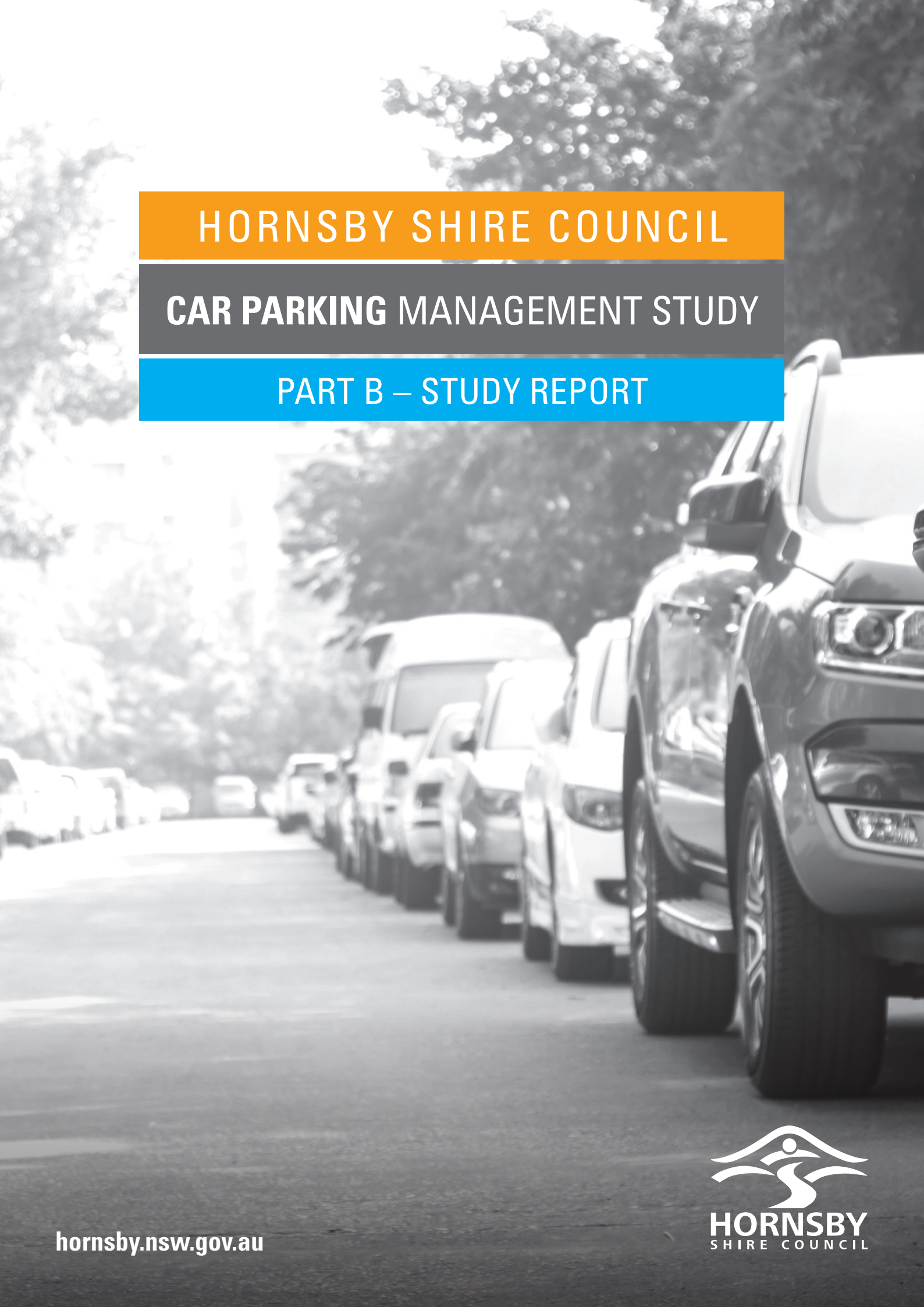


HORNSBY SHIRE COUNCIL

CAR PARKING MANAGEMENT STUDY

PART B – STUDY REPORT

hornsby.nsw.gov.au

HORNSBY SHIRE COUNCIL

VERSION CONTROL

REPORT VERSION NO.	DATE	RELEASED TO CLIENT BY	NATURE OF REVISION
1	22/03/20	Michael Moses	Draft 1 Report
2	22/03/20	Michael Moses	Draft 2 Report
3	11/06/20	Michael Moses	Draft 2 Report
4	18/06/20	Julie Ryland / Bernard Choongo	Draft 3 Report
5	10/08/2020	Michael Moses	Final Report

STRUCTURE OF THE STUDY REPORT

The Study was undertaken in two stages and due to the large number of precincts examined as well as the extent of the data and information gathered during the study, the Report has been divided into four separate volumes as follows:

1. **Executive Summary**

2. **Part A – Summary of Key Findings and Recommendations**
   Summary of Shire Key Findings and Recommendations
   Summary of Precinct Key Findings and Recommendations
   Precinct Heat Maps
   Precinct Parking Hierarchy Tables

3. **Part B – Study Report**
   Background
   Parking Management Options
   Recommendations
   Appendices

4. **Part C – SWOT Analyses**
   Summary of Shire Wide Results
   Stage 1 Precinct SWOT Analyses
   Stage 2 Precinct SWOT Analyses

5. **Part D – Utilisation Surveys**
   Summary of Key Precinct Data
   Stage 1 Precinct Utilisation Surveys
   Stage 2 Precinct Utilisation Surveys

ARRB – YOUR NATIONAL TRANSPORT RESEARCH ORGANISATION
ABN 68 004 620 651
With offices in Brisbane, Sydney, Adelaide, Perth.
National Transport Research Centre and Head Office: 80a Turner St, Port Melbourne, 3207 VIC, Australia
arrb.com.au

CONTENTS

TABLES

FIGURES

GLOSSARY OF TERMS

1/2P, 1P etc.	Half an Hour Parking, 1 Hour Parking etc
ARRB	Australian Road Research Board
Accessible/disabled parking	Parking for people with a disability
ALS	Average Length of Stay.
ANPR	Automatic Number Plate Recognition.
At-grade parking	Surface parking at ground level
CCTV	Closed Circuit Television
Churn	Describes how many cars use a bay in a day
Commuter parking	More than six hours
Council	Hornsby Shire Council
DSS	Data Security Standard
EMV	Europay, MasterCard and Visa
GLA	Gross Leased Area
Loading/unloading	People or goods e.g. bus stops, taxi ranks and commercial vehicles
Long-term parking	More than four hours
LPR	Licence Plate Recognition
Mode share	Refers to the percentage mode of transport used to travel e.g. private car, bus, bicycle, walking
Motorcycle parking	Both restricted and unrestricted
NFC	Near Field Communication
Off-street parking	Council parking that is not on-street
On-street parking	Kerbside public parking bays which may or may not be line-marked including parallel, angle and 90-degree parking
On-street restricted parking	Local government control by establishing time, permit regimes or specifically allotting bays for a specific use (e.g. loading, car share)
On-street unrestricted parking	No time or other restrictions
P	Parking
P 5 minutes, P 10 minutes etc.	5 Minutes Parking, 10 Minutes Parking etc
PCMP	Parking Control and Management Plan
PCI	Payment Card Industry
PCS	Parking Control Systems
PGS	Parking Guidance Systems
PND	Pay and Display
PBS	Pay By Space
PBP	Pay By Plate
PODs	Parking Occupancy Detection Systems
PPS	Parking Payment Systems
QR Code	Quick Response Code
Reciprocal parking	Parking facilities serving separate uses or a mixed-use development, but not shared concurrently between the users and not necessarily on one site
Shared parking	Parking facilities on one site shared concurrently by a mixed-use development or separate developments
Short-term parking	Less than four hours
Special events	Major events imposing extreme demands on parking supply, the road network and the public transport system
SWOT	An analysis of Strengths, Weaknesses, Opportunities and Threats
Taxi parking	Drop off/pickup and layover including Uber type services
TDM	Travel Demand Management
VMS	Variable Message Signage

1 BACKGROUND

1.1 INTRODUCTION

In July 2018, The Australian Road Research Board (ARRB) was appointed by Council to undertake a review of current car parking management practices in the Hornsby Shire and develop the Hornsby Shire Car Parking Management Study (HSCPMS).

The development of an overall parking management study for Hornsby Shire was detailed in a working paper as part of the Hornsby Integrated Land Use and Transport Study (ILUTS).

The main aim of the parking management study for the Shire is to balance the supply of and demand for parking spaces with the objective of minimising additional traffic generation through restraining car use, while ensuring that economic viability of each centre is maintained.

1.2 OBJECTIVES OF THE PARKING MANAGEMENT REVIEW

ARRB recognises that parking issues cannot be dealt with in isolation from the broader issues of car use and transport, and that parking is an essential element of the overall transportation system and not a stand-alone service. The Hornsby Shire Council Local Government Area's (the Shire) transport system needs to reflect convenience and ease of traffic circulation, enhanced pedestrian mobility, slower speeds, more emphasis on multimodal connectivity and more convenient parking. This can be achieved by implementing a suite of demand management measures.

Travel Demand Management (TDM) is a technique which emphasises the movement of people and goods, rather than motor vehicles, and gives priority to more efficient travel and communication modes (such as walking, cycling, car sharing and public transport). It permits more efficient use of existing parking and transport infrastructure as an alternative to expanding roads and parking facilities.

Parking issues can generally be categorised in terms of supply or management. Supply issues deal with too few spaces being available and the expectation that a public or private organisation must provide more spaces. Management issues relate to available facilities not being used effectively and the inefficient use of current parking capacity.

Several parking options and initiatives are appropriate for commercial and high activity centres to use to contribute to sustainable goals. These include regulating the supply of public parking to support parking and transportation objectives including:

- Regulating users and limiting the types of vehicles that may use certain parking spaces.
- Favouring higher value uses – such as for service vehicles, deliveries, customers and access for people with disabilities.
- Encouraging remote parking by offering benefits to employees to encourage them to use alternatives to a car.
- Pedestrian improvements.
- Reducing free parking spaces to push long-stay car parking to more remote locations.

The Hornsby Shire Council Parking Management Study (HSCPMS) has been undertaken considering the above factors and it enables Council to better prepare for, plan for, and manage parking issues by rationalising the management of parking. The study recognises, whilst planning must accommodate the reasonable need for car access to the precinct, other transport modes such as walking, cycling, public transport and multi-occupant cars must play an increasingly significant role. The role of parking supply requires policy to develop a balanced and equitable distribution of parking facilities to support competitive business and a varied community.

The HSCPMS has several objectives for Council, it:

- Provides policy direction and recommendations for Council over a 10-year horizon.
- Allows improved management of parking in and around activity centres.
- Enables parking to be used more effectively to encourage sustainable transport options.
- Identifies actions required in the short, medium and long term.

The HSCPMS will enable Council to better prepare for, plan for, and manage parking issues by rationalising the management of parking.

1.3 STUDY AREAS

The Council identified study areas were divided into two stages with 4 precincts in Stage One and 13 precincts in Stage Two. These are listed below.

The Stage One precincts:

- Hornsby Town Centre
- Waitara Town Centre
- Hornsby Hospital Precinct
- Berowra Town Centre

The Stage Two precincts:

- Brooklyn Activity Centre
- Asquith Town Centre
- Beecroft Town Centre
- Cheltenham Town Centre
- Pennant Hills Town Centre
- Normanhurst Town Centre
- Thornleigh Town Centre
- Cherrybrook Metro Precinct
- Cherrybrook Town Centre
- Fagan Park
- Galston Village Precinct
- Salisbury Road and Leighton Place Industrial Precinct
- Berowra Waters Activity Centre

1.4 METHODOLOGY/STUDY PROCESS

1.4.1 INCEPTION

An inception meeting was convened between ARRB and Council on 25 July 2018, to; confirm an understanding of the brief and gain an appreciation all of the issues relating to the project; identify key stakeholders and project team members; confirm communication protocols, the objectives, outcomes and deliverables and milestones; agree on the dates for the project milestones; obtain existing data and background information held by Council.

ARRB was advised that three precincts as listed above were to be the focus of Stage One of the study and the key strategies and recommended actions derived from the study were to be used as a framework for managing parking in other Town Centres located within the Hornsby Local Government Area (LGA). Berowra was added to Stage One by Council in March 2019.

1.4.2 PRECINCT VISITS AND INSPECTIONS

ARRB undertook site precinct visits on 31 July 2018, with Council's Traffic Ranger Coordinator in attendance. Video evidence was captured as well as audio from Council staff highlighting major issues during the drive through the Shire.

An additional drive through of each precinct was undertaken on 20 August 2018, during the evening to capture evidence which identified pedestrian safety and security issues arising from the current levels of on-street and off-street lighting.

1.4.3 REVIEW OF BACKGROUND INFORMATION

ARRB reviewed the following data and documentation provided by Council:

- Hornsby Shire Council Parking Management Review Hornsby Town Centre, Waitara and Hornsby Hospital Area, prepared by GHD for Hornsby Shire Council, December 2010.
- D01579114 REPORT Hornsby Town Centre Parking Management Review, prepared by Hornsby Shire Council, 20 April 2011.
- Hornsby Station Interview Surveys, prepared by Austraffic for AECOM, 4 March 2010.
- Hornsby Shire Town Centre Parking Surveys, prepared by R.O.A.R. Data for GHD, 27 May 2010.
- Hornsby Integrated Land Use and Transport Strategy, prepared by PBA International for Hornsby Shire Council, November 2004.
- Implementation of Restricted Parking in Hornsby, Hornsby Hospital Precinct and Waitara over the Past Three Years.

1.4.4 EXISTING PARKING DEMAND AND UTILISATION

Trans Traffic Surveys was contracted by Council to undertake the data collection. Using a combination of ANPR and video cameras, surveys were conducted of Council's on-street and off-street parking inventory. The surveys were conducted on Thursday 2 August and Saturday 4 August 2018 between 8.00am and 6.00pm at one-hourly intervals and surveyed the Hornsby Town Centre, Waitara study area and Hornsby Hospital Precinct.

Following presentation of preliminary study findings, Council requested that surveys be undertaken in additional centres forming Stage Two of the study. Precinct visits to the 13 Stage Two precincts listed above were undertaken in March 2020.

The data was processed and analysed to determine parking supply and utilisation in terms of occupancy, duration of stay and turnover.

1.4.5 INTERNAL STAKEHOLDER CONSULTATION

ARRB consulted with members of the project team as well as the Traffic Ranger Coordinator to gather information on pertinent parking issues to be considered in the Shire.

1.4.6 SWOT ANALYSIS

Following the review, investigation and consultation process ARRB noted the key findings. A SWOT analysis was then completed for each precinct.

1.4.7 FUTURE DISRUPTORS AND LATEST EMERGING TECHNOLOGY

ARRB then considered future disruptors which may impact the parking environment as well as latest emerging technologies that could benefit the management of parking in the Shire.

1.4.8 PARKING MANAGEMENT OPTIONS

Parking management principles and tools for implementation were then considered to improve parking controls and increase the efficiency and performance of existing parking infrastructure.

1.4.9 KEY FINDINGS

The key findings from all the above tasks are consolidated and summarised in Part A – Summary of Key Findings and Recommendations and Executive Summary Reports.

1.4.10 RECOMMENDATIONS

Following analysis of the key findings and consideration of the available options, recommendations were then provided as part of an over-arching study for the entire Hornsby Shire as well as selected individual precincts. The recommendations are included in this report with the tabulated timelines for recommendations presented in Part A – Summary of Key Findings and Recommendations.

1.5 LIMITATIONS

The limitations for this study are as follows:

- The construction of the off-street car park at the Hornsby Hospital was occurring during the site inspection and parking occupancy and utilisation surveys. The current parking situation may be different as the Hornsby Hospital off-street paid car park is now operational.
- Construction to upgrade and improve the Brooklyn rail commuter car park and amenities was occurring during the site inspection and parking occupancy and utilisation surveys.
- Brooklyn town centre parking is highly impacted by the River Settlement parkers and their boat trailers. Boat trailer specific analysis is outside of the scope of the study but impacts the results of parking management solutions in Brooklyn town centre.

2 PARKING CONTEXT

2.1 OVERVIEW

Council currently supplies parking both on-street and off-street throughout the Shire. This parking is mostly free and vastly unrestricted. There are competing demands for the parking supply from long term, medium term and short-term parkers. Council is in a position where they need to determine the parking hierarchy and manage the priority parking through various initiatives that support the overall goals in the ILUTS.

2.2 UNDERSTANDING THE STRATEGIC PLANNING CONTEXT

Parking Management in the Shire needs to fit within the strategic planning context. The transport system needs to provide:

- convenience and ease of traffic circulation
- enhanced pedestrian mobility
- slower speeds
- more emphasis on multimodal connectivity
- more convenient parking.

This will help meet the following goals:

- reduced private vehicle use
- increased alternative travel modes
- reduced excessive vehicle kilometres travelled
- user pays for parking.

2.3 REVIEW OF BACKGROUND DATA AND DOCUMENTATION

ARRB was provided with and referred to documentation and data as background to the Study. A summation of the key findings for each is provided as follows:

2.3.1 HORNSBY SHIRE COUNCIL PARKING MANAGEMENT REVIEW HORNSBY TOWN CENTRE, WAITARA AND HORNSBY HOSPITAL AREA, 2010

In the short term, the Review[1] recommended:

- Investigating opportunities for additional short-term parking in Hornsby Town Centre.
- Implementing additional time restrictions on north side of Linda Street between George Street and Hunter Street and south side of Linda Street between Hunter Lane and Hunter Street.
- Reviewing DCP parking provision rates.
- Investigating the suitability of different locations for public parking areas after earlier recommendations have been undertaken (i.e. conversion of some unrestricted parking to short-stay parking).
- Undertaking a review of current parking contribution rate of $22,000.
- Progressively reducing employee parking provision rate required, in line with the Integrated Land Use and Transport Strategy (ILUTS).
- Not providing additional commuter parking, in line with the ILUTS.
- Standardising parking information signage.
- Retaining current rates as maximum for developments within 500 m of railway stations, in line with the ILUTS.
- Considering pay parking after all time restricted parking strategies are undertaken and assessed.
- Further investigating pay parking focusing on short-stay spaces operating at capacity over the entire peak period.

1 Hornsby Shire Council Parking Management Review Hornsby Town Centre, Waitara and Hornsby Hospital Area, prepared by GHD for Hornsby Shire Council, December 2010.

- No requirement for a residential parking scheme.

2.3.2 D01579114 REPORT HORNSBY TOWN CENTRE PARKING MANAGEMENT REVIEW, 2011

This Report[2] by Hornsby Shire Council (Council) assessed the recommendations contained in the Parking Management Review and proposed a number of amendments to the recommendations in seeking adoption by Council. These amendments included:

- As a minimum, apply the 2002 contribution rate ($22,000) indexed to CPI ($26,650 as of September 2010).
- Do not introduce paid parking within the short term (< 5 years) but keep under review.
- Progressively extend time restricted parking within the short term if warranted and monitor its effectiveness.
- Periodically monitor parking occupancy and turnover within the medium to long term (> 5 years) to identify high demand areas.
- Do not introduce resident parking schemes within the short term.
- Monitor impacts on residents within the medium term as on-street residential areas are progressively converted to restricted parking.
- Council shall not construct additional commuter parking areas.
- Lobby the State Government to provide additional commuter parking areas at rail stations, as well as increase the frequency of train and connecting bus services at Hornsby and Waitara Railway Stations.
- Progressively increase the inventory of short-stay parking bays within 500 metres of the town centre and Hornsby Hospital Precinct.
- Review on-street time restrictions and turnover patterns and monitor following implementation.
- Progressively provide more on-street restricted parking bays in Waitara and Hornsby Hospital Precinct.
- In the short term, retain the current minimum parking provision rate of 1 bay per 40 m^2.
- Current public parking inventory should remain free in the short term.
- In the medium term, consider setting the rate of 1 bay per 40 m^2 as a maximum, or decreasing this rate in alignment with the objectives of the Integrated Land Use and Transport Strategy (ILUTS).

Key facts revealed in the document include:

- Of the 1,224 unrestricted car parking bays surveyed in Hornsby Town Centre – East Side, average occupancy was determined to be 88.6%, which is above the 85% benchmark[3].
- The (Draft) North Subregional Strategy forecasts 3,000 additional employees will be working in Hornsby Town Centre by 2031, from approximately 9,400 in 2001 (i.e. a 32% increase over 30 years).
- The Metropolitan Transport Plan (Transport NSW 2010) set a target of 28% for public transport mode share for all trips to work by 2016.

The report recommended the amendments be adopted and the Parking Management Review be endorsed. It further recommended the adopted parking management actions to be used as a framework for developing parking management in other parts of the Shire.

2.3.3 HORNSBY STATION INTERVIEW SURVEYS, 2010

These Intercept Surveys[4] were undertaken manually by Austraffic for AECOM, from 6.00am-9.00am and 3.00pm-6.00pm on Thursday, 4 March 2010. The specific survey locations were Hornsby Station Platforms 1-5.

---

2 D01579114 REPORT Hornsby Town Centre Parking Management Review, prepared by Hornsby Shire Council, 20 April 2011.

3 Shoup Donald 2005, 'The High Cost of Free Parking. American Planning Association *Part II: Section 12*

4 Hornsby Station Interview Surveys, prepared by Austraffic for AECOM, 4 March 2010.

Pertinent questions from the interviews are listed below:

1. Are you waiting to get on / just got off a train?
2. How often do you travel from this station?
3. Do you make a reverse train trip in the morning / afternoon?
4. How did you get to the station?

Figure 2.1 to Figure 2.4 present the breakdown of answers to the above questions.

Figure 2.1: Arrival or departure at Hornsby train station

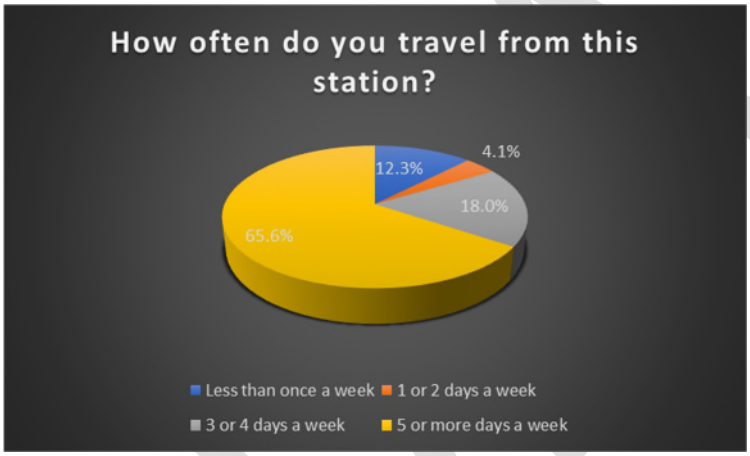


Figure 2.2: Frequency of travel from Hornsby train station

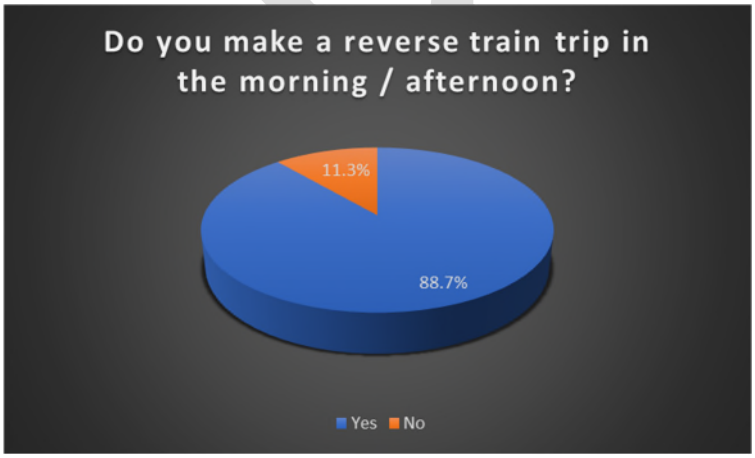


Figure 2.3: Return trips from Hornsby train station

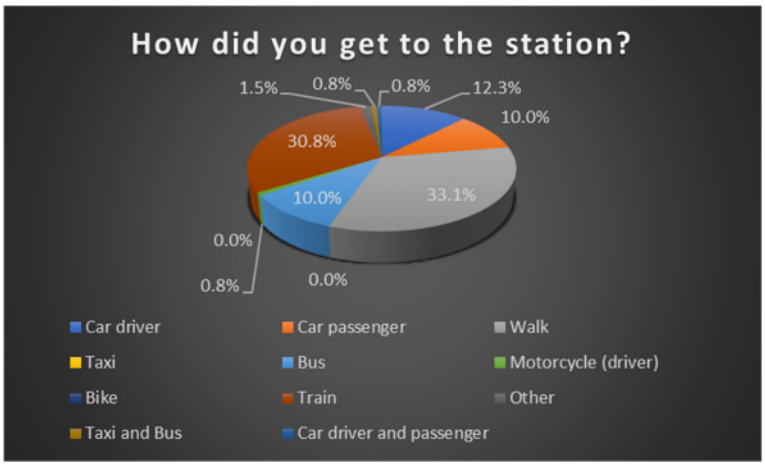


Figure 2.4: Travel mode to Hornsby train station

In summary, the surveys revealed the following:

- 83.6% of respondents travelled 3 days or more from Hornsby train station.
- Car drivers accounted for 12.3% of travel mode to Hornsby train station.
- 40.8% of respondents used public transport (bus and train) as their travel mode to Hornsby train station.
- Walking accounted for 33.1% of travel mode to Hornsby train station.

2.3.4 HORNSBY SHIRE TOWN CENTRE PARKING SURVEYS, 2010

These surveys[5] were undertaken by R.O.A.R. Data for Hornsby CBD, Hornsby Hospital on-street parking and Waitara on Thursday 27 May 2010.

The data collected from these surveys is more than three years old and is no longer reflective of the parking issues these precincts face.

2.3.5 HORNSBY INTEGRATED LAND USE AND TRANSPORT STRATEGY, 2004

The Strategy[6] outlines key parking related issues, objectives, opportunities and constraints:

ISSUES

- The parking Development Control Plan (DCP) sets a minimum standard for car parking provision.
- Parking inventory must be positively managed in order to support a travel mode shift.
- Commuter parking at stations is in high demand and consequently parking overspill occurs in residential streets.

OBJECTIVES

- Use car parking as a travel demand management tool.
- Review the DCP to ensure alignment with the objectives of the ILUTS.
- Manage commuter parking demand to ensure efficient use and minimal parking overspill into residential streets.

OPPORTUNITIES

- Potential revenue generation from charges relating to new restrictions.

---

[5] Hornsby Shire Town Centre Parking Surveys, prepared by R.O.A.R. Data for GHD, 27 May 2010.

[6] Hornsby Integrated Land Use and Transport Strategy, prepared by pba international for Hornsby Shire Council, November 2004.

- Car parking management.
- Investigation of a Metropolitan Parking Strategy.
- Improved station commuter parking management via the public transport integrated ticketing initiative and Smartcard technologies.
- Restrict parking as public transport services are improved.
- Lobby for additional commuter express bus services operating between Sydney CBD and communities in the west of the Shire.

