

# Exploring the relative performance of regional passenger rail in New South Wales and Victoria

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## Abstract

The topic of regional passenger rail lacks significant academic research and attention in comparison with research into public transport in cities and urban areas. While the importance of public transport provision and the need to prevent transport disadvantage is well known, there have been few research papers looking into the performance of existing regional public transport systems. This paper aims to investigate the performance of regional public transport railways in the Australian states of New South Wales (NSW) and Victoria (Vic). Data has been collected and analysed to allow for a comparative performance assessment to be undertaken between the various rail lines across both NSW and Vic. Results investigate both service effectiveness and relative competitiveness of rail lines. Key performance assessment findings show that overall, NSW lines have higher service effectiveness than Vic with the short ‘commuter based’ lines having the highest service effectiveness. In terms of relative competitiveness, Victorian lines generally outperformed those in NSW in terms of travel time competitive with private vehicles while the NSW lines had cheaper ticket price per kilometre. Victorian lines were nearly three times more expensive per km than equivalent NSW lines.

## 1. Introduction

Most academic literature and discussion exploring the topic of public transport focuses on urban public transport and the use of public transport for the purposes of commuter transportation. There are, however, many other ways in which public transport is used, including intercity, regional, and recreational travel. This paper seeks to investigate one of these alternate transportation uses, that being regional public transport railways.

This study examines the regional public transport rail lines operating in Australia’s two most populous states: New South Wales (NSW) and Victoria. The combined populations of NSW and Victoria equate to approximately 14.8 million residents, which represents 57.7% of Australia’s total population (Australian Bureau of Statistics, 2021a). The portion of each state’s population residing outside of the capitals of Sydney and Melbourne are 34.4% and 22.4% respectively. In combination, this results in a regional population of 4.3 million residents which is greater than Australia’s third largest city, Brisbane (Australian Bureau of Statistics, 2021b).

Due to the vast distances across regional Australia and the importance of economic connections between the regional areas and capital cities, transport connections incorporating regional railways are vitally important to the livelihoods and economies of these towns (Deloitte, 2017). Other factors such as a higher vulnerability to social disadvantage and higher levels of car dependency reinforce the social and environmental significance of providing sufficient public transport to these regional populations.

To improve regional public transport systems, it is important to first assess and analyse the efficiency and effectiveness of the rail corridors which provide the backbone of the regional public transport system (Eboli & Mazzulla, 2011). Both the NSW and Victorian State

governments acknowledge the importance of the regional rail networks in their states and have committed large amounts of government expenditure towards existing or future regional public transport projects (V/Line, 2021 & NSW, 2021). However, due to the limited available research in these fields it is unclear what the performance levels of the current regional public transport networks are, and where these future investments should be made. In addition, almost no studies have ever compared the performance of rail in regional NSW with Victoria.

This paper aims to explore the performance of regional railways in NSW and Victoria using a comparative performance assessment approach at the regional rail line level. In addition line performance is also undertaken for ‘regional’ or ‘commuter based’ lines.

This paper commences by providing an overview of the context and background to the provision of rail public transport services in NSW and Victoria. The results of a literature review into the topic of regional public transport and performance assessment is then presented. Research methodology is then outlined. Results of the comparative performance assessment are then presented.

## 2. Context

NSW TrainLink and V/Line are both state government owned organisations which operate the regional rail services in NSW and Victoria respectively. Services have been categorised as either ‘regional’ or ‘commuter based’ because they cater for very different market groups and have different service aims. Commuter services provide peak trains into Melbourne or Sydney CBD and are often limited by the end to end travel time from regional termini.

Figure 1 shows a map of the rail lines being assessed within this report while Table 1 provides an overview of all the lines included in the performance assessment.



**Figure 1: Map of Passenger Rail Lines in New South Wales and Victoria**

For NSW a travel duration of three hours and under has been used to classify services as commuter based while in Victoria a cut off time of two hours has been used. The differences represent difference in scale of state (NSW is larger) also NSW has a larger commuter service catchment of regional settlements and services. Commuter services aim for speed of access

to and from major regional centres and are timed for work periods. More regional trains have a tourism and less frequent travel focus.

**Table 1: Overview of Lines by Context Statistics for New South Wales and Victoria**  
Ranked by line distance and state.

