Office:
Suite 15/9 Hoyle Ave., Castle Hill NSW 2154

All Correspondence:
75 Gindurra Ave, Castle Hill NSW 2154

Telephone: (02) 8850 2788
Facsimile: (02) 8850 2799
E-mail: david@thompsonstanbury.com.au
morgan@thompsonstanbury.com.au
www.thompsonstanbury.com.au

MOBILE PHONES: *David Thompson: 0418 262 125* *Morgan Stanbury: 0410 561 848*

THOMPSON STANBURY ASSOCIATES

ABN: 79 943 737 368

AMENDED
TRAFFIC IMPACT STATEMENT
PROPOSED RESIDENTIAL DEVELOPMENT
ELSIE STREET
BURWOOD

Ref: 03-081-5

AUGUST 2008

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FIGURES

1. INTRODUCTION

This Practice has been engaged by Kavlyn Pty. Ltd. to prepare a traffic impact assessment associated with a Part 3A Application to the Minister of Planning associated with a proposed mixed use development on land fronting Elsie Street, within Burwood town centre. The proposal involves the provision of three residential buildings containing 209 apartments to be provided over an existing approved and constructed podium base which incorporates approximately 11,519m^2 of commercial floor space. The final outcome is therefore proposed to be a mixed use development.

This report forms an amended Statement to that originally submitted in October 2007, following a request from the Department of Planning (DoP) for that report to be amended to include comments by Burwood Council (IHAP meeting 30/05/08) as follows:

- *Disputes traffic study volumes – conservative annual growth rate 1% per annum too low. Should be 4%.*

It is further understood from a recent meeting between the applicant and the DoP, the following items were raised for consideration by this amended report:

- The utilisation of 2001 traffic volume surveys for the then public car park;
- The utilisation of more recent modal split data for the Burwood town centre;
- Provision of a comparison of the traffic generating capacity of the previously approved commercial development with the currently proposed mixed residential and commercial development.

The previous report in October 2007 utilised traffic volume surveys undertaken at various intersections immediately surrounding the subject development in 2003. This coincided with the initial report undertaken by this Practice for a mixed land use development at that time when the Council car park was operational.

Subsequent reports prepared by this Practice adopted the 2003 traffic volumes as a base, but applied a growth factor of 2% per annum between that time and the time of the preparation of the October 2007 report. Ten year projections from that time adopted a further 1% per annum based on the anticipated imposition of future restrictive planning frameworks involving a reduced dependence of private vehicles trips, the availability of public transport and the general ability of certain elements of the road network to accommodate additional vehicular demand.

Our October 2007 report is now amended to reflect the comment from a Council officer that the 1% per annum growth rate is too conservative and that 4% should be adopted. The amendments to the report include applying the 4% growth rate from the 2003 base traffic volumes through to the year 2016. The significance of these growth rates are reflected in the summary computer modelling outputs included in **Tables 2** & **4**. Our comments on the use of such a high growth rate are outlined in detail in Section 6.2 of this report.

This report therefore assesses and documents likely traffic and transportation impacts resulting from the development proposal adopting the growth rates suggested by Council and recommends, where appropriate treatments to ameliorate such impacts. In this regard, this assessment focuses on the following issues:

- Existing road network conditions within the vicinity of the site including traffic volumes and general traffic safety;

- Existing public transport facilities servicing the Burwood town centre;

- Identify vehicular, pedestrian and public transport traffic likely to be generated by the proposed amended development;

- Assess the ability of the surrounding road network to accommodate additional traffic and pedestrian movements projected to be generated by the proposal:

- Assess the ability of the surrounding public transport facilities to accommodate to additional demand projected to generated by the proposed development;

- Assess the suitability of the proposed public and private on-site parking provision with reference to previous on-site provisions and Council's relevant parking requirements; and

- Assess the suitability of the proposed accessibility and internal site layout with respect to parking, internal circulation and servicing.

Reference has been made in this report to the following documents:

- The Roads & Traffic Authority's *Guide to Traffic Generating Developments*;

- Burwood Council's *Burwood Transport Study* (2000) by PPK Environment & Infrastructure Pty Ltd;
- *The Vision Document Incorporating: The Burwood Strategic Planning Review and Town Centre Masterplan* (2004) prepared by and on behalf of Burwood Council;

- *Proposed Town Centre Development: Assessment of Road Network and Traffic Implications* (2006) prepared by Transport & Traffic Planning Associates on behalf of Burwood Council;

- *Report on Traffic Management and Access Strategic Planning for Burwood Town Centre* (2007) prepared by NOVOPLAN; and

- Part 22 of Burwood Council's Consolidated Development Control Plan 2006 relating to *Car Parking*.

The report should be read in conjunction with the architectural plans prepared by Architex and Turner & Associates.

2. BACKGROUND

The subject site previously accommodated a public car park comprising 192 parking spaces, approximately half of which are constrained by two-hour parking restrictions. It was previously owned by Burwood Council and has been leased since 1991 on a 99-year lease to private interests. Holdmark Developers purchased the lease for the site from the original leasee in December 2001.

Burwood Council granted conditional development consent (D379/01) on 6 December 2002 for the erection of a commercial office building with basement level public and private car parking within the subject site, which at the time constituted a public car parking area containing 180 spaces. The development comprised a part 5 and part 7 storey office building containing 17,900m^2 commercial floor space and 125m^2 retail floor space above 3 levels of basement car parking containing 369 parking spaces (200 of which were to be public access spaces).

Council's consultant traffic engineer, Mr Fred Gennaoui assessed the application estimating that the development would generate an additional 164 peak hour trips to and from the subject site (in addition to that previously generated by the public car park. Gennaoui indicated that '*these levels of traffic generation could easily be accommodated in the future by the road and traffic facilities improvements included in Council's s94 contribution plan formulated to accommodate the growth in retail, office and residential growth within the Burwood Town Centre*'.

Since December 2002, the proposal has been the subject of subsequent Section 96 applications to modify the terms of the consent as they related commercial floor area and the provision of on-site car parking. The most recent consent incorporates the accommodation of approximately 11,519m^2 of commercial floor space and a number of levels of basement car parking enabling the accommodation of a total of 553 car parking spaces (205 of which were to be public access spaces).

3. SITE DETAILS

3.1 Site Location

The site is located within the Burwood Town Centre, fronting Elsie, Victoria and George Streets. The site location is shown overleaf by **Figure 1** within the regional context whilst **Figure 2** illustrates the site location within a regional context.

3.2 Site Description

The site is described as 1 – 17 Elsie Street being predominantly rectangular in shape also fronting George and Victoria Streets. The site has a frontage to Elsie Street of approximately 122m and to George and Victoria Streets of approximately 45m, giving the site a total area of 5,633m.

3.3 Existing Use

The site is currently undergoing building construction associated with the current development approval.

3.4 Surrounding Uses

The site has a prominent location in the north-west quadrant of Burwood town centre. Accordingly, the site is surrounded by a mix of high-density residential development and commercial / retail land-uses. In this regard, 6 storey office buildings bound the site to the south and east. Further, 6 – 9 storey residential flat buildings occupy land to the north and a recently constructed 4 storey apartment building is located to the west. Immediately to the west, a series of single storey detached dwellings fronting Gloucester Street.

