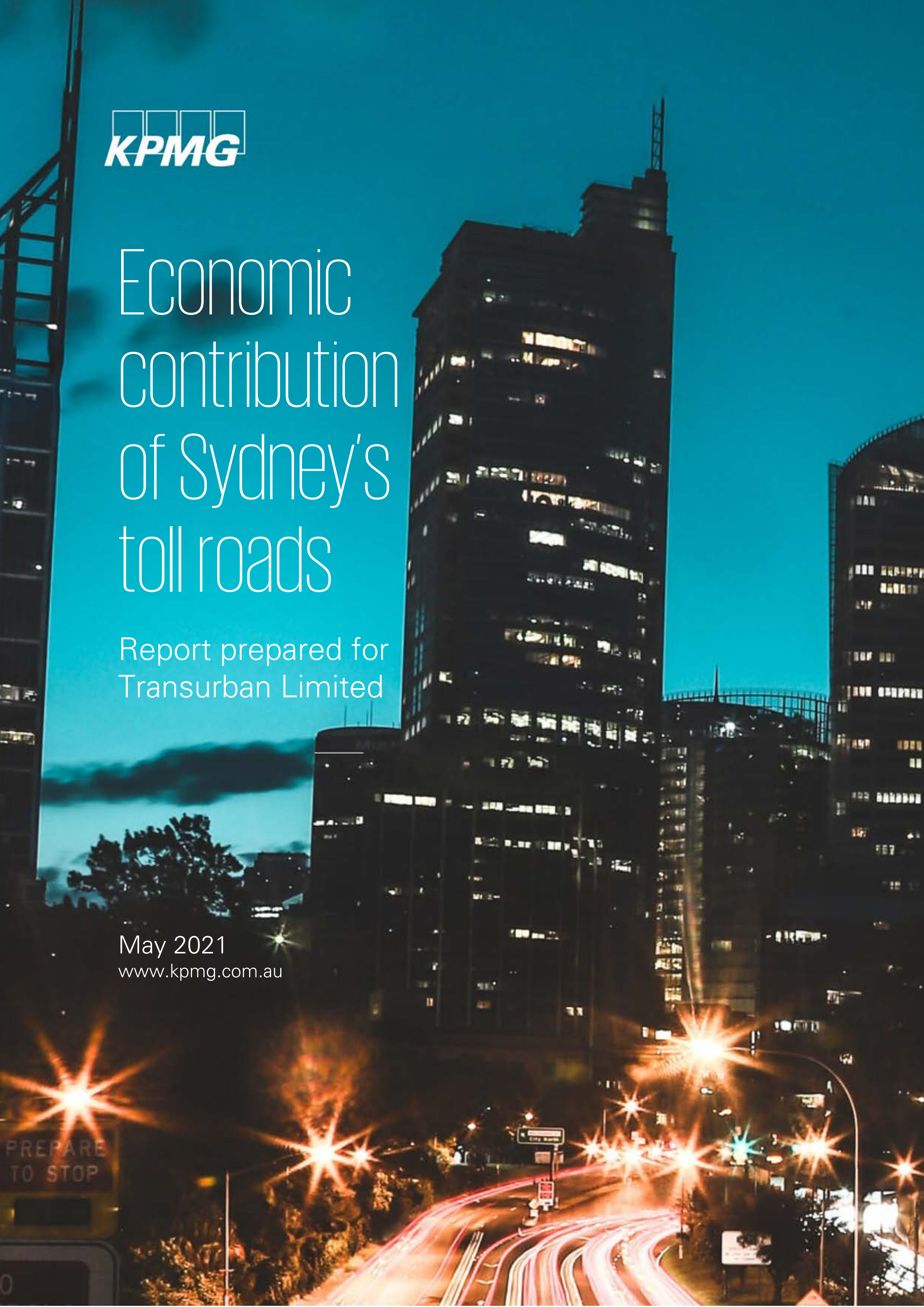

KPMG

Economic contribution of Sydney's toll roads

Report prepared for Transurban Limited

May 2021

www.kpmg.com.au

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Our reporting date corresponds with a period of significant volatility in global financial markets and widespread macro-economic uncertainty. In light of the emergence and spread of COVID-19, this volatility and uncertainty could persist for some time. The assumptions set out in our report will need to be reviewed and revised to reflect any changes which emerge as a result of COVID-19. As a result of the continued uncertainty in relation to the impact of COVID-19, our work may not have identified, or reliably quantified the impact of, all such uncertainties and implications. If the assumptions provided by Transurban on which this report is based are subsequently shown to be incorrect or incomplete, this could have the effect of changing the findings set out in this report and these changes could be material. We are under no obligation to amend our report for any subsequent event or new information.

Executive Summary

Sydney's modern tolled motorway network is estimated to contribute **$5.6 billion** in economic benefits for all road users on average per year over the next **30 years***

Smoothing traffic flows

Sydney's modern motorways ensure the entire road network is efficient and reliable. Everyone – including those who do not use toll motorways – will benefit from shorter travel times, more reliable journeys, lower fuel consumptions and vehicle wear and tear. On average, over the next 30 years these savings are expected to amount to **$3.6 billion per year*.**

Business and freight road users

On average, a trip undertaken by a business or freight user on Sydney's modern toll motorway network contributes around **$35 per trip** in economic benefits (estimated for 2021).

All commercial vehicle operators benefit from an efficient road network and the total benefit on average per year is **$2.0 billion*** over the next 30 years.

Car users

On average, a trip undertaken by a personal user on Sydney's modern toll motorway network contributes around **$10 per trip** in economic benefits (estimated for 2021).

The average annual benefit for all cars in Sydney is estimated at **$1.6 billion*** per year over the next 30 years.

Bringing people and businesses together

Development of Sydney's modern toll motorways lowers transport costs which generates a range of benefits to business, job seekers and consumers of **$2.0 billion per year*** on average over the next 30 years.

Business efficiency (agglomeration)

Sydney's modern toll motorways enhance the accessibility and connectivity of employment centres around the city, which facilitates increased formal and informal interaction. The agglomeration benefit is worth **$1.8 billion*** on average per year over the next 30 years.

Increased labour supply

An efficient road network with improved commuting times improves access to job markets for those seeking employment. Better connecting people and jobs will generate benefits of **$63 million*** on average per year over the next 30 years.

More goods and services

More efficient transport lowers barriers to competition and will increase the supply of goods and services worth **$153 million*** on average per year over the next 30 years.

Fostering economic growth

Productivity improvements and further network capital expansions will contribute to total market value of goods and services supporting jobs creation and improving personal welfare.

GSP generated over the next 30 years on average: **$7.3 billion per year***

Total increase in **GSP per person** on average: **$890 per year***

Jobs supported over the period on average: **12,000 per year***

Saving fuel and reducing emissions

Toll road usage is reducing fuel consumption **by 130 million litres per year**.

Fuel savings reduce emissions by **10.7 million tonnes** valued at **$500 million*** over 30 years.

* Results shown in the Executive Summary relate to the comparison of Scenario 3 and 1 discussed in the report. Unless otherwise stated, all dollar values shown are in present value terms using a real discount rate of 7 per cent.


PREPARE
TO STOP
NO
DANGEROUS
GOODS
IN TUNNEL
LOW
CLEARANCE
4.4m

Contents

May 2021

Document Classification: KPMG Public

1. Introduction

1.1 Scope of work

KPMG was engaged by Transurban to assess the economic contribution of the toll motorway network in Sydney, including for toll motorways which are planned to be developed. The economic assessment estimates the benefits for all road users on the Greater Sydney road network.

To estimate the economic contribution of Sydney's toll road network, we have applied three economic modelling techniques including:

- traditional cost-benefit analysis (CBA) techniques to measure economic benefits for all road users
- wider economic benefits (WEBs) modelling to estimate additional economic benefits such as agglomeration
- economic impact assessment using computable general equilibrium (CGE) modelling to estimate the macroeconomic impacts at a state level.

As is typical for economic assessments, all three modelling techniques derive benefits and impacts by comparing a set of generalised costs estimated at a road network wide level. That is, the analysis focusses on typical average users and does not explicitly account for the specific circumstances of individuals or businesses. All underlying economic parameter values used in the modelling align with best practice appraisals in Australia and are sourced from two key relevant Australian guidelines:

- Transport for NSW "Economic Parameter Values" published in June 2020
- Australian Transport Assessment and Planning Guidelines "PV2 Road Parameter Values" published in August 2016.

To estimate the economic contribution of the toll motorways on the Greater Sydney road network, two scenarios were developed to provide an upper and lower bound estimate, which assume:

- Upper bound: where no tolled motorways are built, to estimate the economic contribution of Sydney's modern tolled motorway network
- Lower bound: where the delivery of tolled motorways is delayed, to estimate the economic benefit of delivering Sydney's modern tolled motorway network as it was planned.

They were compared to the Greater Sydney road network with its current and future toll motorways in place. Importantly, both counterfactual scenarios are hypothetical and do not represent a view or prediction of alternative road network layouts. More specifically, the intention of these scenarios is to isolate the impact the toll road network has on how all road users, people, freight and business move around Greater Sydney's road network. Results presented in this report should be interpreted as providing a range of upper and lower bound estimates.

1.2 Report structure

The remainder of this report is structured as follows:

- **Section 2** describes Sydney's motorway network, its benefits and recent impact of COVID-19.
- **Section 3** provides an overview of the techniques used to model the economic contribution and the scenarios underpinning the results.
- **Section 4** assesses the direct road user economic benefits.
- **Section 5** assesses the Wider Economic Benefits (WEBs).
- **Section 6** assesses the economic impact using Computable General Equilibrium (CGE) modelling.
- **Section 7** provides a summary of the overall economic contribution results.

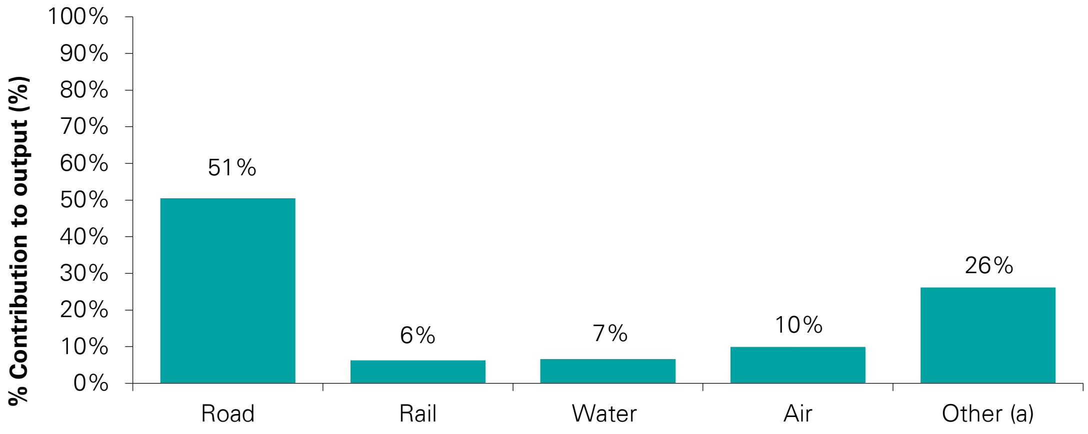
2. Context and background

Transport underpins practically every aspect of daily domestic and economic life; connecting workers to their jobs, materials to construction and manufacturing – and connecting our export economy and households to global supply chains, markets and products.

In 2015 – 2016, transport contributed $122.3 billion, or 7.4 per cent of Australian Gross Domestic Product (GDP), twice that of the U.S. and Canada.[1]

Figure 1 below shows road transport supporting the largest contribution to overall transport mode output; with air and rail at 10 and six per cent only.

Figure 1: Total Output of Australian Transport Modes



Source: Australian Bureau of Statistics (ABS) (2018) [2]
(a) Includes other modes of transport, as well as Postal, courier pick-up and delivery services; Transport support services; and Warehousing and storage services as identified in Australian and New Zealand Standard Industrial Classification (ANZIC) Division I.

Greater Sydney's economy represents some 23.05[3] per cent of the national economy and 71.78 per cent of the NSW economy[4], meaning that the economic value of road transport infrastructure in Sydney is likely to be very high.

[1] Department of Infrastructure, Regional Development and Cities (2018) Australian Transport Economic Account Factsheet p. 1
[2] Australian Transport Economic Account: An Experimental Transport Satellite Account 2018, Australian Bureau of Statistics, accessed 27 April 2021, <https://www.abs.gov.au/statistics/economy/national-accounts/australian-transport-economic-account-experimental-transport-satellite-account/latest-release>
[3] Australian National Accounts: State Accounts, 2019-20 financial year | Australian Bureau of Statistics (abs.gov.au), accessed 13 Maty 2021, <https://www.abs.gov.au/statistics/economy/national-accounts/australian-national-accounts-state-accounts/2019-20>
[4] Greater Sydney | economic profile, id community, accessed 13 May 2021, <https://economy.id.com.au/sydney/gross-product?BMID=40>

The NSW Government has funded major investments into new motorways, recognising the enhanced safety, sustainability and capacity needed to serve growth across Sydney's wider transport network.

