TRANSPORT DISRUPTIONS CAUSED BY INDUSTRIAL DISPUTES: COMMUTER TRAVEL IN THE SYDNEY METROPOLITAN REGION DURING THE RAIL STRIKES

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ABSTRACT:

Resolution of the state-wide rail strike on January 28, 1985 represented the end of the ninth industrial dispute since January, 1980 that disrupted rail services in the Sydney metropolitan region. This paper attempts to describe the responses of both commuters and the traffic authorities in coping with the withdrawal of rail services. It also analyses the change in road traffic conditions during rail strikes by studying the situation before, during and after the nineteen-day strike of June-July, 1983. The traffic counts used in this statistical analysis were collected at ten traffic signal sites in the metropolitan region that formed part of the computerised Sydney Co-ordinated Adaptive Traffic System (SCATS).

INTRODUCTION

The vital importance of transport in the economic and social life of a country is highlighted when there are threats to the normal functioning of the system. For instance, in New South Wales during the rail strike of August, 1984 the State Rail Authority (SRA) lost, each day, an estimated $660,000 in passenger fares and $2 million in freight revenue (Sydney Morning Herald, August 30, 1984). The Retail Trader's Association indicated that store sales in Sydney were down by 10 to 20 percent - a daily trading loss of from $2 million to $4 million - and the three major theatre chains reported a significant drop in attendances. On top of this are extra societal costs: the inconvenience of getting to work, the increased vehicle operating costs to motorists and truck drivers with the extra road congestion, and additional environmental pollution.

Very little, if any, research has been carried out in Sydney on the effects of industrial disputes on traveller behaviour using the functioning transport system. The exception is a report on the effect of the five-week delivery strike to service stations that began in the NSW oil industry in June 1979. Prepared for the Department of Main Roads of New South Wales (Teale, 1980), the study used traffic counts from permanent counting stations in the County of Cumberland to analyse the changes in Sydney's traffic flow which occurred during the strike. In the absence of any previous systematic study Clunas (1984) set out to examine both the short-term and long-term disturbances which occur within urban transport systems, to determine the responses of the relevant authorities to these disturbances, and to assess the magnitude of the changes in travel behaviour and authorities' responses during a specific disturbance or incidence. The Tasman Bridge collapse in Hobart on January 5, 1975 - the result of a collision by 'Lake Illawarra', a bulk ore carrier - has provided an instructive case study for some of the longer term adjustments (Lock and Gelling, 1976; Wood and Lee, 1979).

In this paper, we concentrate on the effects of the nineteen-day-long rail strike in Sydney during June and July 1983 - the longest period that the New South Wales system was closed down since the 37-day strike[1] in 1917. There have been nine occasions since January 1980 that passenger services in Sydney have been disrupted[2] but the 1983 strike is especially appropriate to analyse because it did not coincide with the summer holiday period, school holidays and vacations at tertiary institutions. Primarily, we are interested

1. The NSW government dismissed hundreds of striking train crews, including Mr. Ben Chifley, who returned as a cleaner and was later to become Prime Minister of Australia.

2. The periods for which the Sydney metropolitan passenger rail system was closed down, and the apparent reasons for the strike, are: 19-22 February, 1980 (wage claim by track maintenance workers); 20-26 November, 1980 (wage dispute by drivers); 15-17 February, 1982 (Australian Railways Union members wage claim); 9 December, 1982 (guards roster dispute); 18-24 January, 1983 (Australian Railways Union train crews over cost cutting by State Rail Authority); 14-15 February, 1983 (one-man driver operation of trains); 29 June - 17 July, 1983 (drivers: one-man driver operation of XPT services); 24 August - 2 September, 1984 (Australian Federated Union of Locomotive Enginemen objection to plans for guards to ride in locomotives of Hunter Valley coal trains); and 19-28 January, 1985 (Hunter Valley coal train drivers demarcation dispute with the Australian Railways Union over the coverage of the observer on locomotives).

in the change in commuters' travel behaviour to cope with the withdrawal of suburban rail passenger services. In particular, we attempt to establish whether the typical media cry of 'chaos' - headlines such as 'Peak-hour chaos as four cars catch fire', referring to a collision on Parramatta Road at 6 am that delayed traffic for thirty minutes on the Monday morning of a rail strike (Daily Mirror, August 27, 1984) - is warranted or whether, as suggested by the editorial in the Sydney Morning Herald (January 23, 1985) no matter how their lives are being disrupted by strikes Australians are 'always meek and never wild' and they slip into their train strike mode with extraordinary ease.

The first section describes a conceptual model of travel behaviour and indicates the feedback loops through which adjustments to travel choice are made. This theoretical framework is tested with empirical results aimed at quantifying the magnitude of travel adjustments during a specific transport disturbance such as a rail strike. The final section describes briefly how the various transport authorities coped with the situation, which allows us to assess the claim made by a spokesman for the Minister of Roads, Mr. Laurie Brereton, that small changes made in traffic management, together with motorists using common sense, alleviate the adverse effects of a rail strike (The Sun-Herald, September 2, 1984).

CONCEPTUAL MODEL

One of the most explicit representation of travel behaviour, both as a set of decisions made by individuals in response to the physical transport system and in response to the decisions of other travellers (especially in congested urban situations) is given by Teply (1982). In 'saturated networks' - such as urban roads during a rail strike affecting passenger services - trip-makers are 'forced to re-evaluate their decisions in response to excessive travel times or "costs' of travel' (Teply, 1982, p. 74). Figure 1 shows a vertical sequence of decision processes which are categorised into one of six levels of travel choice. The feedbacks to various 'levels of choice' are shown by the broken lines and they indicate the preferred alternative course of action, both in the short term or in the long run.

Although the sequential ordering of 'levels of choice' may not 'reflect the intuitive, sub-conscious nature of travel decisions' several cogent points can be made. At the first level, choice involves considerations about the need and motiviation for making a trip; if the activities themselves are not considered worthwhile then no trips are made. (The substitution of travel by telecommunications is relevant here.) The second level is about locational decisions which affect the origin and the destination of the trip. In the short term, this may involve destinations closer to origins, or trip chaining to reduce the amount of travel, but in the long term it includes relocation of home and workplace; and the rearrangement of social, cultural and recreational activities. In the advent of a disturbance to any established equilibrium amongst the modes of travel, the third level of choice indicates transport mode choice decisions: for users of private transport, a partial change (for example park-and-ride) or a complete change to public transport; for users of public transport who are not captive riders there is a choice of private transport. The fourth level of choice involves time of travel, both the time of departure from the origin as well as the time of arrival at the destination, and this is clearly a complex phenomenon (Teply, 1982, p. 75; Alfa, et al, 1985). The fifth level of choice are routes which can be continuously modified on impulse by motorists, such as when an unusually long queue of vehicles is approached or for a change of scenery. Finally, for drivers, the final choice, and one closely tied to route choice, is parking.

