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Cross City Tunnel

**Six Month Traffic Impact Analysis
November 2003**

BHBB - Cross City Tunnel Joint Venture

February 2004



Cross City Tunnel

Prepared for
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Executive Summary

This report describes the impact of Cross City Tunnel (CCT) construction works on traffic around the Sydney Central Business District (CBD). It has been produced in accordance with the various Ministerial conditions relating to construction of the Cross City Tunnel.

The Proponents Baulderstone Hornibrook Bilfinger Berger (BHBB) are required to undertake the monitoring of changes at six monthly intervals. Appendix 21 of the Scope of Works and Technical Criteria specifies the scope of monitoring that the Proponent is to undertake during and following construction of the project.

The first series of traffic surveys were undertaken in November 2002 prior to commencement of CCT construction works. The first major change to the road network occurred in late January 2003 with the closure of the Eastern Distributor (ED) Bourke Street on-ramp.

The second series of surveys were undertaken in May and early June 2003. The third series were undertaken in November 2003. During the first year of CCT construction work major changes to the road network along the route of CCT include:

- Eastern Distributor Bourke Street on-ramp closure;
- Sir John Young Crescent, reduction in capacity and intersection alterations;
- Druitt Street, reduction in capacity;
- Sussex Street, changed to two-way operation between Liverpool and Druitt Streets; and
- York Street, 'through' private vehicles banned between Market and Druitt Streets.
- Closure of Bourke Street north of William Street
- Reduction in capacity in vicinity of King's Cross Tunnel

Four main types of traffic survey were undertaken during the two survey periods:

- Intersection Turning Counts;
- Intersection Queue Length;
- Bus Travel Time; and
- Car Travel Time.

In conjunction with data from these surveys, data has also been obtained from the Roads and Traffic Authority (RTA)'s permanent traffic volume recording locations.

Monitoring of traffic impacts has encompassed a considerable area beyond the route of CCT which will extend from Darling Harbour in the west to King's Cross in the east. Monitoring has extended from Iron Cove Bridge in the west to Old South Head Road in the east and from the Harbour crossings in the north to Dacey Avenue in the south.

This report describes the changes that have been observed based on all three series of surveys undertaken although it concentrates on comparisons between November 2002 and November 2003. A similar report "Six Month Traffic Impact Assessment (Nov02 – May/June 03)" was produced in July 2003. This report details comparison of the changes in traffic during the first 6 months of construction work.

Similar to the overall conclusions in the July 2003 report the results of the November 2003 analysis have indicated that CCT construction works have still not had significant detrimental affects on traffic around the CBD.

The most significant trends that the analysis has highlighted is a reduction in traffic flows along the CCT corridor, especially at the western end along Druitt Street, but also in the eastern zone along William Street.

The RTA permanent count station data generally indicated minor changes in traffic volumes at locations around the CBD. At a few locations such as Flinders Street and the Cahill Expressway at Circular Quay the November 2003 volumes were consistently higher than those in November 2002. It is believed that a primary reason at these locations was due to the 2003 Rugby World Cup for which Sydney was a venue for a number of matches, especially during the middle of November.

Given the variable nature of traffic, especially during congested periods, it can be difficult to determine the precise reasons for differences that may have been observed. This is especially true when trying to compare survey data collected on a particular day six or more months apart.

1.0 Introduction

As part of the process of evaluating the impacts of Cross City Tunnel (CCT) construction works on the transport network in Sydney a number of traffic surveys were undertaken at regular intervals during the construction stages.

Following conditions described in Appendix 21 of the Scope of Works and Technical Criteria (SWTC), Boulderstone Hornibrook Bilfinger Berger (BHBB) are obliged to monitor traffic conditions at six monthly intervals.

This data is being used to assess the changes that have occurred since the commencement of construction in January 2003.

It should be noted that the changes in traffic around Sydney CBD may not necessarily be a result of CCT construction works. Traffic volumes and patterns change on a daily basis around the city as well as more gradual changes year on year. They can also differ significantly by the time of year, especially during school holidays, although generally surveys were not undertaken during holiday periods.

The majority of the traffic surveys undertaken were done so on one day. Given that conditions can vary markedly from one day to the next due to numerous incidents on the road network, a comparison between particular days six months apart should be viewed with some degree of latitude.

1.1 Study Area

The CCT study area is defined in Appendix 21 which refers to three sections of coverage:

- Core Area;
- Inner Precinct; and
- Outer Precinct.

These areas are indicated on **Figure 1**.

The terminology is used to define the extent of surveys within each area. Within the core area the survey periods encompassed additional periods of the weekday and also included Saturday.

1.2 Description of Surveys and Other Data Sources

Four types of general surveys were undertaken in accordance with **Appendix 21** stipulations, these were:

- Intersection Turning Counts;
- Intersection Delay;
- Bus Travel Times; and
- Car Travel Times.

To try to assess the overall change between November 2002 and November 2003, data from RTA's permanent traffic count sites were obtained and analysed. These are located at 25 sites around the CBD and record hourly data by direction.

Figure 2 provides a comparison of factors based on four major permanent traffic counting stations at the CBD cordon. These are:

- Sydney Harbour Bridge;
- Sydney Harbour Tunnel;
- Broadway; and
- Anzac Bridge.

Figure 2 shows the weekday (Tuesday, Wednesday and Thursday) annualisation factor for the 12 months of 2002. The annualisation factor has been calculated from the average weekday flow for each month divided by the Annual Average Weekday Traffic (AAWT). As would be expected during December and January average daily flows are below the AAWT volume. The highest flows occurred during November followed by May. This data indicates that for the CCT project, traffic surveys are being undertaken when traffic volumes are at their highest and hence congestion would be at it's worst. It also indicates that November traffic is generally greater than that in May.

1.3 Intersection Turning Counts

Intersection turning counts were undertaken at 66 locations around the CBD as detailed in Appendix 1. The intersections consisted of 23 'core' sites and 43 'precinct' sites.

The intersection survey time periods were:

- Weekday (Tuesday, Wednesday, Thursday)
 - 0700-0930 (Core & Precinct)
 - 1100-1400 (Core & Precinct)
 - 1600-1900 (Core & Precinct)
 - 2000-2400 (Core Only)
- Saturday
 - 1000-1500 (Core Only)

1.4 Intersection Queue Lengths

Intersection queue lengths surveys were undertaken at the 23 'core' intersections and complied with the National Association of Australian State Road Authorities (NAASRA) guide to Traffic Engineering Practice, Part 3 (Traffic Studies).

Surveys were undertaken on both weekdays and Saturdays on the same day as the turning counts and the time periods monitored corresponded to those for the turning counts.

From these surveys it was possible to determine if there had been any significant change in delay associated with the CCT works.

1.5 Bus Travel Times

Five bus corridors in and around the CBD have been surveyed as part of this monitoring process.

- Route 1 - Parramatta Road Services (between Railway Square & Hunter St.)
- Route 2 - Victoria Road Services (between Hunter St. & Victoria Rd.)
- Route 3 - William Street Services (between Bridge St. & Ocean St.)
- Route 4 - Northern Services (between Railway Square & Grosvenor St.)
- Route 5 - Oxford Street Services (between Bridge St. & Liverpool St.)

These corridors account for a significant number of bus routes serving Sydney CBD.

Bus travel times were surveyed on a weekday and Saturday. The weekday surveys were undertaken over the following periods:

- Morning Peak (0600-1000)
- Inter-Peak (1100-1400)
- Afternoon Peak (1500-1900), (1600-1900 in November 2003)
- Evening (2000-2400)

On Saturday bus travel times were surveyed between 1000 and 1500.

1.6 Car Travel Times

These were undertaken on four routes across the CBD;

- Route 1 – Camperdown to Potts Point
- Route 2 – Rozelle to Double Bay
- Route 3 – Sydney (Harbour Bridge) to Bondi
- Route 4 – Moore Park to Ultimo

The 'floating' car method was used whereby times are recorded from a vehicle travelling between the start and end points with timings taken at strategic intersections en-route.

Surveys were conducted during the following periods:

- Morning Peak (0630-1000)
- Inter-Peak (1100-1400)
- Afternoon Peak (1530-1900)

2.0 Analysis

2.1 Survey Periods

The first series of surveys were undertaken in November 2002. Follow-up surveys were undertaken in February 2003 where necessary. The second series of surveys were undertaken during May and June 2003 and the third set during November 2003. Both periods were outside school and tertiary education holiday periods conforming to the conditions specified in Appendix 21. Generally surveys during the subsequent series were undertaken on the same weekday as those during the first series. This assisted in minimising daily variation that might have affected the comparison process.

2.2 Permanent Traffic Volume Count Data

A considerable amount of data was obtained from the RTA relating to their permanent traffic recording stations. These are located at various locations around the Sydney metropolitan area. Data from 25 locations around the CBD was obtained. For most sites this consisted of continuous hourly counts for the period being monitored between November 2002 and November 2003. Given that this is continuous and mostly 'calibrated' data it could be considered a better reflection of the 'real' changes occurring on the CBD road network.

Analysis of the RTA permanent count data produced the following comparison of 'peak' period traffic volumes by day of week. Table 1 shows the 'peak' period factor by day of week. The factor is calculated based on the average of Tuesday, Wednesday and Thursday. Table 1 indicates that there isn't a particularly significant difference between days of the week. Weekday surveys were undertaken on Tuesday, Wednesday or Thursday as Monday (AM peak) and Friday (PM peak) are generally considered to have different commuting patterns.

From **Table 1** it can be seen that traffic volumes on Thursday are above the 'average' whereas Tuesday and Wednesday are slightly below average.

Table 1 - Comparison of 'Peak' Period Flows by Day of Week

	AM Peak (8am-9am)	Midday Peak (1pm-2pm)	PM Peak (5pm-6pm)	Evening Peak (8pm-9pm)	Average (10am-11am)
Monday	1.04	0.97	1.00	0.85	0.97
Tuesday	0.99	0.97	0.97	0.95	0.97
Wednesday	0.96	1.00	0.98	0.99	0.98
Thursday	1.05	1.02	1.05	1.06	1.05
Friday	1.02	1.06	1.01	1.04	1.03
Saturday		1.05			

Figures 4 to 8 detail the change in during the five monitored periods between November 2002 and November 2003. They indicate that the volumes during each of the five periods have not changed significantly between November 2002 and November 2003. At all sites where data were available for both periods (20 sites) the difference in daily volumes was less than 1%. For the individual time periods the change over the 12 months was;

- AM Peak Period (0600-1000) -0.4%
- Business Period (1100-1400) -0.2%
- PM Peak Period (1500-1900) 0%
- Evening Period (2000-2400) +0.3%
- Saturday Period (1000-1500) -0.1%

2.3 Intersection Turning Counts

Intersection turning counts were originally undertaken at 58 intersections across the CBD indicated on **Figure 3**. Of these 23 were classified as 'Core' intersections and were monitored over the following times periods:

- Weekday (Tuesday, Wednesday or Thursday)
 - 0700-0930
 - 1100-1400
 - 1600-1900
 - 2000-2400
- Saturday
 - 1000-1500

At the 36 'Precinct' intersections traffic was counted during the following time periods:

- Weekday (Tuesday, Wednesday or Thursday)
 - 0700-0930
 - 1100-1400
 - 1600-1900

All movements at each intersection were counted continuously for each of the survey time periods. In the first series of surveys vehicles were classified as follows:

- Bicycles;
- Light vehicles (AUSTROADS categories 1 and 2);
- Heavy vehicles (AUSTROADS categories 3 to 13);
- Buses;
- Taxis (categorised from May 2003 survey)

For the second series of surveys taxis were separately identified from light vehicles following a request from the Taxi Council and given that taxis form a significant proportion of traffic in the CBD.

Figures 9a to 13b show the proportional change at each surveyed intersection for the five periods monitored. The comparison is of the peak hour recorded during each time period. Data was collected in 15 minute periods. The peak hour was calculated at each individual intersection and this could vary both between intersections and between the first and second sets of surveys. Figures with suffix 'a' are a comparison of November 2003 against November 2002. Figures with suffix 'b' are a comparison of November 2003 against May 2003.

Figures 14 to 18 indicate the change in approach volumes at the surveyed intersections. These give a clearer picture of directional changes.

Table 8 summarises the proportional changes at the intersections monitored for each of the five surveyed time periods. Six proportional difference ranges have been used. The peak volume was lower at 44% of intersections during the AM period, at 50% during the midday period and at 50% during the PM period. During these three time periods all 58 intersections were monitored.

During the weekday evening and Saturday periods 23 intersections were monitored. These sites are concentrated within the inner CBD area along the route of CCT. The proportional change during the evening indicated that at over 75% of intersections maximum hourly volumes were lower during the evening period whilst on Saturday the maximum volume was lower at over 50% of sites.

At most sites during the common survey periods there was a consistent trend, either the peak hour intersection volume was higher or lower in November 2003 compared to November 2002.

2.3.1 General Changes

Trends from comparison of the November 2003 data with that for November 2002 and May 2003 indicates a number of distinct changes:

- There has been a significant reduction in traffic volumes on Druiitt Street in all five monitored periods since November 2002.
- There have been smaller proportional reductions in volumes at William Street intersections
- There have been significant reductions in volumes at intersections along Sir John Young Crescent
- There has been a general increase in volumes at surveyed intersections in the southern area of the CBD since November 2002
- Compared to May 2003, changes in volumes during peak flow periods along the CCT corridor have been more mixed with increases at some and reductions at others suggesting that traffic patterns had stabilised by the middle of 2003

- There was observed to be a further reduction in the evening and on Saturday since May 2003 on roads in the CCT corridor
- The change in volumes at monitored intersections in the southern CBD area was not as significant between May and November 2003 as occurred over the 12 month period

2.3.2 Changes at Specific Intersections

Of the 58 intersections monitored there were reductions in volumes at 23 and increases at 35 during the AM peak. Generally comparison of November 2003 against November 2002 indicated that at most intersections total peak hour volumes were within 20%. At some locations greater differences were observed and analysis of these differences has indicated the following.

- Int. 26 – Liverpool & Oxford
- Int. 32/33 – Elizabeth / Chalmers & Foveaux
- Int. 40 – Moore Pk & Anzac Parade
- Int. 54 - Cleveland & South Dowling
- Int. 57 - South Dowling & Fitzroy Street

Int. 26 – Liverpool & Oxford

The reason for the significant reduction at this intersection is due in part to some over counting during the previous surveys although it is believed that there has been some reduction in traffic levels at this intersection.

Int. 32/33 – Elizabeth/Chalmers & Forveaux

It has been determined that in the first survey the volume observed on Foveaux Street (330 AM Peak) was considerably lower than that observed in the third survey (1230). This was also evident from comparison with the second survey in May 2003 when the AM peak volume on Foveaux was 1150. It is thought that the first survey data is missing the volume from Foveaux Street through to Eddy Avenue. Comparison with the second survey in May 2003 indicates that volumes in November 2003 were between 8% and 10% higher for the three peak hours surveyed.

Int. 40 – Moore Pk & Anzac Parade

The increase at this location would seem to be due to an undercounting of volumes in November 2002. Comparison against the May 2003 count shows a reduction of 15% in November 2003. Checks using site 42 and a permanent RTA count location on Anzac Parade indicated that the November 2003 volumes were in agreement whereas there were differences in the previous two surveys.

Int. 54 - Cleveland & South Dowling

The increase in traffic volumes here was primarily on South Dowling Street. The first survey was undertaken prior to the closure of the Eastern Distributor Bourke Street on-ramp. This would have resulted in some traffic diverting to the South Dowling corridor. Comparison against the May 2003 volumes as shown on Figure ??? indicates a reduction during the six month period.

Int. 57 - South Dowling & Fitzroy Street

The increase in November 2003 volumes compared to November 2002 is thought to be due to be a transcription error in entering of survey data. Comparison of inflows and outflows at adjacent intersections suggests that volumes have not changed to the degree indicated by the latest volumes. The survey company is currently reviewing their data entry for this location.

2.4 Intersection Queue Lengths

These surveys were undertaken at the 23 'core' intersections and complied with the National Association of Australian State Road Authorities (NAASRA) guide to Traffic Engineering Practice, Part 3 (Traffic Studies).

Surveys were undertaken on both weekdays and Saturdays on the same day as the turning counts and the time periods monitored corresponded to those for the turning counts.

There are a number of terms used within this section that should be clarified:

- Maximum Stationary Queue, this is the number of vehicles stopped at the intersection when the signal changes to green;
- Maximum Back of Queue, is measured when the last stationary vehicle begins to move. Hence it can include vehicles that arrive after the signal changes to green; and
- Overflow Queue, this is the number of queued vehicles that do not pass the stop line within the phase.

The queue length data has been analysed and the 1st and 2nd series of surveys compared.

From the first series of surveys queuing was observed as a significant feature at the following intersections:

- Int. 1 - William & Palmer;
- Int 8 – William & Bourke;
- Int 9 – William & Crown;
- Int 10 – William & College;
- Int 11 – William & Palmer;
- Int. 12 – George & Park;
- Int 13 – Druitt & York;
- Int 16 – Druitt & Sussex (EVENING);
- Int. 17 – Bathurst & Harbour;
- Int. 18 – Bathurst & Day;
- Int 19 – Bathurst & Sussex; and
- Int 20 – Sussex & King.

Details of delays at all the intersections monitored are given in **Table 10**. This indicates that average delay times for the above intersections and the others where queue lengths were monitored. For all intersections monitored the maximum average intersection delay did not exceed two minutes.

Table 2 summarises the changes in delay at the intersections monitored. The highest increase observed was 21 seconds. This occurred at the intersection of York and Druitt during the PM peak. At the intersections on the Druitt Street corridor delays were generally higher in November 2003 than November 2002.

