Australasian Transport Research Forum 2015 Proceedings
30 September - 2 October 2015, Sydney, Australia
Publication website: http://www.atrf.info/papers/index.aspx

What Effect do Queensland's Major Road Infrastructure Projects have on Traffic Volumes and Growth Rates?

Wayne Davies

Transport and Main Roads

wmd03@yahoo.com

Abstract

This paper investigates the effect that major road infrastructure projects have on the traffic volumes and traffic growth rates on sections of the network directly affected by the project. The paper also considers whether such changes in traffic volume, possibly induced traffic, influences the economic viability of such major projects.

A sample of major projects located along Queensland highways and motorways have been used in this study. Traffic volumes before and after the completion of the project are compared to determine if traffic volumes and/or traffic growth rates are influenced by the project. The types of major road infrastructure projects considered in the study are town bypasses, deviations, and major road widening projects. Major projects are compared based on a number of factors such as project type, volume capacity ratio at the time of construction, and the extent of the increase in capacity. These comparisons have been used to determine the extent project and network related factors influence changes to traffic volumes and growth rates.

The results of the study aim to determine the extent that induced traffic influences the benefit streams for major projects. Two hypothetical examples have been included in the paper, one example assumes that traffic growth is unaffected by the project and the other example assumes traffic growth follows a pattern similar to the case studies investigated. This paper will discuss the significance of the impact induced traffic has on the economic viability of projects and the types of projects that are more likely to have their benefit streams eroded by induced traffic.

1. Introduction

Typically, in an ex-ante cost benefit analysis, traffic volumes are assumed unaffected by new or upgraded road infrastructure (Bray 2005). It is difficult to measure the extent that new or upgraded road infrastructure can entice new trips or road users to divert from existing infrastructure (Litman 2015). This paper attempts to shed some light on the extent traffic volumes and traffic growth rates are affected by new or upgraded road infrastructure. This paper attempts to draw conclusions from a study of recently completed Queensland major road infrastructure projects[1]. As part of the study, a sample of seven major road infrastructure projects have been selected. These projects have been completed in the last fifteen years. The projects have been selected based on location, the nature of the upgrade (mostly to address capacity), and the availability of data. The paper investigates the impacts any changes in traffic volume might have on the cost benefit analysis of a project. These impacts relate to the incorporation of induced traffic in the analysis, and the impact this induced traffic has on the existing traffic.

2. Reasons for the Study

Existing literature generally supports the idea that increased road capacity induces traffic. The standing advisory committee on trunk road assessment (SACTRA) published a paper in 1994; this paper focuses on addressing the question of whether new or upgraded roads generate extra traffic in the context of the United Kingdom. The paper covered four key questions. The questions can be summarized as follows:

- Do improved roads induce traffic?
- If so, are the consequences significant?
- If so, which types of major highway improvement is induced traffic likely to be significant?
- How should current forecasting and appraisal methods be amended to incorporate induced traffic?

The SACTRA paper concluded that evidence generally supported the existence of induced traffic but it was hard to prove unequivocally. Upgraded roads are likely to have a network impact that may build up over time. Upgraded roads may also influence changes in land use, which influences traffic volumes; such induced traffic is difficult to attribute to a project.

In regards to the significance of induced traffic, the United Kingdom's Department of Transport's policy stated that induced traffic should not be included as the impacts are not significant[2]; the SACTRA paper does not necessarily agree with this conclusion. The paper also states that excluding induced traffic will overstate the benefits of a project. The paper states that networks operating close to capacity are more likely to induce traffic. The paper recommended that planning should factor the effects of induced traffic at the network level.

Other papers have drawn similar conclusions in the context of the United Kingdom, and the United States of America. Noland (2001) and Duranton and Turner (2011) provide statistical evidence that increasing the number of lanes generates traffic[3] in road networks in the United States. They estimated that lane miles have a statistically significant relationship to vehicle miles travelled (VMT). Hansen (1995) draws the conclusion that adding to road capacity will not reduce congestion based on the high sensitivity of VMT to lane miles obtained in his research. Heanue (1998) considers the extent highway capacity influences the amount of

[1] Projects with expected capital expenditure of greater than $100 million (TMR 2014)
[2] This statement held true at the date of publication of the SACTRA report.
[3] Some authors use 'induced' and 'generated' interchangeable.

traffic generated compared with other factors, which generate traffic. He concluded that increased highway capacity does not have a large impact on the growth of traffic volume.

This paper will explore the questions investigated by SACTRA and other authors but not from a network basis but from the consideration of discrete sections of road. Therefore, changes in traffic volumes on the upgraded roads cannot categorically be stated as induced traffic but might also include traffic diverting from other parts of the network. The volume of diverting traffic for most projects in this study is likely to be minimal, as selected projects have limited viable alternative routes. A broader network analysis has not been adopted in this study because of the lack of available data and access to the necessary transport modelling to make this exercise possible.

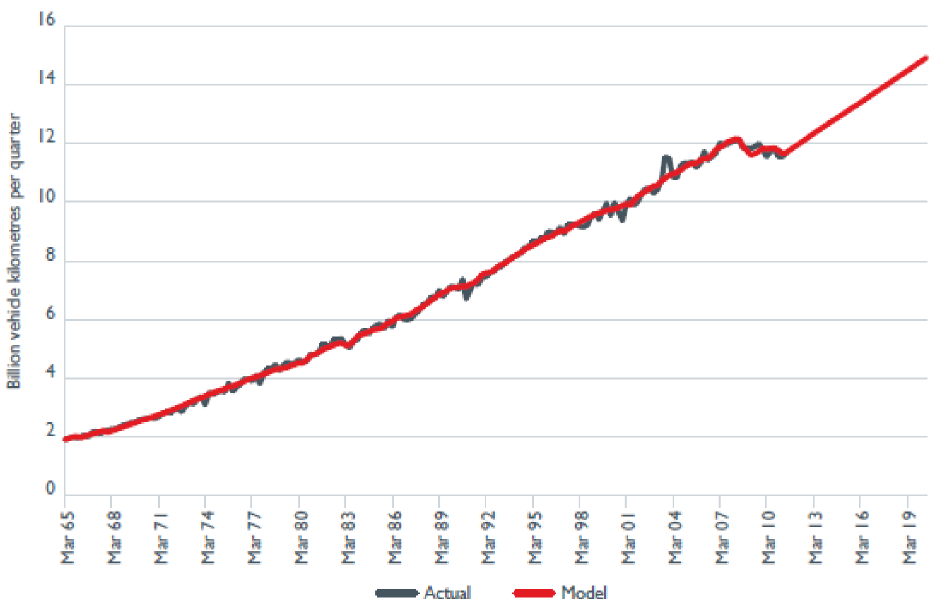
Arguments have been made that existing cost benefit analysis (CBA) practices do not adequately consider the impacts induced traffic have on the costs to existing road users. Pfeider and Dieterich (1995) and Metz (2008) question the whole CBA process in regards to the treatment of induced traffic and travel time cost (TTC) savings. They claim that people allocate a fixed amount of time to travelling. If operating speeds are increased, travel time is not reduced as people respond by travelling longer distances or by increasing the number of trips that they make. This extra travel or trips are considered as generated traffic and this additional traffic is usually ignored in cost benefit analysis practices.

This paper aims to address some of the arguments put forward regarding the impact that induced traffic might have on the stream of benefits for a cost benefit analysis. If major road upgrades induce traffic, is the impact of this induced traffic significant? If so, is this significance dependent on the type of project or some other factors?

3. Methodology Applied to the Study

Before considering individual projects and changes in traffic volumes, the overall pattern of traffic growth for the entire network needs to be considered. Changes in traffic volume could be systemic to the network rather than relating to a particular road or upgrade. Figure 1 contains the traffic volumes across the Queensland network from 1965 to 2012 and includes projections out to 2019.