Routes, parking and time of travel are transport mode-specific and these have special relevance in the application of the conceptual model to commuter travel in Sydney during rail strikes.

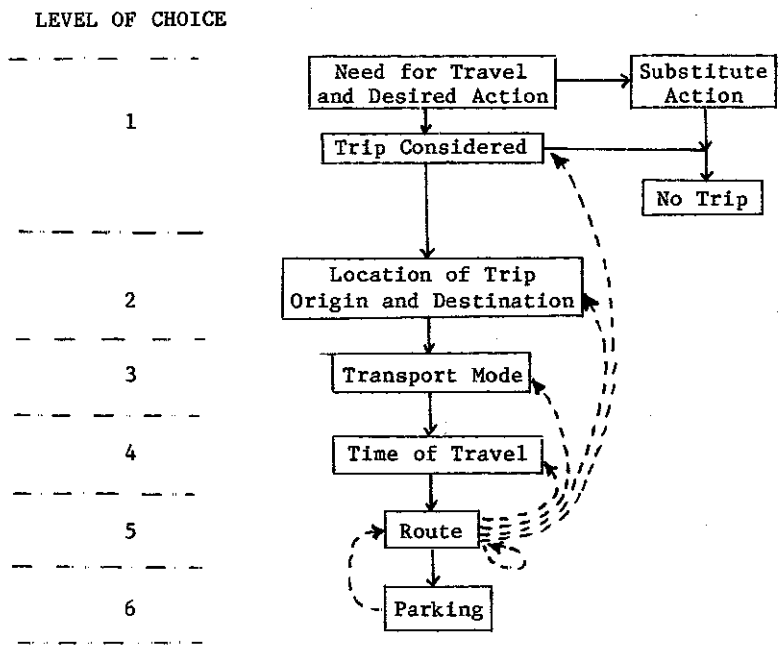

Figure 1. Conceptual Model of Levels of Choice in Travel Behaviour (Source: based on Reply, 1982, Figure 11, p. 75)

Anticipating 'traffic chaos' on the first morning of a rail strike, the Sydney commuter is faced with a series of interrelated decisions that may be represented as Figure 2. For the most typical case, where there is no change to either the location of the place of residence or the place of employment (level of choice 2), the major travel-related decisions to resolve are whether to make the journey from home to work or not (work at home, absenteeism) - that is level of choice 1 - and once the trip is committed what transport mode to choose (level of choice 3). The outcome of this choice process is reflected in usual train travellers having to find an alternative means of getting to work (walk, bus, ferry, cycle, motorcycle, car driver or car passenger) and in a proportion of travellers whose transport mode is not the train changing modes. In this latter category, there are shifts between public and private transport: regular motorists deterred from driving by the expectation of unpleasant road conditions; and regular users of the buses switching to the car because of the likelihood of overcrowding and delays on public transport. Once these modal-choice decisions have been resolved, all motorists are faced with decisions about the time of day of travel (level of choice 4), the route to follow (level of choice 5) and the place to park their vehicle (level of choice 6). Compared with the 'established' or 'routine' pattern of travel from home to work, motorists may make adjustments by setting out earlier or later, by trying different routes, and by choosing (or being forced) to park in different locations. On the return journey, at the end of the working day, the first two of these three adjustments are relevant.

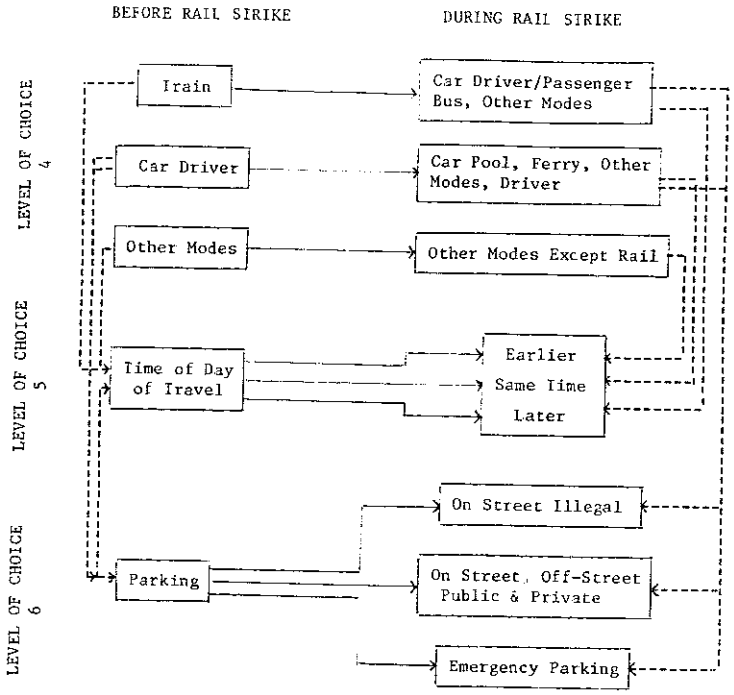

Figure 2. Adjustments to Travel Behaviour of Commuters During a Rail Strike

TRAVEL ADJUSIMENTS DURING A RAIL STRIKE

The New South Wales rail system carried a weekday average of three-quarters of a million passengers per day during 1983 travelling either within the metropolitan area (707,500) or inter-urban (47,000 from the Blue Mountains, Gosford and Central Coast). Of these about 600,000 are classified as commuters. In the 1981 morning peak - defined as those people arriving at work between 7.15 and 9.15 am - of the 154,850 trips to the CBD (from outside the CBD) 128,050 are for work purposes (1981 Sydney Travel Survey data) and of these an estimated 77,000 commuters arrived by rail.

