

Parking Demand Associated with Integrated Healthcare Services

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Traffic Design Group Limited has been involved in a number of projects in the Auckland region providing traffic engineering advice with regard to a number of healthcare facilities. When surveyed, healthcare facilities were found to exhibit varying levels of parking demands, which was particularly different from what the relevant District Plan required the healthcare services to provide. It was found that simply applying the District Plan requirement does not accurately assess the actual parking demand and an alternative method of parking prediction should be investigated.

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1. Introduction

Traffic Design Group Limited has been involved in providing traffic engineering advice on a number of private and public healthcare facility developments. These projects have included new developments as well as major redevelopments of existing facilities and have also ranged from private hospitals to large public hospitals. Part of this involvement has been a need to undertake an analysis of the parking demand of each specific site.

For the majority of projects in New Zealand parking is provided for a development, whether a new development or a redevelopment of existing facilities, at a rate based on District Plan requirements. For various reasons (which are discussed later) these District Plan rates have been deemed to not always give an accurate representation of the parking demand generated by various hospitals in Auckland. Accordingly surveys of actual parking demand for these hospitals have been carried out.

This paper outlines the result of the parking surveys undertaken at three public hospitals and one private integrated hospital in the greater Auckland area. It provides a comparison with these actual measured survey results and the theoretical requirements of the relevant District Plans, as well as a comparison of other recognised parking demand publications.

This paper also describes alternative methods to determine realistic parking demands of various healthcare facilities rather than strictly applying the District Plan rate. As such the paper is designed to be an aid to consultants, Councils and healthcare specialists to better gauge the parking requirements associated with future healthcare facilities.

2. Parking Surveys

2.1 Survey Methodology

Generally parking surveys involve a count of all vehicles throughout a day. Parked vehicles were counted at the beginning and end of the survey period together with a count of vehicle arrivals and departures through all access points to the healthcare facility. As a check, vehicles parked in the site were counted at regular intervals (such as every half an hour) throughout the day. The data was subsequently tabulated and analysed using Microsoft Excel spreadsheet package to produce daily parking profiles of each site, and peak parking demand.

2.2 Survey Locations

Figure 1 shows the location of the hospital facilities that have been surveyed. A summary of each facility is as follows:

North Shore Hospital

This facility is a public hospital within the North Shore City district. At the time of surveying, the hospital comprised of 386 ward beds and 1,322 staff. The hospital provides a variety of services such as Accident and Emergency, clinic facilities, day stay and long term mentally ill, but generally have patients that stay longer than a day. The site was surveyed in February 2000.

Waitakere Hospital

This facility is a public hospital within the Waitakere City area. At the time of surveying, the hospital comprised of 250 ward beds and 826 staff. The hospital provides similar facilities to the North Shore Hospital. The site was surveyed in April 2000.

Auckland Hospital

This facility is a public hospital within the Auckland City area. At the time of surveying, the hospital consisted of 811 ward beds and 25 theatres, and a total of 117,078 m² of gross floor area.⁽¹⁾ The site was surveyed in November 1997.

Ascot Healthcare Facility

This facility is a private hospital integrated with healthcare facilities. The facility is located in Greenlane within the Auckland City area. At the time of surveying, the hospital comprised 108 available beds and 12 theatres. Further, 3,775 m² was assessed as Hospital area and 2,690 m² of area assessed as healthcare. This healthcare area was predominantly clinic-related facilities. This facility generally deals with short-term stay patients. The site was surveyed in September 1999.



Figure 1 : Survey Locations

3. Survey Results

Figure 2 shows four graphs of the observed parking demand of the four surveyed hospital facilities.

