Lies, Damned Lies and Statistics

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Abstract

This paper tracks the historical growth of Sydney's and Melbourne's world-size suburban passenger railways from Federation to the current day prior to the COVID-19 pandemic. At the turn of the 20th Century, the carriage of suburban passengers was commercially attractive since most of their patronage was attracted to each city's growing CBDs. Their patronage growth and average trip lengths prompted electrification during Australia's first heroic age between Federation and the Great Depression. Even so, these suburban railways were still dominated by each city's tram networks. After rail performed heroically during WWII, patronage stagnated and then declined in response to the growth in private vehicular travel. Furthermore, the suburban railways became a drag on railway finances. Rail patronage did not grow again until signature infrastructure projects were completed and traffic congestion made rail more attractive to commuters, who now constituted two-thirds of patronage. Rail was also now attracting commuters who were not travelling to their CBDs. Furthermore, peak hour trains were becoming more crowded than they were immediately prior to WWII. Unfortunately, the COVID-19 pandemic has now stymied the progressive growth in suburban railway patronage.

1. Introduction

The title of this paper is attributed to Benjamin Disraeli, the 19th Century British Prime Minister. Of course this attribution is shaky, just as railway patronage statistics are. The problems in the latter arise from the treatment of multi-ride tickets and even the definition of what constitutes a trip. There is even the no small matter of what may be regarded as a suburban or an interurban trip, since statistical boundaries have moved outwards as metropolitan areas have grown (ABS 2012). Furthermore, the collection of patronage data consumed resources, which sometimes, such as during wartime, just were not available. At such times only estimates were made. Notwithstanding these problems, an analysis of metropolitan and interurban patronage, comparing the Sydney and Melbourne rail systems, should reward us with insights as to how the two systems have developed and have been used.

2. What matters

The first problem is when to begin this comparison. Both the Victorian and NSW railway systems opened in the mid 1850s. However, the systems developed in different ways, in that there was comparatively more interest in Melbourne in developing suburban passenger railways than was the case in Sydney. Nevertheless, both Colonies planned and constructed what were, for their times, *"nation-building"* railways. The land speculation in Melbourne in the 1880s, and the associated orgy of suburban railway construction (Davison 1978), were followed by a bust and a deep recession in the 1890s. Sydney was not immune to this economic downturn, since it had its origins in debilitating drought, as well as bank failure. However, outlooks were improving by the turn of the 20th Century, by which time the Australian Colonies had federated. Therefore, the start of the new country, the Commonwealth of Australia, seems a good a time to begin a comparison.

There is also the matter of placing suburban railway patronage in their overall transport context. Both Sydney and Melbourne had burgeoning tram networks at the turn of the 20th Century. Sydney's was largely a steam tram system starting in 1879, with two isolated cable tram routes, and the beginnings of electric operation by the turn of the century. That in Melbourne was a cable tram system starting in 1885. In both cities, the main tram systems operated alongside horse trams and buses. The significant development in Sydney during the first decade of the century was the rapid conversion of steam and cable operations to electric operation, accompanied by network extension. During the same period in Melbourne, there was a consolidation of cable tram patronage, with the first signs of connecting electric tram services abutting cable tram routes. The significance of tram and, later, bus public transport was whether it complemented or competed with suburban train operations.

The other contextual issues were the rates at which Sydney and Melbourne were growing and their relative dominance of the associated State populations (ABS 2016). Suburban population growth was certainly seen to drive suburban passenger train patronage. This was because residential growth was more likely to spread along suburban railway lines than to intensify along tram routes. The increase in average suburban rail trip length is a marker for this phenomenon. However, population estimates need to be anchored in periodic censuses.

Prior to Federation, each Colony was required to conduct censuses at the British Government's direction. The last such census was undertaken in 1881, but not systematically across all Colonies. The first Australia-wide census was undertaken in 1901 by all States to a common questionnaire. The first national census was undertaken in 1911 for the Commonwealth Government by the predecessor to the Australian Bureau of Statistics (ABS). Censuses were then undertaken in broken intervals at 1921, 1933, 1947, 1954 and 1961. Thereafter, censuses have been undertaken every five years using ever more extensive questionnaires. By 1976, questions on workforce, employment, journey-to-work and principal mode of travel were being asked systematically across Australia. Measures, such as regional population, have been subject to periodic definitional changes, especially since population growth has forced regional boundary changes.

