measures focus on human values and concerns such as labour practices and decent work conditions, local community issues, human rights, and other society and product responsibilities.

The trade-off analysis to balance economic, environmental and social performance of the supply chain is a very challenging and interesting task. Numerous analytical models and decision-support tools have been developed by researchers to tackle problems of this kind. However, these models are based on certain assumptions. Some assume that sustainability measures are always known, quantifiable, and prioritisable. In reality, there is always uncertainty in what performance measures are taken into consideration by individuals and the weighting of each measure – mainly due to variations in individual's preferences.

Limited amount of research has been conducted on understanding how supply chain managers balance economic, environmental and social goals when making strategic supply chain decisions. Past research has focused on the theoretical/conceptual and modelling aspects of supply chain trade-offs, but the personal preferences of a supply chain manager are rarely been considered. We need to understand the situations upon which a supply chain design/configuration is preferred over another. Several factors may contribute to such decisions. Take for example, a supply chain manager's risk aversion, or their familiarity with certain regions or suppliers, sustainability-related values, or the existence of sustainability policies within the organisation, and so on and forth.

Many supply chain managers may claim that they are supportive of sustainability initiatives and that they explicitly consider sustainability measures in their strategic decisions. However, a manager's "willingness to pay" for creating sustainable supply chains is unknown, and research shows what they say is not what they do. This is an emerging area of research that aims to better understand the situations in which supply chain managers are willing to incorporating different sustainability measures.

An organisation's vision statement and corporate policies indicate its level of support of sustainability initiatives. The question is to what extent managers and employees in various departments are committed to these organisational objectives and policies? There is so much evidence indicating that the strategic decisions of supply chain managers do not often align with corporate sustainability objectives. Understanding and explaining the reasons for this lack of commitment and support is an interesting area of research. Whilst most Australian companies

have clear corporate sustainability goals, only some directional and unspecific support for sustainability practices are available at the department level. We know that in these companies no or very limited guidelines are available on how to interpret and operationalise the corporate-level sustainability goals.

There is mounting evidence that in these situations, supply chain managers predominantly apply their personal sustainability preferences in their decision-making. When there is lack of clarity in sustainability goals at the department level, a manager with unfavourable sustainability beliefs may have less intention to implement sustainability initiatives, and as such this attitude would inhibit achieving sustainability objectives at the corporate level. Companies that set clear sustainability goals at the corporate level would also need to consider the benefits that may accrue from better commitment of the department-level managers. In particular, such study can help the top management identify and evaluate the intrinsic forces that act as 'enablers' or 'barriers' to incorporating sustainability initiatives in supply chain decision-making, thereby increasing the likelihood of aligning individual preferences with organisational objectives.

Future research on sustainable supply chain management should be directed to focus on understanding how individual level decisions are made and the relationship between these decisions and corporate sustainability goals and policies. At ITLS, we have a research team specialised in investigating a range of topics in this area. The team collaborates with companies in various industries to help supply chain practitioners make more informed decisions at strategic, tactical and operational planning levels.

Up or out: Travel demand and thirty minute cities

ITLS Think Piece #41-2018-February

By David Levinson

Adapted from Levinson, D. and Krizek, K. (2017). *The End of Traffic and the Future of Access*. Network Design Lab.⁵⁹

Each technological advance in mobility over the past 200 years increased the size of metropolitan areas. The ability to go faster, either owing to new technologies or more completely deployed and deeply connected networks, allowed people to reach more things in less time. The Underground drove the expansion of London, streetcars did the same for many American cities,⁶⁰ while trams and trains made Sydney, Melbourne, and Brisbane among others, and highways have exploded the size of cities everywhere. Historically, the time saved from mobility gains was reflected mostly in additional distance between home and the workplace, maintaining a stable commuting (home to work) time.

Will autonomous vehicles follow the path well worn by earlier technologies?

Fast, driverless cars that allow their passenger to do things other than steer and brake and find parking impose fewer requirements on the traveler than actively driving the same distance. Decreases in the cost of traveling (i.e., the availability of safe in-vehicle multitasking) makes travel easier. Faster roads arise because of capacity gains from vehicle automation (due both to closer following distances and narrower lanes, even more practical with narrower vehicles fit to serve the single passenger they usually carry). Easier travel means increases in accessibility and subsequently increases in the spread of development and a greater separation between home and work, (pejoratively, 'sprawl'), just as commuter trains today enable exurban living or living in a different city.⁶¹ Autonomous automobility reinforces the disconnected, dendritic suburban street grid and makes transit service that much more difficult (as if low density suburbs weren't hard enough). People will live farther 'Out.'

However, concomitant with automation is the emergence of the sharing economy, with at least some people transitioning from today, where the typical Australian owns their own car, to mobility-as-a-service (MaaS) -- automated taxis. This is more likely in larger, central cities where taxis are common, auto ownership is already difficult, and parking scarce and expensive. In this world, while the total cost of travel drops as vehicle ownership costs disappear, the cost per trip might rise, as the cost of ownership is allocated to each trip. This reduces travel demand.

⁵⁹ <https://transportist.org/books/the-end-of-traffic-and-the-future-of-transport/>

⁶⁰ See Levinson, D. (2008). Density and dispersion: the co-development of land use and rail in London. *Journal of Economic Geography*, 8(1), 55-77 and Xie, F., & Levinson, D. (2009). How streetcars shaped suburbanization: a Granger causality analysis of land use and transit in the Twin Cities. *Journal of Economic Geography*, 1bp031.

⁶¹ For more on this reasoning, see Chapter 11 in Levinson, D. and Krizek, K (2008). *Planning for Place and Plexus: Metropolitan Land Use and Transport*. Routledge.

Driverless cars which can be summoned on-demand allow people to avoid vehicle ownership altogether. This reduces vehicle travel, as people will pay more to rent by the minute than exploit the sunk costs of vehicular ownership. By saving total expenditures on transport, more funds are available to pay for rent in cities, and more trips are by walk, bike, and transit. People who seek the set of urban amenities (entertainment, restaurants, a larger dating pool) will find these amenities increasing in response to the population. The greater value in cities with the new more convenient technology leads to more and taller development. (Hence the use of the word 'Up.')

At first blush, 'Up' and 'Out' appear to be contrasting scenarios; they are not exclusive, however. More people living in the outer suburbs or exurbs does not mean fewer people live in cities, because the overall size increases (with more people overall). Sydney for instance, is expected to grow from just over 5 million to about 8 million people over the next four decades.

Similarly, as the cost of travel decreases, people will be more willing to live in locations far from where they work. At safe speeds of 160 km/h on freeway lanes exclusively dedicated to automated vehicles, the commuting range expands widely. From Sydney in this new world, Newcastle can be reached an hour on road, and Kiama and Katoomba are even nearer.

Sydney planners have recently proposed the benchmark of the "30-minute city",⁶² the idea that most people can find work, school, or daily shopping within 30 minutes of their homes by walk, bike, or transit. The threshold of 30-minutes is roughly equal to today's one-way commute in Sydney (actually 35 minutes), shorter by car (26 minutes), longer by train (62 minutes) according to BITRE.⁶³ The long times by train are because trains are designed to serve longer distance trips, and focus on the Central Business District.

The 30-minute city can be achieved through a combination of transport and land use strategies. On the transport side is the question of how fast and how direct the transport network is. On the land use side is the question of where desired activities are located relative to each other.

If the 30-minute city is defined for walk, bike, and transit as the relevant modes, with mobility-as-a-service easily available on-demand, the Up Scenario works best, though getting one-way commuting times for train users down from 60 to 30 minutes is a large ask. In contrast, the Out Scenario can continue to enable a 30-minute city for privately owned autonomous vehicles so long as jobs don't centralize further in downtowns.

The interplay of AVs and road pricing is especially important. While autonomous vehicles may eventually double or quadruple road capacity, total demand will rise as well due to population growth, so long as people continue to work, shop, and play outside-the-home at today's rates, even more if traditional patterns of induced demand hold.

It is quite possible that sharing remains a niche while most people choose to own their own cars — the 'Out' scenario dominates. Thus, exurbanization and AVs better leverage newly available capacity. But, in the absence of pricing, and with cheap energy, there is little to discourage tomorrow's privately owned AVs from circulating empty on the road network rather than pay for high prices of parking, and thereby slow travel for everyone else. This possible outcome is so obviously bad, it suggests road pricing or similarly effective regulation in some form is likely.

⁶² <https://www.greater.sydney/draft-greater-sydney-region-plan>

⁶³ https://bitre.gov.au/publications/2016/files/is_077.pdf

Whimimpact: More questions than answers

ITLS Think Piece #57-2018-April

By Yale Z Wong

NB: This article has been prepared in the context of the MaaS National Reference Committee and [MaaS 2019 conference](#) in Melbourne (May 1-2), coordinated by Intelligent Transport Systems Australia, which will bring together a number of global luminaries including Sampo Hietanen (MaaS Global), Andy Taylor (Cubic Transportation Systems), Colin Lim (SMRT's mobilityX), amongst others. The ITLS team are avid contributors to both these forums.

The contents of this article are motivated by the report [Whimimpact: Insights from the world's first Mobility-as-a-Service \(MaaS\) system](#), prepared by Ramboll, which documents behavioural impacts from MaaS Global's Whim application in Helsinki, Finland for the period January-December 2018.

Whimimpact has been clogging up my LinkedIn feed. Everyday, I am seeing industry figures citing the report and holding it high on a pedestal in ways as though it were gospel. There exists a misguided notion that the report, whilst valuable, serves up a **definitive answer** on the many potential follies of **mobility as a service (MaaS)**—that it may hurt public transport patronage, lead to class segregation (by targeting those living in the urban core), increase single-occupancy vehicles as well as the number of trips people make—all with associated externalities.

The gist of the report (and what have been oft-cited) are the number of conjectures offered up. We present our own observations based on these assertions.

