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Congestion pricing for roads: An overview of current best practice, and the economic and transport benefits for government

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CONGESTION PRICING FOR ROADS

– An Overview of Current Best Practice, and the Economic and Transport Benefits for Governments

PETER MURRAY

INTRODUCTION

Congestion pricing for roads has the potential to deliver significant benefits to Australia's economy. The three tiered toll introduced on to the Sydney Harbour Bridge and Tunnel in 2009 represents a limited first step in testing the benefits of congestion pricing, and whilst this is a step in the right direction, Australia is still lagging behind international best practice. The purpose of this paper is to examine some of the initiatives being undertaken internationally and to illustrate how road pricing by time-of-day can:

- Constructively modify travel behaviours,
- Improve traffic management outcomes, and;
- Generate significant economic benefits.

By now most of us have encountered variable or congestion pricing in one form or another. Congestion pricing mechanisms typically take the form of paying more for something where it is most demanded during a certain time of day, or week, and paying less when it is not. Our off-peak hot water systems heat our water during the night when electricity demand is lowest. Our telephone operators provide us with discounts to call in the late evenings when demand is low. Our parking lots offer "early bird" discounts for those who arrive before the morning rush. In a similar fashion hotels charge more during season peaks during the year and airlines vary their rates according to demand. It should be of little surprise then that roads equally be subject to congestion based time of day charging.

Levying a toll on a road has two effects. Firstly it generates a revenue stream which can be used to fund the road or provide an income stream to the owner. Secondly, a toll can lead to a change in driver behaviour, reducing the level of traffic on the road, and consequently, the level of congestion. The presence of a toll on a road therefore has a secondary effect of suppressing demand and reducing potential congestion. It is this secondary role for tolling, congestion management, which is the focus of this article.

TIME-OF-DAY TOLLING

Road demand invariably changes with the time of day. The weekday traffic profile is familiar to any regular commuter; from the low levels of the early morning, traffic rises steeply to the 'AM Peak' period. Traffic levels then typically fall off moderately during the 'Midday Shoulder' before picking up again for the 'PM Peak'. Depending on the location of the road relative to population and work centres, the AM and PM Peaks may have reversed directional flows, for example, a Northbound AM Peak and Southbound PM Peak.

In economic terms the cost of driving on an uncongested road is relatively low; there may be road wear and the external factors of air and noise pollution. However, peak hour trips on urban roads in major cities are rarely if ever, uncongested. Users who drive on congested roads impose a cost on other motorists in terms of additional travel times and reduced amenity. On a tolled road that is congested users pay twice; financially in terms of the toll paid and secondly in terms of additional travel time from congestion. However, where a road is tolled, there is a notional toll level at which the road will no longer be congested and becomes free flowing. Thus, by varying the toll to match the level of congestion it is possible to maintain a free flowing road at all times of day.

Time-of-day tolling takes two key forms:

- Cordon pricing – where typically a charge is levied to enter a city region such as the CBD, port, or airport
- Corridor pricing – a charge to use a road or corridor and may include tolled lanes alongside untolled roads

In both cases these pricing mechanisms vary in complexity from simple day/night and peak/off-peak charges to dynamically priced systems based on actual traffic and road capacity.

CORDON PRICING

Cordon pricing systems are most commonly used to control congestion by pricing access to urban centres.

Various forms of cordon pricing schemes are currently in place in a number of cities around the world including London, Stockholm, Dubai, Singapore and Rome. Singapore and London have two of the better known implementations with distinctly varied approaches to the problem:

FIGURE 1

London Cordon Pricing Scheme

LONDON

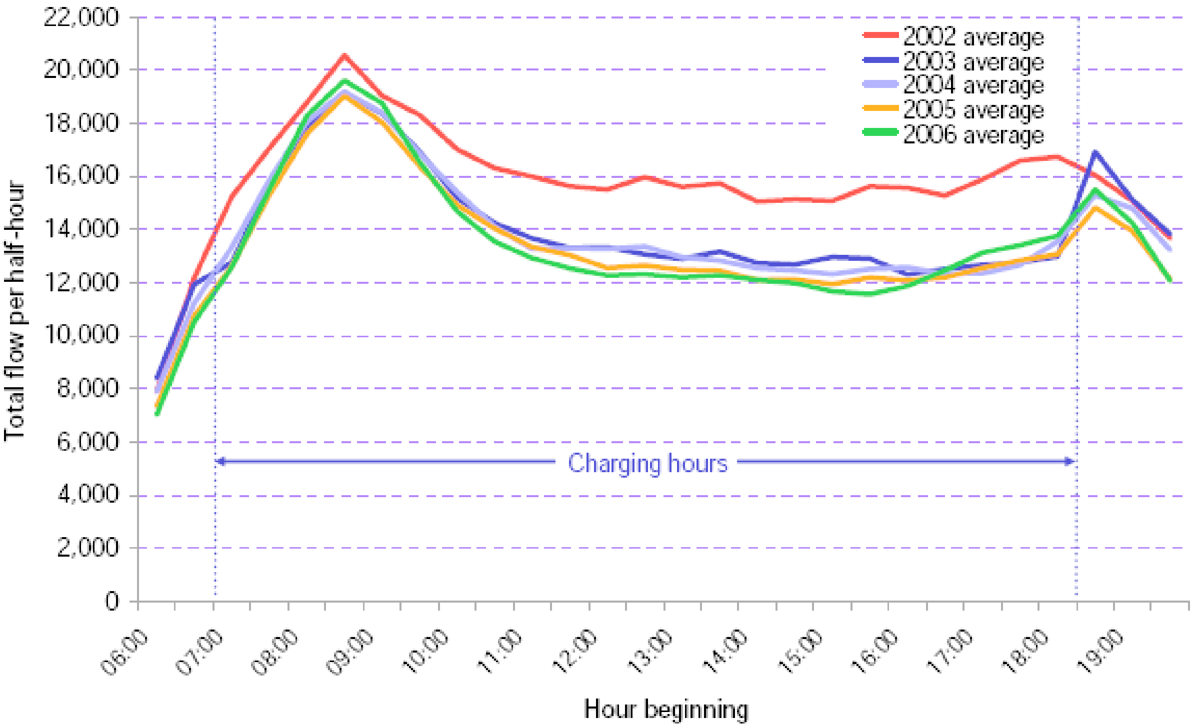
Transport for London (TFL) announced the final form of the congestion pricing scheme In February 2002, and the charge was introduced in February 2003. In February 2007 the charging zone was extended westwards. All monies raised from Congestion Charging are spent on London's transport facilities. Vehicles which drive within a clearly defined zone of central London between the hours of 07:00 and 18:00, Monday to Friday, have to pay an £8 daily Congestion Charge. Payment of the charge allows you to enter, drive within, and exit the Charging Zone as many times as you wish on that day. There is no charge on weekends, English public holidays, designated non-charging days, or between 18:00 and 07:00.

In TFL's June 2007 congestion charging report it was stated that traffic levels on all types of vehicles in 2006 was 16 per cent lower than the 2002 pre-congestion charge levels. A key limitation of the London implementation has been the reliance on number plate recognition technology. This system initially resulted in high degrees of manual verification and rework, particular in comparison to transponder technologies. TFL indicated in its 2007 Annual Report that collection costs (£130m) for the system were in excess of 50 per cent of revenues (£252m)[1].

The London system's effectiveness is limited by the fact that the cordon charge does not vary by time-of-day. As the following chart clearly demonstrates the greatest reduction in traffic is occurring during off-peak periods where there is greater elasticity[2]:

FIGURE 2:

Demand impact of London Cordon Charge



SINGAPORE

Singapore first attempted to reduce road congestion by implementing the Area Licensing Scheme in 1975. This was a manual system of tolls for multiple entries into the Restricted Zone. Since then, many changes were implemented, including shoulder pricing (reduced tolls before and after the peak period) to even out traffic flows in 1994, and the Weekend Car Scheme (1991) and Off Peak Car Scheme (1994) to encourage people to use the roads during off-peak hours.

In 1998, Singapore discarded the manual system of road pricing in favour of Electronic Road Pricing, which permitted the charging of tolls per entry, based on vehicle size, route taken, and time of the day. Benefits included[3]:

- Immediate reduction of 24,700 cars during peak and rise of traffic speed by 22 per cent
- Total reduction of traffic in zone during charging period by 13 per cent from 270,000 to 235,100
- Reduced number of solo drivers
- Vehicle trips shifted from peak to non-peak
- ERP system cut down on previously paper-heavy system

FIGURE 3:

Singapore Electronic Cordon Charge

Different charges for different roads at different times are automatically deducted from the ERP "CashCard" as vehicle passes under gantries. The CashCard is fixed to the vehicle windscreen and can be bought/topped up at retail outlets, banks, petrol stations and automatic machines.

CORRIDOR PRICING

Corridor pricing can refer to a pricing regime for a single specific asset or group of assets servicing a transport corridor.

Congestion pricing for road corridors can range in complexity from simple two tiered systems through to extremely complex pricing schedules, or on-the-fly dynamic toll calculations linked to actual flow rates. The sophisticated differential tolling arrangements to date all exist in parallel to unpriced roads; such as the High Occupancy Tolled (HOT) lane implementations in the United States. The Californian version of the differential tolling model is based on a legally mandated level-of-service (LOS), in this case LOS C.

LEVEL OF SERVICE

The majority of congestion pricing arrangements are linked directly or indirectly to the concept of Level of Service[4]. This concept is used regularly by transport economists and planners to describe the quality of a transportation service given the capacity constraints in place and the underlying and actual levels of demand on the road. The level of service measure applied to roads ranges from A to F in order of increasing congestion and decreasing levels of service. The following diagrams provide a broad illustration of this concept:

LEVEL OF SERVICE A

- Unimpaired flowing traffic;
- Usually only experienced late night in urban roads; and
- Common on rural roads.