Regional Terminus	State	Rail Corridor	End End Distance (km)	End to End Travel Time (hrs:mins)	Average Weekly Pax.	Average Weekly Services
Broken Hill	NSW	Western Line	1,142	12:52	210	2
Casino <sup>1</sup>	NSW	North Coast Line	713	11:32	7,174	42
Griffith	NSW	Southern Line	568	8:20	176	4
Albury <sup>2</sup>	NSW	Southern Line	547	7:30	2,942	28
Armidale	NSW	North West Line	474	8:05	2,664	14
Dubbo	NSW	Western Line	390	6:26	2,454	14
Canberra	NSW	Southern Line	286	4:08	5,586	42
Goulburn	NSW	Southern Highlands	190	3:01	20,410	194
Newcastle	NSW	Nwcstle/CentCst	161	2:37	37,527	546
Lithgow	NSW	Blue Mntns. Line	138	2:51	195,263	444
Kiama	NSW	South Coast Line	120	2:33	40,416	364
Wyong <sup>3</sup>	NSW	Nwcstle/CentCst	103	1:48	329,043	748
Wollongong	NSW	South Coast Line	88	1:42	152,525	698
Swan Hill	VIC	Bendigo Line	338	4:42	2,034	28
Albury	VIC	Seymour Line	316	3:53	5,264	42
Bairnsdale	VIC	Gippsland Line	282	3:59	3,594	49
Warrnambool	VIC	Geelong Line	255	3:39	6,448	52
Echuca	VIC	Bendigo Line	224	3:22	694	18
Ararat	VIC	Ballarat Line	202	3:28	8,470	62
Shepperton	VIC	Seymour Line	181	2:46	2,830	86
Maryborough	VIC	Ballarat Line	168	2:27	598	24
Traralgon	VIC	Gippsland Line	165	2:35	31,214	255
Bendigo	VIC	Bendigo Line	153	1:55	53,810	307
Ballarat	VIC	Ballarat Line	113	1:27	85,162	585
Seymour	VIC	Seymour Line	102	1:36	22,100	269
Geelong	VIC	Geelong Line	71	1:03	182,590	721
NSW Regional	NSW	N/A	N/A	N/A	22,382	160
NSW Commute	NSW	N/A	N/A	N/A	775,184	2,084
VIC Regional	VIC	N/A	N/A	N/A	61,146	616
VIC Commuter	VIC	N/A	N/A	N/A	343,662	1,882
<b>NSW Total</b>	NSW	N/A	N/A	N/A	797,566	2,244
<b>VIC Total<sup>4</sup></b>	VIC	N/A	N/A	N/A	404,800	2,137

<sup>1</sup> Includes the Casino, Grafton and Brisbane services. Patronage to and from Brisbane has been excluded from the analysis/

<sup>2</sup> Albury is serviced by trains between Sydney and Melbourne, Patronage south of Albury on this line has been excluded from this analysis.

<sup>3</sup> Services to Gosford are included in the calculations for Wyong.

<sup>4</sup> Victorian regional and commuter services do not equal the total number of Victorian services as most regional services are also included within the commuter line total.

NSW TrainLink operates services along four regional corridors: North Coast, North West, Southern and Western. Each of these services operates out of Sydney's Central Station. The North Coast Line runs services terminating at either Grafton, Casino or across the state border to the Queensland capital of Brisbane. The North West Line services the cities of Tamworth, Armidale and Moree. The Western Line includes a daily return service to Dubbo and a once weekly return service to the remote city of Broken Hill. The Southern line includes services to Griffith, as well as Canberra and Melbourne. The 'commuter based' routes operated by NSW TrainLink connect Sydney to the nearby cities of Newcastle, Wollongong and Goulburn while also providing services to the Blue Mountains region. The four commuter based lines are shown in the insert within Figure 1. The Hunter Line operating out of Newcastle has not been included in the analysis in this report.

The Victorian network is made up of five corridors each operating with frequent services to a regional centre where a limited number of services then continue further.

The Victorian corridors are the Gippsland Line to Traralgon and Bairnsdale; the Seymour Line which continues on to Shepparton and Albury; the Bendigo Line which continues to Swan Hill and Echuca; the Ballarat Line including both Maryborough and Ararat; and the Geelong Line which continues on to Warrnambool.

Combined, the NSW and Victorian regional passenger railways carry over 1.2 million passengers on average per week, with NSW carrying about twice that of Victoria. There are about 4,300 weekly passenger services in both states so while NSW has twice as much ridership, both states operate a similar number of services. The NSW ridership is heavily concentrated on the shorter routes, with the two shortest routes (Wyong and Lithgow) comprising 60% of total NSW patronage, a figure which is greater than all of Victoria combined. It is also noted that for both networks, patronage is heavily dominated by 'commuter based' services with only 7% of weekly patronage being on the lines categorised as 'regional'.