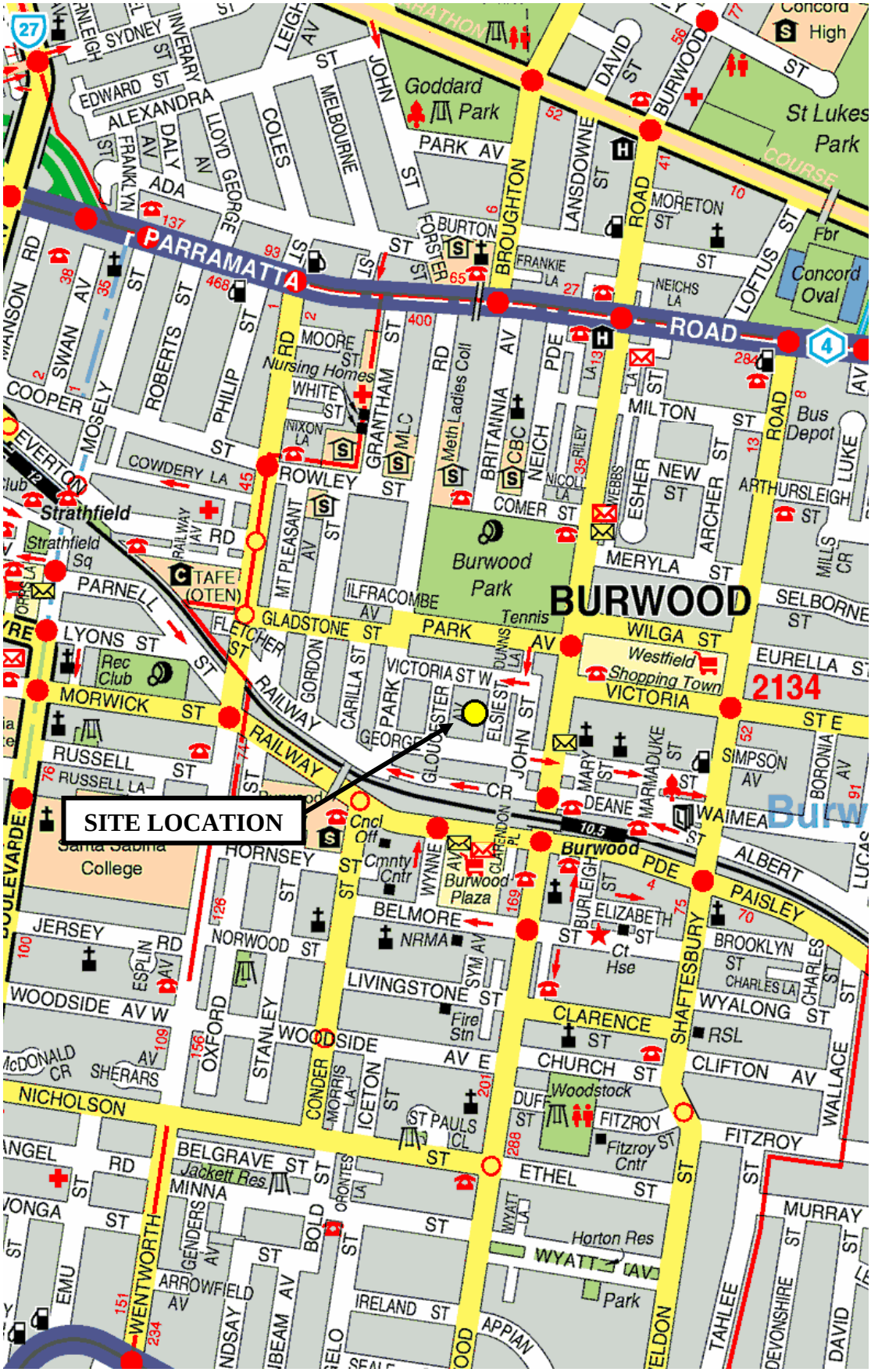

FIGURE 1 – SITE LOCATION WITHIN A LOCAL CONTEXT
SCALE = 1:10000

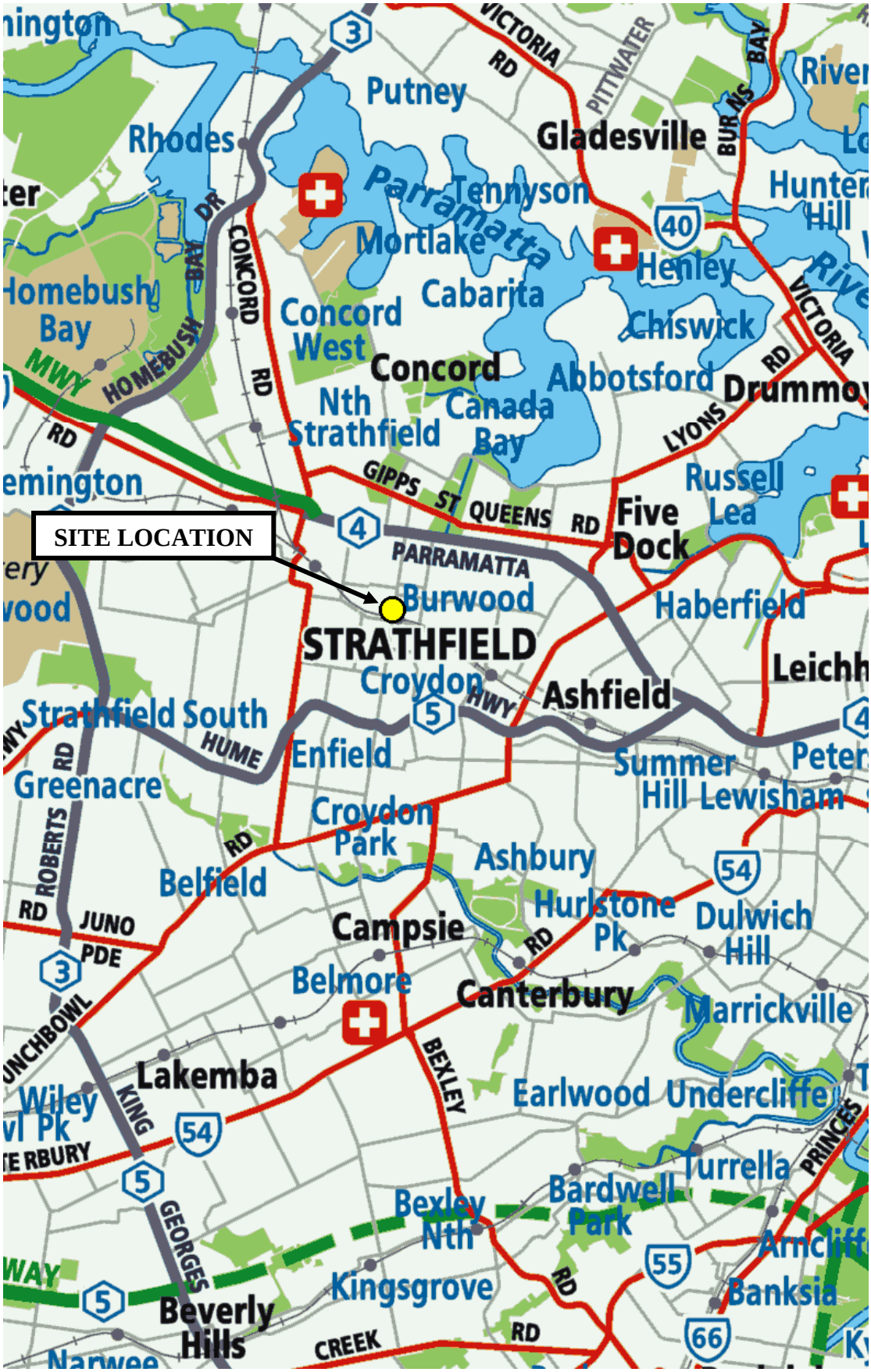

FIGURE 2 – SITE LOCATION WITHIN A REGIONAL CONTEXT
SCALE = 1:70000

4. PROPOSED DEVELOPMENT

4.1 Built Form

The proposed development comprises the construction of three residential building to be provided over an existing approved and constructed podium base. The residential buildings are proposed to contain a total of 209 apartments as follows:

- 45 one-bedroom apartments;
- 109 two-bedroom apartments; and
- 55 three-bedroom apartments.

The existing approved podium base comprises a commercial floor area of approximately 11,519m^2. Accordingly, the subject development will comprise a mixed use development.

The above facilities are proposed to be provided with a combination of private and public off-street car parking located within 5 basement levels as follows:

Public	= 205 spaces
Residential	= 237 spaces
Commercial	= 230 spaces

TOTAL	= 672 spaces

In addition to the above vehicular parking spaces, a total of 25 motorcycle bays and 94 bicycle storage racks are proposed.

Ingress access to the car parking and loading areas is proposed via George Street whilst egress access is proposed via Victoria Street. Pedestrian access is proposed via Elsie Street.

5. ACCESS & INTERNAL CONSIDERATIONS

5.1 Access Arrangements

5.1.1 Vehicular Access

Access to the subject development is proposed to be provided as follows:

- A 6.0m wide ingress only driveway is proposed to provide connectivity to the passenger vehicle basement parking areas from George Street;

- A 6.4m wide egress only driveway is proposed to provide connectivity form the passenger vehicle basement parking areas to Victoria Street; and

- A 6.0m wide combined ingress / egress driveway is proposed to provide connectivity between the loading area and George Street.

In order to undertake an assessment of the proposed passenger vehicle access arrangements, reference is made to the Roads & Traffic Authority's *Guide to Traffic Generating Development Developments*. This publication provides driveway design recommendations based on the number of vehicles to be accommodated on-site and the functional order of the access roads.

Based on the proposed parking provision in excess of 600 spaces and the low functional order of both George Street and Victoria Street, the Authority recommends that, at minimum, the site provide separated 6m wide ingress and egress driveways. The proposed driveways providing connectivity to the basement car parking area are therefore considered to be satisfactory in terms of design.

Assessment of the proposed George Street access driveway providing connectivity to the loading area is based on the largest vehicle required to be accommodated on-site. Consultation with the applicant has indicated that the subject site will be serviced by vehicles up to and including medium rigid trucks. The application of medium rigid truck swept paths provided by the Australian Standards for *Commercial Vehicle Facilities* (AS2890.2-2002) on the architectural plans indicates that such vehicles are capable of entering and exiting the subject site via George Street via the proposed access driveway arrangement. In consideration of this and the above discussion, the proposed access driveway arrangements in terms of design are satisfactory.

5.1.2 Pedestrian Access

Pedestrian access to the subject development is primarily proposed to be focused via Elsie Street. Three marked pedestrian crossings are proposed to be provided at each end and approximately central to the site frontage to Elsie Street to assist in the safe and efficient movement of pedestrians between the subject site and the town centre focal point, Burwood Road. These crossings are proposed to be augmented by footway widening (and thus roadway narrowing) within Elsie Street along with kerb-side parking restrictions. It is understood however that Council officers (as noted in the minutes of the IHAP meeting dated 30 May 2008) stated that three crossings

would not be supported by Council or the Roads & Traffic Authority. This matter would be one for determination by Council's Traffic Committee.

5.2 Parking Provision

5.2.1 Approved and Proposed Parking Provision

Approval has been granted for the provision of approximately 11,519m^2 of commercial floor space. Development consent has been granted for this commercial floor space to be serviced by a total of 553 car parking spaces (205 of which were to be public access spaces).

The subject proposal involves the provision of 672 spaces, being 119 spaces greater than previously approved.

Burwood Council provides locally sensitive parking requirements within Part 22 of BDCP 2006. This document states that parking for commercial floor space is to be provided at a rate of 1 space per 50m^2. Applying this rate to the approved commercial floor space (11,519m^2), a parking requirement of 230 spaces is calculated.

BDCP 2006 also provides the following parking requirements for residential flats within the town centre:

1 space per 1-bedroom unit;
1 space per 2-bedroom unit;
1.5 spaces per 3 bedroom unit; and
1 space per 6 units (visitor parking)

It is however noted that BDCP 2006 states that residential visitor parking is not required to be provided on-site.

Based on the above Council requirements, the residential component of the proposal (comprising 45 one bedroom, 109 two bedroom dwellings and 55 three bedroom dwellings) is required to provide 237 spaces.

Incorporating the provision of 205 public parking spaces, the subject development is therefore required to provide a total of 672 spaces (230 commercial spaces + 237 residential spaces + 205 public spaces). Considering that 672 parking spaces are proposed, compliance with Council's requirements is achieved.

5.2.2 On-Street Parking Reduction

The provision of ingress and egress driveways to and from the development site will necessitate a reduction in on-street kerb-side parking within George Street and Victoria Street. The anticipated loss of six spaces associated with these proposed access points along with some 20 spaces along the site frontage within Elsie Street. This loss of on-street parking will be catered for within the public parking component of the development site (205 spaces) which is greater than what the previous public car park provided on-site.

5.3 Internal Circulation

The loading area on the ground floor level has been designed to allow medium rigid trucks to be able to drive onto the site in a forward direction, reverse into loading bays and then drive out in a forward direction.

The basement car parking levels are proposed with the upper parking levels being allocated to public parking and the balance to tenant and resident parking. All parking spaces have been designed to comply with the Australian Standards for *Off-Street Car Parking* (AS2890.1-2004) with spaces dimensions being 2.4m – 2.6m wide and 5.4m long. Aisles are proposed to be 5.8m wide also complying with the Standard.

Ramps are proposed to provide maximum grades of 1 in 9, which is less than the maximum specified by AS2890.1-2004, which is 1 in 5. A simple clockwise circulation pattern is proposed with efficient loops for up and down circulation from one ramp to the next.

The proposed basement parking levels have been designed in accordance with previous development schemes which have been subject to assessment of a number of occasions by Council associated with previous site approvals. Overall internal traffic arrangements are considered satisfactory.

6. EXISTING TRAFFIC CONDITIONS

6.1 Surrounding Road Network

6.1.1 Road Hierarchy

It is usual to classify roads according to road hierarchy in order to determine their functional role within the road network. Changes to traffic flows on the roads can then be assessed within the context of the road hierarchy. Roads are classified according to the role they fulfil and the volume of traffic they should appropriately carry. In this regard, the Roads & Traffic Authority has set down the following guidelines for the functional classification of roads:

- **Arterial Road** – typically a main road carrying over 15,000 vehicles per day and fulfilling a role as a major inter-regional link (over 1,500 vehicles per peak hour);

- **Sub-Arterial Road** – defined as secondary inter-regional links, typically carrying volumes between 5,000 and 20,000 vehicles per day (500 to 2,000 vehicles per peak hour);

- **Collector Road** – provides a link between local roads and regional roads, typically carrying between 2,000 and 10,000 vehicles per day (250 to 1,000 vehicles per peak hour). At volumes greater than 5,000 vehicles per day, residential amenity begins to decline noticeably;

- **Local Road** – provides access to individual allotments, carrying low volumes, typically less than 2,000 vehicles per day (250 vehicles per peak hour).

Peak hour volumes on most roads are typically eight to twelve percent of the daily volumes. In accordance with the above, the roads in the vicinity of the subject site are therefore described below:

- **Burwood Road** is generally a four-lane regional road running north-south providing connectivity between Hume Highway and Parramatta Road. Further north and south, it provides a residential collector function within Concord and Bankstown respectively. It provides for one through lane of traffic in each direction with parking being allowed on both sides of the road. Vehicular parking within the Town Centre is restricted to half an hour during the weekdays and Saturday mornings.

- **Park Avenue** provides an east-west collector function providing connectivity between Burwood Road and Park Road. With Gladstone Street it provides access to Wentworth Street which provides a north-south local access over the railway line. Park Avenue provides one through lane in each direction with 1 hour kerb-side parking being permitted, being 90^{o} spaces along the northern alignment. The junction of Burwood Road and Park Avenue is governed by traffic signal control providing two turning lanes within Park Avenue and is operated in tandem with the junction of Burwood Road and Wilga Street.

- **Elsie Street** is a local road providing a north-south connection between George Street and Victoria Street. It provides for one through lane of traffic in each direction. 1-hour parking is provided along the eastern kerb with 'No Standing' restrictions governing parking along the western alignment.

- **George Street** provides an east-west local function between Park Road and Burwood Road providing a two-way function to the west of John Street and a one-way (eastbound) traffic function to the east of John Street. West of John Street, it provides one through traffic lane in each direction. Parking is not permitted adjoining the northern kerb between Elsie Street and John Street, the southern kerb between John Street and Burwood Road and the northern kerb between John Street and Burwood Road.