LEVEL OF SERVICE B

- Free flowing traffic;
- Same speed as LOS A; and
- Vehicles may be side-to-side.

LEVEL OF SERVICE C

- Uncongested traffic;
- Passing or changing lanes not always assured; and
- Speed limit can be maintained.

LEVEL OF SERVICE D

- Congested traffic;
- Speeds somewhat reduced; and
- Passing or changing lanes significantly impaired.

LEVEL OF SERVICE E

- Very congested traffic;
- Flow rate is irregular;
- Speeds substantially reduced;

LEVEL OF SERVICE F

- Severely congested traffic;
- Frequent stopping of traffic;
- Travel times cannot be reliably predicted.

Differential tolling linked to level of service seeks to mitigate the worse of these congestion situations by modifying travel patterns through variable road pricing. A key assumption underlying congestion pricing in peak hours is that a significant percentage of peak hour trips are discretionary. A study of traffic and travel patterns

FIGURE 4:
Level Of Service A/B

FIGURE 5:
Level Of Service C/D

FIGURE 6:
Level Of Service E/F

in Sydney indicated that 18 per cent of AM peak, and 38 per cent of PM Peak travel, was discretionary[5]. By pricing the road in peak hours users can potentially be induced to:

- Not travel,
- Travel at the shoulders immediately prior, or subsequently, to the peak,
- Travel in an off-peak time,
- Take an inter-modal option, or
- Take a high occupancy option.

The corresponding offset to higher peak tolls is significantly lower off-peak tolls.

HOT LANES CONCEPT

The most extensive adoption of congestion pricing for motorways to date has been through the managed lanes concept. HOT lanes are alternately described as managed and express lanes. To date there have been no comprehensive implementations of congestion pricing of standalone motorways. Although many toll roads operate on peak/off-peak tolling models. All the HOT lane projects to date have been in the United States. The more established roads are listed in the table below.

Figure 7.9 of the 91 Express in California provides an illustration of a congestion priced managed lane in action operating according to the statutory mandated Level of Service C:

FIGURE 7: 91
Express HOT Lanes

The levels of service are superimposed over the image:

- The outbound peak untolled 4-lane freeway is operating at LOS F;
- The outbound peak tolled 2-lane managed lane is operating at LOS C;
- The inbound off-peak untolled 4-lane freeway is operating at LOS D; and
- The inbound off-peak tolled 2-lane managed lane is operating at LOS A.
- Figure 7: 91 Express HOT Lanes

ROAD	LOCATION	STATE	PRICING MECHANISM
91 Express	Orange County	California	schedule pricing
I-15	San Diego	California	dynamic pricing
MN/I-394	Minneapolis	Minnesota	dynamic pricing
WA167	Seattle	Washington	dynamic pricing

91 EXPRESS ORANGE COUNTY

91 Express opened in 1995 as the first privately financed toll road in the US to commence operations since the 1940s. It was originally procured by the California Department of Transportation under a 35 year concession and subsequently de-privatised when it was acquired by the Orange County Transportation Authority and converted into its current toll road/HOT configuration. The road is operated under contract by Cofiroute USA.

91 Express comprises a 4 lane, 16 km toll road built and operating in the median of an 8 lane public freeway. Customers are required to use a "FasTrak" responder as no cash payments are accepted. The road operates according California's mandated minimum Level of Service C and the toll schedule is adjusted quarterly to ensure that the road is priced accordingly. As the road operates in a heavily congested corridor the peak hour toll has more than doubled in the last 5 years. 91 Express is currently the most expensive peak hour toll road in the US at around USD $10.00 a trip (AUD $0.78/km).

91 Express' own customer surveys have indicated that the managed lane concept enjoys broad support across socio-economic levels. Users have demonstrated that they appreciate the opportunity to access an uncongested trip when individual circumstances make reduced travel times a priority[6].