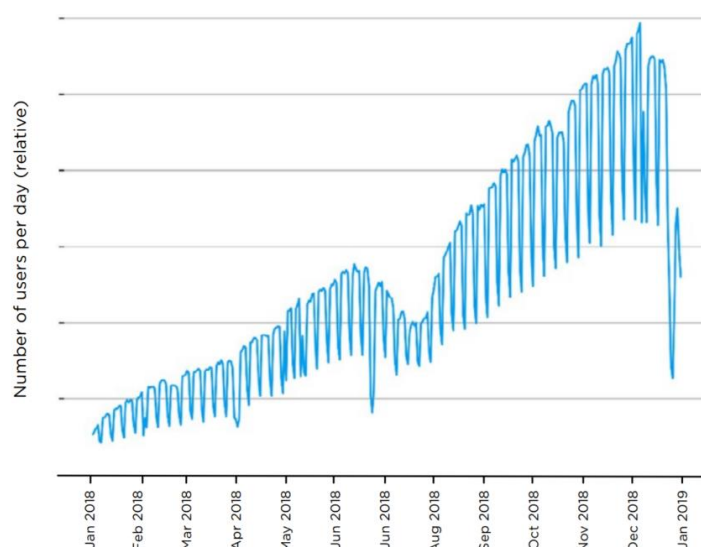
1	MaaS users ride public transportation more than their Helsinki counterparts	Perhaps public transport users are more likely to subscribe to MaaS?
2	MaaS users are multimodalists	Perhaps multimodalists are more likely to subscribe to MaaS?
3	MaaS helps solve the first/last mile problem	What modes did these subscribers use previously?
4	Taxis are a welcome option to MaaS users	Could taxi users be more likely to subscribe? In the unlimited model, what entices people <i>not</i> to choose taxi?
5	MaaS users make shorter citybike trips	What role might visitors play?
6	Average daily trips of MaaS users and typical Helsinki residents are about the same	This is an average but how about the variance in daily trips?
7	Public transportation is the backbone of MaaS	This is the goal but where is the evidence? Is this 'backbone' designed into the MaaS product initially?
8	MaaS grows along public transport corridors	Is this another case of self-selection bias?
9	New transportation solutions can replace 38% of daily car trips	This is an estimate based on behavioural assumptions
10	MaaS users play by the rules	A funny way to put it. How to detect fraud and enforce compliance is a big issue
11	Rental cars are part of MaaS daily trips	Why are rentals more attractive than carsharing?

The conclusions drawn in the Whimimpact report suffer from a number of shortcomings. Firstly, there is the notion that MaaS *causes* behavioural change. This is a massive logic issue in terms of causality since it is likely the case that people of a particular behavioural paradigm (i.e., existing public transport users) self-select to become subscribers of MaaS. This links to the second issue around the inability to define the counter-factual which makes any sorts of valid arguments difficult around the potential impacts of MaaS on travel behaviour.

Thirdly, there are not enough plan options being tested. There are three tiers of service offered in Helsinki: **Whim to Go** as a pay-as-you-go service with no monthly fee; **Whim Urban** (€49 per month) with unlimited public transport, max €10 for taxi (within 5 km), fixed daily €49 rental car fee and free city bikes (30 min max); and **Whim Unlimited** (€499 per month), featuring unlimited public transport, taxi (within 5 km), rental cars and city bikes (30 min max). Note that technically, only the latter two constitute ‘subscription’ models in the pure sense of the word.

Under Assertion 6, the report makes the point “there has been some speculation that unlimited MaaS packages might lead to a major uptick in total trips—particularly taxi”. This is one of the *greatest* risks in deploying MaaS as the provider nudges consumers onto more expensive and lucrative modes. Who wouldn’t default to taxi (or an equivalent point-to-point option like Uber) as their first port-of-call if they had already purchased an unlimited transport bundle?⁶⁴ The report goes on to state that the “data suggest this is not the case”, but buried deep in the Appendix it turns out that Whim Unlimited users were too few and so excluded from the analysis proper.

This links to the final question of what exactly the sample size was for this Helsinki study. The report points to “over 70 000 registered users” of Whim. How many of these are pay-as-you-go (PAYG) customers? How many are regular users? We suspect a large number could constitute app downloads *only* since the report leaves this undefined.⁶⁵ The report offers the below figure (page 53) showing a relative increase in uptake but offers no scale on the vertical axis.



The Helsinki experience *could* offer immense insight into the two greatest points of contention in the MaaS debate. The first relates to the competing merits of subscription versus PAYG models. We are not sure what to infer from Whim Helsinki but in other markets (e.g., West Midlands) Whim only offers a PAYG option. Vij et al. (2018) found that PAYG is more attractive but in our own ITLS research we saw that subscription models were preferred (Ho et al., 2018)—in fact, up to 47% of our sample will subscribe. Consumer preference for these alternatives will likely depend on the design of subscription plans and the discounts built in as part of the MaaS offering.

This is an interesting question since it raises the issue of business models as the original concept is for a MaaS business to purchase transport assets/capacity in bulk and thus negotiate to obtain quantity discounts. They are able to finance this with customers pre-paying for their mobility

⁶⁴ We note heavy congestion might make taxi less attractive than rail or rapid bus.

⁶⁵ There are 50K+ downloads of the Whim application on the Google Play store.

credits, and based on the assumption that some of these credits will remain unused at the end of each period (think phone plans), all whilst passing on a small proportion of the original discount to the consumer (as occurs with Whim Urban). If PAYG is indeed the preferred approach, then what is the value add for the customer beyond a better journey planner? Will this model even be sustainable in the long run?

Linked to business models is the second point of contention around whether government or the private sector ought to take the lead on MaaS. There are many schools of thought on this question, but we think that a government model will lead to issues of bias and stifle innovation (UITP takes another view, of course). Whether government even wishes to be involved in the service provision space is another question—we have explored these questions in detail for over 30 years through the [Thredbo conference series](#). Our latest idea is what we term a **MaaS broker/aggregator** which brings together specialised businesses including transport operators, technology providers and financial enterprise. This is very much a private sector-driven model and indeed we find that private enterprise prefers government involvement at arm's length only—strategic support legitimising the sector and ensuring a fair and level playing field, as opposed to any specific monetary support like subsidies from government (Wong et al., 2019).

At ITLS, we are launching an exciting [MaaS trial in Sydney](#), jointly developed with IAG and SkedGo through the iMOVE Cooperative Research Centre (CRC). Unlike other (often commercially-driven) pilots and trials around the world, the design of our trial has a real emphasis on research and in garnering robust behavioural insights. We will bring in the most sophisticated analytical capabilities to tackle the many unknowns plaguing the sector. What are the barriers to forming MaaS businesses? How attractive are subscription models versus PAYG? With proper before and after data collection, we avoid the issues of **self-selection bias** plaguing Whimimpact and can finally ascertain empirically whether there is any evidence that MaaS can attract car users onto public transport. Our findings will help determine whether we can dismiss the potential follies of MaaS, or might we need extensive government intervention to ensure that MaaS development occurs in a way consistent with common societal objectives (Wong et al., 2017).

We are looking forward to some very fruitful conversations during the week.

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Wishes that are coming true with digital transformation

ITLS Think Piece #60-2019-May

By Behnam Fahimnia

Mechanisation (1760 – 1840) was the first industrial revolution when machines powered by water wheels or steam engines slowly replaced making goods by hand. Mass production was the second industrial revolution (1870 – 1914), as the technological revolution, characterised by introducing assembly lines, interchangeable parts and product/process standardisation (and of course followed by the internal combustion engine and cars and trucks). The third industrial revolution (1960-present) occurred with the mass use of computers enabling manufacturing automation (industrial robots) and computerisation (CNC machines).

The first and third revolutions were the results of emerging new technologies (the steam engines and computers). In contrast, the second revolution was more about optimisation than invention of new technologies. The fourth industrial revolution, commonly known as Industry 4.0, could be a combination of both “invention” and “optimisation”. For example, additive manufacturing, like 3D printing, is the core of the emerging technologies that contribute to the fourth industrial revolution (invention). The results are personalised production and shorter supply chains (reduced cost and environmental burden). On the other hand, transformative technologies such as artificial intelligence, machine learning, sensor technology, advanced robotics, and data analytics may not be as revolutionary, but they can significantly improve how we manage our supply chains today (perhaps more evolutionary, than revolutionary). Similarly, the blockchain concept is expected to play an important role in the supply chains of the future. We believe that 2020s will witness the true digital transformation, a transition toward effective machine-to-machine and human-to-machine communication as well as fast integration of decisions, feedback and control loops.

The terms “Digital Transformation” and “Industry 4.0” have proliferated across trade, business and academic publications in recent years. It is true that the digital age has started to have some real impacts and is rapidly transforming how businesses operate. The extensive use of advanced robotics, artificial intelligence, sensors, and internet of things (IOT) technologies have resulted in improved supply chain integration, visibility, responsiveness and predictive maintenance (reduced disruptions and unplanned downtimes across the supply chains).

The reality is that much of what is reported as new or emerging concepts is not especially new; it has existed since supply chain management was introduced almost three decades ago. The popular buzzwords of digital transformation and Industry 4.0 such as “integration”, “cooperation”, “collaboration”, “visibility” and “data sharing” are the primary keywords of supply chain management. The breakthrough is that new technologies are now available (and affordable) to help turn these concepts into reality.

For example, inventory control systems and feedback mechanisms have existed for several years. But true supply chain visibility can only be achieved through the extensive use of network-connected sensors and advanced data analytics. As another example, cooperation and collaboration with customers, suppliers and suppliers of suppliers are not new concepts. But how can the complex supply chains of today achieve this without the use of IoT technologies and connected sensors feeding back live product information during product lifecycle? This is indeed an exciting time for supply chain executives witnessing their wishes coming true.

There are many opportunities and challenges to take into consideration as we move toward the fourth industry revolution. Firstly, digital transformation offers seemingly limitless options for technology investment. The key question for most businesses is where across the supply chain to invest resources, and which technologies can best serve their strategic needs. Recent survey results indicate that digital transformation is a top strategic objective for most organisations; however, only a small portion of businesses have identified avenues for profitability in the short/medium term. Interestingly, most operations and supply chain executives do not appear to have a seat at the table when it comes to decisions about digital transformation investments.