The ongoing development of Sydney's motorway network is a key enabler for a range of city-shaping initiatives including:

- Western Sydney Airport
- The Greater Sydney Region Plan: '*a metropolis of three cities,'*
- The Future Transport Strategy 2056, including the creation of *'City shaping corridors, city serving corridors and centre serving corridors*.[5]

2.1 Do tolls accelerate network expansion?

Transport infrastructure projects, like motorways, metros or suburban railways are inherently large, complex and expensive, typically requiring large budget allocations to fund new projects, atop existing priorities in transport and across other areas of government service delivery.

The development of modern Public Private Partnership (PPP) models from the 1990s saw a visible acceleration in the construction of transport infrastructure in Sydney. These models allowed private investors to raise the large sums needed to develop each motorway network, risking their initial investment against the long-term revenue from tolls. This approach transferred all costs and financial risks to investors, to be repaid by motorists via tolls – not taxpayers via the budget

Subsequently, the NSW Government has used a mix of concession extensions to allow investors to finance the cost of expanding existing motorways; and used a publicly financed delivery model to construct WestConnex – but is seeking to recover its investment through the staged sale of a majority and two minority stakes – again seeing toll revenues sustain private investment.

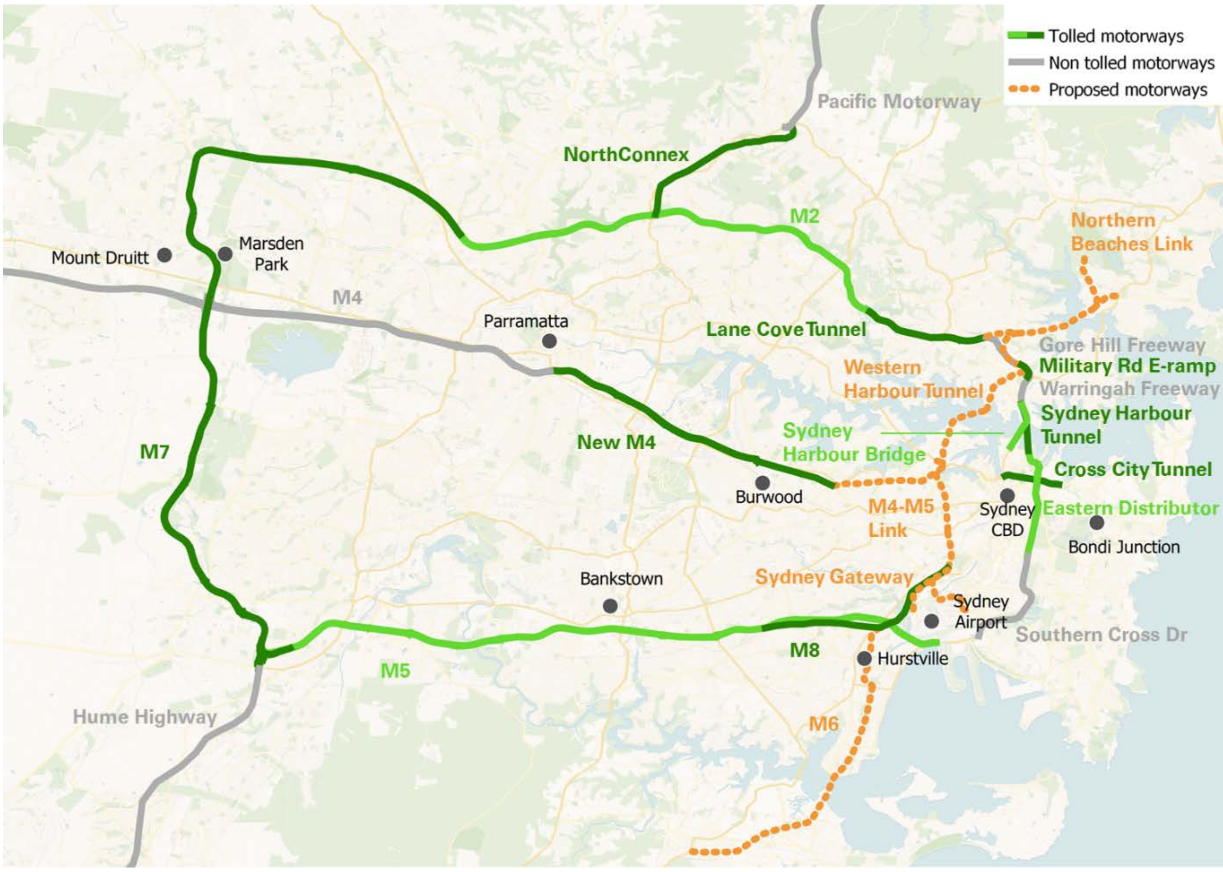
Tolls have created the cash flows needed to deploy private investment in public assets, extending the capacity of the NSW Government to renew Sydney's wider transport network and to fund wider community priorities, like public hospitals, schools and public transport.

[5] Transport for NSW, Future Transport Strategy 2056, p. 34

2.2 Sydney's Modern Motorway Network

Figure 2 below shows Sydney's modern motorway network, which spans some 187 kilometres. Five additional motorways will open in the coming seven years, seeing Sydney's network at 234 kilometres of new and expanded free-flow motorways.

Figure 2: Sydney's Existing and Planned Motorway Network, 2021



Source: KPMG map using Open Street Maps data

The economic assessment contained in this report includes an assessment of the economic benefits across the entire Greater Sydney road network. Table 1 below lists the tolled motorways included in the economic assessment.

Table 1: Sydney's tolled road network, including planned toll roads.

Toll Road	Concession End Date	Open (Year)
Sydney Harbour Bridge		1932
Sydney Harbour Tunnel	2022	1992
M5 West	2026	1992
Hills M2 Motorway	2048	1997
Eastern Distributor	2048	1999
M5 East Motorway	2060	2001
Cross City Tunnel	2035	2005

Toll Road	Concession End Date	Open (Year)
M7 Motorway	2048	2005
Lane Cove Tunnel	2048	2007
Military Road E-Ramp	2048	2007
WestConnex (WCX) M4 (Stages 1a/1b)*	2060	2019
WCX M8 (Stage 2)	2060	2020
NorthConnex	2048	2020
WCX M4-M5 Link (Stage 3)	2060	Est. 2023
Rozelle Interchange	2060	Est. 2023
Western Harbour Tunnel	N/A	Est. 2026
Beaches Link	N/A	Est. 2028

**M4 was tolled in the 1990's through to 2010 then tolled once completion of WCX Stages 1a and 1b*

2.3 The role of motorways in Transport

Motorways sit at the apex of the road network, offering higher speed, higher capacity corridors to move people and goods faster, across longer distances.

2.3.1 Motorists

Motorists make up the vast majority of motorway trips, of average around 80 to 90 per cent of journeys on motorways are for personal travel in cars[6].

An effective motorway network provides means for people to connect to work, education, social and recreational opportunities. Development of Sydney's motorway network over the long term has contributed to decreased congestion and reduced travel times, thereby increasing mobility across the Sydney network.

2.3.2 Freight and business journeys

Motorways provide for the effective movement of goods and services across Sydney, with around 10 to 20 per cent of total demand estimated for freight vehicles[7].

Key segments of Sydney's motorway network are recognised as nationally significant 'key freight routes' including the: M4; M7; M5; and M2[8], which is further strengthened by the NorthConnex.

Around 80 per cent of freight movements in Greater Sydney are undertaken by road[9]. The current and planned motorway network will strengthen the connection of ports, airports and intermodal terminals, by improving freight efficiency and easing traffic on local roads.

[6] Transurban ASX release, March Quarter 2021 Update, 15 April 2021 and KPMG Analysis
[7] Transurban ASX release, March Quarter 2021 Update, 15 April 2021 and KPMG Analysis
[8] Inquiry into National Freight and Supply Chain Priorities, Supporting Paper No. 4 Analysis of Capital City Key Freight Route Performance (2018) Commonwealth of Australia Pp. 7-8
[9] NSW Freight and Ports Plan, Part 2: The State of Freight, accessed 14 May 2021, https://www.transport.nsw.gov.au/projects/strategy/nsw-freight-and-ports-plan-0/part-2-state-of-freight#The_Greater_Sydney_freight_network

2.3.3 Motorways and COVID-19

COVID-19 initially saw a collapse in transport volumes across all modes, reflecting the lock-down of non-essential workers and other restrictions on movement. But motorway volumes have recovered much faster than other modes, suggesting a mode shift toward roads as people seek to adhere to capacity restrictions on public transport.

Throughout 2020, COVID restrictions led to a greater take-up of online purchases, with online sales figures growing 65 per cent[10]. Whilst purchasing online reduces the number of trips a household makes, the delivery of purchased products and consequently, trips by delivery vehicles (usually a Light Commercial Vehicle (LCV) or small rigid truck) have subsequently increased.

Courier pick-up and delivery services in Australia are expected to experience revenue growth of 5.8 per cent in the current year, driven by growth in online shopping and demand for parcel delivery services[11]. Postal and freight services such as Australia Post have responded to this increase in demand and concurrent decline in letter volumes by investing heavily into the growing parcel delivery market, highlighting the importance of maintaining an efficient road network over the long-term.[12]

The increase in road traffic volumes following the easing of COVID restrictions contrasts with the slower increase in public transport patronage, where volumes remain about 60 per cent of pre-COVID levels[13]. One response contributing to increased traffic volumes has been the deployment of additional buses on the road network to assist with social distancing.

Many commuters who chose to travel to office locations have shifted their mode of travel to road vehicles, and while this may be temporary, it does highlight the importance of having effective mode choices.

Over the long-term, the COVID-19 pandemic is unlikely to have created a decrease in congestion as traffic volumes return to normal, and the role of motorways to ease congestion across the entire road network will remain critical.

[10] Australia Bureau of Statistics (ABS) (2021) Online Sales, January 2021 – Supplementary COVID-19 Analysis
[11] Courier Pick-up and Delivery Services in Australia, IBISWorld, accessed 28 April 2021 https://my.ibisworld.com/au/en/industry/i5102/about
[12] Postal Services in Australia, IBISWorld, accessed 28 April 2021, https://my.ibisworld.com/au/en/industry/i5101/industry-at-a-glance
[13] Public Transport Patronage – Top Level Chart, Transport for NSW, Accessed 22 April 2021 <https://www.transport.nsw.gov.au/data-and-research/passenger-travel/public-transport-patronage/public-transport-patronage-top-level>

3. Economic modelling

Modelling the economic contribution of the modern motorway network requires the development of scenario/s which isolate and exclude Sydney's tolled motorways.

We have chosen to develop two counterfactual scenarios, one where much of the modern motorway network is not developed at all and a second in which the motorway network's development is materially slowed in the absence of toll revenues.

Using two alternate scenarios provides us with an upper and lower bound against which to model the benefits to all road users provided by Sydney's contemporary motorway network. To inform our analysis, detailed traffic modelling was provided by Transurban for each of the scenarios and estimated over a 30-year period. Transurban provided modelling of Sydney's whole road network and key statistics including travel times, average speeds and distances travelled for all trips (and by trip purpose). Each of the scenarios modelled are outlined in Table 2.

Table 2: Overview of modelling scenarios and traffic modelling assumptions.