CONSTRAINTS

- Community backlash.
- Shift in policy direction.
- Many parking bays are not within control of Council.
- Restrictive parking controls may shift shoppers and the like to neighbouring municipalities.

The strategy includes the Hornsby Parking Strategy[7]. In considering future parking challenges, the strategy recognised that:

'Parking is a critical part of an integrated transport system. It has a significant influence on car use in that, if parking is not available at the destination, car use is minimised. The aim of a parking policy is to balance the supply of, and demand for, parking spaces with the objective of minimising additional traffic generation through restraining car use, while ensuring the economic viability of each centre is maintained'.

Recommendations in the strategy for Hornsby CBD and the Waitara Station Area are as follows:

HORNSBY CBD

- Various unrestricted on-street parking bays should be considered for progressive conversion to three- and four- hour parking.
- On-street unrestricted parking bays adjacent to auto repair shops and other light industries should be time restricted, however permits and/or vouchers may be issued to allow continued business use of these bays.
- Introduce paid parking (first hour free) at the Council car park on the corner of Burdett Street and George Street.
- Trial paid parking for on-street parking bays on George Street, Linda Street, Hunter Street, Albert Street and Florence Street.
- Extend the coverage of the on-street paid parking scheme (if successful) to all on-street bays within 400 m of the station.
- Future developments must provide sufficient parking in alignment with code requirements, including Section 94 contributions.
- Retain Council car parks for future expansion, for the purpose of Section 94 contributions.
- Do not provide additional parking bays for commuters.

WAITARA STATION AREA

- Long-stay paid parking should be implemented at Alexandria Parade, Romsey Street and Orara Street.
- Four-hour parking should be implemented at Waitara Avenue, Park Street and Balmoral Street (south of Park Lane).

[7] Hornsby Integrated Land Use and Transport Strategy, prepared by pba international for Hornsby Shire Council, November 2004 at Appendix B.

2.3.6 IMPLEMENTATION OF RESTRICTED PARKING IN HORNSBY, HORNSBY HOSPITAL PRECINCT AND WAITARA OVER THE PAST THREE YEARS, 2018

A brief historical summary of the evolution of restricted parking in Hornsby, Hornsby Hospital Precinct and Waitara over the past three years, as well as the reasons for implementing these restrictions, is as follows:

- 3P along eastern side of Waitara Avenue, between Edgeworth David Avenue and Park Lane, to accommodate short term parking for upgraded Waitara Oval and new PCYC centre.
- 10 Additional 2P bays along Derby Road to accommodate visitors to Hornsby Hospital.
- 6 bays of 1/2P along western side of Hunter Lane, north of Burdett Street, to accommodate retail in Hunter Lane.
- Various temporary 'Work Zones' to accommodate approved developments.
- Various upgrade of bus stops to 'Bus Zones' to prevent illegal parking and improve transport operations.
- Various 'No Parking' zones in cul-de-sacs to improve waste collection.

2.3.7 PARKING RECOMMENDATIONS AND IMPLEMENTATION IN HORNSBY, HORSNBY HOSPITAL PRECINCT AND WAITARA OVER THE PAST FIFTEEN YEARS, 2019

Table 2.1 presents a summary of parking recommendations and which recommendations have been implemented.

Table 2.1: Summary of parking recommendations from background documentation

ILUTS 2004	Implemented	GHD 2010	Implemented	Hornsby Shire 2011	Implemented
4P along: • Jersey Street • Bridge Road (between Hunter St and Albert St) • Hunter Street • May Street • Florence Street • Albert Street • Ashley Street • Webb Street • Forbes Street	No	• Review time restrictions and consider implementing for unrestricted sections within 400 m of Town Centre, or • reducing time limits for others (e.g. 3P to 2P)	Yes	• Progressively extend time restricted parking as need is identified, with regular review of effectiveness following installation	No
3P along: • Linda Street • Muriel Street • Thomas Street	No	• If required, initiate to implement additional time restrictions on north side of Linda St between George St and Hunter St and south side of Linda St between Hunter Ln and Hunter St	Yes	• No additional all-day 'rail or bus commuter parking areas' should be provided by Council. • Investigate opportunities to provide additional commuter car parking where appropriate, funded by State Government, at rail stations.	Yes
Permit/voucher parking along: • Hunter Lane • Leonard Street • Hornsby Street • James Street	No	• Convert to short-stay parking Muriel St between Burdett St and Linda St	No	• Progressively increase the supply of short-stay parking spaces within 500 metres of the town centre and Hornsby Hospital	Yes

ILUTS 2004	Implemented	GHD 2010	Implemented	Hornsby Shire 2011	Implemented
Pay parking at the Council car park at the corner of Burdett Street and George Street	No	• Convert Thomas St between Leonard St and Edgeworth David Av in Waitara to short-stay parking	No	• Progressively provide more restricted parking spaces in Waitara and Hornsby Hospital medical precinct.	Yes
Pay parking along: • George Street (existing 1-hour spaces) • Linda Street (allowing for free period) • Hunter Street • Albert Street • Florence Street	No	• Convert angle parking along Derby Rd in Hornsby Hospital area to short-stay parking • Investigate conversion of William St and Dural St restricted spaces in Hornsby Town Centre - West back to unrestricted	No		
Long-stay pay parking along: • Alexandria Parade • Romsey Street • Orara Street	No				
4P along: • Waitara Avenue • Park Street • Balmoral Street, south of Park Lane	No				

2.4 PARKING USER TYPES

The main parking user types who park in each precinct include:

- Rail travellers who access a station by car, including commuters travelling during the peak periods to work and in the inter-peak to access part time work, colleges etc or travel for other purposes;
- Local employees who work in the precinct, arriving in the morning peak and parking for eight hours or more (long stay);
- Visitors, shoppers and part-time employees, who drive to the precinct to visit local businesses or shops and parking for up to four hours (medium stay);
- Loading/drop-off/pick-up who parking for under an hour (short stay);
- Other commuters along inter-regional bus routes such as the M2 Bus service. This is an emerging group of bus users comprising of commuters who park in residential streets particularly adjacent to the M2 Bus route.

2.5 POPULATION TRENDS

According to the Australian Bureau of Statistics8, Table 2.2 and Table 2.3 present both the total population as well as the population by age group for the suburbs of Hornsby, Waitara and Berowra.

[8] Australian Bureau of Statistics 2018, 'Census, Australian Bureau of Statistics, 17 August 2018, viewed 27 August 2018, < http://www.abs.gov.au/websitedbs/D3310114.nsf/Home/census>.

Table 2.2: Population and age statistics from the 2011 and 2016 Census for the suburbs of Hornsby and Waitara

	Hornsby				Waitara			
	2011	**2016**	**% Growth**	**2019 Forecast**	**2011**	**2016**	**% Growth**	**2019 Forecast**
Population	19,863	22,168	11.6%	23711	5,370	5,941	10.6%	6319
Age								
0-4 years	1,436	1,600	11.4	12544	418	516	23.4	7761
5-9 years	1,160	1,406	21.2	19290	336	409	21.7	5734
10-14 years	933	1,107	18.6	13461	222	259	16.7	2854
15-19 years	1,034	1,044	1.0	1670	210	182	(13.3)	-1270
20-24 years	1,260	1,234	(2.1)	-321	249	241	(3.2)	-222
25-29 years	1,677	1,729	3.1	4945	518	469	(9.5)	-2204
30-34 years	2,024	2,231	10.2	15885	743	787	5.9	3573
35-39 years	1,909	2,124	11.3	16525	594	755	27.1	13031
40-44 years	1,558	1,843	18.3	22079	414	540	30.4	10390
45-49 years	1,364	1,563	14.6	15255	259	317	22.4	4577
50-54 years	1,284	1,310	2.0	2882	237	227	(4.2)	-345
55-59 years	1,020	1,204	18.0	14207	206	219	6.3	1047
60-64 years	904	1,041	15.2	10535	162	214	32.1	4336
65-69 years	659	898	36.3	20456	174	192	10.3	1379
70-74 years	534	590	10.5	4307	130	155	19.2	1941
75-79 years	407	487	19.7	6243	129	137	6.2	647
80-84 years	323	354	9.6	2393	176	134	(23.9)	-1788
85 years plus	377	403	6.9	2071	193	188	(2.6)	-105
Total	**19,863**	**22,168**	**11.6%**	**-**	**5,370**	**5,941**	**10.6%**	**-**

Table 2.3: Population and age statistics from the 2011 and 2016 Census for the suburb of Berowra

Berowra				
	2011	**2016**	**% Growth**	**2019 Forecast**
Population	4,623	4,721	2.1%	4780
Age				
0-4 years	366	306	(16.4)	-2705
5-9 years	375	374	(0.3)	307
10-14 years	382	355	(7.1)	-1157
15-19 years	335	364	8.7	2264
20-24 years	253	274	8.3	1639
25-29 years	177	174	(1.7)	-3
30-34 years	202	233	15.3	2372
35-39 years	346	287	(17.1)	-2658
40-44 years	394	388	(1.5)	39
45-49 years	409	408	(0.2)	359
50-54 years	410	391	(4.6)	-688
55-59 years	259	353	36.3	8041
60-64 years	243	243	0.0	243
65-69 years	191	206	7.9	1182
70-74 years	109	168	54.1	5621
75-79 years	84	102	21.4	1412
80-84 years	52	60	15.4%	66
85 years plus	34	42	23.5%	48
Total	**4,623**	**4,721**	**2.1%**	

Both Hornsby and Waitara have experienced strong growths in population of 11.6% and 10.6% respectively, while Berowra recorded a 2.1% increase.

Table 2.4: Population and age statistics from the 2011 and 2016 Census for the suburb of Brooklyn and Berowra Waters

	Brooklyn				Berrilee (Berowra Waters)			
	2011	**2016**	**% Growth**	**2019 Forecast**	**2011**	**2016**	**% Growth**	**2019 Forecast**
Population	744	719	-3%	704	332	233	-42%	182
Age								
0-4 years	47	18	-161%	1	14	11	-27%	9
5-9 years	45	28	-61%	18	21	13	-62%	8
10-14 years	48	41	-17%	37	26	16	-63%	10
15-19 years	48	57	16%	62	15	17	12%	18
20-24 years	38	47	19%	52	18	18	0%	18
25-29 years	25	30	17%	33	15	17	12%	18
30-34 years	26	19	-37%	15	8	12	33%	14
35-39 years	49	31	-58%	20	22	9	-144%	1
40-44 years	59	51	-16%	46	31	12	-158%	1
45-49 years	77	51	-51%	35	25	24	-4%	23
50-54 years	76	76	0%	76	45	16	-181%	0
55-59 years	53	76	30%	90	21	20	-5%	19
60-64 years	51	57	11%	61	21	12	-75%	7
65-69 years	38	48	21%	54	23	4	-475%	0
70-74 years	31	40	23%	45	14	11	-27%	9
75-79 years	16	24	33%	29	4	11	64%	15
80-84 years	10	10	0%	10	5	7	29%	8
85 years plus	7	15	53%	20	4	3	-33%	2
Total	744	719	-3%	-	332	233	-42%	182

Both Brooklyn and Berrilee (where Berowra Waters is located) experienced negative growth over the past several years, with Brooklyn experiencing a 3% decline and Berrilee experienced a significant 42% decrease.

Table 2.5: Population and age statistics from the 2011 and 2016 Census for the suburb of Asquith and Beecroft

	Asquith				Beecroft			
	2011	**2016**	**% Growth**	**2019 Forecast**	**2011**	**2016**	**% Growth**	**2019 Forecast**
Population	3474	3377	-3%	3319	8836	9386	6%	9716
Age								
0-4 years	240	213	-13%	197	418	439	5%	451.6
5-9 years	244	278	12%	298	574	680	16%	743.6
10-14 years	212	226	6%	234	647	691	6%	717.4
15-19 years	219	209	-5%	203	702	650	-8%	618.8
20-24 years	223	190	-17%	170	578	593	3%	602
25-29 years	163	172	5%	177	321	338	5%	348.2
30-34 years	199	177	-12%	164	315	336	6%	348.6
35-39 years	248	249	0%	250	424	491	14%	531.2
40-44 years	274	279	2%	282	607	681	11%	725.4
45-49 years	269	249	-8%	237	690	668	-3%	654.8
50-54 years	243	223	-9%	211	722	696	-4%	680.4
55-59 years	263	200	-32%	162	673	626	-8%	597.8
60-64 years	177	213	17%	235	524	617	15%	672.8
65-69 years	137	151	9%	159	466	496	6%	514
70-74 years	103	125	18%	138	349	459	24%	525
75-79 years	84	80	-5%	78	285	337	15%	368.2
80-84 years	93	56	-66%	34	234	264	11%	282
85 years plus	83	87	5%	89	307	324	5%	334.2
Total	3474	3377	-3%	3319	8836	9386	6%	9716

Asquith has only experienced a small decline of 3% over the five years, which Beecroft has experienced a 6% increase in their population.

Table 2.6: Population and age statistics from the 2011 and 2016 Census for the suburb of Cheltenham and Pennant Hills

	Cheltenham				Pennant Hills			
	2011	**2016**	**% Growth**	**2019 Forecast**	**2011**	**2016**	**% Growth**	**2019 Forecast**
Population	2247	2067	-9%	1959	7031	7296	4%	7455
Age								
0-4 years	95	75	-27%	63	408	396	-3%	389
5-9 years	147	114	-29%	94	422	471	10%	500
10-14 years	167	189	12%	202	442	448	1%	452
15-19 years	204	192	-6%	185	546	511	-7%	490
20-24 years	179	155	-15%	141	459	497	8%	520
25-29 years	75	74	-1%	73	352	370	5%	381
30-34 years	81	39	-108%	14	413	367	-13%	339
35-39 years	95	79	-20%	69	449	496	9%	524
40-44 years	121	138	12%	148	494	516	4%	529
45-49 years	195	200	3%	203	566	517	-9%	488
50-54 years	208	204	-2%	202	522	568	8%	596
55-59 years	186	139	-34%	111	458	526	13%	567
60-64 years	128	143	10%	152	407	410	1%	412
65-69 years	122	88	-39%	68	313	379	17%	419
70-74 years	89	100	11%	107	250	265	6%	274
75-79 years	79	65	-22%	57	186	217	14%	236
80-84 years	39	46	15%	50	176	159	-11%	149
85 years plus	37	27	-37%	21	168	183	8%	192
Total	2247	2067	-9%	1959	7031	7296	4%	7455

Cheltenham has also experienced a negative 9% growth, with Pennant Hills experiencing a 4% increase over the five years.

Table 2.7: Population and age statistics from the 2011 and 2016 Census for the suburb of Thornleigh and Cherrybrook

	Thornleigh				Cherrybrook			
	2011	**2016**	**% Growth**	**2019 Forecast**	**2011**	**2016**	**% Growth**	**2019 Forecast**
Population	8112	8460	4%	8669	18780	18764	0%	18754
Age								
0-4 years	624	580	-8%	554	898	768	-17%	690
5-9 years	585	645	9%	681	1,146	1,187	3%	1212
10-14 years	576	574	0%	573	1,507	1,471	-2%	1449
15-19 years	511	610	16%	669	1,691	1,595	-6%	1537
20-24 years	463	474	2%	481	1,426	1,277	-12%	1188
25-29 years	373	331	-13%	306	761	830	8%	871
30-34 years	475	478	1%	480	686	739	7%	771
35-39 years	668	615	-9%	583	1,053	956	-10%	898
40-44 years	698	726	4%	743	1,400	1,366	-2%	1346
45-49 years	579	706	18%	782	1,727	1,497	-15%	1359
50-54 years	598	569	-5%	552	1,621	1,536	-6%	1485
55-59 years	436	537	19%	598	1,341	1,416	5%	1461
60-64 years	423	437	3%	445	1,173	1,221	4%	1250
65-69 years	339	355	5%	365	788	983	20%	1100
70-74 years	300	301	0%	302	506	671	25%	770
75-79 years	188	239	21%	270	355	466	24%	533
80-84 years	148	145	-2%	143	311	334	7%	348
85 years plus	128	138	7%	144	390	451	14%	488
Total	8112	8460	4%	8669	18780	18764	0%	18754

Thornleigh has experienced a 4% growth in population, while Cherrybrook's population has remained stagnant with little growth.

Table 2.8: Population and age statistics from the 2011 and 2016 Census for the suburb of Normanhurst and Galston

	Normanhurst				Galston			
	2011	**2016**	**% Growth**	**2019 Forecast**	**2011**	**2016**	**% Growth**	**2019 Forecast**
Population	5158	5278	2%	5350	3000	3138	4%	3221
Age								
0-4 years	339	293	-16%	265	155	156	1%	157
5-9 years	354	375	6%	388	208	210	1%	211
10-14 years	408	403	-1%	400	203	236	14%	256
15-19 years	418	481	13%	519	239	205	-17%	185
20-24 years	256	268	4%	275	178	174	-2%	172
25-29 years	212	199	-7%	191	126	122	-3%	120
30-34 years	232	235	1%	237	110	137	20%	153
35-39 years	337	327	-3%	321	175	136	-29%	113
40-44 years	359	401	10%	426	185	220	16%	241
45-49 years	396	399	1%	401	216	217	0%	218
50-54 years	341	373	9%	392	249	210	-19%	187
55-59 years	267	317	16%	347	192	240	20%	269
60-64 years	289	255	-13%	235	198	183	-8%	174
65-69 years	238	257	7%	268	153	180	15%	196
70-74 years	193	228	15%	249	102	149	32%	177
75-79 years	172	160	-8%	153	81	104	22%	118
80-84 years	133	142	6%	147	109	95	-15%	87
85 years plus	128	138	7%	136	121	164	26%	190
Total	5158	5278	2%	5350	3000	3138	4%	3221

Normanhurst and Galston have experienced small amounts of growth, at 2% and 4% respectively.

2.6 TRANSPORT TRENDS

The Australian Bureau of Statistics (2018) also confirms there has been a substantial mode shift away from vehicle use for people travelling to work during the five-year period from 2011 to 2016. This is evidenced by the percentage of workers travelling to work by car compared with those travelling by other modes of transport.

Table 2.9 and Table 2.10 present travel mode statistics for the suburbs of Hornsby, Waitara and Berowra. The travel mode statistics for the other centres are presented in Table 2.11 to Table 2.14 below.

Table 2.9: Travel mode statistics from the 2011 and 2016 Census for the suburbs of Hornsby and Waitara

Travel Mode	Hornsby				Waitara			
	2011	2016	% Growth	2019 Forecast	2011	2016	% Growth	2019 Forecast
Public Transport	3,584	4,296	20%	4808	1,054	1,308	24%	1497
Car Driver or Passenger	4,453	4,495	1%	4520	931	924	-1%	920
Train	3,543	4,219	19%	4702	1,054	1,291	22%	1465
Bus	41	77	88%	118	0	17	N/A	27
Walked	779	763	-2%	754	163	145	-11%	135
Total	**12,400**	**13,850**	**12%**	**14822**	**3,202**	**3,685**	**15%**	**4065**
Total Car	**4,453**	**4,495**	**1%**	**4520**	**931**	**924**	**-1%**	**920**
Total Other Mode	**7,947**	**9,355**	**18%**	**10349**	**2,271**	**2,761**	**22%**	**3145**

Table 2.10: Travel mode statistics from the 2011 and 2016 Census for the suburbs of Berowra

Travel Mode	Berowra			
	2011	2016	% Growth	2019 Prediction
Public Transport	506	641	27%	744
Car Driver or Passenger	1,338	1,388	4%	1419
Train	506	623	23%	709
Bus	0	18	N/A	29
Walked /Worked from home	53	38	-28%	32
Total	**2,403**	**2,708**	**13%**	2958
Total Car	**1,338**	**1,388**	**4%**	1419
Total Other Mode	**1,065**	**1,320**	**24%**	1539

Hornsby recorded a 1% growth in personal vehicular travel with 18% growth in other transport modes with Waitara recording -1% and 22%, and Berowra 4% and 24% respectively.

Table 2.11: Travel mode statistics from the 2011 and 2016 Census for the suburbs of Asquith and Beecroft/Cheltenham

Travel Mode	Asquith				Beecroft-Cheltenham			
	2011	2016	% Growth	2019 Forecast	2011	2016	% Growth	2019 Forecast
Public Transport	473	543	15%	591	1,007	1,209	20%	1355
Car Driver or Passenger	822	841	2%	853	2,200	2,156	-2%	2130
Train	468	537	15%	585	952	1,140	20%	1275
Bus	5	6	20%	7	55	69	25%	80
Walked	60	50	-17%	45	96	73	-24%	63
Total	**1,828**	**1,977**	**8%**	**2077**	**4,310**	**4,647**	**8%**	**4891**
Total Car	**822**	**841**	**2%**	**853**	**2,200**	**2,156**	**-2%**	**2130**
Total Other Mode	**1,006**	**1,136**	**13%**	**1224**	**2,110**	**2,491**	**18%**	**2761**

Asquith recorded a 2% growth in personal vehicular travel with 13% growth in other transport modes while Beecroft-Cheltenham experienced a 2% decrease and 18% increase respectively

Table 2.12: Travel mode statistics from the 2011 and 2016 Census for the suburbs of Pennant Hills and Thornleigh

Travel Mode	Pennant Hills				Thornleigh			
	2011	2016	% Growth	2019 Forecast	2011	2016	% Growth	2019 Forecast
Public Transport	1,006	1,093	9%	1150	920	1,196	30%	1411
Car Driver or Passenger	1,853	1,854	0%	1855	2,190	2,127	-3%	2090
Train	947	1,028	9%	1081	906	1,167	29%	1369
Bus	59	65	10%	69	14	29	107%	48
Walked	95	122	28%	143	73	99	36%	120
Total	**3,960**	**4,162**	**5%**	**4295**	**4,103**	**4,618**	**13%**	**5033**
Total Car	**1,853**	**1,854**	**0%**	**1855**	**2,190**	**2,127**	**-3%**	**2090**
Total Other Mode	**2,107**	**2,308**	**10%**	**2440**	**1,913**	**2,491**	**30%**	**2943**

Pennant Hills recorded virtually no growth in personal vehicular travel with 10% growth in other transport modes while Thornleigh experienced a 3% decrease and 30% increase respectively

Table 2.13: Travel mode statistics from the 2011 and 2016 Census for the suburbs of Cherrybrook and Normanhurst

Travel Mode	Cherrybrook				Normanhurst			
	2011	2016	% Growth	2019 Forecast	2011	2016	% Growth	2019 Forecast
Public Transport	2,071	2,311	12%	2472	590	769	30%	909
Car Driver or Passenger	5,876	5,380	-8%	5108	1,274	1,218	-4%	1186
Train	716	894	25%	1027	581	750	29%	881
Bus	1,355	1,417	5%	1456	9	19	111%	32
Walked	109	64	-41%	48	57	74	30%	87
Total	**10,127**	**10,066**	**-1%**	**10081**	**2,511**	**2,830**	**13%**	**3091**
Total Car	**5,876**	**5,380**	**-8%**	**5108**	**1,274**	**1,218**	**-4%**	**1186**
Total Other Mode	**4,251**	**4,686**	**10%**	**4974**	**1,237**	**1,612**	**30%**	**1905**

Cherrybrook recorded an 8% decrease in personal vehicular travel with 10% growth in other transport modes while Normanhurst experienced a 4% decrease and 30% increase, respectively.

Table 2.14: Travel mode statistics from the 2011 and 2016 Census for the suburb of Galston

Travel Mode	Galston			
	2011	2016	% Growth	2019 Forecast
Public Transport	112	128	14%	139
Car Driver or Passenger	1,040	1,073	3%	1093
Train	85	104	22%	118
Bus	27	24	-11%	22
Walked	61	22	-64%	14
Total	**1,325**	**1,351**	**2%**	**1367**
Total Car	**1,040**	**1,073**	**3%**	**1093**
Total Other Mode	**285**	**278**	**-2%**	**274**

Galston recorded a 3% increase in personal vehicular travel with 2% decrease in other transport modes.

3 EXISTING PARKING CONDITIONS

3.1 OVERVIEW

There are various existing parking issues within the 17 precincts in the study area. Some of the issues are precinct specific but most of the key issues are experienced across all precincts. The key parking issues identified by the community are detailed in Section 3.2 below. Other parking issues both Shire wide and precinct specific are identified in Part C – SWOT Analyses.

3.2 KEY PARKING ISSUES FROM THE COMMUNITY

The key parking issues in Hornsby Shire that have been identified by the community are listed below:

- Local residents objecting to all day parking on their street
- Residents complaining of parking occurring too close to their driveway
- Residents requesting preferential parking at rail stations
- Local employees seeking all day parking near centres
- Business people wishing to park, load/unload near their business premises
- Train and bus commuters seeking all day parking near existing train and bus
- stations
- Parking management on Franklin Road and Robert Road, Cherrybrook to deter commuter parking generated by the North West Metro.
- Brooklyn River residents seeking all day or multi day parking and Brooklyn visitors requiring shorter stay parking
- Berowra Waters River residents seeking all day or multi day parking and visitors requiring shorter stay parking

3.3 EXISTING PARKING SUPPLY AND UTILISATION

The existing parking supply and utilisation survey information is provided as technical report.

4 REVIEW OF PARKING MANAGEMENT PRACTICES

4.1 EMPLOYEE PARKING

Provision for employee parking is a major policy issue. Currently, all commercial and industrial developments in Hornsby LGA are required to provide adequate parking for both employees and visitors in accordance with the Hornsby Development Control Plan (HDCP).

This requirement is considered to be a causation factor of traffic congestion and is a contributory factor to declining public transport use due to the availability of parking.

4.2 RAIL COMMUTER PARKING

Rail commuter parking is a major issue in Hornsby LGA as the train stations are located in the centre of the town or activity centres where there are competing parking demands. There are 14 rail stations within Hornsby LGA and rail commuter parking is provided by Transport for NSW at the following stations.

Table 4.1: Rail commuter parking spaces provided by Transport for NSW and Council (both on-street and off-street)

Station	Spaces Provided By			
	Transport for NSW		Council	
	Off-Street	On-Street	Off-Street	On-Street
Hornsby	477	0	0	78
Waitara	80	0	0	184
Asquith	58	0	0	0
Thornleigh	302	0	0	53
Pennant Hills	0	0	0	0
Normanhurst	0	0	0	0
Beecroft	178	0	0	46
Cheltenham	94	0	0	0
Cherrybrook Metro	400	0	0	0
Berowra	265	0	0	0
Hawkesbury River Station/ Brooklyn	12	0	0	0

The commuter parking provided by Transport for NSW does not cater for the number of rail commuters wanting to park at the stations. This causes overflow parking into the surrounding street network.

Council has previously adopted the position that the provision of rail commuter parking is a State Government responsibility as parking demand generated by the railway station does not necessarily contribute to the local economy. In a Council report from April 2009 rail commuter parking was considered to be detrimental to local communities in the Shire[9]. The reasons provided were:

- It increases traffic flows and congestion on local and residential streets, particularly those adjacent to car parks at peak periods, with associated safety and amenity problems;

[9] Strategic Response to Commuter Parking Demands in Hornsby LGA, April, 2009.