Figure 1: Aggregate Traffic Levels in Queensland



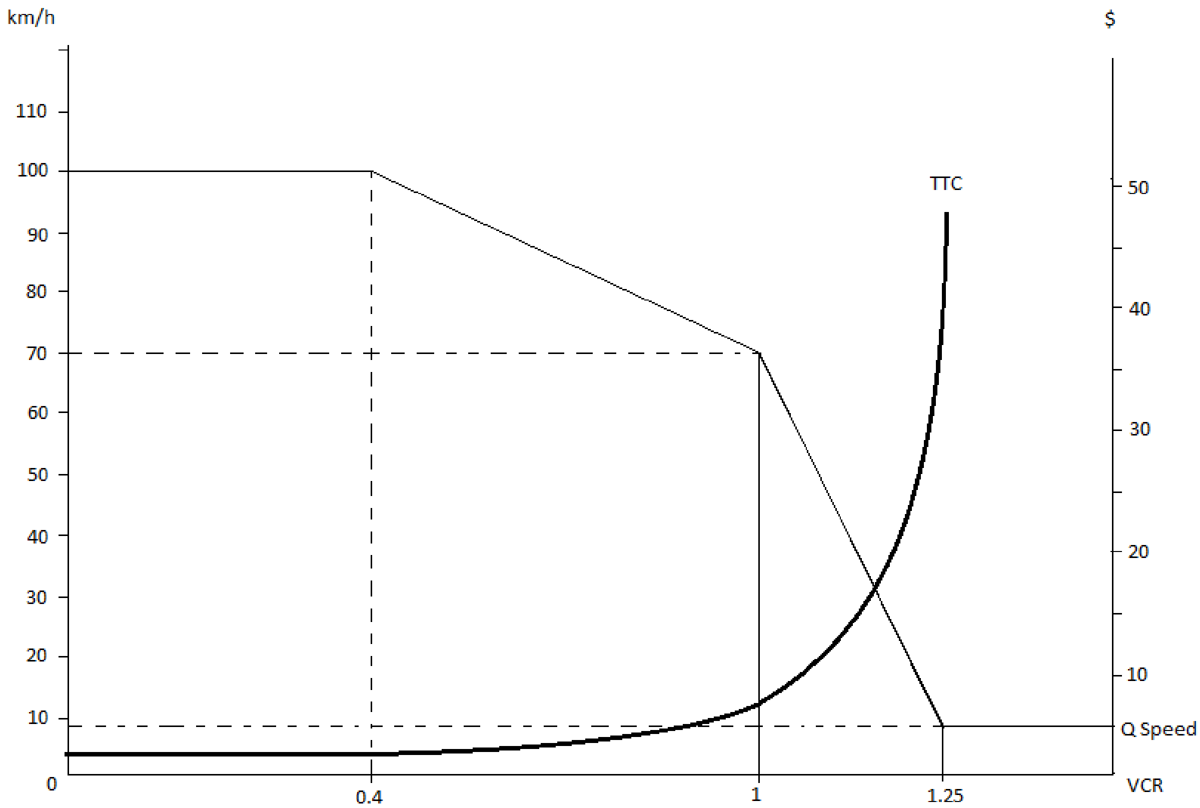
Source: Figure 2.2, Bureau of Infrastructure, Transport and Regional Economics (BITRE) (2012)

Traffic growth appears to be consistent and close to linear for most of the last 50 years; 2007 to 2011 is the only period that does not follow that trend with traffic volumes falling slightly. BITRE forecasts that traffic growth will return to a linear pattern from 2012 to 2019. The fall in traffic volume from 2007 to 2011 will be considered when projects are investigated.

The actual traffic volumes collected from project locations will require a yardstick for comparison. An average traffic growth rate has been calculated using the years of data available prior to the construction of the project. Data for most project sites date back to the early 1990s. Any outlier years (high or low) have been excluded from the study. Data for most project sites indicate traffic growth was close to linear and constant, this aligns with the BITRE data for the network. The calculated average was used to estimate traffic volumes from the start of construction to the most recently collected data at the project location. This method has been used to provide the yardstick for comparison to the actual data. These estimated traffic volumes will be referred to as the base case traffic volumes for the project.

The impact of the upgrade and the changes in traffic volume also needs to be measured. This measurement has been made using the volume capacity ratio (VCR). The VCR measures the relationship between volume and capacity (Volume/Capacity). The VCR influences the operating speed, hence the travel time costs. The relationship between VCR, operating speed, and travel time costs is shown in Figure 2. Figure 2 can be used as a point of reference for comparing the VCRs of the case study projects.

Figure 2: Relationship between VCR, operating speed, and Travel Time Costs[4]



Source: Austroads 2005

Volume has been measured in passenger car units (PCU). A passenger car has a PCU of 1, whereas, a large truck such as a triple road train on a flat gradient has a PCU of 8.8 (TMR

[4] The travel time costs (TTC) included in the Figure 2 are for a private car travelling over a 20km section. A cost of $24 per hour has been used to calculate the TTC; this has been sourced from the 2015 national guidelines for transport system management (NGTSM).

2011). PCUs account for the additional capacity required for larger vehicles. The capacity of the road depends on its model road state (MRS). For highways and motorways, the capacity of each lane is approximately 2,000 vehicles per hour (Austroads 2005). Historical hourly data are not available for most of the projects considered in this paper. Instead, average annual daily traffic (AADT) has been used. The capacity component of the VCR formula can be adjusted to cater for the use of AADT while incorporating the impacts of peak traffic. To do this a capacity factor is used. The recommended capacity factor for national highways is 10% (TMR 2011). Daily capacity is calculated by dividing the hourly capacity by the capacity factor.

4. Projects

In this paper, seven projects have been investigated to determine if traffic volumes and traffic growth rates change after the completion of a major road infrastructure project. Projects have been selected over a 15-year period. Data limitations have prevented the investigation of projects completed before 2000. Table 1 contains the projects investigated in this paper.

Table 1: Major projects considered for study

Project	Capital Cost[5]	Year Completed
Pacific Motorway – 8-laning Logan to Gaven[6]	$1480M	2000
Pacific Motorway - Tugun Bypass[7]	$659M	2008
Bruce Highway - Yandina to Cooroy Duplication[8]	$170M	2003
Bruce Highway - Cooroy to Curra Section B[9]	$450M	2013
Bruce Highway – 6-laning - Caboolture[10]	$140M	2007
Warrego Highway - Gatton Bypass Duplication Package 2 & 3[11]	$71M	2003
Gateway Motorway - Gateway Additional Lane Project	$92M	2014

Of the major Queensland highways and motorways, the Pacific Motorway and the Bruce Highway offered the most complete data. There was not sufficient data for other major highways and motorways such as the Ipswich Motorway, Centenary Motorway, and Gateway Motorway.

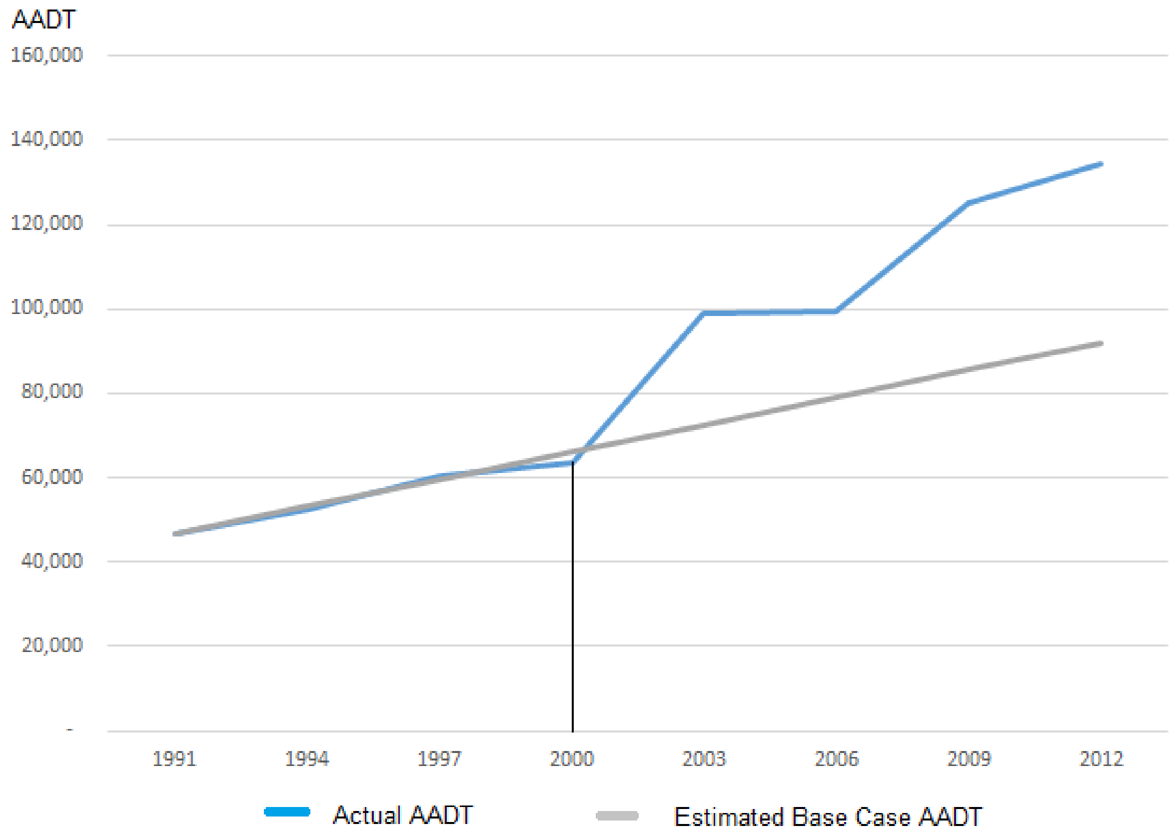
4.1. Pacific Motorway – 8-laning Logan to Gaven