#	Scenarios	Key Assumptions in Traffic Modelling	Investment (capital and operating costs)
'Greater Sydney road network without tolled motorways'			
1	Assumes that Sydney has not developed a modern motorway network. It presents the higher bound of economic modelling results	Toll-road network consists only of the Harbour Tunnel, Eastern Distributor and Sydney Harbour Bridge. Travel occurs using Sydney's existing suburban and arterial roads.	No investment (capital or operating) in future toll roads
'Greater Sydney road network with delayed delivery of tolled motorways'			
2	Forming the lower bound of our modelling results, this scenario assumes delayed delivery of the motorway network.	In the absence of funding capacity provided by tolls, delivery of motorways is substantially delayed.	Delayed delivery of the toll road network by 15 years for NorthConnex, WestConnex M4, M8, M4-M5 Link. This scenario assumes that there is no Western Harbour Tunnel or Beaches Link

#	Scenarios	Key Assumptions in Traffic Modelling	Investment (capital and operating costs)
'Greater Sydney road network with tolled motorways'			
3	Sydney's tolled motorway network occurs as planned. Scenario 3 is compared to Scenario 1 and 2 separately to estimate the incremental economic benefits and impacts.	The current and future Sydney toll road network occurs as planned	Delivery of NorthConnex, WestConnex M4, M8, M4-M5 Link, Western Harbour Tunnel, Beaches Link

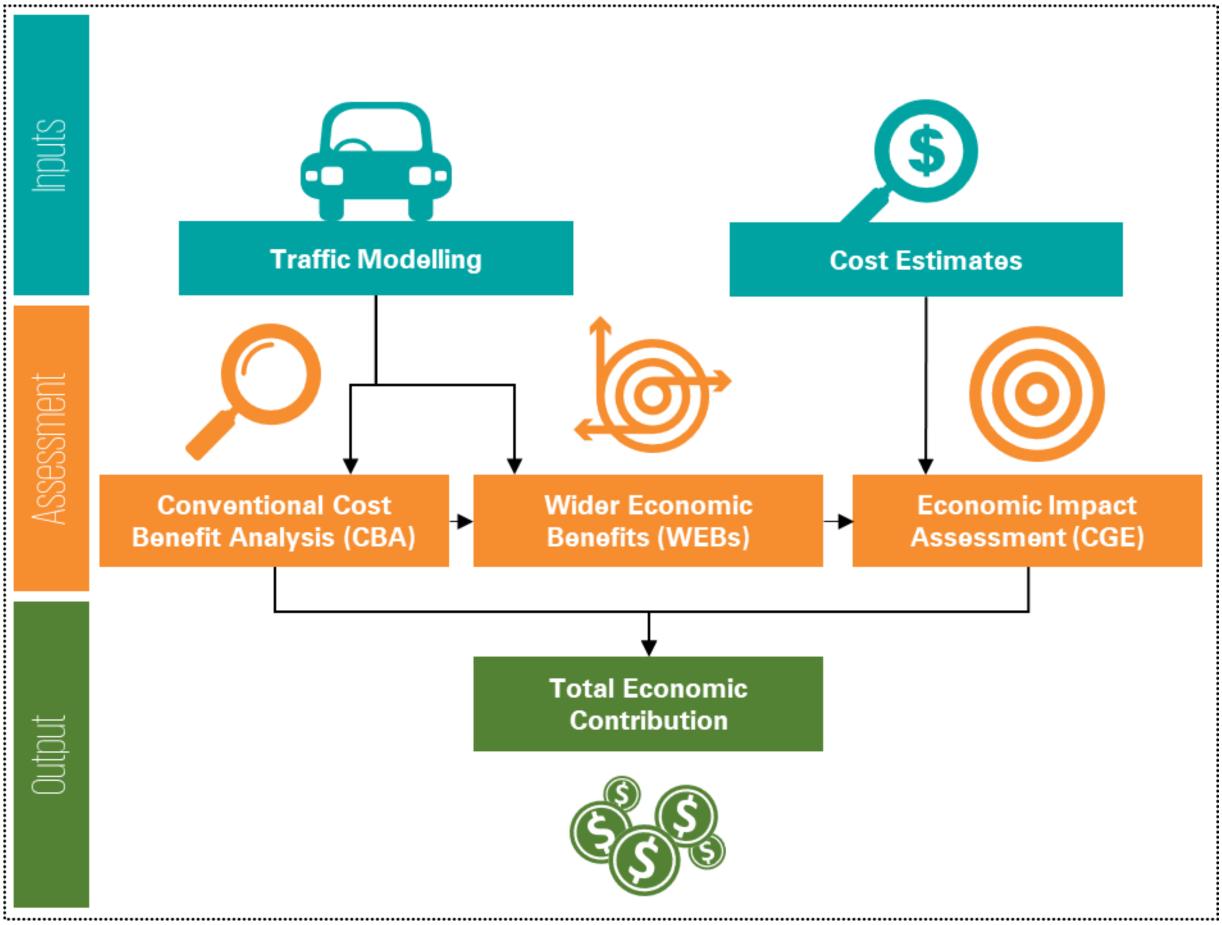
To describe the scenarios further, as an example, under Scenario 1, it is assumed that the WestConnex M4 would not be opened. Under this scenario traffic would have to use existing surface roads. Under Scenario 3, traffic would have the choice to use WestConnex M4.

Using these scenarios and the outputs of the traffic modelling has allowed us to model the contribution of Sydney's motorway network for all road users using three techniques:

- traditional Cost-Benefit Analysis (CBA);
- Wider Economic Benefits (WEBs) assessment; and
- economic impact assessment using Computable General Equilibrium (CGE) modelling.

The framework for our assessment is shown in the figure below:

Figure 3: Economic Assessment Frameworks



Analysis of the results provided through each economic assessment technique are discussed in the following sections.

4. Economic benefits

Sydney's motorways are the high capacity 'arteries' which sit at the apex of the overall arterial and suburban road network. For all motorists, freight, the community and business users alike, motorways provide a range of direct economic benefits including:

- Travel time savings through increased road network capacity;
- Improved travel time reliability;
- Vehicle operating cost (VOC) savings; and
- Environmental benefits for the community.

It is important to note that Sydney's motorways directly benefit a wide array of stakeholders, on and off the tolled motorways. For example, each motorist that chooses a motorway for a trip, is not congesting local suburban and arterial roads, creating room for local journeys; while each consumer may ultimately pay less for their grocery items, if the time and operating cost of freight deliveries are less.

This section outlines key assumptions and applies a traditional Cost Benefit Analysis technique to measure the direct economic benefits provided by Sydney's modern motorway network for all road users.

4.1 Travel time savings

Reductions in travel times are a fundamental benefit offered by transport network investments, including motorways. We have applied the values to travel time, by user type and trip purpose, from the relevant TfNSW guidance.

KPMG has used the outputs of the traffic modelling to model the economic benefit provided by faster journey times by modelling the change in vehicle-hours travelled for trips under each of the scenarios, using the values shown below.

Table 3 Value of time by vehicle type and trip purpose

	Value of time per person hour ($/person-hr)	Average vehicle occupancy	Value of time per vehicle ($/vehicle-hr)	Value of freight time ($/vehicle-hr)*
Car - personal trip	$18.66	1.41	$26.31	-
Car - business trip	$60.54	1.06	$64.17	-
Light commercial vehicle	$31.64	1.19	$37.65	$1.70
Heavy commercial vehicle	$33.38	1.19	$39.72	$46.87

*Source: Transport for NSW (TfNSW) guideline and KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and undiscounted. *value of freight time refers to the economic value of the goods being transported*

4.2 Travel time reliability benefits

Journey time reliability is another direct benefit offered by motorways. Research has consistently shown that unpredictable journey times see road users' factor in the potential delay, causing economic costs through wasted time.

At a conceptual level, Sydney's motorway network improves overall road network reliability by providing additional road capacity and route choices, versus the scenarios without or with delayed development of motorways.

We have applied the United Kingdom Department for Transport's methodology to quantify the time saved through increased travel time reliability on road networks, which are then monetised using the same values of time provided above.

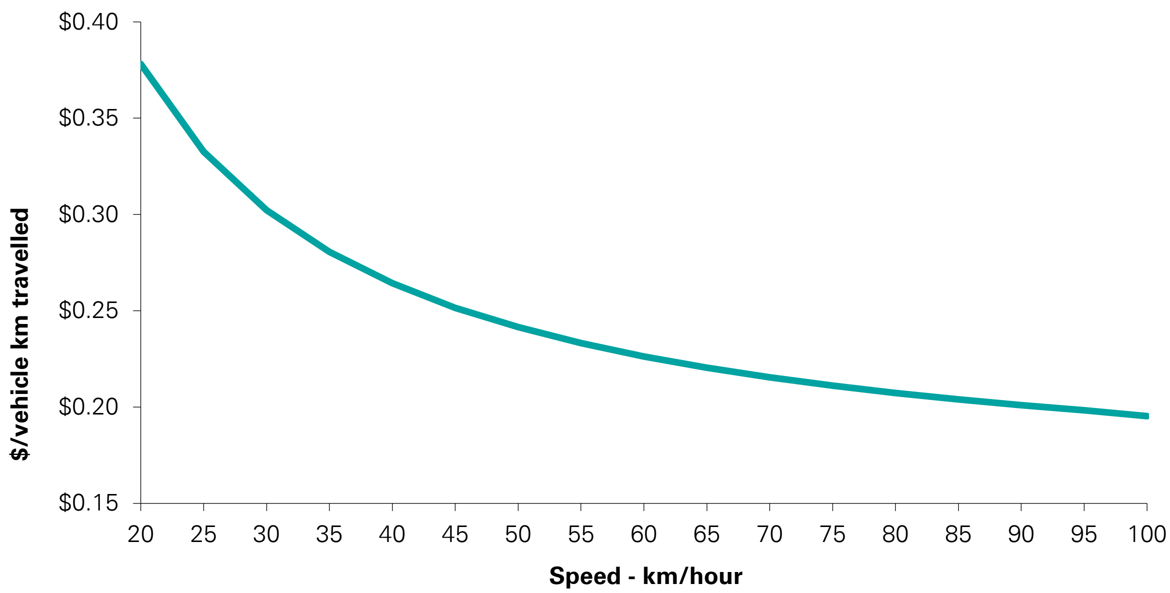
4.3 Vehicle operating cost savings

As the arteries of the broader road transport network, Sydney's modern, free-flowing motorway network offers significant additional capacity thereby enabling lower operating costs to motorists on and off the motorways. Vehicle operating costs will be reduced due to higher operating speeds and smoother traffic flows. The key components of vehicle operating costs include:

- Fuel and oil consumption;
- Repair and maintenance;
- Tyre wear; and
- Vehicle capital costs.

The calculation of vehicle operating cost is based on estimation techniques provided by TfNSW. Vehicle operating costs vary by the speed of the vehicle. As shown below, vehicle operating costs significantly reduce when there is less 'stop start' travel.

Figure 4: Vehicle cost curve – $ per vehicle kilometre travelled



Source: TfNSW guideline and KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and undiscounted.

4.4 Reduction in environmental externalities

Behind stationary energy, transport is the second largest emitter of greenhouse gases and a major contributor to particulate pollution impacting air quality. Transport's emissions are linked to the amount of fuel consumed by vehicles. The following emissions were quantified in the analysis:

- Carbon dioxide (CO2);
- Nitrous oxide (N2O);
- Methane (CH4);
- Carbon monoxide (CO);
- Oxides of nitrogen (NOx);
- Particulate matter (PM10); and
- Non-methane volatile organic compounds.

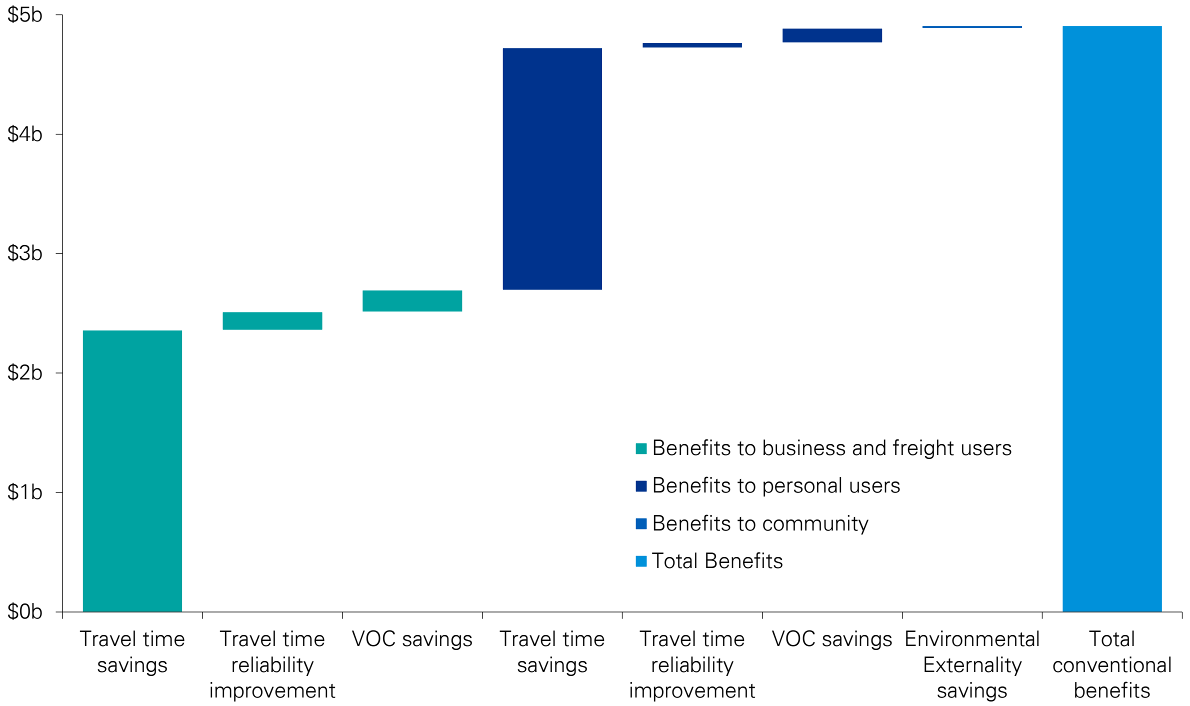
Calculating environmental benefits has much in common with VOCs described above, noting that emissions are a factor of fuel consumed – which in turn, is affected by overall network performance.

