Australian Government
Department of Infrastructure, Transport, Regional Development and Communications
Bureau of Infrastructure and Transport Research Economics

Freight vehicle congestion in Australia's five major cities - 2019

At a Glance

This paper is the first of a planned annual series that uses vehicle telematics data to provide measures of traffic congestion for freight vehicles on 53 selected routes across Australia's five mainland state capital cities—Sydney, Melbourne, Brisbane, Adelaide and Perth. The selected routes comprise the major motorways, highways and arterial roads within each city that service both passenger and freight vehicles. The estimates presented in this report cover calendar year 2019.

For each route, the paper presents measures of congestion based on average excess travel time and excess uncertainty about how long journeys will take compared to *free running* conditions.

Peak travel times

7 to 9am and **3 to 6pm**
Peaks in freight vehicle average travel times coincide with high commuter flows.

Where possible, avoiding travel in peak commuting periods can reduce freight vehicle average travel times and delay.

Routes

Urban motorways, freeways and **major arterial roads**

are included among the major routes covered in this research.

Third peak

Between midnight and 5am
A 'third' peak in freight travel times was observed on some routes across all cities.

The reason for this third peak is unclear, although freight specific activity or road works are potential reasons

Data sources

Freight telematics data
from participating operators in BITRE's freight telematics data project used to derive route travel time measures.

Illustrates the use vehicle telematics data to aid planning by governments, industry and other parts of the community.

Introduction

This paper, the first of a planned annual series, tracks congestion of selected routes from across Australia's major cities by estimating travel times based on observed speeds of freight vehicles. This report covers calendar year 2019.

The paper presents two 'congestion' measures for each route.

- The first is the Mean Excess Time Ratio (METR) which reflects the how much the average expected travel time across the day exceeds the *best* (lowest) expected travel time. These best times are usually in the early hours and are assumed to be close to *free running* conditions.
- The second is the Mean Excess Uncertainty Ratio (MEUR) which reflects how much the average uncertainty – measured as the breadth of the interquartile range, or the middle 50 per cent of trips – exceeds the lowest observed uncertainty.

The lower the uncertainty, and the narrower the interquartile range, the more certainty a firm can have about how long journeys will take and their ability to provide deliveries at agreed times. Because firms are bound by speed limits, this uncertainty usually means more "downside risk", with below average travel time more likely to be slower than above average times are swifter. In the travel time figures presented in this paper, the dark blue lines represent the median travel time over the course of the day, while the light blue bands demonstrate the interquartile range.

These measures are only indicators of congestion and may be prone to 'noise' especially for routes or times of day (such as the early morning) with relatively sparse data. They also do not distinguish between a peak that lasts one hour and a peak that spreads over several.

This initial report highlights several interesting features of traffic congestion on the selected urban routes, including:

- Motorways exhibit more distinct peak periods than surface routes.
- Surface routes (those not on grade-separated motorways) show more 'base level' uncertainty, which is most likely due to intersections and traffic lights.
- Congestion peaks are usually attributable to commuter traffic to or from work and education – for instance motorways tend to show morning peaks moving towards the CBD and afternoon peaks moving away from it. This is supported by prior BITRE telematics work that found travel peaks effectively disappeared on urban freight routes during COVIC-19 lockdowns (BITRE 2020).
- A number of surface routes in all cities also exhibit an unexpected *third peak* in the early morning, around 4-5 AM. The reasons for this third peak are not clear, although freight specific activity or road works are potential reasons.
- Intersections on surface routes and interchanges on motorways, are prominent locations of delays in peak periods. To some extent this captures delays for vehicles entering and exiting the route rather than vehicles travelling the full route.

BITRE has calculated composite measures of congestion for each city, and have indexed them to 1 for 2019. These measures are not comparable between cities, but can be used to track changes in congestion across all selected routes in each city over time. For this initial publication all cities therefore have the same measure (see Table 1).

Table 1. Congestion measures of cities studied in this report

City	Excess Time Index	Excess Uncertainty Index
Sydney	1	1
Melbourne	1	1
Brisbane	1	1
Adelaide	1	1
Perth	1	1

Source: BITRE estimates.

The routes comprise motorways, freeways and major arterial roads within each city that service both passenger and freight vehicles. For each route, separate congestion measures are presented in each direction. The following section provides an overview of observed heavy vehicle travel times (and congestion measures) across all routes in each city. More detailed route-specific outputs, including median and interquartile range travel times for each route, are provided in Appendix A and a brief summary of the methods is outlined in Appendix B.

Australian capital city freight vehicle congestion measures

Sydney

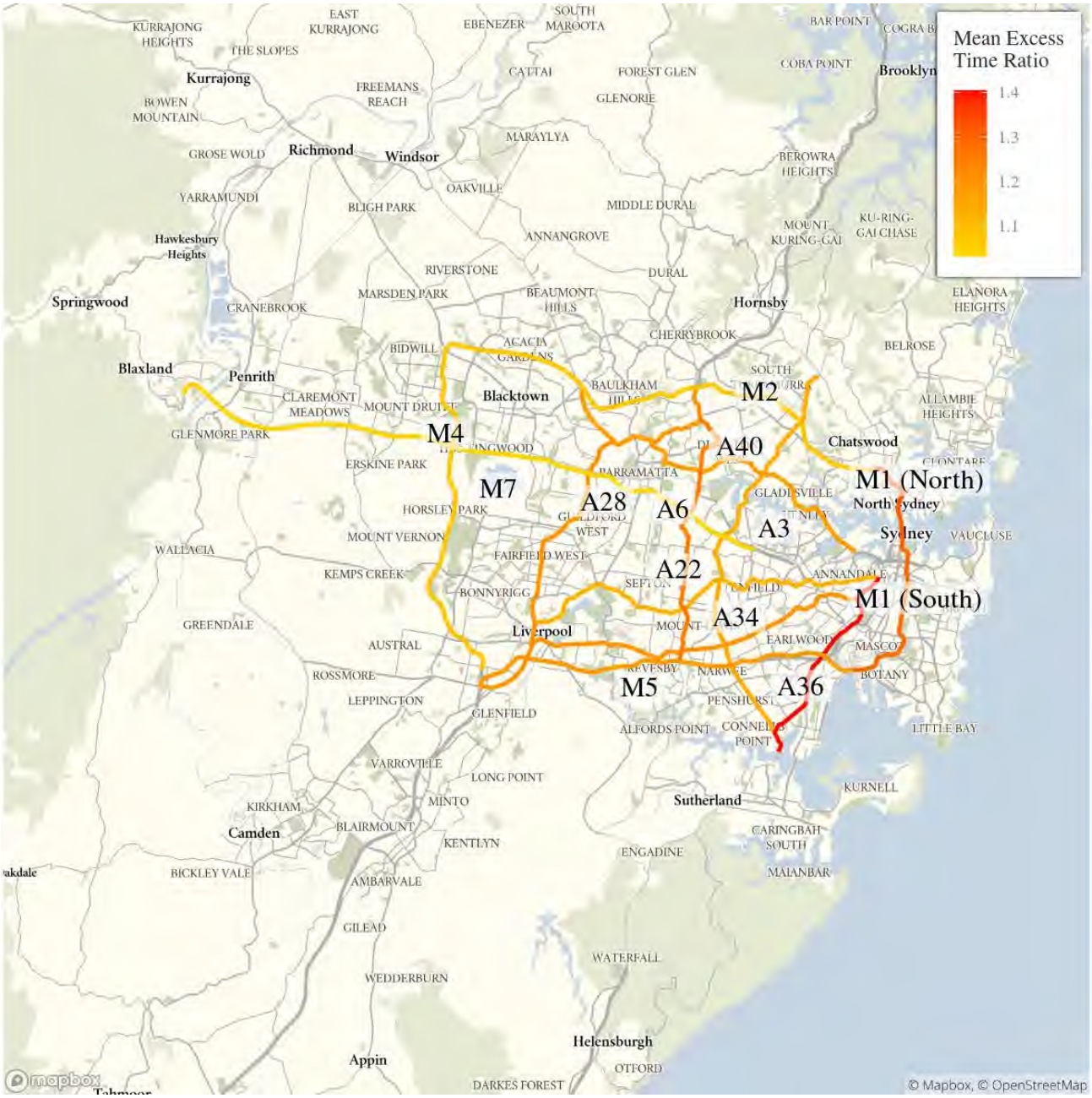
Sydney metropolitan area freight vehicle routes cover the following 13 motorway, freeway and/or major arterial road routes:

- A22 – Glebe to Liverpool / Liverpool to Glebe
- A28 – Casula to M2 Motorway / M2 Motorway to Casula
- A3 – Blakehurst to Pymble / Pymble to Blakehurst
- A34 – Liverpool to Newtown / Newtown to Liverpool
- A36 – Broadway to Georges River / Georges River to Broadway
- A40 – Baulkham Hills to Rozelle / Rozelle to Baulkham Hills
- A6 – Carlingford to Padstow / Padstow to Carlingford
- M1 (North) – Cahill Expressway to M2 / M2 to Cahill Expressway
- M1 (South) – Cahill Expressway to M5 / M5 to Cahill Expressway
- M2 – M1 to M7 / M7 to M1
- M4 – Glenbrook to Strathfield / Strathfield to Glenbrook
- M5 – Hume Motorway to M1 / M1 to Hume Motorway
- M7 – M2 to M5 / M5 to M2

Figure 1 shows all 13 selected Sydney freight vehicle routes and an index of the median excess travel time ratio (METR) – i.e. the ratio of median travel time to best (shortest) travel time – across each route.

The results show that routes to, from or terminating near the Sydney CBD – including M1 (South), M1 (North) and the A36 – exhibit a higher METR than other routes with peak period travel times up to 1.3 or 1.4 times the best (shortest) travel time. These routes also exhibit the greatest variation in travel times, with the median excess uncertainty ratio (MEUR) – i.e. the ratio of the median variation in travel time to minimum variation in travel time – also highest for the M1 (South), M1 (North) and the A36 routes. For example, the MEUR is 4.1 on the M1 (South) route, 3.2 for the A36 and 2.9 for the M1 (North). Although the two M1 routes show significant congestion they are relatively unimportant for freight activity.

Figure 1 Sydney congestion routes and median travel time index[a], 2019



Note: Ratio of median travel time to best (shortest) travel time for each route.
Source: BITRE estimates.

Melbourne

Melbourne metropolitan area freight vehicle routes cover the following 11 motorway, highway and/or major arterial road routes:

- Route 32 – Derrimut to Montrose / Montrose to Derrimut
- Route 55 – Hume Freeway to Montague Street / Montague Street to Hume Freeway
- Route 56 – Laverton to Spotswood / Spotswood to Laverton
- Route 58 – Greenvale to Yan Yean Road / Yan Yean Road to Greenvale
- M1 (West) – City to M80 / M80 to City
- M1 (East) – City to M420 / M420 to City
- M2 – CityLink then Tullamarine / Tullamarine then CityLink
- M3 – Frankston to Hoddle Street / Hoddle Street to Frankston
- M79 – Essendon to Gap Road / Gap Road to Essendon
- M80 – Altona to Greensborough / Greensborough to Altona
- Western Freeway – Bacchus Marsh to Derrimut / Derrimut to Bacchus Marsh.

Figure 2 shows all 11 selected Melbourne freight vehicle routes and an index of the METR across each route.

Like Sydney routes, the results show that routes terminating in or near the Melbourne CBD – including M1 (East) and M1 (West) – generally exhibit higher METRs than other routes, with peak period travel times up to 1.2 or 1.3 times the best (shortest) travel time. These routes also exhibit the greatest variation in travel times, with the MEUR – i.e. the ratio of the median variation in travel time to minimum variation in travel time – also highest for the M1 (East), M1 (West), both around 3.5 to 4.0. In contrast, Routes 32, which traverses the metropolitan area (east–west) and through Melbourne CBD, and the M2, which connects the CBD and Melbourne Airport, do not exhibit as much variation in median travel times.

Figure 2 Melbourne congestion routes and median travel time index[a], 2019

Note: Ratio of median travel time to best (shortest) travel time for each route.
Source: BITRE estimates.

Brisbane

Brisbane metropolitan area freight vehicle routes cover the following 10 motorway, highway and/or major arterial road routes:

- M1 – Bruce Highway to Pacific Motorway / Pacific Motorway to Bruce Highway
- M2 (North) – Logan Motorway to Pacific Motorway / Pacific Motorway to Logan Motorway
- M2 (West) – Gateway Motorway to Ipswich Motorway / Ipswich Motorway to Gateway
- M3-A3 – Airport Link to M1 / A3 – M1 to Airport Link
- M3 (South) – Inner City Bypass to Pacific Motorway / Pacific Motorway to Inner City Bypass
- M4 – Gateway Motorway to Port of Brisbane / Port of Brisbane to Gateway Motorway
- M5 – Bowen Hills to Logan Motorway / Logan Motorway to Bowen Hills
- M6 – Gateway Motorway to Pacific Motorway / Pacific Motorway to Gateway Motorway
- M7-A7 – Logan Motorway to Southern Cross Way / Southern Cross Way to Logan Motorway
- Route 2 – A7 to Gateway / Gateway to A7

Figure 3 shows all 10 selected Brisbane freight vehicle routes and an index of the METR across each route.

Across Brisbane, most routes have METRs of around 1.0 or 1.1, meaning there is little variation between the median travel time and best travel time across the route. The principal exceptions are the M3–A3, M7–A7 and Route 2, which have METRs of around 1.2, meaning the median travel time is around 20 per cent higher than the best travel time. Routes with relatively high MEURs include the M3 (South) and Route 2, where the variation in median travel time variation to the minimum variation is between 2.8 and 3.1 on M3 (South) and 2.3-2.6 on Route 2 (i.e. the ratio of the median variation in travel time to minimum variation in travel time). Unlike Sydney and Melbourne, these routes do not directly connect to the CBD.

Figure 3 Brisbane congestion routes and median travel time index[a], 2019

Note: Ratio of median travel time to best (shortest) travel time for each route.
Source: BITRE estimates.

Adelaide

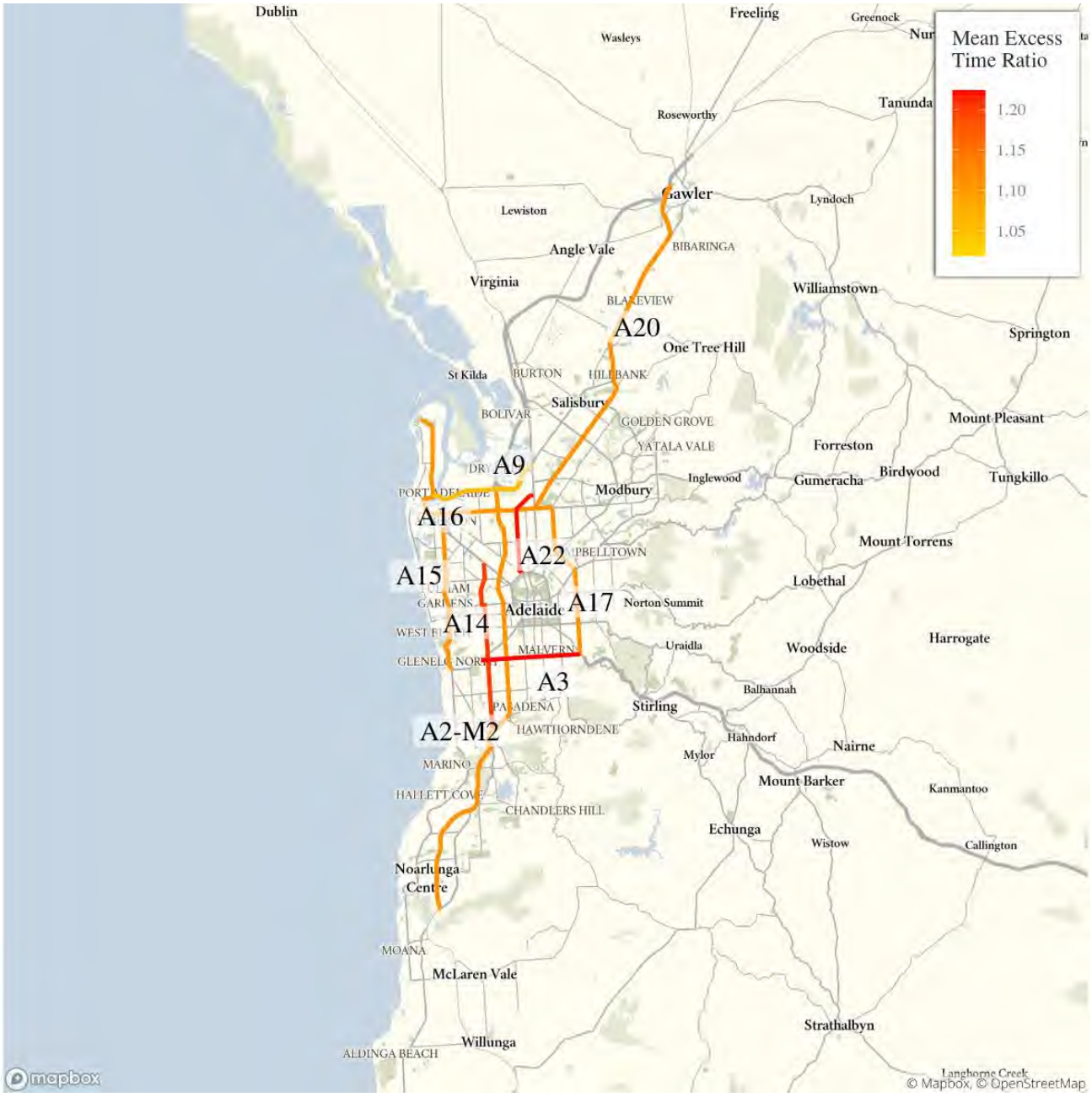
Adelaide metropolitan area freight vehicle routes cover the following 9 highways and major arterial road routes:

- A14 – Port Road to Southern Expressway / Southern Expressway to Port Road
- A15 – ANZAC Highway to Port Road / Port Road to ANZAC Highway
- A16 – Hampstead Road to Outer Harbor / Outer Harbor to Hampstead Road
- A17 – Grand Junction to SE Freeway / SE Freeway to Grand Junction
- A20 – Grand Junction Road to Sturt Highway / Sturt Highway to Grand Junction Road
- A22 – Park Terrace to Port Wakefield Road / Port Wakefield Road to Park Terrace
- A3 – ANZAC Highway to SE Freeway / SE Freeway to ANZAC Highway
- A9 – Nelson Street to Port Wakefield Road / Port Wakefield Road to Nelson Street
- A2-M2 – Main South Road to Port River Expressway / Port River Expressway to Main South Road.

Figure 4 shows all 9 selected Adelaide freight vehicle routes and an index of the METR across each route.

Across Adelaide, most routes have METRs of around 1.1, hence there is little variation between the median travel time and best travel time across the route. Only the A3 (Cross Road) and A14 (Holbrooks Road, Marion Road and Henley Beach Road) routes have METRs of around 1.2, meaning the median travel time is around 20 per cent higher than the best travel time. Routes with relatively high MEURs include the A15, A17 and A3. On theA15, the MEUR is 2.8–2.9 (i.e. nearly three times larger than the minimum travel time variation), on the A17 MEUR is as high as 4.2 and on the A3, the MEUR is 2.4. The Adelaide routes, in contrast to the other capital cities, are predominantly major arterial roads, and thus have greater based levels of uncertainty.

Figure 4 Adelaide congestion routes and median travel time index[a], 2019



Note: Ratio of median travel time to best (shortest) travel time for each route.
Source: BITRE estimates.

Perth

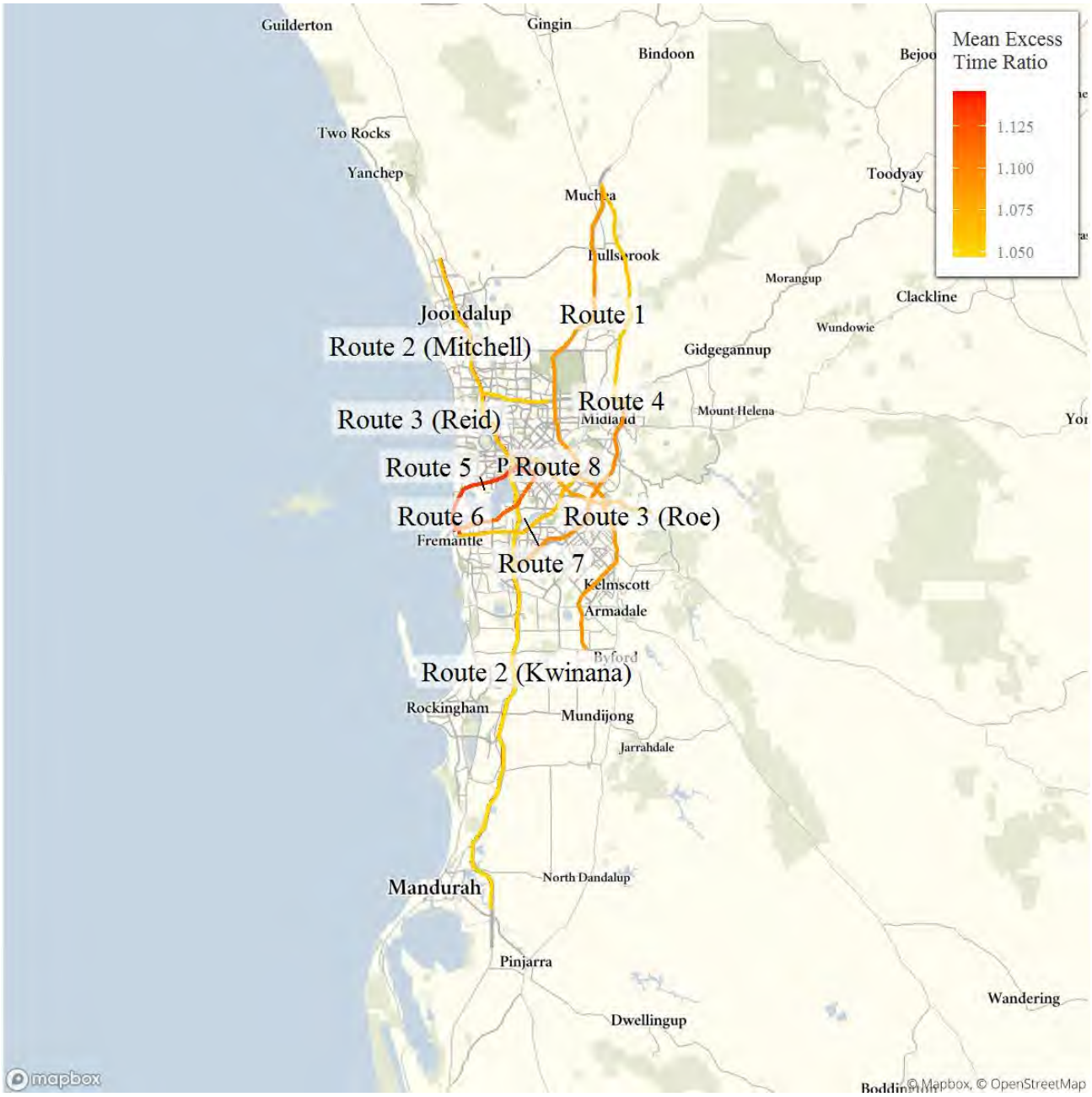
Perth metropolitan area freight vehicle routes cover the following 10 freeway, highway and major arterial road routes:

- Route 1 – Roe Highway to Tonkin Highway / Tonkin Highway to Roe Highway
- Route 2 (Mitchell) – Hester Avenue to Swan River / Swan River to Hester Avenue
- Route 2 (Kwinana) – Forrest Highway to Mitchell Highway / Mitchell Freeway to Forrest Highway
- Route 3 (Roe) – Great Northern Highway to Kwinana Freeway / Kwinana Freeway to Great Northern Highway
- Route 3 (Reid) – Mitchell Freeway to Tonkin Freeway / Tonkin Freeway to Mitchell Freeway
- Route 4 – Great Northern Highway to Thomas Road / Thomas Road to Great Northern Highway
- Route 5 – Great Eastern Highway to Stirling Highway, High Street / Stirling Highway, High Street to Great Eastern Highway
- Route 6 – Fremantle to Great Eastern Highway / Great Eastern Highway to Fremantle
- Route 7 – Stirling Highway to Tonkin Freeway / Tonkin Freeway to Stirling Highway
- Route 8 – Canning Road to Mitchell Freeway / Mitchell Freeway to Canning Road.

Figure 5 shows all 10 selected freight vehicle routes in Perth and an index of the METR across each route.

Across Perth all routes have METRs of around 1.1, hence there is typically around 10 per cent variation between the median travel time and best travel time across each route. Routes 5 and 6, between the CBD and Fremantle (via the Stirling and Canning Highways, respectively), exhibit slightly higher variation. Routes with relatively high MEURs include Route 2 (Mitchell Highway) and Route 3 (Reid Highway). On Route 2 (Mitchell) the MEUR is 2.7 southbound and 4.7 northbound, and on Route 3 (Reid) the MEUR is 2.5 and 2.8 (westbound and eastbound, respectively). In both cases the larger difference between median variation and the minimum travel time variation, is due to there being very little variation in travel time on these routes at non-peak times.

Figure 5 Perth congestion routes and median travel time index[a], 2019



Note: Ratio of median travel time to best (shortest) travel time for each route.
Source: BITRE estimates.

The remainder of the paper presents detailed results for each of the 53 city routes.

Appendix A – Individual route freight vehicle congestion measures

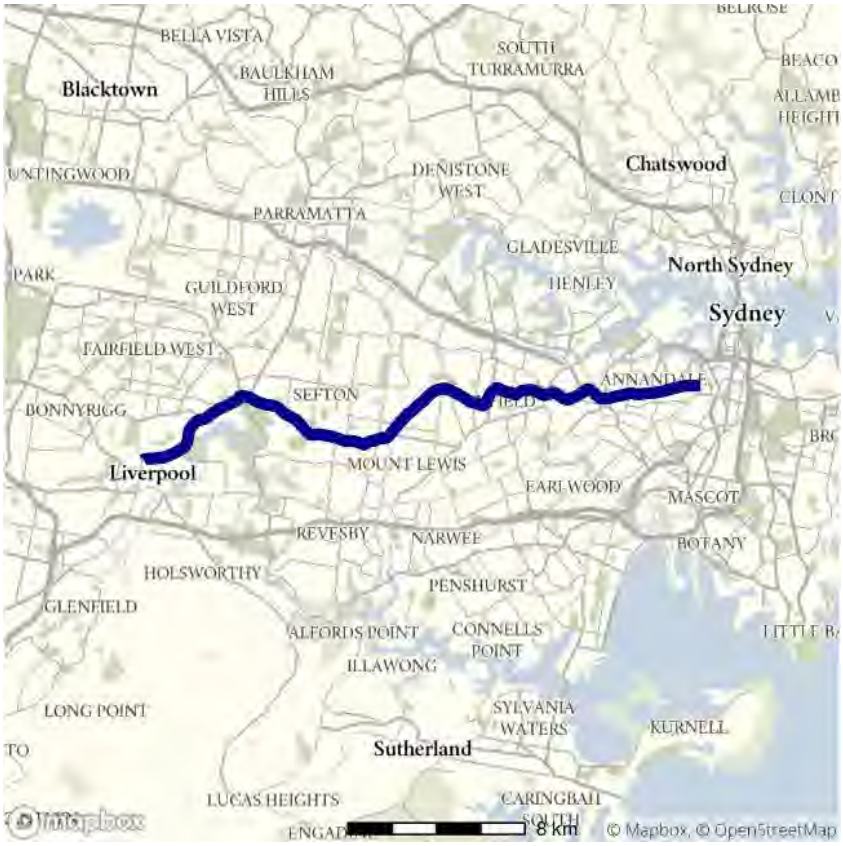
This appendix provides detailed route-specific freight vehicle travel times and congestion measures, including median and interquartile range travel times, for each route in each capital city. The routes are grouped by city and for each route the results comprise a route map, table of median and variation in travel times, and graphs showing the hourly distribution of median and interquartile range of travel time.

Sydney routes

A22 - Glebe to Liverpool / Liverpool to Glebe

This route follows surface roads between the inner city and the south west of Sydney via Ashfield and important logistics sites around Chullora. It is known by various names along its extent, including Parramatta Road, Liverpool Road and also as the Hume Highway for most of its length.

Figure A.1 A22 route map



Source: BITRE estimates.

Table A.1 A22 route travel times and congestion measures, 2019

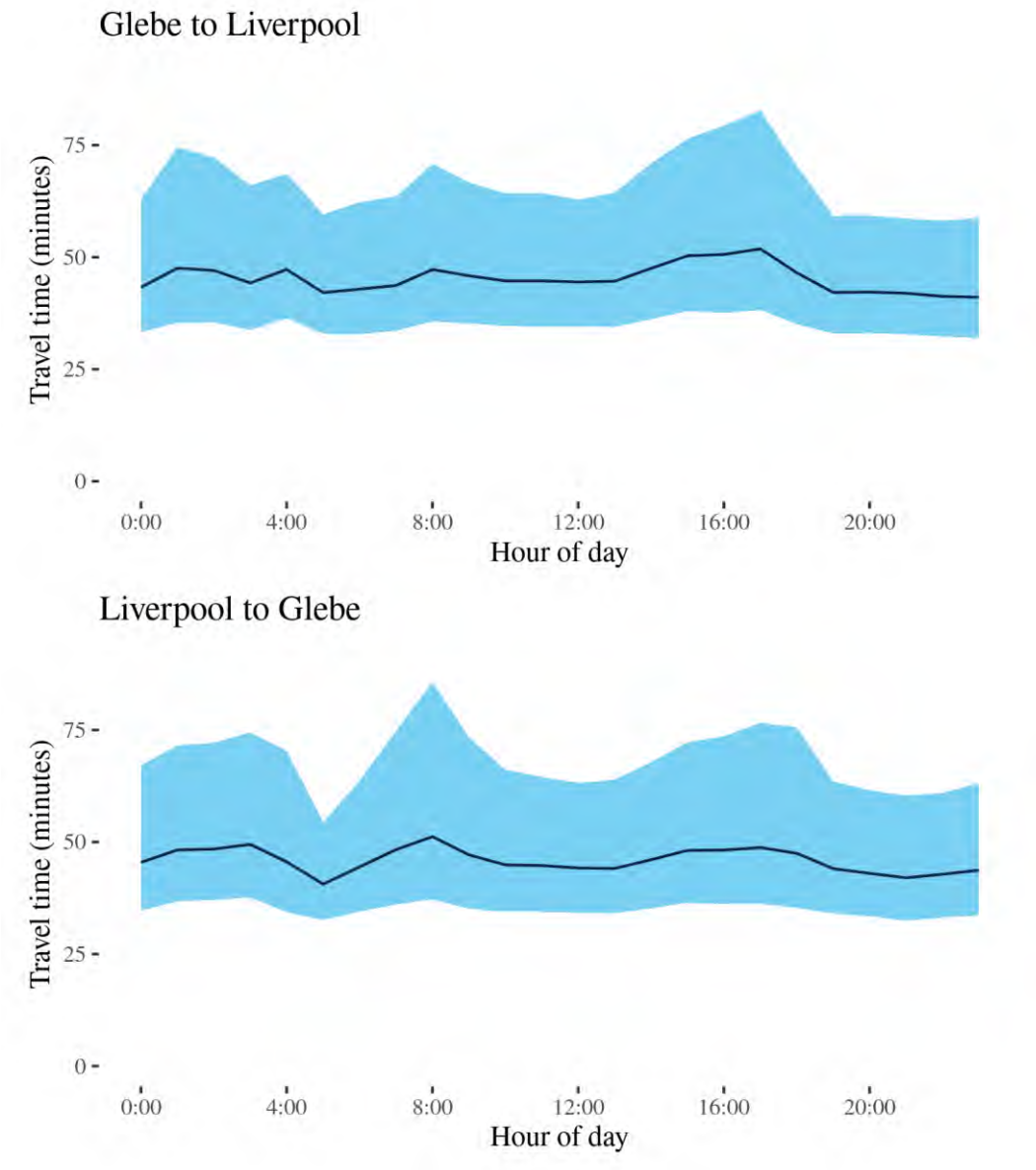
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Glebe to Liverpool	00:41:04	00:51:52	1.1	00:25:48	00:44:33	1.2	29.2
Liverpool to Glebe	00:40:37	00:51:13	1.1	00:21:47	00:48:30	1.5	29.3

Source: BITRE estimates.

The best travel times and lowest uncertainty travelling from Glebe to Liverpool were at 11pm and 9pm at just over 41 minutes and an interquartile range of 26 minutes. The longest travel times and most uncertain travel times were in the afternoon peak at 5pm with a median travel time of 52 minutes and an interquartile range of over 45 minutes respectively. Delays were apparent on Parramatta Road in particular.

The best travel times and lowest uncertainty travelling from Liverpool to Glebe were at 5am with a median travel time of 41 minutes and an interquartile range of 22 minutes. The longest travel times and greatest uncertainty were in the morning peak at 8am with the median travel time 51 minutes and an interquartile range of 48.5 minutes. Unlike the journey leaving the CBD (Glebe), travel into the CBD showed peaks in uncertainty in both the morning and afternoon, with delays most pronounced around the intersection of Liverpool and Parramatta Roads in Ashfield.

Figure A.2 A22 route median and interquartile range travel times



Source: BITRE estimates.

A28 - Casula to M2 Motorway / M2 Motorway to Casula

This surface route traverses much of Western Sydney, from the intersection of the M2 and Pennant Hills Road to the intersection of the Hume Motorway and Camden Velley Way. It passes Wentworthville, Fairfield West, Liverpool and Casula and crosses the A44, M4 and M5 routes.

Figure A.3 A28 route map

Source: BITRE estimates.

Table A.2 A28 route travel times and congestion measures, 2019

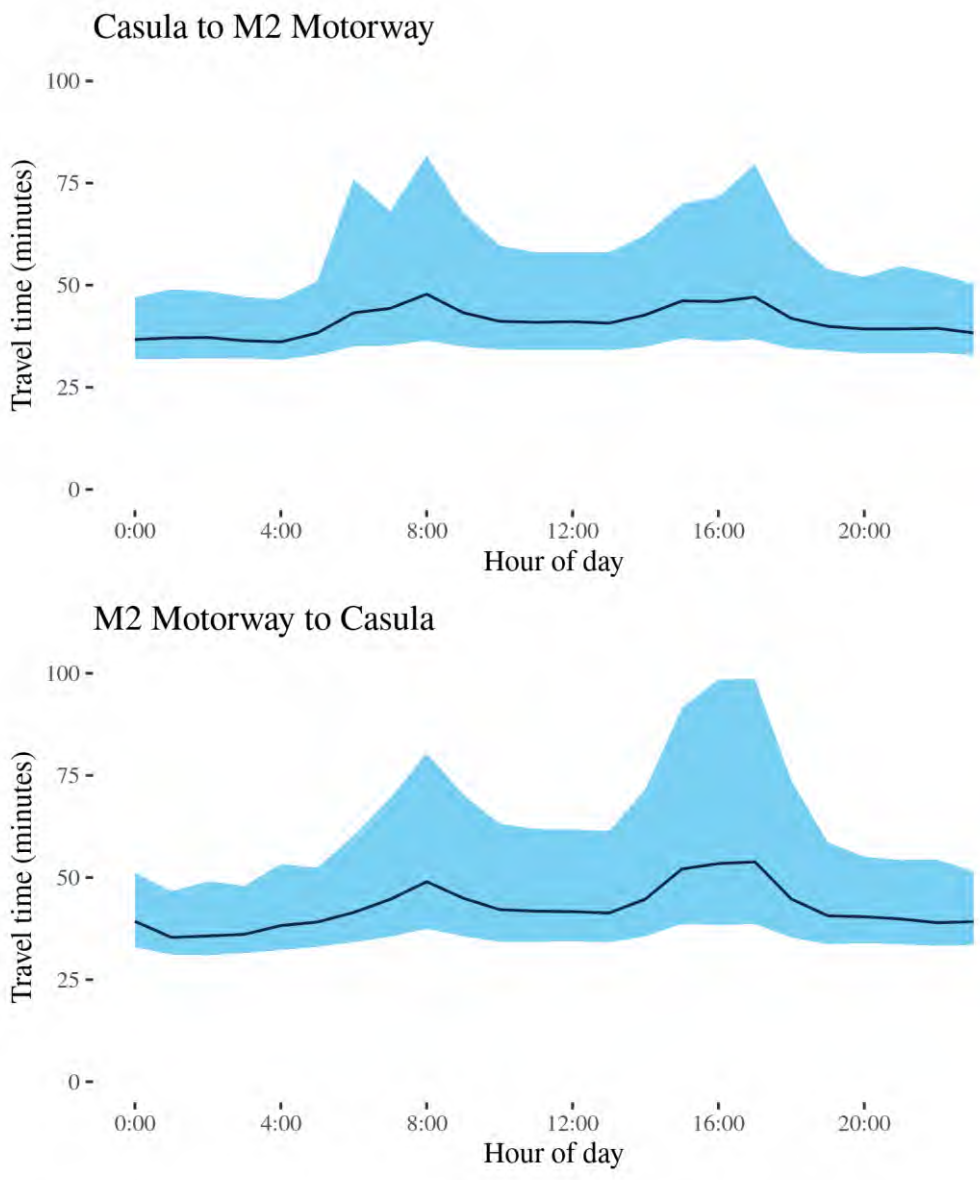
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Casula to M2 Motorway	00:36:07	00:47:49	1.1	00:14:51	00:45:14	1.7	32.8
M2 Motorway to Casula	00:35:21	00:53:49	1.2	00:15:24	01:00:05	1.9	32.9

Source: BITRE estimates.

The best travel times and lowest uncertainty travelling from Casula to the M2 Motorway were at 4am with a median travel time of 36 minutes and an interquartile range of 15 minutes. The longest median travel times and most uncertain travel times were in the morning peak at 8am with a median travel time of 48 minutes and an interquartile range of 45 minutes. Delays were most prominent between Parramatta and Carlingford. There was also a prominent peak in the afternoon, however, heightened uncertainty occurred throughout the day.

The best travel times and lowest uncertainty travelling from the M2 Motorway to Casula were at 1am with a median travel time of 35 minutes and an interquartile range of 15 minutes. The longest travel times were at 5pm with 54 minutes and the greatest uncertainty was at 4pm with an interquartile range of an hour. Like the journey from Casula, two peaks are present in the journey to Casula in the morning and afternoon respectively. Delays were most pronounced around Parramatta, Granville and Liverpool.

Figure A.4 A28 route median and interquartile range travel times



Source: BITRE estimates.

A3 - Blakehurst to Pymble / Pymble to Blakehurst

This route traverses Sydney from the intersection of Ryde Road and the Pacific Highway at Pymble to the Princes Highway at Blakehurst. It passes Ryde, Strathfield, Roselands and Hurstville along its way. It intersects with a number of other routes in this report including the M2, M4 and M5 motorways and the A34, A22 and A40.

Figure A.5 A3 route map

Source: BITRE estimates.

Table A.3 A3 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Blakehurst to Pymble	00:37:26	00:49:09	1.1	00:16:34	00:45:35	1.6	30.5
Pymble to Blakehurst	00:38:15	00:59:15	1.1	00:17:57	00:54:30	1.6	30.8

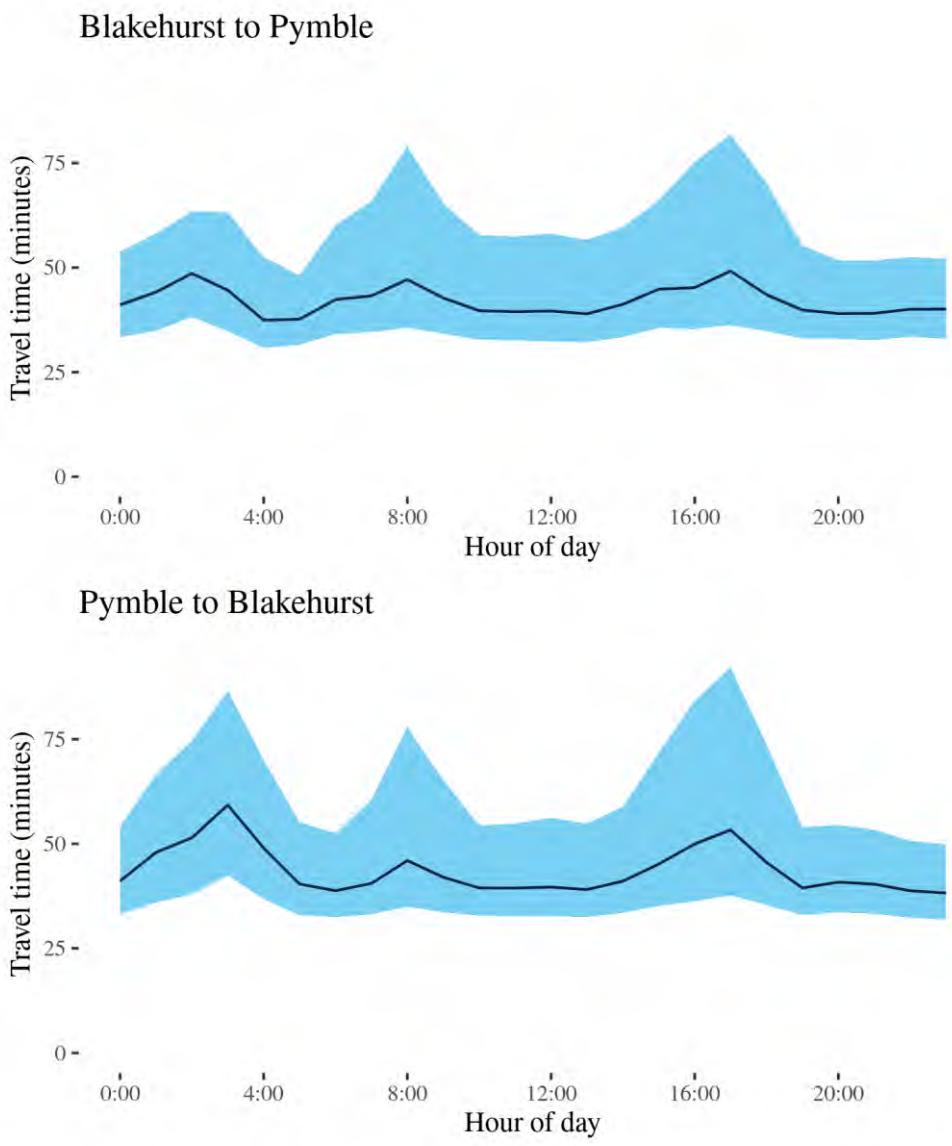
Source: BITRE estimates.