3. Population and public transport patronage trends

Figure 1 presents an historical overview of Sydney and Melbourne patronage (in million passengers per annum - Mppa) on suburban (SB) and interurban (IU) railways and tramways and regional population (in thousands) between 1901 and 2019. Thus, this overview spanned 2016, because this was a census year. Accordingly, reliable statistics and complementary reports were available. Even though each curve is labelled, crossovers between Sydney and Melbourne population and train and tram patronage curves can be difficult to discern.
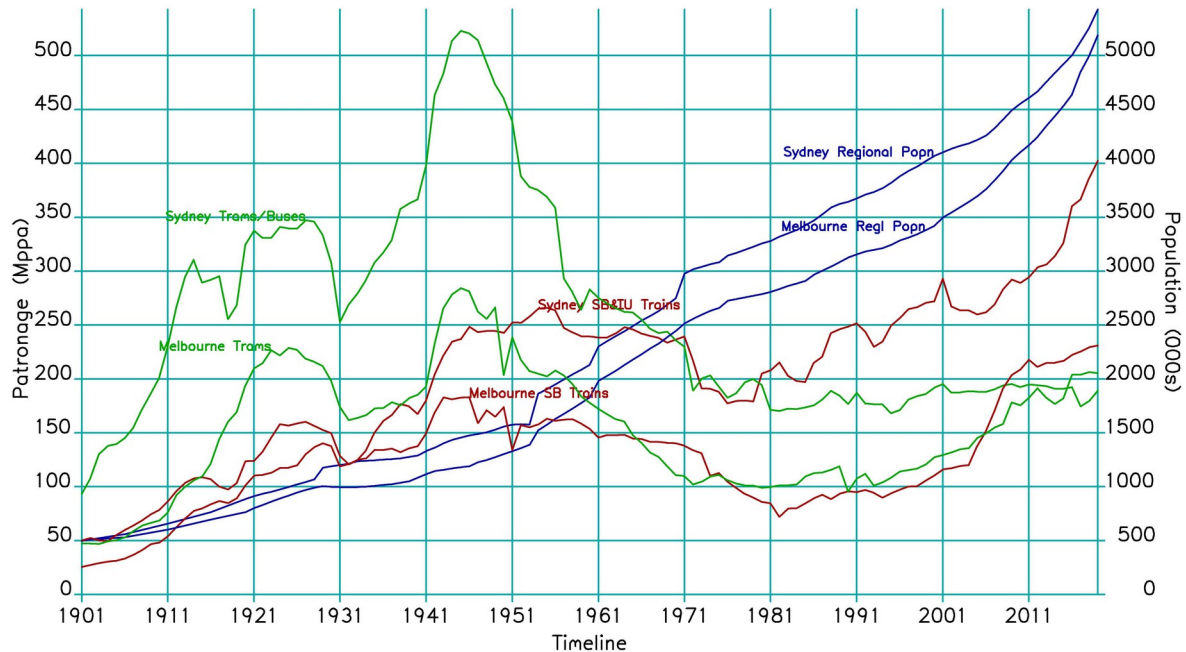
3.1 Regional population changes

At the turn of the 20th Century, Sydney's population had almost caught up to Melbourne's. Within the uncertainties of early population statistics, it is probable that Sydney's population overtook Melbourne's by 1903, because Melbourne had taken longer than Sydney to climb out of the 1890s recession. Thereafter, both cities steadily grew in population. Again, allowing for the coarseness of early population statistics, WWI does not seem to have slowed population growth. Sydney's and Melbourne's populations continued to grow until the Great Depression, after which they plateaued until the start of WWII.

Population grew in both Sydney and Melbourne throughout WWII and beyond at a similar rate, as it did during WWI. However, the impact of post-war immigration does not seem to have become fully apparent until the 1954 census.

The 7-year gap between the 1947 and 1954 censuses and anomalous interpolation masked the year-by-year impact of annual immigration rising to over 150,000. Thereafter, the regional populations of Sydney and Melbourne grew at an accelerated rate, with Sydney gradually drawing away from Melbourne until 1971. This trend continued to 2001, when Melbourne's population began gaining on Sydney's population. Intervening events, such as the 1960 Credit Squeeze, the 1973 Oil Shock, the 1987 Wall Street Crash, Australia's 1992 recession or even the 2008 Global Financial Crisis, do not appear to have affected continued population growth.

Figure 1: Historical Sydney and Melbourne Regional Population and Suburban (SB) and Interurban (IU) Railway and Tramway and Bus Patronage (million passengers per annum – Mppa)

Regional population growth in both Sydney and Melbourne seems to have driven suburban railway patronage until the mid-1950s. There was then a 25-30 year hiatus before suburban railway patronage again began tracking with population, albeit from a lower base than in the 1950s. In this intervening period, both the Sydney and Melbourne suburban railways each lost approximately 80 Mppa.

3.2 Street public transport competition

It seems to have been a recurring theme with the Victorian Railway Commissioners in their Annual Reports, that Melbourne's trams were drawing traffic away from the suburban trains. In one respect, the continued lengthening of suburban railway journeys may have been a reflection of such a phenomenon. However, Melbourne's train patronage still grew steadily until the Great Depression, as did Melbourne's tram patronage. On the other hand, erosion of train patronage by tram services does not seem to have concerned the NSW Railway Commissioners, possibly because they also ran Sydney's trams until 1930.

Sydney's trams attracted many more passengers than Melbourne's trams during WWI but seem to have been more greatly affected by the 1919 Influenza Epidemic than Melbourne's. Thereafter, both tram systems' patronage grew until the start of the Great Depression. They both took large patronage hits during the Great Depression, as did both suburban train systems, but then recovered to 1920s levels by the start of WWII. By then, Sydney was already running complementary bus services. Street public transport (trams and buses) attracted significantly more trips than the adjacent suburban railways until the end of WWII.

However by 1960, tram and bus patronage had collapsed by as much as 50%, particularly in Sydney. On the other hand, suburban train patronage held up until 1970 before declining. At that stage, New South Wales Government Railways (NSWGR) officers were now complaining that the government buses were syphoning off suburban train patronage! However by then, all modes of public transport were losing patronage as private motor vehicle ownership was sharply rising.

By the 1980s, when suburban train patronage was beginning to grow again, tram and bus patronage had stabilised, if not started to grow again, particularly in Melbourne.