Table 2 - Observed Change in Intersection Delay by Time Period (Nov 02 to Nov 03)

	Maximum Delay Increase (Secs)	Maximum Delay Reduction (Secs)
AM	19	-17
PM	21	-9

2.5 Bus Travel Times

For each corridor surveyed there were start and end recording locations plus a one or two intermediate recording stations. The recording stations for each corridor are identified on **Figures 19 to 23**.

The survey was undertaken manually with surveyors at each of the 15 recording stations. Generally one surveyor was used at each location per direction if applicable. Surveyors recorded the following details for every bus passing each location:

- Time;
- Bus Registration Plate;
- Bus Route Number;
- Bus Company;
- Site Number; and
- Direction.

2.5.1 Surveyed Routes

Of the five main corridors the following routes were surveyed between start and end stations:

Route 1 - Parramatta Road Services

422, 423, 426, 428, 431, 432, 433, 435, 436, 437, 438, 440, 470

L23, L28, L38, L40, X31

Route 2 - Victoria Road Services

442, 443, 470, 500, 502, 504, 505, 506, 507, 508, 510, 515, 518, 520
L03, L20, L39, X00, X06, X15, X18

Route 3 - William Street Services

324, 325, 326, L24

Route 4 - Northern Services

175, 178, 244, 247, 251, 252, 253, 254, 261, 270, 286, 288, 290, 291, 292, 293, 610, 620, E86, E87, E88, E89,
L88, L90

Route 5 - Oxford Street Services

373, 377, 380, 392, 394, 396, 399

2.5.2 First Series of Bus Surveys

The first set of bus surveys were undertaken in November 2002. Unfortunately due to poor quality control, there were a number of problems with the survey data that necessitated undertaking the whole survey again.

The surveys was repeated during late March (27th & 29th) and early April (1st & 5th) 2003. Although Cross City Tunnel construction works had commenced by this time, these works were unlikely to have had significant impact on bus services. The changes that had occurred by late March were the closure of the Bourke Street ED ramp and a reduction in capacity along Sir John Young Crescent. The reduction in capacity on Druitt Street did not occur until after (7th April) the surveys were repeated.

Over the survey period almost 18,000 recordings were made of which 14,000 were made on the weekdays and 4,000 on the Saturday. **Table 9** details the number of observations at each of the 14 sites monitored during the repeated surveys. It shows that the busiest survey station was number 7 (George St at Druitt St) with 1760 buses recorded over the 15 hours surveyed on the weekday. Sites 6 (George St at Hunter St) and 8 (George St at Railway Square) had similar volumes of buses passing during the same 15 hour period.

The busiest period of the 5 periods modelled was the PM peak. On average during this period there were some 20% more buses than the morning peak period. The quietest period surveyed was the evening period between 8pm and midnight. During this period bus volumes were only 30% of the PM peak survey period.

2.5.3 Second Series of Bus Surveys (June 2003)

The second series of surveys were undertaken in early June 2003. The locations surveyed were as those in the first series. For this survey all 16 stations were recorded on the same day. In the first series surveys were undertaken over 2 days for each of the weekday and Saturday surveys although on each day the same corridors were surveyed.

2.5.4 Third Series of Bus Surveys (November 2003)

The third series of surveys were undertaken in late November 2003. The surveys were undertaken at the end of November to ensure that they were not impacted significantly by the Rugby World Cup, the final of which occurred on Saturday 22 November. The weekday survey was undertaken on Thursday 27 November and the Saturday survey on the 29 November. One aspect that should be considered is the impact of Christmas shopping, especially on the Thursday when 'late night' shopping occurs in the CBD.

The November 2003 survey was undertaken at 14 stations on the same weekday (Thursday) and Saturday.

Over the survey period 18680 recordings were made of which 13900 were made on the weekday and 4780 on the Saturday. **Table 11** details the number of observations at each of the 14 sites monitored during the third series of bus travel time surveys. As with the first series of surveys, the busiest survey station was number 7 (George St. at Druitt St.) with 2200 buses recorded over the 14 hours surveyed on the weekday. Survey stations 6 (1630 observations) and 8 (1580) were the next busiest locations. It should be noted that in the third survey the PM survey period was between 4pm and 7pm. This was an hour shorter than in the first two surveys which started at 3pm.

2.5.5 Comparison of Bus travel time surveys

In comparing the bus travel time data it should be noted that the comparison of the manual surveys cannot be undertaken for the same month in the previous year, as with the other survey data. The present comparison can only be undertaken against March/April and June data. As shown in Figure 2, traffic volumes in these months around the CBD are lower than those in November. This would also suggest that congestion and hence travel times would generally be lower in these months compared to November.

Tables 12 to 20 detail the comparison of the five bus corridors for the five time periods monitored. Each corridor is separated into 'Inbound' and 'Outbound' directions, with 'Inbound' referring to services travelling towards the CBD. Each table contains four sets of travel time data, three from the manual surveys and one set from the ANTTTS system operated by the RTA's TMC section. The ANTTTS system is an automatic recording system using 'tags' installed on buses and transponders at signalised intersections. Only some buses that operate on CBD services have tags installed and transponders are only installed at a limited number of intersections. However there are enough of both to enable the system to be used to compare against the manual surveys. The limitation with the manual surveys along with the other six monthly manual surveys is that they are only conducted on one day and hence are not an average which would be a better indicator of a trend change.

Observations from **Tables 12 to 20** would suggest that there are some significant differences in bus travel times between the three survey periods especially when comparing individual periods during the day. Although comparison of these three sets of data is valid the recordings for any particular period could be affected by ad-hoc events. For example on Route 1 (Railway Sq. to Hunter St., Inbound) during the midday period travel

times in November 2003 were 22% greater than April and 37% greater than June. The main reason for this increase seemed to be a result of congestion along the northern section of George Street. When compared against the ANTTTS data for the four Thursdays in November 2003 there is quite a different outcome. For this period over the four days the average travel time was 10.2 minutes, considerably lower than the 13.8 minutes observed on the 27 November. The average value is similar to that observed in June and lower than that observed in April.

There is a similar pattern in the 'outbound' direction with the ANTTTS Thursday average generally being lower than the observed times on the 27 November.

On Route 2 (Victoria Road services) the difference between the November 2003 and the previous surveys is not as great. In the 'Inbound' direction the overall difference is 5 to 6% whilst in the 'outbound' direction it was 8 to 12%. Whereas the 'inbound' Saturday times were higher, in the 'outbound' direction they were lower. Unfortunately the ANTTTS system was not recording particularly well on this route due to software incompatibility issues.

On Route 3 (William Street services) travel times in the city bound direction would seem to have increased over the three sets of surveys. However the ANTTTS data suggests that the travel times on the day of survey in November 2003 were higher than the average and hence when using this automated data the times are similar to those in June and some 10% higher than those in April. In the 'outbound' direction the November 2003 times are similar to the June values and 5 to 10% higher than the times recorded in April. The ANTTTS data also indicate that on the 27 November travel times were above average for a Thursday in the outbound direction.

On Route 4 (Northern services) the comparison of November 2003 data with previous surveys indicated that overall travel times were marginally lower. There would seem to be a good correlation with the ANTTTS data in the inbound direction.

For Route 5 (services on Elizabeth Street between Liverpool St and Bridge St.) the November 2003 surveyed times were consistently higher than in previous surveys by some 3 to 4 minutes in the 'inbound' direction. However, the ANTTTS data, as with the other corridors, suggests that travel times on the 27 November were significantly higher than the average for that month. The average ANTTTS travel times are similar to the June survey times in the inbound direction and lower than all the surveyed times in the outbound direction.

2.6 Car Travel Times

Travel times were also undertaken on 4 main routes by car. The four routes were:

- Route 1 – Camperdown to Potts Point (7.3km Inbound, 7.6km Outbound)
- Route 2 – Rozelle to Double Bay (8.5km IB, 8.3km OB)
- Route 3 – Sydney (Harbour Bridge) to Bondi (10.5km IB, 10.8km OB)

- Route 4 – Moore Park to Ultimo (9.5km IB, 4.8km OB)

These routes are indicated on **Figures 24 to 27**.

Generally the 'Inbound' and 'Outbound' directions traversed the same roads in both directions however for some routes this was not possible due to one-way streets or banned turning movements.

The 'floating' car method was used whereby times are recorded from a vehicle travelling between the start and end points with timings taken at strategic intersections en-route.

To comply with Appendix 21 surveys were undertaken during the following periods:

- For all routes travel time surveys to be undertaken on a Tuesday, Wednesday or Thursday (non Public holiday) between 0630-1000 and 1530-1900; and
- Travel times on all routes were also recorded between 1100 and 1400.

For each route travel times were measured in both directions. **Table 3 and 4** detail the average times for each route in the AM and PM peak periods. The change from the November surveys is also given. This indicates that in general travel times on these route were lower on average in November 2003 than they were in November 2002.

The second set of car travel time surveys were not completed until late July 2003. These were undertaken during the first week after the school mid-term holidays and hence may have been subject to lower congestion levels during that week as school start dates do vary.

Table 3 - Comparison of AM Peak Car Travel Times

	Direction	Nov 2002	July 2003	Nov 2003	Change Nov02 to Nov03	Change July03 to Nov03
Route 1	Inbound	21.5	22.4	21.9	2%	-2%
	Outbound	15.9	19.2	19.0	19%	-1%
Route 2	Inbound	23.6	17.2	20.6	-13%	20%
	Outbound	16.4	15.6	18.8	15%	21%
Route 3	Inbound	26.8	22.3	17.4	-35%	-22%
	Outbound	28.7	21.3	26.0	-9%	22%
Route 4	Inbound	20.6	18.2	17.7	-14%	-3%
	Outbound	13.7	13.1	13.5	-1%	3%

*These recordings are thought to be too low

Table 4 - Comparison of PM Peak Car Travel Times

	Direction	Nov 2002	July 2003	Nov 2003	Change Nov02 to Nov03	Change July03 to Nov03
Route 1	Inbound	20.4	22.1	17.6	-14%	-20%
	Outbound	22.6	24.6	19.2	-15%	-22%
Route 2	Inbound	23.8	18.1	20.0	-16%	10%
	Outbound	27.6	18.3	28.5	3%	56%
Route 3	Inbound	26.1	20.4	19.5	-25%	-4%
	Outbound	22.3	21.5	21.1	-5%	-2%
Route 4	Inbound	25.1	21.4	21.1	-16%	-1%
	Outbound	11.8	16.1	14.3	21%	-11%

The car travel time surveys indicated a general reduction in travel times between November 2002 and November 2003 although on some routes average times were greater. Comparison of the November 2003 against those in July 2003 gave a closer match although some routes in the inbound or outbound directions produced more significant differences. On some routes in the November 2003 surveys travel times were affected by incidents for particular time periods. This was particularly true of Route 2, between Victoria Road and Double Bay, especially at it's eastern end.

3.0 Results and Conclusions

3.1 Results

The analysis has indicated a number of issues:

- Based on the comparison of data collected in the first series against that collected in the third series there is no indication that traffic in and around Sydney CBD has been adversely affected by Cross City Tunnel construction works.
- A comparison of the most consistent data, that from the RTA permanent count sites, indicates that overall traffic volumes around the CBD have remained constant.
- Traffic volumes on the CCT corridor(s) have reduced although there have not been any notable increases on other corridors suggesting that there has been a fairly widespread displacement of traffic.

3.2 RTA Permanent Count Sites

Twenty-five sites in and around the CBD were monitored although due to inoperable counters or non-availability of data not all sites could be compared. The previous comparison of November 2002 and May 2003 had indicated an overall reduction of 6% in daily volumes. To an extent this would be expected given that November traffic volumes are some 3% higher than May as indicated on **Figure 2**. The comparison of November 2002 against the same month in 2003 shows a less marked difference. Of the 20 sites with available data there was virtually no difference (-0.1%) in weekday volumes.

A summary of changes for the major routes at the CBD cordon is given in **Table 5**. This also shows a general reduction between November 2002 and May 2003. At only four of the 25 locations were weekday volumes observed to increase by 5% or more between November 2002 and November 2003. These were:

- Flinders Street (south of Oxford Street);
- Cahill Expressway (at Circular Quay);
- Pyrmont Street on-ramp to Western Distributor (Darling Harbour); and
- Cleveland Street (west of Anzac Parade)

These sites are in close proximity to areas that were focal points of the 2003 Rugby World Cup during which Sydney was the venue for a number of matches in November. There were also a number of locations, such as The Rocks and Darling Harbour where facilities were provided as part of the RWC event programme. The traffic generated by these events would be a primary reason for the increases in volumes at the above locations.

Table 5 - Change in traffic volumes at CBD cordon Permanent Count sites (Nov 02 to Nov 03)

	AM Peak 0600-1000	Inter Peak 1100-1400	PM Peak 1500-1900	Evening Peak 2000-2400	Weekday	Saturday 1000-1500
Harbour Bridge	2%	4%	2%	1%	2%	3%
Harbour Tunnel	-2%	0%	-1%	1%	-1%	-1%
City Road	2%	-2%	0%	1%	0%	-1%
Cleveland St	6%	1%	4%	5%	5%	1%
New South Head	-13%	-4%	-6%	8%	-5%	-4%
Syd Einfeld	-2%	-5%	2%	1%	-1%	3%
Parramatta Rd	-8%	-5%	-14%	-8%	-9%	-6%
ANZAC Bridge	8%	0%	2%	-8%	0%	1%
City West Link	1%	2%	0%	0%	1%	2%
Iron Cove Bridge	1%	-1%	1%	-3%	0%	0%
AVERAGE	0%	0%	-1%	-1%	-1%	0%

Further analysis of the permanent count stations by the time periods during which the manual surveys were undertaken also indicated that traffic volumes were only marginally different to those in November 2002. As it shows, during the higher flow periods traffic volumes were marginally lower.

Table 6 – Comparison of traffic volume change November 2002 to November 2003 (RTA Permanent Sites)

AM Peak 0600-1000	Inter Peak 1100-1400	PM Peak 1500-1900	Evening Peak 2000-2400	Weekday	Saturday 1000-1500
-0.4%	-0.2%	0%	+0.3%	-0.1%	-0.1%

3.3 Intersection Surveys

Analysis of the 64 locations monitored in both the first and second surveys indicates that there has tended to be a reduction in traffic on the CCT corridor. This is particularly evident on Druiit Street and also on William Street and Sir John Young Crescent. The reduction on both Druiit Streets and Sir John Young Crescent might be expected given the reduction in capacity on both of these roads due to CCT construction works.

The reduction in traffic volumes on William Street is probably related to these two routes. Based on the intersections monitored it would seem that there could have been a transfer to the Syd Einfeld/Moore Park/Cleveland Street corridor. To an extent this is reflected in the RTA permanent count sites which indicate small increases in this corridor. These routes would likely have been affected by the closure of the Eastern Distributor on-ramp from Bourke Street at the end of January 2003.

Data from the intersection delay surveys suggested that overall delay was marginally higher in November 2003 than November 2002. This occurrence seemed to be more prevalent in the PM peak period.

3.4 Travel Time Surveys

The comparison of bus and car travel time data collected in second series of surveys against that collected in the first series indicated that although some routes experienced an increase in travel times there was no consistent pattern.

Bus travel times were observed to increase during some periods on some corridors in a particular direction, however there was no observed consistency. Given that surveys were undertaken on one day only, the daily variation in traffic conditions that regularly occur in the CBD is more likely to be more significant than the works associated with construction of the Cross City Tunnel.

3.5 Conclusions

As concluded in the July 2003 report comparing the impacts of the first six months of Cross City Tunnel construction, this report reaches a similar overall conclusion in that no significant detrimental impacts to road traffic have occurred.

The most significant trend that the analysis has highlighted are a reduction in traffic flows along the CCT corridor, especially at the western end along Druitt Street, but also in the eastern zone along William Street and on Sir John Young Crescent.

Due to the nature of the comparison of the manual surveys which are generally undertaken on just one day, differences can occur that may be a result of ad-hoc events, such as breakdowns or traffic accidents. Where available, data has been compared over longer time periods and this has generally indicated that the construction works have not had a significant detrimental effect.