- It attracts commuters from other outer areas, particularly Central Coast;
- It provides parking opportunity for employees who would otherwise use public transport;
- It competes with feeder bus services, potentially making them unviable;
- It competes with short stay parking needs in commercial/retail centres; and,
- Commuter car parks occupy prime real estate land that could be used for residential, retail and commercial developments maximizing accessibility to nearby transport facilities.

A decision was made that rail commuter car parks would be considered an interim measure to be replaced by feeder bus services when rail patronage reached critical mass. As such, Council has in the past provided unrestricted parking on some streets close to the Hornsby and Waitara Stations where the carriageway widths can accommodate on-street parking while allowing safe and efficient traffic movements. Specific examples are:

- Alexandria Pde,
- Waitara Ave, Waitara;
- Jersey St south, Hornsby;
- Wongala Cr, Beecroft;
- Lowe Avenue, Hornsby.

Rail commuters occupy the on-street parking provided by Council, leaving limited on-street parking for bona-fide town or activity centre users seeking short to medium term parking opportunities.

Based on previous resolutions, no additional all-day 'rail or bus commuter parking areas' should be provided by Council. This resolution is based on the detrimental effects of commuter parking to residential amenity and economic viability of the town centres with a train station.

4.3 PERMIT PARKING

4.3.1 CURRENT SITUATION

There is currently no permit parking scheme being implemented in Hornsby Shire. A previous Council study determined that there would be limited benefits arising from the cost of implementing permit parking for local residents (Resident Parking Permit Scheme).

4.3.2 PURPOSE OF PARKING PERMITS

Parking Permits can help to improve amenity for particular classes of road users in locations where there is insufficient off-street parking and where on-street parking is restricted. Additionally, they can help balance the needs of the local community with those of the broader community in high demand areas.

All permit parking schemes share some eligibility criteria and features listed below.

- High demand for parking in an area
- Inadequate or little parking and no means to create more parking (for both on-street and off-street)
- Vehicles in scheme are registered in NSW or classified as a vehicle temporarily in NSW are not a truck, bus, tram, tractor or trailer (i.e. a boat or caravan)
- In NSW, there are no areas set aside exclusively for permit parking, parking authorities have discretion over the number of permits and how they distribute them
- Must be distinct from other parking authorities' schemes (such as other councils) if they only operate within a single area. Schemes which cross councils or declared organisation boundaries may have a common identification code and also be distinct from other permit parking schemes
- Users should easily identify which scheme applies to them and their vehicle, with all scheme identification codes being required to be displayed on permissive or pay parking signs where relevant.
- All permits other than resident's visitor permits must specify the vehicle registration to which they relate (this can be done electronically).

Based on the current guidelines for Permit Parking, Council may charge fees for its permit parking schemes at its own discretion. Pricing should be based on cost recovery, e.g. for administration of the scheme/s and the provision of infrastructure, considering the parking authority's return on investment policy (if it has one). Fees levied by councils should be fixed by a council resolution.

The permissive parking signs as prescribed in clause 32 of the Regulation and rule 204 of the NSW Road Rules 2014 must be used in the implementation of permissive parking, permit parking and pay parking schemes. For all new permit parking schemes, the permissive parking signs must have the words **PERMIT HOLDERS EXCEPTED** and an area identifier - to allow permit holders to be exempt from the period restrictions or charges for parking.

4.3.3 PARKING PERMIT TYPES AND ELIGIBILITY

There are currently six classes of permit parking scheme prescribed in the Road Transport 2013 regulation as outlined below. Council isn't required to establish any or all of the permit parking schemes in the LGA. However, if Council wishes to establish a permit parking scheme, it must comply with the current Regulation and the RMS mandatory guideline for Permit Parking.

BUSINESS PARKING PERMITS

Business parking permits are issued to businesses that are located or operate within a parking authority's area of operations. Business parking permits may be issued to:

- Business principals and employees
- Car share operations
- Short term permits for essential business services, e.g. tradespeople.

COMMUTER PARKING PERMITS

Commuter parking schemes are established to encourage people to use public transport. They can only be established after a 12-month commuter parking trial.

Commuter parking permits may be issued as follows:

- Applicants must be able to demonstrate to the satisfaction of the parking authority that they are legitimate commuters
- Commuters do not have to reside in the area of operations, but should be able to demonstrate that the vehicle is normally used by the commuter
- One permit per commuter
- The parking authority should ensure there is a reasonable chance the commuter will find a parking space within the commuter permit parking area.

RESIDENT PARKING PERMITS

For residents within the council area looking to park vehicles on-street

- Applicants must be able to demonstrate to the satisfaction of the parking authority that they are legitimate residents and that the vehicle they use is normally used by the resident (doesn't have to be owned directly by them)
- The number of permits issued for an area should not exceed the number of available on-street parking spaces in the area
- A maximum of one permit per bedroom in a boarding house, or two permits per household. In exceptional circumstances, the number of permits may be increased

- Where the number of requests for permits exceeds the number of available on-street parking spaces, only residents who do not have access to unrestricted parking along their kerbside are eligible to apply for a resident parking permit.

Applications should be prioritised as follows:

- No off-street parking spaces
- One off-street car space
- Two or more off-street car spaces.

RESIDENT'S VISITOR PARKING PERMITS

Residents may apply for visitor parking permits, so their visitors can park within the permit area without time or fee restrictions.

- Where a property is permitted to be leased for short term rental accommodation (STRA) and complies with relevant State Government policies and codes of conduct for STRA, applicants for parking permits must be able to demonstrate:
  - They are the legitimate resident or the owner of the property
  - There is no off-street visitor parking at the resident's address
  - There are no unrestricted on-street parking spaces in front of the residence or along the kerbside
- The parking authority may offer long term and/or short-term visitor parking permits.

SPECIAL EVENT PARKING PERMITS

Special event parking permits may be issued to residents or businesses that are affected by special event traffic management. They can be issued for individual events and the permit must include the date/s and location of the special event.

Alternately, they may be issued as an annual permit for areas where there are many special events, e.g. Homebush near Sydney Olympic Park. Currently there are special events in Hornsby LGA that would qualify for this type of permit e.g., Hornsby Town centre West side vibe.

DECLARED ORGANISATION PARKING PERMITS

Declared organisation parking permits may be issued to people who require access to the area of operations on a frequent basis, e.g. hospital and Tertiary Education staff, and where suitable parking alternatives are not available. As a parking authority, a declared organisation may issue other classes of parking permit in accordance with these guidelines.

4.4 PARKING TIME LIMITS

Hornsby LGA's town centres have limited on-street parking restrictions, especially short stay and medium stay restrictions.

Within town and activity centres, the priority for on-street parking spaces should be short stay and medium stay parkers. Time restrictions are considered an effective tool to increase availability of on-street parking spaces for short and medium stay parkers. With effective enforcement, each on-street parking space provides for multiple customers or visitors per day.

4.5 FUTURE PARKING DEMAND REQUIREMENTS

4.5.1 RESUMPTION OF TAFE STUDENT CAR PARK BY TFNSW

It is understood that TfNSW has acquired the TAFE carpark site in Jersey Street at the rear of Hornsby Council Administration building. This site will be considered as part of the Hornsby Town Centre Review.

Figure 4.1: Hornsby train station

The resumption of the TAFE student car park by TfNSW could lead to the dislocation of up to 86 student parkers. While ARRB is not privy to the terms agreed between TfNSW and TAFE NSW, this proposal will impact demand for parking in the surrounding areas as parking overspill occurs. The surveys revealed on a typical weekday, the car park was operating at 50% occupancy by 8 am and between 75-90% occupancy up until 6 pm.

Council has indicated that it does not support the proposal by TfNSW to use the TAFE site for commuter parking because of its impact on traffic volumes on Peats Ferry Road. Council has indicated that it believes that the proposed parking between the rail corridor and George Street is a more appropriate location because of its access to the through traffic route. Considering the potential for land use intensification in Hornsby Town Centre and the potential increase in pedestrian activity on the western side of Hornsby Station in the vicinity of Coronation Street and Jersey Street, Councils stated position has merit. Ideally, the location of the commuter parking should be on the periphery of the town centre.

4.5.2 HORSNBY HOSPITAL EXPANSION (ALREADY CONSTRUCTED)

A multi-deck car park consisting of 500 bays has been constructed at Hornsby Hospital to provide parking for staff and visitors, as presented in Figure 4.2.

Figure 4.2: Recently constructed car park located at Hornsby Hospital

The parking fees for the car park are presented below.

Table 4.2: Parking fees

Duration	Fee
First 15 minutes	FREE
15 mins - 1 hr	$3.40
1 hr - 2 hrs	$5.00
2 hrs - 3 hrs	$6.70
3 hrs - 4 hrs	$7.90
4 hrs - 5 hrs	$9.00
5 hrs +	$10.10

The Hornsby Hospital car park was initially free of charge. The current fees have increased the potential for parking overspill into surrounding residential areas as people seek free parking alternatives.

4.5.3 HORNSBY PARK (MEDIUM TERM – NEXT 5 YEARS)

The Hornsby Park revitalisation project involves using the material from the NorthConnex tunnel project to fill the quarry void to develop a new landform, as presented in Figure 4.3. The new landform will create a variety of flexible spaces that are suitable for the following range of activities:

- House cafes
- Cultural centre
- Art exhibition space. Small level areas
- Open spaces
- Steep bushland embankments, ideal for camping, bushwalking and other outdoor activities.
- Sports ground
- Bicycle trail.

Figure 4.3: Proposed recreation areas

The Masterplan for the Hornsby Park revitalisation project is yet to be completed and details of specific components and the parking requirements are not available.

4.5.4 HORNSBY TOWN CENTRE REVIEW

The Hornsby Town Centre project aims to facilitate the revitalisation of the HTC to create a liveable, green, and accessible centre that enhances public life for the community.

The desired outcomes from the project include:

- Increased investment and economic activity through employment opportunities and increased land capacity
- Pedestrian friendly public domain offering day and evening activities to improve the destination value of the area
- Improved liveability for existing and future residents through enhanced mobility and a mixed-use offering of residential, educational, community, commercial and cultural amenity
- Design excellence
- A dignified town centre, accessible and safe for all ages and abilities
- A sustainable built environment which improves the health, wellbeing and climate resilience for all Hornsby Shire residents and visitors.

4.5.5 HORNSBY RSL CLUB PLANNING PROPOSAL

The planning proposal for the redevelopment of Hornsby RSL incorporating the three locations along William Street, Ashley Lane, High Street and Webb Avenue, as presented in Figure 4.4 is currently on hold and being considered as part of the larger Hornsby Town Centre Review.

Figure 4.4: Proposed locations for new developments

The Hornsby RSL Club planning proposal, states that 'If development for seniors housing that includes car parking spaces in connection with that use is on land identified as 'Area 1' on the Height of Buildings Map, the development must provide no more than 119 spaces for residents and 21 spaces for visitors.'

4.6 POTENTIAL SITES FOR CONSTRUCTION OF PUBLIC CAR PARKING

There are limited options for the construction of public car parking within the town centres across the Hornsby LGA. The construction of public car parking in town centres would not support the Council's goal of reducing private vehicle use and increasing alternative travel modes.

Public parking could be constructed on the fringe of the town centres.

4.7 PAY PARKING

Council has previously considered charging for public parking and sees it as:

- an effective measure to control and manage on-street parking,
- an appropriate strategy to support business sustainability at major centres provided time limits are set to meet business requirements.

At the moment, pay parking only applies to Fagan Park and Hornsby Aquatic Centre. There is no charge for any other on-street or off-street Council public parking areas.

5 PARKING MANAGEMENT APPROACH

5.1 TRADITIONAL APPROACH TO PARKING

Historically, the approach by local government to the provision of parking in Australian cities has embodied four key factors:

1. Mandatory minimum parking required.
2. Some public parking is to be provided by developers on private land.
3. Cities and Town Centres are to contain both on-street and off-street parking.
4. Each development (land use) is to provide its own parking.

The traditional approach to parking has been that motorists should nearly always be able to easily find convenient, free parking at every destination[10].Under this 'predict and provide' approach, parking planning is based on the premise that a 'parking problem' means 'inadequate supply', and consequently:

- More parking is better.
- Every destination should satisfy its own parking needs (minimum ratios).
- Car parks should never fill.
- Parking should always be free or subsidised or incorporated into building costs.

In the last 15 years there has been an increasing trend towards more efficient use of existing transport infrastructure as an alternative to expanding roads and parking facilities. The approach increasingly being used is, known as travel demand management.

5.2 CHANGING APPROACH FOR MANAGING CAR PARKING

There is increasing recognition that sustainable Town Centres require a balanced multi-modal transport system, and that the parking system should support the transport system. More specifically, parking supply, utilisation, location and price are primary determinants relating to travel mode choice.

Under a new 'demand management' approach, parking facilities should be used more efficiently. This means that car parks located in certain destinations may often fill but parkers should be well informed of alternative parking options that are available nearby. It does not mean that car parks should have enough capacity to cater for once-a-week peak demand. It requires motorists having a choice between pay parking near their destination or free parking within reasonable walking distance of destinations. It also requires a high standard of walking conditions between parking facilities and the destinations that they serve.

Parking management should include shared and reciprocal parking, parking pricing and regulations, parking user information, and pedestrian improvements.

The challenge for the Shire is to find a balance between adequate parking supply and demand to ensure the long-term vitality of the Town Centres and the environmental, social and economic necessity towards more efficient use of infrastructure.

5.2.1 PRINCIPLES

There are a number of principles of parking management and parking options and initiatives that can be adopted by Council as a means of achieving sustainable goals.

They include managing the supply of public parking to support parking and transportation objectives including:

- Regulating users and limiting the types of vehicles that may use certain parking spaces.

---

10 The concept has been clearly articulated by Litman, T (2006) Parking Management Strategies Evaluation and Planning – Victoria Transport Policy Institute.

- Favouring higher value uses – such as for emergency and service vehicles, deliveries, customers and access for people with disabilities.
- Encouraging remote parking by offering benefits to commuters to encourage them to use alternatives to a car. e.g. public transport, shared transport, active transport (walking and cycling).
- Enhancing the pedestrian experience and safety.
- Reducing free parking spaces to discourage long-stay parking.
- Providing better information about available parking.

It is worth considering several important principles and strategic approaches in relation to the nature of parking management in a modern urban environment. This section first considers some fundamentals in relation to the on-going supply and demand for parking. These will form the underlying basis of several recommendations and represents a paradigm shift in the Local Government approach to parking in urban areas.

5.2.2 TRAVEL DEMAND MANAGEMENT

Travel Demand Management (TDM) emphasises the movement of people and goods, rather than motor vehicles, and gives priority to more efficient travel and communication modes (such as walking, cycling, car sharing, public transport and telecommuting), particularly under congested conditions. Environmental concerns and rising fuel costs are other factors prompting a desire to reduce reliance on private motor vehicles.

Controlling parking demand is the counterbalance to the management of parking supply. It is far easier and less expensive to make better use of existing parking capacity than it is to create additional parking. Fees can be used to control demand and to encourage alternative modes. Improvements to transport and access infrastructure can be funded from additional income derived from parking.

In accordance with TDM principles, the future strategy for the Shire must therefore contain recommendations not only to curtail the supply of additional parking, but also to manage parking to constrain demand.

5.2.3 PEOPLE ACCESS

This requires the development of innovative access programs targeted at a more active community. The promotion of increased active access such as convenient cycle ways and walkways rather than the promotion of car use is inherent in this approach.

5.2.4 DRIVER PRIORITIES

Following the decision to drive to their destination, drivers will choose where they park based on four major factors: cost of parking; location of parking; time of day; availability of parking.

While the cost, location and availability of parking are obvious considerations, the time of day is particularly significant. Drivers parking at 7 am will have different parking requirements and expectations to those parking at 3.30 pm.

Parents, having collected their children from school at 3.30 pm, seeking to quickly access parking in a retail precinct prior to driving home, will rate location and availability as a high priority. The cost factor is secondary and perceived as a value for convenience.

When various types of parking are offered at the same price within similar distances of their destination, drivers generally prioritise parking demand as follows:

1st - At kerb on street.

2nd - At-grade off street.

3rd - Above ground multistorey.

4th - Below ground basement/multistorey.

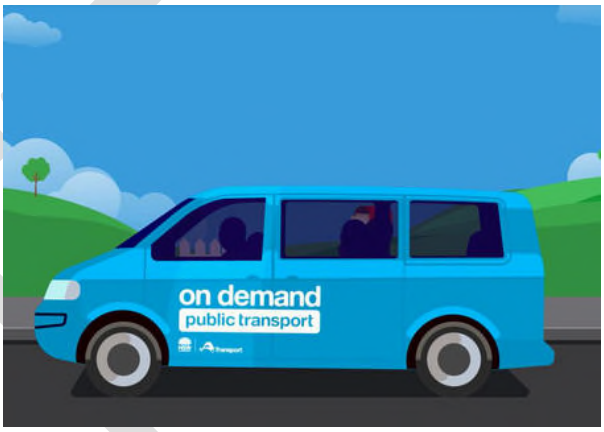
5.2.5 PROVIDE EFFICIENT AND EFFECTIVE ALTERNATIVES TO CAR ACCESS

This requires the promotion of accessibility such as convenient cycle ways and walkways rather than the promotion of parking. The provision of high quality reliable public transport is a fundamental prerequisite for parking policies, which seek to maintain supply within acceptable limits, reduce congestion and encourage alternative modes of transport.

Unfortunately, the Council does not control the provision of bus services and public transport however Council can lobby the New South Wales State Government to provide more convenient and frequent public transport services.

5.2.6 ENCOURAGE SUSTAINABLE TRANSPORT

The provision of town fringe commuter parking facilities which are connected to train stations via shuttle bus services is a major opportunity to reduce the dependency on cars coming into a town centre.



New on-demand public transport services being trialled by TfNSW allow users to book a vehicle to pick them up from either home or a convenient nearby location and take them to a local transport hub or point of interest. The vehicles are booked via an app, online or by phone. Two examples of where the services are being trialled are the Northern Beaches and Sutherland Shire.

The services are relatively cheap as one-way fares start from $2.60 with a concessional fee of $1.30 for a trip under 3km in the Sutherland Shire area.

5.2.7 PROVIDE ADEQUATE PARKING FOR PRIORITY USERS WHICH WILL BE WELL BELOW THE UNCONSTRAINED DEMAND FOR PARKING

This acknowledges that parking must be provided in commercial centres, especially for special groups such as the disabled, or other needs-based groups who must use a car such as the parents of school children. However, the available parking supply should be adequate, not excessive. It need not cater to occasional peak demand and need not ensure that every driver will always be able to find a bay. Rather, it seeks to eliminate over-supply and unused capacity. Consolidated parking is a means of making better use of available supply. Shared parking does not require each land use to provide its own parking.

5.2.8 THE PROVISION OF PARKING REQUIRES A DEMAND MANAGEMENT, NOT A DEMAND SATISFACTION APPROACH

Controlling parking demand is the counterbalance to the management of parking supply, but it is far easier, more flexible and less expensive to make better use of existing parking capacity than to create additional parking. Parking management strategies recognise different hierarchies of users. Fees can be used to control demand and to encourage alternative modes. Additionally, improvements to transport and access infrastructure can be funded from additional income derived from parking.

The future plan for the Shire must therefore contain recommendations not only to curtail the supply of parking, but also to manage parking so as to constrain travel demand.

If the Council intends to move towards a more sustainable, multi-modal transport system, there needs to be a commitment by all stakeholders to adopt and implement a policy based on these principles.

This change in approach to the strategic management of parking has been termed a paradigm shift and is being increasingly applied in urban areas where sustainability is a major objective.

5.3 TRANSPORT MODE SHIFT

The existing public realm for pedestrians, cyclists and public transport users' needs to be significantly improved during the next decade to encourage transport mode shift.

The Council needs to prioritise access for pedestrians, cyclists, public transport users and people with disabilities, and make the most of public transport infrastructure, balanced with the needs of the road network, including the need to minimise congestion. Additionally, educational and media campaigns should be undertaken to inform parkers of the advantages of using sustainable transport options.

There is also a need for better bicycle paths and quality end-of-trip bicycle facilities. Improved bicycle paths and end of trip facilities will encourage more commuter parkers to cycle rather than drive to the train stations.

5.3.1 COMMUTER PARKING

Commuter parking tends to be of lesser value to town centres and should ideally be supplied on the periphery of town centres in large-scale parking structures priced to support all-day parking

A public parking supply can be managed to provide parking for a range of needs. One of the broadest categories for non-residential parking is commuter parking. Commuters tend to displace other parking user groups such as customers in town centres which can result in overflow parking into residential areas.

There is very little chance that capital costs can be recouped from fees, since these fees would need to be low because there are currently no fees attached to Council or commuter parking in the Shire. This implies that an alternative mechanism is necessary to make all-day parking economically feasible and ensure the majority of business staff parking will ultimately be provided on-site.

The effort to create a communal all-day parking supply is considered worthwhile, since commuters tend to arrive during the roadway peak and have the greatest impact on traffic operations. Removing this demographic from the main activity areas improves pedestrian and cycling safety, public transport efficiency and intersection operation. Commuters are also more willing to walk long distances, particularly if the pedestrian environment is attractive.

Increasing Public Transport efficiency and promoting alternate modes such as cycling and carpooling should also be considered. Each suspected Commuter parking area should be surveyed and after analysing survey data, appropriate parking measures should be proposed to the Local Traffic Committee. Graded ticketed parking prices which will be based on the distance from a Town Centre, would redistribute commuter parking to low demand areas.

5.3.2 RESIDENTIAL PARKING

The objective of a resident parking policy is to improve amenity for particular classes of road users in locations where there is insufficient off-street parking and where on-street parking is restricted. Permit parking helps to balance the needs of the local community with those of the broader community in high demand areas, but exclusive kerbside residential parking will not be considered.

To achieve the general object of this policy, the following principles will be used in determining how best to manage permit parking in the Shire:

(i) The needs of commercial facilities must not be prejudiced by provision of on-street permit parking.

(ii) Acknowledging the limits of parking availability within a locality, parking permits will be issued to residents and their visitors to optimise access to on-street parking facilities.

(iii) Community access to residential areas is to be maintained and exclusive on-street residential parking will generally not be acceptable.

The Permit Parking Guidance (version 4) published by Roads and Maritime Services legislates that street parking cannot be wholly allocated to residents. Subsequently, permit parking zones are introduced alongside a two-hour parking restriction '2P permit holders exempt'. This restriction enables non-permit holders to use any available street parking spaces within the zone; however, the time-limit also ensures that a space is vacated multiple times during the day, thereby creating parking opportunity for other visitors or returning residents.

Street parking spaces that are not occupied by permit holders experience high levels of parking occupancy and turnover. These street parking spaces, in particular those located within a 10-minute walk of Town Centre services and amenities are valuable assets located in convenient and highly accessible locations for Town Centre visitors. The provision of free short-stay parking close to Town Centre amenities has resulted in a disproportionate demand and use of parking in residential areas. To alleviate and control the levels of parking demand, consideration should be given to the introduction of Ticket Parking with provisions to exempt permit holders. This measure may also lessen the requirement for residents to park vehicles all day on street in an attempt to secure parking closest to their home.

There are currently four factors impacting the availability of on-street parking for residents and visitors in the Shire, namely:

- The increased development of multi-dwelling apartment blocks with reduced off-street parking.
- The introduction of paid parking at the Hospital.
- The resumption of the TAFE car park.
- A general increase in commuter parking demand.

5.3.3 PARKING FOR BUSINESSES

Business parking permits are issued by businesses that are located or operate within the Shire. Business parking permits may be issued to:

- Business principals and employees
- Short term permits for essential business services, e.g. tradespeople.

To maintain attractiveness and competitiveness as a place for work and business, Council will have to provide sufficient parking for employees and businesses. It is recommended that consideration is given to allocate a proportion of parking to residents and allocate the remaining street parking spaces to visitors at a cost through the introduction of pay-parking.

To encourage employees to park and walk, street parking located furthest from the Town Centres, which would operate at a lower fee than those located nearest to the Town Centres should be considered.

The introduction of designated long-stay street parking areas would not only provide employees the required parking but would also encourage employees to either car share or use alternative and more sustainable modes of transport as a cheaper option.

Providing temporary permits to facilitate long-stay, daily or weekly (Monday – Saturday) parking for trades and contractors should be considered. The permits will exempt contractors from being restricted in short-stay time and resident parking scheme areas temporarily and provide opportunity to park near the work place.

5.3.4 SPECIAL EVENTS

While there is limited off-street parking utilisation data to hand, anecdotal advice confirms a level of frustration from visitors seeking to find available parking during the major event periods.

Council should undertake a detailed analysis of all on-street and off-street parking during special event periods.

As part of the special events approval procedure, Council is to request an event parking plan from the organisers which will include an appropriate communication plan for educating visitors to the festivals.

Special event parking permits may be issued to residents or businesses that are affected by special event traffic management. They can be issued for individual events and the permit must include the date/s and location of the special event. Alternately, they may be issued as an annual permit for areas where there are a large number of special events.

Council do not have a special event parking strategy or measures in place to manage the impact of special event increased parking demand.

5.3.5 TOURIST DESTINATIONS AND RIVER SETTLEMENTS

Utilisation surveys undertaken at Brooklyn and Berowra Waters indicate that current parking supply does not satisfy peak demand periods. It is essential that in these types of tourist destinations parking controls are introduced to enable equitable access during high levels of demand.

Any parking time restrictions or charges introduced should have the flexibility to change to meet seasonal demand. The introduction of time-restricted parking in Brooklyn and Berowra Waters may be warranted. Parking for off shore residents should be investigated.

5.3.6 PARKS AND RESERVES

Hornsby Shire includes large areas of National Park and other bushland that attracts visitors from the local, metropolitan and wider regional area. At present access to these areas is dominated by the private car thereby required provision of adequate and conveniently located car parking spaces for users. Consideration also needs to be given to improving and promoting access by other modes to ensure the future sustainability of these areas.

Pay Parking should be investigated for recreational areas such as Crosslands Reserve. This site is similar to nearby NPWS facilities such as Bobbin Head which has pay and display.

5.4 COST OF PROVIDING PARKING

5.4.1 FREE PARKING

There is no such thing as free parking; the costs are simply subsumed elsewhere in the economy. Reserving large areas of land for parking directly impacts the affordability of property and goods and services. The cost of providing parking for residential dwellings can add 10–30% to the total costs of development. In medium to high-density residential developments, the costs associated with providing parking facilities can exceed the capital value of the land[11]. The true cost of parking is hidden in higher development costs, and consequently higher rents and prices to consumers.

[11] Shoup, Donald 2005, 'The High Cost of Free Parking. American Planning Association.

Ratepayers of the Council fund parking. Ratepayers are not only paying for the cost of cleaning, insurance and maintenance of these bays, they are subsidising parking on valuable land that could be generating income, providing improved amenity or could be put to other uses.

