The value that roads deliver to the Australian community

roadsaustralia

$236bn
Added economic value (GDP) due to roads

1.4m
Jobs supported

$106.8bn
of road projects funded in next 4 years

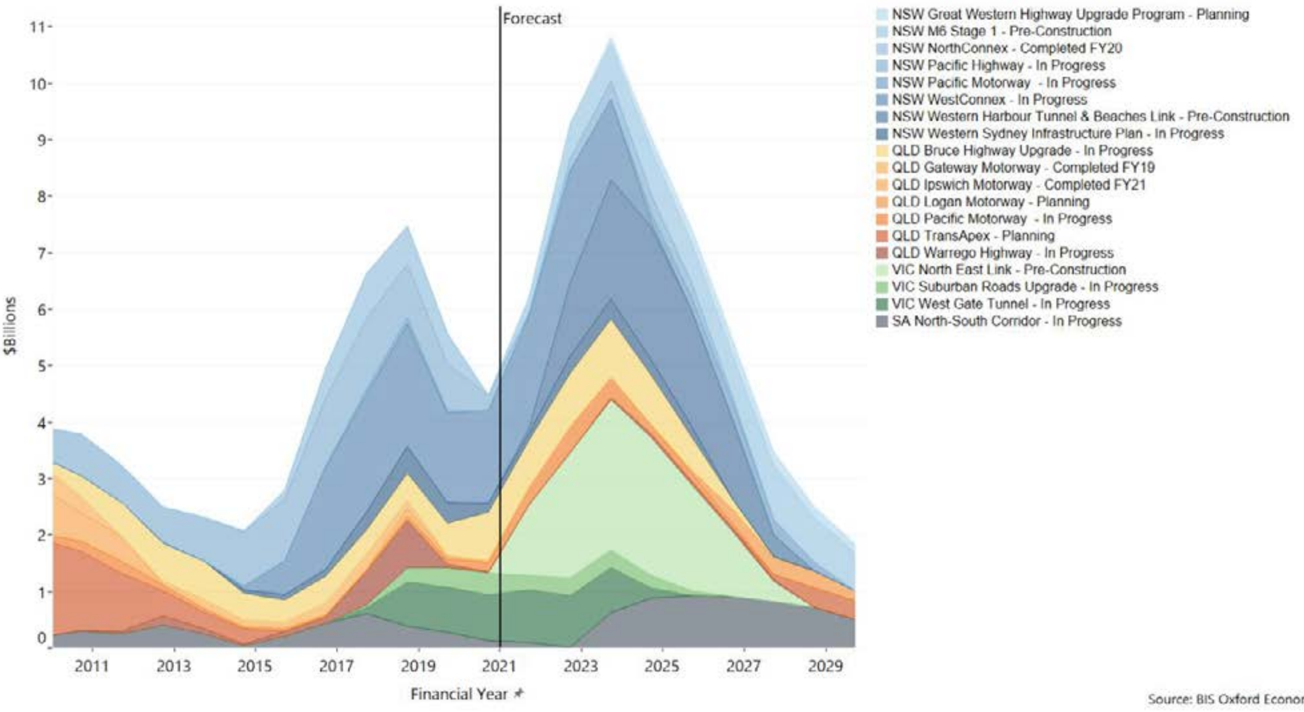
Roads Australia has commissioned research which highlights the growing importance of roads to our economy and our community.

Undertaken by BIS Oxford Economics, this study updates the 2019 report, "The Economic Impact of Australia's Roads", and includes an expanded discussion of the economic benefits of the road network in the context of the strong program of upcoming government investment.

Australian roads ensure the smooth-running of our daily lives while making a valuable contribution to our economy. The roads network is also an integral part of Australia's multi-modal transport network, although the full extent of this is not commonly understood. To better quantify the value of the road network, we adopt two approaches – an economic impact (input-output) and an economic welfare approach.

This includes, at the most general level, the fact that Australia's modern urban environment (and the productivity and employment benefits that flow from that) would not be possible without the existence of the road network.

F1 Estimated Work Done on Road Construction Projects Valued Over $2 Billion



Source: BIS Oxford Economics

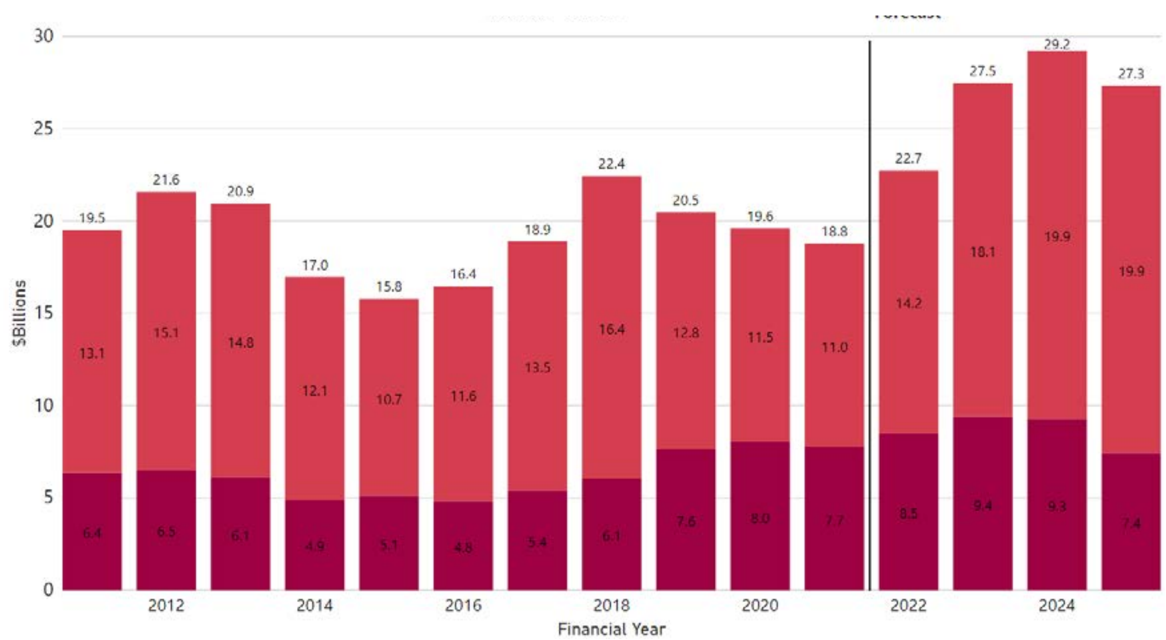
Furthermore, the road network is essential to connecting rail, sea, air and inland port facilities to their respective markets. Light rail and bus services as well as active transport (walk/run and cycle) are also facilitated by the road network – these forms of transport having their own benefits to health and the environment.

Australia's road network coverage is estimated at 877,651 kilometres, with an estimated 238 million kilometres travelled in 2019-2020 (or 12,100 kilometres per vehicle). The road network is responsible for the bulk of passenger travel in Australia (313 billion passenger kilometres, 2017-18), while the rail network handles the majority of the domestic freight task (413 billion tonne kilometres versus 224 billion tonne kilometres).

Australia is heading towards record high levels of road construction activity, driven by a strong program of Federal and State Government investment over the next five years. As illustrated in Figures 1 and 2, road construction activity is forecast to rise to a peak of $29.2 billion in 2023-24, comprised of 68% ($19.9 billion) in public investment.

The study finds that total employment in the road transport industry (both for-hire and in-house) is equal to **556,000 persons on a full-time equivalent basis in 2019-20 – directly accounting for 5.3% of Australian total employment**. Examining the indirect and induced effects of road transport via economic impact analysis indicates that the industry supports **1.4 million jobs** nationally in 2019-20.

F2 **Australian Road Construction Activity by Source of Funding**



Source: BIS Oxford Economics, ABS

For every $1 million invested in Australia's road construction industry:

- **7 workers are employed** in the road construction industry and related industries
- **$2.9 million output is contributed** to the economy, and
- **$1.3 million of value is added** to Australian GDP.

The value that roads deliver to the Australian community

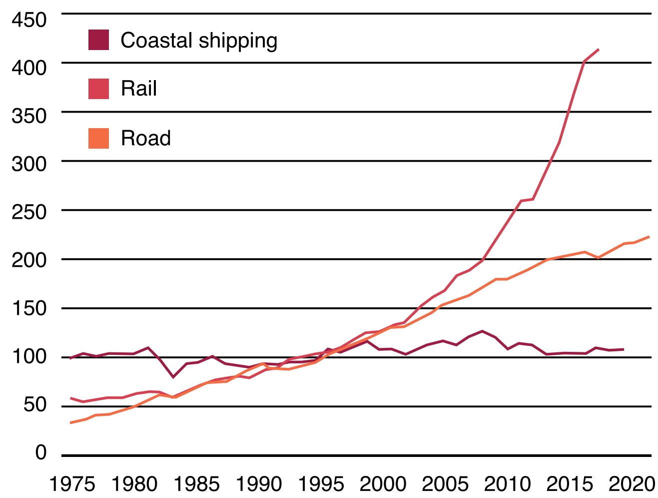
Road transport is a significant contributor to total economic activity as measured by its Gross Value Added (GVA). In the latest financial year of data (2019-20), the road transport industries are estimated to directly comprise **4.5% of total GVA, placing it near wholesale trade (4.2%) and retail trade (4.7%)**.

Over the next four years (2021-22 to 2024-25), the estimated expenditure on roads construction activity is equal to $106.8 billion. Correspondingly, this heightened level of expenditure will lead to the direct and indirect creation of approximately 722,000 jobs (on an annual FTE basis) over the next four years or an average of 181,000 FTE jobs per year.

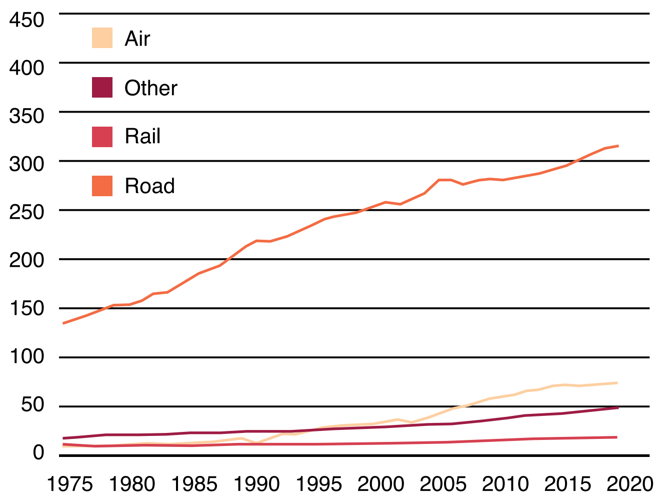
Road construction will further contribute **$306.2 billion** in output to the economy over the next four years (average of $76.5 billion per year) and will provide $138.6 million in value-add to Australian GDP over the next four years (average of $34.6 million per year).

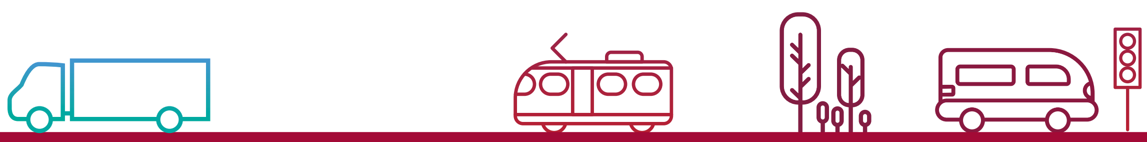
Road construction will further contribute $306.2 billion in output to the economy over the next four year

F3 **Australian Domestic Freight Task, by Mode of Transport**



F4 **Australian Domestic Passenger Task, by Mode of Transport**





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BIS OXFORD ECONOMICS

roads australia

2021 UPDATE: THE VALUE OF AUSTRALIA'S ROADS

AUGUST 2021

PREPARED FOR ROADS AUSTRALIA

BY BIS OXFORD ECONOMICS

BIS Oxford Economics

Effective March 1, 2017, UK-headquartered **Oxford Economics,** one of the world's foremost independent global advisory firms acquired a controlling stake in **BIS Shrapnel**. BIS Shrapnel, which had been in continuous operation since July 1, 1964 as a completely independent Australian owned firm with no vested interests of any kind — providing industry research, analysis and forecasting services — merged with the Australian operation of Oxford Economics. The new organisation is now known as BIS Oxford Economics.