- **Victoria Street** provides an east-west local function between Park Road and Dunns Lane for vehicular traffic whilst a pedestrian link is provided through to Burwood Road. Victoria Street predominantly provides for one through lane of traffic in each direction however the carriageway narrows to provide for only one-way (westbound) traffic function between Elsie Street and Gloucester Avenue.

- **Park Road** provides a north-south local residential access function providing a north-south access function between the railway line and Parramatta Road where it provides for left in / left out movements. It provides one through lane of traffic in each direction with parking being provided on both sides of the road.

6.1.2 Local Traffic Control

The Burwood Town Centre is bisected by the western railway line, which runs east-west through the centre. The road network is generally characterised by a north-south and east-west grid pattern of roads, however the western railway line restricts localised north-south movements to three locations in the vicinity of the study area. These locations are Wentworth Street, accessed via Park Avenue and Gladstone Street, Burwood Road and Shaftsbury Road being access via Victoria Street.

Signalised intersections within the study area include:

- Burwood Road / Park Avenue / Wilga Street;

- Burwood Road and Deane Street;

- Burwood Road and Railway Parade; and

- Shaftsbury Road and Victoria Street.

All other local junctions are governed by signage priority control.

6.2 Traffic Volumes

This Practice previously commissioned extensive traffic surveys immediately surrounding the subject site between 7.00am – 9.00am and 4.00pm – 6.00pm in July 2003 at the following intersections:

- Park Road and George Street;
- Park Road and Victoria Street;
- Burwood Road and Park Avenue;
- Burwood Road and George Street;
- Burwood Road and Wilga Street;
- Park Avenue and Dunns Lane;
- George Street and Elsie Street;
- George Street and John Street; and
- Victoria Street and Elsie Street.

This Practice's October 2007 report adopted the 2003 traffic volumes as a base, but applied a growth factor of 2% per annum between that time and the time of the preparation of the October 2007 report. Ten year projections from that time adopted a further 1% per annum based on the anticipated imposition of future restrictive planning frameworks involving a reduced dependence of private vehicles trips, the availability of public transport and the general ability of certain elements of the road network to accommodate additional vehicular demand.

It is normal traffic engineering practice to apply a 2% per annum growth rate (3% maximum) to traffic volumes within urban areas. This Practice has however previously applied a conservative 1 – 2% per annum growth rate in order to estimate future traffic volumes within the Burwood town centre based on the abovementioned reasons.

However, at the specific request of the DoP based on comments provided by a Council's Manager - Development Assessments, a 4% per annum growth rate as been applied to the previously undertaken traffic surveys to generate current 2008 traffic volumes and projected 2016 traffic volumes. Whilst the imposition of such a growth rate may be applicable in developing areas such as the north-west and south-west, it is considered excessive for a town centre such as Burwood.

Further, a review of the *Proposed Town Centre Development: Assessment of Road Network and Traffic Implications* (2006) prepared by Transport & Traffic Planning Associates on behalf of Council would indicate that the abovementioned high annual growth rate was not applied to existing surveyed base traffic volumes in order to estimate future traffic demands.

Notwithstanding the abovementioned discussion, this Practice at the specific request of the DoP has applied the 4% annual growth rate to the surveyed 2003 traffic volumes in order to create an absolute worst case scenario for the purposes of this assessment.

Figures 3 & **4** illustrate the estimated 2008 peak hour traffic flows at the subject intersections whilst **Figures 5** & **6** illustrate the estimate 2016 volumes.

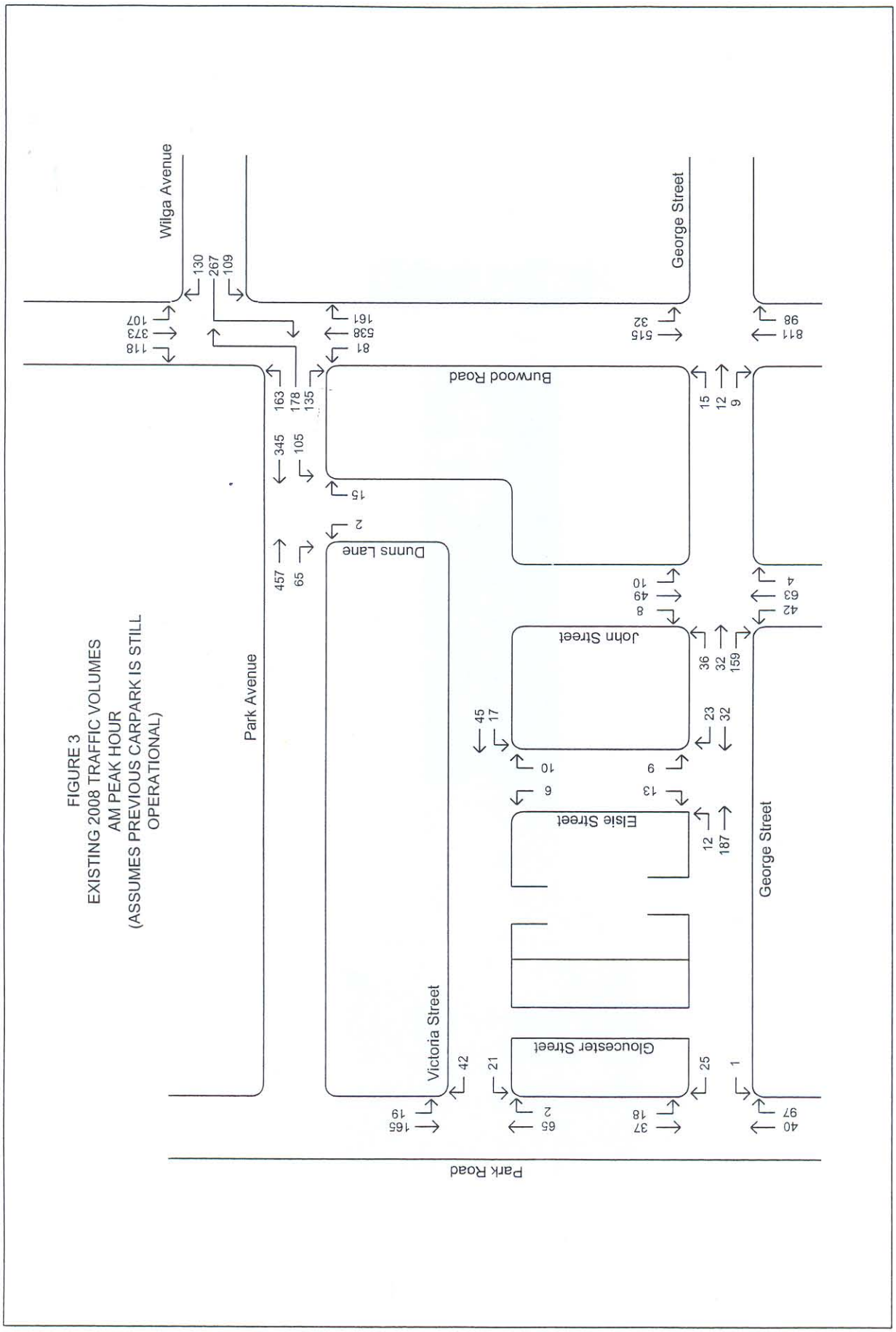

FIGURE 3
EXISTING 2008 TRAFFIC VOLUMES
AM PEAK HOUR
(ASSUMES PREVIOUS CARPARK IS STILL OPERATIONAL)

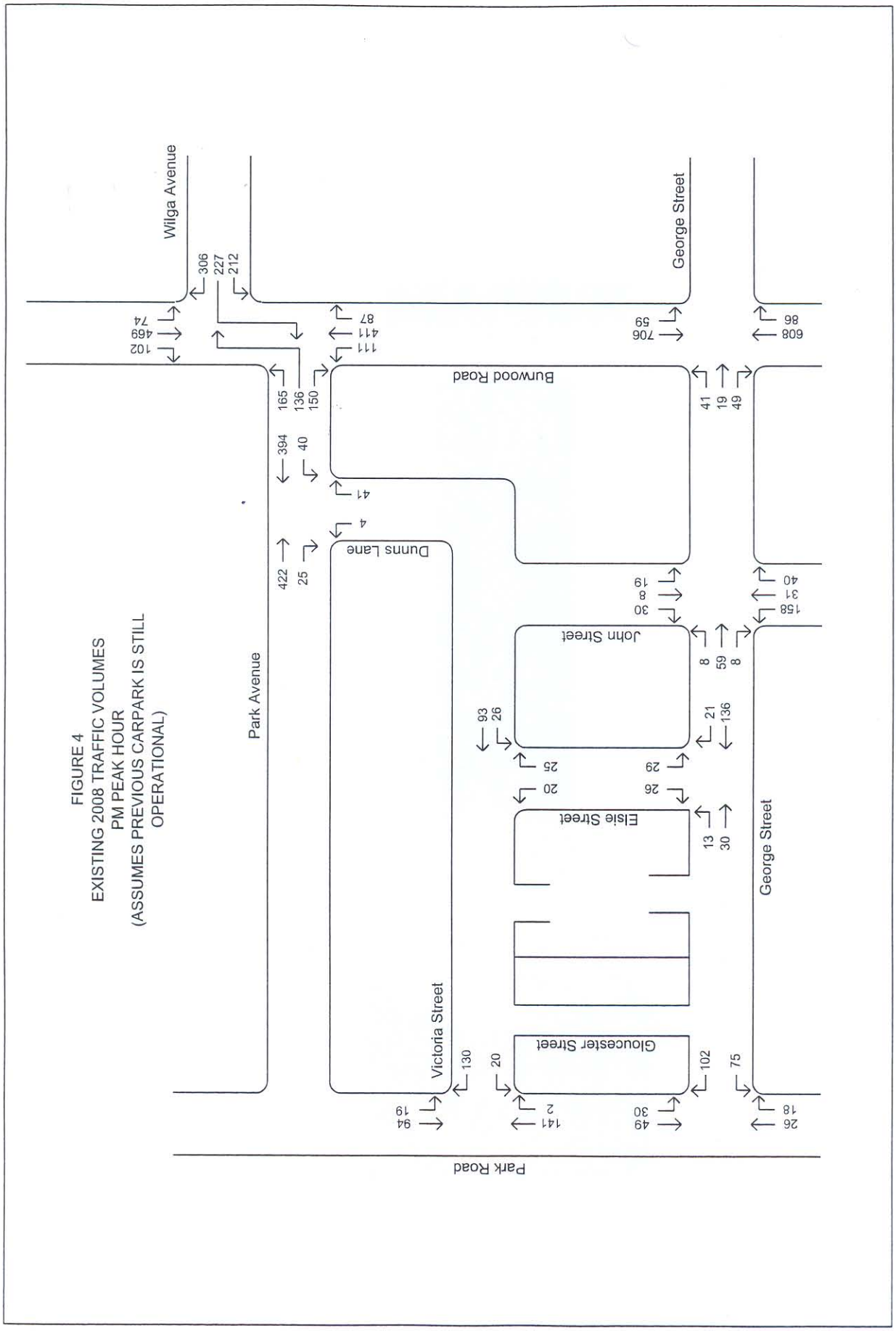

FIGURE 4
EXISTING 2008 TRAFFIC VOLUMES
PM PEAK HOUR
(ASSUMES PREVIOUS CARPARK IS STILL OPERATIONAL)