4.0 Tables

Table 7 - Percentage Change in Traffic Volumes at CORE Intersections

Int	AM (%)	Midday (%)	PM (%)	Evening (%)	Saturday (%)
1	3	-2	0	-19	-10
2	11	11	19	-10	16
3	2	-13	-10	-13	-5
4	-12	13	-40	-49	-7
5	1	-13	-3	4	-8
6	0	3	-2	7	-8
7	12	2	0	-8	13
8	-4	-13	-12	-22	-21
9	12	1	-8	-18	-15
10	4	5	-6	-20	7
11	14	1	16	10	2
12	-16	-16	-9	-16	-8
13	-13	-21	-8	-14	5
14	-3	-12	-10	-34	5
15	-12	-20	-25	-26	-22
16	-16	-11	-23	-2	
17	-7	-9	8	-4	-4
18	-11	0	-4	-4	0
19	-6	10	16	9	11
20	-8	-10	-24	-33	-15
21	2	10	-8	13	-17
23	-31	-8	-44	-23	-15

Table 8 - Percentage Change in Traffic Volumes at PRECINCT Intersections

Int	AM	INTER	PM
	(%)	(%)	(%)
24	-11	8	-12
25	1	3	-7
26	-29	-24	-37
27	-3	-5	5
28	-16	-13	11
29	2	7	4
30	2	7	4
31	8	-5	2
32	45	48	37
34	16	12	17
35	0	-6	-11
36	12	5	15
37	-5	-7	-6
38	9	12	22
39	4	3	14
40	34	7	7
41	18	10	5
42	14	19	13
43	6	10	-2
44	-9	4	-22
45	17	11	13
46	-20	-15	-35
47	-4	-2	-8
48	4	11	22
49	2	7	8
50	3	22	6
51a	12	15	27
51b	17	22	14
52	8	32	49
53	-17	-14	-7
54	20	11	10
55	18	-3	5
56	3	-11	-10
57	26	5	6
58	-1	11	5
59b	-2	12	9

Table 9 - Summary of Bus Volumes Recorded in March/April 2003 Surveys

Recording Station	AM Peak	Business	PM Peak	Evening	Saturday	Grand Total
	0600-1000	1100-1400	1500-1900	2000-2400	1000-1500	
1. Victoria Rd/City West Link	369	140	389	104	227	1229
2. York/Grosvenor	372	131	361	76	180	1120
3. York/King	212	83	136	38	115	584
4. York/Druitt/Park	345	233	528	130	354	1590
5. Clarence/Margaret	321	152	522	81	182	1258
6. George/Hunter	542	337	614	214	503	2210
7. George/Park/Druitt	541	331	633	251	583	2339
8. Railway Square	519	332	542	224	481	2098
10. New South Head Ocean St	82	68	105	28	85	368
11. William/College	150	108	175	62	172	667
12. Phillip/Bridge	296	196	334	134	318	1278
13. Young/Bridge	213	187	363	134	304	1201
14. Bridge St	42	57	142	33	129	403
15. Liverpool/Elizabeth	310	252	436	181	385	1564
Grand Total	4314	2607	5280	1690	4018	17909

Note : Recording Station 9 did not exist

Table 10 - Summary of Bus Volumes Recorded in November 2003 Surveys

Recording Station	AM Peak	Business	PM Peak	Evening	Saturday	Grand Total
	0600-1000	1100-1400	1600-1900	2000-2400	1000-1500	
1. Victoria Rd/City West Link	473	174	407	111	263	1428
2. York/Grosvenor	561	153	327	73	192	1306
3. York/King	328	120	129	64	253	894
4. York/Druitt/Park	366	232	419	153	495	1665
5. Clarence/Margaret	376	183	480	148	311	1498
6. George/Hunter	604	344	447	239	543	2177
7. George/Park/Druitt	811	478	626	291	832	3038
8. Railway Square	580	348	426	227	496	2077
10. New South Head Rd/Ocean St	93	66	79	28	90	356
11. William/College	233	185	227	92	446	1183
12. Phillip/Bridge	238	136	190	87	290	941
13. Young/Bridge	111	90	145	73	152	571
15. Liverpool/Elizabeth	334	263	321	207	418	1543
Grand Total	5108	2772	4223	1793	4781	18677

Note : Recording Station 9 did not exist

* This number is higher than the March/April count as it also includes stations 16 & 17.

Table 11 - Comparison of Average Intersection Delay

Palmer Street and William Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	01:11	01:30	+19
PM	01:07	00:58	-9
Palmer Street and Sir John Young Crescent			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	01:24	01:13	-11
PM	01:15	01:19	+4
William Street and Riley Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	01:02	01:07	+5
PM	01:06	01:09	+3
McLachlan Street and Craigend Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	01:09	01:17	+8
PM	01:06	01:14	+8
Ocean Street and New South Head Road			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	01:10	01:16	+6
PM	01:15	01:17	+2
William Street and Bourke Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	01:13	00:56	-17
PM	01:10	00:55	-15
William Street and Crown Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	01:05	01:16	+11
PM	01:08	01:26	+18
William Street and College Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	01:28	01:12	-16
PM	01:30	01:29	-1
Park Street and Elizabeth Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	01:17	01:19	+2
PM	01:15	01:36	+21

George Street and Park Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	01:14	01:23	+9
PM	01:13	01:24	+11
York Street and Druitt Street			
Time Period	Nov-02	May-03	Change (Secs)
AM	01:01	01:02	+1
PM	01:02	01:04	+2
Clarence Street and Druitt Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	00:24	00:28	+4
PM	00:30	00:28	-2
Kent Street and Druitt Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	01:00	00:57	-3
PM	00:57	01:11	+14
Sussex Street and Druitt Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	00:57	01:06	+9
PM	00:59	01:09	+10
Harbour Street and Bathurst Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	01:03	01:06	+3
PM	01:05	01:05	0
Day Street and Bathurst Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	01:16	01:14	-2
PM	01:19	00:35	
Sussex Street and Bathurst Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	01:00	01:09	+9
PM	01:04	01:11	+7
Sussex Street and King Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	00:44	00:48	+4
PM	00:37	00:34	-3
Sussex Street and Market Street			
Time Period	Nov-02	Nov -03	Change (Secs)
AM	01:01	00:54	-7
PM	01:01	01:01	0

Table 12 – Comparison of BUS Travel Times on Route 1 INBOUND (PARRAMATTA Road services)

	1 st Survey	2 nd Survey	3 rd Survey	ANTTS	Change (Mar/Apr-Nov)		Change (Jun-Nov)	
	Mar/Apr-03	Jun-03	Nov-03	Nov-03*	(Minutes)	(%)	(Minutes)	(%)
AM	11.0	10.8	11.3	10.7	0.4	3%	0.5	5%
Midday	11.2	10.0	13.8	10.2	2.5	22%	3.7	37%
PM	12.1	11.5	12.4	12.6	0.4	3%	1.0	8%
Evening	8.0	7.3	8.0	6.8	0.0	0%	0.7	9%
Ave. Weekday	10.7	10.2	11.6		0.8	8%	1.3	13%
Saturday	9.8	9.1	10.2		0.4	4%	1.1	12%

*ANTTS data is an average of all Thursdays in November 2003

Table 13 – Comparison of BUS Travel Times on Route 1 OUTBOUND (PARRAMATTA Road services)

	1 st Survey	2 nd Survey	3 rd Survey	ANTTS	Change (Mar/Apr-Nov)		Change (Jun-Nov)	
	Mar/Apr-03	Jun-03	Nov-03	Nov-03*	(Minutes)	(%)	(Minutes)	(%)
AM	11.8	10.5	10.7	11.4	-1.0	-9%	0.2	2%
Midday	15.7	12.4	14.6	12.8	-1.1	-7%	2.2	18%
PM	15.8	14.0	17.5	16.3	1.7	11%	3.5	25%
Evening	11.3	9.0	11.5	11.3	0.2	2%	2.6	28%
Ave. Weekday	14.2	12.1	13.9		-0.3	-2%	1.8	15%
Saturday	12.7	11.8	11.7		-1.0	-8%	-0.1	-1%

*ANTTS data is an average of all Thursdays in November 2003

Table 14 – Comparison of BUS Travel Times on Route 2 INBOUND (VICTORIA Road services)

	1 st Survey	2 nd Survey	3 rd Survey	ANTTS	Change (Mar/Apr-Nov)		Change (Jun-Nov)	
	Mar/Apr-03	Jun-03	Nov-03	Nov-03*	(Minutes)	(%)	(Minutes)	(%)
AM	12.8	13.2	13.6		0.7	6%	0.4	3%
Midday	12.5	11.5	14.0		1.5	12%	2.5	22%
PM	13.1	12.6	12.4		-0.8	-6%	-0.2	-2%
Evening	10.1	8.2	10.7		0.7	7%	2.5	31%
Ave. Weekday	12.4	12.5	13.2		0.8	6%	0.7	5%
Saturday	8.8	10.3	11.8		3.0	35%	1.5	15%

*ANTTS data is an average of all Thursdays in November 2003

Table 15 – Comparison of BUS Travel Times on Route 2 OUTBOUND (VICTORIA Road services)

	1 st Survey	2 nd Survey	3 rd Survey	ANTTS	Change (Mar/Apr-Nov)		Change (Jun-Nov)	
	Mar/Apr-03	Jun-03	Nov-03	Nov-03*	(Minutes)	(%)	(Minutes)	(%)
	(Minutes)	(Minutes)	(Minutes)	(Minutes)	(Minutes)	(%)	(Minutes)	(%)
AM	10.4	11.3	10.9		0.6	5%	-0.3	-3%
Midday	12.8	12.3	14.8		2.0	16%	2.6	21%
PM	16.7	15.5	17.8		1.1	6%	2.2	14%
Evening	10.6	9.6	9.5		-1.0	-10%	-0.1	-1%
Ave. Weekday	13.6	13.0	14.6		1.1	8%	1.6	12%
Saturday	13.6	14.8	10.6		-3.0	-22%	-4.2	-29%

*ANTTS data is an average of all Thursdays in November 2003

Table 16 – Comparison of BUS Travel Times on Route 3 INBOUND (WILLIAM Street services)

	1 st Survey	2 nd Survey	3 rd Survey	ANTTS	Change (Mar/Apr-Nov)		Change (Jun-Nov)	
	Mar/Apr-03	Jun-03	Nov-03	Nov-03*	(Minutes)	(%)	(Minutes)	(%)
	(Minutes)	(Minutes)	(Minutes)	(Minutes)	(Minutes)	(%)	(Minutes)	(%)
AM	16.5	18.9	21.0	17.9	4.5	27%	2.0	11%
Midday	17.1	18.8	22.1	18.7	5.0	29%	3.3	18%
PM	17.6	19.4	22.2	21.6	4.6	26%	2.8	14%
Evening	12.4	13.3	14.3	12.1	1.9	15%	1.0	7%
Ave. Weekday	16.1	18.3	19.8		3.7	23%	1.5	8%
Saturday	16.5	16.1	17.3		0.8	5%	1.2	8%

*ANTTS data is an average of all Thursdays in November 2003

Table 17 – Comparison of BUS Travel Times on Route 3 OUTBOUND (WILLIAM Street services)

	1 st Survey	2 nd Survey	3 rd Survey	ANTTS	Change (Mar/Apr-Nov)		Change (Jun-Nov)	
	Mar/Apr-03	Jun-03	Nov-03	Nov-03*	(Minutes)	(%)	(Minutes)	(%)
	(Minutes)	(Minutes)	(Minutes)	(Minutes)	(Minutes)	(%)	(Minutes)	(%)
AM	20.1	21.4	19.8	18.9	-0.4	-2%	-1.7	-8%
Midday	19.1	21.3	20.6	18.6	1.5	8%	-0.8	-4%
PM	20.5	21.6	21.8	20.2	1.3	6%	0.2	1%
Evening	14.9	15.7	15.6	13.5	0.7	5%	-0.1	-1%
Ave. Weekday	18.9	20.3	19.7		0.8	4%	-0.7	-3%
Saturday	15.5	17.0	18.0		2.5	16%	1.0	6%

*ANTTS data is an average of all Thursdays in November 2003

Table 18 – Comparison of BUS Travel Times on Route 4 INBOUND (NORTHERN services)

	1 st Survey	2 nd Survey	3 rd Survey	ANTTS	Change (Mar/Apr-Nov)		Change (Jun-Nov)	
	Mar/Apr-03	Jun-03	Nov-03	Nov-03*	(Minutes)	(%)	(Minutes)	(%)
	(Minutes)	(Minutes)	(Minutes)	(Minutes)	(Minutes)	(%)	(Minutes)	(%)
AM	12.2	9.7	7.3	9.3	-4.9	-40%	-2.3	-24%
Midday	11.5	10.6	10.8	11.0	-0.7	-6%	0.2	2%
PM	11.5	10.8	11.9	11.0	0.4	4%	1.1	10%
Evening	11.7	8.1	9.9	7.9	-1.8	-15%	1.8	22%
Ave. Weekday	11.6	9.9	9.0		-2.6	-22%	-0.9	-9%
Saturday	12.7	5.8	9.2		-3.5	-27%	3.4	58%

*ANTTS data is an average of all Thursdays in November 2003

Table 19 – Comparison of BUS Travel Times on Route 4 OUTBOUND (NORTHERN services)

	1 st Survey	2 nd Survey	3 rd Survey	ANTTS	Change (Mar/Apr-Nov)		Change (Jun-Nov)	
	Mar/Apr-03	Jun-03	Nov-03	Nov-03*	(Minutes)	(%)	(Minutes)	(%)
	(Minutes)	(Minutes)	(Minutes)	(Minutes)	(Minutes)	(%)	(Minutes)	(%)
AM	6.8	6.9	4.7		-2.1	-31%	-2.3	-32%
Midday	8.1	5.3	7.5		-0.5	-6%	2.2	42%
PM	6.4	9.1	6.1		-0.3	-5%	-3.0	-33%
Evening	5.8	4.0	4.4		-1.4	-25%	0.3	8%
Ave. Weekday	6.7	7.1	5.7		-1.0	-14%	-1.4	-19%
Saturday	6.5	5.0	6.0		-0.5	-8%	1.1	22%

*ANTTS data is an average of all Thursdays in November 2003

Table 20 – Comparison of BUS Travel Times on Route 5 INBOUND (OXFORD Street services)

	1 st Survey	2 nd Survey	3 rd Survey	ANTTS	Change (Mar/Apr-Nov)		Change (Jun-Nov)	
	Mar/Apr-03	Jun-03	Nov-03	Nov-03*	(Minutes)	(%)	(Minutes)	(%)
	(Minutes)	(Minutes)	(Minutes)	(Minutes)	(Minutes)	(%)	(Minutes)	(%)
AM	7.6	8.6	9.3	7.9	1.7	23%	0.7	9%
Midday	8.4	8.3	12.0	8.7	3.5	42%	3.7	45%
PM		8.7	12.0	8.0			3.3	37%
Evening		6.0	6.7	5.0			0.7	11%
Ave. Weekday	7.9	8.5	9.8				1.3	15%
Saturday	7.0	7.2	8.0		1.0	15%	0.8	11%

*ANTTS data is an average of all Thursdays in November 2003

Table 21 – Comparison of BUS Travel Times on Route 5 OUTBOUND (OXFORD Street services)

	1 st Survey	2 nd Survey	3 rd Survey	ANTTS	Change (Mar/Apr-Nov)		Change (Jun-Nov)	
	Mar/Apr-03	Jun-03	Nov-03	Nov-03*	(Minutes)	(%)	(Minutes)	(%)
	(Minutes)	(Minutes)	(Minutes)	(Minutes)				
AM	9.5	8.0	7.9	6.0	-1.6	-17%	-0.1	-1%
Midday	10.8	9.1	12.8	7.5	2.1	19%	3.8	41%
PM	13.6	11.4	14.3	8.8	0.7	5%	2.9	25%
Evening	9.0	7.4	8.1	4.3	-0.9	-10%	0.6	9%
Ave. Weekday	11.4	9.5	11.2		-0.2	-1%	1.7	18%
Saturday	9.1	11.3	10.7		1.6	18%	-0.7	-6%

*ANTTS data is an average of all Thursdays in November 2003

5.0 Figures

Figures 1 to 27 follow this page.