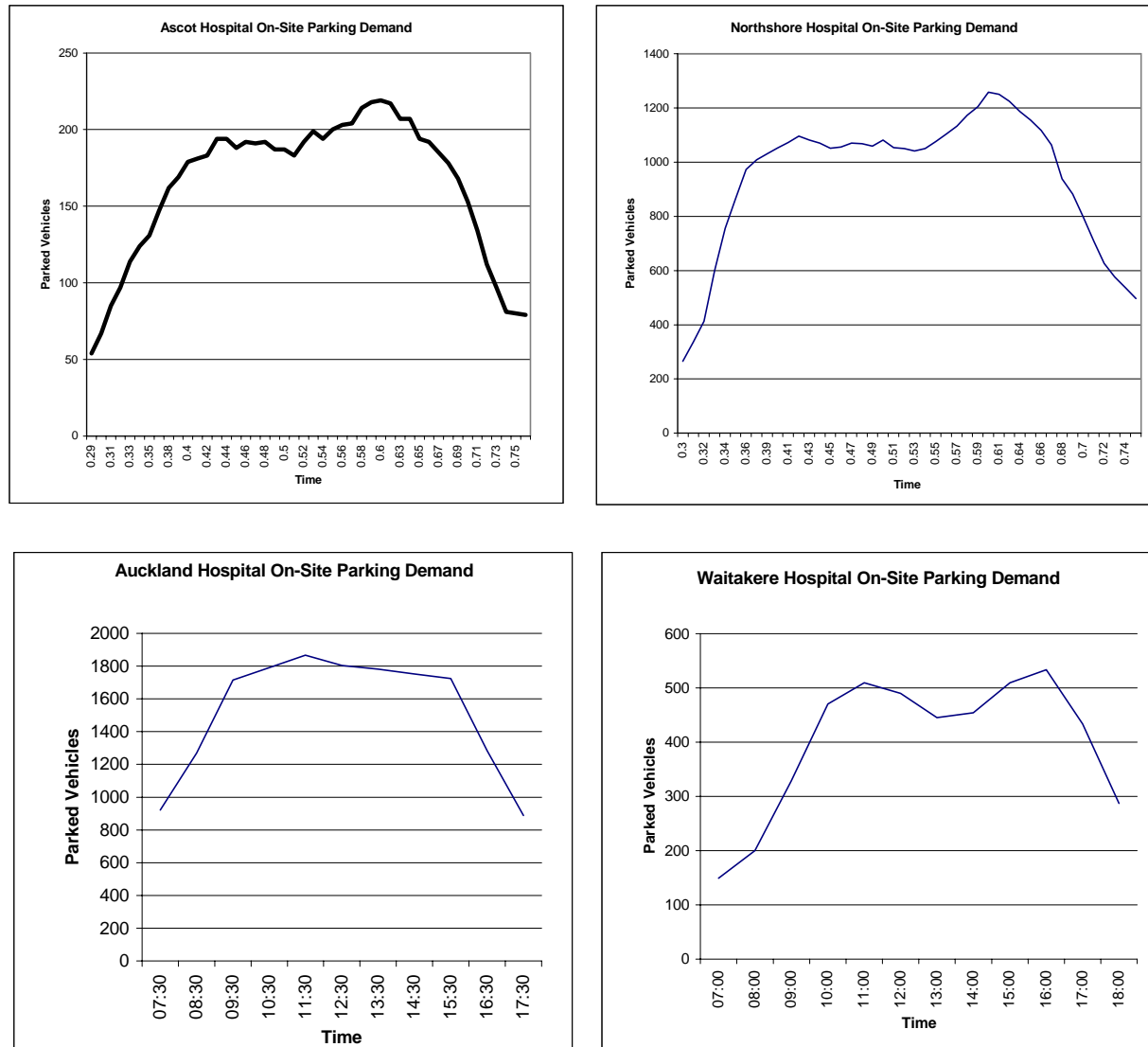


Figure 2 : Survey Results

The graphs generally show an increase in parking demand in the hospital facilities to around 10:00 – 11:00 am where the demand steadies and remains stable until mid afternoon (around 2:00 pm) where the demand peaks further again. From around 3:00 pm the parking demand drops off at all the healthcare facilities. The two peaks of mid morning and mid afternoon generally follow staff shifts and / or visitor peak periods of the facility. A summary of the peak parking demand together with the actual available amount of parking on each site is shown in Table 1 below.