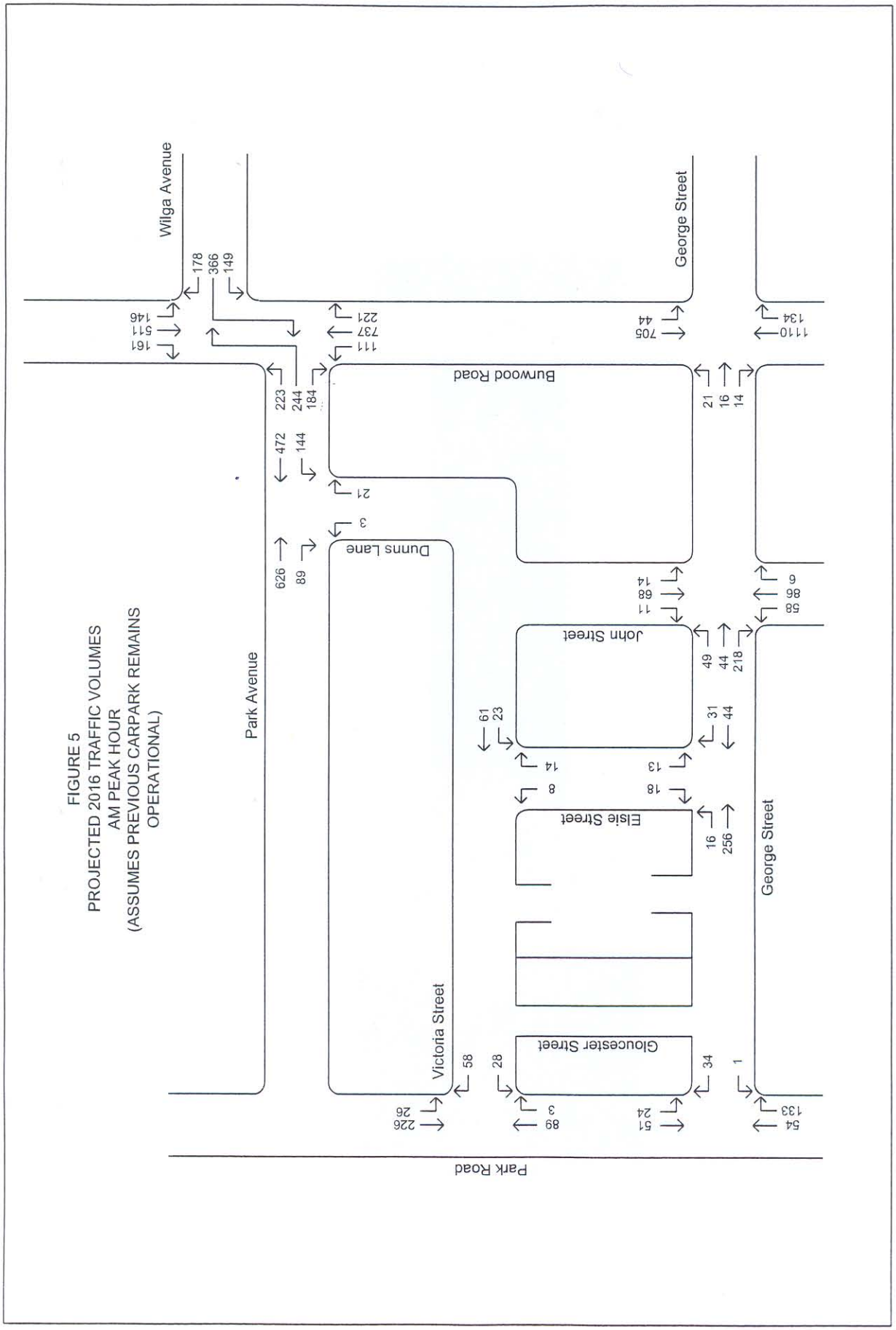

FIGURE 5
PROJECTED 2016 TRAFFIC VOLUMES
AM PEAK HOUR
(ASSUMES PREVIOUS CARPARK REMAINS OPERATIONAL)

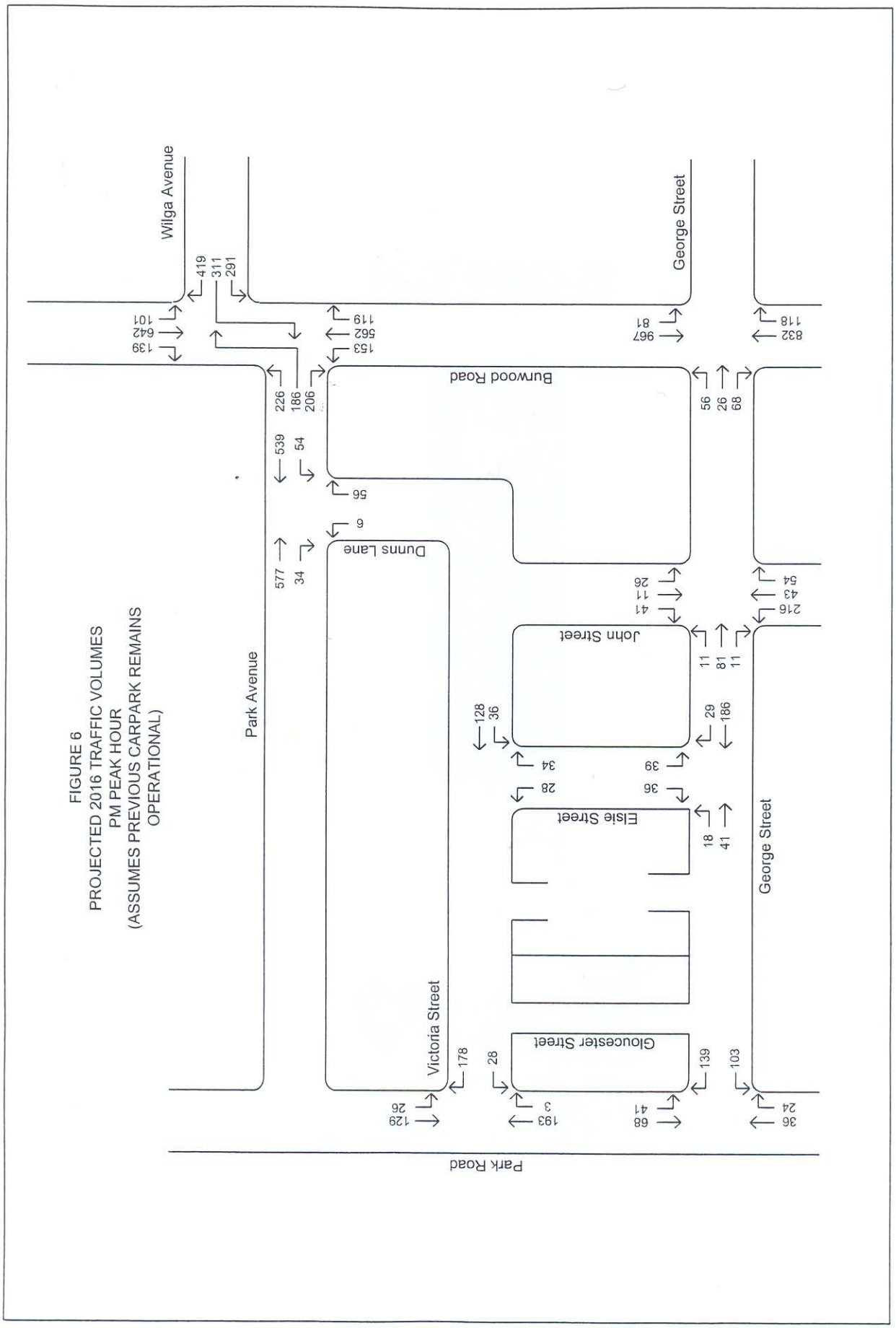

FIGURE 6
PROJECTED 2016 TRAFFIC VOLUMES
PM PEAK HOUR
(ASSUMES PREVIOUS CARPARK REMAINS OPERATIONAL)

6.3 Existing Circulation Patterns

The area accommodates both origin and destination trips associated with the employment generating and residential developments within the town centre. Further, the surrounding road network accommodates a significant portion of through trips. In this regard, Burwood Road, Wentworth Avenue and Shaftsbury Road accommodate the majority of north-south through trips whilst Wilga Street, Park Avenue and Gladstone Street and Railway Parade accommodate the east-west through movements. Our observations indicate that the current through traffic flows utilising the existing pseudo and established regional roads adjoining the study area are not particularly high in either volume or in heavy vehicle composition.

6.4 Existing Intersection Operation

In order to objectively assess the operation of the more important intersections the abovementioned surveyed intersections have been analysed using INTANAL computer intersection analysis program. INTANAL is a computerised traffic arrangement program which, when volume and geometrical configurations of an intersection are imputed, provides an objective assessment of the operation efficiency under varying types of control (ie signs, signal and roundabouts). Key indicators of INTANAL include level of service where results are placed on a continuum from A to F, with A providing the greatest intersection efficiency and therefore being the most desirable by the Roads and Traffic Authority.

Other key indicators provided by INTANAL are average vehicle delay, the number of stops per hour and the degree of saturation. Degree of saturation, known as the X-value, is the ratio of the arrival rate of vehicles to the capacity of the approach. The X-value is a useful and professionally accepted measure of intersection performance. A value of 0.75 permits the intersection to operate in a generally satisfactory manner and provides tolerance for minor disturbances and fluctuations in the traffic conditions. At values of ‘X’ at 0.8 the traffic will be subject to queuing and delays which could extend over more than one signal cycle. For intersections controlled by traffic signals both queue length and delay increase rapidly as DS approaches 1.0.

For intersections controlled by a roundabout or give way or stop signs, a degree of saturation of 0.8 or less indicates satisfactory intersection operation. INTANAL provides analysis of the operating conditions that can be compared to the performance criteria set out in **Table 1** overleaf (adapted from the Roads & Traffic Authority’s ‘*Guide to Traffic Generating Developments*’).

TABLE 1 LEVELS OF SERVICE CRITERIA FOR INTERSECTION			
Level of Service	**Average Delay per Vehicle (secs/veh)**	**Traffic Signals, Roundabout**	**Give Way & Stop Signs**
A	Less than 14	Good Operation	Good operation
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & Spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity; at signals, incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	> 70	Extra capacity required	Extreme delay, traffic signals or other major treatment required

6.4.1 Intersection Modelling Output

The results of the analyses are presented overleaf in **Table 2** overleaf whilst full details are available if required.

TABLE 2 INTANAL OUTPUT –INTERSECTION EFFICIENCY				
	2008		2016	
Intersection	**AM**	**PM**	**AM**	**PM**
Burwood Road / Wilga Street / Park Avenue				
Delay	32.3	25.7	245.2	168.7
Degree of Saturation	0.87	0.82	1.21	1.37
Level of Service	D	C	F	F
Burwood Road & George Street				
Delay	49.6	50.3	115.2	114.7
Degree of Saturation	0.54	0.43	0.76	0.64
Level of Service	D	D	F	F
Park Avenue & Dunns Lane				
Delay	10.4	10.9	13.2	14.3
Degree of Saturation	0.31	0.25	0.43	0.35
Level of Service	A	A	A	B
Park Road & Victoria Street				
Delay	7.1	7.1	7.8	7.9
Degree of Saturation	0.07	0.21	0.10	0.32
Level of Service	A	A	A	A
Park Road and George Street				
Delay	6.0	6.1	6.3	6.8
Degree of Saturation	0.09	0.14	0.13	0.21
Level of Service	A	A	A	A
George Street & Elsie Street				
Delay	7.1	6.2	7.8	6.4
Degree of Saturation	0.04	0.09	0.05	0.12
Level of Service	A	A	A	A
George Street & John Street				
Delay	7.9	6.7	9.2	7.3
Degree of Saturation	0.14	0.26	0.21	0.36
Level of Service	A	A	A	A
Victoria Street & Elsie Street				
Delay	5.6	6.1	5.8	6.5
Degree of Saturation	0.01	0.04	0.02	0.05
Level of Service	A	A	A	A

Note: - 2008 and 2016 traffic volumes have been estimated by applying a 4% pa growth rate to the surveyed 2003 traffic volumes at the specific request of DoP.

6.4.2 Discussion of Output

Table 2 indicates that all local intersections currently operate with a good level of service during peak times, with the exception of those involving Burwood Road. Similar results are expected based on projections for the year 2016. Congestion on Burwood Road results in delays, particularly for vehicles entering Burwood Road from side streets without the benefit of an exclusive traffic signal phase.