Oxford Economics was founded in 1981 as a commercial venture with Oxford University's business college to provide economic forecasting and modelling to UK companies and financial institutions expanding abroad. Since then, we have become one of the world's foremost independent global advisory firms, providing reports, forecasts and analytical tools on 200 countries, 100 industrial sectors and over 3,000 cities. Our best-of-class global economic and industry models and analytical tools give us an unparalleled ability to forecast external market trends and assess their economic, social and business impact.

August 2021

To discuss the report further please contact:

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1. EXECUTIVE SUMMARY

BIS Oxford Economics has been commissioned by Roads Australia to provide an updated study on the economic and social value of the road network. This study updates our original research which formed the 2019 report, "The Economic Impact of Australia's Roads," and includes an expanded discussion of the economic benefits of the road network in the context of the strong program of upcoming government investment.

Australian roads ensure the smooth-running of our daily lives while making a valuable contribution to our economy. The roads network is also an integral part of Australia's multi-modal transport network, although the full extent of this is not commonly understood. To better quantify the value of the road network, we adopt two approaches – an economic impact (input-output) and an economic welfare approach. These two methods capture the economic and social benefits of the road network, including:

- The direct and indirect economic contribution of 'for-hire' and 'in-house' road transport services. These industries are responsible for the efficient transportation of goods and services across the country.

- The direct and indirect economic contribution of the road construction industry, including the employment and output that is supported by investment into road infrastructure.

- The consumer surplus (welfare measure) that persons derive from their usage of the road network, including the benefit that persons receive from road freight, postal services and public transport - and the flexibility of the road network in facilitating additional (marginal) journeys that would otherwise not have been taken for business or pleasure.

- The option value of the road network (i.e. the value of the options that are afforded by the road network, even if the road network is not directly used).

Australia's road network coverage is estimated at 877,651 kilometres[1], with an estimated 238 million kilometres travelled in 2019-20[2] (or 12,100 kilometres per vehicle). The road network is responsible for the bulk of passenger travel in Australia (313 billion passenger kilometres, 2017-18), while the rail network handles the majority of the domestic freight task (413 billion tonne kilometres versus 224 billion tonne kilometres).

Australia is heading towards record high levels of road construction activity, driven by a strong program of Federal and State Government investment over the next five years. As illustrated in Figures 1.1 and 1.2, road construction activity is forecast to rise to a peak of $29.2 billion in 2023-24, comprised of 68% ($19.9 billion) in public investment.

We estimate that total employment in the road transport industry (both for-hire and in-house) is equal to 556,000 persons on a full-time equivalent basis in 2019-20 – directly accounting for 5.3% of Australian total employment. Examining the indirect and induced effects of road transport via economic impact analysis indicates that the industry supports 1.4 million jobs nationally in 2019-20.

Road transport is a significant contributor to total economic activity as measured by its Gross Value Added (GVA). In the latest financial year of data (2019-20), we estimate the road transport industries

[1] The Bureau of Infrastructure, Transport, Regional Development and Communications, 2020. *Australian Infrastructure Statistics - Yearbook 2020*.
[2] Australian Bureau of Statistics, 2020. *Annual Survey of Motor Vehicle Use, Australia (Cat. No. 9208.0)*

directly comprise 4.5% of total GVA, placing it near wholesale trade (4.2%) and retail trade (4.7%) but below mining (11.6%) and construction (7.9%). This corresponds to $74.2 billion in direct value-add to the economy. As with employment, the economic impact analysis allows us to examine indirect and induced effects of road transport, which we find to equal $163 billion (for a combined $236 billion).

Figure 1.1 Estimated Work Done on Road Construction Projects Valued Over $2 Billion

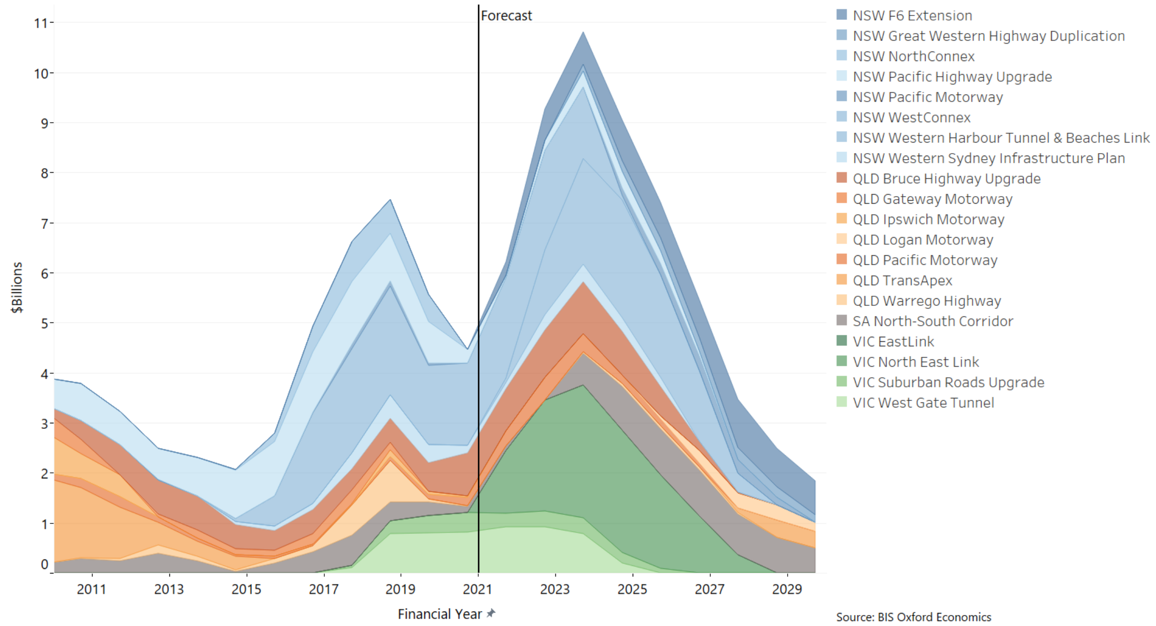
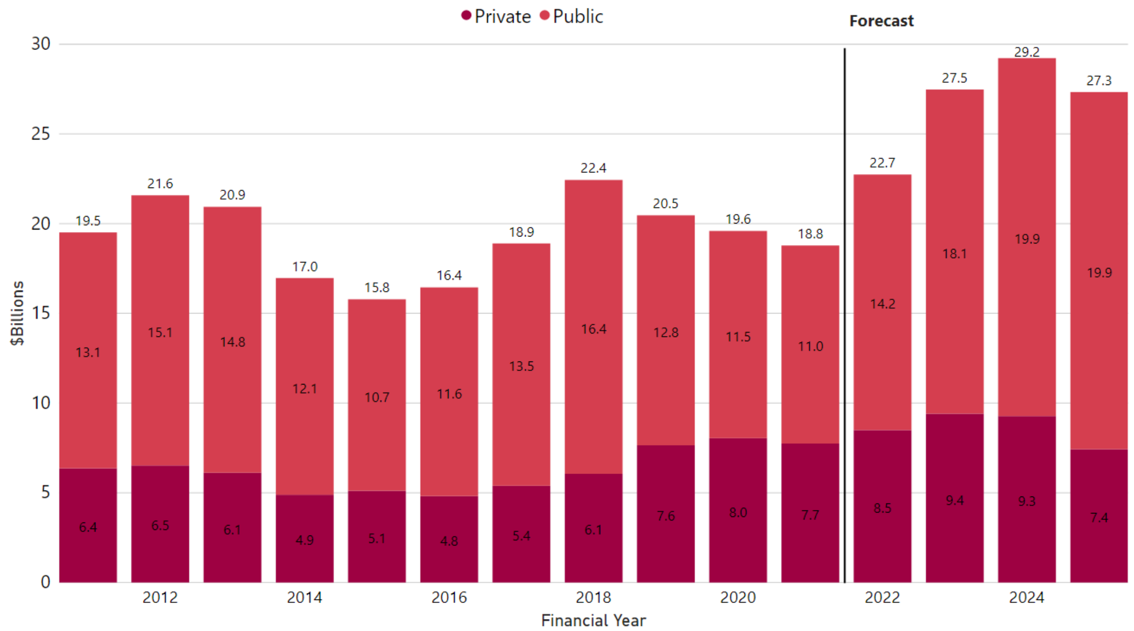


Figure 1.2 Australian Road Construction Activity by Source of Funding



Source: BIS Oxford Economics, ABS

In terms of the economic benefits of road construction activity, we estimate that for every $1 million invested in the Australian road construction industry:

- 7 workers are employed in the road construction industry and related industries
- $2.9 million output is contributed to the economy, and
- $1.3 million of value is added to Australian GDP

Over the next four years (2021-22 to 2024-25), the estimated expenditure on roads construction activity is equal to $106.8 billion. Correspondingly, this heightened level of expenditure will lead to the direct and indirect creation of approximately 722,000 jobs (on an annual FTE basis) over the next four years or an average of 181,000 FTE jobs per year. Road construction will further contribute $306.2 billion in output to the economy over the next four years (average of $76.5 billion per year) and will provide $138.6 million in value-add to Australian GDP over the next four years (average of $34.6 million per year). This is summarised, and split by public and private expenditure, in Table 1.1.

Table 1.1 Total Economic Effects of Road Construction Investment (2021-22 to 2024-25)

Economic Contribution (Average per Year, 2021-22 to 2024-25) Road Construction				
Public Investment				
Type	**Direct (FTE/$m)**	**Indirect (FTE/$m)**	**Induced (FTE/$m)**	**Total (FTE/$m)**
Employment	25,722	51,281	45,018	122,021
Output	18,037	18,871	14,816	51,724
GVA	7,475	8,081	7,858	23,414
Private Investment				
Employment	12,342	24,605	21,600	58,547
Output	8,654	9,055	7,109	24,818
GVA	3,587	3,877	3,770	11,234
Total				
Employment	38,064	75,886	66,619	180,568
Output	26,691	27,926	21,924	76,541
GVA	11,062	11,959	11,628	34,648

Table Notes: These figures are based off BIS Oxford Economics forecasts for public and private road construction expenditure between the years 2021-22 and 2024-25.

Source: BISOE, ABS

The second method of valuing Australia's roads examines the consumer surplus that users of the network receive. We find that passenger cars and motorcycles provide $78.1 billion in surplus, road freight provides $49.6 billion in surplus and bus transport (with an included option value) provides $5.3 billion in surplus. This sums to a total surplus of $133 billion in 2019-20 (shown in Table 1.2), which is remarkably similar to the surplus that was estimated in 2017-18. This is surprising given the decline in passenger car and motorcycle surplus due to the COVID-19 lockdowns in the June quarter of 2020, but the increased surplus of road freight since 2017-18 has covered the decline.

Table 1.2 Total Value of Roads – Welfare Approach

Value of Roads Economic Welfare Approach	
Consumer Surplus	**$Millions**
Passenger Car and Motorcycle	78,052
Road Freight	49,617
Bus Transport	3,438
Total	**131,108**
Option Value (Bus Transport)	1,848
Total Economic Welfare Value	**132,956**

However, there are a range of additional benefits afforded by the road network that would require more advanced literature to fully quantify. This includes, at the most general level, the fact that Australia's modern urban environment (and the productivity and employment benefits that flow from that) would not be possible without the existence of the road network. Furthermore, the road network is essential to connecting rail, sea, air and inland port facilities to their respective markets. Light rail services and active transport (walk/run and cycle) are also facilitated by the road network – these forms of transport having their own benefits to health and the environment.

In terms of social benefits, we note that the road network plays an essential role in enabling the delivery of essential services. The connectivity of the road network allows for the formation of communities, which in-turn have their own intrinsic social value. The economic welfare approach also doesn't consider the surplus that an individual gains from road travel without consuming it (e.g., receiving visits from family/friends or being a passenger in a vehicle).

