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REPORT BY THE WORKING PARTY  
OF THE  
TECHNICAL SUB-COMMITTEE  
OF THE  
TRAFFIC ADVISORY COMMITTEE  
ON  
THE BEFORE AND AFTER STUDY INTO  
THE EFFECT OF THE CLOSURE OF MARTIN PLACE  
ON CITY TRAFFIC CONDITIONS

DATE: 22nd Apr

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DATE: 22nd April, 1971.

SUBJECT: The closure of Martin Place between Pitt Street and George Street, and its effect on city traffic conditions.

As a consequence to the decision by the Minister for Lands to close Martin Place between George Street and Pitt Street on 30th August, 1970, for a six month trial period, and to utilise this area as a pedestrian plaza, traffic studies were undertaken in June-July-August prior to the closure and again in November after the closure, in order to assess the effect on traffic conditions within the city.

The city area encompassed by the studies was that area bounded by Grosvenor Street and Bridge Street in the north, Macquarie Street in the east, Park Street in the south and Kent Street in the west. Within this area, traffic counts and delay studies were undertaken at 10 critical intersections and travel-time surveys were made over 5 survey routes which crossed the city area north/south and east/west.

I: STUDIES UNDERTAKEN

The following 'before' and 'after' studies were undertaken:-

1. Traffic Counts

Traffic counts were carried out from 8.00 a.m. to 6.00 p.m., between 22/6/70 and 10/7/70 for the before study and 3/11/70 and 19/11/70 for the after study, at the intersections of George Street, Pitt Street and Castlereagh Street with Hunter Street, Martin Place and King Street, also George Street with Market Street.

2. Delay Studies

Delay studies were undertaken from 8.00 a.m. to 6.00 p.m., between 23/7/70 and 5/8/70 for the before study and 4/11/70 and 18/11/70 for the after study, at the intersections mentioned in 1. above. Each intersection was observed by one man and each approach was recorded for approximately 15 minutes in rotation. The observer recorded the duration of the red signal to the approach, the number of vehicles in the platoon cut-off by the red and the number of vehicles joining the queue during the red.

3. Travel-time Studies

The travel-time surveys were conducted on Tuesdays, Wednesdays and Thursdays - these days considered equivalent, between 28/7/70 and 13/8/70 for the before study and 3/11/70 and 24/11/70 for the after study, obtaining a minimum of 20 runs (with 30 the desirable goal) on each travel-time route over the following periods of the day:-

- Period A - the morning peak-hour period 8.15 a.m.-9.15 a.m.  
Period B - the morning business hours period 10.15 a.m. -  
12.15 p.m.  
Period C - the lunch hour period 12.45 p.m. - 1.45 p.m.  
Period D - the afternoon business hours period 2.15 p.m. -  
4.15 p.m.  
Period E - the afternoon peak-hour period 5.00 p.m. - 6.00 p.m.

The travel-time survey routes are shown diagrammatically in Figures 1 and 2, and are summarised in the following:-

- Route 1 - George, Bridge, Pitt and Park Streets.  
Route 2 - George, Park, Castlereagh, Bligh, Bent, Gresham and Bridge Streets.  
Route 3 - Hunter, George, Margaret, Kent, King and Phillip Streets.  
Route 4 - George, Hunter, Elizabeth, Bent, Gresham and Bridge Streets.  
Route 5B - Macquarie Street, Martin Place, Wynyard, ('before') Carrington, Margaret, Clarence, Jamison, Lang, Grosvenor, George, Martin Place, Phillip and King Streets.  
Route 5A - Macquarie, Hunter, Margaret, Clarence, ('after') Jamison, Lang, Grosvenor, George, Hunter, Phillip and King Streets.

#### 4. Bus Travel-time Studies

Measurements of the effects on bus services of the closure of the western end (George Street) of Martin Place were obtained in three different ways:-

- (a) Timing checks of buses in the services diverted as a result of the establishment of the Plaza, together with statistics relating to late running on these routes.  
(b) Bus travel-time studies in certain north-south roadways (Pitt, Castlereagh and George Streets) in which 'before' studies were available for comparison.  
(c) A comparison of the statistics of late-running buses in Elizabeth and Macquarie Streets, where travel-time studies were not obtained before the closure of Martin Place.

## II: DATA ANALYSIS

### 1. Traffic Counts

For the purposes of comparison of before and after traffic count data, the use of statistical methods was considered inconclusive due to the small data sample taken for each intersection. Consequently before and after traffic count data was presented diagrammatically.