Figure 1: Study Area

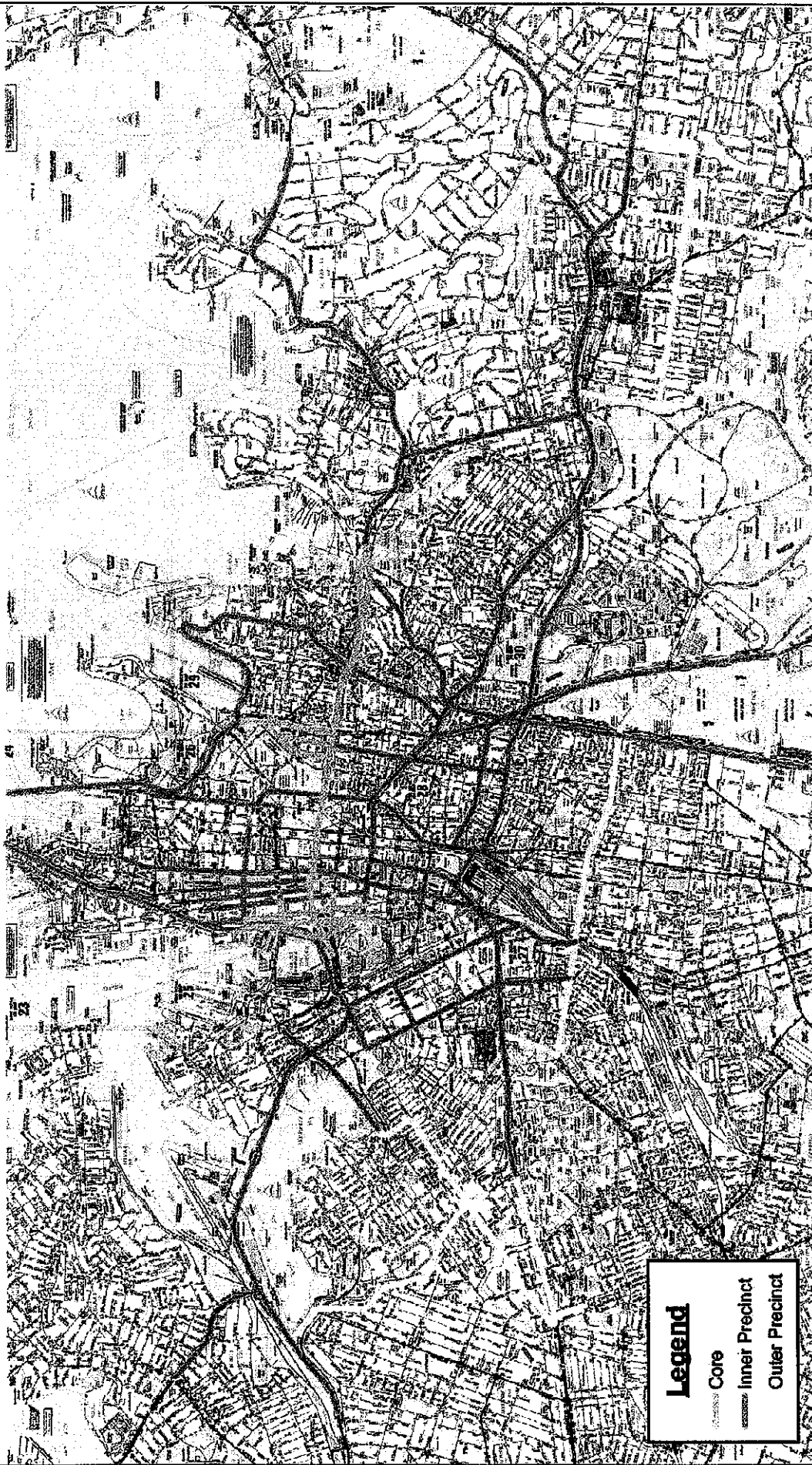


Figure 2 - Monthly Traffic Volume Annualisation Factors

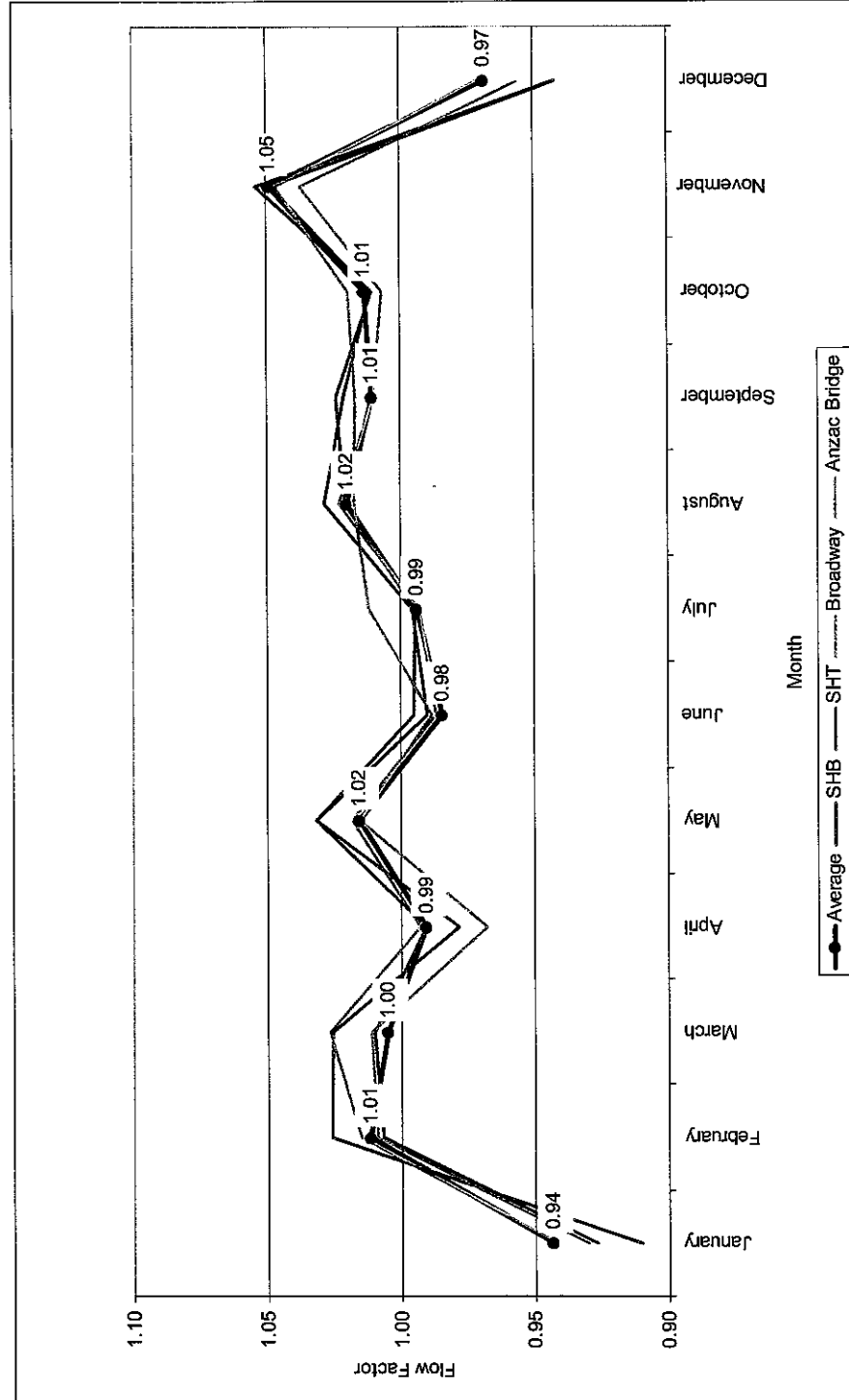
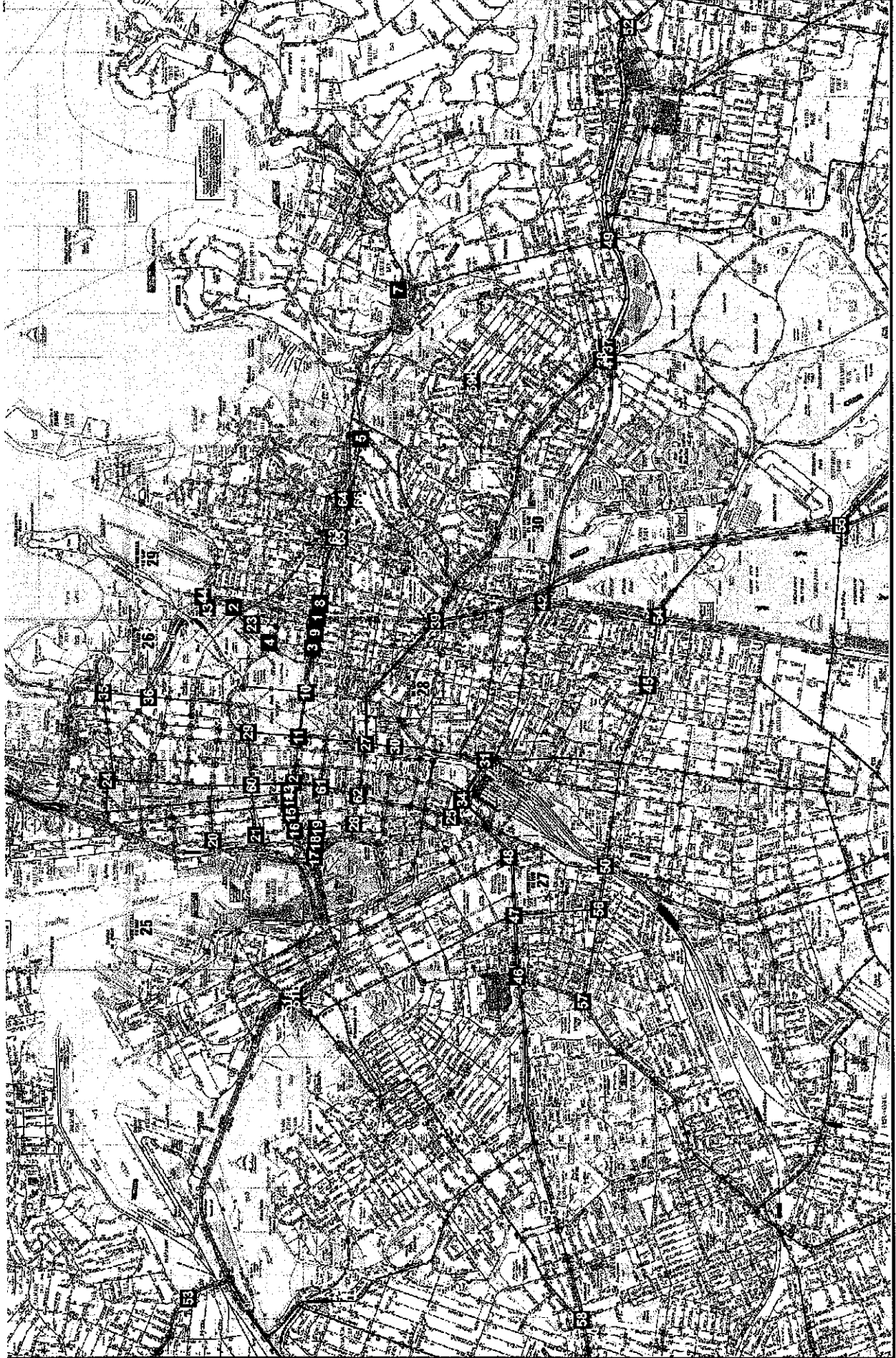
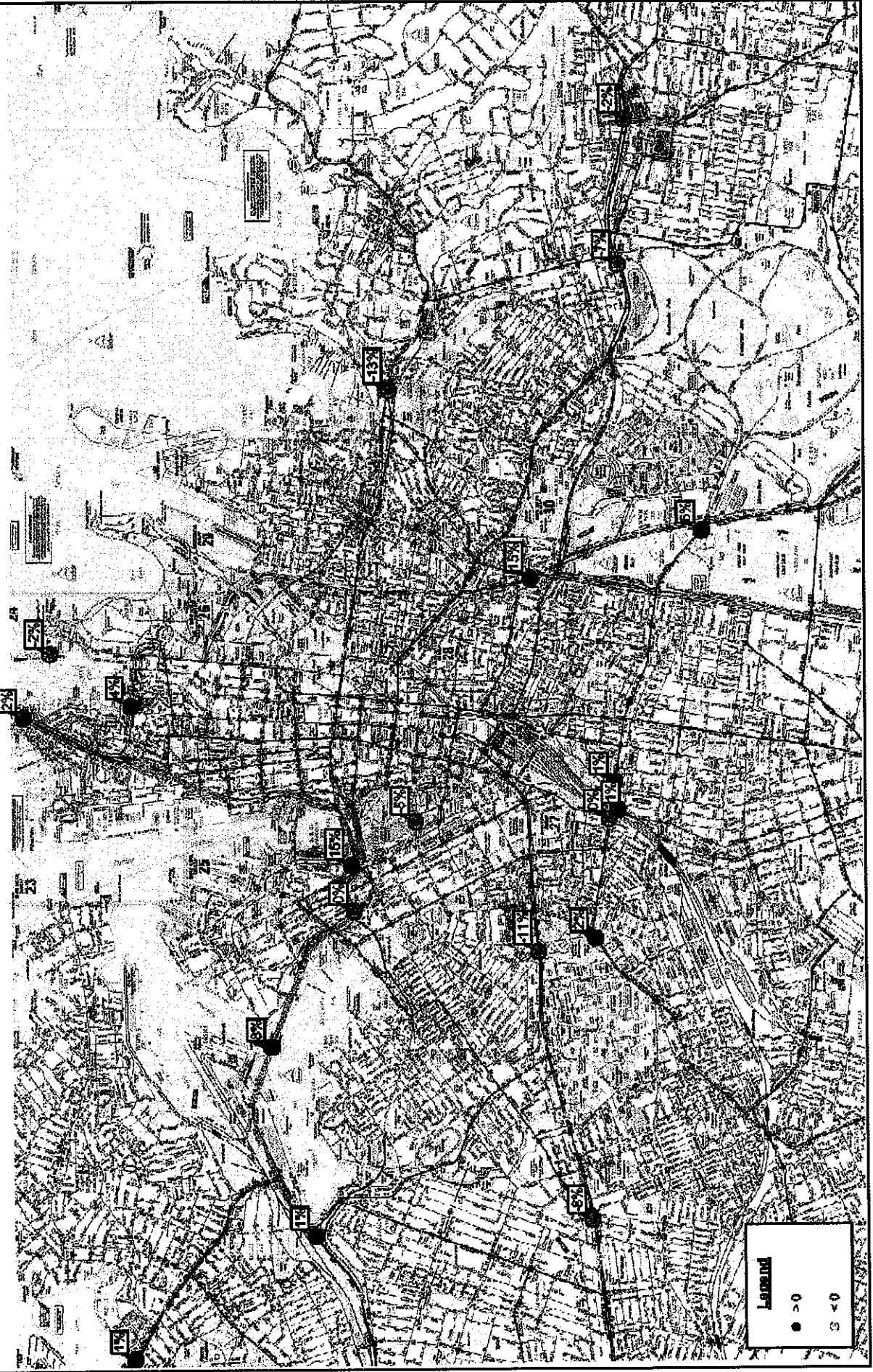


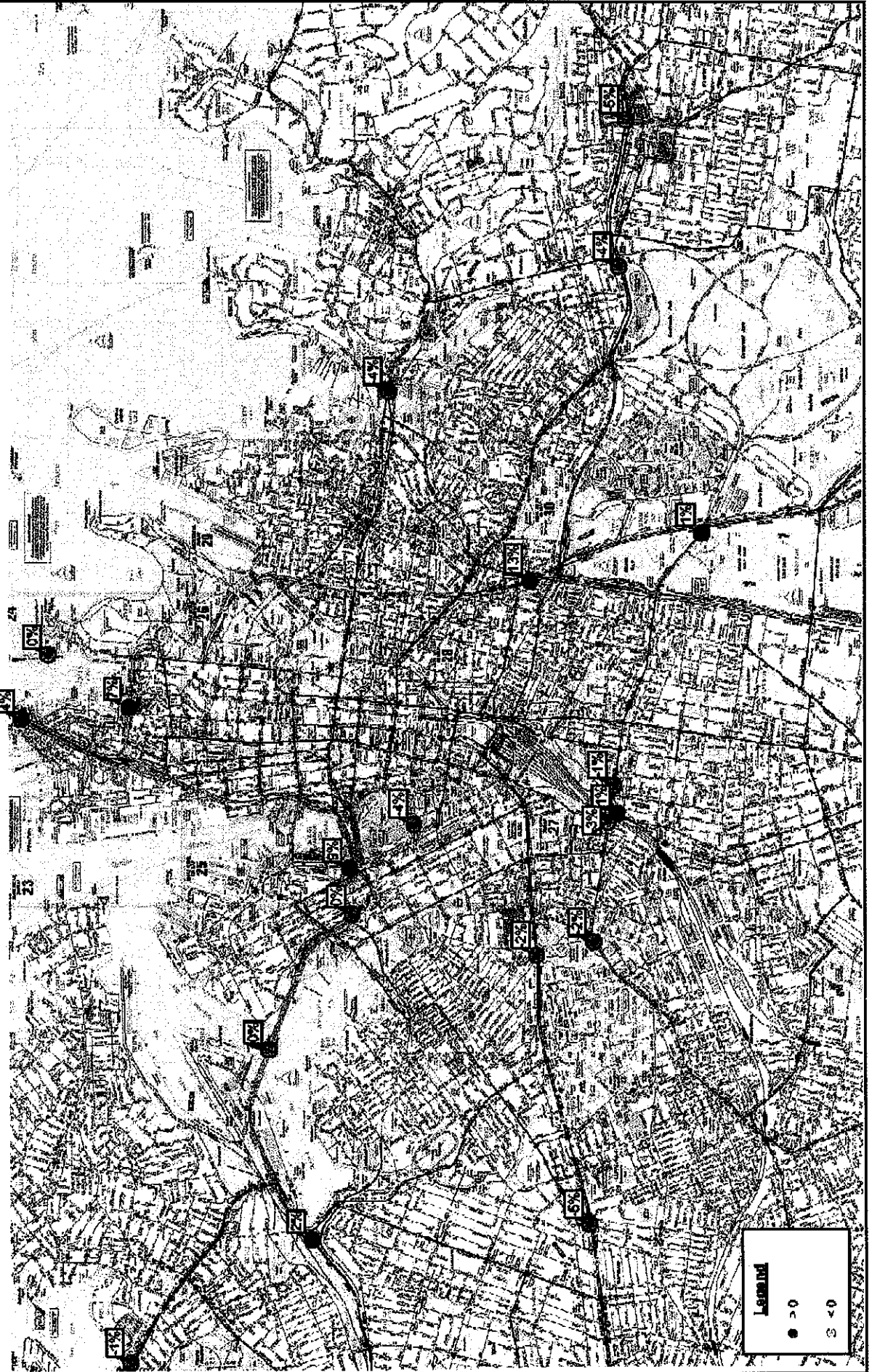
Figure 3: Location of Intersection Surveys