The best travel times for journeys from Blakehurst to Pymble were at 4am with a median of 37 minutes, while the lowest uncertainty were 5am with an interquartile range of 17 minutes. The longest median travel times and most uncertainty were in the afternoon peak at 5pm with a median of 49 minutes and an interquartile range of 46 minutes. There was also a prominent peak in the morning. Delays were most apparent around Macquarie Park and North Ryde.

The best travel times and lowest uncertainty travelling to Blakehurst were at 11pm with a median of 38 minutes and an interquartile range of 18 minutes. The longest median travel times were at 3am with a median of 59 minutes, while the greatest uncertainty were in the afternoon peak at 5pm with an interquartile range of 54.5 minutes. Delays were most apparent around Homebush. There was also a less pronounced morning peak.

In both directions there are signs of an early morning peak, though this is more significant for southbound trips. This peak had lower speeds throughout the route but more pronounced in the stretch between Pymble and the Ryde Bridges. The reasons for this early morning peak are unclear.

Figure A.6 A3 route median and interquartile range travel times



Source: BITRE estimates.

A34 - Liverpool to Newtown / Newtown to Liverpool

This route follows a path almost parallel but more southerly to the A22, passing Marrickville, Punchbowl and Milperra. It is known by names including Canterbury Road and Milperra Road along its length.

Figure A.7 A34 route map

Source: BITRE estimates.

Table A.4 A34 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Liverpool to Newtown	00:32:04	00:46:17	1.2	00:17:14	00:56:52	2.0	26.1
Newtown to Liverpool	00:32:52	00:47:38	1.2	00:19:40	01:03:07	1.8	26.1

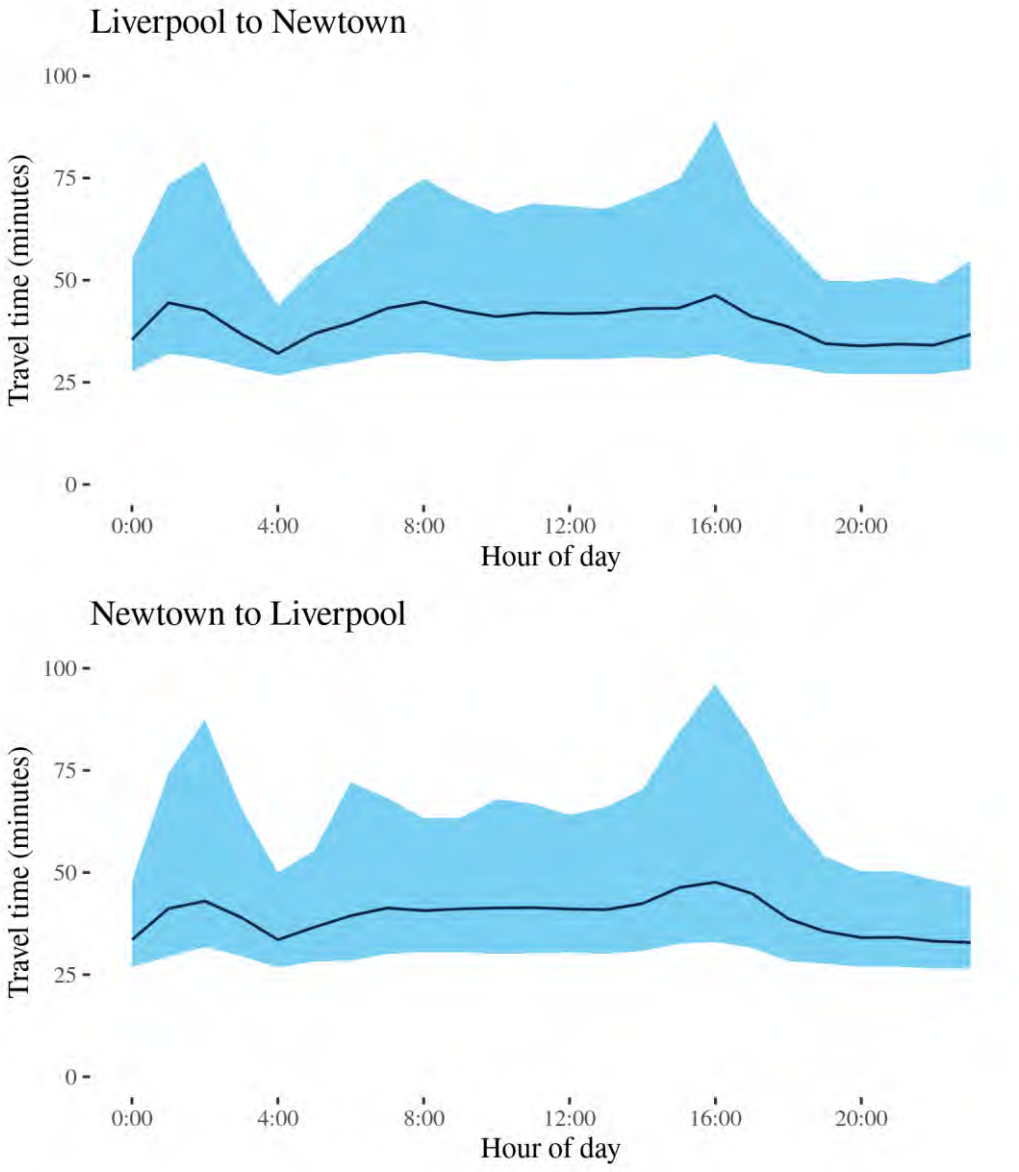
Source: BITRE estimates.

The best travel times and lowest uncertainty travelling from Liverpool to Newtown were 4am with a median travel time of 32 minutes and an interquartile range of 17 minutes respectively. The longest median travel times and most uncertain travel times were in the afternoon peak at 4pm with a median of 46 minutes and an interquartile range of 57 minutes respectively. Delays at this time were mostly evenly spread along the route but slightly more apparent at Newtown and Stanmore.

The best travel times and lowest uncertainty travelling from Newtown to Liverpool were at 11pm with a median travel time of 33 minutes and an interquartile range of 20 minutes. The longest travel times and the greatest uncertainty were at 4pm with a median of 48 minutes and an interquartile range of just over an hour. Delays were similarly distributed along the route but with a slight emphasis in the east.

Like the A3 route, the A34 route also showed a third early morning peak in both directions with delays concentrated in Newtown. The reasons for the early morning peak are not apparent.

Figure A.8 A34 route median and interquartile range travel times



Source: BITRE estimates.

A36 - Broadway to Georges River / Georges River to Broadway

This route travels south from the inner city at Broadway (Glebe), skirting industrial areas at Alexandria and passing through the Street George region before meeting the A3 at Blakehurst. For most of its length it is known as the Princes Highway.

Figure A.9 A36 route map

Source: BITRE estimates.

Table A.5 A36 route travel times and congestion measures, 2019

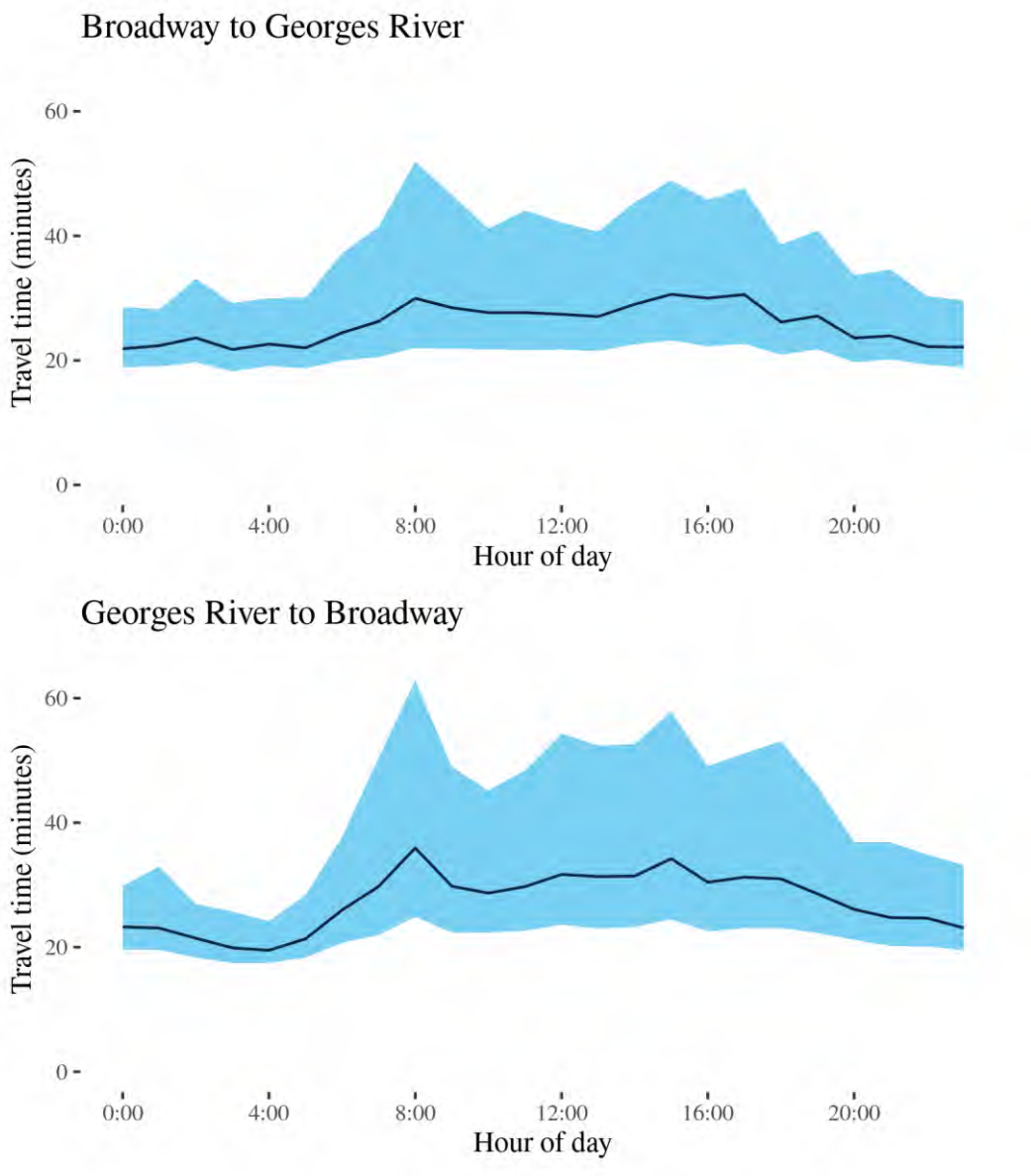
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Broadway to Georges River	00:21:45	00:30:36	1.2	00:09:09	00:29:55	1.9	16.5
Georges River to Broadway	00:19:30	00:35:56	1.4	00:06:41	00:37:54	3.2	16.5

Source: BITRE estimates.

The best travel times travelling from Broadway to Georges River were at 3am with a median travel time of 22 minutes, while the lowest uncertainty were 1am with an interquartile range of 9 minutes. The longest median travel times were in the afternoon peak at 3pm with a median of 31 minutes and the most uncertain time were in the morning peak at 8am experiencing an interquartile range of 30 minutes. Travel times and uncertainty were higher throughout business hours than other times of the day with delays most apparent around Tempe.

The best travel times and lowest uncertainty travelling from Georges River to Broadway were at 4am with a median travel time of 19.5 minutes and an interquartile range of 7 minutes. The longest median travel times and greatest uncertainty were in the morning peak at 8am with a median of 36 minutes and an interquartile range of 38 minutes respectively. Like the opposite direction, travel times and uncertainty were heightened throughout business hours. Delays were experienced at Tempe and at Enmore.

Figure A.10 A36 route median and interquartile range travel times



Source: BITRE estimates.

A40 - Baulkham Hills to Rozelle / Rozelle to Baulkham Hills

This route connects the inner city (Rozelle) and the north-west of Sydney passing through Gladesville, Rydalmere and Toongabbie along its way. It is known at different points as Victoria Road, James Ruse Drive and Old Windsor Road.

Figure A.11 A40 route map

Source: BITRE estimates.

Table A.6 A40 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Baulkham Hills to Rozelle	00:32:37	00:48:16	1.2	00:13:05	00:50:32	2.0	27.8
Rozelle to Baulkham Hills	00:32:05	00:53:33	1.2	00:11:50	01:02:53	2.1	28.1

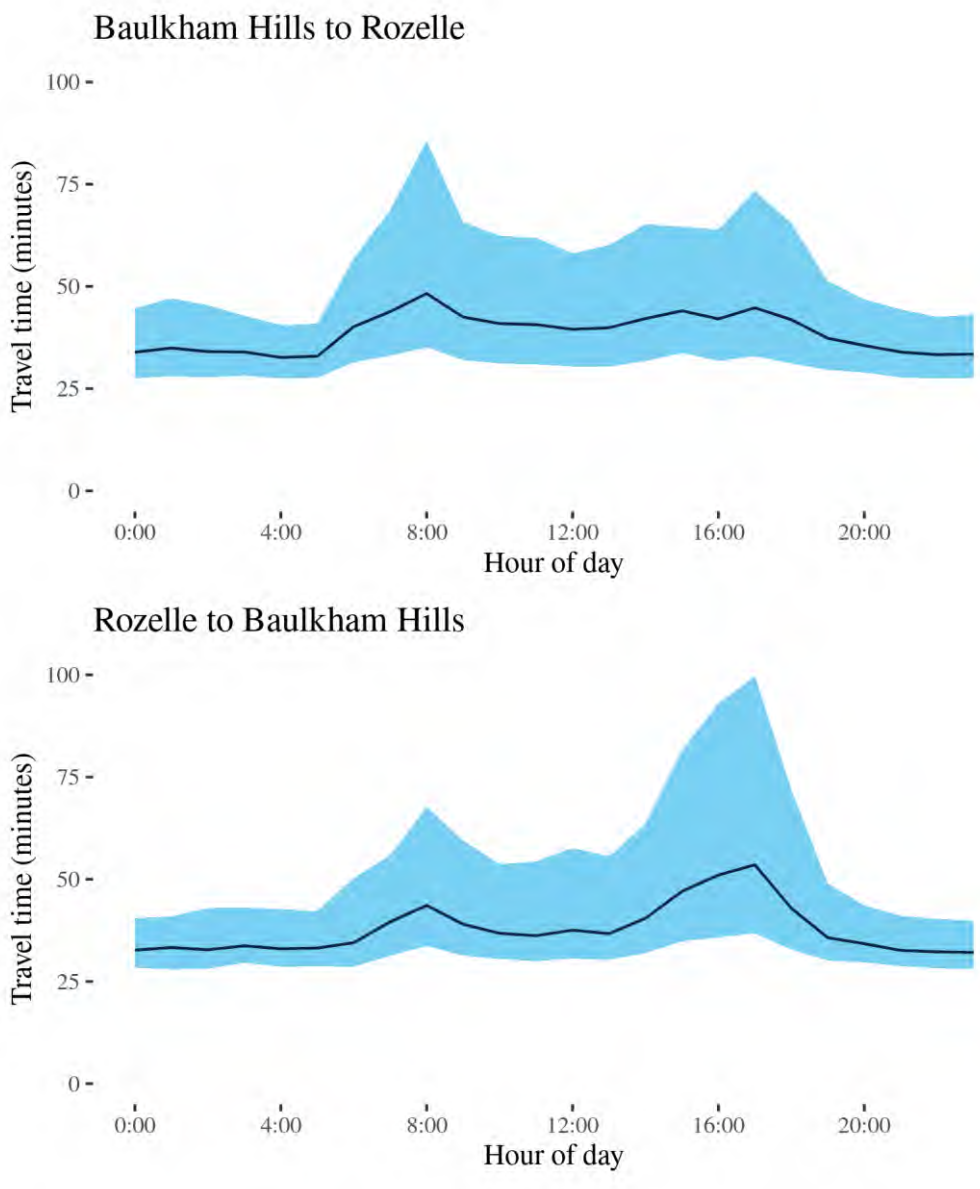
Source: BITRE estimates.

The best travel times and lowest uncertainty for journeys from Baulkham Hills to Rozelle were experienced at 4am with a median travel time of 33 minutes and an interquartile range of 13 minutes. The longest median travel times and most uncertainty were in the morning peak at 8am with a median of 48 minutes and an interquartile range of 51 minutes respectively. Delays were most apparent at Drummoyne but were also apparent at Northmead and West Ryde.

The best travel times and lowest uncertainty travelling to Baulkham Hills were at 11pm with a median travel time of 32 minutes and an interquartile range of 12 minutes. The longest median travel times and greatest uncertainty were at 5pm in the afternoon peak with a median of 54 minutes and an interquartile range of just over an hour respectively. Delays were most apparent at Ryde, Rydalmere and Toongabbie.

Both directions experienced elevated uncertainty throughout business hours, especially travelling to Rozelle.

Figure A.12 A40 route median and interquartile range travel times



Source: BITRE estimates.

A6 - Carlingford to Padstow / Padstow to Carlingford

This route traverses Sydney linking Carlingford and Padstow roughly parallel to but more Westerly than the A3. It passes Rydalmere, Lidcombe and Bankstown. This route intersects with the M2, M4 and M7 motorways and passes the Chullora precinct.

Figure A.13 A6 route map

Source: BITRE estimates.

Table A.7 A6 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Carlingford to Padstow	00:23:22	00:32:51	1.1	00:11:51	00:29:23	1.5	19.9
Padstow to Carlingford	00:22:31	00:35:24	1.3	00:11:26	00:35:55	1.7	20.1

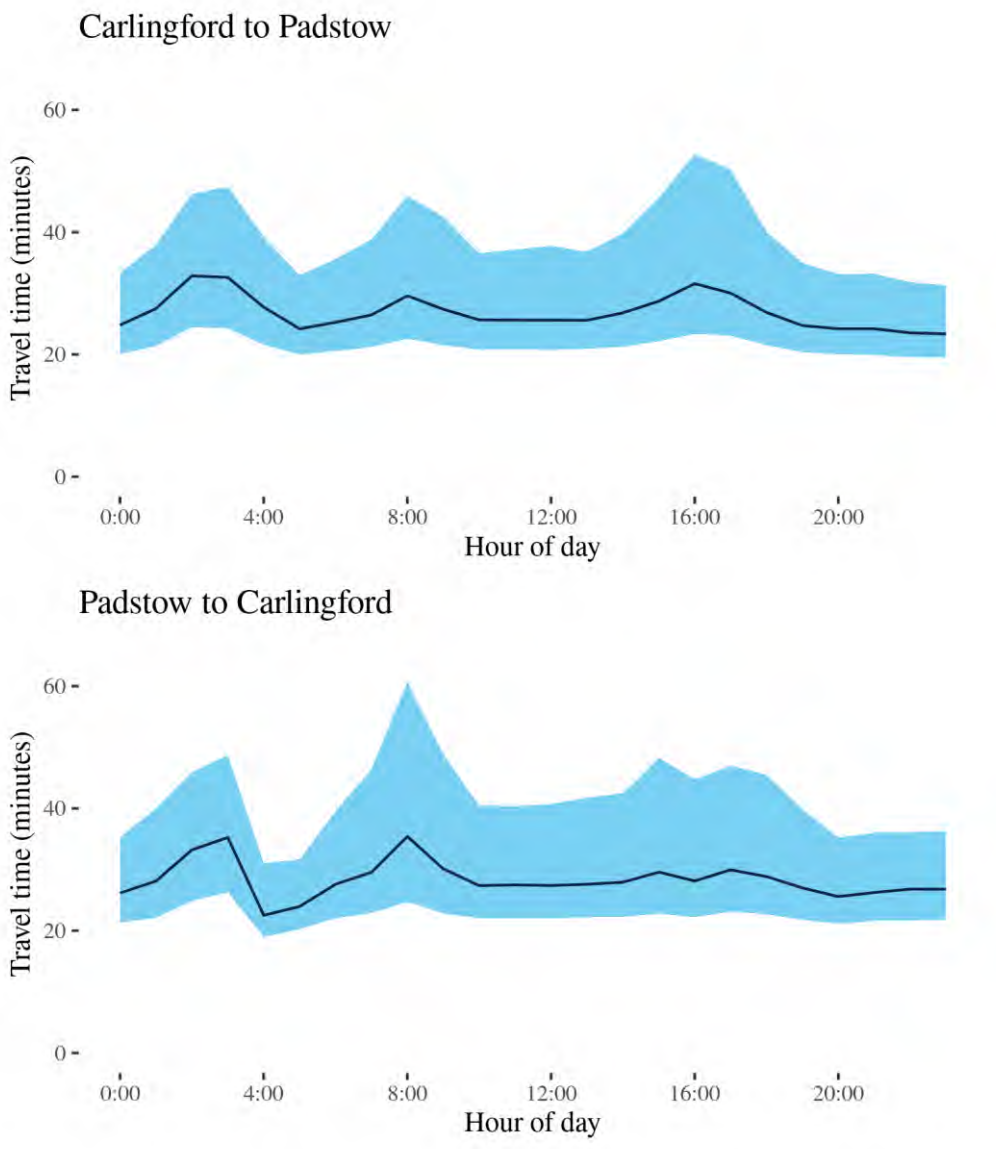
Source: BITRE estimates.

The best travel times and lowest uncertainty travelling from Carlingford were at 11pm with a median travel time of 23 minutes and an interquartile range of 12 minutes. The longest median travel times were at 2am with a median of 33 minutes and the most uncertainty were in the afternoon peak at 4pm with an interquartile range of 29 minutes. There was also a distinct morning peak. Delays were most apparent at Silverwater and Bankstown and, to a lesser extent, at Dundas Valley.

The best travel times travelling to Carlingford were at 4am with a median travel time of 22.5 minutes and the lowest uncertainty were 5am with an interquartile range of 11 minutes. The longest median travel times and greatest uncertainty were at 8am in the morning peak with a median of 35 minutes and an interquartile range of 36 minutes. Delays were most apparent at Punchbowl and Dundas Valley. The afternoon peak was discernible but not prominent.

Like the A3 and A34, the A6 shows a third early morning peak in both directions. This 'third peak' showed delays spread throughout the route but slightly more apparent at locations that also saw delays during peak periods. The reasons for this third peak are not apparent.

Figure A.14 A6 route median and interquartile range travel times



Source: BITRE estimates.

M1 (North) - Cahill Expressway to M2 / M2 to Cahill Expressway

This route links the Sydney CBD to the Lane Cove Tunnel at the beginning of the M2 via the Sydney Harbour Tunnel, the Warringah Freeway and the Gore Hill Freeway. It is a major commuter route but somewhat less important for freight.

Figure A.15 M1 (North) route map

Source: BITRE estimates.

Table A.8 M1 (North) route travel times and congestion measures, 2019

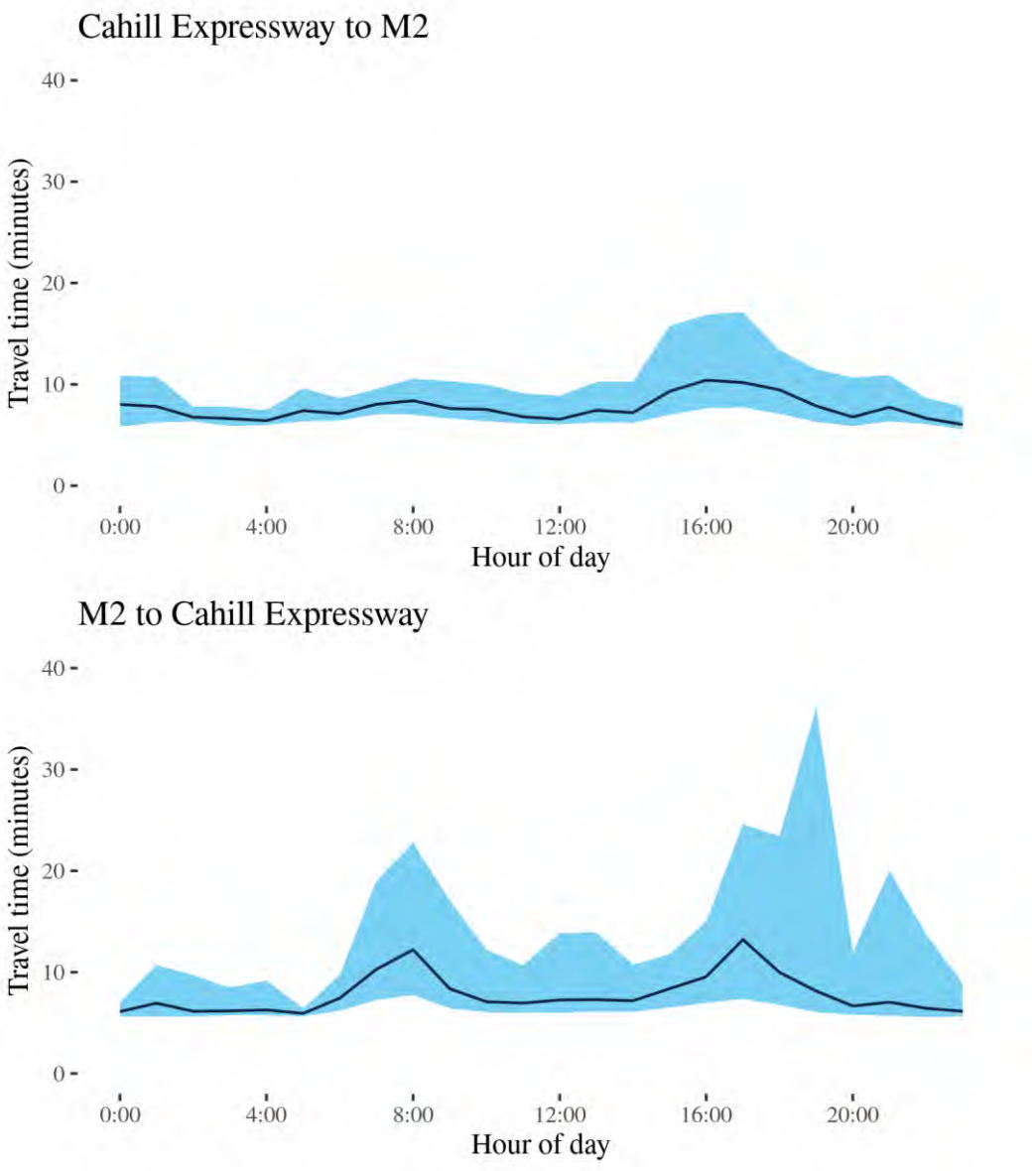
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Cahill Expressway to M2	00:06:02	00:10:25	1.3	00:01:27	00:09:25	2.9	7.3
M2 to Cahill Expressway	00:05:56	00:13:13	1.3	00:00:47	00:30:04	10.6	7.3

Source: BITRE estimates.

The best travel times travelling from the CBD (Cahill Expressway) to the M2 were at 11pm with a median travel time of just over 6 minutes and the lowest uncertainty were at 4am with an interquartile range of 1.5 minutes. The longest median travel times were at 4pm with a median of 10 minutes and the greatest uncertainty was at 5pm with an interquartile range of over 9 minutes. Delays were more apparent on the Cahill Expressway and in the Sydney Harbour Tunnel.

The best travel times and lowest uncertainty travelling from the M2 to the CBD were at 5am with a median travel time of 6 minutes and an interquartile range of less than a minute. The longest median travel times were at 5pm with a median travel time of over 13 minutes and the greatest uncertainty was at 7pm with an interquartile range of just over 30 minutes. Unlike travel out of the CBD (with only one obvious afternoon peak), travel into the CBD had pronounced peaks in both the morning and afternoon. Delays in both peaks were apparent in the Sydney Harbour Tunnel but most pronounced on the Warringah Expressway near Neutral Bay and North Sydney.

Figure A.16 M1 (North) route median and interquartile range travel times



Source: BITRE estimates.

M1 (South) - Cahill Expressway to M5 / M5 to Cahill Expressway

This route travels between the east of the CBD and M5 near Sydney Airport via the Eastern Distributor, South Dowling Street and General Holmes Drive.

Figure A.17 M1 (South) route map

Source: BITRE estimates.

Table A.9 M1 (South) route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Cahill Expressway to M5	00:10:07	00:18:54	1.2	00:01:39	00:17:38	4.1	12.1
M5 to Cahill Expressway	00:10:17	00:26:53	1.3	00:02:12	00:34:19	3.5	12.0

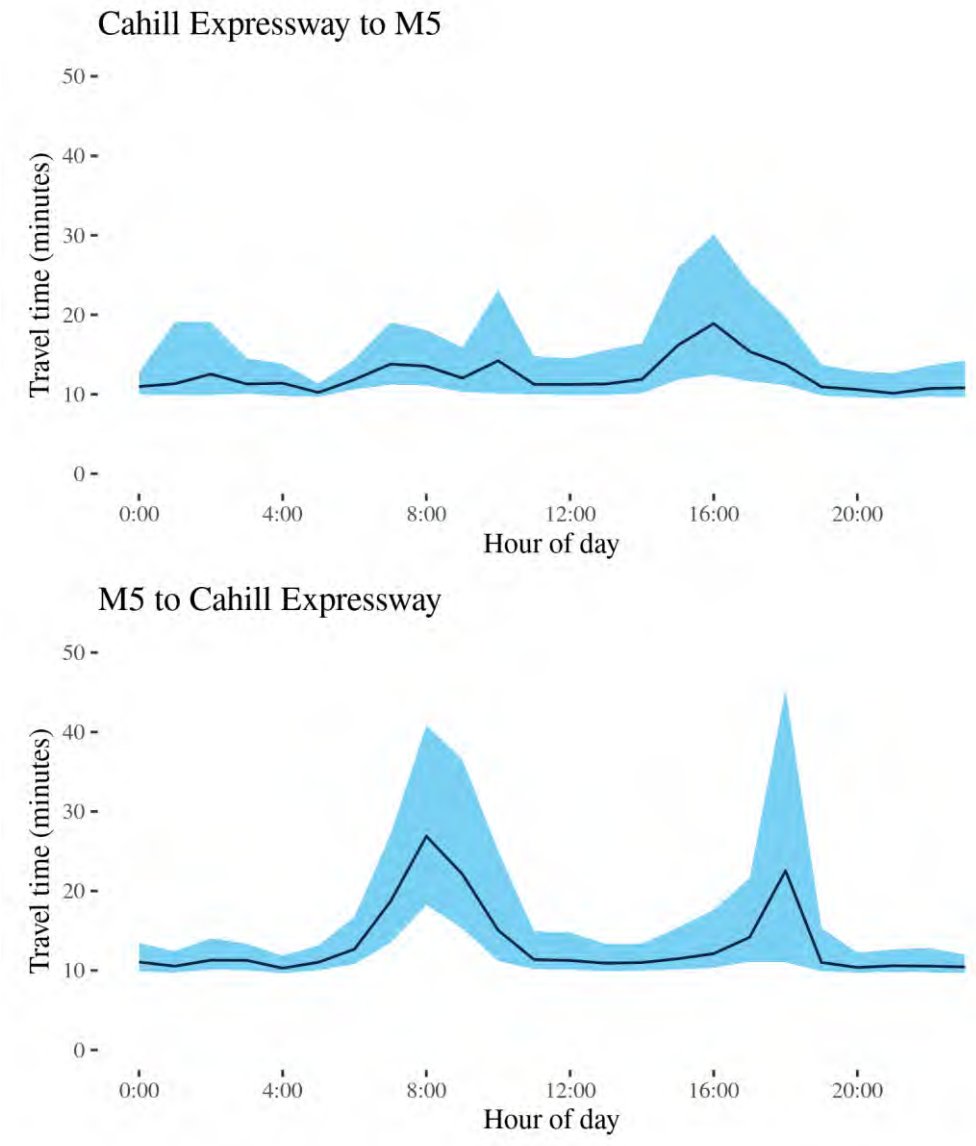
Source: BITRE estimates.

The best travel times travelling from the CBD (Cahill Expressway) to the M5 were at 9pm with a median travel time of over 10 minutes and the lowest uncertainty were at 5am an interquartile range of 2 minutes. The longest median travel times and greatest uncertainty were at 4pm with a median of 19 minutes and an interquartile range of 18 minutes. Delays were most apparent at the northerly and southerly extremes of the route on General Holmes Drive and the Eastern Distributor.

The best travel times and lowest uncertainty travelling from the M5 to the CBD (Cahill Expressway) were at 4am with a median travel time of over 10 minutes and an interquartile range of 2 minutes. The longest median travel times were in the morning peak at 8am with a median of nearly 27 minutes, and uncertainty in the evening at 6pm with an interquartile range of over 34 minutes. Delays in both peaks were most apparent in the southerly part of the route with particular delays near where General Holmes Drive meets Southern Cross Drive.

Like the M1 North, journeys towards the CBD showed much more distinct peak periods than the journey out of the CBD.

Figure A.18 M1 (South) route median and interquartile range travel times



Source: BITRE estimates.

M2 - M1 to M7 / M7 to M1

This route runs between the Hills District and Lane Cove connecting the M7 and M2 via the M2 motorway and the Lane Cove Tunnel. It is an important route for both commuter and freight traffic.

Figure A.19 M2 route map

Source: BITRE estimates.

Table A.10 M2 route travel times and congestion measures, 2019

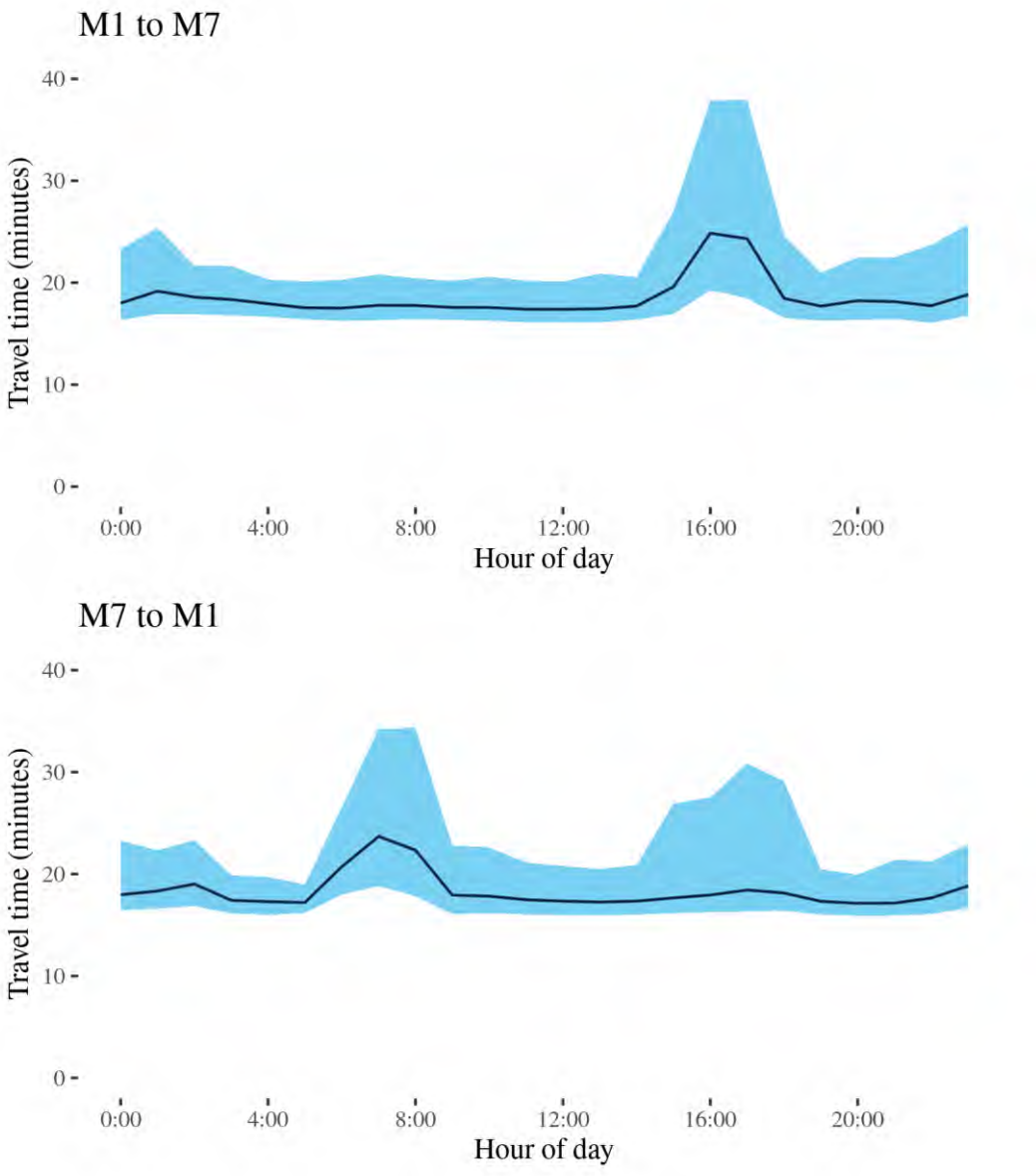
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
M1 to M7	00:17:23	00:24:51	1.1	00:03:39	00:19:28	1.8	24.5
M7 to M1	00:17:08	00:23:42	1.1	00:02:48	00:16:29	2.6	24.3

Source: BITRE estimates.

The best travel times travelling from the M1 to the M7 were at 12pm with a median travel time of over 17 minutes and the lowest uncertainty were at 4am with an interquartile range of nearly 4 minutes. However, there was little variation from 2am to 2pm and no morning peak. The longest median travel times were at 4pm with a median of nearly 25 minutes and the greatest uncertainty was in the afternoon peak at 5pm with an interquartile range of over 19 minutes. Delays were most apparent at the western end of the route particularly near Pennant Hills Road and Windsor Road.

The best travel times travelling from the M7 to the M1 (Gore Hill Expressway) were at 8pm with a median travel time of 17 minutes and the lowest uncertainty were at 5am with an interquartile range of nearly 3 minutes. The longest median travel times was nearly 24 minutes at 7am and the greatest uncertainty was 8am with an interquartile range of 16.5 minutes. There was also a distinct peak of uncertainty, but not median time, during the afternoon. Delays were most apparent when approaching to the Lane Cove Tunnel at Macquarie Park.

Figure A.20 M2 route median and interquartile range travel times



Source: BITRE estimates.

M4 - Glenbrook to Strathfield / Strathfield to Glenbrook

This route runs connects the A32 at Glenbrook with the former terminus of the M4 at Strathfield. It intersects with several north–south routes in this report including the M7, A28 and A6. It does not incorporate Parramatta Road or the City West Link, nor the M4 East tunnel that opened in July 2019.

Figure A.21 M4 route map

Source: BITRE estimates.

Table A.11 M4 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Glenbrook to Strathfield	00:33:38	00:36:40	1	00:04:40	00:13:04	1.5	45.8
Strathfield to Glenbrook	00:33:41	00:41:08	1	00:05:43	00:18:07	1.4	45.8

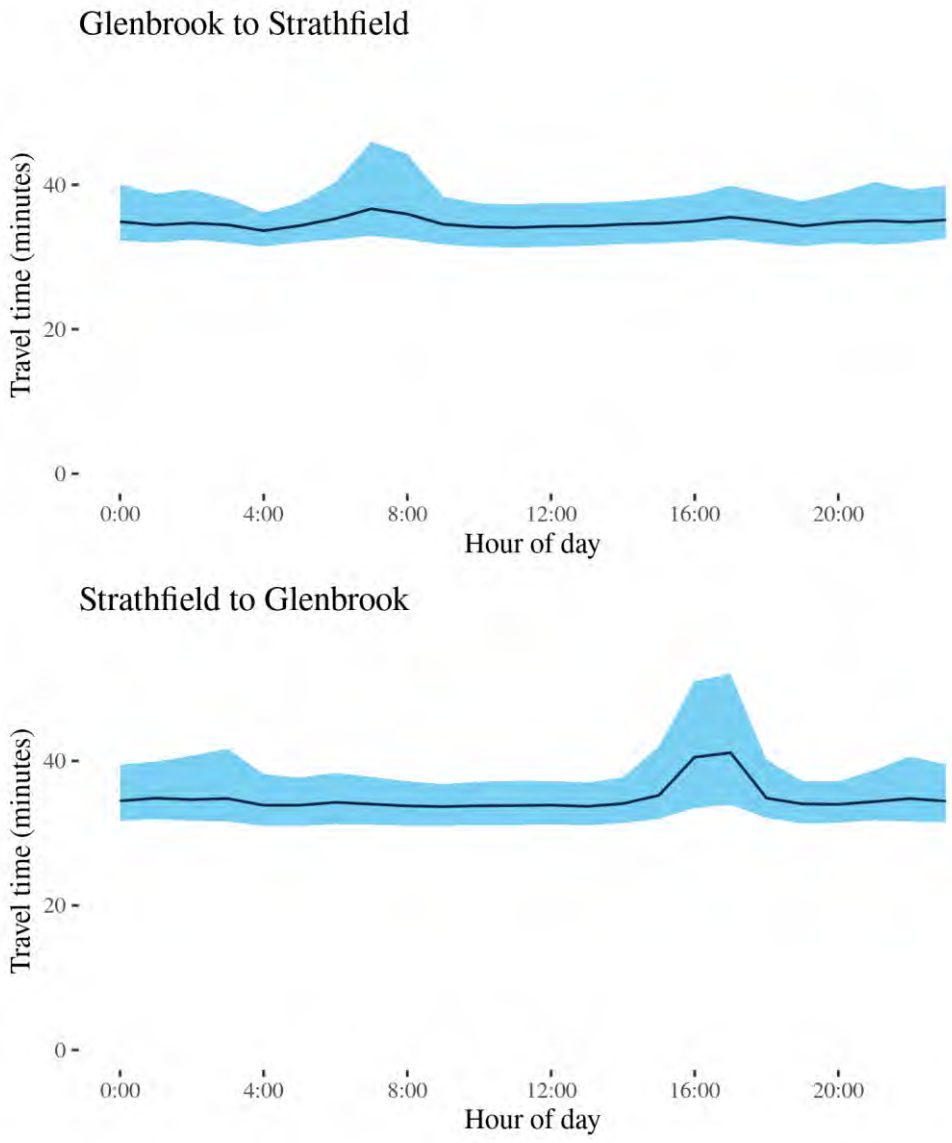
Source: BITRE estimates.