Figures 3-14 accompanying this report show the 'before-after' total intersection volumes (the sum of the average volumes on all approaches) as a function of the time of day, as well as the 'before-after' volumes on each approach movement. Also, the 'before-after' 8.a.m.-10.a.m. average hourly volumes are shown in Figures 15 and 16, and the 4p.m.-6p.m. average hourly volumes are shown in Figures 17 and 18.

Conclusions taken from the graphs are summarised in the following:-

- (i) Apart from the expected decrease in total intersection volume at the intersections of Martin Place with George and Pitt Streets, (25% and 36%), a decrease of 10% in total intersection volume occurred at the intersection of Martin Place and Castlereagh Street, with decreases of less than 1% at the intersection of Hunter and Pitt Streets and the intersection of George and Market Streets.
- (ii) The intersections of Hunter Street with Castlereagh and George Streets, showed increases in total intersection volume of 16% and 5% respectively. Similar increases of 4%, 3% and 3% occurred at the intersections of King Street with George, Pitt and with Castlereagh Streets.
- (iii) The major increases in volume and the percentage increases are listed in the following table together with the appropriate intersection movement:-

Intersection, Approach and Movement	Volume Increase(Vph)	Percentage Increase
(i) <u>8 a.m.-10 a.m.</u>		
(a) Int. of George St/Martin Place George St.Wthbound - Through Mov.	165	30%
(b) Int. of George St/Market St. Market St.Westbound - Through Mov.	98	25%
(c) Int. of Castlereagh St/Hunter Street. Castlereagh St. Wthbound - Left turn.	97	78%
Hunter St.Westbound-Through Mov.	77	29%
(d) Int. of Pitt St/Hunter St. Hunter St. Westbound-Through mov.	80	32%
(e) Int. of Pitt St/Martin Place Martin Pl.Westbound/Left Turn	73	35%
Pitt St.Southbound/Left Turn	67	60%

(ii) <u>4 p.m.-6 p.m.</u>		
(a)	Int. of Pitt St/King St. Pitt St.Southbound - Through Mov.	209
	King St. Eastbound - Through Mov.	122
(b)	Int. of George St/Hunter St. George St.Southbound - Through Mov.	156
	Hunter St.Westbound - Right Turn	142
(c)	Int. of George St/Martin Pl. George St.Southbound-Through Mov.	130
(d)	Int. of Castlereagh St/Martin Pl. Castlereagh St.Nthbound- Through Mov.	127
(e)	Int. of Hunter St/Castlereagh St. Castlereagh St.Nthbound - Through Mov.	87
		29%
		18%
		55%
		65%
		44%
		22%
		19%

In addition to the major increases mentioned above, notable increases occurred in the following minor movements:-

Intersection, Approach and Movement	Volume Increase(vph)	Percentage Increase
(i) <u>8 a.m.-10 a.m.</u>		
(a)	Int. of Martin Pl/Castlereagh St. Martin Pl. Westbound - Right Turn	50
(b)	Int. of George St/King St. George St.Sthbound-Left Turn	36
(c)	Int. of Castlereagh St/King St. Castlereagh Nthbound - Right Turn	68
(ii) <u>4 p.m.-6 p.m.</u>		
(a)	Int. of George St/Hunter St. George St.Sthbound-Left Turn	64
(b)	Int. of George St/King St. George St.Sthbound-Left Turn	21
(c)	Int. of Castlereagh St/Martin Pl. Martin Pl.Eastbound-Left Turn	27
		73%
		33%
		55%
		34%
		60%
		41%

(iv) Similarly, the major decreases in volume and the percentage decreases are listed in the following table together with the appropriate intersection movement:-

Intersection, Approach and Movement	Volume Decrease (vph)	Percentage Decrease
(i) <u>3 a.m.-10 a.m.</u>		
(a) Int. of Castlereagh St/Martin Pl. Martin Pl. Westbound-Through Mov. Martin Pl. Eastbound-Through Mov. Castlereagh St. Northbound-Left Turn	210 87 75	54% 38% 37%
(b) Int. of George St/Hunter St. George St. Southbound-Through Mov. George St. Northbound-Through Mov.	102 87	30% 17%
(c) Int. of George St/Market St. George St. Northbound-Through Mov.	95	12%
(ii) <u>4 p.m.-6 p.m.</u>		
(a) Int. of Castlereagh St/Martin Pl. Castlereagh St. Northbound-Left Turn Martin Pl. Westbound-Through Mov.	155 94	50% 32%
(b) Int. of Castlereagh St/King St. King St. Eastbound-Through Mov.	147	20%
(c) Int. of Pitt St/Hunter St. Pitt St. Southbound - Through Mov. Hunter St. Westbound-Left Turn	73 32	12% 29%

## 2. Delay Studies

The delay studies were undertaken at the ten intersections and associated approaches listed in item I Appendix A. From the traffic delay data collected at these intersections, the total delay (in terms of vehicle-seconds) and the average delay (in terms of seconds) were calculated, assuming a linear arrival of traffic during that period when the red aspect showed to the intersection approach under study.