An additional and quantifiable dimension to the value of connectivity that the road network provides are termed Wider Economic Benefits (WEBs). The WEBs first identified by the UK Department for Transport include the productivity benefits from an agglomerated economy, lower transport costs (which produce a social welfare gain) and higher tax revenues from increased employment.

"WEBs are improvements in economic welfare that are acknowledged, but that have not been typically captured, in traditional cost-benefit analysis"

– *Australian Transport Assessment and Planning Guidelines*

WEBs are a relative measure of the economic value provided by the reduced travel times of a road project and as such can't be extended to valuing the entire network. Further, the usage of WEBs in traditional cost-benefit analysis remains somewhat contentious in Australia – the benefits follow legitimate economic theory and empirical evidence has been found to support these claims. However, the controversy lies with the size of these effects, particularly due to the relative youth of research and the ability for WEBs to significantly improve the Benefit Cost Ratio (BCR) of a given project.

2. INTRODUCTION

2.1 Background to Study

BIS Oxford Economics has been commissioned by Roads Australia to provide an updated study on the economic and social value of the road network. This study updates our original research which formed the 2019 report, "The Economic Impact of Australia's Roads," and includes an expanded discussion of the economic benefits of the road network in the context of the strong program of upcoming government investment.

Broadly, the road network facilitates the transportation of people, goods and services. However, this broad definition short-changes the strategic importance of the road network in facilitating a multi-modal network and the resultant economic and social value. The total value of Australia's roads includes its:

- 'Last mile' role in connecting rail, sea, air and inland port facilities to markets
- Flexibility in facilitating marginal journeys that would not have otherwise been taken for business
- Flexibility in facilitating marginal journeys that would not have otherwise been taken for pleasure
- Important enabling role for health and other essential services
- Enabling of light rail, coach and bus services which are intrinsic to public transport provision
- Enabling of active transport including walking and cycling
- Providing connectivity to areas where rail is not feasible, including regional and remote communities

Furthermore, as highlighted by the Federal Government's National Economic Recovery Plan and the associated $110 billion 10 Year Infrastructure Plan, the construction of road infrastructure is an essential driver of direct and indirect economic activity.

Beyond the benefits highlighted above, there are also wider economic benefits created by the transport time savings from the road network. This includes agglomeration economies – the increase in productivity following a reduction in travel times between urban employment areas – and other wider benefits on employment, induced investment and increased output due to the road network.

2.2 Report Coverage

The focus of the report is to provide an examination of the economic and social contributions of the road network. We adopt two well-established and robust approaches: economic impact analysis with input-output tables that form part of the National Accounts and economic welfare analysis based on the estimated size of consumer welfare from the road network.

However, before discussing the results of these approaches, we include the current size and uses of the road network in Section 3, which are used as inputs into the models described above. Additionally, we discuss the upcoming growth in road construction activity due to the strong program of publicly funded works. Section 4, 5 and 6 then provide our estimates and the basis behind them for the value of the road network, including:

- **Economic impact of road transport**: input-output analysis examining the contribution of the for-hire and in-house road transport industries to employment and output in the economy (Section 4).
- **Economic impact of road construction**: input-output analysis examining the contribution of road construction to employment and output in the economy. We generate an estimate of potential economic benefits from the strong levels of investment over the next four years (Section 4).
- **Economic welfare of road network**: analysis of the value ('consumer surplus') that individuals gain from using the road network, split by passenger vehicles & motorcycles, road freight and public transport. Additionally, we include a key benefit of the road network – the 'option value' – which is the benefit that individuals gain from access to roads or public transport even if they are not used (for instance, people are provided the option to reside away from large population hubs due to road networks). There is limited research on this in Australia but we appropriate estimates from the United Kingdom on the option value of bus transport (Section 5).
- **Wider Economic Benefits**: a discussion on the value of wider economic and social benefits of the road network. This includes a review of current practices used to estimate the wider economic benefits of a road project and how these figures fit in with traditional cost-benefit analysis.

3. AUSTRALIA'S ROAD NETWORK & CONSTRUCTION ACTIVITY

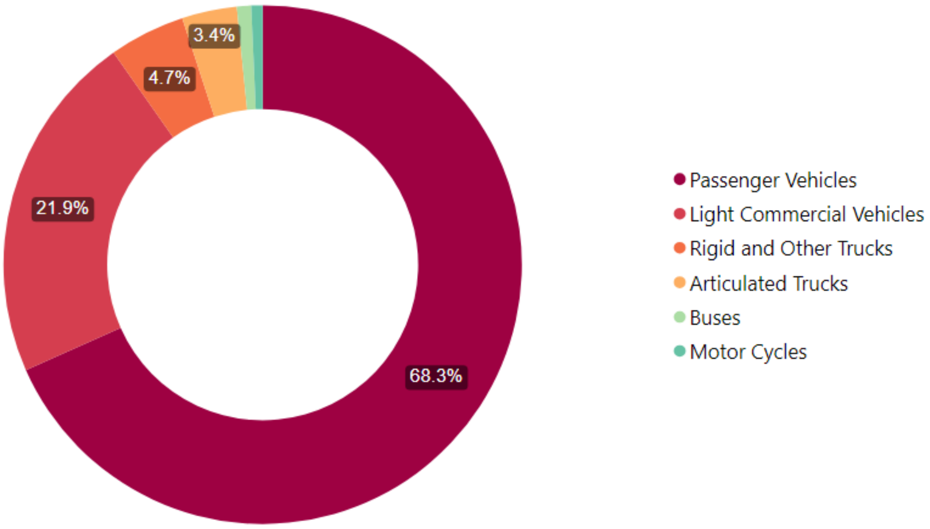
This section establishes the size of Australia's road network and provide the latest figures on the social and economic uses of the network. Furthermore, this section highlights recent historical trends in road construction and the significant program of public road investment planned for the next five years.

3.1 Australia's Road Network

The total road network coverage in Australia is estimated at 877,651km[3], with 83% of the coverage located in non-urban localities.

The Australian Bureau of Statistics (ABS) *Annual Survey of Motor Vehicle Use* indicates a steady rise in the number of vehicles in use over the past decade[4]. In total, there is a recorded 19.8 million motor vehicles in use in 2019-20, a rise of approximately 800,000 compared to 2017-18. Among these vehicles, there is an estimated 238 million kilometres travelled for an average of 12.1 thousand kilometres per vehicle in 2019-20.

Figure 3.1 Modal Share of Kilometres Travelled in Australia, 2019-20



Source: BIS Oxford Economics, ABS *Survey of Motor Vehicle Use, 2019-20*

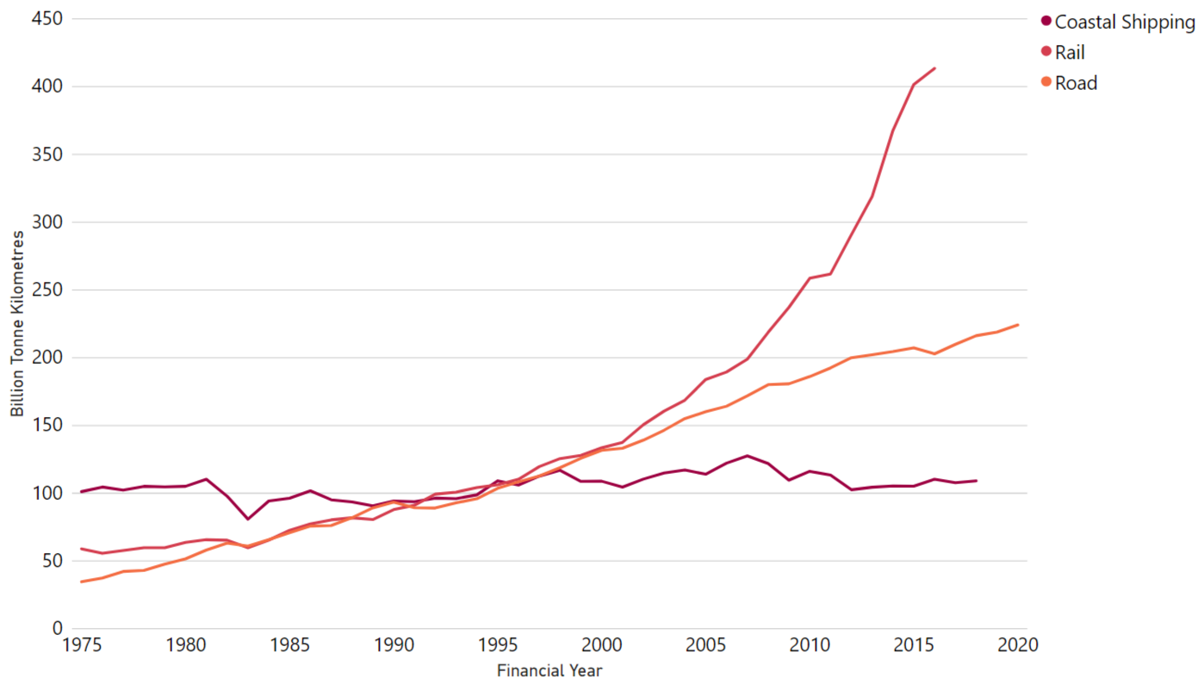
The impact of COVID-19 is captured in the latest figures on motor vehicle usage – the 2019-20 data includes the impact of lockdowns in the June quarter of 2020. The most apparent outcome is the reduction in kilometres travelled for passenger vehicles and motorcycles without a corresponding decrease among commercial vehicles. As illustrated in Figure 3.1, passenger vehicles account for 68% of total kilometres travelled (down from 71% in 2017-18) and were mostly driven for personal and other use (54%) followed by travel to and from work (27%) and travel for business purposes (19%).

The road network is responsible for the bulk of passenger travel in Australia, while the rail network handles the majority of the domestic freight task. Rail freight, as highlighted in Figure 3.2, has seen a

[3] BITRE (ibid, p4)
[4] ABS (ibid, p4)

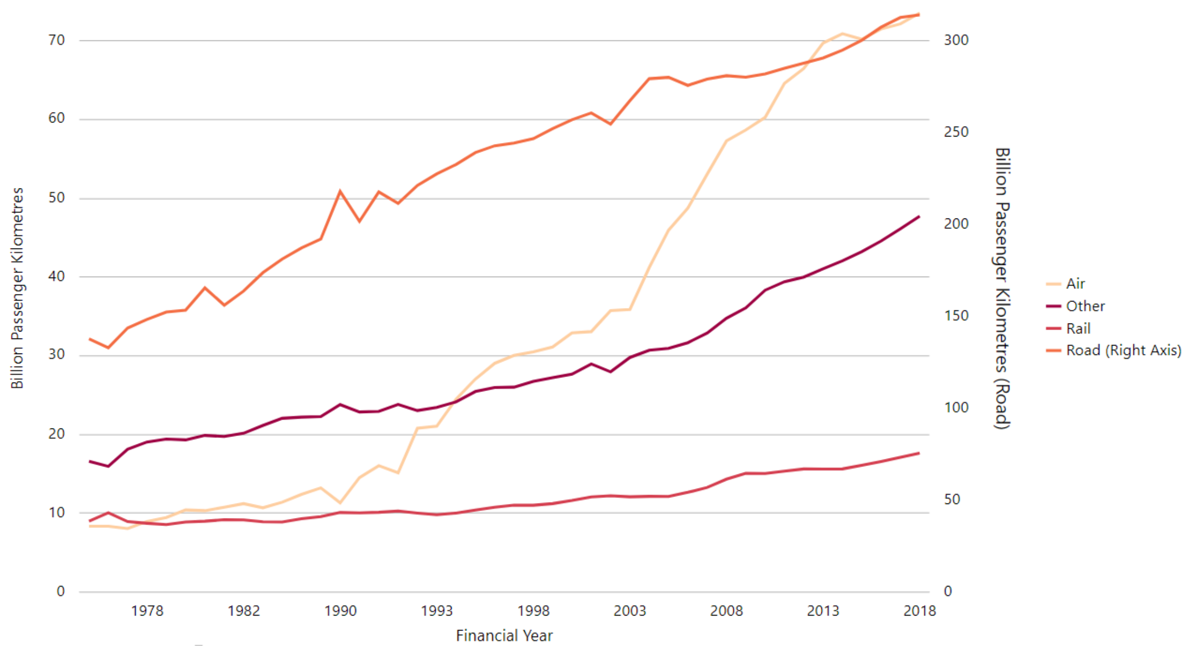
steep rise over the past two decades – accounting for 57% of the total domestic load in the most recent year of data (2015-16). That said, the use of road for domestic freight has continuously risen since the 1990's (excluding a small decline in 2015-16) to a value of 224 billion tonne kilometres in 2019-20.