Level of Choice 1

Absenteeism results in a worker not to making a journey to work. In surveys conducted by the Sydney Chamber of Commerce during rail strikes, absenteeism on the first day of the strike was 25 percent Sydney Morning Herald, February 17, 1982) but was expected to reduce to about 5 percent on the second day and 3 percent on the third and final day of the strike. During the January 1983 strike, the first day absenteeism for January 18 was estimated as 8.5 percent (Sydney Morning Herald, January 19, 1983). On the first day of the rail strike starting on Friday August 24, 1984 absenteeism was 10 percent (Sydney Morning Herald, August 28, 1984). It appears from this evidence that about 10 percent of the workforce do not travel on the first morning of a rail strike.

Level of Choice 2

Not shown in Figure 2 are those group of commuters who have flexibility in the length of the journey between home and work. There are those who, in filling in the Census of Population and Housing, responded to the invitation to write 'N.A.' to the question on 'the full address of the Division, or Branch, or Section (if any) or business ...' thereby indicating no fixed place of work. Manning (1978, p.23) calculates that in Sydney 11 percent of male workers and 8 percent of female workers gave no workplace in the 1971 Census, and we can imagine that during a rail strike some of these workers make sure their workplaces are more, rather than less, convenient to home. At the 1976 Census, the proportion of the total known journey-to-work trips originating within the Sydney Statistical Division with unknown destinations was 12 percent (State Transport Study Group, 1980, Table 1, p. 5).

There are also those who, anticipating the difficulty in getting to work, arrange to stay with friends or relatives or in hotels/motels, and so gain advantages with a shorter journey to work or one with more viable transport arrangements. Anecdotal evidence suggests this proportion might be substantial during the June-July strike of 1983. However, only a specially designed survey of commuters could establish the magnitude of this response.

Level of Choice 3

The effect of a rail strike on bus patronage depends on the service area: the government bus service, operated by the Urban Transit Authority (UTA), covers an area approximately bounded by Palm Beach, Chatswood and Epping in the northern suburbs, Ryde, Lidcombe and Bankstown in the west, and Sans Souci in the south. Based on the increase in fare revenues during rail strikes the UTA estimates that patronage increased by 15 to 20 percent. Private bus operators, serving mainly the middle and outer suburbs report a reduction in patronage and revenue during rail strikes. This is because many routes act as feeder services to and from the railway stations. In recent rail strikes private buses have been chartered to operate from outer metropolitan areas. On Monday, August 27, 1984 the Action For Public Transport organised charter services[3] in thirty-four areas stretching from Blacktown in the west to Wyong in the north, and reported that 60,000 people were carried by charter buses during the 1983 strikes - on average about 3,000 each day. The emergency charter bus services organised by Action for Public Transport and the State Rail Authority for the January 1985 rail strike covered forty-six outer suburbs (Sunday Telegraph, January 20, 1985).

The majority of ferry services connect harbour suburbs on the north of Port Jackson and the Parramatta River with Circular Quay. The Urban Transit Authority estimate that during a rail strike the number of passengers carried increased by approximately 20 percent. As the ferries serve suburbs not connected by rail this increase may be explained in one of two ways. First, there are commuters who either normally drive to the CBD or catch a bus but take the ferry to avoid traffic congestion, especially on the approach roads to the Sydney Harbour Bridge. Secondly, there are those regular rail travellers from the north shore who drive instead and then park near a ferry wharf and so make the last leg of their journey by ferry.

3. In the city centre, private chartered buses were restricted to setting down and picking up passengers at the following locations: Eddy Avenue; Macquarie Street North; the Sydney Entertainment Centre; and West Circular Quay.

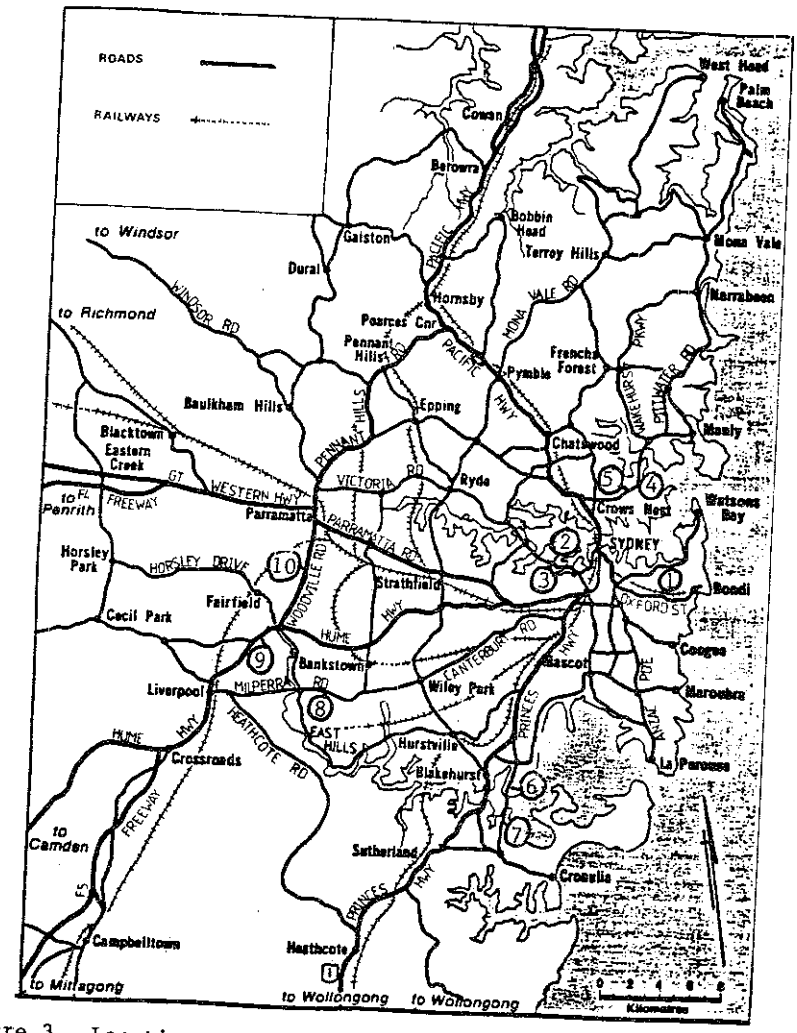

Figure 3. Locations of Traffic Signals at Which Traffic Counts Were Taken in the Sydney Metropolitan Region. The Numbering Scheme and a Description of Each Site is Given in Appendix A.