Many councils in Australia provide free public parking both on-street and off-street. Paying for public provision and management of parking from general rates is regressive and disproportionately impacts those on low and fixed incomes, such as students and the elderly and those ratepayers who elect to use alternative forms of transport and do not normally drive cars.

Owners of private vehicles are expected to cover the costs associated with owning and operating a car and constructing and maintaining road infrastructure; however, in most instances, the costs associated with vehicle storage, e.g. parking, may not be charged directly to users.

5.4.2 CONSTRUCTION COSTS

The provision of cheap parking has an opportunity cost to ratepayers as a car park generates far less income per annum than the income that could be earned on the sale or lease of the land.

It is important to understand some of the costs associated with the provision of parking.

Each on-street kerbside parking space requires 15.6 m² of land and encroaches 2.4 m into the roadway, effectively reducing the roadway by one lane. Off-street parking at-grade, generally requires 28–35 m² per space, which includes an allowance for aisles and vehicle access. The cost of constructing above-ground deck parking is at least $16,700 per space for ground plus one level and $19,700 per space for ground plus 2 levels, plus the cost of land. The cost of below-ground parking is even higher at > $48,000 per space, plus the land.

According to recent land sales in the Shire, the price of commercial land in the Town Centres is conservatively estimated at $2,000 per m². Table 5.1 is an estimate of the cost of provision of different types of parking in Hornsby Town Centre.

Table 5.1: Estimated cost of providing one public parking bay in Hornsby Town Centre

Type of parking	Land per bay	Land cost/m² $2,000	Floor area per bay	Construction cost per bay	Est. min cost per bay
Off-street surface (at-grade)	35 m2	$70,000	35 m²	$3,500	$73,500
Deck – 2 level	16 m²	$32,000	32 m²	$16,700	$48,700
Deck – 4 level	8 m²	$16,000	32 m²	$19, 700	$35,700
Basement – 2 level	16 m²	$32,000	32 m²	$48,000	$80,000

The provision of free or low fee parking has an opportunity cost which can be measured in terms of the value of an alternative use of the land.

5.5 PARKER USER GROUPS

To enable equitable sharing of parking resources, it is necessary to identify all the different parking user groups and prepare a parking hierarchy.

The parking hierarchy assumes there are no other competing interests for the kerbside or off-street parking spaces e.g. pedestrian paths and footpath trading or eating, bus priority or cycle lanes. The following is a list in no specific order of parking user groups, their definitions and priority requirements.

5.5.1 PARKING HIERARCHY

When demand for parking exceeds supply, there needs to be recognition of different user priorities through the introduction of a parking hierarchy. The objectives of the parking hierarchy are to:

- Provide for the safety and convenience of all road users.
- Encourage the use of alternative transport modes such as walking, bus, train and cycling.
- Promote equitable and transparent allocation of parking spaces across all user groups.
- Facilitate consistent decision-making regarding parking infrastructure.

The parking user hierarchy should be applied to planning decisions in the Shire. Policies should be developed to implement the parking hierarchy through pricing, time regulations and enforcement. For example, disabled parking is a high priority in commercial centres and where it cannot be provided in off-street car parks, should take priority over all other potential uses of kerbside parking space.

Table 5.2 shows the desirable parking user hierarchy to be used within the Shire. This hierarchy is desirable to support growth and intensification goals. Requests for alterations to kerbside allocation should be reviewed to determine if they fit within the parking hierarchy for the precinct or location.

Table 5.2: Proposed parking user hierarchy for the Hornsby Shire

Priority	Central Town Centre Parking		Outside Town Centre Parking	
	On-street	**Off-street**	**On-street**	**Off-street**
Highest	Disability permit holders (where appropriate off-street parking cannot be provided)	Disability permit holders	Public transport	Long-stay/ commuter, Facility user
	Loading	Short to medium-stay	Residents	Short to medium-stay
	Public transport	Drop-off/pick-up	Short to medium-stay	Drop-off/pick-up
	Drop-off/pick-up	Loading	Disability permit holders	Park and Ride
	Motorcycle/scooter & cyclists	Motorcycle/scooter	Loading	Residents,
	Short to medium-stay	Cyclists	Drop-off/pick up & motorcycle/scooter & cyclists	Motorcycle/scooter
Lowest	Disability permit holders (where appropriate off-street parking has been provided)	Long stay/commuter & residents	Long-stay/commuter	Disability permit holders & loading & cyclists
Not allowed in this zone	Long-stay/commuter	Public transport		Public transport
	Residents			

5.5.2 PUBLIC TRANSPORT

Parking restrictions are applied to indicate a bus or taxi zone specifically reserved for these vehicles/users. This user group should generally have priority when considering kerbside allocation.

5.5.3 LOADING

Service vehicles are vital to the operation of a commercial centre. They should have a high priority for the allocation of a limited number of on-street parking spaces. However, planning requirements should ensure all

new developments provide for service vehicles within the development itself. Loading zones should not be provided unless off-street loading facilities are not available.

They should cater for the needs of legitimate goods-carrying vehicles only. These vehicles are usually permitted to stand in a loading zone for 30 minutes while engaged in picking up or setting down goods. Proper enforcement is necessary to prevent loading zones from becoming private parking for owners or staff of commercial businesses. Private use motor vehicles should not be entitled to park in loading zones during business hours, but signage should permit short-medium stay parking after hours.

5.5.4 DISABILITY PERMIT HOLDERS

The Australian Disability Parking Scheme helps eligible people park nearer to their destination. Permit holders are entitled to park:

- In any space provided for a person with a disability in an on-street or off-street parking location, such as shopping centres, hospitals etc.
- In local government metered or regulated parking areas on-street for two hours in a 30 minute parking area and unrestricted for over a 30 minute parking area.

Spaces allocated for persons with a disability should be given priority in the immediate vicinity of uses that have a high demand for disability access, such as hospitals and other community services. Wherever possible parking bays for the disabled should be located off-street to provide additional convenience and safety to the driver.

5.5.5 DROP-OFF/PICK-UP

Short-term parking for drop-off/pick-up (e.g. 5–15 minutes parking) should be given priority in premium parking locations near facilities i.e. at schools, public transport nodes and hospitals. Enforcement should ensure the turnover of this parking.

5.5.6 SHORT TO MEDIUM-STAY

Short to medium-stay parking for business and retail needs. Generally short-stay parking is for up to 2 hours and medium-term parking between 2 and 4 hours. These user classes should be provided for commercial centres, hospitals, sports facilities, entertainment centres and hotels. Enforcement should ensure compliant turnover of this parking.

5.5.7 LONG-STAY/COMMUTER

Long-stay parking (4–24 hours) is provided to cater for employees, commuters and other long-term parkers. This user class should generally be allocated a relatively low priority, particularly on-street and in areas with high public transport accessibility.

5.5.8 PARK AND RIDE

This parking is provided to cater for people transferring to another mode of transport to complete their journey (e.g. catching a bus or train). Park and ride should be given priority at satellite/remote public transport nodes. This type of parking is generally not considered appropriate in commercial centres or at transit-oriented developments.

5.5.9 RESIDENTS

Due to the incidence of long stay parker overspill into residential streets together with an increase in multi-dwelling developments near the commercial centres, all options were considered for managing parking in these residential areas. Providing additional on-street parking for owner/occupiers via a Resident Permit Parking Scheme (RPS) is not recommended under the current circumstances. Rather it is more beneficial to increase parking controls to ensure increased availability of short stay parking for visitors, carers and contractors.

Most residential properties in the Shire currently have access to at least one off-street car parking space. However, this may not be the case in future high-density areas as the aim is to discourage motor vehicle use and increase alternative travel modes. Enforcement must ensure that access is not blocked to residents' off-street parking.

The introduction of RPPS is not recommended at this stage as it will encourage car ownership and lead to increased congestion and the overwhelming majority of residences have adequate off-street parking. It has been recommended in the first instance that tighter parking controls be implemented to manage on-street parking affected by long-stay parker overspill to increase the availability.

5.5.10 CYCLISTS

Parking for cyclists falls into two broad categories. Firstly, all-day parking for employees and park-and-ride parking at public transport stations. Secondly, short-term parking for visitors to shops, restaurants, offices, recreational facilities and other institutions (distributed throughout commercial centres).

5.5.11 MOTORCYCLE AND SCOOTER PARKING

Motorcycle/scooter parking is generally treated no differently to that of cars. If vehicles are to be charged for parking, this should apply equally to motorcycles if they use spaces allocated to cars. An incentive for these motorcycles is to provide them with free parking in dedicated motorcycle spaces.

As car parking spaces can be easily divided into two motorcycle spaces, there is flexibility to convert spaces depending on demand.

6 PARKING MANAGEMENT TOOLS AND OPTIONS

The purpose of this section is to provide tools and options that would guide or be used by officers in the management of car parking in Hornsby LGA. The tools and actions outlined below have been developed to address the issues raised by Councillors and the community.

6.1 STREET PARKING PLAN

A street parking plan provides a consistent approach to parking management based on parking occupancy thresholds. Each threshold has a different degree or severity for parking controls. For areas that reach more than 85% occupancy, controls promote mode shift to alternative transport thereby promoting sustainability. The plan provides a flexible approach to parking management, enabling parking controls to adapt to the dynamic and transforming nature of communities and places.

A Street Parking Plan intends to provide a framework to promote consistent and transparent decision-making which supports sustainable outcomes.

The plan is developed around the concept of maintaining the 'operational efficiency' of street parking areas, and parking to support the viable operation of land-use activities. Parking areas that are operating efficiently provide reasonable opportunity to access parking spaces, thereby alleviating 'cruising' and Town Centre congestion. Cruising is the term referring to drivers circulating in search of a parking space. This behaviour is triggered when parking facilities are more than 85% occupied and parking spaces are not readily available. This causes visitors to search or wait for parking spaces to become available.

In general, a parking area which is operating efficiently is defined as operating at 45–85% occupancy. Above and below this range indicates that the parking spaces are not effectively being managed. Using these thresholds, a parking plan has been developed which promotes a consistent and objective review of street parking areas as illustrated in Figure 6.1. This Street Parking Plan should be applied to all precincts.

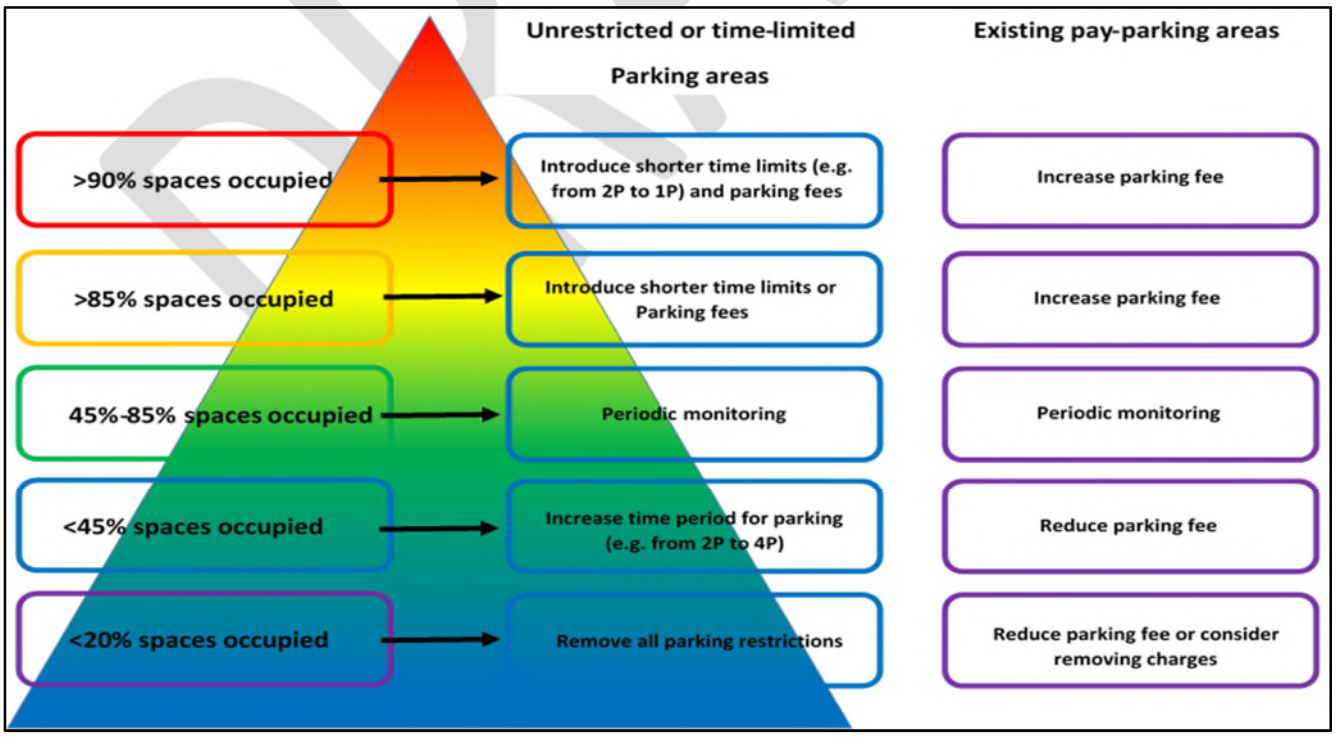


Figure 6.1: Street parking plan

6.2 PARKING CONTROLS

Parking controls should support the viable operation of the adjacent land-use and user needs.

It is important to manage and prioritise access to street parking spaces to one group of road users over another. For example, in areas alongside cafés and restaurants, parking limits of two hours during the weekday act to prioritise parking for visitors who will spend time and money at these establishments over long-stay parkers and commuters. Street specific locations are included in the precinct specific recommendations in the Executive Summary.

6.2.1 COMMERCIAL AND MIXED-USE AREAS

Parking controls in streets dominated by retail and commercial frontages will aim to support the viability and efficient operation of local businesses. The parking controls will encourage street parking turnover and encourage use of off-street parking facilities whilst providing sufficient time for visitors to access services and amenities.

For example, where demand is high for on-street parking by visitors who need more time, daytime controls of two hours would be considered appropriate. Again, changes to the parking time limits can be adapted through monitoring and feedback about parking conditions in reference to the parking plan presented in Figure 6.1. Long-stay parking on the periphery of retail and commercial areas is supplemented by the availability of off-street parking facilities.

Pay parking in town centres will act to improve parking compliance and reduce reliance on enforcement activity. Prices for kerbside parking in these areas will be set to encourage visitors to firstly consider parking in dedicated off-street parking spaces and secondly, to increase the availability of kerbside parking to support local businesses. Pricing will be the key mechanism that regulates demand and will again be monitored and adjusted in accordance to the plan in Figure 6.1. Precinct specific recommendations are included in the Executive Summary.

6.2.2 RESIDENTIAL AREAS

Parking controls in residential areas aim to balance the parking needs of residents with the needs of all households who require street space for visitors, family, care workers and tradespeople. Parking spaces are to be prioritised for residents in streets near to shops and businesses where there is a high visitor demand for parking. This can be managed through the introduction of time restricted parking, adapted to local residential arrangements and lifestyles. Ticket parking eventually will be used in high parking demand areas to facilitate effective and efficient enforcement.

Two-hour parking controls are the preferred parking restriction in residential areas as it allows reasonable access for short visits, without the need for permits. However, local conditions may justify different time limits depending on adjacent land uses and available parking capacity (see Figure 6.1).

Throughout streets where long-stay employee and commuter parking occurs, for example on the fringe of the Town Centre and adjacent to train stations, parking spaces are also to be prioritised to favour visitors and residents. However, in recognition that not all employees reside locally, and many arrive from areas where the car is the only economical or viable transport option,10P ticket parking controls may be implemented. Again, metered parking may be used to facilitate effective and efficient enforcement in these streets.

Ticket parking should only be installed after community consultation. The ticket parking prices in residential areas will be lower than in commercial areas. This will ensure that pricing does not exclude present and future employees from accessing jobs in the Town Centres. However, pricing will be at a level which will actively encourage those travelling locally, to choose alternative and more sustainable transport methods.

6.3 PARKING MANAGEMENT IMPROVEMENT PLAN

Successful parking management increases the availability of parking for competing users of the road space (cars, public transport and bike infrastructure) who need or value it most in a given situation. The intended outcome of a parking management program is a balanced parking system that efficiently prioritises and matches user profiles to available supply. The anticipated result is that as many people as possible have the opportunity to reach their intended destinations and pursue their activities as planned. While this may not mean everyone is able to park directly in front of their destination, the goal is to provide and access parking options that are within a reasonable distance. Some areas may not require significant levels of management, while other areas with high demand or limited supply may require more intensive management to support needs that vary by days (such as for the commuters, employees and weekend shoppers) or times of day (such as in the evenings for the restaurants and hotels).

To significantly improve the current management of parking and improve access in the Shire, several options and recommendations have been considered to address the key issues.

6.4 PAY PARKING

Best practice considers the introduction of pay parking when average peak-hour demand exceeds 85%[12]. The survey results revealed many of Council's high demand parking areas are well above the 85% benchmark.

6.4.1 GUIDING PRINCIPLES

The guiding principles supporting the introduction of pay parking include:

- Facilitating an increased turnover of parking bays.
- Increasing supply and access for short-stay parkers.
- Providing several options for different categories of parker.
- On-street high turnover bays for short stay parking.
- Cheaper parking slightly further away for longer stays (3-4 hours).
- More remote parking for long stays for employees and commuters.
- Improving customer service by providing prioritised parking close to a driver's destination.
- Benchmarking a value for premium, convenient parking.
- Creating a more equitable user-pays system.

All pay parking should offer convenient payment systems and value for money in terms of easy access, wayfinding, security, lighting and clean presentation.

Improvements in technology are reducing the capital and operational cost of pay parking which allows for lower costs to be passed on to the user.

The consequential benefits of pay parking are:

- It is one of the most effective ways of influencing parking and travel demand.
- It can alter parking location, destination, travel mode, travel time, parking duration and vehicle ownership rates.
- It reduces traffic congestion, traffic accidents, energy consumption and pollution.
- It increases equity by charging users (user pay) for their parking costs and by reducing indirect costs imposed on non-drivers.
- It generally results in improved levels of compliance and reductions in car use.

- It is one of the most common measures used to ensure the long-term viability of commercial centres.

Currently there is limited Council managed pay parking in the Shire with just Hornsby Aquatic Centre and Fagan Park having pay parking implemented.

Offering suitable free parking alternatives to pay parking provides drivers a choice and may reduce objections to the implementation of pay parking on ideological grounds. Additionally, offering an initial free period of parking also gives users further incentive to reduce their duration of stay resulting in increased turnover.

6.4.2 OBJECTIVES

It is important to define the objectives for user pay parking in terms of traffic and parking management.

- Traffic management – peak period fees should be high enough to encourage a shift in travel modes or times.
- Parking management – fees during peak demand periods and at the most convenient locations should be high enough to generate a maximum 85% occupancy rate.

The underlying strategy is to increase the turnover of on-street pay parking with alternative off-street parking available free or at a cheaper rate. On-street parking fees should be 15–20% higher than the equivalent off-street parking charges to reflect the premium nature of kerbside parking and to encourage drivers to use the off-street facilities, where they can usually obtain a longer duration of stay.

6.4.3 COMPLIANCE

The effectiveness, benefits and impacts of pay parking are directly linked to compliance. An average occupancy initially recorded as 85% may well be only 75% when more effective enforcement is introduced.

Current levels of enforcement and consequential compliance of time restricted parking need to be considered prior to the introduction of pay parking:

- Average peak demand may be exceeding 85% but the level of enforcement may be well below the industry benchmark.
- Adequate enforcement resources, including personnel and technology are necessary prior to any decision to implement pay parking.
- Parking enforcement rosters should cover all periods of peak demand.
- A high level of compliance by means of regular and unpredictable enforcement needs to exist.

Regular surveys of parking demand should be undertaken to quantify the effectiveness of enforcement.

6.4.4 PAYMENT AND PRICING

A common misperception of businesses is that pricing will deter customers. In reality, pricing often improves the customer experience since it increases the likelihood of finding a parking spot near a preferred destination.

Many successful commercial districts have found that appropriate on-street pricing ensures better parking availability and supports the vitality of high-demand areas.

Charging a fee for on-street parking limits stay duration, increases vacancy rates and increases the predictability of finding a parking space.

The following guidelines[13] are applicable to the implementation of pay parking fees in any sector:

[13] With part acknowledgement to Todd Litman 'Parking Management Best Practices' American Planning Association 2006.

- Charge drivers directly rather than indirectly and offer convenient locations and options for payment including cash, credit card, pay-wave and mobile phone. Cash payment is likely to be phased out by the industry in the medium term.
- Ensure that fee structures are flexible and can be amended to manage changes in demand during the year. It is inefficient to review fees only once a year in accordance with Council's budget timetables. Implement flexible parking pricing at different times of the day and the week such as on weekends or in the evenings.
- Charge higher fees at the most convenient on-street bays to encourage high turnover and use incremental price structures to favour short-term users, for example, first thirty minutes free, $1.50 between 30 minutes and first hour, $3 for second hour then $4.50 for third hour, etc.
- Set parking fees with some reference to popular public transport fares, for example, all day parking should be higher than a two-zone return bus/train fare. Daily rates should be set at greater than six times the hourly rate and minimise discounts for long-term parking (early bird and commuters).
- Use small time charge units so drivers can avoid paying for more time than they need; for example, five-minute units for short-term parking and one-hour units for long-term parking rather than the day.
- Encourage businesses to price parking and offer discounts or refunds to their bona fide clients. This can be accommodated with new technologies.
- Minimise the exceptions to pay parking, for example, all loading vehicles, couriers and other parkers using public or designated on-street parking spaces should be required to pay if they exceed the initial free period and should always display a ticket.

Regardless of the emotion often surrounding the introduction of pay parking, there is little doubt that it represents an efficient and effective means to manage on and off-street parking demand and encourage turnover of bays.

6.5 CAR SHARE AND CAR POOLING

Car share is an innovative form of transport that allows people to hire vehicles on demand for short periods of time, via a telephone or internet booking service. The vehicles are parked in dedicated bays and are accessible to members at any time of the day or night. Members benefit from the flexibility of having access to a private vehicle without having to pay the fixed cost associated with owning a car.

Car share vehicles are currently available on dedicated off-street parking areas within the Hornsby Shire and are well utilised. One car share operator currently exists within the Hornsby LGA. This operator currently has 5 vehicles in dedicated off-street parking bays located in Westfield Hornsby and one in Hornsby Kennard Hire.

Car share provide numerous community benefits such as:

- Encourage more sustainable travel options as car share members generally drive less and use other modes of transport for certain journeys more often than non-members, particularly those that have given up a vehicle in place of a car share membership.
- Reduce emissions as on average, car share vehicles are newer and more fuel-efficient, emitting fewer CO2 emissions than the average car.
- Reduce private vehicle use which is necessary to help achieve Council's targets of zero net emissions by 2050.
- Alleviate parking pressure given that multiple users share one car and one parking space.
- Reduce traffic congestion as car share members tend to use public transport, walk and cycle more after joining a car share scheme.
- Improve access and social inclusion and improve quality of life by providing access to a vehicle without the expense of ownership.

Carpooling can be an effective tool in providing similar community benefits to car sharing as detailed above. It involves a car owner providing transportation for one or more other persons travelling either to the same destination or a destination in a similar direction to the car owner. Carpooling can be achieved and managed

well within a company to reduce the company's need for parking spaces and meet their travel plans as required by Council. Carpooling and even van pooling can have preferential parking provided to encourage its success.

6.6 RATES ON PARKING PROVISIONS

The traditional method of developers supplying a minimum number of parking spaces per metre squared of GFA encourages private vehicle use. To limit private vehicle, use Council should review the Hornsby Development Control Plan with a view to implementing a cap on provision of employee parking, particularly for commercial developments within 500 metres of major town centres such as Hornsby, Waitara Stations and Hornsby Hospital.

This should include increasing the supply of short-stay parking spaces within 500 metres of major town centres to improve the economic viability of businesses in the town centre through increased opportunity for short term parking throughout the day.

6.7 TRAVEL/GREEN PLAN

All new development applications for commercial premises should be required to provide a detailed Travel Plan/Green Plan. This plan should include plans to reduce emissions through sustainable travel choices. Car share, car pooling, encouraging walking, cycling and public transport use through various initiatives should be encouraged.

Development bonuses should be provided by Council for the development of an employee travel plan/green plan that encourages the use of public transport, walking or cycling and discourages the use of private vehicles, private vehicle ownership and vehicle kilometres travelled.

6.8 ENCOURAGE SUSTAINABLE TRAVEL MODES (WALKING, CYCLING AND PUBLIC TRANSPORT)

6.8.1 TRANSPORT MODE SHIFT AND MULTI-MODAL TRAVEL.

Council needs to prioritise access for pedestrians, cyclists, public transport users and people with disabilities, and make the most of public transport infrastructure, balanced with the needs of the road network, including the need to minimise congestion. The existing public realm for pedestrians, cyclists and public transport users needs to be significantly improved during the next decade to encourage transport mode shift.

Additionally, educational and media campaigns should be undertaken to inform parkers of the advantages of using sustainable transport options. The provision of town fringe commuter parking facilities which are connected to trains stations via shuttle bus services is a major opportunity to reduce the dependency on cars coming into a town centre.

As technology further evolves and user acceptance grows, passengers can be transported to and from a destination without the vehicle needing to park in between.

6.9 EDUCATION

Despite every driver being a parker, the broader environmental, economic and social impacts of parking are rarely understood or appreciated by users, unlike their understanding of the effects of vehicle use. The clamour for more parking has been allowed to develop without any communication of its negative effects, and its

growing unsustainability. This is true in the Hornsby Shire where the Council's website relating to parking is very regulation-oriented. An upgraded and on-going campaign of communication on the unsustainability of current parking practices is recommended.

An essential component of the plan will be communication and engagement with the community, and visitors to the Hornsby Shire. They need to be informed of the options for parking as well as available capacity. An education program should be aimed at all stakeholders including planners, developers, designers, retailers, tenants, elected officials and council officers, business and community groups, students, residents, visitors, commuters, and the general public. Education and appreciation of the unsustainability of current parking demand should be available and regularly communicated in the Council's publications.

The community needs to understand that parking needs to be sustainable and there is a cost for the provision of parking; drivers cannot expect unlimited free parking close to their destination; unlimited supply has environmental, social and economic drawbacks; parking users need to share the cost of parking infrastructure equitably; and income from parking services will be reinvested into improving access and associated streetscape and transport infrastructure.

The justification for changing parking restrictions needs to be communicated clearly to constituents. The benefits must be outlined with emphasis on how it will assist them. More specifically, the reasons for implementing various measures should be explained using the following guiding principles and approach.

6.10 MEASURES TO ENCOURAGE BETTER UTILISATION

6.10.1 ENFORCEMENT AND COMPLIANCE

Council's current organisational structure of the Regulatory Team is as follows:

- One Ranger Coordinator.
- Two Team Leaders.
- Seven Parking Rangers.

At most of the on-street parking in the Shire, the current process of monitoring compliance is highly inefficient. The system whereby a parking enforcement officer must patrol an area twice in order to firstly chalk-mark a tyre, and then return one, two or four hours later to check the tyre, is an expensive use of labour resources.