The junction of Burwood Road / Park Avenue / Wilga Street currently operates close to capacity during peak times with vehicle delays not uncommon. This congestion is largely due to the off-set arrangement of Park Avenue and Wilga Street and the multitude of movements which are required to be accommodated. Wilga Street with Park Avenue performs an important east-west link through the Burwood Town Centre and provides access to Westfield Shopping Centre. **Figures 3** and **4** illustrate that there are currently approximately 400 movements between Park Avenue and Wilga

Street during both the morning and afternoon peak periods. The operation of this function in conjunction with the north-south regional function of Burwood Road results in congested conditions during peak periods. The operation of the intersection is projected to deteriorate in the future providing a level of service F representing poor intersection operation.

Traffic studies of the town centre on behalf of Council have indicated that the operation of the Burwood Road intersections with Park Avenue and Wilga Street can be improved by providing additional signalised cross junctions with Burwood Road within the town centre. These additional signalised main road crossing facilities would reduce the abovementioned problematic crossing demand between Park Avenue and Wilga Street. The future operation of the Burwood Road intersections with Park Avenue and Wilga Avenue incorporating the subject development and these planned alterations to the road network are discussed in subsequent sections of this report.

The intersection of Burwood Road and George Street has been modelled to operate with a level of service D and F during the 2008 and 2016 traffic volume scenarios respectively. These levels of service represent operation near capacity and unsatisfactory operation for the existing and projected 2016 traffic volumes scenarios respectively. It is therefore noted that there is currently a demand for consideration to be given for an alternative intersection control to be implemented.

Traffic studies of the town centre on behalf of Council have identified that the intersection of Burwood Road and George Street should be converted traffic signal control thereby providing an additional Burwood Road crossing facility as discussed above. The operation of Burwood Road intersection with George Street incorporating such control is discussed in more detail in subsequent sections of this report.

Considering that the subject Burwood Road intersections currently accommodate operation near capacity, it is noted at this stage that any upgrade work costs would form part of any Section 94 Contribution where it is assumed that such a contribution will be equitably applied based on the extent of additional traffic generated by the subject proposal.

7. PUBLIC TRANSPORT AND PARKING CONDITIONS

7.1 Railways

Figure 1 illustrates that the site is located less than 200m from Burwood railway station, which forms part of the western railway line running east-west through the Burwood Town Centre. This railway line services other major stations such as Parramatta, Blacktown, Penrith and the Blue Mountains to the west of the site and Strathfield and the Sydney CBD to the east.

Burwood railway station is a major interchange station, as a result, the frequency of trains servicing the station is high during all periods of the day. The NOVOPLAN report on *Transport Management and Access Strategic Planning for Burwood Town Centre* presents the following with respect to the servicing of Burwood railway station:

- 594 trains stop at Burwood station daily between Mondays to Friday;
- 378 trains stop at Burwood station daily on Saturdays and Sundays; and
- Services are well-spread throughout the day with appropriate concentrations in peak periods.

7.2 Buses

There are 13 bus routes currently servicing the Burwood town centre providing connections to surrounding suburban areas. The NOVOPLAN report on *Transport Management and Access Strategic Planning for Burwood Town Centre* presents the following with respect to the servicing of Burwood by buses:

- 689 daily bus services operate to, from or through the town centre between Monday to Friday;
- 507 bus services operate to, from or through the town centre on Saturdays;
- 315 bus services operate to, from or through the town centre on Sundays;
- Generally, the main route services operate at a frequency of 2 – 3 buses per hour in peak weekday periods, and somewhat less on weekend days; and
- 76 and 83 services operate along Burwood Road during the morning and afternoon peak weekday hour.

7.3 Taxis

The NOVOPLAN report on *Transport Management and Access Strategic Planning for Burwood Town Centre* presents the following with respect to taxi ranks:

- There are six designated taxi spaces in Deane Street north of the railway station; and

- There are two spaces on the eastern side of Burwood Road north of Wilga Street.

7.4 Modal Split

The mode of travel utilised by residents located within the Burwood town centre and employees travelling to the town centre was investigated within the NOVOPLAN report on *Transport Management and Access Strategic Planning for Burwood Town Centre*. The result of this study is summarised below within **Table 3** below.

TABLE 3
MODE OF TRAVEL TO BURWOOD TOWN CENTRE

Mode	Percentage of Utilisation	
	Commercial Trips From Outside Burwood to Burwood Town Centre	**Residential Trips from Burwood Town Centre to Outside Burwood Town Centre**
Car	58%	36%
Bus	3%	1%
Train	21%	57%
Other	18%	6%
TOTAL	**100%**	**100%**

Note: The "other" travel mode includes walk trips, taxi, bicycle etc

Table 3 indicates that the following:

- 42% of people travelling to Burwood town centre for commercial purposes utilise travel modes other than private vehicle; and

- 64% of residents of Burwood town centre travelling to areas outside of the town centre for work purposes utilise travel modes other than private vehicle.

7.5 Parking Conditions

The NOVOPLAN report on *Transport Management and Access Strategic Planning for Burwood Town Centre* presents that parking in the town centre is reasonably distributed. There are 5,580 off-street parking spaces within the town centre, some 3,000 of which are located with Westfield Shopping Centre. A survey completed in 2000 and presented within the *Burwood Transport Study* identified a further 1,442 on-street spaces within the town centre.

The *Burwood Transport Study* reported that the Burwood town centre provides a total of 3,138 long stay parking spaces, 58% of which were found to be occupied during peak utilisation. It would therefore appear that there is a parking surplus of long stay spaces within the Burwood town centre. The Study indicated that the town centre provides a total of 1,851 short stay parking space, the peak utilisation of which was surveyed to be approximately 82%.

8. PROJECTED TRAFFIC GENERATION & IMPACTS

8.1 Traffic Generation

The subject development proposes a mix of residential and commercial floor space in accordance with Section 3 of this report. The *Burwood Transport Study* and the *Proposed Town Centre Development: Assessment of Road Network and Traffic Implications Report* undertook detailed investigations into the likely future land-use provision within the Town Centre and the likely traffic generation rates for each. The following provides a discussion of the findings of the above investigation relevant to the land-uses proposed within the subject development.

8.1.1 Proposed Development

8.1.1.1 Residential Units

The Roads & Traffic Authority provides the following traffic generation rates for residential apartments within metropolitan sub-regional centres:

Daily vehicle trips = not available
Peak hour vehicle trips = 0.29 trips per unit

The abovementioned traffic generation rate is significantly lower than other lower density forms of development due to a number of factors. The first and most important factor is that of public transport accessibility. The accessibility of public transport in the area of study has a major influence on the suitability of the abovementioned Roads & Traffic Authority rates. The relatively low traffic generation rates compared to say a dwelling house takes into account the high probability of public transport utilisation. This is considered to be a fair assumption given the proximity of the site to Burwood railway station in addition to several bus services previously presented.

The second major influence on the traffic generating characteristics of a residential development is the ratio of car ownership to tenants and the number of on-site parking spaces provided. The Roads & Traffic Authority recommends that high-density residential developments provide approximately 1 parking space per two residents, indicating that around 50% of residents would own a vehicle. The above Roads & Traffic Authority estimated traffic generation rate of 0.29 per unit indicates that a large proportion of residents catch public transport to work.

The *Burwood Transport Study* further assessed that during the evening peak period, 0.19 would be inbound trips and 0.10 would be outbound trips. However, during the calibration of the modelling program utilised during the *Burwood Transport Study*, it was found that the overall rate of residential trips was high. The peak hour generation rates were therefore reviewed during the calibration process such that the following rates are now pertinent to the development:

Evening inbound trips per dwelling = 0.09
Evening outbound trips per dwelling = 0.12
Total trips per dwelling = 0.21

Notwithstanding this, the *Proposed Town Centre Development: Assessment of Road Network and Traffic Implications Report* adopted the previously presented Roads & Traffic Authority generation rate of 0.29 trips per unit for robustness. Utilising the Roads & Traffic Authority rates, the residential component of the proposal (comprising 209 dwellings) is projected to generate a total of 61 peak hour trips. For the purposes of this assessment, these movements are projected to be outbound trips during the morning peak and inbound trips during the evening peak.

8.1.1.2 Commercial

The *Proposed Town Centre Development: Assessment of Road Network and Traffic Implications Report* estimated that future commercial development within the Burwood town centre would generate traffic during peak periods as follows:

1 trip per 100m^2 gross floor area

Based on the above traffic generation rate, the commercial component of the subject proposal (comprising approximately 11,519m^2) is estimated to generate 115 vehicle movements during peak hours. Assuming that the above represent inbound trips during the morning peak and outbound trips during the afternoon peak, the commercial floor space is likely to generate a total of 115 vehicle trips during both the morning and afternoon peak hours.

8.1.1.3 Summary and Discussion

The above discussion on the traffic generation of the two components of the subject development indicates that the development likely to result in the following evening peak hour trip generation

Residential	= 61 trips
Commercial	= 115 trips

TOTAL	**= 176 trips**

The proposed development is therefore projected to generate in the order of 176 peak hour vehicle trips.

8.1.2 Approved Development

Section 2 of this report presented that Burwood Council granted conditional development consent (D379/01) on 6 December 2002 for the erection of a commercial office building with basement level public and private car parking within the subject site. This approved development comprised a part 5 and part 7 storey office building containing 17,900m^2 commercial floor space in conjunction with a small amount of the retail floor space. Applying the abovementioned commercial traffic generation rate of 1 trip per 100m^2 gross floor area to the abovementioned approved development, the subject site could be expected to generate in the order of 179 peak hour trips.

It is therefore noted that the current proposal is projected to generate marginally less traffic than that which could be expected to be generated by development previously approved for the subject site. However for the purposes of this assessment, it has been assumed that the traffic generating potential of the subject development proposal is the equal of that which has previously been granted development consent.

8.2 Trip Assignment

In order to gauge the impact of the traffic projected to be generated by the proposed development on the local road network, it is necessary to determine the impact on surrounding intersection efficiency. The objective of this section is to distribute the traffic generated by the proposed development along the major approach routes before it dissipates throughout the general road network. The additional traffic projected to be generated by the subject development has been distributed to the road system based on journey to work census data provided within the Department of Urban Affairs and Planning report *Integrating Land Use and Transport*. The following distribution was used:

- 40% from the north and east;
- 15% from the north west;
- 30% from the west; and
- 15% from the south and south west.

In regard to the impact of the projected development of the study site, assessment was undertaken in respect of the anticipated traffic movements throughout the Burwood town centre. The above trip assignment to and from the site is represented diagrammatically by **Figures 7** and **8** in the following pages. **Figures 9**, **10**, **11** & **12** provide an estimation of the projected traffic volumes incorporating the abovementioned traffic generation and trip assignment for both 2008 and 2016. It is noted that these volumes incorporate both the previous vehicular trips generated by the public car park as well as that projected to be generated by the amended traffic generation.