Now that we have eliminated intra-modal shifts there are those regular train travellers who change to private transport, either driving their car or obtaining a lift for all (or part) of their journey to work. The outcome of these decisions is reflected by the extra vehicular traffic on the roads and it is here that we are able to make more accurate estimates from traffic volume counts collected from ten traffic signal locations in the Sydney metropolitan area (Figure 3). These signals are part of the computerised Sydney Co-ordinated Adaptive Traffic System (SCATS) which allows the counts to be stored on computer files in the system. The counting exercise at a sample of locations in Sydney involved the collection of fifteen-minute volumes for separate directions on main roads for the period from April 6 to August 21, 1983 and this gave suitable traffic data for periods before, during and after the strike of June and July. Appendix A sets out the details of each location

identified in terms of the intersection name, the identification number of the signals (that is, the TCS No.), the street or road from which the data were collected and the direction of the traffic flow. All of these counting sites are situated on main roads but because of the different land-use characteristics of the areas which these roads connect and the different accessibility between these areas to the rail system, the change in traffic patterns would not be expected to be the same at all locations.

The conventional wisdom is that the volume of road traffic increases during rail strikes. This is a very general statement and would appear, especially to those who travel by road during rail strikes and to the media reporters, to be true. If this is formulated as a hypothesis we can compare and contrast the daily traffic counts on the Tuesdays and Wednesdays before, during and after the rail strike. These are the most stable days for commuter traffic and are not affected by public holidays, long weekends or late night shopping. The daily volumes collected at the ten sites are tabulated by Clunas (1984, Appendix A) and only the variations in daily volumes are shown in Table 1 for inbound traffic and Table 2 for the outbound traffic.

Table 1. Comparison of Daily Inbound Traffic Volumes Before, During and After the July 1983 Rail Strike

Location	Average Daily Traffic (Veh/Day)		
	Before Strike	During Strike	After Strike
Oxford St (TCS362)[1]	13,231	13,564 (+2.5%)	13,026 (-1.5%)
Victoria Rd (TCS 1553)	33,749	34,230 (+1.4%)	33,221 (-1.6%)
Military Rd (TCS 1224)	23,798	22,679 (-4.7%)	23,536 (-1.1%)
Rocky Point Rd (TCS 728)	25,946	28,065 (+8.2%)	25,932 (-0.1%)
Milperra Rd (TCS 2235)	23,133	23,453 (+1.4%)	22,937 (-0.8%)
Hume Highway (TCS 755)	26,484	27,414 (+3.5%)	26,796 (+1.2%)
Woodville Rd (TCS 12)	18,561	18,767 (+1.1%)	18,729 (+1.09%)

1. TCS - identification number of the signals.

(Figures in parenthesis are percentage change from mean volumes 'before' the strike).

Table 2: Comparison of Daily Outbound Traffic Volumes Before, During and After the July 1983 Rail Strike

Location	Average Daily Traffic (Veh/Day)		
	Before Strike	During Strike	After Strike
Oxford St (TCS362)[1]	23,693	24,683 (+4.2%)	23,643 (-0.2%)
Victoria Rd (TCS 1553)	29,263	29,740 (+1.6%)	28,675 (-2.0%)
Military Rd (TCS 1224)	24,719	24,637 (-0.3%)	24,906 (+0.8%)
Taren Point Rd (TCS 374)	24,697	26,791 (+8.5%)	24,722 (+0.0%)
Milperra Rd (TCS 2335)	11,668	11,416 (-2.2%)	11,685 (+0.1%)
Hume Highway (TCS 755)	26,108	27,239 (+4.3%)	25,670 (-1.7%)
Woodville Rd (TCS 12)	18,604	18,944 (+1.8%)	18,658 (+0.3%)

1. TCS - identification number of the signals

(Figures in parenthesis are percentage change from mean volumes 'before' the strike).

The statistical technique used was the students t test concerning the differences in the means of volumes recorded before, during and after the July 1983 rail strike. The two null hypotheses are that there is no difference between the mean daily volumes measured at each location for the period before the strike (measured from May 31) and (a) during the strike (between June 29 and July 17) and (b) after the strike (measured from July 18 to August 13). The hypotheses refer to traffic on Tuesdays and Wednesdays. The analysis indicated that of the fourteen separate and directional twenty-four hour total counts only five (about one-third) showed statistically significant differences between the 'before' and 'during' the rail strike. One of these was significantly lower than for the 'before' period, indicating that the traffic settled back to 'normal'. No statistically significant differences were found for counts 'before' and 'after'.

As total daily traffic volumes are not very illuminating the traffic counts were segmented to provide total volumes at each location for three periods during the day: from 5.00 to 10.00 am; from 10.00 am to 2.30 pm; and from 2.30 to 7.00 pm. Comparisons of these counts are given in Tables 3 to 7. The counts for each of the three days available have been given to show the variation which occurred as the strike progressed.

Table 3 demonstrates that in most cases significant increases in traffic volumes were recorded during the morning inbound peak - about 15 percent along the southern corridor and about 10 percent along the western corridor. The notable exception was Military Road, where typical decreases of 7 percent were recorded. Decreases were also recorded on the first day of the strike at the Hume Highway and Woodville Road locations and on July 6 for the Milperra Road site. As the reasons for the increase are obvious some comments on the decreases are required.

Table 3: Comparison of Morning Peak Inbound Traffic Volumes (5.00 am to 10.00 pm) Before and During the July 1983 Rail Strike

Location	Average Traffic Before Strike (veh)	Traffic Volume on the Specified Day 29 June	5 July	6 July
Oxford St (TCS362)[1]	3,673	3,868(+5.3%)	3,912(+6.5%)	3,750(+2.1%)
Victoria Rd (TCS 1553)	10,701	12,570(+17.5%)	11,627(+8.7%)	12,041(+12.3%)
Military Rd (TCS 1224)	8,019	7,469(-7.4%)	7,405(-7.7%)	7,377(-7.3%)
Rocky Point Rd (TCS 728)	11,483	13,171(+14.7%)	13,169(+14.7%)	13,338(+16.1%)
Milperra Rd (TCS 2335)	10,231	11,069(+8.2%)	10,940(+6.9%)	9,241(-9.7%)
Hume Highway (TCS 755)	9,711	8,577(-11.7%)	10,581(+9.0%)	10.724(+10.4%)
Woodville Rd (TCS 12)	5,614	5,200(-7.4%)	5,790(+3.1%)	5,659(+0.8%)

1. TCS - identification number of the signals

(Figures in parenthesis are percentage change from mean volumes 'before' the strike).