The lines with the highest average patronage in NSW are Wyong (329,043), Lithgow (195,263), Wollongong (152,525) and Kiama (40,416), while Geelong (182,590), Ballarat (85,162), Bendigo (53,810) and Traralgon (31,214) have the highest patronage in Victoria. The lines with the lowest weekly patronage are Griffith (176), Broken Hill (210), Maryborough (598) and Echuca (694).

### **3. Literature Review**

#### **3.1. Regional Public Transport**

It is clear from the research undertaken that the provision of a functioning public transport system offers many benefits to society. These benefits include: increased employment choices, enhanced viability of cities and towns, benefits for the environment, and benefits for the health of users (Cheyne & Imran, 2010). Likewise, the lack of public transport provision to an area can result in transport disadvantage. Transport disadvantage occurs when there are barriers that restrict people's movement and can prevent them from accessing essential services, employment, education and social activities (Cheyne & Imran, 2010, Vidyattama & Nakanishi, 2016, Delbosc & Currie, 2011). Transport disadvantage may also be known as transport poverty, with populations such as the elderly, women, youth, the disabled and people with low incomes being particularly vulnerable (Cheyne & Imran, 2010). Flow on impacts from transport disadvantage include social exclusion and decreases in wellbeing and quality of life (Vidyattama & Nakanishi, 2016, Delbosc & Currie, 2011). The higher proportions of these vulnerable populations residing in regional Australia compared to the capital cities highlights

the importance of regional public transport and why it is crucial for future research to be undertaken into this field.

In the Australian context, many academic papers discuss the provision and transport needs of the major cities (Currie, 2010, Norley, 2010, Xu et al, 2011, Ramsay, 2010, Stanley and Stanley, 2021). There is also extensive discussion relating to future high speed rail connections and their associated impacts (Denham, 2018, Douglas & Thornton, 2004). However, there is only limited discussion about the implications of existing public transport connections to regional cities and towns from a performance perspective.

Peterson (2009) is one of the few articles addressing this field and analysed the transport model used in Switzerland and whether this could be replicated in regional Victoria. Peterson (2009) concluded that if provided effectively, with high levels of integration and an efficient rail connection, it is possible to provide sufficient public transport services and the associated benefits to regional Australia.

The gap of literature focusing on regional public transport is also evident when reviewing international literature. Papers such as Hansson et al (2019) and de Ona & de Ona (2015) acknowledge and identify the lack of research in this field.

There are varying definitions of what exactly regional transport includes. Hansson et al (2019) put forward a definition which creates three categories of trips; local, regional and interregional. These categories are based upon travel patterns rather than individual trips. Local trips are within an urban area, regional trips are traveling between separate urban areas or to rural areas with most trips being made on a frequent basis. Interregional travel is made between different regions with most trips made less frequently than weekly (Hansson et al, 2019). For the purposes of this research paper the rail lines have been categorised on a similar basis to those of Hansson et al (2019). This study uses the terminology of ‘commuter based’ lines and ‘regional’ lines. ‘Commuter based’ lines have been grouped according to the commuting distance of two hours end to end travel time in Victoria and a three hour end to end travel time in NSW. The remaining lines have been categorised as ‘regional’ lines and are made up primarily of lines which would meet the definition of interregional lines outlined by Hansson et al (2019).

### **3.2. Comparative Performance Assessments**

Performance assessment is undertaken for numerous reasons including, but not limited to, assisting in evaluating a transit system’s overall performance, identifying problems in a system and allocation of resources (Eboli & Mazzulla, 2012). Comparative performance assessments focus on comparing transport networks or technologies with similar systems. Comparative performance assessments have previously been carried out into areas such as: Bus Rapid Transit (Shah et al, 2020, Hensher & Golob, 2008); different or new transport technologies (Liu & Ceder, 2016); and public transport performance more generally (Gurjar, Jain & Agarwal, 2020).

The methodologies of these previous articles assessing comparative performance are generally similar. First, a study area is established, data is then collected, followed by determining performance metrics and then comparing the transport system and evaluation (Shah et al, 2020, Liu & Ceder, 2016).

There is a wide variety of transit performance measures which can be used for comparative analysis (Eboli & Mazzulla, 2012). Litman (2009) classifies performance measures into three categories: service quality, outcomes, and cost efficiency. Fielding (1987) provides another classification system for performance measures in what is known as the Fielding Triangle. The

Fielding Triangle classifies performance measures as either service inputs, service consumption or service outputs. Under Fielding's model, ratios can be developed between performance measures in each category to provide different insights in the performance of a transport service. Particularly relevant to this research paper is the issue of service effectiveness, which is a measure of the service consumption (e.g. ridership) relating to the service outputs e.g. rail vehicle kms operated (Fielding, 1987).