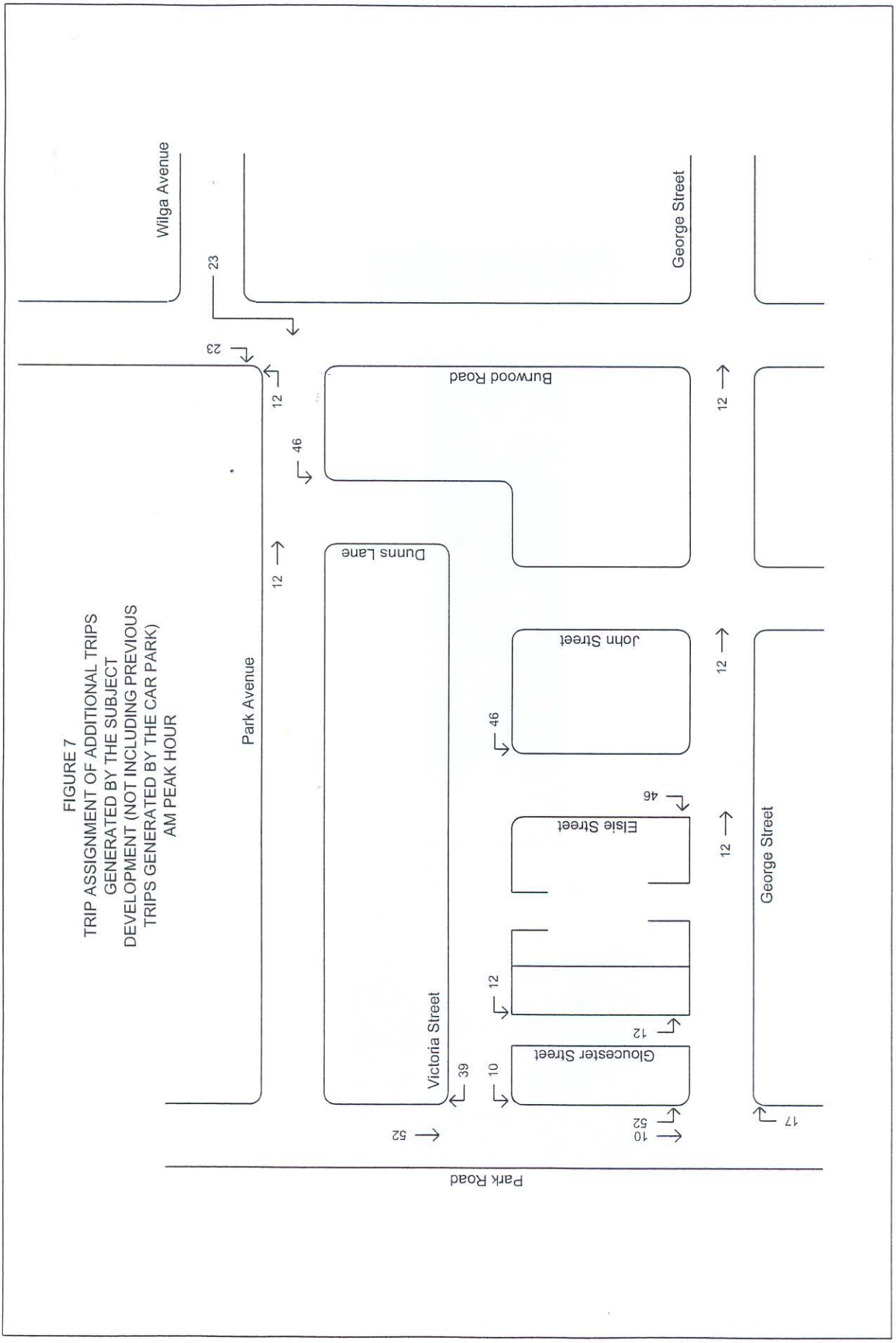

FIGURE 7
TRIP ASSIGNMENT OF ADDITIONAL TRIPS
GENERATED BY THE SUBJECT
DEVELOPMENT (NOT INCLUDING PREVIOUS
TRIPS GENERATED BY THE CAR PARK)
AM PEAK HOUR

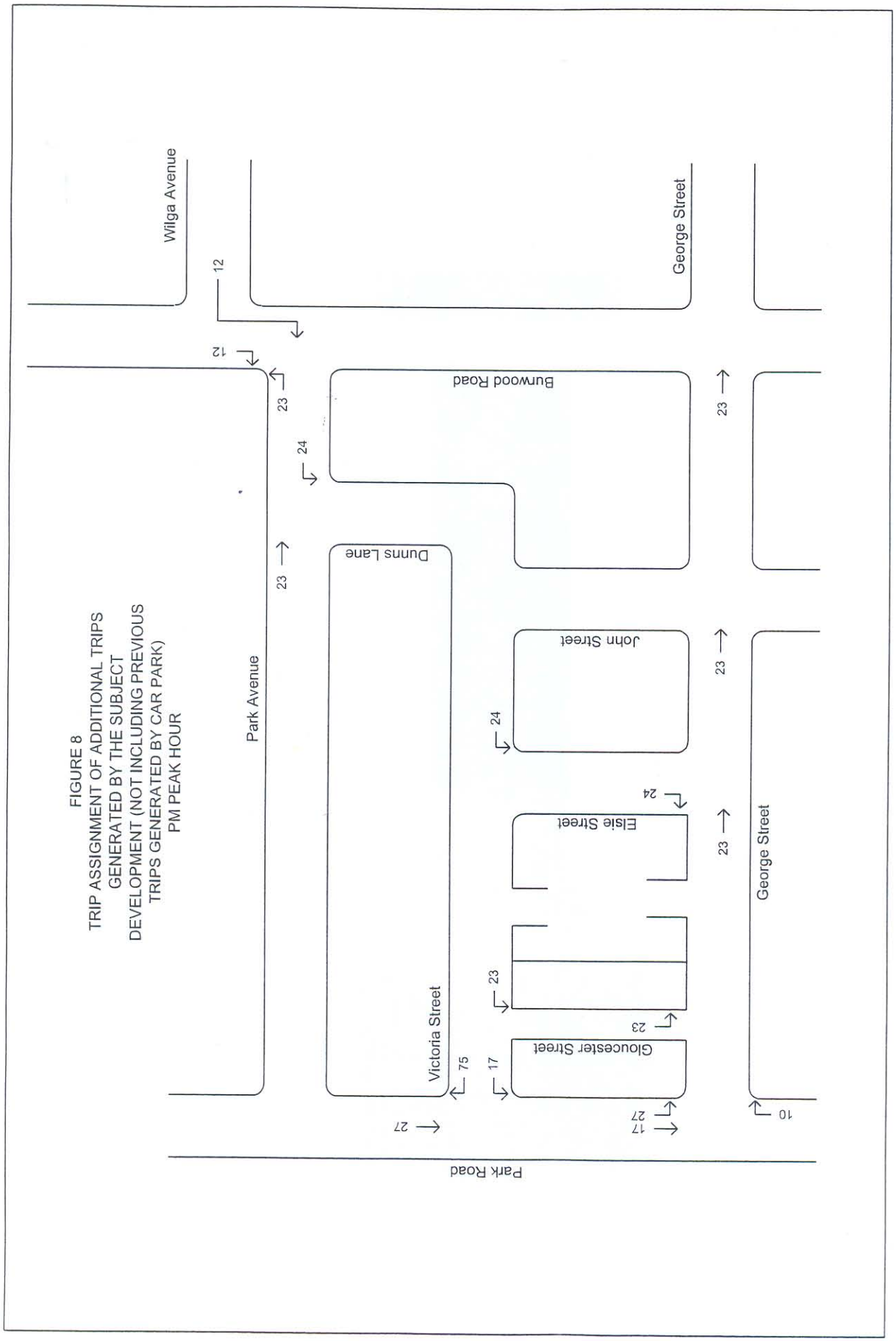

FIGURE 8
TRIP ASSIGNMENT OF ADDITIONAL TRIPS
GENERATED BY THE SUBJECT
DEVELOPMENT (NOT INCLUDING PREVIOUS
TRIPS GENERATED BY CAR PARK)
PM PEAK HOUR

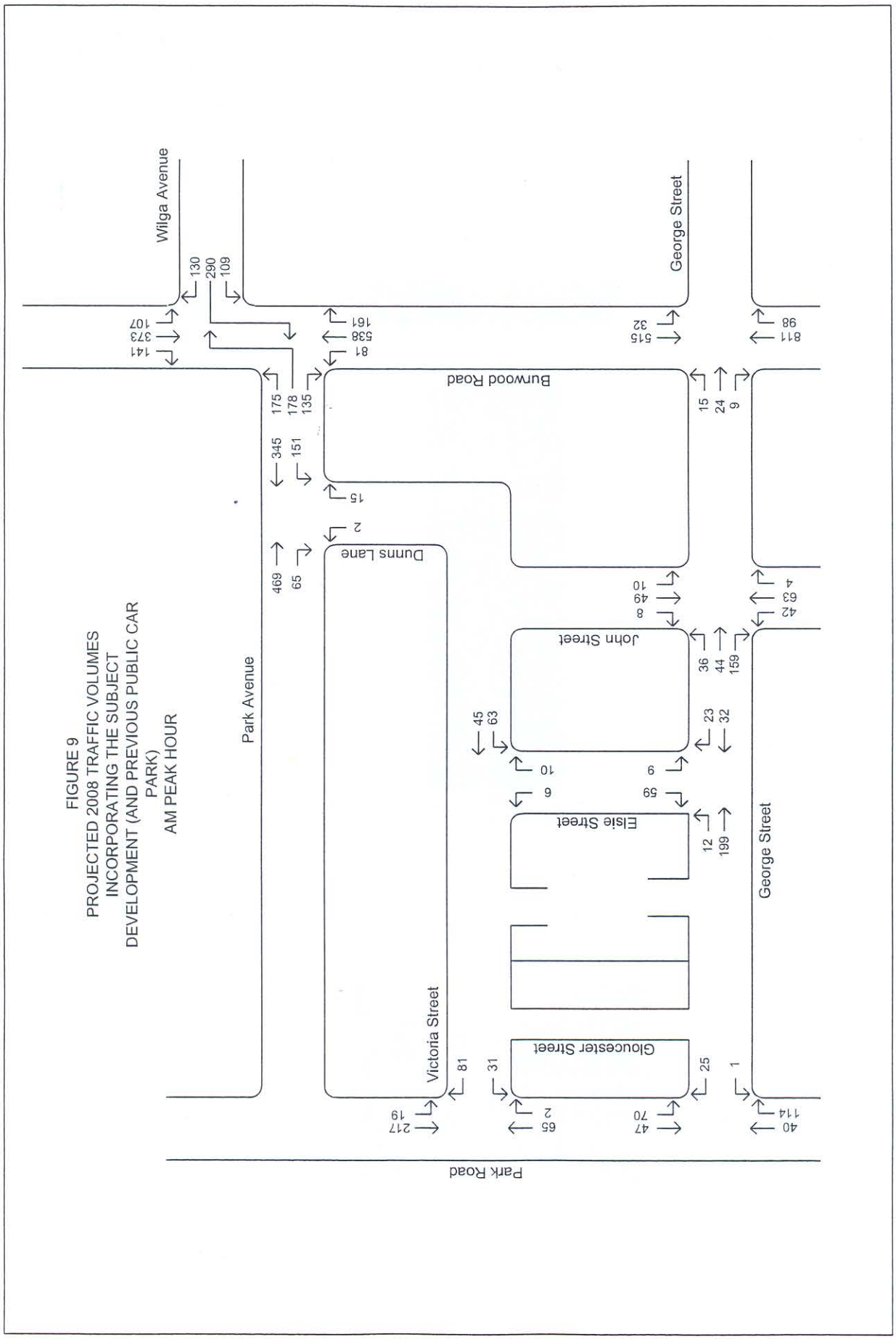

FIGURE 9
PROJECTED 2008 TRAFFIC VOLUMES
INCORPORATING THE SUBJECT
DEVELOPMENT (AND PREVIOUS PUBLIC CAR
PARK)
AM PEAK HOUR