The best median travel times and lowest uncertainty travelling from Glenbrook to Strathfield were at 4am with a median travel time of nearly 34 minutes and an interquartile range nearly 5 minutes. The longest median travel times and greatest uncertainty were in the morning peak at 7am with a median nearly 37 minutes and an interquartile range of just over 13 minutes. Delays, though mild, were distributed evenly along the route.

The best median travel times from Strathfield to Glenbrook were nearly 34 minutes at 9am and the lowest uncertainty were at 8pm with an interquartile range of nearly 6 minutes. The longest median travel times and greatest uncertainty were in the afternoon peak at 5pm with a median of just over 41 minutes and an interquartile range of just over 18 minutes. Delays in the afternoon peak were most apparent between Silverwater and Wentworthville.

Travel times and uncertainty were very similar in both directions throughout most of the day except during the morning peak heading towards Strathfield or the afternoon peak heading towards Glenbrook. Delays in median travel times were more apparent heading towards Glenbrook.

Figure A.22 M4 route median and interquartile range travel times



Source: BITRE estimates.

M5 - Hume Motorway to M1 / M1 to Hume Motorway

This route follows the M5 Motorway between the Hume Motorway at Casula and the M1 at General Holmes Drive. It is a major commuter route and also services freight traffic in areas around the Airport and Port Botany.

Figure A.23 M5 route map

Source: BITRE estimates.

Table A.12 M5 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Hume Motorway to M1	00:20:50	00:37:11	1.2	00:07:17	00:32:17	2.0	29.3
M1 to Hume Motorway	00:21:23	00:41:05	1.2	00:05:37	00:33:38	2.3	29.3

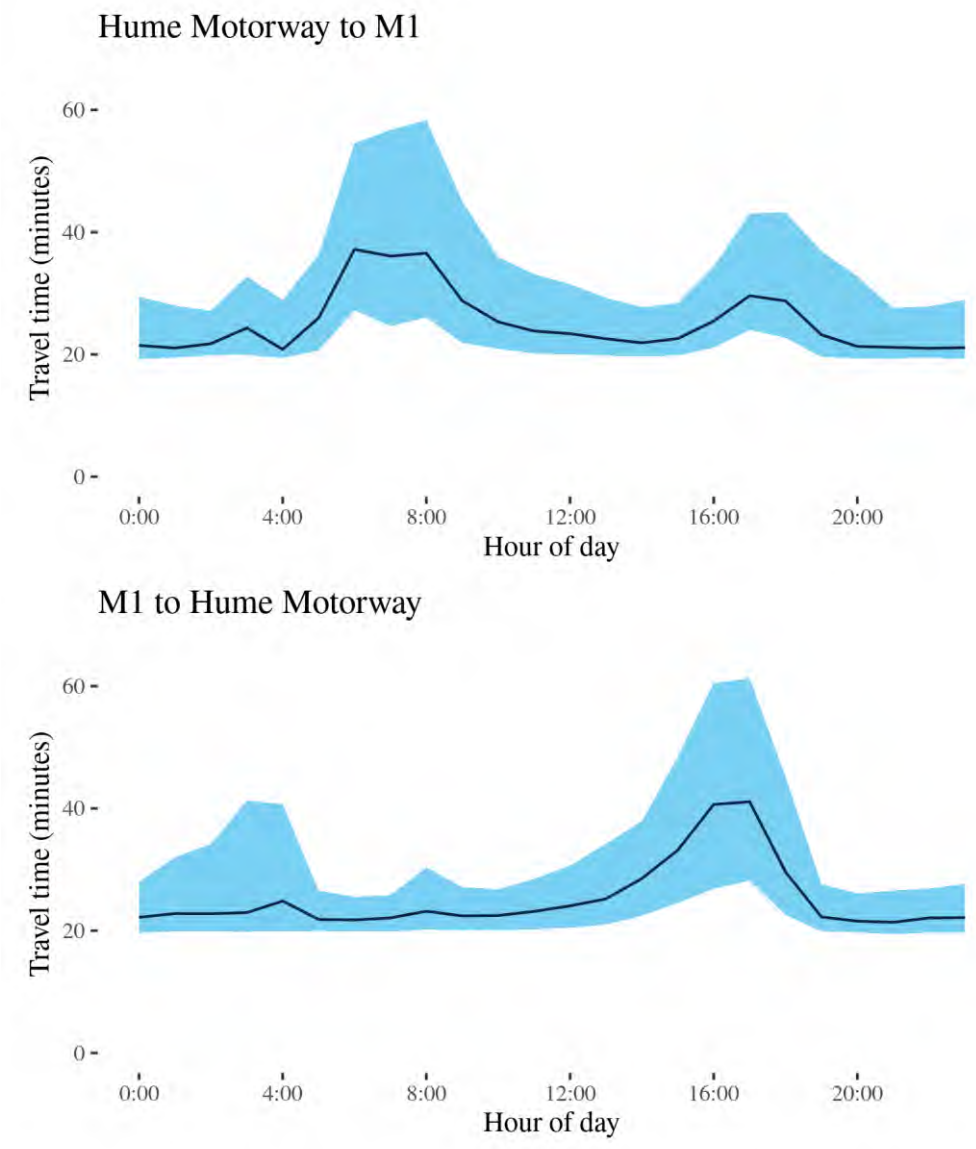
Source: BITRE estimates.

The best median travel times for journeys from the Hume Motorway to the M1 were 21 minutes at 4am and the lowest uncertainty were at 2am with an interquartile range of over 7 minutes. The longest median travel times was 37 minutes in the morning peak at 6am and the greatest uncertainty was at 8am with an interquartile range of over 32 minutes. Delays were most apparent at the easterly end of the route, especially towards the mouth of the M5 tunnel. There was another, smaller afternoon peak.

The best median travel times for journeys from the M1 to the Hume Motorway were over 21 minutes at 9pm and lowest uncertainty were at 6am with an interquartile range of nearly 6 minutes. The longest median travel times were at 5pm with a median of just over 41 minutes and the greatest uncertainty was at 4pm with an interquartile range of nearly 34 minutes. Delays were again most apparent at the easterly end of the route, but there were also delays in the west between Milperra and Moorebank.

Unlike the eastbound route, the westbound route exhibited no significant morning travel peak. However, there was a clear heightened uncertainty in the early morning which is more obvious westbound. This may have been related to construction work on the M8 tunnel.

Figure A.24 M5 route median and interquartile range travel times



Source: BITRE estimates.

M7 - M2 to M5 / M5 to M2

This route follows the M7 Motorway between its confluence with the M2 in the Hills District and Hume Motorway at Casula, skirting much of Western Sydney and crossing the M4 Motorway. It is a major route for intercity freight including trips that do not start or end in Sydney.

Figure A.25 M7 route map

Source: BITRE estimates.

Table A.13 M7 route travel times and congestion measures, 2019

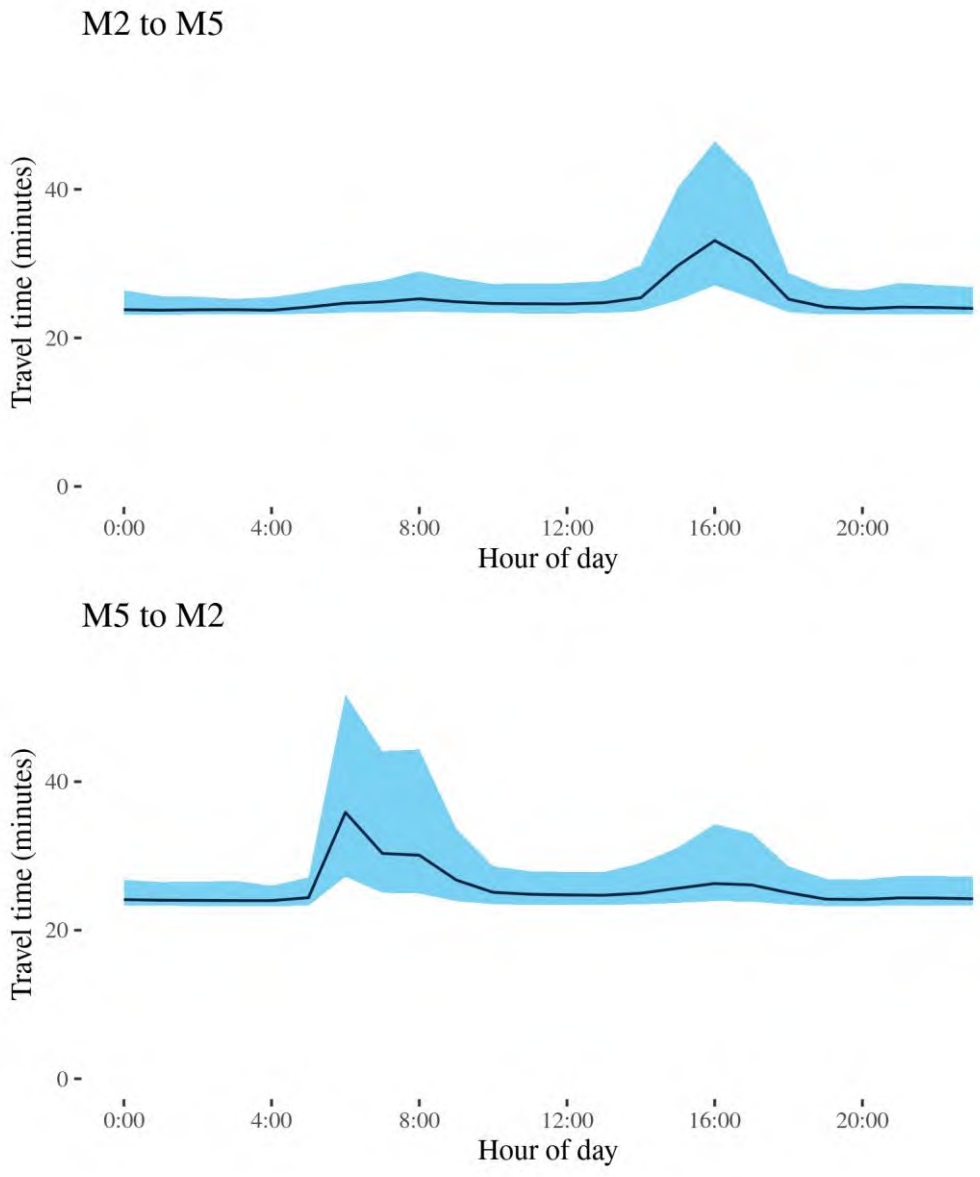
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
M2 to M5	00:23:44	00:33:06	1.1	00:02:02	00:19:22	2.7	38.4
M5 to M2	00:23:59	00:35:52	1.1	00:02:46	00:24:32	2.5	38.5

Source: BITRE estimates.

The best median travel times for journeys from the M2 to the M5 (Hume Motorway) was nearly 24 minutes at 4am and the lowest uncertainty were at 3am with an interquartile range of 2 minutes. The longest median travel times and greatest uncertainty were in the afternoon peak at 4pm with a median of 33 minutes and an interquartile range of over 19 minutes. Delays were most apparent midway along the route around Eastern Creek, south of the M4 Motorway. Travel time and uncertainty were relatively stable throughout the day except the peak in the afternoon.

The best median travel times and the lowest uncertainty travelling from the M5 to the M2 were at 4am with a median of 24 minutes and an interquartile range of nearly 3 minutes. The longest median travel times and highest uncertainty were in the morning peak at 6am with a median nearly 36 minutes and an interquartile range of 24.5 minutes. There was also a smaller peak of uncertainty in the afternoon. Delays were most apparent near the beginning of the M7 near Baulkham Hills, but also apparent just south of Cecil Park.

Figure A.26 M7 route median and interquartile range travel times



Source: BITRE estimates.

Melbourne routes

Route 32 - Derrimut to Montrose / Montrose to Derrimut

This surface route crosses Melbourne linking Derrimut in the West and Montrose in the east. Along its way, it crosses under the M80, passes Somerville Road, Footscray Road, Port of Melbourne and Victoria Street/Parade at Carlton, Burke Road in Camberwell, Canterbury Road, and intersects with the M3 at Ringwood.

Figure A.27 Route 32 route map

Source: BITRE estimates.

Table A.14 Route 32 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Derrimut to Montrose	01:04:36	01:21:17	1.1	00:35:16	01:00:31	1.3	52.9
Montrose to Derrimut	01:11:25	01:37:58	1.2	00:46:23	02:22:34	1.7	53.1

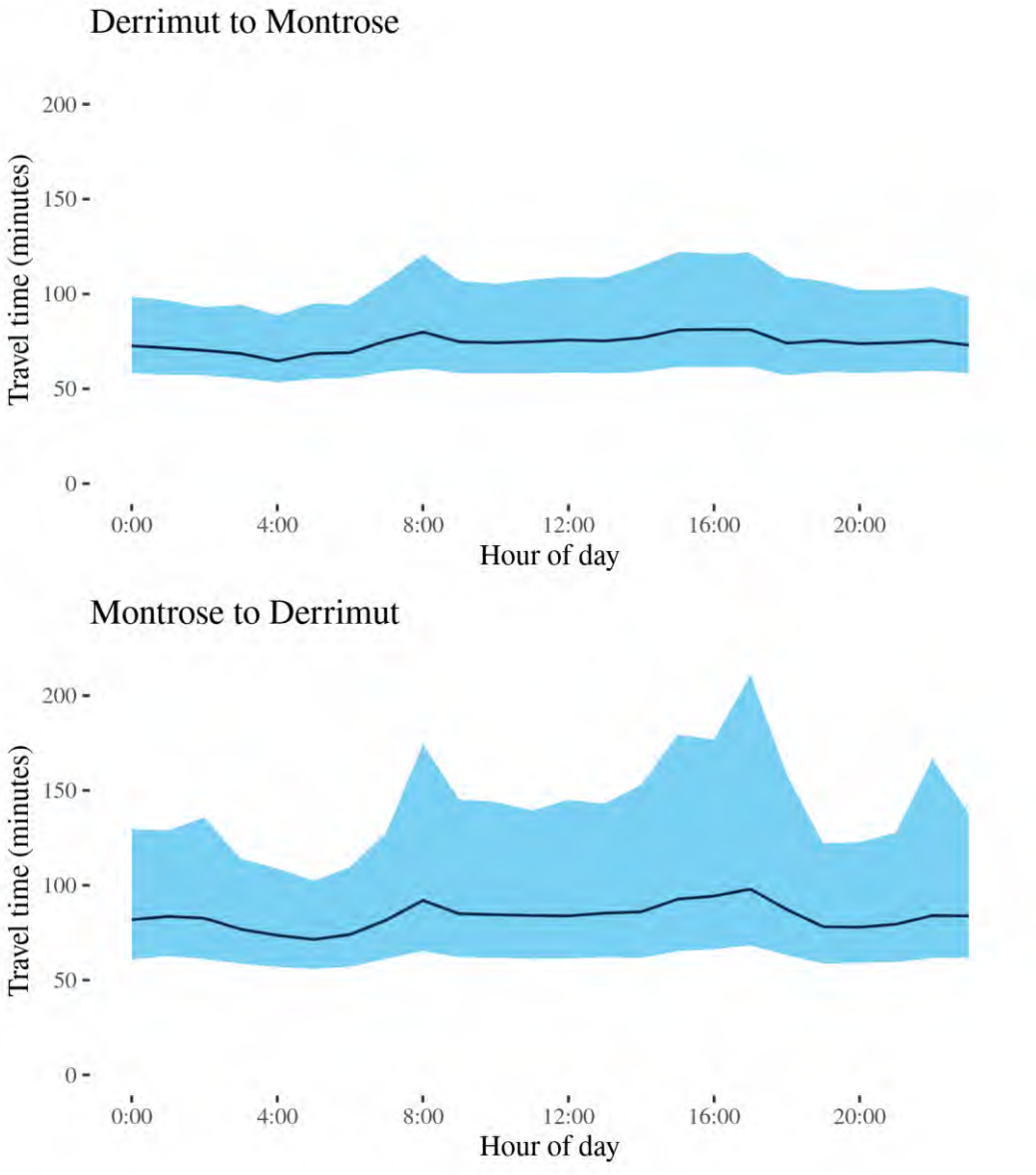
Source: BITRE estimates.

The best median travel times and least uncertainty for journeys from Derrimut to Montrose were at 4am with a median travel time of 1 hour 5 minutes and an interquartile range of 35 minutes. The longest median travel times were at 4pm with a median of 1 hour 21 minutes and the greatest uncertainty was at 3pm with an interquartile range of 1 hours.

The best median travel time and least uncertainty for journeys from Montrose to Derrimut were at 5am with a median travel time of 1 hour 11 minutes and an interquartile range of 46 minutes. The longest median travel times and greatest uncertainty were at 5pm with a median of 1 hour 38 minutes and an interquartile range of 2 hour 23 minutes.

The easterly trip to Montrose and the Westerly trip to Derrimut were similar in terms of travel time, travel time uncertainty and their patterns over the day. Elevated travel time and uncertainty were observed during business hours in both directions. There were no pronounced peaks in either direction.

Figure A.28 Route 32 route median and interquartile range travel times

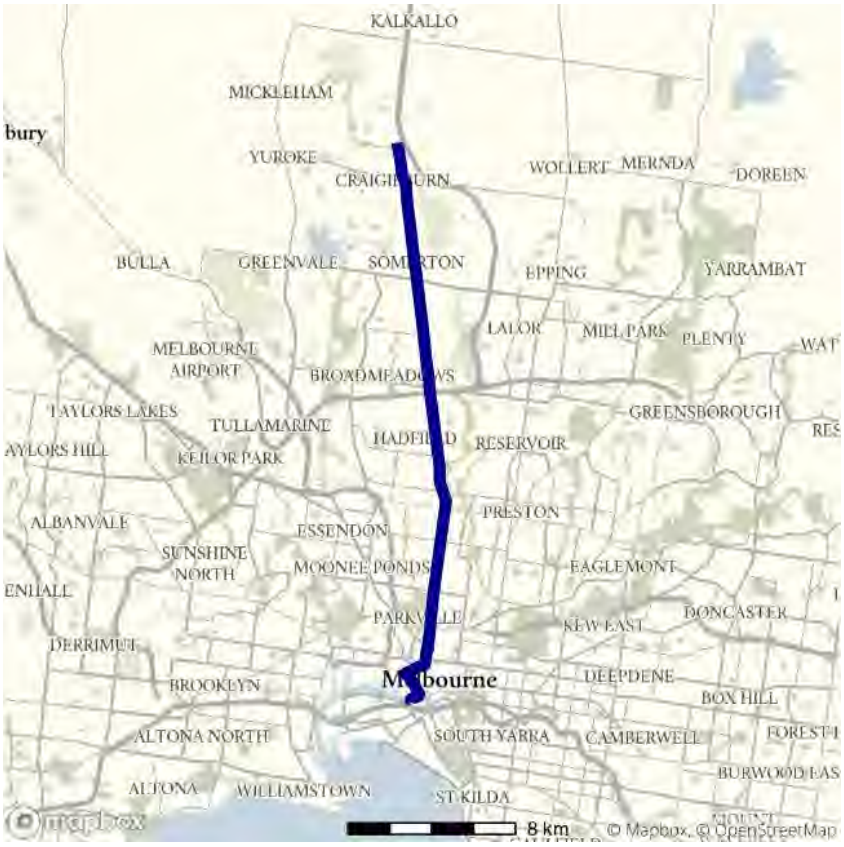


Source: BITRE estimates.

Route 55 - Hume Freeway to Montague St / Montague St to Hume Freeway

This surface route connects the Hume Freeway at Craigieburn and Montague Street in south Melbourne via Sydney Road through Somerton, Coburg and North Melbourne, skirting the CBD along Dudley Street and Wurundjeri Way.

Figure A.29 Route 55 route map



Source: BITRE estimates.

Table A.15 Route 55 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Hume Freeway to Montague St	00:34:13	00:52:49	1.2	00:22:22	01:49:58	2.2	28
Montague St to Hume Freeway	00:32:19	00:45:15	1.2	00:19:09	01:17:16	2.0	28

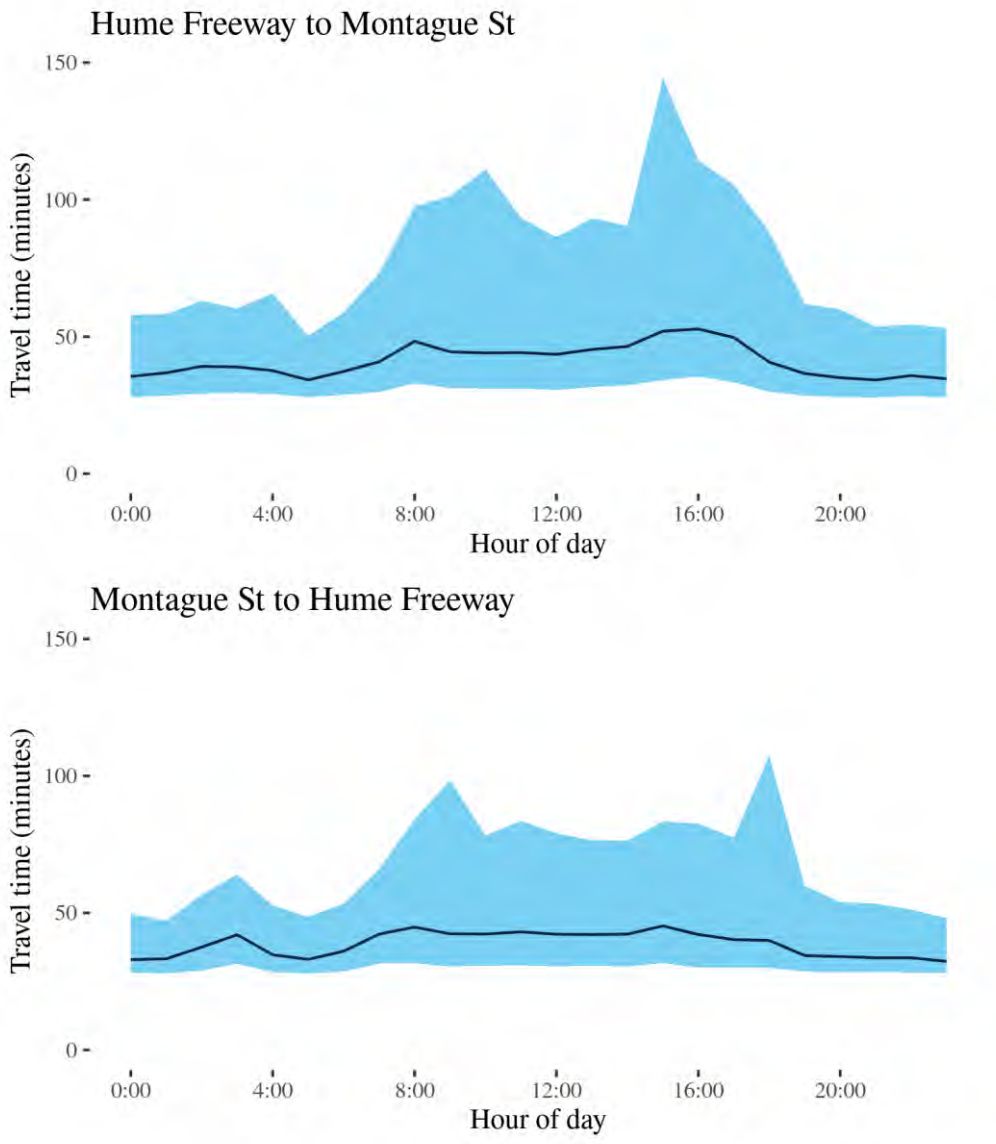
Source: BITRE estimates.

The best travel times for journeys from the Hume Freeway to Montague Street were at 9pm with a median travel time of 34 minutes and the lowest uncertainty were at 5am with an interquartile range of 22.5 minutes. The longest median travel times was 53 minutes at 4pm and the greatest uncertainty was at 3pm with an interquartile range of 1 hour 50 minutes. Delays were fairly evenly spread along the route but somewhat more apparent near the CBD and the M80 (Metropolitan Ring Road) at Broadmeadows.

The best median travel times for journeys from Montague Street to the Hume Freeway were 32 minutes at 11pm and the lowest uncertainty were at 1am with an interquartile range of 19 minutes. The longest median travel times was nearly 45 minutes at 3pm and the highest uncertainty were at 6pm with an interquartile range of 1 hour 17 minutes. Delays were spread fairly evenly throughout the route but slightly more apparent south of Coburg.

Median travel times were similar in both directions throughout the day and uncertainty was also heightened throughout business hours.

Figure A.30 Route 55 route median and interquartile range travel times



Source: BITRE estimates.

Route 56 - Laverton to Spotswood / Spotswood to Laverton

This surface route travels a short distance between Laverton and Spotswood in Melbourne's West using Dohertys Road, Grieve Parade and Blackshaws Road and passes a number of light industrial areas.

Figure A.31 Route 56 route map

Source: BITRE estimates.

Table A.16 Route 56 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Laverton to Spotswood	00:11:45	00:14:42	1.1	00:04:31	00:08:59	1.5	9.1
Spotswood to Laverton	00:11:22	00:15:46	1.1	00:04:18	00:15:00	1.7	9.1

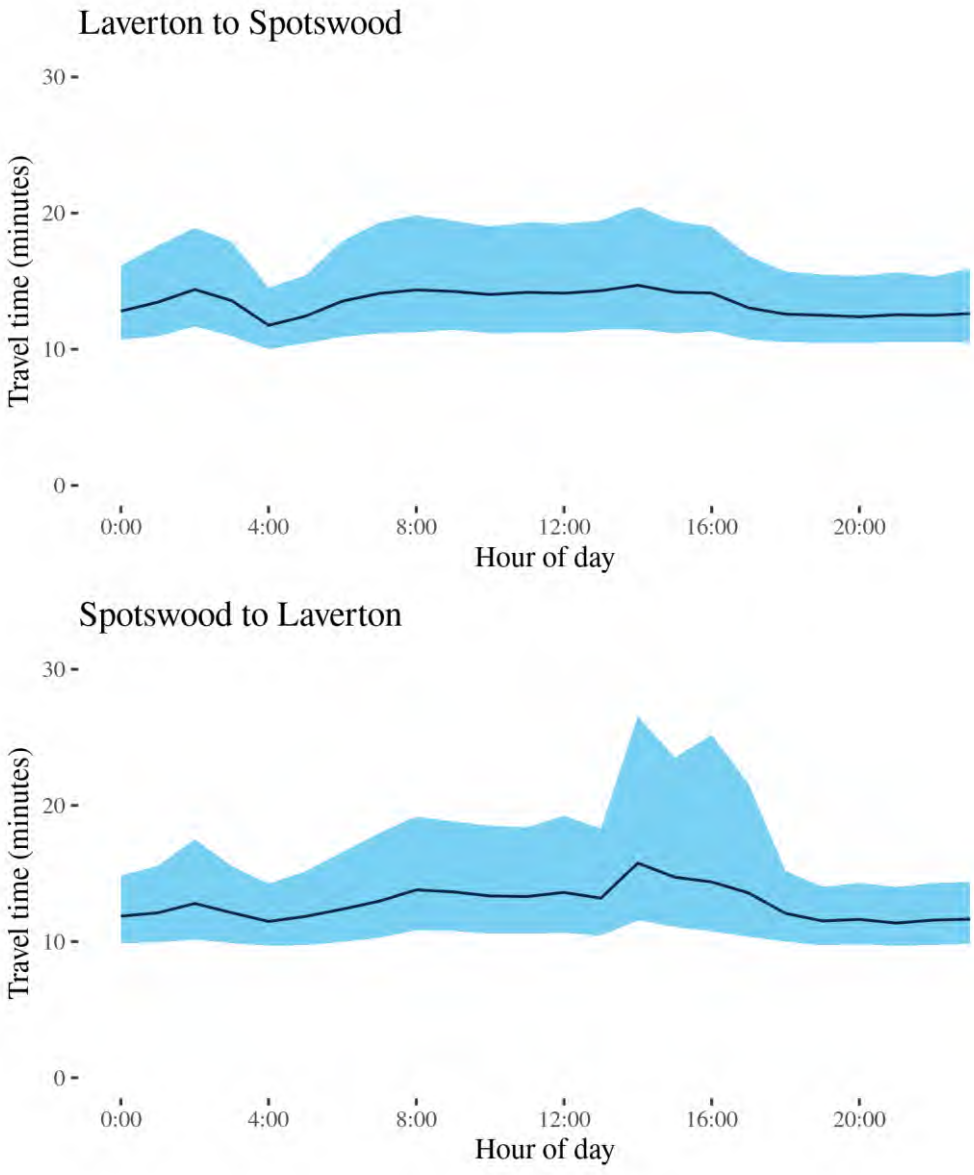
Source: BITRE estimates.

The best travel times and lowest uncertainty travelling from Laverton to Spotswood were at 4am with a median travel time of 12 minutes and an interquartile range of 4.5 minutes. The longest median travel times and greatest uncertainty were at 2pm with a median of 15 minutes and an interquartile range of 9 minutes. Delays were most apparent on Blackshaws Road in Altona North. Travel time and uncertainty were heightened throughout business hours.

The best travel times travelling from Spotwood to Laverton were at 9pm with a median travel time of 11 minutes and the lowest uncertainty were at 7pm and an interquartile range of 4 minutes. The longest median travel times and highest uncertainty were in the afternoon peak at 2pm with a median of nearly 16 minutes and an interquartile range of 15 minutes. Delays were fairly evenly spread along the route but were slightly more pronounced towards Laverton.

The data suggests a third early morning peak in both directions around 2am but the reasons for this are unclear.

Figure A.32 Route 56 route median and interquartile range travel times



Source: BITRE estimates.

Route 58 - Greenvale to Yan Yean Road / Yan Yean Road to Greenvale

This surface route crosses large part of Melbourne's northern fringe connecting Mickleham Road in the west and the intersection of Gorge Road and Yan Yean Road near Plenty in the east. It uses Somerton Road, Cooper Street, High Street and McDonalds Road.

Figure A.33 Route 58 route map

Source: BITRE estimates.

Table A.17 Route 58 route travel times and congestion measures, 2019

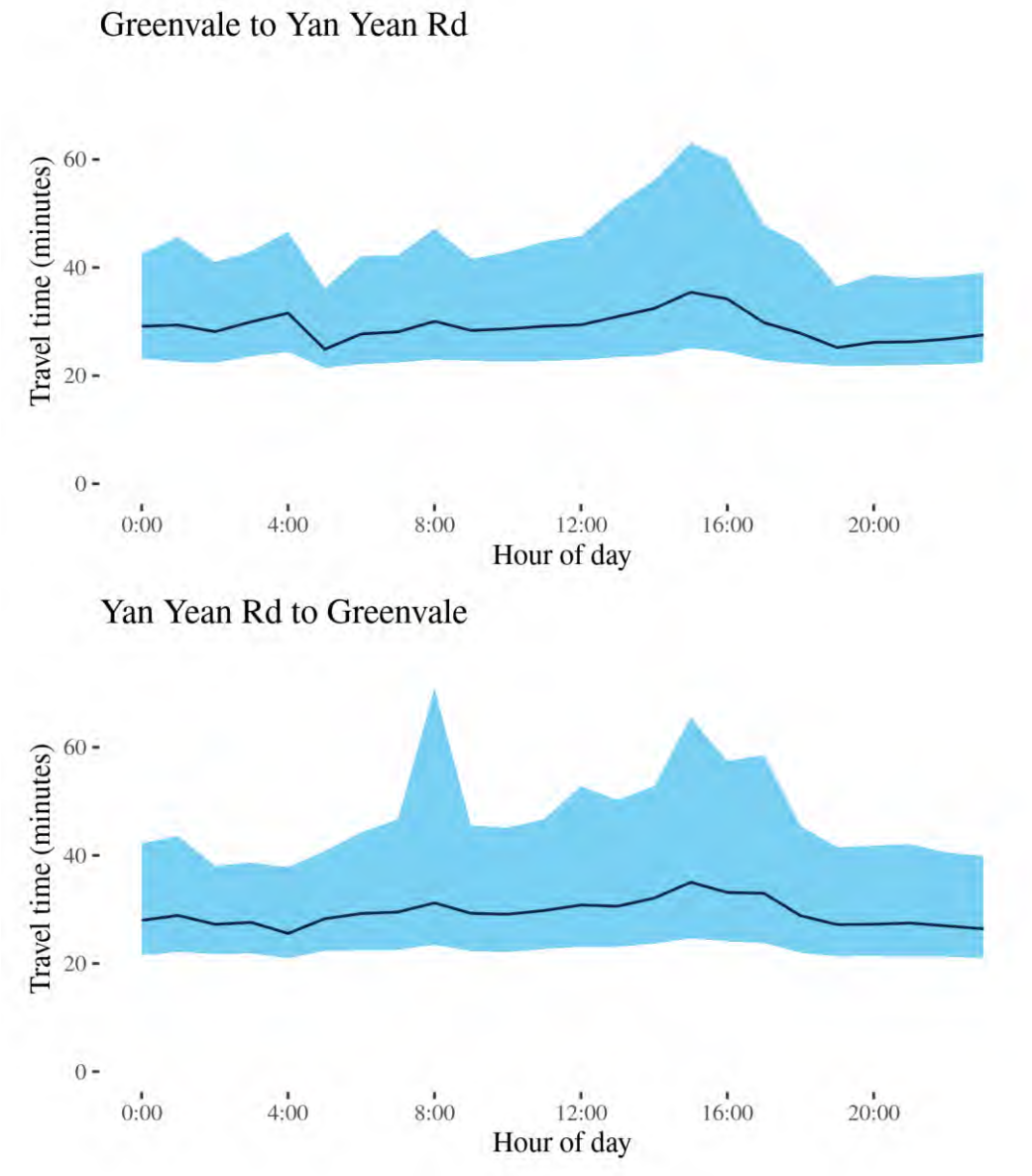
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Greenvale to Yan Yean Road	00:24:53	00:35:26	1.2	00:14:43	00:37:59	1.5	22.6
Yan Yean Road to Greenvale	00:25:33	00:35:00	1.1	00:16:18	00:47:28	1.5	22.2

Source: BITRE estimates.

The best median travel time and lowest uncertainty travelling from Greenvale to Yan Yean Road were at 5am with a median of nearly 25 minutes and an interquartile range of 15 minutes. The longest median travel times and greatest uncertainty were in the afternoon peak at 3pm with a median of 35 minutes and an interquartile range of nearly 38 minutes. Delays were spread evenly along the route but somewhat more apparent in High Street Epping.

The best median travel time travelling from Yan Yean Road to Greenvale were at 4am with a median of 26 minutes and the lowest uncertainty were at 2am with an interquartile range of 16 minutes. The longest median travel times were in the afternoon peak at 3pm with a median of 35 minutes and the highest uncertainty were at 8am with an interquartile range of 47 minutes. Delays were slightly more apparent near South Morang.

Figure A.34 Route 58 route median and interquartile range travel times



Source: BITRE estimates.

M1 (West) - City to M80 / M80 to City

This route follows the West Gate Freeway (M1) connecting at its confluence with the Western Ring Road (M80) at Altona and the M2 at south Melbourne. It serves extensive freight areas around Port Melbourne and in Melbourne's west.

Figure A.35 M1 (West) route map

Source: BITRE estimates.

Table A.18 M1 (West) route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
City to M80	00:07:14	00:18:16	1.3	00:01:24	00:19:05	4.0	9
M80 to City	00:07:22	00:13:35	1.2	00:01:37	00:15:52	3.6	9

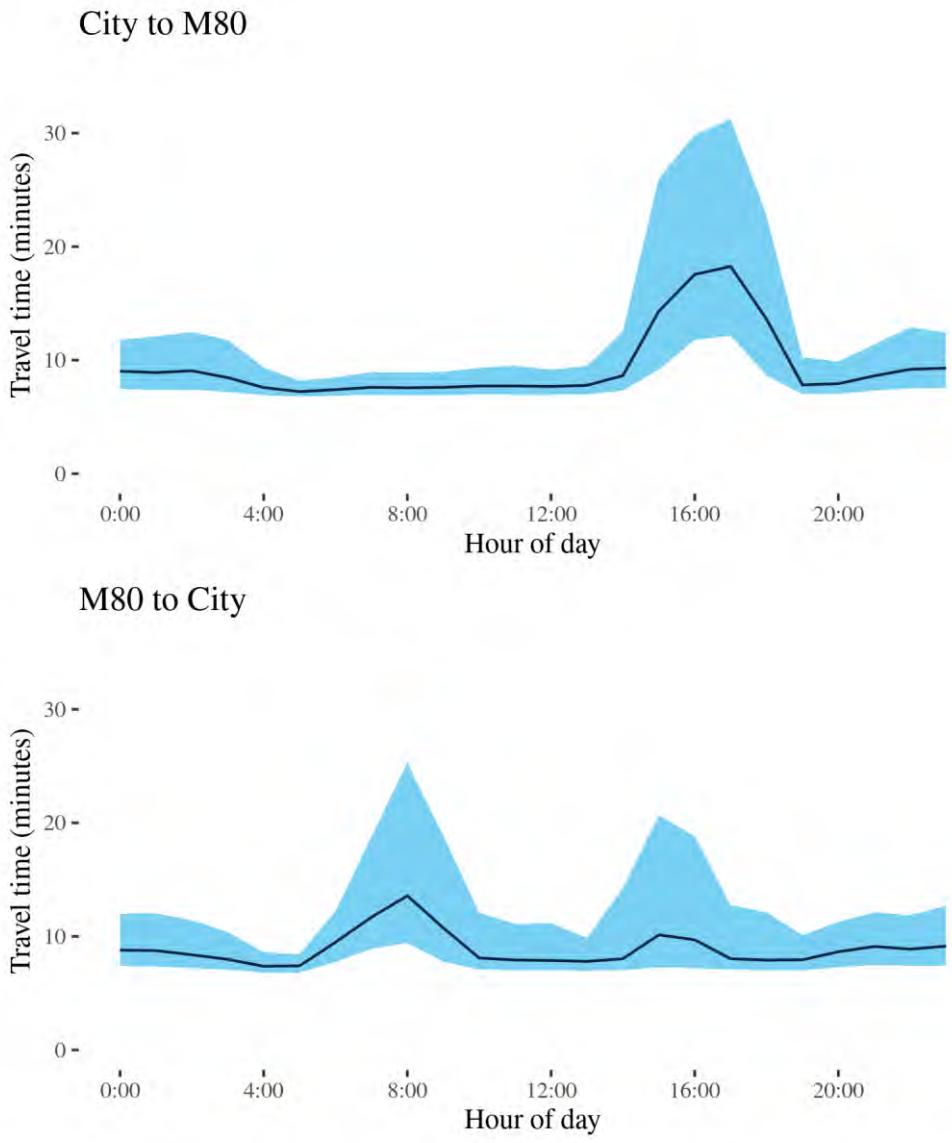
Source: BITRE estimates.

The best travel times and lowest uncertainty travelling from the City to the Western Ring Road (M80) were at 5am with a median travel time of 7 minutes and an interquartile range of 84 seconds. The longest median travel times and greatest uncertainty were in the afternoon peak at 5pm with a median of 18 minutes and an interquartile range of 19 minutes. Delays were spread evenly along the route, but were most severe near Port Melbourne.

The best median travel times for journeys from the Western Ring Road (M80) to the CBD was over 7 minutes at 4am and the lowest uncertainty were at 5am with an interquartile range of 97 seconds. The longest median travel times and highest uncertainty were in the morning peak at 8am with a median of 14 minutes and an interquartile range of 16 minutes. Delays were slightly more apparent at the ends of the route at Altona and Port Melbourne during the morning peak, and most severe at Port Melbourne in the afternoon peak.

The CBD bound route had only a single peak of travel time and uncertainty, whereas the reverse trip had two peaks with the morning peak more obvious than the afternoon peak.

Figure A.36 M1 (West) route median and interquartile range travel times

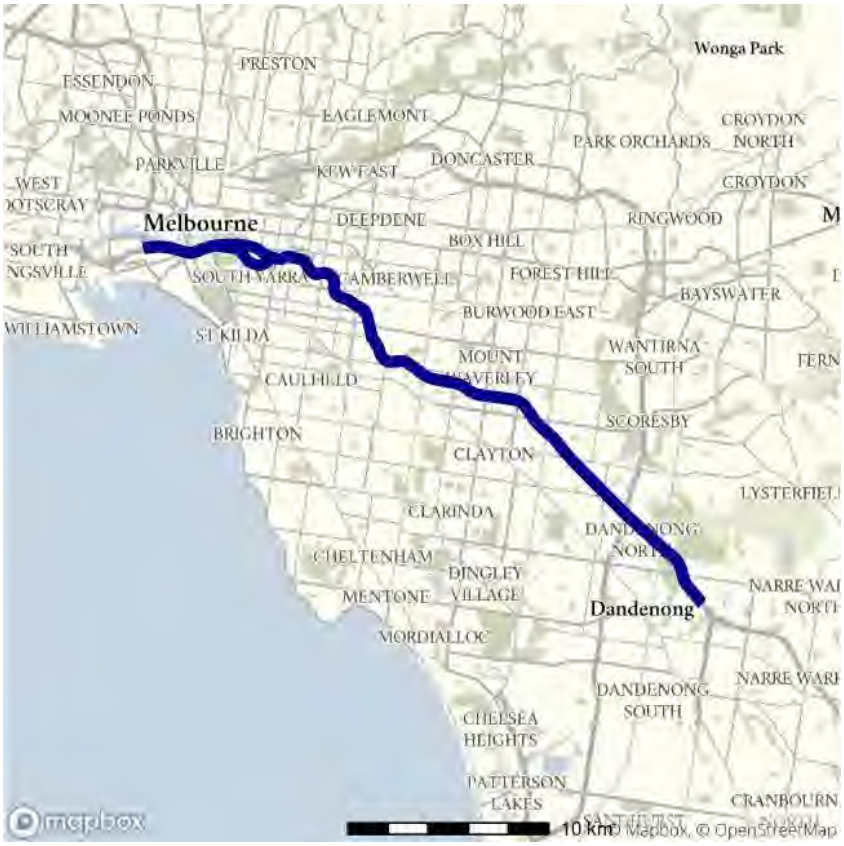


Source: BITRE estimates.