Figure 3.2 Australian Domestic Freight Task, by Mode of Transport



Source: BIS Oxford Economics, BITRE *Australian Infrastructure Statistics – Yearbook 2020*

Figure 3.3 Australian Domestic Passenger Task, by Mode of Transport



Source: BIS Oxford Economics, BITRE *Australian Infrastructure Statistics – Yearbook 2020*

The usage of the road network as a means for transporting people far outweighs other modes of travel. In the latest year of data (2017-18), the total passenger kilometres travelled by road were 314 billion – more than twice the passenger kilometres of all other modes of transport combined. Furthermore, as stated in the original study, these figures do not include the increasing use of active transport (e.g. cycling and walking) which are facilitated by the road network and the rail figures include the tram network which is also facilitated by the road network.

3.2 Record Levels of Public Transport Infrastructure Investment

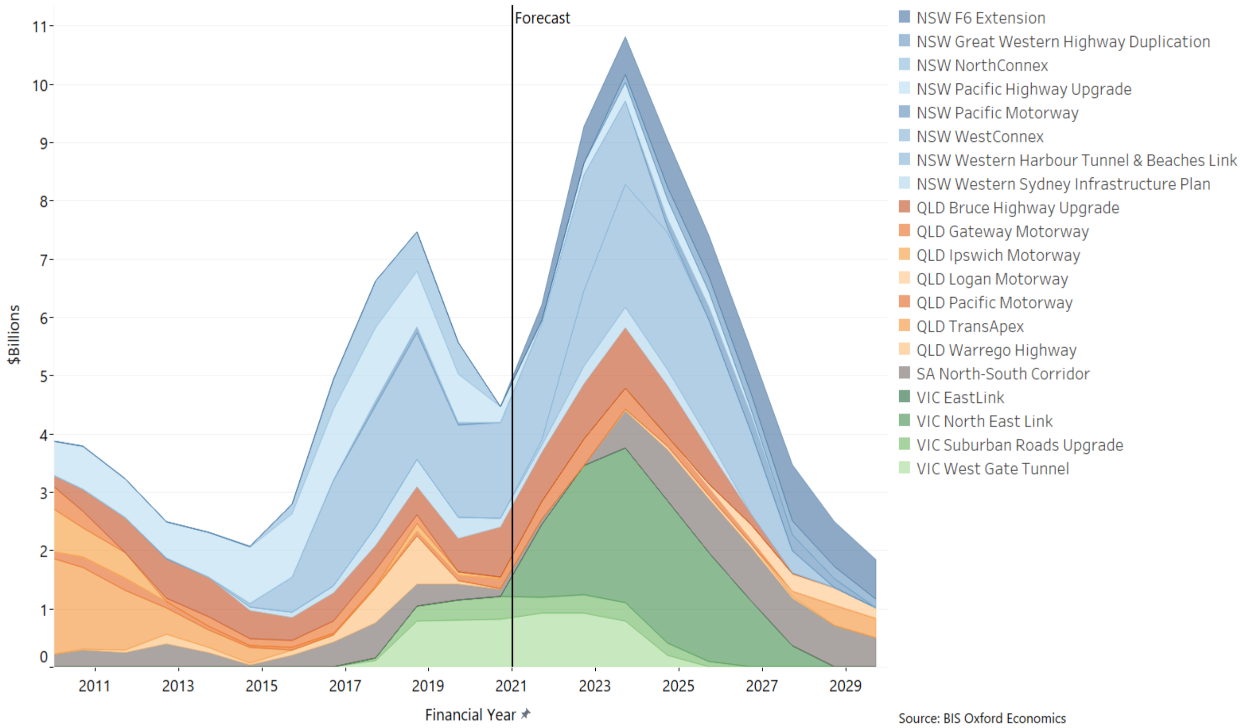
Australia is heading towards record high levels of public transport infrastructure construction, driven by a strong program of Federal and State Government investment over the next five years. Within this program of works, many of the infrastructure projects were budgeted and approved prior to the outbreak of COVID-19 – highlighting the need for improvements to the road network to account for strong population growth and rising urban congestion. As a consequence, increased investment in the road network will provide productivity and social benefits across the nation.

The outbreak of COVID-19 and the associated 'infrastructure-led recovery' has only expedited public expenditure on road projects. As illustrated in Figures 3.4 and 3.5, BIS Oxford Economics forecasts road construction activity to rise to a peak of $29.2 billion in 2023-24, comprised of 68% ($19.9 billion) in public investment.

The importance of the construction industry as a means to support employment and drive growth is evident in the Federal Government's $110 billion 10-year infrastructure program that forms part of their National Economic Recovery Plan.

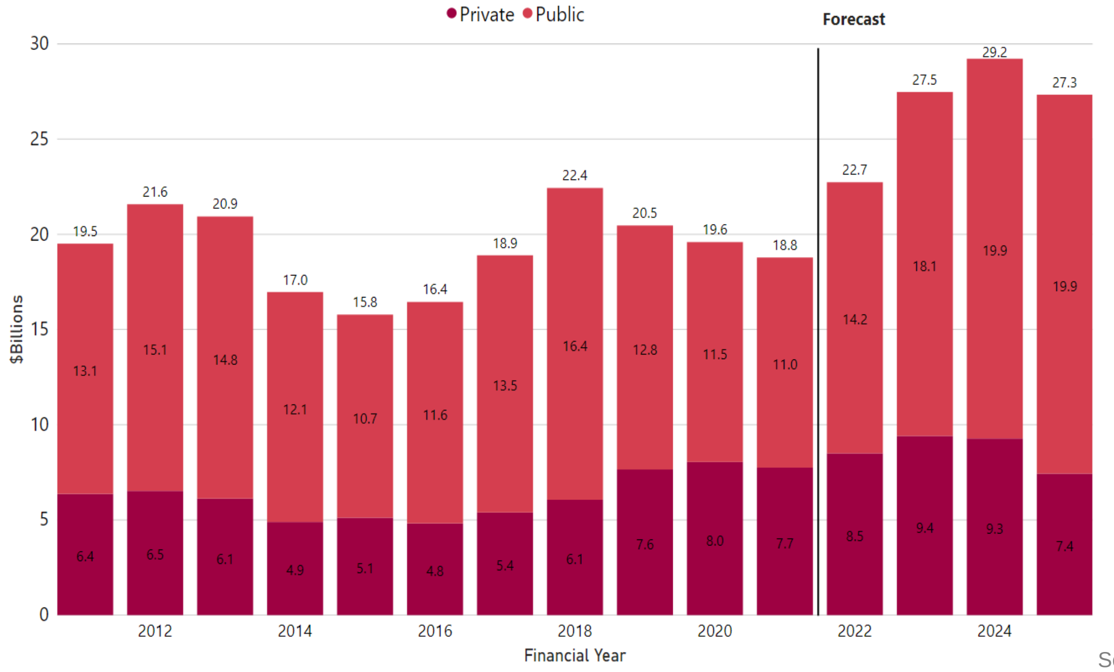
This is in addition to individual state spending – the major east coast states in the most recent 2021-22 budgets are expected to spend record amounts on infrastructure construction. From largest to smallest, NSW has budgeted for a spend of $109 billion on infrastructure (62% on transport), Victoria has budgeted for an infrastructure spend of $78 billion and Queensland has budgeted for a spend of $52 billion over the next four years.

Figure 3.4 Major Road Projects in Australia Valued Over $2 Billion



Source: BIS Oxford Economics

Figure 3.5 Road Construction Activity by Source of Funding



Source: BIS Oxford Economics, ABS

4. ECONOMIC BENEFITS OF ROADS – INPUT OUTPUT APPROACH

This section examines the economic benefits of the Australian road networks across two dimensions. First, we provide an update of the economic contribution of the road transport industry (including the use of in-house transport services within other industries) based from the latest employment and national accounts data. Second, we examine the expected economic impact of the historic rise in road investment (as detailed in Section 3) and associated construction activity over the next five years. Unless otherwise stated, all dollar figures are presented in constant prices base year 2018-19.

4.1 Measuring the Economic Contribution of Roads

The standard approach for estimating the economic contribution of an industry is to employ the supply-use tables which form part of the National Accounts. The supply-use tables provide estimates of the value of inputs from each industry to the output of all industries (i.e. indicating how much a particular industry contributes to the output of another industry).

With respect to road transport, the for-hire sector is included within the transport, postal and warehousing industry division (Division I) in the National Accounts. However, these estimates do not include the economic contribution of in-house transport within each industry. The need to include an estimate for 'in-house' transport is highlighted by the previous study: the economic contribution of these services was estimated to be larger than the for-hire industry.

We are able to separately estimate the economic contribution of the 'in-house' transport industries using the Australian Bureau of Statistics Experimental Transport Satellite Account, 2010-11 to 2015-16 (cat. no. 5270.0) released in October 2018. This release created four in-house transport industries (road, rail, sea and air) in addition to the existing for-hire industries to extend the input-output tables that are captured in the National Accounts. We provide further detail on the methodology used to create the estimates in Appendix A – including a summary on how the model was updated from the original study to create the most up-to-date estimates of the road transport industry.

4.2 Current Size of the Roads Industry

This section provides estimates of the employment and value-add contribution of the road network. These estimates are separate from the economic contribution of road construction activity which will be addressed in Section 4.3.

4.2.1 Employment

The road industry is estimated to have employed 556,000 persons on a full-time equivalent (FTE) basis in 2019-20. This is comprised of an estimated 308,000 (55%) persons for the in-house industry and 248,000 (45%) persons in the for-hire industry.

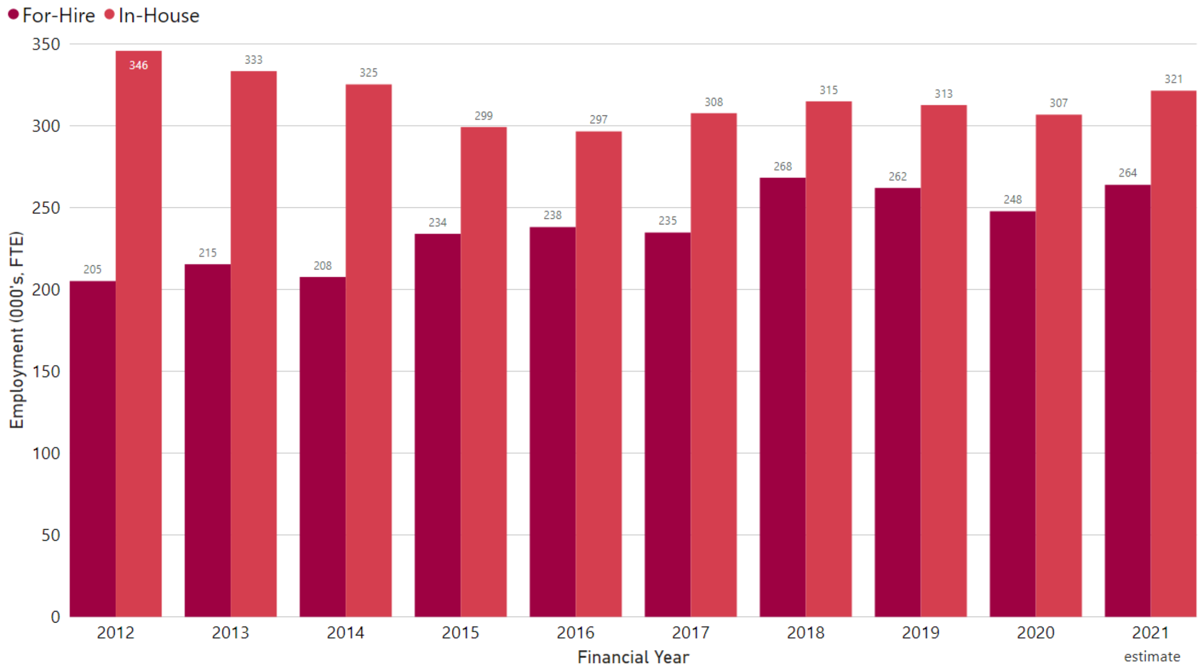
This employment figure represents a small decline of approximately 30,000 persons from 2018-19, depicted in Figure 4.1. As per the ABS Labour Force Quarterly Survey (cat. no. 6291.0), the annual decline in employment is driven by a large fall in the last quarter of the financial year (May 2020)[5] -

[5] The ABS Labour Force Quarterly Survey differs from other estimates of economic activity – it is a survey and thus estimates the level of employment at a specific point in time (in this case, the months of August, November, February and May). We use the moving annual average of the May release to generate financial year estimates of employment.

for-hire industry employment falls by over 50,000 persons. This appears to be a clear repercussion of the COVID-19 outbreak, but we note that employment in the industry was still sitting above average over the past decade.