Secondly, transformation comes with many low hanging fruits that are easy to implement, which will offer business improvements in the short to medium term. But the real opportunities that provide competitive advantage at the national and corporate levels are more difficult to achieve in terms of resource allocation, time commitment, and level of disruption. Companies tend to be conservative when it comes to technology deployment, especially when those technologies tend to disrupt operations and require specialised skills. Digitalisation may sound like one which comes with its own challenges and risks. Equally important are the challenges associated with organisational restructuring when moving from a physical to digital infrastructure.

Thirdly, governments and key industry stakeholders need to recognise the significance of being an active participant in this domain. Australia is well-placed to take advantage of the opportunities created by digital transformation. Digital technologies have potential to provide a major boost to our economic competitiveness by tackling our traditional challenges of high labour costs and long distance to suppliers/markets. Success in this domain requires close collaboration between educational/research institutions and industry to develop skills, design and implement technologies, and manage the transition.

Pool questions

Do you agree that the current transformation trend is revolutionary? Y/N

Do you agree that the current transformation trend is evolutionary? Y/N

Data sharing in a future contractual setting and MaaS

ITLS Think Piece #64-2019-July

By Yale Z Wong

Suddenly, sharing has become trendy. We often hear of the 'shared' or 'collaborative' economy. The rise of transportation network companies (TNCs) like Uber and Grab, ofo and Zipcar, providing *ridesharing*, *bikesharing*, *carsharing* and their ever-increasing market capitalisation epitomises this transformation. We hear the companies promote 'sharing' as a social virtue, although there is the usual confoundment between the far more important sharing of space (or pooling) with the sharing of vehicle assets (linked to temporal utilisation). The sharing of data is placed on a pedestal, as tensions around the legitimacy of these operations continue to boil (Uber as a case in point in many markets). As a storm of media attention surrounds these companies, TNCs are claiming to share their data as an almost 'truce' with city regulators and authorities. Is this sharing just a veil? And more fundamentally, why should these companies have any obligation to share their data? Why does society expect companies who compete commercially, with their entire business models predicated on collecting, mining and selling users' data be expected to share their 'golden goose'?

We often make the comparison with urban public transport where the state maintains control as the principal source of knowledge about travel patterns on the network. In most developed countries, governments either directly operate services or they are provided by the private sector under contract to the government, through a tender process, negotiation, or by direct award. This occurs under a gross cost contract model where government collects the fare revenue and operators are reimbursed on a per kilometre basis, or a net cost model with some element of revenue risk. In either case, the private operators are in effect an 'extended' public servant with a protected area monopoly for a defined period of time. The sharing of data is a given in contracted environments where it is stipulated as part of an agreement, and the data essential to determining the remuneration of the operator and to implement actionable benchmarking, including the administration of incentives and penalties linked to operator performance.

TNCs operating in an economically deregulated market have far less necessity to share data since they are not being directly remunerated by the government. Economic deregulation offers many advantages linked to cost efficiency but also externalities like network effectiveness and the traditional difficulty to regulate. In the developed world, we often point to experience in the UK outside London (

Figure 64.1) where economic deregulation from the 1980s led to the so-called 'bus wars', characterised by headrunning or schedule matching (with links to [Hotelling's law](#) on minimum differentiation), accompanied by lengthy dwells at bus stops to pick up competing operators' customers, all of which led to enormous service instability. The sharing of data even as simple as patronage information would hinder operators' ability to compete 'on the road'. Passenger transport executives would often resort to undertaking their own passenger counts to guide infrastructure investment and to implement subsidised, social services. Operators were even reluctant to share the real time position of their vehicles, arguing that it would only serve to show how late their buses ran. Larger operators benefiting from incumbency often had everything to lose in sharing ticketing products and timetabling information (by giving their captive passengers more choice), as compared with smaller operators who could grow market share by attracting competitors' passengers. The entire regime and predatory behaviour hindered efforts at developing integrated smartcard systems. This aspect of the whole debate in how data sharing

fits within the broader contractual framework, regulatory and institutional settings is often neglected amidst the dogma associated with the 'open data' movement and the need to regulate disruptive new technologies and business models.



Figure 64.1: Manchester's Oxford Rd, hailed as the busiest bus corridor in Europe, is an oft-cited example of the so-called 'bus wars' which accompanied economic deregulation in the bus sector

In studying data sharing issues, it is therefore instructive to consider where the contractual environment might head in the future. The Institute of Transport and Logistics Studies (ITLS) has run the world's premier conference on competition and ownership (known as the **Thredbo series**) which since 1989 has brought together academics, government and industry (operators and consultants) to document global experiences in public transport institutional reform, contract design and implementation. Through the conference series, the series has in many cases pre-empted where governments have moved in terms of the design and specification of contracts, as well as advised numerous cities and countries on their contract reform process. We have witnessed the pendulum swing between varying levels of public and private initiative (competition *in* or *for* the market)—a concept we refer to as 'regulatory cycles' (Gwilliam, 2008), as the inadequacies of one regime are quickly replaced by the shortcomings of another ("grass is greener on the other side" is another apt description).

What we have seen in recent years is an increasing desire for a hybrid model which brings together the best of a contracted regime with the benefits and incentives inherent under economic deregulation (Wong and Hensher, 2018). Whilst present contracts are narrow, area-specific, output-based arrangements to deliver kilometres on defined vehicles types (e.g., buses), future contracts may evolve to become broader, mode-agnostic, outcome-based mobility contract offerings where a broker/aggregator has the flexibility to deliver accessibility using any vehicle of their choosing (Hensher, 2017)—linked to how we see **mobility as a service (MaaS)** being implemented. A mix of new players will enter the market (e.g., TNCs, technology providers and financial enterprise) and enormous challenges emerge in terms of how data is shared and the end user protected. In a mode-agnostic, on-demand environment there will be less need for rigid key performance indicators like on-time running, excess dwell time or headway regularity. Rather than service-specific measures, we will need measures of access, collected at the *individual* level and covering both users and non-users. This might be stipulated in (for instance) X proportion of residents receiving transport service within Y minutes, for Z hours of the day. MaaS operators will be held accountable for *potential* service and a social safety net defined linked to accessibility—with possible subsidies supporting top-up accessibility or non-commercial

services. Any actual service must be remunerated based on accessibility delivered—not just carrying fresh air. The data items are more complex to gather, report, monitor and enforce, but essential in ensuring that MaaS is not a niche product for the few but a scalable proposition for the masses and a true alternative to private vehicle ownership.

But how might this vision be operationalised? For the MaaS broker/aggregator, the right to operate ought to be linked to certain conditions associated with a contracted setting but also the scope to innovate like that of an economically deregulated framework. We speak of 'light touch' regulation with the necessary data supplied for government to act as a monitoring agency (although this role may be outsourced to a third-party intermediary independent of government).⁶⁶ MaaS research at ITLS has found amongst the business community, preference for government to play a strategic supporting role legitimising the sector and ensuring a level playing field, rather than any heavy-handed involvement including the provision of direct financial support like subsidies (Wong et al., 2019). We find that candidate businesses do not necessarily wish to monopolise (at least initially as they test the market) and that they are happy to share as long as all competitors are playing by the same rules.

MaaS also offers itself as an opportunity to price the use of public assets like the road network, with a network efficient charge determined by a combination of distance, time, location, and modal (both spatial and temporal) efficiency built in as part of a package price—invisible to the end user. Incentives and penalties to 'nudge' travel behaviour are another important demand management tool possible with sufficient MaaS adoption. The challenge herein lies in different operators being able to coordinate and act as one, as well as a clearing house mechanism which operates network-wide. Data standards to allow sharing and roaming between jurisdictions are already being developed by actors like [MaaS Alliance](#) who are taking a lead role as the peak industry body for the sector. There are further parallels in this intermediary model to the retail industry in the form of barcodes defined by GS1 standards, covering virtually every product on Earth, and allowing the fast and easy querying of supply chains around the world.

Any discussion on data sharing must not be removed from its institutional context. As a final note, what is often missing amidst the data sharing debate is clarity in the purpose of data being shared.⁶⁷ For government, this could be the need to regulate and prevent market failure, ensure information symmetry, as well as to maintain and optimise public assets. For private enterprise, it is the opportunity to pursue new business opportunities with the assurance that there will be no unfair competition or predatory behaviour. For the community, it is better service for less cost—the quintessential human right and freedom to be mobile. We must not neglect these higher-level objectives. Like many things, data sharing is simply a means to an end, not an end in itself.

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The 16th International Conference on Competition and Ownership in Land Passenger Transport (Thredbo 16) will continue the discussion on data sharing and its role in public transport contracts reform. Thredbo 16 is being held 25-30th August 2019 in Singapore, jointly organised by Nanyang Technological University, the Land Transport Authority and ITLS at the University of Sydney.

Please visit: <https://thredbo-conference-series.org>

⁶⁶ We explore the role of government and private providers in a forthcoming monograph on MaaS by Hensher et al.

⁶⁷ Another issue is what data is being shared and to whom—what is available is typically very limited and highly aggregated

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Australia's digital transformation is suffering from uncoordinated initiatives

ITLS Think Piece #66-2019-October

By Ben Fahimnia

Australia has seen a productivity slowdown since 2010 compared to the previous decade and we are falling behind many other countries in the adoption of digital technologies, despite many digitalisation initiatives undertaken by firms and governments.

Australia is well placed to take advantage of the opportunities created by digital transformation. Most experts agree that digital technologies have potential to provide a major boost to our economic competitiveness by tackling our traditional challenges of high labour costs and long distance to suppliers/markets.

Digitalisation has already influenced almost every aspect of our lives. Consumers use smart devices to research what they buy and to compare their choices. Firms, governments and public organisations cluster and utilise digital data for more informed decision making. However, no organisation is yet at the forefront of digital innovation.

The main reason why Australia has been slow in digital transformation is the lack of coordination and collaboration amongst firms, governments and research institutions. There are numerous examples to illustrate this.

Think about digital identity projects running in parallel. The government's digital identity scheme – known as GovPass – is running separately from Australia Post's scheme called Digital iD. Similar projects have been undertaken by other organisations, all aiming to identify individuals and extract basic personal information – a big step toward supply chain digitalisation. So many projects running in isolation are a clear waste of funds and resources, the cost of distrust between organisations and lack of information sharing.