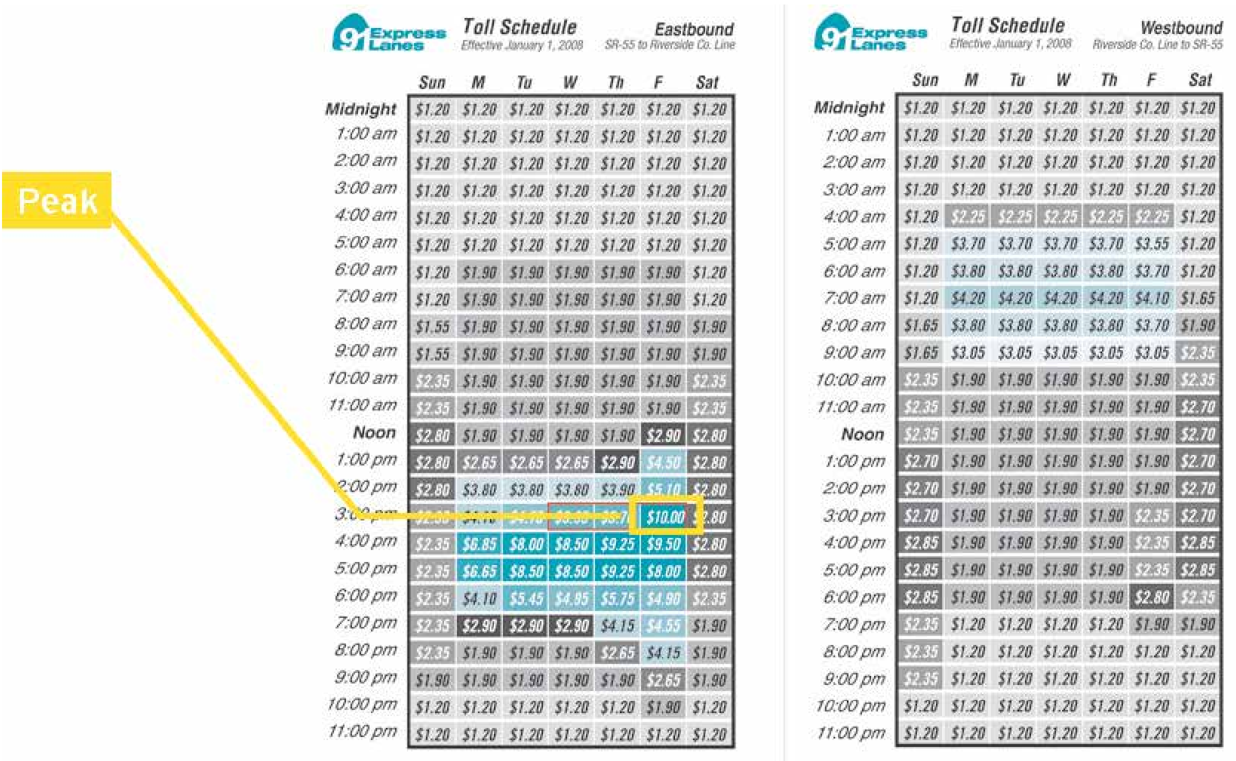
I-15 SAN DIEGO

The I-15 commenced as a study project on congestion pricing in San Diego and has now been expanded into a permanent managed lane solution. Originally a 13 km, 2 lane reversible project in the median of an 8 lane freeway, it is now to be expanded into a 32km, 4 lane toll road due for completion in 2012.

The I-15 was the first road project in the US to use fully dynamic pricing with toll levels ranging from USD 0.50 to USD 8.00 depending on congestion and the resulting level of service. Congestion is calculated by underground sensors which measure flow rate assessed against designed capacity. Tolls are then raised or lowered in 6 minute increments to maintain LOS C. Motorists are informed of the current tolls well in advance by VMS signs on key approaches. In circumstances where a breakdown occurs on the road the toll will rise to maximum to reflect the breakdown induced congestion and discourage traffic entering the road.

FIGURE 8:

91 Express Toll Schedules



Eastbound (SR-55 to Riverside Co. Line)

	Sun	M	Tu	W	Th	F	Sat
Midnight	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20
1:00 am	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20
2:00 am	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20
3:00 am	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20
4:00 am	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20
5:00 am	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20
6:00 am	$1.20	$1.90	$1.90	$1.90	$1.90	$1.90	$1.20
7:00 am	$1.20	$1.90	$1.90	$1.90	$1.90	$1.90	$1.20
8:00 am	$1.55	$1.90	$1.90	$1.90	$1.90	$1.90	$1.90
9:00 am	$1.55	$1.90	$1.90	$1.90	$1.90	$1.90	$1.90
10:00 am	$2.35	$1.90	$1.90	$1.90	$1.90	$1.90	$2.35
11:00 am	$2.35	$1.90	$1.90	$1.90	$1.90	$1.90	$2.35
Noon	$2.80	$1.90	$1.90	$1.90	$1.90	$2.90	$2.80
1:00 pm	$2.80	$2.65	$2.65	$2.65	$2.90	$4.50	$2.80
2:00 pm	$2.80	$3.80	$3.80	$3.80	$3.90	$5.10	$2.80
3:00 pm	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	$10.00	$2.80
4:00 pm	$2.35	$6.85	$8.00	$8.50	$9.25	$9.50	$2.80
5:00 pm	$2.35	$6.65	$8.50	$8.50	$9.25	$8.00	$2.80
6:00 pm	$2.35	$4.10	$5.45	$4.95	$5.75	$4.90	$2.35
7:00 pm	$2.35	$2.90	$2.90	$2.90	$4.15	$4.55	$1.90
8:00 pm	$2.35	$1.90	$1.90	$1.90	$2.65	$4.15	$1.90
9:00 pm	$1.90	$1.90	$1.90	$1.90	$1.90	$2.65	$1.90
10:00 pm	$1.20	$1.20	$1.20	$1.20	$1.20	$1.90	$1.20
11:00 pm	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20

Westbound (Riverside Co. Line to SR-55)