It is also worthwhile to consider a reciprocal monitoring arrangement, whereby in exchange for council enforcement of private parking facilities, the bays are permitted to be used by any driver outside of business hours.

In-ground sensors or parking meters will allow an enforcement officer to patrol once and to easily determine whether a vehicle has parked in excess of any restrictions.

The benefit of more efficient and simplified parking enforcement is the creation of additional capacity and improvement in the turnover of on-street parking bays.

6.10.2 TECHNOLOGY

Smart Parking technology is ultimately not only about driving up productivity and service, but also demonstrating a long-term greener value to customers. Smart Parking options are designed to lower operation costs and improve revenue through increased occupancy. Differentiating parking services, e.g. Including discounted pay parking in promotions and advertising, and providing up-to-date information about vacant spaces, are some approaches to growing the value of parking resources, both as a revenue generator and a real estate asset.

The new technology for Smart Parking will significantly improve customer service by offering better guidance, quicker location of bays and more convenient methods of payment, however increased efficiency in the use of parking bays will not occur solely as a result of technology. Increased efficiency in the use of parking bays will require a fundamental change in the way parking is priced and managed by the Council in conjunction with the implementation of Smart Parking.

6.10.3 WAYFINDING

A coherent wayfinding system is a cost-effective means to reduce searching time for bays and unnecessary circulation of cars. Predictable, consistent and authoritative public information is the key to building confidence.

Parking wayfinding refers to a system of signs, directories and other design features which provide an early warning navigational aid. Most of the Council's public and private parking areas are advertised by an inconsistent array of signs and P logos, which are usually located within 5 m of the car park entrance. They do not assist drivers coming into Town Centres to plan their route well in advance so as to reduce their search time, and therefore reduce traffic congestion. There is a presumption that 'drivers know where the parking is'.

Drivers want to know where to look for wayfinding information when they need it, understand the way the information is communicated, and obtain the information quickly and without fuss.

There are a number of Australian Standards, RMS documents and Austroads guidelines that refer to traffic management, parking, and parking guidance systems which need to be considered when developing a parking guidance scheme, namely:

STANDARDS:

- AS1742.1 – Manual of uniform traffic control devices. General introduction and index of signs, section 4 – Guide signs.
- AS1712.2 – Manual of uniform traffic control devices.
- AS1712.3 – Manual of uniform traffic control devices. Traffic control for works on roads.
- AS1712.11 – Manual of uniform traffic control devices. Parking controls, section 6 – Parking direction signs
- AS1712.15 – Manual of uniform traffic control devices. Direction signs, information signs and route numbering, Appendices B & D – Layout of signs, installation and location.
- AS1743 – Road signs – Specifications, Appendices I – Guide signs.

ROADS & MARITIME SERVICES:

- RMS Traffic Management Document List Part 7, 3.10 – Parking Management
- RMS QA Specification TS105 – Electronic message sign sites.
- RMS Transport corridor outdoor advertising and signage guidelines, Section 5 – RMS assessment and approval on classified roads.

AUSTROADS:

- AGTM 10-16 Guide to Traffic Management Part 10. – Traffic Control and Communication Devices.

6.10.4 PARKING AND ACCESS DATA AND INFORMATION

The provision of better information about on- and off-street parking availability combined with signage indicating pedestrian walking times to major destinations can increase utilisation of all available facilities.

The location and public availability of parking facilities is not always clear to drivers. Even if a facility is open to the public, the rules of that location (such as hours of operation) are often difficult to determine. Confusion or lack of information often results in a driver defaulting to on-street parking.

This involves the provision of information on parking availability using signage, brochures, maps, websites and apps (smart phone applications).

6.11 OTHER TOOLS AND OPTIONS

6.11.1 SHARED PARKING

Efficient sharing of bays can allow the number of parking bays required to service demand to be reduced significantly.

Shared parking means that private parking bays on the same site are shared concurrently by more than one user, which allows parking facilities to be used more efficiently. Shared parking takes advantage of the fact that most parking bays are only used part-time by a particular group, and many parking facilities have a significant portion of unused bays, with utilisation patterns that follow predictable daily, weekly and annual cycles.

6.11.2 REMOTE PARKING

Remote parking can free up quantities of parking for short-stay visitors to the Town Centres.

This involves encouraging long-stay parkers to use off-site or fringe parking facilities through regulation and pricing, for example, streets adjacent to train stations but not conveniently located to commercial centres.

6.11.3 PARKING CONTROL AND MANAGEMENT PLAN

This is a tool for developers to commit to, prior to establishing a new facility with a parking requirement. It is a worthwhile document for the Council, for developers, their tenants, and for other parties as it sets out in detail, how parking for a proposed development or change of use will be controlled and managed after establishment. It has been implemented in several cities (such as Stirling and Cambridge[14]) and provides clarification for all parties affected by parking at a site.

A Parking Control and Management Plan (PCMP) places the onus on the developer to consider the proposed practical plans to manage and control the parking on site in order to comply with the planning conditions. Approval of the plan will form part of the development approval for the project. On-going adherence to the plan will be monitored and enforced.

Discussion of each submitted PCMP needs to occur together with compliance services, who will be responsible for monitoring compliance with the plan after construction. The planning scheme parking ratios should also consider more intensive use than currently categorised for particular developments.

14 Town of Cambridge, Parking Management Plan Information Sheet, 8 February 2010.

7 PARKING RATES AND CASH-IN-LIEU CONTRIBUTIONS

7.1 CURRENT STATUS

Current parking rates in the Hornsby LGA impact the supply of parking in each precinct. The rates provided are generally based on 1 space per metre squared of GFA. The higher the GFA per 1 space, the less parking that is required by the developer, reducing the supply of parking provided for that development. Currently, all commercial and industrial developments in Hornsby LGA are required to provide adequate parking for both employees and visitors in accordance with the Hornsby Development Control Plan (HDCP).

7.1.1 DEVELOPMENT CONTROL PLAN (DCP)

The DCP prescribes the car parking requirements for each type of development within the Hornsby Shire. Figure 7.1 is an excerpt from the DCP which presents the parking rates.

Table: 1C.2.1(d) On Site Car Parking Rates (Excluding Development Listed in Table 1C.2.1(e) in the Epping Town Centre Core) - relevant extracts only

Type of Development	Car Parking Requirement	
	Sites < 800m from Railway Station	Sites > 800m from Railway Station
Residential Accommodation		
Dwelling Houses		
0-2 Bedrooms	1 space/ dwelling	
3 or more Bedrooms	2 spaces/ dwelling	
Secondary Dwellings (see Note*)		
0-2 Bedrooms	1 space/ dwelling	1 space/ dwelling
3 or more Bedrooms	2 spaces/ dwelling	2 spaces/ dwelling
Attached Dual Occupancy		
0-2 Bedrooms		1 space/ dwelling
3 or more Bedrooms		2 spaces/ dwelling
Medium Density Dwellings		
0-1 Bedroom	0.75 space/ dwelling	1 space/ dwelling
2 Bedrooms	1 space/ dwelling	1.25 spaces/ dwelling
3 or more Bedrooms	1.5 spaces/ dwelling	2 spaces/ dwelling
Visitors (see Note***)	1 space per 7 dwellings	1 space per 5 dwellings
High Density Dwellings (including Universal Design Housing**)		
Studio	Maximum 0.4 space/dwelling	
1 Bedroom	Maximum 0.4 space/dwelling	1 space/ dwelling
2 Bedrooms	Maximum 0.7 space/dwelling	1.25 spaces/ dwelling
3 or more Bedrooms	Maximum 1.2 space/dwelling	2 spaces/ dwelling
Visitors (see Note***)	1 space per 7 dwellings	1 space per 5 dwellings
Seniors Housing	per SEPP (Housing for Seniors or People with a Disability) 2004	
Tourist and Visitor Accommodation (see Note)**		
Bed & Breakfast Accommodation, Farmstay Accommodation	1 space/guest bedroom + 2 spaces for the permanent residents	
Short Term Rental Accommodation (Holiday lets)	Apply residential accommodation rates above	
Hotel or Motel accommodation	1 space/room + 1 space per 2 employees	
Caravan Parks	1 space/van, cabin or tent site	
Commercial Premises		
Business or Office Premises	1/48m² GFA	1/40m² GFA
Shops	1/29m² GLFA	1/20m² GLFA
Bulky Goods Premises	1/75m² GLFA, including space for cars with trailers	1/50m² GLFA, including space for cars with trailers
Restaurants or Cafes (ex drive-through take-away restaurants)	1/29m² GLFA	15/100m² GFA + 15/100 m² of outdoor seating area
Vehicle Sales or Hire Premises	1/150m² site area + 6 spaces/work bay	
Markets	2 spaces per stall (customers only)	
Marina	0.6 spaces/ berth	

Figure 7.1: Screenshot of excerpt from DCP Table 1C.2.1(d) car parking requirements

The required parking rates for Hornsby increase when the location of the development exceeds an 800 m radius from a railway station.

7.1.2 INTEGRATED LAND USE AND TRANSPORT STRATEGY (ILUTS)

The current DCP Car Parking rates are in line with the 2004 ILUTS and many local government Council's in Sydney.

In support of the DCP, the stated intention of Council's ILUTS is to balance the supply of and demand for parking spaces with the objective of minimising additional traffic generation through restraining car use, while ensuring the economic viability of each centre is maintained.

7.1.3 COMPARISONS WITH OTHER LGA'S

Table 7.1 presents a comparison of Council's parking requirements, for business or office premises as well as shops, with five other Local Government Areas DCP's.

Table 7.1: Comparison of LGA commercial and shop car parking rates

Local Government Area	Car Parking Rates incorporated in DCP	
	Business or Office Premises (minimum)	**Shops (minimum)**
Hornsby Shire Council	1/48 m² (< 800 m rail) 1/40 m²(> 800 m rail)	1/29 m² (< 800 m rail) 1/20 m²(> 800 m rail)
City of Willoughby	1/110 m² (inside railway precinct) 1/60 m² (outside railway precinct)	1/25 m²
The Hills Shire	1/40 m² (centre) 1/25 m² (non-centre)	1/18.5 m²
Ku-ring-gai Council	1/33 m²	1/26 m² (<400 m rail) 1/17 m²(>400 m rail)
City of Ryde	1/40 m²	1/25 m²
Northern Beaches Council	1/40 m² (Manly), 1/40 m² (Pittwater), 1/40 m² (Warringah)	1/40 m² (Manly), 1/30 m² (Pittwater), 1/16.4 m² (Warringah)

When comparing the business or office premises parking requirements with five other LGA's, Willoughby Council has almost half the required rates of Hornsby Shire. Hornsby Shire has either the same or lower parking requirements than the Hills, Ku-ring-gai, Ryde and Northern Beaches LGA's.

The LGA's of Willoughby, Ku-ring-gai and Hills also apply increasing parking rates to some types of developments as the location of the development becomes more remote from a railway station or town centre. All LGA's, including Hornsby implement minimum parking rates.

7.2 MINIMUM PARKING RATIOS

Minimum parking ratios are also known as parking minimums, parking rates, or minimum parking requirements. The parking ratios require that new developments provide a certain number of parking bays. This has been largely the approach taken in Council's Development Control Plan[15] which is related to the size and nature of the development, where size is generally measured in terms of gross leased area (GLA), bedrooms or employee numbers.

To a large extent, minimum parking ratios are a historical by-product of plentiful and inexpensive land and a lack of convenient payment technologies. The ratios were seen as a means of shifting responsibility for catering for parking demand onto private developers, thereby ensuring the safe and efficient operation of the local road network.

[15] Hornsby Shire Council Development Control Plan – 2013.

The methodology underlying minimum parking ratios is considered to lack accuracy and efficiency in the following ways:

***Uses Conservative Design Standards*:** Minimum parking ratios are typically designed so as to cater for most peak demands. This considers developments independently of the surrounding urban environment and ignores the potential to share parking resources between adjacent developments, leading to an oversupply of parking which is underutilised.

Results in Fragmented Parking Supplies: Because of the requirement for individual developments to cater for their parking demands, urban areas are increasingly dominated by fragmented parking areas.

Ignores Value: Minimum parking ratios ignore value and give no consideration to the marginal benefits and costs of additional parking bays. The costs of meeting minimum parking ratios tend to increase in district centres and growth corridors where land values are higher, thereby preventing intensification and redevelopment. This works against regional and local strategies designed to intensify development.

Unresponsive to Demand Management: There are numerous examples of cost-effective parking management measures that do not require increasing the supply of parking. Examples include shower and locker facilities for employees who walk or cycle, unbundling employee parking from salary packages, providing free passenger transport passes for employees, and developing workplace travel plans. Minimum parking ratios fail to account for demand management strategies and therefore provide no incentive for consideration of alternative transport modes.

For these reasons, minimum parking ratios are considered to be inaccurate and inefficient. It is also significant that the costs associated with minimum parking ratios have become disproportionately high in relation to their advantages.

With the benefit of overseas studies[16], it is apparent that the unintended negative consequences of minimum parking requirements outweigh their benefits in urban areas. These detrimental impacts have, to a large extent, been self-reinforcing and have created a cycle of motor vehicle dependence. This cycle occurs as a result of the following processes:

- Increased vehicle use creates additional demand for parking.
- This increased demand is then reflected in increased minimum parking ratios.
- These increased parking ratios then result in reduced urban density.
- Reduced urban density then stimulates increased vehicle use, repeating the cycle.

The net effect of free or subsidised parking is reduced urban density, increased sprawl, high rates of vehicle ownership and use, more expensive goods and services, as well as increased congestion, air pollution, and noise. This is an eventual scenario for the Town Centres if no action is taken. In short, current parking management practices contribute towards a host of expensive and undesirable consequences. This approach is unsustainable, especially with the anticipated growth of development in the Shire.

7.3 MAXIMUM PARKING RATIOS

Maximum parking ratios should be implemented to limit the oversupply of parking in the town centres. This will reduce the traffic congestion due to limited private vehicles travelling to the town centres and encourage use of other forms of transport. The concept that developers should provide all of their required parking on site should no longer be required. However, with maximum parking rates, the developer's contribution to shared parking facilities should also be required and managed through cash-in-lieu as detailed in Section 7.4.

[16] Parking Management Best Practices, Litman, T. (2006) Chicago, III, American Planning Association.

7.4 CASH-IN-LIEU

Many local governments give developers the option to pay a fee in lieu of providing the required number of parking bays imposed by parking ratios. This money is then traditionally used to supply public parking stations to cate for the parking demands within a town centre. ***Cash-in-lieu is particularly beneficial when parking needs to be limited.***

7.4.1 CURRENT STATUS

The current S711/S12 Development Contributions Plan for Hornsby Town Centre indicates that Council may provide off-site car parking facilities for commercial developments in exchange for a contribution by developers who cannot provide adequate car parking bays within their developments. The current Section S7.11 / S7.12 contribution rate is set at $27,626 per car parking bay.

Due to the current commercial development trends in Hornsby Town Centre, the additional public car parking that is to be funded from developer contributions is likely to be received at a slow rate over a protracted period of time, possibly over the next 20-30 years.

7.4.2 BENEFITS

An effective cash-in-lieu policy will provide many benefits[17]:

Policy Flexibility: Developers gain a new option. If providing all the required parking bays on-site would be difficult or too expensive, developers can pay the cash-in-lieu fee instead of constructing bays.

Shared Parking: Public parking bays built with cash-in-lieu revenue allow shared use among different sites whose peak parking demands may occur at different times (e.g. a bank and a bar), and fewer bays are needed to meet the combined peak parking demands.

Park Once: When all businesses have individual parking bays, they want only their own customers to park there. Once customers have left the premises, the owners want them out of the parking bays as soon as possible, requiring the customers to drive to another parking area in order to make a second stop in a nearby business. Shared public parking allows drivers to park once and visit multiple sites on foot, thereby reducing vehicle traffic and increasing pedestrian traffic.

Consolidation: Some councils also allow developers and property owners to pay cash-in-lieu fees to remove existing required parking bays. This option consolidates scattered parking bays, assists infill development, improves urban design, and encourages conversion of parking areas to higher-and-better uses that provide more services, yield more revenue, and employ more people. All property owners, not just developers, can use more of their land for buildings and less for parking.

Fewer Variances: Where providing the required parking is difficult, developers often request variances to reduce the parking requirements for their sites. These variances weaken the general plan, require administration, and can create unearned economic windfalls for some developers but not others. By making fewer variances necessary, cash-in-lieu fees allow councils to create a level playing field for all developers.

Better Urban Design: Parking requirements typically result in at-grade (surface) parking for smaller buildings that cannot support the expense associated with providing their own deck parking. Because cash-in-lieu fees allow businesses to meet their parking requirements without on-site parking, they allow continuous storefronts without 'dead' gaps created by parking or parking driveways. Public parking structures consume less land than would be required if each site provided its own on-site parking, and councils can place the structures where

[17] Shoup, Donald 2005, 'The High Cost of Free Parking. American Planning Association Chapter 9 at p.232.

they interfere least with vehicle and pedestrian circulation. The cash-in-lieu policy thus contributes to a better-looking, safer and more walkable environment.

True Value: Another important purpose of cash-in-lieu is that it reveals the high cost of providing parking bays especially if they will be subject to a low parking fee or are expected to be provided at no charge. Developers have the choice to pay for or provide their own parking and the flexibility to charge a fee for its use or provide it for free. Note that developers who pay the cash-in-lieu do not subsidise the commercial centre, and the commercial centre does not subsidise developers. Instead, developers subsidise parking.

7.4.3 CONCERNS

It is recognised that there are drawbacks to cash-in-lieu. However, developers' concerns as well as potential solutions are summarised below.

Lack of On-Site Parking: Parking is a valuable asset for any development, and a lack of on-site, owner-controlled parking can reduce a development's ability to attract tenants and customers and thereby reduce the value of the investment. This may be a valid objection, but its solution is simple: developers can provide the required parking rather than pay the cash-in-lieu fee.

High Fees: Councils may not build and operate parking facilities as cheaply as the private sector. Councils may pay extra to improve the architectural design of parking structures and these higher costs may increase the cash-in-lieu fees. Although this might happen, most councils set their cash-in-lieu fees lower than the full cost of providing a public parking space.

No Guarantees: Councils use the cash-in-lieu fee revenue to finance public parking, but they do not guarantee when or where the bays will be provided. To address this concern, some councils build the public parking first and accept cash-in-lieu fees only for the number of public bays already provided. The councils then use the cash-in-lieu fees to retire the debt incurred to finance the bays. Other councils such as the City of Vincent, are obliged to refund the in-lieu fees if they have not built the public parking within a certain time. Councils can also allow developers to defer payment of the cash-in-lieu fees until the public parking bays are built.

Fewer Parking Bays: Councils use cash-in-lieu fees to finance public parking bays, but they do not commit to provide one public space for every private bay not provided. Often they provide fewer. Some provide two public parking bays for each three cash-in-lieu fees paid. When this happens, the cash-in-lieu programs reduce the total number of parking bays. A smaller parking supply may lead to fewer customers and put businesses at a competitive disadvantage. There are two responses to this last concern. First, the more efficient use of shared public parking enables a smaller parking supply to meet the combined peak parking demand. Instead of many individual parking areas being underused much of the time, the Council has fewer but larger parking facilities used throughout the day. Second, if the Council collects cash-in-lieu fees to finance public parking bays instead of granting variances to reduce parking requirements, the cash-in-lieu policy will increase the parking supply.

Time Lag Gap: The establishment of appropriate levels of funding for the construction of additional parking supply solely using cash-in-lieu contributions takes time. When commencing from a zero balance, it is often the case that it requires a minimum of five years contributions to reach sufficient cash levels to construct a maximum of 300 bays, combined with a lead in period of twelve months and a similar construction timetable, it could be up to seven years before a sustainable scheme is in place.

7.4.4 CALCULATION OF THE FEE

There are two basic approaches to setting cash-in-lieu fees. The first is to calculate an appropriate fee on a case-by-case basis for each development or change in land use. The second is to charge a uniform fee for all projects. The case-by-case approach is complicated, time consuming and expensive to administer. It also creates uncertainty for developers.

The following formula that is used in the ACT is proposed for the calculation of the fee in applicable centres of the LGA.[18]

$$C = A1 \times (((A2/A3) \times A4) + (A5 \times A6))$$

The six variables for the formula are set out in Table 7.2. It requires a land value for each precinct and a construction cost per space. The land value should be based on a valuation for each precinct set by the Council every 2 years.

Table 7.2: Variables for formula

Variable name	Unit	Variable description
C	$	Total cash-in-lieu contribution
A1	spaces	Number of parking spaces required under planning scheme which are not being supplied
A2	m^2	Land area per space
A3	levels	Number of building levels (including parking levels)
A4	$/$m^2$	Land value per m^2
A5	m^2	Floor area per parking space
A6	$/$m^2$	Construction cost

7.4.5 OPTIONS FOR COUNCIL

Council has several options to raise funds for the construction of shared parking in existing developed areas:

- Amend the cash-in-lieu formula as above.
- Charge a fee based on land and construction.
- Implement compulsory cash in lieu for all new development which have a short fall in parking.

The fee is to be based on a formula which takes into account the land value for each commercial centre set by the Council every 2 years and the cost of construction.

It would be practical for the fee to be discounted by Council to a maximum of 50%, subject to the development meeting any of the following criteria:

- The developer can show access to alternative options to accommodate the transport access requirements of those potential users of the development for whom on-site parking will not be provided
- There exists adequate provision for car parking in the proximity of the proposed development
- The development will contribute significantly to the streetscape and will encourage the upgrading of the locality
- Council is satisfied that public transport facilities are available to satisfy the transport access demands of employees, residents and visitors to the development.

This discount would provide a benefit to both Council and the developer, and thereby encourage investment.

Note: A developer shall not receive the benefit of both a reduction in the parking ratios and the discount on the cash-in-lieu fee. Council may grant a reduction of up to a maximum of 50% either under the planning ratios or under cash-in-lieu but not both.

[18] ACT Government, Parking Supply Option Study, Luxmoore Parking Consulting Report No. 001239, 24 May 2010.

7.4.6 USE OF FUNDS

Most councils specify that the funds be used to provide off-street public car parking, either in the vicinity or anywhere in the commercial centre or precinct.

Limiting the use of cash-in-lieu generated funds to provide public parking is restrictive and assumes that additional parking is both necessary and desirable. In view of the importance of integrating transport policy and management and the competition for limited funding, it is clearly desirable that the funds raised be available for transport purposes in general. This should include services and infrastructure, such as funding a shuttle bus to serve the commercial centres.

8 SMART TECHNOLOGY

8.1 CAR SHARING

Car sharing is a rapidly growing industry with an increasing number of highly competitive providers. The critical issue faced by suppliers is securing exclusive car sharing spaces at a convenient pick-up point.

Car sharing is an affordable, convenient and sustainable transport option for residents and businesses. Car sharing enables sustainable travel habits and provides increased connectivity. Additionally, car share provides for efficient use of parking space where a single car share vehicle can replace more than 10 private vehicles which would otherwise compete for the same parking space. Car sharing differs from traditional car rentals in several ways:

- Reservation, pickup, and return is all self-service.
- Vehicles can be rented by the minute, by the hour, as well as by the day.
- Vehicle locations are distributed throughout the service area, and often located for access by public transport.

In the City of Sydney almost 31,000 residents and businesses have joined one of the 3 car share schemes that operate in Sydney. Members can book a car online whenever they need one and pick it up from one of close to 700 nearby parking spaces.

As at March 2020 Hornsby has one car share operator in the Shire with 5 vehicles in two locations, Hornsby Westfield and Kennard's Hornsby. 801 residents and businesses in the Hornsby LGA have signed up to the program and membership is growing.

The introduction of additional car sharing schemes in the Shire (short term – next 18 months) will reduce private vehicle use, traffic congestion as well as the demand for on-street parking.

8.2 ALTERNATIVE FUELS

8.2.1 DRIVELESS VEHICLES

Driverless vehicles underpin the creation of a whole new city structure and architecture. It is critical that they are recognised as a central element in future transport planning. Parking infrastructure and spaces will give way to different land uses. If a driverless vehicle car share scheme is implemented, offices and homes may no longer have to factor in car parking spaces as part of the development requirement.

As per the Thought Leadership Parking Paper[19] the general impacts on parking across all parking types may include:

- Significantly reduced parking demand
- Greater space efficiency
- Increased visual impact
- Increased public safety (less opportunity for theft, crashes, assault)

[19] Australia & New Zealand Driverless Vehicle Initiative, 'Thought Leadership Paper – Driverless vehicles and parking' – 23 May 2017.

- Money-saving advantages
- Potential for less income generated from providing parking (parking fees, permits and
- infringements)
- Major road infrastructure investment.

In the future, Council will need to review zoning laws and parking requirements. If autonomous vehicles become the dominant transport mode and car ownership drastically declines (e.g. if a driverless vehicle car share scheme is implemented), these requirements would no longer be relevant. Where houses already have one or two garages, this area could be converted into other more useful space (e.g. bedroom) or reduced in space. The Council will also have to re-evaluate the parking supply and revenue forecasts as a result of declining demand and reduced infringements.

Council planners, landlords, regulators, and lessors must investigate planning mechanisms for newly-constructed and future car parking facilities to ensure they are future proofed and can be adapted or converted to a different land use.

The introduction of driverless cars, combined with changing transport trends by Australians, will bring substantial changes to the parking ecosystem within the longer term (next 5-10 years).

8.2.2 AUTONOMOUS VEHICLES AND PARKING

The advent of autonomous vehicles may have significant implications for parking, including with regards to its size and location. In turn, this may have ramifications for town planning.

The precise nature of the autonomous vehicle transformation will be directly influenced, among other things, by the ownership model favoured by users, be it shared or private, and the market acceptance of this new and continuously improving technology. The uncertainty surrounding these influencing factors makes predicting their impact on parking challenging.

It is generally considered that autonomous vehicles will reduce the need for parking to be located at, or close to, where people spend time. For example, the model of shopping centres being situated with parking around them may become a thing of the past.

With an autonomous vehicle dropping you off and picking you up at the touch of an app, there is no need for vehicles to be stationed close to the shopping centre.

While these developments may be some way off in the future, testing and development of car parks to take advantage of autonomous vehicles is already taking place. For example, in Somerville, Massachusetts, at Assembly Row, the city of Somerville, along with Audi's Urban Future Initiative and the Federal Realty Investment Trust, are working on a car park design that could cut needed parking space by 62 percent.[20]

However, if it turns out that autonomous simply replace the volume of privately-owned, non-autonomous vehicles on highways today, the demand for car parking may not change significantly in the future; the average car utilization today is 5 percent. As such, the number of vehicles on our highways, and the need to park them, would likely remain constant. There might still, however, be potential to relocate car parks to cheaper land away from the city core, and possibly accommodate more vehicles in the same amount of space, as per the Somerville example above.