Street public transport and suburban railways generally serve different market segments. On average, street public transport trips are considerably shorter than suburban train trips. Today, average trip lengths on both the Sydney and Melbourne train systems are about 18 kilometres, having risen from about 10 kilometres at the start of the 20th Century, as both cities spread out.

3.3 The business of suburban passenger railways

Suburban passenger train services were profitable concerns at the beginning of the 20th Century. Both the NSW and Victorian Railway Commissioners encouraged and catered for this burgeoning traffic.

Figure 2 presents an historical comparison of Sydney and Melbourne suburban/interurban railway patronage between 1901 and 2019. WWI brought rapid growth in suburban railway patronage in both Sydney and Melbourne, although Melbourne retained an absolute lead of 20-30 Mppa until 1919. However, Melbourne then experienced a drop of over 10 Mppa in patronage by the end of WWI whereas Sydney experienced a modest increase of 5 Mppa in patronage over the same period. Nevertheless, both systems lost patronage during the 1919 Influenza Epidemic.

Figure 2: Historical Sydney and Melbourne Suburban (SB) and Interurban (IU) Railway Patronage
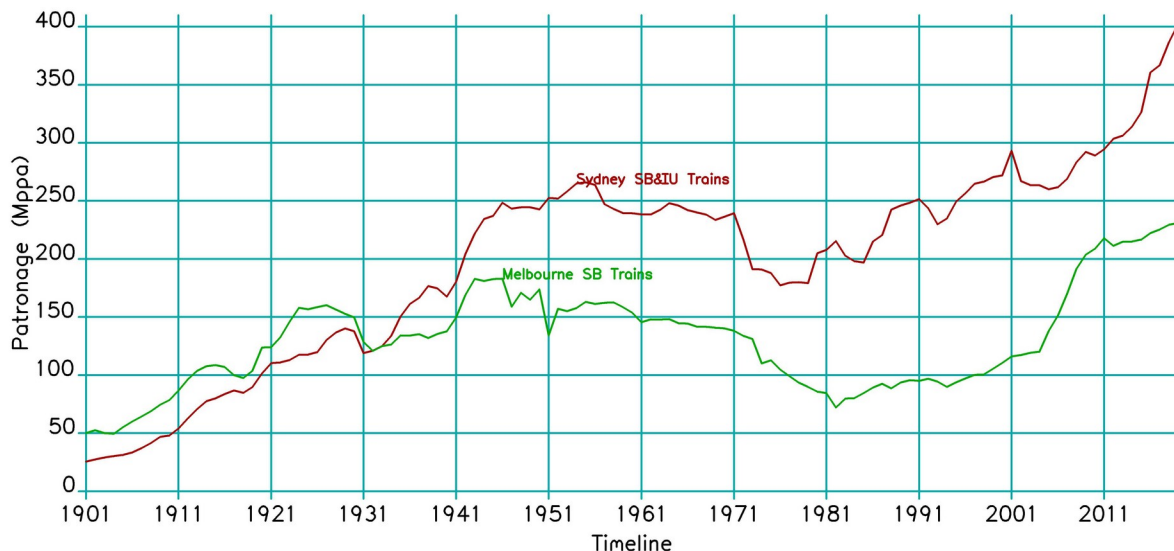

Melbourne's patronage rapidly recovered in step with electrification up to the mid 1920s, gaining almost 60 Mppa between 1919 and 1927, when electrification was complete. Patronage then stabilised, before falling 40 Mppa (25%) by the depths of the Great Depression. Sydney's trains gained 50 Mppa from 1919 to the start of the Great Depression, as the Sydney system was being electrified. However by the time when the Sydney Harbour Bridge was opened in 1932, Sydney's patronage had fallen by 20 Mppa (14%).

Post Depression, Melbourne's patronage grew slowly by 15 Mppa to the start of the WWII, whereas Sydney's grew by over 50 Mppa. Sydney's patronage probably overtook Melbourne's in 1932. Despite an early downturn, Sydney's patronage grew 80 Mppa by the end of WWII and demobilisation, while Melbourne's grew by almost 50 Mppa in the same period.

Thereafter, Sydney's patronage slowly grew by 18 Mppa to a peak of 266 Mppa in the mid 1950s whereas Melbourne's declined 20 Mppa. However, the Melbourne system was beset by coal shortages and prolonged railway strikes during 1949 and 1950. The 1956 Melbourne Olympic Games do not appear to be reflected in Melbourne's train patronage, although there appeared to be a modest upturn in Melbourne's tram patronage. Thereafter, Sydney's and Melbourne's train patronage plateaued until 1970, while the corresponding street public transport patronage was in free fall in both cities.

Sydney's suburban train patronage tumbled 60 Mppa (by roughly 25%) after 1971 following a 50% increase in fares (later moderated). Patronage only started to recover after the opening of the Eastern Suburbs Railway (ESR) in 1979. Sydney's patronage then grew in fits and starts by 114 Mppa to 2001. It received a one-off boost of 15 Mpax from the 2000 Sydney Olympic and Paralympic Games. Melbourne's suburban train patronage declined by more than 60 Mppa until the full opening of the Melbourne Underground Rail Loop (MURL) in 1985 but then grew by 35 Mppa to 2001.