	Sun	M	Tu	W	Th	F	Sat
Midnight	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20
1:00 am	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20
2:00 am	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20
3:00 am	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20
4:00 am	$1.20	$2.25	$2.25	$2.25	$2.25	$2.25	$1.20
5:00 am	$1.20	$3.70	$3.70	$3.70	$3.70	$3.55	$1.20
6:00 am	$1.20	$3.80	$3.80	$3.80	$3.80	$3.70	$1.20
7:00 am	$1.20	$4.20	$4.20	$4.20	$4.20	$4.10	$1.65
8:00 am	$1.65	$3.80	$3.80	$3.80	$3.80	$3.70	$1.90
9:00 am	$1.65	$3.05	$3.05	$3.05	$3.05	$3.05	$2.35
10:00 am	$2.35	$1.90	$1.90	$1.90	$1.90	$1.90	$2.35
11:00 am	$2.35	$1.90	$1.90	$1.90	$1.90	$1.90	$2.70
Noon	$2.35	$1.90	$1.90	$1.90	$1.90	$1.90	$2.70
1:00 pm	$2.70	$1.90	$1.90	$1.90	$1.90	$1.90	$2.70
2:00 pm	$2.70	$1.90	$1.90	$1.90	$1.90	$1.90	$2.70
3:00 pm	$2.70	$1.90	$1.90	$1.90	$1.90	$2.35	$2.70
4:00 pm	$2.85	$1.90	$1.90	$1.90	$1.90	$2.35	$2.85
5:00 pm	$2.85	$1.90	$1.90	$1.90	$1.90	$2.35	$2.85
6:00 pm	$2.85	$1.90	$1.90	$1.90	$1.90	$2.80	$2.35
7:00 pm	$2.35	$1.20	$1.20	$1.20	$1.20	$1.90	$1.90
8:00 pm	$2.35	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20
9:00 pm	$2.35	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20
10:00 pm	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20
11:00 pm	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20	$1.20

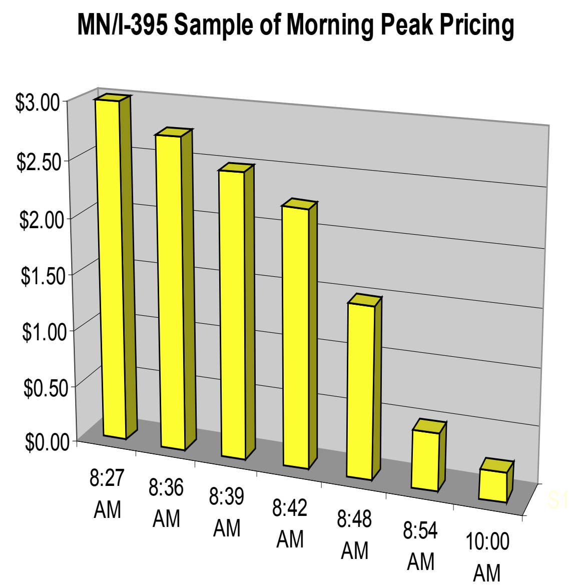
MN/I-394 MINNEAPOLIS

The second dynamically priced, and the third congestion priced toll road opened in the US in 2005. Located in Minneapolis, the implementation was again under the HOT/managed lanes model. Using a custom algorithm the MnPass system adjusts prices in 3 minute intervals.

Following the success of the I-394[7] the Minnesota Department of Transport ("Minnesota DOT") has decided to proceed with further managed lane projects. The managed lanes are operating on a free flow basis and the untolled lanes have seen flow rates improve 6 per cent. Revenues for the project have been below forecast as the project has been a victim of its own success in improving flow rates on the untolled sections. This is a value capture issue which the project may be able to address in later years as congestion intensifies.

FIGURE 9:

MN/I-395 Tolls



RECENT PROJECTS

Overall there appears to be a ground swell of growing support for the HOT concept in the United States. The SR 167 opened in May 2008 as Washington State's first HOT lane pilot project. The Minnesota DOT has recently announced their second HOT lanes project following the success of the I-394; the I-35W a 23km northbound and 19km southbound road.

In December 2007, Transurban and Fluor reached contractual and financial close for the Capital Beltway project involving the construction of four toll lanes on 23km of the Capital Beltway in northern Virginia. The project has a capital value of $1.6b and involves two components:

- A fixed price design and construct contract with Fluor with completion of construction scheduled for 2013
- A 75 year post-construction concession with Capital Beltway Express (Fluor 10%/Transurban 90%)

This deal represents the first true PPP congestion priced road project in the U.S.

BAY AREA EXPRESS LANE NETWORK

In July 2009 the California legislature passed Assembly Bill 744 authorising a 1,200 km express lane network on Bay Area freeways. This initiative is intended to tackle some of the worst congestion areas in the United States. The Bay Area Toll Authority (BATA) will develop, operate and maintain a seamless, regionally managed Express Lane Network in the Bay Area.