### 3.3. Summary

The literature review has highlighted the importance of public transport provision due to both the benefits offered and to address the issue of transport disadvantage. This is of relevance due to higher proportions of people who are particularly vulnerable to transport disadvantage being located in rural and regional areas.

Despite the issue's importance, there is a lack of research into regional public transport as identified by multiple authors. This is particularly prevalent in the Australian context. This research paper seeks to address this gap in the field by looking into the performance of regional public transport railways in Australia's two largest states with a focus on service effectiveness and relative competitiveness.

## 4. Methodology

This research paper compares regional public transport railways in NSW and Victoria. The methodology involved four key steps; a literature review, data collection, data analysis and a comparative performance assessment.

A review of academic literature was carried out into the topic of regional public transport as well as looking into aspects of performance assessment. Articles were sourced that provided commentary or discussion in relation to regional transport with a focus on searching for articles within the Australian context. Searches were also conducted into literature that involved comparative performance assessments to assist in undertaking the performance assessment carried out in this paper.

Data collection was undertaken to obtain the relevant data required to conduct the performance assessment. Data was collected from several sources, including: the relevant timetables, network maps, transport agencies' annual reports, and transport agency websites. Due to a lack of publicly available rail track distances, end to end distances for lines were calculated based upon Google Maps distances between stations. Google Maps was also used to calculate the equivalent private vehicle trip travel time<sup>5</sup>. The number of weekly rail services on each line and the travel time were both sourced through analysis of the relevant timetables for each route<sup>6</sup>. Ticket prices were sourced through the online ticket booking and ticket calculation services on the relevant transport service website<sup>7</sup>.

Patronage data was sourced through various methods and required data analysis to calculate the breakdown between various lines. Data was obtained through the transport agencies' 2018-2019 annual reports, publicly available Opal Card ticketing data (Open Data NSW, 2021a), a

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<sup>5</sup> Private vehicle equivalent trips were calculated on Google Maps as the average trip time departing either Sydney's Central Station or Melbourne's Southern Cross Station at 7:30am on Monday the 1<sup>st</sup> of November 2021.

<sup>6</sup> The number of services and end to end travel time reflects the timetables in operation on the week of the 4<sup>th</sup> of October 2021.

<sup>7</sup> Ticket prices were assumed for a standard adult oneway peak hour trip on Monday the 1<sup>st</sup> of November 2021, calculated in September 2021.

formal request for information to Transport for NSW, and a breakdown of Victorian boardings by station through the transport blog of Philip Mallis (Mallis, 2019).

The patronage figures for the NSW regional lines were included in the information provided on request by Transport for NSW with adjustments only made to the North Coast Line service to Brisbane and the Southern Line service to Melbourne. For both lines, the boardings and alightings from Brisbane and from the stations located south of Albury were subtracted from the overall line totals. The remaining NSW lines and all the Victorian lines were calculated in a twostep process. First, stations were classified by line and terminal station. The patronage of each line grouping as a percentage of the line total was then calculated<sup>8</sup>. The second step involved multiplying the percentages calculated in the first step by the official total line patronage numbers recorded for the 2018-2019 financial year<sup>9</sup>.

The comparative performance assessment has been carried out based upon secondary data calculations including passengers per vehicle kilometre<sup>10</sup>, passengers per service and ticket price per kilometre, as well as a comparison of train travel time and equivalent vehicle travel time.

## 5. Results

The results of the comparative performance analysis are discussed in the context of service effectiveness and relative competitiveness. The patronage figures used for the analysis are from the 2018-2019 financial year and represent the most accurate passenger figures prior to the impacts of COVID19.

### 5.1. Service Effectiveness

As discussed by Fielding (1987), service effectiveness is a measure of the service outputs compared to the service consumption. For the purposes of these results, weekly average boardings represent the service consumption, while weekly services and weekly vehicle kilometres represent the service outputs. Figure 2 shows the results of the service effectiveness analysis.