Figure 3: Comparisons between Suburban (SB) and Interurban (IU) Railway Patronage, the Morning Peak Period Journey-to-Work by Rail and the Levels of Regional Workforce for Sydney and Melbourne
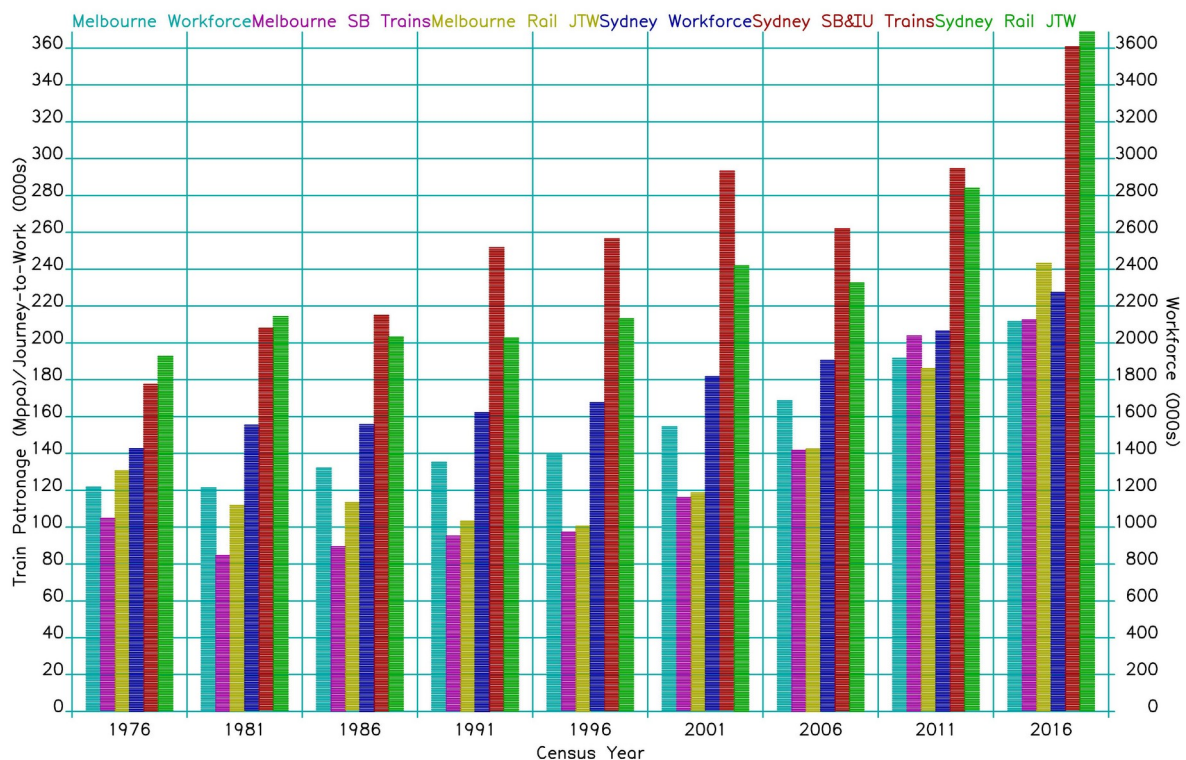
After the 2000 Olympic and Paralympic Games, Sydney's economy seems to have fallen asleep for over five years. In contrast, Melbourne's economy grew substantially, as illustrated in Figure 3. Melbourne's train patronage seems to have tracked with changes in the journey-to-work-by-rail to 2011. After 2011, Sydney's patronage returned to growth, while Melbourne's stagnated. Sydney's journey-to-work-by-rail settled down to being 50% greater than Melbourne's, but Melbourne's total workforce was closing on Sydney's.

There have been major data collection and interpretation problems in comparing Sydney's and Melbourne's suburban train patronage since 2003. Until 2003, suburban train patronage was recorded as <u>trips</u> in both systems. After 2003, Melbourne recorded suburban train patronage as <u>boardings</u>.

Boardings clearly double count trips whenever riders change trains to complete their journeys. Taking Sydney as an example (CityRail 2001-2010), there could have been 158,500 passenger interchange movements on a typical 2009 weekday, during which there were estimated to be 999,000 daily trips, ie boardings might have been 16% greater than trips.

As far as can be established, Public Transport Victoria (PTV), or its predecessors, inflated Metropolitan Transport Authority patronage by roughly 12% from 1982/83 onwards to reflect the difference between trips and boardings. However, since 2008, if not earlier, PTV estimated that boardings only exceed trips by 5%. I have accordingly chosen to reduce Melbourne boardings to trips in the interests of consistent patronage comparisons. That having been said, there has still been a remarkable turnaround in Melbourne's suburban train patronage since the turn of the 21st Century. In the decade from 2001, Melbourne's train patronage rose 100 Mppa, while Sydney's patronage fell 33 Mppa before regaining 34 Mppa. However between 2011 and 2019, Sydney's patronage grew 80 Mppa more than Melbourne's. Nevertheless, Melbourne's patronage has clearly improved in line with the growth in its regional population and the geographic reach of its suburban railway network.