New business models have been developed to support digitalisation initiatives. Research institutes have carried out ground breaking research in this area. But industries are not adequately informed and updated about research outcomes. More importantly, digital transformation research and practice is outpacing the rate at which regulators can review trade policies and privacy legislations.

The type and pace of digitalisation varies from one industry to another, and can even vary from one firm to another within one industry. Firms need to decide which digital technologies to adopt. To do so, they need to understand the potential benefits and challenges of each technology (the role of the research institutes) and have the necessary infrastructure, tools and regulatory support for technology adoption (the role of the governments). Again, collaboration amongst firms, educational/research institutions and governments are essential to develop skills, design and implement technologies, and manage the transition.

Digital transformation comes with significant financial investment. Germany, UK, France and Canada have recently announced their plans to commit massive funds to assist digital transformation. Data processing centres are expensive to build and maintain. Substantial investments are also needed for skill acquisition and organisational restructuring. Close collaboration between research institutions and industry is needed to address the questions of

what data processing centres to build, where across the supply chain to invest resources, and what expertise to acquire.

And finally, the greatest barrier to successful digitalisation is a culture that is innately resistant to change. Australian firms tend to be conservative when it comes to technology deployment and adoption, especially when those technologies tend to disrupt operations and require specialised skills. Digital transformation requires systematic change management programs to tackle these behavioural obstacles. Greater cooperation between researchers and firms/governments is needed to understand the behavioural complications related to digital transformation and how best they can be addressed.

Australia's competitiveness and productivity growth has suffered from uncoordinated digitalisation initiatives. Let us all come to the table and start working together to lift our global standing.

When it is not optimal to look for an “Optimal Policy”? - The case of airport slot allocation

ITLS Think Piece #17-2016-May

By Xiaowen Fu

Economists and operational researchers are trained to look for “optimal” solutions, especially when policy changes are considered. A failed policy will not only lead to substantial economic loss, but will also risk the decision-maker’s credentials. Although the aspiration for better policy should be encouraged, there is always uncertainty associated with any business and economic decisions. Trial and error are often unavoidable for good ideas to grow into excellent decisions and strategies. There is an opportunity cost to postpone important decision making, which has been the case for airport congestion management. Airport congestion and delay has become a global problem. In the United States, if there were no congestion at the 29 business airports, 400 jet aircraft would have been saved to carry the same amount of passengers in 1999. At O'Hare airport in Chicago, more than 28% of flights were delayed in 2014, with an average departure delay of nearly 59 minutes.

Airport capacity expansion is an apparent solution, albeit a very expensive one which often takes a long time from planning to implementation. Building a runway or a large passenger terminal often take 7 to 10 years, whereas a new airport can take more than two decades to go through the process of planning, environment assessment, land acquisition and construction. The planning for the second airport in Sydney started four decades ago and is still not fully finalized. Comparable time has been spent on major capacity expansion projects in the two airports in Tokyo. In Boston, the construction of a new run was suspended for decades due to the disputes with the community nearby.

Another alternative to alleviate airport congestion is to better utilize and allocate the existing capacity. In Atlanta, the world’s largest airport by passenger numbers, the average number of passengers carried by each aircraft movement (i.e., an aircraft landing or take-off) increased substantially from 89 to 98 during year 2010 to 2012, but still substantially lower than those in Narita airport in Tokyo and Hong Kong international airport, which are above 150. The number of passengers carried in Sydney is about 120, comparable to those of New York JFK airport and Paris Charles de Gaulle Airport. Although the number of passengers carried per aircraft movement is not an ideal indicator for airport capacity utilisation, the large difference across airports does suggest some improvements may be achieved by better allocating and utilising existing capacity.

Using a market based mechanism to distribute slots, the scheduled time of arrival or departure allocated to a flight has been proposed for quite some time. The evaluation of alternative mechanisms of slot auction have been published in academic journals and government reports for more than four decades, with numerous studies carried out on this topic from different perspectives. Intuitively, an auction distributes slots to carriers who attach the highest economic value to the precious resource, and thus, economic efficiency can be achieved. In addition, since airlines usually bid higher prices for slots at peak times, such a mechanism will lead to effective congestion pricing, similar to those used for road pricing during peak hours. It is not surprising that the slot auction has been widely supported and well received by researchers, including economists from the US Department of Transport and the Department of Justice. In 2008, the US Department of Transportation proposed to auction slots at three New York airports (i.e., John F.

Kennedy International Airport, LaGuardia Airport and Newark Liberty International Airport). This proposal however met with strong resistance from the Port Authority of New York and New Jersey, the owner of the airports involved. The Port Authority declared that such an auction could have an adverse effect on airport operations, airline services, and the quality of customer service. In addition, some airlines, especially those heavily indebted, were unwilling to pay for slots that would otherwise be used for free. Eventually, the Department of Transport was forced to postpone the plan of slot auction indefinitely because of this resistance.

To be fair, a slot auction may not be a perfect solution for airport congestion problems. High valuations by bidder airlines do not necessarily reflect the social value of resources. Therefore, the outcome of an auction is primarily driven by bidder airlines' profits rather than social welfare. Many European countries auctioned the third-generation mobile licenses and spectrum, which led to substantially different prices in the countries, and very different market outcomes in terms of service affordability and market penetration rates. A study recent carried by myself suggests that slot auction may be inferior to a central allocation if there is little demand uncertainty in a market. Nevertheless, with more than four decades of study and discussion, a lot of benefits have been identified for this promising mechanism. Without actually trying out this method in real markets, one would expect continued arguments and disagreements on paper in the years to come. The search for an "optimal policy", together with different views held by stakeholders with vested interests, have prevented the trial of very promising policies that have been extensively discussed and evaluated.

In Dec 2015 the first airport auction in the aviation industry was carried out for China's Guangzhou airport. The Chinese aviation market is much less deregulated compared to those in Europe, North America and Australia. Ironically, because the airlines have less bargaining power, the regulator could quickly and forcefully implement market-based mechanisms which would have been a mission impossible in deregulated markets. By examining the market outcomes in these Chinese markets, the global aviation industry may obtain some empirical results for the first time for a theory that has been discussed for decades.

Few researchers would argue that developed economies tend to have better regulations. However, the failure to act promptly and boldly in these markets, as in the case of airport slot auction, probably suggests a need to bring some entrepreneurship into the public sector, which would allow policy-makers to take some calculated risks and be more innovative. Good research and planning help, but there is no substitute for policy leadership.

What can be done to improve commercial viability of regional aviation in NSW/Australia?

ITLS Think Piece #29-2017-May

By Rico Merkert

Although Rex has recently reported a slight improvement in outlook, Virgin Australia and Qantas are still seeing tough trading conditions in the regional and domestic Australian aviation markets. With continued volatility in the resources sector and tourism being inherently seasonal, soft demand from regional and business communities has unsurprisingly resulted in lower profit margins for regional airlines. Profitability is an even greater issue for regional airports, with their number having dropped by 46% over the last 20 years. Additionally the Australian Airports Association (AAA) reported in 2016 that 60% of Australian regional airports are still operating at a loss with many of them struggling to fund infrastructure maintenance and ongoing operation. Being largely council run, they suffer from restricted access to capital markets, and lack management and incentive structures to grow profitability. Consolidation appears to be the name of the game.

It therefore seems to be timely to ask what policy makers can do to improve commercial viability of regional aviation in Australia?

Before answering this question one needs to evaluate whether it is worth having regional air services at all. For the regions themselves this is a no brainer because the economic impact of regional aviation is substantial and also because, quite frankly, many regional and remote communities would often not even exist without regular scheduled air services. In Europe and the USA they are hence often referred to as essential or lifeline services. However, what value do such services present to people and businesses residing in urban/metropolitan areas?

Our research, recently published in the *Journal of Transportation Research Part A: Policy and Practice*, provides evidence for such willingness to pay. Our findings suggest that, compared to other modes of travel to regional areas, Sydney residents are willing to pay a premium for regional air services of on average \$126 (\$99 leisure; \$153 business) for one hour of travel time savings. Regional airlines, for example QantasLink, could charge a premium of \$189 as part of the ticket price from say Sydney to Port Macquarie, where the saved travel time is 1.5 hours compared to driving a car.

This has important implications on regulation and public support of such services. The high premiums on time savings resulting from regional aviation services suggest that some form of industry support may be warranted, at the least through ensuring a business friendly institutional environment. Industry subsidies may not be required if the regional air services' essential role is otherwise recognised as part of the future development of the regions. In the context of regulating Sydney Airport (KSA) our findings provide justification for the mandated level of peak hour slots for regional carriers. Our findings also suggest that there is value in considering a further scheme to provide 'medium' and 'large' regional airports with guaranteed access to slots at KSA. This would include a minimum of two slots in both the morning and evening peak-hours (ideally six) which in turn would generate the potential for some true competition between regional carriers. Allowing multiple operators to compete for the lucrative business travel market, which demands morning departures and an evening return, would make regional air services more competitive and therefore attractive to the travelling public.

This may prove more difficult in the regional context than at metropolitan airports and certainly won't be the panacea to solve low passenger numbers. Attracting non-aeronautical revenues such as through car parking, adjacent business parks or freight is another option that some airports are currently exploring, for example Wellcamp, Dubbo and Tamworth. Opportunities around jointly developing routes with all stakeholders (including tourism agencies) which could include federal or local government route development funds is also an option that should be explored.

The potential game change is however something else, namely better integration of regional aviation.

Firstly, the better integration of federal, NSW state and council plans, policies, initiatives and legislation would not only result in a better product but also in improved cost effectiveness. For example, reconsidering the need for federal 'red tape' security regulation at all airports may yield regional benefits, as clearly one size does not fit all in the airport context. Secondly, and perhaps more importantly, there could be greater integration of aviation within the transport sector. Presently, aviation is not recognised as a form of public transport. However, given that people use scheduled, publicly supported and/or regulated regional air services for a range of purposes, it could be said that regional air services have given the name *Airbus* a more literal meaning, and that aviation could be a mode of public transport which would benefit from greater integration with road and rail public transport.