4.5 Direct economic benefits of Sydney 'with' and 'without' tolled motorways

Scenario 3 "Greater Sydney road network with tolled motorways" compared to Scenario 1 "Greater Sydney road network without tolled motorways"

Figure 5 below shows the direct benefit in 2021 by benefit stream and user type, showing direct annual economic benefits of circa $4.9 billion; $2.7 billion (55 per cent) to business and freight users and $2.2 billion (44 per cent) to personal users and the remaining 1 per cent consisting of environmental and externality benefits.

Figure 5: Annual direct economic benefits for all road users (2021) – Scenario 3 compared to Scenario 1



Source: KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and undiscounted. Note: this is a single year figure and not comparable to the annual average estimates which are presented in discounted terms

On a per trip basis, the results show that the modern motorway network economic contribution is around $15 per trip on average for all toll motorway trips in 2021, $35 per trip on average for business and freight trips and $10 per trip on average for personal leisure trips.

The direct economic benefits delivered by the tolled motorways in Sydney on all road users over the next 30 years are summarised in Table 4. The direct economic benefits of Sydney's modern tolled motorway network are around $109.8 billion in present value terms. These benefits have been calculated using the Australian Transport Assessment and Planning (ATAP) and TfNSW recommended discount rate of 7 per cent.

Of the total direct benefits, approximately $60.8 billion (55 per cent) are derived by business and freight users; with $48.5 billion of benefits absorbed by personal users of the motorway network.

Travel time savings represent the majority of benefits to both business and freight, as well as personal users of the network.

The remaining $0.5 billion, less than 1 per cent, is attributable to reductions in greenhouse gas emissions, savings, enjoyed by the broader community.

Table 4: Direct economic benefits for all road users over 30 years (2016 to 2046) – Scenario 3 compared to Scenario 1

Direct benefits for all road users	Present value over 30 years
Benefits to business and freight users	**$60.8 bn**
Travel time savings	$53.4 bn
Travel time reliability benefits	$3.6 bn
Vehicle operating cost savings	$3.8 bn
Benefits to personal users	**$48.5 bn**
Travel time savings	$45.0 bn
Travel time reliability benefits	$1.0 bn
Vehicle operating cost savings	$2.6 bn
Other benefits	**$0.5 bn**
Environmental externalities	$0.5 bn
Total conventional benefits	**$109.8 bn**

Source: KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and discounted at 7%.

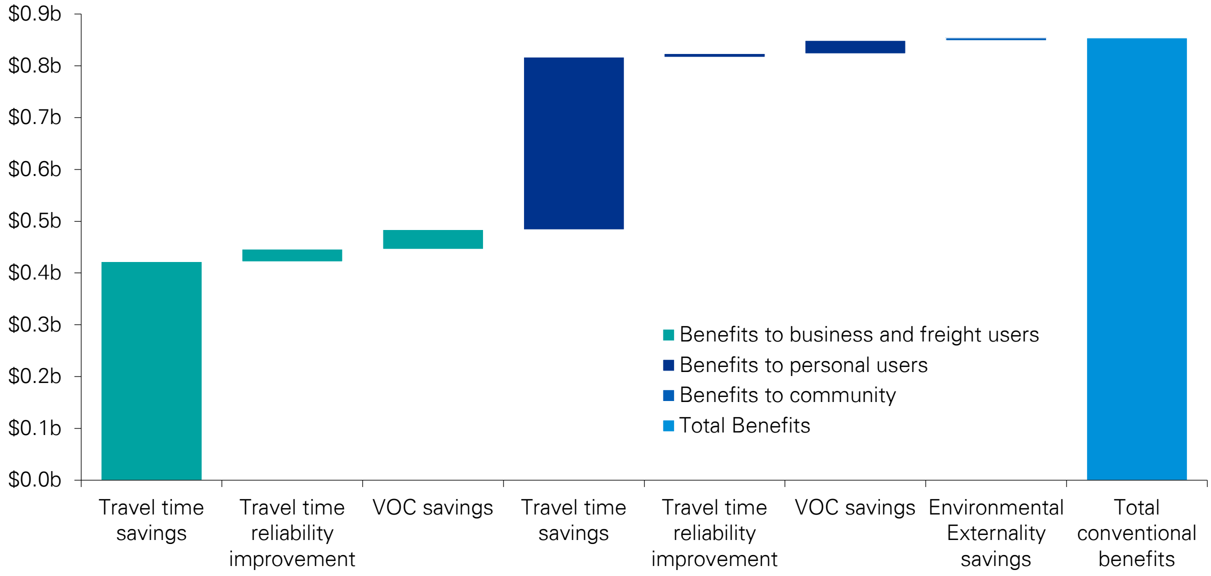
4.6 Direct economic benefits of faster delivery of tolled motorways

Scenario 3 "Greater Sydney road network with tolled motorways" compared to Scenario 2 "Greater Sydney road network with delayed delivery of tolled motorways"

This section presents the estimated direct benefits of the accelerated delivery of toll motorways in Sydney. The analysis was conducted by comparing the cost of travel using the current developed (and planned) toll motorways against a simulated scenario where the toll road network was delayed in delivery (for example due to lack of funding in absence of the user funding contribution).

Figure 6 below shows the direct benefit in 2021 by benefit stream and user type, showing direct annual economic benefits of circa $0.9 billion.

Figure 6: Annual direct benefits of accelerated delivery of toll roads for all road users in Sydney (2021) – Scenario 3 compared to Scenario 2



Source: KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and undiscounted. Note: this is a single year figure and not comparable to the annual average estimates which are presented in discounted terms

The direct economic benefits delivered by the accelerated delivery of toll roads in Sydney were estimated and summarised in Table 5. Over a 30 year time period, the direct economic benefits of accelerated delivery of toll motorways in Sydney have been estimated at around $21.3 billion in present value terms, which highlights the importance of accelerated delivery.

Table 5: Direct benefits for all road users of accelerated toll road delivery Sydney over 30 years (2016 to 2046) – Scenario 3 compared to Scenario 2

Direct benefits for all road users	Present value over 30 years
Benefits to business and freight users	**$11.8 bn**
Travel time savings	$10.5 bn
Travel time reliability benefits	$0.6 bn
Vehicle operating cost savings	$0.7 bn
Benefits to personal users	**$9.4 bn**
Travel time savings	$8.8 bn
Travel time reliability benefits	$0.2 bn
Vehicle operating cost savings	$0.4 bn
Other benefits	**$0.1 bn**
Environmental externalities	$0.1 bn
Total conventional benefits	**$21.3 bn**

Source: KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and discounted at 7%.

4.7 Disaggregated results – benefit for all car users

Table 6 shows the traffic modelling of average travel times across all roads in the Greater Sydney road network, for all car users. Without modern motorways (Scenario 1) average network travel times are around 16.3 minutes per trip in 2021. Average travel times were estimated to increase to 19.3 minutes in 2036 and to 21.1 minutes in 2046.

With modern motorways (Scenario 3), average network travel times are 2.2 minutes less in 2021, 4.1 minutes less in 2036, and 4.8 minutes less in 2046 for all car trips across the overall Greater Sydney road network.

Table 6: Average car trip travel time for all road users in the Greater Sydney road network – Scenario 3 compared to Scenario 1 (undiscounted)

Greater Sydney road network travel times	2021	2036	2046
Number of car trips - annual	2.4 bn	2.9 bn	3.2 bn
Scenario 1 – without modern motorways			
Vehicle hours travelled (VHT) - annual	0.7 bn	0.9 bn	1.1 bn
Average trip time (min)	16.3 min	19.3 min	21.1 min
Travel time cost ($) – annual	$20.8 bn	$29.6 bn	$35.7 bn
Scenario 3 – with modern motorways			
Vehicle hours travelled (VHT) - annual	0.6 bn	0.7 bn	0.9 bn
Average trip time (min)	14.1 min	15.2 min	16.2 min
Travel time cost ($) - annual	$18.0 bn	$23.2 bn	$27.3 bn
Difference between Scenario 3 and 1			
Difference in average trip times (Min)	**2.2 min**	**4.1 min**	**4.8 min**
Travel time cost savings ($)	**$2.9 bn**	**$6.4 bn**	**$8.4 bn**

Source: Traffic modelling output and KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and undiscounted.

4.8 Disaggregated results – benefit for all freight trips

Table 7 shows the traffic modelling of average travel times across all roads in the Greater Sydney road network, for all freight users. Those are mainly freight trips conduced in heavy vehicles ranging from rigid trucks to B-doubles and some larger vehicles on certain parts of the road network.

Without modern motorways (Scenario 1), average network travel times are around 24.7 minutes per trip in 2021. Average travel times were estimated to increase to 29.0 minutes in 2036 and to 32.1 minutes in 2046.

With Sydney's modern motorway network in place (Scenario 3), average network travel times are 4.2 minutes less in 2021, 7.0 minutes less in 2036, and 8.2 minutes less in 2046 for all truck trips across the overall Greater Sydney road network.

Table 7: Average truck trip travel time for all trucks on the overall Greater Sydney road network – Scenario 3 compared to Scenario 1

Greater Sydney road network travel times	2021	2036	2046
Number of truck trips - annual	0.4 bn	0.5 bn	0.6 bn
Scenario 1 – without modern motorways			
Vehicle hours travelled (VHT) – annual	0.2 bn	0.2 bn	0.3 bn
Average trip time (min)	24.7 min	29.0 min	32.1 min
Travel time cost ($) – annual	$8.7 bn	$13.1 bn	$16.8 bn
Scenario 3 – with modern motorways			
Vehicle hours travelled (VHT) - annual	0.1 bn	0.2 bn	0.2 bn
Average trip time (min)	20.5 min	22.0 min	23.9 min
Travel time cost ($) - annual	$7.2 bn	$9.9 bn	$12.5 bn
Difference between Scenario 3 and 1			
Difference in average trip times (Min)	**4.2 min**	**7.0 min**	**8.2 min**
Travel time cost savings ($)	**$1.5 bn**	**$3.2 bn**	**$4.3 bn**

Source: Traffic modelling output and KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and undiscounted.

4.9 Illustrative examples based on selected trips

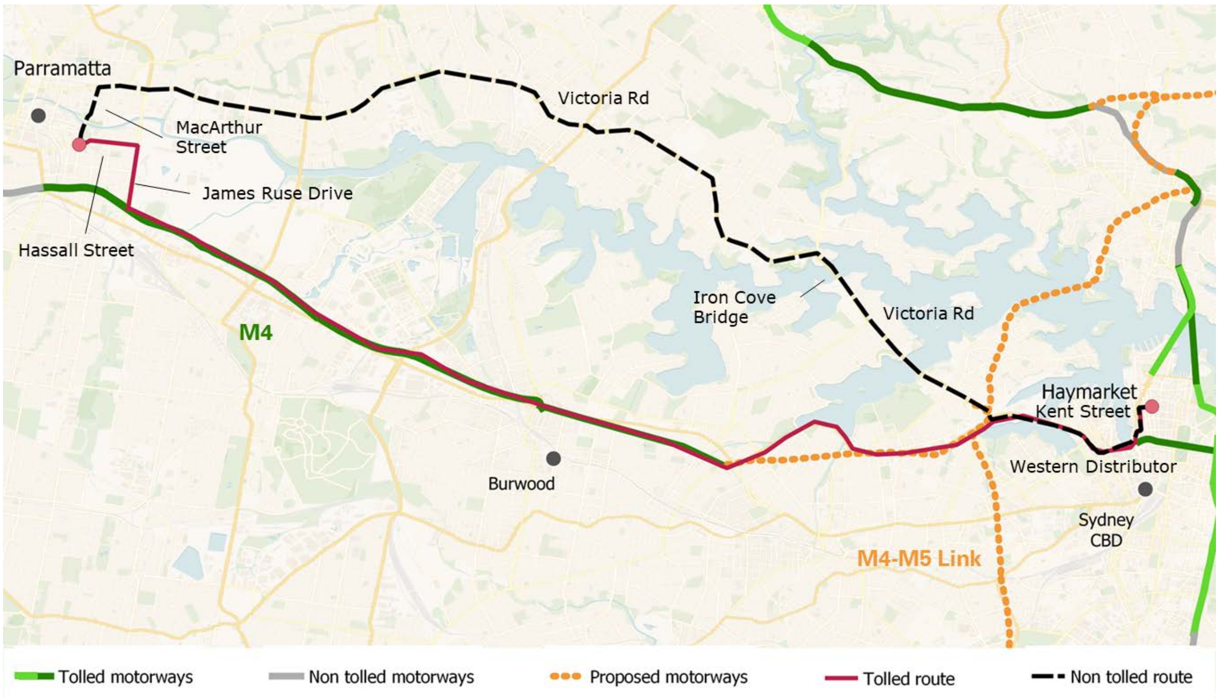
The illustrative examples provide an overview of the difference between trips made under Scenario 1 and Scenario 3. These examples are based on traffic modelling of selected routes, based on average network speeds and average travel times in the modelled AM peak for 2021. These examples show how the economic contribution modelling was undertaken.