Furthermore, we find that the following quarter of data (August 2020) shows a near equal rebound in employment, likely a consequence of the Federal Government's JobKeeper stimulus measure which was introduced in June 2020. To provide increased clarity around the effect of COVID-19 on the transport industry, we have included an estimate for 2020-21 employment. This is based on three quarters of employment and value-add data (at the time of this report)[6]. Overall, we anticipate employment to rebound to levels seen prior to the outbreak of COVID-19, reaching 587,000 persons in 2020-21.

Figure 4.1 Road Industry Employment (000's, FTE's)



Source: BIS Oxford Economics, ABS

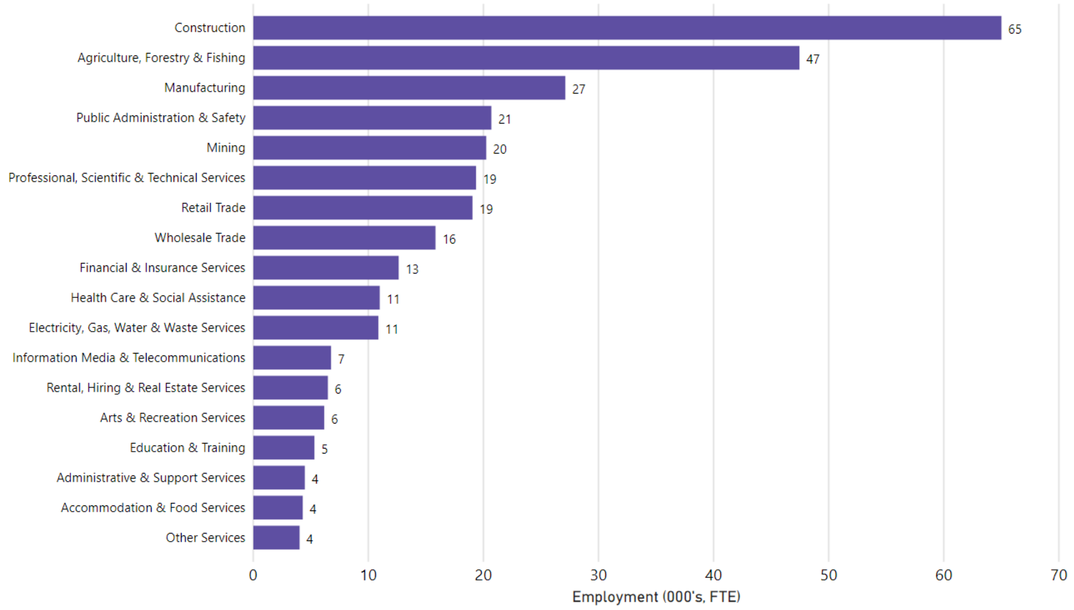
As with the original study, the industries which require significant transportation of goods (for instance, construction, agriculture, manufacturing and retail trade) are the largest sources of in-house road employment. In-house construction transport remains the largest source of employment with approximately 68,000 full-time equivalent workers in 2019-20, followed by agriculture, forestry and fishing with 50,000 persons (depicted in Figure 4.2). Overall, road transport directly accounts for 5.3% of Australian full-time equivalent employment in 2019-20.

We also explore the broader employment benefits of the road industry - examining the indirect and induced effects of the industry based on input-output multipliers. Direct effects on employment are those individuals that are working within the road transport industries, whereas indirect effects are the employment (and value-add, see Section 4.2.2) required by upstream and downstream industries to facilitate the current level of roads activity. Finally, induced effects are the increased household income associated with employment (direct and indirect), a proportion of which will be spent on goods and services.

[6] Gross Value Added (GVA) by industry is used to estimate the proportion of in-house transport employment, whereas for-hire employment is captured by the ABS in their quarterly labour force survey.

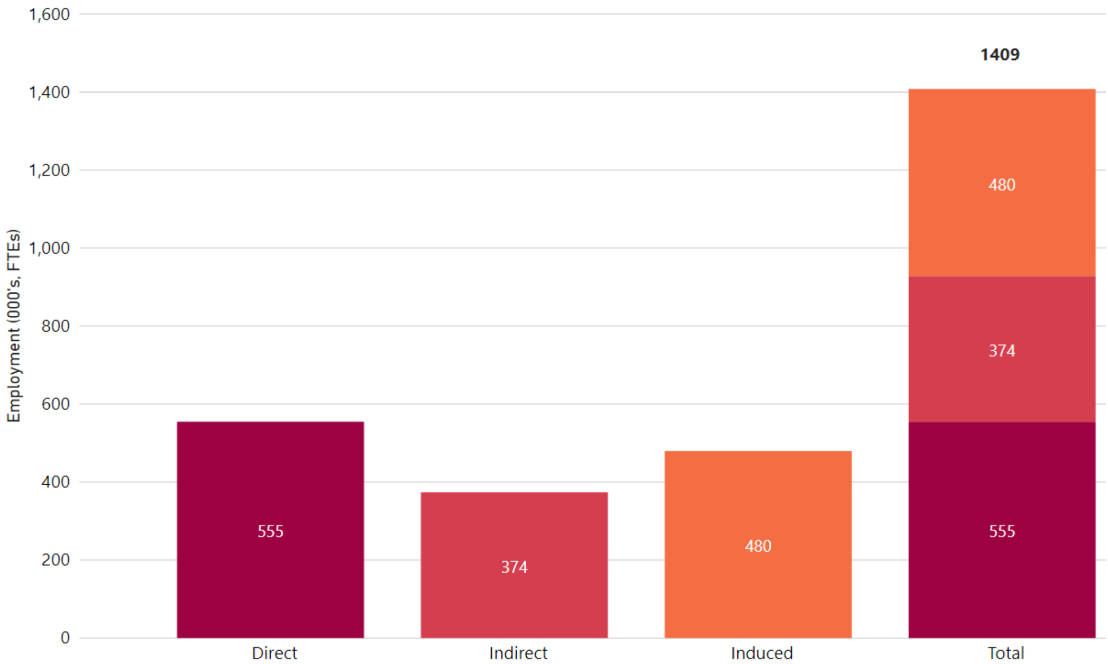
To summarise, the road transport industry is estimated to support 1.4 million jobs nationally in 2019-20 (highlighted in Figure 4.3). As stated above, this is comprised of 556,000 (40%) persons directly employed in for-hire and in-house road industries and 832,000 (60%) persons indirectly supported by road transport.

Figure 4.2 In-House Road Employment by Industry (000's, FTE), 2019-20



Source: BIS Oxford Economics, ABS

Figure 4.3 Total Employment Effects of Roads Industry, 2019-20



Source: BIS Oxford Economics, ABS

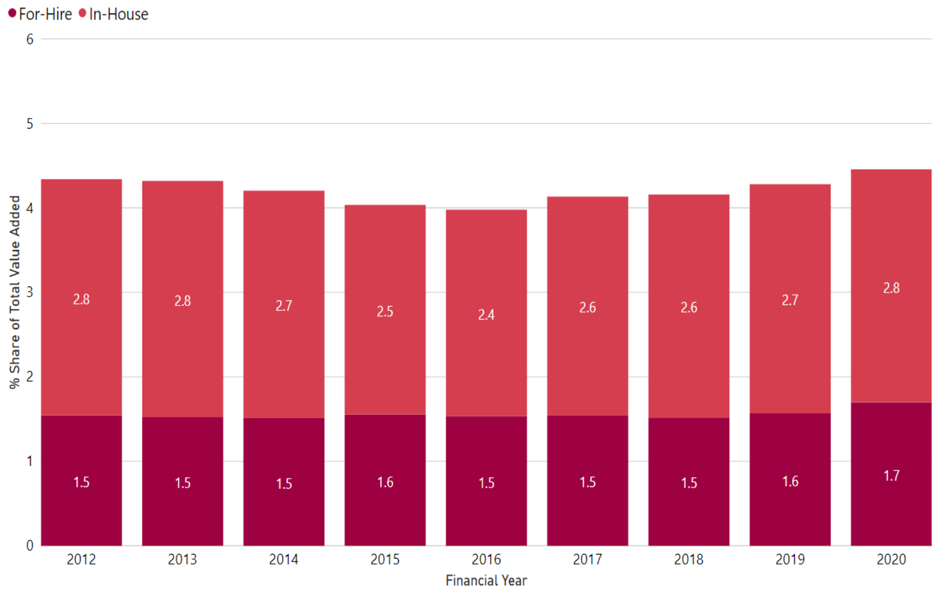
4.2.2 Gross Value Added

Road transport is a significant contributor to total economic activity as measured by the Gross Value Added (GVA). In the latest financial year of data (2019-20), we estimate the road industries to directly comprise 4.5% of total GVA, with for-hire and in-house accounting for 1.7% and 2.8% respectively. In terms of economic contribution, this places the road industry close to wholesale trade (4.2%) and retail trade (4.7%) but below the mining (11.6%) and construction (7.9%) industries.

The input-output approach allows us to assess the value-add contribution of in-house road transport for each industry. This is presented in Figure 4.5, wherein we find that the road industry contributes the most to the value-add of the construction ($9.4 billion) and mining ($7.4 billion) industries.

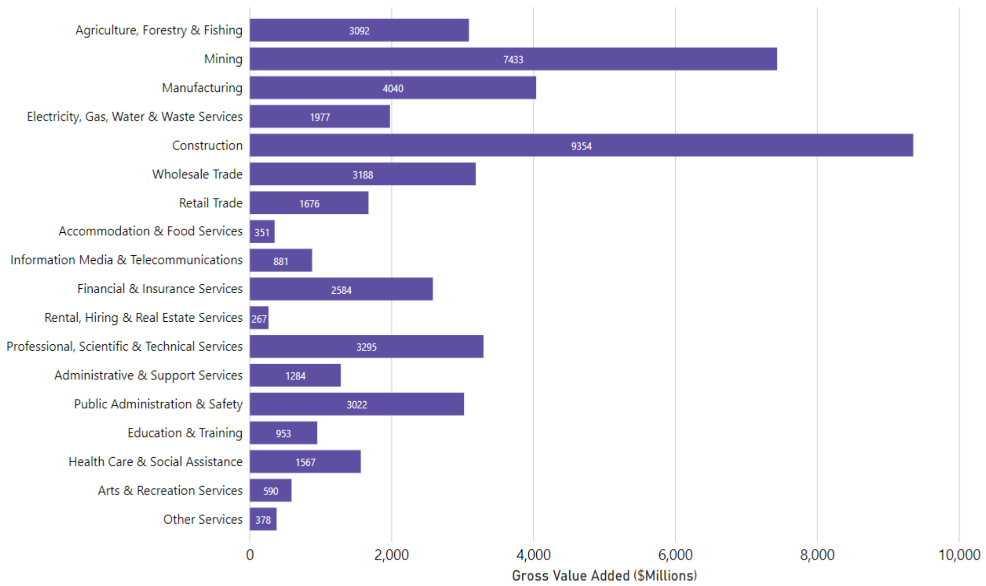
Finally, we examine the direct and indirect contributions of the roads industry. The indirect contributions to value-add are defined the same as employment in the previous section. The total economic value of the roads industry in 2019-20 is valued at $236 billion, comprised of $74 billion in direct effects and $163 billion in indirect effects, illustrated in Figure 4.6.