M1 (East) - City to M420 / M420 to City

This route follows the M1 connecting Port Melbourne and the South Gippsland Freeway (M420) on Melbourne's fringes. It serves light industrial areas around Dandenong and interregional freight from Gippsland. For most of its length it is known as the Monash Freeway.

Figure A.37 M1 (East) route map



Source: BITRE estimates.

Table A.19 M1 (East) route travel times and congestion measures, 2019

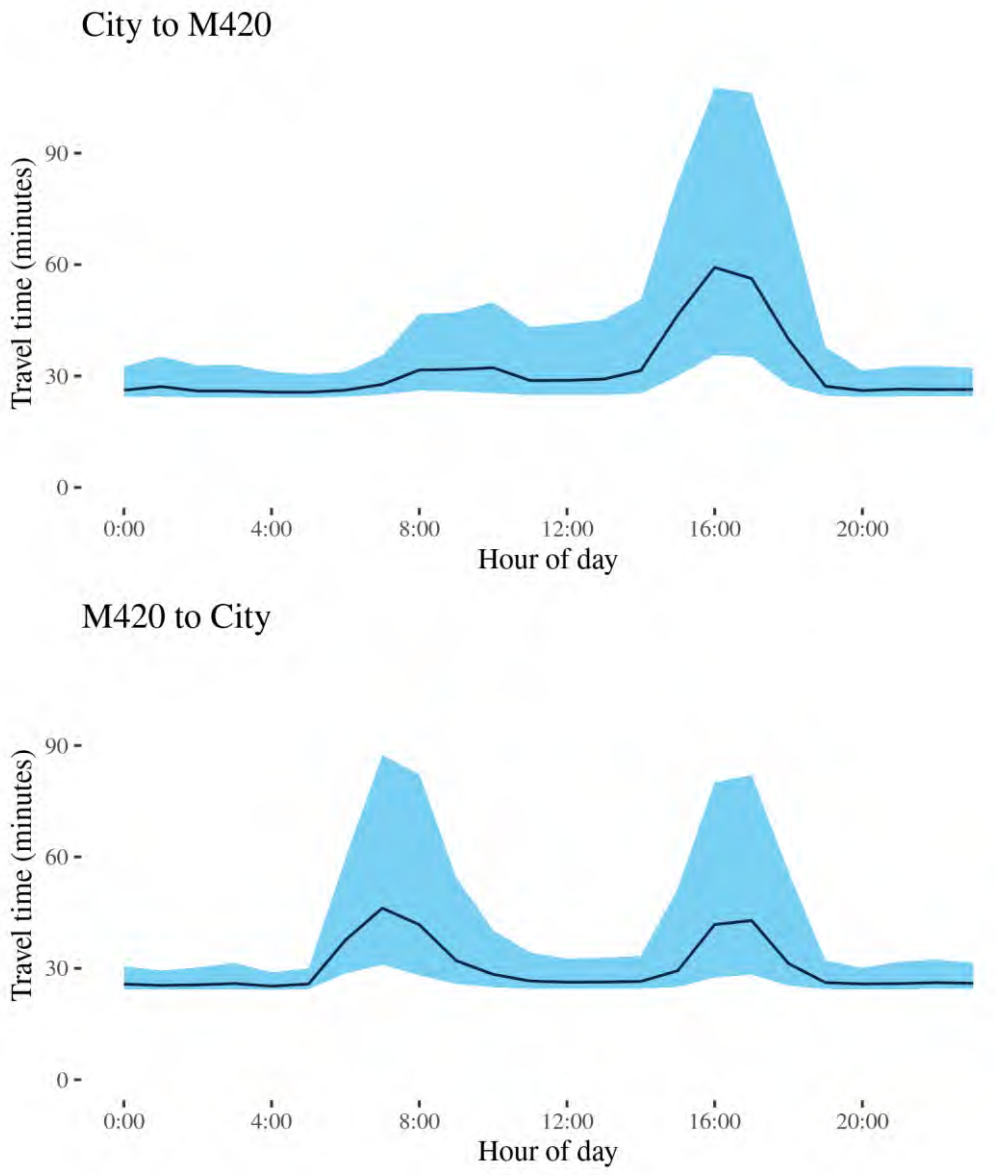
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
City to M420	00:25:38	00:59:14	1.2	00:06:16	01:12:06	3.4	36.0
M420 to City	00:25:13	00:46:13	1.2	00:04:41	00:56:25	4.0	36.5

Source: BITRE estimates.

The best travel times and lowest uncertainty travelling from the CBD to Dandenong were at 5am with a median travel time of 26 minutes and an interquartile range of 6 minutes. The longest median travel times and greatest uncertainty were in the afternoon peak at 4pm with a median of 59 minutes and an interquartile range of 1 hour 12 minutes. Delays were most severe near the CBD and speeds largely improved to closer to Dandenong, with the exception of delays around Burke Road in Camberwell. Uncertainty was higher throughout business hours, but with only a single distinct peak.

The best travel times and lowest uncertainty travelling from Dandenong to the CBD were at 4am with a median travel time of 25 minutes and an interquartile range of 5 minutes. The longest median travel times and highest uncertainty were in the morning peak at 7am with a median of 46 minutes and an interquartile range of 56 minutes. There was a similar, if slightly smaller, peak in the afternoon. Delays were slightly more apparent just north east of the intersection with the M3 (Eastlink) in the morning peak and near South Melbourne in the afternoon peak.

Figure A.38 M1 (East) route median and interquartile range travel times



Source: BITRE estimates.

M2 - CityLink then Tullamarine / Tullamarine then CityLink

This route connects Melbourne Airport and the M1 at Port Melbourne via the CityLink toll road and Tullamarine Freeway.

Figure A.39 M2 route map

Source: BITRE estimates.

Table A.20 M2 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
CityLink then Tullamarine	00:14:44	00:15:33	1	00:01:13	00:06:02	2.4	19.8
Tullarmarine then CityLink	00:14:32	00:16:31	1	00:01:13	00:09:02	2.5	19.8

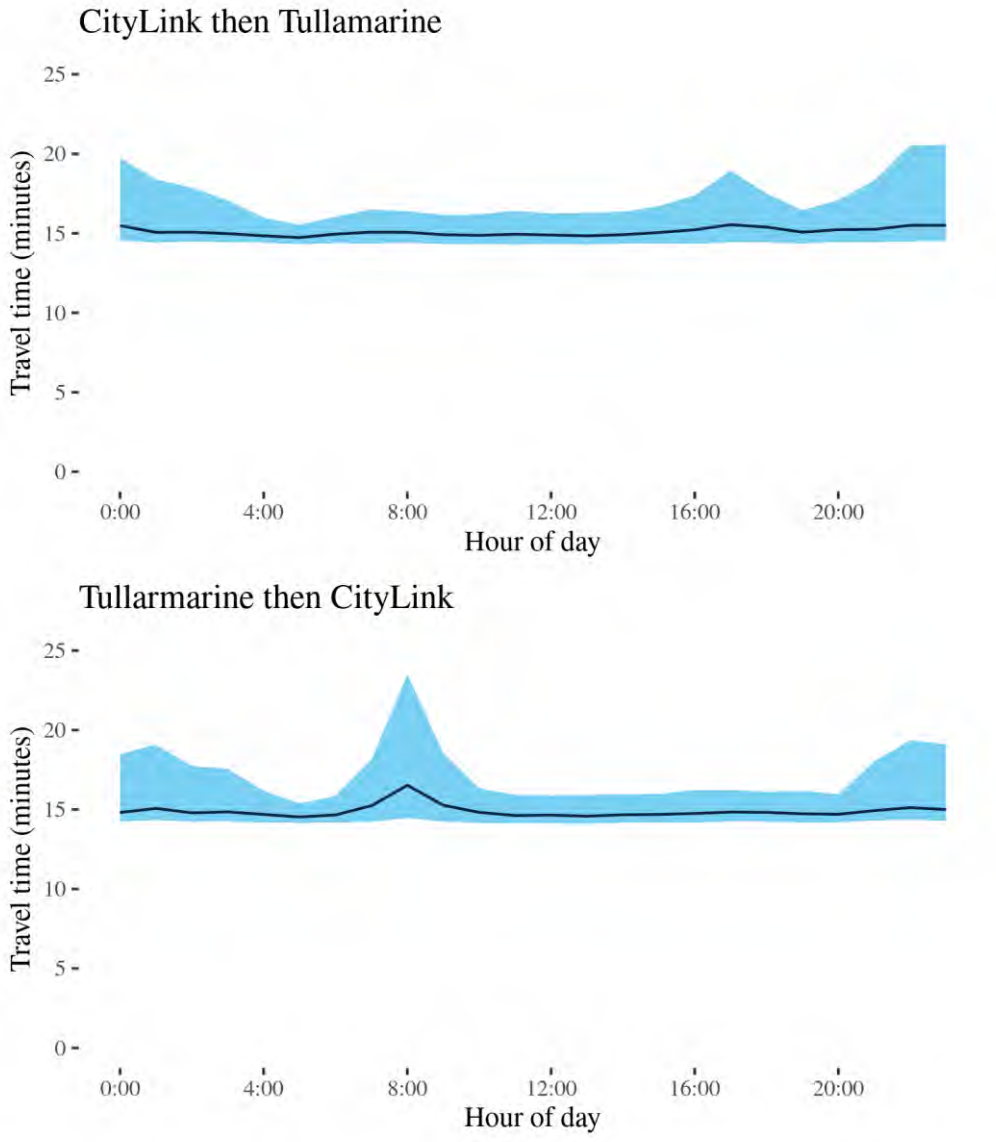
Source: BITRE estimates.

The best travel times and lowest uncertainty from the City to the Airport were at 5am with a median travel time of 15 minutes and an interquartile range of 73 seconds respectively. The longest median travel times were in the afternoon peak at 5pm, however, this was only 49 seconds (5.6 per cent), longer than the best travel time. Uncertainty was greatest at 10pm with an interquartile range of 6 minutes. This is likely due to imposed roadwork speed limits that were present at some points in 2019. This would not reflect uncertainty experienced by vehicles who would be aware if roadworks were occurring or not on a given day. The greatest uncertainty was at 5pm with an interquartile range of about 6 minutes.

The best travel times and lowest uncertainty from the Airport to the CBD were at 5am with a median travel time of 14.5 minutes and an interquartile range of 73 seconds. The longest median travel times were in the morning peak at 8am, with 2 minutes longer than the best travel time. Uncertainty was greatest at 8am with an interquartile range of 9 minutes. Uncertainty at night also appears to be attributable to roadwork.

In both directions delays were most apparent close to the M1.

Figure A.40 M2 route median and interquartile range travel times

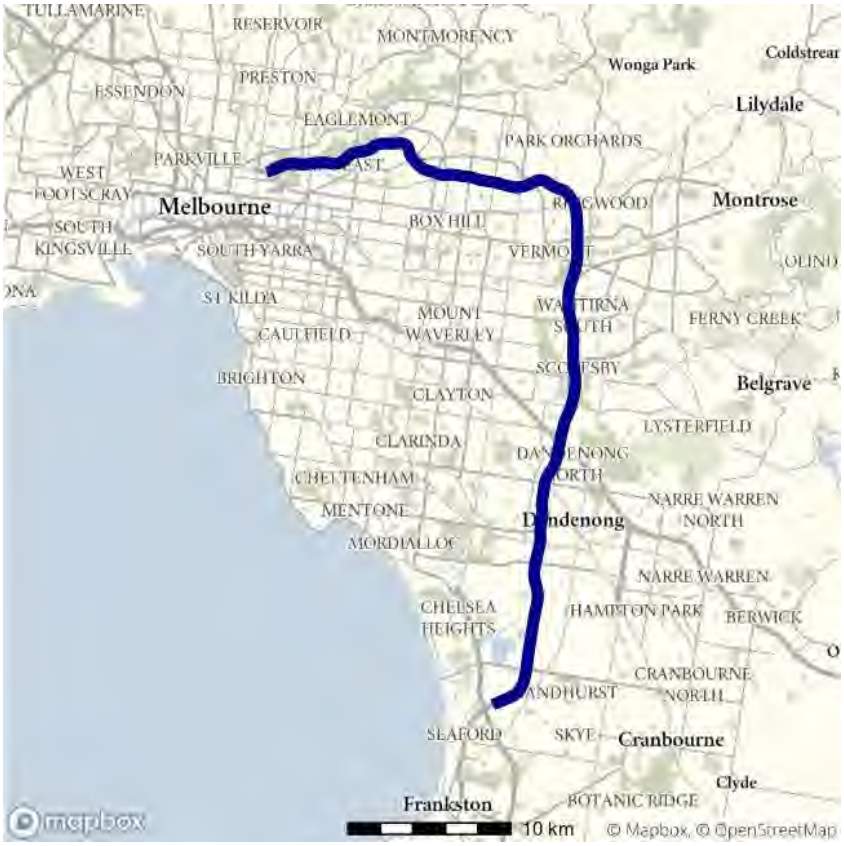


Source: BITRE estimates.

M3 - Frankston to Hoddle St / Hoddle St to Frankston

This route runs between Abbotsford and Frankston in Melbourne's far south east. It uses the Eastern Freeway, Eastlink and the Frankston Freeway.

Figure A.41 M3 route map



Source: BITRE estimates.

Table A.21 M3 route travel times and congestion measures, 2019

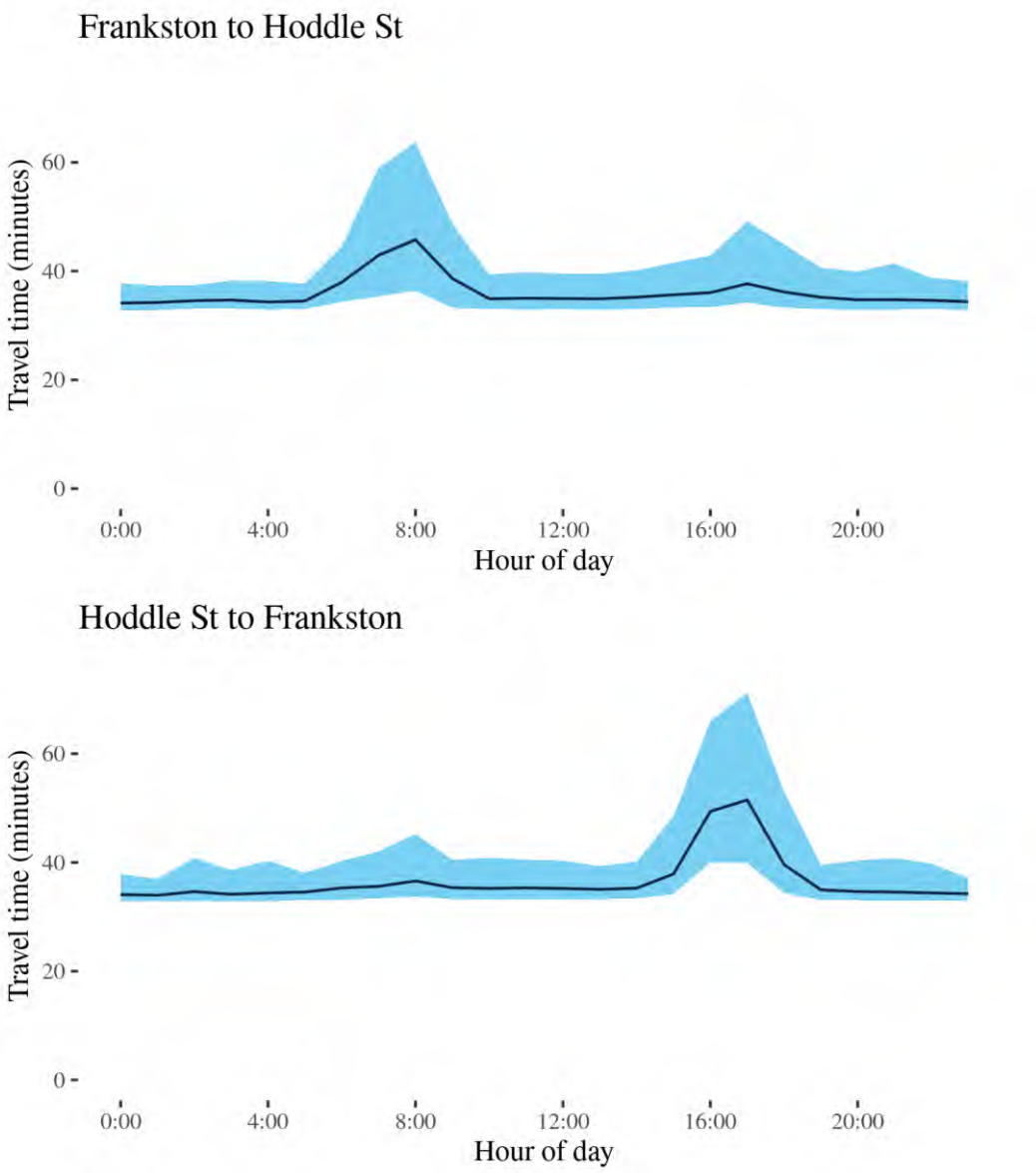
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Frankston to Hoddle St	00:34:08	00:45:46	1.1	00:04:19	00:27:22	2.1	53.0
Hoddle St to Frankston	00:33:57	00:51:29	1.1	00:04:06	00:31:18	2.3	53.3

Source: BITRE estimates.

The best median travel times travelling from Frankston to Hoddle Street were 34 minutes at midnight and the lowest uncertainty were 2am with an interquartile range of 4 minutes. The longest median travel times and greatest uncertainty were in the morning peak at 8am with a median of 46 minutes and an interquartile range of over 27 minutes. Delays were most severe near the end of the motorway at Hoddle Street, but there was also some indication of delays around the Melba tunnel at Ringwood and near the intersection with Wellington Road near Rowville. There was also a second, milder, peak in uncertainty in the afternoon.

The best travel times and lowest uncertainty travelling to Frankston were at 1am with a median travel time of 34 minutes and an interquartile range of 4 minutes. The longest median travel times and highest uncertainty were in the afternoon peak at 5pm with a median of 51.5 minutes and an interquartile range of 31 minutes. Delays were most severe on the Eastern Freeway with signs of milder delays just north of Frankston.

Figure A.42 M3 route median and interquartile range travel times



Source: BITRE estimates.

M79 - Essendon to Gap Road / Gap Road to Essendon

This lengthy motorway route follows the A79/M79 from Gap Road, west of Sunbury, to Essendon where it joins the CityLink toll road. For most of its length it is known as the Calder Freeway.

Figure A.43 M79 route map

Source: BITRE estimates.

Table A.22 M79 route travel times and congestion measures, 2019

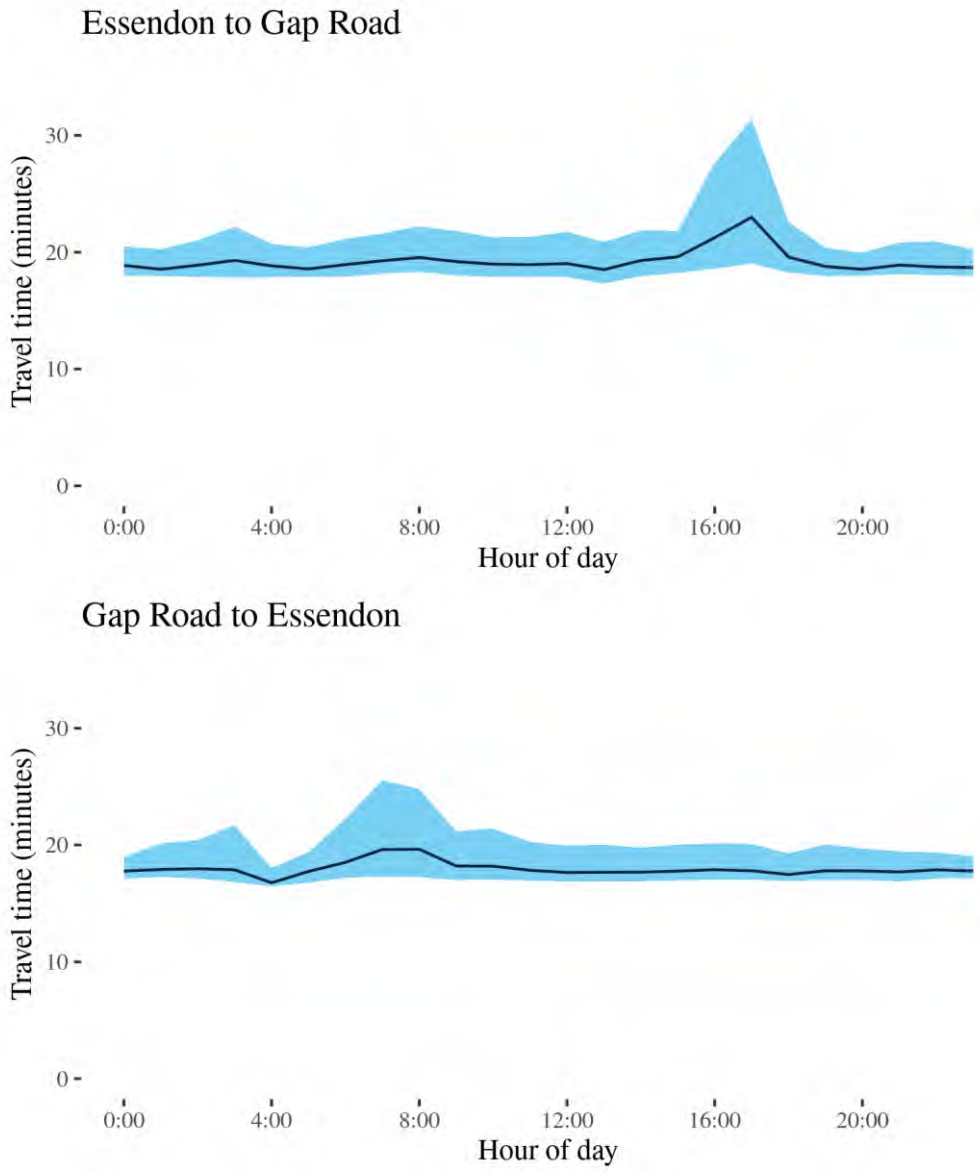
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Essendon to Gap Road	00:18:31	00:22:59	1.0	00:01:58	00:12:22	1.9	27.3
Gap Road to Essendon	00:16:46	00:19:38	1.1	00:01:34	00:08:15	2.2	27.2

Source: BITRE estimates.

The best median travel times from Essendon to Gap Road were 18.5 minutes at 1pm and the lowest uncertainty were at 8pm with an interquartile range of 2 minutes. The longest median travel times and highest uncertainty were in the afternoon peak at 5pm with a median of 23 minutes and an interquartile range of 12 minutes. Delays were again most evident near the Western Ring Road interchange.

The best travel times and lowest uncertainty travelling from Gap Road to Essendon were at 4am with a median travel time of 17 minutes and an interquartile range of 1.5 minutes. The longest median travel times were at 8am with a median of 20 minutes and the greatest uncertainty was at 7am with an interquartile range of 8 minutes. Delays were most evident near the end of the motorway near the intersection with the Western Ring Road.

Figure A.44 M79 route median and interquartile range travel times



Source: BITRE estimates.

M80 - Altona to Greensborough / Greensborough to Altona

This route follows the M80 (Western Ring Road) in the west and north of Melbourne. It passes through the western outskirts of the Melbourne metropolitan area as the Western Ring Road, meets the M1 and proceeds to the Greensborough Bypass in north-east Melbourne as the Metropolitan Ring Road.

Figure A.45 M80 route map

Source: BITRE estimates.

Table A.23 M80 route travel times and congestion measures, 2019

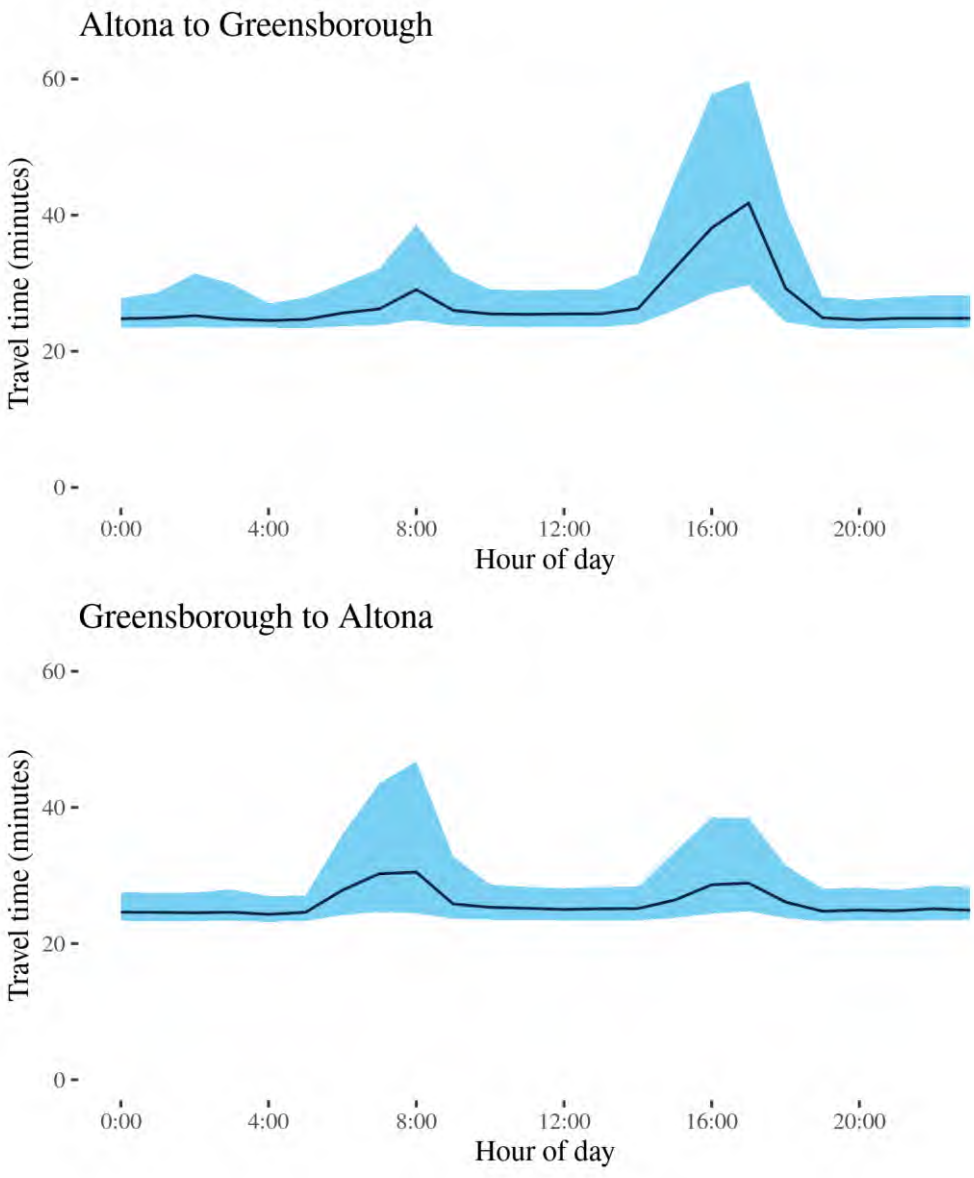
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Altona to Greensborough	00:24:31	00:41:47	1.1	00:03:34	00:30:01	2.5	37.5
Greensborough to Altona	00:24:18	00:30:30	1.1	00:03:41	00:22:19	2.0	37.4

Source: BITRE estimates.

The best travel times and lowest uncertainty for trips from Altona to Greensborough were at 4am with a median travel time of 24.5 minutes and an interquartile range of 3.5 minutes. The longest median travel times and greatest uncertainty were in the afternoon peak at 5pm with a median of 42 minutes and an interquartile range of 30 minutes. Delays were most evident near the end of the motorway at Bundoora with indications of delays near the intersections with the Westlink and Tullamarine Freeways. There was a mild morning peak as well with delays concentrated near Greensborough.

The best travel times for trips from Greensborough to Altona were 24 minutes at 4am and the lowest uncertainty were at 5am with an interquartile range of 4 minutes. The longest median travel times and highest uncertainty were in the morning peak at 8am with a median of 30.5 minutes and an interquartile range of 22 minutes. Delays were again most evident at the start of the M31 (leading to the Hume Freeway) at Thomastown and near the M8 (Western Freeway) at Derrimut. There was also a second afternoon peak with delays most severe near the confluence of the M80 with the M1.

Figure A.46 M80 route median and interquartile range travel times,



Source: BITRE estimates.

Western Freeway - Bacchus Marsh to Derrimut / Derrimut to Bacchus Marsh

This route follows the Western Freeway (M8) linking Bacchus Marsh west of Melbourne and Derrimut where it meets the M80 (Western Ring Road).

Figure A.47 Western Freeway route map

Source: BITRE estimates.

Table A.24 Western Freeway route travel times and congestion measures, 2019

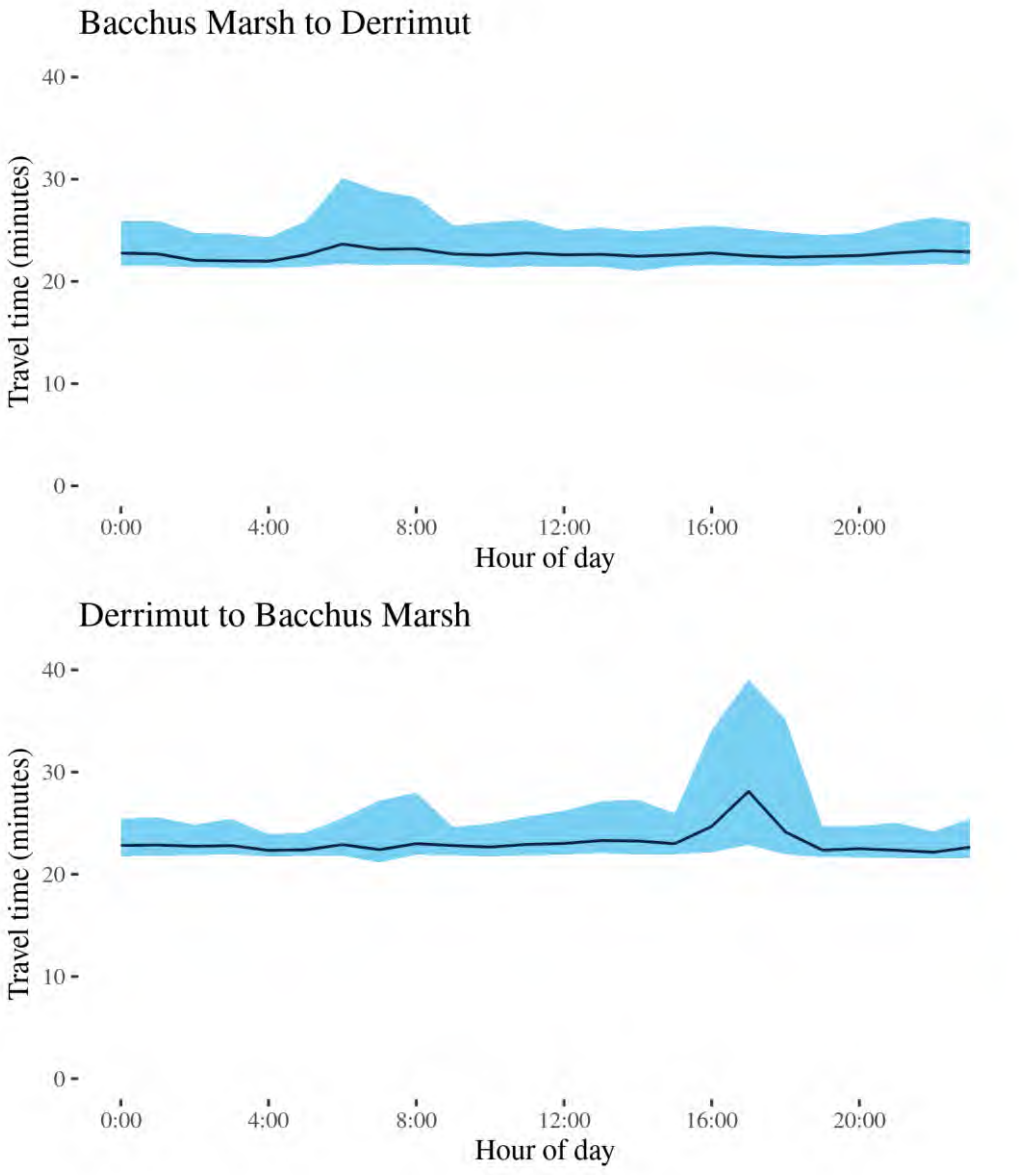
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Bacchus Marsh to Derrimut	00:21:59	00:23:40	1	00:02:59	00:08:22	1.4	35.7
Derrimut to Bacchus Marsh	00:22:10	00:28:06	1	00:02:10	00:16:09	2.3	35.6

Source: BITRE estimates.

The best travel times and lowest uncertainty travelling from Bacchus Marsh to Derrimut were at 4am with a median travel time of 22 minutes and an interquartile range of 3 minutes. The longest median travel times and greatest uncertainty were in the morning peak at 6am with a median of 24 minutes and an interquartile range of 8 minutes. There is evidence of mild delays at Melton.

The best median travel times travelling from Derrimut to Bacchus Marsh were 22 minutes at 10pm and the lowest uncertainty were at 4am with an interquartile range of 2 minutes. The longest median travel times and highest uncertainty were in the afternoon peak at 5pm with a median of 28 minutes and an interquartile range of 16 minutes. This peak was more severe than the morning peak in the other direction and delays were concentrated close to where the motorway meets Ballarat Road coming from Deer Park.

Figure A.48 Western Freeway route median and interquartile range travel times



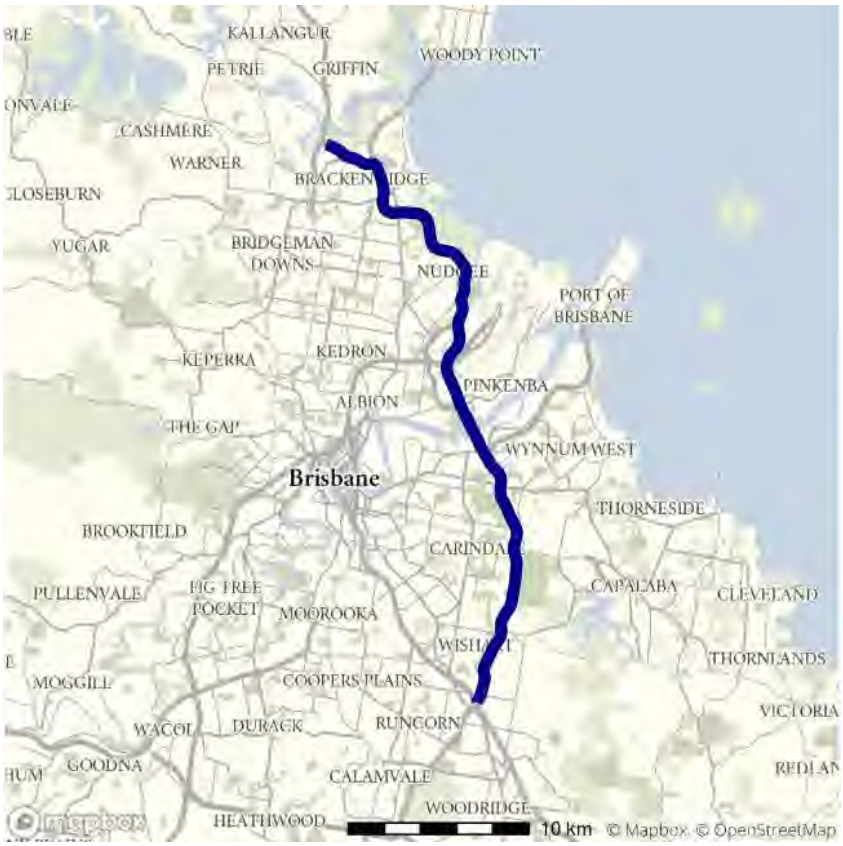
Source: BITRE estimates.

Brisbane routes

M1 - Bruce Hwy to Pacific Motorway / Pacific Motorway to Bruce Hwy

This route crosses Brisbane from north to south. Travelling from the Gympie Arterial Road (M3) at Bald Hills in the north of Brisbane to Eight Mile Plains in the south of Brisbane, crossing the Brisbane River near Eagle Farm. It encompasses most of the Gateway Motorway. It is a major intercity and interregional route through its connections with the Pacific Motorway and Bruce Highway. This route also connects to the M2, M3, M4, M6 and M7 (via Southern Cross Way) motorways also covered in this report.

Figure A.49 M1 route map



Source: BITRE estimates.

Table A.25 M1 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Bruce Hwy to Pacific Motorway	00:24:29	00:31:49	1.0	00:03:22	00:15:06	1.6	37.7
Pacific Motorway to Bruce Hwy	00:23:59	00:35:56	1.1	00:02:36	00:24:52	2.4	37.5

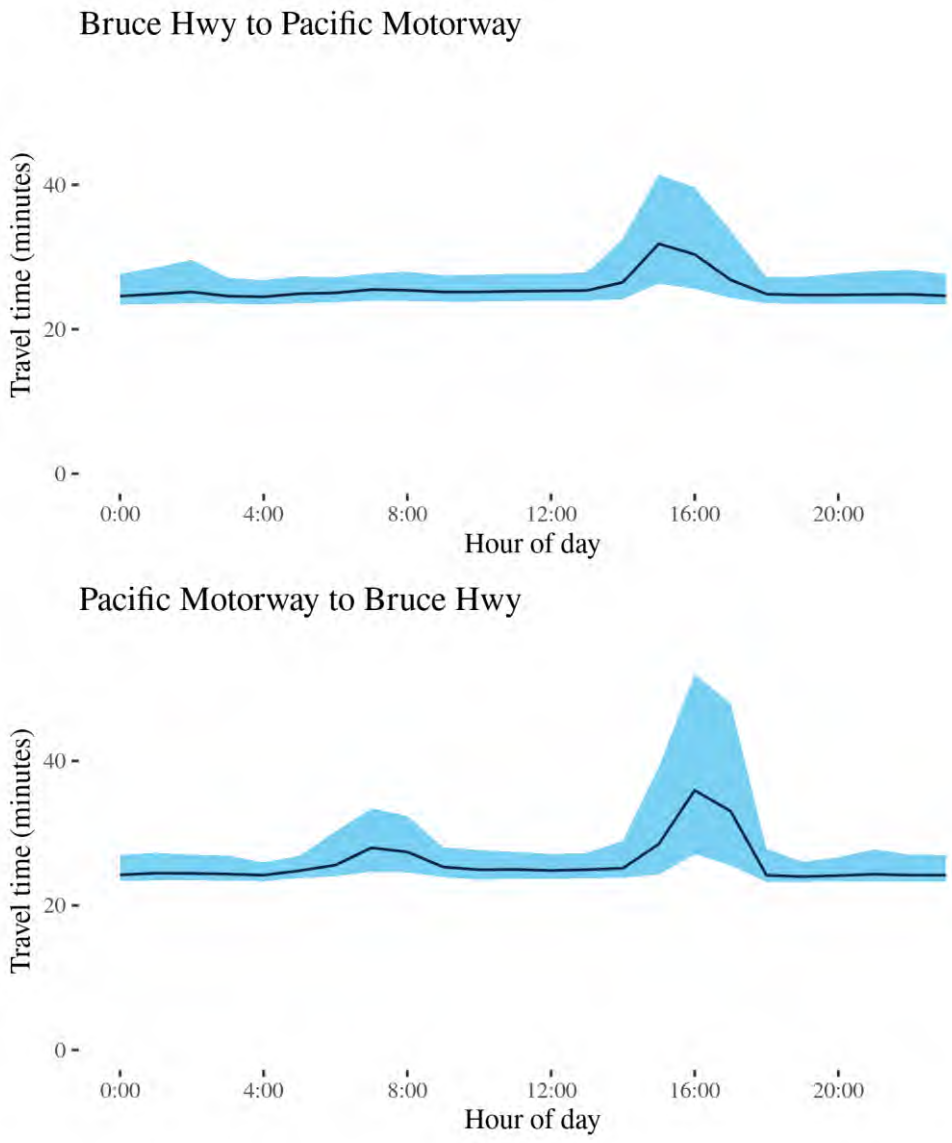
Source: BITRE estimates.

The best travel times and least uncertainty heading south from the Bruce Highway to the Pacific Motorway were experienced at 4am with a median travel time of 24.5 minutes and an interquartile range of 3 minutes. The longest median travel times and most uncertainty were experienced in the afternoon peak at 3pm with a median of 32 minutes and an interquartile range of 15 minutes. Delays were most severe on the portion of the route south of Old Cleveland Road. There was no distinct morning peak.

The best travel times heading north from the Pacific Motorway to the Bruce Highway were experienced at 7pm with a median travel time of 24 minutes and the least uncertainty were at 4am with an interquartile range of 3 minutes. The longest median travel times and most uncertainty were experienced in the afternoon peak at 4pm with a median of 36 minutes and an interquartile range of 25 minutes, both of which were more severe than these of the southbound direction. Delays were most severe in the portion of the route north of Nudgee. A milder morning peak saw delays in the southern part of the route.

The afternoon peaks in both directions can be attributed to commuter traffic leaving the inner areas of Brisbane.

Figure A.50 M1 route median and interquartile range travel times



Source: BITRE estimates.