Hospital Facility	Measured Peak Parking Demand (Time of Day)	Actual Available Parking Spaces	% Full
North Shore Hospital	1,258 (2:15 pm)	1,221	103%
Waitakere Hospital	533 (3:30 pm)	588	91%
Auckland Hospital	1,866 (11:00 am) ⁽¹⁾	1,710 ⁽¹⁾	109%
Ascot Healthcare	219 (2:15 pm)	382	57%

Table 1 : Observed Peak Parking Demand

The results of the parking survey show that the peak surveyed parking demand associated with the public hospitals is generally near or in excess of the actual parking spaces provided. In contrast, the private Ascot hospital peak parking demand was measured to be significantly below the actual amount of on-site parking provided.

The two sites where the parking demand exceeds the supply support on-site observations of vehicles parking on grassed areas not dedicated for parking, or a number of vehicles circulating around the parking areas searching for vacant spaces.

4. District Plan Parking Requirements

The District Plan parking requirements for a hospital / healthcare facilities vary depending on which District Plan is applicable to the area. The three relevant District Plans and the associated parking requirements for Hospital activities are as follows:

- *North Shore City District Plan* ⁽²⁾
Hospitals : one parking space for every three patient bed spaces, plus one for every two employees.
- *Waitakere City District Plan* ⁽³⁾
Hospitals : one parking space per four beds, plus two per every three day staff.
- *Auckland City District Plan* ⁽⁴⁾
Hospitals : one parking space for every three licensed hospital beds in ward areas, plus five for every operating theatre, plus one for every 25 m² GFA of all areas not assessed as ward areas or operating areas.
Healthcare : one parking space for every 20 m² GFA

Applied to the four surveyed hospital locations reveals the following requirements:

Facility	District Plan	Rate	Healthcare Size	Parking Spaces Required
North Shore Hospital	North Shore	1/ 3 beds + 1/ 2 employees	386 beds + 1,322 staff	790
Waitakere Hospital	Waitakere	1/ 4 beds + 2/ 3 employees	250 beds + 826 staff	613
Auckland Hospital	Auckland	1/ 3 beds + 5/ theatre + 1/ 25 m ² of other areas	811 beds + 25 theatres and 43,879 m ² other GFA ⁽¹⁾	2,074
Ascot Hospital	Auckland	1/ 3 beds + 5/ theatre + 1/ 25 m ² of other areas + 1/ 20 m ² of healthcare facilities	108 beds + 12 theatres + 3,775 m ² other hospital and 2,690 m ² healthcare	382

Table 2 : District Plan Requirements

Also of interest are parking rates of both the Roads and Traffic Authority (RTA) of New South Wales⁽⁵⁾ and the Institute of Transportation Engineers (ITE)⁽⁶⁾ guides. These rates are as follows:

- *RTA*
Peak Parking Accumulation = $-26.52 + (1.18 \times \text{beds})$
- *ITE*
Peak Parking Accumulation = $1.79 \times \text{beds}$

Using the above rates of the RTA and ITE guides yields the following parking requirements:

Facility	RTA (spaces required)	ITE (spaces required)
North Shore Hospital	429	690
Waitakere Hospital	268	448
Auckland Hospital	930	1452
Ascot Hospital	101	193

Table 3 : RTA & ITE Requirements

Significantly the RTA and ITE guides generally require a lesser number of required parking spaces than any of the District Plan requirements.

5. Summary of Results

The following table summarises the results of the parking surveys contained in Section 3 compared to the requirements of the relevant District Plan contained in Section 4.

Facility	Surveyed Peak	District Plan Requirement	Survey as % of Requirement
North Shore Hospital	1,258	790	159%
Waitakere Hospital	533	613	87%
Auckland Hospital	1,866	2,074	90%
Ascot Hospital	219	382	57%

Table 4 : Comparison between Survey and Required Parking

A comparison of the actual surveyed results verses the District Plan requirements as contained in Table 4 suggests that the District Plan requirements do not accurately assess the actual demands of healthcare facilities.

The surveyed parking demands ranged between 57% and 159% of the actual District Plan requirements. As such the District Plan's requirements can either underestimate or overestimate the parking demands by over 50% in each case. The requirements as given in the RTA and ITE guides are summarised below against the surveyed peak parking demand.