Our latest study findings on "*Strategic Management of Integrated Public Transport and its Value in the Air Bus Context*" suggest that while the business traveler prefers the current air service and taxi model, the leisure market is more open to integrated land shuttle services from the airport to their destination. Through 11,280 choice experiment observations we determined that metropolitan leisure travelers are willing to pay a premium of \$45.88 for a plane and integrated shuttle at the regional destination and an additional premium of \$23.97 where the shuttle can be booked at the same time as the airfare. This combined willingness to pay (of \$69.85) for just those two integration features (there are many more to explore) represents potentially attractive opportunities to regional airlines and airports that look at mobility as a service that requires management across modes to get people to their destination. The ability to charge this premium may lead to improvements in the profitability of the aviation value chain. If they charge fares below that premium, the competitiveness and attractiveness of regional air services may be enhanced which may ultimately result in higher patronage and boost commercial viability of services, and the economic performance of the regions.

Integrated timetabling, transport service offering, ticketing and marketing are all normal in cities. Who would doubt the benefits of the Opal card in Sydney? Why don't we have something similar for regional aviation and regional transport in general? FlyPelican are now applying elements of this concept as they offer their customers an integrated fare of \$135 "Pelican Sydney Connex" that includes in addition to the air service (from Newcastle) all transfer and ground transportation to/from Sydney Domestic Airport. With new technologies and apps becoming available on a daily basis, it is only a matter of time until fully integrated regional air service solutions will become the norm and force policy makers to rethink their strategies.

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New South Wales cycling laws: One pedal forward, two pedals back

ITLS Think Piece #11-2016-January

By Stephen Greaves

As most New South Wales residents were finalising their Christmas holiday plans, the NSW state government unveiled a package of regulations designed to 'help drivers, bicycle riders and pedestrians Go Together safely'⁶⁸. Motorists will need to give cyclists a one metre gap when overtaking at 60 km/h or less, and 1.5 metres at higher speeds or face a \$319 fine. Cyclists will be required to carry photo ID, which can be requested by police on suspicion of breaking the road rules. Cyclists will also see fines for 'high risk behaviours' including running a red light, riding dangerously, and not stopping at children's pedestrian crossings rise to the same levels as car drivers (\$71 to \$425), while holding on to a moving vehicle and not wearing a helmet will see fines rise from \$71 to \$319.

The regulations, which are due to come in March 1st, 2016, have divided opinion⁶⁹ with some claiming the laws are 'draconian' and will make NSW the 'laughing stock of the world'⁷⁰. Whatever your perspective, it is pertinent to assess the motivation for the laws, whether the laws are likely to achieve their objectives, and speculate on wider implications for cycling.

Cycling has enjoyed something of a renaissance in some Australian cities in the last decade. This has been underpinned by significant investment in cycling infrastructure, which seems imperative to uptake of mainstream cycling – one only needs to look at the Netherlands where, underpinned by an extensive network of separated cycleways, 27% of trips are made by bicycle compared to just over 1% in Australia⁷¹. However, risks of incidents for cyclists remain unacceptably high⁷² - 1,500 cyclists are seriously injured and 11 killed on average in NSW each year.

The new regulations try to address this problem by imposing heavy financial penalties on 'reckless' motorists around cyclists and 'reckless' cyclists, particularly those who don't have an ID on them. Stipulating a safe passing distance seems sensible enough. It is unlikely the police will be there with their tape-measure, it is the message of the law that is important and as has been shown in Queensland where first trialled, it has found general acceptance. What about the ID requirement? On the face of it, while many people carry some form of ID anyway, this seems draconian with questionable safety benefits and one might also ask why cyclists have been singled out over other vulnerable road users. Yes, it is true, many countries require the carrying of compulsory identification cards by all persons over a certain age, including the 'cycling-

⁶⁸ <http://roadsafety.transport.nsw.gov.au/campaigns/go-together/index.html> Accessed 14/1/15.

⁶⁹ <http://www.smh.com.au/comment/nsw-cycling-laws-metre-passing-laws-a-win-but-others-are-bewildering-20151221-glsj4j.html>. Accessed 14/1/15

⁷⁰ <http://www.abc.net.au/news/2015-12-22/new-south-wales-plan-for-cyclists-to-carry-id/7048244>. Accessed 14/1/15.

⁷¹ Pucher J, Garrard J and Greaves SP 2011 'Cycling down under: A comparative analysis of bicycling trends and policies in Sydney and Melbourne', *Journal of Transport Geography*, vol.19:2, pp. 332-45.

⁷² Garrard J, Greaves SP and Ellison AB 2010 'Cycling injuries in Australia: Road safety's blind spot?', *Journal of the Australasian College of Road Safety*, vol.21:3, pp. 37-43

friendly' Dutch⁷³. However, these may only be requested under specific circumstances; they have nothing to do with road safety and the fines are nowhere near the levels proposed under the NSW legislation.

Arguably, the most contentious component of the legislation is the hefty rises in fines for violations of road rules designed to bring cyclists 'into line' with motorists. This follows Victoria and Queensland, where there has been no evidence that increasing the fines has had significant safety benefits. While most of the offences listed are not condonable, it seems unreasonable to view the level of risk posed by a cyclist running a red light as similar to a car. Perhaps we should consider legalised red light progression for cyclists under certain circumstances as is now the case in several European cities, which have reported flow improvements and no increased danger⁷⁴. It is also [frankly] baffling that the \$425 fine for 'riding dangerously' exceeds that of the \$319 for the new passing regulations and for those riders who choose to do so without a helmet, this represents a real blow to the wallet. Australia along with New Zealand are the only nations with mandatory helmet laws and while I personally would not ride on Sydney's busy roads without one, I believe this to be a personal choice as is the case in most of the world. Will the huge increase in the fine leads to more helmet-wearing or a further deterrent to cycling? My fear is along with these other fines, it will largely do the latter.

My perspective of the regulations is that making motorists more aware and courteous towards cyclists can only be a positive. Mandatory helmet laws aside, the road rules by which cyclists must abide are reasonable in themselves, but the hefty rise in fines and the ID requirement, seem to have little tangible link with safety outcomes. If the intent is indeed to make cycling safer, efforts should be geared towards expansion of the separated cycling infrastructure program initiated by the City of Sydney, further education of both motorists and cyclists, and laws that provide greater protection for all vulnerable road users including cyclists as per nations like the Netherlands. Unfortunately, the current state government seems to be taking a somewhat regressive view towards cycling, evidenced by the recent removal of the College Street cycleway, and a set of fines that seem set to only marginalise cycling and polarise opinion further.

⁷³ https://en.wikipedia.org/wiki/List_of_national_identity_card_policies_by_country#Countries_with_no_identity_cards

⁷⁴ <http://www.theguardian.com/cities/2015/oct/27/cyclists-run-red-lights-paris-london-san-francisco>

MARKET RULES: Rebalancing power to restore fairness

ITLS Think Piece #13-2016-January

By Alastair Stone

We all share the goal of a growing economy with wealth for all not just the few. The Federal Government's response to the Harper Report on Competition Policy Review is a recent example of activity on the economic policy front in pursuit of that goal. Inherent in that report and other reviews such as into tax arrangements, is how the term “*market*” is used. This discussion is about how the current use of this term has hidden many changes in the economic framework and what we need to do to restore fairness.

In some ways the term “*market*” has gained a certain sanctity when used to describe exchange, as if it were some god given mechanism. Of course this is simplistic rot - markets are a rules based construct of society. Getting market rules right is an important policy task particularly in the capitalist economies of representative democracies.

A brief but important caveat; changes in market rules take nothing away from the efficiencies gained within a given set of market rules by applying the theory and optimization techniques of micro economics. These micro economic optimization techniques remain valid for any given set of market rules but let us not get them mixed up with the setting of market rules by using them to defend change that is the result of shifts in power – not supply and demand changes.

Market Rules

Markets are where exchange of rights to resources between entities takes place. Rules are established on how exchange should take place, to encourage society to economic action to increase wealth. These rules include setting:

- Value or utility of resources (e.g. property, and labor as in what is a day's work worth?);
- Contract form of the exchange including how to deal with and enforce penalties for failure to perform (who loses all rights for default and who is allowed to work out a debt as in schemes of arrangements when bankruptcy threatens), and crucially, what resources are allocated to enforcing the rules over the longer term – no resources no rule of law;
- Rules for optimum efficiency, such as what is the minimum number of entities competing on both the supply and demand side of exchange?
- Regulations to ensure say, efficient pricing, as in provision of many public infrastructure services by a single entity.

Rarely mentioned in policy discussion about the economy is that the setting of these rules depends on the state of the distribution of political power between the exchanging entities. It is political power which enables each of them to exert influence not just directly over the details of one particular project but more generally over the substance of the rules applied to all similar exchanges.

Changes to Markets⁷⁵

Market rules keep changing, and in a shorter and shorter time frame. Some diverse examples of changes from the last couple of decades are:

- Granting to infrastructure PPPs exclusivity of supply by say a tollway in an urban transport corridor by preventing easy use of existing facilities that could compete for traffic;
- Granting of and duration of exclusive rights for spurious “original” ideas such as the cross harbor tunnel in Sydney, or a new casino license;
- Shift of value judgment by elected politicians to “quasi-professional” determination by politically “independent” bodies such as IPART (Independent Pricing and Regulatory Tribunal of New South Wales, and ACCC (Australian Competition & Consumer Commission;
- Loss of transparency by refusing freedom of information requests on contracts involving public resources based on need for secrecy based on claims of “commercial in confidence” for spurious proprietary intellectual property.

There are many more examples of changes that have systemic impacts on the economy which have produced a shift in power particularly from the income dependent middle and low income wage and salary class to the upper income and capital rich senior executives and inherited wealthy, when there has been little observable change in the worth of their work to the public constituting the broad economy. One telling piece of evidence of market rule change in Australia is the divergence over nearly two decades (since 1997) of labour productivity growth at around 29.5% from real wages growth at around 11.5%⁷⁶. Another is the ratio of CEO remuneration to average remuneration which in fifty years in the USA has gone from 20 times to almost 300 times.