The 8-laning of the Pacific Motorway between Logan and Gaven was a significant project spanning over 36km and costing approximately $1.48 billion in 2014 prices. Queensland Premier Peter Beattie, and Transport and Main Roads Minister Steve Bredhauer commissioned the project on the 6th October 2000. The project offered significant increases to the capacity of the Pacific Motorway. At the time of construction, 170,000 vehicles were projected to use the upgraded motorway by 2020 (DPC 2000). Figure 3 contains the distribution of traffic volume from 1991 to 2012 as well as the base case traffic volumes for that same period.

---

[5] Capital costs for projects have been converted to June 2014 prices using the road and bridge construction index sourced from the Australian Bureau of Statistics (2015).
[6] Source: Media Statements (2000), Queensland Cabinet and Ministerial Directory
[7] Source: Department of Infrastructure and Regional Development (2003)
[8] Source: Department of Infrastructure and Regional Development (2003)
[9] Source: Transport and Main Roads (2015a)
[10] Source: Media Release (2007), Jim Lloyd, Minister for Local Government, Territories and Roads
[11] Source: Department of Infrastructure and Regional Development (2003)

Figure 3: Traffic volumes at the project site of Pacific Motorway Upgrade (Logan to Gaven)



The traffic data suggests a large jump in traffic volume during the 3-year period following the upgrade. Traffic growth remains constant around 2006; this might be explained by the fall in the network traffic growth rate described in the BITRE data provided in Figure 1. The traffic volume jumps again in 2009. From 2009 onwards, the traffic growth rate returns to approximately the same rate as it was prior to the upgrade. Within just a few years, the traffic volume on this section of the Pacific Motorway has increased by more 25% (20,000 more vehicles) than if traffic volume continued to grow at the pre-project level.

Volume capacity ratios of this section of road have been calculated before and after the project and if the project did not proceed. The extent of the fall in VCR provides an indication of the extent that the project relieves congestion. Table 2 contains the VCR before and after project completion.

Table 2: VCR before and after the Logan to Gaven upgrade

Year	VCR (Base Case)	VCR (Project Case)
1991	0.49	NA
1994	0.56	NA
1997	0.63	NA
2000	0.70	0.50
2003	0.76	0.78
2006	0.83	0.79
2009	0.90	0.99
2012	0.97	1.06

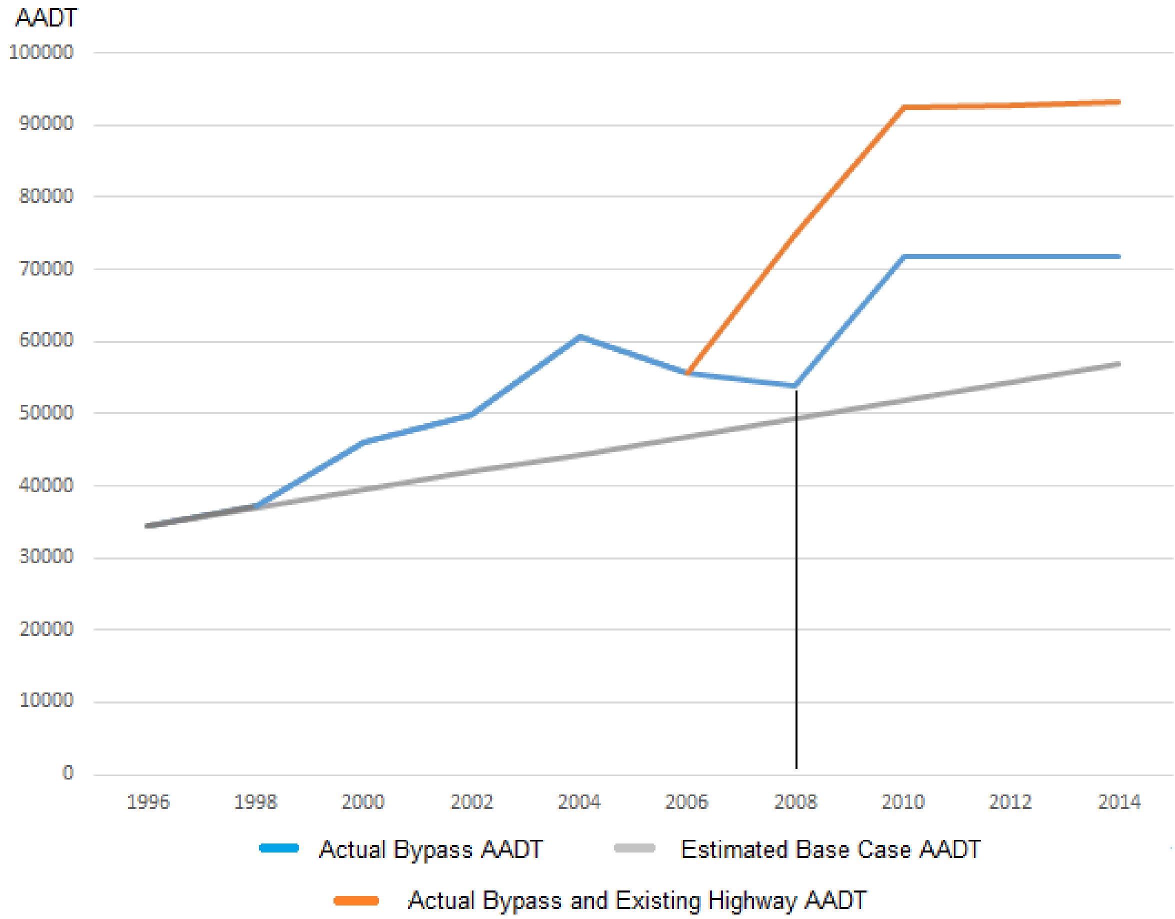
The project initially lowers the VCR for the first few years after the opening of the extra lanes. Three to six years later the VCR exceeds pre-construction levels and is approximately on par with the estimated VCR had the upgrade not taken place. A Brisbane Times article (Moore 2015) supports the evidence suggested by the calculated VCR. This article claimed that this section of the Pacific Motorway is approximately 98 percent choked during peak hours.

4.2. Pacific Motorway – Tugun Bypass

In 2008, approximately eight years after the completion of the 8-laning Logan to Gaven project and approximately 25km further south along the Pacific Motorway, the 4-lane Tugun bypass was completed. The Tugun Bypass aimed to provide an essential link between the Southern Gold Coast and Northern New South Wales (DMR 2007). The bypass should allow traffic moving between New South Wales and Queensland to avoid congestion caused by local Gold Coast traffic.

The impacts on traffic volumes and growth rates is a little unclear for this project as traffic volume increased between 2000 and 2004. This increase is possibly generated from the Logan to Gaven upgrade. The traffic volumes dropped during the construction of the bypass and then increased on completion of the bypass. The combined traffic usage on the bypass and the existing highway have been considered in measuring the overall traffic volume generated from the project. Figure 4 contains the distribution of traffic volume from 1996 to 2014.

Figure 4: Traffic volumes at the project site of Tugun Bypass



Of the seven case studies considered in this paper, this was the only project that involved the construction of a completely new road. Traffic that used the existing highway has now been divided over the existing highway and the new Bypass. In addition, the effects from the Logan to Gaven project has influenced the traffic volume travelling on the Pacific Motorway.