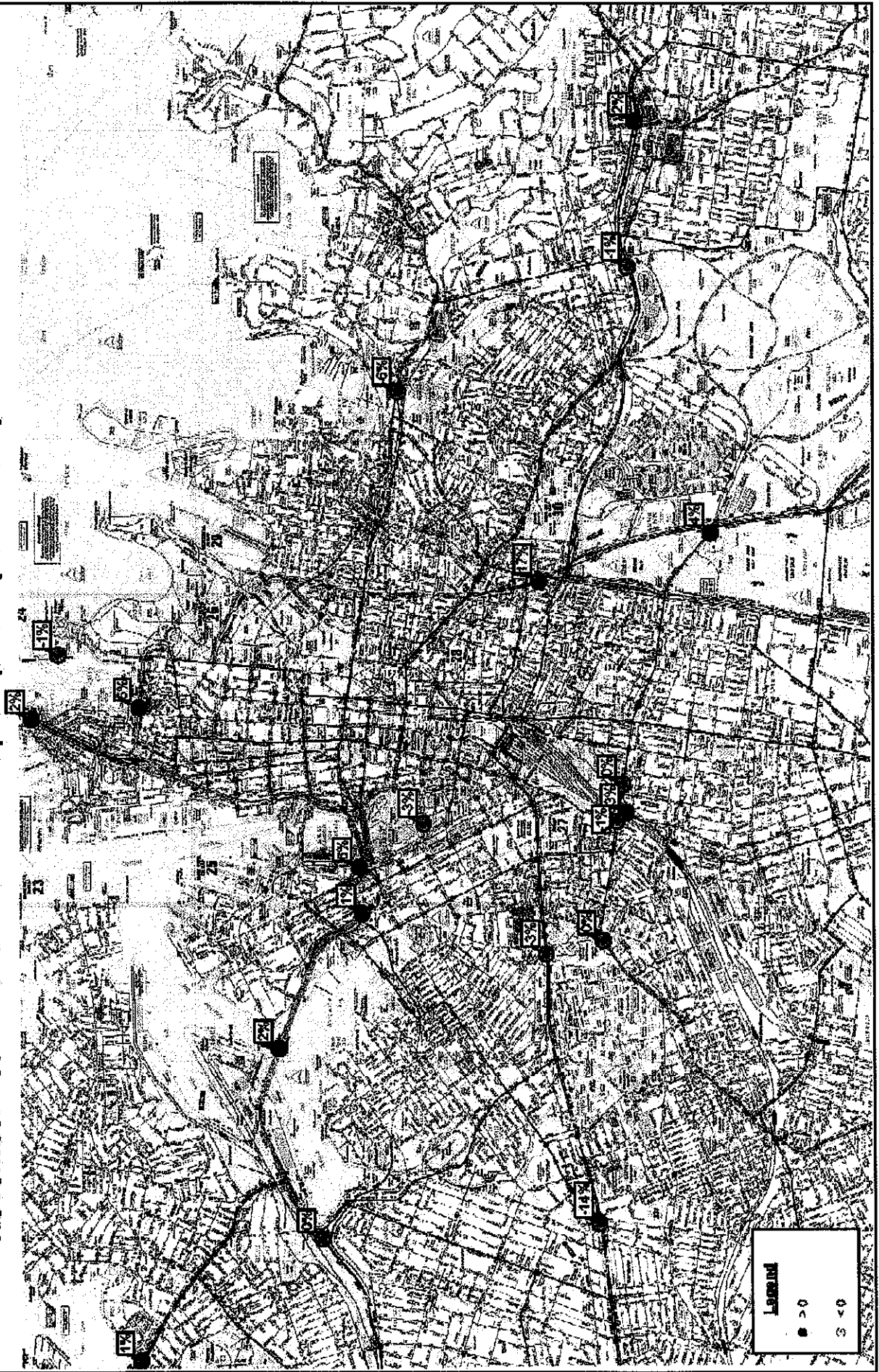
**Figure 4: RTA Permanent Count Site Proportional Change
November 2002 - November 2003 AM peak period (0600 - 1000)**



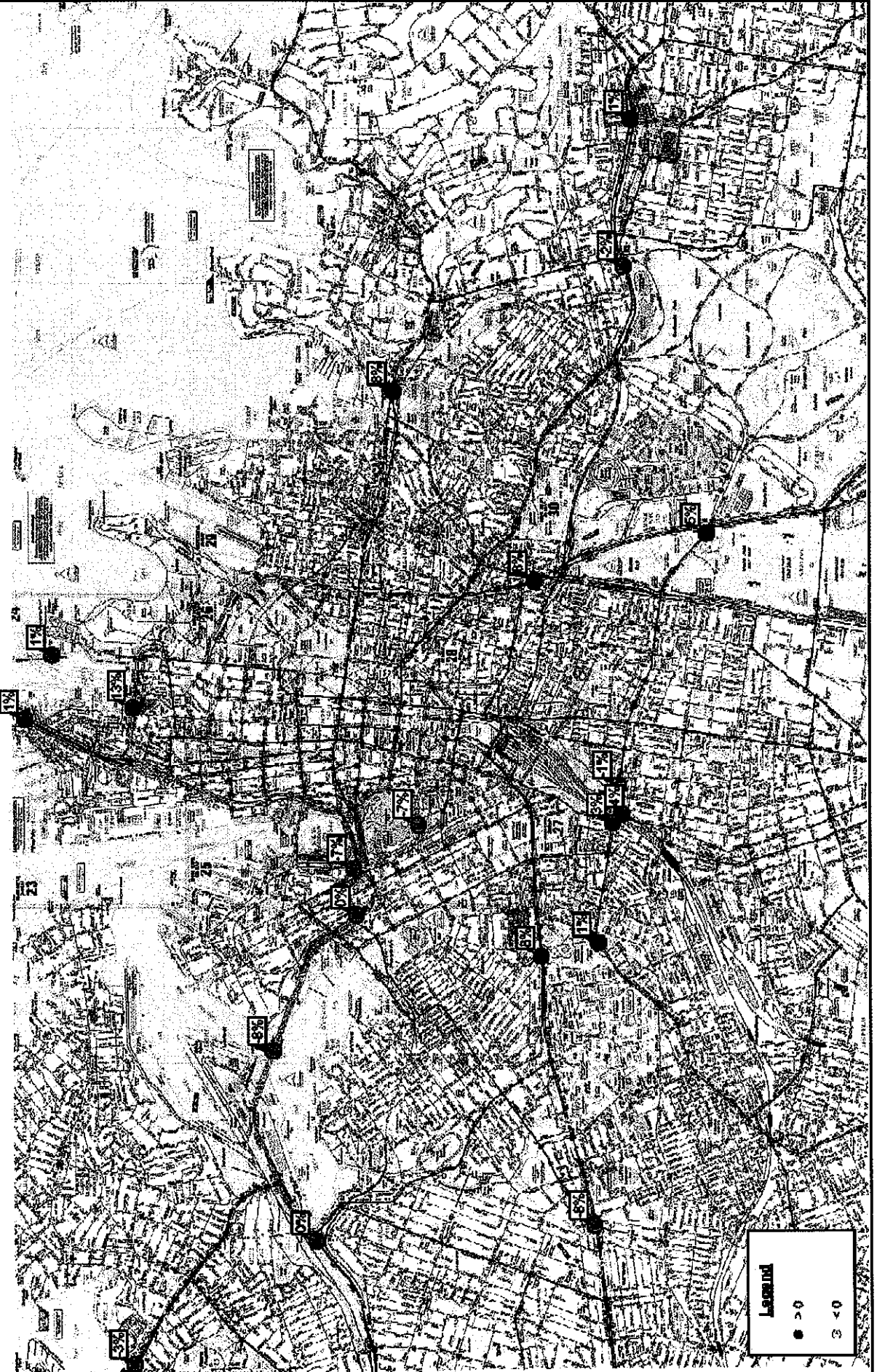
**Figure 5: RTA Permanent Count Site Proportional Change
November 2002 - November 2003 MIDDAY peak period (1100 - 1400)**



**Figure 6: RTA Permanent Count Site Proportional Change
November 2002 - November 2003 PM peak period (1500 - 1900)**



**Figure 7: RTA Permanent Count Site Proportional Change
November 2002 - November 2003 EVENING peak period (2000 - 2400)**



**Figure 8: RTA Permanent Count Site Proportional Change
November 2002 - November 2003 SATURDAY peak period (1000 - 1500)**

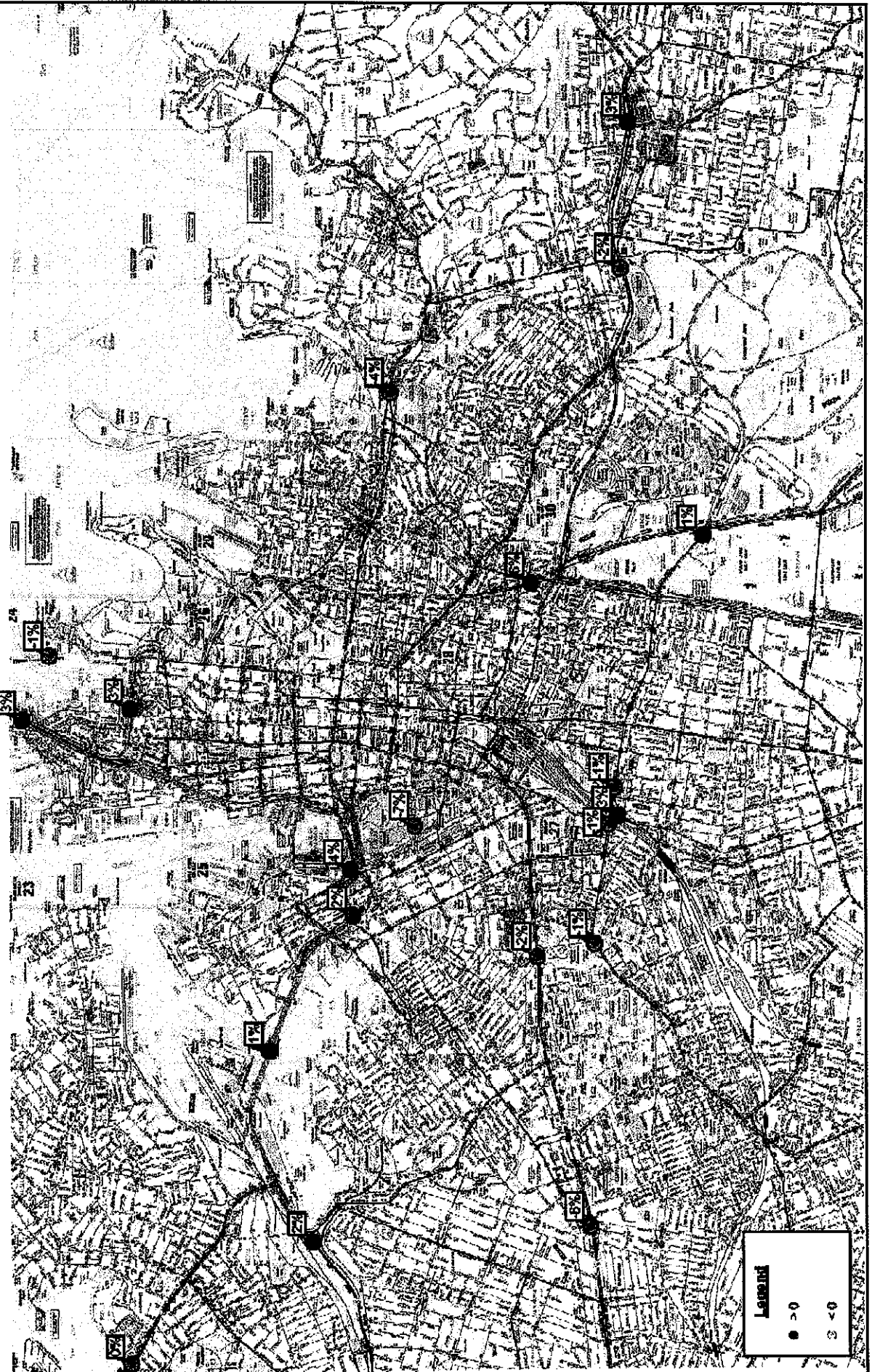


Figure 9a: Proportional Change in Intersection Volumes (AM Peak, Nov 02 - Nov 03)

22/01/2004

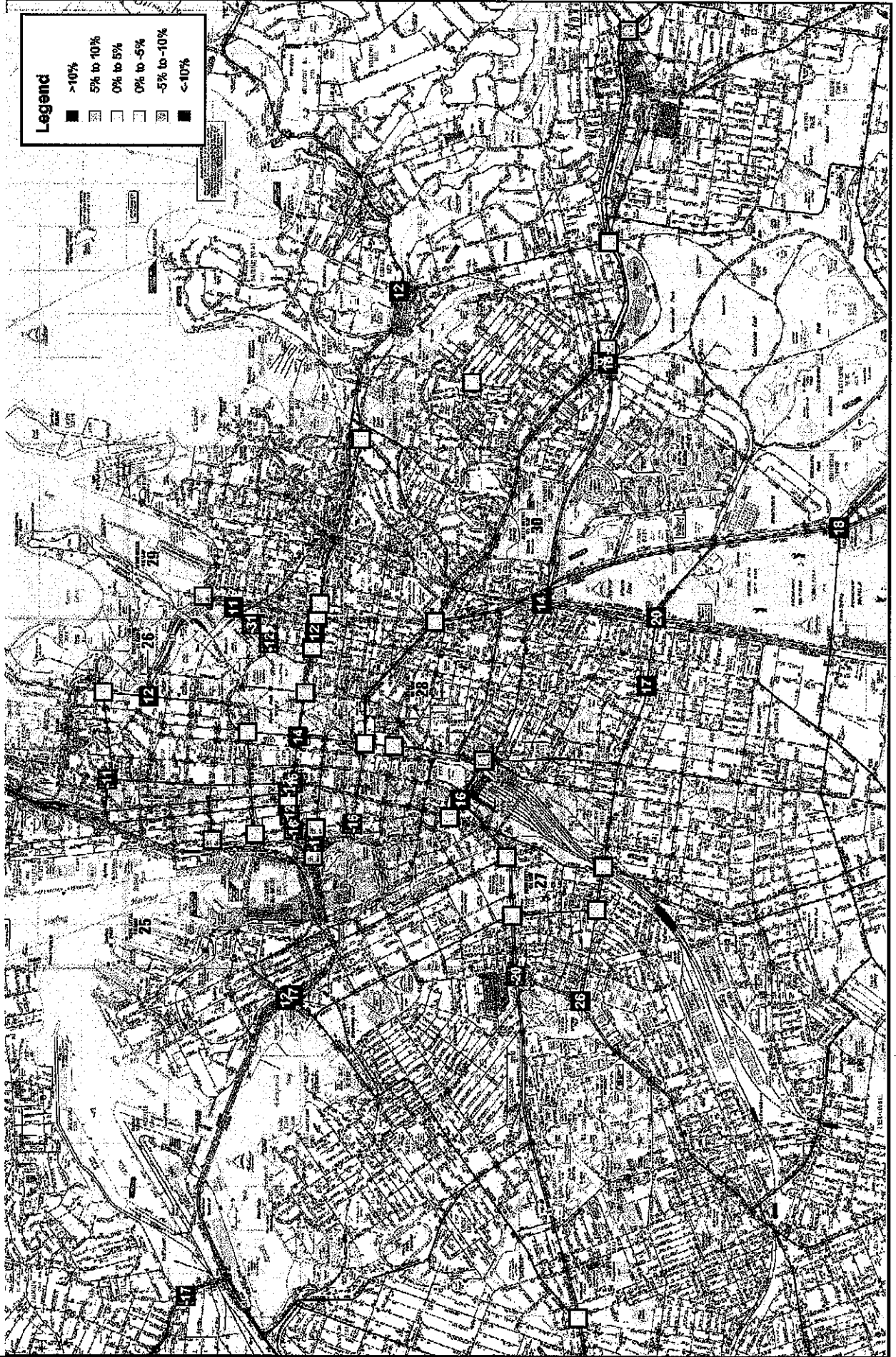


Figure 9b: Proportional Change in Intersection Volumes (AM Peak, May 03 - Nov 03)

22/01/2004

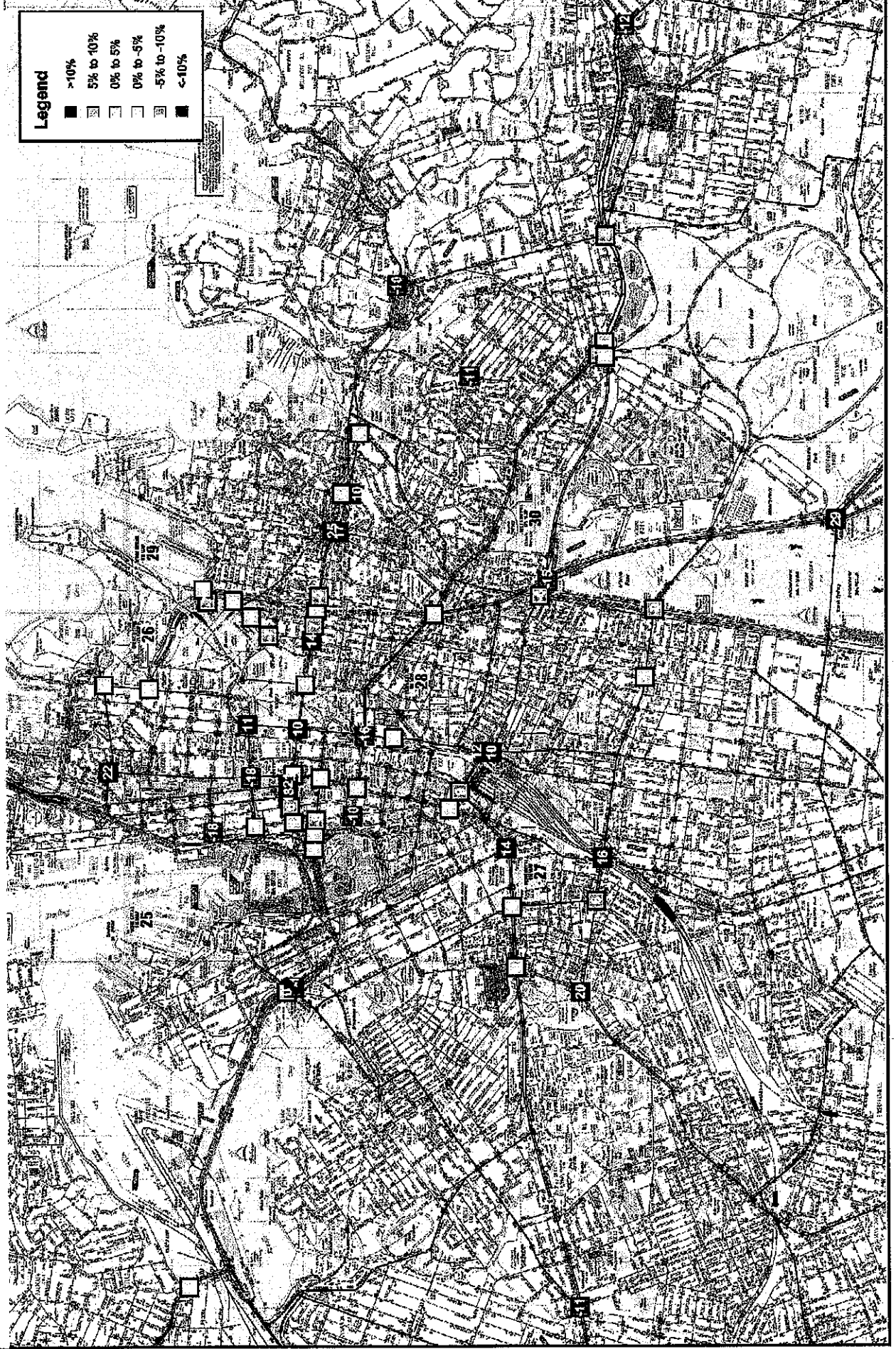


Figure 10a: Proportional Change in Intersection Volumes (MIDDAY Peak, Nov 02 - Nov 03)