The results of the passenger per service (or train trip operated) calculations indicate that;

- The overall weighted average number of passengers per service is 275.
- The NSW weighted average passenger per service (357) is significantly higher than the Victorian weighted average (189).
- Lithgow and Wyong lines both carry the most passengers per service (440).
- The Geelong Line is the third highest line overall and is the best performing Victorian Line with an average of 253 passengers per service.
- The lines with the lowest passengers per service are Maryborough (25), Shepparton (33) and Echuca (39), all of which are in Victoria.
- Both the NSW and Victorian ‘commuter based’ lines outperform their respective ‘regional’ lines.
- Of the ‘regional’ lines, Armidale has the highest rate of passengers per service (190) while Ararat has the highest of the Victorian regional lines (137).

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<sup>8</sup> This was carried out using the Opal boardings ticketing data by station (Open Data NSW, 2021a) and the Victorian station boarding data made available by Mallis (2019).

<sup>9</sup> These figures were obtained in the official train utilisation figures for New South Wales (Open Data NSW, 2021b) and the V/Line Annual Report 1819 (V/Line, 2019).

<sup>10</sup> Vehicle Kilometres calculations include both the end to end services as well as intermittent services along the line.

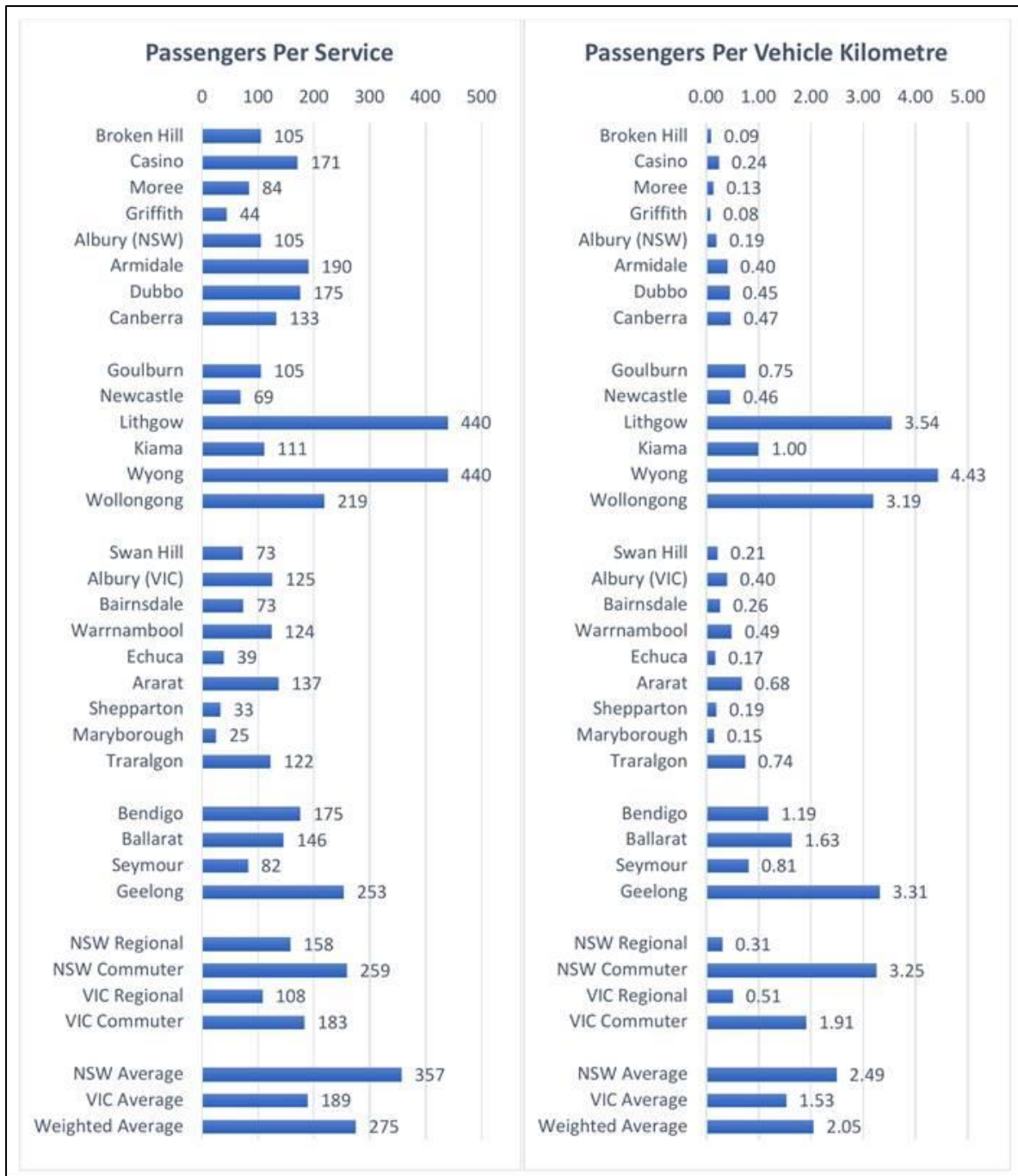


Figure 2: Overview of Service Effectiveness Measures by Line<sup>11</sup>

The passengers per vehicle kilometre analysis results indicate that;