These two factors make it difficult to determine the extent of the change in traffic volume caused by this project. A conservative estimate would be about 20,000 vehicles (difference between the blue line and orange line in Figure 3). The VCR of the Tugun Bypass in 2014 was estimated to be 0.9, which indicates the motorway will soon reach capacity. The estimated base case VCR of the existing highway could not be determined because of the number of intersections. Traffic modelling data is required to determine the traffic flows at each intersection before a valid comparison of congestion can be made.

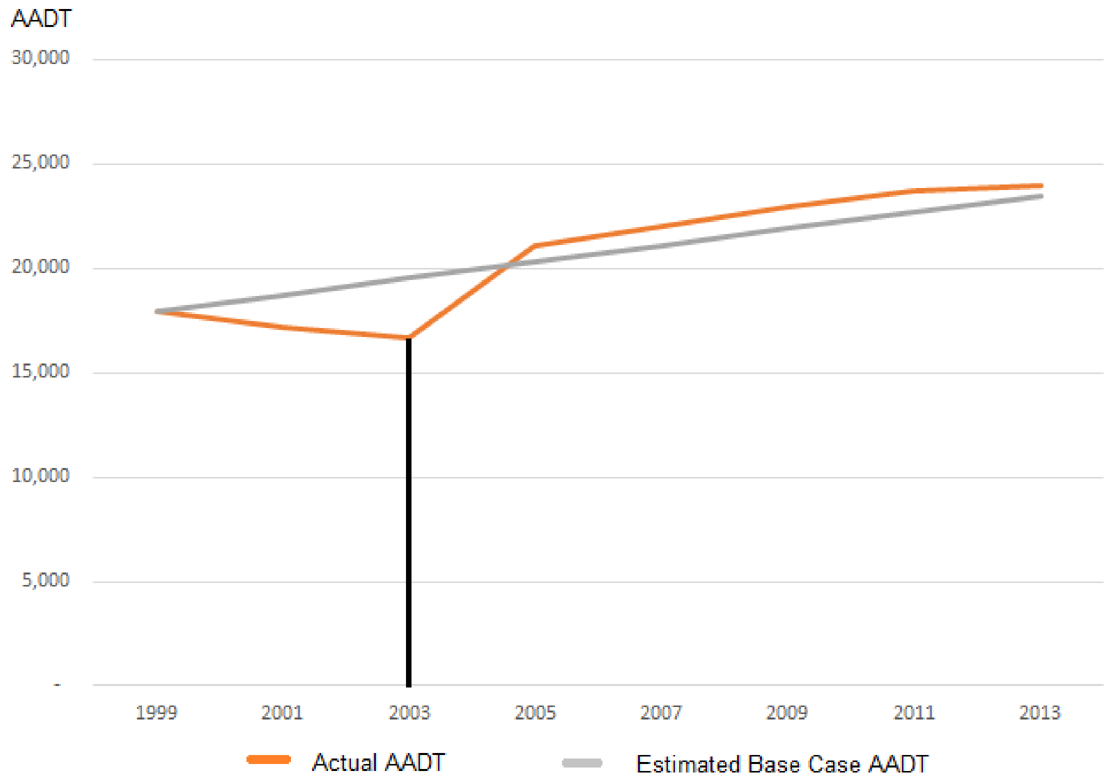
4.3. Bruce Highway – Yandina to Cooroy

The Bruce Highway is another highway considered in this study. Even though the Bruce Highway has lower traffic volumes than the Pacific Motorway, sections have been identified that lack capacity and require upgrading to cater for current and future traffic flows.

In 2003, the 2-lane to 4-lane duplication of the Bruce Highway between Yandina and Cooroy was completed. The upgrade was primarily intended to relieve congestion (VCR>1) and improve road safety.

The traffic volume dropped during the construction period but climbed on completion. Unlike the increases in traffic volume experienced on the Pacific Motorway, the traffic volume for this project climbed only marginally above the estimated base case traffic volumes. Figure 5 contains the distribution of traffic volume from 1999 to 2013.

Figure 5: Traffic volumes at the project site of Bruce Highway (Yandina to Cooroy)[12]



In 2003, on completion of the project, the VCR dropped from 1.11 to 0.31. Ten years after the completion of the upgrade, the VCR remained below 0.5; this indicates that congestion has not returned. Table 3 contains the VCR before and after project completion.

[12] There was insufficient data prior to construction to determine the base case traffic volumes. For this case study, the average of post-completion traffic growth, excluding outliers, was used to determine the base case traffic growth rate.

Table 3: VCR before and after the Bruce Highway Duplication between Yandina and Cooroy

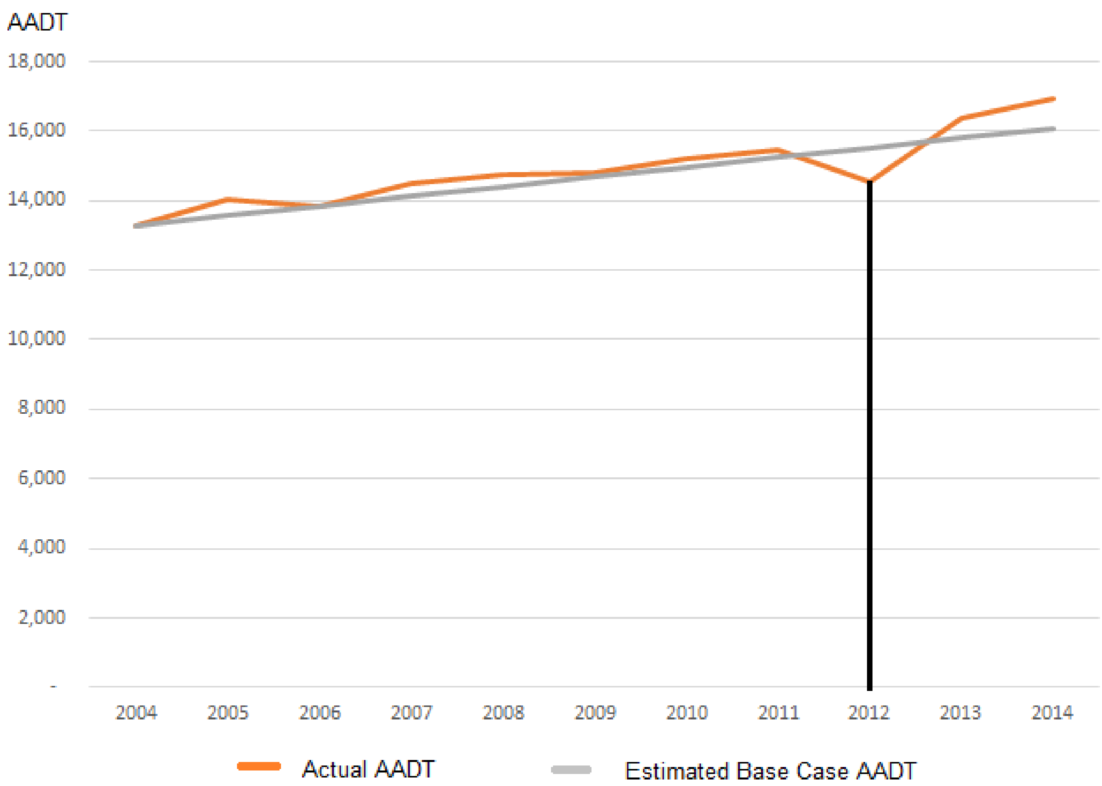
Year	VCR (Base Case)	VCR (Project Case)
1999	1.02	NA
2001	1.07	NA
2003	1.11	0.31
2005	1.16	0.39
2007	1.20	0.40
2009	1.25	0.42
2011	1.29	0.43
2013	1.34	0.44

In addition to the relief of congestion, upgrading a 2-lane single carriageway to a 4-lane dual carriageway also offers improved road safety by eliminating fatal accidents caused by head-on collisions (RTA 2004).

4.4. Bruce Highway – Cooroy to Curra Section B

In early 2013, ten years after the completion of the Yandina to Corooy duplication and 15km north of Cooroy, Section B of the Cooroy to Curra upgrade was completed. Only two years of data after the construction of this project is currently available. In these two years, traffic volume increased upon opening (mostly compensating for the lower traffic volumes during construction). After this two-year period, the traffic growth rate returned to a rate similar to the pre-construction growth rate. Figure 6 contains the distribution of traffic volume from 2004 to 2014.