Figure 4.4 Road Industry Share of Australian Gross Value Added



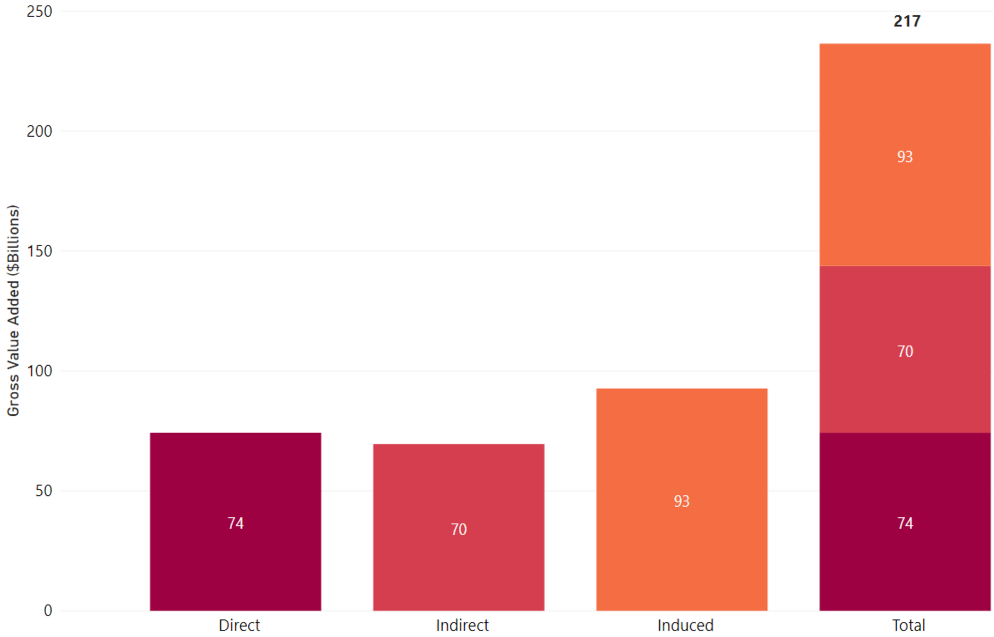
Source: BIS Oxford Economics, ABS

Figure 4.5 In-House Road Industry Usage Across Industries, 2019-20



Source: BIS Oxford Economics, ABS

Figure 4.6 Total Economic Effects of the Roads Industry, 2019-20



Source: BIS Oxford Economics, ABS

4.3 Economic Contribution of Road Investment

As discussed in Section 3.2, road construction is expected to grow from an estimated $18.8 billion in 2020-21 to a peak of $29.2 billion in 2023-24[7]. This is driven by a plethora of public sector investment into the road network – by 2023-24 the level of publicly funded activity is forecast to surpass the current total level (public and privately funded) of road construction activity. Publicly funded road constructoin activity is forecast to rise from $11 billion in 2020-21 to $19.9 billion in 2023-24.

We examine the broader economic impacts of these record levels of public investment into road construction by the use of the national input-output accounts. This is a similar approach to examining the impacts of the road transport industry, although we now shift the focus to the direct and indirect impacts of road construction activity.

We note that the latest input-output tables (2018-19) do not provide enough granularity to specifically examine the road construction industry and as such we use the 'Heavy and Civil Engineering Construction' industry as a proxy[8]. We believe that the economic multipliers associated with the civil construction sector (i.e. not including building construction) will provide the most accurate proxy for road construction due to likely similarities in the input and output structures.

Given the above, we estimate that for every $1 million invested in the Australian road construction industry:

[7] The estimates for 2020-21 for road construction activity are based on three quarters of available data from the Australian Bureau of Statistics Engineering Construction Release (cat. no. 8762.0).
[8] The 'Heavy and Civil Engineering Construction' industry includes all civil construction (i.e. public infrastructure excl. buildings, heavy industry and mining). We estimate that road construction is responsible for approximately 20-25% of total production within the civil engineering industry in 2018-19 using the ABS release, 'Australian National Accounts: Input-Output Tables (Product Details). Input-output analysis examines the multiplying effect of expenditure on across the economy and it is not possible (without unwieldy assumptions) to isolate the full impacts of road construction despite knowing the share of total production.

- 7 workers are employed in the road construction industry and related industries
- $2.9 million output is contributed to the economy, and
- $1.3 million of value is added to Australian GDP

Over the next four years (2021-22 to 2024-25), BIS Oxford Economics forecasts expenditure on roads construction activity equal to $106.8 billion. Correspondingly, this heightened level of expenditure will lead to the direct and indirect creation of approximately 722,000 jobs (on an annual FTE basis) over the next four years or an average of 181,000 FTE jobs per year. Road construction will further contribute $306.2 billion in output to the economy over the next four years (average of $76.5 billion per year) and will provide $138.6 million in value-add to Australian GDP over the next four years (average of $34.6 million per year). This is summarised, and split by public and private expenditure, in Table 4.1.

We note that this analysis requires the assumption that the technology (i.e. input-output structure) of the road construction industry stays constant since the most recent national accounts which these figures are based (2018-19). There are further assumptions required when examining the economic contribution of an industry using input-output analysis, which are discussed in Appendix A.

Table 4.1 Total Economic Effects of Road Construction Investment (2021-22 to 2024-25)

Economic Contribution (Average per Year, 2021-22 to 2024-25) Road Construction				
Public Investment				
Type	**Direct (FTE/$m)**	**Indirect (FTE/$m)**	**Induced (FTE/$m)**	**Total (FTE/$m)**
Employment	25,722	51,281	45,018	122,021
Output	18,037	18,871	14,816	51,724
GVA	7,475	8,081	7,858	23,414
Private Investment				
Employment	12,342	24,605	21,600	58,547
Output	8,654	9,055	7,109	24,818
GVA	3,587	3,877	3,770	11,234
Total				
Employment	38,064	75,886	66,619	180,568
Output	26,691	27,926	21,924	76,541
GVA	11,062	11,959	11,628	34,648

Table Notes: These figures are based on BIS Oxford Economics forecasts for public and private road construction expenditure between the years 2021-22 and 2024-25.

Source: BISOE, ABS

5. ECONOMIC WELFARE APPROACH

5.1 Background

The previous section looked at the economic impact of the road network - covering the employment and value-add benefits of for-hire road transport, in-house road transport and finally, the road construction industry. This does not provide an estimate for the benefits that consumers gain from the road network[9], in which case we turn to an economic welfare approach. This welfare approach provides an estimate of the road network's value to consumers based on their consumer surplus. Additionally, the welfare approach allows for the valuation of "externalities" (or third-party effects) which arise even when no goods or services are directly traded. This is discussed at the end of this section.

This welfare approach is a method of valuing a good or service by aggregating the benefit (consumer surplus) that each individual gains from using the road network. As such, the figures are not interchangeable with those in Section 4, which presents the contribution of the road network to employment and output over the entire economy.

Unless otherwise stated, all figures are in constant prices, with the base year 2018-19.

5.2 Consumer Surplus

Consumer surplus is a key measure in assessing the value of commodities to society based on the welfare they provide to consumers. Consumer surplus refers to the difference between what users pay for a good or service and what they are willing to pay (WTP) for it. For example, a private road user may be WTP $30 for a trip which only costs her $10. Her consumer surplus is $20. Consumer surplus therefore effectively represents a consumer's "profit" – how much they gain from using a commodity in net terms. The sum of all of the consumer surpluses for individual users adds up to the total consumer surplus for society as a whole for road usage.

Consumer surplus (CS) can be estimated using a demand curve relating prices and quantities consumed and data on "price elasticities"[10]. Price elasticities measure the responsiveness of a good or service to a change in price. For example, a price elasticity of 1.0 for road usage means that a 1% increase in the road usage price is associated with a 1% decrease in demand for usage. An elasticity of 0.5 means a 1% increase in price is associated with a 0.5% decrease in demand (known as inelastic demand) while an elasticity of 1.5 means a 1% increase in price is associated with an 1.5% increase in usage.

In essence, a simplified formula for assessing the value of consumer surplus using a linear (straight line) demand curve is:

CS = (Total cost*0.5)/(Elasticity)

While this is likely to form a lower bound value for consumer surplus, it is nonetheless useful in getting a first order approximation of the consumer surplus associated with a given good or service.[11]

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[9] In this context, a consumer is an individual who uses Australia's road network.

[10] For a technical discussion of this see Chapter 4 of Boardman, A., Greenberg, D., Vining, A. and Weimer, D., Cost Benefit Analysis: Concepts and Practice, Fifth Edition, 2018

[11] Technically speaking, models specified in logs (e.g. double log models) can often yield closer approximations to industry demand curves and higher values for CS. However, analysis can "linearise the demand curve" in order to develop a lower bound estimate for consumer surplus values. This is effectively what has been done here.

In the case of valuing Australian's usage of the road network, this approach therefore requires assessing (for passenger cars, motorcycles, bus and road freight):

1. Total costs of usage (the estimated operating costs of road transport, e.g. fuel, fares, fees)
2. The elasticity of demand

In comparison to the original study, we update the total costs of usage based on the most recent data available. Elasticities are kept the same as in the original study as they are unlikely to significantly change over time[12].

5.3 Passenger Cars and Motorcycles

To derive a measure of the cost of passenger car and motorcycle usage, we multiply the following:

1. the number of kilometres travelled per year, and
2. the average cost per kilometre.

The number of kilometres travelled per year by type of vehicle is obtained from the ABS' Survey of Motor Vehicle Usage[13]. The survey indicates that passenger vehicles travelled 163 million kilometres and motorcycles travelled 1.7 million kilometres in 2019-20. Within this, 77% of the total kilometres travelled were in areas considered urban with the remainder in rural areas.

Estimates for vehicle costs per kilometre are provided in the *NSW Principles and Guidelines for Economic Appraisal 2020*, with an assumed average speed of 40 kph in urban areas and 90 kph in rural areas[14]. Operating costs for motorcycles are not available, and we used small car costs as a proxy. This may overstate the operating costs of motorcycles, but given the relatively small motorcycle kilometres travelled this is unlikely to have a material impact on the final welfare calculation.

Operating costs range from the upper bound of 45.4c/km for cars in urban areas to the lower bound of 25.6c/km for motorcycles in rural areas. This represents a slight decrease (in real terms) in urban vehicle costs and a slight increase in rural costs from the original study (range 46.9c/km to 23.3c/km). As before, these costs per kilometre include vehicle capital costs whereas our interest lies with the costs directly associated with road travel. Accordingly, the percentage of vehicle purchase costs within total spending on passenger vehicles and motorcycles is based on the BITRE publication, 'Spending by Australian Households on Owning and Operating Vehicles,' and then excluded from the operating cost calculations[15].

Therefore, we estimate a total operating cost (sans capital costs) of $46.8 billion on passenger vehicles and motorcycles. Using the same elasticity of demand as in the original study (0.3), we estimate a 2019-20 consumer surplus of $78.1 billion in the usage of passenger cars and vehicles[16].