Facility	Surveyed Peak	RTA	ITE
North Shore Hospital	1,258	429	690
Waitakere Hospital	533	268	448
Auckland Hospital	1,866	930	1,452
Ascot Hospital	219	101	193

Table 5 : Comparison between survey and ITE / RTA guides

The above table shows both the RTA and ITE guide greatly underestimate the actual parking demands for the public hospitals however the private Ascot healthcare facility is more accurately predicted by the ITE guide in particular.

The following Figure 3 shows the actual peak parking demand versus the relevant District Plan requirements together with a regression of the data around the graph of $y = x$. It would be expected that if the District Plan rates were accurately predicting actual parking demand then the majority of healthcare sites surveyed would lie on the line of $y = x$, or slightly above this line to allow for a buffer between required and actual parking spaces.

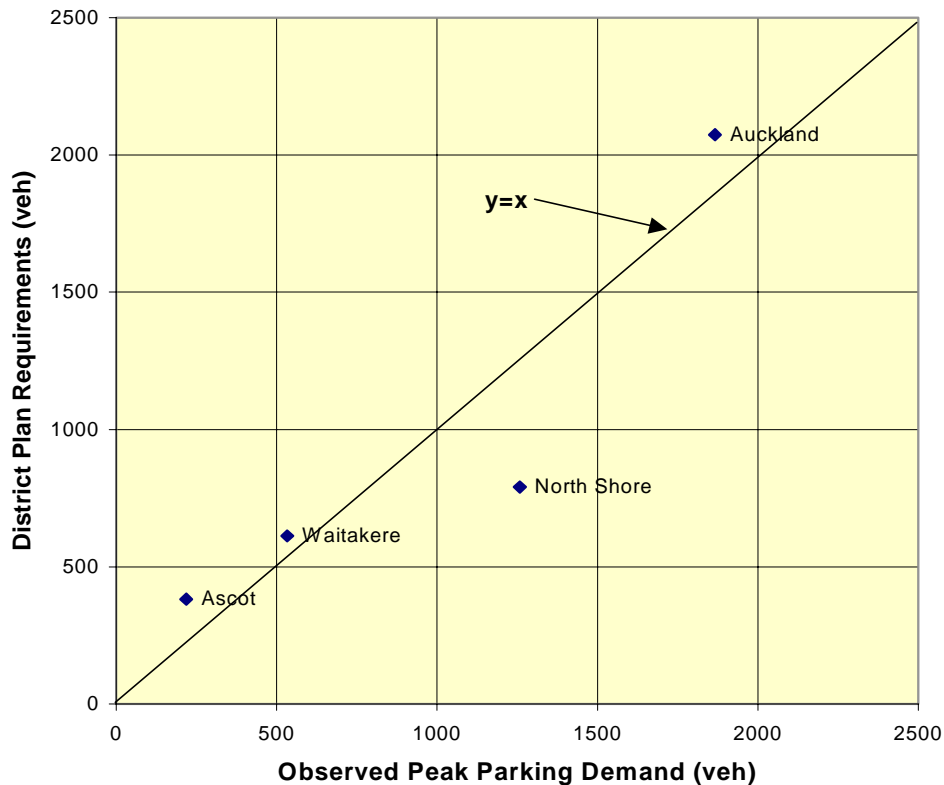


Figure 3 : Measured vs District Plan Requirements

The Coefficient of Determination (R^2) obtained for the set of data is calculated to be 0.82 for the $y = x$. This shows that the District Plan is reasonable in predicting peak parking demand, however the graph shows some alarming flaws in the District Plan prediction particularly on the survey furthest away from $y = x$ (North Shore Hospital) where it shows the District Plan to greatly underestimate the actual parking demand.

6. Discussion

From the above survey results it can be established that the District Plan parking rates, ITE and RTA rates for hospital can both greatly underestimate and overestimate actual parking rates.

The reason for these differences lies in that each hospital facility tends to be greatly different in its operation than another. As such, hospitals tend to have differing levels of staff in similar floor areas, differing sizes of operating theatres, differing levels of Accident and Emergency facilities and differing levels of integration between hospital services and clinic type services. For instance, the Ascot Hospital is believed to generate a lower parking demand than a public hospital due to the integration between the Hospital facilities and Healthcare facility within one single building. As such one single building can provide for General Practitioners (GP), specialist care and pharmacy activities as well as providing for a hospital, thus eliminating multiple visits to various healthcare professionals. This, it appears

from our observations, has a significant effect on reducing parking demand for patients and visitors.