Figure 6: Traffic volumes at the project site of Bruce Highway (Corooy to Curra Section B)



The moderate increase in traffic volume does not sufficiently increase the VCR to a level that suggests congestion is likely. In 2013, the VCR along Cooroy to Curra Section B dropped from 0.94 (close to capacity) to 0.31. In 2014, the VCR increased to just 0.32; this indicates that this section of road remains relatively congestion free. A few more years of data is required to confirm that traffic volumes will not rise significantly above the estimated base case numbers. Table 4 contains the VCR before and after project completion.

Table 4: VCR before and after the Bruce Highway Cooroy to Curra Section B Upgrade

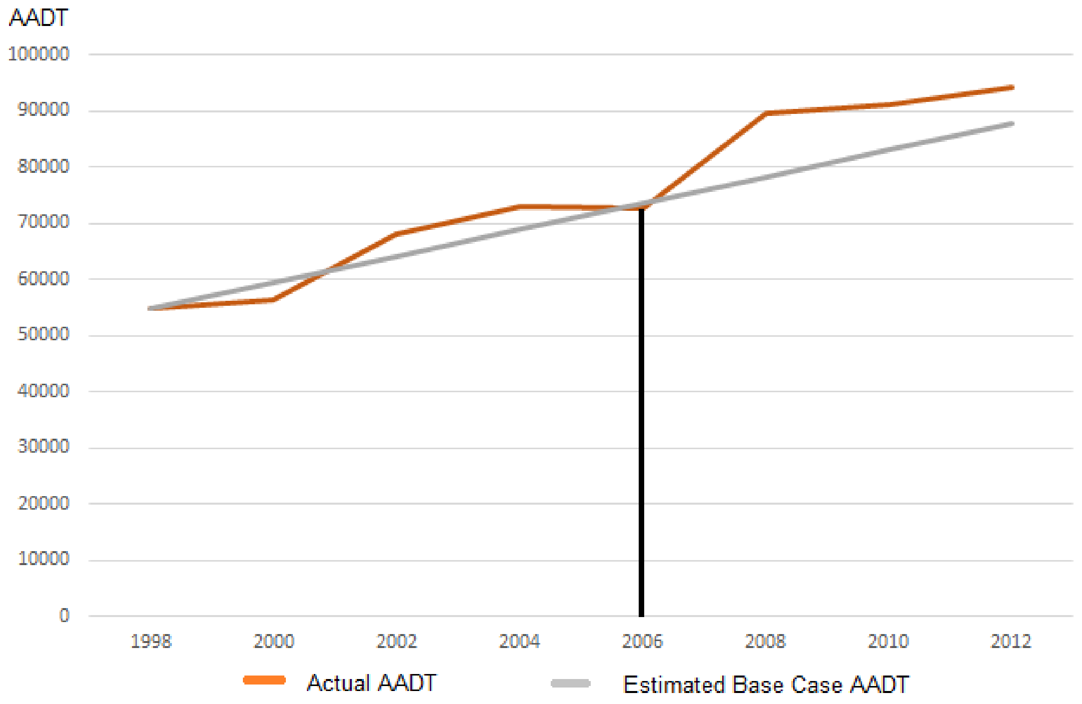
Year	VCR (Base Case)	VCR (Project Case)
2004	0.79	NA
2005	0.80	NA
2006	0.82	NA
2007	0.84	NA
2008	0.85	NA
2009	0.87	NA
2010	0.89	NA
2011	0.90	NA
2012	0.92	NA
2013	0.94	0.31
2014	0.95	0.32

Sections A, C, and D of the Cooroy to Curra Upgrade have not been completed. The traffic volumes along these sections are very similar to Section B and the capacity of these sections are similar as well (TMR 2015a). The upgrade of just Section B seems unlikely to induce more trips as most traffic is required either to travel along the lower capacity Section A or the lower capacity Sections C and D to reach Section B. Revisiting the traffic data on the completion of each of the remaining sections will be necessary to assess the full impact of the whole upgrade.

4.5. Bruce Highway – Caboolture 6-laning

In 2007, seventy kilometres south of Yandina, the Bruce Highway near Caboolture was increased from 4-lanes to 6-lanes. On completion of the project, the traffic volume increased in 2007 and 2008 to about 15,000 vehicles above the estimated base case traffic volumes. The traffic growth rate from 2008 to 2012 is slightly lower than the pre-construction rate. The lower traffic growth rate, over this period, could be attributed to the lower network growth rates described in the BITRE data provided in Figure 1. The increase in traffic volume for this project is greater than the increase in traffic volume of the Bruce Highway projects located further north but less than the Pacific Motorway projects. Figure 7 contains the distribution of traffic volume from 1998 to 2012.

Figure 7: Traffic volumes at the project site of Bruce Highway (Caboolture)



In early 2007, on completion of the 6-laning, the VCR dropped from 1.18 (approximately at full capacity) to 0.78 (still high but low enough to allow mostly free flowing traffic). In 2008, the VCR was up to 0.96 (very close to capacity and the onset of congestion). Table 5 contains the VCR before and after project completion.

Table 5: VCR before and after the Bruce Highway Caboolture 6-laning Project

Year	VCR (Base Case)	VCR (Project Case)
1998	0.88	NA
2000	0.95	NA
2002	1.03	NA
2004	1.10	NA
2006	1.18	0.78
2008	1.25	0.96
2010	1.33	0.97
2012	1.40	1.01

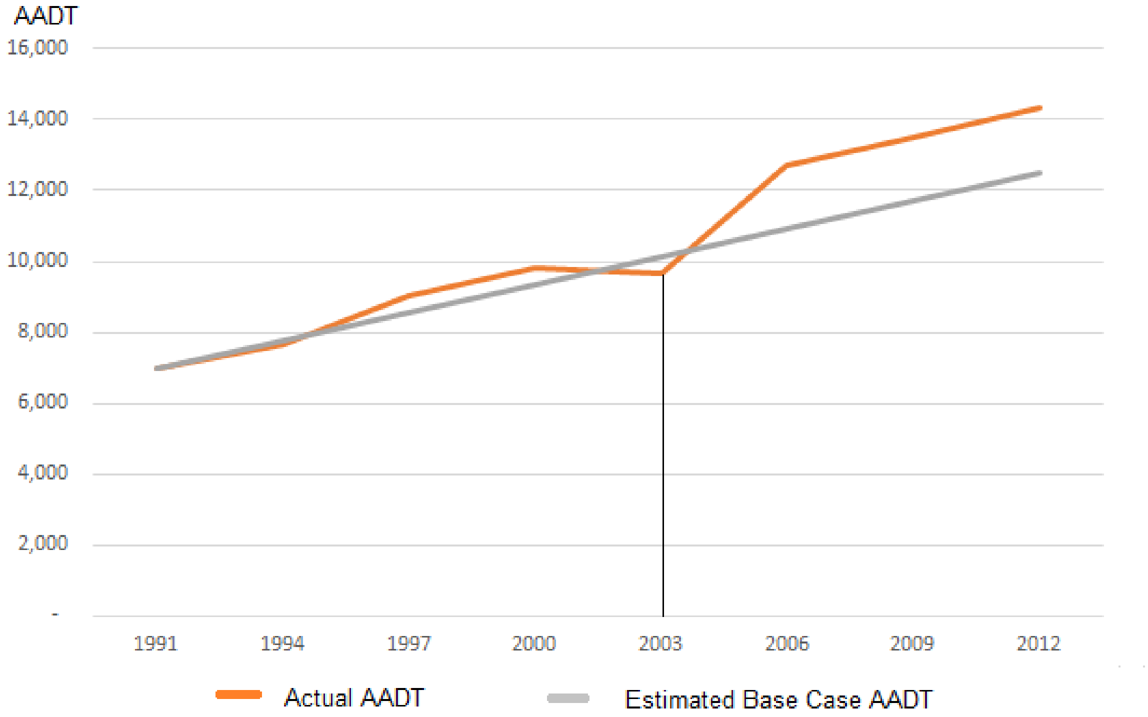
The capacity increase of adding 2-lanes does not appear sufficient as a long-term solution to resolving the level of congestion around Caboolture. The lack of additional capacity provided by the project may have also hindered the extent of induced travel as the road reaches saturation.