If a 'mobility-as-a-service' or 'fleet' model of ownership eventuates – where users hire an autonomous vehicle to make a trip (either by themselves or through ride-sharing) and upon completion of that trip, the vehicle is hired by another user – the need for parking may be limited to the wait time between pick-ups. In this case,

20 HTTPS://WWW.CURBED.COM/2016/8/8/12404658/AUTONOMOUS-CAR-FUTURE-PARKING-LOT-DRIVERLESS-URBAN-PLANNING

car parks may transform themselves into service centres where fleet vehicles are maintained and fuelled/charged in preparation for their next hire.

The reality is that it is likely we will see the coexistence of autonomous vehicles ownership patterns – with autonomous vehicles privately-owned initially and shared increasingly by users who opt to hire autonomous vehicles from fleets. It is also possible that private owners will surrender their cars when the car is not in use, encouraged by car manufacturers keen to maximize the owner's return from a highly depreciating asset. Fleet companies will not be able to supply enough vehicles to service all potential demands, particularly in rural areas, and users underserved by fleets will want to own an autonomous vehicle to guarantee mobility.

KPMG has produced the following chart, presented as Table 8.1,on the impacts of the different scenarios for the uptake of autonomous vehicles and the impacts on parking.[21]

Table 8.1: The Impact of AVs on Parking: 3 Scenarios

Impact	Private (1)	Shared use, single occupancy (2)	Shared use, multiple occupancy (3)
Number of car parks	Equivalent to today, subject to whether vehicles can re-position themselves in different locations on the public road network	Lower than Scenario 1. Fewer vehicles require parking and duration of stay reduces.	Significantly lower than Scenario 1. Significantly fewer vehicles require parking.
Location	Basic autonomy will permit drop-off and parking, lots still need to be located near destination. Higher autonomy will allow drop-off at destination and parking located elsewhere	Car parks could be located in cheaper, out of town locations during periods of lower demand.	Car parks located at key destinations with high demand to provide spare vehicles and servicing centres.
Parking revenues	Same as today or greater	Reduced due to less time spent in car park and fewer parked vehicles.	Significantly reduced due to less time in car park and significantly fewer parked vehicles.
Type of facility	Same as today. Opportunity to widen service offer	Car parks transformed to become service centres and waiting areas until AV is requested by 'user'	
Operational capacity	Capacity optimised (more vehicles, same space)	Fewer spaces needed than Scenario 1	Significantly fewer parking spaces needed than Scenario 1
Rate of change/ implementation	Gradual implementation of AV floors (e.g. one floor at a time)	Big bang (i.e. once Uber decide to do this it will happen quickly)	Subject to local market conditions and familiarity with ridesharing

Similarly, ride sharing services such as Zipcar may also reduce the need for space dedicated to parking.

The impact of the shift to electrification will also be significant, given that most autonomous vehicles are likely to be electric. When there are hundreds of thousands, even millions of electric vehicles entering the city, there will also be many thousands of charging points to keep them 'fuelled' with power. Most of these charging points will be inside car parks, not on the street.

Car parks will therefore need to modernise to feature charging stations and become connected environments with internet access.

It is thought that smarter cars will result in smaller parking spaces, with less development costs associated with parking. As technology advances and more cities begin to adapt, the shift may lead

21 HTTPS://HOME.KPMG/XX/EN/HOME/INSIGHTS/2017/07/PARKING-DEMAND-IN-THE-AUTONOMOUS-VEHICLE-ERA.HTML

more and more local governments to begin to figure out how to repurpose empty parking areas or start moving car parks to the edge of town, given that autonomous vehicles will eventually be able to valet themselves.

8.2.3 ELECTRIC VEHICLES

The Electric Vehicle Council reports globally, there was a 56 per cent increase from 2016 to 2017 in sales volumes and there are now more than 3 million electric vehicles on the road. There were also significant technological shifts in 2017 with several new lower cost models coming to market, along with continued decreases in electric vehicle battery costs. Further, several countries have announced their intention to ban the sale of petrol and diesel vehicles and several global automakers have put forward extensive plans to electrify vehicles.

The number of charging stations in Australia has also substantially increased, with a 64 per cent increase from 2017 to 2018. This currently equates to approximately one charging station for every six electric vehicles. An important consideration for electric vehicles and charging infrastructure is the source of electricity used to power the vehicle. Analysis across all states and territories in Australia shows that an average electric vehicle charged from the grid in 2016 emitted less than an average internal combustion engine vehicle in all states except Victoria, where it is only slightly higher.

Table 2. Public charging infrastructure in Australia.

		ACT	NSW	NT	QLD	SA	TAS	VIC	WA
Total number of charging stations		20	161	5	162	76	21	216	122
Charging stations per 100,000 residents		3.17	2.04	2.03	3.27	4.40	4.02	3.40	4.72
Total #	AC	17	148	5	138	70	21	208	107
	DC	3	13	0	24	6	0	8	15
Total #	Capital City	20	86	3	58	32	4	114	77
	Regional	0	75	2	104	44	17	102	45

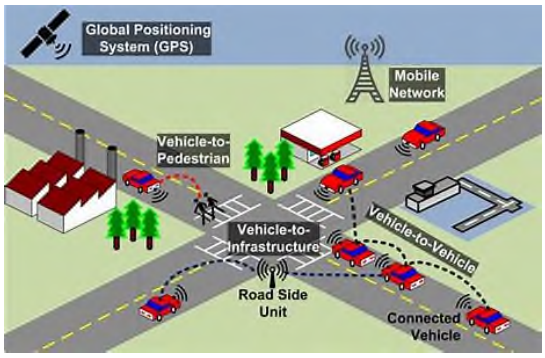
Source: PlugShare (2018) and Australian Bureau of Statistics (2018)

There will be a requirement in the short to medium term for designated electric vehicle on-street charging bays in the Shire.

8.3 TRAVEL PLANS

8.3.1 COOPERATIVE INTELLIGENT TRANSPORT SYSTEMS

Cooperative Intelligent Transport Systems (C-ITS) allow vehicles to communicate with other vehicles, infrastructure, road users (including pedestrians) such as traffic signals, beacons and smart phones, that are fitted with the same system. Drivers then receive alerts about upcoming hazards and traffic information. The technology is sometimes referred to as *connected vehicles*.



The C-ITS device sends and receives information to and from other equipped vehicles and infrastructure 10 times a second. It uses that information to determine if a conflict is likely, based on comparing its own location, direction and speed to those of the other vehicles.

Drivers can be warned of risks on the road ahead, over the crests of hills or around bends. International C-ITS trials have indicated these systems can improve safety and reduce congestion.

Cooperative Intelligent Transport Systems will improve the safety of both pedestrians and drivers in the on-street parking environment in the short term (next 18 months).

8.3.2 MOBILITY AS A SERVICE

Mobility as a Service (MaaS) is a simple, easy-to-understand service model that enables customers to plan and pay for their journeys using a range of services via a single customer interface, such as a mobile phone application.

It enables access to MaaS to a broad range of transport services and provides customers with more choices of travel modes. MaaS relies on sharing real time information across different transport service providers which are consolidated into a single MaaS provider. It assists users and helps them to optimise their journeys by planning and purchasing (usually via a phone application) their end-to-end journey. Users can choose from a range of travel options, such as travelling by public transport, rideshare or bike hire. In real time, the phone application then guides the customer through their journey.

Data drawn from customers via a MaaS platform helps providers offer more personalised services and can also link customers to non-travel related products such as restaurant delivery, event ticketing and retail. MaaS platforms are already being used in other countries such as Finland and Sweden.

The emergence of Mobility-as-a Service is a clear indicator that commuters will increasingly favour a pick-up and drop-off service, which will reduce demand for multiple parking options, and allow those spaces to be repurposed for other uses.

9 LATEST AND EMERGING TECHNOLOGY

9.1 SMART PARKING APPROACH

A recent ITS research paper[22] estimated that nearly 30% of urban congestion is created by drivers cruising for parking. Uncertainties that generate such congestion include searching for on-street parking availability complicated by the need to minimise walking distance or make timely appointments or connections.

For the Shire to be a smart, liveable and sustainable in the future, the Council should adopt a Smart Parking approach to parking.

Smart Parking technology is ultimately not only about driving up productivity and service, but also demonstrating a long-term greener value to customers. Smart Parking options are designed to lower operation costs and improve revenue through increased occupancy. Differentiating parking services, e.g. bundling parking with promotions and advertising, and providing up-to-date information about vacant spaces, are a number of approaches growing the value of parking resources, both as a revenue generator and a real estate asset.

This section reviews parking control systems, payment systems and guidance systems appropriate for a future parking system for the Shire. The analysis and comparisons with innovative technology in other cities are summarised to assist the Shire to achieve the two fundamental objectives underlying this approach; customer service to drivers and efficient management of parking bays.

Drivers travelling into Town Centres tend to begin and end their trip without uncertainty about parking details or burdensome planning and searching. Some of the details include which route to take or when to leave, given traffic or weather, and which parking facility to select based on price, walking distance to final destination and other intangibles. Other driver needs may include bus or rail connections to an event, or the availability of electric charging stations or car/ride sharing. Most personal navigation devices can guide drivers to the correct block but cannot guide them the last several metres to a vacant parking bay which suits their requirements.

This approach does not assume that all on-street parking under the control of the Council will be priced. Some precincts will only be time restricted, while others will have no restrictions. There are still opportunities to utilise technology in these ‘free’ parking areas in order to provide high levels of customer service and optimise use of the scarce parking resources, such as clear indication on the Council’s website of all available free parking options.

The technologies considered in this report for the management of on-street parking are divided into five major categories:

- Parking Control Systems (PCS) – ticket machines, pay by space, pay by plate and virtual phone-based systems.
- Parking Payment Systems (PPS) – cash, credit card and smart phones.
- Parking Guidance Systems (PGS) – in-ground sensors, wayfinding and space indicator signs.
- Compliance – enforcement technologies.
- Information systems – integration of the data available from all of the systems into valuable management information to ensure effective achievement of the Council’s strategies, such as Integrated Transport and Development.

[22] Smart Parking and the Connected Consumer, ITS America Research December 2012. Steven H Bayless and Radha Neelakantan.

A detailed description and examples of the respective technologies is provided in Appendix C. Section 9.2 summarises the different technologies as well as their benefits, drawbacks and suitability for implementation on-street within the study areas and recommendations are proposed for staged implementation.

9.2 BENEFITS AND DRAWBACKS

Table 9.1 highlights the relative benefits and drawbacks for each type of system and considers their customer service and efficiency.

9.2.1 PARKING CONTROL SYSTEMS – TICKET MACHINES, PAY BY SPACE, OR VIRTUAL PHONE-BASED SYSTEMS

Table 9.1: PCS benefits and drawbacks

	Benefits (+)	Drawbacks (–)
Pay and display	• Paid time overlap (> 10% revenue). • Unlimited layout of spaces. • Spaces do not need to be marked. • Automatic issue of ticket and receipt (credit card). • Easily relocated /expanded to additional spaces. • Alternatives available if a machine is not working. • Can be used on- and off-street. • Easily understood by the public. • Less queries on infringements. • More detailed transaction data available from every ticket issued. • A two-part ticket can be used for discounts/validation.	• Extra walking distance. • Uses more paper. • Additional maintenance costs due to more moving parts. • Awkward for some parkers, such as disabled or parents with small children.
Pay by space	• Shorter walking distance for drivers. • Paperless - more environmentally friendly. • Less moving parts therefore less maintenance. • More efficient for enforcement as rangers only visit the machine, not each space. • Receipt can be generated on demand.	• Restricted number of spaces. • Spaces must be marked and numbered. • Overlap is used, unless machine resets to zero. • No alternative if a machine is not working. • Not used off-street. • Inconvenient to relocate. • Numbering requires maintenance. • Fixed fee structure encourages overlap. • Confusing for some parkers, especially elderly.
Pay by plate	• Paid time overlap (> 10% revenue). • More efficient for enforcement and can target repeated offenders. • Spaces may not need to be marked. • Less queries on infringements. • Unlimited layout of spaces. • Paperless - more environmentally friendly. • Can be used on- and off-street. • Discourages free parking period over multiple visits (i.e. drivers moving vehicles for free parking).	• Extra time consumed to enter plate numbers may result in lengthy queues. • Possible error when typing in the number plate. • Higher maintenance on keypad. • Confusing for some parkers, especially elderly.
Mobile phone	• No machines on-street. • No maintenance costs. • Paperless – more environmentally friendly. • Can be used on- and off-street. • Very low set up costs.	• Assumes all drivers have a smart phone. • Detailed signage required. • Administration for debt collection. • Requires sophisticated enforcement software. • No receipt available.

PND is easy to understand and use and, therefore, the level of compliance is high. A major drawback in a Town Centre is that it requires drivers to walk to the machine and then back to their car to display the ticket. This can be inconvenient for parents with small children or disabled parkers.

PBS and PBP both require the parker to remember to enter their bay number or their registration number. They are not popular with drivers who want a receipt or ticket showing proof of payment.

PND is the most popular form of on-street metering device in Australia and Europe, with more than 80% market share.

PND allows optimal distribution of the machines because they are not linked to specific numbered bays. If one machine is not working, another machine can be used by the driver to issue a ticket. This option is not available with PBS.

PBS and PBP only require the enforcement officer to visit the machine to determine the paid status of each vehicle, rather than each individual space as with pay and display. The officer need only attend a space if the vehicle has overstayed.

9.2.2 PARKING PAYMENT SYSTEMS

It is expected for the next 5 years at least, there will be continuing requirement for coin payment, although as the public grows to expect alternative means of payment, coin only technology will diminish[23]. At this time, not everyone carries a credit card or a smart phone.

'Cash and chip and pin payments will remain for some time yet as slow adoption of contactless readers by parking operators is coupled with a general lack of understanding of contactless payments among consumers.'[24]

Credit card usage (by insertion or wave and pay) is a growing market share at on-street parking machines. While some of the systems are cumbersome, data from a number of Australian City Councils shows payment by credit card at >75% and increasing.[25] Machines that issue a ticket serve the dual purpose of providing a form of receipt for the credit card payment.

The use of smart phones with the Apple pay feature would require an upgrade to most existing Pay-wave readers currently used on parking machines.

Reduced quantity and frequency of cash collection is a major benefit. Additionally, less cash provides less opportunity for revenue leakage or theft.

Drivers paying by credit card are less likely to overstay their time because they are not limited by a shortage of coins.

Table 9.2: Cashless and contactless benefits and drawbacks

	Benefits (+)	Drawbacks (-)
Cashless and contactless	• Improves compliance (accommodates for drivers not having coins or cash). • Reduces the frequency of coin and note collection costs. • Minimises opportunity for cash mischarge. • Minimises the possibility of downtime due to coins or notes jammed in machine.	• Lag in payment due to authorisation and transaction of credit cards. • Potential fraud activity with credit cards. • Compliance with PCI and EMV regulations is essential.

23 Parking Payment Systems – Parking Review Essential Guide. October 2012. Landor Links Ltd.

24 Parking Payment Systems at page 23, per Peter Alcock of CreditCall.

25 Stonnington Council, Victoria. 2015.

	Benefits (+)	Drawbacks (-)
	• The use of 'pay wave' or contactless cards (chip and pin) also minimises time required for signature or pin number key in.	

Payment by smart phone is to be distinguished from a variety of other parking-related information available in smart phones. Payment by smart phone is convenient, especially for disabled parkers and for drivers who do not wish to walk to a machine. It also offers the opportunity to top up the time paid from a remote location by adding a further payment. This, however, may be contrary if the Council wishes to ensure a high churn of parking spaces in the Town Centre.

Payment by smart phone essentially links back to a credit card, details of which must be supplied at the time of registration of the phone number.

Payment by smart phone is easier than by cash, but it does not always ensure the provision of a receipt as proof of payment.

Table 9.3: Smart phone and virtual permits benefits and drawbacks

	Benefits (+)	Drawbacks (-)
Pay by phone	• Reduces and may eventually eliminate the need for coin collection; thereby improving audit control and efficiency of collecting parking income. • Parking payments made in the privacy and comfort of the customers vehicle. • Paperless - more environmentally-friendly. • Extension of parking time payment can be made from any phone and anywhere. • With a more convenient way to pay, a higher percentage of people comply with parking rules and regulations. • Allows for the introduction of variable fee structures depending on demand for spaces at certain times. • Considerably easier for disabled drivers. • More efficient for enforcement - allows officers to view by zones and individual bays from a mapping system, highlighting paid spaces, and for how long some spaces have been expired. • Offers text message expiry reminders to improve compliance and customer service.	• No alternative if user does not own a smart phone / credit card or have access to the internet. • Possible human error when entering bay identification or zone number. • Payments are usually exact and will not have a high amount of collection variance. • No alternative if the server or website is down. • Confusing for some parkers, especially the elderly. • Top up may be contrary to council policy if time restrictions are exceeded. • Fee is approximately 40c/transaction. This can be shared between the user and the provider.
Virtual permits	• Savings in face-to-face and physical operations. • Reduced administrative pressure at Council offices. • Cost effective 24 x 7 service. • Applications processed, managed and approved online.	

Enforcement officers require sophisticated hand-held devices with back-to-house wireless connectivity to interrogate payment by drivers for their vehicle. Despite many recent announcements by European, British, American and Australian cities offering smart phone payment options, the take-up has been very slow. In Australia, less than 5% of transactions at on-street parking is paid by smart phone despite some systems having been installed for several years (North Sydney, Fremantle, Melbourne). While this method of payment offers convenience to drivers, the cost/benefit to the council of establishment and maintenance of the supporting infrastructure may be negative.

9.2.3 PARKING GUIDANCE SYSTEMS – IN-GROUND SENSORS, WAYFINDING, SPACE INDICATOR SIGNS

Table 9.4: PGS benefits and drawbacks

	Benefits (+)	Drawbacks (–)
In ground sensors (PODS)	• Accurately recording vehicle arrival and departure time - including overstays. • Can be integrated with mobile handheld device and produce notification of overstaying vehicles. • Improves efficiency and accurately records the infringement type, location details, offence details and signage regulation. • Can be integrated with dynamic signage to advise drivers of spaces available prior to arriving at car park. • Buried beneath the pavement, hence reduces the chance of vandalism.	• Need to transmit back-to-house to a central server for efficiency. • High cost of maintaining/repairing if sensors become faulty – requires small amount of pavement removal. • Battery life over extended term has not yet been proven.
CCTV Analytics	• Accurately recording vehicle arrival and departure time - including overstays. • Can be integrated with dynamic signage to advise drivers of spaces available prior to arriving at car park. • Reduced infrastructure cost for camera deployment. • Can use existing CCTV infrastructure. • 1 camera can cover up to 100 spaces. • Also recognizes vehicles cruising in search of a parking space.	• Need to transmit to a cloud based central server. • CCTV cameras require external power supplies. • Camera maintenance and adjustment required. • Changed weather conditions may alter accuracy.
Wayfinding (dynamic signage, PGS)	• Provides real-time parking information to drivers. • Reduces vehicle congestion caused by vehicle idling and circulating for parking space. • Reduces carbon dioxide released due to vehicle idling. • Reduces driver frustration. • More attractive for drivers and hence increase the chance of revisiting. • Improves the perception of availability of spaces.	• Needs to be integrated with in-ground parking sensors for each on-street bay at significant cost. • May be a safety issue as it may confuse/ distract drivers when driving. • Additional set up and maintenance costs.

9.2.4 COMPLIANCE – ENFORCEMENT TECHNOLOGIES

Table 9.5: Compliance benefits and drawbacks

	Benefits (+)	Drawbacks (–)
Enforcement (issuing fines)	• Improved productivity (no manual chalking or input). • Officers only need to carry one device to detect overstaying vehicles and issue infringements. • Licensed enforcement technology can be loaded onto Android smart phones. • Portable printers connected via Bluetooth to smart phone to print enforcement notices. • Enforcement technology can be loaded onto Android smart phones. • Accurately records activity and management reports for data analysis and assessment. • Improves compliance.	• Needs to be integrated with in-ground parking sensors or CCTV analytics. • Weight of some machines.

	Benefits (+)	Drawbacks (–)
ANPR/ LPR	• Camera captures each vehicle number plate. • Plate information can be used for different enforcement purposes such as report on abandoned vehicles and raise alerts on vehicles of interest (e.g. stolen vehicles and repeat offenders). • Plate information can also assist in reporting on parking duration and specific customer trends. • Identifies fraudulent parking ticket activity. • Discourages free parking period over multiple visits (i.e. drivers moving vehicles for free parking). • Improved officer safety and comfort. • Drive by provides additional element of security.	• Camera may also capture random numbers other than number plates (such as advertising phone number on vehicles). • Additional set up and maintenance cost for camera equipment.

9.2.5 INFORMATION SYSTEMS

Table 9.6: Technology integration benefits and drawbacks

	Benefits (+)	Drawbacks (-)
Technology integration	• Maximises the potential of all invested equipment. • More efficiency and accuracy and greater flexibility with data. • Easy to monitor and less labour intensive.	• Increase in maintenance costs. • May affect terms of warranty. • All systems become dependent on the integration program. If integration program fails, all other systems may not be able to function as standalone.

9.3 CASE STUDIES

Many local governments are installing and using smart technologies to assist in the management of parking. Five examples of case studies are provided below.

9.3.1 GOLD COAST COUNCIL - QLD

The Gold Coast Council have invested $7.5 million to deploy both PbB and pay by plate parking machines with in ground sensors to monitor bay activity throughout Surfers Paradise, Broadbeach, Bundall, Burleigh Heads and Southport. The system includes a smart phone App to provide bay availability, length of stay and payment. GCC are currently trialing a scheme in the Burleigh Heads and Broadbeach precincts to remotely adjust parking rates quarterly based on demand data received from the inground sensors. The demand responsive pricing allows the new parking technology to set pricing according to local parking demand. In low demand streets prices will decrease. In high demand streets parking prices will increase.

9.3.2 MOSMAN COUNCIL - NSW

Mosman Council have deployed over 1,000 in ground sensors in on and off-street locations with overhead guidance indicators and LED parking availability signs. The Council has also introduced a smart phone parking availability App. The introduction of the parking technology is providing:

- Improved parking user experience for free and paid parking, both on and off street.
- Decreased user travel times and time spent ‘circling’ for parking and congestion and reducing user carbon footprint through reduced emissions.
- Improved user compliance and parking enforcement efficiency.
- Improved access to local businesses.

9.3.3 ADELAIDE CITY COUNCIL - SA

The initial project saw the installation of 55 sensors completed and another 2,800 scheduled to be installed. They have also developed a customised smart phone App - Park Adelaide – which will be launched once the hardware install has been completed. The App will provide drivers with:

- Visibility of available bays.
- Send reminders when their time is running low.
- Allows for remote topping up if more time is needed.

9.3.4 MORETON BAY REGIONAL COUNCIL - QLD

Due to increased visitation and parking demand Moreton Bay Regional Council have installed 358 in-ground sensors which monitor and relay individual bay status to communication units installed around the site to provide a live network of connectivity. This real-time information is then sent to the Cloud to allow:

- Processing and analytics.
- Display site visibility.
- Specialised reporting to operators at the Council.
- Remotely control individual parking bay rules.
- Reset sensor behavior after analysing individual bay usage for peak times and typical length of stay.

9.3.5 CITY OF HOBART – TAS

The City of Hobart is currently rolling out PbB meters, inground sensors and a smart phone App. The new meters are replacing the existing parking meters and voucher machines located in the City Centre, Salamanca Place, Dunn Place, Condell Place and Lefroy Street car parks. Each parking bay have a unique 3- or 4-digit number painted on the kerb.

The smart phone app will allow users to pay by phone, top up parking to the maximum time allowed on the go and send a notification advising the parking session is about to expire. Payment is also available by coins or a credit / debit card. The inground sensors installed supports the mobile phone payment system and provides the City with information regarding parking usage to help with future planning.

9.4 VISION FOR SMART PARKING TECHNOLOGY IN THE SHIRE

The key elements of new technology in the next 5–10 years will focus on customer service and efficiency and opportunities to add value to the Town Centres.

Cash payments are decreasing with the move towards more convenient cashless payment increasing. A wide range of payment options will be available for drivers. Besides pay and display machines, there will be credit and debit card-accepting terminals, online booking options and payment via smart phone.

Real-time information on the location and availability of vacant bays will be available in several formats including wayfinding signage, parking guidance systems, variable message signs, apps and in-car information. Importantly, drivers deciding to travel to the town centre will be aware of various options to park, whether they be off-street, on-street or in unmetered areas.

However, rather than new payment technologies simply replacing existing ones, the future probably lies in the increased integration of parallel payment channels. In this way, drivers will be offered a choice of options, both physical and virtual.

All parking systems – physical and virtual – are becoming smarter. Paying for parking used to be an anonymous affair. A driver pulled into a car park or up at the kerb, paid coins into a basic meter and then went about their business. Local authorities and parking operators would have a personal relationship only with people who bought monthly permits and drivers who received an infringement notice.

The growth in cashless parking allows parking providers to build up more of a relationship with their customers. For example, when a driver pre-books a parking space online, uses a credit card at a payment terminal or sets up a phone parking account, there is the potential to start interacting with the motorist as a customer. Account-based systems in particular, allow parking operators to analyse the behaviour of customers, giving detailed insights into an individual's frequency, duration and spend on parking. Where the parking operator has phone and email contacts for an account holder, it is possible to tailor special rates and third party offers from local retailers, restaurants and theatres.

The desirable vision for Smart Parking in the Shire includes the following functionality:

- If a driver requires a parking space, the drivers will input on their mobile phone their final destination. Through the on-board GPS on their mobile phone, the Council Parking App will recognise the driver's current location and automatically determine available parking spaces near the destination. The App will then provide real-time information including pricing, availability, the quickest route as well as other pertinent information.
- Online tools available (QuickPay) for the parking provider (Council) to access the system's database and provide information about the parker, including their parking history, times of usage and demographic information. The provider can then use this information to market products and services, much the same as online retailers' market to potential customers.
- If the provider notes that a number of customers park at times that relate to an event that occurs regularly near the facility, they can be contacted by text or email and offered special rates or reservations for their convenience.
- In an on-street environment, the parker scans a QR Code on a sign at the parking space, or if available, uses a 'near-field communication' tap to capture the information on their cell-phone.
- The system can remind a parker if they are running out of time and offer to allow them to add more time if desired, without having to return to their vehicle. It can also tell the driver where their car is parked and direct them to it if they are lost.

Smart Parking will significantly improve customer service by offering better guidance, quicker location of bays and more convenient methods of payment, increased efficiency in the use of parking bays.

Council will still require officers to undertake enforcement, however, there will be far less time spent on implementation of the process. Compliance will be measured using in-ground sensors or CCTV analytics and vehicle-mounted LPR.

10 RECOMMENDATIONS

10.1 STRATEGY AND ACTIONS

Better managed parking will have a quadruple bottom-line benefit for all stakeholders in the Shire. Implementation of the recommendations coming out of this study will deliver the following benefits:

- **Economic** – Support increased and sustainable development in the Town Centres with more efficient use of land for both parking and other land uses. Parking costs can be minimised and congestion appropriately managed.
- **Social** – Support a shift to higher density, which allows more housing and jobs that are easily accessible but may also reduce the amount of available land, because at-grade parking may be converted to buildings, which may or may not incorporate parking.
- **Cultural** – Placing a price on parking along with more effective monitoring of compliance will create more turnover of spaces in high activity areas and free up more bays for the correct users. This will attract more activity and investment to higher density areas.
- **Environmental** – Until cars become electric and do not emit pollution, emissions will increase in line with increases in parking supply. Additional supply will attract more vehicles to already congested town centres.