- Overall, the weighted average passengers per vehicle kilometre across the network is 2.05.
- The overall trends shown in passengers per service are generally consistent with the results of passengers per vehicle kilometre.
- Similar to the passenger per service analysis, the NSW weighted average (2.49) outperforms the Victorian weighted average (1.53).
- The best performing lines are Wyong (4.43) and Lithgow (3.54).
- Geelong is in third place with a rate of 3.31 passengers per vehicle kilometre, closely followed by Wollongong (3.19).

<sup>11</sup> Averages in Figure 2 are weighted based patronage, number of services per line or vehicle kilometres



- The lowest performing lines are Griffith (0.08), Broken Hill (0.09) and Moree (0.13), all located in NSW.
- The lowest performing Victorian lines are Maryborough (0.15), Echuca (0.17), Shepperton (0.19).
- The ‘commuter based’ services outperform ‘regional’ routes significantly in both NSW and Victoria.
- Across both the NSW and Victorian networks, the passengers per kilometre performance generally improves with a shorter end to end line distance.
- The performance of some lines differs between the two service effectiveness indicators tested. For example, Bendigo outperforms Ballarat in passengers per service however Ballarat has a higher rate of passengers per vehicle kilometres.

## 5.2. Relative Competitiveness

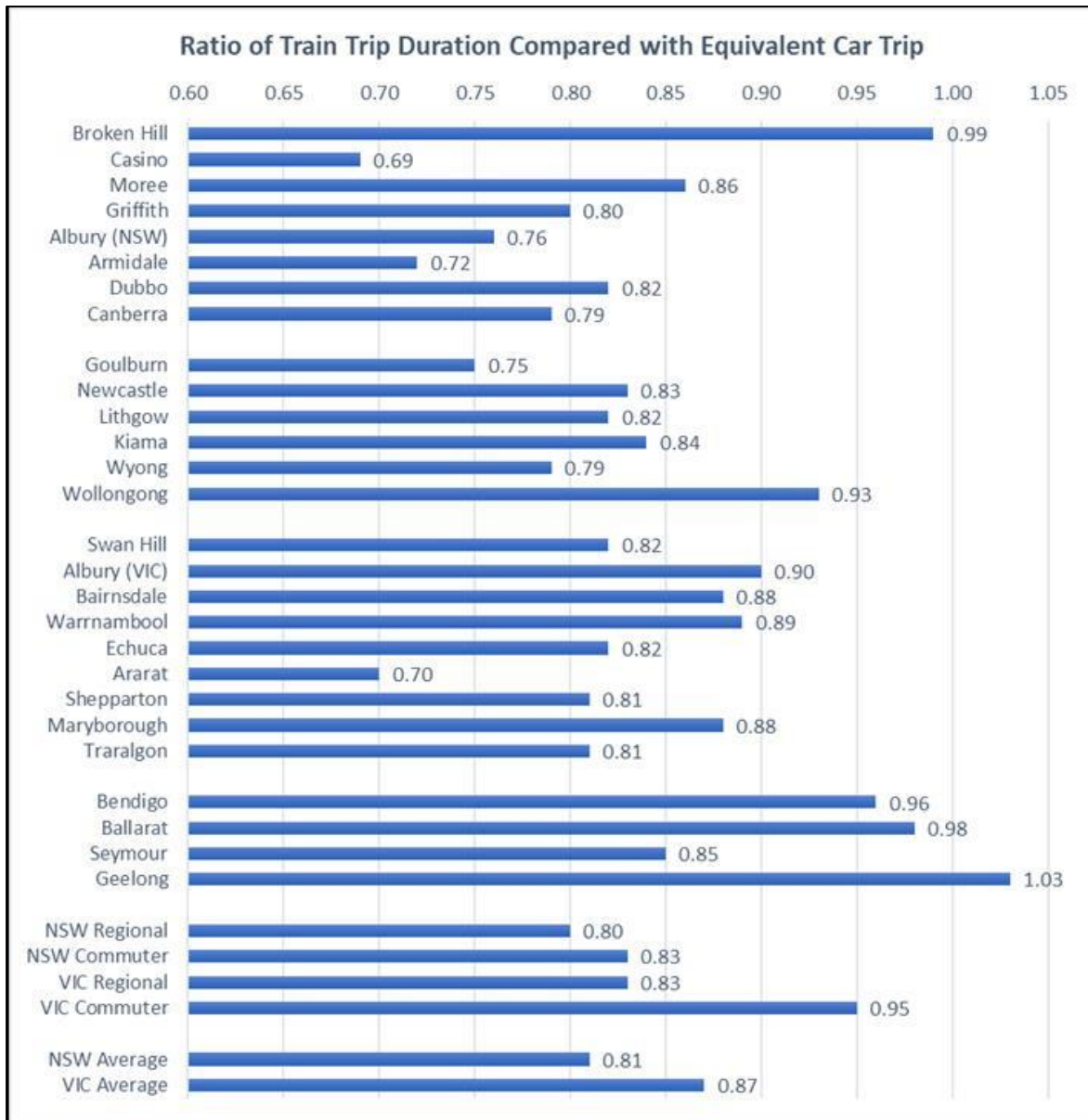
The largest competitor to regional railways in Australia is the use of private vehicles. There are a wide range of factors influencing decisions relating to mode of travel choice. Two of these factors are travel time and ticket prices.