The decrease in Military Road traffic has three possible explanations: that motorists facing long downstream delays at the Warringah Expressway have taken alternative routes to work in the North Sydney - St Leonards areas; that considerable car pooling took place; or, that commuters used alternate means to get to work. Although no data is available on the first two possibilities the third is a plausible explanation because many areas have access to the harbour ferry services. This is supported by the 20 percent increase in the use of ferry services. The fall in volumes at the Hume Highway and Woodville Road locations on June 29, 1983 was probably due to people taking alternative routes because of two accidents that occurred between the counting location and the intersection of Woodville Road and Hume Highway (see, also, Figure 3). However, the decrease of 10 percent at Milperra Road on July 6, 1983 cannot be explained from the data available but a traffic decrease (14 percent) was also experienced at the same time in the opposite direction.

As the morning period outbound volumes showed a general increase, but at a slightly lower percentage than the inbound volumes discussed above, they are not tabulated here. Once again Military Road was the notable exception to the trend with decreases of 4.4 percent, 3.4 percent and 4.5 percent on the three days for which data was available.

In Table 4, the business-hours inbound volumes indicate decreases in Victoria Road and Military Road on all three days of the strike. As these are two of the closer locations to the CBD the decreases may reflect a reluctance of shoppers and business people to go to the CBD where there is little chances of finding convenient parking. At other locations a general increase in

volumes over the normal average value was detected. The Hume Highway location showed the most consistent and highest increases of 6 percent, 9 percent and 7 percent for the three days.

Table 4: Comparison of Business Hours Inbound Traffic Volumes (10.00 am to 2.30 pm) Before and During the July 1983 Rail Strike

Location	Average Traffic Before Strike (veh)	Traffic Volume on the Specified Day 29 June	5 July	6 July
Oxford St (TCS362)[1]	5,545	5,624(+1.4%)	5,707(+2.9%)	5,794(+4.5%)
Victoria Rd (TCS 1553)	8,703	8,649(-0.6%)	8,345(-4.1%)	8,262(-5.1%)
Military Rd (TCS 1224)	5,935	5,864(-1.2%)	5,749(-3.1%)	5,625(-5.2%)
Rocky Point Rd (TCS 728)	5,654	6,025(+6.6%)	5,910(+4.5%)	5,646(-0.2%)
Milperra Rd (TCS 2335)	5,205	5,432(+4.3%)	5,301(+1.8%)	5,150(-1.1%)
Hume Highway (TCS 755)	6,055	6,410(+5.9%)	6,605(+9.1%)	6,473(+6.9%)
Woodville Rd (TCS 12)	5,081	5,327 (+4.8%)	5,236 (+3.1%)	5,310 (+4.5%)

1. TCS - identification number of the signals

(Figures in parenthesis are percentage change from mean volumes 'before' the strike).

Table 5 shows that variations in traffic volumes during business hours for outbound traffic was little different from normal for Oxford Street, Military Road and Milperra Road (the latter site recorded an 8 percent decrease from normal on July 5, 1983). Increases in outbound volumes were recorded at Victoria Road (9 percent), Hume Highway (8 percent) and Taren Point Road (6 percent). The most probable explanation for the increases experienced in Victoria Road was that from 1.30 pm onwards people able to leave the CBD early did so to avoid the congestion of the evening peak period.

One would expect that the evening outbound volumes would reflect the same changes found in the morning inbound volumes but as seen in Table 6 this was not entirely the case. The only locations at which the same increases in volumes for both morning and evening occurred were those at the Rocky Point Road/Taren Point Road and Hume Highway locations. The lower outbound increase for the evening peak along Victoria Road and the Hume Highway reinforce the idea that those able to leave work early did so to avoid congestion. Outbound volumes (Table 7) were very little different from the average at Oxford Street and Milperra Road. Military Road volumes showed an increase from the average on two of the three days for which traffic volumes were recorded during the strike. This could indicate that the decreases occurring in the morning were partly due to motorists taking alternate routes to the North Sydney area (that is, not a symmetrical morning and evening route choice).

Table 5: Comparision of Business Hours Outbound Traffic Volumes (10.00 am to 2.30 pm) Before and During the 1983 Rail Strike

Location	Average Traffic Before Strike (veh)	Traffic Volume on the Specified Day 29 June	5 July	6 July
Oxford St (TCS362)[1]	2,844	2,931(+3.1%)	2,862(+0.6%)	2,859(+0.5%)
Victoria Rd (TCS 1553)	6,422	6,923(+7.8%)	7,070(+10.1%)	7,002(+9.0%)
Military Rd (TCS 1224)	5,650	5,783(+0.6%)	5,626(-0.4%)	5,717(+1.2%)
Rocky Point Rd (TCS 728)	4,999	5,510 (+10.2%)	5,306 (+6.1%)	5,122 (+2.5%)
Milperra Rd (TCS 2335)	3,026	2,940(-2.8%)	2,782(-8.1%)	2,973(-1.8%)
Hume Highway (TCS 755)	5,884	6,4259(-9.2%)	6,276(+6.7%)	6,324(+7.6%)
Woodville Rd (TCS 12)	4,872	5,059(+3.8%)	4,949(+1.6%)	4,943(+1.4%)

Table 6: Comparision of Peak Evening Inbound Traffic Volumes (2.30 pm to 7.00 pm) Before and During the 1983 Rail Strike

Location	Average Traffic Before Strike (veh)	Traffic Volume on the Specified Day 29 June	5 July	6 July
Oxford St (TCS362)[1]	8,564	9,031(+5.5%)	8,957(+4.6%)	9,198(+7.4%)
Victoria Rd (ICS 1553)	8,819	8,457(-4.1%)	7,869(-10.8%)	8,022(-9.0%)
Military Rd (TCS 1224)	5,624	5,374(-4.5%)	5,235(-6.9%)	5,228(-7.1%)
Rocky Point Rd (TCS 728)	5,831	6,237(+7.0%)	5,914(+1.4%)	5,892(+1.0%)
Milperra Rd (TCS 2335)	4,971	4,919(-1.1%)	4,770(-4.1%)	4,775(-4.0%)
Hume Highway (TCS 755)	6,795	6,844(+0.7)	6,861(+1.0%)	6,934(-2.0%)
Woodville Rd (TCS 12)	5,212	5,170(-0.8%)	5,191(-0.4%)	5,199(-0.3%)

1. TCS - identification number of the signals

(Figures in parenthesis are percentage change from mean volumes 'before' the strike).