4. How these suburban railways have been used

4.1 Melbourne afternoon peak hour cordon counts

Table 1: Comparative Afternoon Peak Hour Train (Trns) and Passenger (Pax) Cordon Counts and Average Loads (AvL) for the Melbourne Suburban Railways

| Approach or Departure Line | Afternoon Peak Hour (1700-1800) | | | | | | | | |
| | 1939 | | | 2006 | | | 2011 | | |
	Trns	Pax	AvL	Trns	Pax	AvL	Trns	Pax	AvL
Clifton Hill	18	10393	577	12	8728	727	12	9420	785
Lines North (1 Line)	18	10393	577	12	8728	727	12	9420	785
Burnley	21	13041	621	29	14910	514	29	15810	545
Caulfield	20	14110	706	18	13534	752	22	14430	656
Sandringham	14	9837	703	6	3508	585	7	4510	644
Lines East (3 Lines)	55	36988	673	53	31952	603	58	34750	599
Pt Melbourne & St Kilda	17	5701	335	Nil			Nil		
Lines South (2 Lines)	17	5701	335	Nil			Nil		
Broadmeadows	9	5372	597	6	4383	731	8	5830	729
Rest of Northern	16	9141	571	14	8761	626	20	14690	735
Lines West (2 Lines)	25	14513	581	20	13144	657	28	20520	733
Total Suburban	115	67595	588	85	53824	633	98	64690	660

Victorian Railways' retiring Chief Civil Engineer, JM Ashworth, undertook a comprehensive review of the operations of the Melbourne Suburban Railways between 1939 and 1940 (Ashworth 1940). Mr Ashworth compared Melbourne's trains with its trams and Sydney's trains and trams. He observed the lengthening of suburban railway journeys (and the implications for additional rolling stock). He illustrated the highly peaked nature of suburban railway traffic attracted to the Melbourne CBD and observed that the afternoon peak was more intense than the morning peak. He also dissected the afternoon peak hour train loads departing the Melbourne CBD. Refer to Table 1. He was concerned about the ability of the suburban railways to handle more passengers, either by running more trains or by carrying more passengers per train. For example, 20 Caulfield Line trains were running at 114% of seated capacity during the peak hour.

In 1939, central Melbourne was approached by:

- four double-track lines from the east and north (ie Clifton Hill, Burnley, Caulfield and Sandringham);
- two double-track lines from the south (ie Port Melbourne and St Kilda); and
- two double-track lines from the north and west (ie the North and South Viaducts).

Clifton Hill services operated out of Princes Bridge station, largely independently of the main Flinders Street operations. Similarly, Port Melbourne and St Kilda services operated independently out of Platforms 10&11 on the southern side of Flinders Street station. Eastern traffic exceeded western traffic by more than 150% on the remaining lines.

Originally, the Broadmeadows and Sandringham Lines ran as a through service via the South Viaduct tracks. However by 1939, Sandringham traffic was 80% greater than Broadmeadows traffic so that not all Sandringham trains ran through to Broadmeadows. All other traffic terminated in Platforms 2-9 at Flinders Street. This traffic imbalance was a catalyst for ultimately developing the MURL.

Many works were undertaken to increase the numbers of tracks approaching Flinders Street post WWII. Another double track Caulfield line was completed between Flinders Street and South Yarra in early 1960. A further double track line was completed between Flinders Street and Burnley between 1966 and 1974. The double-track Through Suburban Viaduct was completed between Flinders Street and (then) Spencer Street in 1978. The four single-track MURL Loops were progressively brought into service between 1981 and 1984.

The combination of the greater number of approach lines and the operational independence of the MURL Loops allowed Melbourne suburban operations to be functionally separated into five operating Groups. However, the fifth Group was short-lived because the double-track Port Melbourne and St Kilda Lines were both closed and converted to Light Rail late in 1987.

There have been significant physical and cultural changes to Melbourne in moving from the 1930s to the 2000s. The 1939 afternoon peak was driven by longer and more rigid working hours than nowadays, the culture of the 6 O'clock Swill, the lack of home entertainment (eg television) and low car ownership, amongst other things. By 2006, the Port and St Kilda Lines had been absent from the Melbourne railway network for almost 20 years. Nevertheless, many of the old traffic imbalances still existed, although the Sandringham and Broadmeadows Lines were closer to traffic balance. However, the suburban railways in 2006 were only carrying marginally more passengers (ie 141.6 Mppa) than in 1939 (ie 135.5 Mppa) (Banger 2011). The afternoon peak hour was now less intense than in 1939 while the morning peak hour was probably now more intense than the afternoon peak hour.

In 2011, the Melbourne suburban railways carried 44% more travellers than in 2006. However, the afternoon peak hour only grew by 20%. Afternoon peak hour traffic grew on all lines, although the larger gains now occurred on lines to the north and west of Melbourne (PTV 2013 & 2015). Nevertheless, the eastern vs western traffic imbalance was still apparent.

Notwithstanding the high seating capacity of the swing door (*"Dogbox"*) and sliding door (*"Tait"*) cars of 1939 trains, most trains, on average, would have left with some standees during the afternoon peak hour, particularly to the east of the CBD. Average loads were dragged down by the low loadings of Port Melbourne and St Kilda trains. If those lines were excluded, then loads would have averaged 632 passengers, ie 102% of seats. By 2006, Melbourne's fleet comprised Hitachi, Comeng, Alstom and Siemens trains with an average of 523 seats apiece. While 13% fewer trains were run, there had been virtually no change in average loads, but trains were now running at 121% of seats. The jump in patronage over the five years to 2011 saw a return to 1939 train service levels (ie without Port Melbourne and St

Kilda services) but now trains were running, on average, at 126% of seats. However, trains running to the north and west of the CBD were loaded to 150% of seats.