### Relative Car-Rail Travel Time Competitiveness

Figure 3 shows the comparison of rail travel time to the equivalent private vehicle trip and is displayed as a ratio. The higher the ratio in Figure 3, the more competitive the train travel time is compared with private vehicle trips. Figure 4 shows the ticket price per kilometre for all the rail lines.

The results of the comparison between travel times of train and private vehicles show that:

- Only the Geelong line achieves a train travel time faster than the equivalent vehicle trip.
- Other lines including Broken Hill (0.99), Ballarat (0.98), Bendigo (0.96) and Wollongong (0.93) provide services which have a similar speed to private vehicles.
- Casino (0.69), Ararat (0.70) and Armidale (0.72) have the lowest train to private vehicle travel time ratio.
- Overall, the Victorian rail lines are more competitive in terms of comparison to private vehicle trips than NSW.



**Figure 3: Comparison Between Train Trip and Equivalent Car Trip Duration**<sup>1213</sup>

Relative Ticket Price per Km

In terms of ticket price per kilometre the results show that:

- Ticket prices per kilometre are 7% cheaper in NSW (average of \$0.81) compared to Victoria (average of \$0.87).
- Ticket prices for the Victorian commuter based lines (\$0.20) are nearly three times the price of those in NSW (\$0.07).
- The most expensive lines are Bendigo (\$0.22), Ballarat (\$0.20) and Geelong (\$0.19); each of these lines are classified as Victorian ‘commuter based’ lines.
- The lowest priced lines are Goulburn, Newcastle, Blue Mountains and Kiama, all of which are NSW 'commuter based' lines.
- The NSW 'regional' lines (\$0.80) are slightly cheaper (3.6%) per kilometre than the Victorian 'regional' lines (\$0.83).

<sup>12</sup> Averages used in Figure 3 are not weighted

<sup>13</sup>The scale for Figure 3 is set from 0.60 to 1.05.

- Whilst the Victorian routes are more competitive in relation to trip travel time, the results show that the rail lines in NSW outperform those in Victoria in relation to ticket pricing per kilometre.