For each of the abovementioned ten intersections, the total intersection delay per cycle (the sum of the total delays on all approaches) was graphed as a function of the hour of day as shown in Figures 3-12. The average delay on each intersection approach was found not to vary greatly with the hour of day and for this reason was not presented graphically.

The mean total delay and average delay, in vehicle-seconds and seconds respectively, and the standard deviation of the mean total delay and average delay are tabulated for the before and after study of each intersection and intersection approach, in item II Appendix A. The 95% and 99% confidence intervals of the means are also included in the tabulations.

The before-after comparison of total delay and average delay was achieved using the statistical  $t$  - test, assuming normally distributed data. The results of this method expressed in terms of "significant difference" or "no significant difference", and the delay parameters required to implement the method are included in item III Appendix A. The significant results, the numerical differences and the percentage differences are included in item IV Appendix A, for the before and after study of the ten intersections considered.

Conclusions taken from item IV Appendix A for the before and after study, are summarized in the following:-

- (i) As expected, both the total delay and the average delay at the intersection of George Street and Martin Place decreased significantly. Decreases of 65% (206 veh-secs) and 49% (14.7secs) occurred in total delay and average delay respectively, for the George Street northbound approach, and the corresponding decreases for the southbound approach were 55% (433 veh-secs) and 60% (20.7 secs).
- (ii) Major increases in both total delay and average delay occurred at the intersections of Pitt Street with Martin Place and Castlereagh Street with Hunter Street. At the Pitt Street/Martin Place intersection, increases of 98% (305 veh-secs) and 47% (10.7 secs) occurred in total delay and average delay respectively, for the Pitt Street southbound approach, with corresponding increases of 197% (238 veh-secs) and 131% (23.3 secs), for the Martin Place westbound approach. At the Castlereagh Street/Hunter Street intersection, increases of 50% (55 veh-secs) and 21% (3.0 secs) occurred in total delay and average delay respectively for the Castlereagh northbound approach, with corresponding increases of 109% (59 veh-secs) and 23% (3.5 secs), for the Hunter Street westbound approach.
- (iii) Of the remaining seven intersections studied, four showed an overall increase in total vehicle delay and two an overall decrease. The intersections involved, together with the approach movements are tabulated in the following against the numerical difference and percentage difference in total delay.

Intersection and Approach	-Result	Difference in Total Delay (veh-secs)	Percent Difference in Total Delay
<u>Overall Increases</u>			
(i) Int. of George/Market St.			
-George St. Nthbound	Increase	142	25.3
-Market St. Eastbound	Increase	232	44.2
-George St. Sthbound	Decrease	41	19.2



Intersection and Approach - Result	Difference in Total Delay (veh-secs)	Percent Difference in Total Delay
(ii) Int. of George St/King St. - George St.Wthbound - Increase - King St.Eastbound - Increase	177 62	50.0 16.9
(iii) Int. of George St/Hunter St. - George St.Sthbound - Increase - Hunter St.Westbound - Increase - George St.Wthbound - Decrease	170 115 132	47.0 19.9 36.9
(iv) Int. of Pitt St/King St. - Pitt St.Sthbound - Increase - King St.Eastbound - Increase	201 83	40.3 23.0
2. <u>Overall Decreases</u>		
(i) Int. of Castlereagh St/King St. - Castlereagh Wthbound - Decrease - King Eastbound - Decrease	114 97	37.1 26.2
(ii) Int. of Castlereagh St/Martin Pl. - Martin Pl.Eastbound - Decrease - Martin Pl.Westbound - Decrease - Castlereagh St.Wthbound - Increase	49 82 84	30.1 38.5 24.6

(iv) The intersection of Pitt Street and Hunter Street showed a small decrease in Pitt Street delays and no difference in Hunter Street. Observations (subjective) of this intersection indicate that these results may not be consistent with present traffic conditions and suggest that conditions at this intersection have changed since the after study.

(v) Apart from the notably significant changes in average delay at the intersections and approaches mentioned in (i) and (ii), at the remaining seven intersections, significant increases or decreases were only of the order of some 10%.