Example commuter trip (Parramatta to the CBD)

Figure 7 shows the example routes for a commuter travelling from Parramatta to the CBD:

- **With tolled motorways scenario (red line):** Starts on Hassall Street, enters the M4 via James Ruse Drive, arriving at the CBD via the Western Distributor.
- **Without tolled motorways scenario (black dashed line):** Starts on Hassall Street, traversing Victoria Road and the Western Distributor to arrive at the CBD.

Figure 7: Example commute trip routes from Parramatta to the CBD



Source: Open Street Maps data

The key differences under Scenario 3 and 1 are shown in the table below. This shows that a commuter saves on average more than half an hour per trip between Parramatta and the CBD, compared to a scenario where Sydney's motorways do not exist.

Table 8: Example car trip from Parramatta to the CBD under Scenario 3 and 1 – modelled AM peak 2021

	Scenario 3 – with modern motorways	Scenario 1 – without modern motorways	Benefit
Distance (km)	23.8 km	23.9 km	0.1 km
Average travel time (min)	45.8 min	79.4 min	33.5 min
Average fuel consumption (L)	2.8 L	3.4 L	0.7 L

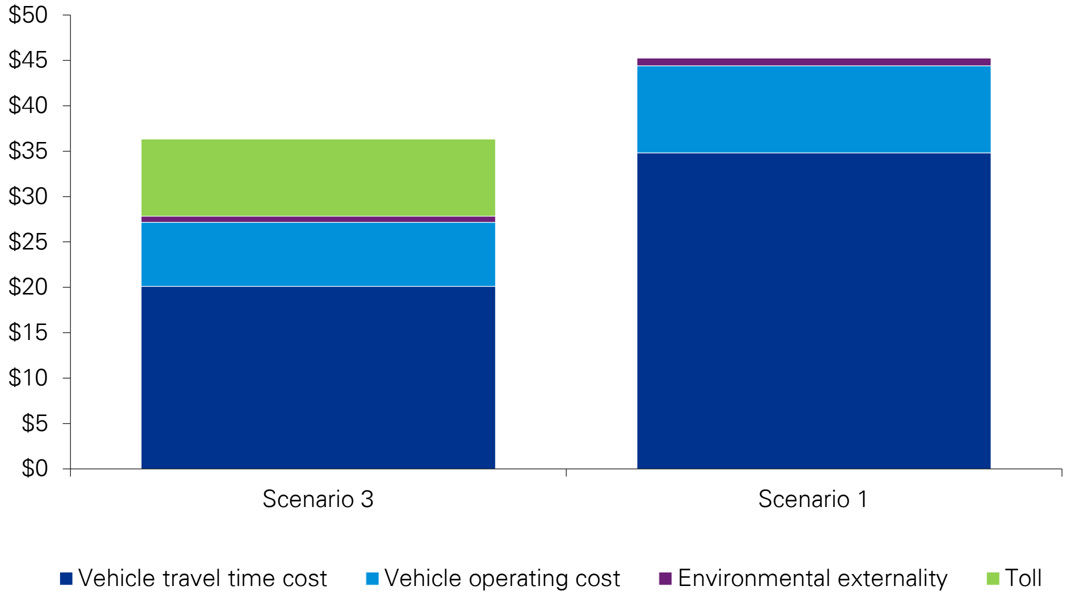
Source: Traffic modelling output and KPMG analysis. Note: The purpose of this example is to show how the economic contribution modelling was undertaken.

Figure 8 shows the average cost breakdown on the two routes. The total travel costs include:

- the financial cost for the car driver including vehicle operating costs and toll charges, and
- the economic costs including the cost of time for the driver and passenger (assuming average vehicle occupancy of 1.4) and environmental externality costs of emissions.

The estimated overall travel costs from Parramatta to the CBD was estimated to be around $36 using the M4 under Scenario 3 and $45 using the Victoria Road under Scenario 1.

Figure 8: Cost comparison for an example car trip from Parramatta to the CBD – Scenario 3 compared to Scenario 1 – AM peak



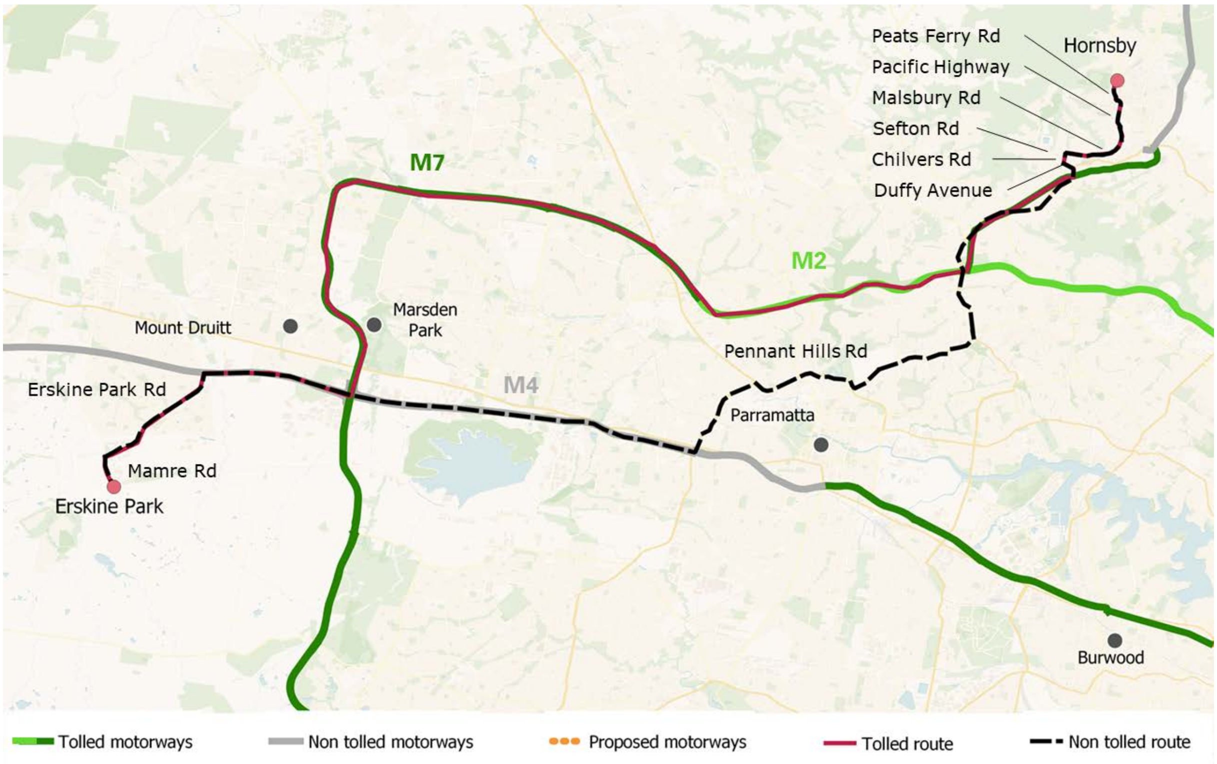
Source: Traffic modelling output and KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and undiscounted. Costs were estimated based on a comparison of Scenario 3 to 1. The purpose of this example is to show how the economic contribution modelling was undertaken.

Example freight trip (Erskine Park to Hornsby)

Figure 9 shows an example route for a freight truck travelling from the Erskine Park area to Hornsby:

- **With tolled motorways scenario (red line):** Commences from Erskine Park Road, using M7, M2 and the newly completed NorthConnex with an estimated distance of around 49 kilometres.
- **Without tolled motorways scenario (black dashed line):** Commences from Erskine Park, using the non-tolled M4 section and Pennant Hills Road, with an estimated distance of some 42 kilometres.

Figure 9: Example freight trip routes from Erskine Park to Hornsby



Source: Open Street Maps data

The key differences under Scenario 3 and 1 are shown in the table below. This shows that a truck saves on average more than 50 minutes per trip between Erskine Park to Hornsby, compared to a scenario where Sydney's motorways do not exist.

Table 9: Example freight trip from Erskine Park to Hornsby under Scenario 3 and 1 – modelled AM peak 2021

	Scenario 3 – with modern motorways	Scenario 1 – without modern motorways	Benefit
Distance (km)	48.8 km	42.3 km	-6.6 km
Average travel time (min)	48.8 min	99.9 min	51.1 min
Average fuel consumption (L)	21.7 L	41.0 L	19.3 L

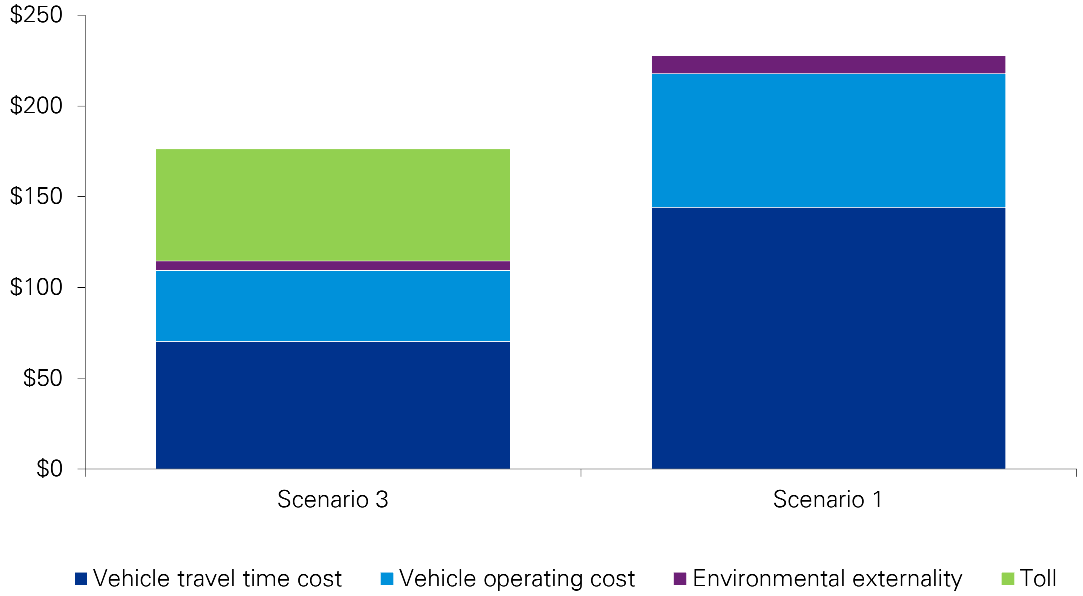
Source: Traffic modelling output and KPMG analysis. Note: The purpose of this example is to show how the economic contribution modelling was undertaken.

Figure 10 shows the cost breakdown of the above routes carried out by freight trucks. The total travel costs include:

- the financial cost for the truck operating including vehicle operating costs and toll charges, and
- the economic costs including the cost of time for the driver and passenger (assuming average vehicle occupancy of 1.1) and the economic value of the freight being transport (freight value of time), as well as environmental externality costs of emissions.

The estimated overall travel costs for the example truck travel from Erskine Park to Hornsby was estimated to be around $176 using the tolled motorway under Scenario 3 and $228 using the non-tolled route under Scenario 1.