The key features of this project are:

- Conversion of 800 kilometres of existing or fully funded High Occupancy Vehicle (HOV) lanes to HOT lanes
- Construction of 480 kilometres of new express lanes incorporating 290 kilometres of gap-closure and 190 kilometres of outward expansion
- Qualifying carpools and buses will use the network free of charge
- Non-carpool use will incur a toll collected electronically
- Free-flowing traffic will be maintained by adjusting tolls as congestion rises and falls

The toll revenue collected will pay for construction, operation, maintenance and enforcement, with remaining net revenue available for additional transportation improvements, including public transit, in network corridors.

IMPLEMENTING A TIME-OF-DAY TOLLING SOLUTION

The following is an overview of the process and issues associated with implementing a complex Time-Of-Day tolling solution based around Level-Of-Service, abbreviated forthwith as "TODLOS". This analysis is a simulation only based on a hypothetical toll road with a typical "camel hump" AM and PM peak traffic profiles.

Although there are examples of TODLOS systems in place around the world these systems are vastly more complex than conventional tolling systems to model, predict, implement and market. There are no sophisticated implementations of time-of-day tolling in Australia to date and no evidence of more than preliminary level analysis and consideration of the issues by government agencies[8].

FIGURE 10:
Indicative Flow Rates

Level of Service	AADT	Total Service Flow Rate	Average Speed	Volume Capacity
A	n/a (design speed <110)	n/a (design speed <110)	n/a (design speed <110)	n/a (design speed <110)
B	65,554	1,445	>= 80	0.45
C	97,252	2,105	>= 75	0.66
D	123,498	2,656	>= 65	0.81
E	143,550	3,214	>= 45	1.00
F	highly variable	highly variable	< 45	> 1.00

FIGURE 11:
Indicative Weekday Traffic Profile

Motorway Traffic - Fixed Toll

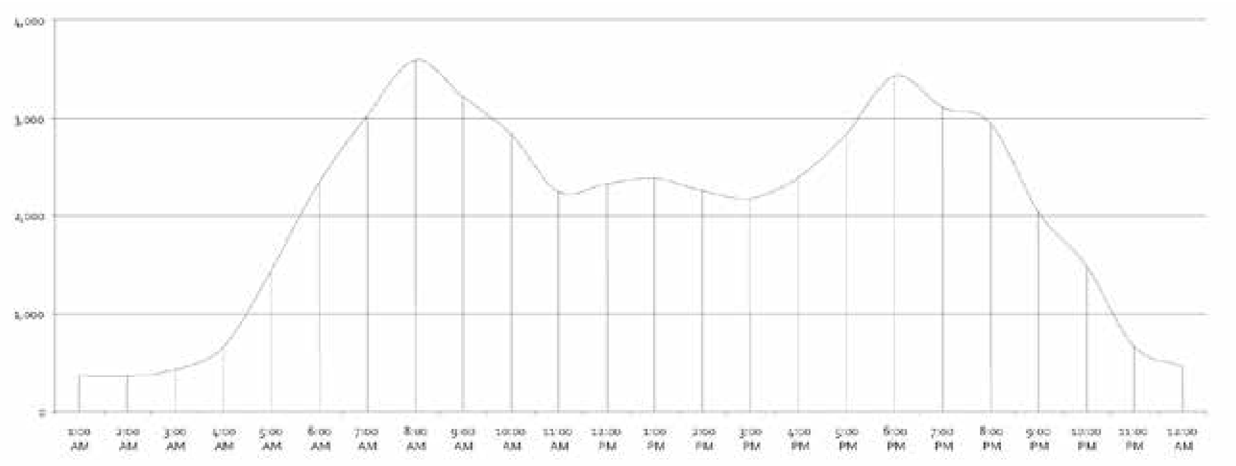
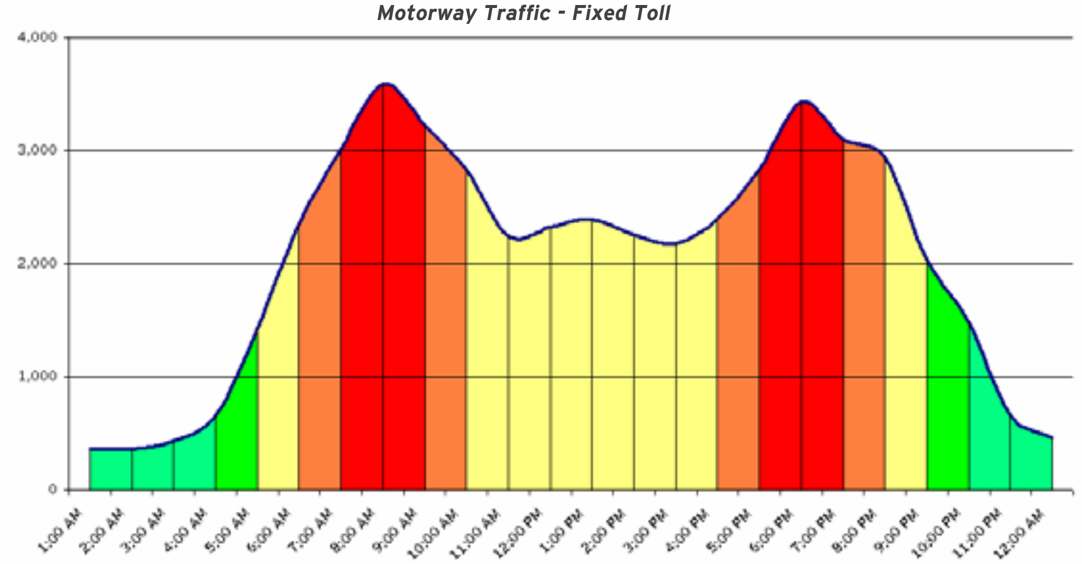