Table 7: Comparision of Peak Evening Outbound Traffic Volumes (2.30 pm to 7.00 pm) Before and During the 1983 Rail Strike

Location	Average Traffic Before Strike (veh)	Traffic Volume on the Specified Day 29 June	5 July	6 July
Oxford St (TCS362)[1]	3,109	3,169(+1.9%)	3,026(-2.6%)	3,017(-3.0%)
Victoria Rd (TCS 1553)	10,369	10,184(-1.8%)	10,878(+4.9%)	11,025(+6.3%)
Military Rd (TCS 1224)	8,099	8,082(-0.2%)	8,668(+7.0%)	8,515(+5.1%)
Taren Point Rd (TCS 728)	11,517	13,085(+13.6%)	13,264(+15.2%)	13,014(+13.0%)
Milperra Rd (TCS 2335)	3,723	3,695(-0.8%)	3,787(+1.7%)	3,656(-1.8%)
Hume Highway (TCS 755)	10,312	10,939(+6.1%)	10,962(+6.3%)	10,880(+5.5%)
Woodville Rd (TCS 12)	6,085	5,989(-1.6%)	5,890(-3.2%)	5,930(-2.6%)

1. TCS - identification number of the signals

(Figures in parenthesis are percentage change from mean volumes 'before' the strike).

The extent to which vehicle occupancy increases during rail strikes is difficult to determine. By carrying more passengers, or making carpooling arrangements[4] motorists gain benefit from using 'Transit' lanes which require a minimum of three persons in the vehicle, but the metropolitan-wide impact of this is not known. The major factor limiting the number of vehicles entering the CBD is the available parking space. There are 25,638 parking spaces in the CBD which are available for all-day parking - this almost matches the figure of 25,650 drivers who enter the CBD during the morning peak period (1981 Sydney Travel Survey). Together with the 9,050 car passengers a typical vehicle occupancy rate is about 1.35. From the Sydney Travel Survey, if the 84,600 who travel by train are forced to go to the CBD by other means and allowing for a 20 percent increase in bus and ferry patronage, approximately 78,000 might make the journey by car. The figure will obviously be slightly less as some journeys such as work, shopping and personal business would be foregone due to the rail strike. If a figure of 70,000 additional trips by road to the CBD is assumed and the above occupancy rate of 1.35 was to be maintained then an additional 52,000 vehicles would enter the CBD during the morning peak. This was not detected in the traffic volumes discussed above, nor was it reflected in the parking figures.

4. The National Roads and Motorists Association (NRMA) promotes this by asking whether motorists can assist with carpooling or whether people want a lift.

During the 1983 rail strike an estimated 5,600 additional parking spaces were made available in the inner city area; these were fully utilised. Also, parking for 8,000 vehicles was made available at Moore Park but only about 400 vehicles used this area daily. Thus, about 6,000 additional vehicles parked in and around the CBD daily during the strike. These figures suggest that occupancy in vehicles entering the CBD increases from 1.53 to 3.3 - which is a significant increase.

Level of Choice 4

Quarter-hourly volume profiles of daily traffic counts were extracted from the data for the locations at Victoria Road (TCS Nos. 1553 and 651), Military Road (TCS Nos. 1224 and 637), Hume Highway (TCS No. 755 - both directions), and Woodville Road (TCS 12 - both directions) and these provide an excellent picture of the temporal distribution of traffic. They are included in Clunas (1984, Figures 3.4 to 3.35) and help answer such questions as: (a) the magnitude of the first days' 'chaos' of a rail strike by comparing a 'before' condition with conditions on the first day of the strike; (b) the extent to which initial adjustments are maintained during a long strike by comparing the 'before' condition with conditions at the start of the second week of the strike; (c) what subsequent adjustments are made by travellers as the strike continues by comparing say conditions on the first day of the strike with those on the first day of the second week; and (d) to see whether travel patterns return to to 'normal' by comparing the 'before' and 'after' conditions.

These graphical plots (Figure 4) give a much clearer indication of the time of journey to work travel than the tabulated volume counts. Perhaps the most noticeable feature is the clear demonstration of the temporal distribution of traffic: during a rail strike the morning peak at TCS Nos. 1553 (Victoria Road) and 755 (Hume Highway) commenced about an hour earlier than normal (Figure 4 (a) and (b)). Figure 4 (c) also plots the drop in volumes during the morning period inbound at TCS 1224 (Military Road) referred to in the discussion above. In this case, there is not a shift in the peak but the volume of the flows has been reduced from 7 to 9 am.

Level of Choice 5

Very little data on travel conditions on the roads during rail strikes are available and there is no evidence to quantify changes in route choice. However, during the strike which occurred in June and July, 1983 a survey of travel times was carried out by the Department of Main Roads, NSW. Another survey was reported in the Sydney Morning Herald (July 5, 1983). The accuracy of the figures in both surveys is questionable because they were not carried out under controlled conditions and probably only one journey time was measured and reported. The results of the surveys are detailed by Clunas (1984, Tables 3.1 and 3.2, pp. 46-47) to show the relative increases in delay experienced by commuters during the morning and evening peaks travelling to and from the CBD.

The DMR figures reveal a wide variability in extra travel time - from 20-40 percent more on routes that vary from between 14 and 54 km. But in all cases, with the exception of Watsons Bay (in the Eastern Suburbs) which would only be minimally affected by additional traffic generated by the rail strike, road travellers experienced considerably longer journey times (the Sydney Morning Herald survey shows a doubling on some routes). The variations in travel times during the strike may be explained by the fact that strikes cause significant numbers of motorists to change routes and the time that they commence their journeys.