### 3. Travel-Time Studies

The travel-time survey was carried out over nine survey routes and five time periods of the day as outlined in item I Appendix B. The travel-time survey routes are also shown diagrammatically in Figures 1 and 2.

For each survey route and time period, the mean travel-time in minutes, the standard deviation and the 95% and 99% confidence intervals of the mean travel-time are tabulated in item II Appendix B, for both the before and after study. The travel-times are also presented graphically as a function of the period of day for each survey route, for both the before and after study, and these graphs are included in item II Appendix B.

The before-after comparison of travel-times was achieved using the statistical t-test, assuming normally distributed data. The results of this method, expressed in terms of 'significant difference' or 'no significant difference', and the travel-time parameters required to implement the method are included in item III Appendix B. The significant results, the numerical differences and the percentage differences are included in item IV Appendix B, for the before and after study of the travel-time routes.

Conclusions taken from item IV Appendix B for both the before and after study, are summarised in the following:-

- (i) Significant decreases in travel-time of between 11.2% (0.43 mins) and 20% (1.0 mins) were found for all periods of the day, for the survey route George Street, southbound between Jamison Street and the Royal Arcade (situated between Market Street and Park Street).
- (ii) Significant increases in travel-time of between 6.8% (0.47 mins) and 63.3% (3.20 mins) were found for all periods of the day, with the exception of the 5 p.m.-6p.m. survey period, for the survey route 5 starting Queens Square and proceeding to the corner of Clarence Street and Margaret Streets via Martin Place during the before study, and via Hunter Street during the after study.
- (iii) No significant differences in travel-time resulted during all survey periods of the day, for the survey route 4, starting Jamison Street and George Street and proceeding via Hunter Street to Chifley Square.
- (iv) The remaining survey routes showed significant variations during certain periods of the day and these variations, expressed in terms of the numerical difference and percentage difference, are tabulated in the following for the corresponding survey route and time period.

Period	Start - Route - Finish	Result	Difference (mins)	Percent Difference
8.15am-9.15am	Picadilly Arcade-Castlereagh St. - Bligh St.	Increase	0.94	22.1
10.15am-12.15pm	Spring St - Pitt St - Picadilly Arcade	Increase	1.11	19.9
	Elizabeth St - Hunter St - George St.	Increase	1.32	43.1
12.45pm-1.45pm	York St - King St - Phillip St.	Decrease	0.81	23.5
	Jamison St - [Martin Pl] - [Hunter St] - Phillip St.	Decrease	0.34	9.7

2.15pm- 4.15pm	Royal Arcade-George St- Jamison St.	Increase	0.62	17.8
	Spring St.-Pitt St- Picadilly Asc.	Increase	0.77	19.7
5.00pm- 6.00pm	Royal Arcade-George St- Jamison St.	Decrease	1.32	31.6
	Jamison St-[Martin Pl] - [Hunter St]			
	Phillip St	Increase	1.01	26.4

#### 4. Bus Travel-Time Studies

The bus travel-time studies as undertaken by the Department of Government Transport are included in their report in Appendix C.

Conclusions taken directly from the report are outlined in the following:-

1. The bus services diverted at the time of closure of the Martin Place were Routes 312 (Wynyard-Woolloomooloo-King's Cross-Central Railway) and 316 (Wynyard-Kings Cross via William Street - Elizabeth Bay). The inward journey to the Wynyard terminus for both Routes was formerly via Martin Place and George Street, but after closure, was diverted to Phillip Street and Bridge Street via Elizabeth Street. Two minutes additional running time was allowed because of the increased length of the inward route. Timing checks from the junction of Macquarie Street and Martin Place to the Wynyard terminus revealed steep increases in bus travel-times up to 10 a.m. on the inward journey. Late running in these services passing through Queen's Square during the A.M. peak has affected 42% more buses and has increased by almost 75%, notwithstanding the allocation of additional recovery time at the City terminal.
2. A comparison of the before and after bus travel-times in Pitt Street, George Street and Castlereagh Street indicated an increase in bus travel-times in Pitt Street and Castlereagh Streets between 9.00am and 4.00 p.m., and a general improvement in George Street operation. The deterioration in Castlereagh Street times has occurred mainly in the area south of Market Street and, increased congestion at the northern end of Pitt Street has reduced Pitt Street travel-times. George Street travel-times have improved owing to the reduction in delay at the intersection of George Street and Martin Place.
3. The comparison of the statistics of late-running buses in Elizabeth and Macquarie Streets indicated an increase in late-running throughout the day and is particularly severe during and just after the morning peak period - at the same time that Routes 312 and 316 are suffering extensive delays.