Political Power as the determinant of market rules

All of the above changes have their origin in legislative or administrative changes that impact market rules. The ability of an entity to change such rules depends on projecting the perception of power to influence voters onto elected political decision makers. A feature of the organization of influential players is aggregated individual power and centralized hierarchical control of decision making. The current corporate form has few equals in delivering this. It now pervades the public as well as private sector and even political parties.

However as the form of rights to resources, in particular property rights and their underlying cost functions, and situational information changes at ever increasing speed, the hierarchical form of decision control with its inherent slowness, is giving away to an intriguing combination of entity wide shared consciousness of goals and context and empowerment of executives at the interface of exchange to make decisions in a time frame that reflects the speed of change⁷⁷.

⁷⁵ For a broader discussion of these and other related issues that is US based but relevant to Australia see; “Saving Capitalism: for the many not the few” by Robert B. Reich.

⁷⁶ For a full explanation of the derivation of these figures see Bill Mitchell's , May 14, 2015 Blog; Australian Wages growth – lowest on record <http://bilbo.economicoutlook.net/blog/?p=30914>

⁷⁷ For a military perspective on this emerging change in corporate management see “Team of Teams: New Rules of Engagement for a Complex World” by General Stanley McChrystal

Again it is important to understand that the current form of influence pedaling is generally played out beyond any one transaction (project) where society is quick to label it “**corruption**”. It is inherent in greater access for large private corporate entities to politicians. It is in the subtle promise of “jobs for the boys” relationships between politicians and private/public corporations. It is in the rationale and strategy for making rule changes usually being laid out for politicians by the agents of private corporate players such as consultants claiming technical expertise, lobbyists, and politically and administratively “sound” lawyers including those engaged as gifted amateurs in the many expert enquiries such as “royal” commissions.

This type of distribution of power is coming to be seen as unfair, including for infrastructure services and more broadly income and ultimately wealth. The lack of fairness is seen in both the shift in power to service sectors such as finance, and away from manufacturing and agriculture; and the shift within sectors between low level employees and senior executives and shareholders. This feeling of a lack of fairness will not be resolved by taxing the new wealthy and redistributing the taxes in some form of state welfare to the less wealthy. It needs the influence of power over market rules to change. So what would it take to rebalance the power over market rules to restore fairness?

Rebalancing Power over Market Rules

This is a broad topic that extends way beyond infrastructure services, and hence will only be partly addressed here by outlining some areas for detailed attention as in:

- Disaggregating the definition of supply products to match existing efficient markets as in finance, and construction (unbundling);
- Defining demand products to match actual exchanges⁷⁸ e.g. in urban areas separate demand for access to networked infrastructure services from amount and timing of physical consumption. This redefinition of products means going beyond, for example, a construction project mentality to say the network level service, and hence the setting of economic/financial responsibility for supply to match scale of demand resulting in regional provision and responsibility to avoid the rent seeking behavior prevalent when say construction finance for local projects is allocated at the Federal level;
- Full transparency for all contracts for public infrastructure service provision;
- In the case of IPART type determination, return value setting and hence the price setting decision to elected representatives, by bringing all pricing and regulation analytical activity back into the public service - similarly, in the case of ACCC. By definition value setting in a democracy cannot be independent of elected representatives guided by expert analysis.

Changes such as the above would rebalance the power distribution in favor of a wider spread of income and wealth from increases in economic efficiency of provision of infrastructure services. Such changes would require a return to a strong technically capable public service to complement the administrative capability that has come to dominate. It would also have the benefit of requiring the invocation of “the market” to include description of impact of change on the rules. Once the population is aware of the power of the underlying rules and they become part of the policy conversation we will have a fairer distribution of growth in wealth to include all not just the few.

⁷⁸ For further discussion see ITLS-BoA-WP-11-01 Systems Economics: Essay 1 - Definition of the economic product.

Our new PM is a transport agnostic – Hallelujah!

ITLS Think Piece #15-2016-March

By David Brown

Our Prime Minister, Malcolm Turnbull, has described himself as a transport agnostic. This is a very good thing.

Transport planning has been unduly affected by a range of thinking that is not independent analysis, but rather a fundamentalism whose passion for a particular mode of transport has verged on religiosity.

It is good to promote transport based on meeting people's needs not on the passionate feelings for one mode of travel.

I am not automatically condemning people who have a faith in something even if it focuses on mechanical means of getting around. The point is that transport planning shows us how taking a passion then turning this into a singular, one dimensional approach that sees other opinion as heresy, can be counterproductive. Each mode of transport produces rituals and rants from those who believe that it is the only solution to all our needs.

What happens with such fundamentalism is that you end up justifying the system and loose sight of the needs of the people you are supposing to serve.

All modes of transport have their acolytes and there can be valid reasons for looking to a particular form of transport to provide some of the answer. But there are always a balance of factors to be considered. When you move away from being a researcher to being a lobbyist for your preferred mode, the best solutions for people are often lost in a sea of generalisations, vague comparisons (local and overseas) and a desire to build a solution no matter what the cost.

In the 50s and the 60s we saw the peak of a car culture that believed in the obvious convenience of a motor vehicle and assumed that as we moved into the future, all we had to do was build more roads. It was reinforced with the image of the joy of living in the suburbs with a quarter acre block. It was a prosperity theology where cars were a way to abundant life.

The principle is that the freedom of the single person driving a car is great, so a million cars must be a million times better. Clearly we have to move to the higher principle of doing things that fit into a system that is for the collective good.

Many people's love of cars is still clear and some car advocates still have a passionate aggression against public transport advocates, motor bikes and/or push bike riders. The ferocity of some of the debate (from all sides) elevates the deliberations to the level of a holy war.

It's not all bad. The motoring clubs in each state, such as the NRMA, RACV and RACQ feel that it is their duty to advocate for more road funds to support their constituents.

It is encouraging to see, however, that motoring clubs have generally moved from the far right and are more actively embracing the need for other modes of transport. They are being more accepting and even promoting things such as public transport, cycling and walking.

Their concept of balance does still include building some roads. While advocates for alternative modes of transport appreciate the support, some are so devout that they believe that there is no such thing as a good road.

Their belief that the "car lobby" (said in a manner that clearly indicates it is an evil identity), is selfish people who could all give up their vehicles and catch public transport is much too simplistic.

It has to be accepted that if you build extra road capacity, it will encourage more people to drive or existing car users to drive further. I do not support the NSW Roads Minister who is justifying some very expensive new road construction projects on the belief that they are "congestion busters".

But there can be a case for building a road as a land-use initiative such as creating a by-pass for efficiency reasons to improve local communities by removing through traffic. Better quality roads can be safer and produce less pollution for the distances travelled.

As a young traffic engineer I had an epiphany. Previously I had stood on the footpath of Church Street in Parramatta when it served arterial traffic by providing a path through the middle of the commercial area. The traffic noise was such that it hurt my ears. The epiphany happened when they remove much of the through traffic, widened the footpaths and closed one section of the road. Sections of Church Street now have bus lanes. The environment was far more pleasing and more helpful to public transport.

The closing of the main street was approved because they had built a bypass road. In principle this was a case of taking four lanes of traffic from "through" vehicles in the centre of the city and giving a similar amount on a bypass road. Providing a bypass was good but providing a huge increase in capacity is a different question altogether. If the new by-pass road gets congested in the peak periods then so be it.

But of course some public transport fundamentalists believe that there is no such thing as a good new road. They say that instead of providing any new roads you should make people use public transport.

Now I believe that we need to make more use of alternative transport systems but a gross generalisation about the needs for transport in a thriving city and how people can serve their needs is not my idea of an answer.

If you want to make your solution (or faith) look obvious, then it is best to simplify and generalise about the evil consequences of the alternative and the redeeming features of your solutions.

We often over emphasise trips to and from the city centre mostly for the purpose of work (which you go to in the morning and return home in the evening). The media usually reflects this image.

If this is true then redemption is straightforward: build public transport to the city centre.

The reality is not that simple. In terms of jobs, there is a significant inbound in the morning outbound in the evening pattern but most work trips are not the CBD. More trips are made for social recreation than for work, travel for shift work jobs at times when it is not as easy (or as safe) is significant. Many trips include several purposes so it is not a case of one getting on one train and staying there. Freight is often vaguely mentioned but not always quantified.

Quite a lot of trips are not readily suited to the traditional public transport projects that are often proposed, including people with disabilities, tradespeople and access to many places that are not going to be served by public transport. Try taking your kids to many sports areas on weekends by public transport. A more successful future will include consideration of non-traditional forms of public transport.

If you hate roads, it is worth remembering that the public transport system that carries the most people in a city like Sydney is buses - which travel on roads. I studied under Professor Ross Blunden who was a passionate public transport advocate but he supported the building of a new cross Sydney road tunnel because it provided the opportunity to create a bus lane across the Harbour Bridge.

The above comments are not definitive. They don't prove that one system or project is good or bad. They just show that over simplifying the needs makes it easier to be adamant.

To the fundamentalist, every public transport proposal is good. To suggest otherwise is to be a heathen.

Within public transport, as a religion, are a series of sects. While they might be united in the general belief that public transport is good, there are disciples with a particular passion for either trains, light rail (never call them a tram) or (more rarely) buses.

Even if you believe that all public transport is good then there is often a clear hierarchy that a train project is always better than light rail which is still always better than buses.

Some years ago the City of Sydney proposed to build a light rail line down the middle of the main north/south thoroughfare, George Street. It was to only run about two kilometres. The Lord Mayor of Sydney, Clover Moore, was right behind the project. Ms Moore is seen by some as controversial but she has a vision for a liveable city that is not dominated by cars which I think is wonderful.

But I did not agree with the initial proposal. The plan called for all the people travelling on buses from the south, south-east and south-west (and many people do this) to change at Central and make the last short part of their trip by the tram.

Changing from one transport mode to another, especially if it is for a short period only, is an inconvenience felt strongly by customers. I remember even passionate public transport advocates such as the late Dr Paul Mees opposed a plan in Melbourne that would make people change for the last short section of their trip.