FIGURE 12:
TODLOS Profile

Motorway Traffic - Fixed Toll



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The implementation of a TODLOS system involves the practical integration of a number of concepts including:

- Capacity and flow rate
- Level of Service
- Time of Day
- Road Usage Pricing

The integrated outcome is a change in travel behaviour, improved infrastructure utilisation, reduced peak flow congestion and the associated economic benefits. A side effect on congested roads with typically mature toll road elasticities[9] is considerable increases in collected revenue.

The example explored in this section of the report involves converting an existing tollway from a conventional fixed priced toll to an hourly TODLOS system. Figure 10 is hypothetical capacity/flow rate specification for a motorway section:

Figure 11 is a hypothetical weekday traffic profile with AM and PM peak congestion, for the same motorway. This motorway has a conventional fixed toll at a single gantry.

By connecting these two concepts we can generate a TODLOS profile for the tollway:

From Figure 12 we can identify the following congestion characteristics:

- Four time slots with heavy to severe congestion levels at LOS E/F
- Peak shoulders operating at moderate to heavy levels of congestion, representing appropriate utilisation, at LOS D
- Midday peak operating at moderate congestion levels, LOS C
- Off-peak time slots with uncongested flow LOS A and B

In our hypothetical example we will seek to move discretionary travel from peak periods to shoulders and other time zones by varying the road price in these time slots. To further encourage asset utilisation in the most uncongested periods we will provide a substantial discount for evening and early morning trips. Our proposed toll schedule is as follows:

Existing fixed toll: $3.00
Congestion based tolls as below (Figure 13).

Following a successful implementation of TODLOS pricing, changes occur to travel behaviour. These changes can include a switch to different travel times by commuters who are making discretionary trips during peak hours. Commuters may also make a choice not to drive (i.e. travel by train)[10]. A small number may make no trip at all. Following the changes the new traffic profile may look as follows:

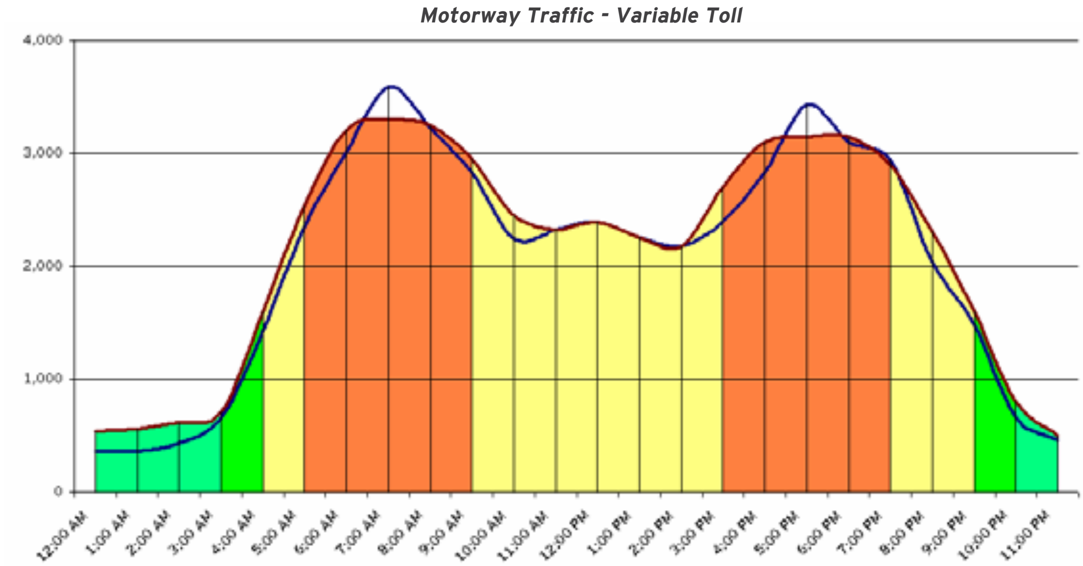
FIGURE 13:

Indicative Time of Day Tolling

Time of Day	Level of Service	New Toll
Morning/Evening Peak	E/F	$6.00
Shoulders	D	$5.00
Weekday Mid	C	$3.00
New Toll	A/B	$1.00

FIGURE 14:

Changed traffic flows and reduced congestion (colour-coded) arising from variable tolling arrangements. Previous traffic levels = blue line.