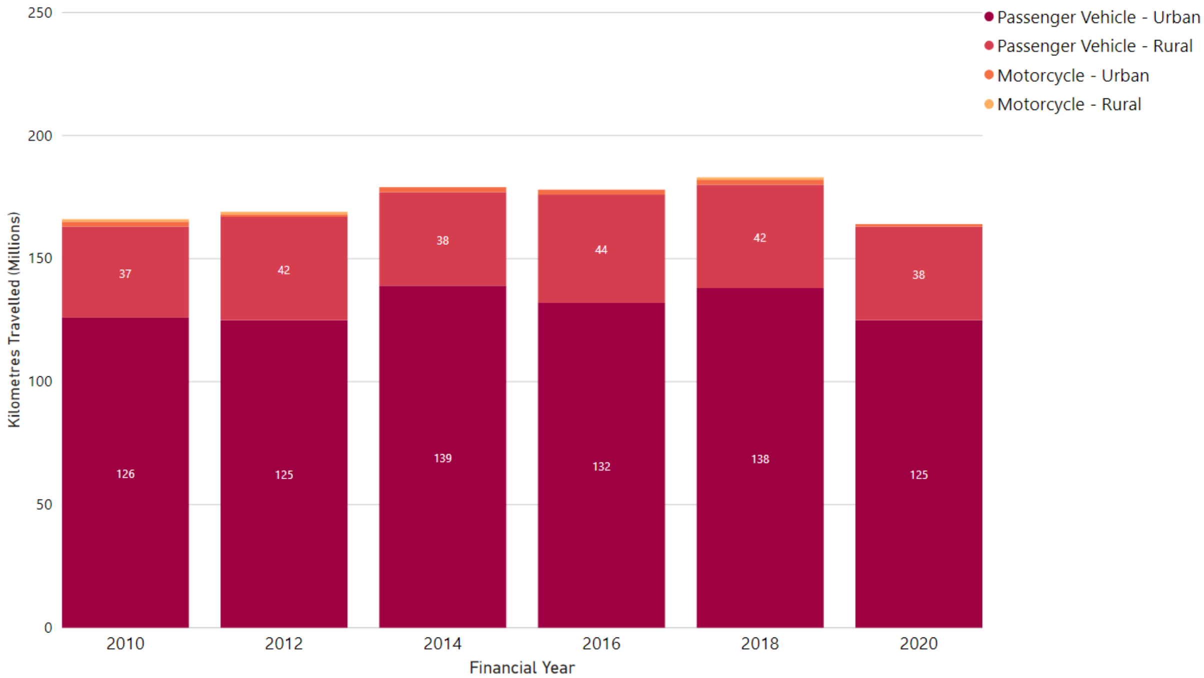
This figure represents a decline in consumer surplus from the previous estimate of $86.5 billion in 2017-18. This appears to be a consequence of the outbreak of COVID-19 and the lockdowns that followed in the June quarter of 2020. The number of kilometres travelled by passenger vehicles and motorcycles has been steadily rising according to the Survey of Motor Vehicle Usage, rising from 165.7 million kilometres in 2009-10 to 182 million kilometres in 2017-18. However, the latest year of

[12] Elasticities measure how consumer demand changes in response to a price change. As such, a shift in consumer elasticities would require significant structural changes in the aggregate preferences of consumers.
[13] Australian Bureau of Statistics, 2020. *Survey of Motor Vehicle Use*, Australia, Cat No. 9208.0
[14] Transport for NSW, 2020. *Principles and Guidelines for Economic Appraisal of Transport Investment and Initiatives*.
[15] Bureau of Infrastructure, Transport, Regional Development and Communications, 2017. *Spending by Australian Households on Owning and Operating Vehicles*.
[16] Wallis, I & Schmidt, N. 2003. *Australasian Travel Demand Elasticities: An Update of the Evidence.*

data in 2019-20 indicates a reversal in trend, with total kilometres travelled falling by -9.5% to 164.7 million kilometres (illustrated in Figure 5.1).

Although there is no data available for 2020-21, we anticipate that total kilometres travelled will have fallen further due to lockdowns in the first half of the financial year. As such, we would expect that consumer surplus estimates will have dropped even further in 2020-21. However, it would be inaccurate to say that the long-term value of the road network is diminished - it is likely that this drop is temporary and the widespread provision of vaccines (and end of lockdowns) should see kilometres travelled return to trend with the road network providing higher than previous estimates of consumer surplus.

Figure 5.1 Total Kilometres Travelled by Vehicle Type and Area



Source: BIS Oxford Economics, ABS

5.4 Road Freight

Estimating the consumer surplus of road freight follows the same process as above – finding a measure of the total cost and an estimate for the elasticity of demand for road freight.

We do not use the same method as in the passenger vehicle and motorcycle section above, but we note that in the *Survey of Motor Vehicle Usage* the kilometres travelled by rigid and articulated trucks increased in 2019-20 compared to the previous year of data, 2017-18. As such, it seems that the road freight industry was relatively unaffected by the June quarter of COVID-19 restrictions and we would expect that consumer surplus would likely be higher than our original estimate for 2017-18.

The ABS release *Business Transport Activity, 2010-11* disaggregates the income from road freight services and is used for an initial estimate of total cost[17]. This was a one-off publication from the ABS and we bring forward the estimates to 2019-20 by indexing them to the sales and service Income of the road transport industry in the ABS release *Australian Industry, 2019-20*[18].

[17] Australian Bureau of Statistics, 2012. *Business Transport Activity, Australia, 2010-11, Cat. No. 9269.0*
[18] Australian Bureau of Statistics, 2020. *Australian Industry, 2019-20, Cat. No. 8155.0*

We estimate the total cost of road freight services in 2019-20 equal to $42.7 billion. This represents a 18.1% increase on the $36.1 billion cost of road freight services in 2017-18. As before, we use the Productivity Commission's price elasticity estimate of 0.43[19].

This yields a road freight consumer surplus of $49.6 billion, a more than $8 billion rise from the consumer surplus figure for 2017-18 in the original study.

The increase in road freight consumer surplus since 2017-18 contrasts against the fall in surplus for passenger vehicles and motorcycles (due to COVID-19 lockdown restrictions limiting kilometres travelled).

5.5 Bus Transport

As is the case for road freight, a one-off supplement to an ABS publication, (ABS 2011, *Australian Industry, 2009-10)* provides income for both urban and interurban/rural bus transport income from passenger fares[20]. This income effectively constitutes the user cost of bus transport.

Two limitations of the data are:

- Includes tram fares
- Related to income in 2009-10

To overcome this, we make numerous adjustments to the data to generate up-to-date measures of total bus fare costs. The methodology differs from the original study in that we now aim to account for the increasing usage in public transport usage since the publication in 2009-10.

First, we exclude tram fares from the passenger fares based on estimates for 2009-10 for the Melbourne tram network[21]. Preferably, all tram fares in Australia would be excluded due to the mixed mode nature of light rail (e.g. some routes operate on dedicated right of ways) but a lack of data availability prohibits this – although Melbourne would represent the majority of tram fares.

Second, we aim to bring forward the 2009-10 estimates of bus fares by indexing them to price growth in the transport component of the Consumer Price Index (CPI). We also account for the increasing usage of the bus network by including the growth of bus passenger kilometres according to BITRE's *Australian Infrastructure Statistics Yearbook 2020*[22]. We extrapolate beyond the most recent year of data (2017-18) by linear trend analysis and allow for a 47% reduction in the usage of bus transport in the June quarter of 2020 based on the ABS release *Household Impacts of COVID-19*.[23] This roughly aligns with the decline in Australian mobility in the June quarter of 2020 according to Apple Mobility Data (see Figure 5.2, an index value of 60 indicates a 40% decline in mobility from January 2020).

An elasticity of 0.4 is used for urban bus transport based on a number of sources[24], and an elasticity of 0.9 is used for rural bus transport based on a major UK study (there is little Australian evidence)[25].

Overall, these figures indicate a consumer surplus of bus transport equal to $3.4 billion in 2019-20. This represents a decline of -10.7% from the 2018-19 consumer surplus, owing to the decline in bus passenger kilometres during the initial lockdowns in the June quarter 2020.

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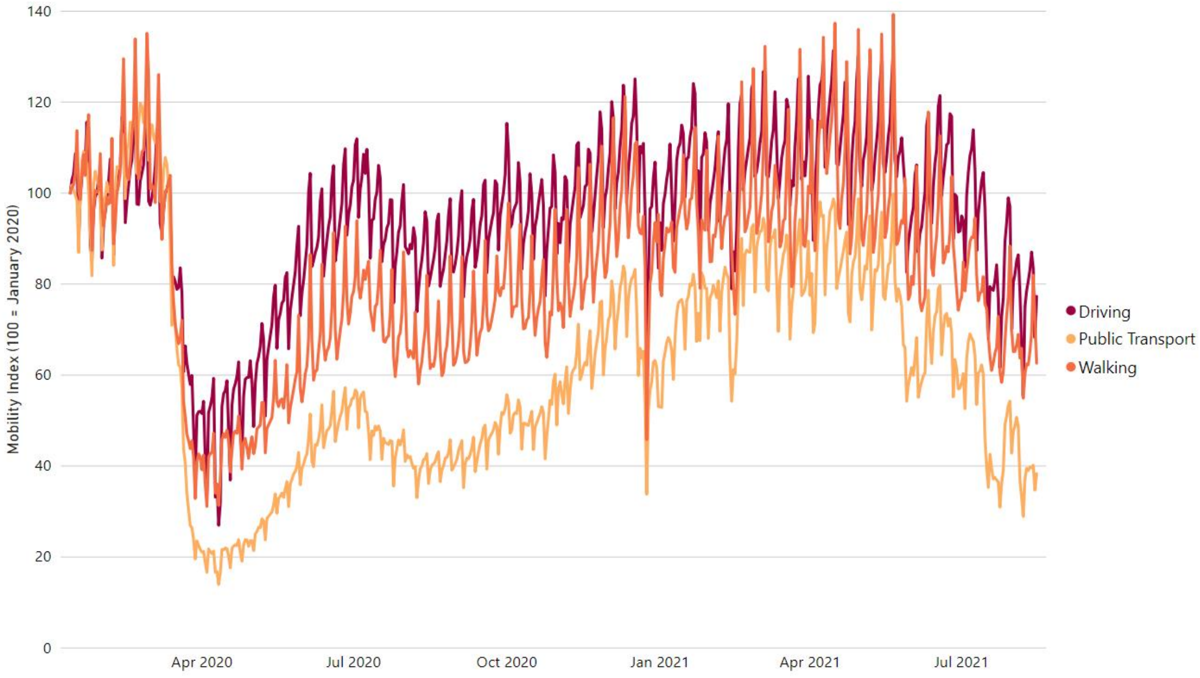
[19] Productivity Commission, 2006. *Road and Rail Freight Infrastructure Pricing*
[20] Australian Bureau of Statistics, 2011. *Australian Industry, 2009-10, Cat. No. 8155.0*
[21] Stone, J. 2015. *Melbourne's Public Transport: Performance and Prospects after 15 years of Privatisation*
[22] BITRE (ibid, p.4)
[23] Australian Bureau of Statistics, 2020. *Household Impacts of Covid-19: Detailed Release, June 2020*
[24] Transport for NSW (ibid, p.22), Wallis & Schmidt (ibid p.22), Australian Transport Assessment and Planning, 2018. *ATAP Guidelines*.
[25] Litman, T, 2019. *Transit Price Elasticities and Cross Elasticities*

Figure 5.2 Mobility Trends for Australia, Base = January 2020



Source: BIS Oxford Economics, Apple Mobility Data

5.6 Option Value

As in the original study, we consider the externalities associated with road transport. One such externality is option value. This is essentially the value associated with the option of having access to a good or service without necessarily using it. In a sense it is akin to a kind of insurance value. Accordingly, having the option of using the road network (or aspects of it) may be of importance to Australians whether or not they make extensive use of large parts of that network and/or network services.

While often discussed, there is little quantification of option value in the Australian or international literature. While there appears to be no generic estimation of the value of accessing the road network *per se*, option values are sometimes estimated for forms of road-using public transport such as bus transport. That being said, there has not been extensive research into the value of options in an Australian context and we rely on bus transport option value estimates developed by the UK Department for Transport as an approximation[26].

The latest estimates (as at July 2021) indicate a value of bus transport options as €92 per household (2020 prices). Converted to the Australian dollar on a Purchase Power Parity basis, this is equivalent to $193.5 per household. Our in-house forecasts for population and household formation estimate approximately 9.5 million households in Australia for the June quarter of 2020.

In total, this indicates a total option value figure for bus services of $1.9 billion in 2019-20.