By dint of analysis it can be discerned that there has been a substantial redistribution of passengers away from Flinders Street to stations around the MURL. In 1939, it was claimed that Flinders Street was the single busiest commuter station in the world with 67,597 passengers entering the station during the afternoon peak hour, possibly representing up to 80% of network station entries. Comparable passenger numbers were not available for 2011. However, the CBD stations as a whole now only accounted for 58% of afternoon peak period station entries and Flinders Street station now only accounted for 34% of CBD station entries. Flinders Street has definitely come off the boil, probably to the relief of station staff.

4.2 Sydney afternoon peak hour cordon counts

Unfortunately, there is no report for Sydney suburban railways comparable to Mr Ashworth's report, although the first attempt at systematic CBD cordon train load counts were undertaken in 1935 (Corry et al 1935), so it is difficult to compare the two systems just prior to WWII. However, there was an internal NSWGR report written in 1963 that explored the consequences of Sydney's rapid post-war urban growth. The County of Cumberland Planning Scheme was prepared in 1948, informed by the results of the 1947 Census. This regional plan sought to incorporate *"Green Belts"* between the suburban railway lines radiating from central Sydney. It also endorsed NSWGR's plans to complete Dr Bradfield's inner and outer suburban electrification plans. In the face of rampant urban growth, the green belts crumbled so that new urban planning directions were needed. In the period between 1947 and 1963 the NSWGR experienced both suburban patronage growth and intensification of its peak periods.

The NSWGR report reviewed population changes between the 1947, 1954 and 1961 censuses. It then looked at patronage changes. While patronage attracted to the Sydney CBD had increased, patronage outside the CBD, for example to the central and western industrial areas, had declined. Finally, like the Ashworth report, it canvassed what opportunities existed to handle the growing peak periods, when the first double deck passenger cars were being introduced in 1964. At that time, there was a love-hate relationship with double deck cars: they could increase train capacity; but they could also lengthen CBD station dwell times.

In 1963 central Sydney was approached by:

- two double-track lines from the south (the Illawarra Main and Illawarra Local Lines), merging into the double-track City Railway entering the CBD via Museum;
- two double-track lines from the west (the Suburban and Local Lines) splitting into the double-track North Shore Line and the double-track City Railway entering the CBD via Town Hall; and
- one double-track line from the north (the North Shore Line).

The double track City Railway comprised the clockwise City Outer (CO) track leading from Platform 17 at Central and the anti-clockwise City Inner (CI) track leading from Platforms 20 and 21 at Central.

Referring to Table 2, and comparing 1939 Melbourne with 1963 Sydney, the Sydney system had to carry more people over fewer approach lines (ie four versus eight) than the Melbourne system but at significantly higher average train loads.

The approaches to the Sydney CBD underwent some significant changes between 1963 and 2000. The double-track ESR was opened in mid 1979 as a shuttle between Central and Bondi Junction. It was through-routed to the Illawarra Line in 1980. This effectively increased the number of approach lines from four lines to six. It also allowed suburban operations to be

separated into three quasi-independent Sectors. However, there could never be as clear a physical division between discrete operating Sectors in Sydney as there could be in Melbourne because of the sharing of:

- the Illawarra tracks between Central and Wolli Creek Junction by Sectors I and II; and
- the Main Suburban tracks between Central and Granville by Sectors II and III.

Finally, the Airport Line was opened between Central and Wolli Creek in 2000, taking pressure off the Illawarra Local Line. In combination with the 1987 completion of the link between East Hills and Glenfield, the operational impact was to divide southwestern CBD approach traffic between the City Outer (via Town Hall) and City Inner (via Museum) tracks.

Table 2: Comparative Afternoon Peak Hour Train (Trns) and Passenger (Pax) Cordon Counts and Average Loads (AvL) for the Sydney Suburban and Interurban Railways

| Approach or Departure Line | Afternoon Peak Hour (1700-1800) | | | | | | | | |
| | 1963 | | | 2006 | | | 2011 | | |
	Trns	Pax	AvL	Trns	Pax	AvL	Trns	Pax	AvL
Eastern Suburbs	Nil			10	4710	471	10	5600	560
Illawarra Main	Nil			11	10645	968	13	13140	1011
Sector I (1/2 Lines)	Nil			21	15355	731	23	18740	815
Airport/Illa Local (CO)	22	21453	975	12	9150	763	11	9645	877
Local (CI)	22	16909	769	16	15010	938	17	15785	929
Sector II (2 Lines)	44	38362	872	28	24160	863	28	25430	908
North Shore	16	10500	656	11	9730	885	13	12380	952
Suburban	20	20770	1039	18	19155	1064	19	18995	1000
Sector III (1/2 Lines)	36	31270	869	29	28885	996	32	31375	980
Total Suburban	80	69632	870	78	68400	877	83	75545	910
Main/Interurban	N/A			15	8040	536	15	8200	547
Total Subn & Interurban	80	69632	870	93	76440	822	98	83745	855

The 6 O'clock Swill did not figure in the 1960s, so Sydney's afternoon peak was at least half an hour earlier than Melbourne's (NSWGR 1963). Car ownership was on the rise. Industrial employment was dispersing to the suburbs. Finally, many households had television, meaning fewer people were travelling to theatres. Government buses bore the brunt of patronage losses at this time. The areas surrounding the Sydney CBD were losing their industrial workforce, indicated by a reduction in CBD arrivals before 0800, while gaining office and retail employment, driving CBD arrivals after 0800 ever higher. It is likely that Sydney's morning and afternoon peak hours did not top out until after 1966. Prior to 1960, it is likely that the afternoon peak hour was more intense than the morning. Thereafter, the morning was busier than the afternoon, but only by 4% in 1963 (NSWGR 1958-1976).