4.6. Warrego Highway – Gatton Bypass Duplication

The Warrego Highway can be considered as Queensland's principal east-west highway (Queensland Government 2015). The Warrego Highway has less traffic than both the Pacific Motorway and the Bruce Highway but is considered an essential freight corridor. The Warrego Highway has a high percentage of heavy vehicles carrying freight for the resources and agriculture industries.

The Gatton bypass duplication along the Warrego Highway was open for traffic in 2003. The project cost $46 million in 2003 prices and covered 15km of the existing bypass. The traffic volume took the typical drop during construction followed by an increase in traffic volume once the project opened. In 2006, the increase in traffic volume above the estimated base case traffic volume was small (approximately 2,000 vehicles). From 2006 to 2012, the traffic growth rate reverted to the pre-construction growth rate. Figure 8 contains the distribution of traffic volume from 1991 to 2012.

Figure 8: Traffic volumes at the project site of Warrego Highway (Gatton Bypass Duplication)



In 2003, on completion of the duplication, the VCR dropped from 0.6 (mostly free flowing) to 0.18 (completely free flowing). In 2012, the VCR gradually increased to 0.27, which is still well below any level that is expected to cause congestion. In 2012, the VCR in the base case is expected to be close to 0.74, which is reaching the onset of congestion. Table 6 contains the VCR before and after project completion.

Table 6: VCR before and after the Warrego Highway Gatton Bypass Duplication

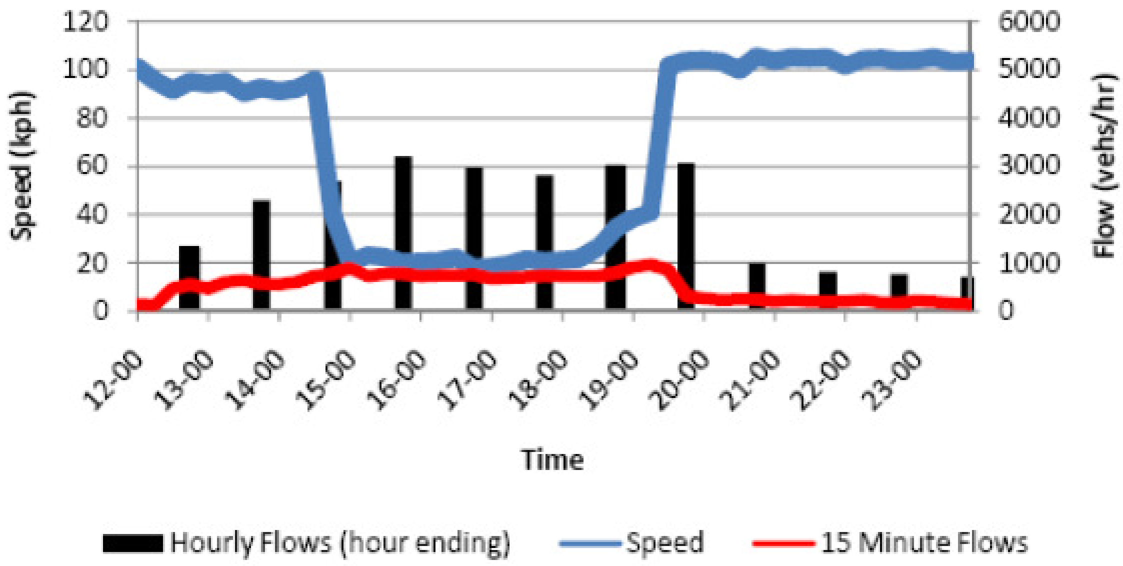
Year	VCR (Base Case)	VCR (Project Case)
1991	0.41	NA
1994	0.46	NA
1997	0.51	NA
2000	0.55	NA
2003	0.60	0.18
2006	0.65	0.24
2009	0.69	0.26
2012	0.74	0.27

4.7. Gateway Motorway – Gateway Additional Lane Project

The Gateway Motorway is a major tolled motorway in Brisbane, Queensland. The Gateway Motorway acts as a bypass of Brisbane allowing for easier access between the Gold Coast and Sunshine Coast (Wikipedia 2015). The Gateway Motorway has a high traffic volume and it has received a number of high capital upgrades. The lack of available traffic data has prevented the inclusion of Gateway Motorway Projects in this paper. The study of the gateway additional lane project relies only upon the data and results presented in the TMR post implementation review

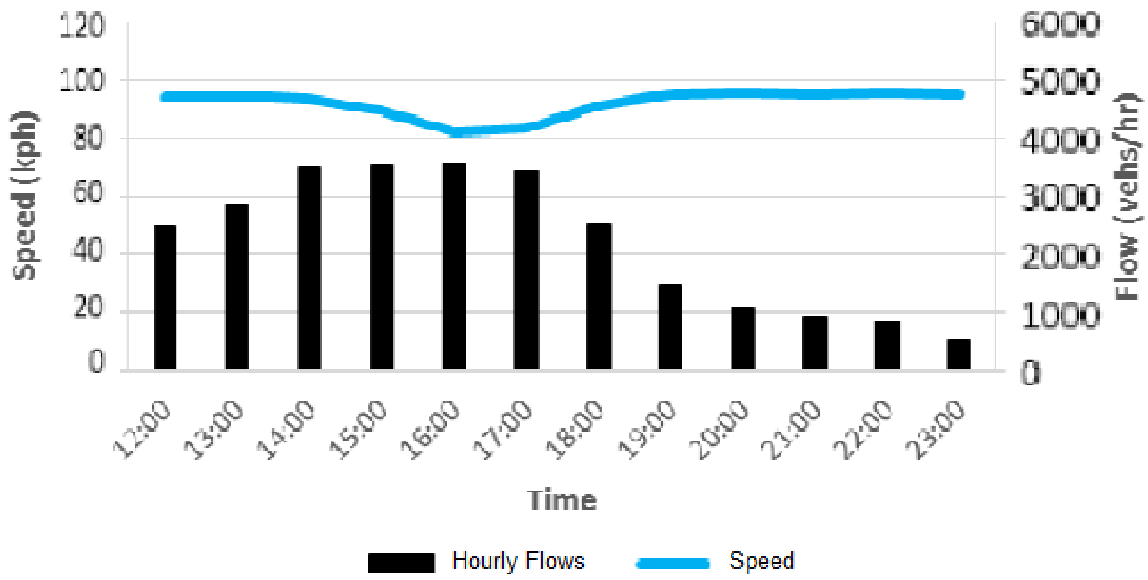
The gateway additional lane project involved the construction of a third northbound lane to ease afternoon peak congestion. Only hourly PM peak traffic volume has been considered in this review. Figure 9 contains the average operating speed during the afternoon peak prior to construction and Figure 10 contains the average operating speed of the project several months post construction.

Figure 9: Northbound Gateway PM Traffic Flows (Bicentennial to Sandgate) Pre Construction



Source: Transport and Main Roads, (2015b)

Figure 10: Northbound Gateway PM Traffic Flows (Bicentennial to Sandgate) Post Opening



Source: Transport and Main Roads, (2015b)

On completion of the project, average PM peak operating speed increased from 20km/h to 83km/h. Maximum peak traffic volume also increased by 17% since the opening of the lane. The additional lane increases the northbound capacity by 50%. The capacity more than compensates for the initial increase in traffic volume. The Gateway Motorway has an approximate annual traffic growth rate of 3%. If we assume the initial traffic volume does not spike further and traffic continues to grow by about 3%, approximately the same level of congestion is likely to reoccur in about 10 years. Evidence from the previous case studies indicates that the spike in traffic growth may take up to 2 years. A post implementation review 2 years after completion would provide a more reliable indication of the extent the project has induced travel and the impact the upgrade has on traffic flows.

4.8. General Findings from the Case Studies

From the case studies investigated, a number of important similarities can be drawn. These similarities can be summarized as follows:

- Traffic volume dropped during the construction period.
- Post-construction traffic volumes climbed above pre-construction traffic volumes in less than two years.
- Post-construction traffic volumes climbed above the projected traffic volume estimated using the pre-construction growth rate.
- Traffic growth rates returned to approximately pre-construction growth rates in just a few years after construction.