4. The overall picture that emerged at the time of the 'after' study in November, 1970, was of a deterioration in bus operating conditions throughout the day in Pitt, Castlereagh, Elizabeth and Macquarie Streets; severe delays on Routes 312 and 316 buses during and just after the morning peak period, and some improvement in bus travel-times in the northern end of George Street. It is important to note however that since the 'after' study, the implementation of various kerbside restrictions has improved operating conditions for buses and has resulted in a lessening in the degree of deterioration experienced earlier.

### III CONCLUSIONS

The closure of any street in such a well trafficked area as downtown Sydney will inevitably produce a rearrangement of traffic flow patterns over a number of alternative routes. The object of this particular study on the closure of Martin Place, between Pitt Street and George Street, was to ascertain whether, in the course of this redistribution of traffic, any insupportable conditions would arise which would offset the advantages to the City arising out of the creation of the Plaza.

The study consisted of detailed investigations of various traffic parameters within a cordon in close proximity to the Plaza supplemented by a general report on operating conditions for bus traffic within a broader area of the central business district.

The detailed investigations comprised three individual studies and the results of these are summarised below:

#### 1. Traffic Volume Counts

Traffic volumes were measured at ten intersections in the proximity of the closed section of Martin Place, as indicated under Item 1 of "Part I: Studies Undertaken". As was expected, the total volumes taken over the sum of all approaches showed that the total before and after traffic in the area was unchanged. As summarised earlier in the report, the only major individual variations, apart from the anticipated decreases at the intersections of Martin Place with George Street and Pitt Street, occurred at the intersections of Castlereagh Street with Martin Place and Hunter Street (decrease and increase respectively).

#### 2. Delay Studies

The delays for each approach to the ten intersections for which volume counts were made as above, were analysed. As with the volumes, there were found to be fluctuations from the before period to the after; variations ranging from 197% increase to 65% decrease were noted for the total delays on individual approaches. However, the overall summation of delays on all approaches of all ten intersections indicates that the average delay per vehicle is little altered while for the total delay an increase of approximately 10% was noted.

# Travel Time Study

Travel times were measured for five routes in the city of the Plaza section of Martin Place and the conclusion of the statistical testing of the results are given below.

## TRAVEL TIME RESULTS

ROUTE	PERIOD				
	A	B	C	D	E
George St Northbound					
Pitt St					
George St Southbound					
Collins St					
Hunter St Westbound					
Queen St					
Hunter St Eastbound					
Queen's Sq. to Clarence & Margaret Sts, via Martin Pl.					
Clarence & Jamison Sts to Phillip St via Hunter St					

## CODE

Not Significantly Different	
Significant Increase	
Highly Significant Increase	
Significant Decrease	
Highly Significant Decrease	

Note: 10 increase  
8 decrease  
27 no change

These results indicate that travel times generally have been little affected within the cordon area. For routes 1 to 4, it will be noted that there is some deterioration in Pitt Street, that travel times have improved for south-bound traffic in George Street, and that the remainder are largely unaltered. Route 5 traversed different streets between the same end points in the before and after studies; this was brought about because it was decided to measure the travel time for cross-city traffic while the Martin Place was available and compare it with the after conditions when Martin Place was closed. Although the comparison of times indicates a finite increase in travel time for the route, comparisons of travel times on the individual streets involved leads to the conclusion that the routes chosen for the after study were in fact the slower routes than the alternative 'before' routes, rather than that there had been a deterioration in the same route on a 'before-and-after' basis.

The overall conclusion from the travel time study then is that, although individual streets showed significant variation in travel time during particular periods, the introduction of the Plaza resulted in little general alteration of travel times in the survey area.

## Report by Department of Government Transport

The report by the Department of Government Transport observations of bus operating conditions is included hereunder. The findings of the Department were that some deterioration of running times for some services, and particularly for those which needed to be re-routed as a result of the closure of Martin Place, occurred. The George Street times have improved.

As a result of observations made after the closure, various adjustments were made in relation to kerbside allocations in the northern part of the city subsequent to the survey period. The recent indications are that these alterations have improved conditions considerably for bus operations and that the deterioration noted by the Secretary in his report dated 8th December, 1970, has to some extent been ameliorated.

GENERAL SUMMARY

The traffic has redistributed itself over the available routes without causing any insupportable problems.

Travel times have not generally been adversely affected by the closure.

Some increase in intersection delay and in bus running times were noted as a result of the closure and up till the end of November. However, as a result of various adjustments subsequently made in the control of traffic in the area including alterations in the kerbside allocations, some of the loss has been made up and current observations are that conditions are tolerable.

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