Recommendation 1 (i)

Explore opportunities to maximise the use of existing supply, including the application of technology to provide information, shared parking arrangements, the use of loading-zones outside of business hours, and promotion by the Council of all off-street public parking facilities. When these are available to the public, the focus is to be on maximising the use of all existing parking resources to the greatest extent possible.

Recommendation 1 (ii)

Coordinate the parking study for the Shire with an integrated transport strategy. The integrated transport strategy is to incorporate five sustainable parking principles:

- Focus on people movement rather than vehicle access.
- Provide efficient and effective alternatives to car access.
- Parking policy and strategy must support sustainable transport.
- The appropriate amount of parking for a centre will be well below the unconstrained demand for parking.
- The provision of parking requires a demand management, not a demand satisfaction approach.

10.2 TRAVEL DEMAND MANAGEMENT

Recommendation 2

Curtail the supply of additional parking and manage parking to constrain demand.

10.3 MANAGE PARKING AS AN ASSET

Recommendation 3

Optimise the use of existing parking resources before building new facilities.

10.4 TRANSPORT MODE SHIFT

Recommendation 4 (i)

Improve the public realm for pedestrians, cyclists and public transport users' needs during the next decade to encourage transport mode shift. Implement better pedestrian paths, dedicated bicycle routes and quality end-of-trip bicycle facilities in support of sustainable transport initiatives. Additionally, a bicycle sharing scheme could be trialled at a few locations within a town centre such as Hornsby to determine the utilisation of such a scheme.

Recommendation 4 (ii)

Prioritise access for pedestrians, cyclists, public transport users and people with disabilities, and make the most of public transport infrastructure, balanced with the needs of the road network, including the need to minimise congestion. Additionally, undertake educational and media campaigns to inform parkers of the advantages of using sustainable transport options.

10.5 INTRODUCE IMPROVED WAYFINDING AND SMART TECHNOLOGY

Recommendation 5 (i)

Introduce or review wayfinding signage in all town centres and improve it to guide drivers to the off-street car parks. This signage would be best placed along the main roads leading into the town centres. The signs should indicate if the parking is short, medium or long-term parking. Directing drivers to available off-street parking ensures premium on-street parking is available for short term parkers. Clear, concise parking wayfinding signage assists drivers to find parking more efficiently, reducing the circulation of vehicles in the town centres.

Recommendation 5 (ii)

Clearly and consistently sign for drivers the approach to the entrances to Council owned and maintained off-street car parks.

Recommendation 5 (iii)

Implement smart technology in some of the town centres. The real time information on the signs will show the number of available bays remaining in a car park and will help drivers to make early parking decisions before they turn off the main road into the town centre. This technology will involve the installation of parking technology at the entrances and exits of car parks to provide the real time information to the smart technology signs. This information should be available on the internet.

10.6 HIERARCHY OF PARKING

Recommendation 6

Implement a hierarchy of parker user groups in determining parking policy. This will consider which uses have priority to a specific section of parking supply. Consider the nature of the surrounding land use and the function that the particular road plays in the overall transport network. This allows for different priority within the same neighbourhood depending on the adjacent generators of kerbside demand. See report for recommended hierarchy of parkers. This should include pick up/drop off opportunities throughout the precincts in highly desirable locations such as near train and bus stations.

10.7 PARKING OCCUPANCY SURVEYS

Recommendation 7

Undertake parking occupancy surveys consistently at the same time each year not only as a snapshot of parking demand, but to assess how demand is changing. Surveys in high demand areas should be undertaken

once every two years, and once every five years in areas of less demand. Surveys should measure occupancy, duration of stay and compliance with restrictions, and the results should identify peak time occupancy and average occupancy for each street.

10.8 EVIDENCE BASED APPROACH

Recommendation 8

Use an evidence-based approach to develop a framework for consistent and transparent decision-making to promote the efficient, fair and equitable use of available street parking to where and when pricing and time restrictions need to be introduced.

This will require undertaking parking surveys to establish parking demands and availability during these periods as well as measuring parking occupancy, turnover and compliance to the existing controls.

An analysis of current use of space in the neighbourhood being examined should be undertaken together with an assessment of potential future use of space in the next 3 to 5 years.

10.9 TIME LIMITED PARKING RESTRICTIONS

Recommendation 9

Alter and expand time limited parking restrictions to provide consistent and appropriate parking opportunities. Driver confidence in finding an on-street parking space within the town centre is increased with the limiting of parking times to two or three per town centre. Parking surveys provide parking demand information which has been used to assess the appropriateness of the time limited parking restrictions in each town centre.

On-street parking in a high demand area, particularly near the middle of the town centre. Further from the town centre, the demand for on-street parking decreases but remains a recommended short to medium term opportunity. On the fringe of the town centre the on-street parking can be unrestricted. An alternative option is the installation of limited 10P parking bays.

Typical days that parking time limits are applied in town centres is Monday – Friday 8am to 5 or 6pm and Saturday 8am to 12pm. Each area will have slightly differing demands on weekends and the appropriate time limits need to take into consideration the adjacent land uses.

10.10 INTRODUCE PAY PARKING

Recommendation 10 (i)

Engage a sub-contractor to implement pay parking as a tool to encourage transportation mode choice. Utilise current parking enforcement staff to monitor and manage pay parking.

Pay parking will improve the turnover of vehicles to improve the likelihood of finding a premium parking space in the town centres. Drivers will typically think more about their parking needs and times when they are required to pay to park. The more turnover of vehicles in the high demand parking areas allows more clients, customers and visitors to shop, dine, do business and to be entertained in the Hornsby Shire.

The introduction of pay parking utilising various forms of new technology will benefit all stakeholders. Improved turnover of bays and the consequential increased availability of parking for all users will improve accessibility. The increased volume of short stay parkers visiting the precincts will generate increased sales for local

businesses and create the opportunity for them to subsidise customer parking. It is recommended on-street pay parking be introduced in the medium term.

Recommendation 10 (ii)

Upon the introduction of pay parking, adjust parking rates up or down with the goal of maintaining an average 85% occupancy at peak times.

An occupancy range of 70-90% is considered an acceptable range. An occupancy rate of approximately 85% ensures that parking resources are well-used and people can park in reasonable proximity to their destination.

Recommendation 10 (iii)

Implement the following on-street and off-street parking fee structure (in 2019 dollars) to the areas of pay parking:

ON-STREET BAYS:

- **Town Centre and high Demand Tourist Areas: First 30 minutes free and thereafter $1.50 per hour to a maximum of $6.00 (4 hours).**

OFF-STREET BAYS:

- **First hour free and thereafter $1.00 per hour to a maximum of $4.00 per day (4 hours).**

Recommendation 10 (iv)

Undertake a pay parking trial on high demand streets in the Hornsby Town Centre, prior to the shire wide implementation.

While there will always be some resistance to the introduction of pay parking, it is important that all stakeholders understand that, as the number of vehicles on the roads increases and parking supply does not increase at the same rate, short-term parkers will find it more and more difficult to find a vacant bay. If this is allowed to continue unmanaged, the attractiveness of commercial precincts will decline. Drivers do not go to a precinct because the parking is free. They require confidence in being able to easily access the precinct.

The estimated income and costs to introduce pay parking are included in Section Appendix A.

10.11 ALLOCATE PAY PARKING REVENUE

Recommendation 11 (i)

Write into policy that revenue received from pay parking to be exclusively used for maintenance and upgrade of parking equipment and facilities, the improvement of active transport between centres of high activity and peripheral parking and pedestrian and cyclist facilities generally within Hornsby Shire.

Providing community accessibility through the improvement and expansion of cyclist and pedestrian facilities using parking revenue shows residents that they benefit from the implementation of pay parking.

Recommendation 11 (ii)

Information on how pay parking revenue will be utilised should be communicated to residents as part of the communication regarding the introduction to pay parking.

10.12 TECHNOLOGY

Recommendation 12 (i)

Incorporate technology into on-street parking policy to enable the provision of real-time management data into a MaaS system. Provide live-streamed wayfinding and bay availability to prospective users of the on-street parking.

New technology used to manage on-street parking should have the functionality to provide demand data in a simple to analyse format which can support the Council's decision making when determining expansion of time restricted or pay parking areas and the revision of prices. The technology should be capable of easily adapting to new developments, especially alternative payment and communication options. The data derived from the system should assist cross-divisional input and output within Council. For example, using a pay by plate on-street parking system can provide Council with trip origin data of all parkers which will be useful to Council's Planning and Compliance Division when considering future development.

Recommendation 12 (ii)

New technology be used to assist in enforcement including handheld enforcement devices and LPR surveillance which decrease the time taken to issue tickets and in return increase compliance with parking restrictions. This will discourage long term parkers from using the short- and medium-term car parks and allow bona fide users to find a parking space.

Recommendation 12 (iii)

Consistent and regular enforcement is the best way to encourage good parking behaviour as drivers know that if they don't comply with the parking restrictions they will be fined. It should be used as a tool to encourage turnover, giving drivers equal parking opportunities.

The effectiveness, benefits and impacts of pay parking are directly linked to compliance. An average occupancy initially recorded as 85% may well be only 75% when more effective enforcement is introduced.

10.12.1 RECOMMENDED TECHNOLOGY

Recommendation 12 (iv)

LPR ticketless technology is employed to manage pay parking in both on-street and off-street parking. This will include the installation of Pay by Plate (PbP) parking machines, in-ground parking sensors and a mobile LPR system for enforcement.

The PbP parking machines should accept payment by cash, credit/debit card and mobile phone App. In accordance with RMS guidelines, less machines will need to be installed compared with Pay and Display (PnD) ticket machines as parkers will not be required to return to their vehicles from the machine to place a ticket on the dashboard. The mobile phone payment App should also be integrated to provide live streamed bay availability and guidance to drivers.

Each on-street and off-street bay is to have an in-ground parking sensor installed. In-ground sensors will allow an enforcement officer to patrol once and to easily determine whether a vehicle has parked in excess of any restrictions. Smart parking technology will provide real-time information of available parking capacity in on-street and off-street car parks, statistical information on the use and turnover of all spaces and increase the turnover of available spaces due to reactive and targeted enforcement. The sensors and parking machines will provide detailed demand data reporting and analytics which will negate the need for future utilisation

surveys to be undertaken in the installed areas. Additionally, by agreement with RMS, trip origin data can be retrieved from the licence plate data.

Recommendation 12 (v)

Enforcement of both pay parking and time restricted parking areas is to be undertaken using a mobile LPR system. This will include on vehicle LPR cameras, licensed smart phones and associated hardware and software which will improve the efficiency of the parking officers by enabling more frequent patrols of the time restricted areas and targeted patrolling of the pay parking areas when integrated with the parking sensors.

As an example, Table 10.1 presents an estimate of the costs associated with the implementation of pay parking in the Hornsby Hospital Precinct for 150 on-street parking bays located on Lowe Road and Palmerston Road, between Lowe Road and Burdett Street.

Table 10.1: Bill of quantities and estimated costs Hornsby Hospital Precinct road segment

Hardware/Firmware/Software	Quantity	Unit Cost	Total Cost
Pay by Plate parking machines	15	$11,000	$165,000
Parking Sensors	150	400	60,000
Repeaters	12	2,000	24,000
Licence fees and system software*	1	5,000	5,000
Mobile LPR enforcement system *	1	2,500	2,500
Enforcement software & setup*	1	1,500	1,500
Civil works/line marking/signage	1	20,000	20,000
Contingency @ 15%			$41,700
Total			**$319,700**

** Apportioned unit costs.*

This equates to approximately $2,130 per bay.

10.12.2 STAGED IMPLEMENTATION

This vision for on-street parking technology in the Council will not be achieved in the short term (< three years) and will evolve and change as technologies improve.

In order to achieve the two strategic goals of optimising the use of on-street parking and improving the performance of on-street parking services for all stakeholders, it is recommended that the Council implement the following technology improvements:

In the short term (within three years):

- Prepare a monitoring and pay parking implementation procedure, which will provide Council transparent documentation, guidelines and triggers for a regular survey procedure to identify areas where paid parking should be implemented. The trigger for implementing paid parking is if peak parking is regularly trending at about 85%, it is then appropriate to introduce paid parking. The survey results indicate that parking exceeded 85% during peak periods in a significant number of streets and precincts.
- Prepare and implement sophisticated technology which is environmentally-friendly. Offer multiple forms of payment including payment by smart phone.

- Trial the use of vehicle-mounted LPR to assist patrolling, especially of time restricted areas.
- Implement a pilot paid parking and bay monitoring system (parking sensors) in the limited precincts.
- Implement a smart phone App for available spaces and guidance.
- Implement PCS, PPS and PGS software providing a common denominator for recording payment and reporting for all on-street related equipment.

In the medium-term (four to seven years):

- Implement a pilot parking guidance system in a particular precinct (e.g. introduce Vimoc technology near Town Centres). This is to be integrated with all off-street parking in the precinct.
- Integrate the information on all on and off-street parking into a single integrated Council parking service.
- Provide a region-wide PGS embracing wayfinding and space availability and linked to apps and website searching.
- Implement flexible, demand-based pricing structures for on- and off-street parking.
- Install in-ground sensors or CCTV analytics in high demand streets.

While much of the new technology for Smart Parking will significantly improve customer service by offering better guidance, quicker location of bays and more convenient methods of payment, increased efficiency in the use of parking bays will not occur solely as a result of technology. Smart Parking requires a fundamental change in the way parking is priced and managed by the Council.

Council parking management need the ability to alter the price of parking depending on demand. If prices are changed only once a year in July, they will not react to changing patterns of demand and will therefore not encourage the most efficient use of bays. Prices must be allowed to fluctuate within reasonable parameters depending on demand.

10.12.3 PROCUREMENT CONSIDERATIONS

Council need to consider the following with regard to available technology options during the procurement process:

- Latest emerging technology.
- Latest tested technology
- Monitoring and enforcement functionality.
- Future integration with wayfinding systems, Council website and phone Apps.
- Future proofing capabilities including expansion, upgrade and Integration.
- The level of service and maintenance support to be provided.
- The availability and cost of spare parts.
- The monitoring, control, flexibility, enforcement and system reporting capabilities of the technology.
- Maintaining consistent technology across all precincts.

10.13 ENHANCE PARKING GUIDANCE

Recommendation 13

Provide information for parking on the internet covering all precincts, with pricing, time restrictions, locations of car parks and real time availability to assist users to find a vacant bay, reducing the time wasted in searching for a car park.

10.14 ENCOURAGE UNBUNDLED PARKING

Recommendation 14

Talk to the proprietors of adjacent shops and businesses to propose they unbundle their parking and share a larger area of parking between a group of shops and businesses. This will provide more availability of spaces

for customers and clients. It creates a more cohesive parking area rather than segregated areas where drivers need to check each bay to determine if the bay is reserved for a business.

10.15 LOBBY STATE GOVERNMENT FOR MORE BUS SERVICES

Recommendation 15

Lobby the State Government for more bus services to be provided from the surrounding suburbs and stopping at the bus interchanges and near the train stations in the town centres. More bus services will reduce the need for parking supply in the town centres.

This effort from Council should be communicated to the residents so that they know Council is trying to provide alternative transportation options in the Shire.

10.16 INVESTIGATE MORE BICYCLE LANES AND PATHWAYS

Recommendation 16

Investigate the provision of more bicycle lanes to improve mode share in the Hornsby Shire. Sustainable transportation requires the installation of more cycling facilities for a wide range of users.

On-street options should be investigated but may not be appropriate due to the high traffic flows and limited lane widths on existing roads. It is envisaged the expansion of available cycle lanes will encourage transport mode shift.

With the provision of further bicycle lanes/paths, further end of trip facilities should also be provided. This includes secure bicycle parking, lockers and showers where appropriate.

10.17 ENHANCING THE PEDESTRIAN EXPERIENCE AND SAFETY

Recommendation 17

Provide designated pedestrian pathways, pedestrian crossings and pedestrian refuge islands where proposed in the specific precinct recommendations. This will improve connectivity with parking areas and improve pedestrian safety. Accessibility for pedestrians requires enhancement in most precincts.

The lighting in some of the town centres along pedestrian routes should be reviewed and improved to meet Australian Standards. This is of importance for pedestrian crossings and streets that have a high night time pedestrian flow.

10.18 CASH-IN-LIEU

Recommendation 18 (i)

Base the cash-in-lieu fee on a formula which considers the land value for each commercial centre set by the Council every 2 years and the cost of construction. The cash-in-lieu fee for all projects is charged, but with a regular adjustment to the fee that is more accurate of parking construction costs.

10.18.1 PAYMENT BASIS

Property owners/developers complying with the criteria shall make payments in lieu of providing a proportion of required on-site parking in accordance with the following:

- Not less than the sum of the construction cost to the owner plus the value of that area of the applicant's land that would have been allocated to parking spaces including access and manoeuvring areas.
- The value of the land shall be based on an independent valuation that is current at the time of the application.
- The cash-in-lieu fee shall be based on the formula as set out below.

C = A1 x (((A2/A3) x A4) + (A5 x A6))

The six variables for the formula are set out in Table 7.2. It requires a land value for each precinct and commercial centre and a construction cost per space. The land value would need to be reviewed every two years.

This fee sets the benchmark for the true cost that would otherwise be incurred by the lessee/developer.

- The fee may be discounted by Council to a maximum of 50%, subject to the development meeting any of the following criteria and no other reduction on parking supply having been permitted:
- The developer can show access to alternative options to accommodate the transport access requirements of those potential users of the development for whom on-site parking will not be provided
- There exists adequate provision for car parking in the proximity of the proposed development
- The development will contribute significantly to the streetscape and will encourage the upgrading of the locality
- Council is satisfied that public transport facilities are available to satisfy the transport access demands of employees, residents and visitors to the development.
- The cost accounts for any on-street parking that is resumed to construct a driveway to the new development.

10.18.2 ALLOCATION OF INCOME

Recommendation 18 (ii)

Allocate income received as parking cash-in-lieu to a special fund for accessibility improvements including:

- Purchase of land for parking.
- Construction of parking spaces by council or within a joint venture.
- Implementing smart parking technology.
- Improving parking information systems.
- Real-time transit information system.
- Security lights and improved pathways to access parking area.
- Cycle paths and other cycling support facilities.
- Upgrading the design of on-street parking facilities.

10.18.3 RECORD-KEEPING

To maximise developer, buy-in and ensure a streamlined process, it is important to ensure that there is an effective record-keeping process to manage cash-in-lieu contributions. This system would track payments by developers, current land and construction costs, infrastructure works and planning. Maintaining a transparent process of cash-in-lieu through which developers can see direct value will assist in achieving both mandatory and voluntary contributions.

10.19 PARKING RATIOS

Recommendation 19 (i)

Include measures to maximise the use of all non-resident parking for the public as shared parking, and the expansion of time limited and pay for parking to encourage turnover (churn) of bays in regulations related to the provision of parking.

Recommendation 19 (ii)

Undertake a detailed floor space survey and re-evaluate the existing parking rates against future growth estimates.

Recommendation 19 (iii)

Implement mandatory maximum and minimum parking requirements in some precincts in order to achieve an appropriate level of parking supply. Set a maximum on the total supply of parking in the central core precincts.

Recommendation 19 (iv)

Implement, subject to community consultation, the existing 1 per 48sqm. GFA within a radius of 800 m of a railway station minimum parking requirement for business and office premises as a maximum requirement and introduce a minimum requirement of 1 per 60sqm GFA.

Recommendation 19 (v)

Amend the parking requirement for shops to 1 per 29 sqm GFA maximum and 1 per 35 sqm GFA minimum.

Recommendation 19 (vi)

Implement a radius of 800 m around a railway station.

Recommendation 19 (vii)

Offer special dispensation on a case by case basis to developers willing to incorporate car share schemes in a development.

Recommendation 19 (viii)

Implement a residential development parking requirement within 800m radius of a train station should provide 1 space per 1-2-bedroom residence and 2 spaces per 3+ bedroom residence.

10.20 PARKING CONTROL AND MANAGEMENT PLAN

Recommendation 20

Require a parking control and management plan (PCMP), as per the attached Draft annexed as Appendix B, to be provided by developers, together with their building application as part of the development assessment process for all developments requiring more than five spaces. Reference to the PCMP should be included in the parking policy, together with penalties for non-compliance.

10.21 MAXIMISE EXISTING PARKING INVENTORY

Recommendation 21

Optimise the use of existing parking resources before building new facilities.

10.22 COMMUTER PARKING

Recommendation 22 (i)

Provide commuter parking primarily on or accessed via major approach roads on the boundaries of the town centres, to minimise the impact of commuter parking and commuter traffic on the operation of the internal road network.

It should not be Council's responsibility to provide commuter parking.

Recommendation 22 (ii)

Provision of commuter parking should not be a priority for Council when considering the appropriate use of parking infrastructure in a central activity area. Commuters should be encouraged to seek alternative and more sustainable and environmentally friendly forms of transport rather than prioritising vehicle usage. The priority should be for Council to encourage visitation by maintaining a sufficient inventory of short stay parking. This will instil confidence in the minds of all visitors in believing it is 'easy' to park near their final destination within the precinct. This will in turn inevitably encourage future business investment.

Recommendation 22 (iii)

Do not directly increase the commuter parking inventory within the Hornsby LGA. Rather, lobby TfNSW to provide appropriate commuter parking supply commensurate with current and forecast levels of demand. This parking supply is to be provided outside of the core business and retail areas within the LGA.

Additionally, it is noted TfNSW have commenced a pilot scheme to introduce access control in commuter car parks. Non-commuters will be discouraged by the implementation of parking fees and transport mode shift will be encouraged.

Recommendation 22 (iv)

Consider the potential future impacts on shopkeepers and staff currently using the commuter car parks in the precincts.

10.23 ON-DEMAND SHUTTLE BUS

The New South Wales government is currently trialling an on-demand shuttle bus service.

Recommendation 23

Liaise with the state government and undertake comparative surveys to identify the impacts of the service of on-demand shuttle buses on parking. This service will significantly reduce the high demand for commuter parking whilst reducing travel time for commuters.

10.24 CAR SHARE

Recommendation 25

Implement Council's Car Share Policy regarding car share vehicles and the installation of dedicated parking (pods) for these vehicles. Allocate two on-street parking bays for each town centre for the use of car share vehicles on a twelve-month trial basis. The usage of car share vehicles is to be carefully monitored and the allocation of bays revised where necessary.

10.25 ELECTRIC VEHICLE CHARGING

Recommendation 26 (i)

Investigate the installation of charging facilities for electric vehicles. This service should offer short term parking plus a fee for the provision of a rapid charge.

Recommendation 26 (ii)

Do not provide long term electric vehicle charging facilities on-street. Figure 10.1 presents examples of electrical vehicle charging stations.

Figure 10.1: Examples of on-street and off-street electric vehicle charging stations

Recommendation 26 (iii)

Implement a pilot scheme with two electric vehicle charging stations to be installed in the Dural Lane, Dural Street and Aquatic off-street car parks as well as two on-street bays on each of Jersey Street and Hunter Street.

10.26 EDUCATION

Despite every driver being a parker, the broader environmental, economic and social impacts of parking are rarely understood or appreciated by users, unlike their understanding of the effects of vehicle use. The clamour for more parking has been allowed to develop without any communication of its negative effects, and its growing unsustainability. This is true in the Shire where the Council's website relating to parking is very regulation-oriented. An upgraded and on-going campaign of communication on the unsustainability of current parking practices is required.

An education program needs to be aimed at all stakeholders including planners, developers, designers, retailers, tenants, elected officials and council officers, business and community groups, students, residents, visitors, commuters, and the general public.

Recommendation 27 (i)

Regularly communicate to the public the education and appreciation of the unsustainability of current parking demand through Council's publications.

The community need to understand that:

- Drivers cannot expect unlimited parking close to their destination.
- Unlimited supply has environmental, social and economic drawbacks.
- Parking needs to be sustainable.
- There is a cost for the provision of parking.
- Parking users need to help to share the cost of parking infrastructure equitably.
- Net surplus from parking services are to be reinvested into improving access and transport infrastructure.

Having a very informative parking website for shoppers, visitors, employees and residents will help to educate the community about considering a range of possible parking options.

Recommendation 27 (ii)

Establish a Stakeholder Group that includes Council staff and representatives of Business Associations, residents and other stakeholders for the purpose of community engagement. The Stakeholder Group will provide a sustainable forum to gather community input and consult with Council for reform and solutions addressing specific parking issues.

Appendix A PAY PARKING COSTS AND INCOME

A.1 PROPOSED METER NUMBERS AND LOCATIONS

The identified areas for the introduction of paid parking are split into two, on-street and off-street.

A.1.1 ON-STREET Paid Parking

Normally, parking meters are installed on-street to service up to six parallel parking bays. Therefore, six parallel parking bays have been used as the basis for feasibility as well as provision of parker convenience. The more meters that are provided, the greater the convenience for drivers.

When considering on-street angle parking, 10-12 bays per meter, depending on specific street locations, have been allowed.

Table A 1 presents the number of parking meters required for on-street paid parking.

Table A 1: Number of parking meters required for on-street paid parking

Location	Angle bays	Parallel bays	Total bays	No of meters
Hornsby Town Centre				
Coronation Street		6	6	2
High Street		14	14	2
Hunter Street south of Burdett Street		2	2	1
Florence Street from Albert Street to Albert Lane southern side		10	10	1
Station Street in place of existing 1/4P and 1/2P parking spaces		6	6	2
Peats Ferry Road from High Street to Coronation Street		19	19	3
William Street from Peats Ferry Road to Frederick Street		44	44	8
Government Road except for existing P parking zone		13	13	2
Hunter Lane from Burdett Street to George Street		27	27	4
Hunter Street from Burdett Street to Linda Street		54	54	9
Hunter Street from Linda Street to Bridge Road western side		28	28	4
Florence Street from Albert Street to Muriel Street		24	24	4
Albert Street south of Florence Street eastern side		7	7	1
Dural Street from Peats Ferry Road to Frederick Street except for the current no parking zone		11	11	3
Peats Ferry Road from Coronation Street to Jersey Lane	29	15	44	6
Jersey Street from Coronation Street to Jersey Lane	69	35	104	16
Total	*98*	*315*	*413*	*68*
Hornsby Hospital Precinct				
Lowe Road from Palmerston Road to Derby Road	50	25	75	8
Derby Road from Lowe Road to Burdett Street	45	56	101	16
Burdett Street from Derby Road to Balmoral Street	48	21	69	5
Palmerston Road from Burdett Street to Lowe Road		54	54	6
Total	*143*	*156*	*299*	*35*

Location	Angle bays	Parallel bays	Total bays	No of meters
Waitara study area				
Pattison Avenue	17	36	53	8
Hornsby Street from Leonard Street to the end		15	15	2
Leonard Street from Hornsby Street to Pattison Avenue		18	18	3
Waitara Avenue from Park Lane to end	65	41	106	10
Alexandria Parade northern side from Romsey Street to Waitara Avenue	19		19	3
Leonard Street from Pacific Highway to Hornsby Street		18	18	2
Hornsby Street from Pacific Highway to Leonard Street		21	21	4
James Street from Pacific Highway to Leonard Street		27	27	4
James Lane from Pacific Highway to Pattison Avenue		4	4	1
Romsey Street from Pacific Highway to Pattison Avenue		13	13	2
Waitara Avenue from Alexandria Parade to Park Lane	9	18	27	3
Pacific Highway southern side from Unwin Road to College Crescent		10	10	2
Pacific Highway northern side from Carden Avenue to College Crescent		42	42	4
Waitara Avenue from Pacific Highway to end		6	6	2
Total	*110*	*269*	*379*	*50*
Total on street	***351***	***740***	***1,091***	***153***

A.1.2 OFF-STREET Paid Parking

Off-street parking requires fewer meters as many of the bays are located end-to-end as well as being angled parking. A meter can be centrally located to service up to 40 bays. Allocations have been site specific, based on topography and layout.