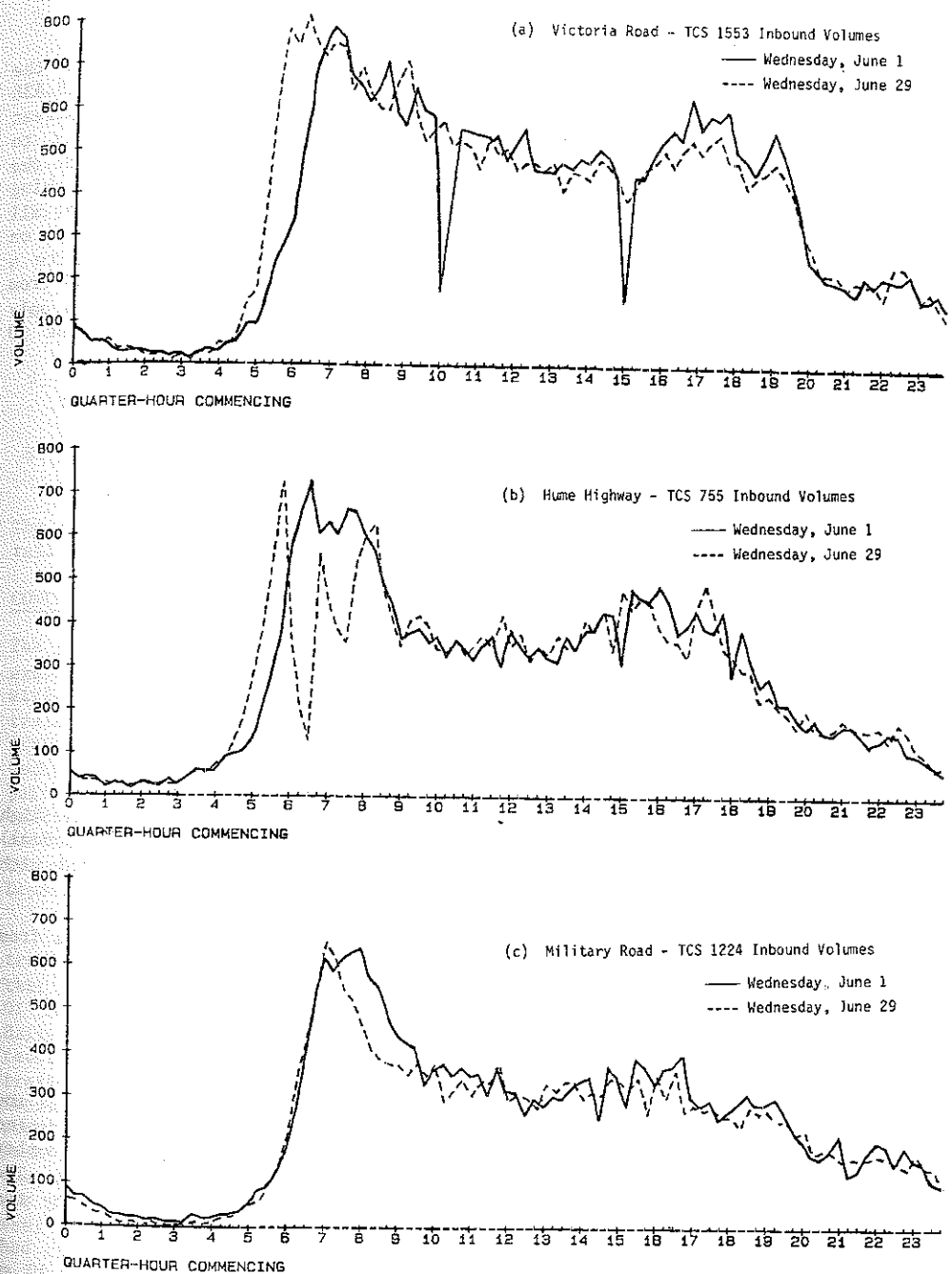

Figure 4. Inbound Iraffic Flow Rates for Fifteen-Minute Intervals at Iraffic Signal Detectors on (a) Victoria Road, (b) Hume Highway and (c) Military Road Measured Before and During the June, 1983 Rail Strike.

Level of Choice 6

The usual parking situation in the CBD is established by a survey by the Sydney City Council in 1979. The total number of spaces was 25,638 (categorised by 12,377 public off-street spaces, 11,177 private off-street spaces and 1,084 unrestricted on-street spaces). Special arrangements to assist people getting to work in the City during train strikes are made by the State Transport Emergency and Table 8 sets out the emergency car parking locations and gives their vehicle capacity. The 9.30 am opening curfew at all city parking stations is lifted during rail strikes. The Moore Park site on the southeast corner of the CBD has a capacity of 8,000 cars but despite a free shuttle bus service run by the Urban Transit Authority (UTA) to and from Elizabeth Street (6.00 to 9.30 am and 3.00 to 6.30 pm) was reported to be only about 10 percent full. Thus, the parking supply is increased by about 60 percent.

Table 8: Emergency Car Parking Made Available by the State Transport Emergency Committee

Location Number[1]	Site	Capacity (Vehicles)
1	Domain	3,000
2	Darling Harbour	2,000
3	Moore Park[2]	8,000
4	Wentworth Park	2,100
5	Huntley's Point Road[3]	200
8	Bondi Junction	n/a
9	Hickson Road	500
11	Tempe Railway Station[2]	n/a
Total		15,800

1. Locations 6 (Gardeners Road Public School), 7 (North Sydney Boys High School and Crows Nest High School) and 10 (Cleveland Street High School) were available during the August 1984 rail strike which coincided with school holidays.
2. Connected to CBD by UTA shuttle or regular service
3. 7.40 am ferry from Gladesville to Circular Quay; return at 5.30 pm from Circular Quay

(Source: based on Sydney Morning Herald, August 28, 1984)

RESPONSE OF THE TRANSPORT AUTHORITIES

The responses of the traffic authorities in the Ministry of Transport, in the Police Department and in the Department of Main Roads have been directed towards the minimisation of road congestion. With the experience of a number of rail strikes over recent years a plan of action has been developed. The following eight arrangements are brought into effect during a strike by the State Transport Emergency Committee.

1. In 1983, 'clearway' hours, which normally apply from 6.30 am to 9.30 am and from 3.30 am to 6.00 pm, are extended to begin thirty minutes earlier and to end thirty minutes later - that is, 6.00 am to 9.30 am and 3.00 pm to 6.30 pm. For the strike in August, 1984 'clearway' hours were extended to 5.30 am to 10.30 am and from 2.30 pm to 7.30 pm.

2. Motorists on 'clearways' are permitted to pick up and set down passengers.

3. Chartered private buses are given specific locations in the city to pick up and set down passengers.

4. Taxis are permitted to multiple hire.

5. Motor-vehicle insurance provisions concerning the carrying of passengers by private vehicles are waived to encourage car pooling. The NRMA assists with a 'hot-line' telephone number to facilitate car pooling.

6. The toll on the Sydney Harbour Bridge is abolished to improve traffic flow - a loss of government revenue of about 16,000 per day.