M2 (North) - Logan Motorway to Pacific Motorway / Pacific Motorway to Logan Motorway

This route consists of the Gateway Motorway section of the M2 linking the M1 and the Logan Motorway at Drewvale in Southern Brisbane.

Figure A.51 M2 (North) route map

Source: BITRE estimates.

Table A.26 M2 (North) route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Logan Motorway to Pacific Motorway	00:05:48	00:06:49	1.1	00:00:56	00:03:27	2.1	8.4
Pacific Motorway to Logan Motorway	00:05:40	00:06:48	1.1	00:00:55	00:03:54	2.1	8.3

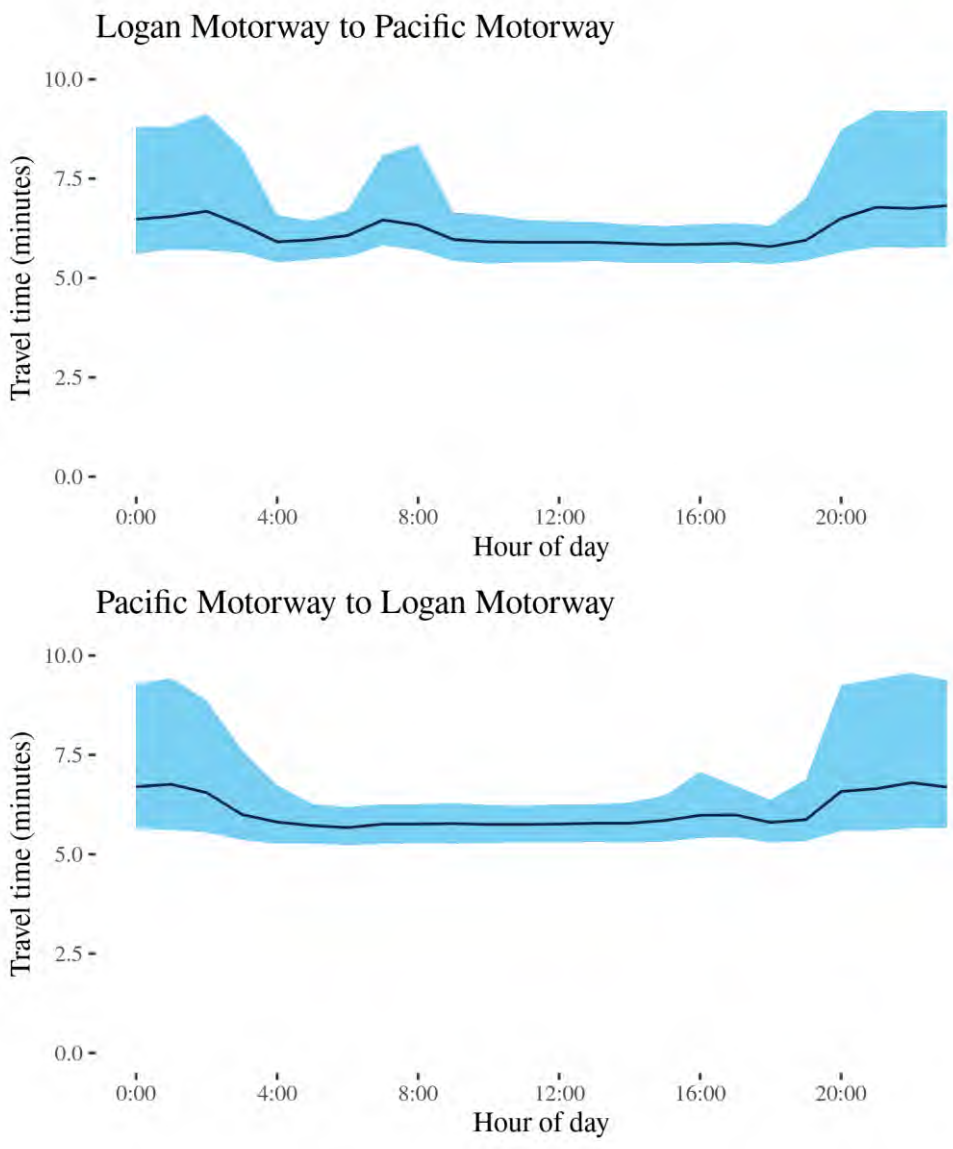
Source: BITRE estimates.

The best median travel time heading north from the Logan Motorway to the Pacific Motorway was 6 minutes at 6pm and the least uncertainty were experienced at 3pm with an interquartile range of 1 minute. The longest median travel times were 7 minutes at 11pm and the most uncertainty were experienced in the evening at 9pm with an interquartile range of 3.5 minutes. Speeds were slower and more uncertain at night which may possibly be enforced roadwork speed limits rather than congestion. There was a very mild peak in the morning at 7am but otherwise travel time and uncertainty were stable throughout the day time.

The best median travel times heading south from the Pacific Motorway to the Logan Highway were 6 minutes at 6am and the least uncertain travel times were experienced at 11am with an interquartile range of 1 minute. The longest median travel times and most uncertainty were at 10pm with a median of 7 minutes and an interquartile range of 4 minutes. Like the northbound direction, the elevated travel time and uncertainty at night are likely attributable to night-time road works, otherwise they were stable during the day time.

The best and longest travel time as well as the least and greatest uncertainty of both directions were the same or very similar with only seconds difference.

Figure A.52 M2 (North) route median and interquartile range travel times



Source: BITRE estimates.

M2 (West) - Gateway Motorway to Ipswich Motorway / Ipswich Motorway to Gateway

This route uses the Logan Motorway section of the M2 between its confluence with the Gateway Motorway (M2 North) and junction with the M7 (Ipswich Motorway) at Gailes. It crosses the M5 (Centenary Highway) at Carole Park.

Figure A.53 M2 (West) route map

Source: BITRE estimates.

Table A.27 M2 (West) route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Gateway Motorway to Ipswich Motorway	00:10:59	00:12:02	1.0	00:01:47	00:04:56	1.6	16.1
Ipswich Motorway to Gateway	00:10:37	00:13:06	1.1	00:01:41	00:09:20	1.9	15.8

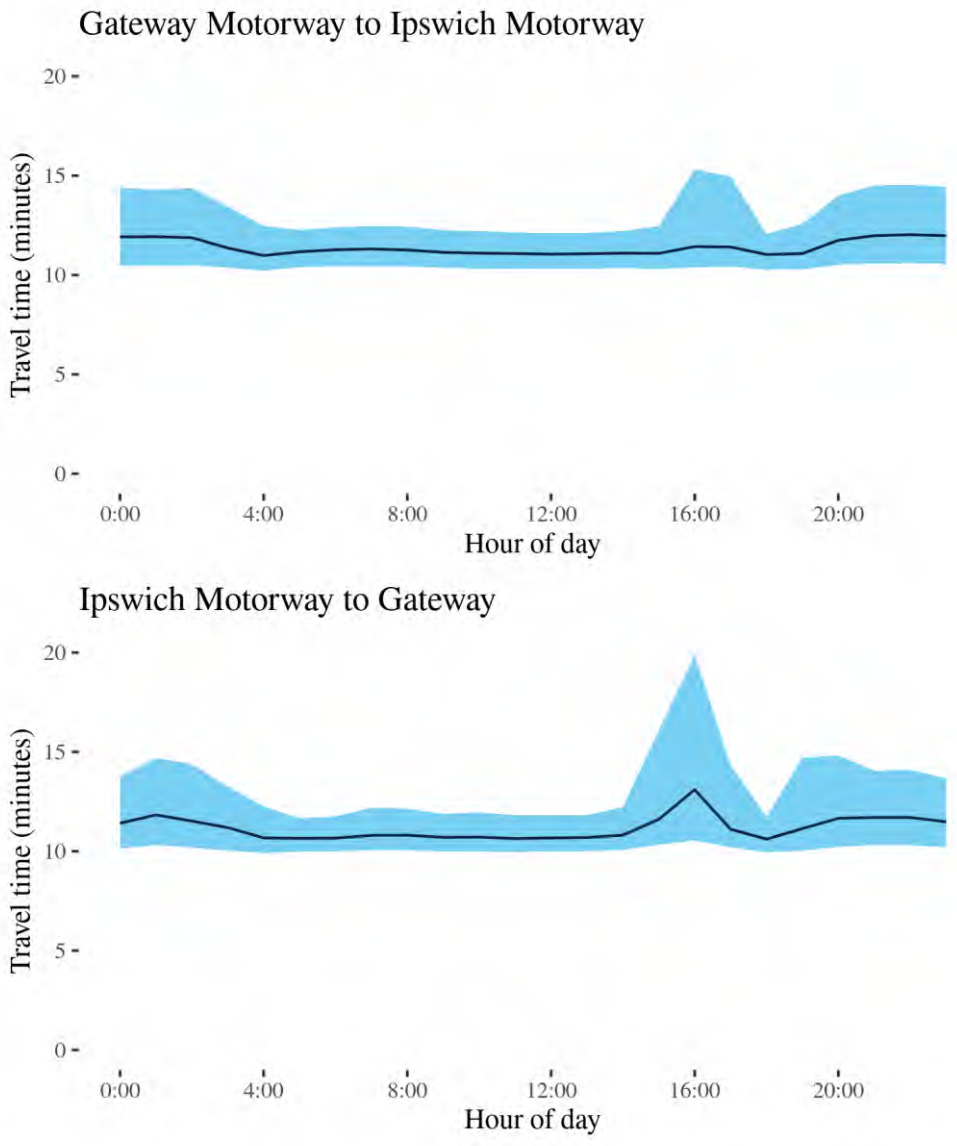
Source: BITRE estimates.

The best median travel times heading west from the Gateway Motorway to the Ipswich Motorway were 11 minutes at 4am and the least uncertainty were experienced at 12pm with an interquartile range of 2 minutes. The longest median travel times were 12 minutes experienced at 10pm and the highest uncertainty was at 4pm with an interquartile range of 5 minutes.

The best median travel time heading east from the Ipswich Motorway to the Gateway Motorway were 11 minutes at 6pm and the least uncertain travel times were experienced at 5am with an interquartile range of 2 minutes. The longest median travel times and the most uncertainty were experienced in the afternoon peak at 4pm with a median of 13 minutes and an interquartile range of 9 minutes, both of which were longer than the westbound route.

The route exhibits clear afternoon peaks in travel time variation. However, travel time peak was only obvious in the journey heading east to the Gateway Motorway. Mildly increased travel time and uncertainty were present in both directions at night, while these were relatively stable during day time, except during the afternoon peak. This pattern is similar to that of M2 route (northbound).

Figure A.54 M2 (West) route median and interquartile range travel times



Source: BITRE estimates.

M3-A3 - Airport Link to M1 / M1 to Airport Link

This route follows the M3 and the surface road A3 with one end merging with the M1 at Bald Hills and the other meeting Airport Link (M7) next to Gordon Park. It is known as Gympie Road when labelled as the A3 and the Gympie Arterial Road when labelled as the M3.

Figure A.55 M3-A3 route map

Source: BITRE estimates.

Table A.28 M3-A3 route travel times and congestion measures, 2019

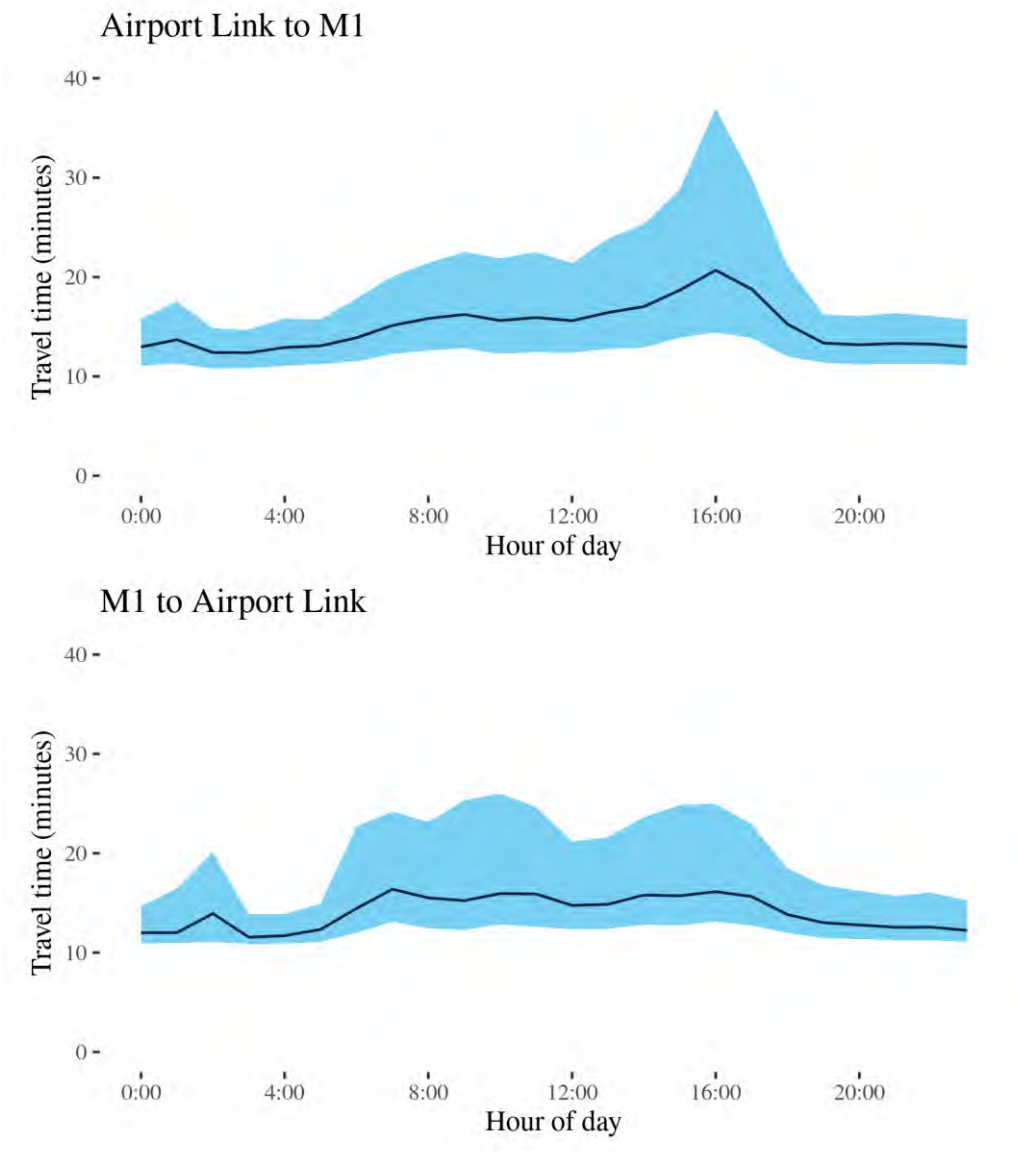
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Airport Link to M1	00:12:23	00:20:41	1.2	00:03:52	00:22:33	2.2	13
M1 to Airport Link	00:11:33	00:16:23	1.2	00:02:58	00:13:11	2.7	13

Source: BITRE estimates.

The best median travel times and least uncertainty heading north from the Airport Link to the Bruce Highway were at 3am with a median of 12 minutes and an interquartile range of 4 minutes. The longest median travel times and most uncertainty were experienced in the afternoon peak at 4pm with a median of 21 minutes and an interquartile range of 23 minutes. Delays were most significant at the southerly end of the A3 portion of the route near Chermside and at the southerly end of the M3 portion. Unusually amongst the routes in this report, travel time uncertainty increased gradually throughout business hours to a distinct afternoon peak.

The best median travel times heading south from the M1 to the Airport Link was 11.5 minutes at 3am and the least uncertainty were experienced at 4am with an interquartile range of 3 minutes. The longest median travel times were 16 minutes at 7am and the greatest variation were experienced at 10am with an interquartile range of 13 minutes. Delays were most severe in the A3 section where it uses surface roads. Travel time and uncertainty were slightly elevated throughout business hours rather than experiencing a distinct peak such as along the northbound route. There is also a small "third peak" around 1-2am similar to other surface routes in this report.

Figure A.56 M3-A3 route median and interquartile range travel times



Source: BITRE estimates.

M3 (South) - Inner City Bypass to Pacific Motorway / Pacific Motorway to Inner City Bypass

This route follows the M3 connecting the Inner City Bypass at Bowen Hills and the M1 (Pacific Motorway) at Springwood in Brisbane's southeast. It passes around the western edge of the CBD and crosses the Brisbane River at Woolloongabba and follows the Pacific Motorway.

Figure A.57 M3 (South) route map

Source: BITRE estimates.

Table A.29 M3 (South) route travel times and congestion measures, 2019

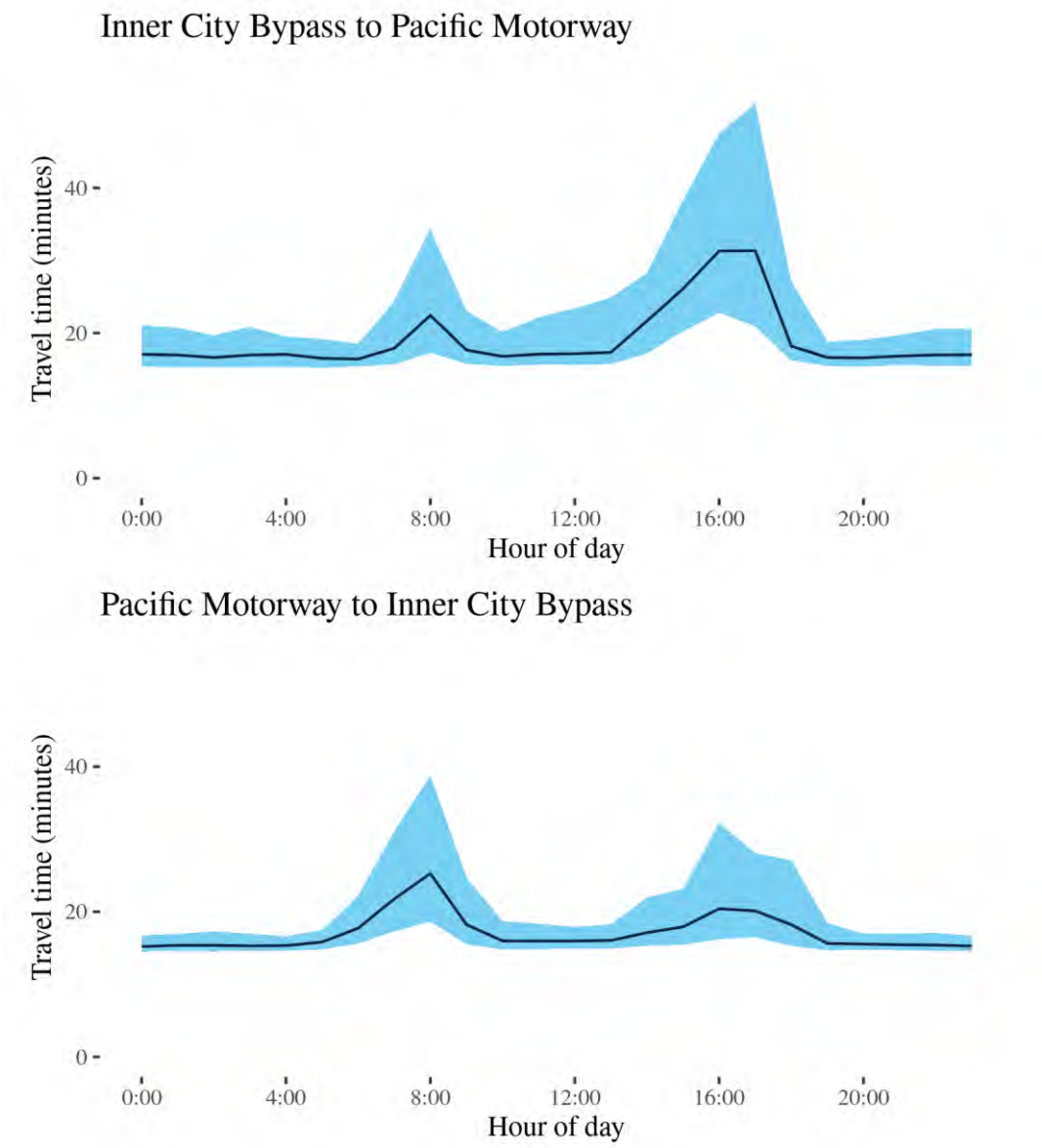
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Inner City Bypass to Pacific Motorway	00:16:25	00:31:21	1.2	00:03:05	00:30:43	2.8	20.1
Pacific Motorway to Inner City Bypass	00:15:13	00:25:16	1.1	00:01:58	00:20:08	3.1	20.1

Source: BITRE estimates.

The best travel times and the least uncertainty heading south to the Pacific Motorway were experienced at 6am with a median travel time of 16 minutes and an interquartile range of 3 minutes. The longest median travel times and the greatest travel time uncertainty were at 5pm with a median of 31 minutes and an interquartile range of 31 minutes. There was also a milder and less prolonged morning peak. Delays were most severe near and south of the Brisbane River crossing and near the junction with the M1.

The best travel times heading north from the Pacific Highway to the Inner City Bypass were experienced at midnight with a median travel time of 15 minutes and the least uncertainty were at 4am with an interquartile range of 2 minutes. The longest median travel times and the greatest range of variation were experienced during the morning peak at 8am with a median travel time of 25 minutes and an interquartile range of 20 minutes. There was also a smaller, but more prolonged afternoon peak. In both peaks, delays were most severe just south of the Brisbane River crossing.

Figure A.58 M3 (South) route median and interquartile range travel times



Source: BITRE estimates.

M4 - Gateway Motorway to Port of Brisbane / Port of Brisbane to Gateway Motorway

This route links the Gateway Motorway (M1) at Murarrie and the Port of Brisbane via Port Drive and Port of Brisbane Motorway. It is an important route for freight to and from the Port but is not a major commuter route.

Figure A.59 M4 route map

Source: BITRE estimates.

Table A.30 M4 route travel times and congestion measures, 2019

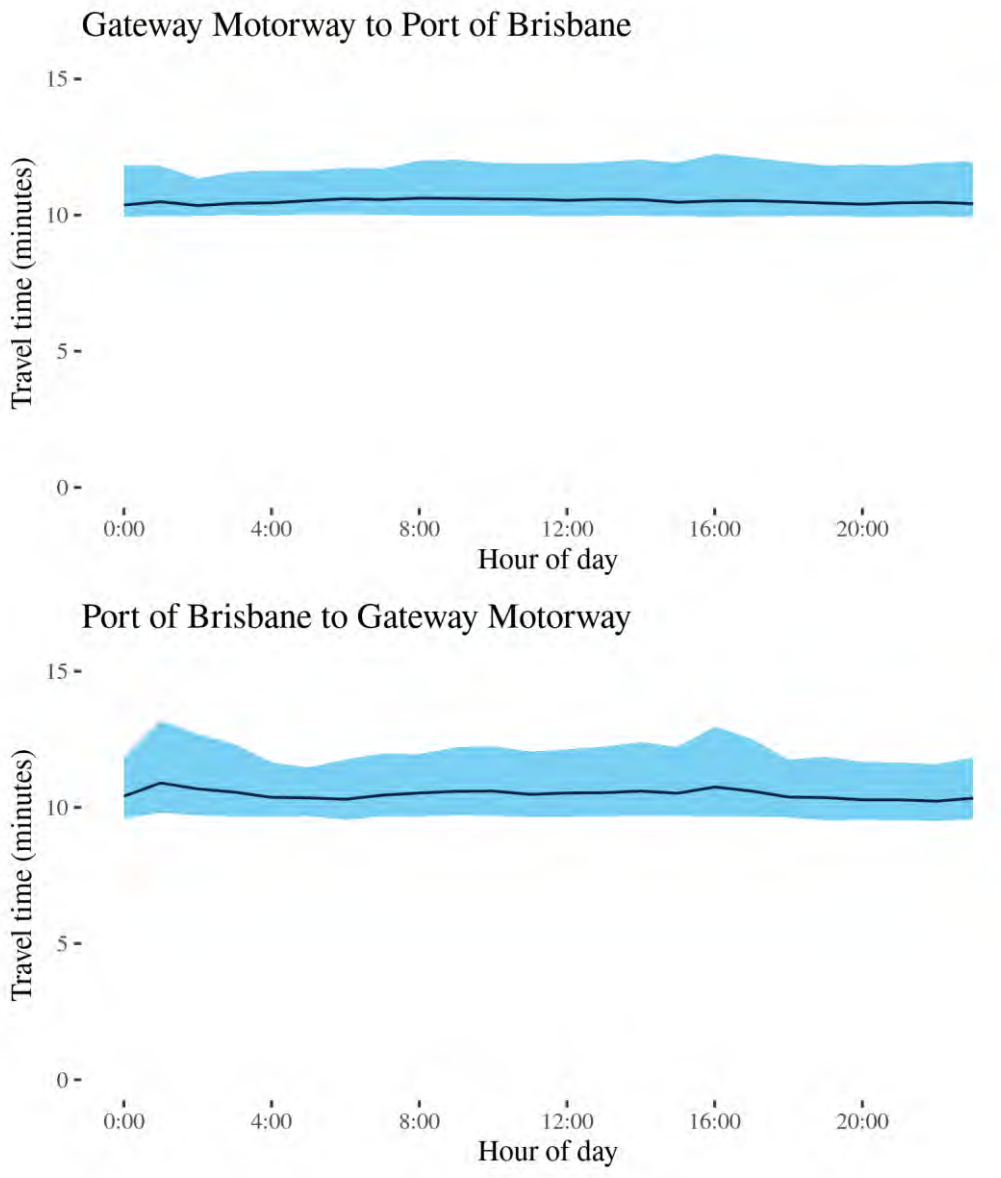
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Gateway Motorway to Port of Brisbane	00:10:21	00:10:37	1	00:01:23	00:02:19	1.4	11.7
Port of Brisbane to Gateway Motorway	00:10:14	00:10:54	1	00:01:47	00:03:23	1.4	11.7

Source: BITRE estimates.

The best travel times and least uncertainty travelling to the Port were experienced at 2am with a median travel time of 10 minutes and an interquartile range of 83 seconds. The longest median travel times were at 8am with a median of 11 minutes and the greatest uncertainty was experienced at 4pm with an interquartile range of 2 minutes. There were no distinct peak periods as this route has little or no commuter traffic.

The best median travel times travelling from the Port to the Gateway Motorway was 10 minutes at 10pm and the least uncertainty were experienced at 5am with an interquartile range of 2 minutes. The longest median travel times and the greatest uncertainty were experienced at 1am with a median of 11 minutes and an interquartile range of 3 minutes. Like the Port-bound route there were no distinct peak periods.

Figure A.60 M4 route median and interquartile range travel times



Source: BITRE estimates.

M5 - Bowen Hills to Logan Motorway / Logan Motorway to Bowen Hills

This route follows the M5 from the M3 and M7 motorways at Bowen Hills and meets the Logan Motorway (M2) at Forest Lake. It traverses the southwest fringe of Brisbane and is known at various points as the Inner City Bypass, Legacy Tunnel, Western Freeway and Centenary Highway.

Figure A.61 M5 route map

Source: BITRE estimates.

Table A.31 M5 route travel times and congestion measures, 2019

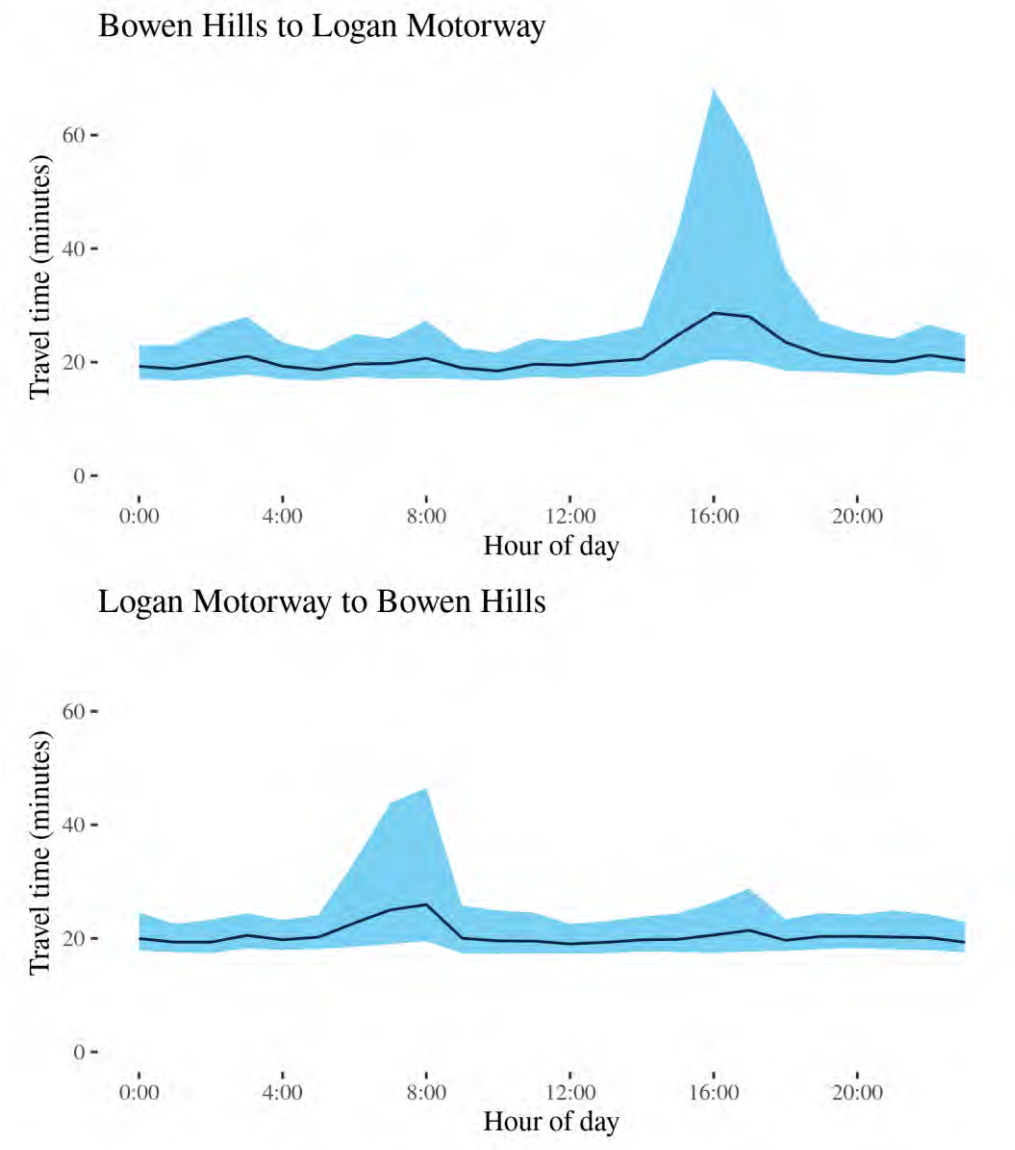
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Bowen Hills to Logan Motorway	00:18:27	00:28:40	1.1	00:04:55	00:47:44	2.3	24.1
Logan Motorway to Bowen Hills	00:19:02	00:25:56	1.1	00:04:56	00:26:59	1.7	24.2

Source: BITRE estimates.

The best travel times and least uncertainty travelling from Bowen Hills to the Logan Motorway were experienced at 10am with a median travel time of 18.5 minutes and an interquartile range of 5 minutes. The longest median travel times and greatest uncertainty were experienced in the afternoon peak at 4pm with a median of 29 minutes and an interquartile range of 48 minutes. The range of variation in the afternoon peak suggests that the route can become very congested. Apart from this period, both travel time and uncertainty were relatively stable throughout the day. Delays were most apparent on the Centenary Highway near where it crosses the Brisbane River.

The best median travel times travelling from the Logan Motorway to Bowen Hills were 19 minutes at 12pm and the least uncertain travel times were experienced at 1am with an interquartile range of 5 minutes. The highest median travel times and greatest uncertainty were experienced in the morning peak at 8am with a median of 26 minutes and an interquartile range of 27 minutes. Like the southbound route, the peak of uncertainty was much more prominent than the peak of median travel time. Delays were again most significant on the Centenary Highway near where it crosses the Brisbane River.

Figure A.62 M5 route median and interquartile range travel times



Source: BITRE estimates.

M6 - Gateway Motorway to Pacific Motorway / Pacific Motorway to Gateway Motorway

The M6 route merges with the M2 at Drewvale and meets the Pacific Motorway (M1) at Loganholme using the Logan Motorway

Figure A.63 M6 route map

Source: BITRE estimates.

Table A.32 M6 route travel times and congestion measures, 2019

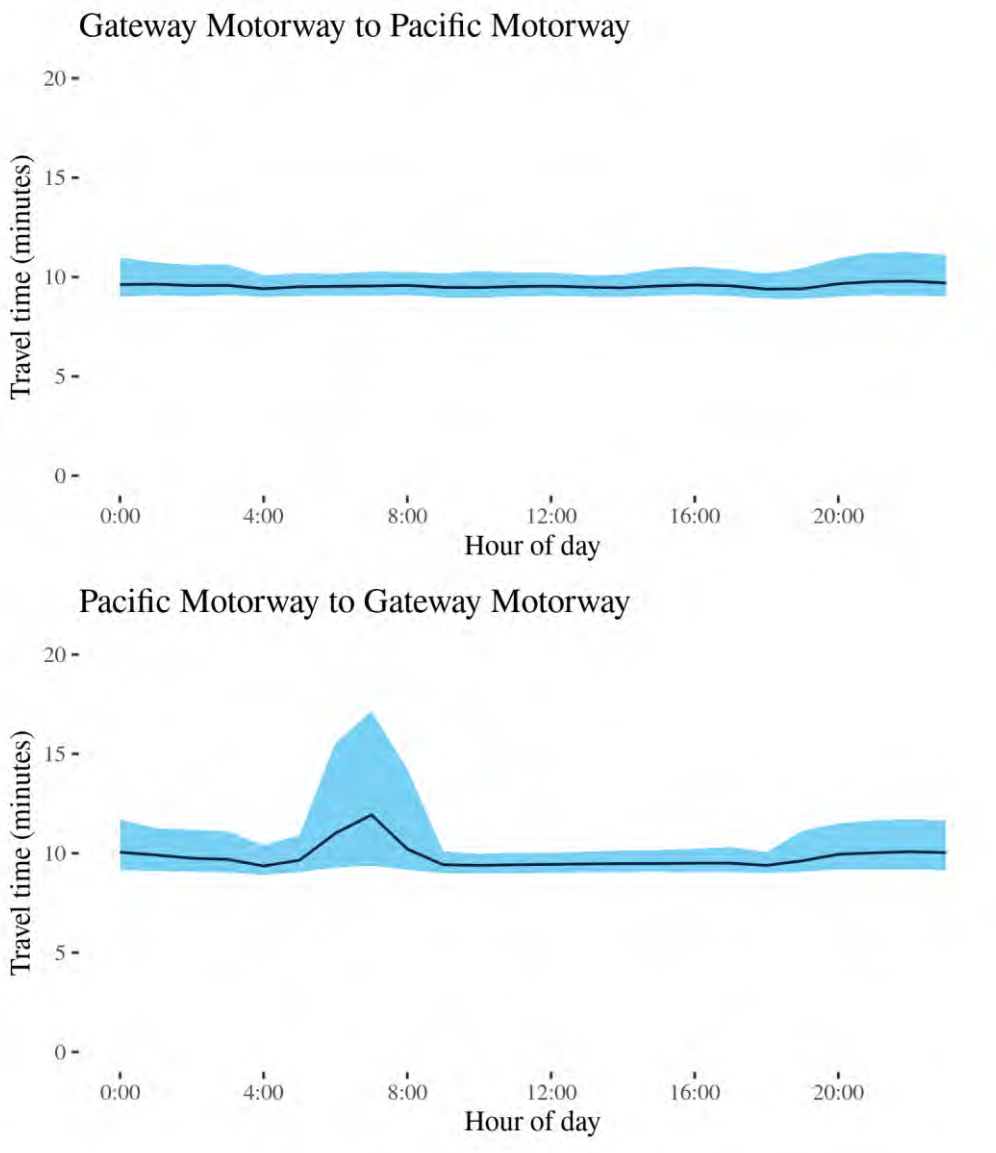
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Gateway Motorway to Pacific Motorway	00:09:23	00:09:47	1.0	00:01:05	00:02:11	1.3	14.6
Pacific Motorway to Gateway Motorway	00:09:21	00:11:56	1.1	00:01:00	00:07:46	2.3	14.5

Source: BITRE estimates.

The best median travel times travelling east from the Gateway Motorway to the Pacific Motorway was 9 minutes at 6pm and the lowest uncertainty were experienced at 1pm with an interquartile range of 1 minute. The longest median travel times and highest uncertainty were experienced at 10pm with a median of 10 minutes and an interquartile range of 2 minutes. There was little variation in either measure throughout the day and no discernible peaks.

The shortest travel time westbound from the Pacific Motorway to the Gateway Motorway were experienced at 4am with a median travel time of 9 minutes and the lowest uncertainty were at 10am with an interquartile range of 1 minutes. The longest median travel times and greatest uncertainty were experienced in the morning peak at 7am with a median travel time of 12 minutes and an interquartile range of 8 minutes. Unlike the eastbound route there was a distinct peak in the morning with delays most severe near the western end of the route near the Gateway Motorway.

Figure A.64 M6 route median and interquartile range travel times



Source: BITRE estimates.

M7-A7 - Logan Motorway to Southern Cross Way / Southern Cross Way to Logan Motorway

This route follows the A7 and M7 through central Brisbane and links the Logan Motorway (M2) at Gailes in the south and the Southern Cross Way branch of the Gateway Motorway near Brisbane Airport. It uses Ipswich Motorway (M7), Ipswich Road (A7) and Airport Link M7 past the CBD and under the Brisbane River as the Clem Jones Tunnel along its way.

Figure A.65 M7-A7 route map

Source: BITRE estimates.

Table A.33 M7-A7 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Logan Motorway to Southern Cross Way	00:25:30	00:37:08	1.1	00:09:18	00:37:08	1.7	30.3
Southern Cross Way to Logan Motorway	00:26:07	00:36:58	1.2	00:09:03	00:32:07	1.7	30.5

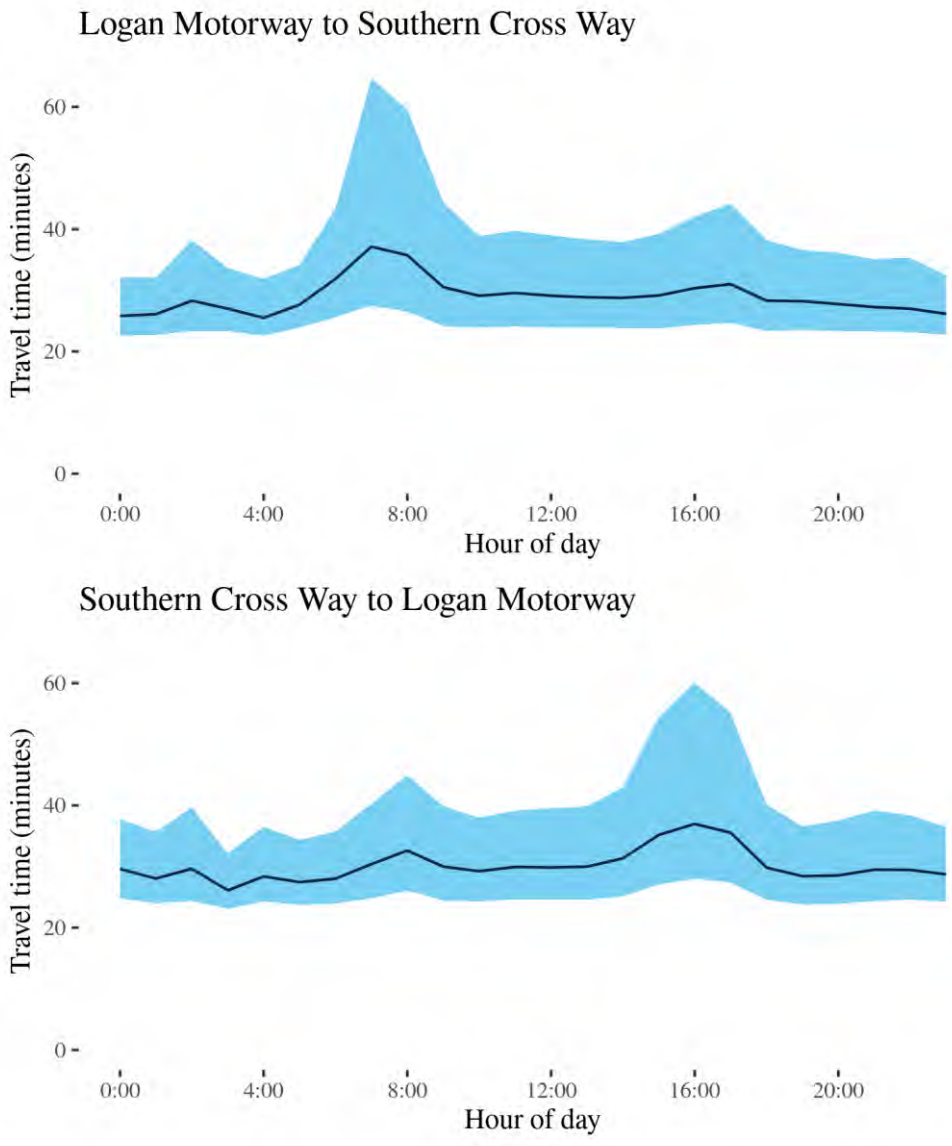
Source: BITRE estimates.

The best travel times and lowest range of variation northbound from the Logan Motorway to Southern Cross Way were experienced at 4am with a median travel time of 26 minutes and an interquartile range of 9 minutes. The longest median travel times and greatest uncertainty were experienced at 7am in the morning peak with a median of 37 minutes and an interquartile range of 37 minutes. Delays were most apparent on the surface section (Ipswich Road) of this route and the Ipswich Motorway near Oxley.