Figure 10: Cost comparison for an example truck trip from Erskine Park to Hornsby – Scenario 3 compared to Scenario 1 – modelled AM peak 2021



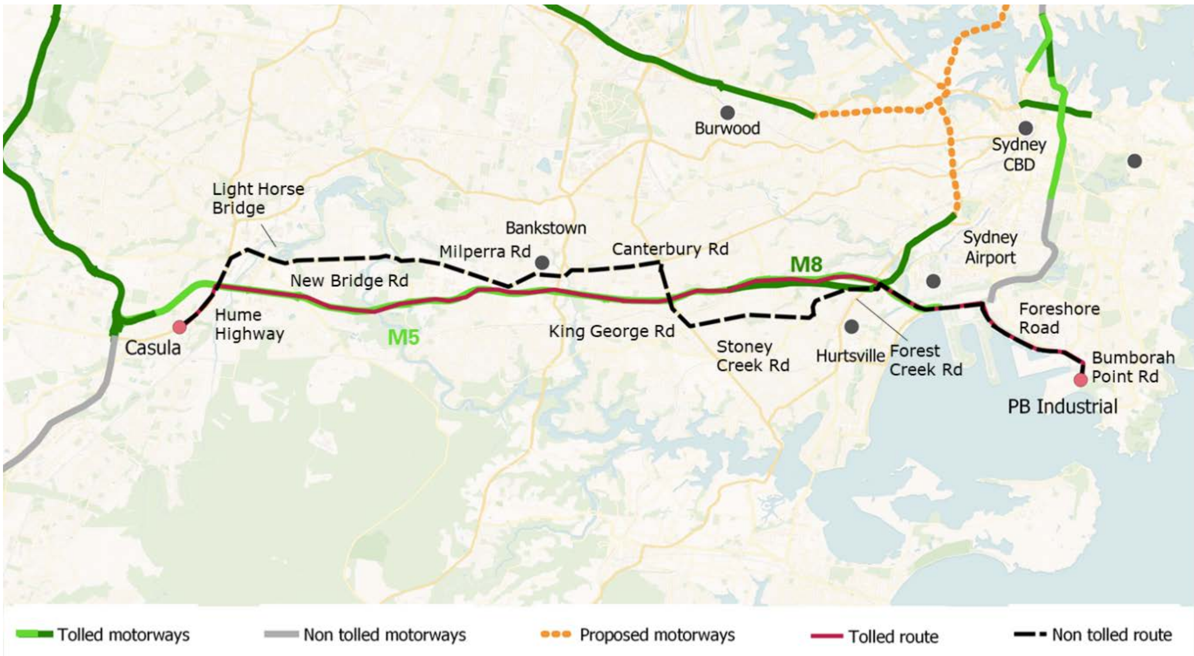
Source: Traffic modelling output and KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and undiscounted. Costs were estimated based on a comparison of Scenario 3 to 1. The purpose of this example is to show how the economic contribution modelling was undertaken.

Example freight trip (Casula to Port Botany)

Figure 11 shows an example route for a freight truck travelling from Casula to Port Botany:

- **With tolled motorways scenario (red line):** Takes the M5 and Foreshore Road with an estimated distance of around 35 kilometres.
- **Without tolled motorways scenario (dashed black line):** Stoney Creek Road, Forest Road, General Holmes Drive, M1 to Foreshore Road with an estimated distance of around 39 kilometres.

Figure 11: Example freight trip routes from Casula to Port Botany



Source: Open Street Maps data

The key differences under Scenario 3 and 1 are shown in the table below. This shows that a truck saves on average around 55 minutes per trip between Casula to Port Botany, compared to a scenario where Sydney's motorways do not exist.

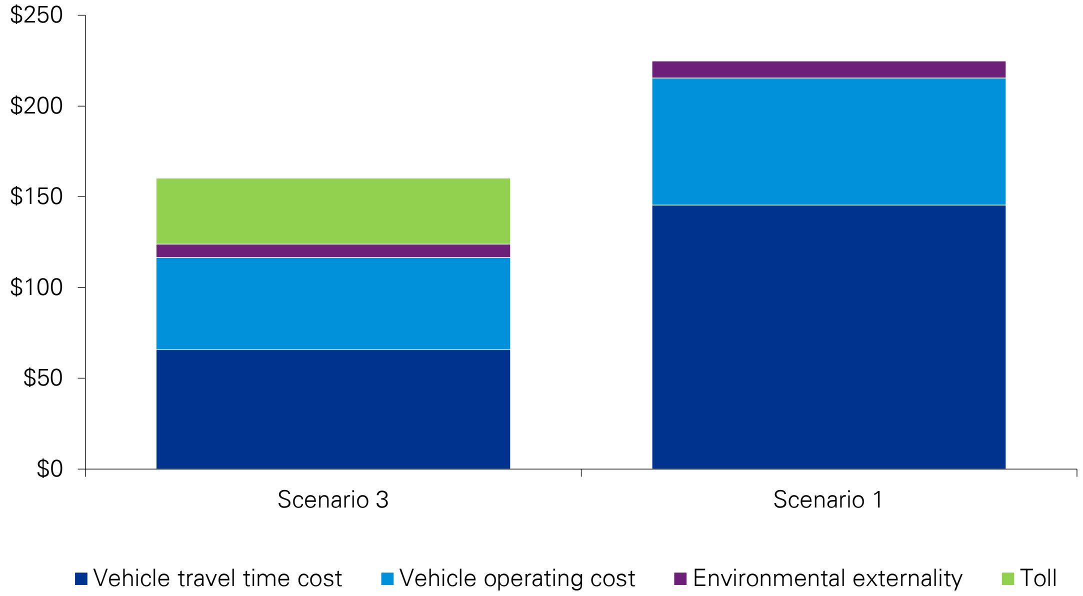
Table 10: Example freight trip from Casula to Port Botany under Scenario 3 and 1 – modelled AM peak 2021

	Scenario 3 – with modern motorways	Scenario 1 – without modern motorways	Benefit
Distance (km)	34.9 km	38.9 km	3.9 km
Average travel time (min)	45.6 min	100.8 min	55.2 min
Average fuel consumption (L)	30.5 L	38.5 L	8.0 L

Source: Traffic modelling output and KPMG analysis. Note: The purpose of this example is to show how the economic contribution modelling was undertaken.

Figure 12 shows the cost breakdown of the above routes carried out by freight trucks. The estimated overall travel costs for the example truck travel from Casula to Port Botany was estimated to be around $160 using the tolled motorway under Scenario 3 and $225 using the non-tolled route under Scenario 1.

Figure 12: Cost comparison for an example truck trip from Casula to Port Botany – Scenario 3 compared to Scenario 1 – modelled AM peak 2021



Source: Traffic modelling output and KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and undiscounted. Costs were estimated based on a comparison of Scenario 3 to 1. The purpose of this example is to show how the economic contribution modelling was undertaken.

5. Wider economic benefits

Beyond a tradition Cost Benefit Analysis approach sits a range of 'real world' imperfections which see the price and marginal social cost of transport diverge. This sees an array of additional benefits or costs created beyond the range captured in the direct benefit assessment.

These additional sources of impacts are commonly referred to as Wider Economic Benefits (WEBs). These benefits are most relevant to significant transport and urban (re)generation projects and typically refer to changes in the productive capacity of the economy. As with other transport modes, Sydney's modern motorway network allows a more efficient transmission of goods and skills across the NSW economy; and to the global markets beyond.

The toll road network improves access between places, which in effect, brings businesses and knowledge centres closer together. This will result in a number of wider economic benefits including:

- Agglomeration economies;
- Labour market deepening; and
- Output change in imperfectly competitive markets.

5.1 Agglomeration economies

Agglomeration economies refer to benefits that flow to firms and workers located in close proximity. Agglomeration economies arise from economies of scale and scope. The toll road network reduces the time and cost of travel. By lowering costs, toll roads enhance the accessibility and connectivity of employment centres and facilitate increased formal and informal interaction. The measure for these improvements in interaction is increasing 'effective density'.

In this context, effective density can be understood as a measure of access to opportunities, for instance, typical jobs, which is quantified using a measure of travel impedance (i.e. generalised cost, time or distance of travel). Higher effective density leads to firms enhancing their productivity through input sharing, knowledge and technological spill overs and output sharing, the principal source of agglomeration economies in the modern economy.

The resulting agglomeration impacts are measured as changes in Gross Value Added (GVA) for all industries. The change in GVA by industry (for each origin) is mainly driven by the percentage change in productivity between the project scenarios which reflects the rate of change in business-to-business effective density. Change in effective density is the mechanism through which agglomeration impacts are transmitted through changes in transport network performance delivered by the toll roads.

5.2 Increased labour supply benefits

Labour market deepening benefits arise from increased participation in the labour market (WEB2a): increased labour supply).[14] Toll roads reduce network travel times and improves travel time reliability, which in turn encourages job participation (e.g. less burdensome to get to and from work, especially for people with caring responsibilities) and allows greater accessibility to better matched jobs. While benefits are typically measured as increased (income) tax revenue, labour market deepening has a strong social component as it grows the pool of potential jobs individuals can choose from and thus is grows participation rates and ultimately job satisfaction.

Increased labour supply benefits (WEB2a) are based on the theory that in choosing whether to take up work, individuals trade off the perceived benefit of the potential wages with the perceived disbenefit of commuting. A reduction in commuting costs can impact the supply of labour, either by increasing the number of people who choose to work (e.g. an increased participation rate) or by increasing the number of hours worked by those already working. This can be alternatively described as an increase in the labour supply at the extensive and intensive margin respectively. The welfare benefit is the additional tax revenue received by the Government, which is a combination of taxes on labour (income and payroll tax) as well as tax on the additional output created by businesses.

Increased labour supply benefits are quantified by estimating the change in the average daily generalised cost of commuting due to the transport improvement for different areas of the city. The perceived benefit of working (measured in dollars) for each area is defined as the average daily wage minus the average daily generalised cost of commuting. A reduction in the generalised cost of commuting translates to an increase in the perceived benefit of working.

5.3 Output increase in imperfectly competitive markets

Transport costs act as a barrier to competition and therefore help to maintain imperfect competition. In imperfectly competitive markets firms are incentivised to sell less output at higher prices than they would in a perfectly competitive market. Toll roads reduce transport costs which can enhance the ability for firms to produce goods at a lower cost, therefore generating additional consumer surplus due to the existence of the price-cost mark-up.

[14] There is also WEB2b which arises from existing workers switching to more productive jobs. WEB2b is excluded in this assessment as it is associated with land use changes which is not considered to be significant between the project scenarios.

5.4 Results

As summarised in the table below, the incremental wider economic benefits for Sydney were estimated to be $60.4 billion (Scenario 3 compared to Scenario 1). Agglomeration benefits account for around 90 per cent of the total wider economic benefits. Estimated at $53.9 billion, this shows the significant importance of the toll motorway network to the productivity of all business in Sydney by bringing those businesses closer together.

Table 11: Wider economic benefits (WEBs) - 2016 to 2046

Wider economic benefits	Scenario 3 compared to Scenario 2 (delayed delivery)	Scenario 3 compared to Scenario 1 (without modern motorways)
Agglomeration economies	$13.2 bn	$53.9 bn
Labour market deepening	$0.4 bn	$1.9 bn
Increased output (imperfectly competitive markets)	$0.9 bn	$4.6 bn
Total wider economic benefits	**$14.5 bn**	**$60.4 bn**

Source: KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and discounted at 7%.

6. Economic impact

The direct and wider economic benefits focus on the effects directly associated with the toll road network. Economic impact modelling adds another layer to this analysis by estimating its contribution to total market value of goods and services including direct and indirect (or flow-on) effects as well as employment.

6.1 Measuring economic impact

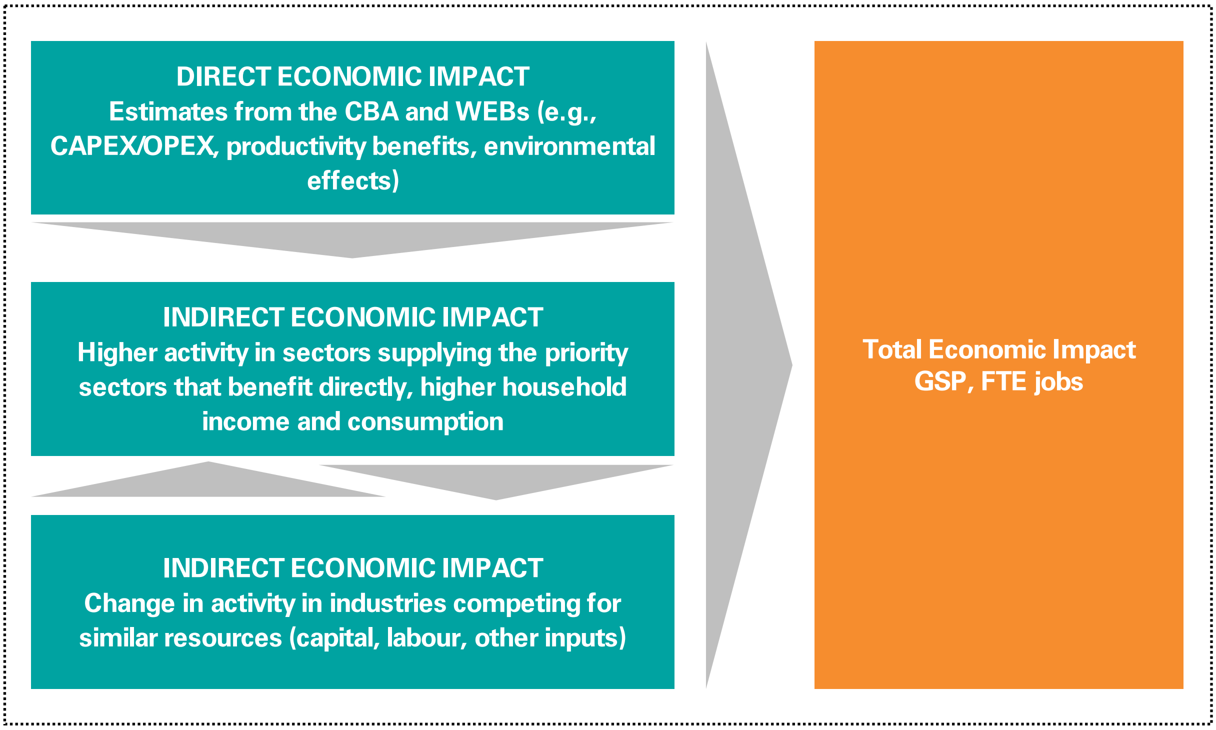
Economic impacts measure the broad effects on the economy. Thus, the total economic impact of the toll road network is measured in terms of gross state product (GSP) – a standard metric for the total market value of goods and services produced in an economy. This is equivalent to gross national expenditure (i.e., sum of household consumption, government consumption and investment) plus (international and interstate) exports of goods and services less (international and interstate) imports of goods and services. GSP measures the total market value of goods and services produced in an economy. This metric includes all taxes and subsidies raised on economic activity in an economy. While individual taxes and subsidies distort the allocation of resources in an economy, higher GSP is consistent with higher net tax revenue, and vice versa.