7. As noted in Table 8, additional car parking areas are provided within the Sydney CBD and surrounds.

8. Adjustments are made to traffic signal timings to provide longer green times to arterial roads.

The impact of these traffic management schemes on easing the disruption of rail strikes is summarised in the concluding section.

CONCLUSIONS

The effects of an industrial dispute on the rail transport system have been examined. Such strikes affect wide areas but in different ways. During rail strikes the effect is immediate because those persons who normally travel by train are forced to find an alternate mode. The experience of recent rail strikes indicates that the majority of rail commuters are forced to travel to work by road in private cars. In many cases, these additional cars, particularly those going into the CBD, will have to travel on roads on which traffic flows are at, or near, capacity in normal peak hour conditions. The additional vehicles cause these levels to be exceeded and saturation results: travel times increase by the order of 20 to 40 percent, according to a Department of Main Roads survey, perhaps higher according to the newspapers.

From traffic counts taken before, during and after a rail strike from ten traffic signal locations in the Sydney metropolitan area it was demonstrated that not all showed significant increases in daily traffic during the strike. Of the fourteen counting locations only five indicated significant changes in daily volumes - of about 10 percent - and of the five, one location actually recorded a fall in volumes in the morning peak period. There were also traffic increases in the afternoon peak but these did not all reflect the same increase as those in the evening peak. It was also found that in some areas where it was likely that capacity was approached the temporal duration of the peak was extended: the morning peak began about an hour earlier and ended at the same time as under normal conditions. The same effect of peak spreading was observed from the evening peak at some locations. The occupancy of vehicles entering the CBD was estimated to have increased significantly - it had risen from 1.5 to about three. It would appear from the analysis that the availability of parking in and around the CBD could be the major factor in determining the number of private cars driven to work during a train strike.

Whilst it has been suggested by some observers that traffic conditions settle down and improve as people adjust their travel habits during rail

strikes there was not enough evidence in the traffic data available to determine whether this was true or not. One thing that is certain, and this point is common to all traffic disruptions, is that their effects can be minimised by proper planning. In the case of the industrial disputes on the railways the planning of the authorities described in this paper is augmented by the motorist making adjustments to commuting habits in an effort to reduce individual travel costs and the disruption to the urban economy. The fact that motorists do cope and that the changes made in traffic management are effective should give the Minister for Roads more confidence to address the media during the next rail strike.

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APPENDIX A - Traffic Counting Locations

For each location in Figure 3, a short description of the characteristics likely to affect traffic patterns is given together with: (a) the intersections at which the signals are located; (b) the idenfitication number of the signals (TCS no.); (c) the road (or street) from which the data was collected; and (d) the direction of the traffic flow.

Oxford Street links the CBD and Bondi Junction in the eastern suburbs. The main parallel public transport connection is the Eastern Suburbs railway which carries 68,000 passengers daily.

Location 1: (a) Oxford Street and Ocean Street, Woollahra; (b) TCS No. 362; (c) Oxford Street; (d) Eastbound (outbound) and westbound (inbound).

Victoria Road carries traffic between the CBD and the north-western and western suburbs. The outer suburbs are served by the northern (Strathfield to Hornsby) and western (Parramatta) railway lines. The counting sites are located on the western edge of the CBD, adjacent to the Glebe Island Bridge.

Location 2: (a) Victoria Road and Sommerville Road, Rozelle; (b) ICS No. 1553; (c) Victoria Road; (d) Eastbound (inbound).

Location 3: (a) Victoria Road and The Crescent, Rozelle; (b) ICS No. 651; (c) Victoria Road; (d) Westbound (outbound).

Military Road carries traffic between the Warringah Expressway and northern beach suburbs via the Spit Bridge. There is no rail service to the Warringah penninsula. Although this road is the most direct route between the Spit Bridge and the CBD there is a slightly longer, sign-posted by-pass route around Spit Junction. Regular ferry services in this area carry passengers from Manly, Cremorne, Mosman and Neutral Bay to Circular Quay.

Location 4: (a) Military Road and Spit Road, Spit Junction; (b) ICS No. 637; (c) Military Road; (d) Northbound (outbound).

Location 5: (a) Military Road and Cowles Road, Spit Junction; (b) TCS No. 1224; (c) Military Road; (d) Southbound (inbound).

Rocky Point Road and Iaren Point Road are the approaches to Iaren Point Brigde. The counting sites are located on each approach. These roads link the southern suburbs to the CBD via either the Princess Highway or General Holmes Drive. A rail service exists between Cronulla and the City.

Location 6: (a) Rocky Point Road and Wellington Road, Sans Souci; (b) ICS No. 728; (c) Rocky Point Road; (d) Northbound (inbound).

Location 7: (a) Iaren Point Road and Holt Road, Iaren Point; (b) TCS No. 374; (c) Iaren Point Road; (d) Southbound (outbound).

Milperra Road links the south-western areas of Liverpool and Campbelltown to the industrial areas of Bankstown. From Bankstown, Milperra Road joins Canterbury Road which provides access to the inner southern suburbs and to the CBD. A rail service exists between Campbelltown, Liverpool and the CBD. Travel by train from Liverpool to suburbs such as Bankstown, East Hills or suburbs on the Sutherland (Illawarra) line requires at least one change of train depending on the route taken.

Location 8: (a) Milperra Road and Murray Jones Drive, Milperra; (b) TCS No. 2235; (c) Milperra Road; (d) Eastbound (inbound) and westbound (outbound).

The Hume Highway the most direct road link between Liverpool and the CBD. It reduces in width from six to four lanes as it gets closer to the CBD. In the narrow sections, capacity is approached during peak periods. At the counting site the highway is a six-lane, dual-carriageway road. Approximately 1 km towards the city from the counting location the three-lane, inbound carriageway reduces to two lanes to cross the historic Lansdowne Bridge. A further 1/2 km beyond that point the capacity is again restricted by a major at-grade intersection (Woodville Road and Henry Lawson Drive). Direct rail services either via Granville or Regents Park connect Liverpool to the City.

Location 9: (a) Hume Highway and Lansdowne Road, Lansdowne; (b) TCS No. 755; (c) Hume Highway; (d) Eastbound (inbound) and westbound (outbound).

Woodville Road links the south-western suburbs in the Milperra area with Parramatta. There is no direct rail service between these areas.

Location 10: (a) Woodville Road and Kirrang Street, Villawood; (b) TCS No. 12; (c) Woodville Road; (d) Northbound (inbound) and southbound (outbound).