In the post-Olympics Sydney of 2006, the total suburban and interurban afternoon peak hour passenger flow was 10% higher than in 1963. There had been a significant redistribution of traffic away from the City Railway to the Eastern Suburbs and Illawarra approach lines. There had also been a shift of some traffic from suburban to interurban services. Furthermore, the morning peak hour was now 30% higher than the afternoon peak hour (CityRail 2001-2010).

There was a further 12% increase in annual patronage and a 10% increase in afternoon peak hour flows in the five years from 2006 to 2011. At a Sector level, the Eastern Suburbs and Illawarra Lines grew the most in patronage. However at a Line level, the North Shore Line grew the greatest, reflecting traffic growth from the Epping-Chatswood Rail Link (ECRL).

In 1963 the Sydney suburban railways were approaching severe peak hour crowding. Since the late 1930s, more standing area had been created in the trains by converting the end compartments of cars from transverse to longitudinal seating and by increasing the size of door vestibules. By 1963, an 8-car single deck train would have averaged 550 seats. However,

afternoon peak hour trains would have been running at 158% of seated capacity. The newly introduced double deck cars promised increased seating capacity, but they then only amounted to 10% of the fleet.

Moving to 2006, afternoon peak hour suburban train numbers and average loads were static with 2% fewer trains but the completed conversion of the fleet from single deck rolling stock to double deck rolling stock had increased average seating capacity to roughly 864, ie an increase of 57% over single deck rolling stock. Average afternoon peak hour loads were 101% seats, compared to that for the morning peak hour of 118% seats. Moving on five years to 2011, afternoon peak hour train numbers had increased 4% from 1963, however there had been a slight increase in average train capacity to 885 seats, ie an increase of 61% over single deck rolling stock. Average afternoon peak hour loads were 103% of seats, compared to that for the morning peak hour of 118% of seats (BTS 2012). Clearly the conversion of the fleet to double deck trains, coupled with the redistribution of traffic after the through routing of Eastern Suburbs and Illawarra trains, has, on average, dramatically eased crowding.

As a result of the way in which the City Railway, North Shore and ESR served the Sydney CBD, passengers had always been distributed between stations to within 400-800 metres of their destinations. Prior to completion of the City Railway, Wynyard and St James were the most important CBD stations. Once the City Railway had been completed in 1956, Wynyard became the dominant CBD station. It grew from 23,899 morning peak hour exits in 1958 (35% of total station exits) to a high point of 34,591 exits in 1966 (44% of the total). The ESR was opened in 1979 during the post-WWII patronage nadir. Wynyard declined to 22,399 exits in 2013 (26% of morning peak hour station exits) because Martin Place drew off Illawarra traffic and because Town Hall (23,479 exits) and Central (21,222 exits) caught up as CBD development moved southwards towards Railway Square (NSWGR 1958-1976 & BTS 2014).

5. The Sydney and Melbourne CBDs as traffic attractors

5.1 Sydney's railways

By collating system-wide 2011 morning peak period station entries and exits with CBD cordon counts, the following balances may be obtained (see BTS 2012):

- 352,150 passengers (100.0%) entered the network;
- 148,870 passengers (42.3%) exited the network upstream of the CBD;
- 203,280 passengers (57.7%) crossed the CBD cordon;
- 157,670 passengers (44.7%) exited the CBD stations; and
- 45,610 passengers (13.0%) exited the network downstream of the CBD.

Thus, roughly 45% of morning peak period passengers were attracted to the CBD while roughly 55% of passengers were attracted to stations outside the CBD. Of these latter passengers, 42% exited stations en route to the CBD and 13% transited the CBD to exit stations on the opposite side of the CBD. This suggests that Sydney has a land use disposition that encourages public transport accessible employment development outside the CBD.

5.2 Melbourne's railways

By collating system wide 2011 morning peak period station entries and exits with CBD cordon counts, the following balances may be obtained (see PTC 2013 & 2015):

- 232,710 passengers (100.0%) entered the network;
- 80,710 passengers (35.0%) exited the network upstream of the CBD;
- 152,000 passengers (65.0%) crossed the CBD cordon;
- 137,000 passengers (59.0%) exited the CBD stations; and

- 15,000 passengers (6.0%) exited the network downstream of the CBD.

Thus, roughly 60% of morning peak period passengers were attracted to the CBD while roughly 40% of passengers were attracted to stations outside the CBD. Of these latter passengers, 35% exited stations en route to the CBD and 5% transited the CBD to exit stations on the opposite side of the CBD.