But to the fundamentalist, if you oppose any non-car proposal, you are clearly anti-public transport.

I was doing a regular interview on ABC radio around this time. One day we took talk-back calls on this light rail proposal. Most callers (in fact if I remember correctly I think it was all callers) were opposed to it with bus passengers being the most vociferous.

I made the point that just because trams can carry a good number of people and they have been implemented in other cities, it doesn't mean every tram project is a good solution. I said that sometimes passionate advocates take the attitude that "The answer's a tram, now what's the question?".

Actually I am not saying this expression sums up the whole situation and I know I offended some tram lobbyists but a very significant number of transport planners supported my comment. One transport expert used this as his opening line when he later met with Malcolm Turnbull (who was still the opposition leader). Apparently Mr Turnbull laughed spontaneously.

The interesting thing about the City of Sydney situation is that they are now building a much longer light rail system that has the advantage of not only feeding longer distance, city-bound trips but serving the reverse travel tasks of many people going to the University of NSW (which has some 28,000 students!). That is a better result. Some think the solution should have been a train (because they believe a train system would carry more people) and some think that a bus system would have been the more cost-effective solution and with the money left over other

transport solutions in other locations could have been provided. So it is not just a question about cars versus trams.

The bicycle lobby has also, on occasions, slipped over into hard core fundamentalism doing, I believe, considerable damage to their cause.

Fundamentalism can also lead to hypocrisy. Some bicycle lobbyists are super critical of the aggressive nature of car drivers and that is a fair thing. But local government transport professionals have reported that when they implement share paths ways for cycling and pedestrians, the aggressive, rude and even belligerent attitude of some bike riders to pedestrians has been their main problem.

When a senior Netherlands government official Martijn J. te Lintelo recently came to Australia to talk about the things that made his home country so successful in using bicycles, he remarked how bike riders in Sydney seemed to be all alpha males traveling at relatively high speeds. In his home town they are a much wider mix of riders from the very casual to those in business suits.

If you think that the attitude of some intense bike riders is not an issue then at the recent conferences, meetings and discussions I have had with cyclists, most cycling advocates are specifically stating that they do not wear lycra and they do not want to be associated with the fundamentalists.

Pushing issues that are fundamentally obvious to you might not produce the results you intended. I recently wrote an article about why the cycling fraternity should not over emphasise enormous physical health benefits of riding a bike because it associates the activity only with huge effort and much sweat. I took this line to encourage bike riding across a wider audience. Some researchers have noted that we should try and get a lot of short trips onto bikes but this will do little for your physical health.

The overall problem of fundamentalism is that it ultimately focuses on the supply side of the equation rather than the demand side.

This is not to say that we should avoid interaction with people who are part of the passionate parishioners; we need a broad church of people and their opinions.

To make it useful we need to be able to understand needs, listen to other's ideas and then to identify effective solutions that fit people's requirements.

A better transport system will rely on the vision of helping people which considers the need of the whole congregation. This will not be achieved if we only concentrate on perpetuating the belief in one particular system.

The current Prime Minister likes to be seen catching public transport, he has reversed his predecessors policy of only funding roads. But he does not seem to be a person of blind faith, just practical realities.

David Brown has an honours degree in Civil Engineering and has practiced in the fields of traffic engineering and transport planning. He is now a writer and media commentator.

Poll Question

Does transport planning concentrate too much on the supply side and not enough on the demand side?

The impact of slugs and rabbits on the throughput of escalators

ITLS Think Piece #19-2016-July

By Michiel Bliemer

Escalators are important to efficiently move pedestrians around in crowded multi-level public spaces such as shopping malls, train stations, etc. Efficiency of escalators can be measured by looking at the throughput, that is, the number of pedestrians that can exit the escalator per hour. There is debate regarding whether we should allow pedestrians to walk on escalators, not only because of **safety issues**, but also because it actually may increase efficiency. There is **empirical evidence** from the UK that letting everyone stand on escalators yields a higher throughput than letting some people walk. This is counter-intuitive, so in this article we analyse this further.

Particularly in underground metro and train stations, a high escalator throughput is essential in order to let the large number of travellers (that simultaneously exit the metro or train carriage) leave the platforms as quickly as possible. It is interesting to look at how different behaviours on escalators affect throughput.

Behaviour on escalators varies widely across the world. There are typically no set rules for these behaviours, so it is mainly determined by etiquette and vary from country to country. In many countries people stand on both sides of escalators, however, in some countries (e.g., the UK, USA, Germany), pedestrians stand on the right, allowing others to walk on the left. Australia is one of the few exceptions in which pedestrians stand on the left.

In general, the maximum theoretical throughput is called the *capacity* and would be observed if pedestrians occupy each step of the escalator, see Figure 19.1(a). However, the *effective capacity* is much lower since people typically leave gaps for various reasons (e.g., comfort), as illustrated in Figure 19.1(b). A situation in which everyone walks as shown in Figure 19.1(c) does not necessarily increase the capacity. Given a (relatively fast) escalator speed of 0.7 m/s and the fact that **people do not really walk upward much faster than this**, leaving one or more steps empty (required to comfortably and safely walk) could actually decrease throughput.

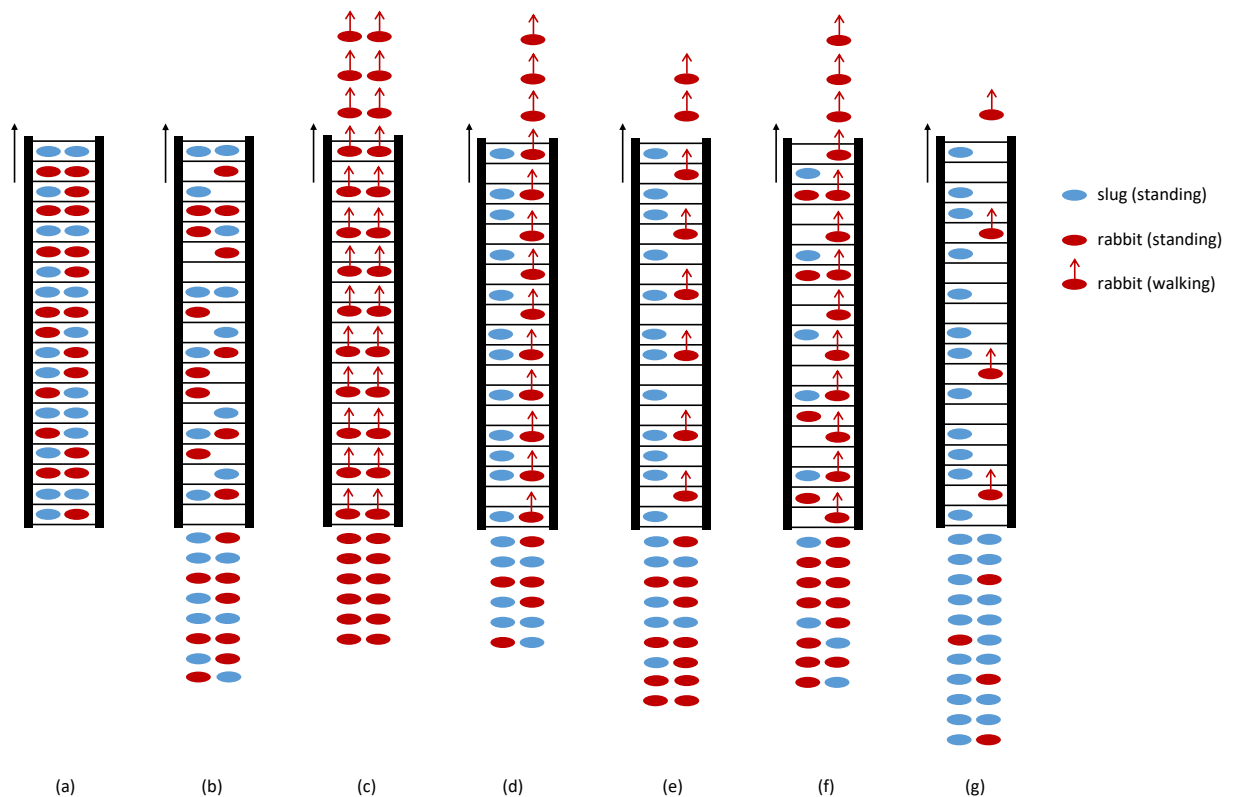


Figure 19.1: Throughput in upward direction on typical escalators

Carlos Daganzo UC Berkeley) proposed a **behavioural theory of multi-lane motorway traffic flow** that is also applicable to escalators. In this theory, *slugs* travel at a low speed and in our case would be pedestrians that do not walk on escalators (by choice or due to other reasons, e.g., age, luggage, or low level of fitness), while *rabbits* travel at higher speeds and would prefer to walk. In most cases there will be a mix of slugs and rabbits on an escalator. If there are slugs both on the left and right side, then a so-called *one-pipe regime* results in which all pedestrians are standing as shown in Figure 19.1(b). In case slugs only stand on the left side, the right side will be used by faster rabbits and a so-called *two-pipe regime* results in which the left side stands and the right side walks, see Figures 19.1(d)-(g). Once the rabbits have entered the escalator, they exit faster than the slugs. However, because they are walking, more space is required between rabbits. If the average passage time between rabbits (referred to as *headway*) is larger than the average headway of slugs (who are closer together), then the throughput may actually decrease and it will take longer for all pedestrians in the queue to exit the area, see Figure 19.1(e).

We know from this behavioural traffic flow theory that two-pipe regimes often have a lower throughput, especially if the number of slugs and rabbits is quite unbalanced. In Figure 19.1(f) there is a situation with relatively many rabbits. On a motorway this would typically leave many gaps between slugs and decrease throughput. However, one would expect on escalators that rabbits would simply fill some of the gaps since standing on the escalator still moves them forward and they can start walking once there is a sufficiently large gap on the right. Therefore, a situation with many rabbits is likely not problematic. More common and more problematic is a situation with relatively many slugs as shown in Figure 19.1(g). In this case, reserving the right side for rabbits leads to an inefficient use of the escalator and a significant decrease in throughput. This can also be nicely shown in **animations**. It is however possible that two-pipe regimes increase the throughput if slugs and rabbits are relatively balanced and if the rabbits have short headways as shown in Figure 19.1(d).