22/01/2004

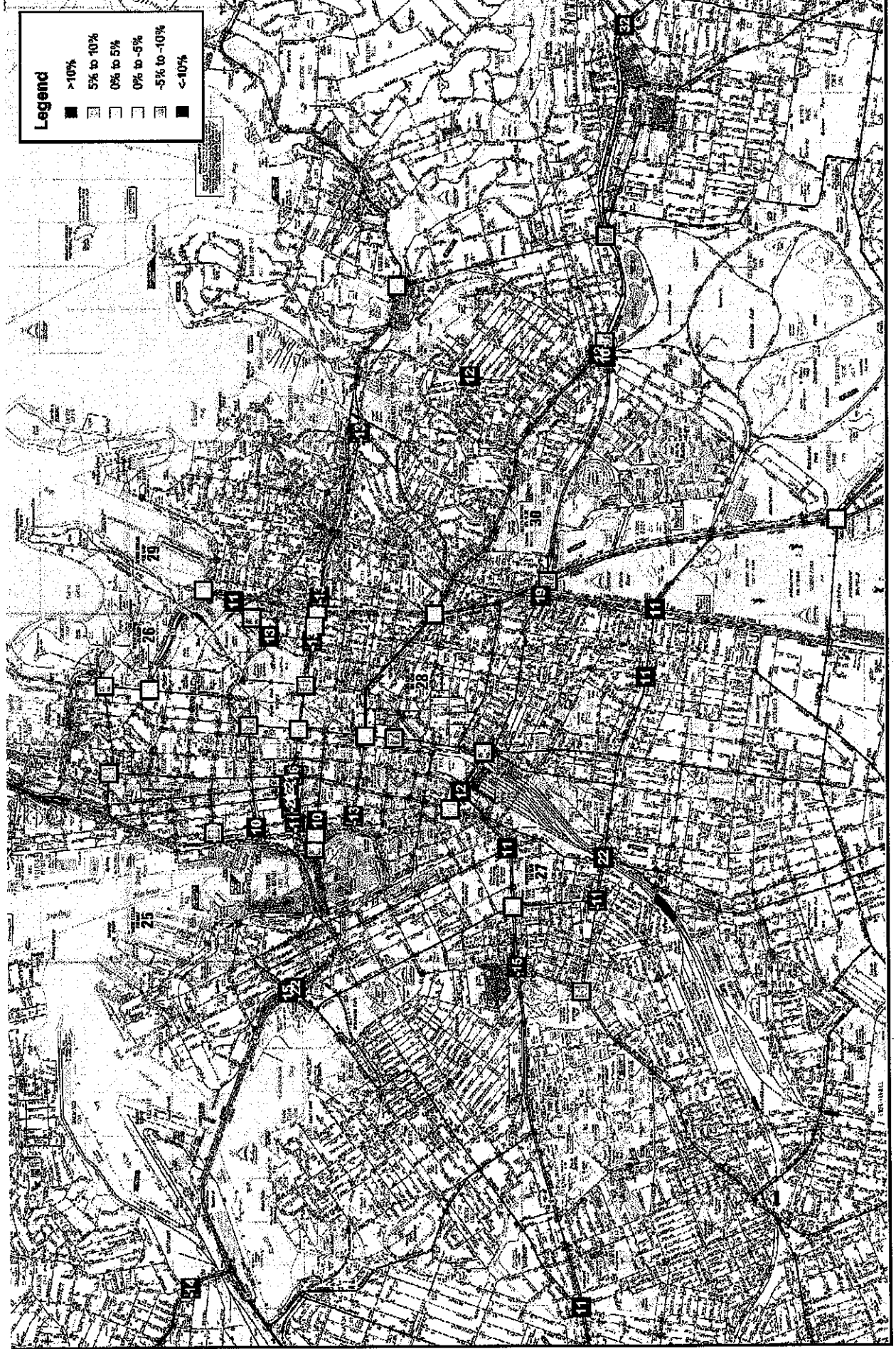


Figure 10b: Proportional Change in Intersection Volumes (MIDDAY Peak, May 03 - Nov 03)

22/01/2004

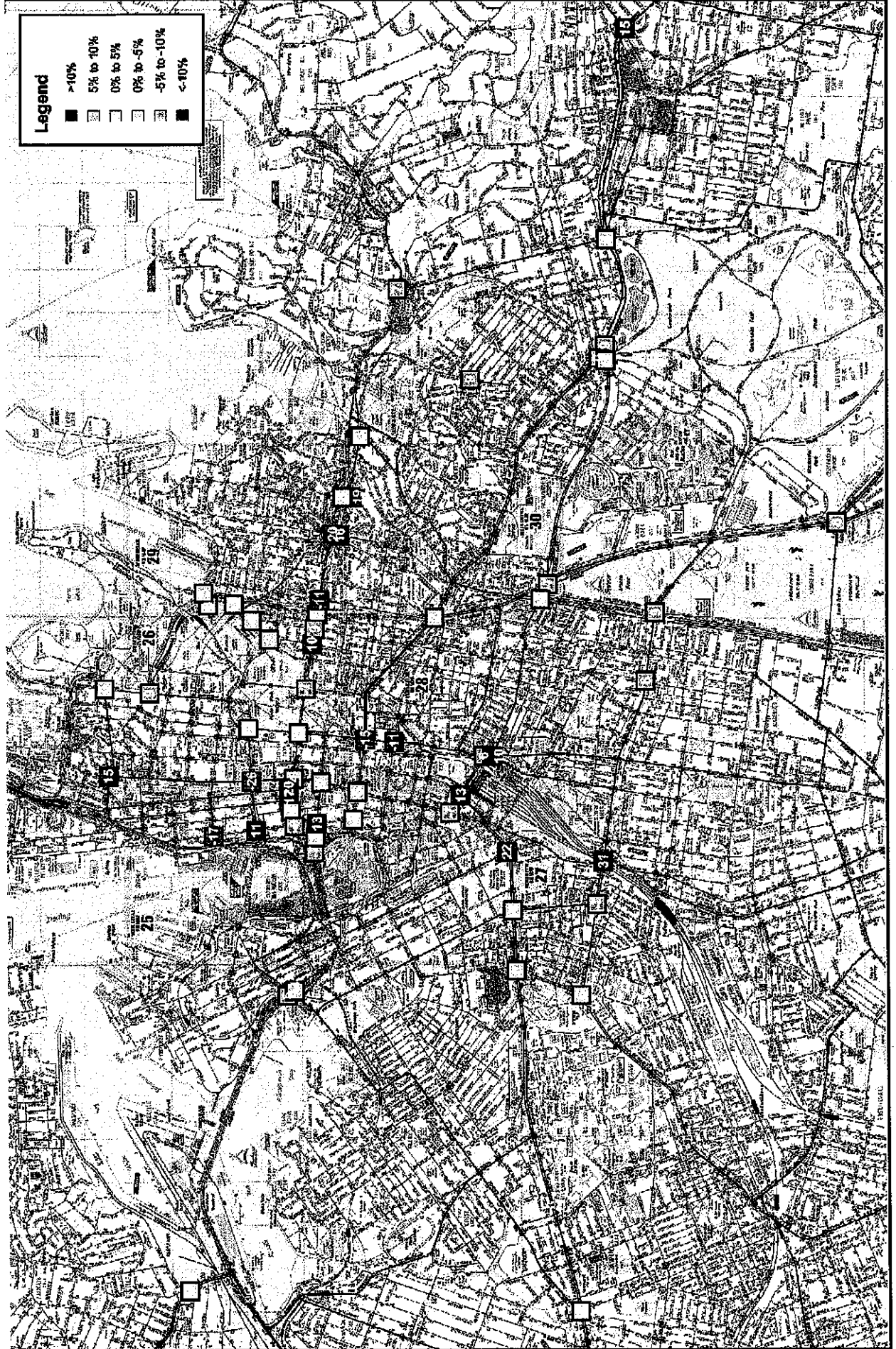


Figure 11a: Proportional Change in Intersection Volumes (PM Peak, Nov 02 - Nov 03)

22/01/2004

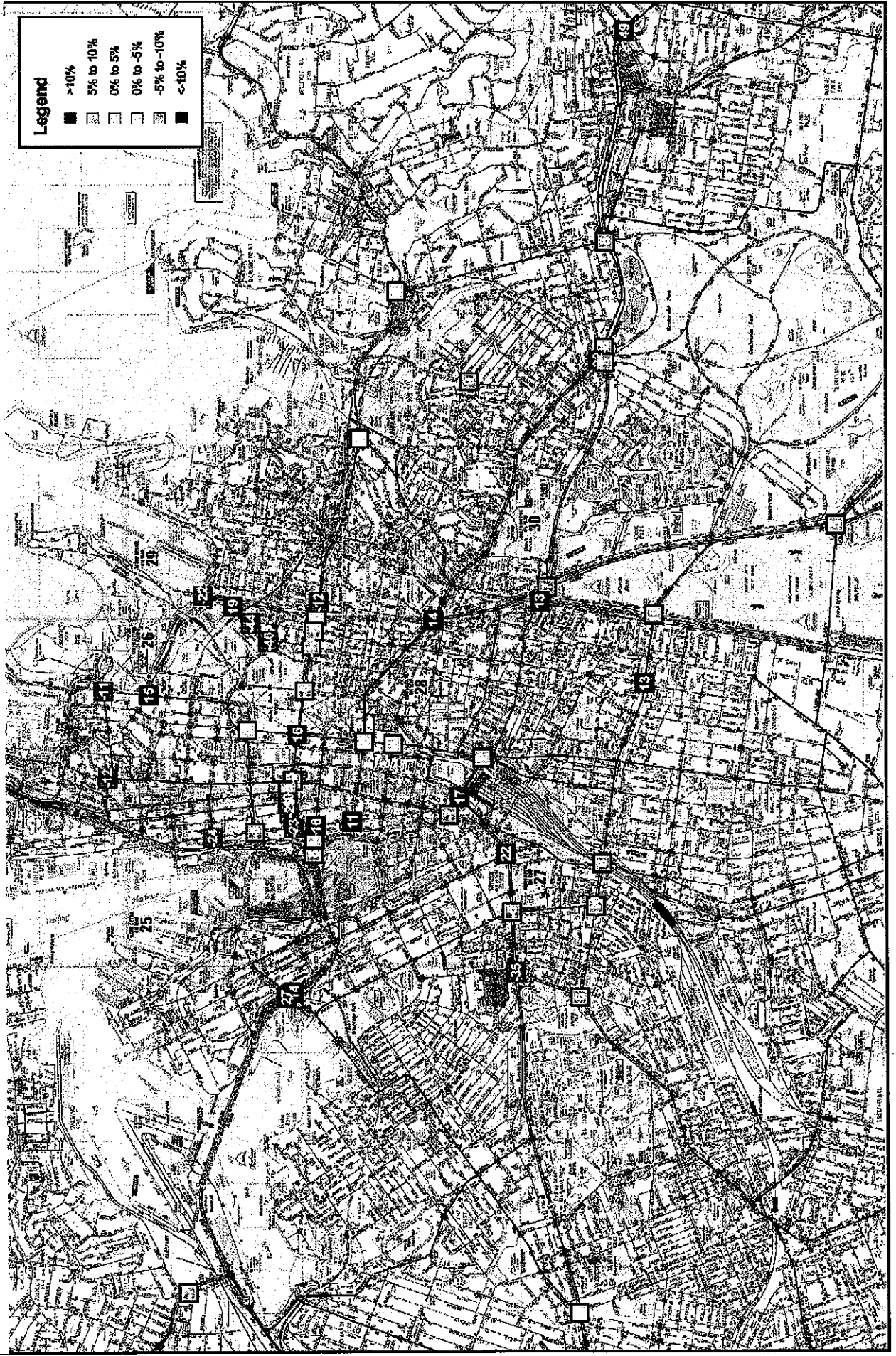


Figure 11b: Proportional Change in Intersection Volumes (PM Peak, May 03 - Nov 03)

22/01/2004

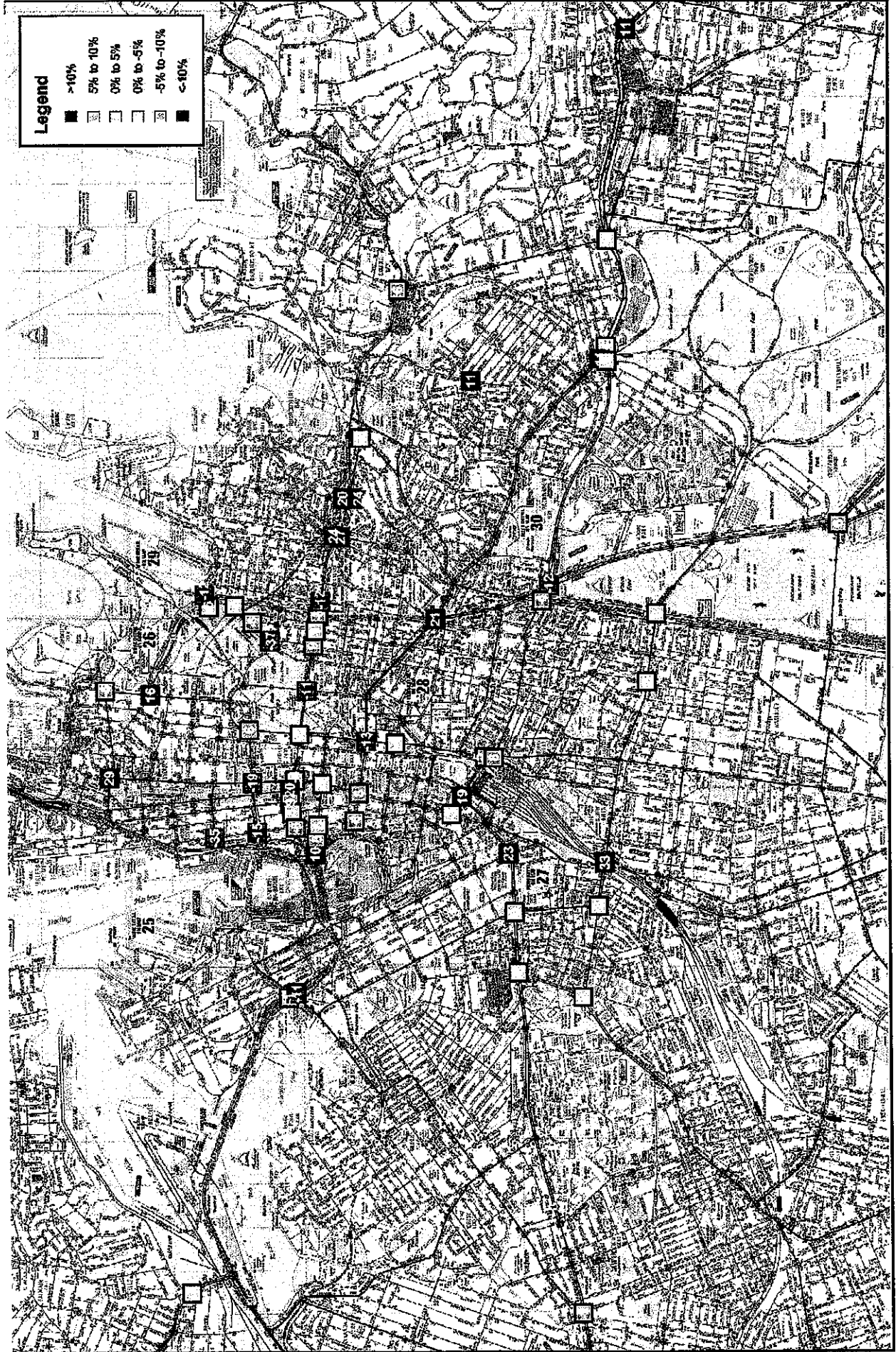


Figure 12a: Proportional Change in Intersection Volumes (EVENING Peak, Nov 02 - Nov 03)

22/01/2004



Figure 12b: Proportional Change in Intersection Volumes (EVENING Peak, May 03 - Nov 03)