Figure 4: Comparison of 2011 Sydney and Melbourne Morning Peak Passengers Entering their Networks
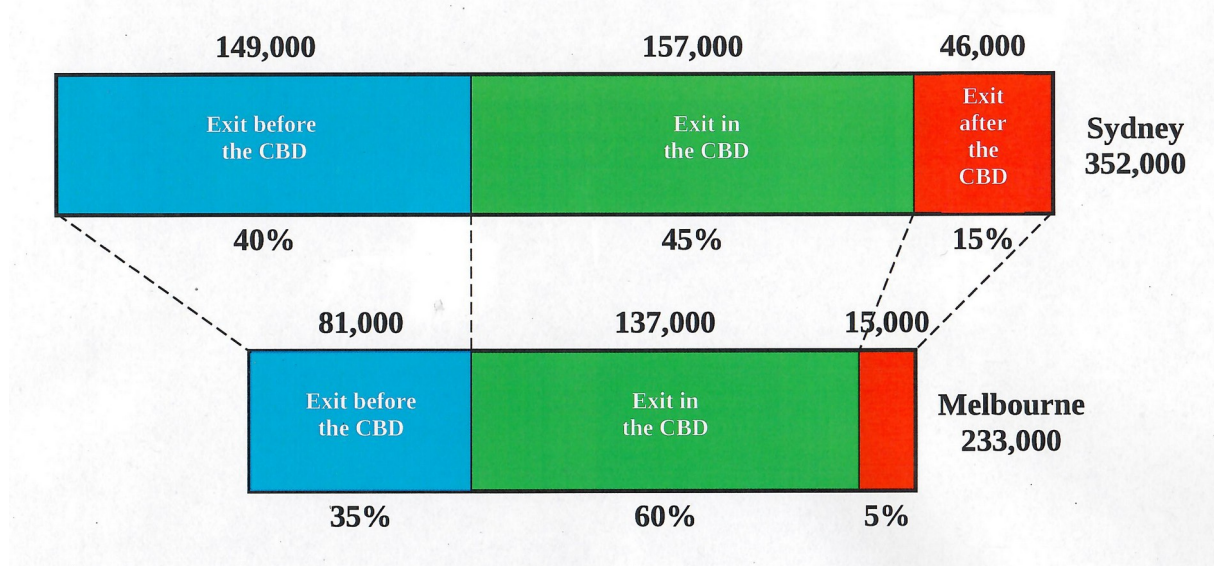
5.3 Invidious comparisons

Figure 4 illustrates the numbers of passengers entering Sydney's and Melbourne's networks during the 2011 morning peak period (ie start of business to 0930) and assigns them to destinations relative to each CBD. The Sydney and Melbourne CBDs are the major trip attractors for their respective suburban and interurban railway systems. While the numbers of passengers exiting each CBD are similar, Sydney carries proportionally more passengers to non-CBD destinations. Thus, Sydney seems to be attracting significantly more non-CBD commuters than Melbourne.

Furthermore, significantly more commuters transit the Sydney CBD than the Melbourne CBD, partly because of the locations of suburban employment locations and partly because of the physical ease of transiting the Sydney CBD. Both Central and Town Hall stations were designed with cross-platform, same-direction transfers in mind. In Sydney, not only are there direct services between the Illawarra Line and the ESR and between the Northern and Western Lines and the North Shore Lines, but also it is comparatively easy to transfer between other services within the CBD for on-travel. By comparison, Melbourne's network is more CBD-centric than Sydney's. Until Metro is operational, Melbourne's only through services run between the Sandringham Line and the Broadmeadows Line.

6. Conclusions

The purpose of this paper was to draw out the similarities and differences between Sydney's and Melbourne's electrified suburban and interurban railways. There have been major definitional differences between what each system regards as trips and what time periods constitute peak periods. This paper has accordingly attempted to level the statistical playing field to draw out the impressive achievements of these two railway systems.

Both Sydney's and Melbourne's suburban and interurban railways are world class in their physical extents and their patronage as suburban or commuter railways, as distinct from inner

city or CBD-centric <u>metros or subways</u>. Patronage grew as the Commonwealth of Australia grew, encouraged by the successive electrifications of Melbourne's and Sydney's systems. The Great Depression reduced both systems' patronage just as they had completed their initial electrifications. Patronage had barely recovered to pre-Depression levels before the onset of WWII. By then, the Sydney system had overtaken the Melbourne system in patronage. WWII led to significant patronage growth because of the suppression of private vehicular travel. Suburban railway patronage tumbled in the 1970s as a result of the post-war growth in private vehicular travel and did not pick up until the 1980s, after both systems had opened signature infrastructure. Sydney then grew more strongly than Melbourne until 2000 while Melbourne grew more strongly than Sydney in the first decade of the 21st century. However, Sydney's patronage growth then accelerated from 2011 to 2019.

Both suburban railway systems primarily serve their respective CBDs and largely cater for the journey-to-work and the journey-to-education. The Sydney system probably now handles more peak period passengers outside the CBD than inside. However, it also encourages peak period passengers to transit the CBD as suburban business districts have grown across the Harbour and out towards Parramatta. The Melbourne system seems more CBD-centric. Nevertheless, it seems that both systems transact two-thirds of their business during the morning and afternoon peak periods. The remaining one-third of their business is spread around their networks outside the peak periods.

The Sydney system probably offers more suburban travel opportunities than the Melbourne system. However, the onset of the COVID pandemic has completely changed the journey-to-work paradigm. In April 2021, the Sydney and Melbourne suburban railway systems were probably transacting barely 60% of their pre-pandemic business (TfNSW 2021).

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