The best travel times and least uncertainty southbound from Southern Cross Way to the Logan Motorway were at 3am with a median travel time of 26 minutes and an interquartile range of 9 minutes. The longest median travel times and greatest range of variation were experienced in the afternoon peak at 4pm with a median of 37 minutes and an interquartile range of 32 minutes. Congestion was most apparent near Route 2 at Rocklea.

The data exhibits morning and afternoon travel time peaks and uncertainty in both directions. The morning peak is more severe than the afternoon peak northbound to Southern Cross Way, but the opposite is true for the reverse journey. This makes the M7-A7 route one of the most symmetrical routes in this report.

Figure A.66 M7-A7 route median and interquartile range travel times



Source: BITRE estimates.

Route 2 - A7 to Gateway / Gateway to A7

This short surface route links the M7/A7 at Rocklea with the Gateway Motorway (M1) at Mackenzie. It passes Robertson and under the Pacific Motorway (M3) along the way.

Figure A.67 Route 2 route map

Source: BITRE estimates.

Table A.34 Route 2 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
A7 to Gateway	00:11:09	00:17:15	1.2	00:02:45	00:16:18	2.6	11.1
Gateway to A7	00:11:51	00:16:15	1.2	00:03:49	00:16:05	2.3	11.1

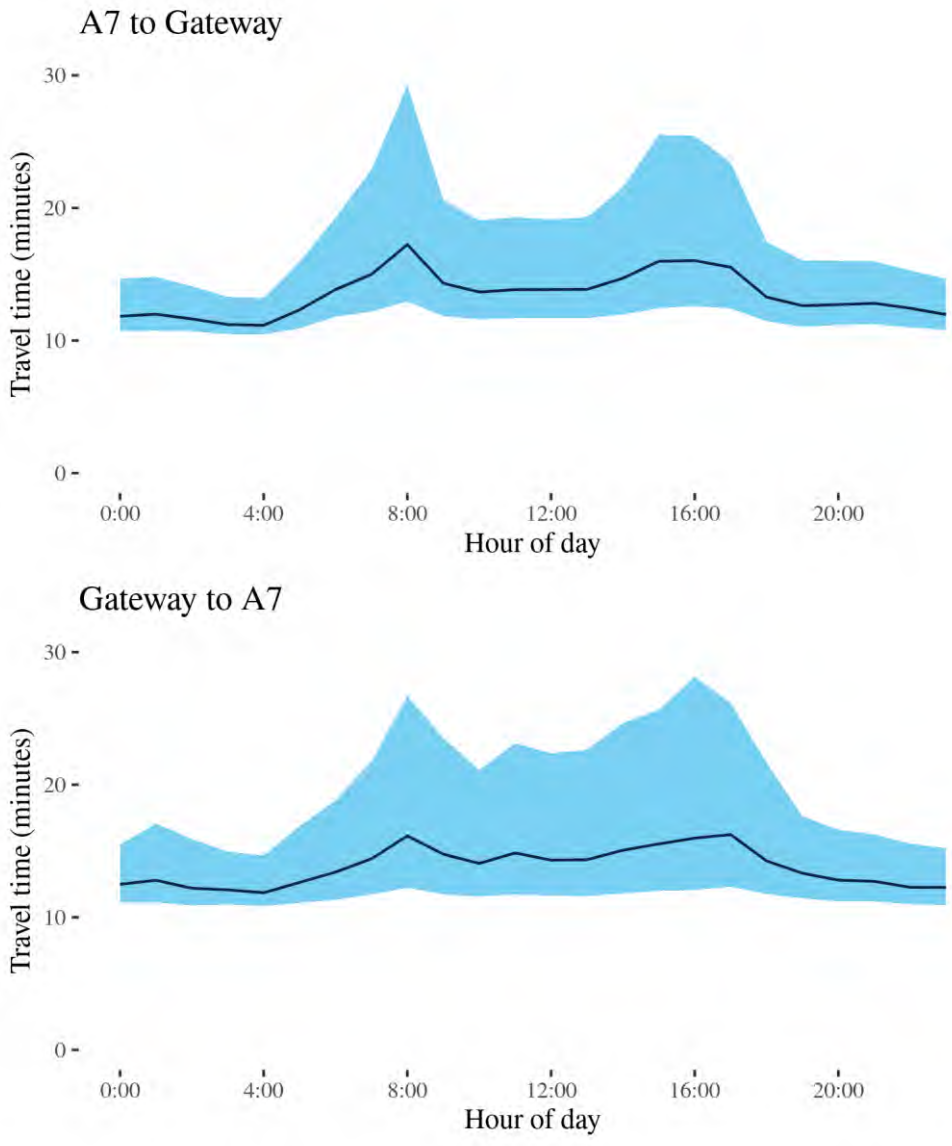
Source: BITRE estimates.

Eastbound from M7/A7 junction to the Gateway Motorway, the best travel times and lowest uncertainty were experienced at 4am with a median travel time of 11 minutes and an interquartile range of nearly 3 minutes. The longest median travel times and most uncertain travel time were experienced at 8am during the morning peak with a median of 17 minutes and an interquartile range of 16 minutes. There is also a prolonged afternoon peak. Delays were spread relatively evenly along the route but more apparent near the M3.

Westbound from the Gateway Motorway to the M7/A7 junction, the shortest median travel times and least uncertain travel time were at 4am with a median of 12 minutes and an interquartile range of 4 minutes. The longest median travel times and most uncertain travel times were experienced during the afternoon peak with a median of 16 minutes at 5pm and an interquartile range of 16 minutes at 4pm. There was also a similar but less prolonged morning peak in the westbound direction. Again delays were more apparent near the M3 but also near Beaudesert Road in both peaks.

In both directions, average travel times were higher and the variation in travel greater during business hours. However, morning and afternoon peaks were more pronounced on the westbound route to the A7/M7 junction.

Figure A.68 Route 2 route median and interquartile range travel times



Source: BITRE estimates.

Adelaide routes

A14 - Port Road to Southern Expressway / Southern Expressway to Port Road

This surface route traverses Adelaide's eastern suburbs and links Port Road (A7) at West Croydon in the north with the A13 at Darlington in the south. It passes Richmond near the Adelaide Airport and Plympton along the way. The route comprises several different roads including Holbrooks Road, Marion Road and Henley Beach Road.

Figure A.69 A14 route map

Source: BITRE estimates.

Table A.35 A14 route travel times and congestion measures, 2019

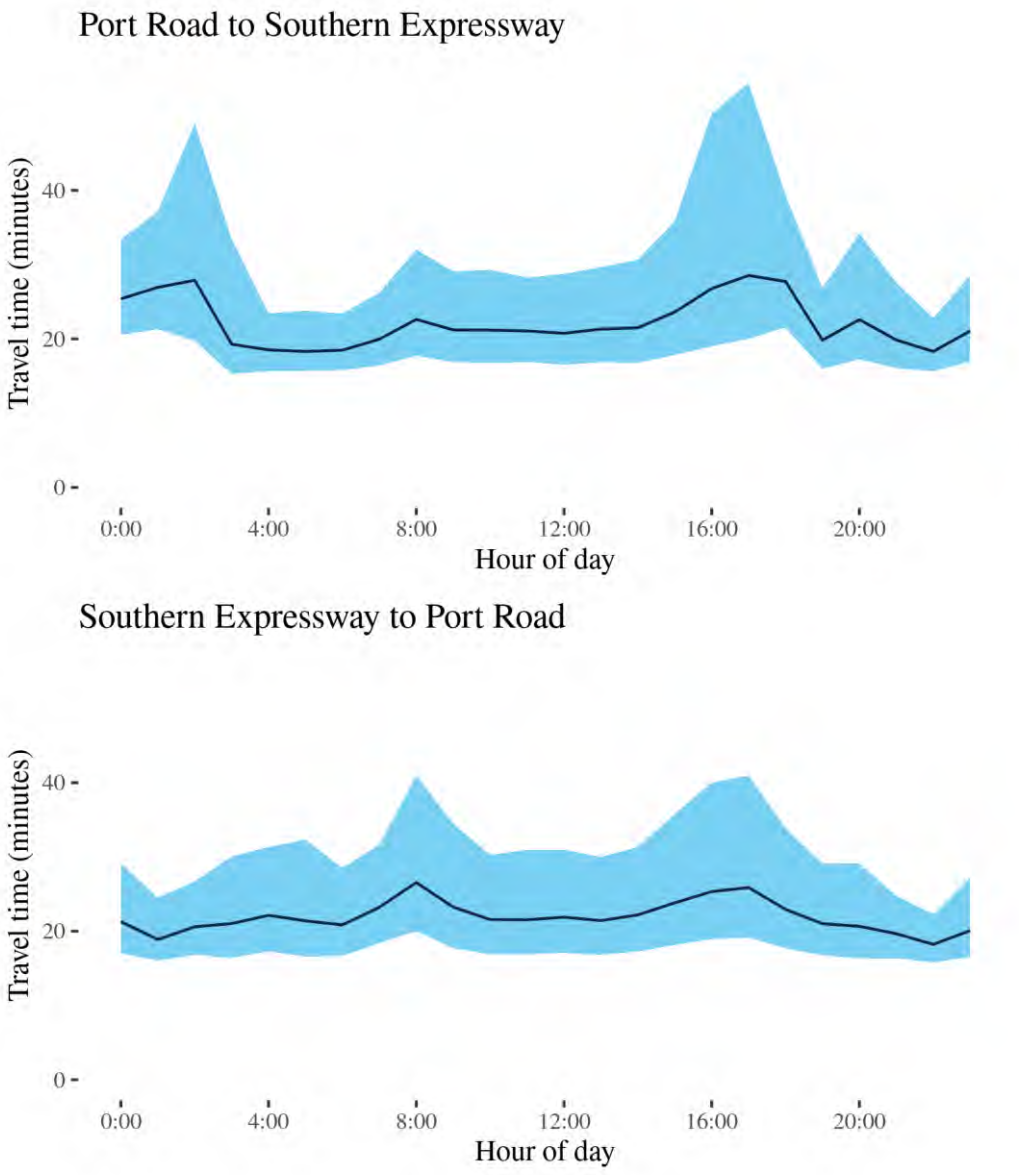
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Port Road to Southern Expressway	00:18:19	00:28:32	1.2	00:07:13	00:34:27	2.1	15
Southern Expressway to Port Road	00:18:14	00:26:33	1.2	00:06:28	00:21:47	2.1	15

Source: BITRE estimates.

For southbound trips, the lowest median travel times were 18 minutes at 5am and the least uncertainty were experienced at 10pm with an interquartile range of 7 minutes. The longest median travel times and greatest uncertainty were at 5pm with a median of 28 minutes and an interquartile range of 34 minutes. In both morning and afternoon peaks, delays were present near the intersection with Cross Road at Hilton and the early morning and evening peaks saw delays near Sir Donald Bradman Drive at Hilton and also near Port Road.

The shortest median travel time and lowest travel time uncertainty northbound were at 10pm with a median travel time of 18 minutes and an interquartile range of 6.5 minutes. The longest median travel times were 27 minutes experienced in the morning peak at 8am and the greatest travel time uncertainty were in the afternoon peak at 5pm with an interquartile range of 22 minutes. In both morning and afternoon peak periods, delays were generally fairly evenly distributed along the route, but were particularly evident near Sir Donald Bradman Drive.

Figure A.70 A14 route median and interquartile range travel times

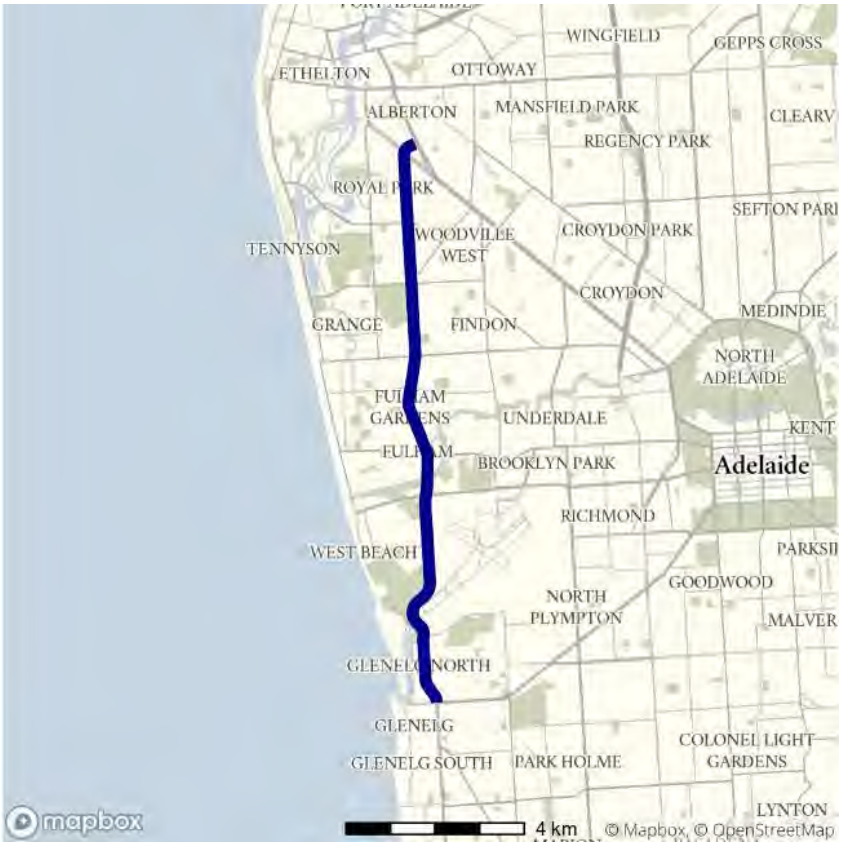


Source: BITRE estimates.

A15 - ANZAC Hwy to Port Road / Port Road to ANZAC Hwy

This route traverses the western suburbs of Adelaide between Glenelg and Queenstown-Alberton. Its northern sections run parallel to the A14 route in this report, but passes west of Adelaide Airport. This route is also known as Tapleys Hill Road.

Figure A.71 A15 route map



Source: BITRE estimates.

Table A.36 A15 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
ANZAC Hwy to Port Road	00:13:11	00:18:11	1.1	00:01:40	00:12:36	2.9	13.1
Port Road to ANZAC Hwy	00:13:27	00:18:04	1.1	00:02:00	00:14:23	2.8	13.0

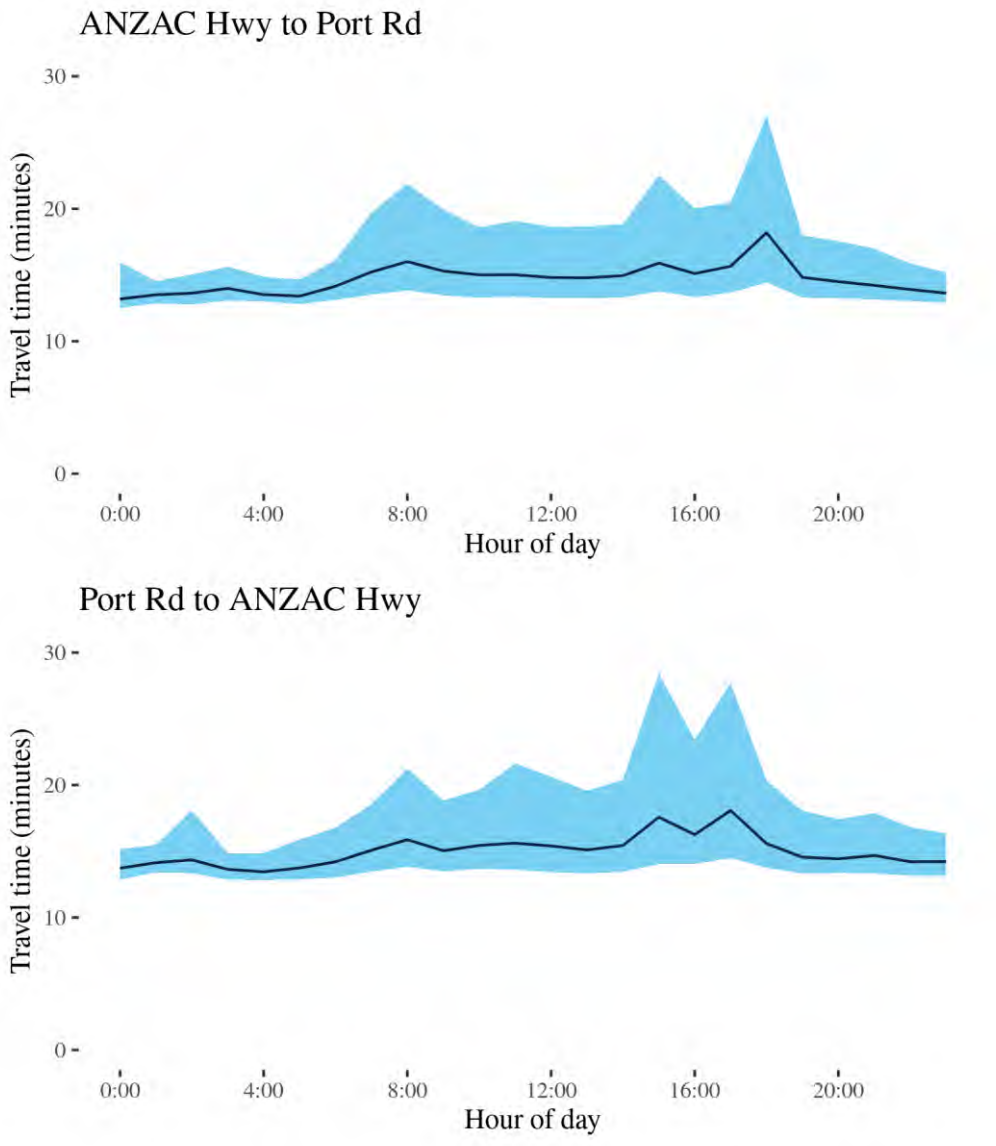
Source: BITRE estimates.

The best travel times travelling north from Glenelg to Port Road were experienced at midnight with a median travel time of 13 minutes and the lowest uncertainty were at 1am with an interquartile range of 2 minutes. The longest median travel times and greatest uncertainty were in the afternoon peak at 6pm with a median of 18 minutes and an interquartile range of 13 minutes. There is also a significant, but less pronounced, morning peak. Delays were somewhat more apparent near the intersection with Sir Donald Bradman Drive at Fulham.

The shortest median travel times southbound on the routes were 13.5 minutes at 4am and the lowest uncertainty were at 3am with an interquartile range of 2 minutes. The longest median travel times were 18 minutes experienced in the afternoon peak at 5pm and the greatest uncertainty was during the afternoon peak at 3pm, with an interquartile range of 14 minutes. Delays were fairly evenly distributed but were particularly evident near Sir Donald Bradman Drive and Grange Road.

The route exhibits significant travel time variability, in both directions, during business hours, presumably due to light vehicle traffic.

Figure A.72 A15 route median and interquartile range travel times



Source: BITRE estimates.

A16 - Hampstead Road to Outer Harbor / Outer Harbor to Hampstead Road

This route connects the Port of Adelaide, at Outer Harbor, and the north Adelaide at Hampstead Road (A17). It uses Grand Junction Road, Causeway Road and Semaphore Road and Victoria Road through the suburbs of Ethelton and Birkenhead.

Figure A.73 A16 route map

Source: BITRE estimates.

Table A.37 A16 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Hampstead Road to Outer Harbor	00:23:49	00:28:46	1.1	00:07:27	00:18:03	1.6	20.7
Outer Harbor to Hampstead Road	00:23:32	00:29:10	1.1	00:08:06	00:19:57	1.6	20.8

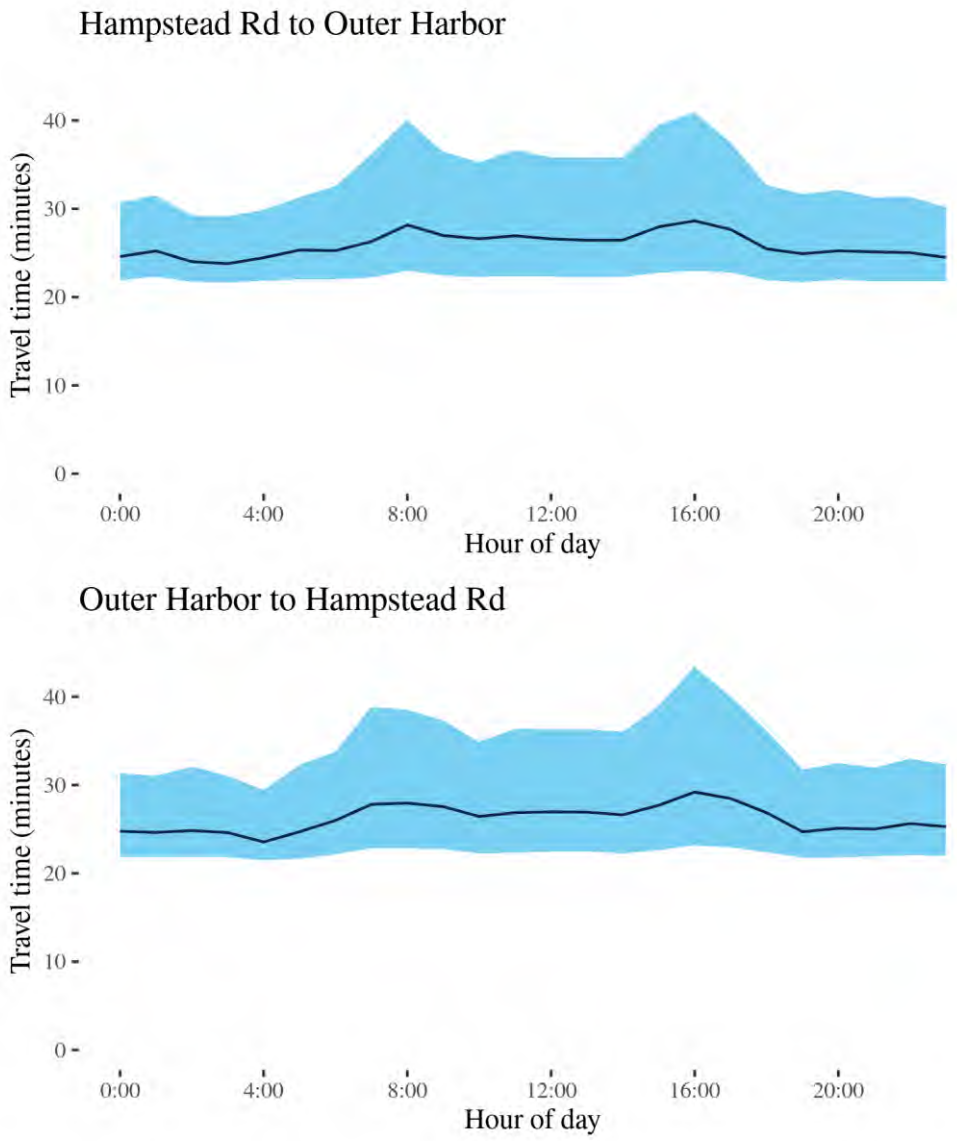
Source: BITRE estimates.

The best travel times travelling from Hampstead Road to Outer Harbor were experienced at 3am with a median travel time of 24 minutes and the lowest uncertainty were at 2am an interquartile range of 7.5 minutes. The longest median travel times and the greatest uncertainty were in the afternoon peak at 4pm with a median travel time of 29 minutes and an interquartile range of 18 minutes—the morning peak is very similar to the afternoon peak. Delays were spread fairly evenly along the route but more apparent on Grand Junction Road and most severe near the intersection with the Princes Highway (A1) at Gepps Cross in both peaks.

The best travel times and lowest uncertainty travelling from Outer Harbor to Hampstead Road were at 4am with a median travel time of 24 minutes and an interquartile range of 8 minutes. The longest median travel times and greatest uncertainty were experienced in the afternoon peak at 4pm with a median travel time of 29 minutes and an interquartile range of 20 minutes. There was also a milder morning peak. Delays were also more apparent along Hampstead Road but most severe near Hampstead Road.

In both directions there was heightened uncertainty throughout business hours.

Figure A.74 A16 route median and interquartile range travel times



Source: BITRE estimates.

A17 - Grand Junction to SE Freeway / SE Freeway to Grand Junction

This route follows the A17 south from the A16 (Grand Junction Road) through Adelaide's eastern suburbs and connects to the South Eastern Freeway and Cross Road at Glen Osmond. The route traverses Hampstead Road, Ascot Avenue and Portrush Road along its length.

Figure A.75 A17 route map

Source: BITRE estimates.

Table A.38 A17 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Grand Junction to SE Freeway	00:14:16	00:19:57	1.1	00:01:29	00:21:46	4.2	13.6
SE Freeway to Grand Junction	00:14:40	00:18:34	1.1	00:02:24	00:10:47	2.4	13.6

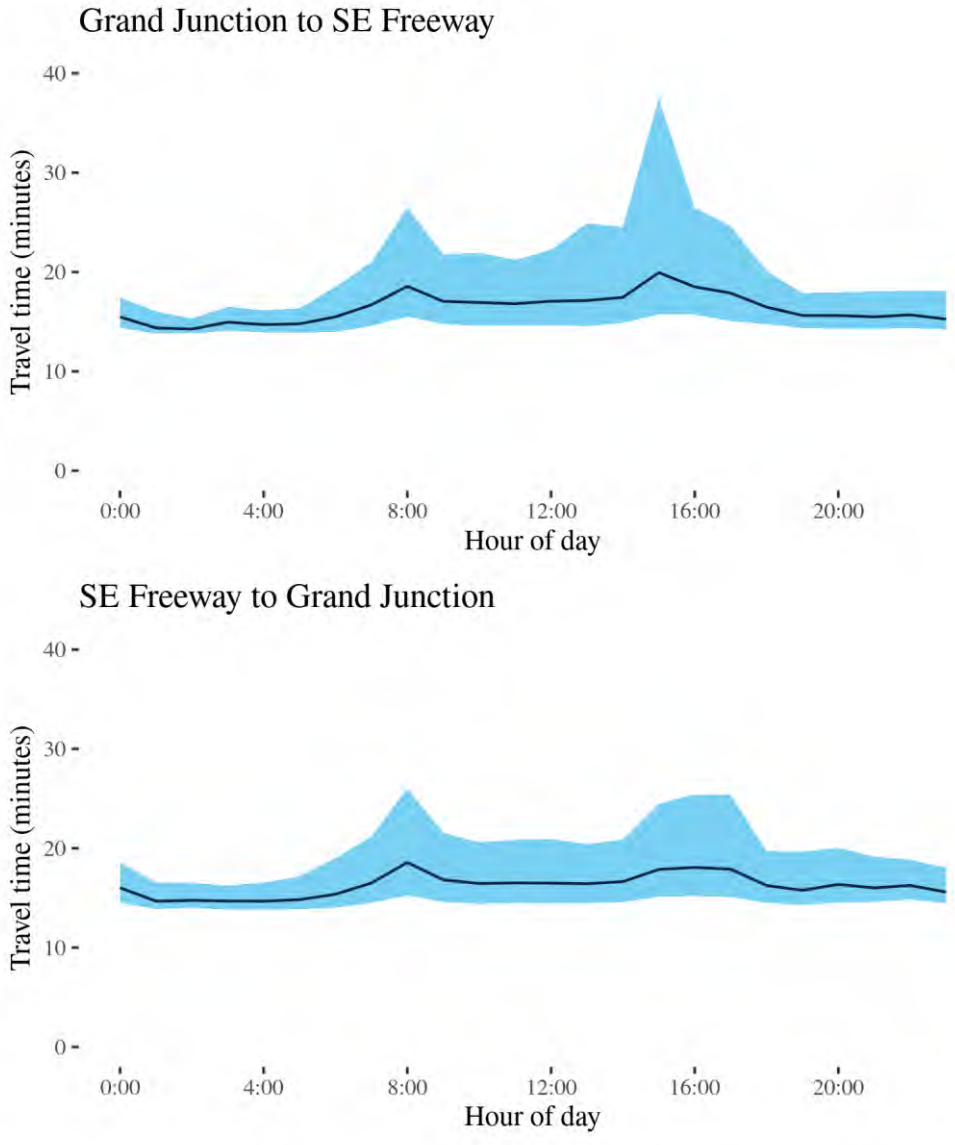
Source: BITRE estimates.

The best travel times and lowest uncertainty southbound were at 2am with a median travel time of 14 minutes and an interquartile range of 1.5 minutes. The longest median travel times and greatest uncertainty were in the afternoon peak at 3pm with a median travel time of 20 minutes and an interquartile range of 22 minutes. There was also a milder peak in the morning. Delays were fairly evenly distributed along the route.

The best median travel times northbound were 15 minutes at 4am and the lowest uncertainty were at 3am with an interquartile range of 2 minutes. The longest median travel times and greatest uncertainty were experienced during the morning peak at 8am with a median of 19 minutes and an interquartile range of 11 minutes. There was also a smaller but more extended peak in the afternoon. Delays were fairly evenly distributed along the route but with indications of greater delays at the intersection with North East Road (A10).

The route exhibits greater travel time uncertainty throughout business hours in both directions.

Figure A.76 A17 route median and interquartile range travel times



Source: BITRE estimates.

A20 - Grand Junction Road to Sturt Highway / Sturt Highway to Grand Junction Road

This route follows the A20 (comprising Main North Road and the Gawler Bypass) from Grand Junction Road at Gepps Cross north to the Stuart Highway near Gawler, and passes through Evanston Park, Blakeview, Elizabeth, Salisbury Park and Mawson Lakes.

Figure A.77 A20 route map

Source: BITRE estimates.

Table A.39 A20 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Grand Junction Road to Sturt Highway	00:25:37	00:32:12	1.1	00:05:02	00:27:08	2.7	32.4
Sturt Highway to Grand Junction Road	00:26:59	00:34:05	1.1	00:08:53	00:27:41	2.0	32.6

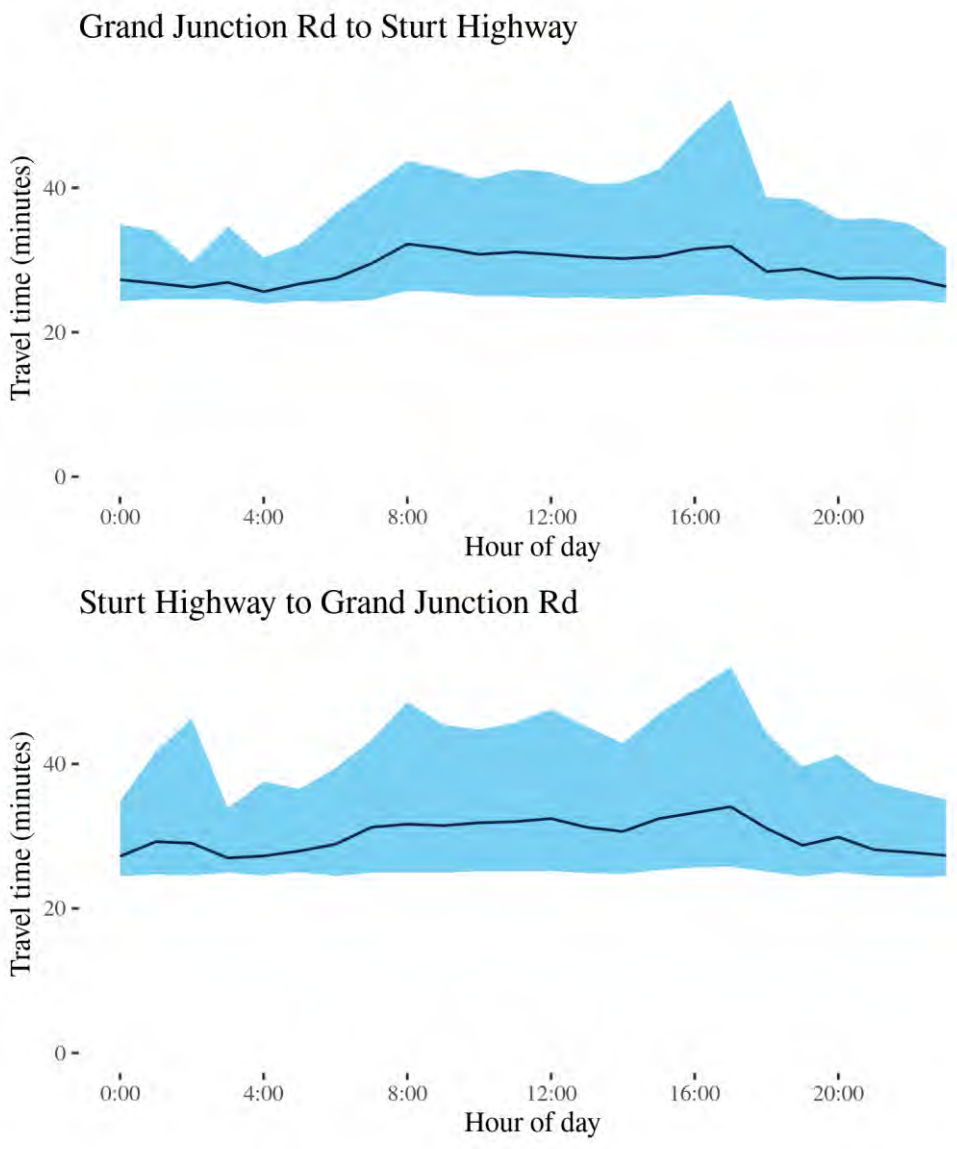
Source: BITRE estimates.

The best travel times on the northbound lanes were experienced at 4am with a median travel time of 26 minutes and the lowest uncertainty were at 2am with an interquartile range of 5 minutes. The longest median travel times were at 8am with a median of 32 minutes and the greatest uncertainty was at 5pm with an interquartile range of 27 minutes. Delays were more apparent at the beginning of the route.

The best travel times and the lowest uncertainty travelling south were at 3am with a median travel time of 27 minutes and an interquartile range of 9 minutes. The longest median travel times and the greatest uncertainty were, like the reverse direction, experienced in the afternoon peak at 5pm with a median of 34 minutes and an interquartile range of 28 minutes. Delays were again more evident in the southern portions of the route.

This route, like other key routes in Adelaide, exhibits greater travel time uncertainty throughout business hours in both directions. Moreover, the increase in travel time variation is more significant than the increase in median travel times, suggesting that a small but significant proportion of road users experience significant delays on this route.

Figure A.78 A20 route median and interquartile range travel times,

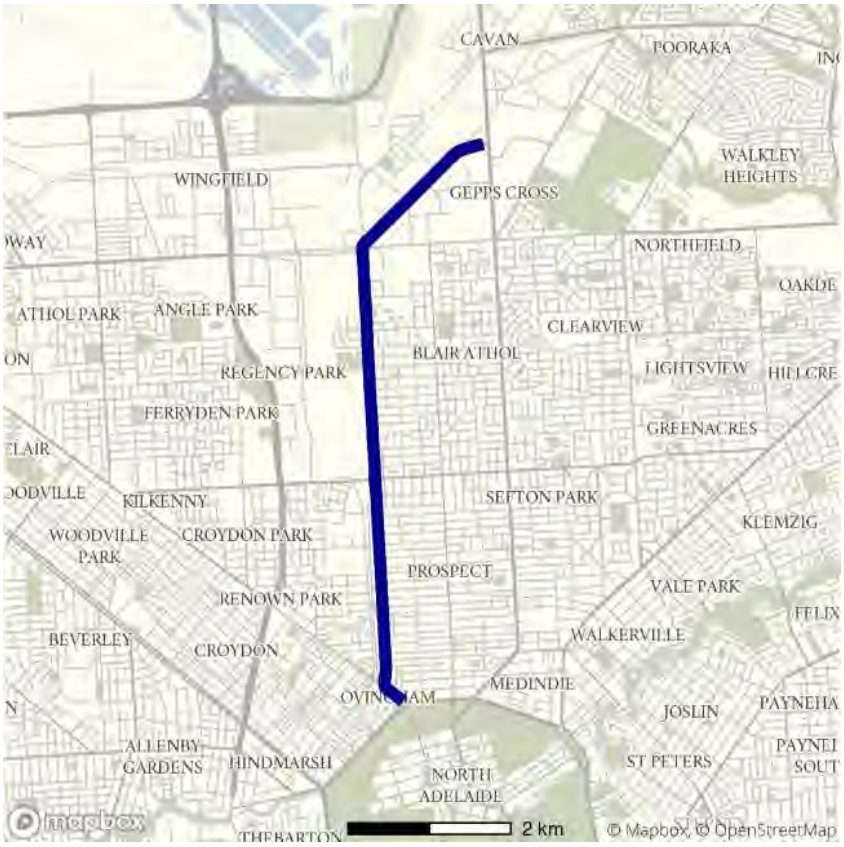


Source: BITRE estimates.

A22 - Park Terrace to Port Wakefield Road / Port Wakefield Road to Park Terrace

This route follows the A22 north from Park Terrace at north Adelaide and meets the Princes Highway (A1, Port Wakefield Road) at Gepps Cross. It uses Churchill Road and Cavan Road, crossing Grand Junction Road (A16) along its way.

Figure A.79 A22 route map



Source: BITRE estimates.

Table A.40 A22 route travel times and congestion measures, 2019

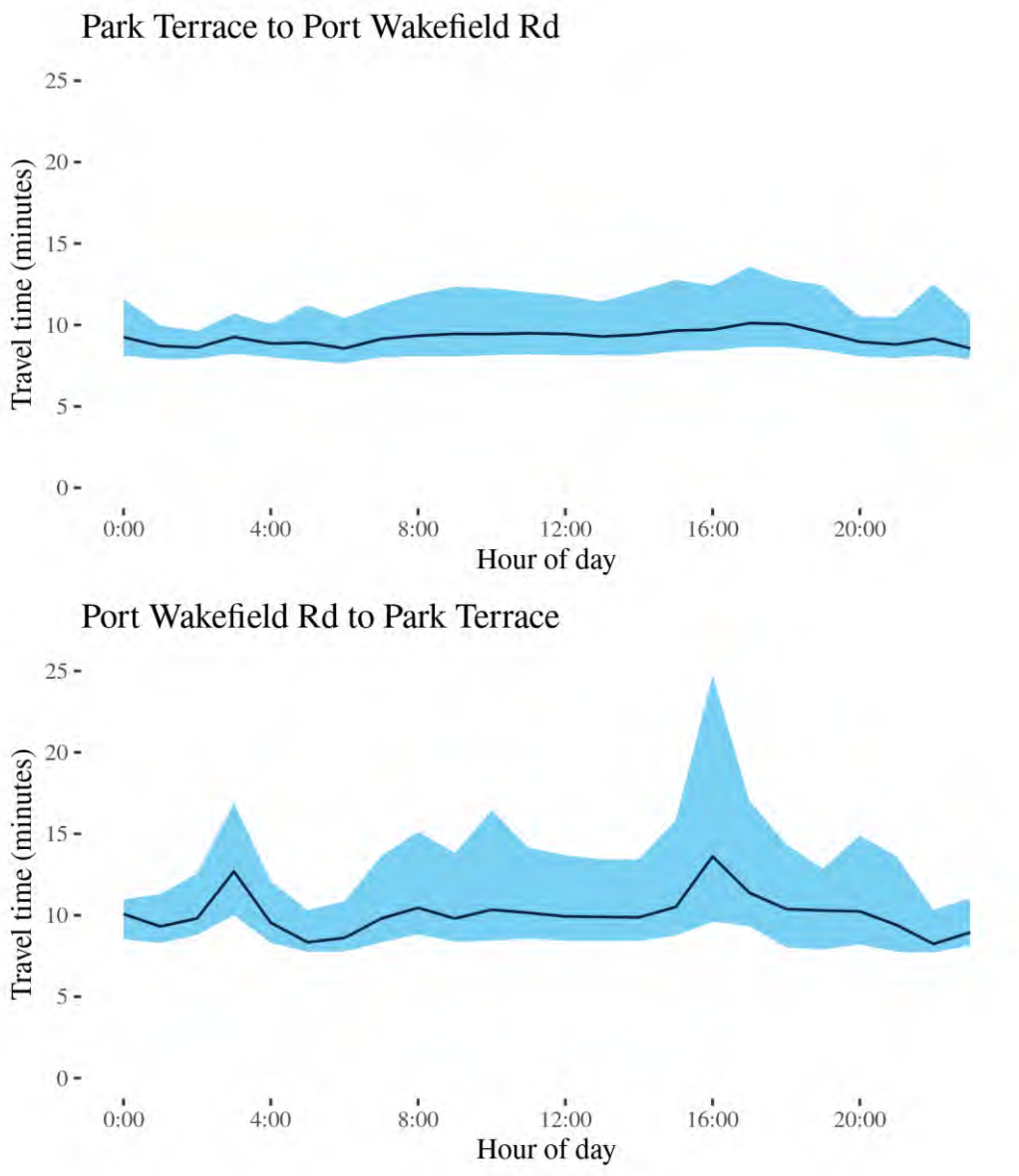
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Park Terrace to Port Wakefield Road	00:08:33	00:10:07	1.1	00:01:42	00:04:55	2.0	7.7
Port Wakefield Road to Park Terrace	00:08:15	00:13:36	1.2	00:02:27	00:15:07	2.2	7.6

Source: BITRE estimates.

The best median travel time northbound from Park Terrace to Port Wakefield Road was 8.5 minutes at 11pm and the lowest uncertainty were experienced at 2am with an interquartile range of nearly 2 minutes. The longest median travel times and the greatest uncertainty were during the afternoon peak at 5pm with a median travel time of 10 minutes and an interquartile range of 5 minutes. Delays were slightly more apparent near the intersection with Park Terrace.

The best median travel time travelling south was 8 minutes at 10pm and the lowest uncertainty were at midnight with an interquartile range of 2.5 minutes. The longest median travel times and the greatest uncertainty were experienced during the afternoon peak at 4pm with a median travel time of 14 minutes and an interquartile range of 15 minutes. The southbound direction morning and afternoon peaks are significantly more distinct than any peak in the opposite direction with delays most apparent in the southern parts of the route near Prospect.

Figure A.80 A22 route median and interquartile range travel times



Source: BITRE estimates.

A3 - ANZAC Highway to SE Freeway / SE Freeway to ANZAC Highway

This route follows Cross Road (A3) between the ANZAC Highway (A5) and the South Eastern Freeway at Glen Osmond. It traverses Adelaide's Southern Suburbs.