This study uses the KPMG-REG model to estimate the economywide impacts of Sydney's toll road network. KPMG-REG is a multi-regional, dynamic CGE model; it is a bespoke proprietary model developed by KPMG. As each state and territory is modelled as a separate economy, KPMG-REG is ideally suited to determining the impact of a region-specific project or change. The model contains explicit representations of intra-regional, inter-regional and international trade flows based on regional input-output data and includes detailed data on State and Federal Governments budgets and debt.

In assessing the economic impact of Sydney's toll roads, results of a counterfactual scenario are compared against that of a business-as-usual (or baseline) scenario. The baseline represents an estimate of how the size and structure of how the New South Wales economy will evolve in the absence of Sydney's toll roads. For the counterfactual scenario, the direct impacts (costs and benefits) of Sydney's toll roads are quantified outside the model based on the CBA and WEBs described above. The direct impacts are then implemented as shocks, which are translated into the model as the first-round effects of project. Then the second-round flow-on effects are captured via the model's input-output linkages subject to economy-wide and international resource constraints. By comparing the scenario results to the baseline, KPMG-REG quantifies economic impacts such as GSP and employment. The results are presented in percentage and dollar change (present values) terms, and full-time equivalent employment.

Figure 13 illustrates this process. Further detail on the KPMG-REG model and the modelling of the direct benefits are provided in Appendix 1.

Figure 13: Flow of economy-wide impacts in the KPMG-REG model



Source: KPMG diagram

6.2 Economic impact of the modern motorways

Scenario 3 "Greater Sydney road network with tolled motorways" compared to Scenario 1 "Greater Sydney road network without tolled motorways"

The toll motorway network drives NSW GSP, employment and wages. Our analysis shows that the investment in its expansion, through construction (see Figure 2) over the next 20 years will increase labour demand and decrease the unemployment rate, which in turn accelerates (real) wage growth.

Aggregated over the assessment period, the toll motorways and its planned capital expansions will generate GSP of $189.1 billion in present value terms discounted at 7 per cent or close to one fifth of NSW's current annual GSP. Annualised over the assessment period this translates to an average GSP contribution of the toll road network of $7.3 billion per year. Taking the population of NSW of just under 8.2 million, on a per capita basis across NSW, this is equivalent to $890 per person per year. These GSP increases are expected to be associated with average annual job creation of approximately 12,000 FTEs over the assessment period.

Table 12: Economic impacts of toll motorways in Sydney – Scenario 3 compared to Scenario 1

Economic impacts	Economic impacts
State-wide NSW economic outputs	
Gross state product	$7.3 bn (average annual)
Gross state product per capita	$890 per person (average annual)
Jobs (FTE)	12,000 FTE (average annual)

Source: KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and discounted at 7%.

As the vast majority of this economic growth is associated with productivity improvements, it can be expected that they will continue well beyond the assessment period as the network continues to support Sydney's economy.

6.3 Impact of the accelerated delivery

Scenario 3 "Greater Sydney road network with tolled motorways" compared to Scenario 2 "Greater Sydney road network with delayed delivery of tolled motorways"

While less pronounced than the above, NSW also significantly benefits from the accelerated delivery of toll motorways. Our analysis shows that the investment in its expansion, through construction (see Figure 2) over the next 20 years will increase labour demand and decrease the unemployment rate, which in turn accelerates (real) wage growth.

Aggregated over the assessment period, the toll motorway network and its planned capital expansions will generate GSP of $64.5 billion in present value terms discounted at 7 per cent. Annualised over the assessment period this translates to an average GSP contribution of the toll motorway network of $2.5 billion per year. Taking the population of NSW of just under 8.2 million, on a per capita basis, this is equivalent to $300 per person per year across NSW. These GSP increases are expected to be associated with average annual job creation of approximately 5,300 FTE over the assessment period.

Table 13: Economic impacts of toll road network in Sydney – Scenario 3 compared to Scenario 2

Economic impacts	Economic impacts
State-wide NSW economic outputs	
Gross state product	$2.5 bn (average annual)
Gross state product per capita	$300 per person (average annual)
Jobs (FTE)	5,300 FTE (average annual)

Source: KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and discounted at 7%.

7. Summary of results

7.1 Economic contribution of the toll motorways

Our analysis has estimated the economic contribution of the Sydney toll motorway network. The scenarios tested provide a range for the economic contribution the toll motorway network has on all road users and the broader economy in NSW. Results should be interpreted as providing a range of upper and lower bound estimates.

Scenario 3 "Greater Sydney road network with tolled motorways" compared to Scenario 1 "Greater Sydney road network without tolled motorways"

The overall economic contribution of the toll motorway network includes the direct benefits, wider economic benefits as well as the state-wide macroeconomic impacts. A summary of the economic contribution on average each year is shown in the table below.

Table 14: Economic impacts of toll road network in Sydney – Scenario 3 compared to Scenario 1

Economic contribution	Average annual
Direct economic benefits	$3.6 bn (average annual)
Wider economic benefits	$2.0 bn (average annual)
Economic impacts (GSP)	$7.3 bn (average annual)
Jobs (FTE)	12,000 FTE (average annual)

Source: KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and discounted at 7%.

Scenario 3 "Greater Sydney road network with tolled motorways" compared to Scenario 2 "Greater Sydney road network with delayed delivery of tolled motorways"

A summary of the economic contribution on average each year when comparing Scenario 3 and 2 is shown in the table below.

Table 15: Economic impacts of toll road network in Sydney - 'With toll roads' scenario compared to the 'delayed delivery of toll roads' scenario

Economic contribution	Average annual
Direct economic benefits	$0.7 bn (average annual)
Wider economic benefits	$0.5 bn (average annual)
Economic impacts (GSP)	$2.5 bn (average annual)
Jobs (FTE)	5,300 FTE (average annual)

Source: KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and discounted at 7%.

7.2 Disaggregated summary of results

Scenario 3 "Greater Sydney road network with tolled motorways" compared to Scenario 1 "Greater Sydney road network without tolled motorways"

The overall economic contribution is summarised in Table 16. It was estimated that the long term economic benefit over 30 years of the toll motorway network is around $170.1 billion including $109.8 billion of direct benefits and $60.4 billion of WEBs using a discount rate of 7 per cent.

Table 16: Total economic contribution over 30 years (2016 to 2046) – Scenario 3 compared to Scenario 1

Benefits to all road users	Present value over 30 years
Direct economic benefits	
Benefits to business and freight users	**$60.8 bn**
Travel time savings	$53.4 bn
Travel time reliability benefits	$3.6 bn
Vehicle operating cost savings	$3.8 bn
Benefits to personal users	**$48.5 bn**
Travel time savings	$45.0 bn
Travel time reliability benefits	$1.0 bn
Vehicle operating cost savings	$2.6 bn
Other benefits	**$0.5 bn**
Environmental externalities	$0.5 bn
TOTAL DIRECT BENEFITS	**$109.8 bn**
Wider economic benefits	
Agglomeration economies	$53.9 bn
Labour market deepening	$1.9 bn
Increased output under imperfectly competitive markets	$4.6 bn
TOTAL WIDER ECONOMIC BENEFITS	**$60.4 bn**
TOTAL BENEFITS	**$170.1 bn**
Productivity benefits	**$114.6 bn**
Economic impact analysis	
Gross State Product	$7.3 bn (average annual)
Gross State Product per capita	$890 per person (average annual
Jobs	12,000 FTE (average annual)

Source: KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and 7% discount rate.

Scenario 3 "Greater Sydney road network with tolled motorways" compared to Scenario 2 "Greater Sydney road network with delayed delivery of tolled motorways"

The overall economic contribution when compared to Scenario 2 is summarised in Table 17. It was estimated that the total economic benefits for the accelerated delivery of toll motorways are around $35.8 billion including $21.3 billion of direct benefits and $14.5 billion WEBs using a discount rate of 7 per cent.

Table 17: Total economic contribution of accelerated delivery of toll roads in Sydney over 30 years (2016 to 2046) – Scenario 3 compared to Scenario 2

Benefits to all road users	Present value over 30 years
Direct economic benefits	
Benefits to business and freight users	**$11.8 bn**
Travel time savings	$10.5 bn
Travel time reliability benefits	$0.6 bn
Vehicle operating cost savings	$0.7 bn
Benefits to personal users	**$9.4 bn**
Travel time savings	$8.8 bn
Travel time reliability benefits	$0.2 bn
Vehicle operating cost savings	$0.4 bn
Other benefits	**$0.1 bn**
Environmental externalities	$0.1 bn
TOTAL DIRECT BENEFITS	**$21.3 bn**
Wider economic benefits	
Agglomeration economies	$13.2 bn
Labour market deepening	$0.4 bn
Increased output under imperfectly competitive markets	$0.9 bn
TOTAL WIDER ECONOMIC BENEFITS	**$14.5 bn**
TOTAL BENEFITS	**$35.8 bn**
Productivity benefits	**$25.0 bn**
Economic impact analysis	
Gross State Product	$2.5 bn (average annual)
Gross State Product per capita	$300 per person (average annual
Jobs	5,300 FTE (average annual)

Source: KPMG analysis. Note: Monetary values presented in $2021 price year, real terms, and 7% discount rate.


PREPARE TO STOP
NO DANGEROUS GOODS IN TUNNEL
LOW CLEARANCE 4.4 m
CAHILL TUNNEL
DETOUR

Appendices

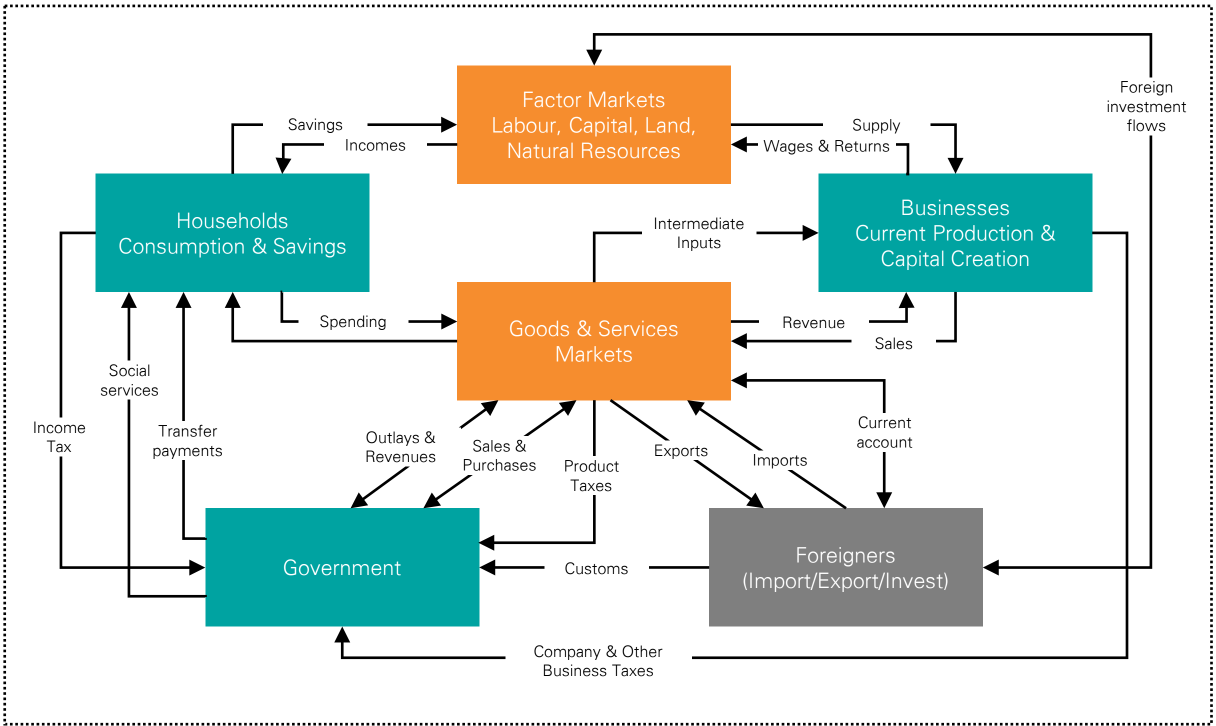
Appendix 1: The KPMG-REG model

The economic impacts of the Sydney toll road network have been modelled using KPMG's in-house economic model (KPMG-REG), a detailed regional computable general equilibrium model of the Australian economy. KPMG-REG is specifically designed for the analysis of regional projects as it explicitly captures

- linkages between industries within and between regions;
- flows of income stemming from jobs and profits supported by industry activity within each region; and
- relationships between the government sector and the rest of the economy.