The biggest difference between the case studies was the extent of the post-construction increase in traffic volume. The Pacific Motorway 8-laning Logan to Gaven project experienced a 38% increase in traffic volume in the first two-years of operation. Whereas, the Cooroy to Curra Section B only experienced a 17% increase in traffic volume in the first two-years of operation. Table 7 contains the percentage increase in traffic volume in the first 2 years as well as the approximate percentage increase in capacity provided by the upgrades.

Table 7: Comparison of changes in volume and capacity two years post-completion

Project	Δ Volume	Δ Capacity[13]
Pacific Motorway – 8-laning Logan to Gaven	38%	33%
Pacific Motorway - Tugun Bypass	33%	100%
Bruce Highway - Yandina to Cooroy Duplication	26%	211%
Bruce Highway - Cooroy to Curra Section B	17%	211%
Bruce Highway – 6-laning - Caboolture	25%	50%
Warrego Highway - Gatton Bypass Duplication Package 2 & 3	21%	211%

The capacity upgrades of the higher volumes roads offered smaller percentage increases in capacity but these roads experienced higher percentage increases in traffic volume. The 8-laning Logan to Gaven upgrade capacity increase did not cover the 2-year post construction increase in traffic volume. Evidence from this paper suggests that higher volume roads and roads that are very close to capacity are more susceptible to large increases in traffic volumes; this is consistent with the findings of SACTRA. The evidence also implies that providing additional capacity to high volume roads only offers a temporary solution to reducing congestion.

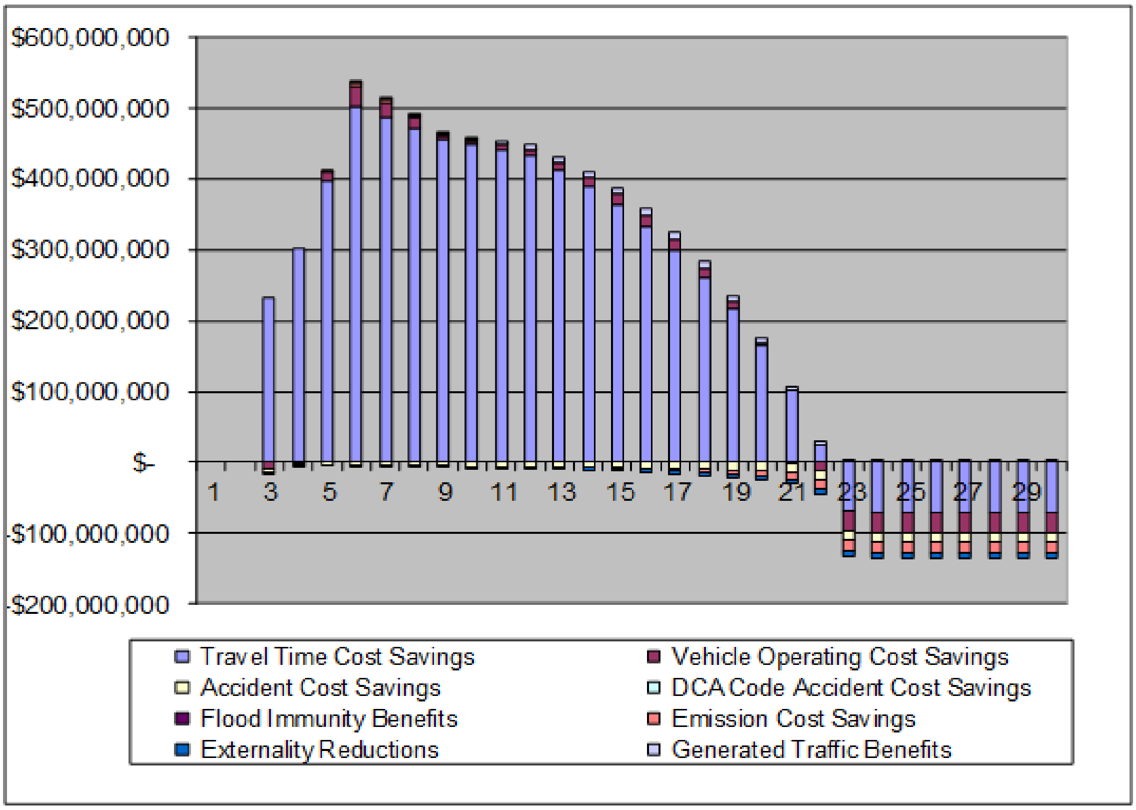
[13] Percentage capacity increase has been derived using the hourly capacity of roads based on model road state categories stated in Austroads (2005).

5. Impact on the Cost Benefit Analysis (CBA)

The changes in VCR observed in the case studies imply that increases in traffic volume can be expected to influence the results of a CBA. A project that generates a small or no increase in traffic volume is expected to produce a longer larger stream of benefits than a project that generates a large increase in traffic volume. Insufficient resources are available to conduct ex-post CBAs for the case studies presented in this paper. Therefore, a basic hypothetical example has been used to provide some indication of the possible extent the benefits of a project are influenced by increases in traffic volume.

The basic hypothetical example has been defined as a 20km upgrade from 6-lanes to 8-lanes. This road currently has an AADT of 100,000[14]. The example has been evaluated using the TMR concise analysis of road programs (CARP) model[15]. Two scenarios of this example has been run using the model. The first scenario assumed an AADT of 100,000 in both the base case and the project case with a 3% linear traffic growth rate. The second scenario assumed an AADT of 100,000 in the base case and an AADT of 125,000[16] in the project case with a 3% linear traffic growth rate. At a discount rate of 7%, the first scenario produced $3,585,884,243 worth of benefits and the upgrade took 22 years to reach saturation. At a discount rate of 7%, the second scenario produced $884,128,782 worth of benefits and the upgrade took 11 years to reach saturation. Figure 11 contains the annual benefits for the hypothetical example under the first scenario and Figure 12 contains the annual benefits for the hypothetical example under the second scenario.

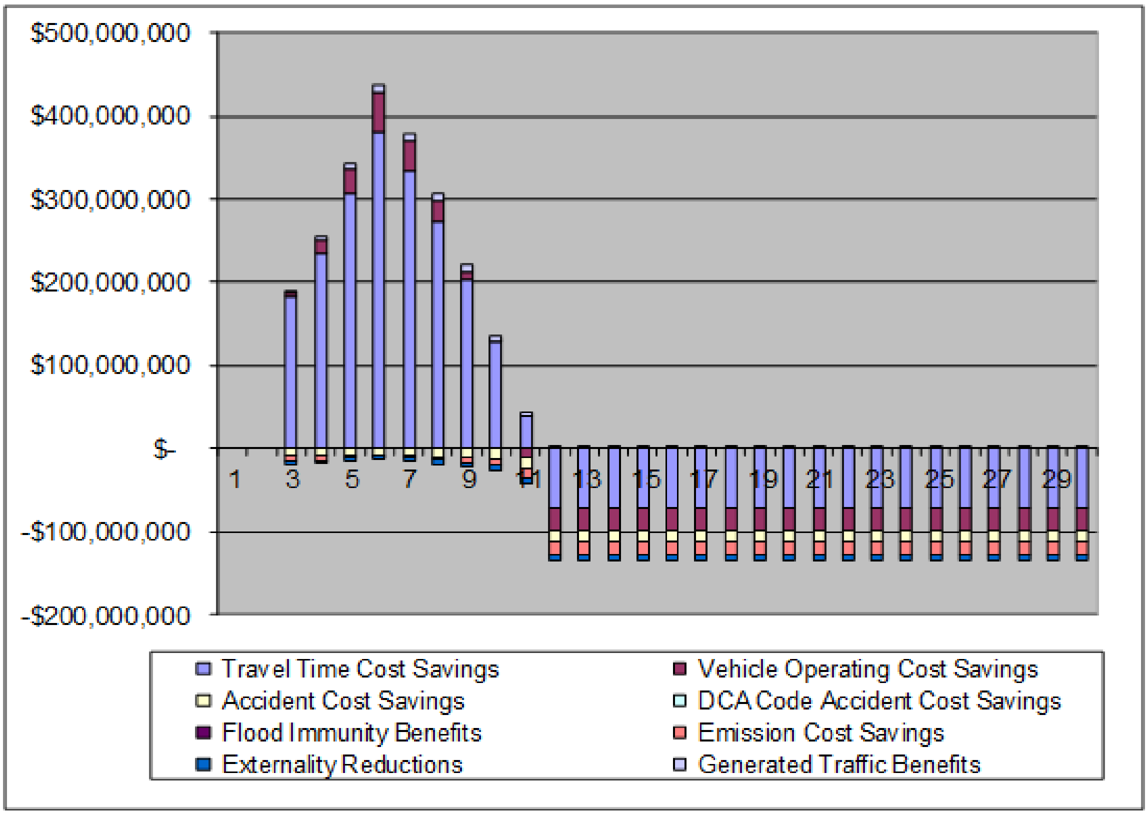
Figure 11: Scenario 1 Annual Benefit Distribution (Undiscounted)



Source: Output from TMR CARP model

[14] AADT of 100,000 vehicles on a 6-lane motorway has been used to replicate a typical South-east Queensland motorway such as the Pacific Motorway.
[15] CARP is a TMR in-house CBA model designed for rapid analysis of projects and/or programs when there is insufficient data to conduct a detailed analysis (TMR 2015c).
[16] The 25% increase has been used to roughly represent the findings from the case studies.