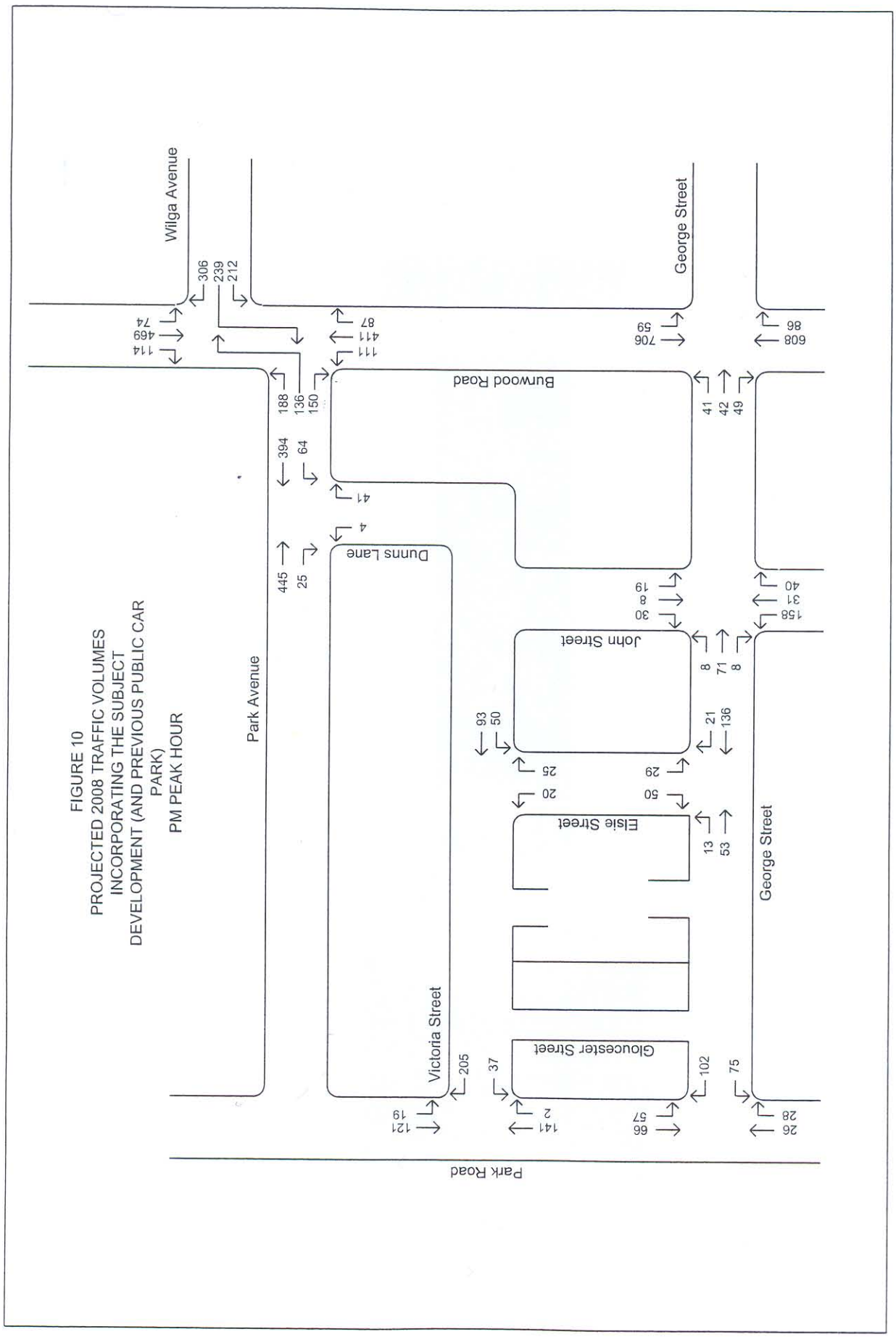

FIGURE 10
PROJECTED 2008 TRAFFIC VOLUMES
INCORPORATING THE SUBJECT
DEVELOPMENT (AND PREVIOUS PUBLIC CAR
PARK)
PM PEAK HOUR

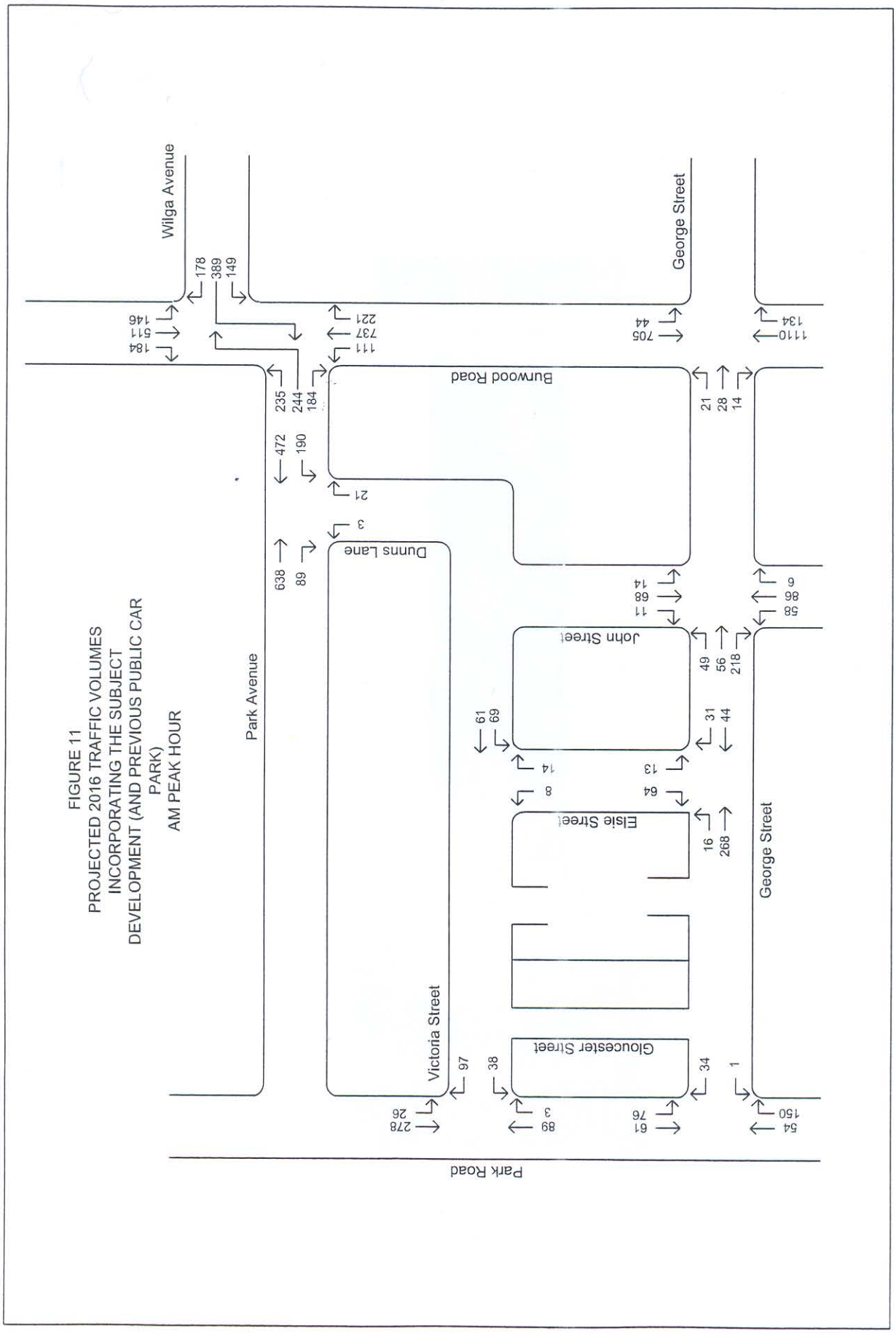

FIGURE 11
PROJECTED 2016 TRAFFIC VOLUMES
INCORPORATING THE SUBJECT
DEVELOPMENT (AND PREVIOUS PUBLIC CAR
PARK)
AM PEAK HOUR

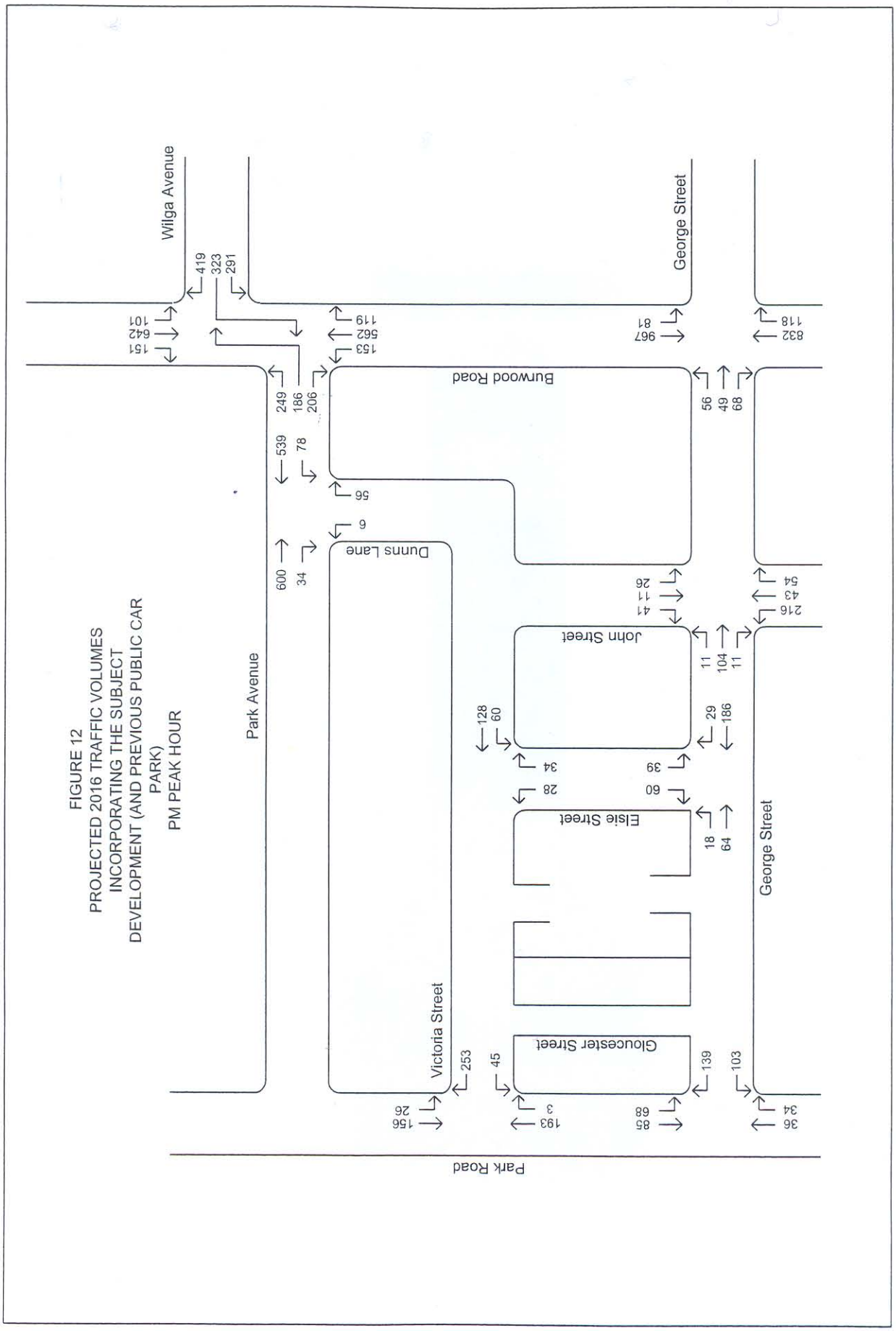

FIGURE 12
PROJECTED 2016 TRAFFIC VOLUMES
INCORPORATING THE SUBJECT
DEVELOPMENT (AND PREVIOUS PUBLIC CAR PARK)
PM PEAK HOUR

8.3 Intersection Performance

8.3.1 Intersection Modelling

Utilising the projected traffic generation characteristics of the proposed development and the abovementioned assumed trip assignment, a number of significant junctions have been modelled in order to estimate that likely impact on traffic safety and efficiency. A summary of the most pertinent results are indicated within **Table 4** whilst full details are available if required.