Figure A.81 A3 route map

Source: BITRE estimates.

Table A.41 A3 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
ANZAC Highway to SE Freeway	00:09:50	00:14:53	1.2	00:02:57	00:15:28	2.4	8.7
SE Freeway to ANZAC Highway	00:09:43	00:15:22	1.2	00:02:58	00:18:08	2.5	8.7

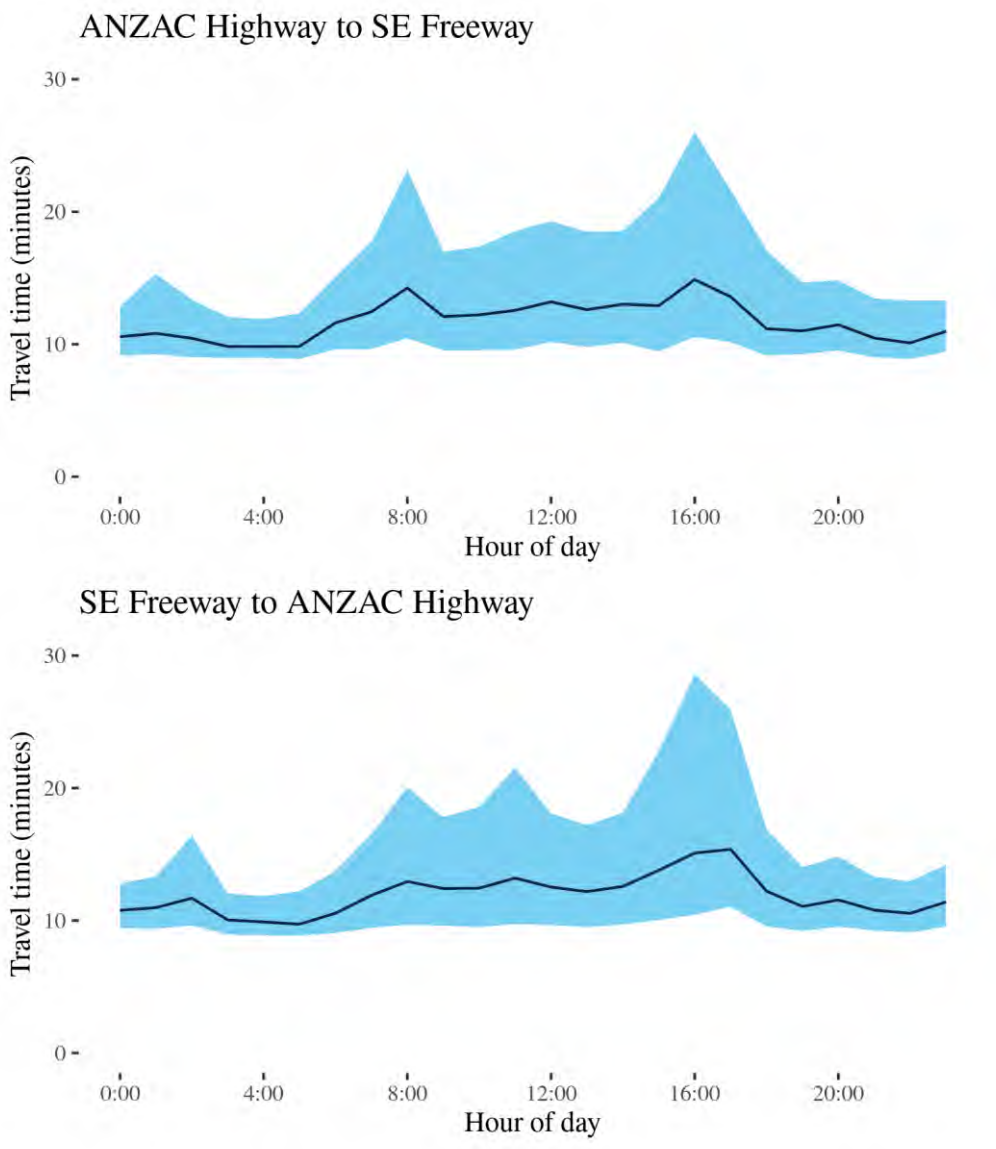
Source: BITRE estimates.

The best travel times and lowest uncertainty travelling eastbound from ANZAC Highway to the South Eastern Freeway were experienced at 4am with a median travel time of 10 minutes and an interquartile range of 3 minutes. The longest median travel times and the greatest uncertainty were during the afternoon peak at 4pm with a median travel time of 15 minutes and an interquartile range of 15.5 minutes. There was also a smaller peak in the morning. Delays were spread evenly along the route, but with indications of more apparent delays near South Road in the morning and closer to the South Eastern Freeway in the afternoon.

The best median travel time travelling west was 10 minutes at 5am and the lowest uncertainty were at 4am with an interquartile range of 3 minutes. The longest median travel times was 15 minutes experienced during the afternoon peak at 5pm and the greatest uncertainty was at 4pm with an interquartile range of 18 minutes. Delays were fairly evenly distributed along the route.

In both directions, there was an increase in the median travel time and travel time uncertainty throughout business hours and during the morning and afternoon peak, although median travel time did not vary as much westbound as eastbound.

Figure A.82 A3 route median and interquartile range travel times



Source: BITRE estimates.

A9 - Nelson St to Port Wakefield Road / Port Wakefield Road to Nelson St

This route traverses the light industrial areas on Adelaide's northern fringe. It links Victoria Road and Nelson Street at Birkenhead and the Princes Highway (Port Wakefield Road, A1) at Mawson Lakes, and is an important link for freight from northern Adelaide to the port. It is known at different points on its route as the Port River Expressway and the Salisbury Highway.

Figure A.83 A9 route map

Source: BITRE estimates.

Table A.42 A9 route travel times and congestion measures, 2019

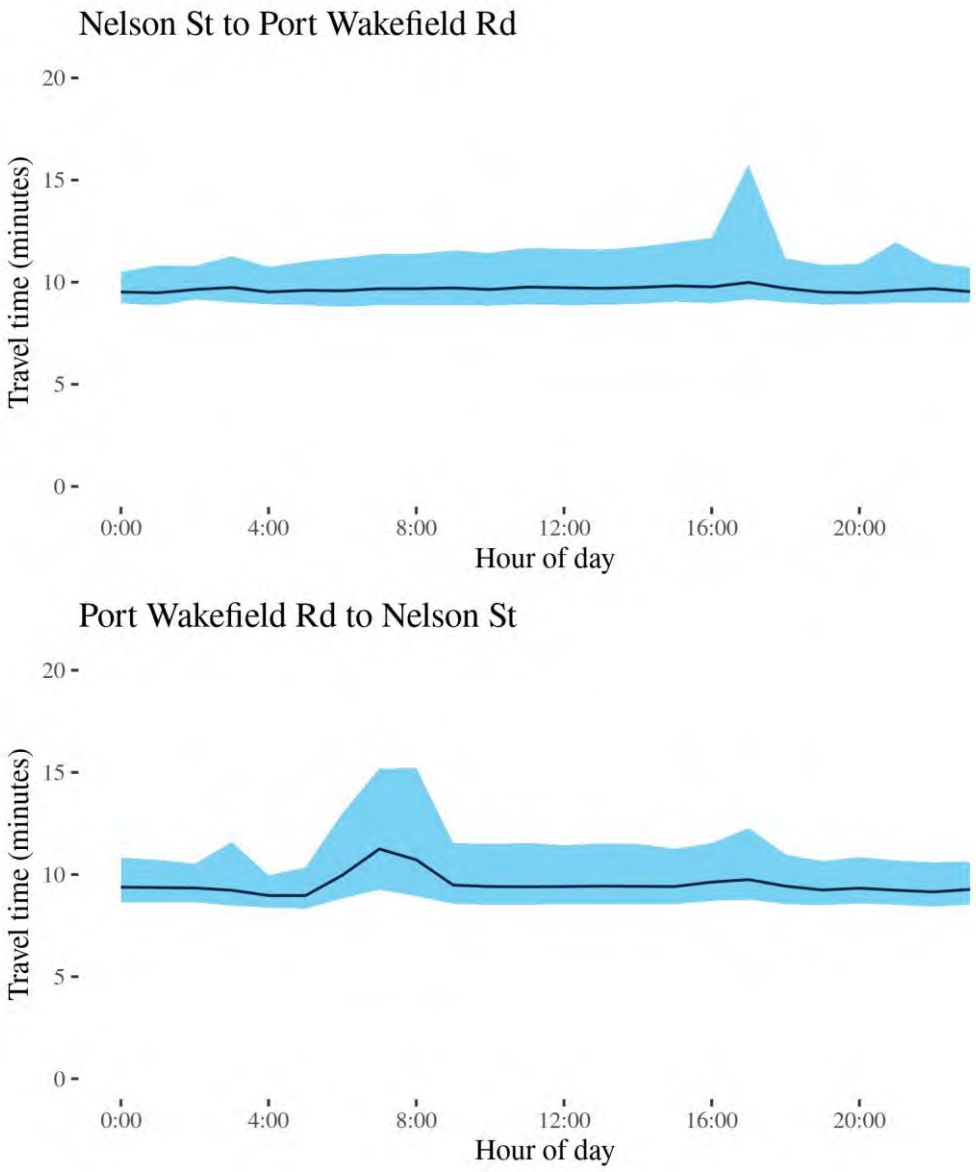
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Nelson St to Port Wakefield Road	00:09:29	00:09:59	1.0	00:01:31	00:06:35	1.7	10.2
Port Wakefield Road to Nelson St	00:08:58	00:11:15	1.1	00:01:35	00:06:16	1.8	10.2

Source: BITRE estimates.

The best travel times travelling east were experienced at 1am with a median travel time of 9.5 minutes and the lowest uncertainty were at midnight with an interquartile range of 1.5 minutes. The longest median travel times and the greatest uncertainty was during the afternoon peak at 5pm with a median of 10 minutes and an interquartile range of 6.5 minutes. There was also a milder peak of uncertainty in the morning.

The best median travel time westbound was 9 minutes at 5am and the lowest uncertainty were at 4am with an interquartile range of 1.5 minutes. The longest median travel time was 11 minutes experienced during the morning peak at 7am and the greatest uncertainty was at 8am with an interquartile range of 6 minutes.

Figure A.84 A9 route median and interquartile range travel times

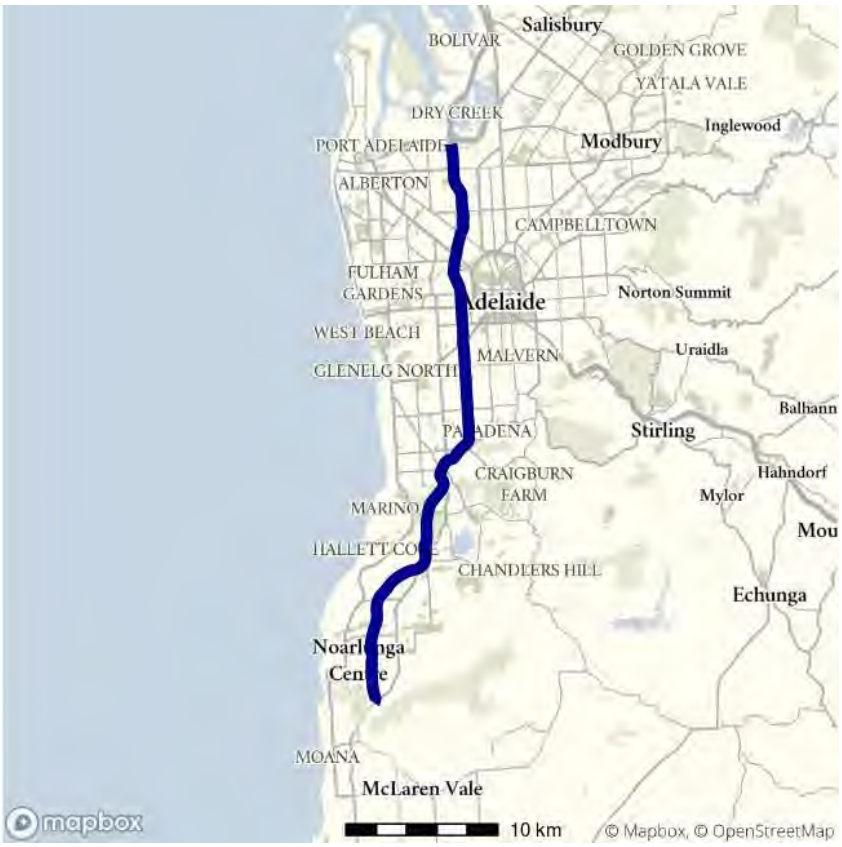


Source: BITRE estimates.

A2-M2 - Main South Road to Port River Expressway / Port River Expressway to Main South Road

This route, the only Adelaide route in this report with motorway sections, traverses Adelaide north to south. It follows the A2 and the M2, from the Port River Expressway (A9) at Angle Park and merging with Main South Road at Noarlunga Downs. This route uses the Southern Expressway (M2), South Road (A2) and the North-South Motorway (M2). It does not include the Northern Connector opened in March 2020.

Figure A.85 A2-M2 route map



Source: BITRE estimates.

Table A.43 A2-M2 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Main South Road to Port River Expressway	00:34:56	00:49:16	1.1	00:08:19	00:45:25	2.1	40.1
Port River Expressway to Main South Road	00:34:52	00:45:45	1.1	00:07:34	00:40:21	2.4	39.8

Source: BITRE estimates.

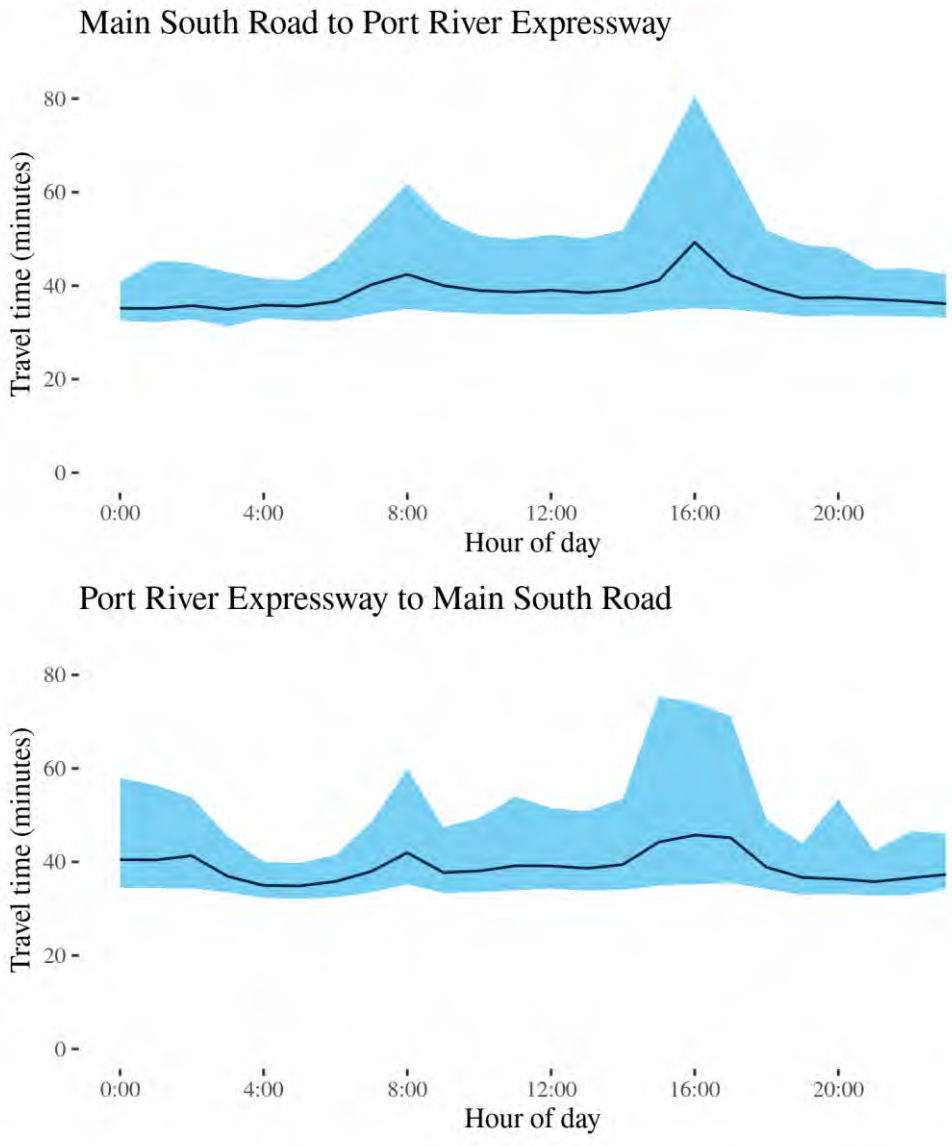
The best median travel time travelling north from Noarlunga to the Port River Expressway was 35 minutes at 3am and the lowest uncertainty were experienced at midnight with an interquartile range of 8 minutes. The longest median travel times and the greatest uncertainty was at 4pm during the afternoon peak with a median travel time of 49 minutes and an interquartile range of 45 minutes. There was also a smaller peak in median travel time and travel time uncertainty in the morning peaks. Delays during both peaks were more apparent in the surface road sections west of the CBD and on the North-South Motorway.

The best travel times and the lowest uncertainty for southbound trips were at 5am with a median travel time of 35 minutes and an interquartile range of 7.5 minutes. The longest median travel times were experienced during the afternoon peak at 4pm with a median of 46 minutes and the greatest uncertainty was at 3pm with an interquartile range of 40 minutes. There was also a smaller increase in travel times in the morning peak. Delays were most apparent on the surface route sections and the northern parts of the Southern Expressway.

In both directions there was increased uncertainty throughout business hours.

The locations of the travel delays suggest both directions were congested primarily due to afternoon traffic leaving inner parts of Adelaide in opposite directions.

Figure A.86 A2-M2 route median and interquartile range travel times



Source: BITRE estimates.

Perth routes

Route 1 - Roe Hwy to Tonkin Hwy / Tonkin Hwy to Roe Hwy

This route follows the Great Northern Highway north-south between the Tonkin Highway at Muchea and the Roe Highway–Reid Highway junction at Middle Swan. It passes Herne Hill, Upper Swan and Bullsbrook along its way. The BITRE telematics data shows it is a major route for freight heading north out of Perth.

Figure A.87 Route 1 route map

Source: BITRE estimates.

Table A.44 Route 1 route travel times and congestion measures, 2019

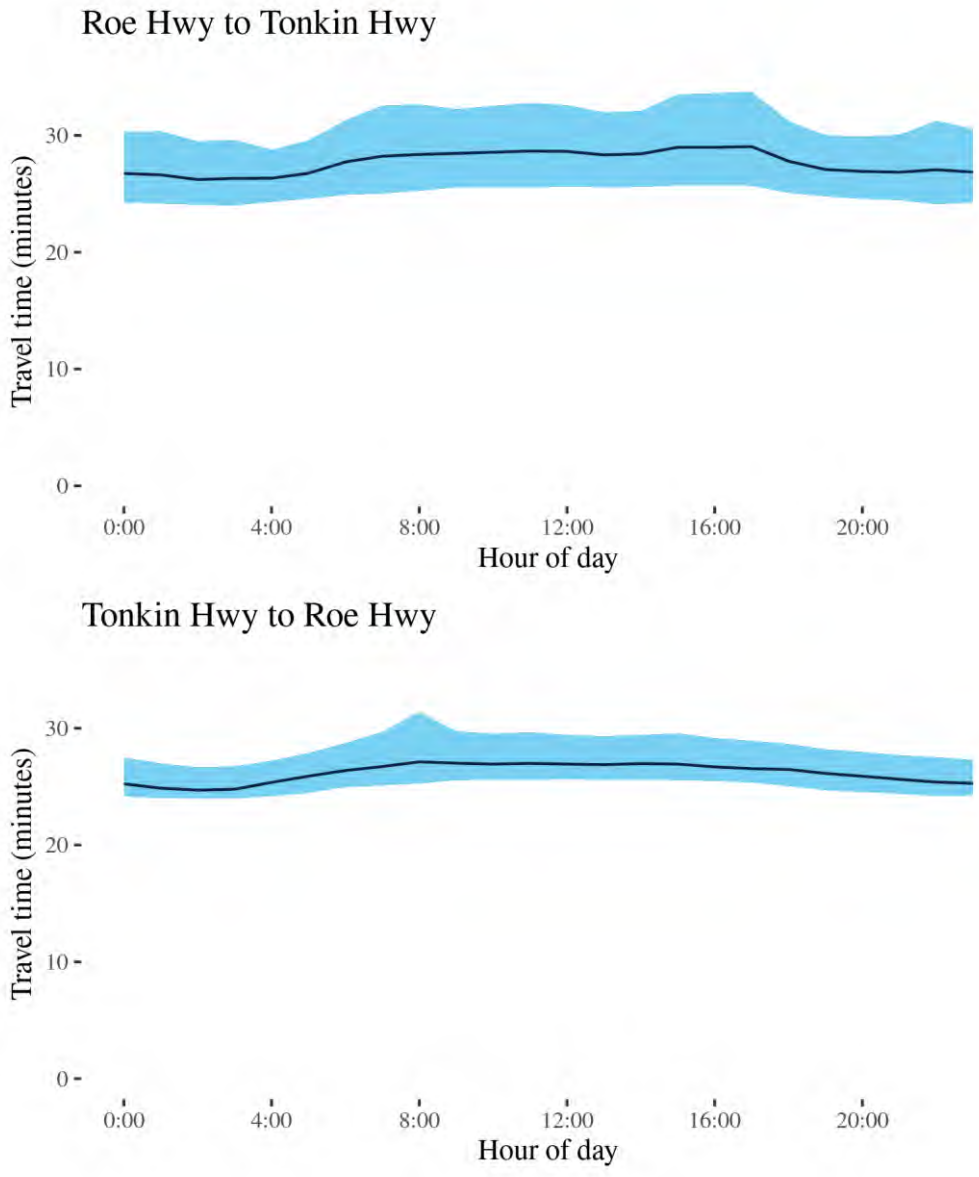
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Roe Hwy to Tonkin Hwy	00:26:13	00:29:02	1.1	00:04:29	00:08:05	1.4	34.5
Tonkin Hwy to Roe Hwy	00:24:42	00:27:07	1.1	00:02:40	00:06:09	1.4	34.5

Source: BITRE estimates.

The best median travel time travelling north was 26 minutes at 2am and the lowest uncertainty was experienced at 4am with an interquartile range of 4.5 minutes. The longest median travel times and the greatest uncertainty were during the afternoon peak at 5pm with a median travel time of 29 minutes and an interquartile range of 8 minutes. Travel times and uncertainty were slightly higher throughout the day. Mild delays were more apparent in the southern part of the route.

The best travel times and the lowest uncertainty travelling south were at 2am with a median travel time of 25 minutes and an interquartile range of 3 minutes. The longest median travel times and the greatest uncertainty were experienced in the morning peak at 8am with a median of 27 minutes and an interquartile range of 6 minutes. Travel times and uncertainty were slightly higher throughout daylight hours. Again mild delays were more apparent in the southern sections of the route.

Figure A.88 Route 1 route median and interquartile range travel times

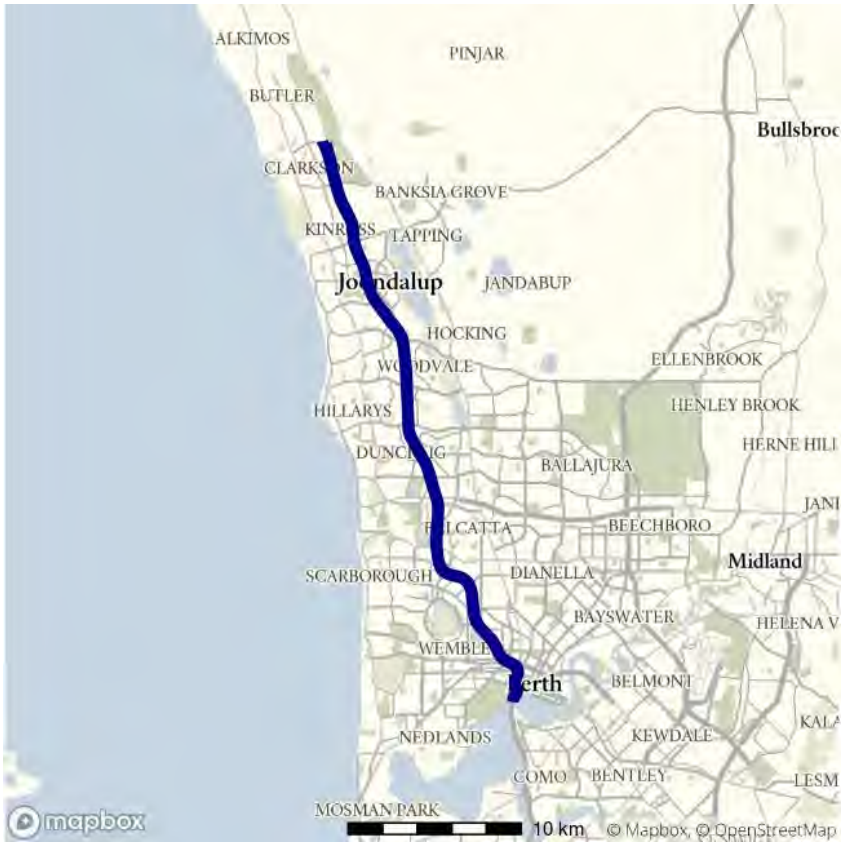


Source: BITRE estimates.

Route 2 (Mitchell) - Hester Avenue to Swan River / Swan River to Hester Avenue

This route follows the Mitchell Highway (Route 2) between Hester Avenue near Ridgewood in Perth's northern suburbs, and the Swan River near the Perth CBD, and is one of the main routes servicing Perth's northern suburbs. It also carries some traffic from the north coast of Western Australia.

Figure A.89 Route 2 (Mitchell) route map



Source: BITRE estimates.

Table A.45 Route 2 (Mitchell) route travel times and congestion measures, 2019

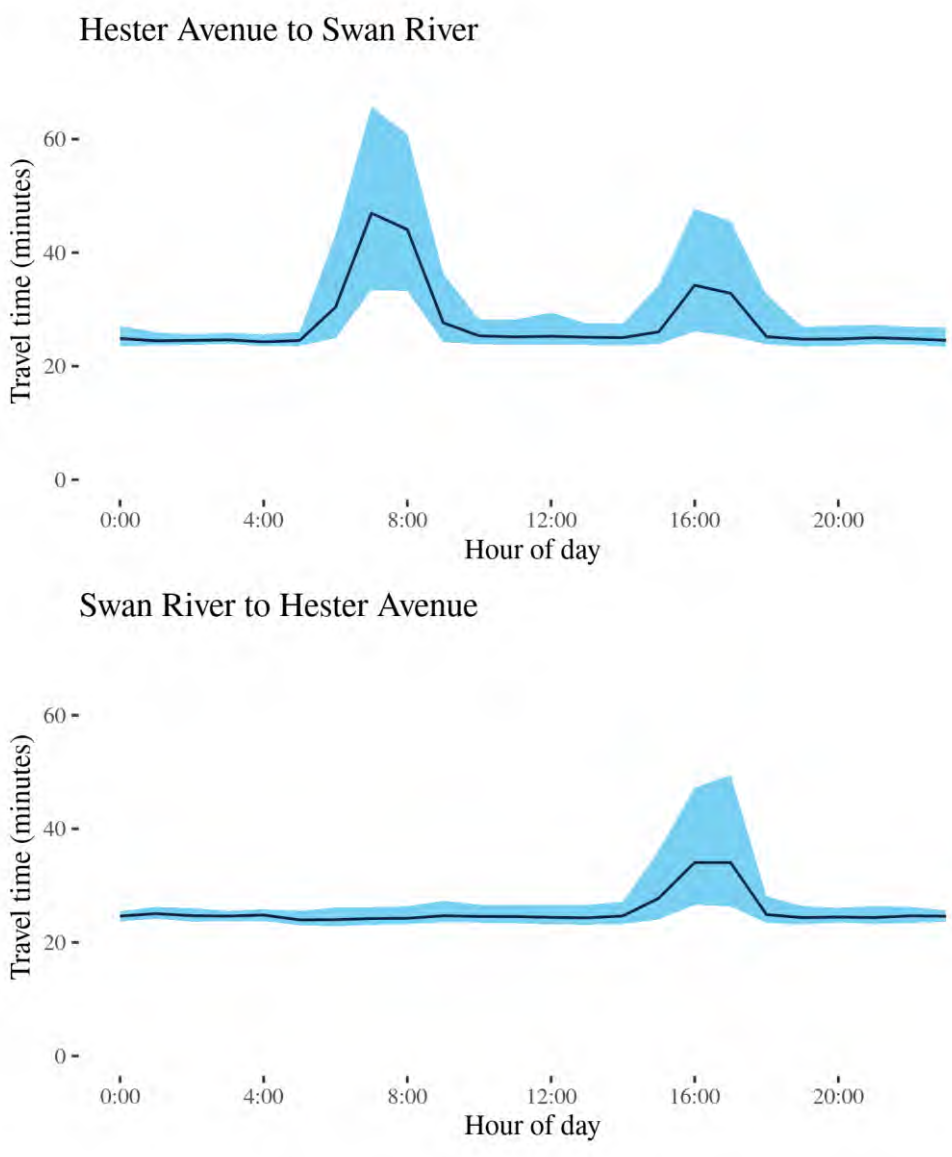
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Hester Avenue to Swan River	00:24:18	00:46:56	1.1	00:01:50	00:32:15	4.7	35.9
Swan River to Hester Avenue	00:23:58	00:34:04	1.1	00:01:47	00:23:08	2.7	35.9

Source: BITRE estimates.

The best median travel time southbound from Hester Avenue to the Swan River was 24 minutes at 4am and the lowest uncertainty were experienced at 2am with an interquartile range of 2 minutes. The longest median travel times and the greatest uncertainty were during the morning peak at 7am with a median travel time of 47 minutes and an interquartile range of 32 minutes. There was also a smaller, but still significant, increase in travel time and uncertainty in the afternoon peak. Delays were most apparent in two sections: one near Edgewater (south of Joondalup) and the other near Stirling (closer to the CBD).

The best median travel time travelling north was 24 minutes at 5am and the lowest uncertainty was at 3am with an interquartile range of 2 minutes. The longest median travel times were at 4pm with a median travel time of 34 minutes and the greatest uncertainty was experienced at 5pm with an interquartile range of 23 minutes. Unlike the southbound direction, there was no observable morning peak in northbound journeys, reflecting the significance of this route as a corridor for commuter's heading south towards the CBD. Congestion was again most apparent near Stirling.

Figure A.90 Route 2 (Mitchell) route median and interquartile range travel times

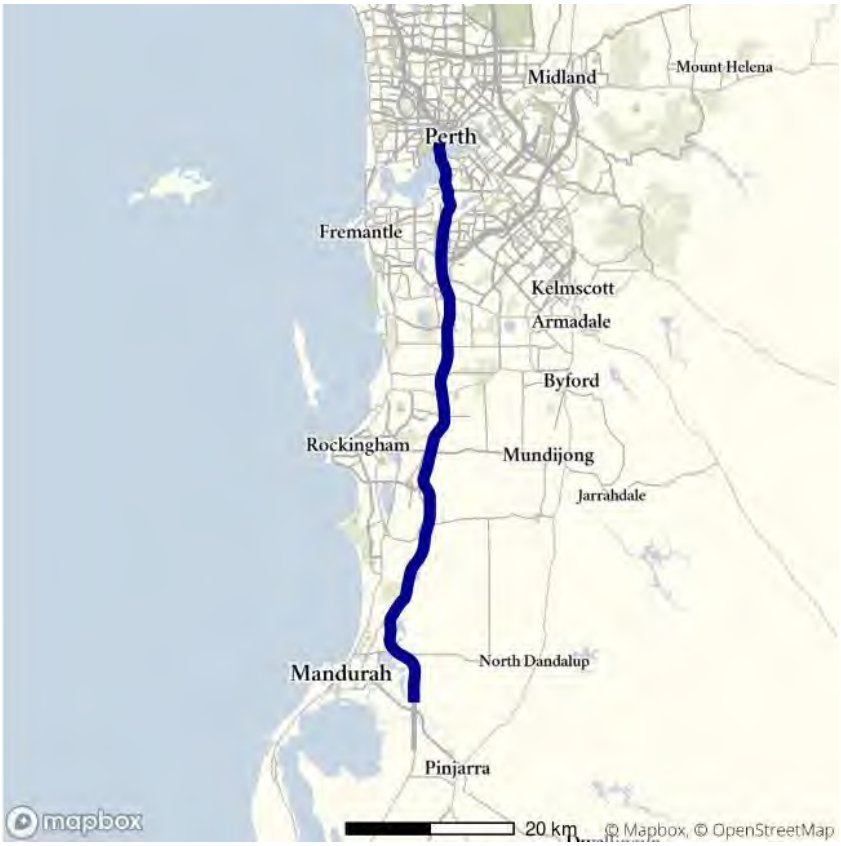


Source: BITRE estimates.

Route 2 (Kwinana) - Forrest Hwy to Mitchell Hwy / Mitchell Freeway to Forrest Hwy

This route follows the Kwinana Highway connecting the Forrest Highway south of Mandurah and the Mitchell Highway at the Swan River near the Perth CBD. It is one of the main routes servicing Perth's southern suburbs and Rockingham and Mandurah south of Perth.

Figure A.91 Route 2 (Kwinana) route map



Source: BITRE estimates.

Table A.46 Route 2 (Kwinana) route travel times and congestion measures, 2019

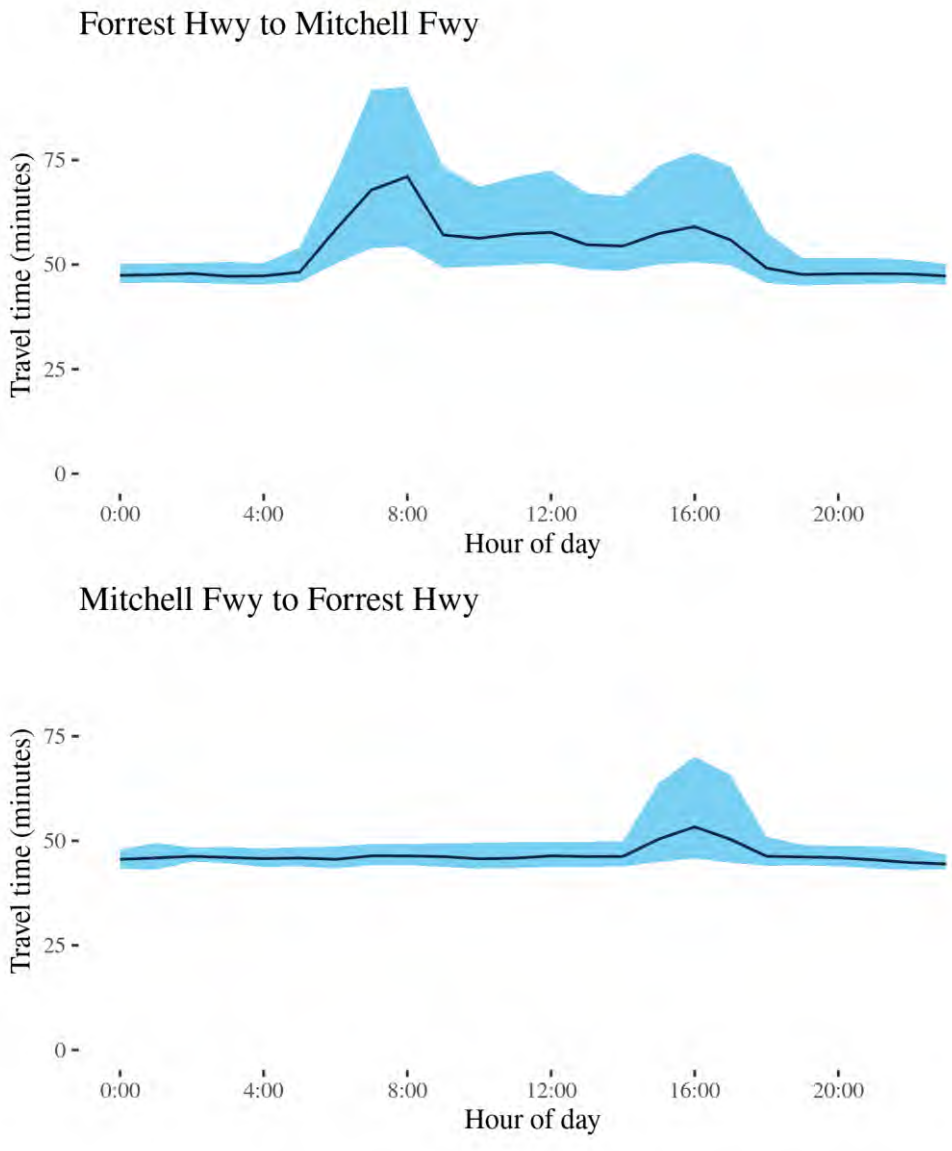
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Forrest Hwy to Mitchell Hwy	00:47:12	01:11:01	1.1	00:04:30	00:38:13	3.4	70.7
Mitchell Freeway to Forrest Hwy	00:44:27	00:53:20	1.0	00:03:18	00:24:23	2.2	70.7

Source: BITRE estimates.

The best median travel time for northbound travel was 47 minutes at 3am and the lowest uncertainty were experienced at 1am with an interquartile range of 4.5 minutes. The longest median travel times and greatest uncertainty were experienced at 8am during the morning peak with a median of 1 hour 11 minutes and interquartile range of 38 minutes. Travel times and uncertainty remained elevated throughout business hours. Delays were severe immediately south of the Swan River and near the intersection with the Roe Highway at Leeming.

The best median travel time heading south was 44 minutes at 11pm and the lowest uncertainty were at 2am with an interquartile range of 3 minutes. The longest median travel times and the greatest uncertainty were experienced during the afternoon peak at 4pm with a median travel time of 53 minutes and an interquartile range of 24 minutes. Unlike the northbound reverse route, travel time and uncertainty remained stable throughout the whole day except the peak hours in the afternoon, likely reflecting the significance of this route as a corridor for commuter traffic heading north towards the CBD.

Figure A.92 Route 2 (Kwinana) route median and interquartile range travel times



Source: BITRE estimates.

Route 3 (Roe Highway) - Great Northern Highway to Kwinana Freeway / Kwinana Freeway to Great Northern Highway

This route follows the Roe Highway between its junction the Great Northern Highway (Route 1) in the north and its connection with the Kwinana Freeway (Route 2) at Leeming in Perth's south.

Figure A.93 Route 3 (Roe Highway) route map

Source: BITRE estimates.

Table A.47 Route 3 (Roe Highway) route travel times and congestion measures, 2019

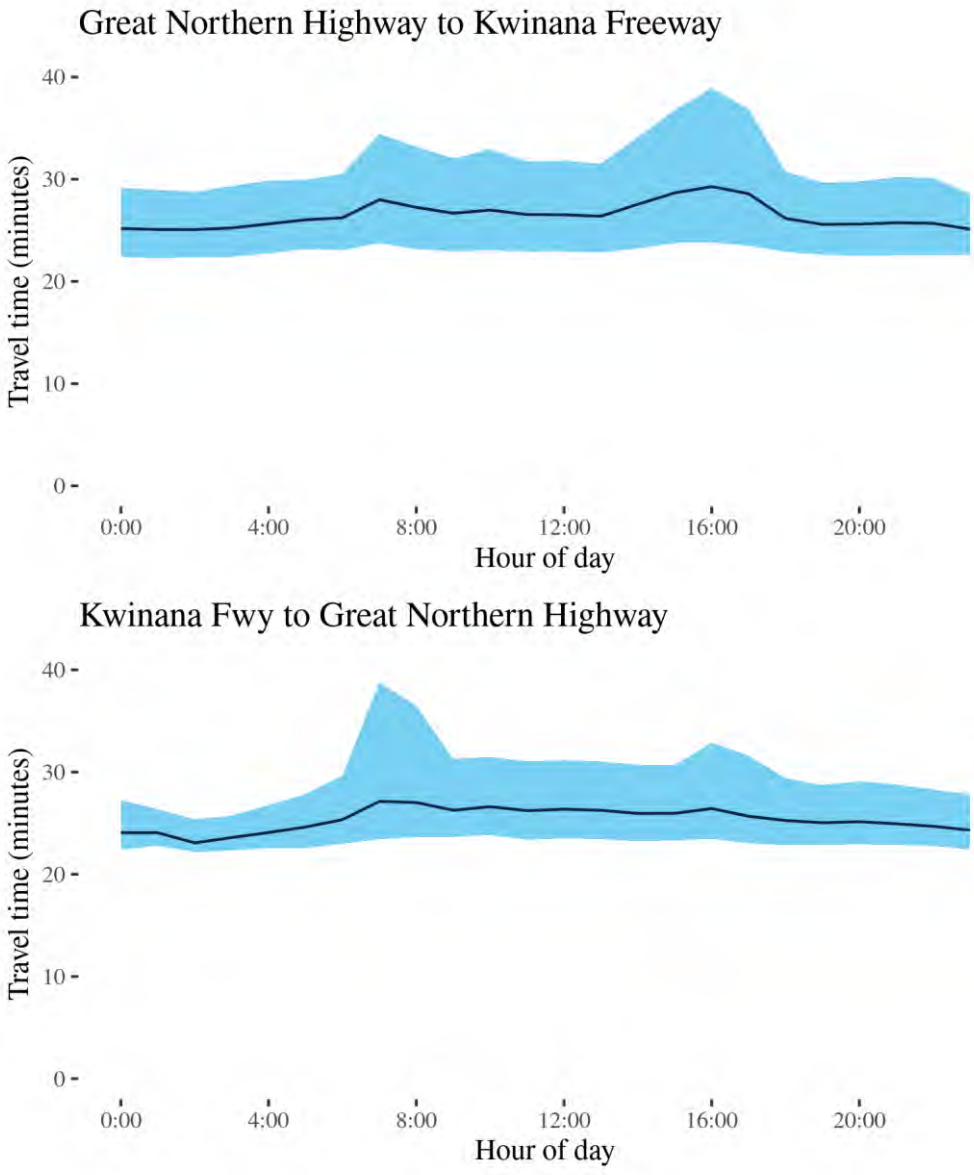
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Great Northern Highway to Kwinana Freeway	00:25:03	00:29:17	1.1	00:05:51	00:14:34	1.5	34.1
Kwinana Freeway to Great Northern Highway	00:23:04	00:27:08	1.1	00:03:13	00:15:21	2.1	34.2

Source: BITRE estimates.