It is therefore suggested that a more prudent approach in predicting what the parking demand of a hospital should be is to use a parking model of the existing healthcare facility rather than simply relying on the District Plan requirements, or RTA / ITE publications. It is considered that the use of a parking model which more accurately predicts actual parking demand is particularly important in hospitals, more so than other developments due to:

- (i) hospitals tend to have a number of patients and visitors who are highly stressed when they arrive at the hospital and hence searching for vacant parking spaces can only heighten stress levels; and
- (ii) hospitals, and especially public hospitals, tend to have very limited budgets and as such an oversupply of carparking is an expense that could be avoided by an accurate parking model.

7. Parking Models

To more accurately predict the future parking demand of any healthcare facility, parking models have been set up for existing healthcare facilities. These models generally divide the parking into, various groups because each group has different parking demand both in terms of quantity and when the demand occurs over a day. The groups that are suggested to be used are:

- staff;
- in-patients (clinic patients);
- out-patients;
- delivery vehicles;
- emergency vehicles; and
- visitors.

To divide the existing parking demand into groups such as above, an interview survey is usually required as part of the parking survey to ascertain the group to which the vehicle belongs.

A plot of the existing parking demand of each healthcare group can be made showing parking demand throughout the survey day. From indicators such as floor area increases, projected revenue increases and future building changes, estimates can be made in each group above to the percentage increase from existing levels in each group. These percentage increases need to be extensively discussed with the operators of the healthcare facility to ensure accuracy.

An example of an existing plot of parking demand for each group within the North Shore Hospital is shown in Figure 4 below. Figure 5 further shows the predicted parking demand of the facility using the Parking model methodology described above.