TABLE 4
INTANAL OUTPUT
EXISTING & PROJECTED INTERSECTION EFFICIENCY

Intersection	Without Development				With Development			
	2006 Conditions		2016 Conditions		2006 Conditions		2016 Conditions	
	AM	PM	AM	PM	AM	PM	AM	PM
Burwood Rd / Wilga St / Park Av								
Delay	32.3	25.7	245.2	168.7	39.6	27.6	285.3	193.7
Degree of Saturation	0.87	0.82	1.21	1.37	0.90	0.83	1.24	1.16
Level of Service	D	C	F	F	E	C	F	F
Burwood Rd & George St								
Delay	49.6	50.3	115.2	114.7	50.4	51.9	117.4	118.9
Degree of Saturation	0.54	0.43	0.76	0.64	0.54	0.43	0.76	0.64
Level of Service	D	D	F	F	D	D	F	F
Park Av & Dunns Ln								
Delay	10.4	10.9	13.2	14.3	10.4	11.0	13.3	14.4
Degree of Saturation	0.31	0.25	0.43	0.35	0.32	0.26	0.44	0.36
Level of Service	A	A	A	B	A	A	A	A
Park Rd & Victoria St								
Delay	7.1	7.1	7.8	7.9	7.8	7.8	8.7	8.8
Degree of Saturation	0.07	0.21	0.10	0.32	0.14	0.35	0.18	0.47
Level of Service	A	A	A	A	A	A	A	A
Park Rd and George St								
Delay	6.0	6.1	6.3	6.8	6.2	6.5	6.5	7.0
Degree of Saturation	0.09	0.14	0.13	0.21	0.11	0.15	0.15	0.21
Level of Service	A	A	A	A	A	A	A	A
George St & Elsie St								
Delay	7.1	6.2	7.8	6.4	7.4	6.4	8.2	6.7
Degree of Saturation	0.04	0.09	0.05	0.12	0.10	0.09	0.12	0.12
Level of Service	A	A	A	A	A	A	A	A
George St & John St								
Delay	7.9	6.7	9.2	7.3	8.1	6.9	9.5	7.7
Degree of Saturation	0.14	0.26	0.21	0.36	0.14	0.26	0.22	0.37
Level of Service	A	A	A	A	A	A	A	A
Victoria St & Elsie St								
Delay	5.6	6.1	5.8	6.5	5.6	6.1	5.8	6.5
Degree of Saturation	0.01	0.04	0.02	0.05	0.01	0.04	0.02	0.05
Level of Service	A	A	A	A	A	A	A	A

Table 4 indicates that the proposed development is likely to have some minor impacts on the efficiency of some intersections within the study area whilst other junctions are likely to remain significantly unaffected by the proposal and future works. All localised intersections have been modelled to operate with a level of service A or B

representing good operation with the exception of the Burwood Road intersections with George Street and Wilga Street / Park Avenue.

The Burwood Road intersection with Park Avenue and Wilga Street has been modelled to operate with level of service E and C during the post development 2008 morning and afternoon scenarios respectively. The level of service of this intersection is projected to continue to deteriorate incorporating future increases in traffic flow to the year 2016 such that it will provide unsatisfactory levels of operation.

The intersection of Burwood Road and George Street has been projected to operate with a level of service D and F during the post development 2008 and 2016 scenarios respectively.

Whilst the modeled post development levels of service for the Burwood Road junctions with Park Avenue / Wilga Street and George Street represent operation near capacity and / or unsatisfactory operation, it is noted that the roads forming these intersections form important functional roads within the surrounding road network and therefore accommodate significant volumes of the vehicles during peak periods. In this regard, it is noted that the subject Burwood Road intersections have already been modelled to operate with such levels of service without the subject development.

Comparison of the pre development and post development modelling output suggests that the subject development will have very little impact on the operation of the subject junctions. In consideration of this, any upgrade work costs would form part of any Section 94 Contribution where it is assumed that such a contribution will be equitably applied based on the extent of additional traffic generated by the subject proposal.

Traffic studies undertaken by others on behalf of Burwood Council have identified upgrade works which will assist the Burwood Road intersections accommodating future traffic demands, a discussion on which is provided within Section 8.3.2 of this report.

With respect to the greater road network, preliminary consultation with the Roads & Traffic Authority has indicated that they require comment on the likely implications of the development on existing signalised intersections somewhat removed from the subject precinct, in particular the junctions of Burwood Road with Railway Parade, Dean Street and Parramatta Road. Whilst it is noted that the modelling output results only provide projected service levels for those intersections immediately impacted by the subject development, the traffic assignment indicated in **Figures 7** and **8** indicates the above junctions of interest are anticipated to accommodate negligible increases in traffic demand as a result of the subject development such that the current traffic service is unlikely to be affected.

8.3.2 Town Centre Studies

The poor levels of service of the Burwood Road intersections within George Street and Wilga Street / Park Avenue were identified in the *Burwood Transport Study*. This study recommended that the direction of Victoria Street east of Burwood Road be reversed and that the intersection of the two roads be signalised. This was intended to

draw traffic off Wilga Road. The *Burwood Transport Study* found that this would provide short term relief to the Burwood Road / Park Avenue intersection although in the long term this would be one of the 'throttle points' ultimately restricting the use of Burwood Road as a through route.

In regard to the above, signalisation of the Victoria Street intersection is included within the Town Centre Section 94 Contributions Plan however is yet to be implemented. Ultimately, it is expected that the system of three north-south roads through Burwood, being Shaftsbury Road, Burwood Road and Wentworth Avenue will establish an equilibrium such that north-south route delays would stabilise and the non-essential traffic would choose an alternative route.

Further to the above, the Council commissioned *Proposed Town Centre Development: Assessment of Road Network and Traffic Implications* report undertook a further assessment of the Burwood town centre road network with a view to developing a road improvements program which would be capable of accommodating future redevelopment in accordance with Council's *Vision Document.*

The Transport and Traffic Planning Associates report concluded that the surrounding road network would be capable of accommodating future redevelopment (incorporating the subject site) up to and including 2016 traffic demands incorporating a rationalisation of traffic movement with a system of 'one way' and 'no right turn' restrictions. The principal changes incorporated in the recommended road improvements program which directly relate to the subject development application and its immediate precinct are as follows:

- The 'opening up / widening' of Victoria Street and George Street to provide a one-way pair crossing Burwood Road;

- The widening of Shaftsbury Road; and

- The prohibition of right-turn movements along Burwood Road.

The Transport and Traffic Planning Associates report summarised the following findings of the traffic modelling (NETANAL and SCATES) process for the town centre:

- The 2016 base case outcome is just satisfactory with all intersection levels of service reaching 'C' and 'D';

- The 2016 case incorporating the projected town centre redevelopment (incorporating the subject site) with the recommended road / traffic arrangements are satisfactory with levels of service 'A' to 'D'.

In regard to the precinct immediately surrounding the subject development, recommendations contained within the same report were as follows:

- The extension of Victoria Street to the east to provide a signalised four way intersection with Burwood Road (with Victoria Street providing an eastbound only traffic function from Elsie Street to Burwood Road); and

- The widening of Victoria Street between Elsie Street and Gloucester Avenue to accommodate a two-way traffic function.

Whilst it is noted that the improvements incorporated within the recommended road network works program will assist in the accommodation of the additional traffic projected to be generated by the subject development, it must be noted that the development is not dependent upon such alteration within the short term.

9. PUBLIC TRANSPORT AND NON CAR TRAVEL

9.1 Modal Split

In order to undertake an assessment of the public transport and non car travel generation of the proposal, a number of assumptions have been made as follows, being primarily based on previously presented Census data:

- The site will accommodate approximately 428 residents (based on one person per bedroom);

- The site will accommodate 426 employees at any one time (based on one employee per 17m^2 commercial floor area, a 70% weekday shift and a 90% attendance rate);

- Of the 428 residents, the following provides a summary of their travel modes (other than private vehicle):

    - 1% or approximately 4 people will travel to and from the site via bus;

    - 57% or approximately 243 people will travel to and from the site via train; and

    - 6% or approximately 26 people will travel to and from the site via other means (walk, taxi, bicycle etc).

- Of the 426 employees accommodated on-site, the following provides a summary of their travel modes (other than private vehicle):

    - 3% or approximately 13 people will travel to and from the site via bus;

    - 21% or approximately 89 people will travel to and from the site via train; and

    - 18% or approximately 77 people will travel to and from the site via other means (walk, taxi, bicycle etc).

9.2 Train Trips

The critical capacity constraints of the train system are eastbound in the morning and westbound in the evening. In transport planning terms, a major mixed use development in Burwood would provide an ‘intervening opportunity’ intercepting some employees and residents that would otherwise have travelled from the west, through Burwood to the CBD, North Sydney or other employment locations to the east. Thus not all rail trips would be new to the system. When this is taken into account, the nett addition onto the rail system during peak periods in the peak flow directions is likely to be reduced.

Notwithstanding this, it is understood that Railcorp has committed to upgrading Burwood railway station in order to provide greater capacity to accommodate existing and forecast patronage.

9.3 Bus Trips

The *Proposed Town Centre Development: Assessment of Road Network Traffic Implications* report provides a work scheme which also incorporates the provision of a bus interchange in conjunction with the railway station upgrade. This would improve the ability of the existing services to accommodate future increases in demand associated with the subject development as well as other future redevelopments.

9.4 Walk Trips

With respect to walk trips, pedestrian connectivity to the and from the site is proposed to be enhanced by the provision of three marked pedestrian crossings at each end and approximately central to the site frontage of Elsie Street (Council has commented that only one crossing would be supported). The central pedestrian crossing provides direct connectivity to an existing east-west pathway which connects to John Street. The *Vision Document* also provides for this east-west connection to be extended through to the main town centre pedestrian focal point, Burwood Road.

The *Vision Document* also refers to a Pedestrian Access and Mobility Plan which has been prepared on behalf of Council for the Burwood town centre. This plan recommends a number of improvements to assist pedestrian safety including additional pedestrian crossings, refuges and fences. The cost of these improvements is planned to be met by Section 94 Contributions.

10. CONCLUSION

This Practice has undertaken an assessment of the potential traffic related impacts resulting from a proposed mixed commercial / residential development located on land fronting Elsie Street, Burwood. Based on this assessment, the following conclusions are now made:

- The proposed internal circulation, servicing and parking arrangements provide for satisfactory manoeuvring throughout the subject site in accordance with the relevant requirements of AS 2890.1-2004 and AS 2890.2-2002;

- Access to the proposed development is satisfactory in terms of safety and efficiency and having regard to the location of the proposed driveway arrangements and the existing / projected traffic conditions within George and Victoria Streets;

- The surrounding road network operates with a good level of service during peak periods, with then exception of the Burwood Road intersections with Park Avenue, Wilga Street and George Street;

- The junction of Burwood Road / Park Avenue / Wilga Street currently operates close to capacity during peak times with vehicle delays not uncommon;

- Traffic studies of the town centre on behalf of Council have indicated that the operation of the Burwood Road intersections with Park Avenue and Wilga Street can be improved by providing additional signalised cross junctions with Burwood Road within the town centre. Such road network alterations have been incorporated with Council's Section 94 Contributions Plan;

- The intersection of Burwood Road and George Street has been modelled to operate with a level of service D and F during the 2008 and 2016 traffic volume scenarios respectively. These levels of service represent operation near capacity and unsatisfactory operation for the existing and projected 2016 traffic volumes scenarios respectively;

- Traffic studies of the town centre on behalf of Council have identified that the intersection of Burwood Road and George Street should be converted traffic signal control thereby providing an additional Burwood Road crossing facility as discussed above. Such road network alterations have been incorporated with Council's Section 94 Contributions Plan;

- Considering that the subject Burwood Road intersections currently accommodate operation near capacity, any costs associated with the undertaking of any upgrade works should not be borne (partially or fully) by the applicant outside of normal Section 94 Contributions;

- The proposed development has been projected to generate in the order of 176 additional peak hour trips (over and above that previously generated by the public car park) to and from the site; and

- The surrounding road network is considered to be capable of accommodating the additional traffic projected to be generated by the development incorporating the outstanding road upgrades proposed as part of Council's Section 94 Contributions Plan and / or recently recommended road upgrades by Council commissioned town centre studies.

Based on contents of this report and the above conclusions, it is our view that there are no traffic related issues associated with the proposed development which would prevent this Practice from recommending the proposal for approval.