5.7 Total Value of Roads

Given the above, we value the Australian road network at $132.9 billion in 2019-20 with the welfare approach. This is near the total value of roads calculated in the 2017-18 study, which is surprising given the impact of COVID-19 on passenger kilometres in the June quarter of 2020. The fall in

[26] UK Department for Transport, 2021. *Transport Analysis Guidance Data Book*.

passenger vehicle and motorcycle consumer surplus has been covered by the increase in surplus from road freight services.

Table 5.1 Total Value of Roads – Welfare Approach

Value of Roads Economic Welfare Approach	
Consumer Surplus	**$Millions**
Passenger Car and Motorcycle	78,052
Road Freight	49,617
Bus Transport	3,438
Total	**131,108**
Option Value (Bus Transport)	1,848
Total Economic Welfare Value	**132,956**

6. WIDER ECONOMIC BENEFITS

6.1 The Connectivity of the Road Network

Thus far, this report has adopted two separate approaches to measure the economic and social value of Australia's road network. These approaches analyse the economic contribution of the road transport and construction industries (input-output) and the consumer surplus derived from using the road network (welfare approach). However, the road network plays an essential role in facilitating other economic and social activity that is not fully captured in these measures – there is the 'option value' of roads which is discussed in Section 5.6[27] and the network also enables other forms of transport including light rail services and active transport (which in turn have their own respective health and environmental benefits).

In addition to these factors, there are a blend of other social benefits delivered by roads that would require additional research. This includes the extent that roads play a role in facilitating the delivery of essential services and potential other services. There is an intrinsic social value associated with communities which is also facilitated by the road network. Aside from this, the welfare approach considers the surplus that an individual derives from using the road, but this doesn't consider the surplus derived by passengers in the vehicle or other persons who benefit from road travel without consuming it (e.g., receiving visits from family and/or friends).

6.2 Introduction to Wider Economic Benefits

An additional and quantifiable dimension to the value of connectivity that the road network provides are termed Wider Economic Benefits (WEBs). The WEBs first identified by the UK Department for Transport include the productivity benefits from an agglomerated economy, lower transport costs (which produce a social welfare gain) and higher tax revenues from increased employment.

"WEBs are improvements in economic welfare that are acknowledged, but that have not been typically captured, in traditional cost-benefit analysis"

– *Australian Transport Assessment and Planning Guidelines*

More formally, these benefits are:

- **Agglomeration Economies**: these traditionally provide the largest economic benefit and consider the improvements in productivity from firms and workers being located more closely together (in terms of travel time). This includes the benefits from, in any given area, having access to larger product, input and labour markets and additional knowledge and spill-over effects[28].
- **Output Change in Imperfectly Competitive Markets**: the reduction in business travel time due to road networks leads to an increase in output (all else equal). Under traditional cost benefit analysis – with the assumption of perfectly competitive markets - this output is valued at the marginal cost of producing it (wages + fixed costs). However, in imperfect markets, output prices are assumed above the marginal cost, thus creating a gap between the actual

[27] Noting that we only attempt to quantify the option value of bus transport in this report, but there are other benefits provided by the road network such as the option to reside away from major population hubs due to the road network.

[28] Transport and Infrastructure Council, 2016. *Australian Transport Assessment and Planning Guidelines*

output and the calculated output. Therefore, increases in output from reductions in business travel time are undervalued under standard approaches[29].

- **Tax Revenues from Labour Markets**: the connectivity of the road network may induce more individuals to work and/or travel geographically further for higher paid jobs (at the same or reduced travel time). The value of this increase in income (post-tax) is incorporated into standard cost benefit approaches but the tax revenue received by the government is not.
- **Other Benefits**: the three benefits listed above are considered the main source of WEBs, but this does not include the potential for induced investment following an improvement in road networks. Of particular note is the potential for an increase in investment into commercial or residential developments following the completion of a road project.

The use of WEBs as an additional dimension in calculating the total benefits of a particular road project (for use in cost-benefit analysis) is somewhat contentious. Currently, Infrastructure Australia recommends that WEB calculations are calculated as a sensitivity test to the traditional results from cost-benefit analysis – furthermore, the Australian Transport Assessment and Planning Guidelines (ATAP) indicate numerous caveats, including sub-optimal Australia-specific data and research, to incorporating WEBs into traditional cost-benefit analysis[28].

Since the publishing of the ATAP in 2016, there has been developments in creating Australia specific parameters for WEB analysis. In particular, the ABS and KPMG developed a set of estimates for WEB analysis in Australia in 2017[30]. First, they estimated a set of 152 agglomeration effects for 19 industries in each of the 8 jurisdictions – these estimates ranging from 0 to 17%, at the maximum this represents a 17% increase in output for a doubling of effective employment density[31] for a given area, industry and jurisdiction of Australia.

Further, the KPMG and ABS study generated estimates for the additional output in imperfectly competitive markets when there is a reduction in travel times. The 'uprate' factor represents the increased output in imperfect markets as a percentage of the typical increase from standard cost-benefit analysis (which assumes a perfectly competitive market). KPMG presents factors for different Australian cities between 5%-25%, while the UK Department for Transport suggests an uprate factor of 10% for WEB analysis. In practice, this would imply - during cost-benefit analysis - that a calculated increase of output equal to $100 million due to reduced travel times would be valued at $110 million due to imperfect market conditions.

However, we note that the usage of WEBs is relatively young – indeed, the assumptions used to generate the above estimates have received numerous forms of criticism, with a publication released during the Australian Transport Research Forum Proceedings (2019) [29] concluding that, "agglomeration economies … are likely to be exceptional and small," mainly due to the calculation able to estimate an increase in productivity due to a reduction in travel costs without a corresponding increase in employment[32]. Furthermore, the report indicates that the KPMG and ABS study only found 42% of the 152 estimates of agglomeration effects to be statistically significant and positive, among other criticisms of methodology.

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[29] Abelson, P. 2019. *The wider economic benefits of transport infrastructure*.
[30] KPMG, 2017. *Measuring WEBS in Australian Cities*.
[31] Effective employment density is the employment in a given area + employment in surrounding areas weighted by their relative distance (where distance is defined by time, so a reduction in travel times could increase effective employment all else equal).
[32] This position does contain some nuance, the paper doesn't dispute dynamic agglomeration economies (i.e. an increase in productivity with greater urban employment) but rather disputes the existence of static agglomeration economies (i.e. an increase in productivity with greater effective employment density). The reason being that effective employment density can rise due to a reduction in travel costs but no respective increase in employment.

6.3 Summary of Wider Economic Benefits

Ultimately, the discussion surrounding the true value of road network WEBs is nuanced – the benefits listed above follow legitimate economic theory and empirical evidence has been found to support these claims. The more controversial discussion lies with the size of these effects, particularly due to the relative youth of research and the ability for WEBs to significantly improve the Benefit Cost Ratio (BCR) of any given project.

Further, in terms of valuing Australia's entire road network, it is not realistic to calculate WEBs (see next paragraph) - although it is worth noting in general terms that it would not be possible, given the economic structure of Australia, to have any modern urban environment (and the productivity, employment benefits that flow from that) without the usage of the road network.

WEBs are measures of improved economic outcomes relative to a counterfactual of no such improvement to the road network and associated reduction in travel times. As such, it doesn't make theoretical sense to generate a WEB estimate of the entire road network relative to a counterfactual of no road network (e.g., for agglomeration economies, what is employment density if roads didn't exist). We conclude this section by providing the total costs and benefits of major road projects, including the estimated WEBs to give an indicator of recent estimates[33].

Table 6.1 Wider Economic Benefits – Recent Project Examples

Wider Economic Benefits
Selection of Major Road Projects

Project	Total Capital Cost ($m)	Total Benefits - excl. WEBs ($m)	Wider Economic Benefits ($m)
F6 Extension Stage 1 - NSW	1,383	2,005	236
Western Harbour Tunnel & Freeway Upgrade - NSW	3,900	4,887	1,548(e)
M12 Motorway - NSW	1,440	2,611	not estimated
M1 Varsity Lakes, Tugun - QLD	629	1,048	not estimated
North East Link - VIC	8,200	10,840	890
M80 Ring Road - VIC	687	1,080	not estimated
WestConnex - NSW	16,800	22,300	2,100
WestGate Tunnel - VIC	3,283	4,642	1,212

Source: BISOE, Infrastructure Australia (e) estimate, not reported

33 Projects were not chosen for any particular reason other than being able to locate the business case summaries and cost-benefit analysis.

7. APPENDIX A – METHODOLOGY

7.1 Input Output Analysis

BIS Oxford Economics relies on the Australian Bureau of Statistics' Input-Output tables published on an annual basis to generate the employment, output, and gross value-added multipliers. For the purposes of this report, we have built our input-output model using the latest tables from the ABS (2018-19). This model generates a range of multipliers which indicate the increases in employment, output and gross value-added resulting from $1 million invested in a given industry.

These multipliers can also be used to estimate the economic impact of an industry at a given point in time, as is done for in-house and for-hire road transport in this report.

There are three types of effects captured in input-output modelling:

- **Direct effect**: this is the effect of the investment in the industry(ies) of interest. An increase in investment spending is likely to result in an increase in demand for labour increasing employment and an increase in capacity increasing output and GVA.
  For example, increased investment in the construction industry will lead to additional work and thus an increase in employment and output from the construction industry.
- **Indirect effect**: this is the second-round effect. The increase in direct output requires increases in both upstream and downstream industry activity.
  For example, an increase in the building construction industry requires an increase in cement supply (upstream) and an increase in real estate services (downstream). The increase in demand for upstream and downstream services is referred to as indirect as the investment in construction indirectly results in an increase in demand for supporting industries
- **Induced effect:** this is the effective third round effect. This is the increase in economic activity in other industries not directly related to the initial industry. Continuing the construction example, the direct and indirect increases in employment results in an increase in income for those individuals, which will lead to further increases in the consumption of goods and services in other industries (e.g. retail, banking, and property). These industries are now seeing induced benefits from the initial investment in the construction industry.

The sum of the direct, indirect, and induced effects of investment in an industry is the total economic effect of the investment spending.

7.2 Notable Input-Output Specific Assumptions

The input-output model results are caveated with a number of assumptions. In particular, the model relies on the historical linkages between industries and their outputs. This implies that any future impacts are assumed to take place in a structurally identical environment.

Additionally, IO modelling does not consider the opportunity cost of increased output of a target industry. As such, the model does not detail which industry is most deserving of further investment to boost output; rather, the model simply shows the economic outcomes of such investment. Furthermore, the model does not consider supply-side constraints that may limit the economic benefits of increased investment or output. In the case of the construction industry, for example, this includes labour, which may be in short-supply or face educational constraints, or construction inputs, which may face logistical bottlenecks and other such risks of delivery.

7.3 Transport Satellite Account

The Transport Satellite Account identifies the input and outputs of in-house road transport. With respect to inputs, three components are specified: transport related (e.g. fuel, repairs, parts and rental, registration and insurance costs); non-transport related (e.g. other intermediate inputs such as account and support services) and value-added components (e.g. taxes, gross operating surplus and compensation of employees). Each of the new industries was assumed to only produce a single output, being in-house transport relating to a specific mode (road, rail, air, sea).

The original study extended the national input-output accounts to include the four in-house industries based on the inputs and outputs (detailed in paragraph above) contained within the 2015-16 Transport Satellite Account supply-use tables. The extended tables were then used to generate a series of multipliers that could be applied to the 2017-18 employment and gross value-added figures.

This study moves a step further, updating the supply-use tables contained within the Transport Satellite Account by bringing forward the estimates of each usage of in-house road transport based on growth in their intermediate usage (from the supply use tables published between 2016-17 and 2018-19). These estimates have then been incorporated into the most recent national input-output account (2018-19) to generate a new series of multipliers for both the in-house and for-hire road industries. Finally, these new multipliers were then applied to the 2019-20 estimates of employment and gross value added.

An adjustment was made to the input-output table (with the added in-house industries) to switch the treatment of imports from indirect to directly allocated. Practically, this focuses the economic contribution of the road industry to domestic employment and production. This was also done for the analysis of the economic contribution of road construction activity.

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