22/01/2004

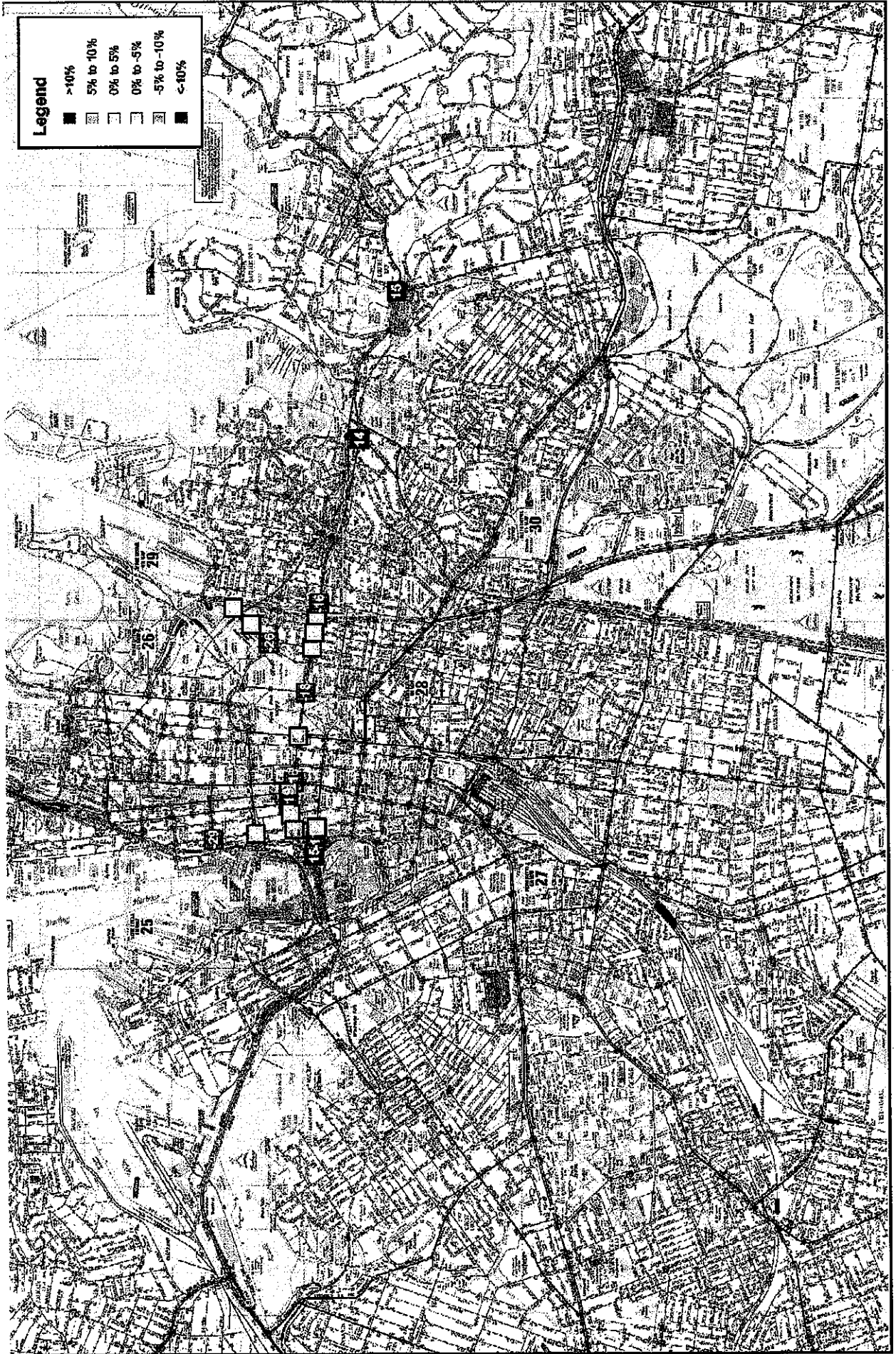


Figure 13a: Proportional Change in Intersection Volumes (SATURDAY Peak, Nov 02 - Nov 03)

22/01/2004



Figure 13b: Proportional Change in Intersection Volumes (SATURDAY Peak, May 03 - Nov 03)

22/01/2004



Figure 14: Proportional Change in Approach Volumes (AM Peak, Nov 02 - Nov 03)

22/01/2004



Figure 15: Proportional Change in Approach Volumes (MIDDAY Peak, Nov 02 - Nov 03)

22/01/2004

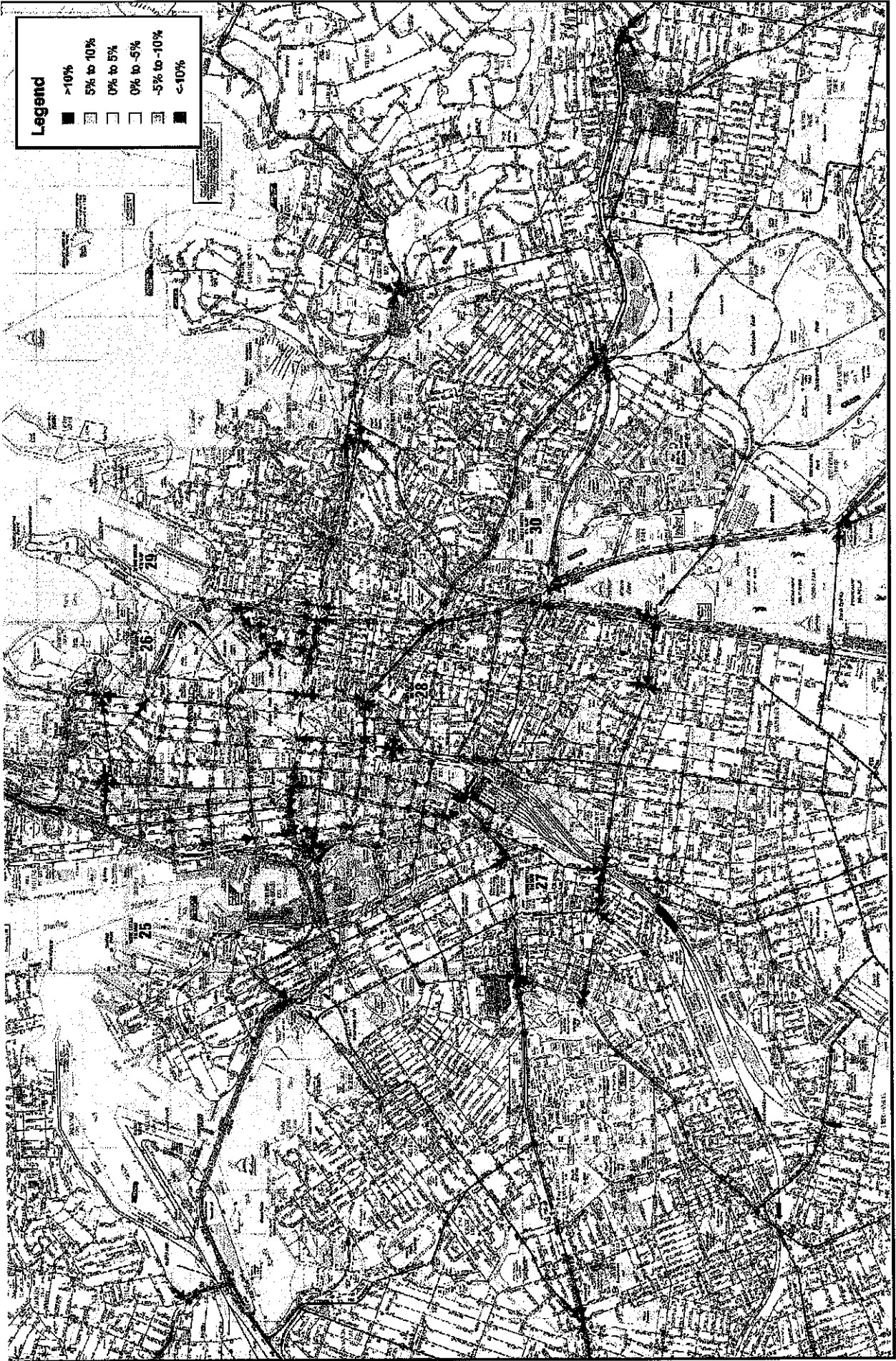


Figure 16: Proportional Change in Approach Volumes (PM Peak, Nov 02 - Nov 03)

22/01/2004

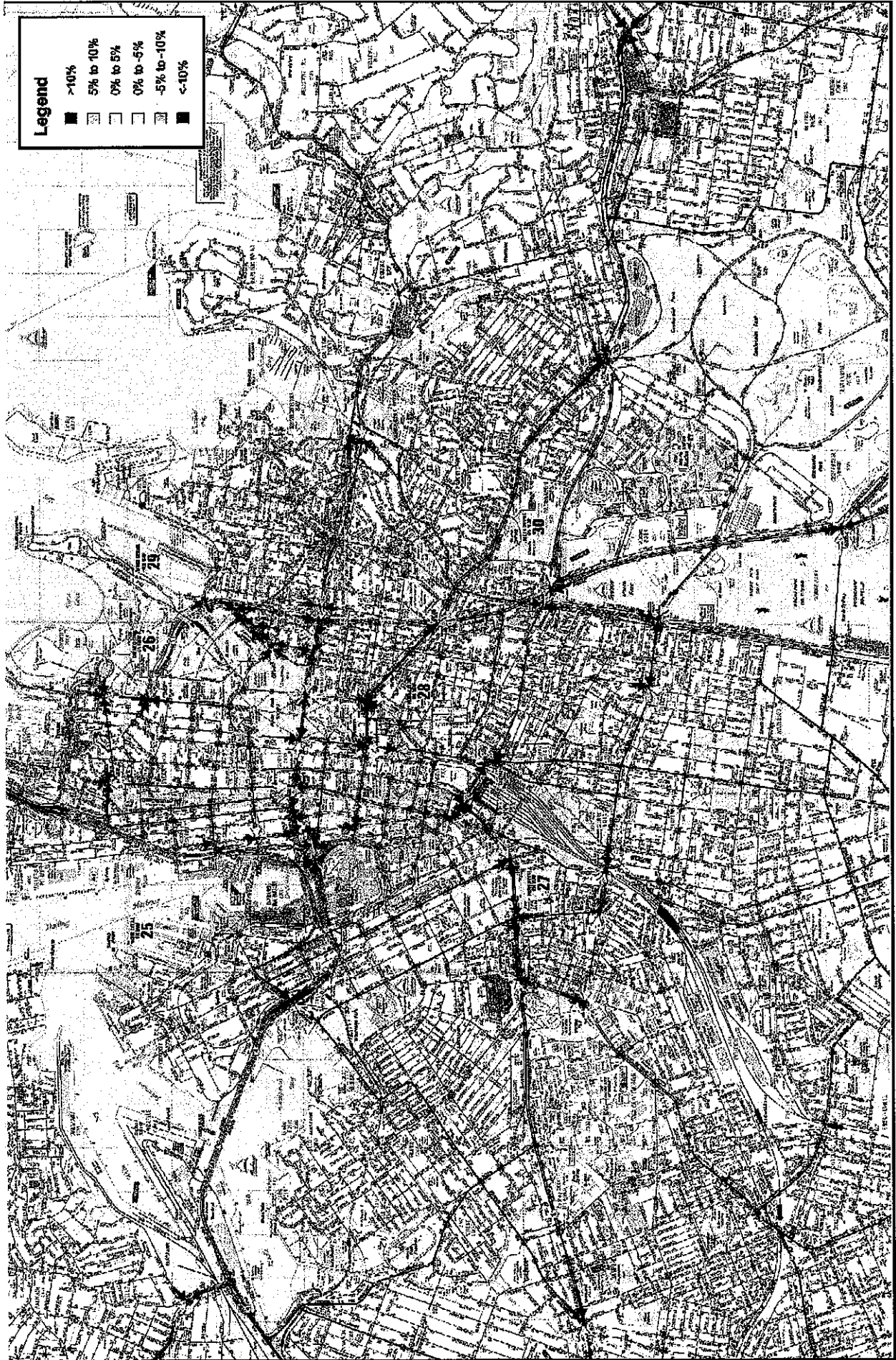


Figure 17: Proportional Change in Approach Volumes (EVENING Peak, Nov 02 - Nov 03)

22/01/2004



Figure 18: Proportional Change in Approach Volumes (SATURDAY Peak, Nov 02 - Nov 03)