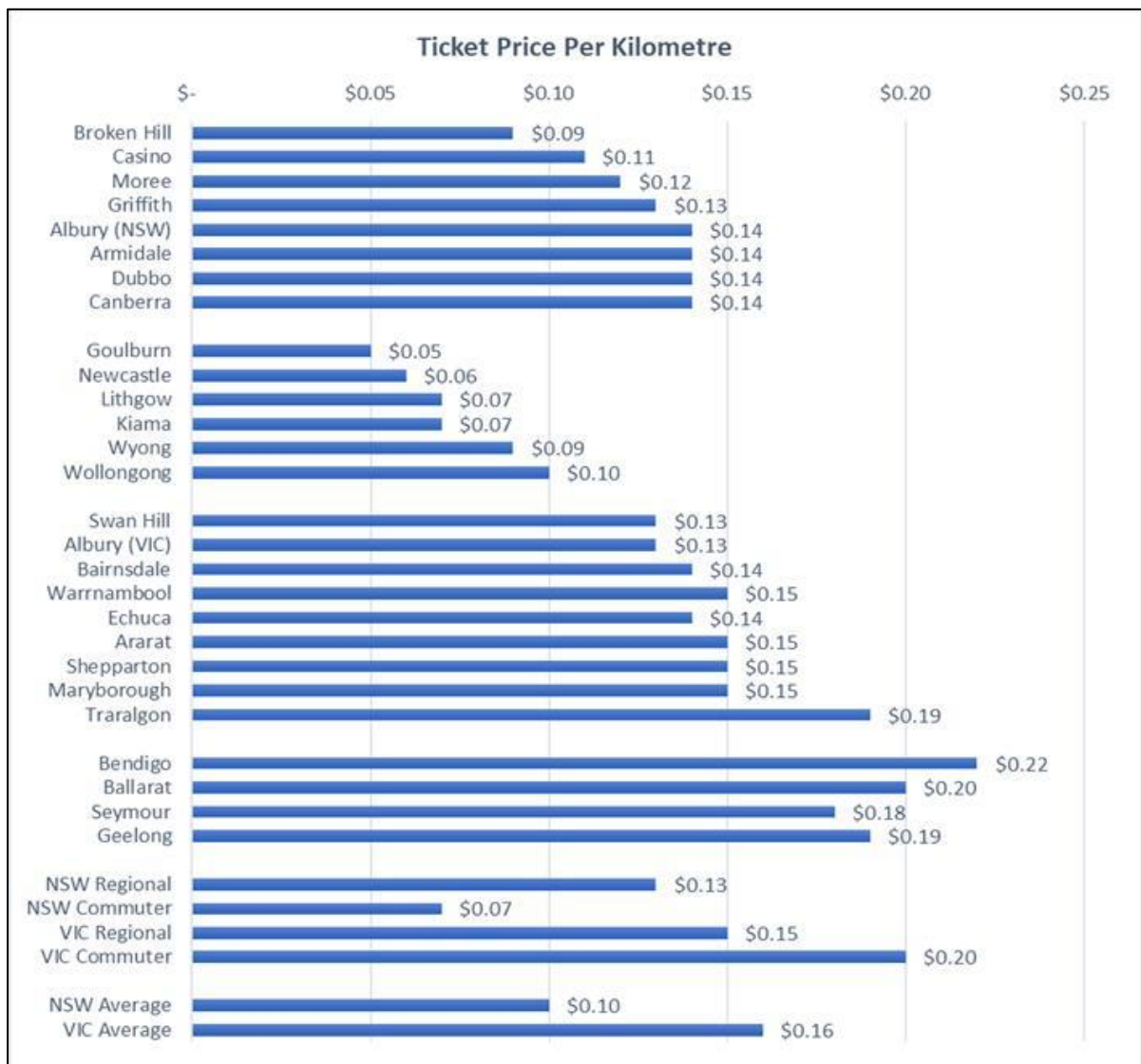


Figure 4: Ticket Price per Kilometre by Line

## 6. Discussion and Conclusions

This research paper has conducted a performance assessment into regional public transport railways in the Australian states of New South Wales and Victoria. The performance assessment was undertaken in terms of service effectiveness and relative competitiveness. Results indicate that broadly, the railways in NSW have higher service effectiveness than those in Victoria. Service effectiveness is also higher on the ‘commuter based’ lines compared to ‘regional’ lines in both states.

In terms of relative competitiveness, results were provided in terms of two different aspects of competitiveness: travel time and price. Results indicate that Victorian commuter based lines vastly outperformed the NSW lines and Victorian regional lines with competitiveness with regards to equivalent travel time with private vehicles. However, the ticket price per kilometre

was the highest for the Victorian commuter lines, being nearly three times that of the equivalent routes in NSW.

It is clear from these findings that pricing policies in each state are rather different and have little association with service competitiveness with the private car.

It is observed from the results that the highest performing lines in terms of service effectiveness (Wyong and Lithgow) are below average in travel time comparisons with private vehicle trips. The Ararat line in Victoria also shares this trend, being the highest performing Victorian regional line in terms of service effectiveness yet, having the second lowest travel time ratio in terms of service competitiveness. This would suggest that comparative travel time with private vehicles may not be a dominant factor in passenger travel mode choice.

It is suggested that future research be undertaken into the topic of regional public transport. Future studies should investigate the boarding patterns of regional railways to determine what percentage of passengers use the rail lines for travel into the capital cities as opposed to other trips along the rail corridor. Analysis of rail lines in other Australian states including Queensland and Perth would also allow for further insights into the performance of regional railways in Australia.

## 7. Acknowledgements

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