A summary of the effects of this pricing and the resultant congestion outcomes are:

- Discretionary travel moved out of peak periods
- 'Flattening' of the traffic profile
- Severe congestion mitigated in peak periods
- Significant increases in toll revenues on mature toll roads
- Discounted travel in off-peak periods
- Improved travel times in peak periods

KEY BENEFITS OF CONGESTION PRICING

Congestion pricing of roads can offer a wide range of benefits as listed below.

ECONOMIC

TODLOS pricing mechanisms offer the following economic benefits:

- Better alignment between individuals' social marginal cost (willingness to pay) and toll level, thus improving the economic efficiency of the system
- TODLOS pricing is likely to result in a net benefit to users when travel time savings associated with a smoothing of demand is considered relative to the toll charged
- TODLOS has the potential to extend the useful life of road assets avoiding the need for additional capital expenditure brought on but unacceptable peak period congestion
- TODLOS can also lead to some switching of transport modes, especially to public transport

A study undertaken by a Californian university on the longest running congestion pricing project in the US, the 91 Express, yielded a Benefit Cost Ratio of 1.5[11].

SOCIAL AND ENVIRONMENTAL

TODLOS pricing mechanisms offer the following social and environment benefits:

- Amenity benefits will arise for local communities around the road as traffic queues are reduced
- Pricing mechanisms designed to avoid roads operating at Level of Service F will prevent stop-start traffic flow and avoid resultant pollution
- Avoiding stop-start traffic flows will also result in reductions in accidents
- Avoiding stop-start traffic flows will also result in reduced fuel consumption
- Health benefits can be expected to accrue from reductions in driver stress and harmful emissions

FINANCIAL

On mature assets, congestion pricing offers the potential for significant additional revenues due to inelasticity of demand. Additional revenues can be used to fund expansion of the corridor, other transport initiatives such as public transport, or be applied against off-peak discounts. San Francisco's Bay Area Express Lane network is expected to generate gross revenues of USD 13.7 billion over the next 25 years[12].

COMMUNITY

Despite initial perceptions of TODLOS pricing mechanisms such as the reference to HOT lanes as "Lexus Lanes", designed for wealthy drivers, the evidence from research has indicated that HOT lanes are used by the entire socio-economic spectrum. HOT lanes offer drivers an alternative of a fast uncongested trip and while lower income earners may use the HOT lane less frequently, the option is still greatly valued when needed.

SUMMARY

A recent study[13] into congestion pricing for roads commissioned by the Australian Treasury reached the following conclusions:

"Specifically, it might be best to congestion price a few major roads and to cordon price the CBD of large cities, perhaps in accompaniment with more cohesive and imaginative parking policies, before a really substantial step towards comprehensive electronic pricing of all the externalities associated with road travel are internalised."

Currently the road pricing debate is being driven at the Federal level. This is despite the fact that control of the relevant urban road assets lies with State governments and a number of private motorway operators. The opportunity exists at the State government and private operator level to lead the debate for the practical application of road pricing to urban assets.

There are significant economic benefits to be realised from road pricing in terms of congestion management, transport efficiency and asset utilisation that have been recognised and realised in jurisdictions across the globe. Australia has some way to come if it is to fully test the benefits, and examine the challenges, of dynamic congestion pricing mechanisms for its road network.

* This article was written and submitted by the author when at a previous employer. The contents of this paper represent the author's own views and not necessarily those of his employer.

ENDNOTES

1. Transport for London, Annual Report and Statement of Accounts, 2006/07
2. Transport for London, Central London Congestion Charging Impacts Monitoring, Fifth Annual Report, July 2007
3. Source: e-atomium Demand Management Training Manual
4. Refer to Highway Capacity Manual, Transport Research Board (US)
5. Analysis of Peak Hour Travel Using the Sydney Household Travel Survey Data, Grace Corpuz, Transport and Population Data Centre, New South Wales Department of Planning, Australia
6. http://www.octa.net/pdf/Attachment%20A_Final%20Report.pdf
7. https://support.mnpass.net/survey/results.php?sid=29
8. The Sydney Harbour Tunnel and Bridge operate under a three tier system that varied by time-of-day but is not explicitly linked to congestion levels.
9. A mature toll road will typically experience increasing revenues as tolls rise, as the reduction in traffic is generally not proportional
10. An intermodal switch
11. Benefit-Cost Analysis of Variable Pricing Projects: SR-91 Express Lanes, J. Transp. Engrg. Volume 132, Issue 3, pp. 191-198 (March 2006)
12. http://www.mtc.ca.gov/planning/hov/Express_lane_fact_sheet3.pdf
13. A Conceptual Framework for the Reform of Taxes Related to Roads and Transport, Harry Clarke and David Prentice, School of Economics and Finance, La Trobe University, June 2009

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