The average number of off-street bays serviced by each meter is 25.

Table A 2 presents the number of parking meters required for off-street paid parking.

Table A 2: Number of parking meters required for off-street paid parking

Location	Angle bays	Parallel bays	Total bays	No of meters
Hornsby Town Centre				
Dural Lane and Dural Street car parks	132		132	4
Total	132		132	4
Total off street	***132***		***132***	***4***

A.2 ESTIMATED COSTS

Table A 3 presents the indicative capital costs, on-going costs for year 1 and total costs for year 1 of 5 paid parking options.

Table A 3: Establishment, Year 1 on-going and Year 1 total costs

Costs	Per Meter	Hornsby Town Centre	Hornsby Hospital Precinct	Waitara study area	Total
Capital Costs					
PbP or PbB Meter	$10,000	$720,000	$350,000	$500,000	$1,610,000
PbB Parking Sensors	$12,700	$914,400	$444,500	$635,000	$1,993,900
PbP LPR	$10,000	$720,000	$350,000	$500,000	$1,610,000
PbP LPR/Parking Sensors	$12,700	$914,400	$444,500	$635,000	$1,993,900
Phone App/Parking Sensors	$3,000	$216,000	$105,000	$150,000	$471,000
On-going Costs Year 1					
PbP or PbB	$1,100	$83,200	$38,500	$55,000	$172,700
PbP Parking Sensors	$1,980	$142,560	$69,300	$99,000	$310,860
PbP LPR	$900	$64,800	$31,500	$45,000	$141,300
PbP LPR/Parking Sensors	$1,380	$99,360	$48,300	$69,000	$216,660
Phone App/Parking Sensors	$100	$7,200	$3,500	$5,000	$15,700
Total Costs Year 1					
PbP or PbB	$11,100	$799,200	$388,500	$555,000	**$1,742,700**
PbB Parking Sensors	$14,680	$1,056,960	$513,800	$73,400	**$2,304,760**
PbP LPR	$10,900	$784,800	$381,500	$504,500	**$1,711.300**
PbP LPR/Parking Sensors	$14,080	$1,013,760	$492,800	$704,000	**$2,210,560**
Phone App/Parking Sensors	$3,100	$223,200	$108,500	$155,000	**$486,700**

A.2.1 Enforcement Costs

With regards to enforcement, Table A 4 presents the indicative capital costs, on-going costs for year 1 and total costs for year 1 of 5 paid parking options.

Table A 4: Enforcement establishment, Year 1 on-going and Year 1 total costs

Costs	Per Enforcement device	9 Enforcement Staff	Enforcement setup, implementation and deployment	Total
Capital Costs				
Android Phone	$2,000	$18,000	$30,000	$50,000
Enforcement software license	$1,000	$9,000		$9,000
Bluetooth infringement printer	$700	$5.600		$5,600
On-going Costs Year 1				
Enforcement licenses	$1,000	$9,000		$9,000
Thermal printer paper	$500	$4,500		$4,500
Total Costs Year 1				
Android Phone	$2,000	$18,000	$30,000	**$50,000**
Enforcement software license	$1,000	$9,000		**$9,000**
Bluetooth infringement printer	$700	$5.600		**$5,600**
Enforcement licenses	$1,000	$9,000		**$9,000**
Thermal printer paper	$500	$4,500		**$4,500**

A.2.2 On-going Annual Costs

The continuous operation of on and off street parking meters and ground sensors attract on-going annual costs, as shown in Table A 3 and Table A 4. These costs may vary depending on the type of meter, its location and reporting method, solar or mains power to operate the meter, type of ground sensor and their communications method and the enforcement technology and on-going licencing costs.

Based on previous experience and knowledge of other projects these costs may include the following:

- Supervision and administration of the complete system.
- Cash collection fees.
- Credit card clearing fees.
- 3G/4G data network reporting costs.
- Paper rolls – receipt costs.
- Software licensing, cloud hosting and online support for ground sensors.
- Enforcement software licensing.
- Electricity for meter power and safety lighting.
- Insurances.
- On-going maintenance costs after the warranty period has expired.

A.3 ESTIMATED INCOME

A.3.1 Revenue Forecasts

Based on a conservative assumption of 50 weeks per annum with a 75% level of compliance, Table A 5 presents the estimation of income per bay.

Table A 5: Income per bay

	6 bays
Estimated volumes per day (6 bays)	**Total $ per annum**
Location	
0900-2100 Mon-Fri (6 bays x 6 hrs x 85% occupancy x 75% compliance x $1.50/hr x 5 days x 50 weeks)	$8,606
0900-2100 Sat-Sun (6 bays x 2 hrs x 85% occupancy x 75% compliance x $1.50/hr x 2 t/over x 2 days x 50 weeks)	$2,300
Total	**$10,906**
Income/bay	**$1,818**

The financial feasibilities below are annual. They amortise the initial expenditure and make no allowance for fee increases from time to time.

Table A 6 and Table A 7 employ all the assumptions to estimate the net surplus per annum, excluding any escalation in fees, for on-street and off-street parking respectively.

Table A 6: On-street paid parking annual net surplus

On-street		Hornsby Town Centre	Hornsby Hospital Precinct	Waitara Study Area
PbP bays		545	299	379
PbP meters		72	35	50
Revenue per bay	$1,818	$990,810	$543,582	$689,022
Establishment cost per meter over 7 years	$2,457	$176,904	$85,995	$122,850
On-going annual cost per bay	$550	$299,750	$164,450	$208,450
Annual Net surplus		$514,156	$293,137	$357,722

Table A 7: Off-street paid parking annual net surplus

Off-street		Hornsby Town Centre
PbP bays		132
PbP meters		4
Revenue per bay	$1,818	$239,976
Establishment cost per meter over 7 years	$2,457	$9,828
On-going annual cost per bay	$550	$72,600
Annual Net surplus		$157,548

Appendix B DRAFT PARKING CONTROL AND MANAGEMENT PLAN

Proposed Parking Control and Management Plan to accompany Development Application

1. Background

- Describe objective of this Parking Control and Management Plan
- Property address
- Property description

Number of parking bays per category, e.g. tenant bays, short stay bays, mobility bays etc.

Number and category of bicycle bays to be managed (if applicable)

Other property details

- Operational Responsibilities and Contact Details
- Landlord
- Day to day management of car park
- Day to day management of all parking including motorcycles, bicycles and mobility bays

2. Conditions

- General Conditions relating to the Precinct Parking Plan

  Examples include:

  - Short stay turnovers
  - Tenant and public parking bays used for those purposes in accordance with the Development Approval
  - Mobility bays clearly marked and set aside for exclusive use
  - Loading/unloading bays clearly marked and set aside for exclusive use
  - Leasing of tenant bays to off-site tenants
  - On-going availability of bicycle end of trip facilities

Proposed Parking Control and Management Plan to accompany Development Application

3. Surrounding area

Details of parking on properties within 250 m of the pedestrian entry to the premises located on the property.

Property name and address	Type & No. bays	Method of control	Fee (if any)
1.	Reserved Tenant All day Short-term Loading Mobility Other TOTAL		
2.			
3. etc.			

4. Details of Public Transport and pedestrian facilities serving the premises

Appendix C LATEST AND EMERGING TECHONOLGY

C.1 Parking Control Systems

Ticket machines

There are a variety of parking control systems available in Australia which can accommodate different needs. The machines are known by different names.

Pay and display (PnD)

Also known as ticket parking machines, these are stand-alone machines which are commonly used in on-street and large car parks, where drivers park and walk to their closest machine, select and pay for the duration of stay they require. The machine produces a ticket recording the time and date of purchase and the expiry time and date. The driver will then display this ticket in a visible location (usually under the windscreen) so that compliance officers will be able to view it during inspections. It is the most common form of on-street ticket parking system in Australia.

It is also used in off-street surface and a few deck car parks where boom gates are not practical, such as at remote parking facilities for park and ride or for special events.

There are many different manufacturers and suppliers of ticket machines in Australia

Figure C 1: Pay and display machine (Newcastle NSW)

Pay by space (PBS)

Also known as 'multi-bay meters', they are similar to pay and display, except they do not issue a ticket but require the driver to insert their parking bay number and then pay for their selected time. Drivers pay for the duration of stay at the closest machine according to the parking bay number marked on the ground (or otherwise displayed). Pay by space is a greener option than pay and display as it does not produce tickets and requires less maintenance, because of less moving parts.

Most manufacturers of pay and display also offer pay by space and pay by plate (refer Virtual phone based systems (APPS) Figure C 4).

Figure C 2: Pay by space machine (Melbourne VIC)

Pay by plate (PBP)

Similar to pay by space, these do not issue a ticket but require the driver to insert their vehicle registration number and then pay for their selected time. The machine requires an alphanumeric keypad which allows drivers to type in their vehicle registration number, then select and pay for the duration of stay they require. Tickets are not issued but receipts can be provided.

Figure C 3: Pay by plate machine (Brisbane QLD)

Virtual phone-based systems (APPS)

Virtual phone-based systems are also known as ticketless systems. This is a payment by smart phone for your vehicle registration number that can be added to many electronic parking pricing systems. The mobile acts as a meter recording the commencement time and counts down the duration of the stay according to the payment made. Smart phone-based applications allow drivers to top up payment to extend their duration of stay, which is beneficial for unexpected or unpredicted situations where the drivers require more time for parking. The system can alert drivers of the expiry of their parking by phone call or SMS.

Figure C 4: Smart phone parking app (Perth WA)

Camera only systems (LPR)

A camera that records vehicles' registration numbers is mounted on vehicles which travel along streets recording the date and time of parked cars. Also known as LPR (licence plate recognition) or ANPR (automatic number plate recognition), they are seldom used for on-street parking control other than for enforcement.

Licence plate recognition is gaining prominence for detecting occupancy and enforcement. These programs are data-driven and use occupancy data to determine rates in different neighbourhoods, to record parking turnover, and to pass on information about violators to enforcement officers. Additionally, the occupancy data can be relayed to web interfaces and smartphone applications for end users to access.

Figure C 5: Mobile LPR (Melbourne VIC)

Smart phone only

Parking control and payment can be replaced by smart phone only technology.

At Curtin University, students can only pay for parking of their authorised vehicle by using their smart phone. The system eliminates the need for tickets, permits or boom gates. It assumes every user has a smart phone and has pre-registered their vehicle. Thus, it is unsuitable for visitor or public parking.

Figure C 6: Smart phone only parking (Curtin University WA)

C.2 Parking payment systems (PPS)

Cash

In Australia, on-street parking machines must offer payment by coins. Sometimes payment by notes is practical where fees are high, such as for all day parking.

Credit Card

Credit card requires a third party 'gateway' to process the card data to a bank for delayed payment to the Council. As new encryption and security requirements are regularly evolving, software upgrades are necessary for existing machines and are likely to require retro application to newer machines. Credit card payment requires implementation and an understanding of PCI DSS and EMV. These terms are explained in the following sections.

Figure C 7: Wave and pay available on a parking meter (Westminster UK)

Smart phone

Smart phones can be used solely as a form of payment. Once a driver has registered their smart phone number with a supplier (which implies linking it to a credit card) the driver avoids the need for small change or payment by credit card.

Figure C 8: Single space parking meter offering pay by phone option (South Yarra VIC, Canada Bay NSW)

Near Field Communication (NFC)

An NFC parking system uses special stickers posted onto pay and display machines in parking locations that allow NFC-enabled smart phones to pay for parking using the tap and go principle. The NFC sticker has a passive electronic chip that does not require a battery and stores information such as the unique parking space location number. This data can be read wirelessly by any NFC-enabled phone.

Figure C 9: N-marked logo for certified devices

Virtual permits

This uses a (PND) ticket parking machine to issue permits in addition to pay and display tickets. Residential, business, loading and other parking permits can be purchased (by authorised users) directly from the machine. This saves on council administration time and provides convenience for customers who can purchase a permit at any time.

Figure C 10: Virtual permit example (Milton Keynes UK)

Vimoc technology

This wireless system obtains and distributes multiple forms of data such as duration of stay and parking usage, for the benefit of stakeholders. The parking information provided is presented in Figure C 11: Extracts from Kaooma website Figure C 11.

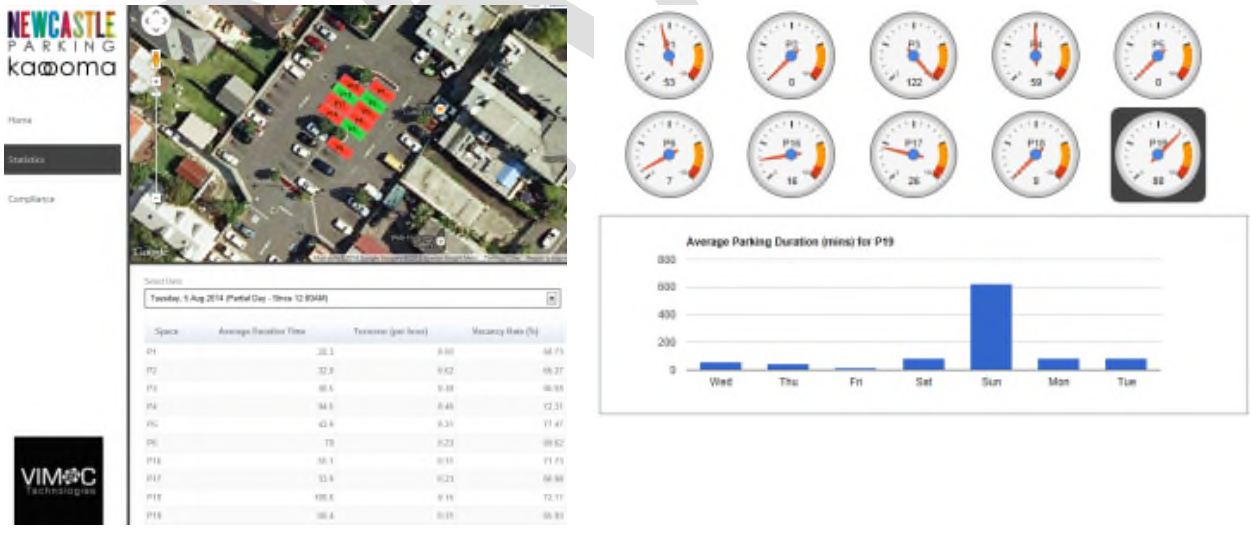


Figure C 11: Extracts from Kaooma website

While this parking information is not yet sophisticated enough to be of value in managing the council's parking assets, it will eventually provide further options for real-time data on patterns of parking demand, which can be incorporated into future council Smart Parking applications.

EMV

EMV stands for Europay, MasterCard and Visa, a global standard for authenticating credit and debit card transactions, in particular those where a signature cannot be obtained, such as the use of contactless cards ('PayPass', 'PayWave', 'ExpressPay') at a parking meter.

EMV is being phased in across the world, under names such as 'IC Credit' and 'Chip and PIN'. In Australia all new and existing payment machines that accept MasterCard must be made EMV compliant.

Council should ensure EMV compliance in any new payment technology that is purchased in the future.

C.3 Parking Guidance Systems (PGS) and Wayfinding

These have a dual purpose. Firstly, they provide data to a parking information device via the cloud or an app. Secondly, the data can be used by enforcement officers to determine whether and how long a vehicle has been parked in a particular space. Both purposes assist in reducing congestion and improve the efficient management of parking. For these systems to operate effectively the bay locations need to be line marked.

In ground sensors

In-ground parking bay sensors, also known as PODs (parking occupancy detection systems), are underground embedded devices which detect the presence of a vehicle in a designated area.

They record the arrival and departure time of the vehicle and transmit this data to a central server, which collates the data and forwards it to a parking guidance system or other device. They are often integrated with hand-held devices to inform compliance officers of vehicle overstays.

Figure C 12: In ground bay sensors (Cottesloe WA, Maribyrnong VIC, Holdfast Bay SA)

CCTV Analytics

CCTV views from existing cameras of on and off-street parking areas are used to mark virtual parking spaces with vacant, occupied and no parking areas. The images are transmitted to a cloud based central server. Analytics are then used to determine occupancy. One camera correctly placed can cover up to 100 parking spaces.

The analytics determine the arrival and departure time of the vehicle and the central server collates the data and forwards it to a parking guidance system or other device. They are also integrated with hand-held devices to inform compliance officers of overstays or illegally parked vehicles.

The analytics can also recognise vehicles searching for a parking space. The guidance system will not direct a user to a vacant space if there are other searching vehicles heading in that direction.

Real time and historical parking data and heat maps are available to manage current parking and future planning.

Figure C 13: CCTV Analytics (City of Jerusalem)

Parking guidance (PGS)

Parking guidance can take many forms. The term refers to signage and information which assists drivers to find available parking and inform them on the availability of vacant spaces.

Parking guidance can vary from a simple directional arrow, to a sign with real-time information on the location of spaces to the provision of the data on an app or an in-car device.

Fremantle, Claremont and North Sydney Councils have installed PGS which advise the location and number of spaces available for both on and off-street parking in particular precincts.

Figure C 14: Parking guidance examples (North Sydney NSW and Claremont WA)

Variable message signs (VMS)

Variable message signs can be used for multiple purposes, such as daily parking guidance or special event management.

They allow the display of numbers and also multiple messages in short sentences on different slides.

Figure C 15: Variable message sign (San Diego US)

Space counting systems

On-street space counting uses data from meters, in-ground sensors (PODS) or CCTV analytics to provide real-time occupancy/vacancy information and guidance to drivers prior to entering a car park or a parking precinct.

It improves parking utilisation and directs drivers to empty parking bays before they arrive at their destination. This reduces 'cruising' for a space and associated queuing and congestion.

Figure C 16: Space counting VMS (Nottingham UK)

Parking apps

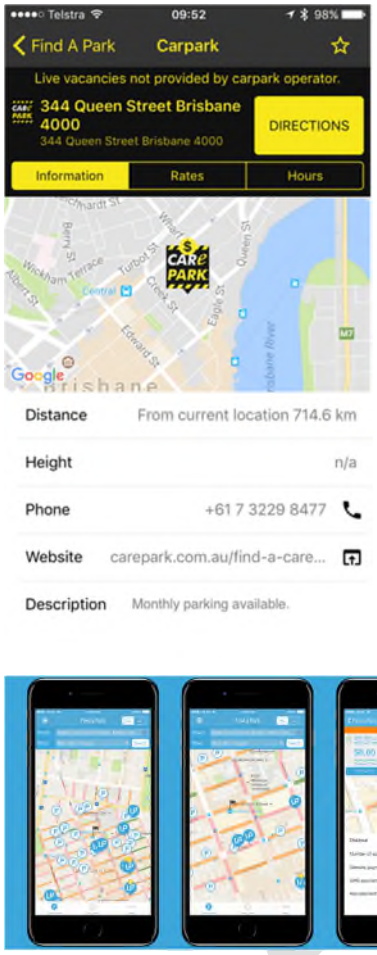


Figure C 17: Smart phone parking app (CAREPARK Brisbane)

Apps provide real-time information on parking availability, and other information such as fees and operating hours. Australian car park operators now offer iPhone apps which allow customers to search for car parks by location, operating hours and surrounding attractions. They provide the user with a map, directions and navigation guidance to the car park.

The most sophisticated phone Apps provide all of these features and accept on line bookings, secure credit card payments, electronic receipts and automatic access to the carpark selected.

They can also be white labelled to allow them to be linked to websites and customised with an Operator or Council artwork and logo. They provide interfaces to both On and Off-street parking technologies to display availability of individual parking spaces of on-street parking and vacancy counts in off-street multideck car parks.

To provide an excellent level of service to all drivers planning to park in Council precincts, the Council can also integrate the availability of all public and private parking bays in the Council precincts into a future Council Parking App. This type of service will require negotiation with private operators and other providers.

C.4 Enforcement Systems

Hand-held devices (hand-helds)

These assist enforcement officers to monitor vehicle parking compliance in real time with the regulations and restrictions in each bay.

They alert enforcement officers of overstay or illegal parkers and guide them to the location if required.

They not only issue and print an infringement, they can take a picture of an offending vehicle, record a conversation with a driver, check back to base data for the vehicle's history of offences and provide a panic button to alert a control room of an emergency situation.

Software and licenses are now available for Council to provide their own Android Smart Phone hardware linked via Bluetooth to a thermal printer clipped onto the enforcement officer's belt.

Figure C 18: Hand-held parking enforcement equipment (Melbourne VIC)

C.5 Information Systems

The greatest challenge in parking technology is systems integration, because of the wide variety of hardware and software platforms.

The available technology includes many types of hardware sensors, dynamic messaging systems and traffic control devices, wireless telecommunications systems, computer servers and hardware drivers and application interfaces. In addition, customers carry a variety of devices as well, such as parking tag transponders, licence plates (some of which are machine readable), mobile smart phones, and embedded telematics systems. Connecting all of these devices from many vendors and tying them together into one platform is the greatest challenge in reducing the cost and complexity of Smart Parking.

It is rare to find sophisticated, fully integrated, hardware-intensive smart parking systems.

The manufacturers and Australian local agents of the different technologies seldom supply more than a few integrated products. These products are often supplied by different manufacturers who are very protective of their source code and proprietary software. It is important to ensure the required level of integration of the various hardware and software items, and particularly, the reporting from each type of technology. Independent Australian companies exist that have expertise in such integration. They are equipment agnostic and specialise in integration of parking system data.[26]

[26] www.unifiedparking.com.au

C.6 Technology for Unpriced Parking

As not all parking bays will be subject to 'user-pay', in order to provide current information on availability and ensure effective and compliant use of the bays, all of the above technologies, except Parking Control and Parking Payment Systems, would still be appropriate for on-street parking precincts.

The introduction of smart parking technology would provide real-time information of available parking capacity in on and off-street car parks, statistical information on the utilisation of all spaces which can increase the turnover of available spaces resulting from reactive and targeted enforcement. This will in turn reduce traffic congestion from people circling to find available spaces, increase infringement revenue and reduce the labour resources required to carry out enforcement. Where possible, guidance, compliance and other technology should consider both on and off-street parking to ensure that integrated and comprehensive parking information is collected and relayed. This will ensure that the whole parking network operates in a more efficient manner.

C.7 Other Types of Technology

Other technologies considered for the management of on-street parking are as follows.

Drones

Drones would allow an aerial view of the on-street parking portfolio and mounted with high definition cameras and/or Lidar sensors can take video footage, photos and 3 dimensional images of target areas. The potential use of drones could include parking surveys and identifying overstays with licence plate recognition (LPR).

Figure C 19: Drone capturing aerial view

The use of drones within Hornsby, Hornsby Hospital Precinct and Waitara to undertake parking surveys will require the Council to hold a Remote Pilot Aviation Operator's Certificate (ReOC) and each staff member operating the drones will have to complete a one-week training course and qualify for a Remote Pilot's Licence (RePL).

The cost of suitable commercial grade drones capable of carrying out this type of work would begin at approximately $5,000.00 each and an integration into the enforcement software would have to be developed.

Body-Cameras and Duress Systems

Body cameras are being used successfully by enforcement officers in Australian LGA's to reduce the number of confrontations with the public. However, they are only turned on when a confrontation is likely, and the recorded video footage is saved at the camera and later downloaded to a server if it is to be used.

Body cameras that employ a 4G SIM card are available which allow the enforcement officer, when they turn the camera on, to send a duress signal and stream the video footage for viewing and recording to a Remote Monitoring Centre (RMC). The Monitoring Centre operator can then assess the confrontation and alert a team leader or Police if necessary.

Consideration should be given to transition to this technology.

Social Media Platforms

Social media platforms such as WAZE provide GPS navigation from the user's location to another selected location.

Smart and Internet of Things (IOT)

IoT is a system of electronic devices that have unique IDs and the ability to communicate with each other using various methods of communication; Wi-Fi, Bluetooth, 4G, etc. and then transfer the data over the internet. Software integration and applications use this data for information, control and action.

Off-street parking has systems that use IoT such as a phone App, Bluetooth, 4G and hard wired ethernet to communicate via the internet to identify a mobile phone, identify the car park and the entry or exit lane as well as provide hands free access and egress. Additionally, the IoT will then automatically debit the user's credit card when they leave the car park.

Artificial Intelligence (AI)

AI in parking is the ability of machines (computer and software) to analyse the data it is receiving or collecting and automatically adapt and change to enhance its performance.

Examples of this are parking guidance systems (PGS) that utilize camera images to determine if a parking bay is occupied or empty. They are generally installed and placed in a learning mode for several weeks before final commissioning where adjustments were previously carried out by software engineers. Some systems now use AI to carry out the adjustments.

Another example is licence plate recognition cameras (LPR) that improve their performance over time through AI.

Lidar

LIDAR is a type of radar that uses laser light instead of radio signals. It measures the distance and angle of all objects within its field by illuminating the target with pulsed laser light and measuring the returned pulses. The differences in laser return times and wavelengths are used to make digital 3-D image of the objects with a large degree of accuracy.

360-degree LIDAR units in autonomous vehicles are also used to navigate the vehicle into parking spaces.

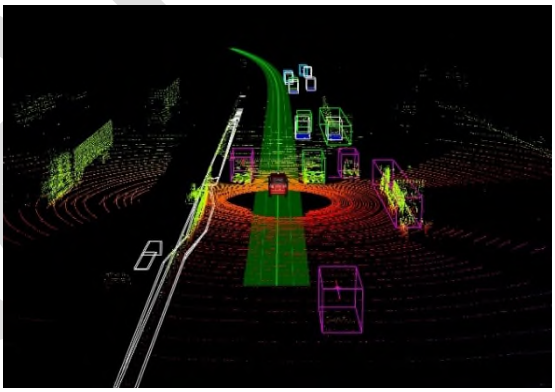


Figure C 20: LIDAR technology

Future use of LIDAR detectors in parking may be in enforcement. They could be mounted on drones to patrol and capture a unique 3-D image of all vehicles in their exact location then deploying an enforcement officer to the exact location for an overstay infringement.