Figure 12: Scenario 2 Annual Benefit Distribution (Undiscounted)



Source: Output from TMR CARP model

The benefit streams in CARP includes travel time cost (TTC) savings, vehicle operating costs (VOC), accident cost savings, externality cost savings, and generated traffic benefits. These benefits have been calculated using the methodologies defined in Austroads (2005), and the National Guidelines to Transport System Management. The additional vehicles in Scenario 2 have been treated as induced traffic and have been calculated using the rule of half (ATC 2006).

The hypothetical example used in this paper is in the context of South East Queensland motorways and highways. This approach was not intended to bias the results but to place emphasis on the part of the Queensland network with the highest number of major road infrastructure projects. TMR's Statewide Program Investment Delivery Application (SPIDA) reports that 15 of 29 national capital[17] projects of capital expenditure in excess of $100 million are proposed to be constructed in South East Queensland (TMR 2015d); all of these projects are focused on increasing road capacity. Between 2009 and 2026, the Queensland Government plans to spend $96.4 billion on road and rail infrastructure projects in South East Queensland (Queensland Government 2009) most of this expenditure is likely to be on major road infrastructure projects.

The results from the hypothetical example should only be taken as an indication of the type of impact that induced traffic can have on the stream of benefits. The broader network needs to be considered for a more definitive answer. For example, some upgrades might reduce congestion on other parts of the network as in the case for the Tugun Bypass, which has reduced congestion on the Gold Coast Highway. For most projects in South East Queensland, congestion reductions are likely to be small, as the number of alternatives to South East Queensland Motorways is limited. SACTRA cited evidence that the surrounding network might become more saturated as road users travel further distances rather than

[17] Projects to be funded by the Australian Commonwealth Government

save travel time; this argument supports the jump in traffic volume observed in the Tugun Bypass case study following the completion of the Pacific Motorway 8-laning project. Existing transport models such as VISSIM[18] are capable of determining the impact a project has on the wider network, these models should be incorporated into corridor program planning and provide input into economic analysis when appropriate.

6. Conclusion

The case studies strongly suggest that major road infrastructure projects increase the traffic volumes on roads in Queensland. These increases may or may not adversely affect the effectiveness of the upgrade. The use of infrastructure solutions to upgrade high capacity roads (4-lane or 6-lane motorways) does not appear to be an effective approach to addressing congestion. The 8-laning of the Pacific Motorway between Logan and Gaven and the 6-laning of the Bruce Highway near Caboolture are examples of major road infrastructure upgrades that will not provide sustained relief of congestion. Upgrading lower capacity roads such as 2-lane single carriageway highways to 4-lane dual carriageway highways appears to offer a longer-term solution to congestion even if the upgrade induces traffic. Cooroy to Curra Section B, Yandina to Cooroy duplication, and the Gatton Bypass duplication are examples of projects that have induced traffic but not to the extent that the travel time savings of the existing traffic on these roads will be eroded.

The extent a major road infrastructure project will induce traffic will depend on a number of factors such as location, the nature of the infrastructure upgrade, and the level of congestion that currently exists on the road. From the case studies included in this paper, traffic volumes appear to increase between 15% and 40% within the first two years after the completion of the project but after the initial jump in traffic volume, growth rates appear to return to the pre-construction level. Traffic modelling needs to account for these increases in traffic volumes. Cost benefit analysis practices need to incorporate this traffic modelling. If the traffic modelling fails to account for increases in traffic volume, sensitivity analysis can be applied to the cost benefit analysis to determine a range of results.

References

Australian Bureau of Statistics (2015), 6427.0 – Producer Price Indexes, Australia, Mar 2015, Australian Bureau of Statistics.

Australian Transport Council (2006), National Guidelines for Transport Systems Management, 5 Background Material, Commonwealth of Australia, Canberra.

Austroads (2005), Economic Evaluation of Road Investment Proposals: Harmonisation of Non-Urban Road User Cost Models, Austroads, AP-R264/05.

Bray, D., (2005), Improving Economic Evaluation of Urban Transport Projects in Australia, Australasian Transport Research Forum 2005.

Bureau of Infrastructure, Transport and Regional Economics (2012), Traffic Growth in Australia, Research Report 127, Department of Infrastructure and Transport, Australian Government.

Department of Infrastructure and Regional Development, (2003), Over $300 million for Queensland Roads, Australian Government.

Department of Main Roads (2007), Community Newsletter – Tugun Bypass Ahead of Schedule, Queensland Government.

Department of the Premier and Cabinet (2000), M1 Drives Growth in South East, Queensland Government.

---

[18] Traffic in cities – simulation model

Duranton, G. and Turner, M A., (2011), The Fundamental Law of Road Congestion: Evidence from US Cities, The American Economic Review, 2616-2652

Hanson, M. (1995), Do highways Generate Traffic? Access, University of California Transportation Center.

Heanue, K. (1998), Highway capacity and induced travel: Issues, evidence and implications, Transport Research Circular.

Litman, T., (2015), Generated Traffic and Induced Travel – Implications for Transport Planning, Victoria Transport Policy Institute.

Metz, D., (2008), The Myth of Travel Time Savings, Transport Reviews, 28, (3), p321-336.

Moore, T., (2015), Queensland's Infrastructure Health Check –Where We Stand, Brisbane Times, available at: http://www.brisbanetimes.com.au/queensland/queenslands-infrastructure-health-check--where-we-stand-20150521-gh71r8.html, accessed on 22/05/2015.

National Guidelines for Transport System Management in Australia (2015), Road Parameter Values [PV2], Transport and Infrastructure Council, Commonwealth of Australia.

Noland, R. B. (2001), Relationships between highway capacity and induced vehicle travel, Transportation Research Part A, 35, 47-72.

Pfeiderer, R. H. H. and Dieterich, M. (1995), New roads generate new traffic. There is widespread ignorance concerning the generation of additional traffic, World Transport Policy & Practice, 1, (1), p29-31.

Queensland Government, (2015), Warrego Highway Upgrade Program, Queensland Government, available at: https://www.qld.gov.au/transport/projects/warrego/, accessed on 29/05/2015.

Queensland Government, (2009), South East Queensland Infrastructure Plan and Program 2009-2026, Queensland Government.

Road Transport Authority (2004), Accident Reduction Guide, TD 2004/RS01, NSW Government.

Standing Advisory Committee on Trunk Road Assessment (SACTRA) (1994), Trunk Roads and the Generation of Traffic, HMSO, London.

Transport and Main Roads (2015a), ChartView – Data for 10A Bruce Highway (Brisbane to Gympie), Queensland Government.

Transport and Main Roads (2015b), Post Implementation Review – Gateway Additional Lane Project, Queensland Government (Unpublished).

Transport and Main Roads (2015c), Guide to Model Usage, Queensland Government (Unpublished).

Transport and Main Roads (2015d), Queensland Transport and Roads Investment Program (Live) 2014-15, Queensland Government.

Transport and Main Roads (2014), Transport Infrastructure Project Delivery System Volume 1 (Selection of Delivery Options), Queensland Government.

Transport and Main Roads (2011), Cost-benefit Analysis Manual: Road Projects, Queensland Government, Brisbane.

Wikipedia (2015), Gateway Motorway, Wikipedia, The Free Encyclopedia, available at: http://en.wikipedia.org/wiki/Gateway_Motorway, accessed on 29/05/2015.