The KPMG-REG model represents the economy as a system of interdependent economic agents and thus is capable of tracing and quantifying the impact of the transport project from one sector to another. Figure A1 shows a stylised representation of the transmission channels through which the impact of the Sydney toll road project affects the whole economy.

Figure 14: System of interdependent economic agents



Economic theory is used to specify the behaviour and market interactions of economic agents in KPMG-REG. Defining features of the theoretical structure include:

- optimising behaviour by households and businesses in the context of competitive markets with explicit resource constraints and budget constraints;
- the price mechanism operates to clear markets for goods and factors, such as labour and capital, i.e., prices adjust so that supply and demand are equal; and
- marginal costs are equal to marginal revenues in all economic activities.

The model combines data from input-output tables, labour force surveys and other sources with the model theory to quantify sophisticated behavioural responses such as:

- price and wage adjustments driven by resource constraints;
- household spending and government spending and taxing adjustments driven by budget constraints; and
- allowance for input substitution possibilities in production (e.g., allowing the combination of labour, capital, and other inputs required for production to vary in response to relative price changes).

KPMG-REG takes a 'bottom-up' approach to multiregional modelling. In each region, economic agents decide on the allocation of labour, capital and land to different productive activities. The cost structure of firms in each sector, the composition of investment goods, the endowments and preferences of households and the level and composition of public expenditures are all region-specific. Regions are interdependent via bilateral flows of goods and services between regions and with the rest of the world. These bilateral trades are facilitated in the model via a detailed specification of transport margins for goods.

The dynamic features of KPMG-REG are built on the premise that economic adjustment to economic shocks takes place over a period of years with the economy demonstrating much greater flexibility in the long-run than in the short-run. A core dynamic feature is the accumulation of capital. Investment behaviour is industry-specific and is positively related to the expected rate of return, which depends on the growth rate of the capital stock. The capital growth rate is determined by investment in the previous year less capital depreciation.

Another dynamic feature of KPMG-REG is the lagged adjustment process in the labour market. The wage rate adjusts gradually over time to changes in labour market conditions. This relationship is calibrated using coefficients estimated by the NIGEM macroeconomic model. In the long-run the wage rate adjusts so that the unemployment rate reaches its long-run equilibrium level. Workers are somewhat mobile across regions in response to changes in real wage rate relativities.

Other lagged adjustment processes relate to the stock of government debt and net foreign liabilities. Government debt accumulates depending on the evolution of the budget balance. Typically, the ratio of government debt to GDP is assumed to vary in the short-run but stabilise in the long-run. Stabilisation is typically achieved via the adjustment of the income tax rate. Net foreign liabilities as a share of GDP can also vary in the short run depending on the behaviour of household saving rate. The household saving rate is endogenous and responds to a consumption function that is a lagged function of income, wealth and the number of consumers who are liquidity constrained; these effects are calibrated using coefficients estimated by the NIGEM macroeconomic model. This form of consumption function exhibits consumption smoothing over time. In the long-run household consumption and the household saving rate adjust so that net foreign liabilities stabilise as a share of GDP.

KPMG-REG shocks representing Sydney's toll motorways

The first set of shocks is designed to capture the direct economic impacts of the project's investment costs. The capital expenditure and operating expenditure are implemented in the model as annual investment shocks to the road passenger and freight sectors.

The second set of shocks is designed to capture the operational benefits of the Sydney toll roads. There are three types of benefits estimated from the CBA:

1) Travel time savings,
2) Travel time reliability benefits, and
3) Vehicle operating cost savings.

These benefits accrue to three groups of beneficiaries:

1) Business users,
2) Freight users, and
3) Personal users.

Business travel time savings and travel time reliability benefits are assumed to be devoted to work. The *business* travel benefits are implemented as labour-saving and input-saving productivity improvements for firms in the service sectors, which predominantly use cars and other light vehicles. Freight travel time savings and travel time reliability benefits are assumed to accrue to firms in non-service industries, which predominantly use trucks or other heavy vehicles. These *freight* travel benefits are translated into input-saving productivity improvements. Personal travel time savings and travel time reliability benefits are assumed to increase leisure time. These *personal* savings/benefits are implemented in KPMG-REG as an exogenous increase in welfare derived from leisure for households.

Reductions in vehicle operating costs are modelled as reductions in consumption of Petrol Products and Motor Vehicles and Repairs by service sectors (business users), non-service industries (freight users), and households (personal users).

The wider economic benefits (WEB) of the project are also captured in KPMG-REG. WEB1 (agglomeration) contributes most of the benefits while WEB2a (move to more productive jobs) makes a small contribution to the benefits. This is because proximity effects (reductions in travel times) are large relative to labour market effects (i.e., relocation of workers to more productive jobs). KPMG also estimated the WEB3 benefits, but these are not implemented here. This is because these benefits arise from imperfect competition in product markets and this is not consistent with the assumption of perfectly competitive markets in KPMG-REG. The WEB1 and WEB2a inputs are represented in the CGE model as labour productivity improvements.

Appendix 2: Note to Readers

For readers of this report it should be noted that in 2015 KPMG prepared a report for Transurban on the economic contribution of all toll motorways in Australia. This report however focusses on toll motorways in Sydney. This report has also applied a different approach to the development of the scenarios used to model the economic contribution. Therefore, results of this report are not intended to be compared to the 2015 report.

Some key differences between the two reports include:

- This report has modelled three scenarios consisting of the Greater Sydney road network with and without toll motorways and a delayed toll motorway delivery scenario of 15 years.
- The 2015 report considered the delayed delivery of the toll network under 5, 10 and 30 year scenarios.
- The 2015 report did not compare the Sydney road network with and without toll motorways.
- A major difference between the reports is that in 2015 the benefit estimate was based on toll road users only. This report considers the benefits to all road users.
- The evaluation period for the analysis in the 2015 report was 10 years while this report has adopted a longer time period of 30 years.
- Forecasts undertaken in 2015 are different to forecasts undertaken for this report. For example, population growth and economic growth forecasts have all changed since 2015 and are different to forecasts made today.
- The price basis was $2014 in the 2015 report while the price basis in this report is $2021.
- All economic parameter values have changed since the 2015 report and the best practice guidance material has been updated.
- The 2015 report did not account for the economic impact resulting from the construction of the toll motorways.

These factors explain the difference in the results and should therefore not be compared given the changes in modelling assumptions and scenarios.

Appendix 3: Glossary

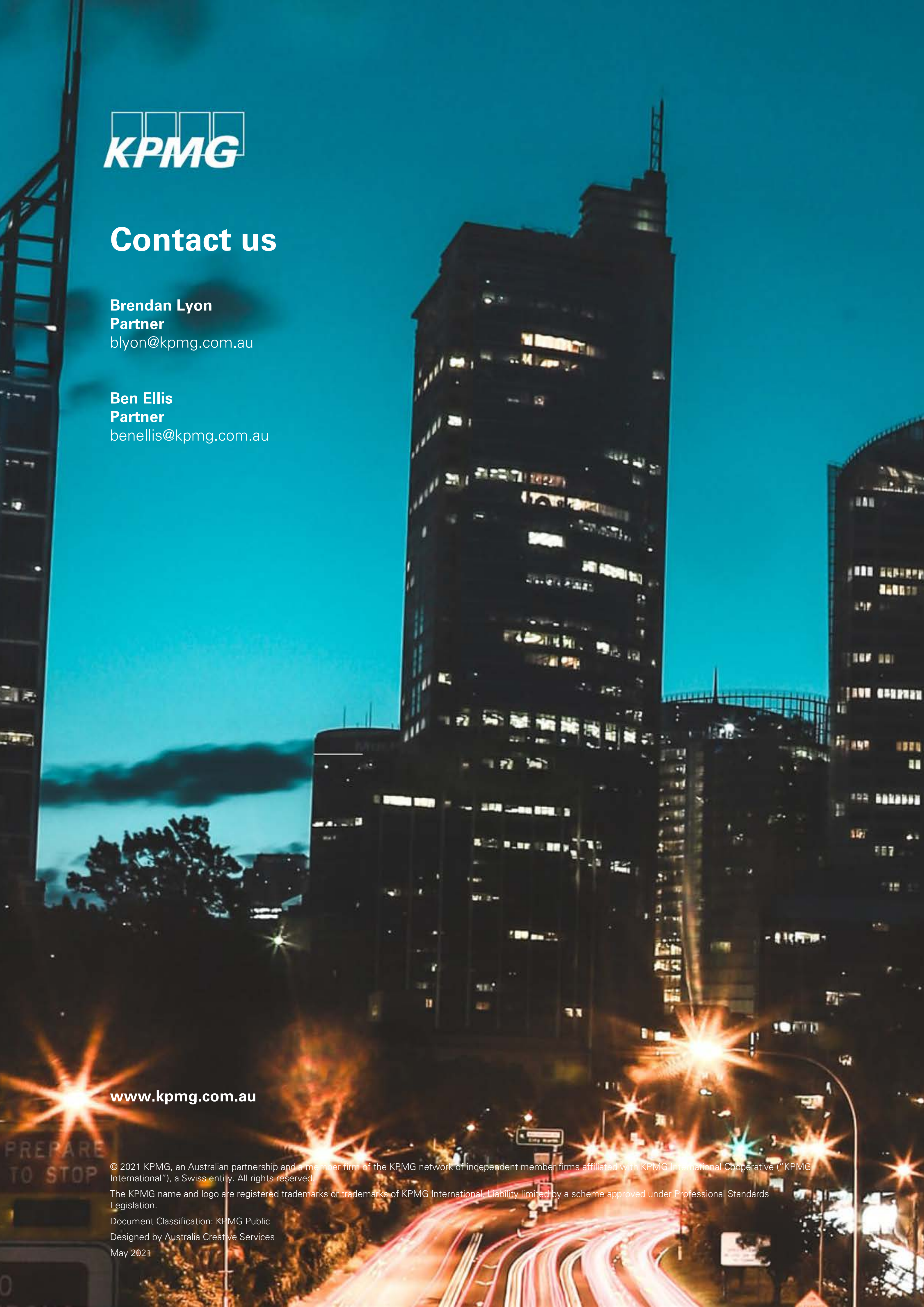
Acronym	Term
ABS	Australian Bureau of Statistics
ATAP	Australian Transport Assessment and Planning
ANZIC	Australian and New Zealand Standard Industrial Classification
BITRE	Bureau of Infrastructure, Transport and Research Economics
BN	Billion
CAPEX	Capital Expenditure
CBA	Cost-Benefit Analysis
CGE	Computable General Equilibrium
CH4	Methane
CO2	Carbon Dioxide
CO	Carbon Monoxide
COVD-19	The COVID-19 disease.
FTE	Full Time Equivalent
GDP/GSP	Gross Domestic Product/Gross State Product
GVA	Gross Value Added
HCV	Heavy commercial vehicle
KFRs	Key Freight Routes
KPMG-REG	A multi-regional, dynamic CGE model of the Australian economy.
LCV	Light Commercial Vehicle
NIGEM	NIGEM macroeconomic model.
N2O	Nitrous Oxide
NPV	Net Present Value
NSW	New South Wales
OPEX	Operating Expenditure

Ox	Oxides of Nitrogen
PM10	Particulate Matter
U.S.	The United States of America
TfNSW	Transport for NSW
Tkm	Tonne kilometres
UK	United Kingdom
VHT	Vehicle Hours Travelled
VOC	Vehicle Operating Cost
WCX	WestConnex
WEBs	Wider Economic Benefits
WEB1	Agglomeration economies
WEB2	Increased labour supply benefits
WEB3	Increased output due to imperfect competition

Appendix 4: Lists

List of Tables

List of Figures



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