22/01/2004

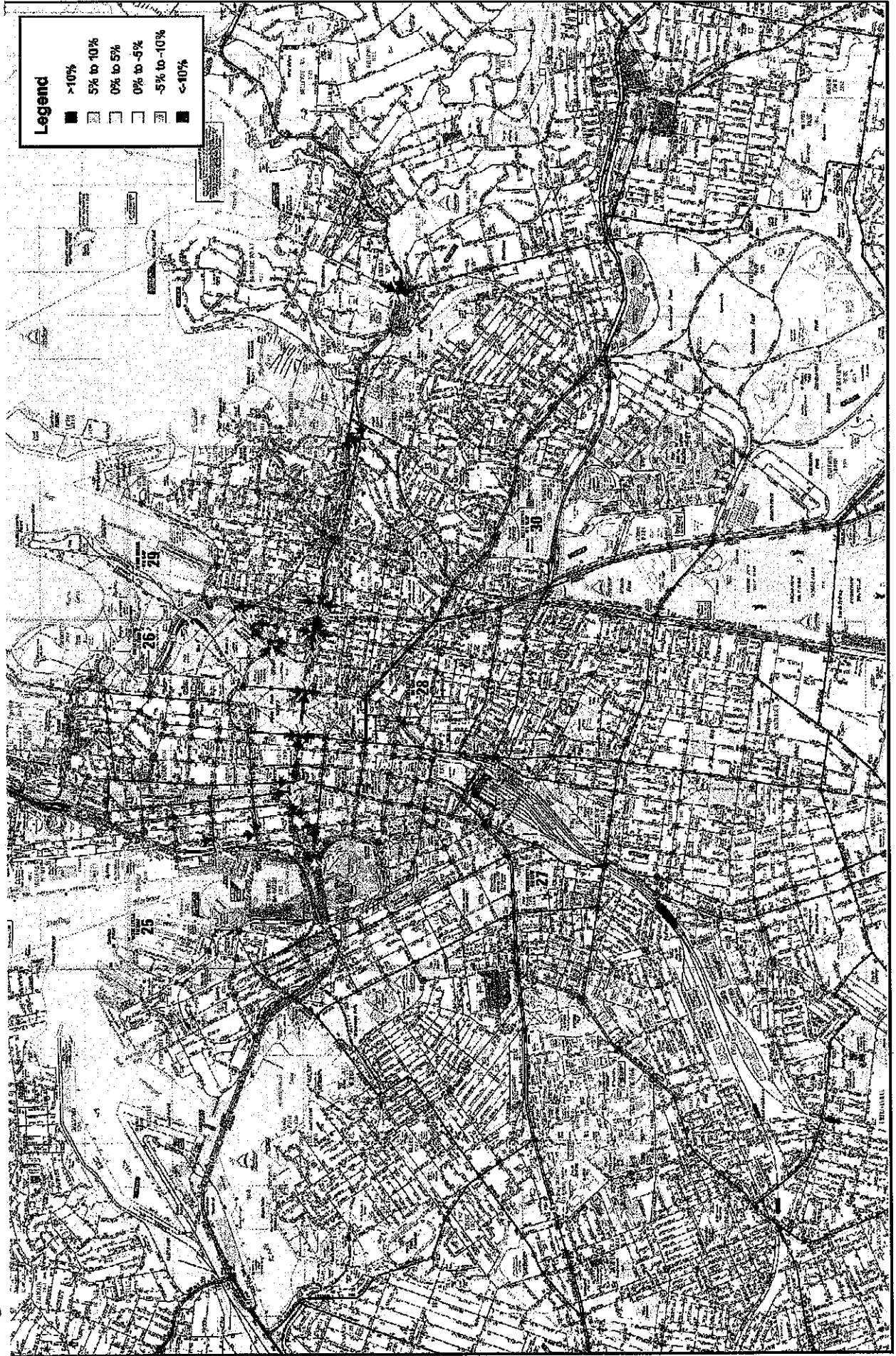


Figure 19: Bus Travel Time Route 1, Parramatta Road Services

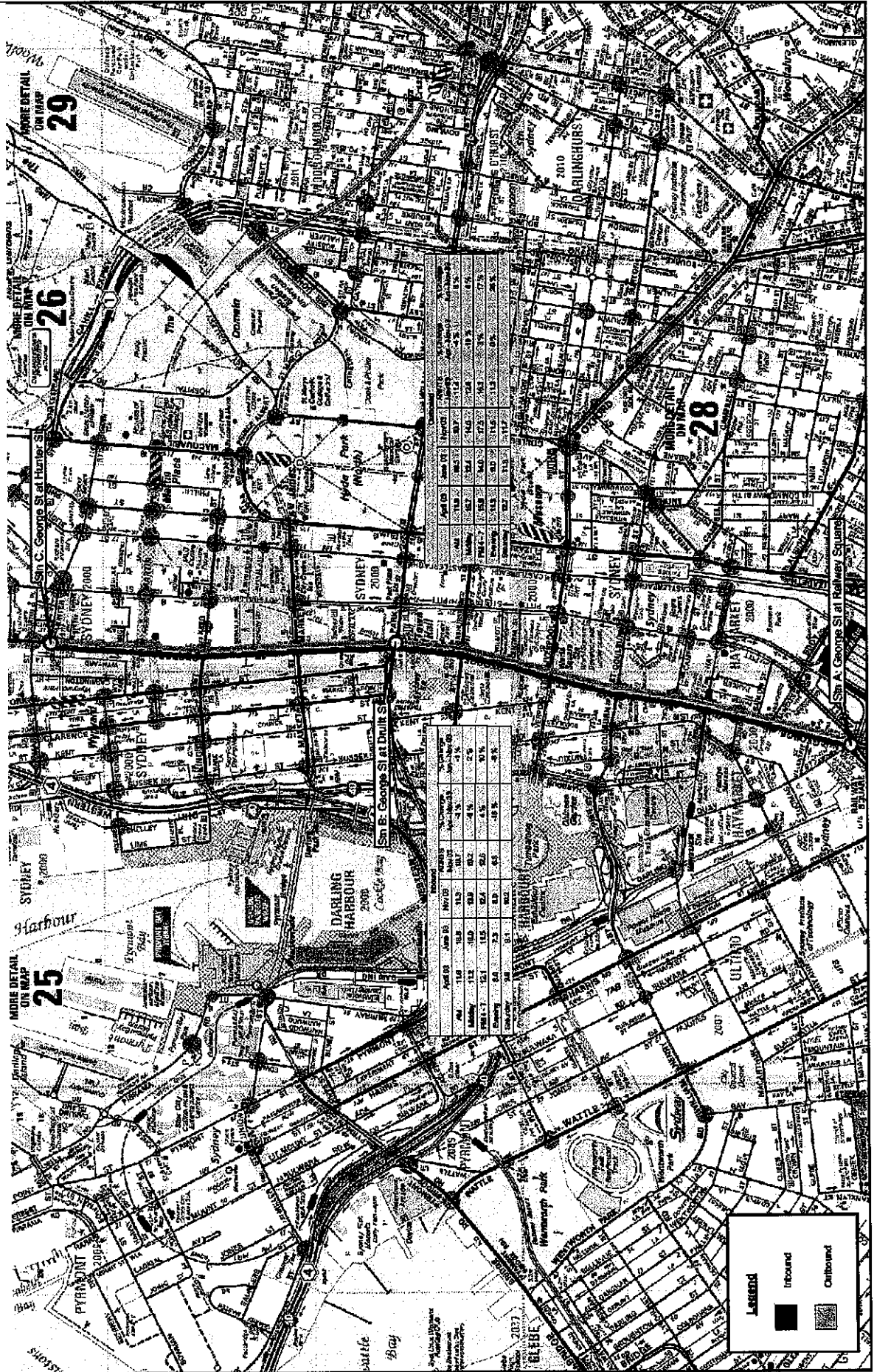


Figure 20: Bus Travel Time Route 2, Victoria Road Services

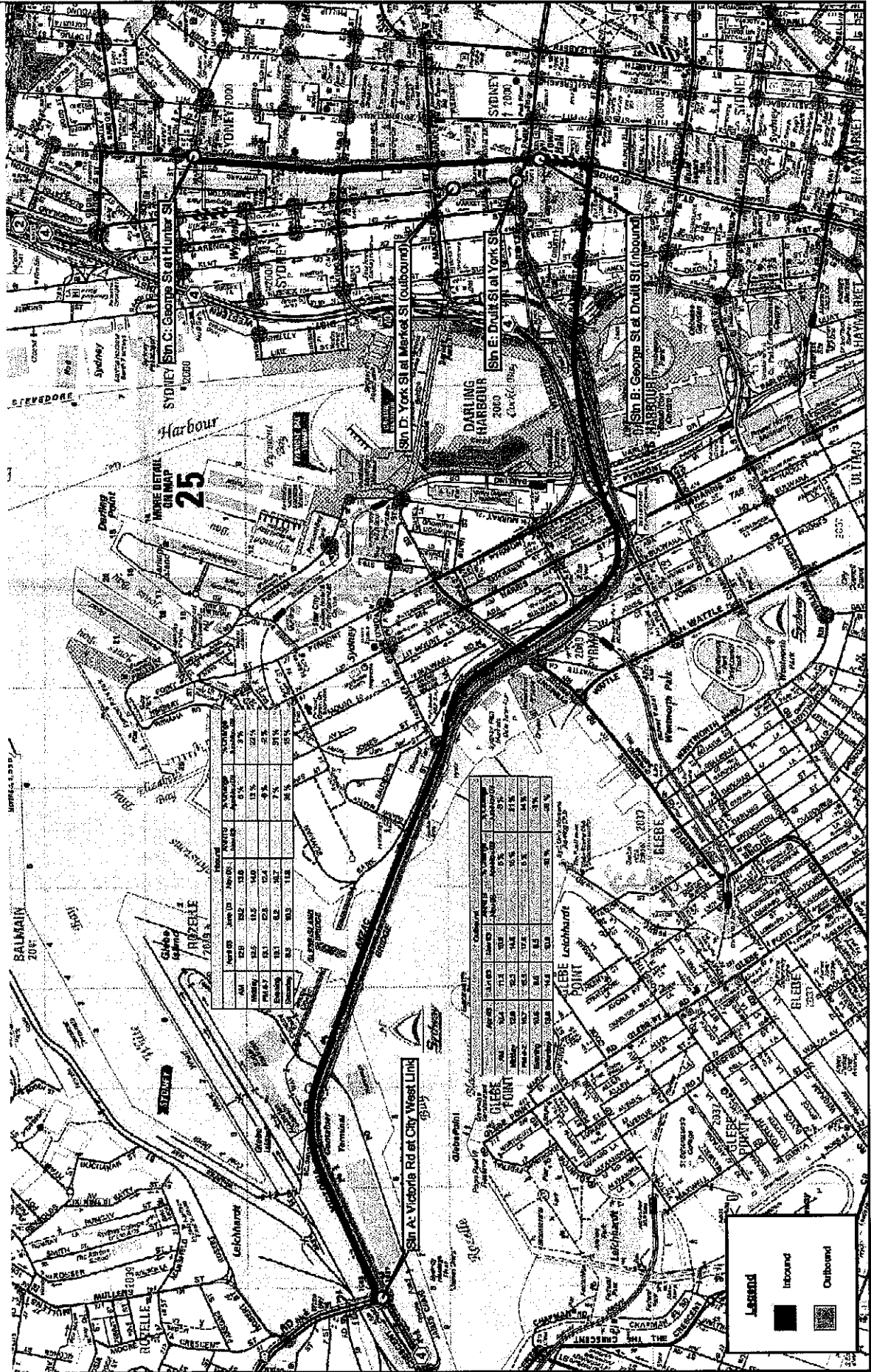


Figure 21: Bus Travel Time Route 3, William Street Services

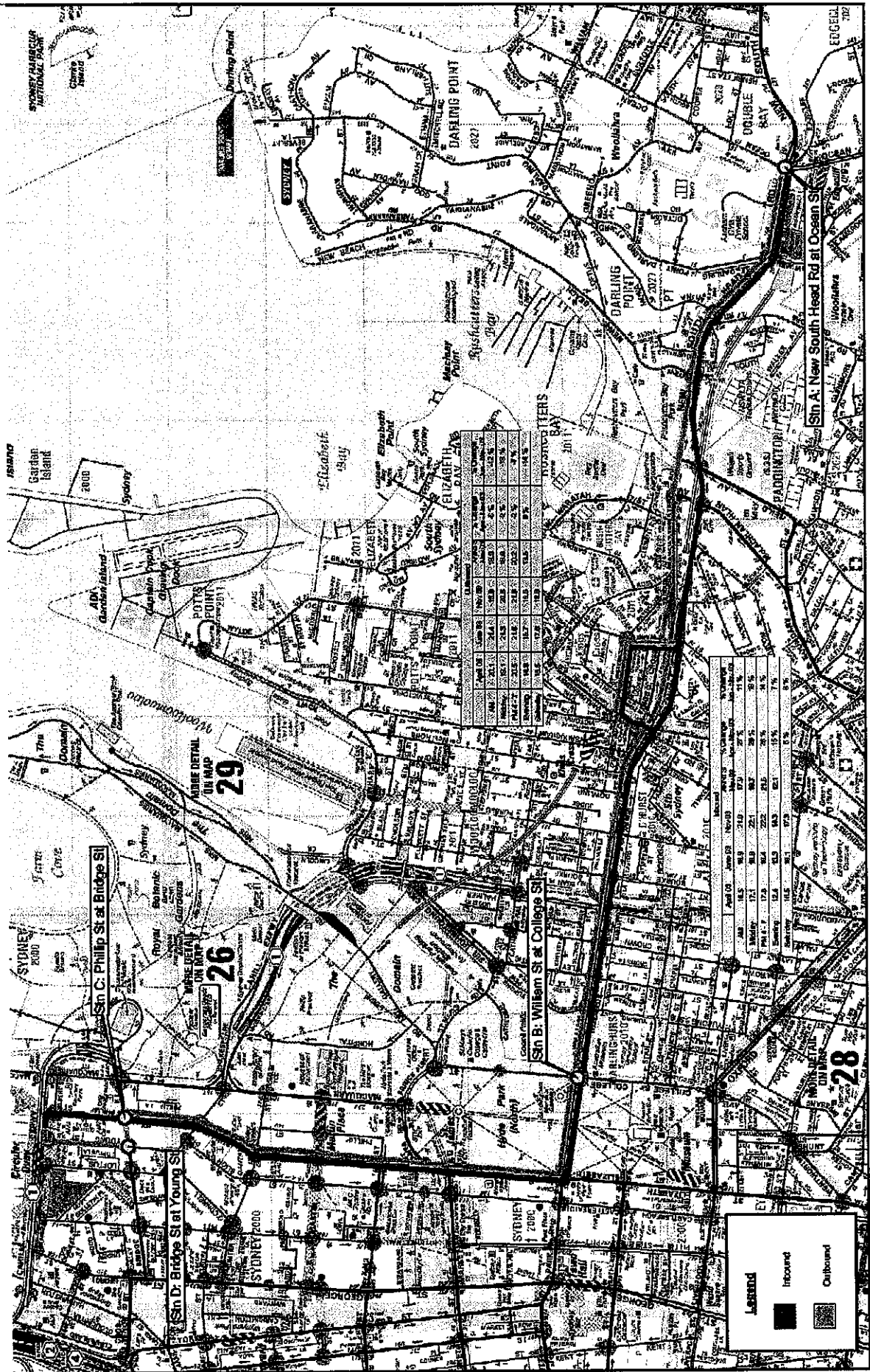


Figure 24: Car Travel Time Route 1, Camperdown to Potts Point

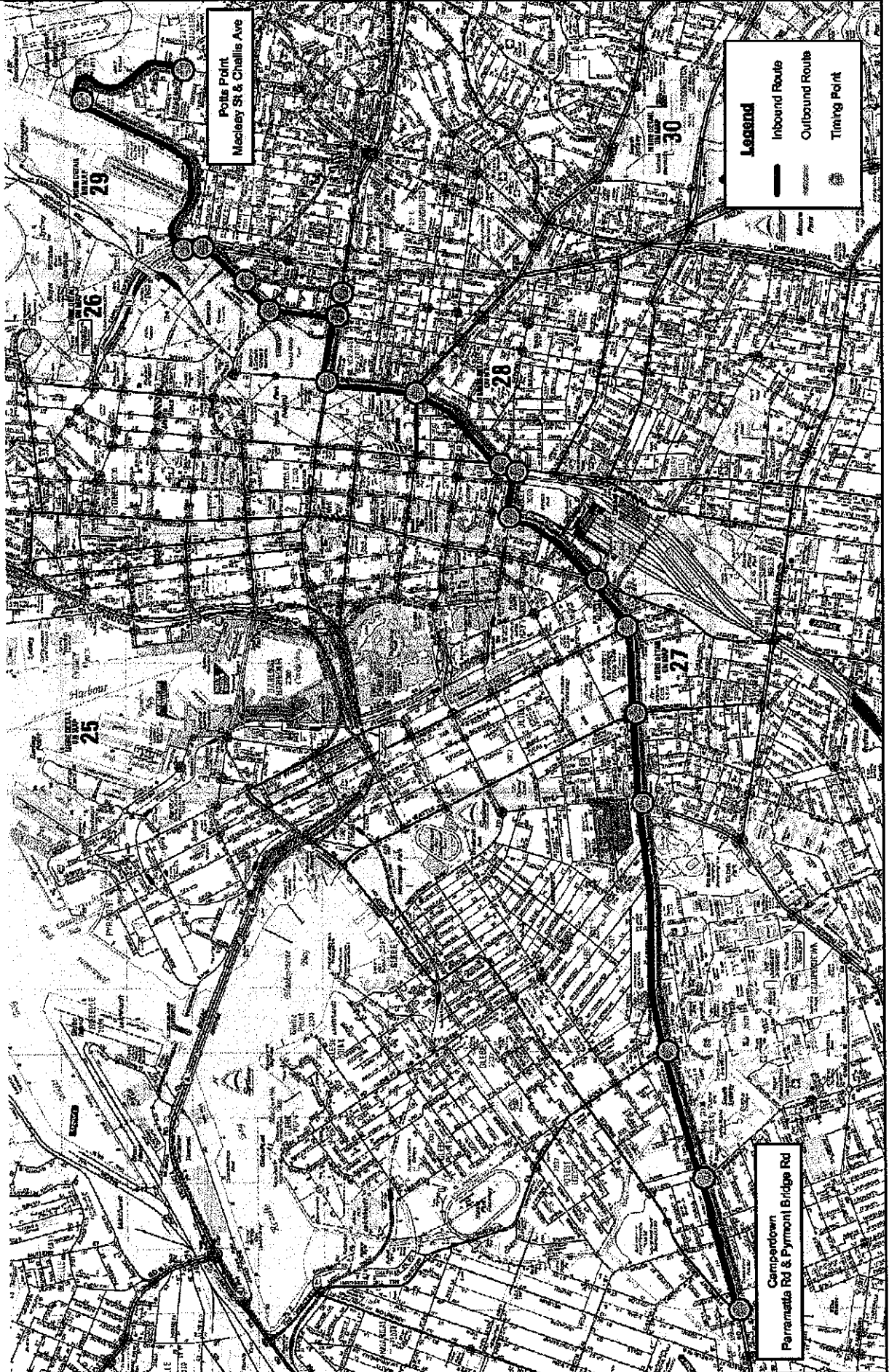


Figure 25: Car Travel Time Route 2, Rozelle to Double Bay



Figure 26: Car Travel Time Route 3, Sydney to Bondi

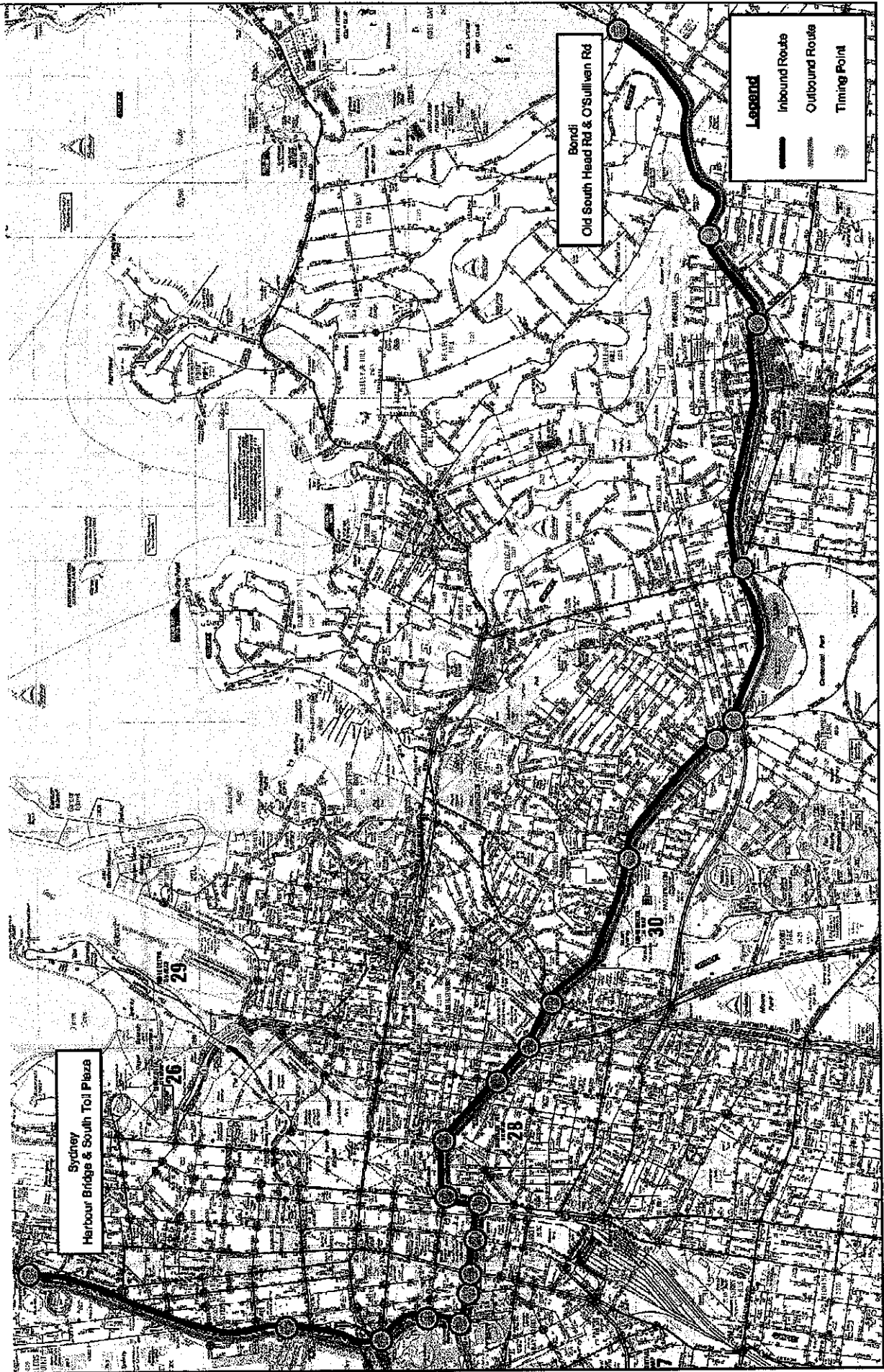


Figure 27: Car Travel Time Route 4, Moore Park to Ultimo