The best median travel times and lowest uncertainty for southbound travel were at 11pm with a median of 25 minutes and an interquartile range of 6 minutes. The longest median travel times and the greatest uncertainty were during the afternoon peak at 4pm with a median travel time of 29 minutes and an interquartile range of 15 minutes respectively. Travel time and uncertainty remained elevated throughout business hours. Delays were most apparent near intersections with Route 1 at Middle Swan, Route 4 at Forrestfield and the Kwinana Freeway (Route 2) at Leeming.

The best travel times and the lowest uncertainty travelling north were at 2am with a median travel time of 23 minutes and an interquartile range of 3 minutes. The longest median travel times and greatest uncertainty were at 7am with a median of 27 minutes and an interquartile range of over 15 minutes.

Figure A.94 Route 3 (Roe Highway) route median and interquartile range travel times



Source: BITRE estimates.

Route 3 (Reid Highway) - Mitchell Freeway to Tonkin Freeway / Tonkin Freeway to Mitchell Freeway

This route follows the Reid Highway between its connection with the Mitchell Freeway (Route 2) north of Perth's CBD, and its interchange with the Tonkin Freeway (Route 4) at Malaga, in Perth's near northern suburbs. It passes the Perth suburbs of Westminster, Murrabooka and Noranda.

Figure A.95 Route 3 (Reid Highway) route map

Source: BITRE estimates.

Table A.48 Route 3 (Reid Highway) route travel times and congestion measures, 2019

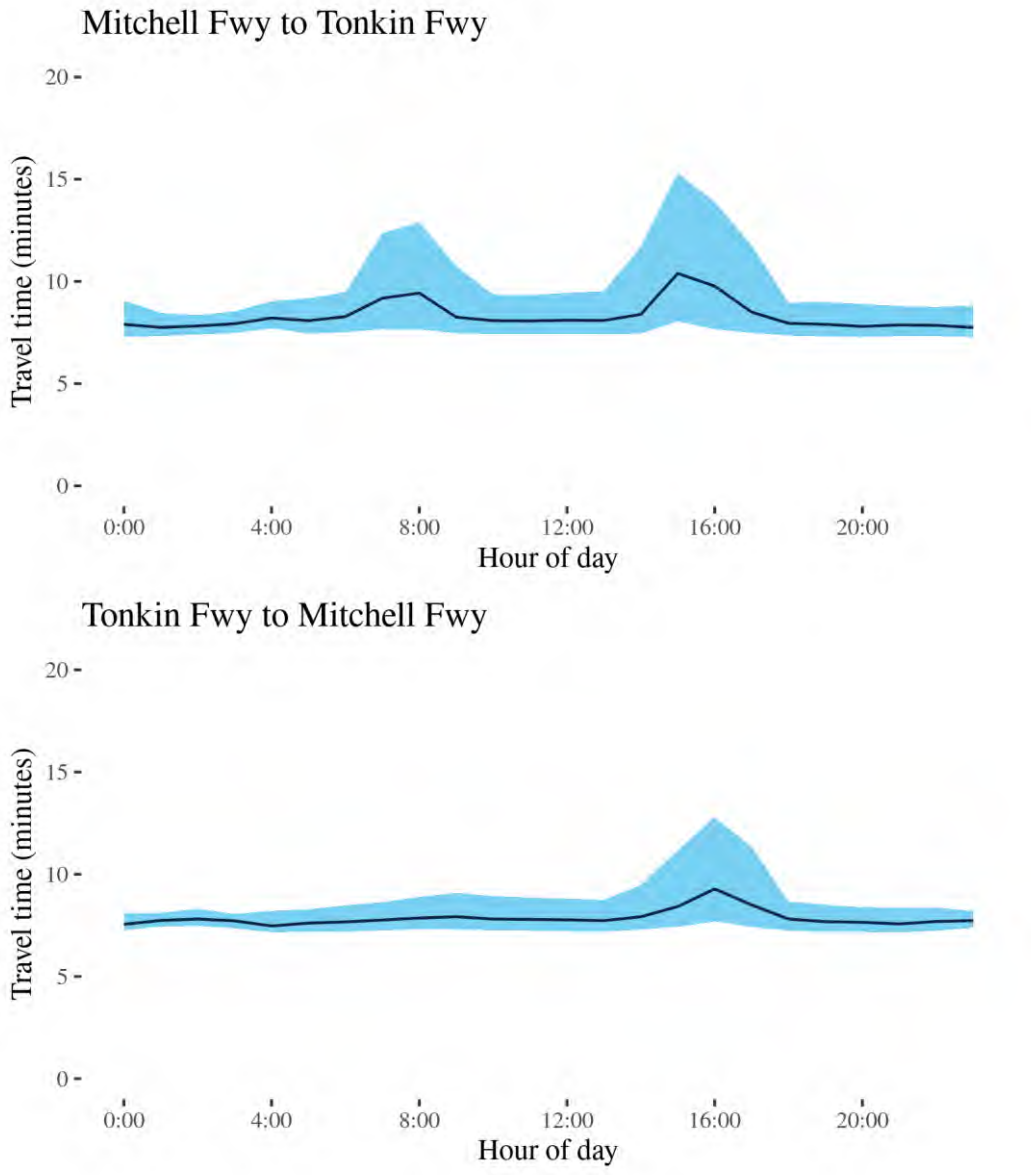
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Mitchell Freeway to Tonkin Fwy	00:07:45	00:10:23	1.1	00:00:57	00:07:15	2.8	10.3
Tonkin Freeway to Mitchell Fwy	00:07:28	00:09:17	1.1	00:00:40	00:05:07	2.5	10.5

Source: BITRE estimates.

The best median travel time eastbound on the route was 8 minutes at 11pm and the lowest uncertainty were experienced at 2am with an interquartile range of 1 minute. The longest median travel times and greatest uncertainty were during the afternoon peak at 3pm with a median travel time of 10 minutes and an interquartile range of 7 minutes. There was also a smaller peak between 7 and 9am in the morning. Delays were most apparent near the Kwinana Freeway.

The best median travel time travelling west was 7.5 minutes at 4am and the lowest uncertainty were at 1am with an interquartile range of 40 seconds. The longest median travel times and the greatest uncertainty were experienced during the afternoon peak at 4pm with 9 minutes and an interquartile range of 5 minutes respectively. Unlike the eastbound direction, there was no morning peak observed in westbound trips. Again delays were most apparent near the Kwinana Freeway.

Figure A.96 Route 3 (Reid Highway) route median and interquartile range travel times



Source: BITRE estimates.

Route 4 - Great Northern Highway to Thomas Road / Thomas Road to Great Northern Highway

This route follows the Tonkin Highway (Route 4) between its junction with the Great Northern Highway, at Muchea north of Perth, and its terminus at Thomas Road on Perth's southern outskirts. It crosses the Reid Highway (Route 3) north of Morley and the Swan River near Redcliffe, and runs past Perth airport.

Figure A.97 Route 4 route map

Source: BITRE estimates.

Table A.49 Route 4 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Great Northern Highway to Thomas Road	00:55:57	01:07:21	1.1	00:13:20	00:43:22	1.6	79.9
Thomas Road to Great Northern Highway	00:53:27	01:09:15	1.1	00:10:00	00:31:13	1.7	79.9

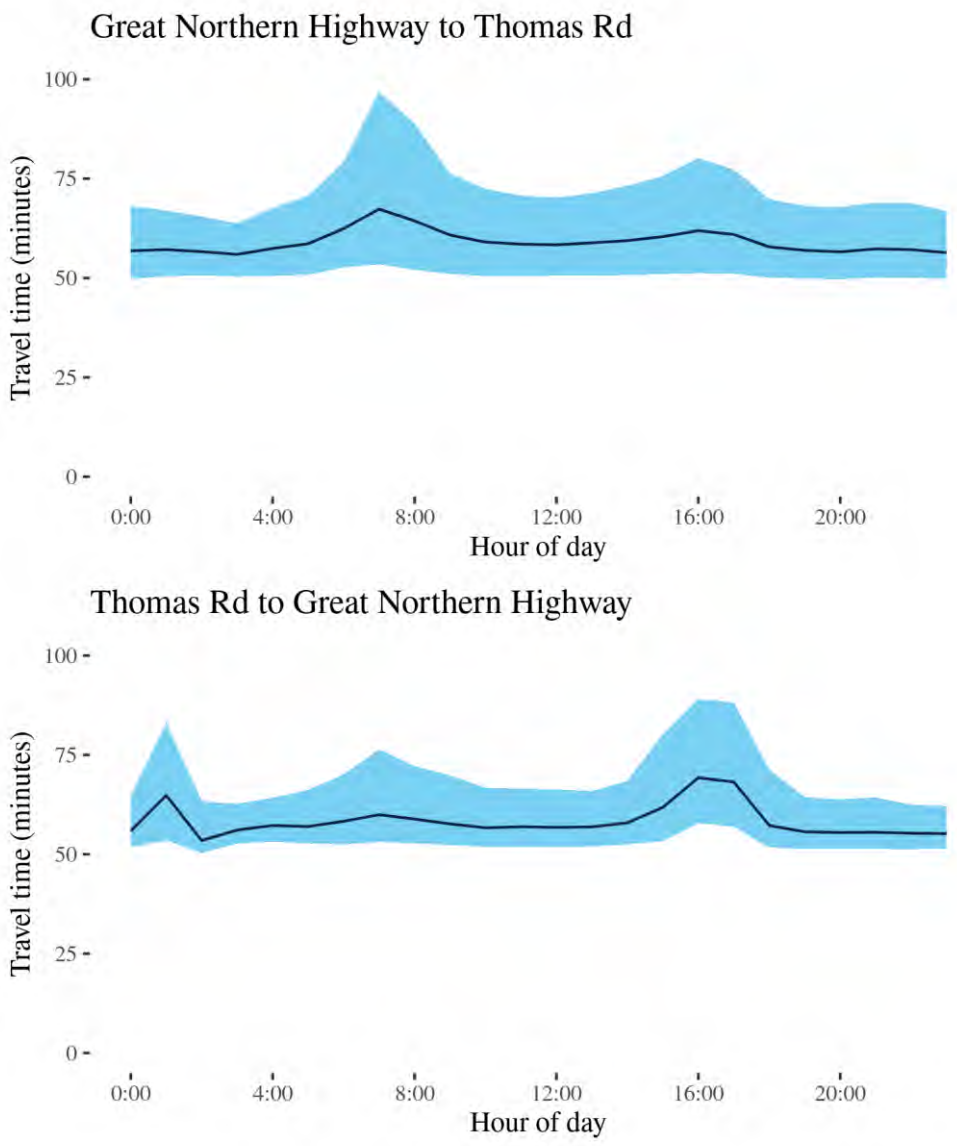
Source: BITRE estimates.

The best travel times and the lowest uncertainty for southbound travel to Thomas Road were experienced at 3am with a median travel time of 56 minutes and an interquartile range of 13 minutes. The longest median travel times and greatest uncertainty were experienced at 7am with a median of 1 hour 7 minutes and an interquartile range of 43 minutes, both of which occurred during the morning peak. There was a mild afternoon peak in uncertainty as well.

The best travel times for northbound trips were at 2am with a median travel time of 53 minutes and the lowest uncertainty were at 3am with an interquartile range of 10 minutes. The longest median travel time was 1 hour 9 minutes experienced during the afternoon peak at 4pm and the greatest uncertainty was at 5pm with an interquartile range of 31 minutes. The causes of the third peak are unclear. Otherwise the greatest uncertainty was during the afternoon peak at 4pm. There was also a small increase in travel time uncertainty during the morning peak.

In both directions delays were most apparent near the Swan River between Redcliffe and Bayswater. This was true of the morning, afternoon and "third" peaks.

Figure A.98 Route 4 route median and interquartile range travel times

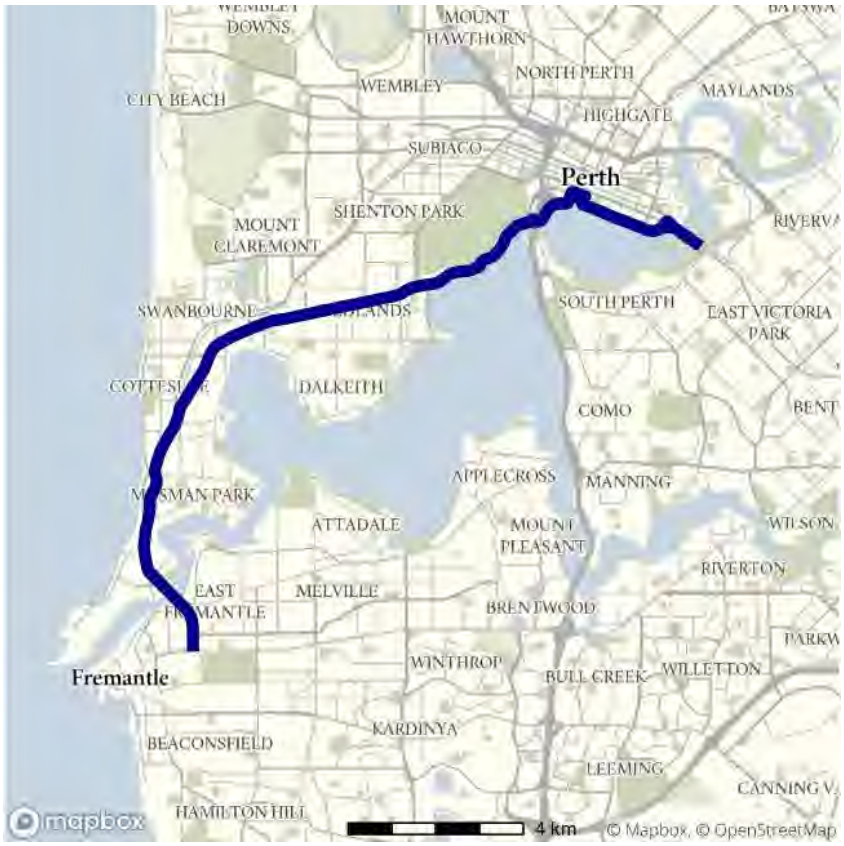


Source: BITRE estimates.

Route 5 - Great Eastern Highway to Stirling Hwy, High Street / Stirling Hwy, High Street to Great Eastern Highway

This route runs between High Street (Route 7) in Fremantle, via the northern side of the Swan River and to the junction of Albany Highway, Great Eastern Highway (GEH) and Canning Highway near Burswood, southwest of the CBD. It traverses the Stirling Highway, Mounts Bay Road, Riverside Drive and the Causeway.

Figure A.99 Route 5 route map



Source: BITRE estimates.

Table A.50 Route 5 route travel times and congestion measures, 2019

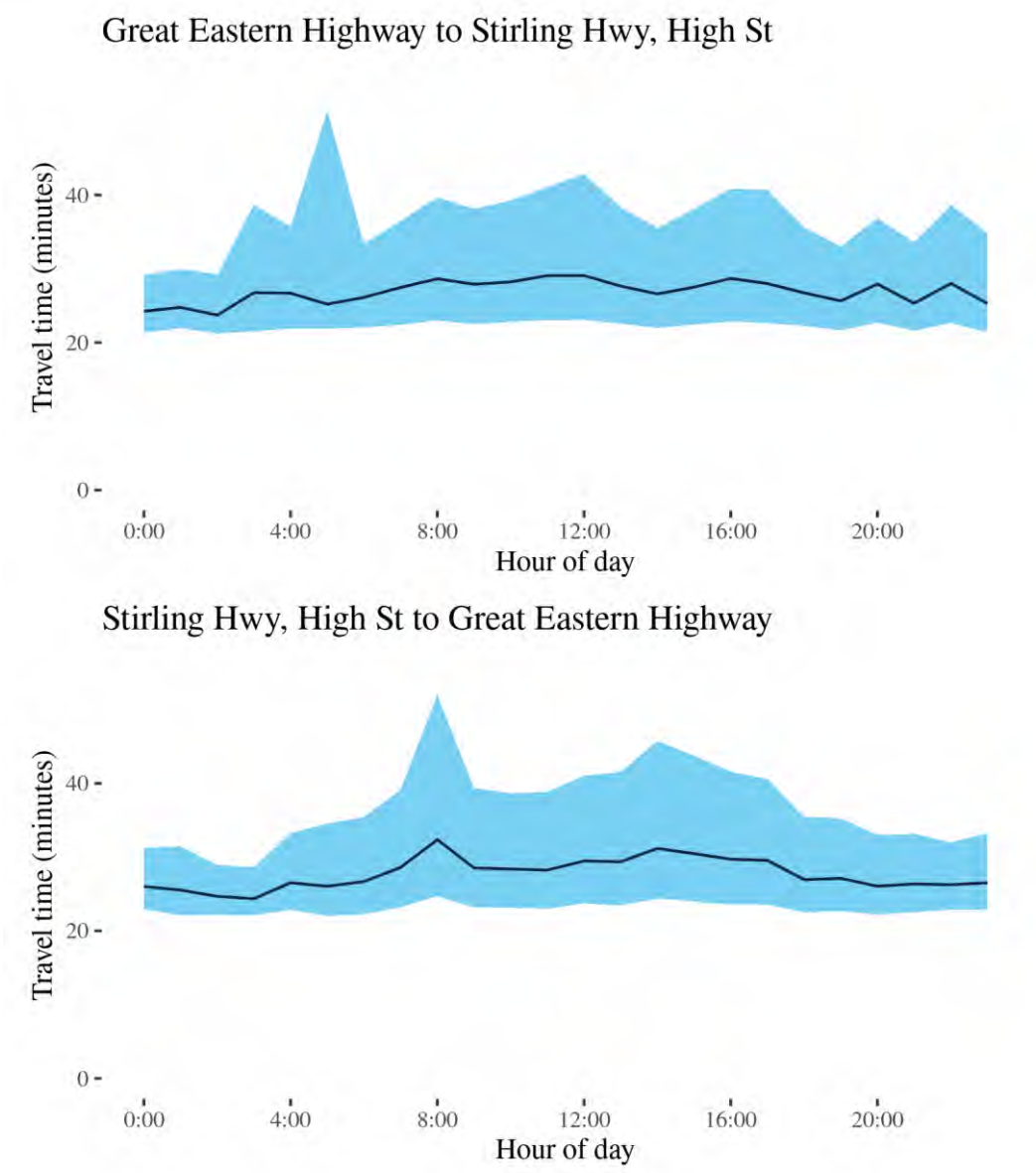
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Great Eastern Highway to Stirling Hwy, High Street	00:23:43	00:29:05	1.1	00:07:52	00:29:34	1.9	20.3
Stirling Hwy, High Street to Great Eastern Highway	00:24:21	00:32:21	1.1	00:06:30	00:27:15	2.1	20.7

Source: BITRE estimates.

The best median travel time travelling from Burswood to Fremantle (i.e. Great Eastern Highway to Stirling Highway) was 24 minutes at 2am and the lowest uncertainty were experienced at midnight with an interquartile range of 8 minutes. The longest median travel times were experienced at 12pm with a median travel time of 29 minutes and the greatest uncertainty was at 5am with an interquartile range of 30 minutes. There were no distinctive peaks in travel time along this route, but there is significant variation in travel time uncertainty across the entire 24-hour period.

The best travel times and the lowest uncertainty travelling in the reverse direction (from Fremantle to the CBD (and Burswood) were experienced at 3am with a median travel time of 24 minutes and an interquartile range of 6.5 minutes. The longest median travel times and greatest uncertainty were during the morning peak at 8am with a median travel time of 32 minutes and an interquartile range of 27 minutes. There was a slight increase in uncertainty during the afternoon peak, which was also higher throughout business hours. Delays were more apparent near the CBD and near Claremont.

Figure A.100 Route 5 route median and interquartile range travel times



Source: BITRE estimates.

Route 6 - Fremantle to Great Eastern Highway / Great Eastern Highway to Fremantle

This surface route follows the Canning Highway between Fremantle and the Great Eastern Highway, to the east of the Perth CBD—like Route 5 but south of the Swan River.

Figure A.101 Route 6 route map

Source: BITRE estimates.

Table A.51 Route 6 route travel times and congestion measures, 2019

Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Fremantle to Great Eastern Highway	00:18:36	00:24:20	1.1	00:05:57	00:20:19	1.9	16.0
Great Eastern Highway to Fremantle	00:18:29	00:23:26	1.1	00:04:13	00:16:45	2.5	15.8

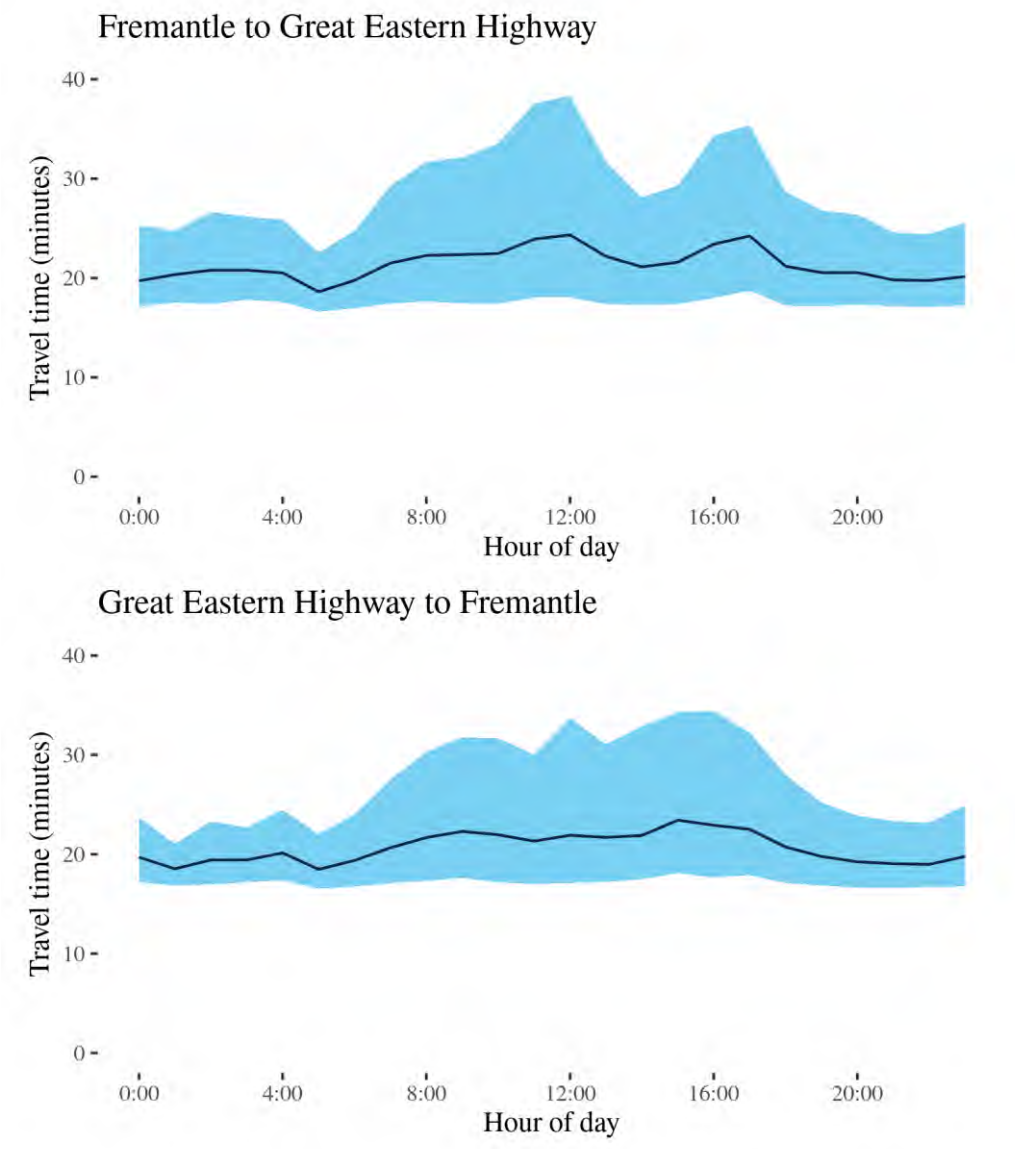
Source: BITRE estimates.

The best travel times and the lowest uncertainty for eastbound travel to the CBD were experienced at 5am with a median travel time of 19 minutes and an interquartile range of 6 minutes. The longest median travel times and the greatest uncertainty were at midday with a median travel time of 24 minutes and an interquartile range of 20 minutes. Travel time uncertainty gradually increased between 4am and midday (12pm) where it formed a distinct peak, which is not necessarily associated with commuter traffic flows, making this route unique in this report. There was also a smaller peak in the afternoon. Delays were more apparent closer to Fremantle.

The best median travel time travelling west to Fremantle was 18 minutes at 5am and the lowest uncertainty were experienced at 1am with an interquartile range of 4 minutes. The longest median travel time was 23 minutes at 3pm and the greatest uncertainty was in the afternoon at 4pm with an interquartile range of 17 minutes. Delays and uncertainty were at similar levels throughout business hours. Delays were fairly evenly distributed across the route.

Elevated median travel time and uncertainty were observed during business hours in both directions.

Figure A.102 Route 6 route median and interquartile range travel times

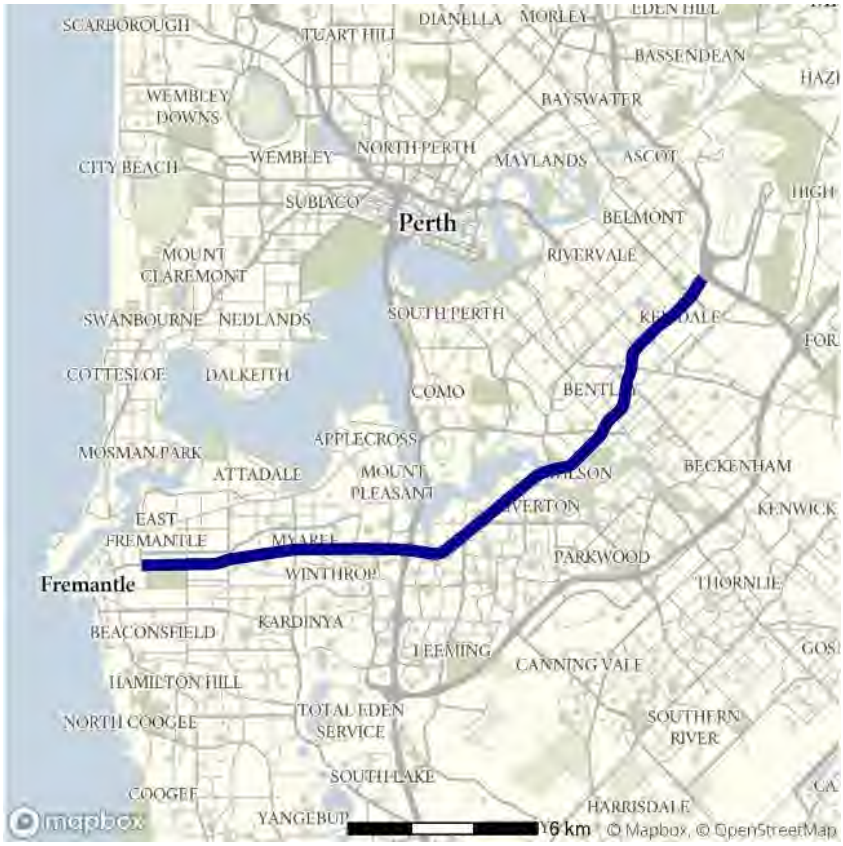


Source: BITRE estimates.

Route 7 - Stirling Hwy to Tonkin Freeway / Tonkin Freeway to Stirling Hwy

This route follows the Leach Highway (Route 7) between the Stirling Highway (Route 6), at Fremantle, to the interchange with the Tonkin Freeway (Route 4) near Perth Airport.

Figure A.103 Route 7 route map



Source: BITRE estimates.

Table A.52 Route 7 route travel times and congestion measures, 2019

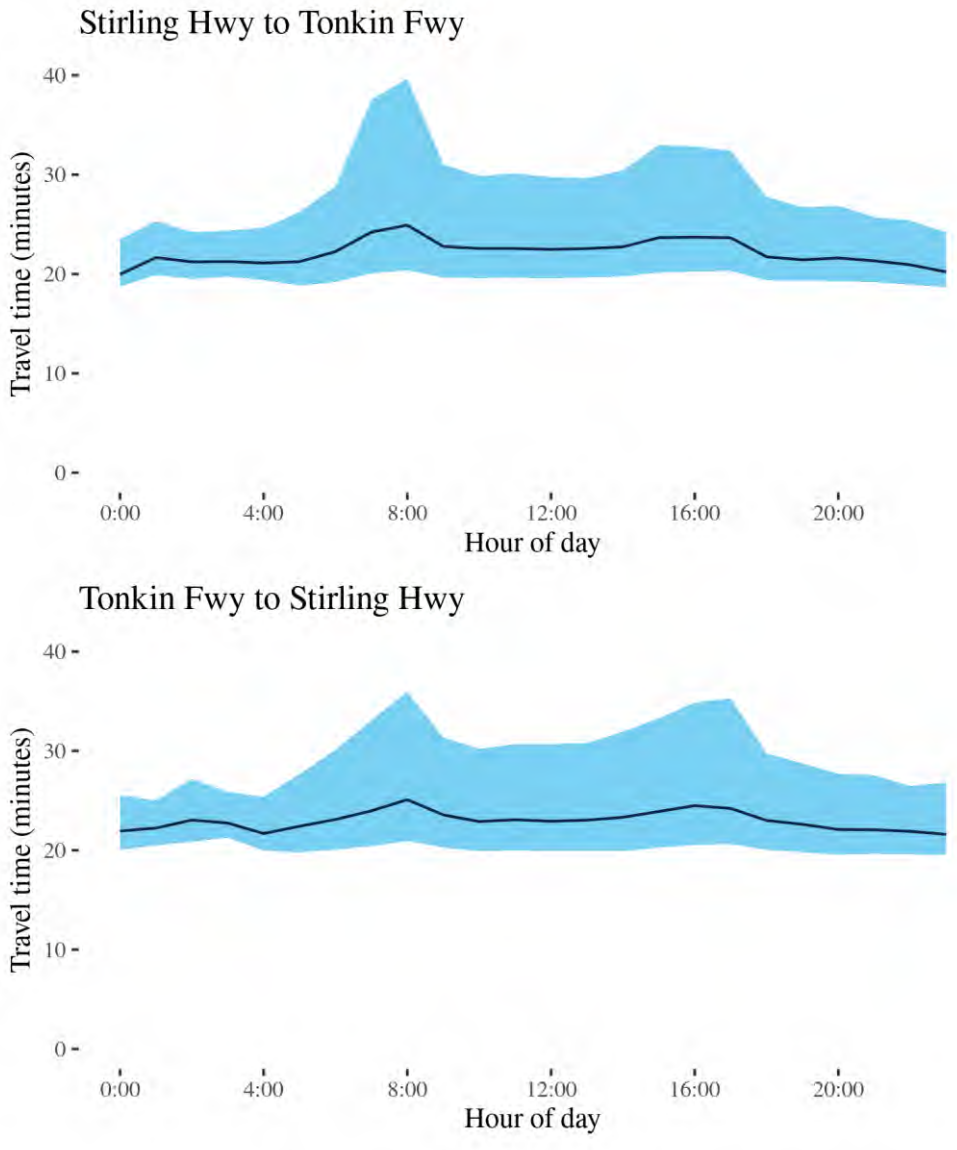
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Stirling Hwy to Tonkin Freeway	00:19:58	00:24:55	1.1	00:04:38	00:19:18	2.0	21.9
Tonkin Freeway to Stirling Hwy	00:21:36	00:25:05	1.1	00:04:31	00:15:00	2.1	22.1

Source: BITRE estimates.

The best median travel time for eastbound trips from Fremantle to the Tonkin Freeway was 20 minutes at midnight and the lowest uncertainty were experienced at 3am with an interquartile range of 5 minutes. The longest median travel times and the greatest uncertainty were during the morning peak at 8am with a median travel time of 25 minutes and an interquartile range of 19 minutes. There were also smaller peaks in median travel time and travel time uncertainty in the afternoon and evening. Delays were evenly distributed along the route but slightly more apparent around Riverton midway along the route.

The best median travel time for westbound travel from the Tonkin Freeway to Fremantle was 22 minutes at 11pm and the lowest uncertainty were experienced at 1am with an interquartile range of 4.5 minutes. The longest median travel times and greatest uncertainty were at 8am with a median of 25 minutes and an interquartile range of 15 minutes. There was also an afternoon peak where the increase in uncertainty was of similar magnitude to that of the morning peak. Delays were more apparent near Fremantle and Welshpool.

Figure A.104 Route 7 route median and interquartile range travel times



Source: BITRE estimates.

Route 8 - Canning Road to Mitchell Freeway / Mitchell Freeway to Canning Road

This route runs from Canning Road on Perth's eastern fringe, through Perth's eastern suburbs, to the Mitchell Freeway (Route 2) just west of the CBD. The route follows the Graham Farmer Freeway, Orrong Road and Welshpool Road.

Figure A.105 Route 8 route map

Source: BITRE estimates.

Table A.53 Route 8 route travel times and congestion measures, 2019

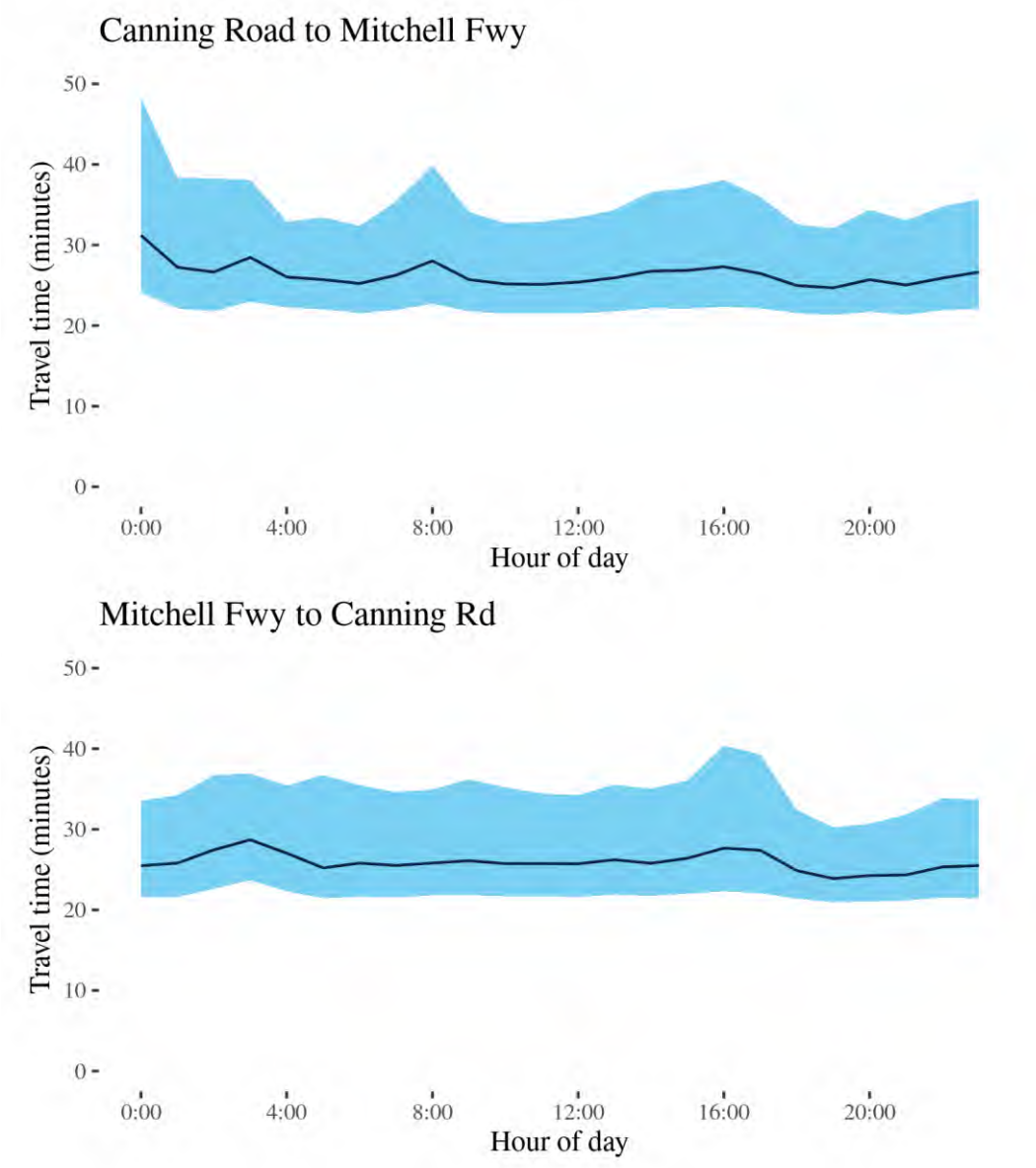
Direction	Best travel time	Longest median travel time	METR	Least uncertainty travel time	Most uncertainty travel time	MEUR	Distance
Canning Road to Mitchell Freeway	00:24:41	00:31:12	1.1	00:10:39	00:24:07	1.3	24.1
Mitchell Freeway to Canning Road	00:23:54	00:28:42	1.1	00:09:16	00:18:05	1.4	24.1

Source: BITRE estimates.

The best median travel time travelling west to the CBD (Canning Road to the Mitchell Freeway) was 25 minutes at 7pm and the lowest uncertainty were experienced at 4am with an interquartile range of 11 minutes. The longest median travel times and the greatest uncertainty were at midnight with a median travel time of 31 minutes and an interquartile range of 24 minutes. The reasons for these delays at a time that would ordinarily be assumed to be free running conditions are not apparent, but delays were most apparent on Orrong Road near Carlisle. Otherwise there were mild morning and afternoon peaks.

The best travel times and the lowest uncertainty eastbound (Mitchell Freeway to Canning Road) were experienced at 7pm with a median travel time of 24 minutes and an interquartile range of 9 minutes. The longest median travel time was 29 minutes at 3am. Like the midnight peak in the reverse direction, the reason for this are unclear but delays were concentrated on Welshpool Road East. Otherwise travel times were largely stable throughout the day. The greatest uncertainty was in the afternoon at 4pm with an interquartile range of 18 minutes.

Figure A.106 Route 8 route median and interquartile range travel times



Source: BITRE estimates.

Appendix B – Brief summary of methods and measures

For this paper, BITRE used freight telematics to collate speeds experienced by freight vehicles on individual road segments ranging in length from a few to several hundred metres. BITRE defined routes and identified the segments that make up those routes. Median travel times were determined by calculating the time taken if a vehicle experienced the median travel speeds across all segments on the route, and the same method was applied for the interquartile range with speeds at the 1st and 3rd quartiles.

The Mean Excess Time Ratio (METR) is calculated as the mean hourly ratio of median travel times to the best observed median travel time. The Mean Excess Uncertainty Ratio (MEUR) is calculated as the mean hourly ratio of interquartile range to the smallest observed interquartile range.

The aggregate measures for each city are calculated as the mean of these two measures for a city, weighted by the distance and volumes of traffic observed on each route. This ensures congested, but relatively short and unimportant routes for freight, such as the M1 in Sydney, do not overly affect results.

Some data sparse segments required Bayesian estimation. Bayesian estimation was implemented via the Stan modelling language for Bayesian analysis (Stan Development Team 2020), implemented through the 'rethinking' package for R (McElreath 2020).

The segments making up routes were identified with a lightly modified version of the OSRM routing engine (Luxen and Vetter 2011).

Summary data for all routes and segments on this report will be available on data.gov.au, and the analysis code will be made available at data.gov.au.

Appendix C – About the BITRE freight telematics program

This paper uses data from the BITRE telematics project. This project transforms GPS traces from freight vehicles of private road freight operators into data about Australia's road freight industry and road freight network, to help inform industry, government and other interested parties. This data can help inform planning and investment in the road network and rest areas, inform industry and government on economic activity and assist trip planning among other things. The project uses BITRE's independently developed Yulo framework (Green and Mitchell, 2018, BITRE 2021a). By tracking the entirety of vehicles' journeys it can generate data on more parts of the road network than is practical using conventional road data collection means such as fixed cameras or pneumatic tubes. This report is based on over 60 million observations from over 5 000 road segments whilst the database contains billions of observations on over 700 thousand road segments.

Previous publications using this data include an analysis of the effect of COVID 19 lockdowns on freight route performance in 2020 (BITRE 2020) and a display of the freight catchments served by Australian ports (BITRE 2021b).

References

BITRE 2020, *Freight route performance under COVID-19*, Information Sheet 107, BITRE, Canberra. URL: https://www.bitre.gov.au/publications/2020/freight-route-performance-under-covid-19.

BITRE 2021a, BITRE Yulo telematics data project repository. URL: https://github.com/BITRE-Telematics/Yulo.

BITRE 2021b, *Regional port catchment for road freight*, Information Sheet 110, BITRE, Canberra. URL: https://www.bitre.gov.au/publications/2021/regional-port-catchments-road-freight.

Green, R and Mitchell, D 2018, 'Adapting truck GPS data for freight metrics', Paper presented at the Australian Transport Research Forum, Darwin, ATRF 2018 Paper 18.

Luxen, D. and Vetter, C 2011, 'Real-time routing with OpenStreetMap data', Proceedings of the 19th ACM SIGSPATIAL International Conference on Advances in Geographic Information Systems, URL: https://github.com/Project-OSRM/osrm-backend.

McElreath, R 2020, 'rethinking', URL: https://github.com/rmcelreath/rethinking.

Stan Development Team 2020, *Stan Modeling Language Users Guide and Reference Manual*, 2.26. URL: https://mc-stan.org.

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