A situation with many slugs as shown in Figure 19.1(g) will mostly occur when an escalator is relatively long. Therefore, in order to increase throughput, standing-only escalators may be a good idea for long escalators in order to avoid situations as depicted in Figure 19.1(g).

Given the similarity with behaviour and traffic flow theory on motorways, an interesting thought is to explore ways in which traffic management has improved throughputs on motorways, and whether similar principles can be applied to escalators. A standing-only rule on escalators can be thought of as a speed harmonising measure with decreased speed limits on a motorway. In case there are multiple escalators going up (e.g., at Martin Place train station in Sydney CBD there are three escalators on one side going up in the morning), one could also think of separating heterogeneous traffic flows (i.e., slugs and rabbits) by making one escalator walk-only and other escalators stand-only. This could minimise merging effects in queues with slugs that want to stand left and rabbits that want to walk right, and hence decrease gaps in the flow. There may even be an optimal escalator length with a balanced mix of slugs and rabbits that will optimise throughput (Figure 19.1(d)). By thinking outside the box we may be able to find new ways to optimise traffic flows on escalators.

Poll Questions

1. Do you typically prefer to stand or walk on escalators?

A: stand

B: walk

2. Should we discourage walking on escalators for the sake of efficiency?

A: yes

B: no

On bias, bollocks and better practice

ITLS Think Piece #44-2018-March

By John Stanley

Formal cost benefit analysis of land transport initiatives has been common for fifty years, with Australia a pioneer in the field, particularly through the internationally acclaimed work of the (then) Commonwealth Bureau of Roads. Travel time, vehicle operating costs and accidents formed the initial focus of benefit quantification work for roads, together with changes in operational and maintenance costs.

Since those early days, there has been considerable progress in extending the scope of land transport CBA, from roads to public and active transport and with the inclusion of a range of additional benefits and costs, such as Wider Economic Benefits (e.g. agglomeration economies). A number of countries, Australia included, have produced guidelines that suggest ways to undertake assessments, particularly if governmental funding support is sought.

ITLS researchers have played a leading role over the last decade in building understanding of links between mobility, social exclusion and well-being, working with colleagues from Monash and Melbourne Universities. This is the only international research, to our knowledge, that has produced values of trip making as a contributor to reducing risks of social exclusion. Those values are independent of particular modes but can be used in a modal setting. For example, application of the research suggests the single biggest benefit from Melbourne's route bus services is their social inclusion value (Stanley and Hensher, 2011).

The research in question has passed peer review testing that saw publication in such noted international journals as the Journal of Transport Economics and Policy, Transportation Research Part A and Urban Studies. In short, it is seen as good quality research. Notwithstanding such peer recognition, the values that flow from this research are yet to be incorporated in evaluation guidelines, even in Australia where the research was based. This poses the question, "Why not?" Meeting the peer review test for acceptability should probably be the first criterion for inclusion. The research clearly passes that test.

Alignment with the fundamentals of CBA is a second test. CBA is essentially a means of aggregating measures of individual preference with respect to particular policies or other initiatives, or programs thereof, where money is used as the means for aggregation. We might prefer to measure utility but money is a bit easier! Willingness-to-pay for a benefit, or accept to be compensated for a cost, provides a consistent framework for measurement identification and quantification, albeit very difficult at times. The incidence of benefits/costs (who wins and loses) is also an important evaluation input, since it is heroic to assume that a dollar has equal value for all. Equity weighting procedures provide a means of transitioning from dollars to a proxy for societal utility or welfare (Stanley and Stopher, 2014). If there are ethical reasons for not including particular individual preferences, such as where individual preferences might differ from the preferences a person might hold when thinking of themselves as part of a community or society, than this can be taken into account in a CBA (Nash et al., 1975). Such considerations underline the value bases of CBA, which most analysts unfortunately ignore.

The valuation work on trip making as a means of reducing risks of social exclusion was designed from the start to align with willingness-to-pay methodologies, which should mean a tick for inclusion in evaluation. Interestingly, the research indicates that the value of additional trips, in terms of reducing risks of exclusion, tends to increase proportionally with declining household

income. This generally accords with broader equity weighting approaches to CBA used in places such as the UK.

It might be argued that, because no other international research has identified values of trip making in terms of reducing risks of social exclusion, why should Australia use these values? I would make three points about such an argument. First, deriving values of the kind that have been found in the Australian research requires very detailed and expensive survey work. The Australian research had the benefit of an ARC grant and considerable funding and/or in-kind support from the Victorian State Government, the Victorian bus industry, local government and the Brotherhood of St Laurence, equivalent to well over \$1 million in today's terms. We are not aware of any other research program in this area that has had such a level of support, so the absence of similar findings elsewhere is little surprise.

Second, the suggestion that, if no-one else does it, then neither should Australia, is a recipe for returning mankind to caves. Progress needs new knowledge and understanding to be developed and applied in the pursuit of improved life chances and a more sustainable environment. Australia has the opportunity to set an international precedent by including the valuation work on trip making, as it relates to reducing risks of social exclusion, in its national transport evaluation guidelines.

Finally, I make the important point that to ignore these values is to perpetuate a bias in transport sector CBA against projects and policies whose purpose is, or might include, reducing risks of social exclusion. Counting agglomeration benefits, for example, given spatial distribution of associated benefits, but ignoring exclusion benefits tilts the analysis platform firmly in a regressive direction and perpetuates risks of exclusion. It is time for a more balanced approach.

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Harnessing the wisdom of crowds for better cities

ITLS Think Piece #55-2018-November

By Supun Perera

Infrastructure management in modern cities, with rapidly growing populations, is a challenging task. Authorities spend considerable levels of resources for the purposes of asset status monitoring, so that capital work fund allocations for maintenance and upgrades can be appropriately prioritised. Therefore, tangible benefits can be achieved by the authorities through involvement of the users in monitoring the status of assets in any given system.

The users who frequently interact with a system (for example, users of roads, public transport services, active transport or recreational infrastructure etc.) can be thought of as ‘agents’ who depend on the functional integrity and performance of the assets which constitute that system. These ‘agents’ are therefore capable of gathering valuable information and insights related to the status and functionality of assets, which may not be immediately available to the operators of the overall system. With the advancement in the speed and reach of communications and information flow, any user can act as a ‘consultant’ by sharing their individual experiences, insights and/or recommendations [1]. Therefore, a tool which enables the relevant authorities to harness this collective intelligence from the system users, can be invaluable for efficiently monitoring and managing assets.

The practice of soliciting help towards a common goal from a distributed audience is referred to as ‘crowdsourcing’. Crowdsourcing itself is not a new idea (a good example of crowdsourcing is Wikipedia - a free, web-based collaborative encyclopedia platform which operates on a non-profit basis through active volunteer contributors who continuously add new knowledge to the system). However, the significant increase in smartphone ownership worldwide, within the past decade in particular, has enabled unlocking the full potential of crowdsourcing. A range of interesting crowdsourced mobile apps, which allow users to contribute and benefit in various ways, already exist [2].

Based on a review of currently available apps, one which facilitates sharing of asset status information by users with relevant authorities was identified. This app is named Snapendsolve [3] and is currently operational across most regions in Australia and NZ. Snapendsolve enables users to share comments and/or complaints (including photographs) about a certain issue with the relevant authority. The app is capable of automatically identifying the authority responsible for a given issue on the basis of the location and the type of the issue (as selected by the user of the app). In essence, this app is similar to the ‘contact us’ form in authority webpages, with the difference being that the user does not need to know the authority responsible for the impacted asset. Whilst this app is a good starting point, which enables the users to communicate easily with relevant authorities on issues pertaining to assets in various systems, there are multiple ways in which additional functionalities could be added to unleash the full potential of crowdsourcing.

For instance, an open user community in a street map setting could be envisaged as the basic platform of the crowdsourcing app (similar to Waze [4] – a community-based GPS navigation app). This will enable users to drop a pin on the map (similar to Apple maps) and identify the locations of the assets of interest. Comments and photos of the issue (the types of issues could be predefined by the app in a drop-down list) that should be brought to the attention of the relevant authority can be directly uploaded to the system, transparently, by all users. Upon identification of an issue by a user, the app will automatically direct the complaint to the relevant authority.

Beyond the asset status monitoring application, this app could prove helpful in identification of hazards, ranging from an uneven footpath posing a tripping hazard to pedestrians or a broken swing in a park posing a safety hazard to children to road black spot identification. In particular, until the matter is attended to by the relevant authority, others in the local community will also be informed of the asset issues through the app, so that they can take relevant actions to minimize their exposure to the hazards.

The open community platform, in a map display, will allow the users to transparently contribute and interact with other users. For instance, users could add comments or up vote the issues other users have already identified. This will enable prioritization of issues that need to be resolved by the relevant authority and minimize the duplication of complaints on a single issue (which is unavoidable in a non-transparent 'contact us' web form system that is currently being used).

A key challenge in current systems is encouraging the active participation of the community (beyond the good Samaritans) in the comment/complaint submission process. The transparency of the proposed platform is useful in this regard, for attracting more users to engage with the app, since it enables one to be aware of the hazards in their local area and avoid these in advance. In addition, users can be further incentivized by allowing the authorities to communicate back with them through the app, as it will enable the users to be up to date more easily with the latest local information [5]. For instance, a local Council could easily alert the app user community of the location of a traffic disruption and inform the users of the road system to avoid the affected route.

This kind of a crowdsourcing application, through a mobile app, is an ideal way to involve the local community in the betterment of infrastructure and management of hazards. The wealth of data collected from the app over time can form a larger picture that could be used for many different purposes in future, beyond policy decision making. This concept, if developed and implemented, is capable of fundamentally transforming the current reactive approach for asset monitoring and hazard identification towards a more rigorous, evidence-based and proactive approach.

Poll Question

If this crowd sourcing concept based app is developed, will you interact with it regularly (at least once a week)? Yes or No.

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