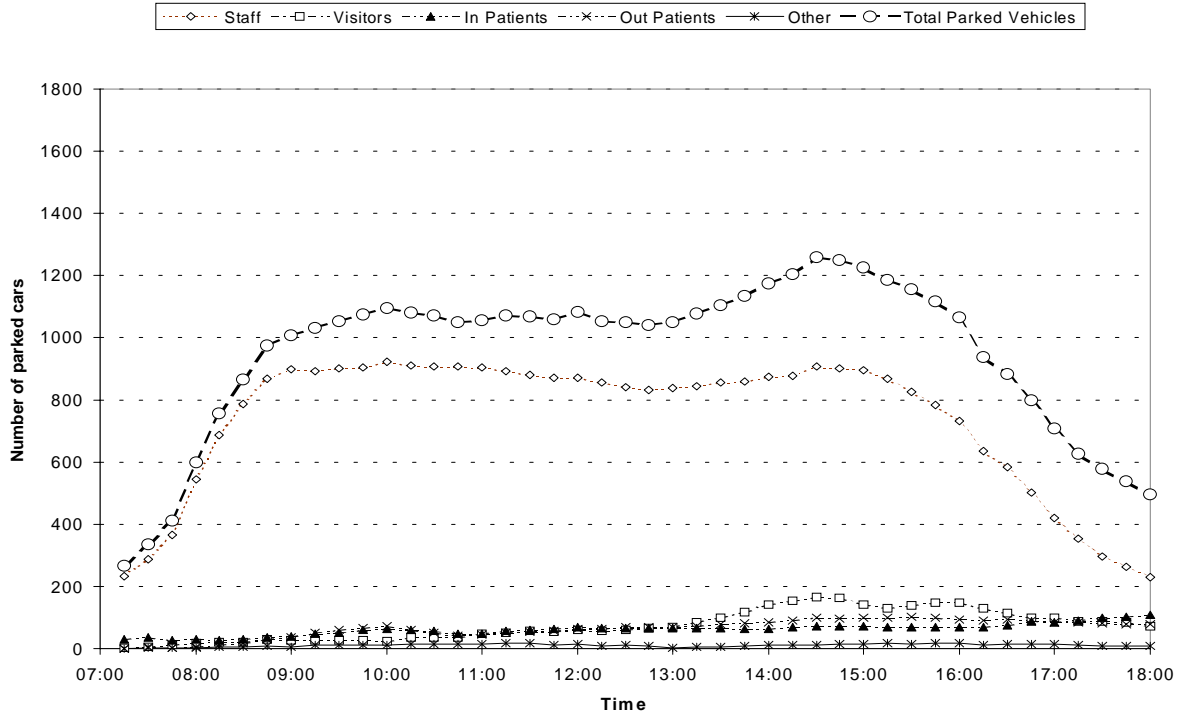


Figure 4 : North Shore Hospital – Existing Parking Demand

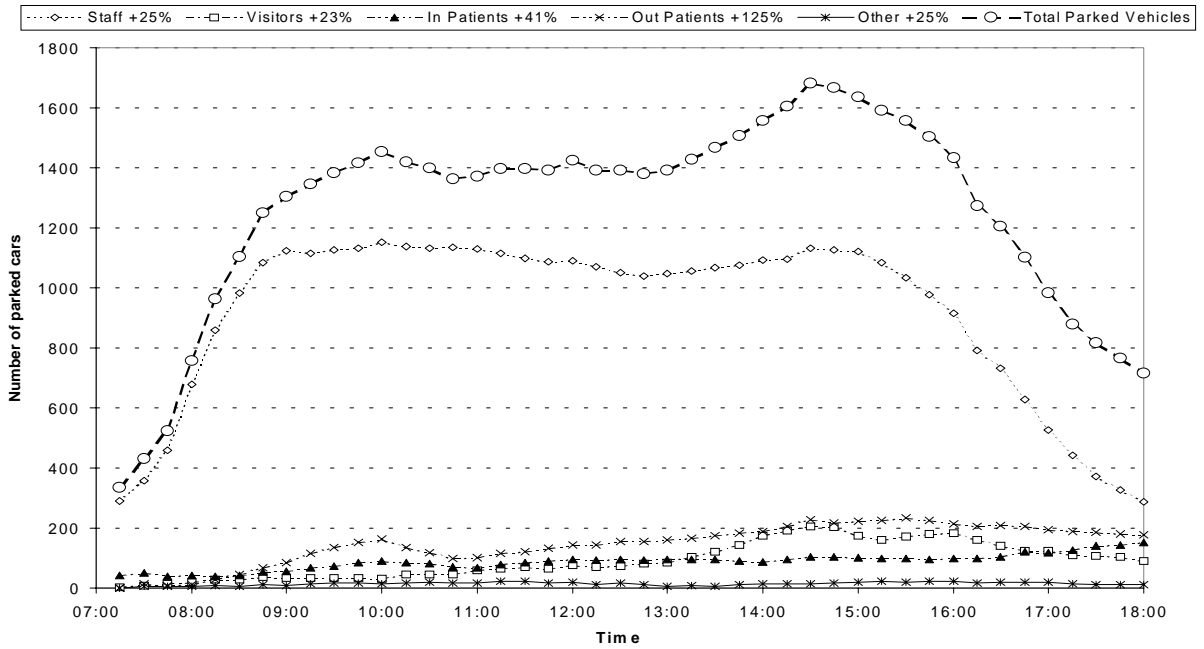


Figure 5 : North Shore Hospital – Predicted Future Parking Demand

8. Conclusions

As discussed in this paper the District Plan parking rates for hospital activities may not give a true indication as to the actual parking demand generated by the activities. These hospitals tend to be site specific and parking demand depends on many variables such as staff, patients, visitors and the amount of integration between healthcare services and hospital services. Many of these various factors are not accounted for in the District Plans. As such it is important not to only rely on the District Plan criteria when assessing the parking requirements of a Hospital.

We suggest that a more accurate method of predicting the parking requirements of an updated healthcare facility is to firstly measure the existing facility in terms of parking requirements particularly measuring the parking requirements of different groups within the facility as a base to predict parking demand growth. This method should however be used in conjunction with the District Plan requirements rather than a complete replacement of these requirements.

8. Acknowledgements

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9. References

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